PORT OF PORT TOWNSEND

CONTRACT PROVISIONS AND PLANS

FOR

BOAT HAVEN BOATYARD STORMWATER IMPROVEMENT

Washington State Department of Commerce

American Rescue Plan Act

State and Local Fiscal Recovery Funds

Award Number: 22-96515-004

Local and Community Projects Program

Award Number: 25-96647-015

Jefferson County Taxpayers

Industrial Development District

Port of Port Townsend Project No. BH-01-008

SECTION 01 00 00

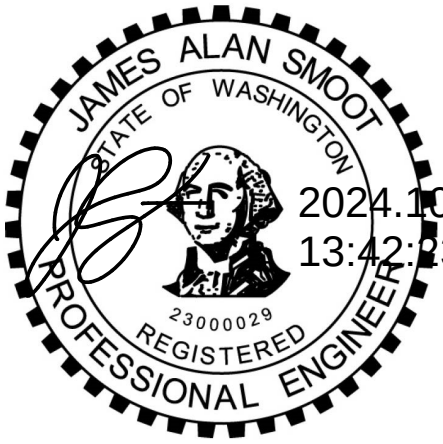
PROFESSIONAL RESPONSIBILITIES AND SEALS

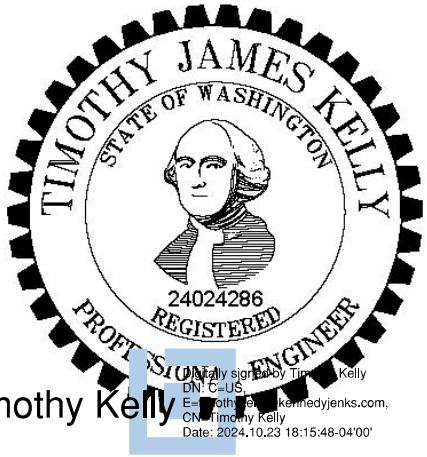
Port of Port Townsend
Port Townsend, Washington
Boat Haven Stormwater Improvement Project

October 2024

The following Technical Specification Division(s) and/or Section(s) of this Project Manual: Division 0 Division 1 were prepared under the direction and supervision of (whose seal and signature appear to the right): Matthew D. Klontz, PE License No. 43674 Port of Port Townsend 2701 Jefferson Street Port Townsend, WA 98368	

The following Technical Specification Division(s) and/or Section(s) of this Project Manual: Division 2 Division 5 Division 6 Division 9 Division 11 Division 31 Division 32 Division 33 Division 40, Section 40 27 00 were prepared under the direction and supervision of (whose seal and signature appear to the right): Samantha Nicole Mallon Karpa, PE License No. 21024598 Kennedy/Jenks Consultants, Inc. 32001 32nd Avenue South, Suite 300 Federal Way, WA 98001	

The following Technical Specification Division(s) and/or Section(s) of this Project Manual: Division 3 were prepared under the direction and supervision of (whose seal and signature appear to the right): James Alan Smoot, PE License No. 23000029 FACET NW, Inc. 9706 4th Ave NE, Suite 300 Seattle, Washington 98115	 2024.10.23 13:42:23

The following Technical Specification Division(s) and/or Section(s) of this Project Manual: Division 26 were prepared under the direction and supervision of (whose seal and signature appear to the right): Timothy Kelly, PE License No. 24024286 Kennedy/Jenks Consultants, Inc. 2202 N Westshore Blvd, Suite 200 Tampa, FL 33607	 Timothy Kelly Digitally signed by Timothy Kelly DN: C=US, E=tothy@kennedyjenks.com, CN=Timothy Kelly Date: 2024.10.23 18:15:48-04'00'

The following Technical Specification Division(s) and/or Section(s) of this Project Manual: Division 40 (Instrumentation Sections Only) were prepared under the direction and supervision of (whose seal and signature appear to the right): Stephan Koweluk, PE License No. 55808 Kennedy/Jenks Consultants, Inc. 421 SW 6th. Avenue, Suite 1000 Portland, OR 97204	

It is a violation of applicable laws and regulations governing professional licensing and registration for any person, unless acting under the direction of the licensed and registered design professional(s) indicated above, to alter in any way the Specifications in this Project Manual.

END OF PROFESSIONAL RESPONSIBILITIES AND SEALS

THIS PAGE INTENTIONALLY BLANK

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 11 13 Advertisement for Bids
00 21 13 Instructions to Bidders
00 41 43 Bid Form
00 43 13 Bid Security Form
00 52 13 Agreement Form
00 61 13.13 Performance Bond Form
00 61 13.16 Payment Bond Form
00 72 00 General Conditions
00 73 00 Supplementary Conditions
00 73 19 Health and Safety Requirements

DIVISION 01 – GENERAL REQUIREMENTS

01 11 00 Summary of Work
01 20 00 Measurement and Payment
01 31 19 Project Meetings
01 33 00 Submittal Procedures
01 40 00 Quality Requirements
01 41 00 Regulatory Requirements
01 50 00 Construction Facilities and Temporary Controls
01 57 00 Environmental Protection
01 75 00 Facility Commissioning Testing and Startup

DIVISION 02 – EXISTING CONDITIONS

02 40 00 Demolition

DIVISION 03 – CONCRETE

03 20 00 Concrete Reinforcement and Reinforcement Supports
03 30 00 Cast-in-Place Concrete

DIVISION 05 – METALS

05 50 00 Miscellaneous Metals

DIVISION 06 – WOOD, PLASTICS, and COMPOSITES

06 60 00 Fiberglass Fabrications

DIVISION 09 – FINISHES

09 96 00 High Performance Coatings

DIVISION 11 – EQUIPMENT

11 00 00 General Equipment and Mechanical Requirements

DIVISION 26 – ELECTRICAL

26 05 00	General Electrical Requirements
26 05 10	Electric Motor Drives
26 05 19	Low Voltage Wire and Cable
26 05 20	Signal Cable
26 05 26	Electrical Grounding
26 05 33	Electrical Raceway Systems
26 05 43	Underground Electrical Work
26 05 73	Power System Studies
26 27 26	Wiring Devices
26 28 00	Protective Devices and Switches
26 29 00	Control Devices
26 29 33	Variable Frequency Drives (VFD)
26 33 54	Uninterruptible Power Supply (UPS) 1.5 kVA & Smaller

DIVISION 31 – EARTHWORK

31 00 00	Earthwork

DIVISION 32 – EXTERIOR IMPROVEMENT

32 12 16	Paving and Surfacing
32 93 00	Landscaping

DIVISION 33 – UTILITIES

33 05 33	Fusible HDPE Pipe and Fittings
33 42 20	Submersible Stormwater Pumps
33 44 19	Biofiltration System
33 49 20	Precast Concrete Structures

DIVISION 40 – PROCESS INTERCONNECTIONS

40 27 00	Piping, Valves and Accessories
40 60 00	Instrumentation and Controls, General Requirements
40 67 00	Panels
40 71 00	Flow Measurement
40 72 00	Level Measurement
40 73 00	Pressure Measurement
40 78 00	Panel Mounted and Miscellaneous Field Instruments

APPENDICES

Appendix A - Geotechnical Report and Hydrograph
Appendix B – Permit Documents
Appendix C – Prevailing Wages
Appendix D – Stormwater Permits
Appendix E – Project Administration Forms
Appendix F – Record Drawings
Appendix G – Inadvertent Discovery Plan
Appendix H – Apprentice Utilization Plan

END OF TABLE OF CONTENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS
Section 00 11 13 – Advertisement for Bids

The PORT OF PORT TOWNSEND (Port) is currently accepting sealed bids for construction of the following:

Contract No.: BH-01-008
Boat Haven Boatyard Stormwater Improvement

The work required for the Boat Haven Boatyard Stormwater System, as indicated in the Contract Documents (engineer's estimate $4.0-4.3M), includes the following improvements:

1. Installation of a four-stage stormwater treatment system
2. Installation of a lift station, valve vault, two submersible stormwater pumps and associated accessories and appurtenances.
3. Installation of approximately 1,200 linear feet of 8" diameter storm drain force main piping, 715 linear feet of 24" diameter gravity main piping.
4. Installation of associated electrical wiring, cabling and devices, including instrumentation
5. Re-grading work associated with the above items, including restoration
6. Temporary erosion and sediment control and traffic control during construction

Prepare and submit bids in accordance with the Instructions to Bidders. Bid due time is **4:00 p.m. on November 25, 2024,** or as modified by a future addendum issued during the bid period. Bids are to be submitted only on the Bid Form provided to **registered plan-holders** on the Port's plan-holder list.

All bidding and construction are to be performed in compliance with the Contract Provisions, Plans and any addenda issued thereto that are on file at the Administrative Offices of the Port, 2701 Jefferson Street, Port Townsend, WA 98368. Bidders may obtain a copy of the Contract Provisions, Plans and Bid Form, free of charge, in electronic format (PDF via email link) along with registration as a plan-holder through the Port Engineering Office. Requests may be emailed to ntoews@portofpt.com.

Disadvantaged, Minority, and Women's Business Enterprises are encouraged to respond. The Port does not discriminate on the grounds of race, color, religion, national origin, sex, age, gender identity, sexual orientation or disability in consideration for a project award.

This project includes an apprentice utilization requirement of **15%** and contains a monetary incentive for contractors who meet the requirement and a penalty for those who fail to demonstrate a good faith effort.

The Port reserves the right to reject any and all bids, waive technicalities or irregularities, and to accept any bid if such action is believed to be in the best interest of the Port.

All questions shall be directed to matt@portofpt.com.

(Advertisement Dates: 10/30, 11/4, 11/12)

Bid Table of Contents

PART 1. BIDDING REQUIREMENTS 1
1.01 RECIPROCITY PREFERENCE FOR RESIDENT CONTRACTORS 1
1.02 EXAMINATION OF CONTRACT DOCUMENTS AND REGULATIONS 2
1.03 INSPECTION OF WORK SITE 2
1.04 CLARIFICATION OF CONTRACT DOCUMENTS 2
1.05 PRE-BID CONFERENCE 3
1.06 SUBSTITUTION REQUESTS 3
PART 2. PREPARATION AND SUBMITTAL OF BIDS 3
2.01 FORM OF BID 3
2.02 BID PRICE 3
2.03 TAXES 4
2.04 BIDDER'S NAME AND SIGNATURE 4
2.05 PROPOSED SUBCONTRACTORS 4
2.06 BID GUARANTEE 5
2.07 BID SUBMITTAL 5
2.08 ALTERNATIVE BIDS 5
2.09 WITHDRAWAL OR MODIFICATION OF BID 5
2.10 BID OPENING 5
2.11 BID VALIDITY 5
PART 3. BID EVALUATION 6
3.01 EVALUATION STANDARD 6
3.02 VERIFICATION OF BID PRICES 6
3.03 CLAIM OF ERROR 7
3.04 RESPONSIVE BIDS 7
3.05 BIDDER QUALIFICATIONS 7
3.06 SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA 8
3.07 COLLUSION 9
3.08 RETURN OF BID GUARANTEE 9
3.09 SINGLE BID RECEIVED 9
3.10 NO BID RECEIVED 9
3.11 RIGHTS OF THE CONTRACTING AGENCY 10
PART 4. AWARD OF CONTRACT 10
4.01 NOTICE OF AWARD 10
4.02 PERFORMANCE AND PAYMENT BONDS 10
4.03 EXTENSION OF TIME 10
4.04 FAILURE TO EXECUTE CONTRACT 10
4.05 CANCELLATION OF AWARD 11

PART 1 - BIDDING REQUIREMENTS

1.01 RECIPROCITY PREFERENCE FOR RESIDENT CONTRACTORS

A. In accordance with RCW 39.04.380, the State of Washington is enforcing a Reciprocal Preference for Resident Contractors. Any public works project in which a bid is received from a nonresident contractor from a state that provides a percentage bidding preference, a comparable percentage disadvantage must be applied to the bid of that nonresident contractor.

B. A nonresident contractor from a state that provides a percentage bid preference means a contractor that:

1. is from a state that provides a percentage bid preference to its resident contractors bidding on public works contracts; and
2. at the time of bidding on a public works project, does not have a physical office located in Washington.

C. The state of residence for a nonresident contractor is the state in which the contractor was incorporated or, if not a corporation, the state where the contractor's business entity was formed.

D. This section does not apply to public works procured pursuant to RCW 39.04.280, RCW 39.04.151 through 39.04.154, or any other procurement exempt from competitive bidding.

1.02 EXAMINATION OF CONTRACT DOCUMENTS AND REGULATIONS

A. The bidder shall examine the Contract Documents and any other data made available to the bidder relating to the Work and shall comply with all instructions and provisions. The bidder shall promptly notify the Port of Port Townsend (Contracting Agency) of ambiguities, inconsistencies, or errors, if any, which it may discover upon examination of the Contract Documents and any other data made available to the bidder relating to the Work. The submission of a Bid shall constitute an acknowledgement upon which the Contracting Agency may rely that the bidder has thoroughly examined and is familiar with the Contract Documents and has reviewed all applicable federal, state and local statutes, regulations, ordinances and environmental documents relating to the work and all permits which have been applied for and/or issued pertaining to the Work. The failure or neglect of a bidder to examine any of the Contract Documents, statutes, regulations, ordinances, environmental documents or permits shall not relieve the bidder from any obligations with respect to the Contract Documents or the Work.

B. The bidder shall verify that all documents provided by the Contracting Agency, and upon which the bidder is basing its bid, are full and complete with no missing pages, sheets or unintentional blank spaces. Submittal of a bid indicates the bidder has verified it has obtained all Contracting Agency Contract Documents. No claim for additional work due to missing bid information will be considered.

C. If the bidder elects to review or download Contract Documents electronically from websites it is the bidder's responsibility to ensure that all documents are complete and that all addenda have been reviewed prior to submission of Bid.

1.03 INSPECTION OF WORK SITE

A. Bidder shall inspect and compare the work site and Contract Documents to evaluate the location of the Work, the actual physical conditions of the site, and surface and subsurface conditions ordinarily encountered and generally recognized as inherent in the Work. Bidder may enter the work site but shall obtain written permission from the Contracting Agency prior to \conducting physical testing of the work site

B. If the bidder finds facts or conditions which appear to conflict with the Contract Documents or with any other data made available to the bidder relating to the Work, the bidder shall promptly notify the Contracting Agency in writing.

1.04 CLARIFICATION OF CONTRACT DOCUMENTS

A. Requests for interpretation or reports of ambiguities shall be made in writing and delivered to the Contracting Agency at least five (5) calendar days before the Bid submittal deadline. Clarifications, interpretations, or supplemental instructions which change the scope of work and or schedule described in the contract documents, will be issued only in the form of written addenda. All addenda shall become part of the Contract Documents and any subsequently awarded Contract.

B. Addenda will be distributed to registered plan-holders who are registered on the Contracting Agency's plan holder list. It is the responsibility of the bidder to verify issuance of any addenda prior to the Bid submittal deadline.

C. Each bidder shall acknowledge the receipt of all addenda issued on its Bid. If such acknowledgement is not made, the Contracting Agency reserves the right to show constructive notice through delivery records or the bidder's use of information contained in the addenda.

D. Bidders shall not rely upon any oral statements or conversations, whether at the pre-bid conference or otherwise, that they may have with Contracting Agency employees, agents or representatives regarding the Contract Documents. No oral clarification or interpretations will be made to any bidder as to the meaning of the Contract Documents.

1.05 PRE-BID CONFERENCE

A. Prospective bidders are **not required** to attend a pre-bid conference. No pre-bid conference is scheduled.

1.06 SUBSTITUTION REQUESTS

A. Products, equipment, materials or methods described in the Contract Documents are to establish a standard of quality, function, appearance, and dimension. A proposed substitution shall have equal attributes in all respects.

B. During the bidding period written requests by prime bidders for substitutions may be considered if received by the Contracting Agency at least fourteen (14) days prior to the bid submittal deadline. The Contracting Agency may, in its sole discretion, defer the consideration of a proposed substitution until after Contract award.

C. Each substitution request shall, in accordance with the applicable provisions of Section 01 33 00, describe the proposed substitution in its entirety including the name of the material or equipment, drawings, catalog cuts, performance or test data and all other information required for an evaluation. The submittal shall also include a statement noting all changes required in adjoining, dependent or other interrelated work necessitated by the incorporation of the proposed substitution. The bidder shall bear the burden of proof to show that the proposed substitution meets or exceeds the required function and is equal or superior to the specification.

D. The Contracting Agency may require that samples be submitted or demonstration made prior to approval. The Contracting Agency's decision of approval or disapproval of a proposed substitution shall be final.

E. Approval of substitutions will be made by addenda prior to bid submittal deadline or by change order after contract execution, at the Contracting Agency's sole discretion.

PART 2 - PREPARATION AND SUBMITTAL OF BIDS

2.01 FORM OF BID

A. Bids shall be submitted on the forms provided by the Contracting Agency in Specification Section 00 41 43 – Bid From.

B. All blanks on the bid forms shall be filled in by ink or typed.

C. Alterations, erasures, or interlineations within the blanks, if any, shall be in ink and initialed by the signer of the Bid.

D. The bidder shall make no deletions, additional conditions or stipulations on the bid form or qualify its Bid in any manner.

2.02 BID PRICE

A. All prices on the bid form shall be in U.S. dollars.

B. For unit price bids a price shall be submitted for each item of the Work, an extension thereof, and, if requested, the total Contract Sum.

C. The price on the bid form for that element of Work shall include everything necessary for the prosecution and completion of the Work in accordance with the Contract Documents including, but not limited to, furnishing all required materials, equipment, tools, transportation of Contracting Agency furnished materials, plant and other facilities, quality control testing, survey, and all home office management, superintendence, labor and services, and field design, except as may be otherwise provided in the Contract Documents.

D. Estimated quantities, if any, set forth on the bid form are estimates only, being given only as a basis for the comparison of Bids, and the Contracting Agency does not warrant, expressly or by implication, that the actual amount of work will correspond to the estimated quantities. The Contracting Agency reserves the right to increase or decrease the amount of any class or portion of the Work and to make changes in the Work as the Contracting Agency may deem necessary or appropriate. The basis of payment for unit price bid items for which estimated quantities were set forth on the bid form shall be the actual number of unit items provided or performed under this Contract. In the event of a 25% quantity increase or decrease, the unit price may be adjusted as provided in the General Conditions.

E. Prices shall be expressed in figures only.

2.03 TAXES

A. The Work to be performed under this Contract constitutes a "retail sale" as such term is defined in RCW 82.04.050. The prices on the bid form shall not include state or local retail sales taxes. The Contracting Agency will pay state and local retail sales tax on each progress payment and final payment to the Contractor for transmittal by the Contractor to the Washington State Department of Revenue or to the applicable local government. The Contractor will pay retail sales tax on all consumables used during the performance of the work and on all items which are not incorporated into the final work, which tax shall be included in the prices on the bid form.

B. No increase will be made in the amount to be paid by the Contracting Agency under this Contract because of any misunderstanding by or lack of knowledge of the Contractor as to liability for, or the amount of, any taxes for which the Contractor is liable or responsible by law or under this Contract.

C. Retail sales tax to be paid by the Contracting Agency on each payment shall be shown as a separate item on the bid form. In any case where it is not included as a separate item, the Contracting Agency will add the sales tax to the total of the bid prices shown.

2.04 BIDDER'S NAME AND SIGNATURE

A. The bid form shall include the legal name and contractor registration number of the bidder and shall indicate whether bidder is a sole proprietor, a partnership, a corporation, joint venture, or other legal entity. The bid form shall be signed by a person legally authorized to bind the bidder to a contract and shall indicate the bidder's address. A bid form signed by an agent shall have a current power of attorney attached certifying agent's authority to bind the bidder. Upon request of the Contracting Agency the bidder shall provide corporate or partnership documentation evidencing the bidder's legal status and showing the authority of the person signing the bid form to execute contracts on behalf of the bidder.

B. The bid form shall not become a part of the Contract Documents except by inclusion into the Agreement.

2.05 PROPOSED SUBCONTRACTORS

A. The Contracting Agency encourages and supports the use of M/WBE subcontractors and suppliers on all Work.

B. The bidder shall list on the bid form the name of each subcontractor responsible for performing work or suppling material in excess of fifteen percent (15%) of the total amount bid. For each qualifying subcontractor and supplier, the bidder shall provide the information requested on the bid form for proposed subcontractors and suppliers.

C. For purposes of this paragraph, a subcontractor is defined as one who contracts directly with the Contractor to furnish materials, equipment, and labor for the performance of the Work. A supplier is one who supplies materials to be permanently or temporarily incorporated into project by either the Contractor or it's subcontractors.

2.06 BID GUARANTEE

A. The Bid Guarantee shall be in one of the following forms and made payable to the Port of Port Townsend: a bid bond, either the form provided in Section 00 43 13, or a form accepted by the Contracting Agency prior to bid which contains provisions substantially similar to those in Section 00 43 13, duly completed by a guarantee company authorized to do business in the state of Washington; a U.S. postal money order; or a certified check or cashier's check drawn upon a banking institution. The surety signing the bid bond must appear on the U.S. Treasury Department's most current list (Circular 570 as amended), and the surety's name must appear in the current Authorized Insurance Company List in the State of Washington published by the Office of the Insurance Commissioner. Attorneys-in-fact who sign bid bonds must file with each bond a certified and effectively dated copy of their Power of Attorney.

2.07 BID SUBMITTAL

A. Registration on the Contracting Agency's plan-holder list is required to submit a responsive Bid.

B. The Bid, the Bid Guarantee, and all other documents required to be submitted with the Bid shall be enclosed in a sealed envelope marked "bid submittal by" followed by the name and address of the bidder, the project title, and the date and time for the opening of Bids.

C. If the Bid is mailed, it shall be addressed to the Port of Port Townsend, P.O. Box 1180, Port Townsend, WA 98368. The Bid shall be enclosed within another envelope with the notation "BID ENCLOSED" on the face.

D. If the Bid is hand delivered, it shall be delivered to the Port's Administration Office reception counter, which is located at 2701 Jefferson St, Port Townsend, WA. As parking is very limited in the area, be sure to allow sufficient time for delivery of the bid.

E. No Bid (includes mailed and courier Bids) shall be considered which has not been received at the Port's Administration Office reception counter before the Bid submittal deadline specified in the Advertisement for Bids. Bidder shall assume full responsibility for timely delivery of its Bid at the specified location.

F. Oral, telephonic, telefaxed, electronic, or telegraphic Bids are invalid and will not receive consideration.

2.08 ALTERNATIVE BIDS

A. If alternative or optional bid items, additive or deductive, are included in the bid schedule, the bidder is required to submit a price for the alternate or optional bid items in their bid submittal.

2.09 WITHDRAWAL OR MODIFICATION OF BID

A. A bidder may withdraw or modify its Bid before the Bid submittal deadline by submitting written notice to the Contracting Agency signed by the bidder. After Bid opening no bidder may withdraw or modify its Bid unless Contract award is delayed beyond the time specified in the 2.11 Bid Validity or provision 3.03 Claim of Error is followed.

2.10 BID OPENING

A. Unless stated otherwise in the Advertisement for Bids, all Bids which have been properly identified and received will be publicly opened and the prices read aloud. No evaluation of the Bids will be made at that time except for the announcement of the apparent low bidder.

B. Unless stated otherwise in the Advertisement for Bids, public bid opening shall take place at the Port's Administration Office, located at 2701 Jefferson St, Port Townsend, WA.

2.11 BID VALIDITY

A. All Bids submitted shall be valid and binding on the bidder for a period of sixty (60) calendar days following the Bid submittal deadline and for any extension of time granted by the bidder.

PART 3 - BID EVALUATION

3.01 EVALUATION STANDARD

A. Award of contract will be made at the Contracting Agency's sole discretion, in the Contracting Agency's best interest considering the base bid, alternative/optional bid item(s), if any, and other factors. The Contracting Agency may reject all bids and not award the contract.

B. Additionally, the Contracting Agency reserves the right to negotiate base bid prices (including changes to the contract plans and specifications) with the low responsive, responsible Bidder to bring the final contract amount within the funds available prior to award or prior to Contract Execution.

C. The intent of the Contracting Agency is to award a contract to the low-responsive, responsible Bidder by considering the following:

1. Relevant Experience Criteria:

Relevant Experience shall be provided on the bid form. The bidder along with subcontractors will be evaluated on successful past project completion, either as a general contractor or principal subcontractor (relevant experience of qualified employees who have worked for other general contractors or principal subcontractors may also be considered based upon previous work experience) of one or more projects containing similar construction elements to this Project including the following:

a. Underground and aboveground utility construction;
b. Lift station construction; and
c. Structural concrete construction.

2. Responsibility:

As defined in 39.04.350 RCW, and including such additional factors, including but not limited to:

a. The ability, capacity, and skill of the Bidder to perform the work;
b. The character, integrity, reputation, judgement, experience, and efficiency of the Bidder;
c. Whether the Bidder can perform the work within the time specified;
d. The quality of performance of pervious work;
e. Ability to provide required deliverables under the contract documents in a responsive and timely manner including, but not limited to, required shop drawings, schedules, submittals, and as-builts;
f. Demonstration of being reasonable in pricing change orders;
g. Demonstration of being responsive in resolving warranty issues in a timely manner;
h. Demonstration of ability to perform the work and adhere to contract documents without litigation or the threat of litigation**;**
i. The previous and existing compliance by the Bidder with laws and requirements relating to the work and contract;
j. Such other information as may have bearing on the decision to award the contract.

3. Non- Responsive:

a. Not registered on the Contracting Agency's plan-holder list.
b. An incomplete or non-conforming bid proposal;
c. Not a registered contractor as required by law;
d. No subcontractor's list when required by invitation to bid;
e. Submitting a modified and conditioned bid or bid form;
f. No Bid Guarantee when required by invitation to bid;
g. No certification when required by invitation to bid.

3.02 VERIFICATION OF BID PRICES

A. Prices set forth in the Bid will be reviewed by the Contracting Agency for mathematical accuracy. The Contracting Agency reserves the right to correct mathematical errors or complete

mathematical calculations that are obvious on the face of the Bid. In the event of a discrepancy between a unit price and the extended amount for a Bid item, the unit price will control. The prices, corrected for mathematical errors, shall be used as the amount of the Bid items for evaluation and award purposes.

3.03 CLAIM OF ERROR

A. A bidder claiming error in its Bid must submit supporting evidence including cost breakdown sheets within 24 hours of Bid opening and provide any other supporting documentation requested by the Contracting Agency. In the event the bidder demonstrates an error in the Bid to the Contracting Agency's satisfaction, the Contracting Agency may allow the bidder to withdraw its Bid.

3.04 RESPONSIVE BIDS

A. The Contracting Agency, in its sole discretion, reserves the right to determine Bid irregularities which render a Bid non-responsive, and to waive informalities and immaterial irregularities in the Bid. A Bid shall be considered irregular and may be rejected by the Contracting Agency as non-responsive for reasons including, but not limited to:

1. If the bid form furnished or authorized is not used or is altered;
2. If the bid form or any required supplemental documents are incomplete, contain any additions, deletions, conditions, or otherwise fail to conform to the Contracting Agency's requirements;
3. If the bidder adds any provisions reserving the right to reject or accept the award, or enter into the contract;
4. If the Bid or Bid Guarantee is not properly executed, or shows an incorrect amount;
5. If the Bid fails to include a price for every bid item;
6. If the Contracting Agency reasonably deems the Bid Guarantee inadequate; or
7. If the Contracting Agency deems any of the bid prices to be excessively unbalanced either above or below the amount of a reasonable bid price for the item of Work to be performed, to the potential detriment of the Contracting Agency.

3.05 BIDDER QUALIFICATIONS

A. Each Bidder, as part of the bid form, shall provide a Statement of Bidder's Qualifications and Proposed Subcontractors, which includes a statement of Bidder's Work experience and general ability to perform the Work contemplated. The Contracting Agency shall have the right to make such investigations as it deems necessary to determine the ability of the Bidder to furnish the Work as described in the Contract Documents, and the Bidder shall furnish to the Contracting Agency all such information and data for this purpose, as the Contracting Agency may request. Each Bidder shall be skilled and regularly engaged in the general class or type of Work called for in the Contract Documents. Proposed Subcontractors shall be competent, experienced, and thoroughly familiar with aspects of the Work that they will perform. The Contracting Agency reserves the right to reject any bid if the evidence submitted by, or the investigation of, such Bidder fails to satisfy the Contracting Agency that such Bidder and its proposed Subcontractors are properly qualified to carry out the obligations of the Contract and to furnish the Work described in the Contract Documents at the required standard(s) of quality.

B. It is the intent of the Contracting Agency to award a contract to the low responsible bidder. Before award, the bidder must meet the following bidder responsibility criteria to be considered a responsible bidder. The bidder may be required by the Contracting Agency to submit documentation demonstrating compliance with the criteria. The bidder must:

1. At the time of bid submittal, have a current certificate of registration in compliance with chapter 18.27 RCW.

2. Have a current Washington Unified Business Identifier (UBI) Number.

4. If applicable:

   a. Have industrial insurance (workers' compensation) coverage for the bidder's employees working in Washington, as required by Title 51 RCW;

   b. Have a Washington Employment Security Number as required Title 50 RCW.

   c. Have a Washington Department of Revenue state excise tax registration number, as required by Title 82 RCW.

5. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3) or listed as a federally excluded on SAM.gov.

6. For public works projects subject to the apprenticeship utilization requirements of RCW 39.04.320, not have been found out of compliance by the Washington state apprenticeship and training council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under chapter 49.04 RCW for the one-year period immediately preceding the first date of advertising for the project.

C. The Contracting Agency reserves the right to investigate the qualifications of any bidder, including but not limited to, contacting any reference or any financial institution to verify that the bidder is qualified to successfully complete the Work.

D. To verify that the bidder has adequately incorporated all elements of the Work and the requirements of the Contract Documents in its bid prices, the bidder will make available upon request, for the Contracting Agency's review a complete itemization of its Bid, and clearly define all phases of its work.

E. Prior to award, if requested by the Contracting Agency, the bidder and selected proposed subcontractors or suppliers shall attend a bid evaluation conference and shall bring to the conference any documents requested by the Contracting Agency to evaluate the Bid and the bidder's qualifications.

3.06 SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA

A. In addition to the bidder responsibility criteria above, the Contracting Agency may adopt relevant supplemental criteria for determining bidder responsibility applicable to a particular project which the bidder must meet (RCW 39.04.350 (2)). Adopted criteria, if any, shall be stated in Specification Section 00 73 00 - Supplementary Conditions.

B. As evidence that the bidder meets the bidder responsibility criteria stated in Section 00 73 00, the apparent low bidder must submit the requested documentation to the Contracting Agency within 48 hours of the bid submittal deadline. In the interests of meeting the project's schedule, the Contracting Agency may request that the next lowest bidder(s) also submit the documentation.

C. In the event bidder fails to supply the supplemental information requested concerning responsibility within the time and manner specified, the Contracting Agency may base its determination of responsibility on any available information related to the supplemental criteria or may find the bidder not responsible. The Contracting Agency reserves the right to request such documentation from other bidders also.

D. The Contracting Agency may conduct reference checks for the bidder whose bid is under consideration for award. If information obtained from the reference checks:

1. Reveals that the bidder does not meet the Supplemental Bidder Responsibility Criteria; or

2. Indicates concerns about the bidder's performance on projects identified as meeting the Supplemental Bidder Responsibility Criteria, which may include, but not be limited to the quality of construction, the bidder's management of subcontractors, timeliness of required submittals, and safety record on the project; or

3. Indicates other concerns about the bidder's ability to successfully perform the work, the Contracting Agency may determine that the bidder is not a responsible bidder. Prior to making such a determination that a bidder is not responsible based on information received through reference checks, the Contracting Agency will discuss with the bidder the information obtained from the references and provide the bidder with the opportunity to offer explanations that may help inform whether the Contracting Agency declares the bidder not responsible.

4. In conducting reference checks, the Contracting Agency may include itself as a reference if the bidder has performed work for the Contracting Agency, even if the bidder did not identify the Contracting Agency as a reference.

E. The Contracting Agency shall consider an overall accounting for determining bidder responsibility. If the Contracting Agency determines the bidder does not meet the bidder responsibility criteria and is therefore not a responsible bidder, the Contracting Agency shall notify the bidder in writing with the reasons for its determination. If the bidder disagrees with this determination, it may appeal the determination within 24 hours of receipt of the Contracting Agency's determination by presenting additional information to the Contracting Agency. The Contracting Agency will consider the additional information before issuing its final determination. If the final determination affirms that the bidder is not responsible, the Contracting Agency will not execute a contract with any other bidder until two 2 business days after the bidder determined to be not responsible has received the final determination.

F. The Contracting Agency may award the contract to the next lowest bidder who meets the Supplemental Bidder Responsibility Criteria and whose reference checks validate the ability of the bidder to successfully perform the work. The Contracting Agency will use the same process in checking references for any bidders other than the low bidder.

G. Any bidder, within seven (7) business days before the bid submittal deadline, may request that the Contracting Agency modify the Supplemental Criteria. The Contracting Agency will evaluate the request submitted by any potential bidder and respond before the submittal deadline. If the evaluation results in a change of the criteria, the Contracting Agency will issue an addendum to the bidding documents identifying the new criteria.

3.07 COLLUSION

A. If the Contracting Agency determines that collusion has occurred among the bidders, none of the Bids of the participants in such collusion will be considered. The Contracting Agency's determination of collusion shall be conclusive.

3.08 RETURN OF BID GUARANTEE

A. As soon as the bid prices have been compared, the Contracting Agency will return the Bid Guarantee accompanying any Bids which, in the Contracting Agency's judgment, would not be considered for award. All other Bid Guaranties will be held until the Contract and bonds have been executed, after which all remaining Bid Guaranties, except which as have been forfeited, will be returned.

3.09 SINGLE BID RECEIVED

A. If the Contracting Agency receives a single responsive, responsible Bid, the Contracting Agency shall have the right, in its sole discretion, to conduct a price or cost analysis on such Bid. The bidder shall promptly provide all cost or pricing data, documentation and explanation requested by the Contracting Agency to assist in such analysis. By conducting such analysis, the Contracting Agency shall not be obligated to accept the single Bid; the Contracting Agency reserves the right to reject such Bid or any portion thereof.

3.10 NO BID RECEIVED

A. For Contracts estimated to cost less than $300,000, where the Contracting Agency receives no bids, the Contracting Agency shall have the right, in its sole discretion, to award a contract to a

responsible Contractor chosen from the Small Works Roster. The Contract amount shall be at a negotiated price that does not exceed 10% of the published Engineer's estimate, and in no case shall the contract award exceed $300,000.

3.11 RIGHTS OF THE CONTRACTING AGENCY

A. The Contracting Agency reserves the right to accept the Bid in the best interest of the Contracting Agency from a responsive, responsible bidder, a bid schedule based upon plans and specifications prepared by the Bidder, to reject any or all Bids, republish the Advertisement for Bids, revise or cancel the work to be performed, or to do the work otherwise, if in the judgment of the Contracting Agency, the best interests of the Contracting Agency is served thereby.

PART 4 - AWARD OF CONTRACT

4.01 NOTICE OF AWARD

A. The acceptance of a Bid will be evidenced by a written notice of award delivered to the bidder whose Bid is accepted.

B. Within ten (10) days after issuance of the notice of award the Agreement form set forth in Section 00 52 13 shall be executed in duplicate and returned, together with the performance and payment bonds, and certificates of insurance with endorsements as required by the Contract Documents.

C. The bidder shall not commence physical modification of the work site until the Contracting Agency has issued its notice of award, notice to proceed, and the Contracting Agency has received the executed Agreement form and bonds and certificates of insurance meeting the requirements of the Contract Documents.

4.02 PERFORMANCE AND PAYMENT BONDS

A. The bidder awarded this Contract shall furnish performance and payment bonds on forms set forth in Section 00 61 13.13 and Section 00 61 13.16, or similar form acceptable to the Contracting Agency in the amount of 100% of the total Contract Sum as security for the faithful performance and completion of the Work. Such bonds shall be executed and sealed by a duly licensed surety registered with the Washington State Insurance Commissioner, and the surety's name shall appear in the current Authorized Insurance Company List in the State of Washington published by the Office of the Insurance Commissioner. Attorneys-in-fact who sign bonds must file with each bond a certified and effectively dated copy of their Power of Attorney.

B. The scope of the performance and payment bonds shall not affect or alter the liabilities of the Contractor to the Contracting Agency under the terms of the Contract Documents.

C. The Contracting Agency may require the surety to appear and qualify itself upon the bond. If at any time the Contracting Agency determines, in its sole judgment, that the surety is insufficient, the Contracting Agency may require the Contractor to furnish additional surety in form and arrangement satisfactory to the Contracting Agency and in an amount not exceeding that originally required. Payments will not be made on the Contract until sufficient surety as required is furnished.

D. The person signing the performance bond on behalf of the Contractor shall also sign the Agreement form and bonds.

4.03 EXTENSION OF TIME

A. If the Agreement form is not executed or not submitted to the Contracting Agency within the time required and, in the Contracting Agency's discretion, circumstances warrant an extension of time, it may extend the time for execution of the Agreement form or for furnishing bonds and insurance certificates for a period not to exceed ten (10) additional days.

4.04 FAILURE TO EXECUTE CONTRACT

A. If the bidder awarded the Contract fails to execute the Agreement form and furnish the required bonds and insurance certificates within ten days from delivery of the notice to award, or declares

in writing its intent not to execute the Contract, its Bid Guarantee shall be forfeited to the Contracting Agency and the Contracting Agency may issue notice of award to the second lowest responsible Bidder, and in like manner until the Agreement form and bonds are executed by a responsible bidder to whom award is made, or further Bids are rejected. Forfeiture of the Bid Guarantee shall not limit the Contracting Agency's right to recover damages from the bidder caused by the bidder's failure to execute the Contract.

4.05 CANCELLATION OF AWARD

A. The Contracting Agency reserves the right to cancel the award of any Contract at any time before the execution of said Contract by all parties without liability to the Contracting Agency.

END OF SECTION

BID FORM

BIDDER'S NAME _____

PROJECT TITLE: Boat Haven Boatyard Stormwater Improvement

Contract No. BH-01-008

The undersigned bidder declares that it has read the specifications, understands the conditions, has examined the site, and has determined for itself all situations affecting the work herein bid upon.

Evaluation of the bid schedule and award of contract will be at the Contracting Agency's sole discretion to lowest bid price, responsive and responsible bidder in the Contracting Agency best interest. The cumulative total contract bid price including all schedules and sales tax will serve as the basis for determining the lowest bid price. The order of award will first be Schedule A, and second, Schedule B is contingent upon available funding.

And, bidder proposes and agrees, if this proposal is accepted, to provide at bidder's own expense, all labor, equipment, machinery, tools, materials, etc., including all work incidental to, or described or implied as incidental to such items, according to the Contract Documents, and that the bidder will complete the work within the time stated, and that bidder will accept in full payment therefore the unit price(s) and/or lump sum prices as set forth in the bid below: (Note: Show prices in figures only.)

Unit prices and estimated quantities shall be used to determine the Bid. These prices shall also be used to adjust the Contract in the event there is an increase or decrease in the estimated quantities. All costs shall be "in place" costs and complete, **excluding State Sales Tax**. In the event of an irregularity, the unit price prevails. The Contracting Agency reserves the right to make mathematical corrections of multiplication or addition errors on the bid form.

REGISTRATION ON THE CONTRACTING AGENCY'S PLAN-HOLDER LIST IS REQUIRED TO SUBMIT A BID FORM.

ALL PAGES OF THIS BID FORM IN ITS ENTIRETY INCLUDING BID SECURITY FORM (00 43 13) MUST BE RETURNED IN ACCORDANCE WITH THE INSTRUCTION TO BIDDERS. ADDITIONAL PAGES CAN BE PROVIDED TO COMPLETE THE STATEMENT OF BIDDERS QUALIFICATONS.

BID REQUIREMENTS

Bidder shall submit a price for all items on the Bid Schedule as shown above including the alternative/option bid item(s), if any. Incomplete Bid Schedule will not be considered responsive Bids and, therefore, will be rejected.

Schedule A – Boat Haven Boatyard Stormwater Improvement

Item No.	Description	Qty	Unit	Unit Price	Total Price
A1	Mobilization	1	LS		
A2	Temporary Erosion and Sediment Control	1	LS		
A3	Potholing/Existing Utilities Verification	19	EA		
A4	Construction Survey	1	LS		
A5	Trench Safety Excavation Provisions	1	LS		
A6	Demolition	1	LS		
A7	Electrical Pedestal Relocation	4	EA		
A8	Stockpile (Excess Material)	3000	CY		
A9	Stormwater Treatment System Stage 1, 2, & 3	1	LS		
A10	Trail Surfacing (1/4" Basalt)	40	TON		
A11	Crushed Surfacing Base Course	680	TON		
A12	Quarry Spalls	680	TON		
A13	Pavement Removal	320	SY		
A14	8" HDPE Force Main	1100	LF		
A15	24" PVC Stormwater Pipe	720	LF		
A16	12” PVC Stormwater Pipe	70	LF		
A17	4'-ID Storm Drain Manhole	9	EA		
A18	Lift Station	1	LS		
A19	Outlet Structure (2-1)	1	EA		
A20	42" Reinforced Concrete Pipe (RCP)	55	LF		
A21	36" Reinforced Concrete Pipe (RCP)	10	LF		
A22	18” Reinforced Concrete Pipe (RCP)	5	LF		
A23	12" Ductile Iron (DI) Pipe	10	LF		

Item No.	Description	Qty	Unit	Unit Price	Total Price
A24	24" Check Valve	1	EA		
A25	42" Check Valve	1	EA		
A26	Concrete Curb and Gutter	420	LF		
A27	Plantings	1	LS		
A28	HMA Cl. ½-inch PG 64-22 (Pavement Repair)	180	TON		
A29	Planning Bituminous Pavement	1370	SY		
A30	HMA Cl. 1/2-inch PG 70-22 (Overlay)	170	TON		
A31	Apprenticeship Utilization Adjustment	1	CALC	$5,000.00	$5,000.00
				Subtotal	$
				City of Port Townsend Sales Tax @ (9.40%)	$
				TOTAL BID SCHEDULE A	$

Schedule B – Boat Haven Boatyard Stormwater Improvement

Item No.	Description	Qty	Unit	Unit Price	Total Price
B1	Stormwater Treatment System Stage 4	1	LS		
				Subtotal	$
				City of Port Townsend Sales Tax @ (9.40%)	$
				TOTAL BID SCHEDULE B	$

BID SUMMARY

TOTAL BID SCHEDULE A	**$**
TOTAL BID SCHEDULE B	**$**
TOTAL BID PRICE (all schedules)	**$**

Failure to return this Declaration as part of the bid proposal package will make the bid nonresponsive and ineligible for award.

NON-COLLUSION DECLARATION

I, by signing the proposal, hereby declare, under penalty of perjury under the laws of the United States that the following statements are true and correct:

1. That the undersigned person(s), firm, association or corporation has (have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this proposal is submitted.
2. **That by signing the signature page of this proposal, I am deemed to have signed and to have agreed to the provisions of this declaration.**

NOTICE TO ALL BIDDERS

To report rigging activities call:

1-800-424-9071

The U.S. Department of Transportation (USDOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m., eastern time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of USDOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the USDOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

DOT Form 272-036H EF
Revised 5/06

FORM **CD-512**
(REV 05-17)

U.S. DEPARTMENT OF COMMERCE

CERTIFICATION REGARDING LOBBYING
LOWER TIER COVERED TRANSACTIONS

Applicants should review the instructions for certification included in the regulations before completing this form. Signature on this form provides for compliance with certification requirements under 15 CFR Part 28, "New Restrictions on Lobbying."

LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 15 CFR Part 28, for persons entering into a grant, cooperative agreement or contract over $100,000 or a loan or loan guarantee over $150,000 as defined at 15 CFR Part 28, Sections 28.105 and 28.110, the applicant certifies that to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in conncection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying." in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

Statement for Loan Guarantees and Loan Insurance

The undersigned states, to the best of his or her knowledge and belief, that:

In any funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to insure or guarantee a loan, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required statement shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above applicable certification.

NAME OF APPLICANT	AWARD NUMBER AND/OR PROJECT NAME
	Boat Haven Stormwater Improvement Project
PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE	
SIGNATURE	DATE

Certification of Compliance with Wage Payment Statutes

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date (October 30, 2024), the bidder is not a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

I declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

_____
Bidder's Business Name

_____
Signature of Authorized Official*

_____
Printed Name

_____
Title

_____ _____ _____
Date City State or country

Check One:
Sole Proprietorship ☐ Partnership ☐ Joint Venture ☐ Corporation ☐

State of Incorporation, or if not a corporation, State where business entity was formed:

_____

If a co-partnership, give firm name under which business is transacted:

_____

** If a corporation, proposal must be executed in the corporate name by the president or vice-president (or any other corporate officer accompanied by evidence of authority to sign). If a co-partnership, proposal must be executed by a partner.*

STATEMENT OF BIDDER'S QUALIFICATIONS AND PROPOSED SUBCONTRACTORS

(1) Bidder certifies that it has the following experience and qualifications:

1.1 Bidder's experience in this type and magnitude of Work, as outlined in the Bid Evaluation Section of Section 00 21 13 – Instruction to the Bidders:

1.2 Bidder's qualifications, including technical qualifications, to properly, timely and efficiently perform the Work:

(2) Bidder's References:

2.1 Financial:

2.2 Name and provide the current addresses, current telephone numbers and current email addresses of at least three persons that the Contracting Agency may contact to obtain information about bidder's prior work of this type:

(i)

(ii)

(iii)

(3) Schedule:

3.1 List any and all factors that might preclude bidder from meeting any part of the contract schedule and restrictions specified in the General Requirements Section 1.03; 1.04; 1.05:

(4) Subcontractors or Suppliers (performing/providing 15% or more of the work):

4.1 Subcontractors/Supplier's name, work item description and amount of work performed:

4.2 Bidders Subcontractor's/Supplier's experience in this type and magnitude of Work:

4.3 Bidders Subcontractor's/Supplier's qualifications, including technical qualifications, to properly, timely and efficiently perform the Work: _____

_____

_____

_____

_____

(5) Facilities/equipment that bidder will use to perform the Work:

_____

_____

_____

_____

_____

(8) Bidder certifies the following:

8.1 It has registered as a plan-holder on the Contract Agency's plan-holder list.

8.2 It has received, reviewed, and incorporated Addenda issued during the bid period.

Number of Addendums Received _____(Insert Number)

8.3 It has in place a proper safety and accident prevention program that for this Work fully complies with all safety orders, rules, regulations codes and requirements of all federal, state, and local governmental agencies that have jurisdiction over safety relating to the Work, including but not limited to federal OSHA and state WISHA.

8.4 It will require each of its subcontractors of any tier (if any) to have in place a proper safety and accident prevention program that meets or exceeds all requirements listed in 8.1 above.

8.5 It will strictly enforce all requirements of safety and accident prevention programs throughout the entire Work, including but not limited to all requirements relating to safety equipment, work rules, worker safety, written site-specific safety plans, safety meetings, safety inspections and all requirements to assure the safety of all work sites, all workers, all Contracting Agency employees and/or representatives, and the general public.

8.6 It will strictly comply with and ensure that all subcontractors and suppliers of any tier will strictly comply with all requirements of Section 00 73 19 Health and Safety Provisions.

8.7 It will defend, indemnify and hold the Contracting Agency harmless from any and all consequences of any failure by it or any of its subcontractors to fully comply with all the requirements of Section 00 72 00 General Conditions.

8.8 It will meet Responsibility requirements as outlined in 39.04.350 RCW and stated in the Bid Evaluation Section of 00 21 13 - Instruction to Bidders.

8.9 All costs for developing bids will be borne by each bidder. The Contracting Agency is not responsible for any compensation for costs incurred as a result of compiling a bid.

I represent and warrant that the data provided above is true and accurate.

SIGNATURES

_____
Name of Firm

_____
Signature By (Type or Print) Title Date

_____
Mailing Address City State Zip Code

_____
Telephone Number E-mail

Washington State Contractor's License No._____

Date of Issue _____ Expiration Date

Legal Formation (sole proprietor, partnership, corporation, joint venture, etc.) _____

Federal Tax ID No. _____

Bids submitted without a signature will be determined non-responsive, In accordance with Specifications Section 00 21 13, paragraph 3.04

KNOW ALL MEN BY THESE PRESENT:

That we, _____, as Principal, and _____, as Surety, are held and firmly bound unto the PORT OF PORT TOWNSEND as Obligee, in the penal sum of _____ Dollars, for the payment of which the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigned, jointly and severally, by these present.

The condition of this obligation is such that if the Obligee shall make any award to the Principal for completion of the Boat Haven Boatyard Stormwater Improvement project, according to the terms of the proposal or bid made by the Principal therefore, and the Principal shall duly make and enter into a contract with the Obligee in accordance with the terms of said proposal or bid and award and shall give bond for the faithful performance thereof, with Surety or Sureties approved by the Obligee; or, if the principal shall, in case of failure to do so, pay and forfeit to the Obligee the penal amount of the deposit specified in the call for bids, then this obligation shall be null and void; otherwise it shall be and remain in full force and effect and the Surety shall forthwith pay and forfeit to the Obligee, as penalty and liquidated damages, the amount of this bond.

SIGNED, SEALED AND DATED THIS _____ day of_____, 202____.

BY _____
Principal

BY _____
Surety

_____
Agent and Address

Note: Bidder may submit surety's bid bond form, provided it is similar in substance, made out in the name of the Port of Port Townsend, and that the agent's name and address appear as specified. **Bonds containing riders limiting responsibility for toxic waste or limiting the term of responsibility will be rejected.**

Boat Haven Boatyard Stormwater Improvement

Project No. BH-01-008

THIS AGREEMENT entered into this _____ day of _____ 202____ by and between the Port of Port Townsend, a municipal corporation of Jefferson County, Washington, hereinafter called the Contracting Agency, and _____, hereinafter called the Contractor.

WHEREAS the Contracting Agency, by authority in it vested, has awarded the Contractor a contract for furnishing all the labor, equipment, materials and services necessary to complete the work described in the Contract Documents, on the Port of Port Townsend properties. This work will be accomplished as bid, for the contract sum of _____ **AND /100 DOLLARS ($0.00)**, including Washington State Sales Tax. This work will be performed in accordance with the Contract Documents and the bid of the Contractor. The Contractor has accepted such award and said Contract Documents and bid are made a part hereof as though fully set out herein.

NOW THEREFORE, this Agreement has been executed in duplicate as of the date first written above, as authorized by the Port Commission in regular session on the ____ day of _____ 202____.

PORT OF PORT TOWNSEND	**CONTRACTOR**
Eron Berg Executive Director	Name: Title: Company:

PERFORMANCE BOND

CONTRACTOR:
(Name, legal status and address)

_____

_____

_____

_____

SURETY:
(Name, legal status and principal place of business)

_____

_____

_____

_____

CONSTRACTING AGENCY:
Port of Port Townsend
P.O. Box 1180
Port Townsend, WA 98368

CONSTRUCTION CONTRACT:
Date: _____

Amount: $_____

Description: _____

_____

_____

BOND:

Date: _____

(Not earlier than Construction Contract Date)

Amount: $_____

Modifications to this Bond: ☐ None ☐ See Section 13

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)

Signature: _____

Name & Title: _____

SURETY:
Company: (Corporate Seal)

Signature: _____

Name & Title: _____

(Any additional signatures appear on the last page of this Payment Bond)

(FOR INFORMATION ONLY – Name, address and telephone)

AGENT or BROKER:

CONTRACTING AGENCY'S REPRESENTATIVE:
(Contracting Agency, Architect, Engineer or other Agent)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Contracting Agency for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Contracting Agency Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

1. the Contracting Agency first provides notice to the Contractor and the Surety that the Contracting Agency is considering declaring a Contractor Default. Such notice shall indicate whether the Contracting Agency is requesting a conference among the Contracting Agency, Contractor and Surety to discuss the Contractor's performance. If the Contracting Agency does not reuest a conference, the Surety may, whtin five (5) business days after receipt of the Contracting Agency's notice, request such a conference. If The Surety timely requests a conference, the Contracting Agency shall attend. Unless the Contracting Agency agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Contracting Agency's notice. If the Contracting Agency, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Contracting Agency's right, if any, subsequently to declare al Contractor Default;
2. the Contracting Agency declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
3. the Contracting Agency has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Contracting Agency to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Contracting Agency has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Contracting Agency, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Contracting Agency for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Contracting Agency and an contractor selected with the Contracting Agency's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Contracting Agency the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Contracting Agency as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

1. After investigation, determine the amount for which it may be liable to the Contracting Agency and, as soon as practicable after the amount is determined, make payment to the Contracting Agency; or
2. Deny liability in whole or in part and notify the Contracting Agency, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Contracting Agency to the Surety demanding that the Surety perform its obligations under this Bond, and the Contracting Agency shall be entitled to enforce any remedy available to the Contracting Agency. If the Surety proceeds as provided in Section 5.4, and the Contracting Agency refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Contracting Agency shall be entitled to enforce any remedy available to the Contracting Agency.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Contracting Agency shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Contracting Agency to the Surety shall

not be greater than those of the Contracting Agency under the Construction Contract. Subject to the commitment by the Contracting Agency to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
2. additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Contracting Agency or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Contracting Agency or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Contracting Agency or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 **Definitions**

§ 14.1 **Balance of the Contract Price**. The total amount payable by the Contracting Agency to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Contracting Agency in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 **Construction Contract**. The agreement between the Contracting Agency and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 **Contractor Default**. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 **Contracting Agency Default**. Failure of the Contracting Agency, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 C**ontract Documents.** All the documents that comprise the agreement between the Contracting Agency and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Contracting Agency shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____

Name & Title: _____

SURETY:
Company: *(Corporate Seal)*

Signature: _____

Name & Title: _____

PAYMENT BOND

CONTRACTOR:
(Name, legal status and address)

_____

_____

_____

_____

SURETY:
(Name, legal status and principal place of business)

_____

_____

_____

_____

CONTRACTING AGENCY:
Port of Port Townsend
P.O. Box 1180
Port Townsend, WA 98368

CONSTRUCTION CONTRACT:
Date: _____

Amount: $_____

Description: _____

_____

_____

BOND:

Date: _____

(Not earlier than Construction Contract Date)

Amount: $_____

Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)

Signature: _____

Name & Title: _____

SURETY:
Company: (Corporate Seal)

Signature: _____

Name & Title: _____

(Any additional signatures appear on the last page of this Payment Bond)

(FOR INFORMATION ONLY – Name, address and telephone)

AGENT or BROKER:

CONTRACTING AGENCY'S REPRESENTATIVE:
(Contracting Agency, Architect, Engineer or other Agent)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Contracting Agency to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms:

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Contracting Agency from claims, demends, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Contracting Agency Default under the Construction Contract, the Surety's obligation to the Contracting Agency under this Bond shall arise after the Contracting Agency has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Contracting Agency or the Contracting Agency's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Contracting Agency has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Contracting Agency against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claims, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Contracting Agency to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Contracting Agency, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to dsicharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Contracting Agency to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Contracting Agency accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Contracting Agency's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Contracting Agency, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Contracting Agency shall not be liable for the payment of any costs or expenses of any Claimant under this

Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the State in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Contracting Agency or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Contracting Agency shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 **Claim.** A written statement by the Claimant including at a minimum:

.1 the name of the Claimant;
.2 the name of the person for whom the labor was done, or materials or equipment furnished;
.3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
.4 a brief description of the labor, materials or equipment furnished;
.5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
.6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
.7 the total amount of previous payments received by the Claimant; and
.8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 **Claimant.** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 **Construction Contract.** The agreement between the Contracting Agency and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16,4 **Contracting Agency Default.** Failure of the Contracting Agency, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 **Contract Documents**. All the documents that comprise the agreement between the Contracting Agency and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Contracting Agency shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____

Name & Title: _____

SURETY:
Company: *(Corporate Seal)*

Signature: _____

Name & Title: _____

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS
Section 00 72 00 – General Conditions

ARTICLE G-01	ABBREVIATIONS AND DEFINITIONS OF TERMS	
	G-1.01	Abbreviations
	G-1.02	Definitions
	G-1.03	Titles or Headings
ARTICLE G-02	INTENT, CORRELATION, AND EXECUTION OF THE CONTRACT DOCUMENTS	
	G-02.01	Intent of the Contract Documents
	G-02.02	Correlation of the Contract Documents
	G-02.03	Ownership of the Contract Documents
	G-02.04	No Warranties by the Port
ARTICLE G-03	PORT OF PORT TOWNSEND	
	G-03.01	Authority of the Project Manager and the Engineer
	G-03.02	Administration of the Contract
	G-03.03	Information Provided by the Port
	G-03.04	Review of Working Drawings, Product Data Samples and Other Submittals
	G-03.05	Contracting Agency's Right to Carry Out Other Work
	G-03.06	Officers and Employees of the Contracting Agency Have No Personal Liability
	G-03.07	Service of Notices on the Contractor
ARTICLE G-04	CONTRACTOR'S RESPONSIBILITIES	
	G-04.01	Examination of the Site of Work and Contract Documents
	G-04.02	Error, Inconsistency, Omission or Variance in the Contract Documents
	G-04.03	Supervision and Construction Procedures
	G-04.04	Contractor to Provide all Labor, Materials, and Equipment
	G-04.05	Prevailing Wage Rates to be Paid
	G-04.06	Materials and Equipment to be New
	G-04.07	Substitutions of Materials or Equipment
	G-04.08	Disposal of Demolished or Excavated Materials
	G-04.09	Warranties
	G-04.10	State and Local Taxes
	G-04.11	Permits, Licenses, Fees and Notices
	G-04.12	Utilities and Similar Facilities
	G-04.13	Contractor to Comply with All Laws
	G-04.14	Safety
	G-04.15	Disruption Caused by Labor or other Disputes
	G-04.16	Progress Schedule

	G-04.17	On-Site Documents
	G-04.18	Working Drawings, Product Data, Samples, and other Submittals
	G-04.19	Cutting, Fitting, and Patching of Work
	G-04.20	Inspection of the Work
	G-04.21	Uncovering of Work
	G-04.22	Correction of Work
	G-04.23	Responsibility for Work
	G-04.24	Hazardous Materials
	G-04.25	Clean Up
	G-04.26	Protection of Work During Suspension
	G-04.27	Survey
	G-04.28	Archeological Items
	G-04.29	Gratuities
	G-04.30	Notice and Detailed Breakdown of Claim
	G-04.31	Prerequisite to Suit
	G-04.32	Responsibility for Damage
	G-04.33	Indemnification
	G-04.34	Apprenticeship Utilization Requirements
ARTICLE G-05	SUBCONTRACTORS AND SUPPLIERS	
	G-05.01	Contractor is Responsible for Actions of Subcontractors and Suppliers
	G-05.02	Award of Contracts to Subcontractors and Suppliers
	G-05.03	Subcontractor and Supplier Relations
ARTICLE G-06	NON-DISCRIMINATION	
	G-06.01	Comply with All Laws
	G-06.02	M/WBE Participation
ARTICLE G-07	TIME	
	G-07.01	Contract Time
	G-07.02	Hours of Work
	G-07.03	Extension of Contract Time
	G-07.04	Liquidated Damages
ARTICLE G-08	PAYMENTS, COMPLETION AND FINAL ACCEPTANCE	
	G-08.01	All Payments Subject to Applicable Laws
	G-08.02	Scope of Payment
	G-08.03	Retained Percentage (Retainage)

	G-08.04	Progress Payments
	G-08.05	Payment for Stored Materials
	G-08.06	Payment for Work Done on a Force Account Basis
	G-08.07	Payment for Changes
	G-08.08	Substantial Completion
	G-08.09	Final Completion
	G-08.10	Completion of Punch List
	G-08.11	Final Acceptance
	G-08.12	Final Payment
	G-08.13	Payments Do Not Relieve Contractor From Responsibility For Work
ARTICLE G-09	CHANGES IN THE WORK	
	G-09.01	The Contracting Agency May Make Changes
	G-09.02	Request for Proposal
	G-09.03	Compensation for Changes
	G-09.04	Issuance of Change Order
	G-09.05	Procedure for Protest by the Contractor
	G-09.06	Changed Conditions
ARTICLE G-10	PORT OF PORT TOWNSEND'S RIGHTS AND REMEDIES, AND TERMINATION OF CONTRACT	
	G-10.01	General
	G-10.02	No Waiver of Contracting Agency's Rights
	G-10.03	Contracting Agency's Right to Suspend Work for Unsuitable Weather and other Condition
	G-10.04	Contracting Agency's Right to Stop the Work
	G-10.05	Contracting Agency's Right to Withhold Payment
	G-10.06	Termination of Contract for Cause
	G-10.07	Termination for Convenience
	G-10.08	Damages for Unexcused Delays by the Contractor
	G-10.09	Contracting Agency's Right to Use the Premises
	G-10.10	Prevailing Party to be Awarded Litigation Expenses
ARTICLE G-11	BONDS AND INSURANCE	
	G-11.01	Performance Bond
	G-11.02	Payment Bond
	G-11.03	Failure to Provide Bonds
	G-11.04	Insurance

ARTICLE G-01
ABBREVIATIONS AND DEFINITIONS OF TERMS

Whenever, in the Contract Documents, or elsewhere in the Project Manual, the following abbreviations, words, and defined terms are used, the meaning will be as follows, which meaning shall be applicable to both the singular and plural forms thereof:

G-01.01 Abbreviations

ACI	American Concrete Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISE	Association of Iron and Steel Engineers
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
AGC	Associated General Contractors of America
CPM	Critical Path Method of Project Scheduling
CRSI	Concrete Reinforcing Steel Institute
ECY	Department of Ecology
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
IBC	International Building Code
IEEE	Institute of Electrical and Electronic Engineers
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NRC	National Response Center
OFCCP	Office of Federal Contract Compliance Programs
ORCAA	Olympic Region Clean Air Agency
OSHA	Occupational Safety and Health Act

PCA	Portland Cement Association
POPT	Port of Port Townsend
SMACNA	Sheet Metal & Air Conditioning Contractors' National Association, Inc.
UL	Underwriter's Laboratory
USACE	United States Army Corps of Engineers
WDFW	Washington Department of Fish and Wildlife
WISHA	Washington Industrial Safety & Health Act
WSDOT	Washington State Department of Transportation

G-01.02 Definitions

Addendum	A written or graphic document issued by the Contracting Agency prior to the opening of bids that clarifies, corrects, or changes a document contained or referenced within the Contract Documents. Addenda will be distributed to plan holders of record.
Agreement	A written form executed by the Contracting Agency and the Contractor that binds the Contractor to perform the Work in accordance with the Contract.
Bid	The offer of a bidder, on the prescribed bid form, properly executed, setting forth the price or prices for the Work to be performed.
Change Order	A written document issued by the Contracting Agency on or after the date of the execution of the Agreement that authorizes and directs an addition, deletion, or other revision in the Work, or an adjustment in the Contract Time or Contract Sum.
Contract	The Contract is the legal relationship between the Contracting Agency and the Contractor, and describes the rights, duties and obligations of each as set forth in the Contract Documents.
Contracting Agency	The Port of Port Townsend. The term Contracting Agency also includes all of the Port's commissioners, officers, employees and other authorized representatives.
Contract Bonds	The approved form of security in the form of a Performance Bond and a Payment Bond, furnished by the Contractor and its surety as required by the Contract Documents.
Contract Documents	The Contract Documents consist of the advertisement for bids, instructions to bidders, Agreement, the Plans, Drawings, Specifications, General Conditions, Supplementary Conditions, Addenda, Change Orders, form of bond, insurance certificates, the bid form and any other form indicated by the Contracting Agency as being part of the Contract Documents. Words and abbreviations that have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.
Contract Sum	The Contract Sum stated in the Agreement Form as amended by Change Order is the total amount payable by the Contracting Agency to the Contractor for performance of the Work in accordance with the Contract

	Documents. The Contract Sum does not include state or local sales tax on the transaction between the Contracting Agency and the Contractor.
Contract Time	Contract Time is the period of time provided in the Contract Documents for the performance of the Work by the Contractor. Contract Time may be changed only by way of Change Order.
Contractor	The Contractor is the individual, partnership, firm, corporation, joint venture, or other business entity identified as such in the Agreement which has agreed to perform the Work in accordance with the Contract Documents.
Day	The term Day shall mean a calendar day unless otherwise specifically designated.
Drawings	The graphic presentation of the Work, or parts thereof, which indicates the size, form, location, and arrangement of the various elements of the Work.
Engineer	The Contracting Agency representative who directly supervises the engineering and administration of a construction Contract. Contracting Agency
Final Acceptance	The official act of the Port of Port Townsend Commission as described in Article G-08.
Final Completion	When all Work specified in the Contract Documents is completed and all obligations of the Contractor under the contract are fulfilled by the Contractor occurs as set forth in Article G-08.
Final Payment	Is the payment to be made to the Contractor in accordance with Article G 08.12.
Force Account Work	Is Work performed on a reimbursable basis as set forth in Article G 08.06.
Hazardous Materials	The term "Hazardous Materials" means any hazardous or toxic substances, materials and wastes listed in the United States Department of Transportation Hazardous Materials Table (49 CFR 172.101) or listed by the Environmental Protection Agency as hazardous substances (40 CFR Part 302) and any amendments thereto, and any substances, materials or wastes that are or become regulated under federal, state or local law. Hazardous Materials (or substances) shall also include, but not be limited to: regulated substances, petroleum products, pollutants, and any and all other environmental contamination as defined by, and in any and all federal, state and/or local laws, rules, regulations, ordinances or statutes now existing or hereinafter enacted relating to air, soil, water, environmental or health and safety conditions.
Inspector	The Engineer's authorized representative assigned to make inspections of the Contractor’s performance of the Work.
In-Water Work	Is Work that has the potential to create turbidity or create underwater noise occurring below the water surface and is therefore subject to the limitations of the in-water work window from September 15 to January 15 during two consecutive construction seasons. The limitation does not apply to equipment that operates under USCG rules for vessels.

Liquidated Damages	The amount of money set forth in the Contract Documents, if any, for failure of Contractor to comply with certain provisions of the Contract Document.
Notice to Proceed	The written notice from the Contracting Agency to the Contractor authorizing and directing the Contractor to proceed with the Work and establishing the date on which Contract time begins.
Physical Completion	Physical Completion occurs when all Work required as a whole, or a designated portion thereof is complete in accordance with the Contract Documents as set forth in Section G-08. All documentation required by the Contract and required by law does not necessarily need be furnished by the Contractor by this date.
Project Manager	The authorized representative for the Contracting Agency who is located on or near the project site and assigned immediate charge of the on-site administration of the construction project.
Plans	The concept or mental formulation for the Work. The plans may be represented graphically by drawings, by the written words within the Contract Documents, or both.
Product Data	The illustrations, standard schedules, performance charts, brochures, diagrams, and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the Work.
Project	The particular Work described in the Contract Documents.
Provide	The all-inclusive actions required to furnish, install, connect, adjust, test, and make ready for use or occupancy.
Punch List	Shall have the meaning set forth in Section G-.08.08.
Samples	Physical examples illustrating materials, equipment or workmanship and establishing standards by which the Work will be judged.
Schedule of Prices	Means the unit prices set forth in the Contract Documents.
Shop Drawings	Same as “Working Drawings” as defined in these General Conditions.
Specifications	Those portions of the Contract Documents consisting of the written technical descriptions of materials, equipment, construction systems, standards, workmanship and other requirements which govern the quality and performance of the Work.
Subcontractor	A Subcontractor is a business entity that has an agreement with the Contractor to perform a portion of the Work. The term "Subcontractor" means and includes the Subcontractor and its authorized representatives.
Sub-subcontractor	A Sub-subcontractor is a business entity that has an agreement with a Subcontractor to perform a portion of the Work. The term Sub subcontractor means and includes the Sub-subcontractors at all tiers.
Substantial Completion	Substantial Completion occurs when the Work as a whole or a designated portion thereof is sufficiently complete, in accordance with the Contract Documents, so that the Contracting Agency can use or occupy the Work or a designated portion thereof for the use for which the Contracting Agency intended and the requirements set forth in G-08have been satisfied.

Supplementary Conditions	That portion of the Contract Documents that amends or supplements these General Conditions.
Supplier	A vendor, supplier, distributor, or materialman that supplies material or equipment used in the performance of the Work.
Unit Price Work	Work to be paid for on the basis of unit prices stated in the Schedule of Prices or a Change Order, if any. Such Work to be measured for payment as described within the Contract Documents.
Work	All services, labor, materials, equipment, and incidentals necessary for the complete and successful completion of the work and service required by, or reasonably inferable from, the Contract Documents, including all materials and equipment to be incorporated in the construction, all as set forth in the Contract Documents.
Working Drawings	Shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, stress diagrams, bending diagrams for reinforcing steel, or other diagrams, plans, or data used to illustrate some portion of the Work which the Contractor is required to submit to the Engineer for approval.
WSDOT Standard Specifications	Refers to the “Standard Specifications for Road, Bridge, and Municipal Construction”, most recent publication, by the Washington Department of Transportation.

G-01.03 Titles or Headings

The titles or headings of the sections, divisions, parts, articles, paragraphs, or subparagraphs, of the specifications are intended only for convenience of reference and shall not be considered as having any bearing on the interpretation of the text.

ARTICLE G-02

INTENT, CORRELATIONS, AND EXECUTION OF CONTRACT DOCUMENTS

G-02.01 Intent of the Contract Documents

A. The intent of the Contract Documents is to prescribe a complete Work. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary and appropriate to complete all parts of the Work. Compensation for the cost of furnishing the foregoing and for full performance of the Work in full conformance with the Contract Documents is included in the Contract Sum.

B. The Contract Documents which set forth the rights and responsibilities of the Contracting Agency and the Contractor shall be construed in accordance with the laws of the state of Washington. Exclusive jurisdiction and venue for any action between the Contracting Agency and the Contractor, arising out of or in connection with the Project, shall be the Superior Court in Jefferson County, Washington.

C. The Contract represents the entire and integrated agreement between the Contracting Agency and the Contractor. It supersedes all prior discussions, negotiations, representations or agreements pertaining to the Work, whether written or oral.

G-02.02 Correlation of the Contract Documents

A. Each Contract Document is an essential part of the Contract between the Contracting Agency and the Contractor, and a requirement present in one Contract Document is binding as though it was present in all. The Contract Documents are intended to be complementary and prescribe and provide for all Work required by the Contract Documents. Anything mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both. Any Work, materials or equipment that has not been specifically included in the Contract Documents but which is reasonably required to produce the intended result shall be provided by the Contractor as though it had been specifically included.

B. Conditions or Work not covered by the specifications may be described in other Contract Documents and shall be performed by the Contractor in accordance therewith and in accordance with the Specifications insofar as applicable. Work required by the Contract Documents for which a separate price is not provided in the Contract Documents shall nevertheless be considered as a part of the Work and all costs of the same are deemed to be included in the Contract Sum.

C. The drawings listed in the General Conditions indicate only such details as are necessary to give a comprehensive idea of the Work. The Engineer may furnish to the Contractor such additional drawings and clarifications, consistent with the purpose and intent of the Contract Documents, as the Engineer may deem necessary to detail and illustrate the Work. The Contractor shall conform its Work to such drawings and explanations. The furnishing of such additional drawings or clarifications shall not entitle the Contractor to an increase in the Contract Time or Contract Sum.

D. If there are discrepancies between the various Contract Documents, Specifications shall govern over conditions and Drawings, Drawings shall govern over conditions, larger scale drawings shall govern over smaller scale drawings, Supplementary Conditions shall govern over General Conditions, computed dimensions shall govern over scaled dimensions, and specific descriptions shall govern over general ones.

E. In the event of a conflict between the Contract Documents and applicable laws, codes, ordinances, regulations or orders of governmental authorities having jurisdiction over the Work or any portion thereof, or in the event of any conflict between such applicable laws, codes, ordinances, regulations, or orders, the most stringent requirements of any of the above shall govern and be considered as a part of this Contract in order to afford the Contracting Agency the maximum benefits thereof.

F. The organization of the Specifications and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of the Work to be performed by any trade. The

Contracting Agency assumes no responsibility to act as arbiter in the division and proper coordination of Work between particular Subcontractors or workers.

G. Contract Drawings: The following drawings are a part of the Contract Documents.

DRAWING LIST	
DWG NO.	DESCRIPTION
C-002	CIVIL LEGEND
C-101	EROSION AND SEDIMENT CONTROL PLAN AND NOTES
C-102	EROSION AND SEDIMENT CONTROL DETAILS
C-201	STORMWATER CONVEYANCE PLAN AND PROFILE 8" SDFM - STA 1+00 TO STA 5+00
C-202	STORMWATER CONVEYANCE PLAN AND PROFILE 8" SDFM - STA 5+00 TO STA 9+50
C-203	STORMWATER CONVEYANCE PLAN AND PROFILE 8" SDFM - STA 9+50 TO END
C-204	STORMWATER CONVEYANCE PLAN AND PROFILE 18" SD - STA 3+00 TO STA 7+50
C-205	STORMWATER CONVEYANCE PLAN AND PROFILE 18" SD - STA 3+00 TO 0+00
C-206	STORMWATER CONVEYANCE PLAN AND PROFILE 36" SD - STA 50+00 TO END
C-301	GRADING PLAN
C-302	STORMWATER TREATMENT PLAN
C-303	STORMWATER TREATMENT SECTIONS
C-304	CHITOSAN CONTACT MANIFOLD PLAN, SECTIONS, AND DETAILS
C-305	STORMWATER TREATMENT CHAMBER PLAN AND SECTION ENLARGEMENT - I
C-306	STORMWATER TREATMENT CHAMBER PLAN AND SECTION ENLARGEMENT - II
C-500	STORMWATER TREATMENT DETAILS
C-501	CIVIL DETAILS - I
C-502	CIVIL DETAILS - II
L-001	BIOFILTRATION PLANTING PLAN, DETAILS, AND NOTES
S-001	STRUCTURAL GENERAL NOTES
S-101	STRUCTURAL KEY MAP
S-102	STORMWATER TREATMENT SYSTEM PLAN
S-103	STORMWATER TREATMENT SYSTEM SECTIONS - I
S-104	STORMWATER TREATMENT SYSTEM SECTIONS - II
S-105	STORMWATER TREATMENT SYSTEM DETAILS-I
S-106	STORMWATER TREATMENT SYSTEM DETAILS-II
I-001	INSTRUMENTATION LEGEND AND NOTES
I-101	INSTRUMENTATION DETAILS
I-201	P&ID STORMWATER LIFT STATION
M-001	MECHANICAL ABBREVIATIONS AND NOTES
M-101	STORMWATER LIFT STATION PLAN AND SECTION
E-001	ELECTRICAL ABBREVIATIONS AND NOTES
E-002	ELECTRICAL LEGEND - I

E-003	ELECTRICAL LEGEND - II
E-100	ELECTRICAL OVERALL SITE PLAN
E-101	STORMWATER LIFT STATION PLAN
E-201	ELECTRICAL DETAILS
E-301	SINGLE-LINE DIAGRAM
E-302	LIFT STATION CONTROL SCHEMATIC
E-303	PANELBOARD SCHEDULES

G-02.03 Ownership of the Contract Documents

The Contract Documents furnished to the Contractor shall remain Contracting Agency property and the Contracting Agency shall retain all intellectual property rights, including copyrights in the same. They are to be used only with respect to this Project and are not to be used on any other project.

G-02.04 No Warranties by the Contracting Agency

A. Any "bid quantities" set forth in the bid form are estimates only, being given only as a basis for the comparison of bids by the Contracting Agency. The Contracting Agency does not warrant either expressly or by implication that the actual amount of Work will correspond to those estimates. The right to increase or decrease the amount of any class or portion of the Work, or to make other changes in the Work, is reserved by the Contracting Agency in Article G-09. The basis of payment will be the actual quantities performed in accordance with the Contract Documents.

B. No information derived from inspection of records or reports of investigation concerning the Work or conditions (including soil or sub-surface conditions) at the site(s) of the Work made or provided by the Contracting Agency will in any way relieve the Contractor from its responsibility for properly performing its obligations under the Contract Documents. Such records and reports are provided solely for the convenience of the Contractor with no warranties whatsoever, express or implied, by the Contracting Agency. Such records and reports are not part of the Contract Documents. The Contractor shall make its own conclusions and interpretations from the data supplied, information available from other sources, and the Contractor's own observations.

ARTICLE G-03
PORT OF PORT TOWNSEND (CONTRACTING AGENCY)

G-03.01 Authority of the Project Manager and the Engineer

A. The Project Manager will be the Contracting Agency's representative and shall administer the Contract Documents in coordination with the Engineer, except that Final Acceptance as provided for in Article G-08 shall be accomplished by the Port of Port Townsend Commission, unless the authority to grant Final Acceptance of the Work has been delegated to a Contracting Agency official in which case Final Acceptance shall be accomplished by such official. The Project Manager has the authority to enforce all obligations imposed on the Contractor by the Contract Documents.

B. The Work shall be performed in accordance with the Contract Documents. The Project Manager and the Engineer have the authority but not the obligation to reject Work that is defective or does not otherwise conform to the Contract Documents.

C. Neither the Project Manager nor the Engineer shall be responsible for, or have control or charge of the means, methods, techniques, sequences, or procedures of construction, or for safety precautions or programs incidental thereto, these being the sole responsibility of the Contractor. Neither the Project Manager nor the Engineer will be responsible for or have any control or charge of the acts or omissions of the Contractor,

Subcontractors, Sub-subcontractors, suppliers, or any of their agents or employees, or any other persons performing a portion of the Work.

G-03.02 Administration of the Contract

A. Nothing in this Article or elsewhere in the Contract Documents shall be construed as requiring the Project Manager, Engineer, Inspector, or other representative of the Contracting Agency to direct or advise the Contractor as to the method or manner of performing the Work. No approval or advice given by the Contracting Agency as to the method or manner of performing the Work or procuring materials to be furnished shall constitute a representation or warranty by the Contracting Agency that the result of such method or manner will conform to the Contract Documents or achieve the desired results. Such approval or advice shall neither relieve the Contractor of any of its obligations under the Contract nor create any liability to the Contracting Agency on account of approval or advice.

B. The Project Manager, Engineer, or Inspectors may call to the attention of the Contractor defective Work or Work that does not conform otherwise to the Contract Documents. However, the failure of the Project Manager, Engineer, or Inspectors to so inform the Contractor shall not constitute approval or acceptance of such defective or non-conforming Work.

C. The presence of the Project Manager, Engineer or Inspector during the progress of any construction does not relieve the Contractor from responsibility for defects in the Work, nor does it bind the Contracting Agency in determining Final Completion of the Work.

D. Work done or material furnished which at any time is found not to conform to the requirements of the Contract Documents shall be at the Contractor's risk and expense and shall furnish no basis for an increase in the Contract Sum or Contract Time, even though the Project Manager, Engineer or Inspector fails to reject such Work or material.

G-03.03 Information Provided by the Contracting Agency

The Contracting Agency will furnish the Contractor, without charge, up to three (3) additional copies of Drawings and Specifications, and one (1) electronic copy in .pdf format.

G-03.04 Review of Working Drawings, Product Data, Samples and Other Submittals

A. Review by the Project Manager or Engineer of the Contractor's working drawings, product data, or samples shall not relieve the Contractor of full responsibility for the accuracy of dimensions and details. Such review shall likewise not constitute acceptance by the Project Manager or Engineer of the correctness or adequacy of such submittals, nor shall it constitute a representation or warranty by the Project Manager or Engineer that the drawings will satisfy the requirements of the Contract. The Project Manager's, or Engineer's, review of a submittal shall not relieve the Contractor from responsibility for errors or omissions in the submittals.

B. The Project Manager and/or Engineer will not review submittals that depend for their review on other submittals not yet submitted, that are not required by the Contract Documents, or that are not submitted by the Contractor.

G-03.05 Contracting Agency's Right to Carry Out Other Work

The Contracting Agency reserves the right at all times to perform, or cause to be performed, other and additional work on or near the site of the Project. Should such other or additional work or Contracting Agency operations be either underway or subsequently undertaken at or near the Project, the Contractor shall coordinate its activities with those of all other work forces and conduct its activities to avoid or minimize any conflict between the operations of the Contractor and those persons performing the other or additional work or operations.

G-03.06 Officers and Employees of the Contracting Agency Have No Personal Liability

Neither the Commissioners, Project Manager, Engineer, Inspector, nor any other officer, employee or agent of the Contracting Agency, acting within the scope of their employment, shall be personally liable to Contractor for any of their acts or omissions arising out of the Project.

G-03.07 Service of Notices on the Contractor

Any written notice required under the Contract Documents to be given to the Contractor may, at the option of the Contracting Agency, be served on the Contractor by personal service, electronic or facsimile transmission, or private courier delivery of the notice to the last address provided in writing to the Project Manager or Engineer. For the purpose of measuring time in determining the parties' rights and obligations with respect to notice given pursuant to the Contract Documents (other than that given by the personal service) is conclusively presumed to be received by the Contractor on the next business day following the Contracting Agency's electronic or facsimile transmittal or delivering it to the private courier.

ARTICLE G-04
CONTRACTOR'S RESPONSIBILITIES

G-04.01 Examination of the Site of Work and Contract Documents

A. By executing the Contract, the Contractor represents that it has carefully examined and investigated the site(s) of the Work, including material site(s), and the Contract Documents. The submission of its Bid shall be conclusive evidence that the Contractor represents and acknowledges that it has made such examinations and investigations and is satisfied as to the conditions to be encountered in the performance of the Work, including the character, quantity, quality, and scope of the Work, safety precautions to be undertaken, the quantities and qualities of materials to be supplied, the character of soils and subsurface materials, and equipment and labor to be used, the requirements of all Contract Documents and how all such requirements correlate to the conditions at the site(s) of the Work.

B. The Contractor shall determine from careful examination of the Contract Documents and the site of the Work, the methods, materials, labor, and equipment required to perform the Work in full, and the Contractor shall reflect the same in its Bid.

G-04.02 Error, Inconsistency, Omission or Variance in the Contract Documents

The Contractor shall carefully study and compare the Contract Documents and shall promptly report to the Engineer any error, inconsistency, omission, or variance in the Contract Documents or from applicable laws, statutes, codes, ordinances, or regulations which are discovered by the Contractor. If the Contractor promptly reports such discovery prior to commencement of any portion of the Work affected by any such error, inconsistency, omission, or variance, the Contractor shall not be liable to the Contracting Agency for damage resulting from such error, inconsistency, omission, or variance. If, however, the Contractor fails either to carefully study and compare the Contract Documents, or to promptly report the discovery of any error, inconsistency omission, or variance known or believed by the Contractor to exist, the Contractor shall assume full responsibility therefore and shall bear all costs, liabilities and damages attributable to such error, inconsistency, omission, or variance.

G-04.03 Supervision and Construction Procedures

A. The Contractor shall supervise and direct the Work using its best efforts, skills and attention. The Contractor shall be solely responsible for, and shall have full control and charge of construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract, including the Work of Subcontractors, Sub-subcontractors, Suppliers, and all other persons performing a portion of the Work. The Contractor is for all purposes an independent contractor and not an agent or employee of the Contracting Agency.

B. The Contractor may not assign any portion of this Contract without the Contracting Agency's prior written consent.

C. The Contractor shall be fully responsible to the Contracting Agency for the acts or omissions of its employees, agents, Subcontractors, Sub-subcontractors, Suppliers, and their agents and employees, and all other persons who are to perform any of the Work.

D. The Contractor shall keep a competent resident superintendent at the site of the Work continuously during its progress. Within ten (10) Days after receipt of the Notice of Award, the Contractor shall designate in writing who such superintendent shall be. The superintendent shall not be replaced without prior written notice to the Contracting Agency. The superintendent shall be experienced, capable of understanding and familiar with the Work, and able to properly supervise performance of the Work. The superintendent shall be the Contractor's representative and shall have authority to act on behalf of and bind the Contractor with respect to this Contract, except that the Contractor may indicate, in writing, limits on the authority of the superintendent. Communications or notices directed or given to the superintendent shall be as binding as if given to the Contractor.

E. All Work shall be performed under the continuous supervision of competent and skilled personnel experienced in the tasks being performed. All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

F. The Contractor shall at all times enforce strict discipline and good order among all workers on the Project. The Contractor shall immediately remove incompetent, careless, or negligent workers from the performance of the Work.

G. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the Work to full completion in the manner and time required by the contract, plans and specifications.

H. Any person employed by the Contractor or by any subcontractor who violates any operational regulations and, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the Work without approval of the Engineer.

I. Should the Contractor fail to remove such persons or person, or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work, the Engineer may suspend the Work by written notice until compliance with such orders.

J. All equipment proposed for use on the Work shall be of sufficient size and in such mechanical condition as to meet requirements of the Work and to produce a satisfactory quality of Work. Equipment used on any portion of the Work shall be such that no damage to previously completed Work, adjacent property, or existing facilities will result from its use.

K. When the methods and equipment to be used by the Contractor in accomplishing the Work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the Work in conformity with the requirements of the contract, plans, and specifications.

L. When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless the Engineer authorizes others. If the Contractor desires to use a method or type of equipment other than specified in the contract, they may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing Work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the Work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining Work with the specified methods and equipment. The Contractor shall remove any deficient Work and replace it with Work of specified quality, or take such other corrective action as the Engineer may direct.

No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this subsection.

G-04.04 Contractor to Provide all Labor, Materials, and Equipment

In accordance with the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution of the Work to completion, whether the same are temporary or permanent and whether or not incorporated or to be incorporated into the Work.

G-04.05 Prevailing Wage Rates to be Paid

A. This Contract is subject to the minimum wage requirements of RCW 39.12. The hourly minimum rates for wages and fringe benefits are listed in the Contract Provisions. When Federal wage and fringe benefit rates are listed, the rates match those identified by the U.S. Department of Labor's "Decision Number" shown in the Contract Provisions. Wage rates to be paid to all laborers, workers, and mechanics who perform any part of this Contract shall be not less than the prevailing wage rates as required by Chapter 39.12 R.C.W., WAC 296-127, or the Federal Davis-Bacon and Related Acts (DBRA).This requirement applies to laborers, workers, and mechanics whether they are employed by the Contractor, Subcontractors, Sub-subcontractors, or any other person who performs a portion of the Work contemplated by the Contract Documents. Higher wage rates may be paid.

B. When the project is subject to both State and Federal hourly minimum rates for wages and fringe benefits and when the two rates differ for similar kinds of labor, the Contractor shall not pay less than the higher rate unless the State rates are specifically preempted by Federal law. When the project involves highway Work, heavy Work, and building Work, the Contract Provisions may list a Federal wage and fringe benefit rate for the highway Work, and a separate Federal wage and fringe benefit rate for both heavy Work and building Work. The area in which the worker is physically employed shall determine which Federal wage and fringe benefit rate shall be used to compare against the State wage and fringe benefit rate

C. By including the hourly minimum rates for wages and fringe benefits in the Contract Provisions, the Contracting Agency does not imply that the Contractor will find labor available at those rates. The Contractor shall be responsible for any amounts above the minimum that will actually have to be paid. The Contractor must bear the cost of paying wages above those shown in the contract provisions.

D. Certified payrolls are required to be submitted by the Contractor for themselves and all subcontractors. The payrolls shall be submitted weekly on all Federal-aid projects and no less than monthly on State funded projects. Certified Payroll shall be submitted to the Engineer and to the Washington State L&I online Prevailing Wage Intent & Affidavit (PWIA) system. When apprenticeship is a requirement of the contract, include in PWIA all apprentices. On all Federal-aid projects, provide a Federal Certified Payroll through PWIA.

E. Pursuant to Chapter 39.04 RCW: The Contractor or subcontractor directly contracting for "Off-Site, Prefabricated, Non-Standard, Project Specific Items" shall identify and report information required on the affidavit of wages paid form filed with the Department of Labor and Industries. The Contractor shall include language in its subcontracts requiring subcontractors and lower-tier subcontractors to comply with the reporting requirements for" Off-Site, Prefabricated, Non-Standard, Project Specific Item" on the affidavit of wages paid.

F. The Contractor or subcontractor shall comply with the reporting requirements and instructions on the affidavit of wages paid form, and shall report the following information on the affidavit of wages paid form submitted to the Department of Labor and Industries in order to comply with the reporting requirements for use of "Off-Site, Prefabricated, Non-Standard, Project Specific" items:

1. The estimated cost of the public works project;

2. The name of the awarding agency and the project title;

3. The contract value of the off-site, prefabricated, nonstandard, project specific items produced inside and outside Washington State, including labor and materials; and

4. The name, address, and federal employer identification number of the contractor that produced the off-site, prefabricated, nonstandard, project specific items.

G. In case any dispute arises as to what are the prevailing rates of wages for work of a similar nature and such dispute cannot be resolved by the parties in interest, including labor and management representatives, the matter shall be referred for arbitration to the Director of the Department of Labor and Industries and the Director's decision therein shall be final and conclusive and binding on all parties involved in the dispute, as provided for by R.C.W. 39.12.060.

H. The Contractor shall, pursuant to R.C.W. 39.12.040, file with the Contracting Agency, a "Statement of Intent to Pay Prevailing Wages" and an "Affidavit of Wages Paid" for itself and all Subcontractors and Sub-subcontractors in performance of the Work. Such Statements require the approval of, and the Affidavits the certification of, the Industrial Statistician of the Department of Labor and Industries before such Statements or Affidavits are submitted to the Contracting Agency. The Department of Labor and Industries charges a fee for such approval and certification, which fee shall be paid by the Contractor. Any change in the fee will not be grounds for revision in Contract Sum.

I. If a State of Washington minimum wage rate conflicts with an applicable federal minimum wage rate for the same labor classification, the higher of the two shall govern, when federal Davis Bacon prevailing wage requirements are applicable to the project. The Contracting Agency will designate in the Contract Documents when federal wage rates apply.

G-04.06 Materials and Equipment to be New

All materials and equipment required to be incorporated into the Work shall be new, unless specifically provided otherwise in the Contract Documents. All such materials and equipment shall be applied, installed, connected, erected, used, cleaned, maintained and conditioned in accordance with the instructions of the applicable manufacturer, fabricator or processor, unless specifically provided otherwise in the Contract Documents. Upon the request of the Engineer, the Contractor shall furnish satisfactory evidence as to the kind, quality, and manufacturer of materials and equipment.

G-04.07 Substitutions of Materials or Equipment

The product, equipment, materials, or methods described or noted within the Contract Documents are to establish a standard of quality, function, appearance, dimension, and shall be deemed to be followed by the words "or equal". By proposing a substitute, Contractor represents that the proposed substitution has equal attributes in all material respects to that specified and no such substitutions shall be allowed if the Contracting Agency rejects in its sole discretion such product, equipment, materials, or methods offered in the substitution. For additional requirements for substitutions of Materials or Equipment see Technical Specification Section 01 33 00 – Submittals.

G-04.08 Disposal of Demolished or Excavated Materials

A. All materials to be demolished or excavated or dredged, and which are to be disposed off of Contracting Agency property shall become the property of the Contractor upon their severance, demolition or excavation, and shall be tested as required by the Contracting Agency prior to removal from Contracting Agency property, except as otherwise provided in the Contract Documents. The Contractor is solely responsible for the lawful disposal of all demolished or excavated materials, and shall indemnify and hold the Contracting Agency harmless from all liability, claims, damages, lawsuits, penalties, and expenses, whether direct, indirect, or consequential (including but not limited to attorney's and consultant's fees and other expenses of litigation or arbitration) arising out of or connected in any way with the demolition, excavation, dredging or disposal of materials.

B. Prior to offsite disposal, Contractor shall provide, for the Contracting Agency approval, the name and location of the disposal sites and copies of permits or other documentation demonstrating that the disposal sites are approved by appropriate regulatory jurisdictions to receive such materials. Under no circumstances shall soil be placed as fill in adjoining waterways or on Tribal Trust land.

C. With respect to hazardous wastes or hazardous substances which originate at the site and are not brought onto the site by the Contractor, the Contractor shall not have liability as an owner, operator, generator or discharge of such hazardous wastes or hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (42 U.S.C. section 9601 et seq.), or the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. Section 6901 et seq.), or WAC 173-303 Dangerous Waste Regulations, or, WAC 173-340 The Model Toxics Control Act (MTCA) Cleanup Regulations. Contractor shall, however, have liability for performing this Contract, and such liability shall include the responsibility to fully and completely comply with all applicable federal, state and local laws, statutes, standards, rules, regulations, orders or permits that apply to the Work.

D. After Final Completion of the Work by Contractor in accordance with the Contract Documents, subject to its continuing obligations under the Contract Documents (including, without limitation, its obligations under the representations, warranties and guaranties with respect to the Work performed), Contractor shall not be responsible for the performance of any further remedial action, removal actions or cleanup of hazardous waste or hazardous substances at the site that the Contracting Agency may be ordered, directed or required to perform by any governmental authority after the date of Final Completion, unless such remedial action, removal action or cleanup is necessary because of the Contractor's failure to perform this Contract, any negligence in the performance of the Work, or any willful misconduct in connection with the performance of the Work.

E. Nothing in this section shall limit or restrict the liability or responsibility of the Contractor (or any of its subcontractors, consultants, employees or agents) in the event of any failure to perform or comply with the terms of the Contract Documents, any negligence in the performance of the Work, nor shall this paragraph in any way limit or restrict the Contractor's responsibilities under the Contract Documents and applicable law in connection with the handling, transport, storage or disposal of hazardous waste or hazardous substances and/or the arranging therefore.

G-04.09 Warranties

A. All Work will be of good quality, free from fault or defect, and in strict accordance with the requirements of the Contract Documents. Any Work not conforming to the foregoing warranty, including unapproved or unauthorized substitutions, shall be considered defective.

B. All Subcontractors', Sub-subcontractors', manufacturers', and Suppliers' warranties, expressed or implied, respecting any part of the Work and all materials used therein shall be obtained and enforced by the Contractor for the benefit of the Contracting Agency without the necessity of separate transfer or assignment thereof. When directed by the Engineer or required by the Contract Documents, the Contractor shall require that Subcontractors, Sub-subcontractors, manufacturers, and Suppliers execute separate warranties in writing directly to the Contracting Agency. Warranty provisions that purport to limit or alter the Contracting Agency's rights under the Contract Documents are null and void.

C. The Contractor warrants that title to all Work, materials and equipment covered by a progress payment or final payment will pass to the Contracting Agency either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances. The Contractor further warrants that no Work, materials, or equipment covered by a request for a progress payment or final payment will have been acquired by the Contractor, or by any other person performing Work at the project site or furnishing materials and equipment for the project, which Work, materials, or equipment are subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller of the same or is otherwise imposed by the Contractor or other person.

G-04.10 State and Local Taxes

A. All or a portion of the labor and materials furnished under this Contract may be subject to retail sales taxes and other state and local taxes which taxes are payable by the Contractor.

B. The Contractor should direct all questions concerning applicable taxes on any portion of the Work to the State of Washington Department of Revenue or to the local taxing authority.

C. State and local retail sales taxes applicable to the transaction between the Contracting Agency and Contractor for sales to the Contracting Agency of tangible personal property or charges to the Contracting Agency for labor or services which constitute a retail sale under Section 82.04.050 of the Revised Code of Washington will be added to the Contract Sum. The Contracting Agency will add retail sales tax to each progress payment for the Contractor to forward to the taxing authority.

D. The Contractor shall be responsible for complying with the requirements of all permits obtained by the Contracting Agency as well as those obtained by the Contractor. Any additional permits, certificates or agency approvals required for completion of this work are the responsibility of the Contractor per G-04. The permits obtained or applied for by the Port of Port Townsend are as follows:

1. City of Port Townsend Building Permit and Floodplain Development Permit BLD24-237
2. City of Port Townsend Substantial Shoreline Development Permit LUP24-039
3. City of Port Townsend SEPA Mitigated Determination of Non-Significance (MDNS) LUP 24-040
4. Department of Ecology Construction Stormwater Permit
5. Hydraulic Project Approval (HPA)

G-04.11 Permits, Licenses, Fees and Notices

A. Unless otherwise specified, the Contractor shall procure and pay for all permits, licenses, and all governmental inspection fees which are necessary or incidental to the performance of the Work, and shall give all notices required by such permits and licenses. Any action taken by the Contracting Agency to assist the Contractor in obtaining permits or licenses shall not relieve the Contractor of its sole responsibility to obtain permits or licenses.

B. Where applicable law, regulations, ordinances or agency policy prohibits the issuance of a necessary temporary operational or other permit to entities other than a public agency, the Contracting Agency will support the Contractor's request for such permit and will accept the permit in the Contracting Agency's name, but only if:

1. The Contractor takes all necessary action leading to the issuance of the permit;
2. The permit is determined to be in the public interest;
3. The permit applies only to Work performed in connection with this project;
4. The Contractor agrees in writing, in a form approved by the Contracting Agency, to abide by all requirements of the permit, and to defend and hold harmless the Contracting Agency from any liability in connection with Work prosecuted under the permit; and
5. The Contractor agrees, in writing, to indemnify, defend, and hold the Contracting Agency harmless from all expenses incurred in connection with such permit.

C. All costs incurred in connection with permits and licenses shall be considered incidental to the Contract and included in the Contract Sum; no increase in the Contract Time or Contract Sum will be made. Loss of time, if any, suffered by the Contractor due to unreasonable delays in obtaining permits or licenses may be considered in relation to a request by the Contractor for an adjustment to the Contract Time in accordance with paragraph G-07.03.

D. The Contractor shall assume all costs and liabilities arising from the use of patented devices, materials, or processes used on or in performance of the Work.

G-04.12 Utilities and Similar Facilities

A. Where removal or relocation of utilities is necessary to accommodate construction as specified in the Contract Documents, such removal or relocation shall be performed by Contractor's unless it is specified in the Contract Documents that it will be performed by the utility owner or others.

B. Where the utility owner is identified as being responsible for removing or relocating utilities, such Work will be accomplished at the utility owner's convenience, either during or in advance of construction. If the Contractor discovers the presence of any utilities at the Project site, it shall immediately so notify the Contracting Agency in writing.

C. The right is reserved to the Contracting Agency and the utility owner to enter upon the Project site from time to time to make such changes as are necessary for the relocation of the utilities or to make necessary connections or repairs. The Contractor shall cooperate with the forces engaged in such Work and shall conduct its operations in such a manner as to avoid unnecessary delay or hindrance to the Work being performed by such other forces. Whenever necessary, the Contractor shall make timely arrangements with the utility owner for the coordination of the Work.

D. When the Contractor wishes to have any rearrangement made to any utility or other improvement for the Contractor's convenience in order to facilitate the construction operation, which rearrangement is in addition to or different from the Work indicated in the Contract Documents, the Contractor shall (after obtaining the Contracting Agency's written approval of the proposed rearrangement) make whatever arrangements are necessary with the owners of such utility or other improvements for such proposed rearrangement and the Contractor shall bear all expenses in connection therewith.

E. All costs incurred as a result of performance of the Contractor's obligations under this paragraph G-04.12 shall be considered incidental to the Contract and included in the Contract Sum; no increase in the Contract Sum or Contract Time will be granted. Loss of time, if any, suffered by the Contractor due to unreasonable delays in removal or relocation of any utilities by others may be considered in relation to a request by the Contractor for an adjustment to the Contract Time in accordance with paragraph G-07.03.

F. If any known underground utility not identified in the Contract Documents or located by the Contracting Agency must be relocated to accommodate the Project or adversely affects the performance of the Work, the Contractor shall adhere to the requirements of paragraph G-04.30. The Engineer will either arrange for the relocation of such utility, if necessary, or provide written authorization for the Contractor to do such Work. If the Contractor performs such Work with authorization from the Engineer, at the Contracting Agency's option the Contractor will be paid for the Work by unit prices, if applicable, a price previously agreed to by the Engineer and the Contractor, or on a Force Account basis.

G. R.C.W. 19.122.030 requires that the Contractor "call before you dig" not less than two (2) business days and not more than ten (10) business days before beginning excavation and to mark the proposed excavation area as required by the statute. If the Contractor intends to work at multiple sites or at a large project, the Contractor must take reasonable steps to confer with utility owner(s) to enable them to locate underground facilities reasonably in advance of the start of excavation for each phase of the Work. The number to call in the Puget Sound region is 1-800-424-5555. The Contractor shall comply with this law and, in addition, shall utilize a locator service to locate utilities on Contracting Agency property.

G-04.13 Contractor to Comply with All Laws

The Contractor shall at all times comply with all federal, state and local laws, ordinances, and regulations. Such compliance shall include, but is not limited to, the payment of all applicable taxes, royalties, license fees, penalties, and duties.

G-04.14 Safety

A. The Contractor assumes full responsibility for and shall comply with all safety laws, regulations, ordinances and governmental orders with respect to the performance of the Work and shall be responsible for employing

adequate safety measures and taking all other actions reasonably necessary to protect the life, health and safety of the public and to protect adjacent and Contracting Agency - owned property in connection with the performance of the Work. The Contractor shall perform the Work in a manner to offer the least possible obstruction and inconvenience to the Contracting Agency, its tenants, public and abutting property owners.

B. The Contractor shall have the sole responsibility for the safety, efficiency and adequacy of the Contractor's plant appliances and methods, and for any damage or injury resulting from their failure, or improper maintenance, use, or operation.

C. The Contractor shall be solely and completely responsible for the conditions of the Project site, including safety of all persons and property in performance of the Work. This requirement shall apply continuously, and not be limited to normal working hours. The required or implied duty of the Engineer to conduct construction review of the Contractor's performance does not, and shall not, be intended to include review and adequacy of the Contractor's safety measures in, on, or near the Project site.

D. In carrying out its obligations set forth in G-04.14A, the Contractor shall consider establishing and supervising the following as part of its safety program:

1. a safe and healthy working environment;
2. an accident prevention program; and
3. training programs to improve the skill and competency of all employees in the field of occupational safety and health.

E. The Washington State Department of Labor and Industries shall be the sole and paramount administrative agency responsible for the administration of the provisions of the Washington Industrial Safety and Health Act of 1973 (WISHA).

F. The Contractor shall comply with the Federal Occupational Safety and Health Act of 1970 (OSHA), including all revisions and amendments thereto; the provisions of the Washington Industrial Safety Act of 1973 (WISHA); and the requirements of the following chapters of the Washington Administrative Code:

1. Chapter 296-24 WAC General Safety and Health Standards.
2. Chapter 296-62 WAC Occupational Health Standards.
3. Chapter 296-155 WAC Safety Standards for Construction Work.

G. In addition, the Contractor shall comply with the following requirements when they are applicable:

1. Chapter 296-44 WAC Safety Standards - Electrical Construction Code.
2. Chapter 296-45 WAC Safety Standards - Electrical Workers.
3. Local Building, Fire and Construction Codes.

H. In cases of conflict between different safety regulations, the more stringent regulation shall apply.

I. The Contractor shall maintain at the Project site office, or other well-known place at the Project site, all articles necessary for providing first aid to the injured. The Contractor shall establish, publish and make known to all employees, procedures for ensuring immediate removal to a hospital, or doctor's care, persons, including employees, who may have been injured on the Project site. Employees should not be permitted to work on the Project site before the Contractor has established and made known procedures for removal of injured persons to a hospital or a doctor's care.

G-04.15 Disruptions Caused by Labor or Other Disputes

A. Definition: The term "dispute" as used in this paragraph includes labor-related and non-labor-related disputes, whether or not the persons or other entities involved in the dispute have an employment relationship with either the Contractor or the Contracting Agency. Examples of such disputes include, but are not limited to, informational or other picketing, and all other forms of concerted or non-concerted activity.

B. Required Contractor Actions: The Contractor will take all reasonable steps to prevent all disputes arising from the presence of or from the performance of the Work by the Contractor, its Subcontractors, Sub-subcontractors or Suppliers, from disrupting the Project or otherwise interfering with access to Contracting Agency property by the Contracting Agency, its agents, employees, tenants or employees thereof, or other contractors engaged on or near the site of the Work. If such dispute disrupts the progress of the Work or interferes with access to Contracting Agency property, the Contractor shall promptly and expeditiously take all reasonable action to eliminate or minimize such disruption or interference, including but not limited to: (a) utilizing all reasonable means to prevent all unlawful conduct or picketing, or to restrict all lawful picketing or other activities to a single entrance to Contracting Agency property; (b) posting notices or signs which advise interested persons and labor organizations that a particular entrance to Contracting Agency property is for the employees or "primary" or, as the case may be, "neutral"" employers; (c) policing entrances to assure that only authorized personnel may use the same; (d) notifying all interested labor organizations of the "primary" or "neutral" status of particular entrances; (e) upon the request of the Contracting Agency, altering or rerouting the access to the site(s) of the Work; and (f) in the event any such picketing or activity is unlawful or has a secondary impact upon the employees of neutral employers, tenants or their suppliers or Contractors, promptly and expeditiously taking appropriate action to seek recourse through the appropriate governmental agency or state or federal courts to limit the location of such picketing so as to reduce the impact thereof upon neutral employers.

C. The Contracting Agency will cooperate with the Contractor to accomplish the foregoing actions and will render its assistance where appropriate; however, the Contracting Agency shall have the right, without providing additional compensation to the Contractor, to direct the Contractor to modify any of the foregoing actions which the Contractor has taken or plans to take, or to overrule such actions, to designate the entrances to be used as "primary" or "neutral" entrances, and to take appropriate legal action in order to protect the interests of the Contracting Agency and those of its tenants and other Contractors. The foregoing actions to be taken by the Contractor are the Contractor's primary responsibility. Neither the failure of the Contracting Agency to request that the Contractor take a specific action nor the exercise by the Contracting Agency of its rights under this paragraph shall modify or constitute a defense to or waiver of the obligations imposed upon the Contractor in this article.

D. Failure to take the action described above or to comply with the directives of the Contracting Agency shall be considered a material breach of the Contract Documents.

E. If and to the extent that the Contractor fails to satisfy the obligations imposed on it by subparagraph B of this paragraph, the Contractor shall be liable for and defend, indemnify and hold harmless the Port, Commission, Engineer, and all other officers, employees, and agents of the Contracting Agency from all liability, claims, damages, losses, and expenses (including but not limited to, attorneys' and consultants' fees and other expense of litigation or arbitration) brought against the Contracting Agency by a third party (including, but not limited to, lessees, tenants, contractors, customers, licensees and invitees of the Contracting Agency) for injunctive relief or for monetary losses caused by loss of use, lost revenue or interference with the activities of the Contracting Agency in establishing and enforcing the Contracting Agency's rights under this article, whether or not suit was instituted.

F. The Contractor shall pay all attorneys' fees and expenses incurred by the Contracting Agency in establishing and enforcing the Contracting Agency's rights under this article, whether or not suit was instituted.

G-04.16 Progress Schedule

A. Promptly after the award of the Contract, the Contractor shall prepare a Progress Schedule in a form satisfactory to the Engineer and the Contracting Agency's Project Manager. Within ten (10) Days after issuance of the notice of award, the Contractor shall submit two (2) copies of the Progress Schedule to the Contracting Agency. Failure of the Contractor to provide a proposed Progress Schedule in a form satisfactory to the Contracting Agency within the allowed time will not constitute grounds for an extension of the Contract Time.

B. Unless otherwise specified, the Progress Schedule shall consist of a network analysis of the Critical Path Method (CPM) in arrow diagram form showing an activity description, cost, activity precedence, and duration

(in calendar days) for all significant design, manufacturing, construction, and installation activities. An activity list shall be included with each copy of the Progress Schedule.

C. Within ten (10) Days after its receipt by the Contracting Agency, one (1) copy of the Progress Schedule will be returned to the Contractor. This copies will be returned with comments, if any, following review by the Contracting Agency. Review by the Contracting Agency of the proposed Progress Schedule shall not constitute an approval of the Contractor's construction means, methods, sequences, or schedule.

D. The Progress Schedule shall outline the proposed operations, the interrelations of the various operations, and the order of performance in sufficient detail that progress of the Work can be evaluated accurately at any time during the performance of the Work. If abbreviations are used in the make-up of the Progress Schedule, a legend shall be provided to define all abbreviations.

E. If milestone completions are required by the Contract Documents, then those milestones shall be clearly defined on the Progress Schedule.

F. Should it become evident that the Contractor may fail to meet the scheduled dates as shown; the Engineer or the Contracting Agency's Project Manager may require the Contractor to submit a recovery schedule demonstrating its proposed plan to make up lag in scheduled progress and to ensure completion of the Work within the Contract Time. The Contractor may be required at Contractor's own expense to submit a revised Progress Schedule and to increase Contractor's work force and working hours (second and third shifts) as required to bring the actual completion dates of the activities into conformance with the Progress Schedule. Further, Contractor shall submit a revised Progress Schedule at no cost to the Contracting Agency when, in the opinion of the Engineer, Contractor's sequence of Work varies significantly from that shown on the Progress Schedule. The Contracting Agency reserves the right to withhold progress payments until such time as an approved modified Progress Schedule in a form satisfactory to the Engineer has been provided by the Contractor.

G. Failure of the Contractor to substantially comply with the requirements of this article may be considered grounds for a determination by the Contracting Agency that the Contractor is failing to prosecute the Work with such diligence as will ensure its completion within the time specified, and to take whatever action the Contracting Agency deems necessary and appropriate under Article G-10.

H. The Progress Schedule shall represent a practical plan to complete the work within the contract time(s) of completion indicated and shall convey the contractor's intent in the manner of prosecution and progress of the work.

I. The scheduling and execution of construction in accordance with the contract documents are the responsibility of the contractor. The Contractor shall involve and coordinate all Subcontractors and material suppliers in the development and updating of Progress Schedules.

J. The submittal of Progress Schedules shall be understood to be the Contractor's representation that the Progress Schedule meets the requirements of the contract documents and that the work will be executed in the sequence and duration indicated in the Progress Schedule.

K. The schedule shall be computer produced utilizing scheduling software that is fully compatible Microsoft Project.

L. The Progress Schedule shall illustrate a time scale, network and logic diagram, start and completion dates of each phase of the project and shall define each activity in sufficient detail to identify the work that is to be accomplished.

M. The Progress Schedule shall be used as the base document for preparation of the three-week look-ahead schedule presented at each weekly construction meeting.

G-04.17 On-Site Documents

A. The Contractor shall maintain at the Project site, in good order for ready reference by the Engineer or the Contracting Agency's Project Manager, one complete record copy of the Contract Documents, including the Addenda, Change Orders, and all working drawings, Progress Schedule, and other approved submittals.

B. The Contractor must maintain a document control system to monitor the generation, status and filing of documents. Documents such as Contracts, Requests for Information (RFI's), Requests for Proposal (RFP's), Change Order Requests (COR's), Transmittals, Meeting Minutes, and Correspondence with the Contracting Agency must be controlled using the system.

C. The Contract record drawings shall be marked to truly record all changes made during construction, i.e., the "as-built" conditions. The location of all existing or new underground piping, valves and utilities, and obstructions as located during the Work, shall be appropriately marked on the ground until the Contractor incorporates the actual field location dimensions and coordinates into the Project's record drawings. The Project's record drawings shall be updated on a weekly basis and before elements of the Work are covered or hidden from view. After the completion of the Work or portions of the Work and before requesting final inspection, the record copy of the record drawings shall be given to the Contracting Agency's. The Contractor's record drawings shall include but are not limited to;

1. Show the invert elevation of all gravity piping and the top of pipe, top of conduit or top of protective concrete encasement for other utilities. Elevations shall be related to a permanent visible elevation benchmark set *at the site* by the Contractor.
2. Show the horizontal location of underground utilities measured from permanent visible physical features such as face of building, curb line, face of tank, or centerline of manhole.
3. Comply with detailed requirements in technical specification sections describing the type of information required on record drawings. The Contractor's copy of Contract Documents, Contract modifications and record drawings shall be available to the Engineer for weekly verification that the records are being continuously updated.

D. The information shown on the record drawings shall be neat and legible to allow the Contracting Agency's drafters to transfer all information recorded on record drawings during construction to a set of .DWG format CADD drawings.

G-04.18 Working Drawings, Product Data, Samples, and other Submittals

A. The Contractor shall review and submit all working drawings, product data, samples and other items required by the Contract Documents to be submitted to the Contracting Agency accompanied by a "submittal transmittal" form. Such submittals shall be given to the Contracting Agency in a complete and final form at least 30 Days prior to any Contractor need for review response or such other longer time that may be needed to allow time for detailed review by the Contracting Agency or others. The Contractor shall take into account sufficient time for the possibility of rejection of the submittal, needed revisions, and resubmittal review time.

B. By submitting working drawings, product data, and samples, the Contractor represents that it has determined and verified all materials, field measurements, and related field construction criteria are in accordance with the Contract Documents, and that the Contractor has checked and coordinated the information contained within the submittal with the requirements of the Work and the Contract Documents. The costs incurred by the Contracting Agency to review resubmitted working drawings, product data, and samples may be offset from any monies due the Contractor when the Contractor has failed to comply with this Subparagraph.

C. Review by the Contracting Agency of the Contractor's working drawings, product data, or samples shall not relieve the Contractor of responsibility for the accuracy of dimensions and details. Such review shall likewise not constitute acceptance by the Contracting Agency of the correctness or adequacy of such submittals, nor shall it constitute a representation or warranty by the Contracting Agency that the drawings will satisfy the requirements of the Contract Documents. The review of a specific item shall not indicate approval of an

assembly in which the item functions. The Contracting Agency's review of a submittal shall not relieve the Contractor from responsibility for errors or omissions in the submittals.

D. Any Work delayed by reason of a properly rejected submittal is deemed to be entirely the Contractor's risk, and shall not be the basis for a claim by the Contractor for additional compensation or an extension of Contract Time. Drawings marked "subject to change" or the like will not be reviewed. The Contracting Agency is not required to review submittals that depend for their review on other submittals not yet submitted. See paragraph G-03.04.

E. When resubmitting a submittal, the Contractor shall direct specific attention, in writing or on the resubmittal itself, to all revisions it has made.

F. No portion of the Work requiring submittal of a working drawing, product data, or sample shall be commenced until the submittal has been approved by the Contracting Agency as provided in paragraph G-03.04. All portions of the Work involving submittals shall be performed in accordance with the approved submittals.

G. For additional submittal administrative requirements refer to Technical Specification Section 01 33 00 - Submittals.

G-04.19 Cutting, Fitting, and Patching of Work

A. The Contractor shall be responsible for all cutting, fitting, patching or such other altering as may be required to complete the Work, or to make its several parts fit together properly.

B. The Contractor shall not damage or endanger any portion of the Work, other work of the Contracting Agency, or that of any separate contractor's by cutting, fitting, patching or other altering of any work, or by excavation. The Contractor shall not alter any of the work of the Contracting Agency or any separate contractor without written authorization from the Contracting Agency.

G-04.20 Inspection of the Work

The Contracting Agency shall have the right but not the obligation to inspect the Work, and to reject and refuse all labor and materials or methods of application, or any part thereof, that does not comply in kind, quality or material with the requirements of the Contract Documents. Any labor or material rejected, as not conforming to the Contract Documents shall be promptly removed, and labor and materials, which do so conform, shall be furnished and delivered in place thereof.

G-04.21 Uncovering of Work

A. If any portion of the Work should be covered prior to inspection called for by law or as required by the Contract Documents, the Contractor shall, upon request of the Engineer, uncover or remove the Work for inspection by the Engineer or other governmental representatives, and replace the Work to the standard required by the Contract Documents, all at the Contractor's expense.

B. If any other portion of the Work has been covered or completed, the Contractor shall, upon the request of the Engineer or Contracting Agency, remove or uncover such Work for the Engineer or Contracting Agency. The Contractor shall subsequently restore that portion of the Work to the standard required by the Contract Documents.

G-04.22 Correction of Work

A. The Contractor shall, at no additional expense to the Contracting Agency, promptly correct all Work which is defective or otherwise fails to conform to the requirements of the Contract Documents. Such Work shall be corrected whether or not it was previously inspected by the Contracting Agency or Engineer, whether or not payment for it was included in a progress payment, whether or not it was completed, and whether or not it was observed before or after the date of Substantial Completion.

B. If, within one (1) year after Substantial Completion of the Work (except as otherwise may be provided pursuant to subparagraph C of paragraph G-08.08), or within such longer period of time as may be prescribed by law or by the terms of any applicable additional warranty required by the Contract Documents, any of the Work is found to be defective or otherwise not in conformance with the Contract Documents, the Contractor shall, at its cost, promptly correct such defective or non-conforming Work after receipt of written notice from the Contracting Agency to do so. The obligation of this subparagraph shall survive termination of the Contract.

C. If the Contractor refuses or neglects to correct the defects as the Engineer may direct, then the Contracting Agency may obtain, use and employ materials, labor, tools and implements to do the same and the expense thereof shall be deducted from moneys which may otherwise be then due or thereafter may become due to the Contract, or the Contracting Agency may terminate this Contract as provided in paragraph G-10.06.

D. Work corrected by the Contractor shall also be subject to the provisions of this paragraph to the same extent as Work originally performed and for an additional one (1) year period. Such one (1) year time period shall commence upon the acceptance by the Contracting Agency of the corrected Work.

E. Nothing contained in this paragraph G-04.22 shall be construed to establish a period of limitation with respect to any other obligation imposed on the Contractor by the Contract Documents or law, including the obligations imposed by paragraph G-04.09. The establishment of the time period of one (1) year after the date of Substantial Completion or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents relates only to the specific obligation of the Contractor to correct defective or non-conforming Work, and bears no relationship to the time within which the Contractor's obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to obligations imposed on it by the Contract Documents or as otherwise may exist in law.

F. The Contracting Agency may, at its sole option, elect to retain defective or nonconforming Work. In such case, the Contracting Agency shall reduce the Contract Sum in a reasonable amount as determined by the Contracting Agency to account for such defect or non-conformance.

G-04.23 Responsibility of Work

All Work performed under the Contract and all materials to be incorporated in the Work, whether in storage or on the Project site and whether under the care, custody and control of the Contractor, Subcontractors, or Sub-subcontractors, shall be at the sole risk of loss and responsibility of the Contractor until Final Completion of the entire Project, except as may be limited by the Engineer in writing for the period following Substantial Completion of the Work or designated portion thereof as provided in subparagraph G-08.08C. Damage from any cause to either permanent or temporary Work, utilities, materials, equipment, existing structures, the Project site, and other property owned by the Contracting Agency or others, shall be repaired by the Contractor to the satisfaction of the Engineer at no additional cost to the Contracting Agency. At no time during the execution of this Contract shall the Contractor direct Contracting Agency staff or Contracting Agency agents to assist in the execution of the Work.

G-04.24 Hazardous Materials

A. The Contractor shall exchange Hazardous Materials information to prevent injury or illness to Contracting Agency or Contractor personnel, to comply with WISHA WAC 296-62-054.

1. The Contracting Agency has available to the Contractor the following:

i) A list of all known Hazardous Materials in use at the Port. Information on each can be obtained by reviewing the Material Safety Data Sheets (MSDS).

ii) Precautions to be taken to lessen the possibility of exposure.

2. The Contractor will:

i) Notify all subcontractors and/or suppliers of any Hazardous Materials the Contracting Agency may have on site.

ii) Label any Hazardous Materials brought on site as to contents, hazard warning, name and address of manufacturer.

iii) Provide the following written information, prior to commencement of Work:

(1) A list of Hazardous Material to be used during the construction phase of the Work, along with the MSDS's.

(2) A list of any Hazardous Materials that have been incorporated into the project and will remain on site, along with the MSDS's.

3. Contractor shall not cause or permit any "Hazardous Materials" (as defined herein) to be brought upon, kept or used in or about the job site except to the extent such Hazardous Materials are necessary for the prosecution of the Work or are required pursuant to the Contract Documents. Removal of such Hazardous Materials shall be undertaken within twenty-four (24) hours following Contracting Agency's demand for such removal. Such removal shall be undertaken by Contractor at its sole cost and expense, and shall be performed in accordance with all applicable laws. Any damage to the Work, the job site or any adjacent property resulting from the improper use, or any discharge or release of Hazardous Materials shall be remedied by Contractor at its sole cost and expense, and in compliance with all applicable laws. Contractor shall immediately notify Contracting Agency of any release or discharge of any Hazardous Materials on the job site. Contractor shall be responsible for making any and all disclosures required under applicable "Community Right-to-Know" laws. Contractor shall not clean or service any tools, equipment, vehicles, materials or other items in such a manner as to cause a violation of any laws or regulations relating to Hazardous Materials. All residue and waste materials resulting from any such cleaning or servicing shall be collected and moved from the job site in accordance with all applicable laws and regulations. Contractor shall immediately notify Contracting Agency of any citations, orders or warnings issued to or received by Contractor or of which Contractor otherwise becomes aware, that relate to any Hazardous Materials on the job site. Without limiting any other indemnification provisions pursuant to law or specified in this Contract, Contractor shall indemnify, defend (at Contractor's sole cost, with legal counsel approved by Contracting Agency) and hold Contracting Agency harmless from and against any and all such claims, demands, losses, damages, disbursements, liabilities, obligations, fines, penalties, costs and expenses in removing or remediating the effect of any Hazardous Materials on, under, from or about the job site, arising out of or relating to, directly or indirectly, Contractor's failure to comply with any of the requirements of this Subparagraph G-04.24.3.

G-04.25 Clean Up

A. At all times, and as may specifically be requested by the Contracting Agency's Project Manager or Engineer, the Contractor shall clean up and remove all refuse resulting from the Work in order that the Project site remains free from an accumulation of construction debris. Upon failure to do so within 24 hours after request by the Engineer, the Contracting Agency may do such clean up, and the cost thereof shall be charged to the Contractor and deducted from the Contract Sum.

B. Upon completion of the Work and before final inspection, the Contractor shall clean the entire Work premises occupied or used in connection with the Work of all rubbish, surplus and discarded materials, false work, temporary structures, equipment, and debris. The entire Work premises shall be left in a clean, neat, and presentable condition. The Contractor shall not remove warning, regulatory, or guide signs prior to Final Completion except as requested by the Engineer.

G-04.26 Protection of Work During Suspension

In preparation for and during any suspension of Work as provided in paragraph G-10.03, the Contractor shall take every precaution to prevent damage to, or deterioration of, the Work. Except as provided elsewhere in the Contract Documents, the Contractor shall be responsible for all damage or deterioration to the Work during the period of suspension and shall, at its sole expense, correct or restore the Work to a condition acceptable to the Engineer prior

to resuming Work. A suspension of Work shall not relieve the Contractor of any of its responsibilities under the Contract Documents.

G-04.27 Survey

A. The Contracting Agency will set three (3) benchmarks using the proper elevation datum in the vicinity of the project.

B. The Contractor shall provide construction survey including all layout, grade staking, and intermediate control necessary to perform the Work in accordance with the Contract Documents.

C. Prior to precasting any structures, the Contractor shall use a Professional Land Surveyor to survey existing pipe inverts that will connect to the new precast structure. The surveyors invert elevations will be incorporated into the Contractor's submittals such as shop drawings for precast structures.

G-04.28 Archaeological Items

A. This project includes archaeological monitoring during excavation by a Contracting Agency provided archaeologist. If archeological materials are encountered during the development of the property, Work shall be halted in the vicinity of the find until the discovery can be inspected and assessed. The project archeologist will be immediately contacted to review the discovery and notify the relevant parties. An assessment of the discovery and consultation with government and tribal cultural resources staff is required by law. After evaluation and consultation, the next steps will be determined.

B. If human remains are discovered, the general process to follow includes;

1. The Contractor will immediately stop Work in the vicinity of the find and notify the Contracting Agency's Project Manager.

2. 24-Hour security will be arranged.

3. The Contracting Agency's Project Manager shall immediately notify the following:

   i) Port Security

   ii) Jefferson County Prosecuting Attorney/Coroner

   iii) (Identify Grant Funding Point of Contract if any)

4. The Jefferson County Prosecuting Attorney/Coroner shall determine if the human remains are of archeological significance. The resources shall not be moved unless the resources are determined to have no archeological significance.

5. The Prosecuting Attorney's/Coroner's determinations will be transmitted by the Contracting Agency's Project Manager to:

   i) State Office of Archaeology and Historic Preservation

   ii) All Tribal interests

6. The press will not be notified prior to notification of Tribal groups.

7. The Contracting Agency and its Contractor shall work with a professional archaeologist to resume construction as soon as possible without compromising the archeological find.

C. An Inadvertent Discovery Plan has been prepared for this project and is provided in the Appendix.

D. If the Contracting Agency finds that the suspension of Work in the vicinity of the discovery increases or decreases the cost or time required for performance of the any part of the Work under this Contract, the Contracting Agency will make an adjustment in payment or the time required for performance of the Work in accordance with Section G-09

G-04.29 Gratuities

The Contractor shall not extend any loan, gratuity, or gift of money or services in any form whatsoever to any employee or officer of the Contracting Agency or its agent, nor shall the Contractor rent or purchase any equipment, materials, or services from any employee or officer of the Contracting Agency or Contracting Agency consultant.

G-04.30 Notice and Detailed Breakdown of Claim

A. Notice. If unforeseen conditions or changes in the Work arise for which the Contractor believes an equitable adjustment in time or money or any other adjustment in Contract Time or Contract Sum is or will be due, the Contractor shall give the Contracting Agency immediate oral notice followed by written notice within seven (7) Days of such event, which notice in all events must be given and the Engineer's direction received prior to performing the Work which Contractor believes entitles it to such adjustments. Such notice must identify in detail the basis for the claim. The date such written notice is received by the Contracting Agency shall define the start of time for any purpose regarding the claim.

B. Detailed Breakdown. Within 30 Days of the Contracting Agency's receipt of written notice above, the Contractor shall provide the Contracting Agency with a written breakdown of all of the elements and sub elements of the claim detailing the increase in the Contract time or Contract Sum being sought.

C. A request for an equitable adjustment Contract Sum shall be based on written notice delivered to the Contracting Agency within 7 Days of the occurrence of the event giving rise to the request. For purposes of this part, "occurrence" means when Contractor knew, or in its diligent prosecution of the Work should have known, of the event giving rise to the request.

D. Failure to give such written notice shall, to the extent Contracting Agency's interests are prejudiced, constitute a waiver of contractor's right to an equitable adjustment.

G-04.31 Prerequisite to Suit

No legal action against the Contracting Agency may be filed on account of a claim or other liability arising, out of or related to the Project unless:

A. The requirements of paragraph G-04.30 have been complied with, and

B. The procedures of paragraph G-09.05 have been exhausted, and

C. The lawsuit is filed and served on the Contracting Agency within 180 Days of the date of Substantial Completion. The Contractor's failure to strictly comply with all requirements of this section shall be a complete bar to any claims, suit or cause of action against the Contracting Agency.

G-04.32 Responsibility for Damage

A. The Contractor shall bear sole responsibility for any pollution which may occur as a result of its operations, including but not limited to soil, air, water, noise, light, or other pollution, including but not limited to any costs (including attorneys' and consultants' fees), penalties, or other liabilities imposed or sought to be imposed as a result of such pollution.

B. The Contractor shall protect from damage all private, public, and Port-owned utilities, including but not limited to communication lines, power lines, sewer and water lines, railroad tracks and appurtenances, traffic lighting and signal systems, and similar facilities.

C. The Contractor shall be responsible for damage to the Work caused by winds, storms, or other causes, and must make good any defects arising from or discovered in the Work until Final Completion of the Work.

G-04.33 Indemnification

A. The Contractor shall defend, indemnify and hold the Contracting Agency, its officers, officials, employees and agents from any and all claims, injuries, damages, losses or suits including attorney fees, arising out of or in

connection with the performance of this Contract, except for injuries and damages caused by the sole negligence of the Contracting Agency, its officers, officials, employees and agents.

B. Should a court of competent jurisdiction determine that this Contract is subject to RCW 4.24.115, then, in the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of the Contractor and the Contracting Agency, its officers, officials, employees, and agents, the Contractor's liability hereunder shall be only to the extent of the Contractor's negligence. It is further specifically and expressly understood that the indemnification provided herein constitutes the Contractor's waiver of immunity under Industrial Insurance, Title 51 RCW, solely for the purposes of this indemnification. The parties have mutually negotiated this waiver. The provisions of this section shall survive the expiration or termination of this Agreement.

C. The Contractor shall pay all attorneys fees and expenses incurred by the Contracting Agency in establishing and enforcing the Contracting Agency's rights under this paragraph, whether or not suit was instituted.

G-04.34 Apprenticeship Utilization Requirements

This Contract includes an Apprentice Utilization Requirement. Fifteen (15) percent or more of project Labor Hours shall be performed by Apprentices unless Good Faith Efforts are accepted. Apprentice Utilization will be determined using the Department of Labor and Industries (L&I) online Prevailing Wage Intent & Affidavit (PWIA) system.

A. **Definitions**

For the purposes of this specification the following definitions apply:

1. Apprentice is a person enrolled in a State-approved Apprenticeship Training Program.

2. Apprentice Utilization is the apprentice labor hours, on the project, expressed as a percentage of project Labor Hours based on certified payrolls or the affidavits of wages paid, whichever is least. The percentage is not rounded up.

3. Apprentice Utilization Requirements is the minimum percentage of apprentice labor hours required by the Contract.

4. Good Faith Effort(s) (GFE) describes the Contractor's efforts to meet the Apprentice Utilization Requirements including but not limited to the specific steps as described elsewhere in this specification.

5. Labor Hours are the total hours performed by all workers receiving an hourly wage who are subject to prevailing wage requirements for work performed on the Contract as defined by RCW 39.04.310. Labor Hours are determined based on the scope of work performed by the individuals, rather than the title of their occupations in accordance with WAC 296-127.

6. State-approved Apprenticeship Training Program is an apprenticeship training program approved by the Washington State Apprenticeship Council.

7. Apprentice Wage Rates are the applicable wage rates that are to be paid for an apprentice registered in a training program, separate from Journey Level rates, as set by the Washington State Apprenticeship Training Council and Washington State Department of Labor and Industries (L&I).

B. **Electronic Reporting**

The contractor shall use the PWIA System to submit the "Apprentice Utilization Plan". Reporting instructions are available in the application.

C. **Apprentice Utilization Plan**

1. The Contractor shall submit an "Apprentice Utilization Plan" by filling out the Apprentice Utilization Plan Form (Appendix H) within 30 calendar days of execution, however no later than the preconstruction meeting, demonstrating how and when they intend to achieve the Apprentice Utilization Requirement. The Plan shall be in sufficient detail for the Engineer to track the

Contractor's progress in meeting the utilization requirements. An Apprentice Utilization Plan shall be updated and resubmitted as the Work progresses or when requested by the Engineer.

2. If the Contractor is unable to demonstrate the ability to meet the Apprentice Utilization Requirement with their initial Apprentice Utilization Plan submission, an effort must be made to find additional registered apprentices to perform on the contract. If after attempts have been made at every tier and every scope, the Contractor must submit GFE documentation to the Contracting Agency. The Contractor shall actively seek out opportunities to meet the Apprentice Utilization Requirement during the construction Work.

D. **Contacts**

The Contractor may obtain information on State-approved Apprenticeship Training Programs by using the Apprentice Registration and Tracking System (ARTS) https://secure.lni.wa.gov/arts-public/#/program-search or contacting the Department of Labor and Industries directly at:

Specialty Compliance and Services Division, Apprenticeship Section, P.O. Box 44530, Olympia, WA 98504-4530 or by phone at (360) 902-5320.

E. **Compliance**

1. The Contractor is expected to make attempts to employ Apprentices and shall include the requirement in any subcontracts at any tier. In the event that the Contractor is unable to achieve the Apprentice Utilization Requirement, the Contractor shall submit GFE documentation demonstrating the efforts and attempts they made. Final GFE documentation shall be submitted to the Contracting Agency after Substantial Completion but no later than 30 days after Physical Completion.

2. If the Contractor fails to actively attempt to employ Apprentices, submit GFE documentation, or if the Engineer does not approve the GFE, the Contractor will be assessed a penalty. The Engineer will provide the Contractor with a written notice at Final Acceptance of the project informing the Contractor of the failure to comply with this specification which will include a calculation of the penalty to be assessed as provided for in the Payment section in this supplement provision.

3. If the Contractor achieves the required Apprentice Utilization, and incentive will be assessed with Final Payment.

F. **Good Faith Efforts**

The GFE shall document the attempts (efforts) the Contractor (and any subcontractor at any tier) made to meet the Apprentice Utilization Requirement. Emails, letters, or other written communications with letterhead, titles, and contact information are required.

Documentation must include one or ore of the following accepted GFEs:

1. Demonstrated Lack of Availability of Apprentices. Correspondence from State-approved Apprenticeship Training Program(s), with project specific responses confirming there is a lack of availability of Apprentices for this project.

2. Demonstrated Disproportionate Ratio of Material/Equipment/Products to Labor Hours. Documentation explaining the bid includes a disproportionately high cost of material/equipment/products to Labor Hours. (E.g., a $2 M estimated contract includes $1 M or more in procurement costs of equipment to be installed.)

3. Demonstrated Lack of Necessary Labor Hours. Correspondence from a State-approved Apprentice Training Programs confirming there is not enough time in the project to meet required journey level to apprentice training ratios.

4. Demonstrated Lack of Available Approved Programs. Correspondence from State-approved Apprentice Training Programs, confirming there are no programs that train for the scopes

included/anticipated on the project. Contractor and state programs to submit training program detail needs and details that could be used for future program creation.

5. Funding Precedent. Documentation that shows conflicting, more restrictive, or precedent requirements for other training on the Project. Examples include, but are not limited to, Tribal Employment Rights (TERO), Federal Training Hours, or Special Training that affect the ability to use state-registered apprentices.

6. Warranty Work. Documentation from Original Equipment Manufacturers, or similar, confirming that work performed must only be completed by certified journey-level installers or risk voiding warranty, or similar.

7. Other Effort. The Contractor may submit other evidence, documentation, or rationale for not being able to achieve the required Apprentice Utilization that are not covered in the other efforts named. Other efforts will still need to be corroborated by an independent, knowledgeable third-party

Contractors may receive a GFE credit for graduated Apprentice hours through the end of the calendar year for all projects worked on as long as the Apprentice remains continuously employed with the same Contractor/subcontractor they were working for when they graduated. If an Apprentice graduates during employment on a project of significant duration, they may be counted towards a GFE credit for up to one year after their graduation or until the end of the project (whichever comes first). Determination of whether Contract requirements were met in good faith will be made by subtracting the hours from the journeyman total reported hours for the project and adding them to the apprentice hour total. If the new utilization percentage meets the Contract requirement, the Contractor will be reported as meeting the requirement in good faith.

G. **Approving Good Faith Efforts**

The Contracting Agency will review submitted Good Faith Efforts and issue a determination. The Engineer may request additional information, documentation, evidence or similar in order to approve such efforts. A determination by the Engineer is final. The approved Good Faith Efforts will be loaded into the PWIA system by the Contracting Agency.

H. **Financial Incentive**

1. An incentive in the amount of $5,000 will be included with the Final Payment to the Contractor if the Apprentice Utilization Requirement is met without a reduction by Good Faith Effort.

2. Apprenticeship Hours will be measured for each hour of work performed by an apprentice as shown on the Monthly Apprentice Utilization Report, based on certified payrolls or the affidavits of wages paid, whichever is least. The percentage is not rounded up. For the purpose of providing a common proposal for all bidders, the Contracting Agency has entered an amount in the proposal to become a part of the total bid by the Contractor.

3. When the Contractor fails to meet the Apprenticeship goal of 15%, a penalty will be assessed for each hour that is not achieved, unless a Good Faith Effort is approved by the Contracting Agency.

4. Apprenticeship Utilization Penalty will be calculated as described below:

Percent of goal met	Penalty per hour of unmet goal
100%	$0.00
90% to 99%	$2.00
75% to 89%	$3.50
50% to 74%	$5.00
1% to 49%	$7.50
0%	$10.00

I. **Payment**

1. Payment will be made for the following Bid Items:

a) "Apprenticeship Utilization Adjustment", by Calculation

2. For the purpose of providing a common proposal for all bidders, the Contracting Agency has entered an amount in the proposal for "Apprenticeship Utilization Adjustment" to become a part of the total bid by the Contractor. The calculation of the "Apprenticeship Utilization Adjustment," will be made in accordance with the Financial Incentive provision of this specification.

3. The Contractor shall include all related costs in the unit Bid prices of the Contract, included but not limited to implementing, developing, documenting, and administering an apprenticeship utilization program, recording and reporting hours and all other costs to comply with this provision.

ARTICLE G-05
SUBCONTRACTORS AND SUPPLIERS

G-05.01 Contractor is Responsible for Actions of Subcontractors and Suppliers

The Contractor is fully responsible for the acts and omissions of all Subcontractors, Sub-subcontractors, Suppliers, and all other persons performing a portion of the Work.

G-05.02 Award of Contracts to Subcontractors and Suppliers

A. The Contractor shall, if required by the Contract Documents, submit to the Engineer in writing the identity of all subcontractors and suppliers proposed to furnish materials or equipment specifically designed for this Project. This list shall be provided to the Contracting Agency not more than 10 Days after Notice of Award. The Engineer will respond to the Contractor within 10 Days in writing stating whether or not the Contracting Agency has an objection to any such proposed subcontractor or supplier. Failure of the Engineer to respond shall constitute notice of no objection. If at any time during the performance of the Work the Contractor wishes to make a substitution for a proposed subcontractor or supplier, the Contractor shall first give the notice required above, and the Contracting Agency may object to such proposed substitution within 10 Days of being so notified.

B. The Contractor shall not enter into a contract with a proposed subcontractor or a supplier of specifically designed equipment to whom the Contracting Agency has made reasonable objection pursuant to subparagraph A of this paragraph. Likewise, the Contracting Agency will not require the Contractor to contract with an entity with which the Contractor has a reasonable objection.

C. The award of a subcontract or contract for the supplying of materials or equipment by the Contractor does not create a contract between the Contracting Agency and the Subcontractor or Supplier. Except as otherwise set forth by statute, Subcontractors and Suppliers shall have no rights whatsoever against the Contracting Agency by reason of their contract with the Contractor. The foregoing provision shall apply with equal force to Subcontractors, Sub-subcontractors, Suppliers, and all other persons otherwise engaged to do any portion of the Work.

D. When a portion of the Work, which has been subcontracted by the Contractor, is not being prosecuted in accordance with the Contract Documents, the Contractor shall, on the written request of Engineer, take immediate steps to correct the deficiency or remove the Subcontractor, or Sub-subcontractor, from the Project. In the event of removal, the removed Subcontractor, or Sub-subcontractor, shall not be further employed in the Work.

E. The Contractor shall make available to each Subcontractor, Sub-subcontractor and Supplier, prior to execution of contracts by the same, a copy of the Contract Documents to which the Subcontractor, Sub-subcontractor, or Supplier is to be bound.

F. The Contracting Agency reserves the right to obtain copies of any Subcontractor, Sub-Subcontractor and Supplier agreements at any tier from the Contractor.

G-05.03 Subcontractor and Supplier Relations

A. By an appropriate agreement, the Contractor shall require that each Subcontractor and Supplier, to the extent of the Work to be performed by that Subcontractor or Supplier, be bound to the Contractor to perform such portion of the Work according to the terms of the Contract Documents and to assume toward the Contractor all of the obligations which the Contractor assumes toward the Contracting Agency under the Contract Documents. Such agreement shall preserve and protect the rights of the Contracting Agency with respect to the Work to be performed by the Subcontractor or Supplier so that the Contracting thereof by the Contractor to others will not prejudice the Contracting Agency's right to have the Work performed in accordance with the Contract Documents. The Contractor shall require each Subcontractor and Supplier to enter into similar agreements with all Sub-subcontractors and Suppliers, so that this requirement shall be applicable to Sub-subcontractors and Suppliers at all tiers.

B. Each subcontract agreement for a portion of the Work is hereby assigned by the Contractor to the Contracting Agency provided that:

1. The assignment is effective only after termination by the Contracting Agency for cause pursuant to section G-10.06 and only for those subcontracts which the Contracting Agency accepts by notifying the Subcontractor or Supplier in writing; and

2. After the assignment is effective, the Contracting Agency will assume all future duties and obligations toward the Subcontractor or Supplier that Contractor assumed in the subcontract agreement.

3. The assignment is subject to the prior rights of the surety, if any, under any bond in accordance with the Contract Documents

ARTICLE G-06
NON-DISCRIMINATION

G-06.01 Comply with all laws

The Contractor shall fully comply with all applicable laws, regulations, and ordinances pertaining to non-discrimination.

G-06.02 Minority Business Enterprise/Women Business Enterprise Participation

A. The policy of the Contracting Agency is to provide and promote the maximum lawful, practicable opportunity for increased participation by Minority and Women's Business Enterprises in contracting and procurement processes with the Contracting Agency.

B. Definitions for the minority groups protected by the Civil Rights Act of 1964 and women will be those used by the State of Washington, Office of Minority and Women Business Enterprises.

ARTICLE G-07
TIME

G-07.01 Contract Time

A. The Contract Time is that period of time allotted in the Contract Documents, as adjusted by Change Orders, for Contractor to achieve Substantial and/or Physical Completion of the Work as more fully set forth in the Contract Documents.

B. The Contract Time begins on the first Business Day following the 10th calendar day after the issuance of the written Notice to Proceed or the first day on which the Contractor begins to perform Work on the site, whichever occurs first. Time is of the essence of this Contract. All the Work must be completed within the time limits set

forth in the Contract, and the Contractor's unexcused failure to do so will result in the assessment of Liquidated Damages as provided in the Contract.

C. The Contractor must complete all of the physical Work within calendar milestones as specified as Contract Time. A non working day is a Sunday or a day on which the Contract suspends work, or one of the following holidays: January 1st; the third Monday of January; the third Monday of February; Memorial Day; July 4th; Labor Day; November 11th; Thanksgiving Day; the day after Thanksgiving; and Christmas. Whenever any of these holidays falls on a Sunday, the following Monday will be counted a non working day. When the holiday falls on a Saturday, the preceding Friday will be counted a non working day. The Contractor must account for and include non-working days in the Contractor's work plan and progress schedule.

D. The Contractor must account for and include unworkable Days in the Contractor's work plan and progress schedule. An unworkable Day is defined as a partial or whole day that is unworkable because of weather, conditions caused by the weather, or such other conditions beyond the Contractor's control that prevent the satisfactory and timely performance of the Work, and such performance, if not hindered, would have otherwise progressed toward Physical Completion of the Work. The Contracting Agency will not adjust Contract Time due unworkable Days.

E. In accordance with the permit requirements, all in-water work shall be completed between September 15- January 15. Timing and duration of the project is limited to 2 consecutive seasons in the designated work window of September 15- January 15. A notice of work suspension will be issued after Season 1. A notice to resume suspended work will be issued for Season 2.

F. The calendar milestones specified as Contract Time include;

Boat Haven Boatyard Stormwater Improvements	
Early Start – Begin On Site Work	5/19/2025
Close 300 Ton Haul Out Pier & Intersection	6/19/2025
Open 300 Ton Haul Out Pier & Intersection	6/30/2025
Close 300 Ton Haul Out Pier & Intersection	8/23/2025
Open 300 Ton Haul Out Pier & Intersection	8/31/2025
Substantial Completion	9/02/2025
Physical Completion	9/30/2025

G. Substantial Completion occurs when;

1. the Contracting Agency can use or occupy the Work for the use for which it is intended,
2. the stormwater treatment system including conveyance fully tested and is operation,
3. the Boat Haven Boat Yard is restored and available for vessel blocking, and
4. the Contracting Agency has provided the Substantial Completion Date in writing to the Contractor.

H. Physical Completion occurs when;

1. all physical Work required by the Contract is complete including re-inspection and Contracting Agency approval of all Punch List work, and

2. the Contracting Agency has provided the Physical Completion Date in writing to the Contractor.

I. Final Completion occurs when all requirements of the Contract Documents have been properly and completely fulfilled including but not limited to:

1. All Work required in the Contract Documents is complete;
2. Maintenance and Operations manuals;
3. Final Good Faith Effort Documents for Apprentice Utilization
4. Warranties;
5. Submittals required by the Specifications;
6. Occupancy permits and related approvals by any authority with jurisdiction for same;
7. Submittal of final pay estimate and Final Contract Voucher Certification;
8. Submittal of list of all subcontractors and MWBE suppliers used on the project and the amount paid to each;
9. Submittal of all material tests results, bills of laden, certificates of compliance, and certification of material origin.
10. Submittal of all properly completed as-built record drawings; and
11. Submittal of any other documents required by the Contract Documents.

J. Final Acceptance is the formal action of the Port Commission accepting the Work as meeting the requirements for Final Completion. Final Acceptance is required for contracts greater than $300,000.

G-07.02 Hours of Work

A. Except in the case of an emergency or unless otherwise approved by the Contracting Agency, the work hours shall be between 7 a.m. through 6 p.m. Monday through Friday, excluding the non-working day restrictions listed. Work on Saturday between the hours of 7 a.m. through 4 p.m. is permissible but shall first be approved by the Contracting Agency.

B. The contractor shall ensure full uninterrupted marina access to boaters (navigation channel clear) on Sundays or on another day of week as approved and coordinated with the Contracting Agency.

C. The contractor shall be restricted for on-site work during the following days and hours:

1. Work on site is not allowed on the Friday – Sunday weekend during the annual Port Townsend Wooden Boat Festival (second weekend in September).
2. Steel pile or sheet pile installation and driving is not allowed on Sunday.
3. No impact driving shall be allowed within two hours of sunrise or sunset.
4. If the Contractor desires to perform Work on holidays or outside the work hours stated above, the Contractor shall request in writing to the Contracting Agency for authorization to work such days or times.

G-07.03 Extension of Time

A. Reasonable Delays. The Contractor should anticipate that some reasonable delays, including those caused by normal weather patterns, may occur. The Contractor shall not be entitled to any compensation, damages, or extension of the Contract Time for such reasonable delays.

B. Excusable Delays. For Excusable Delays the sole and exclusive remedy of the Contractor will be an equitable extension of time allowed for completion. The Contract Time may be extended without compensation by the Contracting Agency for a period equivalent to the time that the Contractor was delayed in the Work by one or

more of the following causes, beyond the control of the Contracting Agency and the Contractor, occurring during the performance of the Work:

1. Fire or other casualty for which the Contractor is not at fault or otherwise responsible;
2. Strike riot, war, or civil disorder;
3. Suspension of Work due to unusual and severe weather (i.e., defined as adverse weather which at the time of year in which it occurred is unusual for the place in which it occurred);
4. Delay cause by another contractor in the performance of a contract with the Contracting Agency;
5. Suspension of Work due to other unsuitable conditions in accordance with paragraph G-10.03.

C. Unreasonable Delays. Extensions of Contract Time, if any, shall be determined by the Engineer. Time extensions will be allowed only to the extent that completion of the Work is unreasonably delayed through no fault of the Contractor, which must in all cases be substantiated by impact to the critical path on the Progress Schedule. Any extension of the Contract Time by the Contracting Agency will be set forth in a Change Order, which shall specify the Days by which the Contract Time is to be increased.

D. No extension of time shall be allowed for any claimed delay which is caused by or results from concurrent delay or the fault, negligence, or collusion of the Contractor, or its Subcontractors, Sub-Subcontractors, Suppliers, or any others, or any of their acts or failure to act or to timely perform the Work according to the Contract. Failure to make timely submittals to the Contracting Agency, procure materials or workmen or perform the Work in accordance with the requirements of the Contract Documents or to adequately plan for such functions will not be an adequate reason for an extension of Contract Time.

E. In no event shall the Contractor be entitled to loss or damage, including a change in Contract Sum for any delay in the Contractor's prosecution of the Work, even if such delay is caused by the Contracting Agency, except to the extent such acts or omissions of the Contracting Agency result in a delay to the Project's critical path, in which case the Contractor may receive an adjustment to the Contract Sum. Any request for such cost shall be established and documented by the Contractor in detail to the satisfaction of the Engineer in accordance with Paragraph G-09.03, Compensation for Changes.

F. If the Contractor fails to fully comply with paragraph G-04.30, its claim for an extension of Contract Time or adjustment to the Contract Sum on account of such claimed delay is waived.

G-07.04 Liquidated Damages

A. Contract Time: Time is of the essence in this contract and the Contracting Agency has determined that the completion of the Work in this Contract is critical to the proper operation of Contracting Agency's facility and the Contractor's failure to complete the Work within the time will cause damage to the Contracting Agency. Because exact damages are difficult to determine or forecast, the sum of $500 per Day is hereby established by the parties as a reasonable estimate of just compensation to the Contracting Agency for the failure of the Contractor to complete the Work by the time set forth in the Contract or authorized extension thereto. This sum is not to be in any sense a penalty but rather reflects the parties' agreement and reasonable forecast of the actual amount the Contracting Agency will be damaged by the Contractor's failure to timely complete the Work. Charges for Liquidated Damages will begin accumulating on the first Day following the Substantial Completion date established in the Contract or by Change Order and will continue until the date of Substantial Completion. The Contracting Agency will notify the Contractor in writing of the Substantial Completion Date. Physical Completion will not be issued until all punch list items have been completed.

B. For overruns in Contract Time occurring after the Substantial Completion Date, Liquated Damages will be assessed on the basis of the direct engineering and related costs assignable to the project until the actual Physical Completion of all the Contract Work.

C. Liquidated Damages will not be assessed for any Days for which an extension of time is granted. No deduction or payment Liquidated Damages will, in any degree, release the Contractor from further obligations and liabilities to complete the entire Contract.

D. The Contractor does hereby authorize the Contracting Agency to deduct such Liquidated Damages from the amount due or to become due the Contractor. The Contractor further agrees that any such deduction shall not in any degree release the Contractor from further obligations and liabilities in respect to the fulfillment of the entire Contract.

ARTICLE G-08
PAYMENTS, COMPLETION AND FINAL ACCEPTANCE

G-08.01 All Payments Subject to Applicable Laws

A. All payments made to the Contractor are subject to all laws applicable to the Contracting Agency.

B. The Contracting Agency shall not make any payments to the Contractor under this Contract until approved Statements of Intent to Pay Prevailing Wages have been filed with the Contracting Agency as required by paragraph G-04.05 and R.C.W. 39.12.040.

G-08.02 Scope of Payment

A. The Contractor shall be compensated as provided for in the Contract Documents for performing all of the Work in accordance with the Contract Documents, including changes made to the Work by Change Order. Payment of the Contract Sum shall constitute the full compensation to the Contractor for performance of the Work, including all risk, loss, damages, or expense of whatever character arising out of the nature of the Work or the prosecution thereof, and for all reasonable expenses properly incurred in the event and consequence of a suspension or discontinuance of the Work pursuant to the Contract Documents.

B. The Contracting Agency need not pay for Work done beyond lines and grades established by the Engineer, or extra Work or materials furnished without prior written approval of the Engineer. The Contracting Agency may order such unauthorized Work to be removed at no expense to the Contracting Agency.

G-08.03 Retained Percentage (Retainage)

In accordance with Chapter 60.28 R.C.W., the Contracting Agency will retain five (5) percent of each monthly progress payment. For purposes of Chapter 60.28 R.C.W. “completion” shall mean Final Completion.

G-08.04 Progress Payments

A. Progress payments will be made following the Contractor’s request therefore once each month during the Contract Time; payment shall be based upon invoices approved by the Engineer or by pay estimates prepared by the Engineer and approved by the Contractor and Engineer, as established at the Preconstruction Meeting.

B. If the Contractor does not occur with the Pay Estimate established by the Contracting Agency , the Contractor may propose changes necessary to obtain the Engineer’s concurrence and resubmit with supporting documents such as scale tickets or receipts. If the Engineer recommends payment, the Contracting Agency will, within thirty (30) days pay the Contractor’s progress payment.

C. If the Engineer does not concur with the invoice or pay estimate, the Contractor may make the changes necessary to obtain the Engineer’s concurrence and resubmit the progress payment request. If the Engineer recommends payment, the Contracting Agency will, within thirty (30) Days after the Contractor satisfactorily completes the remedial actions identified in the Engineer’s rejection of the payment request, pay the Contractor’s progress payment.

D. Payment shall be based upon the actual quantities of Work performed according to the Contract Documents. Quantities will be determined as percentages of each scheduled activity for lump sum Contracts. Where the Contract provides for unit prices, quantities will be determined by the actual measurement of completed units in accordance with the Contract Documents.

E. Payment requests shall be accompanied by a complete revised construction schedule in accordance with Article 04.16.

F. The Contractor is required to make payment to all Subcontractors and all Suppliers within ten (10) business days from the receipt of all progress payments for all the Work included in the progress payments. Furthermore, the Contractor shall require all subcontracts issued under this contract to all Subcontractors and Suppliers at all tiers to also make all due payments within ten (10) business days of their receipt of payment. The Contractor must justify to the Contracting Agency in writing any intent to withhold payment of monies due to any Subcontractor or Supplier within the same ten (10) business days.

G. The Contractor shall supply the Contracting Agency's form of certification signed by a corporate or company officer included with each Pay Estimate. This certification shall attest that all payments by the Contractor due to Subcontractors or Suppliers from the last payment estimate have been made within the ten (10) business days payment period. The certification shall attest that the Contractor will make payment within ten (10) business days of all obligations due from the current payment estimate. The Contractor is required to receive the same certification from all Subcontractors and Suppliers at all tiers. No progress payments will be processed until the Contractor's certification is received.

G-08.05 Payment for Stored Materials

A. On-site Materials: A progress payment may include payment for permanent materials or equipment to be incorporated into the Work and properly stored and safeguarded on the site.

B. Off-site Materials: A progress payment may also include payment for permanent prefabricated materials such as steel piles and aggregate or specifically designed equipment to be incorporated into the Work if properly stored and secured, even though off-site. The maximum allowable payment for such off-site material will be eighty-five (85%) percent of the invoice price for the material.

C. Any payment for materials or equipment stored on or off the site but not yet incorporated into the Work shall be based upon the cost of the materials or equipment as determined by the Contracting Agency considering invoices to the Contractor, bills of sale, or by such other means satisfactory to the Engineer and which will establish the Contracting Agency's title to such materials or equipment and otherwise protect the Contracting Agency's interest. This shall include provisions for insurance and transportation to the site in the case of materials and equipment stored off the site. All necessary material certifications of compliance and certification of material origin must be provided by Contractor to the Contracting Agency in order to receive any payment for stored materials

G-08.06 Payment for Work Done on a Force Account Basis

A. Whenever, under the terms of the Contract, work, materials, or equipment are to be paid for on a Force Account basis, the amount of such payment shall be certified in writing on a daily basis by agreement of Contractor and the Engineer. Payment will be included in monthly Pay Estimates Payment for Force Account Work and will be determined as follows:

1. Labor:

For all labor, including such foreman supervision (but excluding the superintendent and project manager) as may be necessary upon any particular operation, the Contractor shall be paid an amount equal to the sum of the following:

a) Weighted Wage Rate

The agreed weighted wage rate for all labor used shall include and be restricted to the current certified basic wage plus fringe benefits made the obligation of the Contractor by a collective bargaining agreement or other employment agreement, and benefits paid on an account of such labor by the Contractor pursuant to the:

(1) Federal Insurance Compensation Act (FICA);

(2) Federal Unemployment Tax Act (FUTA); and

(3) State Unemployment Compensation Act (SUCA).

b) Travel Allowance and/or Subsistence

The Contractor shall be reimbursed the actual costs of travel and subsistence allowances paid to laborers engaged upon the Work when such allowances are required by the terms of employment for such laborers.

c) Industrial Insurance and Medical Aid Premiums

The Contractor shall receive reimbursement for industrial insurance premiums as may be required under State or federal statues, and medical aid premiums which become an obligation of the Contractor and are chargeable to the labor performed on the Work to be paid for on a Force Account basis. The rate of compensation for the above premiums shall be a composite rate based upon the full premium for Industrial Insurance and one-half the premium for medical aid, which premiums are prescribed by the regulatory body for the Contractor, Subcontractor, Sub-subcontractor, or other person actually performing the Force Account Work. This composite rate may be adjusted upon request to conform to adjustments prescribed by the regulatory body.

d) Overhead and Fee

The Contractor shall be reimbursed in an amount equal to Fifteen percent (15%) of the sum of the items listed in subparagraphs a, b, and c above for the Contractor's overhead and fee, bonds, all insurance (except as specified in subparagraph c above), and all other costs incurred in supplying such labor.

2. Materials

a) For all materials furnished by the Contractor for the Work, payment shall be made in the amount of the actual invoice cost for such materials, including actual freight and express charges and applicable taxes less all offered or available discounts and rebates, notwithstanding the fact that they may not have been taken by the Contractor. To the above-determined cost shall be added a sum equal to fifteen percent (15%) for overhead, fee, bonds, insurance, and all other costs incurred in supplying such materials.

b) The Contractor shall furnish to the Contracting Agency, as support for all charges for materials, valid copies of supplier invoices, including freight and express bills. As to such materials as may be furnished from the Contractor's own inventory for which an invoice is not available, the Contractor shall furnish a sworn affidavit certifying its actual cost of such materials.

c) If, in the opinion of the Engineer, the Contractor's cost of such materials furnished is excessive or if the Contractor does not furnish satisfactory evidence of its costs, the Contracting Agency reserves the right to establish the cost of all or part of such materials at the lowest current wholesale prices less all applicable discounts and exemptions at which said materials are available in the quantities required to be furnished pursuant to the Contract Documents.

d) The Contracting Agency reserves the right to furnish such materials to the Contractor as it deems advisable, and the Contractor shall have no claim for any costs, overhead, or fee on such materials.

3. Equipment

a) For any machine-power tools or equipment, except small tools, which the Engineer deems necessary for the Contractor to use, payment shall be made in accordance with the rates stated in the "AGC-Washington State Department of Transportation Equipment Rental Agreement," another equipment rate sheet approved by the Engineer, or an actual rental invoice in effect at the time such tools or equipment were used, subject to reduction under subparagraph b below.

b) The rates stated in the "AGC Washington State Department of Transportation Equipment Rental Agreement," are the maximum rates allowable for equipment of modern design and in good working condition, and include and are full compensation for overhead, fee, bonds, and for furnishing all fuel, oil, lubrication, repairs, maintenance, insurance, and all other costs incidental to the furnishing of such tools and equipment, except for the labor to operate the same. The stated compensation for use of tools or equipment not of modern design or not in good working conditions shall be reasonably reduced as determined by the Engineer. If equipment is required for which a rental rate is not included in the current schedule, an agreed rental rate shall be established for that equipment based upon the same elements of costs used in establishing the current schedule or rental rates. The Engineer must approve such rates prior to use of the equipment on the Force Account work.

c) A current "AGC-Washington State Department of Transportation Equipment Rental Agreement" is maintained at each district office of the Department of Transportation and at each of the offices of the Associated General Contractors of America.

d) If the necessary equipment is not already at the site of the project and it is not anticipated that it would be required for the performance of other Work under the terms of the Contract, the Contractor will be paid in accordance with the terms and conditions specified in the then current "AGC-Washington State Department of Transportation Equipment Rental Agreement".

e) Overhead and Fee

The Contractor shall be reimbursed in an amount equal to Fifteen percent (15%) of the sum of the items listed in subparagraphs a. thru d. above for the Contractor’s overhead and fee, bonds, all insurance, and all other costs incurred in supplying such equipment.

4. Subcontractors

When Work is performed on a Force Account basis by Subcontractors, the Contractor will be allowed an additional markup based on the following schedule:

a) First $10,000.00 of Work done on each Change Order by Subcontractors (less Subcontractor markups for overhead and fee) the Contractor will be allowed ten percent (10%) supplemental markup.

b) All Work in excess of $10,000.00 done by Subcontractors on each Change Order (less Subcontractor markups for overhead and fee) the Contractor will be allowed a five percent (5%) supplemental markup.

The ten (10) percent supplemental markup shall apply to the first $10,000.00 accumulated total of all Force Account Work performed by all subcontractors on any single change order.

5. Sub-subcontractors

a) The provisions of this subparagraph as applicable to the Contractor shall also be applied in the same manner to Subcontractors at each tier.

b) The payment provided for in subparagraph A.1 through A.5 of this paragraph shall constitute full compensation for all Work done on a Force Account basis, for all delays related in any way to the change requiring the Work done on Force Account basis or which may result from the performance of such changed Work. Such payment shall cover all costs of labor, materials, equipment, overhead, fee, damages, if any, and all other costs or expenses, of whatever kind or type, which are occasioned either directly or indirectly, including payments required under the Social Security Act, State Unemployment Compensation Act, occupational tax, and any other federal or state insurance policies, and for the use of small tools and equipment for which no rental is allowed.

6. No compensation for Work performed on a Force Account basis shall be paid unless the Engineer provided prior written direction to the Contractor to perform the Work on such a basis. No Work shall be considered to be Force Account work that can be measured and paid for at the unit price in the Schedule of Prices.

G-08.07 Payment for Changes

Compensation for Changes in the Work as provided in a Change Order will be made in accordance with the payment provisions of the Contract Documents.

G-08.08 Substantial and Physical Completion

A. A portion of the Work will be considered for Substantial Completion and Physical Completion prior to completion of the entire Work only if such portion is specifically so designated in the Contract Documents or the Engineer determines that it is in the best interest of the Contracting Agency.

B. When the Work, or a designated portion thereof, is considered by the Contractor to be substantially complete or physically complete the Contractor has submitted the documents required by subparagraph G-07.01I and G-07.01J. The Work, or a designated portion thereof, is considered by the Contractor to be substantially complete, the Contractor may request that the Engineer schedule an inspection. With the request the Contractor shall provide a preliminary list of items to be completed or corrected in order to make the Work comply with the Contract Documents. The Engineer will review the list and determine whether the Work is ready for inspection. The Engineer will perform the inspection together with the Contractor. The preliminary list, as revised during the inspection, is referred to as the Punch List. The Engineer may revise the Punch list at any time prior to Physical Completion when items needing completion or correction are discovered.

C. When the Contractor has completed all items on the approved Punch List or otherwise considers the Work to be fully completed in accordance with the Contract Documents and the Contractor has submitted the documents required by subparagraph G-07.01J, the Contractor shall so notify the Engineer and request a final inspection. The Engineer will perform such inspection. If the Engineer finds the Work not to be complete, the Engineer will so advise the Contractor and provide the Contractor with a revised Punch List of items to be completed or corrected, and then a re-inspection will be scheduled. When the Engineer finds that the Work is complete in accordance with the Contract Documents, the Engineer will so advise the Contractor in writing by sending a notice of Physical Completion thereby establishing a Physical Completion date.

D. When Substantial Completion or Physical Completion of the Work or designated portion thereof has been achieved, the Engineer will advise the Contractor in writing of the date Substantial Completion or the date of Physical Completion for the Work or such designated portion thereof was achieved. Such writing will state whether the Contracting Agency shall thereupon assume responsibility for security, maintenance, heat, utilities, risk of loss, and insurance with respect to the Work or designated portion thereof determined to be substantially complete. If such writing does not so state, all responsibility for the foregoing items shall remain with the Contractor until the date of the Final Completion as provided for in paragraph G-08.09 below. Warranties required by the Contract Documents shall commence on the date of Final Completion of the Work.

E. The failure of the Contractor or the Engineer to include any items on the Punch List does not alter the Contractor’s responsibility to complete all Work in accordance with the Contract Documents, nor shall such failure be any indication that the Engineer considers any items not included on the Punch List to be complete.

G-08.09 Final Completion

When the Contractor has completed all Work in accordance with the Contract Documents and the Contractor has submitted the documents required by subparagraph G-07.01K and G-07.01E, the Engineer will so advise the Contractor in writing by sending a notice of Final Completion thereby establishing a Final Completion date.

G-08.10 Completion of Punch List

If the Contractor does not expeditiously proceed with correctional completion of Punch List items identified in the final Inspection, the Contracting Agency may, in its sole discretion, remove such items from the scope of Work by Change

Order. In such instance, the Contracting Agency may choose to (1) have the Work performed by another contractor with the cost of such Work to be deducted from the amount due the Contractor or claimed against the retained percentage, or (2) accept a credit for the uncompleted Work to be deleted by change order, with the amount of the credit to be determined at the sole discretion of the Engineer. The rights provided the Contracting Agency under this paragraph shall not relieve the Contractor of its responsibilities as required under any other provisions of the Contract Documents.

G-08.11 Final Acceptance

Final Acceptance shall be by formal action of the Port of Port Townsend Commission. Final Acceptance shall not constitute acceptance of unauthorized or defective Work, material or equipment. The Contracting Agency shall not be barred by Final Acceptance from requiring the Contractor to remove, replace, repair, or dispose of unauthorized or defective Work, material, or equipment or from recovering damages for the same.

G-08.12 Final Payment

A. The Final Payment shall be the release to the Contractor of the retained percentage or retainage bond when provided. The Final Payment of retained monies or release of retainage bond will be made only upon receipt of:

1. Final Completion date has been established; and
2. Final Pay Estimate has been signed by the Contractor; and
3. Completion of the Final Contract Voucher Certification; and
4. Approved Affidavits of Wages Paid for the Contractor and all Subcontractors (at all tiers).
5. No monies will be released to the Contractor prior to forty-give (45) days after Final Completion, and until such tie as all properly filed liens have been removed, and;
6. Certificate of Releases from Washington State Departments of Labor and Industries, Revenue, and Unemployment Security.

B. The making of the Final Payment shall not relieve the Contractor from claims arising from: liens, faulty or defective work appearing or discovery after completion of the Work, failure of the Work to comply with the requirements of the Contract Documents, or from the terms of special warranties required by the Contract Documents.

C. The Contractor’s and all Subcontractors' (at all tiers) original accounting records, certified payrolls, and all other relevant records pertaining to the Work or submitted as a claim for additional compensation, additional time or any combination thereof, shall be open to inspection and audit by representatives of the Contracting Agency for a period of not less than three (3) years after the date of Final Completion, and the Contractor shall retain such records for that period. The Contracting Agency shall have the right to seek reimbursement of any amount it determines was overpaid to the Contractor. Where payment for equipment, materials, labor or other incidentals thereto is based on the cost to parties other than the Contractor, the Contractor expressly guarantees that the records of such other parties shall be open to inspection and audit by representatives of the Contracting Agency on the same terms and conditions as the records of the Contractor. If an audit is to be commenced more than sixty (60) Days after Final Completion of the Contract, the Contractor will be given a reasonable notice of the time when such audit is to begin. The Contractor agrees that no claim shall be made against the Contracting Agency for the Work described herein unless the Contractor makes available to the Contracting Agency all records to be maintained in accordance with this subparagraph.

G-08.13 Payments Do Not Receive Contractor From Responsibility For Work

Payment to the Contractor of progress payments or the Final Payment does not in any way relieve the Contractor from its responsibility for the Work or its responsibility to repair, replace, or otherwise make good defective Work, materials or equipment. Likewise, the making of such payment does not constitute a waiver of the Contracting Agency’s right to reject defective or non-conforming Work, materials, or equipment (even though the same is covered by the payment), nor is it a waiver of any other rights of the Contracting Agency.

ARTICLE G-09
CHANGES IN THE WORK

G-09.01 The Contracting Agency May Make Changes

A. Without invalidating the Contract and without notice to the Contractor's surety, and at any time during the progress of the Work, the Contracting Agency may make changes in the Work, which changes include but are not limited to the following:

1. Increases or decreases in quantities of Work;
2. Deletion or alteration of all or any portion of the Work;
3. Changes in Specifications, designs, or both;
4. Altering the way the Work is to be done;
5. Addition of new Work;
6. Altering facilities, equipment, materials, services, or sites, provided by the Contracting Agency; and
7. Ordering the Contractor to speed up or delay the Work.

B. All such changes in the Work shall be authorized by Change Order, which order shall provide for any increase or decrease in the Contract Time or Contract Sum caused by such change. The Contract Sum and Contract Time may be changed only by Change Order. Contractor shall be deemed to have waived any claim for a change in Contract Time or Contract Term if Contractor fails to strictly comply with the provisions of paragraph 04.30.

G-09.02 Request for Proposal

In connection with a possible or proposed change, the Contracting Agency may request that the Contractor submit a proposal or provide other information to the Contracting Agency. The Contractor will submit such proposal or other information in a form and within the time period requested by the Contracting Agency. The Contractor's proposal shall include detailed price calculations for the proposed change, which shall specify the cost of all labor, material, equipment, and Subcontractor quotations. The Contractor's proposal shall also show as a separate item the proposed amount for markup, contingency, overhead, and fee, the total of which shall not exceed the applicable percentage as would be allowed for Work performed on a force account basis pursuant to paragraph G-08.06. A request by the Contracting Agency to the Contractor for a proposal shall not constitute authorization for the Contractor to proceed with any such proposed change in the Work, nor shall such request justify any delay in the performance of existing Work.

G-09.03 Compensation for Changes

A. General. Change Order Work under this Contract may be measured for payment at the Contracting Agency's sole discretion, as unit price work or as a lump sum item or as Force Account Work. "Unit price work", includes Work for which a unit price is established in the Contract's Schedule of Prices or by Change Order, but excludes items of Work listed either in such schedule or a Change Order as "lump sum" items. "Bid Quantity", means the total quantity of an item of unit price work which is listed in the Schedule of Prices.

B. Changes in the quantity of unit price Work. Where the nature of the changed Work does not differ materially from Work which is unit price Work, the change shall be measured and paid for (or credited) at the established unit prices, subject to the following exceptions:

1. Where quantity is less than 75%. If the quantity of an item or unit price Work actually performed or to be performed is less than 75 percent of the bid quantity for that item, the Contractor or the Contracting Agency may request a Change Order revising the unit price for that portion of the Work which is less than 75 percent of the bid quantity. Such request shall be accompanied by evidence to support the requested revision. The proposed revision will be evaluated by the Contracting Agency

considering such factors as the changes, if any, to the Contractor of the item, and the share, if any, of fixed expenses (excluded variable) properly chargeable to the change in quantity of that item up to 75 percent of the bid amount for that item. If the Contracting Agency and the Contractor agree on the change, a Change Order will be executed. If the parties cannot agree, the Contracting Agency may nevertheless issue the Change Order pursuant to paragraph G-09.04, and the Contractor will have the rights provided in paragraph G-09.05.

2. Where quantity is more than 125%. If the quantity of an item of unit price Work actually performed or to be performed is more than 125 percent of the bid quantity for that item, the Contractor or the Contracting Agency may request a change order revising the unit price for that portion of the Work which exceeds 125 percent of the bid quantity. Such request shall be accompanied by evidence to support the requested revision. The proposed revision will be evaluated considering such factors as the change in actual cost, if any, to the Contractor of that portion of the Work exceeding 125 percent of the bid quantity, and the share, if any, of fixed expenses (excludes variable) properly chargeable to that portion of change in quantity which exceeds 125 percent of the bid amount for that bid item.. If the Contracting Agency and Contractor agree on the change, a change order shall be executed. If the parties cannot agree, the Contracting Agency may nevertheless issue a change order pursuant to paragraph G-09.04 and the Contractor will have the rights provided in paragraph G-09.05.

C. Changes to Work Other than Unit Price Work

1. Additional Work. If no unit price has been established for Work added to the Contract by the Contracting Agency, the Contracting Agency and the Contractor will attempt to reach agreement as to the increase or decrease, if any, in the Contract Sum and the Contract Time caused by such change. The Engineer may require, prior to approval of such change order, that the Contractor submit a proposal detailing the information identified in paragraph G-09.02. If the Contracting Agency and Contractor agree, on the change, a Change Order will be executed. If the parties cannot so agree, the Contracting Agency may nevertheless issue a Change Order pursuant to paragraph G-09.04 and the Contractor will have the rights provided in paragraph G-09.05.

2. Deleted Work. The Contracting Agency may elects to delete all or a portion of the Work or may terminate the Contract in whole or part as provided in paragraph G-09.01. When the Contract is terminated in part, the partial termination shall be treated as a deletion change order for payment purposes as follows;

a) Payment will be made for the actual number of units of Work completed at the unit Contract prices unless the Engineer determines the unit prices are inappropriate for the Work actually performed. When that determination is made by the Engineer, payment for Work performed will be as mutually agreed. If the parties cannot agree the Engineer will determine the amount of the equitable adjustment in accordance with paragraph G-09.04;

b) Payment for partially completed lump sum items will be as mutually agreed. If the parties cannot agree, the Engineer will determine the amount of the equitable adjustment in accordance with paragraph G-09.04;

c) To the extent not paid for by the Contract prices for the completed units of Work, the Contracting Agency will pay as part of the equitable adjustment those direct costs necessarily and actually incurred by the Contractor in anticipation of performing the Work that has been deleted or terminated;

d) To the extent not paid for by the Contract prices for the completed units of Work, the Contracting Agency will pay as part of the equitable adjustment those direct costs necessarily and actually incurred by the Contractor in anticipation of performing the Work that has been deleted or terminated;

e) The total payment where the Contract is terminated in its entirety shall not exceed the total Contract price as modified by approved change orders less those amounts paid to the Contractor before the effective date of the termination; and

f) No claim for damages of any kind or for loss of anticipated profits on deleted or terminated Work will be allowed because of the termination or change order.

3. Acceptable materials ordered by the Contractor or delivered prior to the date the Contractor was notified to delete the Work may, at the Contracting Agency's option, be purchased from the Contractor at the Contractor's actual cost and thereupon become the property of the Contracting Agency, or the Contracting Agency will reimburse the Contractor for its actual costs connected with returning such materials to the suppliers.

a) No amount will be paid to the Contractor for any anticipated or estimated fee, which the Contractor could or would have earned if the deleted Work had been performed.

G-09.04 Issuance of Change Order

If the Contracting Agency and the Contractor are unable to reach agreement concerning the adjustment, if any, in the Contract Sum or Contract Time caused by a change, the Contracting Agency may nevertheless issue a Change Order implementing the change in the Work and directing the Contractor to perform the Work as changed. The Change Order may embody such terms as the Contracting Agency deems appropriate, and the Contractor shall diligently prosecute the Work in the most efficient, economical, and workmanlike manner, consistent with the best interests of the Contracting Agency. Unless otherwise stated in the Change Order the Contractor shall perform the changed Work on a Force Account basis pursuant to paragraph G-08.06. The Contractor shall be entitled to a change in the Contract Sum, or Contract Time to the extent directly caused by the change in Work.

G-09.05 Procedure for Protest by the Contractor

A. If the Contractor accepts the terms of a change order by the Contractor's endorsement thereon, or by failure to protest as provided in this paragraph, payment by the Contracting Agency in accordance with the terms of the Change Order shall constitute full compensation, including but not limited to that for labor, material, equipment, overhead, fee (including profit), and damages (direct or indirect) or any other claim for damages of any kind or nature, if any, and for all changes to the Work and to the Contract Time.

B. If the Contractor disagrees with any of the terms of a Change Order issued by the Contracting Agency, the Contractor shall give immediate oral notice of protest to the Engineer prior to performing the Work and shall submit a written protest to the Engineer within ten (10) Days of the Contractor's receipt of the Change Order. The protest shall identify the point of disagreement, those portions of the Contract Documents believed to be applicable, and an estimate of quantities and costs involved in the change. When protest of a Change Order relates to compensation, the Contractor shall keep full and complete records of the cost of such changed Work and shall permit the Contracting Agency to have access to those records as requested by the Contracting Agency to enable the Contracting Agency to evaluate the merits of the protest.

C. A protest shall not relieve the Contractor of its obligation to proceed without delay with the Work as directed in the Change Order. No adjustment to the Contract Sum or Contract Time will be made on account of Work performed preceding the Contractor giving oral notice of protest to the Engineer (to be followed by written protest as required in subparagraph B of this paragraph).

D. Within 30 Days of the Contracting Agency's receipt of written notice above, the Contractor shall provide the Contracting Agency with the following details:

1. A detailed factual statement of the claim for a change in Contract Sum and Contract Time, if any, providing all necessary dates, locations and items of Work affected by the claim;

2. The date on which facts arose which gave rise to the claim;

3. The name of each employee or agent of Contracting Agency, knowledgeable about the claim;

4. The specific provisions of the Contract Documents which support the claim,

5. The identification of any documents and the substance of any oral communications that support the claim;

6. Copies of any identified documents, other than the Contract Documents, that support the claim;

7. If an adjustment in the Contract Time is sought, the specific days and dates for which it is sought; the specific reasons Contractor believes an extension in the Contract Time should be granted; and Contractor's analysis of its progress schedule to demonstrate the reason for the extension in Contract Time (time impact analysis);

8. If an adjustment in the Contract Sum is sought, the exact amount sought and a breakdown of that amount into the categories set forth in article, G-09.02;

9. A statement certifying, under penalty of perjury, that the claim is made in good faith, that the supporting cost and pricing data are true and accurate to the best of Contractor's knowledge and belief, that the claim is fully supported by the accompanying data, and that the amount requested accurately reflects the adjustment in the Contract Sum or Contract Time for which Contractor believes the Contracting Agency is liable. The individual signing such certification shall be a duly authorized representative of the Contractor who has the necessary and appropriate authority and responsibility to commit the Contractor to the truthfulness of the certification; and

10. A statement that the claim covers all changes in cost and in time (direct, indirect, impact, consequential, and otherwise) to which the Contractor (and Subcontractors and Suppliers of any tier) is entitled.

E. The Contracting Agency shall be entitled to recover its costs incurred for analysis/administration of processing and evaluating a claim to the extent a portion of the claim that is determined to be not recoverable from the Contracting Agency. The cost of reimbursement will be the percentage of the original claim that is determined to be not recoverable times the cost of analysis/administration.

F. Dispute Resolution Process

1. Level I. Within seven (7) Days of receipt of the Contractor's documentation, the senior site representative of the Contractor and the Project Manager for the Contracting Agency shall meet, confer, and set a schedule for resolving the claim.

2. Level II. Within seven (7) Days of the close of the Level I meetings, the general manager (or equivalent) of the Contractor and the Engineer for the Contracting Agency, (none of whom attended the Level I meeting) shall be jointly briefed by both the Contracting Agency and Contractor Level I representatives on the results of the Level I meetings, their respective positions, and remaining areas of disagreement. The Contracting Agency and Contractor Level II representatives shall then establish a schedule for resolving the claim. The Contracting Agency shall have the right to request additional information from the Contractor and its Subcontractors, Suppliers, etc. at any time prior to or during the Level II meeting. If an adjustment to the Level II meeting schedule is necessary to accommodate such requests for additional information, such adjustment shall be as mutually agreed by the representatives. If agreement on the schedule cannot be reached, the Level II meetings shall be terminated and the matter referred to the following Level III.

3. Level III: Within seven (7) Days of the close of the Level II meeting, the owner or corporate officer of the Contractor (who did not attend the Level I or II meetings) and the Contracting Agency's Executive Director (who did not attend the Level I or II meetings) shall be jointly briefed by both the Contracting Agency and Contractor Level II representatives on the results of the Level II meetings, their respective positions, and remaining areas of disagreement. The Contracting Agency and Contractor Level III representatives shall then establish a schedule for resolving the claim. The Contracting Agency shall have the right to request additional information from the Contractor and its Subcontractors, Suppliers, etc. at any time prior to or during the Level III meeting. If an adjustment to the Level III meeting schedule is necessary to accommodate such requests for additional information, such adjustment shall be as mutually agreed by the representatives. If agreement on

the schedule cannot be reached, the Level III meetings shall be terminated and the matter referred to the next level in this Dispute Resolution Process.

4. The terms of the resolution of all claims concluded in Level I, II or III meetings shall be documented in writing and signed by each party.

5. Dispute Review Board. When a Dispute Review Board is required by Supplemental Conditions, and the claim is not resolved within seven (7) Days of completion of the Level III meeting, the claim shall be submitted to the Dispute Review Board as provided for in the Supplementary Conditions.

6. Mediation. If the claim is not resolved in the Level III meeting and no Dispute Review Board is required, the Contractor may bring no claim against the Contracting Agency in litigation unless the claim is first subject to non-binding mediation or non-binding arbitration as mutually agreed by the Contracting Agency and Contractor. If no agreement is reached, then Contracting Agency has the sole right to determine which method is utilized. Mediation shall be conducted before a single mediator under the Voluntary Construction Mediation Rules of the American Arbitration Association. The parties shall schedule mediation sessions at the earliest possible date(s), subject to the schedule of the selected (or appointed) mediator. The parties shall cooperate with the mediator and assure timely and full access to such personnel and documents as the mediator may request. The costs of mediation and/or arbitration shall be equally divided between the parties. Payment to the mediator shall be by the Contracting Agency who, after payment, shall deduct 50% of the cost (less 50% of any costs that may have been paid directly by the Contractor) from monies due the Contractor.

G. Litigation. The Contractor may bring no litigation on claims unless such claims have been properly raised and considered in the procedures above. All unresolved claims of the Contractor shall be waived and released unless the Contractor has strictly complied with the time limits of the Contract Documents, and a lawsuit is served and filed within the limits stated in Paragraph G 04.31. This requirement cannot be waived, except by an explicit written waiver signed by the Contracting Agency.

H. Claims Audits. All claims filed against Contracting Agency shall be subject to audit at any time following the filing of the claim. Failure of Contractor, or Subcontractors of any tier, to maintain and retain sufficient records to allow the Contracting Agency to verify all or a portion of the claim or to permit the Contracting Agency access to the books and records of the Contractor, or Subcontractors of any tier, shall constitute a waiver of the claim and shall bar any recovery. The audit may be performed either by employees of Contracting Agency or a representative of the Contracting Agency. The Contractor, and its Subcontractors, shall provide adequate facilities acceptable to the Contracting Agency for the audit during normal business hours. The Contractor, and all Subcontractors, shall make a good-faith effort to cooperate with the Contracting Agency's auditors.

I. Joinder. At the Contracting Agency's sole discretion, Contracting Agency may require all claims or controversies arising out of this Contract may be consolidated in mediation between Contracting Agency and Contractor and its Subcontractors or Sub-subcontractors.

G-09.06 Changed Conditions

A. In the event Contractor encounters: (a) subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents, (b) unknown physical conditions of an unusual nature at the site differing materially from those ordinarily encountered and generally recognized as inherent in the Work of the character provided for in the Contract Documents, and such conditions cause an increase in Contractor's cost or time of performance, Contractor may be entitled to an equitable adjustment in Contract Time. The Contractor shall notify the Engineer promptly orally and in writing in accordance with G04.30 of such changed conditions or other conditions for which an equitable adjustment in Contract Sum or Contract Time is desired. If such notice is not given prior to the condition being disturbed (or other action being taken by the Contractor which may result in a claim for an increase in the Contract Time or the Contract Sum), or such condition is disturbed before the Contracting Agency directs the Contractor to proceed with the Work despite the condition, the Contractor will be deemed to have waived any claim for extra compensation or extension of the Contract Time on account of any additional or different work (including labor, material and equipment) required because

of such condition. Oral notice alone by the Contractor to the Contracting Agency regarding such condition shall not be adequate to avoid such waiver.

B. If the Engineer determines that conditions exist which entitle the Contractor to equitable adjustment in the Contract Sum to account for the performance of the work involved, and the additional Contract Time, if any, required to perform such work, Engineer will determine such adjustment. If the Contracting Agency and the Contractor agree on such adjustment, the same shall be set forth in a Change Order to be executed by the parties. If the parties are unable to so agree, the Contracting Agency may nevertheless issue a Change Order directing the Contractor to perform the changed Work pursuant to paragraphs G-09.03, and G 09.04.

C. If the Engineer determines that the Contractor's request does not warrant an equitable adjustment in the Contract Sum and/or Contract Time, the Contractor shall diligently pursue the Work in accordance with the Engineer's direction while retaining the right to protest the Engineer's decision in accordance with paragraph G-09.05.

ARTICLE G-10
PORT OF PORT TOWNSEND'S RIGHTS AND REMEDIES, AND TERMINATION OF CONTRACT

G-10.01 General

A. The rights and remedies of the Contracting Agency set forth in the Contract Documents are cumulative and in addition to and not in limitation of any rights and remedies otherwise available to the Contracting Agency under law. The pursuit of any remedy by the Contracting Agency shall not be construed to bar the Contracting Agency from the pursuit of any other remedy in the event of similar, different, or subsequent breaches of this Contract.

B. The rights reserved or possessed by the Contracting Agency to take any action with respect to the Project shall not give rise to any duty on the part of the Contracting Agency to exercise any such right for the benefit of the Contractor, Subcontractor, Sub-subcontractor, Supplier, or any other person.

G-10.02 No Waiver of Contracting Agency's Rights

A. No action, delay in acting, or failure to act by the Contracting Agency shall constitute a waiver of any right or remedy of the Contracting Agency or be held to reduce any amount owed to the Contracting Agency by the Contractor. Nor shall such action, delay, or failure to act constitute an approval or acquiescence in any breach or defect in Work, materials, or equipment. Likewise, delay or failure of the Contracting Agency to act upon or enforce any provision of this Contract shall not constitute a waiver of such provision or otherwise prejudice the right of the Contracting Agency to enforce such provision at any subsequent time. No provision of this Contract shall be held to be waived, modified, or deleted except as expressly stated in a Change Order.

B. The Contracting Agency shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after the Substantial Completion or Final Completion of the Work and payment therefore from showing the true amount and character of the Work performed and materials furnished by the Contractor, or from showing that any such measurement, estimate or certificate is untrue or was incorrectly made, or that the Work or materials do not conform in fact to the requirements of the Contract Documents. Notwithstanding any such measurement, estimate, certificate, or payment in accordance therewith, the Contracting Agency shall not be precluded or estopped from recovering from the Contractor and its sureties such damages as the Contracting Agency may sustain by reason of the Contractor's failure to perform the Work in accordance with the Contract Documents or to otherwise comply with the requirements of the Contract Documents.

C. Neither the final inspection, Final Completion, Final Acceptance, nor any payment for the whole any part of the Work, nor any extension of time, nor any possession or use of the Work taken or made by the Contracting Agency, shall operate as a waiver by the Contracting Agency of any provision of the Contract Documents or of any rights, remedies, or damages herein provided for, or bar recovery of any money wrongfully or erroneously paid to the Contractor.

G-10.03 Port's Right to Suspend Work for Unsuitable Weather and Other Conditions

A. The Engineer may direct that all or any part of the Work be suspended for such time period as the Engineer deems proper because of unsuitable weather, or other conditions beyond the control of the Contracting Agency and the Contractor, which prevents satisfactory performance of the Work. The Contractor shall immediately comply with the directive to suspend Work. The Contractor shall resume the suspended Work when so directed by the Engineer.

B. Such suspension of Work by the Engineer shall not be grounds for a claim by the Contractor for an increase in the Contract Sum, however, Contract Time may be adjusted in accordance with paragraph G-07.03 unless the Engineer concludes that the Contractor could have performed the suspended Work if the Contractor had diligently prosecuted the Work prior to such suspension.

G-10.04 Contracting Agency's Right to Stop the Work

A. If the Contractor fails to perform the Work in accordance with the Contract Documents, fails to correct defective Work as required by paragraph G-04.22, or fails to comply with any other directive issued by the Contracting Agency, the Contracting Agency may order, in writing, that the Contractor stop all or any portion of the Work until the cause for such order is eliminated.

B. In the event of an order to stop Work, the Contractor shall not be entitled to any increase in the Contract Time or Contract Sum, nor to any damages or relief from liability, on account of such order to stop Work.

C. Upon ten (10) Days' written notice to the Contractor, the Contracting Agency may suspend the Work for its convenience and without cause. In the event such suspension causes a change in Contractor's cost or time of performance of the Work, Contractor shall be entitled to make a claim for a change in Contract Time and Contract Price as set forth in Article G-09.

G-10.05 Contracting Agency's Right to Withhold Payment

The Contracting Agency has the right to withhold making all or part of any payment otherwise due the Contractor if and so long as the Contractor is in breach of any of its obligations under this Contract.

G-10.06 Termination of Contract for Cause

A. The Contracting Agency may terminate the Contract as to all or any portion of the Work remaining to be performed upon seven (7) Days' written notice to the Contractor and Contractor's surety, and to complete the Work by whatever method the Contracting Agency may deem expedient, and recover the costs thereof from the Contractor and the Contractor's surety in the event the Contractor:

1. Refuses or fails to supply sufficient, properly skilled workers or materials of the proper quality or quantity;

2. Refuses or fails to make prompt payment to Subcontractors, or for labor or materials;

3. Fails to prosecute the Work continuously to completion with promptness and diligence;

4. Fails to perform any of its obligations under the Contract; or

5. Becomes insolvent or is declared bankrupt or commits any acts of bankruptcy or insolvency or makes an assignment for the benefit of Contractor's creditors.

B. Upon termination of the Contract under this paragraph, the Contracting Agency may exclude the Contractor from the Project site(s), take possession of the Work and all materials and equipment stored on or off site for which payment has been made pursuant to paragraph G-08.05, and complete the Work if and as it sees fit.

C. If the Contracting Agency elects not to complete the Work, the Contractor and the Contractor's surety shall not thereby be released from any liability it may have to the Contracting Agency for damages on account of the breach of its obligations under this Contract.

D. If the Contracting Agency elects to complete all or a portion of the Work, it may do so as it sees fit. The Contracting Agency shall not be obligated to the Contractor to accept the lowest bid for completion of the Work. The Contracting Agency may choose to complete all or a portion of the Work using its own work force. The cost of such Work shall be deducted from the amount due to the Contractor or claimed against the retained percentage. In any event, if the costs to the Contracting Agency (including all administrative costs) exceed the unpaid portion of the Contract Sum applicable thereto, the Contractor is liable for and shall pay the difference to the Contracting Agency.

E. The rights provided by this paragraph shall survive the termination of this Contract, as shall all other rights to damages or other remedies against the Contractor.

G-10.07 Termination for Convenience

Upon ten (10) Days written notice to the Contractor, the Contracting Agency may terminate the Contract at its convenience and without cause. In such case, the Contractor shall be paid for all Work performed and reasonable expenses properly incurred in connection with the termination. No amount will be paid to the Contractor for any anticipated or estimated fee or profit for Work not performed which the Contractor could or would or may have earned if the Contract had not been terminated. Title to all Work performed at the time of termination shall be transferred to the Contracting Agency upon payment therefore.

G-10.08 Damages for Unexcused Delays by the Contractor

A. The Contractor recognizes that any unexcused delay by the Contractor in the prosecution and completion of the Work will cause inconvenience and expense to the Contracting Agency, its lessees, and other users of Port facilities. The Contractor further acknowledges that unexcused delays in the prosecution and completion of the Work may obstruct water, or other traffic, interfere with and delay business and commerce, or expose the Contracting Agency to possible claims of direct and consequential damages from third parties. Additionally, such delays may cause the Contracting Agency to incur substantially increased costs of administration, engineering, supervision, and inspection in connection with the completion of the Work.

B. In certain circumstances, it is recognized that it will be impracticable and extremely difficult to ascertain and determine the actual damages, as generally described above, which will be suffered by the Contracting Agency as a result of an unexcused delay by the Contractor. In such circumstances, where specifically provided for in the General Requirements or Supplementary Conditions, the Contractor shall be liable to the Contracting Agency for Liquidated Damages in the amount set forth in the General Requirements or Supplementary Conditions, for each Day following the Substantial Completion date that Contractor achieves Substantial Completion and for each day following the Final Completion date that Contractor achieves Final Completion. Neither this subsection nor any amounts specified in the General Requirements or Supplementary Conditions as Liquidated Damages shall be considered to be a penalty, it being the express agreement of the Contractor and the Contracting Agency that the Liquidated Damages provided shall be a reasonable approximation of actual damages to be suffered by the Contracting Agency for late performance.

C. Any deduction or payment of Liquidated Damages shall not in any way release the Contractor from any further or other obligation and liability with respect to Contractor's obligation to achieve Final Completion.

D. If the General Requirements or Supplementary Conditions do not provide for Liquidated Damages as provided in subparagraph B of this paragraph, the Contractor shall be subject to liability for the actual damages (including but not limited to the items set forth in subparagraph A of this paragraph) suffered by the Contracting Agency as a result of delay in completing the Work.

G-10.09 Contracting Agency's Right to Use the Premises

A. The Contracting Agency reserves the right to use any part of the Work before completion of the entire Work without relieving the Contractor of any of its obligations under the Contract. Such use shall not constitute acceptance by the Contracting Agency of any of the Work.

B. No additional compensation will be paid to the Contractor for costs incurred by it as a result of the Contracting Agency's use or occupancy of the Work or a designated portion thereof following its Substantial Completion, or for additional safety measures including warning device costs, made necessary to protect the Contractor's operations, the public, or Contracting Agency employees.

G-10.10 Prevailing Party to be Awarded Litigation Expenses

In any action between the Contracting Agency and the Contractor concerning the rights and obligations imposed on them by this Contract, the prevailing party in such action, upon a finding by a court having jurisdiction, shall be entitled to recover from the other party its expenses of litigation (including reasonable attorneys' fees, expert consultants' fees, and other expenses related to the action). The cost of publicly employed counsel of the Contracting Agency shall be recoverable by the Contracting Agency under this paragraph, and the fees of such counsel shall be established based on the prevailing rate for attorneys in private practice of comparable qualifications and experience.

ARTICLE G-11
BONDS AND INSURANCE

G-11.01 Performance Bond

A. The Contractor shall furnish a duly executed performance bond upon a form acceptable to the Contracting Agency, within ten (10) Days following receipt of the notice of award. The bond shall be executed by a licensed surety (or sureties) which is registered with the Washington State Insurance Commissioner and the surety's name shall appear in the current Authorized Insurance Company List for the state of Washington published by the Office of the Insurance Commissioner, and must be approved by the U. S. Department of Treasury as evidenced by a listing in the Federal Register. In addition, the surety or sureties must be rated "A-, FSC (6)", or higher by A.M. Best Rating Guide. The penal amount of the bond shall be in an amount equal to the Contract Sum plus Washington State Sales Tax, if applicable, and conditioned upon the faithful performance of the Contract by the Contractor within the Contract Time.

B. If the Contract Sum does not exceed $25,000 the Contractor may, in lieu of providing a bond, request the Contracting Agency to retain 50% of the Contract amount earned for a period of 45 Days following Final Completion of the Work or until receipt of all necessary releases and settlement of any liens filed under Chapter 60.28 R.C.W., whichever is later, at which time the Contracting Agency will make Final Payment.

G-11.02 Payment Bond

A. The Contractor shall also furnish a duly executed payment bond upon a form acceptable to the Contracting Agency, within ten (10) Days following receipt of the notice of award. The bond shall be executed by a licensed surety (or sureties) which is registered with the Washington State Insurance Commissioner and the Surety's name shall appear in the current Authorized Insurance Company List in the state of Washington published by the Office of the Insurance Commissioner, and must be approved by the U. S. Department of Treasury as evidenced by a listing in the Federal Register. In addition, the surety or sureties must be rated "A-, FSC (6)", or higher by A.M. Best Rating Guide. The penal amount of the bond shall be in an amount equal to the Contract Sum plus Washington State Sales Tax, if applicable, and conditioned upon the payment by the Contractor to all laborers, mechanics, Subcontractors, and Suppliers, and all persons who shall supply the Contractor, subcontractors or sub-subcontractors with provisions, equipment, or supplies for the performance of the Work covered by this Contract.

B. If the Contract Sum does not exceed $25,000 the Contractor may, in lieu of providing a bond, request the Contracting Agency to retain 50% of the Contract amount earned for a period of 45 Days following Final Completion of the Work or until receipt of all necessary releases and settlement of any liens filed under Chapter 60.20 R.C.W., whichever is later, at which time the Contracting Agency will make Final Payment.

G-11.03 Failure to Provide Bonds

A. Failure to timely provide performance and payment bonds will result in cancellation of the Contract award and forfeiture of the bid guaranty to the Contracting Agency.

B. The Contracting Agency may, from time to time, require the Contractor's surety or sureties to appear and qualify themselves upon the bonds. If such surety or sureties shall refuse or fail to so appear and qualify, or if the Contracting Agency determines that such surety or sureties are insufficient to fulfill the terms and conditions of the bonds, then the Contracting Agency shall require the Contractor to furnish additional surety or sureties as may be necessary to fulfill the terms and conditions of the bonds. Payments may be withheld on the Contract until sufficient surety, as required, is furnished.

C. If the Contract Sum is increased by Change Order, the Contractor agrees to provide the Contracting Agency with such additional performance and payment bonds as required to assure performance of any additional Work and payment for the labor and materials incidental to such Work. Change Orders may be issued without notice to sureties. Compensation for additional bonding, where required by a Change Order, shall be included in the 15% markup allowed the Contractor for all Change Orders.

G-11.04 Insurance

A. The Contractor shall procure and maintain for the duration of the Agreement, insurance against claims for injuries to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the Contractor, their agents, representatives, employees or subcontractors.

B. Limitation. Contractor's maintenance of insurance as required by the agreement shall not be construed to limit the liability of the Contractor to the coverage provided by such insurance, or otherwise limit the Contracting Agency's recourse to any remedy available at law or in equity.

C. Minimum Scope of Insurance

Contractor shall obtain insurance of the types described below:

1. **Automobile Liability** insurance covering all owned, non-owned, hired and leased vehicles. Coverage shall be written on Insurance Services Office (ISO) form CA 00 01 or a substitute form, providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage.

2. **Commercial General Liability** insurance shall be written on ISO occurrence form CG 00 01 or the equivalent and shall cover liability arising from premises, operations, independent contractors, products-completed operations, stop gap liability, personal injury and advertising injury, and liability assumed under an insured contract.

3. **Excess or Umbrella Liability** insurance shall be excess over and as least as board in coverage as the Contractor's Commercial General and Automobile Liability coverages. All entities listed as additional insured shall be named as additional insured on the Contractor's Excess or Umbrella Liability insurance policy.

4. **Contractor's Pollution Liability** insurance for claims, including investigation, defense, or settlement costs and expense for bodily injury and property damage (including natural resources damages and loss of use of tangible property that has not been physically injured) arising out of:

   a) Pollution conditions caused or made worse by the Contractor's performance of the Work, including clean-up costs for a newly caused condition or a historical condition made worse; and;

   b) The vicarious liability of subcontractors or any tier.

5. **Workers' Compensation** coverage as required by the Industrial Insurance laws of the state of Washington.

D. Minimum Amounts of Insurance

Contractor shall maintain the following insurance limits:

1. **Automobile Liability** insurance with a minimum combined single limit for bodily injury and property damage of $1,000,000 per accident.

2. **Commercial General Liability** insurance shall be written with limits no less than $1,000,000 each occurrence, $2,000,000 general aggregate and a $2,000,000 products-completed operations aggregate limit for each one (1) year policy period.

3. **Excess or Umbrella Liability** insurance with limits of not less than $3,000,000 each occurrence and annual aggregate.

4. **Contractor's Pollution Liability** insurance with a minimum "per project" limit of $1,000,000 each occurrence and in the aggregate.

E. Other Insurance Provisions

The insurance policy are to contain, or be endorsed to contain, the following provisions for Automobile Liability and Commercial General Liability insurance:

1. The Contractor's insurance coverage shall be primary insurance as respects the Contracting Agency. Any Insurance, self-insurance, or insurance pool coverage maintained by the Contracting Agency shall be excess of the Contractor's insurance and shall not contribute with it.

2. The Contracting Agency, its elected and appointed officials, and its employee and agents shall be named as an insured under the insurance policies with respect to the Work and obligations to be performed by the Contractor.

3. The Contractor's insurance shall be endorsed to state that coverage shall not be cancelled by either party, except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the Contracting Agency.

4. The Contractor shall procure and maintain any other insurance applicable to this contract as may be required by local, state, or federal law.

5. The Contractor shall be Named Insured and the Contracting Agency, its elected and appointed officials, and its employees and agents (collectively the "Additional Insured") shall be included as Additional Insured, or as appropriate, a Named Insured, under the policy and coverage.

6. The Contractor's insurance policies shall contain an express waiver of any right of subrogation by the insurance company against the Contracting Agency and its elected officials, employees or agents.

7. The Contractor's insurance policies shall expressly provide that the defense and indemnification of the Contracting Agency as an "Additional Insured" will not be effected by any act or omission by Contractor which might otherwise result in a forfeiture of said insurance.

8. The Contractor's insurance policies shall contain a separation of insureds provision such that the policy applies separately to each insured that is subject of a claim or suit.

9. The Contractor's insurance policies shall not contain a cross-claim, cross-suit, or other exclusion that eliminates coverage by one insured against another.

10. The Contractor's insurance policies shall provide for coverage for damage to the Contracting Agency's property caused by the Contractor.

11. The Contractor shall assume full responsibility for all loss or damage from any cause whatsoever to any tools, Contractor's employee-owned tools, machinery, equipment, or equipment/boom borrowed from the Contracting Agency, or motor vehicles owned or rented by the Contractor, or the Contractor's agents, suppliers, or Contractors as well as to any temporary structures, scaffolding, and protective fences.

F. Acceptability of Insurers

Insurance is to be placed with insurers with a current A.M. Best rating of not less than A:VII.

G. Verification of Coverage

Contractor shall furnish the Contracting Agency with original certificates and a copy of the amendatory endorsements, including but not necessarily limited to the additional insured endorsement, evidencing the insurance requirements of the Contractor before commencement of the Work.

H. Subcontractors

Contractor shall ensure that each subcontractor of every tier obtain at a minimum the same insurance coverage and limits as stated herein for the Contractor. Upon request from the Contracting Agency, the Contractor shall provide evidence of such insurance.

I. Additional Insured

All insurance policies, with the exception of Workers Compensation, LHWCA, Professional Liability, and Builder's Risk (if required by this Contract) shall name the following listed entities as additional insured(s) using the forms or endorsements required herein:

1. The Contracting Agency and its officers, elected officials, employees, and agents

The above-listed entities shall be additional insured(s) for the full available limits of liability maintained by the Contractor, irrespective of whether such limits maintained by Contractor are greater than those required by this Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor describes limits lower than those maintained by the Contractor.

For Commercial General Liability insurance coverage, the required additional insured endorsements shall be at least as broad as ISO forms CG 20 10 10 01 for ongoing operations and CG 20 37 10 01 for completed operations.

END OF SECTION

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS
Section 00 73 00 - Supplementary Conditions

The Contractor is notified that this contract is funded through the Washington State Department of Commerce with federal funds from the U.S. Treasury ARPA SLFRF under CFDA #21.027.

The Contractor must comply with the terms and conditions below.

The following supplements shall modify, delete, and/or add to the General Conditions or Instructions to Bidders. Where any article, paragraph, or subparagraph in the General Conditions is supplemented by one of the following paragraphs, the provisions of such article, paragraph, or subparagraph shall remain in effect and the supplemental provisions shall be considered as added thereto. Where any article, paragraph, or subparagraph in the General Conditions is amended, voided, or superseded by any of the following paragraphs, the provisions of such article, paragraph, or subparagraph not so amended, voided, or superseded shall remain in effect.

The supplements referenced within this section are identified with the same number and title used for that topic in the General Conditions.

Supplement Article G-03 PORT OF PORT TOWNSEND with the following section:

SC-03.08 ACCESS TO RECORDS AND REPORTS

In accordance with CFR 200.336, the Contractor agrees to provide the Port of Port Townsend, applicable federal agencies, the Comptroller General of the United States, the State of Washington, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.

Supplement Article G-04 CONTRACTOR'S RESPONSIBILITIES with the following section:

SC-04.35 RECYCLED PRODUCTS

To the extent practicable and economically feasible, the Contractor shall provide a competitive preference for products and services that conserve natural resources and protect the environment and are energy efficient. Examples of such products may include, but are not limited to, products described in U.S. Environmental Protection Agency (U.S. EPA) guidelines at 40 C.F.R. Parts 247-253, implementing section 6002 of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. § 6962. The Contractor shall include this provision in all of its subcontracts, with the requirement that it shall flow down to all subcontracts regardless of tier.

Supplement Article G-04 CONTRACTOR'S RESPONSIBILITIES with the following section:

SC-04.36 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT (40 U.S.C 3701-3708)

A. Overtime Requirements: No contractor or subcontractor contracting for any part of the Work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

B. Violation; Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph (A) of this provision, the Contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (A) of this provision, in the sum of $31 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in subparagraph (A) of this provision.

C. Withholding for Unpaid Wages and Liquidated Damages: The Port shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (B) of this provision.

D. Compliance with OSHA: The Contractor agrees to comply with section 107 of the Contract Work Hours and Safety Standards Act, 40 U.S.C. 333, and applicable Department of Labor regulations, "Safety and Health Regulations for Construction" 29 CFR 1926. Among other things, the Contractor agrees that it will not require any laborer or mechanic to work in unsanitary, hazardous, or dangerous surroundings or working conditions.

E. Subcontracts: The Contractor or subcontractor shall insert in any subcontracts the paragraphs set forth in this provision 5, Contract Work Hours and Safety Standards Act, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in this provision.

1. The term "subcontract" under this section is considered to refer to a person who agrees to perform any part of the labor or material requirements of a contract for construction, alteration, or repair. A person who undertakes to perform a portion of a contract involving the furnishing of supplies or materials will be considered a "subcontractor" under this provision if the work in question involves the performance of construction work and is to be performed (1) directly on or near the construction site, or (2) by the employer for the specific project on a customized basis. Thus, a supplier of materials, which will become an integral part of the construction is a "subcontractor" if the supplier fabricates or assembles the goods or materials in question specifically for the construction project and the work involved may be said to be construction activity.

2. If the goods or materials in question are ordinarily sold to other customers from regular inventory, the supplier is not a "subcontractor." The requirements of this section do not apply to contracts or subcontracts for the purchase of supplies or materials or articles normally available on the open market.

Supplement Article G-04 CONTRACTOR'S RESPONSIBILITIES with the following section:

SC-04.37 CLEAN AIR ACT (42 U.S.C. 7401-7671q.) AND THE FEDERAL WATER POLLUTION CONTROL ACT (33 U.S.C. 1251-1387), AS AMENDED

The Contractor shall comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

All contracts must comply with the mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. 6201).

Supplement Article G-04 CONTRACTOR'S RESPONSIBILITIES with the following section:

SC-04.38 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS – PRIMARY COVERED TRANSACTIONS

A. Contractor must comply with Executive Orders 12549 and 12689 and 2 C.F.R. Part 180, which restricts awards, subawards, and contracts with certain parties that are debarred, suspended, or

otherwise excluded from or ineligible for participation in federal assistance programs or activities. Contractor must certify that it is not presently debarred, suspended, or proposed for debarment, declared ineligible, or voluntarily excluded from participating in this Agreement by any federal department or agency.

B. The prospective first tier participant agrees by submitting this Bid that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, and is providing the assurance and certification for such.

Supplement Article G-04 CONTRACTOR'S RESPONSIBILITIES with the following section:

SC-04.39 ANTI-LOBBYING AMENDMENT

Contractors who apply or bid on a solicitation valued at $100,000 or more shall file the certification required by 31 USC 1352, " Additionally, the Contractor shall require each subcontractor and each lower tier subcontractor exceeding $100,000 to certify to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier shall also disclose the name of any registrant under the Lobbying Disclosure Act of 1995 who has made lobbying contacts on its behalf with non-Federal funds with respect to that Federal contract, grant or award covered by 31 U.S.C. 1352. Such disclosures are forwarded from tier to tier up to the Contractor to be submitted to the Port.

Supplement Article G-04 CONTRACTOR'S RESPONSIBILITIES with the following section:

SC-04.40 PREVAILING WAGES

This Contract is subject to the Washington State prevailing wage requirements – the Davis-Bacon Act requirements do not apply to this project as it is funded solely with award funds from the ARPA-SLFRF program. The applicable Washington State Prevailing Wages will be the prevailing wage rate for Jefferson County effective on the date the bid is due, as provided in the Contract Documents.

Supplement Article G-04 CONTRACTOR'S RESPONSIBILITIES with the following section:

SC-04.41 DOMESTIC PREFERENCE (2 C.F.R. 200.322)

A. To the greatest extent practicable, this procurement contains a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this award.

B. For purposes of this section:

1. "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

2. "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

Supplement Article G-06 NON-DISCRIMINATION with the following section:

SC-06.03 OPEN AND FAIR OPPORTUNITIES

A. During the term of this Agreement, the Contractor shall not create barriers to open and fair opportunities to participate in Port contracts or to obtain or compete for contracts and subcontracts as sources of supplies, equipment, construction, and services. During the performance of this Agreement, neither the Contractor nor any party subcontracting under the authority of this Agreement shall discriminate nor tolerate harassment on the basis of race, color, sex, religion, nationality, creed, marital status, sexual orientation, age, or the presence of any sensory, mental, or physical disability in the employment or application for employment or in the administration or delivery of services or any other benefits under this Agreement.

1. The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

2. The selected Contractor shall comply fully with all applicable federal, state, and local laws, ordinances, executive orders, and regulations that prohibit such discrimination including RCW Chapter 49.60. The Contractor further agrees to comply with all applicable civil rights statutes and implementing regulations including, but not limited to the following:

a) Nondiscrimination in Federal Programs: The selected Contractor agrees to comply with the provision of, 41 CFR, Part 60 et seq., which provides for equal opportunity and prohibits discrimination on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin, and prohibits such discrimination in any business opportunity or employment, including application for employment, promotion, demotion, transfer, recruitment, layoff or termination, rates of pay or compensation, or selection for training, including apprenticeship.

b) Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Non-discrimination on the grounds of race, color, religion, sex, sexual orientation, gender identity, or national origin.

c) Information and Reports: The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the federal agency to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the federal agency, as appropriate, and will set forth what efforts it has made to obtain the information.

d) Incorporation of Provisions: The contractor will include the provisions of paragraphs in this section in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the Port may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the

contractor may request the United States to enter into the litigation to protect the interests of the United States.

Supplement Article G-06 NON-DISCRIMINATION with the following section:

SC-06.04 CONTRACTING WITH SMALL AND MINORITY BUSINESS, WOMEN'S BUSINESS ENTERPRISES, AND LABOR SURPLUS AREA FIRMS

The prime contractor shall be required to take the affirmative steps listed in 2 CFR 200.321, if subcontracting work, to assure that minority businesses, women's business enterprises, and labor surplus area firms are used whenever possible.

Supplement Article G-10 PORT OF PORT TOWNSEND'S RIGHTS AND REMEDIES, AND TERMINATION OF CONTRACT with the following section:

SC-10.11 TERMINATION OF CONTRACT

The Port of Port Townsend reserves the right to terminate this Agreement at any time by sending written notice of termination to Contractor ("Notice"). The Notice shall specify a termination date ("Termination Date") at least fourteen (14) days after the date the Notice is issued. The Notice shall be effective ("Notice Date") upon the earlier of either actual receipt by Contractor or three business days after issuance of the Notice. Upon the Notice Date, Consultant shall immediately commence to end the Work in a reasonable and orderly manner. Unless terminated for Contractor's material breach, the Contractor shall be paid or reimbursed for (a) all hours worked and Eligible Expenses incurred up to the Notice Date, less any payments previously made and (b) those hours worked and Eligible Expenses incurred after the Notice Date, but prior to the Termination Date, that were reasonable necessary to terminate the Work in an orderly manner. The Notice shall be sent by express mail (such as Federal Express), by the United States Mail to Contractor's address provided herein, postage prepaid, certified or registered mail, return receipt requested, or by hand delivery. The Port does not by this section waive, release, or forego any legal remedy for any violation, breach, or non-performance of any of the provisions of this Agreement. At its sole option, The Port may deduct from the final payment due the Contractor (a) any damages, expenses or costs arising out of any such violations, breaches, or non-performance and (b) any other back charges or credits.

END OF SECTION

PART 1 – GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements apply to this Work as if specified in this section.

1.02 DESCRIPTION OF WORK

A. The Work includes the requirements for health and safety provisions necessary for all Work at the site for this project.

B. The Work is in an active Boat Yard and should be treated as an industrial site. Possible contaminants of potential concern include metals, petroleum hydrocarbons, creosote.

C. Failure on the part of the Contractor to follow its site-specific Health and Safety Plan(s) or to conduct work in an unsafe manner may result in suspension of the Work by the Contracting Agency. The Contractor shall not be entitled to extra compensation for health and safety related suspensions, nor shall the Contract completion date be extended.

1.03 APPLICABLE LAWS AND REGULATIONS

A. The Contractor shall perform all Work in compliance with the applicable provisions of the Washington Industrial Safety and Health Act, as well as other applicable federal, state, and local laws, regulations, and permits. The Contractor is fully responsible for planning and executing all the Work under this Contract in a manner that meets the regulatory requirements of Chapter 296-843 of the Washington Administrative Code (WAC) for protecting the health and safety of workers and the public.

B. While performing the Work, the Contractor may be subject to on-site inspections by regulatory inspectors from the Washington State Department of Labor and Industries, and other federal, state, or local agencies. If the Contractor is found to be in violation of pertinent regulations, the Contractor shall cease all Work immediately, notify the Contracting Agency, and correct the violation. Standby time required to resolve such violation shall be at the Contractor's sole expense.

1.04 SAFETY

A. Safety is the full responsibility of the Contractor. The Contractor is to fully review the Contract Documents prior to the commencement of Work and bring any safety concerns to the attention of the Contracting Agency. The Contractor shall have a safety program in place and shall submit the program to the Contracting Agency for approval. The safety program shall address the specific work to be performed and site conditions.

PART 2 – PRODUCTS

2.01 MATERIALS

A. The Contractor shall provide all health and safety equipment and supplies (e.g., shoring equipment, personal protective equipment, fencing, gas meters, first aid supplies, etc.) necessary to support the Contractor’s and subcontractors’ work.

B. All personnel shall be trained to operate the appropriate safety equipment that would be utilized during their work. It is the responsibility of the Contractor’s designated Site Safety and Health Officer to ascertain that all safety equipment is being used appropriately.

C. All equipment and supplies shall be kept in proper working order.

PART 3 – EXECUTION

3.01 PREPARE HEALTH AND SAFETY PLAN

A. Prior to the start of any Work, the Contractor shall prepare a site-specific Health and Safety Plan (HASP) which meets all the requirements of WAC 296-843-100 as well as other applicable local,

state and federal laws, regulations, and permits for construction safety and hazardous waste operations and emergency response (HAZWOPER). A copy of the HASP shall be submitted to the Contracting Agency and any government agency performing a health and safety inspection.

B. Each organization with on-site workers is expected to prepare a HASP. The Contractor can submit one comprehensive HASP for all Contractor and subcontractor work, or subcontractors can prepare separate plans at no additional cost to the Contracting Agency.

3.02 SITE SAFETY AND HEALTH OFFICER

A. The Contractor shall provide a person designated as the Site Safety and Health Officer, who is thoroughly trained in rescue procedures and the use of all necessary safety equipment, air monitoring equipment, and gas detectors. The person must be present while Work is being performed and conduct testing, as necessary.

B. The Site Safety and Health Officer shall be empowered with the delegated authority to order any person or worker on the project site to follow the construction and health and safety rules. Failure to observe these rules is sufficient cause for removal of the person or worker(s) from this project.

C. The Site Safety and Health Officer is responsible for determining the extent to which any safety equipment must be utilized, depending on conditions encountered at the site.

3.03 IMPLEMENT HEALTH AND SAFETY PLAN

A. The Contractor shall perform whatever work is necessary for safety and be solely and completely responsible for conditions of the job site, including safety of all persons (including employees of the Contracting Agency, agent, and Contractor) and property during the contract period. This requirement applies continuously and is not limited to normal working hours.

B. The Contractor shall inform all persons entering the site, including Contractor employees, subcontractor employees, and visitors, of the potential danger associated with construction activities and contaminated media at the site. The Contractor shall maintain proof that all on-site persons have read the Site Health and Safety Plan (HASP) and are aware of the site hazards.

C. The Contractor shall maintain at least one copy of the site-specific HASP(s) at the work site.

D. The Contracting Agency’s review of the Contractor's submittals and performance does not include approval of the adequacy of the Contractor's Site Safety and Health Officer, the site-specific HASP, safety program or any safety measures taken in, on, or near the construction site.

E. On-site activities involving potential soil or water exposures must be performed by HAZWOPER-trained personnel with current certifications. These personnel must have cards in their possession verifying current training status and must present the cards when requested by the Contracting Agency, the organization(s) conducting oversight, and/or regulatory officials.

F. The Contractor is solely responsible for all health and safety procedures and mitigation measures associated with asphyxiating (toxic) gases, explosive gases, and oxygen-deficiency conditions (e.g., confined space entry).

G. The Contractor shall conduct regular on-site health and safety meetings and include other on-site workers such as subcontractors, the organization(s) conducting oversight, and third-party samplers. The Contractor shall also brief on-site visitors about pertinent health and safety matters.

H. Accidents causing death, injuries, or damage must be reported immediately to the Contracting Agency in person or by telephone or messenger. In addition, promptly report in writing to the Contracting Agency all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on, or adjacent to, the site, giving full details and statements of witnesses.

I. If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing within 24 hours after occurrence, to the Contracting Agency, giving full details of the claim.

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE

A. The Work included in this Contract is defined on the drawings listed in Section 00 72 00 – General Conditions, and within these specifications under the following Division Numbers:

1. DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS
2. DIVISION 01 – GENERAL REQUIREMENTS
3. DIVISION 02 – EXISTING CONDITIONS
4. DIVISION 03 – CONCRETE
5. DIVISION 05 – METALS
6. DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES
7. DIVISION 09 – FINISHES
8. DIVISION 11 – EQUIPMENT
9. DIVISION 26 – ELECTRICAL
10. DIVISION 31 – EARTHWORK
11. DIVISION 32 – EXTERIOR IMPROVEMENT
12. DIVISION 33 – UTILITIES
13. DIVISION 40 – PROCESS INTERCONNECTIONS
14. APPENDICES

B. The Work under this contract is to provide and furnish and/or install all labor, materials and equipment, as may be required to complete the Work, installed, tested, and ready for use, and as described in these documents.

C. The Work includes facility improvements at Boat Haven Boatyard including but not limited to:

1. Demolish, removal, and/or abandonment in place of stormwater structures and conveyance as shown on the Drawings
2. Installation of approximately 1,200 linear feet of 8” diameter stormwater force main.
3. Installation of a new four-stage stormwater treatment system
4. Installation of a new lift station wet well, valve vault, two submersible stormwater pumps and associated accessories, and appurtenances.
5. Installation of 10 new storm drain manholes and approximately 735 linear feet of 24” diameter
6. Installation of associated electrical wiring, cabling and devices, including instrumentation, as shown on the Drawings
7. Pavement restoration above utility excavation including asphalt milling and overlaying
8. Provision of temporary erosion and sediment control and traffic control during construction.

1.02 LOCATION

A. This project is located at the Boat Haven Boatyard, 2790 Washington Street, Port Townsend, WA 98368.

1.03 ACCESS TO SITE

A. Access to site will be primarily from the Boat Haven entrance at the intersection of Sims Way (SR-20) and Haines Place. Absolutely no parking of private vehicles overnight on site is permitted unless otherwise allowed by the Owner.

1.04 ENGINEERING AND INSPECTION

A. Engineers, inspectors and other agents of Contracting Agency will perform engineering and inspection work throughout the duration of the Contract.

B. Engineers and inspectors of the local permitting authority (City of Port Townsend) will enter the project site and shall perform its engineering and inspection work.

1.05 COORDINATION

A. The Contractor shall coordinate its activity with Contracting Agency's operations, so interference with boat yard activities will be minimized.

B. The Contractor shall also coordinate its work with adjacent properties throughout the life of this contract at no additional expense to the Contracting Agency.

1.06 MATERIALS TESTING

A. Necessary materials testing shall be performed by an independent testing laboratory and paid for in accordance with Section 01 40 00 – Quality Requirements. Access to the area necessary to perform the testing and/or to secure the material for testing, shall be provided by the Contractor.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Specification Section includes descriptions for all Bid Items for the Project. The Contract specific Bid Items are listed in this Specification in addition to the Bid Form.

1.02 GENERAL PROVISIONS

A. The total Contract Amount covers the Work required by the Contract Documents. All costs in connection with the successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

B. If used, all estimated quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only (a) for the purpose of comparing the bids submitted for the Work, and (b) as a basis for determining an initial Contract Amount. The actual amounts of Work completed, and materials furnished under unit price items, may differ from the estimated quantities. The Port does not expressly or by implication represent that the actual quantities involved will correspond exactly to the quantities stated in the Bid Form; nor shall the Contractor plead misunderstanding or deception because of such estimate or quantities or of the character, location or other conditions pertaining to the Work. Payment to the Contractor will be made only for the actual quantities of work performed or material furnished in accordance with the Drawings, Specifications, and other Contract Documents, and it is understood that the quantities may be increased or decreased as provided in the General Conditions.

C. If used, the unit prices listed in the Bid Form shall include all services, obligations, responsibilities, labor, materials, devices, equipment, royalties and license fees, supervision, temporary facilities, construction equipment, bonds, insurance, taxes (as applicable), clean up, traffic control, control surveys, field offices, close out, overhead and profit and all connections, appurtenances and any other incidental items of any kind or nature, as are necessary to complete the Work in accordance with the Contract Documents, unless otherwise noted.

D. The Contractor agrees that it will make no claim for damages, anticipated profits, or otherwise because of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore.

E. Where payment by scale weight is specified under certain items, the Contractor shall provide suitable weighing equipment which shall be kept in accurate adjustment at all times and the scales shall be certified. The results of weighing of all material shall be submitted to the Contracting Agency for review.

1.03 MEASUREMENT AND PAYMENT

A. Measurement – The complete amount of the unit of measure installed and accepted as complete within the limits specified and shown in the Drawings and specified in the Contract Provisions. Contractor shall provide supporting documentation (i.e. drawings, delivery tickets, invoices, surveying calculations, etc.) to verify actual installed quantities and to compare to measurement and quantities prepared by the Engineer. Common units of measurement used for bidding comprise of the following:

1. Linear Feet (LF)
2. Square Feet (SF)
3. Square Yard (SY)
4. Cubic Yard (CY)
5. Each (EA)
6. Lump Sum (LS)
7. Ton (TON)

B. Bid Items of payment that have lump sum or force account in the Bid item of Work shall have no specific unit of measurement requirement.

C. Measurement Method – For each basis of measurement listed below, the Engineer will use the method measurement described, for bid items or materials measured on the basis of;

1. Hour – Measured for each hour that Work is actually performed. Portions of an hour will be round up to a half hour.

2. Square Yard or Square Foot - The measurement shall be a calculation from the neat dimensions shown in the Plans or as altered by the Engineer. If there is an exception within the measured area where the item of Work is not performed (such as a drainage vault within a measured sidewalk) and if the exception area is greater than 9 square feet, then the area of the exception will be subtracted from the payment area calculated from the neat dimensions.

3. Linear Foot – A length measured along an element unless the Plans requires otherwise.

4. Volume (of excavation and embankment) – Measured by the average-end-area method or by the finite element analysis method utilizing digital terrain modeling techniques. All or some computations may be based on ground elevations and other data derive photogrammetrically. The Engineer may correct for curvature.

5. Volume (in the hauling vehicle) – Measured at the point of delivery. Hauling vehicles may be of any size or type the Engineer approves provided that the body is of such shape that the actual contents may be readily and accurately determined. If the Engineer requires, the Contractor shall level loads at the delivery point to facilitate measurement.

6. Weight – Weight as required in section below.

D. Weight – Measurement for payment will be at the unit price (TON) as stipulated in the bid form for the items listed below. Payment shall be considered full compensation for furnishing all labor, materials, and equipment to complete the work as specified.

1. Measurement Method (stone and processed Materials) – Unless specified otherwise, all construction materials to be proportioned or measured and paid for by weight shall be weighed on scale.

   a. Measurement for imported materials delivered by trucks shall be measured in accordance with these procedures and requirements. Imported materials include the following:

      1) Trail Surfacing (1/4” minus Basalt)

      2) Crushed Surfacing Base Course (CSBC)

      3) Quarry Spalls

      4) HMA Cl. ½ inch PG 64-22 (Pavement Repair)

      5) HMA Cl. ½ inch PG 70-22 (Overlay)

b. Scales: All material delivered by vehicle shall be weighed on public scales or scales provided by the Contractor and approved by the Contracting Agency. The scales shall be of sufficient capacity to permit weighing the transporting vehicle, both empty and full. Documentation of scale certification shall be provided to ensure accuracy of the scale being used.

1) The accuracy of the scale will be checked. When a state scale inspector is not immediately available for checking the scale, the Contractor may, at his own expense, secure a check from the local official sealer of weights and measures. The Engineer may give tentative approval based on check truckloads weighed on other scales that bear an official seal placed in the current calendar year.

c. The total weight of a single highway vehicle shall be weighed as a single draft and shall not be determined by adding together the results obtained by separately weighing each end of such vehicle except that weighing of a coupled combination may be determined with uncoupling under the following conditions:

1) The brakes are released.

2) There is no tension or compression of the drawbar.

3) The approaches are straight and in the same level plane as the scale platform.

4) The approaches are paved at least fifty (50) feet in each direction with a seal coat or high type surfacing.

5) The approaches are of sufficient width and length to endure level positioning of vehicles during the weighing operations.

d. Print-Out Weigh Tickets: Each truck shall be weighed and bear a unique identification number. Each vehicle operator shall obtain a weigh or load ticket from the scale operator. The tickets shall, at a minimum contain the following information:

1) Date of haul;

2) Contract number;

3) Contract unit Bid item;

4) Unit of measurement;

5) Identification number of hauling vehicle; and

6) Weight delivered:

a) Net weight in the case of batch and hopper scales

b) Gross weight, tare and net weight in the case of platform scales (tare may be omitted if a tare beam is used).

c) Approximate load out weight in the case of belt conveyor scales.

7) The vehicle operator shall deliver the ticket in legible condition to the material receiver at the material delivery point. The material delivery point is defined as the location where the material is incorporated into the permanent Work.

8) When requested by the Contracting Agency's, the Contractor's representative shall collect the tickets throughout the day and provide them to the designated Contracting Agency receiver, not later than the end of shift, for reconciliation. Tickets for loads not verified as delivered will receive no pay.

9) Stone Products: Types of material shall not be mixed in any given load.

e. Weigh Bills: For scales not equipped with a printout system, weight bills shall contain the same or equivalent data as specified for the printout system. Weight bills, including printouts, shall be certified by the signature of the scale operator. The scale operator shall attest that the information shown on the weigh bill and the weight(s) observed on the scale at the time the weigh bill was signed are correct. Each truck shall be plainly marked by a distinctive number, letter, or name, which shall not be changed or given to any other truck during the Contract Period. The Contracting Agency reserves the right to periodically inspect the weighing operations at the scales.

f. Verification of Weights: The Contracting Agency reserves the right to have loaded and unloaded trucks re-weighed at another certified weigh scale, at no additional expense to the Contracting Agency.

E. For each item listed below, the Engineer will use the method of measurement described.

1. Timber – Measured by the thousand board feet (MBM) actually used in the Structure. Measurements will be based on nominal widths and thicknesses and the extreme length of each piece.

2. Standard Manufactured Items (fence, wire, plates, rolled shapes, pipe conduit, etc., when specified) – Measured by the manufacturer's identification of gage, unit weight, section dimension, etc. The Engineer will accept manufacturing tolerances set by each industry unless cited Specifications require more stringent tolerances.

3. Cement – Measured by the pound, ton, or sack. A sack shall be 94 pounds.

4. Asphalt – Measured by the gallon or ton. If measured by gallon, measurement will be made at 60 F (or will be corrected to the volume at 60 F in keeping with ASTM D1250). If shipped by rail, truck, or transport, measurement will be by net certified scale masses or certified volumes (corrected for material lost in route or not actually incorporated into the Work).

F. No measurement will be made for:

1. Work performed or materials placed outside lines shown in the Plans or set by the Engineer;

2. Materials wasted, used, or disposed of in a manner contrary to the Contract;

3. Rejected materials (including those rejected after placement if the rejection resulted from the Contractor's failure to comply with the Contract);

4. Hauling and disposing of rejected materials;

5. Material remaining on hand after the Work is completed, except as provided in the General Specification for deleted or terminated Work; or

6. Other Work or material contrary to the Contract Provisions

G. Scope of Payment – The payment provided for in the Contract shall be full payment to the Contractor for:

1. Furnishing all materials and performing all Work under the Contract (including changes in the work, materials, or Plans) in a complete and acceptable manner:

2. All risk, loss, damage, or expense of whatever character arising out of the nature or prosecution of the work; and

3. All expense incurred resulting from a suspension or discontinuance of the Work as specified under the Contract.

H. The payment of an estimate or retained percentage shall not relieve the Contractor of the obligation to correct defective Work or materials.

I. Unless the Plans and Special Provisions provide otherwise, the unit Contract prices for the various Bids items shall be full payment for all labor, materials, supplies, equipment, tools, and all other things required to completely incorporate the item into the Work as though the item were to read "In Place".

J. Certain payment items appearing in these Specifications contain a fill-in indicated by an underbar at the end or within the Payment Item. The Plans and Proposal will include additional information to fill in the underbar, such as:

1. The words "For Structure", "For Concrete Barrier", "For Bridge", etc., with the intent of clarifying specific use of the item; or
2. The words "Site (Site Designation)", with the intent of clarifying where a specific item of Work is to be performed.
3. Words indicating the type of product to be used.

Modification of payment items in this manner shall in no way change the intent of the Specifications relating to these items.

1.04 BID ITEMS

A. Measurement for payment will be at the unit price as stipulated in the bid form for the items listed below.

1. **Bid Item A1 – Mobilization**

a. Measurement: Lump Sum (LS)

b. Description: Mobilization of construction equipment and costs of preparatory Work and operations performed by the Contractor, typically occurring before 10 percent of the total original Contract amount is earned from other contract Bid items.

c. Payment: As follows:

1) When 5 percent of the total original Contract amount is earned from other Contract items, excluding amounts paid for materials on hand, 50 percent of the amount Bid for mobilization, or 5 percent of the total original Contract amount, whichever is the least, will be paid.

2) When 10 percent of the total original Contract amount is earned from other Contract items, excluding amounts paid for materials on hand, 100 percent of the amount Bid for mobilization, or 10 percent of the total original Contract amount, whichever is the east, will be paid.

3) When the Substantial Completion Date has been established for the project, payment for mobilization in excess of 10 percent of the total original Contract amount, if any, will be paid.

Nothing herein shall be construed to limit or preclude partial payments otherwise provided by the Contract.

2. **Bid Item A2 – Temporary Erosion and Sediment Control**

a. Measurement: Lump Sum (LS)

b. Description: Work under this item shall include all submittals, monitoring, materials, supplies, equipment, and labor required for fabricating, constructing,

installing, and maintaining and repairing environmental protection measures including but not limited to temporary erosion and sediment control (TESC), water quality protection and compliance with permit conditions, and spill prevention as described in the Contract Provisions and as shown in the Contract Drawings. Work elements for this item include, if required, but are not limited to:

1) Spill Prevention, Control and Countermeasures Plan (SPCC Plan)

2) TESC Plan and Compliance

3) Certified Erosion & Sediment Control Lead (CESCL)

4) BMPs (silt fencing, construction fencing, as needed for compliance with permits

5) Noise and air pollution controls

6) Stormwater Pollution Prevention Plan (SWPPP) and compliance

In addition, work under this item shall also include all materials, supplies, equipment, and labor required for restoring the project site to its original condition.

c. Payment: As follows:

1) The Contracting Agency will pay 15 percent of the bid amount for the initial set up for the item. Initial set up includes the following:

a) Acceptance of the TESC Plan provided by the Contracting Agency or submittal of new TESC Plan,

b) Submittal of an updated Stormwater Pollution Prevention Plan (SWPPP) for Construction Stormwater General Permit (CSWGP) coverage.

c) Submittal of a schedule for the installation of the BMPs,

d) Identifying water quality sampling locations, and

2) Seventy percent of the bid amount will be paid based on the Contractor's progress towards completing the Work.

3) Once the project is physically complete and copies of all reports submitted to Ecology have been submitted to the Engineer, and, if applicable, transference of the CSWGP back to the Contracting Agency is complete, the remaining 15 percent of the bid amount shall be paid.

3. **Bid Items A3 – Potholing/Existing Utilities Verification**

a. Measurement: Each (EA)

b. Description: Work under this item shall include all submittals, materials, supplies, equipment, and labor required for the location of existing utilities and structures as shown on the Contract Drawings and as specified in the Contract Provisions. Work includes, but is not limited to, excavation, demarcation, recording of crossing locations and depth, backfilling, compaction and restoration of boatyard surfacing materials.

c. Payment: "Potholing/Existing Utilities Verification" per each utility identified through performing potholing Work. Multiple utilities discovered in a shared trench, such as duct banks, will be measured and paid as a single locate.

4. **Bid Items A4 – Construction Survey**

a. Measurement: Lump Sum (LS)

b. Description: Work under this item shall include all submittals, materials, supplies, equipment, and labor required to provide the construction survey necessary to complete the Work in accordance with the Contract Documents.

c. Payment: “Construction Survey” per Lump Sum.

5. **Bid Items A5 – Trench Safety Excavation Provisions**

a. Measurement: Lump Sum (LS)

b. Description: Work under this item shall include all submittals, materials, supplies, equipment, and labor required to provide the safe temporary excavation bracing or extra excavation and associated backfilling and compaction necessary to complete the Work in accordance with the Contract Documents.

c. Payment: “Trench Safety Excavation Provisions” per Lump Sum. No separate measurements and payment will be made for extra excavation performed by the Contractor at the Contractors option to complete the Work.

6. **Bid Items A6 – Demolition**

a. Measurement: Lump Sum (LS)

b. Description; Work under this item shall include all submittals, materials, disposal fees, trucking, shipping, transportation, handling, dewater, containment, cutting, chipping, pipe plugging, CSBC, quarry spalls, supplies, equipment and labor required to complete the Demolition Work in the Contract Documents, including but not limited to, backfill, compaction and surface restoration.

c. Payment: “Demolition” per Lump Sum for all Contract demolition Work.

7. **Bid Items A7 – Electrical Pedestal Relocation**

a. Measurement: Each (EA)

b. Description: Work under this item shall include all submittals, materials, equipment, and labor required to remove and relocate existing electrical pedestals in conflict with concrete curb and gutter.

c. Payment: “Electrical Pedestal Relocation” per each pedestal relocated.

8. **Bid Items A8 – Stockpile (Excess Material)**

a. Measurement: Cubic Yard (CY)

b. Description: Work under this item shall include all materials, supplies, equipment, and labor required to provide a neatly shaped stockpile of suitable excavation spoils not incorporated into Work in accordance with the Contract Documents (01 57 00 Environmental Protection 1.03).

c. Payment: “Stockpile” per cubic yard placed measured by comparing existing ground at the stockpile to the final stockpile in-place. The Contracting Agency’s measurements will be taken using GPS RTK survey equipment and will compare quantities using digital modeling and analytical software.

9. **Bid Item A9 – Stormwater Treatment System Stages 1-3**

a. Measurement: Lump Sum (LS)

b. Description: Work for this item shall include all Work to construct the first three stages of the stormwater treatment system (Chitosan Detention Basin, Coarse Filter and Biofiltration) system complete as shown on the Drawings or described in these Specifications, including but not limited to, submittals, concrete structures, foundations, CSBC, quarry spalls, piping between stages, manifolds, overflow structures and pipes up to manholes, warning tape, drainage basins,

geotextile, treatment media, aggregates, and quality control testing. Work for this item includes but is not limited to, excavation and fill, compaction and restorative work necessary to construct the system in accordance with the Contract Documents.

c. Payment: "Stormwater Treatment System Stages 1-3", Lump Sum for a complete Stormwater Treatment System Stages 1-3.

10. **Bid Item A10 – Trail Surfacing (1/4" Basalt)**

a. Measurement: U.S. Ton (TON)

b. Description: Work under this item shall include the materials, storing, handling, shipping, supplies, equipment, and labor required for the supply and installation of trail surfacing (1/4" basalt), including but not limited to, compaction, as described in these Specifications and as indicated in the Contract Drawings.

c. Payment: "Trail Surfacing (1/4" Basalt)" per Ton placed.

11. **Bid Item A11 – Crushed Surfacing Base Course (CSBC)**

a. Measurement: U.S. Ton (TON)

b. Description: Work under this item shall include the materials, storing, handling, shipping, supplies, equipment, and labor required for the supply and installation, including compaction, of Crushed Surfacing Base Course (CSBC) as described in these Specifications and as indicated in the Contract Drawings that is not included in other Bid items

c. Payment: "Crushed Surfacing Base Course" per Ton placed. No separate measurements and payment will be made for CSBC included in the payment of other Bid items.

12. **Bid Item A12 – Quarry Spalls**

a. Measurement: U.S. Ton (TON)

b. Description: Work under this item shall include the materials, storing, handling, shipping, supplies, equipment, and labor required for the supply and installation, including compaction, of Quarry Spalls as described in these Specifications and as indicated in the Contract Drawings.

c. Payment: "Quarry Spalls" per Ton placed. No separate measurements and payment will be made for Quarry Spall included in the payment of other Bid items.

13. **Bid Item A13 – Pavement Removal**

a. Measurement: Square Yard (SY)

b. Description: Work under this item shall include the material, labor, and equipment to complete the pavement removal Work required to in the Drawings and Contract Provisions including but not limited to, saw cutting, second relief saw cut, removing, handling, transporting and disposing of asphalt pavement spoils.

c. Payment: "Pavement Removal" per square yard removed. No separate measurement will be made for removing pavement damaged during the pavement removal and utility trenching.

14. **Bid Items A14 – 8" HDPE Force Main**

a. Measurement: Linear Feet (LF)

b. Description: Work under this item shall include installation of 8" Diameter High Density Polyethylene (HDPE) pipe, including but not limited to, all necessary

submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, trench excavation, dewatering, bedding preparation, pipe fusing, pipe placement, underground utility supports, warning tape, backfilling with native material, surface restoration using existing surfacing set aside during excavation, compaction, cleaning, cutting, trimming, and testing.

c. Payment: "8" HDPE Force Main" per linear foot of pipe installed. Separate measurement and payment will be made for placing imported CSBC and Quarry Spalls (i.e. CSBC Bid item, Quarry Spall Bid Item), if any, to complete the gravel yard surfacing or pavement base only after reuse of existing CSBC set aside by the Contractor during trench excavation.

15. **Bid Item A15 – 24" PVC Stormwater Pipe**

a. Measurement: Linear Feet (LF)

b. Description: Work under this item shall include installation of 24" Diameter Polyvinyl Chloride (PVC) pipe, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, trench excavation, dewatering, bedding preparation, pipe placement, underground utility supports, warning tape, backfilling with native material, surface restoration using existing surfacing set aside during excavation, compaction, cleaning, cutting, trimming, and testing.

c. Payment: "24" PVC Stormwater Pipe" per linear foot of pipe installed. Separate measurement and payment will be made for placing imported CSBC and Quarry Spalls (i.e. CSBC Bid item, Quarry Spall Bid Item), if any, to complete the gravel yard surfacing or pavement base only after reuse of existing CSBC set aside by the Contractor during trench excavation.

16. **Bid Item A16 – 12" PVC Stormwater Pipe**

a. Measurement: Linear Feet (LF)

b. Description: Work under this item shall include installation of 12" Diameter Polyvinyl Chloride (PVC) pipe, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, trench excavation, dewatering, bedding preparation, pipe placement, underground utility supports, warning tape, backfilling with native material, surface restoration using existing surfacing set aside during excavation, compaction, cleaning, cutting, trimming, and testing.

c. Payment: "12" PVC Stormwater Pipe" per linear foot of pipe installed. Separate measurement and payment will be made for placing imported CSBC and Quarry Spalls (i.e. CSBC Bid item, Quarry Spall Bid Item), if any, to complete the gravel yard surfacing or pavement base only after reuse of existing CSBC set aside by the Contractor during trench excavation.

17. **Bid Item A17 – 4' ID Storm Drain Manhole**

a. Measurement: Each (EA)

b. Description: Work under this item shall include installation of 4' Inside Diameter Storm Drain Manholes including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, excavation, dewatering, bedding, CSBC, quarry spalls, setting manhole bases, cones, risers, grade ring, ladders, castings, adjustment to final grade, structural backfill, pipe connections, grouting, and testing.

c. Payment: “4’ ID Storm Drain Manhole” per each manhole installed.

18. **Bid Item A18 – Lift Station**

a. Measurement: Lump Sum (LS)

b. Description: Work under this item shall include installation of a Lift Station system complete, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, excavation, dewatering, bedding preparation, CSBC, quarry spalls, structural backfill, wet well, pumps and components, ductile iron pipe and fittings, valves, valve vault and all components, electrical and instrumentation items, electrical trenching, pump controls, startup, testing, etc all in accordance with the Contract Documents.

c. Payment: “Lift Station” Lump Sum for a complete Lift Station system installed.

19. **Bid Item A19 – Outlet Structure (2-1)**

a. Measurement: Each (EA)

b. Description: Work under this item shall include installation of an Outlet Structure including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, excavation, dewatering, bedding preparation, CSBC, quarry spalls, structural backfill, setting manhole bases, cones, risers, grade ring, ladders, castings, adjustments to final grade, backfilling, pipe connections, grouting, and testing.

c. Payment: “Outlet Structure” per each manhole installed.

20. **Bid Item A20 – 42” Reinforced Concrete Pipe (RCP)**

a. Measurement: Linear Feet (LF)

b. Description: Work under this item shall include installation of 42” Diameter Reinforced Concrete pipe, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, trench excavation, dewatering, bedding preparation, pipe placement, underground utility supports, warning tape, backfilling, compaction, cleaning, cutting, trimming, and testing.

c. Payment: “42” Concrete Pipe” per linear foot of pipe installed. Separate measurement and payment will be made for placing imported CSBC and Quarry Spalls (i.e. CSBC Bid item, Quarry Spall Bid Item), if any, to complete the pavement base only after reuse of existing CSBC set aside by the Contractor during trench excavation.

21. **Bid Item A21 – 36” Reinforced Concrete Pipe (RCP)**

a. Measurement: Linear Feet (LF)

b. Description: Work under this item shall include installation of 36” Diameter Reinforced Concrete pipe, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, trench excavation, dewatering, bedding preparation, pipe placement, underground utility supports, warning tape, backfilling, compaction, cleaning, cutting, trimming, and testing.

c. Payment: “36” Reinforced Concrete Pipe” per linear foot of pipe installed. Separate measurement and payment will be made for placing imported CSBC and Quarry Spalls (i.e. CSBC Bid item, Quarry Spall Bid Item), if any, to complete pavement base only after reuse of existing CSBC set aside by the Contractor during trench excavation.

22. **Bid Item A22 – 18" Reinforced Concrete Pipe (RCP)**

    a. Measurement: Linear Feet (LF)

    b. Description: Work under this item shall include installation of 18" Diameter Reinforced Concrete pipe, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, trench excavation, dewatering, bedding preparation, pipe placement, underground utility supports, warning tape, backfilling, compaction, cleaning, cutting, trimming, and testing.

    c. Payment: "18" Reinforced Concrete Pipe" per linear foot of pipe installed. Separate measurement and payment will be made for placing imported CSBC and Quarry Spalls (i.e. CSBC Bid item, Quarry Spall Bid Item), if any, to complete the gravel yard surfacing or pavement base only after reuse of existing CSBC set aside by the Contractor during trench excavation.

23. **Bid Item A23 – 12" Ductile Iron (DI) Pipe**

    a. Measurement: Linear Feet (LF)

    b. Description: Work under this item shall include installation of 12" Diameter Ductile Iron pipe, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, trench excavation, dewatering, bedding preparation, pipe placement, backfilling, compaction, cleaning, cutting, trimming, and testing.

    c. Payment: "12" Ductile Iron (DI) Pipe" per linear foot of pipe installed.

24. **Bid Item A24 – 24" Check Valve**

    a. Measurement: Each (EA)

    b. Description: Work under this item shall include installation of a 24" Check Valve, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work in accordance with the Contract Documents.

    c. Payment: "24" Check Valve" per each check-valve installed.

25. **Bid Item A25 – 42" Check Valve**

    a. Measurement: Each (EA)

    b. Description: Work under this item shall include installation of a 42" Check Valve, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work in accordance with the Contract Documents.

    c. Payment: "42" Check Valve" per each check-valve installed.

26. **Bid Item A26 – Concrete Curb and Gutter**

    a. Measurement: Linear Feet (LF)

    b. Description: Work under this item shall include installation Concrete Curb and Gutter, including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, foundation preparation, forming, concrete, finishing, curing, and striping in accordance with the Contract Documents.

    c. Payment: "Concrete Curb and Gutter" per linear foot of concrete curb and gutter installed.

27. **Bid Item A27 – Plantings**

    a. Measurement: Lump Sum (LS)

    b. Description: Work under this item shall include installation of Plantings in the biofiltration media filter (Stage 3), including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, mulch, plants, planting, and watering in accordance with the Contract Documents.

    c. Payment: "Plantings" per lump sum for plantings.

28. **Bid Item A28 – HMA CL ½"-inch PG 64-22 (Pavement Repair)**

    a. Measurement: U.S. Ton (Ton)

    b. Description: Work under this item shall include HMA for Pavement Repair including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, mix design, asphalt, tack coat, compaction, and density testing in accordance with the Contract Documents

    c. Payment: "HMA CL ½"-inch PG 64-22 (Pavement Repair)" per Ton for HMA placed.

29. **Bid Item A29 – Planning Bituminous Pavement**

    a. Measurement: Square Yard (SY)

    b. Description: Work under this item shall include Planning Bituminous Pavement including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to, milling, sweep, transport, and disposal of millings in accordance with the Contract Documents

    c. Payment: "Planning Bituminous Pavement" per square yard of existing asphalt milled.

30. **Bid Item A30 – HMA CL ½"-inch PG 70-22 (Overlay)**

    a. Measurement: U.S. Ton (Ton)

    b. Description: Work under this item shall include HMA including but not limited to, all necessary submittals, materials, shipping, storage, transportation, supplies, equipment, and labor to perform the Work including but not limited to mix design, asphalt, tack coat, compaction, and density testing in accordance with the Contract Documents.

    c. Payment: "HMA CL ½"-inch PG 70-22 (Overlay)" per Ton for HMA placed.

31. **Bid Item A31 – Apprentice Utilization Adjustment**

    a. Measurement: Calculation

    b. Description: Work under this item shall include the calculation of the incentive or penalty for Utilization of Apprentice in accordance with Contract Documents.

    c. Payment: "Apprentice Utilization Adjustment" by Calculation. For the purpose of providing a common bid, the incentive amount is included on the Bid Form.

32. **Bid Item B1 – Stormwater Treatment System Stage 4**

    a. Measurement: Lump Sum (LS)

    b. Description: Work for this item shall include all Work to construct the fourth stage of the stormwater treatment system (Polish Filter) system complete, as shown on

the Drawings or described in these Specifications, including but not limited to, submittals, concrete structures, foundations, CSBC, quarry spalls, piping between stages, manifolds, overflow structures and pipes up to manholes, warning tape, drainage basins geotextile, treatment media, aggregates, and quality control testing. Work for this item includes but is not limited to, excavation and fill, compaction and restorative work necessary to construct the system in accordance with the Contract Documents.

c. Payment: "Stormwater Treatment System Stage 4", Lump Sum for a complete Stormwater Treatment System Stages 1-4.

END OF SECTION

PART 1 - GENERAL

1.01 PRECONSTRUCTION MEETING

A. NOTIFICATION

1. Following the award, the Contracting Agency's Representative will notify the selected bidder of the time and date of a preconstruction meeting.

B. LOCATION

1. The preconstruction meeting will be scheduled at the Port of Port Townsend Administrative Office Building or other designated Contracting Agency facility.

C. ATTENDANCE

1. Preconstruction meeting attendees may include are not limited to:

a. Contracting Agency Representatives:

(1) Contracting Agency's Representative

(2) Contract Administrator

(3) Port Operations and Maintenance Staff

(4) Harbormaster

(5) Consultants

b. Contractor's Representatives:

(1) Project Manager (Superintendent)

(2) Contract Administrator

(3) Major Subcontractors

c. City of Port Townsend Representatives:

(1) City Engineers and/or Inspectors

d. Private Utility Representatives:

(1) Project Engineers

(2) Consultants

2. The preconstruction meeting agend may include but are not limited to:

(1) Communications and routing/Contact List

(2) Discussion of the General Conditions

(3) Discussion of the General Requirements

(a) Pedestrian safety, parking, Larry Scott Trail

(b) Boatyard Operations and work hours

(c) Laydown, Staging and Parking

(4) Discussion of the Technical Specifications

(a) Construction Sequencing Work Plan

(b) Other work plans

(5) Schedule

(6) Jobsite Walk

1.02 PROGRESS MEETINGS

A. The Contracting Agency will schedule and administer weekly progress meetings throughout progress of the Work.

B. The Contracting Agency will arrange meetings, prepare standard agenda with copies for participants, preside at meetings, record minutes and distribute copies within ten (10) days to the Contractor, meeting participants, and others affected by decisions made.

C. Attendance is required for the Contractor's job superintendent, and major subcontractors, and Contracting Agency as appropriate to the agenda topics for each meeting.

D. The Contractor will prepare weekly look ahead schedules, RFI logs, Submittal Logs, Corrective Action Log, and other field reports.

E. The progress meeting agenda may include but is not limited to:

1. Safety moment
2. Review minutes of previous meeting.
3. Review of work progress (3 week look ahead).
4. Maintenance of progress schedule.
5. Corrective measures to regain projected schedules.
6. Corrective action log to track Work needing correction.
7. Planned progress during succeeding work period.
8. Field observations, problems, and decisions.
9. Identification of problems that impede planned progress.
10. Submittal Review/Submittal Status
11. Request for Information Status
12. Maintenance of quality and work standards
13. Review of monthly pay estimates.
14. Demonstration that the project record drawings are up-to-date.
15. Other business relating to the work.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for submittals, including contractor work plans, shop drawings, product data, certificates of compliance, certificates of material origin, test reports, samples, and other submittals.

B. Related Requirements:

1. Section 01 31 19 – Project Meetings
2. Required submittals are identified in each of the individual Sections.

1.02 RELATED SECTIONS

A. All Technical Specification sections relate to this section.

1.03 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Contracting Agency's receipt of submittal. No extension of the Contract time will be authorized because of failure to transmit submittals enough in advance of the work to permit processing, including resubmittals.

B. Initial Review: Allow fourteen (14) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. The Contracting Agency will advise the Contractor when a submittal being processed must be delayed for coordination.

C. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

D. Resubmittal Review: Allow five (7) days for review of each resubmittal.

E. Submittals: Place a permanent label or title block on each submittal item for identification.

F. Indicate name of firm or entity that prepared each submittal on label or title block.

G. Include the following information for processing and recording action taken:

1. Project name.
2. Date.
3. Name of construction manager.
4. Name of Contractor.
5. Name of Subcontractor.
6. Name of supplier.
7. Name of manufacturer.
8. Submittal number or other unique identifier, including revision identifier.
9. Number and title of appropriate Technical Specification section.
10. Contract Drawing number and detail references, as appropriate.
11. Location(s) where product is to be installed, as appropriate.
12. Highlight or identify product in instances where there are multiple products on a single data sheet.
13. Other necessary identification.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Contracting Agency.

I. Distribution: Furnish copies of final submittals to manufacturers, Subcontractors, suppliers, fabricators, installers, and others as necessary for performance of construction activities. Show distribution on transmittal forms. Contractor is responsible for furnishing copies to agencies from which Contractor has secured permits.

J. Use for Construction: Retain complete copies of submittals on project site. Use only final submittals that are marked with approval notation from the Contracting Agency.

K. All text shall be legible with a font size 8 points or larger when printed on 8.5x11-inch paper.

PART 2 – PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General submittal procedure requirements: Prepare and submit submittals for all permanent materials permanently incorporated into the project required by individual Technical Specifications using the WSDOT Form Request for Approval of Material from 350-071 as a coversheet. Types of submittals are indicated in individual Technical Specification sections and may include, but not limited to the following:

B. Product data: Collect information into a single submittal for each element of construction and type of product or equipment.

C. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as shop drawings, not as product data.

D. Mark each copy of each submittal to show which products and options are applicable.

E. Include the following information, as applicable:

1. Manufacturer's catalog cuts.
2. Manufacturer's product specifications.
3. Standard color charts.
4. Statement of compliance with specified referenced standards.
5. Testing by recognized testing agency.
6. Application of testing agency labels and seals.
7. Notation of coordination requirements.
8. Availability and delivery time information.
9. Certificate of Material Origin WSDOT Form 350-109 (for Acceptance of Steel Materials)
10. Mill Certifications, Test results, Fabrication Approval, Certificates of Compliance
11. Submit product data before or concurrent with samples.

F. Shop Drawings: Prepare project-specific information, drawn accurately to scale. Do not base shop drawings on reproductions of the Contract Drawings or standard printed data.

G. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

1. Identification of products.
2. Schedules.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Relationship and attachment to adjoining construction clearly indicated.
7. Seal and signature of professional engineer if required.

H. Sheet Size (when hard copies required): Except for templates, patterns, and similar full-size drawings, submit shop drawings on sheets at least 8-1/2 by 11 inches, but no larger than 22 by 34 inches.

I. Samples: Submit samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

J. Transmit samples that contain multiple, related components such as accessories together in one submittal package.

K. Identification: Attach label on unexposed side of samples that includes the following:

1. Generic description of sample.
2. Product name and name of manufacturer.
3. Sample source.
4. Number and title of applicable Technical Specification section.
5. Technical Specification paragraph number and generic name of each item.

L. Disposition: Maintain sets of approved samples at project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

M. Samples that may be incorporated into the work are indicated in individual Technical Specification sections. Such samples must be in an undamaged condition at time of use.

N. Samples not incorporated into the work, or otherwise designated as Contracting Agency's property, are the property of Contractor.

O. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

P. Contractor's Construction Schedule: Comply with requirements specified in the Specific Requirements and Technical Specification Section 01310 – Project Management and Coordination.

Q. Test and inspection reports and schedule of tests and inspections submittals.

R. Pre-work Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

S. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

T. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Include a detailed description of the differing conditions, together with recommendations for correcting the differing conditions. All Change Order requests must be submitted in accordance with the Contract Documents.

U. Closeout Submittals: Project Record Drawings, and Lift Station Operation and Maintenance Manual with Part List.

V. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and Contracting Agencies, and other information specified.

W. Manufacturer, product, and material certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer, its products, and/or its materials comply with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

X. Material test reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Y. Product test reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

Z. Material origin certificates: In the case of steel materials, submit WSDOT Form 350-109 Certificate of Material Origin to demonstrate compliance with Contract Documents.

2.02 COMPLIANCE

A. In the absence of an approved submittal that meets the requirements of this section, the Contractor shall furnish the exact materials specified or materials selected by the Owner's Representative based on the Contract Drawings.

2.03 WORKING DRAWINGS

A. The Contracting Agency will not accept Working Drawings that prohibit the Contracting Agency from making sepias or copies for its own use.

B. Quality: Working Drawings shall be prepared accurately to scale sufficiently large to indicate all pertinent features of the products and the method of fabrication, connection, erection, or assembly with respect to the work.

C. All Drawings submitted to the Contracting Agency's Representative for this approval shall be drawn on sheets in 11-inch by 17-inch format or sheets that are multiples of 8-1/2 inches by 11 inches. Upon the Contracting Agency's Representative's specific request, the Contractor shall furnish copies of any drawing on sheets having the dimensions 22 inches wide by 34 inches long in overall dimensions. All text shall be legible with a font size 8 points or larger when printed on 11x17-inch paper.

D. Type of Prints Required:

1. Whenever possible, the Contractor shall transit all submittals in portable document format (PDF).
2. If PDF format is not feasible, the Contractor shall submit six prints or copies of all Shop Drawings or supplemental Working Drawings in accordance with the General Conditions.

E. Distribution: The Contracting Agency will review any Drawings provided by the Contractor, mark with appropriate notations, prepare the required number of prints for its use, and return marked copies to the Contractor. The Contractor may then order, at the Contractor's expense, as many additional copies as required for Contractor's work.

2.04 PRODUCT DATA

A. The Contractor shall submit product data in PDF format.

B. Catalog cuts or brochures shall show the type, size, ratings, style, color, manufacturer, and catalog number of each item and be complete enough to provide for positive and rapid identification in the field. General catalogs will be accepted when products are highlighted or marked to make distinct specific product being provided. Partial lists will not be accepted.

2.05 SAMPLES

A. The sample submitted shall be the exact or precise article proposed to be furnished.

B. Samples, color chips, finish styles, etc., shall be submitted in sufficient number as to provide the Engineer with alternate choices.

2.06 SUBSTITUTIONS

A. The Contract is based on the materials, equipment, and methods described in the Contract Documents.

B. The Engineer will consider proposals for substitutions of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Engineer to evaluate the proposed substitution.

C. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing for this work by the Contracting Agency's Representative or Engineer.

D. Requests for substitutions may be made after award. Such requests shall be accompanied by all technical data and costs, and delivery information. When, in the opinion of the Engineer, the product is equal, or better, in all respects to the product specified, it will be approved subject to Contract requirements and the Contractor's assumption of all responsibility therefore.

E. After written approval, this submission shall become a part of the Contract, and may not be deviated from except upon written approval of the Contracting Agency.

F. Catalog and product data for equipment approved by the Engineer does not in any case supersede the Contract Documents. The approval by the Engineer shall not relieve the Contractor from responsibility for deviations from the Plans, unless Contractor has in writing called the Engineer's attention to such deviations at the time of the submission, nor shall it relieve Contractor from responsibility for errors of any sort in the items submitted. The Contractor shall check the work described by the product data with the Contract Documents for deviations and errors.

G. It shall be the responsibility of the Contractor to ensure that items to be furnished fit the space available. Contractor shall make necessary field measurements to ascertain space requirements, including those for connections and shall order such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Drawings and Specifications.

H. Where equipment requiring different arrangement of connections from those shown as approved is used, it shall be the responsibility of the Contractor to install the equipment to operate properly, and in harmony with the intent on the Plans, and to make all changes in the work required by the different arrangement of connections together with any cost of redesign necessitated thereby, all at Contractor's expense.

I. Where the phrase "or approved alternate" or "or equal" occurs in the Contract Documents, do not assume that material, equipment, or methods will be approved by the Engineer unless the item has specifically been approved for this Work by the Engineer.

PART 3 – EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Submittals: Review each submittal and check for coordination with other work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with submittal stamp before submitting to Contracting Agency.

B. Submittal Stamp: Contractor shall stamp the cover page of each submittal with a uniform, approval stamp. Include project name and location, submittal number, Technical Specification section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

C. All working drawings, brochures, and product data shall be submitted in Portable Document Format (PDF) generated by a PDF writer or scanned to PDF format.

D. Samples shall be submitted using electronic means following a system selected by the Contracting Agency and discussed at the pre-construction conference.

3.02 CONTRACTING AGENCY'S ACTION

A. The Contracting Agency's Representative will review each submittal, make marks to indicate corrections or revisions required, and return it. The Contracting Agency's Representative will forward each submittal to the Contractor.

B. Partial submittals prepared for a portion of the work will be reviewed when use of partial submittals has received prior approval from Contracting Agency.

C. Incomplete submittals are unacceptable, may be considered nonresponsive, and may be returned for resubmittal without review at the Contracting Agency discretion.

D. Submittals not required by the Contract Documents may be returned by the Contracting Agency without action.

E. Submittal Response: The Contracting Agency will note the submittal status when responding to a submittal as follows:

1. Under Review.
2. Approved: If the review indicates that the submittal appears to be in conformance with the Contract Documents, the submittal will be marked "APPROVED". The Contractor may begin implementing the work method or incorporating the material or equipment covered by the submittal.
3. Approved As Noted: If the review indicates that the submittal is insufficient or that limited corrections are required, the submittal will be marked "APPROVED AS NOTED". The Contractor may begin implementing the work method or incorporating the material or equipment covered by the submittal, in accordance with the noted corrections. Where submittal information will be incorporated in operation and maintenance plan, a corrected copy shall be provided within 30 days, otherwise no further action will be required.
4. Resubmit: If the review reveals that the submittal is substantially insufficient or contains incorrect data to an extent that requires revision and re-review by the Contracting Agency prior to proceeding with the associated work, the submittal will be marked "RESUBMIT" and returned to the Contractor. This indicates that the Contractor should not proceed with the relevant portion of work, at-risk or otherwise, until a revised submittal has been submitted, reviewed, and accepted by the Contracting Agency as either "APPROVED", or "APPROVED AS NOTED."
5. Rejected. If the review reveals a proposed product which does not meet the specifications, the submittal will be marked "REJECTED" and returned to the Contractor. This indicates that the Contractor should not proceed with the relevant portion of work.
6. N/A: If the review reveals that the submittal is not required by the Contract Documents, at the Contracting Agency's discretion it may be returned by the Contracting Agency without action marked "N/A" This does not constitute review of the submittal, and is only communicating that Contracting Agency review of this submittal is not required by the Contract Documents. It is the Contractor's responsibility to follow up with the Contracting Agency if the Contractor needs approval of information in a submittal that was marked "N/A."

END OF SECTION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of the responsibility for compliance with the Contract Document requirements.

1. Specific quality assurance and quality control requirements for individual construction activities are provided in the relevant specification sections. Requirements in those sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality assurance and control services required by the Contracting Agency or authorities having jurisdiction are not limited by provisions of this section.

4. Specific test and inspection requirements are not specified in this section.

1.02 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into Work and completed construction comply with requirements. Services do not include contract verification activities performed by Contracting Agency’s Representative.

C. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

D. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

E. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

F. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.03 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections are the Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide Quality Control Services specified and those required by authorities having jurisdiction. Perform Quality Control Services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified Testing Agency to perform these quality control services.

a. Contractor shall seek the Contracting Agency's Representatives approval of the laboratory or inspection agency the Contractor desires to employ. In instances where the Contractor and the Contracting Agency are not able to mutually agree on the laboratory or inspection agency, the Contracting Agency shall select the laboratory or inspection agency.

b. Contractor shall not employ same entity engaged by the Contracting Agency, unless agreed to in writing by the Contracting Agency's Representative.

3. Notify testing agencies at least two business days (8AM to 5PM) or forty-eight (48) hours, whichever is greater in advance of time when work that requires testing or inspecting will be performed.

4. Where Quality Control Services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, Contractor shall be responsible for costs associated with Quality Control Services, including retesting and reinspecting, for construction that replaced Work which failed to comply with the Contract Documents.

C. Testing Agency Responsibilities: Cooperate with Contracting Agency and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Contracting Agency and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

D. Contractor Coordination: Coordinate sequence of activities to accommodate required quality assurance and Quality Control Services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

2. Notify Contracting Agency's Representative at least two business day (8 a.m. to 5 p.m.) or forty-eight (48) hours, whichever is greater, in advance of time when Work that requires Contracting Agency's Representative presence will be performed.

1.04 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Contracting Agency's Representative for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Contracting Agency's Representative for a decision before proceeding.

1.05 INFORMATIONAL SUBMITTALS

A. Contractors Quality Control Plan

1. Quality Control Plan, General: Submit quality control plan meeting the requirements of 01 33 00 – Submittal Procedures, within twenty-one (21) days of Contract Award. Submit in format acceptable to the Contracting Agency. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality assurance and quality control responsibilities in a manner coordinated with Contractor's progress schedule.

2. Testing and Inspection: In the quality control plan, include a comprehensive schedule of work requiring testing or inspection, schedule or frequency for conducting the testing or inspection, and similar quality control services. This including the following:

a. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.

3. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents as a component of Contractor's quality control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update the testing schedule as the Work progresses.

4. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include Work the Contracting Agency has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of permits and building code requirements.

1.06 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.

2. Project title and number.

3. Name, address, and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.

8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.

12. Name and signature of laboratory inspector.

13. Recommendations on retesting and reinspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.

2. Statement on condition of substrates and their acceptability for installation of product.

3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

4. Results of operational and other tests and a statement of whether observed performance complies with requirements.

5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Contracting Agency's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of Authorities Having Jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: Testing agency shall be a Nationally Recognized Testing Laboratory (NRTL), an accredited laboratory through National Voluntary Laboratory Accreditation Program (NVLAP), or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual sections; and, where required by authorities having jurisdiction, that is acceptable to authorities. NRTL and NVLAP are further defined below.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Contracting Agency's Representative.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain Log at Project Site. Post changes and revisions as they occur. Provide access to test and inspection log for Contracting Agency's Representative's reference during normal working hours.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

B. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

C. Protect construction exposed by or for Quality-Control Service activities.

D. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for Quality-Control Services.

END OF SECTION

PART 1 – GENERAL

1.01 PERMITS, CODES AND REGULATIONS

A. The following permits have been applied for, included in the Appendix, or are on file with Contracting Agency and are incorporated into the contract:

1.City of Port Townsend Building Permit and Floodplain Development Permit BLD24-237 (in Appendix)

2. City of Port Townsend Substantial Shoreline Development Permit LUP24-039 (pending issuance)

3. City of Port Townsend SEPA Mitigated Determination of Non-Significance (MDNS) LUP24-040 (in Appendix)

4. Hydraulic Project Approval (HPA) (pending issurance)

5. Department of Ecology Construction Stormwater Permit (pending submission)

B. The Contractor must obtain and pay fees for licenses, permits, perimit inspections, and approvals required by laws, ordinances, and rules of appropriate governing or approving agencies necessary for proper completion of Work (other than those listed under item 1.1A. above and Special Inspections called for by the International Building Code). The following permits must be obtained by the Contractor:

1.Transfer of Coverage of Department of Ecology Construction Stormwater Permit

C. Conform with the requirements of listed permits and additional or other applicable permits, codes, and regulations as may govern Work.

D. Conform with current applicable codes, regulations and standards, which is the minimum standard of quality for material and workmanship. Provide labor, materials, and equipment necessary for compliance with code requirements or interpretations, although not specifically detailed in the Drawings or specifications. Be familiar with applicable codes and standards prior to bidding.

E. Process through the Contracting Agency's Representative, requests to extend, modify, revise, or renew any of the permits (listed in 1.1A above). Furnish requests in writing and include a narrative description and adequate Drawings to clearly describe and depict proposed action. Do not contact regulatory agency with requests for permit extensions, modifications, revisions, or renewals without the prior written consent of the Contracting Agency's Representative.

1.02 VARIATIONS WITH CODES, REGULATIONS AND STANDARDS

A. Nothing in the drawings and specifications permits Work not conforming to codes, permits or regulations. Promptly submit written notice to the Contracting Agency's Representative of observed variations or discrepancies between the Contract documents and governing codes and regulations.

B. Appropriate modifications to the Contract documents will be made by Change Order to incorporate changes to Work resulting from code and/or regulatory requirements. Contractor assumes responsibility for Work contrary to such requirements if Work proceeds without notice.

C. Contractor is not relieved from complying with requirements of Contract Documents which may exceed, but not conflict with requirements of governing codes.

1.03 COORDINATION WITH REGULATORY AGENCIES

A. Coordinate with the Contracting Agency on all communication with the regulatory agencies.

B. Provide advance notification for proper regulatory agency notice, of Project schedule and schedule revisions throughout Project duration, in order to allow scheduling of inspection visits at proper stages of Work completion.

C. Regulation coordination is in addition to inspections conducted by the Contracting Agency's Representative. Notify the Contracting Agency's Representative of scheduled inspections involving outside regulating officials, to allow Contracting Agency's Representative to be present for inspections.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

PART 1 - GENERAL

1.01 TEMPORARY INTERSECTION AND LIFT PIER CLOSURE

A. The General Conditions (Section 00 77 00, G-07 Time) outline the calendar-based milestones for the closure of the 300-ton haul-out pier and the adjacent intersection, restricting (closing) access for vehicle traffic and the travel lift. This section also specifies the milestones for reopening the intersection and lift for use. The Contractor may utilize the closure period to perform Work, provided that:

1. Temporary detours for vehicle traffic are established.
2. The progress schedule demonstrates that the work undertaken during the closure can be completed.
3. The Contracting Agency has approved the Contractors requested hours of work that fall outside the standard workday and week.
4. All associated submittals including those for materials and work plans have been reviewed and “approved” by the Contracting Agency.

B. Work performed outside the specified closure period must occur with the lift pier and intersection open to traffic and boat yard operations in accordance with Temporary Traffic Regulation and other specifications contained herein.

1.02 TEMPORARY LAYDOWN AND STAGING AREA

A. The Contractor may, during the contract period, have full access and use of the following defined area for staging, materials, and parking:

1. Starting at the curbline immediately adjacent to the northwest corner of the restroom building adjacent to the trailhead of the Larry Scott Trail, a section extending 50’ from the north side of the curbline westward to the maintenance road near the west end of the proposed chitosan detention basin.

B. The Contractor, prior to mobilization, shall submit to the Engineer for approval, a Site Plan showing the proposed location and layout of the laydown yard and staging area including sanitation facilities, fencing, and contractor offices, as applicable.

1.03 TEMPORARY CONSTRUCTION

A. The Contractor is solely and exclusively responsible for;

1. The designs, construction and maintenance of all temporary construction means and methods including but not limited to traffic control, forms, falsework, shoring, scaffolding, stairs, ladders, dewatering, bypass pumping, pipe plugs, testing appurtenances, surfacing, paving and all other similar items not permanently incorporated into the Work.
2. Providing temporary plates and bridges to maintain vehicle, boat yard travelift, and pedestrian access.
3. Providing temporary barriers, guardrails, ladders, stairs, guards, and barricades to protect persons in accordance with applicable regulations
4. Providing temporary fencing to secure the site.

1.04 TEMPORARY TRAFFIC REGULATION

A. The Contractor must;

1. Provide temporary barricades, barricade lights, lights, flaggers and other means to safely control pedestrian and vehicular traffic entering and leaving the project site and on the project site all in accordance with the Manual of Uniform Traffic Control Devices.
2. Conduct operations to offer the least possible obstruction and inconvenience to boat yard operations and public traffic.
3. Maintain a travel way during Work except for designate intersection and haul out pier closures.
4. Maintain a travel way for the travelift or sequence Work in coordination with Contracting Agency to avoid disruption of boat yard operations.
5. Do not overload or damage paved or improved surfaces, sidewalks, curbs or gutters.
6. Park construction personnel vehicles designated boatyard parking areas or in the construction staging area/laydown yard.
7. Park equipment and vehicles in manner at the end of the work shift that does not create a hazard to the public.

B. The Contractor, prior to mobilization, shall submit to the Contracting Agency for approval, Temporary Traffic Control plans showing the method of handling traffic during performance of the Work. The Contracting Agency may request the Contractor submit supplemental or revised Traffic Control Plans during the performance of the Work.

1.05 TEMPORARY UTILITIES

A. Sanitary Facilities: Provide and maintain self-contained portable sanitary facilities for the Contractor's, subcontractor's and Contracting Agency's use. Facilities shall comply with applicable regulations and shall be serviced, cleaned and disinfected frequently.

B. Temporary Water, Power

1. Potable Water: Connect to existing water service and provide backflow prevention devices. Read meter and reimburse the Contracting Agency for the cost of water used.
2. Construction Water: Connect to existing fire hydrants and obtain a hydrant meter with backflow prevention from the City of Port Townsend.
3. Power: Connect to the existing electrical service with a service disconnect switch. Provide overcurrent and ground fault protection. Read meter and reimburse Contracting Agency for the cost of energy used.

C. Temporary Ventilation: Provide equipment to ventilate enclosed areas to facilitate curing concrete, to dissipate humidity and to prevent accumulation of dust, fumes, or gases. Utilize existing OR new ventilation equipment, if any, and supplement with temporary fans to maintain clean air and safe conditions for construction operations. Replace or clean filters on existing or new equipment on completion of the project.

D. Dissipation of Hazardous Fumes Prior to Completion and Occupancy by Contracting Agency: Provide high-capacity fans and heaters or use existing OR new equipment to

provide 100% fresh air at elevated temperatures OR 90°F for several days to dissipate hazardous fumes from new construction materials such as paint, adhesives, carpet and wall coverings.

E. Temporary Lighting: Provide and maintain lighting for construction operations when necessary to achieve a lighting level to complete the Work.

F. Temporary Fire Protection:

1. Provide and maintain fire protection equipment, including extinguishers, fire hoses, and other equipment required by law or insurance carriers, or as necessary for proper fire protection during the Work.
2. Use fire protection equipment only for fighting fires.
3. Locate fire extinguishers in field offices, storage sheds, tool houses, temporary buildings, and throughout the construction site.
4. Comply with the 2021 International Fire Code as amended by WAC 51-54A

1.06 PROTECTION OF INSTALLED WORK

A. The Contractor is solely and exclusively responsible for;

1. Providing temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.
2. Protecting finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by covering surfaces with non-staining heavy-duty reinforced moisture-resistant Kraft building paper with joints continuously taped with waterproof tape OR ½ inch-thick CDX plywood with all joints continuously taped with 2 inch-wide duct tape.
3. Prohibiting traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is unavoidable, provide adequate protection to prevent damage to waterproof membranes and comply with recommendations for protection of the waterproofing or roofing material manufacturer.
4. Providing heavy planking to protect curbs, gutters, culverts, paving and similar surfaces from damage by heavy equipment or vehicles.

1.07 TEMPORARY CONTROLS

A. The Contractor is solely and exclusively responsible for;

1. Cleaning:
    1. During Construction: Maintain the site and all work in a clean orderly fashion free of waste debris and rubbish. Store debris in covered containers. Pick up and remove debris daily if required, but not less frequently than weekly. Burning debris on site is not permitted. Remove debris from permanently closed spaces prior to enclosing them. Clean mud from vehicles before leaving the site.
    2. If work under this Contract creates dusty, dirty or unsightly conditions in adjacent areas, the Contractor shall immediately cleanup the affected areas.
    3. Final cleanup is specified in Section 01 77 00.
2. Dust Control: Employ measures to prevent the creation of dust which may produce damage or nuisance to property or persons. Be responsible for all damage resulting

from dust produced by construction operations. Periodically wet down unpaved areas where vehicles are operated. See Division 31 Earthwork specification sections.

3. Erosion and Sediment Control: Employ measures to prevent erosion and trap any sediment created by construction operations before it leaves the site. Prevent sediment from entering stormwater systems, streams or other water bodies. Grade any areas damaged by construction or by erosion and hydroseed with grass.
4. Noise Control: Comply with regulations limiting construction noise levels. Prevent noise disturbance to the public and adjacent property owners.
5. Pest and Rodent Control: Avoid creating conditions conducive to pests and rodents. Comply with regulations governing the use of chemicals to control pests and rodents.
6. Water Control: Maintain excavations free of water. Grade site to drain. OR Protect site from puddling or running water. See Division 31 Earthwork specification sections.

PART 1 - GENERAL

1.01 SCOPE

A. During the progress of the work, keep the work areas occupied by the Contractor in a neat and clean condition and protect the environment both onsite and offsite, throughout and upon completion of the construction project.

1.02 SUBMITTALS

A. Develop an Environmental Protection Plan in detail and submit in accordance with Section 01 33 00 Submittals within thirty (30) days from the date of the preconstruction meeting. The Environmental Protection Plan shall include, but not be limited to, the following items:
   1. Copies of required permits.
   2. Proposed sanitary landfill site.
   3. Other proposed disposal sites.
   4. Copies of any agreements with public or private landowners regarding equipment, materials storage, borrow sites, fill sites, or disposal sites. Any such agreement made by the Contractor shall be invalid if its execution causes violation of local or regional grading or land use regulations.
   5. Spill Control and Countermeasure Plan (SPCC).

B. Distribute the Environmental Protection Plan to all employees and to all subcontractors and their employees.

C. The Contracting Agency intends to secure an NPDES construction stormwater permit from the Washington State Department of Ecology. A preliminary Stormwater Pollution Prevention Plan (SWPPP) is included in the Appendix. The SWPPP must be updated by the Contractor as defined in this Section. The Contractor must submit the SWPPP no later than 30 days following contract execution or no later than 90 days before the anticipated Notice to Proceed Date, whichever comes first. The SWPPP must be submitted to the Contracting Agency which will apply for the NPDES permit. Upon issuance of the NPDES permit, the Contractor must coordinate with the Contracting Agency, and apply for transfer of coverage. The Contractor must transfer coverage back to the Contracting Agency following Physical Completion.

1.03 DISPOSAL OPERATIONS

A. Excavated Materials:
   1. Native soil complying with the requirements of Section 31 00 00 Earthwork may be used for backfill, fill and embankments as allowed by that section.
   2. Spoil Material:
      a. Stockpile all material which is excavated in excess of that required for backfill. The Contracting Agency has designated an area at the southwest end of the maintenance access road lying just southwest of the maintenance building. The Contractor must shape the stockpiled material into a coned shaped pile and stabilize with grass seeding.
      b. Remove all material which is unsuitable for backfill, from the site and dispose of offsite in accordance with applicable regulations at the disposal site indicated in the Environmental Protection Plan. No additional compensation will be paid to the Contractor for such disposal. Include all such costs in the lump sum prices

bid for the project. Remove rubbish and materials unsuitable for backfill immediately following excavation.

c. Unsuitable material shall consist of all materials not classified as suitable materials or rubble and shall include shrubbery, trees, timber, trash and garbage.

B. Solid Waste Management:
   1. Supply solid waste transfer containers. Daily remove all debris such as spent air filters, oil cartridges, cans, bottles, combustibles and litter. Take care to prevent trash and papers from blowing onto adjacent property. Encourage personnel to use refuse containers. Convey contents to a sanitary landfill.
   2. Washing of concrete containers where wastewater may reach adjacent property or natural water courses will not be permitted. Remove any excess concrete to the sanitary landfill.

C. Chemical Waste and Hazardous Materials Management: Furnish containers for storage of spent chemicals used during construction operations. Dispose of chemicals and hazardous materials in accordance with applicable regulations.

D. Garbage: Store garbage in covered containers, pick up daily and dispose of in a sanitary landfill.

E. Dispose of vegetation, weeds, rubble, and other materials removed by the clearing, stripping and grubbing operations off site at a suitable disposal site in accordance with applicable regulations.

1.04 MITIGATION OF CONSTRUCTION IMPACTS

A. Requirements: All Contractor operations shall comply with all federal, state and local regulations pertaining to water, air, solid waste and noise pollution.

B. Definitions of Contaminants:
   1. Sediment: Soil and other debris that have been eroded and transported by runoff water.
   2. Solid Waste: Rubbish, debris, garbage and other discarded solid materials resulting from construction activities, including a variety of combustible and non-combustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves and tree trimmings.
   3. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalies, herbicides, pesticides, disinfectants, organic chemicals and inorganic wastes. Some of the above may be classified as "hazardous."
   4. Sanitary Wastes:
      a. Sewage: That which is considered as domestic sanitary sewage.
      b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing and consumption of food.
   5. Hazardous Materials: As defined by applicable laws and regulations. Undisclosed hazardous material contamination, if encountered will constitute a changed site condition. The Contracting Agency may retain a separate contractor to dispose of undisclosed hazardous material encountered.

C. Protection of Natural Resources:
   1. General: It is intended that the natural resources within the project boundaries and outside the limits of permanent work performed under this Contract be preserved in their existing condition or be restored to an equivalent or improved condition upon

completion of the work. Confine construction activities to areas defined by the public roads, easements, and work area limits shown on the Drawings. Return construction areas to their pre-construction elevations except where surface elevations are otherwise noted to be changed. Maintain natural drainage patterns. Conduct construction activities to avoid ponding stagnant water conducive to mosquito breeding.

2. Land Resources: Do not remove, cut, deface, injure or destroy trees or shrubs outside the work area limits. Do not remove, deface, injure or destroy trees within the work area without permission from the Engineer.
   a. Protection: Protect trees that are located near the limits of the Contractor's work areas which may possibly be defaced, bruised or injured or otherwise damaged by the Contractor's operations. No ropes, cables or guys shall be fastened to or attached to any existing nearby trees or shrubs for anchorages unless specifically authorized. Where such special emergency use is permitted, the Contractor shall be responsible for any damage resulting from such use.
   b. Trimming: Trim and seal tree limbs overhanging the line of the work and in danger of being damaged by the Contractor's operations in accordance with recognized standards for such work. Remove other tree limbs under the direction of the Engineer, so that the tree will present a balanced appearance.
   c. Treatment of Roots: Do not cut roots unnecessarily during excavating or trenching operations. Expose major roots encountered in the course of excavation and do not sever. Wrap them in burlap as a protective measure while exposed. Neatly trim all other roots larger than 1 inch in diameter that are severed in the course of excavation at the edge of the excavation or trench and paint them with a heavy coat of an approved tree seal.
   d. Repair or Restoration: Repair or replace any trees or other landscape features scarred or damaged by equipment or construction operations as specified below. The repair and/or restoration plan shall be favorably reviewed prior to its initiation.
   e. Temporary Construction: Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction as directed by the Engineer. Level all temporary roads, parking areas and any other areas that have become compacted or shaped. Any unpaved areas where vehicles are operated shall receive a suitable surface treatment or shall be periodically wetted down to prevent construction operations from producing dust damage and nuisance to persons and property, at no additional cost to the Owner. Keep haul roads clear at all times of any object that creates an unsafe condition. Promptly remove any contaminants or construction material dropped from construction vehicles. Do not drop mud and debris from construction equipment on public streets. Sweep clean turning areas and pavement entrances as necessary.

3. Water Resources: The Contractor must:
   a. Regulatory Compliance
      1. Investigate and comply with all applicable Federal, State, and local regulations concerning the discharge of pollutants into underground and natural waters.

2. Refer to Section 31 00 00 Earthwork for "dewatering" disposal requirements.

b. Environmental Impact
   1. Perform all work under this Contract to minimize adverse environmental impacts to a level acceptable to the Engineer and regulatory agencies including;
      - Oily Substances:
        - Implement measures to prevent oily or hazardous substances from entering the ground, drainage areas, or local water bodies.
        - Contaminated soil or water must be disposed of according to applicable regulations.
      - Prevent Portland cement from entering local water bodies.
      - Prevent muddy water from operations from entering local water bodies.

c. Pollution Prevention Measures
   1. Exercise precautions to protect wetlands, streams, and coastal waters from pollutants (fuels, oils, etc.).
   2. Conduct operations to minimize muddying and silting of affected waters.
   3. Water pollution control work includes but is not limited to:
      - Constructing facilities as shown in Drawings or specified in Section 00 72 00 General Conditions.
      - Temporary measures such as dikes, basins, ditches, and applying straw and seed.

d. Stormwater Pollution Prevention Plan (SWPPP)
   1. Submit an updated SWPPP to control water pollution during construction.
      - The plan must detail erosion control schedules and proposed pollution control measures the contractor intends to implement.
      - No clearing, grubbing, or earthwork is allowed until the SWPPP is accepted and Contractor has secured transfer of coverage for the NPDES Construction Permit from the Washington State Department of Ecology.
      - The Contracting Agency is not liable for delays due to an unaccepted SWPPP.
      - The Contractor may request a waiver for a written pollution control plan if erosion is unlikely, but this does not relieve responsibility for other compliance provisions.

- If measures are inadequate, the Engineer may require revisions to operations or the SWPPP, which must be addressed before proceeding with work.
- The Contractor remains responsible for compliance with statutes related to water pollution prevention and abatement.
- The Contractor remains responsible for compliance with statutes related to water pollution prevention.

4. Erosion and Sediment Control: The Contractor must:
   a. Runoff Management
      1. Bypass existing stormwater flow around Work.
      2. Discharge construction runoff into small drainages to prevent erosive flows.
      3. Prevent runoff over unprotected slopes.
      4. Minimize disturbed areas for construction.
      5. Keep runoff away from disturbed areas.
      6. Direct flows over vegetated areas before discharging into storm systems.
      7. Trap sediment using check dams, sediment ponds, or siltation fences.
      8. Remove and dispose of siltation from offsite retention ponds.
      9. Stabilize disturbed areas promptly.
   b. Best Management Practices (BMPs)
      1. Implement BMPs according to the Stormwater Management Manual for Western Washington (SWMMMWW) such as:
         - Limit access points for vehicles to prevent sediment trackout.
         - Use flags or fences to prevent soil disturbance outside easements.
         - Water excavated material to control dust, ideally twice daily.
         - Cease earthmoving activities during high winds (>25 mph).
         - Cover or water offsite transported materials to prevent dust.
         - Minimize disturbed areas continuously.
         - Limit onsite vehicle speed to 15 mph.
         - Stabilize disturbed areas promptly.
         - Use sandbag dikes, silt fences, or equivalent for side and downslope boundaries.
         - Install inlet protection BMPs to prevent silt in pipes.
         - Sweep or wash sediment from paved areas at the end of each workday.

5. Fish and Wildlife Resources: Perform all work and take such steps required to prevent any interference or disturbance to fish and wildlife. The Contractor will not be permitted to alter water flows or otherwise significantly disturb native habitat adjacent to the project area which are critical to fish and wildlife except as may be indicated or specified.

6. Cultural Resources: The project does not pass through any known archaeological sites. However, it is conceivable that unrecorded archaeological sites could be discovered during the construction. In the event that artifacts, human remains, or other cultural resources are discovered during excavations at locations of the Work, the Contractor shall protect the discovered items, notify the Engineer, and comply with applicable law.

7. Revegetation of Disturbed Areas:
    a. Tree and Shrub Replacement: Replace trees and shrubs damaged or disturbed by the construction or as noted on the Drawings after completion of earthwork in the area. Plant nursery stock of the same species and variety, in 5-gallon cans for trees and 1-gallon cans for shrubs on a one-for-one basis. Plant in the early fall. If planting is not feasible in early fall, the Engineer will reschedule the planting operations.
    b. Planting of Trees and Shrubs:
        1) Selection: Deliver trees and shrubs to the site in the nursery containers, with the nursery tags identifying the species and variety. The trees and shrubs should be selected for shape and symmetrical branching habit, which at maturity will produce strong, full foliated specimens. The specimens shall have grown in the designated size of container for a sufficient length of time for the root system to hold the earth when taken from the container, but not long enough to become rootbound or cause a "hardening off" of the root system. Specimens which are loose in the root ball will be rejected. Remove all rejected specimens from the site and replace with specimens as specified. Specimens shall be sound, healthy, vigorous and free from insects, pests, plant diseases and injuries.
        2) Protection: Specimens which cannot be planted within one day of delivery shall be properly protected and kept moist to prevent drying.
        3) Planting Procedure: Planting hole shall be twice the width of the root ball and at least one and one-half times the height of the root ball. Fill the planting hole with water and let drain away. Mix excavated soil with a planting mix appropriate for the type and condition of the soil and the species of tree or shrub and place the mixed soil in the planting hole to the depth necessary to bring the root ball slightly higher than the surrounding soil. Remove the specimen from the container carefully so that the root ball remains unbroken. Place in planting hole and fill with mixed soil to one-half the height of the root ball, tamp thoroughly, then water. Set specimens at such a level that after settlement the top of the root ball is level with the surrounding finish grade. Add mixed soil to form watering basin, fill basin twice with water immediately after planting. Water plantings as frequently as required to keep the specimens adequately moist until well established. The Contractor will be responsible for maintaining specimens for a minimum of one year after final acceptance or planting, whichever is later.

4) Staking: Use 2-inch x 2-inch redwood or cedar stakes of length adequate to support each tree. Drive a stake on each side of each specimen outside of the root ball, to a depth of 3 feet. Support tree to stakes using twisted galvanized wire covered with reinforced rubber hose where in contact with the specimen.
5) Mulching: Fill all watering basins of trees and shrubs with a layer of mulch not less than 2 inches thick.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

PART 1 - GENERAL

1.01 EQUIPMENT AND FACILITY STARTUP

A. Commission all systems and equipment to verify performance, function, and correct operation by performing procedures to activate, startup, adjust, test, and demonstrate that the work is in operating order in accordance with the general requirements of this Section and the detailed requirements of the technical sections under the system or equipment specified. To ensure that the work is ready for full-time operation, the procedures shall include verification, balancing, calibration, witness testing, documentation, inspection by equipment manufacturers and operator training where specified.

B. The Contractor shall designate a Project Startup Coordinator. The Startup Coordinator shall oversee preparation of the Startup Plan, coordinate startup activities, ensure proper testing and sign-offs for various mechanical, electrical and instrumentation and controls checks, and oversee the Facility Startup and Testing requirements. The Startup Coordinator shall have experience in the coordination, startup, and testing of similar capacity lift stations.

C. Notification: Notify the Engineer seven (7) days prior to starting each system or piece of equipment.

D. Coordination: During the startup period, coordinate the operation of the facility with Engineer, subcontractors, operators, and manufacturer's representatives. Provide regular updates of construction schedule and startup activities to the Contracting Agency.

E. The Contractor shall furnish test equipment, measuring devices, and supplies required to conduct tests.

F. The Contractor shall maintain the equipment until acceptance. Provide all lubricants, chemicals, and electricity necessary until acceptance.

G. The Contractor shall furnish all expendable supplies, gas, water, etc., required for startup, demonstration, and testing, and dispose of all waste or used supplies, water, etc.

H. Operations and Maintenance (O&M) Manuals shall be submitted twenty (20) days before the startup of new equipment/facilities.

1.02 SUBMITTALS

A. Startup Plan, Forms, and Schedule: Prepare a facility startup plan and schedule. The plan shall include test methods and procedures and sample forms for recording commission, test, and startup data. The plan and schedule shall include time for testing and debugging of the control logic and HMI interface for each system component. The amount of time necessary shall be coordinated with and approved by the Engineer.

B. Submit qualifications of proposed Project Startup Coordinator.

C. Provide Affidavits as described in paragraph 1.04 B.

D. Submit documentation of tests, balancing reports, and the like.

1.03 INITIAL STARTUP AND OPERATION OF FACILITIES

A. Portions of the work may be started up and operated during the construction period to permit continued operation of the existing facilities or to permit demolition and conversion of existing facilities to new uses. Refer to the general work sequence and early partial use occupancy requirements of Section 01010 (01 11 00). Perform steps **1 through 13** in paragraph B below for the initial startup and operation of the systems and equipment that shall be started up and operated during the construction period and before the entire plant work is completed.

B. The following listing is a general sequence of startup activity steps to be used in placing facility systems into operation:

1. Perform initial lubrication of equipment and have manufacturers check and adjust equipment. Provide all subsequent lubrication and maintenance, and such staff as required for test operation until the Contracting Agency assumes equipment maintenance responsibility after Step 15 below.
2. Perform satisfactory testing of electrical work required prior to energizing of the electrical system.
3. After completion of Step 2, perform satisfactory electrical testing required after energizing of the electrical system.
4. Complete calibration of instruments.
5. Satisfactorily complete system verification of instrumentation work.
6. After completion of Steps 1 and 3, perform a rotational test of equipment and correct backward rotating drives.
7. After completion of Steps 5 and 6, test operate the equipment by manually initiating the operation. Where manual operation bypasses alarm or safety monitoring, provide continuous supervision of such parameters.
8. Concurrent with Step 7, perform instrumentation and control testing and adjustments as related to the equipment being tested.. Provide personnel to assist in operation of equipment and adjustments of this system debugging and testing. All controls, interlocks, alarms, etc. including signals from other parts of the facility shall be tested. Provide simulation of inputs if needed during this step.
9. Concurrent with Step 7 and where possible at this stage of startup, complete the performance testing specified for the equipment.
10. Concurrent with Step 7, perform adjustments of the electrical work as related to the equipment being tested.
11. Repeat Steps 1 through 10 as required for other equipment items and systems until all process components and utility systems are ready for new system(s) operation. It may be necessary for the Contractor to put portions of the newly constructed facility in service before constructing other portions of the facility or completing the Work as a whole.
12. Submit to the Engineer the required documentation of testing, calibration, and equipment affidavits.
13. Notify the Engineer fifteen (15) days before new system(s) operation is to occur so that the Contracting Agency may order chemicals and make other arrangements for full-time operation. Notify the Contracting Agency and Engineer again, exactly seven (7) days before total plant operation is to begin.
14. Submit any remaining documentation of testing, balancing reports, equipment affidavits, and the like commissioning before acceptance.

1.04 MANUFACTURER'S FIELD SERVICE AND AFFIDAVITS

A. Field Service: Where specified, manufacturers of equipment shall provide field service. Field service shall be provided by an authorized factory-trained and qualified manufacturer's representative for the specific equipment. Equipment shall not be considered ready for full-time operation until after the manufacturer's representative has checked and adjusted the equipment, and certified by written affidavit that the equipment has been properly installed, tested, adjusted, lubricated, and calibrated, and is ready for full-time operation.

B. Affidavits: Acceptable affidavits shall be submitted prior to completion of the work.
   1. Affidavits shall contain the following specific wording:
      "The insert name of equipment has been properly installed, tested, adjusted, lubricated, and calibrated, and is ready for full-time operation. The installation has been inspected and has been found to be in conformance with our (the manufacturer's) standards and requirements."
   2. Except for insertion of the equipment name, no amplification, dilution, or modification of this specific wording will be permitted.

1.05 TRAINING

A. Submit Operation and Maintenance Manuals and Parts Lists specified in Section 01300 (01 33 00) at least fifteen (15) days prior to the first training session.

B. Demonstrate the operation, maintenance and safety procedures for all systems and equipment to personnel designated by the Contracting Agency. Arrange training and demonstrations to allow split shifts of operating personnel, such that repeat sessions are provided for approximately half the designated personnel at each session.

C. Provide 4 hours of onsite demonstration of systems and equipment.

D. In addition to overall training specified above, provide special demonstration and training for specific pieces of equipment specified in the Technical Specification Sections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

A. Equipment reference forms attached to this Section are not specific to any piece of equipment or facility to be installed as a part of this project. The examples are provided as a means of illustrating the level of detail required for the preparation of commission, testing and startup forms for this project. Reference Division 16 Electrical and Division 17 Instrumentation for additional commissioning, testing, and startup requirements.

REFERENCE FORMS

Title
Equipment Test Report Form
Operation and Maintenance Transmittal
Equipment Record Form
Manufacturer's Installation Certification
Spare Parts / Extra Stock Chain of Custody Form

EQUIPMENT TEST REPORT FORM:

CITY OF SAMPLE

PROJECT NAME HERE

EQUIPMENT TEST REPORT

Equipment Name:
Equipment Number:
Specification Ref:
Location:

	Manufacturer		Contract AgenccyRepresentative	
	Verified	Date	Verified	Date
PREOPERATIONAL CHECKLIST				
Mechanical				
Lubrication				
Alignment				
Anchor bolts				
Seal water system operational				
Equipment rotates freely				
Safety guards				
Valves operational				
Related systems operational				
O&M manual information complete				
Electrical (circuit ring-out and high-pot tests)				
Circuits:				
Power to MCC ??				
Control to HOA				
Indicators at MCC:				
Red (running)				
Green (power)				
Amber (auto)				
Indicators at local control panel				
Wiring labels complete				
Nameplates:				
MCC				
Control station				

	Manufacturer		Contract AgenccyRepresentative	
	Verified	Date	Verified	Date
Control panel				
Equipment bumped for rotation				
Piping Systems				
Cleaned and flushed:				
Suction				
Discharge				
Pressure tests				
Temporary piping screens in place				
Instrumentation and Controls				
Flowmeter calibration				
Calibration Report No.				
Flow recorder calibrated against transmitter				
VFD speed indicator calibrated against independent reference				
Discharge overpressure shutdown switch calibration				
Simulate discharge overpressure Shutdown				
FUNCTIONAL TESTS				
Mechanical				
Motor operation temperature satisfactory				
Pump operating temperature satisfactory				
Unusual noise, etc.?				
Pump operation: ?? gpm/?? psig				
Measurement:				
Flow				
Pressure:		Test gage number:		
Alignment hot				
Dowelled in				
Remarks:				

	Manufacturer		Construction Superintendent	
	Verified	Date	Verified	Date
Electrical				
Local switch function:				
Runs in *HAND*				
No control power in *OFF*				
Timer control in *AUTO*				
Overpressure protection switch functional in both *HAND* and *AUTO*				
Overpressure protection switch set at ?? psig				
PLC ??? set at ??-hour cycle, ?? min *ON*				
OPERATIONAL TEST				
48-hour continuous test. Pump cycles as specified, indicators functional, controls functional, pump maintains capacity, overpressure protection remains functional, hour meter functional				

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

Comments: _____

_____

_____

_____

_____

_____ _____

Date Manufacturer

_____

Signature of Authorized Representative

_____ _____

Date Signature of Contract Agency's Representative

OPERATION AND MAINTENANCE TRANSMITTAL FORM:

Date: _____ Submittal No: _____

To: _____ Contract No: _____

_____ Spec. Section: _____

_____ Submittal Description: _____

_____ From: _____

Attention: _____ _____

Checklist	Contractor		Construction Superintendent	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and post-shutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks: _____

_____

CONTRACTOR'S SIGNATURE

EQUIPMENT RECORD FORM:

EQUIP DESCRIP		EQUIP LOC	
EQUIP NO.	SHOP DWG NO.	DATE INST	COST
MFGR		MFGR CONTACT	
MFGR ADDRESS			PHONE
VENDOR		VENDOR CONTACT	
VENDOR ADDRESS			PHONE

MAINTENANCE REQUIREMENTS	D	W	M	Q	S	A	Hours
LUBRICANTS: RECOMMENDED:							
ALTERNATIVE:							
MISC. NOTES:							

RECOMMENDED SPARE PARTS			
PART NO	QUAN	PART NAME	COST

ELECTRICAL NAMEPLATE DATA			
EQUIP			
MAKE			
SERIAL NO.		ID NO.	
MODEL NO.		FRAME NO.	
HP	V	AMP	HZ
PH	RPM	SF	DUTY
CODE	INSL. CL	DES	TYPE
NEMA DES	C AMB	TEMP RISE	RATING
MISC.			
MECHANICAL NAMEPLATE DATA			
EQUIP			
MAKE			
SERIAL NO.		ID NO.	
MODEL NO.		FRAME NO.	
HP	RPM	CAP	SIZE
TDH	IMP SZ	BELT NO.	CFM
PSI	ASSY NO.	CASE NO.	
MISC			

MANUFACTURER'S INSTALLATION CERTIFICATION FORM:

Contract No: _____ Specification section: _____

Equipment name: _____

Manufacturer of equipment item: _____

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

Comments: _____

_____

_____

_____

_____

_____ _____

Date Manufacturer

_____

Signature of Authorized Representative

_____ _____

Date Signature of Contract Agency's Representative

SPARE PARTS / EXTRA STOCK CHAIN OF CUSTODY FORM:
(For use with loose-shipped spare parts, extra stock, or spare parts which are not permanently mounted within another piece of equipment)

PART INFORMATION (Use a new form for each part type)

PART NAME/DESCRIPTION:	
ID TAG.(IF APPLICABLE):	
MFR:	MFR PART/MODEL NO:
SERIAL NO (IF APPLICABLE)	
STYLE (IF APPLICABLE)	COLOR (IFF APPLICABLE)
ASSOCIATED/PARENT EQPM NAME:	
ASSOCIATED/PARENT EQPM ID TAG (IF APPLICABLE):	
SPEC REFERENCE:	QTY REQ'D:

CHAIN OF CUSTODY

QTY DELIVERED	DATE/ TIME/ LOCATION	RELEASED BY	RECEIVED BY
	Date:	COMPANY	COMPANY/AGENCY
	Time:	NAME/TITLE	NAME/TITLE
	Location:	SIGNATURE	SIGNATURE

END OF SECTION

SECTION 02 40 00

DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all demolition required to perform the work covered under this contract including without limitation:
   1. Remove existing construction shown to be removed.
   2. Remove and replace existing construction and/or finishes as required to provide access to perform other work included in this contract.
   3. Include removal of mechanical and electrical work that is to be abandoned and is contained in construction to be removed whether or not the mechanical and electrical work is shown. Disconnect and cap off utilities in accordance with applicable codes and safety regulations.
   4. Where utilities that are not shown pass through construction that must be removed, and those utilities serve other areas notify the Contracting Agency before disrupting service. If rerouting is required to maintain service, the Contracting Agency may issue a Change Order to accomplish the required work.
   5. Store and protect items intended for reuse.
   6. Assume ownership of debris and unwanted materials, remove from the site and dispose of legally.
      a. Special requirements for waste management during construction operations.
         1) Protect the environment, both onsite and offsite, during construction operations.
         2) Prevent environmental pollution and damage.
         3) Maximize source reduction, reuse, and recycling of solid waste.
   7. Include the cost of removing and disposing of hazardous material including without limitation asbestos or asbestos-containing material, lead-containing paint, and PCBs.
   8. Comply with all State permit requirements for demolition. The Contractor shall perform a pre-demolition survey to determine whether hazardous material is present. If material is identified as hazardous, retain qualified and State-licensed Contractor to remove and dispose of the materials legally.
   9. If illegal electrical wiring is encountered such as "BX" or nonmetallic sheathed cable, notify the Engineer.

B. The details shown on the Drawings are based upon information contained in the reference drawings. The details indicate typical features of the various structures and shall not be construed as complete or adequate to supplant actual on-site inspection, additional review, and interpretation of the reference drawings by the Contractor.

1.02 NOISE AND DUST CONTROL

A. Perform work in accordance with requirements in Division 1.

B. Provide temporary partitions to control dust and noise and exclude unauthorized persons.

C. Perform work in a manner to cause least disturbance to tenants and least damage to work to remain.

D. Maintain adequate means of safe, clear egress for tenants.

E. Employ all available techniques for construction noise abatement. Use remote, well-mufflered air compressors and newest noise suppressed pneumatic and electric tools.

1.03 WARNING

A. The Contractor is advised that work under this Section may be hazardous. The Contractor is to take all necessary precautions to ensure the safety of workers and property. Removal of and/or working in areas containing even minor amounts of hazardous material including without limitation, asbestos, lead-based paint, PCBs or other hazardous materials requires special precautions, knowledge, and procedures. If hazardous material is suspected, notify the Contracting Agency.

1.04 QUALITY ASSURANCE

A. Maximize use of source reduction and recycling procedures.

1.05 PRECONSTRUCTION MEETING

A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with the Contracting Agency to discuss the proposed Solid Waste Management Plan and to develop mutual understanding relative to details of environmental protection.

1.06 SUBMITTALS

A. Information to be submitted in accordance with Section 01 33 00.

B. Submit copies of all executed permits.

C. Solid Waste Management Plan: Not less than 10 days before the Pre-construction meeting, prepare and submit a Solid Waste Management Plan including, but not limited to, the following:
   1. List of the recycling facilities, reuse facilities, municipal solid waste landfills and other disposal area(s) to be used. Include:
      a. Name, location, and phone number.
      b. Copy of permit or license for each facility.
   2. Identify materials that cannot be recycled or reused. Provide explanation or justification.
   3. Revise and resubmit Plan as required by the Contracting Agency.
      a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

D. Record Submittals: With Record Submittals as specified in Section 00 72 00, submit the following:
   1. Summary of solid waste disposal and diversion. Submit on form as approved by the Contracting Agency.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 SOLID WASTE MANAGEMENT

A. Develop and implement a waste management program in accordance with ASTM E1609 and as specified herein.

B. Collection: Implement a recycling/reuse program that includes separate collection of waste materials of the following types as appropriate to the project waste and to the available recycling and reuse programs in the project area:
   1. Land clearing debris.
   2. Asphalt.
   3. Concrete and Masonry.
   4. Metal.
      a. Ferrous.
      b. Non-ferrous.
   5. Wood, nails, and staples allowed.
   6. Debris.
   7. Paper.
      a. Bond.
      b. Newsprint.
      c. Cardboard and paper packaging materials.
   8. Plastic.
      a. Type 1: Polyethylene Terephthalate (PET, PETE).
      b. Type 2: High Density Polyethylene (HDPE).
      c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
      d. Type 4: Low Density Polyethylene (LDPE).
      e. Type 5: Polypropylene (PP).
      f. Type 6: Polystyrene (PS).
      g. Type 7: Other. Use of this code indicates the package in question is made with a resin other than the six listed above or is made of more than one resin listed above and used in a multi-layer combination.
   9. Others as appropriate.

C. Recycling/Reuse: Maximize recycling and reuse of materials.
   1. Recycling/Reuse on project site: Items to be reused include trench spoils and crushed surfacing base course.

D. Handling:
   1. Clean materials that are contaminated prior to placing in collection containers. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process).
   2. Arrange for collection by or delivery to the appropriate recycling or reuse facility.
   3. Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

3.02 REMOVAL OF CONSTRUCTION IN AREAS TO RECEIVE NEW WORK

A. Remove all unwanted mechanical and electrical work (whether shown or not) that is not wanted and is not needed to serve other areas that is in, on, or concealed behind work being removed. Cap off or terminate all mechanical or electrical work in accordance with the requirements of Divisions 26 and 40.

B. Protect mechanical and electrical work that serves other areas. Relocate concealed mechanical and electrical work that is required to preserve service to other areas.

C. Remove structural work designated for removal. Take precautions not to damage structural work intended to remain. Where temporary shoring is needed, submit a design prepared by an appropriately licensed engineer for review before proceeding.

D. If structural elements are encountered that were not shown, protect them from damage and report their presence to the Engineer.

3.03 REMOVAL OF LIMITED PORTIONS OF EXISTING CONSTRUCTION TO PERMIT MODIFICATIONS

A. Provide careful, selective cutting and removal of existing construction as required to permit relocation or modification of partitions, doors, or openings. Cut and remove the least amount of work possible except when a larger area needs to be removed to permit strengthening existing construction or when required to remove finishes to a natural break line such as a corner or change in material.

B. Protect existing construction to remain with temporary coverings.

C. Treat existing mechanical, electrical, or structural work as described in other parts of this Section.

D. When modifications are complete, replace removed work with new construction and finishes to match adjacent existing work. Standards of material and workmanship shall be in accordance with other portions of this Specification or if not covered then in accordance with current practice for this class of work. Salvaged materials may be used for replacement if in good condition.

3.04 REMOVAL OF EXISTING CONSTRUCTION TO PROVIDE ACCESS TO PERFORM WORK

A. Provide careful selective cutting and removal of existing construction where required to permit installation of new concealed mechanical or electrical work, or installation of equipment, fixtures or devices.

B. Treat existing mechanical, electrical, or structural work as described in other parts of this Section.

C. Replace and/or patch removed construction and finishes in accordance with other parts of this Section.

3.05 PROTECTION OF WORK TO REMAIN

A. Protect all work to remain. Repair damage with materials, workmanship, and finishes matching existing work when new.

B. Most existing floor finishes will not be replaced in this contract. It is essential these floors be protected from any damage due to impact, dirt, abrasion, paints, and solvents.

3.06 CUTTING HOLES IN CONCRETE AND/OR CONCRETE MASONRY UNIT (CMU)

A. The Contractor is cautioned that electrical conduits and reinforcing that are not shown on Drawings may be concealed in concrete CMU construction. Use electronic detection equipment to locate concealed items before cutting holes. Take all required precautions to avoid damage to existing conduits or reinforcing.

B. New openings in existing concrete walls or slabs may be saw cut to opening perimeter lines where Drawings do not call for adding reinforcing trim bars to strengthen openings. Do not run saw kerfs past corners of openings. Complete concrete removal at opening corners by chipping and grinding. Take all required precautions to avoid water damage to existing construction or the Contracting Agency’s property.

C. Where Drawings call for adding reinforcing trim bars to strengthen openings, limit saw cutting to a depth of 3/4 inch to avoid cutting existing reinforcing steel. Carefully chip out concrete to avoid damaging existing reinforcing steel which is to remain.

D. Use chipping guns to chip out small holes for pipes or conduits. Proceed carefully to avoid damage to concealed conduits. Core drilling is permitted only at the Contractor's risk and only with the Contracting Agency’s permission. If core drilling is used, the Contractor shall: 1) use electronic detection equipment to locate conduit before drilling, 2) take precaution to avoid water damage to existing construction or the Contracting Agency’s property, and 3) replace, at its own expense, any damaged electrical or signal wiring or conduits.

3.07 REMOVE UNWANTED FIXED EQUIPMENT

A. If items are designated on the Drawings to be salvaged, remove them carefully without causing damage.

B. Store and protect items to be reused until time of need on jobsite.

3.08 IF HAZARDOUS MATERIALS ARE ENCOUNTERED

A. If hazardous materials are discovered, comply with paragraph 1.01 of this Section and all applicable laws.

3.09 REMOVAL AND DISPOSAL OF MATERIAL

A. Removed material (other than material to be reused) shall become the property of the Contractor who shall remove it from the site and dispose of it in a legal manner.

3.10 UTILITY LOCATES AND DEMOLITION

A. There are electrical conduits that may nor may not be shown on the Drawings. Locate, demolish, and restore as required for the construction.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work under this section shall include all labor, materials, tools, and equipment necessary for the manufacture, detail, cutting, bending, transporting, and placing concrete reinforcement and associated items in conformance with the drawings and specifications.

1.02 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete

1.03 REFERENCES

A. American Concrete Institute (ACI) Manual of Concrete Practice

ACI 315 (2004) Manual of Standard Practice for Detailing Reinforced Concrete Structures

B. ASTM International (ASTM)

ASTM A615 (2016) Standard Specification for Deformed & Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A706 Specification for Weldable Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

ASTM A767 (2016) Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

C. City of Port Townsend Municipal Code

D. Washington State Department of Transportation (WSDOT)

(WSDOT) Standard Specification for Road, Bridge, and Municipal Construction; and Amendments

1.04 SUBMITTALS

A. Manufacturer’s product data, specifications, and installation procedures for proprietary materials and reinforcement.

B. Steel producer’s certificates of mill analysis, tensile and bend tests.

C. Certificate of Material Origin WSDOT Form 350-109.

D. Concrete reinforcement will not be delivered to the job site until receipt of shop drawings and bending diagrams are approved by a qualified engineer.

E. Shop drawings for fabrication, bending and placement.

F. Other materials required for installation.

1.05 QUALIFICATIONS OF WORKERS

A. Provide at least one qualified person who shall be present at all times during execution of this portion of the work. The qualified person shall be thoroughly familiar with the type of materials being installed and the best methods for their installation. The qualified person shall direct all Work performed under this section.

1.06 CODES AND STANDARDS

A. In addition to complying with all pertinent codes and regulations, concrete reinforcement work shall comply with all pertinent recommendations contained in "Manual of Standard Practice for Detailing Reinforced Concrete Structures," publication ACI 315 of the American Concrete Institute.

1.07 QUALITY CONTROL/QUALITY ASSURANCE

A. Prior to beginning the placement of concrete reinforcing materials, the Contractor shall furnish to the Engineer a QA/QC plan outlining how concrete reinforcing will be inspected on site.

PART 2 - PRODUCTS

2.01 GENERAL

A. All concrete reinforcement materials shall be new and free from rust and shall comply with the following reference standards:
   1. As indicated on Drawings.

2.02 REINFORCING STEEL

A. Reinforcing steel shall be ASTM A615 deformed bar, Grade 60.

B. Where concrete reinforcement bar is to be welded. It shall conform to ASTM A706.

2.03 OTHER MATERIALS

A. Chairs or spacers for reinforcing shall be non-ferrous or plastic coated when resting on exposed surfaces.

B. All other materials not specifically described but required for a complete and proper installation of reinforcement, shall be selected by the Contractor, and submitted to the Engineer for review and approval.

PART 3 - EXECUTION

3.01 GENERAL

A. Prior to installation of this section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.

3.02 PRODUCT HANDLING

A. Protection
   1. Protect reinforcement before, during and after installation and protect the installed work and materials of other trades.

2. Store material in a manner to prevent fouling with dirt, grease, and other bond-breaking coatings.
3. Use all necessary precautions to maintain identification after the bundles are broken.

B. Replacements
1. In the event of damage, approval from the Engineer shall be required for all repairs and replacements necessary at no additional cost to the Contracting Agency.

3.03 REINFORCING STEEL BARS

A. Order Lists
1. Before ordering material, Contractor shall furnish all order lists and bending diagrams for approval by the Engineer; reinforcement placing drawings submitted for approval shall conform to CRSI detailing practice and ASTM A767 as applicable. Material shall not be ordered until such bending diagrams have been approved. The approval of bending diagrams by the Engineer shall in no way relieve the Contractor of responsibility for the correctness of such lists and diagrams.

B. Fabrication
1. Contractor shall bend all bars cold to the shapes indicated on the Engineer approved shop drawings. Do not field-bend bars partially embedded in concrete except as indicated on the drawings or as approved by the Engineer. Make bends and hooks in accordance with the applicable portions of the International Building Code (IBC) and ASTM A767 as applicable.

C. Marking and Identification
1. All bars shall be marked so their identification can be made when the final in place inspection is made.

D. Placing and Fastening
1. Contractor shall place all steel reinforcement accurately and hold firmly in the position indicated on the drawing during the placing and setting of concrete. Reinforcement shall be placed in accordance with the Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice". Each reinforcing bar shall be wired to a cross bar at a maximum spacing of 24" O.C. Tie bars at all intersections, except where spacing is less than one-foot in each direction, and then tie alternate intersections. Provide all accessories necessary to support reinforcing in positions shown on the plans.
2. Contractor shall provide minimum concrete covering of reinforcement as indicated on the drawings or otherwise approved by the Engineer.
3. In the event of reinforcement interferences as indicated on the drawings or as otherwise required, Contractor shall immediately consult the Engineer and obtain approval of new procedure before placing concrete.
4. All dowels and other hardware to be set in concrete shall be tied in place prior to placement of concrete. No wet setting, stabbing, rodding, or other movement of embedded items shall be performed during placement of concrete.

E. Splicing
1. Contractor shall furnish all reinforcement in the full lengths indicated on the drawings. Splicing of bars, except when indicated on the drawings, will not be

permitted without written approval of the Engineer. When approved, stagger splices as far as possible.

2. Splice length shall be 45 diameters, 24 inches minimum.
3. Unless shown otherwise on drawings, Contractor shall lap all reinforcing steel as follows:
   a. No. 6 bar and smaller shall have 46 bar diameters.
   b. No. 7 bar through No. 9 bar shall be 86 bar diameters.

3.04 CLEANING REINFORCEMENT

A. Steel reinforcement, at the time concrete is placed around it, shall be free from loose rust or mill scale, oil, paint, and all other coatings which will destroy or reduce the bond between steel and concrete.

3.05 SPECIAL INSPECTIONS

A. Periodic
   1. Inspect reinforcing steel and placement at the discretion of the Contracting Agency.

PART 4 - MEASUREMENT AND PAYMENT

4.01 GENERAL

A. No separate measurement or payment will be made for reinforcing steel. The cost for this work will be included in the lump sum costs for “STORMWATER TREATMENT SYSTEM” as described in Specification Section 33 44 19, as applicable.

END OF SECTION

SECTION 03 30 00

CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work in this section includes the following:
   1. The Work under this Section includes providing all labor, materials, tools, and equipment necessary for furnishing and installing cast in place concrete for the slab on grade and walls of treatment tanks in conformance with the Drawings and Specifications.

1.02 RELATED SECTIONS

A. Section 03 20 00 – Concrete Reinforcing

1.03 REFERENCES

A. ACI (American Concrete Institute) Manual of Concrete Practice

ACI 318	(2014) Building Code Requirements for Structural Concrete and Commentary
ACI 347	(2014) Recommended Practice for Concrete Formwork

B. ASTM International (ASTM)

ASTM A29	(2016) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
ASTM A706	(2014) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C31	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	(2013) Standard Specification for Concrete Aggregates
ASTM C39	(2021) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C143	(2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150	(2015) Standard Specification for Portland Cement
ASTM C260	(Er. 2006, 2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C330	(2017) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C494	(2013) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2015) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C. City of Port Townsend Municipal Code

D. Washington State Department of Transportation (WSDOT)

(2016) Standard Specification for Road, Bridge, and Municipal Construction; and Amendments

(2016) Standard Plans for Road, Bridge, Municipal Construction; and Amendments

1.04 SUBMITTALS

A. Delivery tickets for all concrete delivered to the site.

B. Concrete Mix Design. Mix design shall include manufacturer’s data stating material properties and installation instructions for all materials included in the concrete mix design. Manufacturer’s data shall demonstrate that it is in conformance to all specifications and standards outlined in these specifications and referenced standards.

C. Material certificates certifying conformance to ASTM C150.

D. Material certificates and sieve analysis for aggregates.

E. Slump Test results for each load of concrete delivered to the project site in conformance with ASTM C143.

F. Air Entrainment test results for each load of concrete delivered to the project site in conformance with ASTM C260.

G. Material certificates for any other admixtures used.

H. Material test reports consisting of one set of test cylinders for every 50 cubic yards of concrete delivered to the site, with the creation of the cylinders as directed in ASTM C31.

I. Manufacturer’s product data for waterstops, bonding agents, joint filler, curing materials.

J. Shop drawings for proposed locations of additional construction or control joints not shown on the structural joints.

K. Minutes from pre-installation conference.

PART 2 - PRODUCTS

2.01 COMPOSITION OF CONCRETE

A. All Portland cement concrete shall be ready mix, provided by an approved plant regularly engaged in the production of concrete, unless otherwise authorized in writing by the Engineer. Ready mix concrete shall conform to the requirements of ASTM C494.

B. The Contractor shall furnish the mix design to the Engineer for approval. The mix design shall be suitable for its intended use. Concrete shall be designed using an absolute volume analysis. The Contractor shall be responsible for having each mix laboratory tested. Prior to the start of production of any mix design, the Contractor shall submit test results and certifications for all materials, detailed mix design data and results of laboratory tests to the Engineer for approval. Approval by the Engineer will be based on apparent conformity to these specifications. It shall remain the Contractor's responsibility during production to produce concrete conforming to the mix design and the minimum acceptance criteria in the contract.

When requested by the Engineer, the Contractor shall submit samples of all materials for verification testing. Production shall not commence until the mix design is approved by the Engineer.

C. Do not use concrete containing chlorides.

2.02 MIX CRITERIA

A. Concrete mix design and testing shall meet the requirements of the building, code, and specifications. All concrete mixes shall be designed by a recognized testing lab stamped and sealed by a licensed civil engineer in the state where the work is being performed and submitted to the Engineer for review prior to concrete placement.

B. Cast in Place (C.I.P.)
   1. All cast-in-place concrete for the slab on grade and walls of treatment tanks shall be standard weight, Portland cement concrete appropriately proportioned to meet or exceed the following minimum requirements for strength and serviceability.
   2. Minimum 28-day compressive strength
      a. f'c= 4,500 psi
   3. Maximum water cement ratio = 0.45
   4. Air Entrainment = 5 1/2% +/- 1 1/2%
   5. Slump:
      a. 4" +/- 1" Max

C. Cast-In-Place Grout
   1. Drypack of nonshrink grout shall have a minimum 28-day compressive strength of 5,000 psi, and consist of Masterflow 713, Five Star grout, Sika Grout 212, or approved equal. For thick grout layers follow manufacturer's guidelines to attain the required strength, which may include the addition of washed ¾" pea gravel.

D. Mixture Substitutions
   1. Fly ash or other pozzolans conforming to ASTM C618 class N or F may be used as a partial substitution for Portland cement up to a maximum of 25% total cementitious materials by weight if the mix design is proportioned by method B or C.

2.03 AGGREGATES

A. Aggregates shall conform to ASTM C33 (hardrock), with maximum aggregate size as follows:

Location	Max. Aggregate Size
All	1.0"

B. Aggregates shall be stored so as to prevent deterioration, segregation and intrusion of foreign material.

2.04 ADMIXTURES

A. Any additives must have prior approval of the Engineer before being used.

B. Admixtures, if used, including water reducers, retarders, and accelerators, shall conform to ASTM C494. Calcium chloride shall not be used. All admixtures used shall be submitted for approval with the Concrete Mix Design.

2.05 AIR ENTRAINING AGENTS

A. Air entraining mixtures shall conform to ASTM C260.

2.06 PORTLAND CEMENT

A. Portland cement shall be ASTM C150 Type II.

2.07 MIXING WATER

A. Water used for the mixing of concrete shall be potable and be free of foreign materials. Water containing 2 percent or more salt shall not be used.

2.08 SHIPPING AND STORAGE OF CEMENT

A. Cement may be shipped from pretested approved bins. The cement shall be well protected from rain and moisture, and any cement damaged by moisture, or which fails to meet any of the specified requirements shall be rejected and removed from the work.

B. Cement stored by the Contractor for a period longer than sixty (60) days in other than sealed bins or silos shall be retested before being used. Cement of different brands, types, or from different mills shall be stored separately.

2.09 EMBEDS

A. Deformed bar anchors shall be ASTM A29, Grade 1010 through 1020 and shall have standard bends as noted on the plans.

2.10 FORMS

A. Forms shall be so designed and constructed that they may be removed without injuring the concrete.

B. Unless otherwise specified, forms for exposed surfaces shall be made of plywood, hard pressed fiberboard, sized and dressed tongue and groove lumber, or metal in which all bolt and rivet holes are countersunk, so that a plane, smooth surface of the desired contour is obtained. Rough lumber may be used for surfaces that will not be exposed in the finished structure. All lumber shall be free from knotholes, loose knots, cracks, splits, warps, or other defects affecting the strength or appearance of the finished structure. All forms shall be mortar tight, free of bulge and warp, and shall be cleaned thoroughly before reuse.

C. In designing forms and falsework, the Contractor shall design formwork to resist the applied concrete loading based on the equations and procedures outlined in ACI 347.

D. The Contractor shall state the placement rate and minimum concrete temperature on the working drawings for concrete form work. Deflection of plywood, studs, and walers shall not exceed 1/360 of the span between supports.

E. Forms shall be so designed that placement and finishing of the concrete will not impose loads on the structure resulting in adverse deflections or distortions.

F. The forms shall be so designed that portions covering concrete that is required to be finished may be removed without disturbing other portions that are to be removed later. As far as practicable, form marks shall conform to the general lines of the structure.

G. When possible, forms shall be daylighted at intervals not greater than 10 feet vertically, the openings being sufficient to permit free access to the forms for the purpose of inspecting and working.

H. Metal ties or anchorages within the forms shall be so constructed as to permit their removal to a depth of at least 1-inch from the face without injury to the concrete. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest possible size.

I. All exposed edges 90 degrees or sharper shall be chamfered 3/4-inch unless otherwise noted. Chamfering of forms for reentrant angles shall be required only when specifically indicated on the Plans.

J. Forms shall be inspected immediately prior to the placing of concrete. Dimensions shall be checked carefully, and any bulging or warping shall be remedied and all debris and standing water within the forms shall be removed. Special attention shall be paid to ties and bracing and where forms appear to be braced insufficiently or built unsatisfactorily, either before or during placing of the concrete, the Engineer shall order the work stopped until the defects have been corrected.

K. Forms shall be constructed true to line and grade. Clean out ports shall be provided at construction joints.

L. The construction of concrete slabs with permanent steel forms shall conform to the requirements of this specification and as shown on the plans. Removable forms may be substituted for permanent metal forms with no adjustment in prices.

M. All forms shall be installed in accordance with approved fabrication and erection plans.

N. All porous forms shall be treated with non-staining form oil or saturated with water immediately before placing concrete.

O. Forms shall not be removed without the consent of the Engineer. The Engineer's consent shall not relieve the Contractor of responsibility for the safety of the work. Blocks and bracing shall be removed at the time the forms are removed and in no case shall any portion of the wood forms be left in the concrete.

2.11 JOINT FILLERS

A. Joint fillers shall meet AASHTO M213 and WSDOT Section 9-04.1

PART 3 - EXECUTION

3.01 GENERAL

A. Concrete shall be mixed, placed, and cured in accordance with ACI 318 latest edition and these specifications.

B. Concrete mixing operations shall conform to ASTM C494.

C. All concrete shall be placed before it has taken its initial set and, in any case, within 90 minutes after mixing. Concrete shall be placed in such manner as to

avoid segregation of coarse or fine portions of the mixture, and shall be spread in horizontal layers when practicable. Special care shall be exercised in the bottom of slabs to assure the working of the concrete around nests of reinforcing steel, so as to eliminate rock pockets or air bubbles. Enough rods, spades, tampers, and vibrators shall be provided to compact each batch before the succeeding one is dumped and to prevent the formation of joints between batches.

D. No concrete which has developed an initial set shall be used. Partially hardened concrete shall not be retempered or remixed.

E. Placement of concrete shall only occur after reinforcement placement has been inspected and approved by the Engineer or their representative.

F. The Engineer shall be notified of any concrete casting no later than 48 hours before any concrete pour.

G. The forms shall be free of all ice and debris. No standing water shall be permitted inside of the forms.

H. Vibrating shall be done along all faces to obtain smooth surfaces. Care shall be taken to prevent mortar from splattering on forms and reinforcing steel and from drying ahead of the final covering with concrete.

I. Concrete shall not be placed in slabs or other sections requiring finishing on the top surface when precipitation is occurring or when in the opinion of the Engineer precipitation is likely before completion of the finishing unless the Contractor shall have ready on the job all materials and equipment necessary to protect the concrete and allow finishing operations to be completed.

J. Troughs, pipes, or short chutes used as aids in placing concrete shall be arranged and used in such a manner that the ingredients of the concrete do not become separated. All chutes, troughs, and pipe shall be kept clean and free of hardened concrete by flushing thoroughly with water after each run. Water used for flushing shall be discharged clear of the concrete in place. Troughs and chutes shall be of steel or plastic or shall be lined with steel or plastic and shall extend as nearly as possible to the point of deposit. The use of aluminum for pipes, chutes or tremies is prohibited. When discharge must be intermittent, a hopper or other device for regulating the discharge shall be provided.

K. Dropping the concrete, a distance of more than 5 feet or depositing a large quantity at any point and running or working it along the forms will not be permitted. The placing of concrete shall be so regulated that the pressures caused by wet concrete shall not exceed those used in the design of the forms. In such cases, hoppers and vertical chutes or trunks shall be used. Chutes or trunks shall be of variable lengths so that free unconfined fall of concrete shall not exceed six feet. A sufficient number of chutes or trunks shall be used to ensure the concrete is kept level at all times.

L. High frequency internal vibrators of either the pneumatic, electrical, or hydraulic type shall be used for compacting concrete in all structures. The number of vibrators used shall be ample to consolidate the fresh concrete within fifteen (15) minutes of placing in the forms. In all cases, the Contractor shall provide at least two concrete vibrators for each individual placement operation (one may be a standby), which shall conform to the requirements of these specifications. Prior to the placement of any concrete, the Contractor shall demonstrate that the two vibrators are in good working order and repair and ready for use.

M. The vibrators shall be an approved type, with a minimum frequency of 5,000 cycles per minute and shall be capable of visibly affecting a properly designed mixture with a 1-inch slump for a distance of at least 18 inches from the vibrator.

N. Vibrators shall not be held against forms or reinforcing steel, nor shall they be used for flowing the concrete or spreading it into place. Vibrators shall be so manipulated as to produce concrete that is free of voids, is of proper texture on exposed faces, and of maximum consolidation. Vibrators shall not be held so long in one place as to result in segregation of concrete or formation of laitance on the surface.

O. Concrete shall be placed continuously throughout each section of the structure or between indicated joints. If, in an emergency, it is necessary to stop placing concrete before a section is completed, the slab on grade shall be placed as the Engineer may direct and the resulting joint shall be treated as a construction joint.

P. The presence of areas of excessive honeycomb may be considered sufficient cause for rejection of a structure. Upon written notice that a given structure has been rejected, the rejected work shall be removed and rebuilt, in part or wholly as specified, at the Contractor’s expense.

Q. See civil plans for locations of depressions, curbs, etc., and other embedded items not shown on the structural plans.

3.02 SAMPLING AND TESTING

A. Third Party field tests of all concrete shall be performed by the Contracting Agency. Minimum testing shall consist of a unit weight test, slump test, and air-entrainment test for each delivery of concrete to the site, and three concrete cylinder compressive tests, two 28-day and one 7-day, for every 50 cubic yards or every three deliveries to the site, whichever will result in the least testing. The same test shall be required for prestressed concrete except that four compressive test cylinders shall be required, two release strength cylinders and two 28-day cylinders. All testing shall be performed under the provisions of ACI and ASTM. Compressive strength reports shall be submitted to the building department and Engineer.

B. Additional cylinders may be required if an error in batching is suspected.

C. Materials that fail to meet contract requirements, as indicated by laboratory tests, shall not be used in the Work. The Contractor shall remove all defective materials from the site.

D. Types and sizes of concrete specimens shall be in accordance with ASTM C 31. Additional slump tests and/or test cylinders may be required at the discretion of the Engineer. Should the analysis of any test cylinder not meet the preceding requirements of Article 2.10, Composition of Concrete, its representative concrete shall be removed and replaced at the Contractor's expense.

E. One hard copy, and one electronic copy via email, of all test reports shall be furnished to the Engineer.

F. Measure slump prior to the addition of superplasticizers, where applicable.

3.03 PUMPING CONCRETE

A. Concrete may be placed by pumping if the Contractor demonstrates that the pumping equipment to be used will effectively handle the particular class of

concrete with the slump and air content specified and that it is so arranged that no vibrations result that might damage freshly placed concrete. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced.

B. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned. Slump tests shall be taken at the discharge end of the pipe.

3.04 CONSTRUCTION JOINTS

A. Construction joints shall be located where shown on the plans or as permitted by the Engineer. Construction joints shall be perpendicular to the principal lines of stress and in general shall be located at points of minimum shear.

B. Construction joints shall have formed pour stops.

C. At horizontal construction joints, gage strips 1-1/2 inches thick shall be placed inside the forms along all exposed faces to give the joints straight lines. Before placing fresh concrete, the surfaces of construction joints shall be washed and scrubbed with a wire broom, drenched with water until saturated, and kept saturated until the new concrete is placed.

D. Immediately prior to placing new concrete the forms shall be drawn tight against the concrete already in place. Concrete in substructures shall be placed in such manner that all horizontal construction joints will be truly horizontal and, if possible, in locations such that they will not be exposed to view in the finished structure. Where vertical construction joints are necessary, reinforcing bars shall extend across the joint in such a manner as to make the structure monolithic. Special care shall be taken to avoid construction joints through large surfaces which are to be treated architecturally.

3.05 EXPANSION JOINTS

A. Full depth expansion joints shall be spaced as shown in the plans.

B. Open Joints. Open joints shall be placed in the location shown on the plans and shall be formed. The form shall be removed without chipping or breaking the corners of the concrete. Reinforcement shall not extend across an open joint, unless so specified on the plans.

C. Filled Joints. Unless otherwise shown on the plans, expansion joints shall be constructed with pre-molded expansion joint filler with a thickness equal to the width of the joint.

D. The joint filler shall be cut to the same shape and size as the adjoining surfaces. It shall be fixed firmly against the surface of the concrete already in place in such manner that it will not be displaced when concrete is deposited against it.

E. Immediately after the forms are removed, the expansion joints shall be inspected carefully. Any concrete or mortar that has sealed across the joint shall be removed.

3.06 FINISHING CONCRETE SURFACES

A. All Joints shall be edged with a quarter-inch (1/4") radius edger, as directed by the Engineer in the field.

B. All concrete surfaces exposed in the completed Work shall receive a medium broom finish as described in subsection G.

C. After striking off and consolidating concrete, smooth surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface irregularities and refloat repaired area to provide a continuous smooth finish.

D. Ordinary Finish
   1. An Ordinary Finish is defined as the finish left on a surface after the removal of the forms, the filling of all holes left by form ties, and the repairing of all defects. The surface shall be true and even, free from stone pockets and depressions or projections. All surfaces that cannot be satisfactorily repaired shall be given a Rubbed Finish.

E. Unfinished
   1. An unfinished surface is defined as the surface that bears against soil and is not visible. No finishing work is required.

F. Medium Broom Finish
   1. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete a medium broom finish as follows:
      a. Draw a fiber or wire broom across concrete surface, perpendicular to the line of traffic or as noted on the Drawings. Broom out trowel edges. The Engineer's decision will be final on acceptance of joint finishing details and surface finishes. The use of mortar topping for concrete surfaces shall in no case be permitted.

G. All concrete surfaces shall be finished according to the following:

Location	**Concrete Finish**
Stormwater Tank Walls	None
Stormwater Tank Slab	None
Stage 1 Concrete Slab	Medium Broom

H. As soon as the forms are removed, metal devices that have been used for holding the forms in place, and which pass through the body of the concrete, shall be removed, or cut back at least 1-inch beneath the surface of the concrete. Fins of mortar and all irregularities caused by form joints shall be removed.

I. All small holes, depressions, and voids that show upon the removal of forms shall be filled with cement mortar mixed in the same proportions as that used in the body of the work. In patching larger holes and honeycombs, all coarse or broken material shall be chipped away until a dense uniform surface of concrete exposing solid coarse aggregate is obtained. Feathered edges shall be cut away to form faces perpendicular to the surface. All surfaces of the cavity shall be saturated thoroughly with water, after which a thin layer of neat cement mortar shall be applied. The cavity shall then be filled with stiff mortar composed of one part of Portland cement to two parts of sand, which shall be thoroughly tamped into place. The mortar shall be pre-shrunk by mixing it approximately 20 minutes before using. The length of time may be varied in accordance with brand of cement used, temperature, humidity, and other local conditions. The surface of this mortar shall be floated with a wooden float before the initial set takes place and shall be neat in appearance. The patch shall be kept wet for a period of five days.

J. For patching large or deep areas, coarse aggregate shall be added to the patching material. All mortar for patching on surfaces which will be exposed to view in the completed structure shall be color matched to the concrete. Test patches for color matching shall be conducted on concrete that will be hidden from view in the completed work and shall be subject to approval.

3.07 COLD WEATHER CONCRETE AND CURING

A. Maintain concrete above 50 degrees Fahrenheit and in a moist condition for a minimum of 7 days after placement unless otherwise accepted by the Engineer.

B. Concrete shall not be placed when the descending air temperature in the shade, away from artificial heat, falls below 40 degrees Fahrenheit nor resumed before the ascending air temperature reaches 35 degrees Fahrenheit, without specific written authorization. When the air temperature falls below 40 degrees Fahrenheit, or is, in the opinion of the Engineer, likely to do so within a 24-hour period after placing concrete, the Contractor shall have ready on the job materials and equipment required to heat mixing water and aggregate and to protect freshly placed concrete from freezing.

C. Concrete placed at air temperatures below 40 degrees Fahrenheit shall have a temperature not less than 50 degrees Fahrenheit nor greater than 70 degrees Fahrenheit when placed in the forms. These temperatures shall be obtained by heating the mixing water and/or aggregate. Mixing water shall not be heated to more than 160 degrees Fahrenheit.

D. Binned aggregates containing ice or in a frozen condition will not be permitted nor will aggregates which have been heated directly by gas or oil flame or heated on sheet metal over an open fire. When aggregates are heated in bins, only steam coil or water coil heating will be permitted, except that other methods, when approved, may be used. If live steam is used to thaw frozen aggregate piles, drainage times comparable to those applicable for washed aggregates shall apply.

E. When the temperature of either the water or aggregate exceeds 100 degrees Fahrenheit, they shall be mixed together so that the temperature of the mix does not exceed 80 degrees Fahrenheit at the time the cement is added.

F. When placing concrete in cold weather, the following precautions shall be taken in addition to the above requirements:
   1. Heat shall be applied to forms and reinforcing steel before placing concrete as required to remove all frost, ice, and snow from all surfaces which will be in contact with fresh concrete.
   2. When fresh concrete is to be placed in contact with hardened concrete, the surface of the previous pour shall be warmed to at least 35 degrees Fahrenheit, thoroughly wet, and free water removed before fresh concrete is placed.
   3. Freshly placed concrete shall be maintained at a temperature of not less than 70 degrees Fahrenheit for three (3) days or not less than 50 degrees Fahrenheit for five (5) days, when Type I or II cement is used, and not less than 70 degrees Fahrenheit for two (2) days or not less than 50 degrees Fahrenheit for three (3) days, when Type III cement is used. The above requirements are not intended to apply during the normal summer construction season when air temperatures of 40 degrees Fahrenheit or higher can reasonably be anticipated during the two-week period immediately

following concrete placement, or until the concrete is no longer in danger from freezing.

G. When temperatures below 20 degrees Fahrenheit are not expected during the curing period and, in the opinion of the Engineer, no other adverse conditions, such as high winds, are expected, concrete temperatures may be maintained in thick concrete sections by retention of heat of hydration by means of adequately insulated forms.

H. When, in the opinion of the Engineer, greater protection is required to maintain the specified temperature, the fresh concrete shall be completely enclosed, and an adequate heat source provided. Such enclosure and heat source shall be so designed that evaporation of moisture from the concrete during curing is prevented. Precautions shall be taken to protect the structure from overheating and fire.

I. At the end of the required curing period protection may be removed, but in such a manner that the drop in temperature of any portion of the concrete will be gradual and not exceed 30 degrees Fahrenheit in the first 24 hours.

J. For concrete placed within cofferdams and cured by flooding with water, the above conditions may be waived provided that the water in contact with the concrete is not permitted to freeze. Dewatering shall not be carried out until the Engineer determines that the concrete has cured sufficiently to withstand freezing temperatures and hydrostatic pressure.

K. The Contractor shall be wholly responsible for the protection of the concrete during cold weather operations. Any concrete injured by frost action or overheating shall be removed and replaced at the Contractor's expense.

3.08 CURING COMPOUND

A. Curing compounds used on concrete that is to receive finishes shall be compatible with tile and adhesives or grouts in accordance with manufactures data and be approved for use.

3.09 BACKFILLING AND PROTECTION AGAINST LOADS

A. Prior to erecting any elements that load the foundation, concrete must reach an unconfined compression strength of 2000 psi minimum as determined by testing or previously documented data for the mix design used under similar conditions and must be allowed to cure for a minimum of 3 days.

3.10 CONCRETE ANCHORS

A. All drilled installation epoxy anchors and wedge anchors shall be installed per manufactures recommendations.

3.11 CLEANUP

A. Upon completion of the structure and before final acceptance, the Contractor shall remove all falsework.

3.12 CORE DRILLING

A. Coring is not permitted without prior approval by the Engineer.

B. Core drills required shall not cut any reinforcing. The contractor is to coordinate work of all trades to ensure compliance. All core drills are to be presented to the Engineer for verification. The Engineer is to document cores examined indicating an absence of reinforcing.

3.13 SPECIAL INSPECTIONS

A. The following elements are to be special inspected.
   1. Inspector to visually certify slab on grade reinforcing bar prior to pour.
   2. Third party to sample concrete for compressive strength lab tests per ASTM C39.
   3. Third party to sample slump per ASTM C143.
   4. Third part to sample for air entrainment per ASTM C260.

B. Continuous:
   1. Sampling fresh concrete and performing slump and air content tests and determining the temperature of fresh concrete at the time of making specimens for strength tests.
   2. Inspection of concrete placement for proper application techniques.

C. Periodic
   1. Verify use of required mix design.
   2. Inspection for maintenance of specified curing temperature and technique.
   3. Inspect post-installed and adhesive anchors.

PART 4 - MEASUREMENT AND PAYMENT

4.01 GENERAL

A. No separate measurement or payment will be made for cast-in-place concrete. The cost for this work will be included in the lump sum costs for “STORMWATER TREATMENT SYSTEM” as described in Specification Section 33 44 19, as applicable.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS (MISCELLANEOUS METAL)

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. All metal fabrications and other miscellaneous metal items together with related accessory items and fasteners, including:
      a. Steel stairs and ladders.
      b. Grating support angles.
      c. Pipe line marker posts.
      d. Weir plates and aluminum slide plates.
      e. Steel fascias, angles, and trim exposed as part of the finished structure.
      f. All other metal fabrications and miscellaneous metal not covered under other sections.

1.02 REFERENCES

A. American National Standards Institute:
   1. B18.23.1 Beveled Washers

B. ASTM International (ASTM):
   1. A36 Specification for Carbon Structural Steel
   2. A53 Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
   3. A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   4. A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   5. A283 Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
   6. A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
   7. A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   8. A501 Specifications for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
   9. A653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   10. A786 Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy and Alloy Steel Floor Plates
   11. A793 Specification for Rolled Floor Plate, Stainless Steel
   12. B632 Specification for Aluminum-Alloy Rolled Tread Plate
   13. C595 Specification for Blended Hydraulic Cement
   14. C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)
   15. F844 Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

16. F2329 Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

C. Publications of the National Association of Architectural Metal Manufacturers (NAAMM):
   1. "Metal Product Outline; Division 5 Metal"
   2. "Metal Stair Manual"
   3. "Metal Finishes Manual"
   4. "Pipe Railing Manual"
   5. "Metal Bar Grating Manual"

D. The Society for Protective Coatings (SSPC), Volume 2. Standards for Surface Preparation are specified by SSPC followed by SP and a number indicating the specified type of surface preparation.

E. International Building Code (IBC)

F. International Code Council (ICC).

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

B. Product Data: Fully describe every product proposed for use.

C. Shop Drawings:
   1. Show dimensions, finishes, joining, attachments, inserts, and relationship of work to adjoining construction.
   2. Indicate all shop and erection details including cuts, copes, connections, holes, threaded fasteners and welds. Indicate welds using AWS "Welding Symbols."
   3. Show field measured dimensions of this and adjacent work and location of inserts on fabrication drawings.
   4. Submit details for all gratings and grating support frames.
   5. Fabrication drawings showing layouts with dimensions consistent with the Drawings, connections to structural system, and anchoring details. Anchoring details shall include the required bolt diameter, embed, spacing, and edge distances consistent with the calculations.
      a. Erection and installation drawings indicating thickness, type, grade, material strength, class of metal, coating system and dimensions.

D. Calculations
   1. Where calculations are required as part of a deferred submittal, the following requirements shall be met: complete calculations, details, and complete reference drawings that are required to be submitted as part of a deferred submittal and as defined in the IBC and the Contract Documents, shall be prepared, stamped, signed, and furnished by a Professional Civil or Structural Engineer licensed to practice in the State of Washington.
   2. Calculations shall be comprehensible and complete. When evaluating the structural strengths, indicate stress for comparing with strengths or show the demand versus capacity ratio in the structural elements. Evaluating the results by stating “Okay by Inspection” is not acceptable. When spreadsheets are used, clearly reference equations and formulas presented in submittal calculations.

3. Reference drawings shall include plans, sections, details, and equipment information as necessary for seismic calculations. Indicate the location of the equipment on plan which is necessary for load calculations.
4. Submittals shall be returned without review if:
    a. Submittals include only calculations without reference drawings.
    b. Calculations have no sheet numbers or sheets are missing.
    c. Calculations or reference drawings are illegible.
    d. Calculations are made based on wrong information, assumptions, or design parameters.
    e. Information in reference drawings is insufficient for calculations or review.
5. The calculations and details shall demonstrate a complete vertical and lateral load path and shall clearly indicate all forces imposed on the supporting structure.
6. Anchor Bolt Calculations and Details:
    a. Anchor bolt calculations shall clearly show that the capacity of the anchor and the capacity of the concrete that the anchor is embedded in are adequate to resist all applicable load combinations, including wind and seismic loads.
    b. The design of anchors resisting seismic forces shall satisfy the ductility requirements stated in the IBC, ASCE 7, and ACI 318-19.
    c. Reduction factors associated with edge distance, embedment length, grout and base plate thickness, and bolt spacing shall be considered in the design and clearly indicated on the submittal drawings.
    d. Anchor bolts shall be designed for bending due to eccentricity where raised grout pads will be installed for leveling.

E. Welding procedures and welder certificates and qualifications.

F. U-Channel Concrete Inserts: Manufacturer’s product description and allowable load tables.

G. Passivation method for stainless steel fabrications.

1.04 QUALITY ASSURANCE

A. Contractor’s Qualifications:
1. Welding procedures, welders, and welding operations shall be qualified for the type of work required in accordance with AWS Standard Qualification Procedures.
2. Apply fusion epoxy coating by a specialty contractor regularly engaged in the application of fusion epoxy coatings for industrial corrosion protection applications. Application of decorative epoxy coatings to ornamental iron work is not considered an acceptable qualification.

B. Regulatory Requirements: Comply with the following codes and reference standards unless higher standards are specified, shown or required by applicable codes:
1. "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," American Institute of Steel Construction (AISC), latest edition.
2. Structural Welding Code of the American Welding Society, AWS D1.1, latest edition.
3. International Building Code (IBC), adopted edition, especially Paragraphs 1013, Guardrails, Paragraph 1012, Handrails and Paragraph 1009, Stairs.

4. Stair, guardrail and accessibility design requirements in IBC, OSHA and WAC Chapter 296 (notably 296-800), and the Federal Americans with Disabilities Act (ADA).

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver anchorage devices that will be embedded in the work of other trades in sufficient time to permit their timely installation. Provide proper setting drawings, templates, and directions for installation.

B. Store materials above ground on platforms, skids, or other supports. Store all fasteners and welding electrodes in a weathertight and dry location until ready for use. Store packaged materials in their original labeled containers.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Standard Structural Steel Shapes:
1. Bars, Plates, Shapes (not W shapes): ASTM A36
2. Steel Pipe (seamless): ASTM A53, Type E or S, Grade B
3. Architectural Steel Items: ASTM A283, Grade A
4. Eyebolts: ASTM A489

B. Aluminum:
1. Sheets and Plates: ASTM B209, Alloy 6061-T6
2. Bars, Flats, Similar Items: ASTM B211 or B221, Type 6061-T6
3. Shapes: ASTM B308, Alloy 6061-T6
4. Round Tubes and Pipe: ASTM B241, Alloy 6061-T6 or 6063-T5 with anodized finish
5. Square and Rectangular Tubes: ASTM B221, Alloy 6063-T6
6. Bolts: ASTM F593, Type 304 or 316
7. Nuts and Washers: ASTM F594, Type 304 or 316

C. Stainless Steel:
1. Sheets and Plates: ASTM A240, Type 316 or 316
2. Shapes, Bars, Similar Items: ASTM A276, Type 304 or 316

D. Weld Type Bends and Fittings for Pipe Guardrails, Handrails and Stair Rails: R&B Wagner, Inc.; J.G. Braun; or equal.
1. Provide manufactured preformed side outlet (3-way) elbows, radius elbows, bends, tees, crosses and other fittings of flush design for welded assembly.
2. Provide elbows with a 1-inch-inside radius.
3. Provide three-way elbows with a 1/8-inch inside radius.
4. Provide inside alignment sleeves.

E. Concrete Inserts for Guardrail Posts: 16-gauge galvanized steel sleeves, or foam polystyrene inserts ½-inch larger than post diameter x 6 inches (150 mm) deep with removable slip-on plastic covers.

F. Anchorages to Concrete and Masonry:
1. Provide cast-in-place, expansion or bonded anchorages with minimum size 3/8-inch-diameter, 3-inch embedment.
2. Provide a satisfactory evaluation report by ICC.
3. Do not load the anchorage in excess of half the ICC values without inspection by Engineer.

4. Material: Stainless steel or as noted on the Drawings.
5. Do not use for loads in tension or withdrawal or for loads subject to vibration.

G. Drive-Anchors: One-piece deformed spring steel anchor: RAWL-Drives, Buildex, or equal. ¼-inch minimum diameter. Drive anchors shall be long enough so that all of the deformed portion plus ½-inch will be embedded in the concrete or masonry. Use for loads less than 200 pounds.

H. Handrail Wall Brackets for Steel Railing: ¼-inch formed steel drilled for screw attachment to pipe rail and expansion bolt anchor to wall, Wagner H-B-1 Type 1-H; Blumcraft wall bracket; or equal.

2.02 SHOP PRIMING

A. Refer to Section 09 91 00 for surface preparation, pretreatment, primers, and application techniques.

B. Apply one shop coat of rust inhibiting primer in accordance with Section 09 91 00 to all steel fabrications not scheduled to be galvanized.
1. Apply two coats of primer to surfaces not in contact but inaccessible after assembly.

2.03 ISOLATION COATINGS

A. Coat aluminum in contact with other metals in accordance with aluminum pigmented asphalt paint or two coats of a high build polyamide epoxy paint, Tnemec 66 or equal, with a total thickness of system DF = 8.0 mils, minimum.

B. Coat aluminum in contact with concrete, masonry or plaster with Tnemec 46-465 or equal, with a total thickness of system DFT = 8.0 mils, minimum.

C. Provide neoprene or phenolic washers and isolation bolt sleeves or insulating compound at all stainless-steel fasteners to aluminum interfaces. Isolation washers shall be capped under a stainless-steel washer. Insulating compounds shall be Tef-Gel by Ultra Safety Systems Company, Lanocote by Forespar, or equal.

2.04 FABRICATIONS

A. Grating Support Frames:
1. Material: Stainless steel or as noted on the Drawings.
2. Provide grating support angles for all gratings and floor plates. Fabricate grating support angles in complete, closed frames that will lie completely flat in a true plane. Install support frames so they will support the grating and floor plates with even, uniform, non-rattling bearing. Set frames so that the surface of the grating and floor plates are flush with the adjacent floor or surface.
3. Design and fabricate support frames as required to prevent twisting due to any large ratio of length to width. Restrict the length of each closed section of long narrow support frames to 10 feet maximum.

2.05 ATTACHMENTS

A. Metal Anchors: Provide metal anchors and fasteners required to secure all frames and other items rigidly in place and detailed for installation into concrete forms prior to placing concrete.

PART 3 - EXECUTION

3.01 ERECTION TOLERANCES

A. Conform to straight plumb and horizontal lines which also form a true flat plane to within 1/8-inch in 2 feet and ¼-inch in 10 feet and 1/2 maximum overall.

B. Curved surfaces shall conform to a true arc of a circle to within 1/8-inch in 12 inches and ¼-inch maximum overall.

3.02 INSTALLATION GENERAL

A. Fabricate and pre-fit metal work in the shop, in transportable components ready for field erection.

B. Make proper allowance for expansion and contraction of the metals and of the materials to which they are fastened.

C. Where metal is fastened to concrete, make the connection by means of sleeves and fastenings embedded in concrete or by expansion shield anchor bolts or wedge anchor bolts. Wood plugs, plastic plugs or powder driven studs are not acceptable.

D. Construct steel work in accordance with AISC Standard practices to withstand the forces normally applied and in compliance with IBC and OSHA requirements.

E. Grind welds smooth on all metal work exposed to view. Provide work that has:
   1. Surfaces that are flat, straight, square, plumb and level.
   2. Smooth curves, free of flat spots, and of uniform radius or, if intended to be of changing radius, follow a flowing fair curve.
   3. Make transitions between curved and straight portions of work at tangent points to achieve smooth and free flowing lines and surfaces without flat spots or abrupt changes in direction.

F. Provide 1/8-inch radius corners and edges on all exposed work.

G. Perform all welding in accordance with AWS Code D1.1. Employ methods and techniques to achieve strength and good appearance.

H. Field Assembly: Set members to lines and elevations indicated. Align and adjust members before making permanent connections.

I. Touch-up Painting (Ferrous Metals): After field assembly, clean all bare metal and all abrasions to shop coat, and spot paint with same primer used in the shop.

3.03 LADDERS

A. Install ladders with stainless steel expansion anchor bolts or as shown on Drawings.

B. Locate first rung same distance above surface below it as space between other rungs.

3.04 REPAIRS

A. Repair or replace all defective work including:
   1. Unsightly welds.
   2. Discontinuous welds.

3. Uneven connections.
4. Variations exceeding specified tolerances.
5. Kinks, bends.
6. Other defects affecting the quality, strength, utility. and appearance of the work.

3.05 CLEANING

A. Wash thoroughly using clean water and detergent.

B. Do not use acid solutions, steel wool or other abrasives.

C. Remove stubborn grease stains with mineral spirits.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 06 60 00

FIBERGLASS FABRICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. This Section is applicable to fiberglass-reinforced polymer (FRP) grating and appurtenances associated with fabrication of the FRP grating system.

1.02 REFERENCES

A. American Iron and Steel Institute (AISI).

B. ASTM International (ASTM):
   1. ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
   2. ASTM D638 Standard Test Method for Tensile Properties of Plastics
   3. ASTM D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
   4. ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
   5. ASTM D2344 Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
   6. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

C. Occupational Safety and Health Administration (OSHA).

D. International Building Code (IBC).

E. Washington Administrative Code (WAC).

1.03 SUBMITTALS

A. Product Data: Fully describe all products proposed for use. Include data on physical, chemical, and structural engineering properties. Include submittal for catalyzed resin sealant for repairs.
   1. For grating, provide additional Manufacturer's published literature including:
      a. Structural design data.
      b. Structural properties data.
      c. Grating load/deflection tables.
      d. Corrosion resistance tables.
      e. Certificates of compliance.
      f. Test reports as applicable.

B. Shop Drawings: Custom prepared project specific shop drawings showing dimensions, joint locations and connection details.
   1. For grating: Furnish manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication and erection of components including, but not limited to, location,

lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.

2. Shop drawings shall clearly show the segments of grating and the self-weight of the grating in terms of pounds (lbs).
3. The Contractor shall verify the actual field dimensions prior to fabrication. Clearly indicate any deviations on the shop drawings.

C. Samples: Submit samples of grating, including proposed color.

D. Calculations: Design calculations for systems not sized or designed in the contract documents.

1.04 QUALITY ASSURANCE

A. Qualifications: Provide work fabricated and installed by a licensed specialty contractor who has been exclusively engaged in fiberglass fabrication work of the type required for the past 5 years.

B. Regulatory Requirements:
1. Comply with the:
   a. IBC.
   b. The Washington Administrative Code.

1.05 DELIVERY AND STORAGE

A. Inspect all items delivered to the site for damage. Replace items that have splintered or suffered surface damage.

B. Store in a clean area without adding other concentrated or distributed loads above the items.

C. Store in accordance with Manufacturer's requirements.

PART 2 - PRODUCTS

2.01 GRATING

A. Provide fiberglass grating manufactured by Grating Pacific, Mona Composites, Fibergrate Composite Structures; or equal.

B. Size grating and support members as shown on the Drawings. Where not shown, grating shall be size for 100 pounds per square foot superimposed load with a grating deflection not to exceed 1% of span or 1/4 of an inch, whichever is less. FRP is to be manufactured by pultruded process.

C. Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern providing bidirectional strength. Install grating flush with adjacent concrete or other walking surfaces. All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance.

D. Provide grating panels that are absolutely flat, correctly sized, and fabricated to lie in their frames with uniform, non-rattling bearing on all supporting surfaces.

E. Provide stainless steel type AISI 316 hold-down clips and other connection devices as required by manufacturer or Drawings.

F. Band ends of all fixed and removable grating section with banding bars of the same thickness and the same depth as the main bearing bars to the ends of all bearing and cross bars.

G. Leave "split" openings in the gratings when required for the passage of pipes, valve stems or other devices.

H. Provide "fixed" grating for all operating grating platforms. Bolt "fixed" grating to support members with stainless steel saddle clips and stud bolts.

I. Where required for access or where noted, provide removable grating sections sized to limit the weight of any one section to 90 pounds. Bolt removable sections in place by the same method used for fixed grating. Mark removable sections by painting the banding bars red.

J. Provide a non-skid walking surface to the top of the grating.

K. Use a resin compound that will provide a Class 1 Fire Rating and a tested flame spread rating of 25 or less per ASTM E 84 Tunnel Test.

L. Manufacture with a resin formulation that includes UV inhibitors to resist ultraviolet light.

M. Color: Dark gray. Submit samples to the Contracting Agency for final acceptance of the color prior to ordering or fabricating any materials.

2.02 STRUCTURAL FIBERGLASS FASTENINGS

A. Provide stainless steel type AISI 316 bolt assemblies and other connection devices as required by the manufacturer and as specified on the Drawings.

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate all grating assemblies in the shop to the greatest extent possible. Field fabrication of FRP grating will not be accepted.

B. Sealing: All shop fabricated cuts or drilling shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated cuts or drilling shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

C. Gratings:
   1. Install support frames so that gratings have continuous support and will sit in their frames without rattling or rocking in any direction including across diagonal corners.

3.02 INSTALLATION

A. Set structural components accurately in position and hold with support devices until permanent anchors are secured.

B. Set grating accurately in position and install all fastenings as directed by manufacturer or drawings.

C. Repair all damaged surfaces with catalyzed resin sealant.

3.03 REPAIRS

A. Repair all damaged surfaces with catalyzed resin sealant or as directed by the manufacturer.

B. Repairs that are not acceptable to the Engineer will be removed and replaced at no additional cost to the Contracting Agency.

END OF SECTION

SECTION 09 96 00

HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Section 09 96 00 provides the requirements for; coating systems, surface preparation, coating application, and quality assurance/quality control relative to the equipment, structures listed in the Finish Schedule/Contract Drawings.

B. Unless specified elsewhere, or shown on the Contract Drawings, the following shall not be coated:
   1. Metal completely embedded in concrete (except aluminum).
   2. Piping buried in ground or encased in concrete.
   3. Chain-link fence and galvanized fence gates.
   4. Rubber.
   5. Plastic pipe, including: polyvinyl chloride, polyethylene, and polypropylene piping.
   6. Stainless steel.
   7. Bronze, brass.
   8. Nameplates and grease fittings.
   9. Factory finished electrical panels.
   10. Factory fusion-bonded epoxy coated items.
   11. Aluminum handrail and aluminum guardrail.
   12. Fiberglass.
   13. Electrical conduit.
   14. Copper pipe.

C. The Contractor’s bid shall be based upon using the products specified. If the products specified are not available in formulations that meet applicable regulations for volatile organic compound (VOC) levels at time of application, the Contractor shall submit for review products of equivalent quality and function that comply with regulations in effect at that time. A reasonable difference in cost of material between the first named items specified and the products that are required to meet regulations that change after the bid date and are in effect at the time of application may be approved for payment by Change Order in accordance with the General Conditions.

1.02 DEFINITIONS

A. Abrasive: Material used for blast-cleaning, such as sand, grit or shot.

B. Abrasive Blast Cleaning: Cleaning/surface preparation by abrasive propelled at high speed.

C. Anchor Pattern: Profile or texture of prepared surface(s).

D. American National Standards Institute (ANSI).

E. ASTM International (ASTM).

F. The Association for Materials Protection and Performance (AMPP) formerly NACE

G. Bug Holes: Small cavities, usually not exceeding 15 mm in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and compaction.

H. Coating/Lining Thickness: The total thickness of primer, intermediate and/or finish coats.

I. Dewpoint: Temperature of a given air/water vapor mixture at which condensation starts.

J. Dry Film Thickness (DFT): Depth of cured film, usually expressed in mils (0.001-inch). Use this definition as opposed to existing definition.

K. Drying Time: Time interval between application and curing of material.

L. Dry to Recoat: Time interval between application of material and ability to receive next coat.

M. Dry to Touch: Time interval between application of material and ability to touch lightly without damage.

N. Feather Edging: Reducing the thickness of the edge of paint.

O. Feathering: Operation of tapering off the edge of a point with a comparatively dry brush.

P. Field Coat: The application or the completion of application of the coating system after installation of the surface at the site of the work.

Q. Hold Point: A defined point, specified in Section (09 96 00), at which work shall be halted for inspection.

R. Holiday: A discontinuity, skip, or void in coating or coating system film that exposes the underlying substrate.

S. Honeycomb: Segregated condition of hardened concrete due to non-consolidation.

T. ICRI: International Concrete Repair Institute.

U. Incompatibility: Inability of a coating to perform well over another coating because of bleeding, poor bonding, or lifting of old coating; inability of a coating to perform well on a substrate.

V. Laitance: A layer of weak, non-durable concrete containing cement fine that is brought to the surface through bleed water as a result of concrete finishing/over-finishing.

W. Mil: 0.001-inch.

X. Moisture Vapor Emission Rater (MVER): measurement of the moisture vapor emitted from concrete measured in pounds per 24 hours per 1,000 square feet.

Y. National Association of Corrosion Engineers International (NACE) now known as AMPP

Z. NSF previously known as the National Sanitation Foundation.

AA. Overspray: Dry spray, particularly such paint that failed to strike the intended surface.

BB. Pinhole: A small diameter discontinuity in a coating or coating system film that is typically created by outgassing of air from a void in a concrete substrate resulting in exposure of the substrate or a void between coats.

CC. Pot Life: Time interval after mixing of components during which the coating can be satisfactorily applied.

DD. Resurfacer/Resurfacing Material: A layer of cementitious and/or resin-sed material used to fill or otherwise restore surface continuity to worn or damaged concrete surfaces.

EE. Shelf Life: Maximum storage time for which a material may be stored without losing its usefulness.

FF. Shop Coat: One or more coats applied in a shop or plant prior to shipment to the site of the work, where the field or finishing coat is applied.

GG. Spreading Rate: Surface area covered by a unit volume of paint at a specific film thickness.

HH. The Society for Protective Coatings (SSPC) now merged with NACE and known as AMPP.

II. Stripe Coat: A separate coat of paint applied to all weld seems, pits, nuts/bolts/ washers, and edges by brush. This coat shall not be applied until any previous coat(s) have cured and, once applied, shall be allowed to cure prior to the application of the subsequent coat(s).

JJ. Surface Saturated Dry (SSD): Refers to concrete surface condition where the surface is saturated (damp) without the presence of standing water.

KK. Tie Coat: An intermediate coat used to bond different types of coatings. Coatings used to improve the adhesion of a succeeding coat.

LL. Touch-Up Painting: The application of paint on areas of painted surfaces to repair marks, scratches, and areas where the coating has deteriorated to restore the coating film to an unbroken condition.

MM. Technical Practice Committee (TPC).

NN. VOC Content: The portion of the coating that is a compound of carbon, is photo chemically reactive, and evaporates during drying or curing, expressed in grams per liter (g/l) or pounds per gallon (lb/gal).

OO. Immersion: Refers to a service condition in which the substrate is below the waterline or submerged in water or wastewater at least intermittently if not constantly.

PP. Weld Spatter: Beads of metal scattered near seam during welding.

QQ. Wet Film Thickness (WFT): The primer or coating film’s thickness immediately following application. Wet film thickness is measured in mils or thousandths of an inch (0.001-inch) and is abbreviated WFT.

1.03 REFERENCES

A. Section 09 96 00 contains various guide documents, technology reports, and other industry standards relative to surface preparation, coating application, and testing methods. They are a part of Section 09 96 00 as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of Section 09 96 00 shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

C. Standards, References, and Mandatory Quality Control Testing are included as Appendix A.

D. The following Reference standards are also included for high performance coatings.
   1. Society for Protective Coatings (SSPC), SSPC Painting Manual, Volume I, 4th Edition, “Good Painting Practice.”
   2. SSPC Painting Manual, Volume II, 2008 Edition, “Systems and Specifications.”
   3. SSPC, “The Fundamentals of Cleaning and Coating Concrete.”
   4. SSPC, “Procedure for Determining Conformance to Dry Coating Thickness Requirements”, SSPC-PA2.

1.04 SUBMITTALS

A. Provide the following:
   1. Submit a list and description of all surfaces for which there is a question about what standard coating system to apply as part of the work covered by Section 09 96 00 through a Request for Information.
   2. Submit a Complete Finish Schedule including the specified Finish Schedule included in paragraph 2.02 and any additional surfaces to be coated by products submitted under this Section 09 96 00. Denote the specific products and specific manufacturers for each item (structure, equipment, or substrate plus the manufacturer's brand name, product name, and designation number for each coat of each system to be used).
      a. If materials other than those listed are submitted, provide information to justify and define the proposed substitution. The Contracting Agency may further require the Contractor to furnish additional test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost to the Contracting Agency.
      b. Submit a color card or fan deck for each manufacturer and each coating product submitted.
   3. Prior to ordering material, confirm the items included in the Complete Finish Schedule and submit the Complete Finish Schedule plus the Contracting Agency approved colors for each location (structure, equipment, substrate).
   4. Current printed recommendations and product data sheets for coatings/coating systems including:
      a. VOC data.
      b. Storage requirements.
      c. Surface preparation recommendations.
      d. Primer type, where required.
      e. Maximum dry and wet mil thickness per coat.

f. Minimum and maximum curing time between coats, including atmospheric conditions for each.
g. Curing time before submergence in liquid.
h. Thinners/solvents for reduction and cleaning.
i. Ventilation requirements.
j. Minimum and maximum atmospheric application conditions.
k. Allowable application methods.
l. Maximum allowable moisture content (concrete substrates) or MVER.
m. Maximum shelf life.

5. Manufacturer's Certification that the submitted coatings meet applicable state or local regulatory agency as to allowable VOC content for the place of application and use intended.
6. Qualifications for Quality Control personnel to be provided on site by the Contractor including, but not limited to, the inspector's NACE and SSPC Certification numbers for the certifications requested in paragraph 1.05.E.2 of this Section 09 96 00.
7. Material Safety Data Sheets (MSDS) for all materials to be delivered to the job site, including coating system materials, solvents, and abrasive blast media.
8. Detailed, written instructions for coating system treatment and graphic details for coating system terminations in the structures to be coated including pipe penetrations, metal embedments, grate frames, and other terminations shown on the Contract Drawings.
9. A minimum of five project references, including current contact name, address, and telephone number where the submitted materials have been successfully applied, in similar exposures, within the past 5 years. This submittal is only required if products not listed in Section 09 96 00 are submitted.
10. A letter from the selected and approved coating manufacturers for the project that verifies that the applicator meets the quality assurance requirements of paragraph 1.05.C of Section 09 96 00 including application personnel training requirements.
11. Information that defines the end date for field coating application for all equipment, machinery, and piping to ensure that the maximum recoat time for the shop applied primers will not be exceeded when field applied coatings are installed.
12. Provide written confirmation by the shop and field applied coating manufacturers that compatibility between the shop and field applied coatings has been checked and approved by those manufacturers.
13. NSF/ANSI/CAN 61 and 600 certification for coatings in contact with potable water.

1.05 QUALITY ASSURANCE

A. Environmental Regulatory Requirements:
1. All work, material, procedures, and practices under Section 09 96 00 shall conform to requirements of the local Air Resources Board or Air Quality Management District having jurisdiction. Prime or finish coat painting done in locations other than the project site shall be in accordance with air quality regulations in effect at the place the coating is applied. Products specified herein are, to the best of the Engineer's knowledge, in compliance with the applicable VOC levels allowable at the date these Specifications were issued for bid.

2. The state or local regulatory agency having jurisdiction may prohibit the sale or application of paints and enamels containing more than the stipulated quantities of volatile organic compounds manufactured after a stated date. Provide material meeting applicable regulations effective at the date of manufacture, or if not available, provide top of the line materials developed as replacements for specified materials and meeting applicable regulations as to VOC content.
3. If the Contractor applies coatings that have been modified or thinned other than as recommended or approved by manufacturer, the Contractor shall be responsible for any fines, costs, remedies, or legal actions that may result.
4. Surface preparation activities that result in the generation of airborne emissions shall be performed in accordance with applicable Federal, State, County, or Local regulations and ordinances. The Contractor shall be responsible for securing any and all licenses and permits required, at no additional cost to the Contracting Agency.
5. All debris (liquid or solid) generated from surface preparation or coating activities shall be disposed offsite in accordance with applicable Federal, State, County, or local regulations and ordinances. The Contractor shall be responsible for all required testing, licenses, permits, and fees, at no additional cost to the Contracting Agency.

B. Coating Manufacturer's Qualifications:
   1. All protective coatings furnished under Section 09 96 00 shall:
      a. Be of a manufacturer who has been regularly engaged in the manufacture of protective coatings with a minimum of 10 years of successful experience.
      b. Demonstrate to the satisfaction of the Engineer successful performance on comparable projects.

C. Coating Applicators Qualifications:
   1. The application company or entity must demonstrate with written references as required in 1.04 A. 9. and 10. a minimum of five (5) years of practical experience in the application of the specified coatings and the successful completion of a minimum of five (5) projects of similar size and complexity within the last five (5) years. This must be verified in writing by the selected coating system manufacturer.
   2. The application company or entity must be QP-1 and QP-2 Certified by SSPC for coatings work relevant to the qualifications of QP-1 and QP-2. Shop coating applicators must be QP-3 certified.
   3. For the application company's or entity's personnel: Employ only those persons on the project trained in the application of the specified protective coatings. Written confirmation of this must be provided by the approved coating systems manufacturer.

D. Contractor Quality Control Requirements:
   1. The Contractor is responsible for ensuring that the surface preparation and coating activities meet the requirements of this specification. Inspections by the Contracting Agency, or a representative of the coating manufacturer, will not relieve or limit the Contractor's responsibilities.
   2. The specified quality control tasks shall be performed by an individual who has been properly trained and has a minimum of 5 years' experience. The Contractor shall provide the Contracting Agency documentation indicating that the individual designated to perform quality control has received training

similar to NACE CIP Level 3, SSPC PCI Level 2, and, has a minimum of 5 years' field experience.

3. Coatings application shall conform to requirements of this specification. Changes in the coating system installation requirements will be allowed only with the written authorization of the Contracting Agency before work commences.
4. Contaminated, outdated, diluted materials, and/or materials from previously opened containers shall not be used.
5. For repairs, the Contractor shall provide the same products, or products recommended by the coating manufacturer, as used for the original coating.
6. The Contractor shall identify the points of access for inspection by the Contracting Agency. The Contractor shall provide ventilation, ingress and egress, and other means necessary for the Contracting Agency's personnel to safely access the work areas.
7. The Contractor shall conduct the work so that the coating system is installed as specified and shall inspect the work continually to ensure that the coating system is installed as specified. Coating system work that does not conform to the Specifications or is otherwise not acceptable shall be corrected in accordance with the coating manufacturer's written procedures.
8. The Contractor shall prepare and submit coating work daily reports for each day while on site. The coating work daily reports shall be submitted to the Contracting Agency no later than 1:00 p.m. the following workday. The coating work daily reports shall include the following:
    a. Number of coating applicator employees on site.
    b. Start and finish time of work shift.
    c. Climatic conditions at 4-hour intervals (i.e., partly cloudy, air temperature 78°F, relative humidity 63%, dew point 68°F, and WNW wind @ 4 mph).
    d. Major equipment on site regardless of utilization (i.e., trailers, air compressors, generators, spray pumps, scaffolding, aerial lifts, pressure washers, and sandblast pots).
    e. Inventory of coatings, solvents, and abrasive media stored on site including information relative to deliveries received each day.
    f. Summary of work performed to include:
        1) Substrates/structures prepared (size, quantity, and location).
        2) Surface preparation methods including materials consumed and equipment utilized.
        3) Substrates/structures coated (size, quantity, and location).
        4) Mixing method and time mixed (coating materials).
        5) Induction time, pot life, and application start time.
        6) Coating application methods including equipment utilized.
        7) Application finish time.
        8) Coating materials consumed [sequencing, product name, batch number(s) and manufacture date].
        9) Problems encountered (i.e., equipment malfunctions or disruption/interference by other trades).
        10) Accidents or near misses.
        11) Quality control testing results indicated in Appendix A.
9. Mandatory quality control tests are included in Appendix A.
10. Acceptance criteria for each Quality Control test shall be as indicated on the Coating Detail Sheets, the manufacturer's published data, or elsewhere in this specification, whichever is more stringent.

E. Mandatory Hold Point Inspections:
   1. Hold Point Inspections shall be performed in the Contracting Agency's presence. The Contractor shall provide the Contracting Agency a minimum two (2) hours' notice prior to performing a Hold Point Inspection.
   2. Hold Point Inspections shall be performed as follows for each structure, equipment, substrate to receive coating application:
      a. Prior to surface preparation to determine if the environmental or site conditions would be detrimental to surface preparation/coating application, and if the substrate is void of detrimental defects/contamination.
      b. Upon completion of the specified surface preparation (concrete and non-ferrous substrates) or upon completion of the first full production day of surface preparation (ferrous substrates), ensure that the specified level of cleanliness and surface profile have been achieved.
      c. Upon completion of each coating system component ensure that no visual coating defects such as runs, sags, voids, holidays, and embedment of foreign matter are present, and ensure that the specified dry film thickness has been achieved.
      d. Upon final cure of the complete coating system, identify visual coating defects, measure coating system dry film thickness, perform cure evaluation testing, perform holiday detection testing, and perform adhesion testing. Due to the nature and complexity of the specific testing requirements, this Hold Point may encompass between several hours to several days.
      e. Upon completion of remedial repairs (final inspection), should the coating defects be identified at the final cure Hold Point Inspection, all previously stated Hold Points will be applicable during the coating repair process after which a final inspection will be performed. Retesting will be required for the repaired areas at no additional cost to the Contracting Agency.
   3. The Contractor shall indicate the execution and nature of each Hold Point Inspection in the daily report.
   4. The Contracting Agency will acknowledge participation at each individual Hold Point on a Contractor prepared document appended to the daily report. The document must include a section wherein the Contracting Agency may indicate exceptions or qualifications. It shall be the Contractor's responsibility to ensure that the Hold Point Inspection is acknowledged by the Contracting Agency.
   5. Failure to comply with any or all of the Hold Point Inspection requirements may result in the rejection of all subsequent work.
   6. Hold Point Inspections may only be waived by written authorization from the Contracting Agency.

1.06 ILLUMINATION

A. Provide the following minimum illumination during all phases of work:
   1. General work area: 25-foot candles.
   2. Surface preparation and coating application: 30-foot candles.
   3. Inspection: 50-foot candles.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver all coating materials in unopened containers with manufacturer's label, which must include name, batch number, manufacturer date, shelf life, and VOC content.

B. Store in an assigned area onsite with concurrence from the coating manufacturers. Maintain storage area clean and fire safe. Dispose of used rags, thinner, and buckets daily. Store solvents in closed approved storage containers.

1.08 WARNINGS

A. Be advised that application of paint, epoxy, and protective coating materials may be hazardous. Take all necessary precautions to ensure the safety of workers and property.

B. Be advised that as a part of this work abrasive blasting is required. This may require the use of special equipment. Become familiar with the existing site conditions and take all steps necessary to protect adjacent facilities and personnel, at no additional cost to the Contracting Agency. In addition, abrasive blasting and painting is called for in, on or around mechanical equipment, which may be damaged by grit, dust, or painting overspray. Mask, wrap, enclose, and provide all protection required to safeguard this equipment at no additional cost to the Contracting Agency.

C. Perform abrasive blasting activities in a manner that will not cause nuisance to Contracting Agency operations, and adjacent public and private property and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The Coating Detail Sheets in Appendix B refer to specific manufacturers and have been provided as levels of quality as well as jurisdictional VOC compliance for the specified substrate and exposure conditions. Although not stated on the Coating Detail Sheets, the term “or approved equal” is applicable.

B. Coatings used in each coating system shall be the products of a single coating manufacturer. Mixed manufacturer coating systems are prohibited.

C. Alternate coating systems submitted for consideration must be of the same generic type as those specified.

D. Coatings shall not contain heavy metals that exceed the regulated levels of the jurisdiction in which the coatings will be applied.

E. Colors are to be factory mixed, using light-fast colorants proportioned by accurate measurement into proper type base.

F. Abrasive Media:
   1. Shall not be classified as a health or environmental hazard.
   2. Shall be delivered to the site in sealed bag or containers.
   3. Shall be kept clean and dry while stored on site.
   4. Shall not be reused for abrasive blasting unless specifically manufactured for reuse and appropriate recycling equipment is utilized.

5. Shall be of an appropriate size, shape, and hardness to produce the specified surface profile(s).

2.02 COATING SYSTEMS

A. System Designations and Related Requirements:

1. The following Finish Schedule provides a general list of the coating systems by both substrate and exposure conditions. Additional information regarding surface preparation, application, dry film thicknesses, and approved products by manufacturer is provided on the Coating Detail Sheets (CDS) in Appendix B. Standards, References, and Mandatory Quality Control Testing are included in Appendix A.
2. It shall be the Contractor's responsibility to ensure that there is chemical compatibility between all shop applied primers or coatings on all machinery and equipment provided for the project and any field applied coatings. Compatibility shall mean that there is no chemical reactivity or physical property of the shop or field applied coatings which will cause or promote intercoat adhesion problems or proper cure problems for the shop or field applied coatings on machinery or equipment or piping. The Contractor shall provide written confirmation by the shop and field applied coating manufacturers that compatibility has been checked and approved by those manufacturers. The rework to correct any compatibility problem between shop and field applied coatings shall be solely the responsibility of the Contractor at no additional cost to the Contracting Agency.
    a. If coating repair work is required, the Contractor shall submit a procedure for rectifying this problem. The procedure must include detailed requirements for coatings to be used, surface preparation, coating, application, and adhesion testing to confirm compatibility. This procedure shall be submitted for review and approval prior to coating repair work.

B. Finish Schedule (General):

1. The Finish Schedule identifies major structures, equipment, and substrates to be coated in accordance with Section 09 96 00. The Finish Schedule is not intended to be a complete listing of all surfaces to be coated and other requirements may be identified elsewhere in the Specifications or on the Drawings. There may be additional surfaces for the project that require coating application which may not be listed in the Finish Schedule, and the Contractor shall be responsible for coating those surfaces in accordance with the requirements of Section 09 96 00. The Contractor shall be responsible to identify any surfaces for which there is a question about what standard coating system to apply. Address any questions in writing in accordance with paragraph 1.04.A.2 of Section 09 96 00. The Finish Schedule designates the coating system to be applied. Specific information relative to number of coats and film thicknesses is indicated on the Coating Detail Sheets found in Appendix B.

C. Finish Schedule (Coating Selection Tables):

Structure	Substrate	Comments	Coating System
Piping and Supports	Ductile Iron or Carbon Steel (includes galvanized steel supports)	Immersed, nonpotable Exposed metallic piping	No. 3

1. Refer to contract drawings details regarding coating elevation termination and the favorably reviewed transition details.

D. The Contractor shall provide one unopened gallon container of each color and type of coating and solvent/thinner applied during the course of the project to the Contracting Agency upon completion of the project.

PART 3 - EXECUTION

3.01 COATINGS

A. General:
1. Coating application shall not proceed until the Contracting Agency has received the VOC certifications specified in paragraph 1.04.A.5, the Contracting Agency has inspected the materials, and the coating manufacturer has trained the Contractor in the surface preparation, mixing, and application of each coating system.

B. Shop and Field Coats:
1. Shop applied prime coat: Except as otherwise specified, prime coats may be shop-applied or field-applied. Shop-applied primer shall be compatible with the specified coating system and shall be applied at the minimum dry film thickness recommended by the coating manufacturer. Product data sheets identifying the shop primer used shall be provided to the on-site coating application personnel. Adhesion tests shall be performed on the shop primer as specified in paragraph 3.01.B.3. Damaged, deteriorated, and poorly applied shop coatings that do not meet the requirements of Section 09 96 00 shall be removed and the surfaces recoated. If the shop prime coat meets the requirements of this Section, the field coating may consist of touching up the shop prime coat and then applying the finish coats to achieve the specified film thickness and continuity.
2. Field Coats: Field coats shall consist of one or more prime coats and one or more finish coats to build up the coating to the specified dry film thickness. Unless otherwise specified, finish coats shall not be applied until other work in the area is complete and until previous coats have been inspected.
3. Adhesion Confirmation (metallic surfaces): The Contractor shall perform an adhesion test after proper cure in accordance with ASTM D3359 to demonstrate that: (1) the shop applied prime coat adheres to the substrate; and (2) the specified field coatings adhere to the shop coat. Test results showing an adhesion rating of 5A on immersed surfaces and 4A or better on other surfaces shall be considered acceptable for coatings 5 mils or more in thickness (Method A). Test results showing an adhesion rating of 5B on immersed surfaces and 4B or better on other surfaces shall be considered acceptable for coating thicknesses less than 5 mils.

C. Application Location Requirements:
1. Equipment, Non-immersed: Items of equipment, or parts of equipment which are not immersed in service, shall be shop primed and then finish coated in the field after installation with the specified or acceptable color. If the shop primer requires top coating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.

If equipment removal and reinstallation is required for the project, touch-up coating work shall be performed in the field following installation.

2. Equipment, Immersed: Items of equipment, or parts and surfaces of equipment which are immersed when in service, with the exception of pumps and valves, shall have surface preparation and coating work performed in the field. Coating systems applied to immersed equipment shall be pinhole free.

3.02 PREPARATION

A. General:

1. Surface preparations for each type of surface shall be in accordance with the specific requirements of each Coating System Detail Sheet (CDS) and the manufacturer's requirements. In the event of a conflict, the more stringent requirement shall take precedence.
2. Surfaces to be coated shall be clean and dry. Before applying coating or surface treatments, oil, grease, dirt, rust, loose mill scale, old weathered coatings, and other foreign substances shall be removed. Oil and grease shall be removed before mechanical cleaning is started. Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded, and free of contaminants which might interfere with the adhesion of the coatings. The air used for blast cleaning shall be sufficiently free of oil and moisture to not cause detrimental contamination of the surfaces to be coated.
3. Cleaning and coating shall be scheduled so that dust and spray from the cleaning process shall not fall on wet, newly coated surfaces. Hardware, hardware accessories, nameplates, data tags, machined surfaces, sprinkler heads, electrical fixtures, and similar uncoated items which are in contact with coated surfaces shall be removed or masked prior to surface preparation and painting operations. Following completion of coating, removed items shall be reinstalled. Equipment adjacent to walls shall be disconnected and moved to permit cleaning and painting of equipment and walls and, following painting, shall be replaced and reconnected.
4. Containment: The Contractor shall erect and maintain protective enclosures as required to ensure that surface preparation debris, including dust, is contained within the immediate work area. All costs associated with containment shall be paid by the Contractor.
5. Dust and Contaminants: Protect substrate from excessive dust and airborne contaminants during coating application and curing. Use temporary dust barriers to close off areas being painted from areas where other work is being performed.

B. Abrasive Blast Cleaning:

1. When abrasive blast cleaning is required to achieve the specified surface preparation, the following requirements for blast cleaning materials and equipment shall be met:
    a. Used or spent blast abrasive shall not be reused on this project.
    b. The compressed air used for blast cleaning shall be filtered and shall contain no condensed water and no oil. Moisture traps shall be cleaned at least once every 4 hours or more frequently as required to prevent moisture from entering the supply air to the abrasive blasting equipment.

c. Oil separators shall be installed just downstream of compressor discharge valves and at the discharge of the blast pot discharges. These shall be checked on the same frequency as the moisture traps.
d. Regulators, gauges, filters, and separators shall be in use on compressor air lines to blasting nozzles times during this work.
e. An air dryer or desiccant filter drying unit shall be installed which dries the compressed air prior to blast pot connections.
f. The air dryer shall be used and maintained for the duration of surface preparation work.
g. The Contractor shall provide ventilation for airborne particulate evacuation (meeting pertinent safety standards) to optimize visibility for both blast cleaning and inspection of the substrate during surface preparation work.
h. If between final surface preparation work and coating system application, contamination of prepared and cleaned metallic substrates occurs, or if the prepared substrates' appearance darkens or changes color, re-cleaning by water blasting, re-blasting and abrasive blast cleaning shall be required until the specified degree of cleanliness is reclaimed.
i. The Contractor is responsible for dust control and for protection of mechanical, electrical, and other equipment adjacent to and surrounding the work area.

C. Solvent Cleaning:
1. Any solvent wash, solvent wipe, or cleaner used, including but not limited to those used for surface preparation in accordance with SSPC SP-1 Solvent Cleaning shall be of the emulsifying type which emits no more than 340 g/L VOCs for AIM regions, 250 g/L for CARB regions and 100 g/L for SCAQMD regions, contains no phosphates, is biodegradable, removes no zinc, and is compatible with the specified primer.
2. Clean white cloths and clean fluids shall be used in solvent cleaning.

D. Ferrous Metal Substrates:
1. Ferrous surfaces shall be prepared in accordance with applicable surface preparation specifications of SSPC/NACE specified for each coating system. Specific surface preparation requirements are stated on the CDS. The profile depth of the surface to be coated shall be in accordance with the CDS requirements and shall be measured by Method C of ASTM D4417. Blast particle size shall be selected by the Contractor to produce the specified surface profile. The solvent in solvent cleaning operations shall be as recommended by the coating manufacturer.
2. Preparation of ferrous metal surfaces shall be based upon comparison with SSPC-VIS1, and as described in the CDS for each coating system. If dry abrasive blast cleaning is selected and to facilitate inspection, the Contractor shall, on the first day of cleaning operations, abrasive blast metal panels to the standards specified. Plates shall measure a minimum of 8-1/2 inches by 11 inches. Panels meeting the requirements of the specifications shall be initialed by the Contractor and the Contracting Agency and coated with a clear non-yellowing finish. One of these panels shall be prepared for each type of abrasive blasting and shall be used as the comparison standard throughout the project.
3. Blast cleaning requirements for steel and ductile-iron substrates are as follows:

a. Ferrous steel piping shall be prepared in accordance with SSPC SP-6 and primed before installation unless a higher level of surface preparation is required by the CDS.
b. Ductile-iron piping surfaces including fittings shall be prepared in accordance with NAPF 500-03, NAPF 500-03-04, and NAPF 500.
c. Remove traces of grit, dust, dirt, rust scale, friable material, loose corrosion products, or embedded abrasive from substrate by vacuum cleaning prior to coating application.
d. Care must be taken to prevent contamination of the surface after blasting from worker's fingerprints, deleterious substances on workers' clothing, or from atmospheric conditions.

3.03 APPLICATION

A. Workmanship:
1. Coated surfaces shall be free from excessive runs, sags, drips, ridges, waves, laps, and brush marks. Coats shall be applied to produce an even film of uniform thickness completely coating corners and crevices. Minor and infrequent runs and sags which are within the total specified D.F.T. plus a few mils (no more than 10% more mils than the specified total D.F.T.) will be acceptable. However, frequent runs or sags which exceed these limits or otherwise will be detrimental to coating system performance shall not be accepted.
2. The Contractor's spray equipment shall be designed for application of the materials specified. Compressors shall have suitable traps and filters to remove water and oils from the air. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators, and properly sized spray tips.
3. Each coating application be applied evenly and sharply cut to line. Care shall be exercised to avoid overspray or spattering paint on surfaces not to be coated. Glass, hardware, floors, roofs, and other adjacent areas and installations shall be protected by taping, drop cloths, or other suitable measures.
4. Coating applications method shall be as recommended by the coating manufacturer.
5. Allow each coat to cure or dry thoroughly, according to the coating manufacturer's printed instructions, prior to recoating.
6. Vary color for each successive coat for coating systems when possible.
7. When coating complex steel shapes, prior to overall coating system application, stripe coat welds, edges of structural steel shapes, metal cut-outs, pits in steel surfaces, or rough surfaces with the prime coat. This involves applying a separate coat using brushes or rollers to ensure proper coverage. Stripe coat via spray application is not permitted.

B. Coating Properties – Mixing and Thinning:
1. Coatings, 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 and adhesion of subsequent coats. Coating materials shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings consisting of two or more components shall be mixed in accordance with the coating manufacturer's instructions. Where necessary to suit the conditions of the surface, temperature, weather and method of application, the coating may be thinned

as recommended by the coating manufacturer immediately prior to use. The VOC of the coating as applied shall comply with prevailing air pollution control regulations. Unless otherwise specified, coatings shall not be reduced more than necessary to obtain the proper application characteristics. Thinner shall be as recommended by the coating manufacturer.

2. Mixing of partial “kits” is strictly prohibited unless authorized in writing by the coating manufacturer and the Contracting Agency. This prohibition also applies to coatings mixed for touchup or repairs. If authorized to mix partial kits, the Contractor shall utilize containers with appropriate graduated markings/calibrated weight scales.

C. Environmental Conditions:
   1. Provide adequate heat, ventilation, and dehumidification to ensure that the coating manufacturer’s environmental requirements are met and to ensure no loss of production days due to failure to meet coating manufacturer’s environmental requirements.
   2. Provide sufficient and continuous ventilation and air movement across coated substrates to remove volatile constituents (solvent) throughout the manufacturer’s published curing period.
   3. Air and surface temperatures: Prepare surfaces, apply and cure coatings within air and surface temperature range recommended by coating manufacturer.
   4. Relative humidity: Prepare surfaces, apply and cure coatings within relative humidity range in accordance with coating manufacturer’s instructions.
   5. Dew Point: Do not apply coatings unless the temperature of the dew point is 5°F or greater than the temperature of the substrate.
   6. Precipitation: Do not apply coatings in rain, snow, fog, or mist.
   7. Wind: Do not spray apply coatings when the wind direction and velocity are such that overspray may result in property damage.

D. Protection of Coated Surfaces:
   1. Items which have been coated shall not be handled, worked on, or otherwise disturbed, until the coating is completely dry and hard. After delivery at the site, and upon permanent erection or installation, shop-coated metalwork shall be recoated or retouched with specified coating when it is necessary to maintain the integrity of the film.

E. Film Thickness and Continuity:
   1. WFT of the first coat of the coating system and subsequent coats shall be verified by the Contractor, during application of each coat.
   2. Coatings shall be applied to the minimum dry film thickness specified as indicated on the CDS. Dry film thickness shall be determined using the appropriate industry standard for the substrate (SSPC-PA 2, SSPC-PA 9, or ASTM D1400). Coatings determined to be above the maximum dry film thickness as indicated on the CDS or the coating manufacturer’s product data sheet, will be removed at the Contracting Agency’s discretion.
   3. In testing for continuity of coating about welds, projections (such as bolts and nuts), and crevices, the Contracting Agency shall determine the minimum conductivity for smooth areas of like coating where the dry mil thickness has been accepted. This conductivity shall be the minimum required for these rough or irregular areas. Pinholes and holidays shall be recoated to the required coverage.

4. The ability to obtain specified film thickness is generally compromised when brush or roller application methods are used and, therefore, more coats may be needed to be applied to achieve the specified dry film thickness.

3.04 TOUCHUP PAINTING

A. Paint film damaged due to field welding or other Contractor activities shall be immediately restored to its original thickness after thorough cleaning and necessary surface preparation according to the written manufacturer's recommendations.

B. Touchup painting shall be at the Contractor's expense.

3.05 FINAL INSPECTION

A. Contractor shall conduct a final inspection to determine whether coating system work meets the requirements of the Specifications.

B. The Contracting Agency will subsequently conduct a final inspection with the Contractor to determine the work is in conformance with requirements of the contract documents.

C. Any rework required shall be marked. Such areas shall be re-cleaned and repaired as specified at no additional cost to the Contracting Agency.

3.06 CLEANUP

A. Upon completion of the work, the Contractor shall remove and dispose of surplus materials, protective coverings, spent abrasive, and accumulated rubbish.

B. All surfaces shall be thoroughly cleaned and any damage resulting from surface preparation or coating application shall be repaired.

END OF SECTION

SECTION 09 96 00

APPENDIX A
STANDARDS AND REFERENCES AND MANDATORY QUALITY CONTROL TESTING

I. STANDARDS AND REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI/NSF/CAN 61 Drinking Water System Components
2. ANSI/NSF/CAN 600 Health Effects Evaluation and Criteria for Chemicals in Drinking Water

B. ASTM International (ASTM):

1. ASTM D16- Standard Terminology for Paint, Related Coatings, Materials and Applications
2. ASTM D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
3. ASTM D4138 Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means
4. ASTM D4262 Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces
5. ASTM D4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
6. ASTM D4285 Standard Test Method for Indicating Oil or Water in Compressed Air
7. ASTM D4414 Standard Practice for Measurement of Wet Film Thickness by Notch Gages
8. ASTM D4417 Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
9. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
10. ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
11. ASTM D4940 Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Cleaning Abrasives
12. ASTM D5162 Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
13. ASTM D5402 Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs
14. ASTM D7091 Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
15. ASTM D7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
16. ASTM D7682 Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty

17. ASTM E337 Standard Test Method for Measuring Humidity With a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)
18. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
19. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

C. Federal (Aerospace Material Specification Standard 595):
1. AMS-STD-595: Federal Standard Colors

D. International Concrete Repair Institute (ICRI):
1. ICRI 310.2R Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays, and Concrete Repair

E. Association for Materials Protection and Performance (AMPP) – (formerly National Association of Corrosion Engineers International (NACE)):
1. NACE Standard SP0188 Standard Recommended Practice – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
2. NACE Standard RP0288 Recommended Practices for Inspection of Linings on Steel and Concrete
3. NACE Standard SP0892 Coatings and Linings over Concrete for Chemical Immersion and Containment Service
4. NACE Publication TPC2 Coatings and Linings for Immersion Service

F. National Association of Pipe Fabricators (NAPF):
1. NAPF 500-03 Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings

G. Occupational Safety and Health Administration (OSHA):
1. OSHA Title 29, Part 1926 Safety and Health Regulations for Construction

H. Association for Materials Protection and Performance (AMPP) – (formerly Society for Protective Coatings (SSPC)):
1. SSPC-PA COM Commentary on Paint Application
2. SSPC-AB 1 Mineral and Slag Abrasives
3. SSPC-AB 2 Cleanliness of Recycled Ferrous Metallic Abrasive
4. SSPC-PA 1 Shop, Field, and Maintenance Painting of Steel
5. SSPC-PA 2, Level 3 Determining Compliance to Required DFT
6. SSPC-PA 9 Measurement of Dry Coating Thickness on Concrete
7. SSPC Technology Guide 6 Containment of Debris
8. SSPC Technology Guide 7 Disposal of Debris
9. SSPC-PA Guide 10 Contractor ESH Requirements
10. SSPC-PA Guide 11 Edge Protection 2020
11. SSPC Technology Guide 12 Illumination of Painting Projects
12. SSPC-PA Guide 15 Retrieval and Analysis of Soluble Salts
13. SSPC-PA 17 Determining Profile Compliance

14.	SSPC-PA Guide 19	Selecting Coatings for Use Over Galvanizing
15.	SSPC SP1	Solvent Cleaning
16.	SSPC SP2	Hand Tool Cleaning
17.	SSPC SP3	Power Tool Cleaning
18.	SSPC SP5	White Metal Wet Blast Cleaning
19.	SSPC SP6	Commercial Wet Blast Cleaning
20.	SSPC SP7	Brush-Off Wet Blast Cleaning
21.	SSPC SP10	Near White Wet Blast Cleaning
22.	SSPC SP11	Bare Metal Power Tool Cleaning
23.	SSPC SP 13	Surface Preparation of Concrete
24.	SSPC SP 14	Industrial Blast Cleaning
25.	SSPC SP 15	Commercial Power Tool Cleaning
26.	SSPC SP 16	Brush-Off Blast Cleaning Non-Ferrous Metals
27.	SSPC-TR 2/NACE 6G198	Wet Abrasive Blast Cleaning
28.	SSPC-TR3/NACE 6A192	Dehumidification
29.	SSPC-TU-3	Overcoating Existing Coating Systems Applied to Steel Substrates
30.	SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
31.	SSPC-VIS 3	Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning
32.	SSPC-VIS 4	Guide and Visual Reference Photographs for Steel Cleaned by Waterjetting
33.	SSPC-VIS 5	Guide and Visual Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blast Cleaning
34.	NACE/SSPC No 1,2,3,4	Joint Surface Preparation Standards Package

II. MANDATORY QUALITY CONTROL TESTS

Test Requirement	**Reference Standard**	**Interval / Frequency**
Measure and Record Ambient and Surface Temperatures	N/A	Each day coating application is performed. Immediately prior to coating application. During coating application and initial cure. Every 3 hours.
Measure and Record Relative Humidity and Dew Point	ASTM E 337	During coating application and initial cure. Every 3 hours,
Abrasive Cleanliness	SSPC AB-1 SSPC AB-2 ASTM D 4940	Each day abrasive blasting is performed. Immediately prior to start of abrasive blasting.

Test Requirement	Reference Standard	Interval / Frequency
Compressed Air Cleanliness	ASTM D 4285	Each day compressed air is utilized for abrasive blasting, paint application, or to remove surface contamination; immediately prior to any of the indicated operations.
Determining Level of Cleanliness (substrate condition after the specified surface preparation has been completed)	SSPC – VIS 1 SSPC – VIS 3 SSPC - VIS 4/NACE VIS 7 SSPC - VIS 5/NACE VIS 9 SSPC - SP 1 SSPC - SP 2 SSPC - SP 3 SSPC - SP 5/NACE No. 1 SSPC - SP 6/NACE No. 3 SSPC - SP 7/NACE No. 4 SSPC - SP 10/NACE No. 2 SSPC - SP 11 SSPC - SP 13/NACE No.6 SSPC - SP 14/NACE No.8 SSPC - SP 15 SSPC - SP 16 NACE/SSPC No 1,2,3,4	Each day surface preparation is performed immediately prior to coating application.
Levels of Soluble Salt Contamination (steel and other nonporous substrates)	SSPC Technology Guide 15	Each day coating application is performed; immediately prior to coating application.
Surface pH (concrete or metal)	ASTM D 4262 (use 6.1 and 6.2 for metal)	Each day coating application is performed; immediately prior to coating application.
Measurement of Surface Profile (metal substrates)	ASTM D 4417	Each day surface preparation is performed. Upon completion of shift or task.
Measurement of Surface Profile (concrete substrates)	ASTM D 7682 or ICRI 310.2R	Each day surface preparation is performed. Upon completion of shift or task.
Comparison of Surface Profile (concrete substrates)	ICRI 310.2R	Each day surface preparation is performed. Upon completion of shift or task.
Moisture in Concrete	ASTM D 4263 or ASTM F 1869 or ASTM F 2170	Upon completion of surface preparation. Whenever climatic conditions substantially change.
Relative Humidity (slabs/concrete floors)	ASTM F 2170	As recommended by coating/lining manufacturer.

Test Requirement	Reference Standard	Interval / Frequency
Wet Film Thickness	ASTM D 4414	Each day coating application is performed. Hourly during coating application.
Dry Film Thickness (ferrous metal/magnetic substrates)	SSPC-PA 2	After coating has properly cured. After each layer (component) of the specified coating system.
Dry Film Thickness (non-ferrous metal substrates)	ASTM D 7091	After coating has properly cured. After each layer (component) of the specified coating system.
Dry Film Thickness (cementitious substrates)	SSPC-PA 9	After coating has properly cured. After each layer (component) of the specified coating system.
Dry Film Thickness (destructive method – all substrates)	ASTM D 4138	Whenever verification as to the accuracy of other methods is deemed necessary.
Holiday Detection (conductive substrates)	NACE SP0188	After coating system has properly cured. Once on entire surface and as necessary over repaired areas to verify effectiveness of the repair(s).
Holiday Detection (metal substrates)	ASTM D 5162	After coating system has properly cured. Once on entire surface and as necessary over repaired areas to verify effectiveness of the repair(s).
Adhesion Testing (metal substrates)	ASTM D 4541	After coating system has properly cured. Number of tests proportionate to surface area.
Adhesion Testing (concrete substrates)	ASTM D 7234	After coating system has properly cured. Number of tests proportionate to surface area.
Final Cure (solvent rub – organic coatings)	ASTM D 5402	After coating system has been cured per manufacturer's published recommendations.

Coating Detail Sheet:	**System No. 3**
Coating Material:	Epoxy coating (cycloaliphatic amine or curing agents providing similar chemical resistance performance).
Surface:	Metal, Concrete, Masonry
Service Condition:	Immersed, nonpotable; non-immersed, corrosive environment, color required. (Not for Biogenic Sulfide Corrosion areas.)
Surface Preparation:	
Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.5 to 3.0 mils. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning) or SSPC-SP-3 (Power Tool Cleaning). Damaged shop coating shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.5 to 3.0 mils and spot primed with the primer specified. Shop epoxy primed surfaces shall require light abrasive blasting or abrading to achieve a uniform surface profile of 1.0 to 1.5 mils in the intact shop primer prior to receiving finish coats if the maximum recoat time for the primer has been exceeded. For ductile iron surfaces, refer to the requirements in Section 09 96 00, paragraph 3.02.D.
Non-ferrous and Galvanized Metal:	Non-ferrous and galvanized metal shall be prepared in accordance with SSPC SP-16 to achieve a 1.5 to 2.0 mil profile that is uniform. Galvanized steel with this coating system shall not be used in immersion service in wastewater.
Concrete	Concrete surfaces shall be allowed to cure for at least 28 days following initial concrete placement and allowed to dry to the moisture content recommended by the coating manufacturer before coating work proceeds. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 35 00. Cleaning can be performed using abrasive blast cleaning or water blast cleaning methods to produce a minimum concrete surface profile of CSP-2 in accordance with ICRI 310.2.

Coating Detail Sheet:	**System No. 3**
	After cleaning, all air voids or bugholes in the concrete shall be filled with a surfacer or block filler compatible with the specified primer and finish coats
Application:	Field
General:	Prime coat may be thinned and applied as recommended by the coating manufacturer, provided the coating as applied complies with prevailing air pollution control regulations.
Ferrous Metal:	Prime coat shall be an epoxy primer compatible with the specified finish coats.
Non-ferrous and Galvanized Metal:	Non-ferrous and galvanized metal, non-immersed, shall be coated prior to the application of the prime coat with a grease emulsifying agent in accordance with the coating manufacturer's written instructions. Non-ferrous metal to be immersed shall not be painted. Galvanized metal shall not be immersed even if it is painted with this coating system.
Concrete, Masonry	Apply filler/surfacer as recommended by coating manufacturer to fill “bugholes” and air voids or block texture, etc. leaving a uniformly filled surface that does not produce blow holes or outgassing causing pinholing of the coating system. Apply manufacturer approved epoxy block filler to masonry substrates in lieu of epoxy.
System Thickness:	15 to 20 mils dry film.
Coatings:	
Primer:	One coat at coating manufacturer’s recommended dry film thickness.
Finish:	Two or more coats at coating manufacturer's recommended dry film thickness per coat to achieve the specified system thickness.

Approved Manufacturers:

1. All of U.S. except California:

System Manufacturer	First / Prime Coat(s)	Finish Coat(s)
PPG	Amerlock 2/400	Amerlock 2/400
Carboline	Carboguard 890	Carboguard 890
International Paint	Bar-Rust 231	Bar-Rust 231
Sherwin Williams	Macropoxy 646	Macropoxy 646
Tnemec	Series 104	Series 104

2. All of California (California Air Resources Board) except SCAQMD:

System Manufacturer	First / Prime Coat(s)	Finish Coat(s)
PPG	Amerlock 2/400	Amerlock 2/400
Carboline	Carboguard 890	Carboguard 890
International Paint	Bar-Rust 231	Bar-Rust 231
Sherwin Williams	Macropoxy 646	Macropoxy 646
Tnemec	Series 104	Series 104

3. South Coast Air Quality Management District:

System Manufacturer	First / Prime Coat(s)	Finish Coat(s)
PPG	Amerlock 2/400 VOC	Amerlock 2/400 VOC
Carboline	Carboguard 890 VOC	Carboguard 890 VOC
International Paint	Bar-Rust 231 LV	Bar-Rust 231 LV
Sherwin Williams	Macropoxy 646-100	Macropoxy 646-100
Tnemec	Series 22	Series 22

END OF SYSTEM NO. 3

SECTION 11 00 00

GENERAL EQUIPMENT AND MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: The general requirements for all Equipment and Mechanical work in the scope of the Project, included in Divisions 11, 26, 33, and 40 and elsewhere wherever specifically mentioned in these Specifications.

B. Direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

1.02 REFERENCES

A. American Gear Manufacturers Association (AGMA).

B. American Institute of Steel Construction (AISC).

C. Hydraulic Institute.

D. National Electrical Manufacturers Association (NEMA).

E. Occupational Safety and Health Act (OSHA).

1.03 STANDARDS FOR THE WORK

A. Complete Systems: Provide pipe, fittings, wiring, and supports to produce complete, operable systems with all elements properly interconnected. If a specific dimensioned location is not shown for interconnections or smaller system elements, select appropriate locations and show them on Shop Drawing submittals for review.

B. Provide equipment and material new and without imperfections. Erect in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance, and repair. Locate oil and lubrication fittings clear of and away from guards, base, and equipment and within reach from the operating floor. Coordinate location of all motor connections in order to properly orient encased electrical conduits. In order to meet these requirements with equipment as furnished, minor deviation from the Drawings may be made as favorably reviewed by the Engineer.

C. The recommendations and instructions of the manufacturers of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.04 SUBMITTALS

A. Shop Drawings: Show sizes and arrangement of equipment, foundations, and anchor bolts required; performance characteristics; pump curves; control diagrams; wiring diagrams; motor data sheets; methods of assembly; pipe hanging details;

and connections to other work. Date and sign drawings as certified for use in construction of this project. The arrangement of mechanical equipment and appurtenant piping shown on the Drawings may be varied as necessary to fit the favorably reviewed certified manufacturer's installation drawings. However, manufacturers' drawings shall not deviate in substance from the Contract Drawings and Specifications as to location, size, type, and design of equipment. The following minimum requirements shall accompany all equipment submissions:

1. Overall dimensions.
2. Mounting arrangement and dimensions.
3. Description of materials.
4. Connection sizes and orientation.
5. Capacity and location of lifting eyes.
6. Motor arrangement showing location of electrical connections.
7. Rating data - Mechanical and Electrical as applicable.
8. Detail electrical wiring diagrams, showing component designation and rating.
9. Motor data as specified in Section 26 05 10.
10. List of special tools and/or spare parts to be furnished, if any.

B. Each piece of equipment, for which certified witnessed or non-witnessed performance tests are required, shall be accompanied by a completed form containing at least the following information:

1. Contracting Agency's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph and page.
5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number). A specific list of the test results plus a list, which shows the values that differ from Specifications.
6. Motor data, type, voltage, frequency, phase, full load amperes, starting method, frame size, enclosure insulation type (NEMA Code letter), dimensions, service factor, serial number.
7. Date and signature of person certifying the performance.

C. Operations and Maintenance Manuals: Prepare and submit manuals covering installation, operation and maintenance of all equipment and machinery specified in Divisions 11, 26, 33, and 40

D. Manufacturers' Affidavits: Where called for in the Specifications, each equipment manufacturer, or their authorized representative, shall submit an affidavit conforming to the requirements of Section 01 75 00.

1.05 RESPONSIBILITY AND CARE OF EQUIPMENT

A. The Contractor shall be responsible for the equipment included in this Contract until it has been finally inspected, tested, and accepted in accordance with the requirements of these Specifications.

B. The Contractor shall make his own provisions for properly storing and protecting all material and equipment against theft, injury, or damage from any and all causes. Damaged material and equipment shall not be used in the work.

PART 2 - PRODUCTS

A. DESIGN

B. General: Design all equipment for the service intended, of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and during continuous or intermittent operation. Adequately stay, brace and anchor, and install equipment in a neat and workmanlike manner. Give consideration to appearance and safety, as well as utility, in the design of details. Use cathodically compatible materials of construction.

C. Controls: Unless noted otherwise, the design of the electric control of any equipment system and/or equipment package shall be the responsibility of the manufacturer of the equipment system and/or equipment package. The elementary control diagrams as shown on the Electrical Drawings and the diagrams shown on the Instrumentation Drawings are illustrative of control and monitoring requirements pertaining to various equipment of this project. The manufacturers shall design their own functional electric control devices and circuitry, in consultation with the specific elementary control diagrams and other project specifications, to meet the equipment control requirements. All such systems and package controls shall be furnished by the equipment manufacturer, except that controls shown in motor control centers and process controllers, remote control devices, and their interconnecting wiring shall be provided under Divisions 26 and 40.

2.02 MATERIALS AND STANDARD SPECIFICATIONS

A. Materials: Design, fabricate, and assemble equipment and systems with new materials and in accordance with acceptable modern engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field.

B. Uniformity: Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

2.03 LUBRICATION

A. Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for consumption prior to completion, testing and final acceptance.

2.04 STRUCTURAL METAL FRAMING

A. Details of fabrication shall be in accordance with Section 05 50 00.

B. Weld submerged steel surfaces which butt or bear against each other, to seal the surfaces against the penetration of the liquid. Weld all gaps between adjacent submerged steel surfaces less than 1/32-inch wide to seal the surfaces. Weld size shall be not less than the thickness of the thinnest member of the lapped or joined assembly.

2.05 EQUIPMENT BASES AND BEDPLATES

A. Mount equipment assemblies on a single heavy cast iron or welded steel bedplate where shown or specified. Provide bases and bedplates with machined support pads, tapered dowels for alignment or mating of adjacent items, adequate

openings to facilitate grouting, and openings for electrical conduits. Round or chamfer and grind smooth all corners. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide jacking screws in equipment bases and bedplates to aid in leveling prior to grouting. Mount all equipment bases and baseplates on reinforced concrete pads at least 3 inches high.

2.06 ANCHORS

A. Each equipment manufacturer shall furnish an anchor bolt pattern and the required anchor bolts, nuts, and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1 1/2 inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified.

B. Provide anchor and assembly bolts and nuts of ample size and strength for the purpose intended. All bolts shall be standard machine bolts, with cold pressed hexagon nuts. Provide suitable degauling compounds for bronze and stainless steel threaded components. Any space wholly or partially underground, or having a wall or ceiling forming part of a water channel, is classified as a moist location. Unless otherwise specified or noted on the Drawings, provide materials as follows:
   1. Bolts and nuts in submerged locations or submerged and embedded in concrete or buried in earth: Type 316 stainless steel.
   2. Bolts and nuts for supports or equipment in dry or moist locations: Galvanized steel (hot-dipped), with oversize nuts.
   3. Use other bolting materials where specifically called for in the Specifications or on the Drawings.

C. Anchor all motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment.

D. Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Drawings, expansion type anchors may be used.

2.07 SAFETY GUARDS

A. Cover belt or chain drives, fan blades, couplings, nip points, exposed shafts, and other moving or rotating parts on all sides with safety guards conforming to all federal, state, and local codes and regulations pertaining; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically, guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide hinged doors with latch for service and lubrication access.

B. Cover all pipes, manifolds, heaters, and other surfaces which have a surface temperature sufficient to burn human tissue with a thermal insulating material or otherwise guard against contact.

C. Guards to comply with OSHA and local requirements.

2.08 LIFTING EYES

A. Supply all equipment weighing over 100 pounds with lifting eyes. Parts of equipment assemblies which are normally serviced separately, such as motors, to have lifting eyes of their own.

2.09 DRIVES

A. General: Provide all drive units with an AGMA rating and service factor suitable for 24 hours per day operation under the operating load.

B. Electric Motors: Conform to the requirements of Section 26 05 10.

2.10 NAMEPLATES

A. Manufacturer's Nameplate: Furnish each piece of equipment and its driver with a corrosion-resistant metal nameplate fastened to the item in a readily readable position. This nameplate to contain the manufacturer's name, equipment rating, capacity, size, model, serial number, and speed. All information written or printed to be in English.

B. Direction of Rotation: Furnish each piece of rotating equipment with a direction of rotation arrow.

C. Functional Identification: Label each piece of equipment using a plastic laminate label with the functional name and number of the equipment.
   1. Fasten labels to the equipment, its base, or other acceptable location:
      a. Letters: At least 1/2-inch high with the border trim on all sides not less than 1/4 inch.
      b. Color: Green background with white letters.
      c. Fasteners: Brass or stainless steel screwed into inserts, anchor shields, or tapped holes in equipment or base.

2.11 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, provide suitable insulation between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings, or bushings.

2.12 SPECIAL TOOLS

A. For each type of equipment to be furnished, provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of such equipment.

2.13 FINISHES

A. Conform to applicable requirements of Section 09 96 00.

B. Factory Painting: On pumps, motors, drives, starters, control panels, and other similar self-contained or enclosed components, apply a factory protective paint system unless otherwise noted. Paint or otherwise protect surfaces that are inaccessible after assembly by a method which provides protection for the life of the equipment.

C. Shop Priming: Except where field sandblasting is required, apply one or more shop coats of metal primer on surfaces to be finish painted at the site, of sufficient

thickness to protect surfaces until finished. Primer shall be compatible with finish coat.

D. Rust Preventive: Coat machined, polished, other ferrous surfaces, and non-ferrous surfaces which are not to be painted with rust preventive compound.

2.14 NOISE AND VIBRATION

A. Mechanical and electrical equipment, as installed in this project, shall not create sound levels that are in excess of that permitted by OSHA for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved. If the required sound level cannot be achieved by bare equipment in its designated environment, provide sound attenuating enclosures. Sound attenuating enclosures shall have necessary ventilation to prevent equipment overheating and shall be constructed for easy removal to permit maintenance. Devices necessary for day-to-day operation shall pierce the enclosure or otherwise be accessible without need to remove the enclosure.

B. Equipment which when operating has obvious excessive vibrations shall be repaired or replaced as directed by the Engineer. Baseline vibration measurements shall be made where specified.

2.15 FACTORY TESTS

A. Perform factory tests on each piece of equipment that will be installed where specifically called for in the section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard is hereby made a part of these Specifications. Conduct factory tests at the same speeds and other conditions at which the equipment will operate in the field, except as noted.

B. Where specifically noted, performance tests may be witnessed by the Engineer or his representative. Inform the Engineer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, supply certified results.

C. Perform factory testing of pumps in accordance with the requirements and standards of the Hydraulic Institute.

D. Tests of other equipment shall conform to the requirements set forth in these Specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect each item of equipment for damage, defects, completeness, and correct operation before installing.

3.02 PREPARATION

A. Prior to installing equipment, ensure that the areas are clean. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service equipment in accordance with the approved Instruction Manuals and specific recommendations of the equipment manufacturer.

3.03 INSTALLATION

A. Structural Fabrications: Conform to the AISC Code and Specification referenced in Article "Structural Steel Fabrications," and conform to Section 05 50 00.

B. Equipment: Conform to approved Operations and Maintenance Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects. Align and pin to common bedplate equipment and drivers connected by flexible couplings.

C. Anchor Bolts: Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed.

D. Base and Bedplate Grouting: Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45 degree angle, except round exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for 3 days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform approved corrective work as required to conform to the tolerances given in the applicable Instruction Manual.
   1. Make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Drawings. Use steel shims to level and adjust the bases. Shims may be left embedded in the grout; in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise approved, all grout shall be favorably reviewed, non-shrink, non-metallic grout.
   2. Grout: Dimensionally stable, inorganic, premixed and resistant to acids, alkalis, and salt water, and unaffected by water and oil. It shall have high strength even when used as a pourable mixture and shall bond well with steel and cured concrete or be compatible with a suitable bonding agent which shall then be used to effect the bond. Use in strict accordance with the manufacturer's recommendations. Provide Five Star Grout as manufactured by U.S. Grout Corporation, Bonsal Construction Grout as manufactured by Bonsal Company, or equal. Submit for favorable review by the Engineer prior to use.
   3. Where practicable, place the grout through the grout holes in the equipment base and work outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

3.04 EQUIPMENT STARTUP AND ADJUSTMENT

A. Arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to check the installation and adjust and test the equipment. Said representative shall be experienced and knowledgeable of the equipment being tested. Furthermore, the representative shall assist and instruct the operating staff in adjusting and operating the equipment during the initial plant operation period.
   1. Provide initial lubrication for all equipment.
   2. Test and demonstrate to the Engineer that all equipment operates properly and specified performance has been attained. For pumps, include

measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means or through a suitably calibrated meter for two points on the performance curve. For adjustable-speed pumps, conduct tests at a minimum of two speeds. Furnish any test equipment or measuring devices required which are not part of the permanent installation.

3. In addition, demonstrate that the entire facility is in full operating condition prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, immediately remove and replace it, all at the Contractor's expense. Pay for all tests involved in this Section.
4. Pressure test equipment and connections thereto as required by these Specifications.

3.05 PERFORMANCE TESTS

A. Upon completion of the work, and after all systems are set and balanced, conduct performance tests in accordance with Division 1 and other applicable sections of these Specifications. Submit test conditions, test data and results to the Engineer for review.

3.06 TOOLS, LOOSE PARTS, AND LUBRICANTS

A. Tools and Loose Parts Supplied: Provide an inventory of tools and loose parts required to be supplied under the project. Turn over inventory and parts to the Contracting Agency. The Contracting Agency’s written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment. Refer to Section 01 75 00 and relevant technical sections of these Specifications for additional instructions.

B. Recommended Spare Parts: Furnish a complete list of recommended spare parts and supplies for each equipment furnished with current prices and a source of supply.

C. Provide a list of all recommended lubricants not listed in the Operations and Maintenance Manuals.

END OF SECTION

SECTION 26 05 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work Included:
   1. Provide all required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment, and satisfactorily complete all electrical work shown on the Drawings, included in these Specifications, or required for a complete and fully operating facility. In addition, provide wiring for the equipment that will be provided under other Divisions of these Specifications.
   2. Provide conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions. Coordinate with the supplier of electrical equipment specified under other Divisions.
   3. Provide all conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. This also includes lightning and surge protection equipment wiring at process instrumentation transmitters if required. Contractor shall install vendor furnished cables specified under other Divisions.
   4. Provide a complete raceway system for the specialty cable systems. Install the specialty cable systems in accordance with the system manufacturer's installation instructions. Review of the raceway layout, prior to installation, with the system supplier and cable manufacturer to ensure raceway compatibility with the system and materials being furnished. Where redundant cables are furnished, install them in separate raceways.
   5. Auxiliary Devices: Provide conduit and wire for power and control for all auxiliary devices such as solenoid valves, pressure switches, and instruments that are included as part of a manufacturer's packaged system (i.e., all systems specified in Divisions 11 through 48. Contractor shall be responsible for conduit and wire to these auxiliary devices even if not specifically shown on the Drawings or specified herein.
   6. Provide concrete, excavation, backfill and steel reinforcement required for encasement, installation or construction of the WORK of the various Sections of Division 26 as a part of the WORK under the respective Sections, including duct banks, manholes, handholes, equipment housekeeping pads and light pole bases.

B. Work to be Done by Utilities:
   1. Providing and connecting power company meters and instrument transformers.
   2. Providing telephone company instruments, relays, terminals, and cables.

C. Safety: Conduct operations in accordance with NFPA 70E, Standard for Electrical Safety Requirements for Employee Workspaces.

1.02 CODE COMPLIANCE AND REFERENCE STANDARDS

A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:
   1. National Electrical Safety Code (NESC)
   2. Occupational Safety and Health Administration (OSHA)
   3. National Fire Protection Association (NFPA)
   4. National Electrical Manufacturers Association (NEMA)
   5. American National Standards Institute (ANSI)
   6. Insulated Cable Engineers Association (ICEA)
   7. Instrument Society of America (ISA)
   8. Underwriters Laboratories (UL)
   9. Factory Mutual (FM)
   10. Institute of Electrical and Electronics Engineers
   11. American Society of Testing Materials (ASTM)
   12. Local Telephone Company requirements
   13. Local Utility Company requirements

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

C. All materials and equipment for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without a UL label affixed. Other Nationally Recognized Testing Laboratories (NRTLs) acceptable for this project include:
   1. FM Approvals (Factory Mutual)
   2. ETL (Intertek Electrical Testing Labs)
   3. CSA-us (Canadian Standard Association)

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Contracting Agency.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times.

1.03 SUBMITTALS

A. Shop Drawings shall be custom prepared for this project and submitted as listed in each of the Electrical Specification Sections. Shop drawings shall include the following:
   1. Complete materials list stating manufacturer, brand name and catalog number of each item or class of material.
   2. For equipment, panels, boxes, control devices, wiring devices, and other uniquely-tagged items as indicated on the Drawings, include the respective tag(s) on each applicable shop drawing and cut sheet.

3. Shop drawings for grounding work not specifically indicated on the drawings but required under the NEC.
4. Front, side and rear elevations along with top views with required dimensional data.
5. Location of conduit entrances and access plates.
6. Catalog cuts defining component data.
7. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size and cable numbers.
8. Method of anchoring, seismic requirements and weight.
9. Types of materials and finish.
10. Nameplates.
11. Temperature limitations, as applicable.
12. Voltage requirements, phase and current, as applicable.
13. Front and rear access requirements.
14. Test reports.

B. O&M Manuals and other documentation, shall be submitted in accordance with these contract documents. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc. to instruct operating and maintenance personnel unfamiliar with such equipment. All manuals and other documentation shall be submitted as listed in each of the Electrical Specification Sections and include the following:
1. A comprehensive index.
2. A complete "As-built" set of approved shop drawings.
3. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.
4. A table listing of the "as left" settings for all timing relays and alarm and trip set points.
5. System schematic drawings "As-Built", illustrating all components, piping and electrical connections of the system supplied under this Section.
6. Detailed service, maintenance and operation instructions for each item supplied.
7. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
8. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
9. Complete parts list with stock numbers, including spare parts.

C. Record Drawings shall be promptly furnished when the equipment installation is complete. Payment may be withheld until Record Drawings have been furnished and approved.

D. At the time of delivery of the equipment, the Contractor shall have an approved shop drawing in his possession for the Contracting Agency’s Inspector and/or Engineer for verification.

E. As-Built Drawings: As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called "As-Built Drawings". The As-Built Drawings and specifications shall be kept up to date throughout the project. As-Built Drawings shall accurately show the installed condition of the following items at a minimum:
1. One-line Diagram(s).

2. Raceways and pullboxes.
3. Conductor sizes and conduit fills.
4. Panelboard Schedule(s).
5. Control Wiring Diagram(s).
6. Luminaire Schedule(s)
7. Luminaire, receptacle and switch outlet locations.
8. Underground raceway and duct bank routing including manhole/handhole locations.
9. Plan view, sizes and locations of switchgear, switchboards, distribution transformers, motor control centers and panelboards.

1.04 TESTS

A. The Contractor shall be responsible for factory and field tests indicated in Division 26, as required by the Engineer and as required by other authorities having jurisdiction.

B. Furnish necessary testing equipment

C. Pay the costs of the tests, including replacement parts and labor due to damage resulting from damaged equipment or from testing and correction of a faulty installation.

D. Reporting
1. Where test reporting is indicated, submit proof-of-design test reports for mass-produced equipment with the Shop Drawings.
2. Submit factory performance test reports for custom-manufactured equipment for approval prior to shipment.
3. Submit field test reports for review prior to Substantial Completion.

E. Remove and replace equipment or material that fails a test, or, if the Engineer approves, repair and retest for compliance.

F. Connections to equipment or materials with a factory warranty shall be as recommended by the manufacturer and shall be performed in a manner that does not void the warranty.

1.05 PERMITS AND INSPECTIONS

A. Obtain permits and pay all fees required for permits inspections.

B. Pay inspection, connection and turn-on service charges required by the utility company.

C. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. Provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory.

D. Inspection of the equipment at the factory by the Engineer will be made after the manufacturer has performed satisfactory checks, adjustments, tests and operations.

E. Favorable review of the equipment at the factory only allows the manufacturer to ship the equipment to the project site. The Contractor shall be responsible for the proper installation and satisfactory startup operation of the equipment to the satisfaction of the manufacturer and the Engineer.

1.06 COORDINATION

A. Coordinate the electrical work with the other trades, code authorities, utilities, and the Contracting Agency.

B. Where connections must be made to existing installations, properly schedule all the required work with the Contracting Agency, including the power shutdown periods. Schedule and carry out shutdowns so as to cause the least disruption to operation of the plant and privately owned facilities.

C. Submit a written sequencing request indicating the sequence and duration of activities to be performed during the plant shutdown.

D. Switching, safety tagging and other project related tasks required for shutdown or to isolate existing equipment, shall be coordinated.

E. In no case shall the Contractor begin any work in, on or adjacent to existing equipment without written authorization from the Engineer.

F. Modifications
   1. Perform modifications or alterations to existing electrical facilities as required to successfully install and integrate the proposed electrical equipment as indicated.
   2. Perform modifications to existing equipment, panels and cabinets in a professional manner. Repair coatings of existing equipment to match existing
   3. The costs for modifications to existing electrical facilities that are required for a complete and operable system shall be included as part of the Work.

G. Existing Utilities
   1. Exercise extreme caution when digging trenches to not damage existing underground utilities.
   2. The cost of repairs of damages caused during construction shall be included as a part of the Work.

H. Field Verifications
   1. Visit the site before submitting a Bid to become better acquainted with the Work of this Contract.
   2. The lack of knowledge will not be accepted as justification for extra compensation to perform the Work.
   3. The Contractor shall be responsible for identifying available existing circuit breakers in lighting panel for the intended use as required.
   4. The Contractor shall be responsible for field verifying the available space in switchgear, switchboards and/or motor control centers to integrate new overcurrent protective devices meeting the requirements of these Specifications.
   5. The cost for the above field verifications shall be included as part of the Work.

I. Installation of Temporary Power
   1. To facilitate the continuous operation of existing equipment, provide temporary equipment as indicated.
   2. Submit installation and connection details for favorable review and acceptance by the Engineer.
   3. Costs associated with these temporary installations shall be included as part of the Work.
   4. Temporary wiring and equipment shall remain the property of the Contractor unless indicated otherwise.

1.07 ELECTRICAL AND TELEPHONE SERVICES

A. Contact the serving utility and verify compliance with requirements before construction.

B. Coordinate schedules and payments for Work by utilities.

C. Where conduits and conductors in the Work are indicated to be larger, heavier schedule, or have greater protective coating than utility requirements, provide the larger size, heavier schedule or greater protection.

D. Provide electrical service as indicated and as required by the serving utility.

E. Verify and provide service conduits, fittings, transformer pad, grounding devices and service wires not provided by the serving utility.

F. Verify with the utility the exact location of each service point and type of service, and pay charges levied by the serving utilities as part of the Work.

1.08 LOCATIONS

A. General: Use equipment, materials and wiring methods suitable for the types of locations in which they are located, as defined in Paragraph B. herein.

B. Definitions of Types of Locations:
   1. Dry Locations: All those indoor areas which do not fall within the definitions below for Wet, Damp, Hazardous, or Corrosive Locations and which are not otherwise designated on the Drawings.
   2. Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.
   3. Damp Locations: All spaces wholly or partially underground, or having a wall or ceiling forming part of a channel or tank, unless otherwise designated on the Drawings.
   4. Hazardous Locations: All areas in which fire or explosion hazards may exist, normally or accidentally, due to flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings. These areas are shown on the Drawings, together with the Class and Division designations as defined in the NEC, determining the enclosure types and wiring methods required.
   5. Corrosive Locations: Areas where chlorine or sulfur dioxide gas under pressure, sulfuric acid, or liquid polymer are stored or processed. These areas are shown on the Drawings.

C. Unless otherwise specified herein or shown on the Drawings, electrical enclosures and associated installations shall have the following ratings:
   1. NEMA 1 gasketed or 12 for dry, non-process indoor above grade locations
   2. NEMA 3R for outdoor installations identified not to be hazardous or corrosive.
   3. NEMA 4X enclosures of Type 304 or 316 stainless steel in corrosive areas except in chlorine and HFS areas where non-metallic enclosures shall be provided.
   4. NEMA 6 or 6P enclosures for submersible, indoor or outdoor use. Enclosures for temporary submersion shall be rated NEMA 6 and prolonged submersion shall be rated 6P at limited depth.
   5. NEMA 7 enclosures (and listed for use in the area classifications shown) for "Class 1 Div. 1 Group D" and "Class 1 Div. 2 Group D" hazardous locations shown on the Drawings or as defined in NFPA 820 or other codes.

6. NEMA 9 enclosures (and listed for use in the area classifications shown) for "Class 1 Div. 1 Group E, F and G" and "Class 1 Div. 2 Group E, F and G" hazardous locations shown on the Drawings or as defined in NFPA 820 or other codes.

D. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.

E. Equipment and materials installed in areas designated as hazardous on the Drawings shall be UL Listed for the appropriate hazardous area classification.

1.09 PHASE BALANCING

A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on motor control centers and panelboards shall be field connected to result in evenly distributed loads across all three phases.

B. Field balancing of circuits shall not alter the conductor color coding requirements defined in Section 26 05 19.

1.10 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure the tilting does not impair the functional integrity of the equipment.

PART 2 - PRODUCTS

2.01 GENERAL

A. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are favorably reviewed by the Engineer prior to installation.

B. It is the intent of these Specifications and Drawings to secure high quality in all materials and equipment in order to facilitate operation and maintenance of the facility. All equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses, which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.

C. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light-duty, fragile and competitive grade devices of doubtful durability shall not be used.

D. Where a NEMA enclosure type is indicated in a non-hazardous location, use that type of enclosure despite the fact that certain modifications such as cutouts for control devices may negate the NEMA rating.

E. Temperature Ratings of Equipment Terminations and lugs shall be rated for use with 75-degree C conductors. Wire sizes in the Contract Documents are based on NEC ampacity tables using the 75-degree C ratings.

2.02 MOUNTING HARDWARE

A. Miscellaneous Hardware
   1. Provide nuts, bolts and washers constructed of stainless steel.
   2. Provide threaded rods for trapeze supports constructed from continuous threaded galvanized steel, 3/8-inch diameter minimum.
   3. Slotted channel
      a. Construct struts for mounting of conduits and equipment of stainless steel OR galvanized steel OR aluminum OR fiberglass slotted channel.
      b. Where contact with concrete or dissimilar metals may cause galvanic corrosion, use suitable non-metallic insulators in order to prevent such corrosion.
      c. Slotted channel manufacturer shall be Unistrut, B-Line or approved equal.
   4. Provide plastic protective end caps for all exposed slotted channel ends. End caps shall be manufactured by Unistrut P2860-33 or approved equal
   5. Provide stainless steel expansion anchors for attaching equipment to concrete walls, floors and ceilings. Expansion anchors shall be manufactured by Power Fasteners, Inc and be the "Power-Bolt" or "Power-Stud" series or approved equal.

2.03 LENS COLOR SCHEME

A. Indicating light lens colors shall be green for “Run”, “Open” or “On”; red for “Stop”, “Close” or “Off”; and amber for alarm.

2.04 NAMEPLATES

A. For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings and the model designation.

B. Identify each piece of equipment and related controls with a rigid laminated engraved phenolic nameplate. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using fasteners constructed of brass, cadmium plated steel or stainless steel and screwed into inserts or tapped holes as required. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the Engineer upon prior request by the Contractor.

C. Provide engraved characters of the block style, with no characters smaller than 1/8 inch top to bottom.

D. Each control device, including pushbuttons, control switches, and indicating lights, shall have an integral legend plate or nameplate indicating the device function. These shall be inscribed as indicated on the Drawings or as favorably reviewed by the Engineer.

E. Unless otherwise noted, all nameplates shall be black background with white letters.

2.05 PROTECTIVE MATTING

A. Provide full-length, high-voltage switchboard matting in front of indoor switchgear, service equipment and motor control centers.

B. For equipment rated at 600-volt, provide matting that is ¼-inch thick and 42" wide.

C. Protective matting shall be as manufactured by Rhino or approved equal

2.06 PAINTING

A. Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish, which has been damaged or is otherwise unsatisfactory, to the satisfaction of the Engineer.

B. Wiring System: Paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed. Paint finishes shall include proper surface preparation, prime coat and a final finish coat, and shall conform to Section 09 96 00.

PART 3 - EXECUTION

3.01 REQUIREMENTS

A. All electrical installations shall conform to the codes and standards outlined in this Section.

3.02 WORKMANSHIP

A. Assign a qualified representative who shall supervise the electrical construction work from beginning to completion and final acceptance.

B. Perform all labor using qualified craftsmen, who have had experience on similar projects. Provide first-class workmanship for all installations.

C. Ensure that all equipment and materials fit properly in their installations.

D. Perform any required work to correct improperly fit installations at no additional expense to the Contracting Agency.

E. Provide materials and incidental required for a complete and operable system, even if not required explicitly by the Contract Documents.

F. Typical incidentals are terminal lugs not furnished with vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and control wiring required by vendor-furnished equipment to connect with other equipment indicated in the Contract Documents.

3.03 EXCAVATION AND BACKFILL

A. Provide the excavations for electrical equipment foundations and trenches for conduits as shown on the Drawings.

B. Exercise caution during all excavation work and avoid damage to existing underground pipes. Exercise extreme caution when working near existing

electrical conduits and facilities. Field verify the location of all electrical facilities before proceeding with any nearby work.

C. Refer to Division 31, Earthwork, of these Specifications for all excavation and backfilling work.

3.04 CONCRETE

A. Where shown on the Drawings or specified, provide the required concrete installations for conduit encasement and equipment foundations.

B. Refer to Division 3, Concrete, of these Specifications for all concrete work.

3.05 CONDUCTOR IDENTIFICATION

A. Identify all wires and cables in conformance with the requirements of Sections 26 05 19, 26 05 13, and 26 05 20. This requirement applies to all equipment provided under this contract, regardless of Division, as well as to all conductors provided or worked on during this contract.

3.06 CONCRETE HOUSEKEEPING PADS

A. Provide concrete housekeeping pads for floor-standing electrical equipment.

B. Install all floor-mounted equipment on 4-inch-high reinforced concrete pads. The Contractor, suppliers, and fabricators shall take this requirement into consideration when designing, fabricating, and installing panels, motor control centers, and other enclosures so that height above the floor of the operating handles of electrical devices meets the requirements of these Specifications and applicable codes.

C. Provide concrete housekeeping curbs 3-inches above the finished floor or grade for conduit stub-ups in indoor locations that are not concealed by equipment enclosures.

3.07 CUTTING, DRILLING, AND WELDING

A. Provide any cutting, drilling, and welding that is required for the electrical construction work.

B. Structural members shall not be cut or drilled, except when favorably reviewed by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry.

C. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel.

D. Perform patch work with the same materials as the surrounding area and finish to match, as specified in Division 3 of these Specifications.

3.08 METAL PANELS

A. Mount all metal panels which are mounted on or abutting concrete walls in damp locations or any outside walls 1/4 inch from the wall, and paint the back sides of the panels with a high build epoxy primer. Film thickness shall be 10 mils minimum.

3.09 PROTECTIVE DEVICE COORDINATION

A. Perform power system studies and provide protective device coordination in accordance with Section 26 05 73.

3.10 TESTING

A. Perform acceptance testing in accordance with Section 26 01 26.

B. Perform additional testing as indicated within specific equipment sections.

3.11 EQUIPMENT STORAGE AND PROTECTION

A. During construction, provide adequate storage for all equipment and materials that will become part of the completed facility so that it is protected from weather, dust, water, and other environmental impacts, or damage from construction operations.

B. Store and protect products in accordance with manufacturer's instructions. Seals and labels shall be intact and legible.

C. Store moisture sensitive products including electrical equipment, instruments and controls in weathertight, humidity and temperature-controlled enclosures to avoid condensation and dust buildup.

D. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

E. Exercise care at all times after installation of equipment, motor control centers, etc., to keep out foreign matter, dust, dirt, debris, or moisture. Use protective sheet-metal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

3.12 CLEANING EQUIPMENT

A. Before final acceptance, thoroughly clean the electrical Work of cement and other materials.

B. Clean out and vacuum all construction debris from the bottom of all equipment.

C. Provide and touch-up to original condition any factory painting that has been marred or scratched during shipment or installation, using paint furnished by the equipment manufacturer.

D. Remove temporary tags, markers, stickers and the like.

E. Remove all oil and grease spots with a non-flammable cleaning solvent by carefully wiping and scraping cracks and corners.

F. Clean luminaires inside and out.

G. Dispose of cleaning debris and refuse off-site.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 05 10

ELECTRIC MOTOR DRIVES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide motors to drive equipment specified in other sections and Divisions, including, but not limited to, Divisions 26, 33, and 40. Refer to driven equipment sections for additional requirements. Requirements of the driven equipment Specifications shall take precedence over the requirements of this Section, where conflict occurs. This Section applies to all electric motors furnished for this project, unless otherwise noted.

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Standard:
   1. MG 1 Motors and Generators

B. Institute of Electrical and Electronics Engineers (IEEE) Standard:
   1. 112 Test Procedure for Polyphase Induction Motors and Generators

C. Underwriters Laboratories (UL) Publication: Recognized Component Directory

1.03 SUBMITTALS

A. For each motor, include the following data in the shop drawing submittal for the driven equipment, as part of the driven equipment’s Product Review submittals:
   1. Machine name and specification number of driven machine
   2. Manufacturer's name.
   3. Motor model and dimension drawing, including motor weight.
   4. Manufacturer's type and frame designation.
   5. Nominal Horsepower output.
   6. Time rating.
   7. Maximum ambient temperature rating.
   8. Winding Insulation class and temperature rise class.
   9. RPM at full load.
   10. Voltage, number of phases, frequency and full load amperes.
   11. Code letter for locked rotor kVA.
   12. Service factor at 40°C ambient.
   13. NEMA design letter.
   14. Enclosure type.
   15. Bearing data including lubrication requirements, type and frequency.
   16. KW input power and power factor at 75% and 100% of rated horsepower output.
   17. Guaranteed minimum full load efficiency. Also, nominal efficiencies at 1/2 and 3/4 load.
   18. Type of thermal protection or overtemperature protection, if included.
   19. Wiring diagram for devices such as motor leak detection, temperature or zero speed switches, as applicable.
   20. If utilized with a variable frequency controller, verify motor is inverter duty type. Include minimum speed at which motor may be operated for the driven machinery. Provide shaft grounding information and details.

21. Power factor at 1/2, 3/4 and full load.
22. Recommended size for power factor correction capacitors to improve power factor to 0.95 percent lagging when operated at full load.

B. If water cooling is required for motor thrust bearings, the Shop Drawing submittals shall indicate this requirement.

1.04 COORDINATION

A. General: Coordinate motors with driven equipment requirements. Unless otherwise specified, equipment manufacturers or suppliers shall select and provide motors for their equipment in conformance with these Specifications. Give particular attention to coordination of requirements for:
1. Power.
2. Starting torque.
3. Speed.
4. Bearing load.
5. Ambient temperature.
6. Frequency of starting.
7. Moisture exposure.
8. Adjustable speed control, where applicable.

B. Suppliers of motors to be used with adjustable speed systems shall:
1. Provide all relevant motor data to the adjustable speed control manufacturer for analysis. Provide motors in conformance with and compatible with the adjustable speed control manufacturer's equipment and requirements.
2. Provide all relevant motor data to the pump manufacturer for vibration, reed critical frequency and other required analyses.

1.05 SPECIFIC REQUIREMENTS

A. The following motor characteristics are specified with the driven equipment in all cases:
1. Speed.
2. Horsepower or supplier responsibility to determine.
3. Horizontal or vertical arrangement.
4. Indoor or outdoor location.

B. Additional motor characteristics are specified with the driven equipment only where the required motor differs from the typical characteristics described below or where additional properties or characteristics are required that are not specified in this Section.

PART 2 - PRODUCTS

2.01 GENERAL

A. Motors shall be designed, built, and installed in the driven equipment, to provide long, trouble-free life in industrial service and shall be rated in conformance with NEMA MG1. Motors rated 100 horsepower or less and rated 600V or less shall be listed in UL Recognized Component Directory or shall be listed and labeled by other organizations acceptable to the authority having code enforcement jurisdiction.

B. Unless otherwise specified with the driven equipment, provide motors with the following typical characteristics:
   1. NEMA Design: Electric motors shall be NEMA Design B unless otherwise indicated. In no case shall starting torque or breakdown torque be less than the value in NEMA MG 1. Motors shall be suitable for the indicated starting method.
   2. Voltage Ratings:
      a. 1/2 horsepower or less: 115 volts, single phase, 60 Hz, capacitor start. Small fan motors may be split phase or shaded pole type if standard for the equipment. Dual voltage motors rated 115/230 volts, 115/208 volts, or 120-240 volts are acceptable, provided leads are brought out to the conduit box.
      b. Above 1/2 horsepower: 460 volts, three phase, 60 Hz, squirrel cage induction motors. Dual voltage motors rated 230/460 volts or 208/230/460 volts are acceptable, provided every lead is brought out to the conduit box.
   3. All motors shall have a service factor of 1.15 in an ambient temperature of 40°C.
      a. Exceptions: Motors, which have special enclosures or winding configurations, may carry a Unity (1.0) Service Factor. Examples are totally enclosed, explosion proof, or submersible motors.
   4. Windings shall be copper.
   5. Horizontal motors 3 HP and larger and every vertical motor shall have split-type cast metal conduit boxes. Motors shall be provided with oversized conduit boxes. Motors other than open drip-proof shall be gasketed.
   6. Provide ground lug inside the terminal box.
   7. Provide lifting eye on each motor weighing more than 50 pounds.
   8. Each motor shall be suitable for six starts per hour (5 minutes on and 5 minutes off, continuously) when powering the specific driven equipment required for this project.
   9. Each motor shall have an overall sound power level at no load not greater than given in NEMA MG1-Part 9.
   10. Inverter duty motors shall be provided with shaft grounding rings. Rings shall be factory installed, and shall be by Aegis, or equal. The motor warranty shall include coverage against VFD-induced bearing damage or failure.
   11. Motors, which have special operating characteristics such as multi-speed, high torque/high slip, short time intermittent ratings shall be nameplated to show how these characteristics differ from standard design.

C. Motors used with variable frequency drives shall have inverter duty complying with NEMA MG-1, Section IV, Part 31, and shall be clearly identified as “Inverter Duty.”

D. Increased circuit breaker, magnetic starter, and conductor and conduit capacities required for motors larger than the indicated sizes shall be provided as part of the Contractors work.

E. Two speed motors shall be of the two-winding type,

F. Exempt Motors: Motors for valve operators, submersible pumps, or motors which are an integral part of standard manufactured equipment, i.e., non-NEMA mounting, common shaft with driven element, or part of domestic or commercial use apparatus may be excepted from these requirements to the extent that such variation reflects a necessary condition of motor service or a requirement of the driven equipment.

2.02 NAMEPLATE

A. Provide stainless steel nameplate for each motor, attached to the motor by stainless steel screws or drive pins. Nameplates shall indicate clearly the information required by NEMA MG1, Part 10 and Part 12.

2.03 ENCLOSURE TYPE BY LOCATION

A. Unless otherwise specified with the driven equipment, provide motors with the following typical enclosures:
   1. Indoors and non-hazardous: Horizontal motors shall be open, drip-proof; vertical motors shall be drip-proof with guard.
   2. Outdoors and non-hazardous: Vertical motors shall be weather-protected type I. Horizontal motors shall be totally enclosed, fan cooled. All motors shall have the following features:
      a. Bearing protection.
      b. Anti-corrosion treatment of external hardware and internal metal parts.
      c. Weatherproof terminal box with gaskets between the motor, terminal box, and terminal box cover.
      d. Guard screens on ventilation openings.
      e. Moderate moisture resistant insulation, specified hereinafter.
      f. Interior and exterior corrosion protection coatings.

B. Special attention to leads into terminal box. When specifically called for in the Specifications for the driven equipment or required by Code, provide the following enclosure types:
   1. Hazardous locations: Motors for use in hazardous locations shall have enclosures suitable for the classification indicated. Such motors shall be U.L. listed and be stamped as such.
   2. Severe duty: Motors shall have the following features:
      a. Totally enclosed, fan cooled enclosure.
      b. Stainless steel nameplate.
      c. Cast iron housing, bearing brackets, and fan guard.
      d. Cast iron conduit box with threaded conduit entrance.
      e. Corrosion resistant fan.
      f. Corrosion resistant hardware.
      g. Automatic breather/drain.
      h. Ground lug.
      i. Regreasable bearings.
      j. Provision for excluding water and dust from bearings.
      k. Class F insulation.
      l. Service factor of 1.15.
      m. Epoxy coating on all external surfaces.
   3. Submersible: Submersible motors shall comply with the following:
      a. Air-filled or oil-filled squirrel cage induction type.
      b. Service factor of 1.15 or better.
      c. Class F insulation, Class B temperature rise.
      d. Rated for six (6) starts per hour.
      e. Listed by either UL or FM for Class 1, Division 1, Groups C and D hazardous locations.
      f. Suitable for operating in free air continuously (i.e., not submerged in sewage).
      g. Bearing B10 life 18,000 hours minimum.
      h. Tungsten carbide seals.

i. Lower bearings of either the ball or roller type.
j. If required by the manufacturer to not void the motor warranty, provide a moisture detection system and a motor winding thermostat system. These systems shall be complete, including all necessary interfaces, control panels, conduits, and wires, even though these may not be shown on the Drawings.

2.04 INSULATION

A. Three phase motors shall be provided with Class F insulation, rated to operate at a maximum ambient temperature of 40 degrees C and at the altitudes where the motors will be installed and operated, without exceeding Class B temperature rise limits stated in NEMA MG 1-12.44. Single phase motors shall have Class F insulation with temperature rise not to exceed the insulation class. Motors to be operated from adjustable frequency drives shall be provided with insulation systems to withstand 1600 volt spikes, with dV/dT as defined in NEMA MG 1-31. The adjustable frequency drive manufacturer shall coordinate with the motor manufacturer to determine when additional dV/dT protection is required. Where required, it shall be furnished and installed as per the manufacturer's written instructions.

B. Where called for in the Specifications for the driven equipment, provide the following type of insulation:
1. Moderate Moisture Resistant: Provide extra dip and bake of epoxy or polyester varnish to resist somewhat higher than normal moisture in the atmosphere.

2.05 MOTOR HORSEPOWER

A. The maximum permissible motor loading:
1. Motors with service factor 1.15 or greater: 100% of nameplate horsepower.
2. Motors with service factor less than 1.15: 90% of nameplate horsepower.

B. Probable motor horsepower ratings have been specified or shown on the Drawings. Changes from the specified horsepower may be accepted, if necessary, to assure that motors do not exceed their maximum permissible loading, as defined above, under normal operation. Motor horsepowers shall not be less than those specified in driven equipment sections. If a larger horsepower rating is required by the driven equipment, provide all changes required to motor starting and control equipment and to the conduit and wiring system without any additional cost to the Port.

2.06 EFFICIENCY

A. For motors 1 Horsepower and Larger:
1. Provide NEMA premium efficient units. Motors shall be stamped with the efficiency on the nameplate with the caption "NEMA Nominal Efficiency" or "NEMA Nom. Eff." Premium efficiency motors shall have nominal and minimum efficiencies at full load not less than those listed in Table 16050-1. Both efficiencies shall be included in the Shop Drawing submittal.

B. Efficiencies shall be determined by using the IEEE 112, Test Method B using segregated loss determination.

C. Single-phase fractional horsepower motors 1/4 HP through 3/4 HP motors shall be high-efficiency split-capacitor types having minimum efficiency ratings of not less than 64% and power factors of not less than 94.5%.

TABLE 16050-1

OPEN DRIP-PROOF (ODP)						
FULL-LOAD EFFICIENCIES OF NEMA PREMIUM EFFICIENCY MOTORS RATED 600 VOLTS OR LESS						
	2 POLE		**4 POLE**		**6 POLE**	
HP	**Nom. Effic.**	**Min. Effic.**	**Nom. Effic.**	**Min. Effic.**	**Nom. Effic.**	**Min. Effic.**
1	77.0	74.0	85.5	82.5	82.5	80.0
1.5	84.0	81.5	86.5	84.0	86.5	84.0
2	85.5	82.5	86.5	84.0	87.5	85.5
3	85.5	82.5	89.5	87.5	88.5	86.5
5	86.5	84.0	89.5	87.5	89.5	87.5
7.5	88.5	86.5	91.0	89.5	90.2	88.5
10	89.5	87.5	91.7	90.2	91.7	90.2
15	90.2	88.5	93.0	91.7	91.7	90.2
20	91.0	89.5	93.0	91.7	92.4	91.0
25	91.7	90.2	93.6	92.4	93.0	91.7
30	91.7	90.2	94.1	93.0	93.6	92.4
40	92.4	91.0	94.1	93.0	94.1	93.0
50	93.0	91.7	94.5	93.6	94.1	93.0
60	93.6	92.4	95.0	94.1	94.5	93.6
75	93.6	92.4	95.0	94.1	94.5	93.6
100	93.6	92.4	95.4	94.5	95.0	94.1
125	94.1	93.0	95.4	94.5	95.0	94.1
150	94.1	93.0	95.8	95.0	95.4	94.5
200	95.0	94.1	95.8	95.0	95.4	94.5
250	95.0	94.1	95.8	95.0	95.4	94.5
300	95.4	94.5	95.8	95.0	95.4	94.5
350	95.4	94.5	95.8	95.0	95.4	94.5
400	95.8	95.0	95.8	95.0	95.8	95.0
450	96.2	95.4	96.2	95.4	96.2	95.4
500	96.2	95.4	96.2	95.4	96.2	95.4

Source: NEMA MG1 - 2011, Table 12-12

TOTALLY ENCLOSED - FAN COOLED (TEFC)						
FULL-LOAD EFFICIENCIES OF NEMA PREMIUM EFFICIENCY MOTORS RATED 600 VOLTS OR LESS						
	2 POLE		4 POLE		6 POLE	
HP	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1	77.0	74.0	85.5	82.5	82.5	80.0
1.5	84.0	81.5	86.5	84.0	87.5	85.5
2	85.5	82.5	86.5	84.0	88.5	86.5
3	86.5	84.0	89.5	87.5	89.5	87.5
5	88.5	86.5	89.5	87.5	89.5	87.5
7.5	89.5	87.5	91.7	90.2	91.0	89.5
10	90.2	88.5	91.7	90.2	91.0	89.5
15	91.0	89.5	92.4	91.0	91.7	90.2
20	91.0	89.5	93.0	91.7	91.7	90.2
25	91.7	90.2	93.6	92.4	93.0	91.7
30	91.7	90.2	93.6	92.4	93.0	91.7
40	92.4	91.0	94.1	93.0	94.1	93.0
50	93.0	91.7	94.5	93.6	94.1	93.0
60	93.6	92.4	95.0	94.1	94.5	93.6
75	93.6	92.4	95.4	94.5	94.5	93.6
100	94.1	93.0	95.4	94.5	95.0	94.1
125	95.0	94.1	95.4	94.5	95.0	94.1
150	95.0	94.1	95.8	95.0	95.8	95.0
200	95.4	94.5	96.2	95.4	95.8	95.0
250	95.8	95.0	96.2	95.4	95.8	95.0
300	95.8	95.0	96.2	95.4	95.8	95.0
350	95.8	95.0	96.2	95.4	95.8	95.0
400	95.8	95.0	96.2	95.4	95.8	95.0
450	95.8	95.0	96.2	95.4	95.8	95.0
500	95.8	95.0	96.2	95.4	95.8	95.0

Source: NEMA MG1 - 2011, Table 12-12

2.07 MOTOR THERMAL PROTECTION

A. Single Phase Motors: Single phase 120, 208, or 230 volt motors shall have integral thermal overload protection or shall be inherently current limited.

B. In each motor to be used with adjustable speed drives, in all motors 60 horsepower and larger, or where called for in the Specifications for the driven equipment, provide integral thermostats or other approved devices to protect the motor from overheating. Thermostats shall be snap action, bi-metallic, temperature actuated switch. Thermostats shall be normally closed and the switch point shall be precalibrated by the manufacturer. Thermostats shall be rated 125 Vac, 1 amp.

2.08 SPACE HEATERS

A. On all outdoor motors, where called for in the Specifications for the driven equipment, or where shown on the Drawings provide space heaters or solid-state motor winding heating systems for motors. Heaters shall be 120 or 240 volts,

single-phase, as required by the control circuit voltage. Heater wattage and voltage ratings shall be indicated on motor nameplate.

2.09 MOTOR BEARINGS

A. General: Bearings shall conform to Section 11 00 00 – General Equipment and Mechanical Requirements, except as indicated herein.

B. Motors greater than 2 HP shall have bearings designed for 17,500 hours (belted) or 100,000 hours (coupled) L-10 life.

C. Fractional Horsepower: Motors with fractional horsepower through 2 HP shall be provided with lubricated-for-life ball bearings.

D. Horizontal Motors Over 2 HP: Motors larger than 2 HP shall be provided with relubricatable ball bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

E. Vertical Motors Over 2 HP: Vertical motors larger than 2 HP shall be provided with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

F. Water Cooled Motors: If water cooling is required for the thrust bearings, cooling water lines shall be provided complete with shut-off valve, strainer, solenoid valve, flow indicator, thermometer, throttling valve, and, (where subject to freezing), insulation with heat tracing.

G. Inverter Duty Motors: Provide an insulated bearing to prevent circulating bearing currents.

2.10 MANUFACTURERS, OR EQUAL

A. U.S. Motors

B. General Electric

C. WEG

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install motors in driven equipment in conformance with motor manufacturer's recommendations and requirements. Motor nameplate shall be visible when installed on the driven equipment. Where applicable, shaft grounding devices shall be connected to the grounding system in accordance with the manufacturer’s recommendations.

B. Related electrical WORK involving connections, controls, switches, and disconnects shall be performed in accordance with the applicable sections of Division 26.

3.02 FACTORY TESTS

A. Motors shall be factory tested in conformance with IEEE 112, IEEE 43 - Recommended Practice for Testing Resistance of Rotating Machinery, and NEMA MG-2. Except where specific testing or witnessed shop tests are required by the

specifications for driven equipment, factory test reports may be copies of routine test reports of electrically duplicate motors. Test report shall indicate test procedure and instrumentation used to measure and record data. Test report shall be certified by the motor manufacturer's test personnel and be submitted to the Engineer.

3.03 FIELD TESTING

A. The Contractor shall perform the following field tests:
   1. Inspect each motor installation for any deviation from rated voltage, phase, frequency, and improper installation.
   2. Visually check for proper phase and ground connections. Verify that multi-voltage motors are connected for proper voltage. Verify shaft grounding devices are properly grounded.
   3. Check winding and bearing temperature detectors and space heaters for functional operation.
   4. Test for proper rotation prior to connection to the driven equipment.
   5. Visually check that motor overload heaters are properly sized and that MCP breaker settings are correct for the motor installed.
   6. Test insulation (megger test) of new and re-used motors in accordance with NEMA MG-1. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE WIRE AND CABLE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish labor, materials, equipment and incidentals necessary to install field wire and cable specified under this Section. Electrical work shall be in accordance with Specification 26 05 00 – General Electrical Requirements.

B. Work shall include building wire, cable, wiring connections and terminations and modular wiring systems.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
   1. B3-74 Specification for Soft or Annealed Copper Wire
   2. B8-77 Specification for Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   3. B173-71 Specification for Rope Lay Stranded Copper Conductors Having Concentric Stranded Members

B. Insulated Cable Engineers Association (ICEA):
   1. S-66-524 Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable

C. International Electrical Testing Association (NETA):
   1. ATS Acceptance Testing Specifications

D. National Electrical Manufacturers Association
   1. WC-3 Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
   2. WC-5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

E. Underwriters Laboratories (UL) Standards:
   1. 62 Flexible Cords and Fixture Wire
   2. 510 Insulating Tape
   3. 1063 Stranded Conductors for Machine Tool Wire

1.03 SUBMITTALS

A. Submit the following material or equipment data:
   1. Each type of cable and wire to be used.
   2. Cable and wire splices
   3. Wire markers

1.04 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall protect all cable and wire from being damaged at all times.

B. Cable ends shall be protected from water entry in accordance with the manufacturer’s recommended procedures. Cable ends shall not be left open in manholes or other locations subject to submergence. If the cable ends become

submerged prior to splicing or termination, the cables shall be replaced in their entirety.

C. Cables shall be pulled into raceways in accordance with the manufacturer's requirements. Under no circumstances shall cable pulling tensions exceed the manufacturer's written instructions.

D. Pulling tensions on raceway cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where needed, shall be UL approved.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. General: Conductors, include grounding conductors, shall be stranded copper. Aluminum conductor and/or solid conductor wire and cable will not be permitted. Insulation shall bear the UL label, the manufacturer's trademark, and identify the type, voltage, and conductor size. Conductors except flexible cords and cables, fixture wires, and conductors that form an integral part of equipment such as motors, controllers, and industrial control panels shall conform to the requirements of Article 310 of the National Electric Code, latest edition, for current carrying capacity. Flexible cords and cables shall conform to Article 400, and fixture wires shall conform to Article 402. Wiring shall have wire markers at each end.

B. Power and Control Conductors, 600 volts and Below:
   1. Solid copper wires shall be 600 volt Type XHHW, sizes #12 and #10 AWG for use with lighting and receptacle circuits only.
   2. Stranded copper wire for power circuits shall be 600 volt Type XHHW or RHW, Class B stranding, sizes #12 AWG and larger.
   3. Stranded copper wire for control circuits shall be 600 volt Type XHHW or RHW, Class B stranding, size #14 AWG.
   4. Control wires inside panels and cabinets shall be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations.
   5. Fixture wire shall be 600 volt, silicone rubber insulated, 200°C, UL Type SF 2, with stranded copper conductors.
   6. Cords shall be 600 volt, 2 conductor plus ground, Type SO, hard service, of adequate length and with grounding type plug attached, rated in amperes as shown on the Drawings.
   7. Conductors for feeders as defined in Article 100 of the NEC shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
   8. Conductors for branch circuits as defined in Article 100 of the NEC shall be sized to prevent voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.

C. VFD Power Cables
   1. VFD power cable shall be three (3) conductor, stranded copper, PVC jacketed, shielded type, tray cable (TC-ER) rated 2000 volts with three (3) symmetrical ground conductors. The individual conductors shall be UL listed

as Type XHHW-2 or RWH-2 rated for 90 degrees C at wet and dry locations, with XLPE insulation.

2. VFD Cables shall be as manufactured by Belden, Alpha, General Cable, or equal. Design basis shall be Belden 29724C or equal.

2.02 SPLICES AND TERMINATIONS OF CONDUCTORS

A. Splices:

1. Wire and Cable Splicing Materials and Applications:
    a. For Lighting Systems and Power Outlets: Wire nuts shall be twist-on type insulated connectors utilizing an outer insulating cover and a means for connecting and holding the conductors firmly. They shall be UL listed and suitable for connecting two to four solid copper conductors of #14 or #12 AWG size or two or three #10 AWG solid copper conductors.
    b. All Equipment: Crimp type connectors shall be insulated type with nylon jacket, suitable for the size and material of the wires and the number of wires to be spliced and for use with either solid or stranded conductors. They shall be UL listed.
    c. Division 16 Equipment and Power Conductors: Bolted pressure connectors shall be suitable for the size and material of the conductors to be spliced. They shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor.
    d. All Equipment: Epoxy splice kits shall include epoxy resin, hardener, and mold, and shall be suitable for use in wet locations and hazardous locations.
2. Terminal Cabinets: Provide terminal cabinets per Section 40 67 00. Termination system shall include insulated, crimp-type connectors. Coordinate the lug and boards for correct fit. All terminations shall include marker sleeves.

B. Terminations:

1. Low Voltage Terminations:
    a. Crimp type terminals shall be UL listed, self-insulating sleeve type, with ring or rectangular type tongue, suitable for the size and material of the wire to be terminated, and for use with either solid or stranded conductors.
    b. Terminal lugs shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor. Tongues shall have NEMA standard drilling.
    c. Crimp with manufacturer recommended ratchet-type tool with calibrated dies. Hand crimping tools are not acceptable.

C. Tape used for splices and terminations shall be compatible with the insulation and jacket of the cable and shall be of plastic material. Tape shall conform with UL 510. Varnished cambric, rubber and thermoplastic tape shall be used for all split-bolt terminations.

D. Wire markers shall be heat shrink type (Raychem; T&B; or equal). Wire identification numbers shall be permanently imprinted on the markers. In locations which are not practical for heat shrink type labels, such as conduit bodies and small pull boxes, machine-printed, adhesive backed wire markers shall be used.

Markers shall be custom-printed with the full identification string. Individual character markers and clip-on wire markers are not acceptable.

PART 3 - EXECUTION

3.01 CONDUCTOR INSTALLATION

A. The Contractor shall provide, terminate and test all power, control, and instrumentation conductors.

B. The Contractor shall, as a minimum, provide the number of control wires listed in the conduit schedule or on the Contract Drawings. Excess wires shall be treated as spares for future use.

C. Conductors shall not be pulled into any raceway until raceway has been cleared of moisture and debris.

D. Wire in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be neatly fanned out to terminals.

E. Single conductor cable in cable trays shall be No. 1/0 or larger and shall be of a type listed and marked for use in cable trays. Tray cable smaller than 1/0 shall be multi-conductor, with outer jacket.

F. Provide the following types and sizes of conductors for the uses indicated for 600 volts or less:
   1. Solid Copper, Sizes #12 and #10 AWG: As shown on the Drawings for circuits for receptacles, switches and light fixtures with screw-type terminals.
   2. Stranded Copper, Size #14 AWG and Larger, Individual Conductors or CC: As shown on the Drawings for the control of motors or other equipment. Size #14 shall not be used for power supplies to any equipment.
   3. Stranded Copper, Sizes #12 AWG and Larger: As shown on the drawings for motors and other power circuits.
   4. Stranded Copper, #6 AWG and Larger.
   5. Fixture Wire: For connections to all fixtures in which the temperature may exceed the rating of branch circuit conductors.

G. Color Coding: All wire shall be coded with specific colors infused in the conductor insulation at the time of manufacture. If a conductor is specified in a gauge not available with integrally colored insulation, it shall be marked by the Contractor at the time of installation using colored electrical coding tape or an approved marking paint. Where tape or paint is used as the conductor identification system, it shall clearly distinguish the conductor over its entire exposed length in all junction boxes, manholes, conduit bodies, or other accessible intermediate locations, and at every termination. Wiring shall conform to the following wiring color code, unless part of a proprietary cable assembly such as a manufacturer-specific cable which uses a special connector:

SYSTEM	CONDUCTOR	COLOR
120/240 volt AC, 1-Phase, 3 Wire	Neutral Line 1 Line 2	White Black Red

SYSTEM	CONDUCTOR	COLOR
120/208 volt AC, 3-Phase, 4 Wire;	Neutral Phase A Phase B Phase C	White Black Red Blue
277/480 volt AC, 3-Phase 4 Wire	Neutral Phase A Phase B Phase C	Grey Brown Orange Yellow
All Systems	Earth, System, or Equipment Ground	Green Insulation, Green w/ Yellow Tracer, or Bare Conductor
120 volt AC Control Power Circuits (In field or in Control Cabinets)	Neutral Line 1 Line 2	White Black Red
120 volt AC UPS-derived Control Power (secondary side)	Neutral Line	White w/ Red Tracer Red w/ White Tracer
24 volt AC Control Power Circuits (In field or in Cabinets)	Neutral Line	White or Grey, w/ Yellow Tracer Brown
12 or 24 volt DC Control Wiring (PLC Discrete I/O, etc.)	DC Negative DC Positive DC Switched (DI/DO)	Yellow Orange Blue
120 volt AC Control Wiring inside or outside cabinets to/from PLC Discrete I/O	Common or Neutral 120 VAC discrete inputs 120 VAC relay or discrete outputs	White or Grey, w/ Blue Tracer Blue Red
Instrumentation Twisted-shielded Cabling (PLC Analog I/O @ 4-20mA, or 1-5 volt DC, etc.) Process Signals to/from Transmitters, Analyzers, etc.	Negative Polarity Positive Polarity (1st Conductor) Positive Polarity (2nd Conductor) Shield Drain Wire	Black White (or clear) Red Bare Conductor, or covered w/ heat-shrink tubing of a unique color
Instrumentation wiring in cabinets (PLC Analog I/O from field terminations of shielded cables).	PLC Analog Input Connections PLC Analog Output Connections	Grey Brown

H. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

I. Wrap all cables in manholes with fireproofing tape. Extend tape 1-inch into ducts.

J. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length unless splices are favorably reviewed.

K. Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in any flexible conduit or any raceway in which all or any portion of a run consists of non-metallic duct or conduit. For flexible conduit, an external bonding jumper is an acceptable alternative.

L. In panels, bundle incoming wire and cables, No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

M. For cables crossing hinges, utilize extra flexible stranded wire, make up into groups not exceeding 12, and arrange so that they will be protected from chafing and excess flexing when the hinged member is moved.

3.02 CONDUCTOR SPLICES AND TERMINATIONS

A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Engineer. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice or terminate wire and cable as follows:
   1. Watertight Splices: Splices in concrete pullboxes, for any type of cable or wire, shall be watertight and rated for continuous submergence. Make splices in low voltage cables using epoxy resin splicing kits rated for application up to 600 volts.

B. Terminations:
   1. Terminate stranded #14 wire using crimp type terminals where not terminated in a box lug type terminal. Terminals must be coordinated with type of terminal board where provided.
   2. Excess control wire shall be long enough to terminate at any terminal block in the enclosure, be properly taped, be identified with origin and be neatly coiled.

3.03 CONDUCTOR IDENTIFICATION

A. Except for interior lighting and receptacle circuits, identify each wire or cable at each termination and in each pullbox, junction box, handhole, and manhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule or as favorably reviewed by the Engineer.

B. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

END OF SECTION

SECTION 26 05 20

SIGNAL CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 become a part of this Section as if repeated herein.

B. Related Work Described Elsewhere:
   1. Division 40: Instrumentation and Controls

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA):
   1. 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards

B. American Society for Testing and Materials (ASTM):
   1. B8-11 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronic Engineers (IEEE):
   1. 1143 Shielding Practice for Low Voltage Cables, Guide on

D. Insulated Cable Engineers Association (ICEA)
   1. S-73-532 Standard for Control, Thermocouple, Extension, and Instrumentation Cable

E. National Fire Protection Association (NFPA):
   1. 262 Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

F. Underwriters Laboratories Incorporated (UL):
   1. 13 Standard for Power-Limited Circuit Cables
   2. 83 Thermoplastic-Insulated Wires and Cables
   3. 444 Communications Cables
   4. 1666 Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section .26 05 00

PART 2 - PRODUCTS

2.01 INSTRUMENTATION CABLE

A. Provide UL listed, twisted pair instrumentation Tray Cable (TC) conforming to ICEA S-73-532, and suitable for transmission of 4-20mA analog, low voltage signals.

B. The cable shall be two-conductor (2/C), three-conductor (3/C), four-conductor (4/C), or more as indicated on the Drawings.

C. Each conductor in the cable shall be #16 AWG 7x24 stranded bare copper, or as indicated on the Drawings.

D. Conductor insulation: Polyvinyl Chloride/Nylon

E. Shield: Aluminum Foil, 100 percent coverage

F. Drain wire: #18 AWG, stranded, tinned copper

G. Jacket material: Polyvinyl Chloride, minimum thickness 0.047 inches.

H. Insulation shall be rated at 600 volts.

I. Temperature rating: UL dry, 90 degrees C; UL web, 75 degrees C

J. Instrumentation cable installed in underground conduits shall be rated as suitable for the application.

K. Instrumentation cable shall be Belden 3090A, 3091A, or approved equal.

L. Provide UL listed, twisted (triad, quad, or pair) instrumentation Tray Cable (TC) as specified above for use with RTDs.

2.02 ETHERNET (TCP/IP) CABLE

A. Office/Admin use:
1. Provide UL listed, Category 6 unshielded twisted pair (UTP) Ethernet cable conforming to ANSI/TIA-568-C.2 and suitable for use indoors.
2. Conductors: 4 pairs of #23 AWG solid bare copper
3. Conductor insulation: Fluorinated Ethylene Propylene
4. Jacket material: Polyvinyl Chloride, factory marked at regular intervals indicating verifying organization and performance level.
5. Insulation shall be 300 volt class.
6. Insulation temperature range: 0 to 50 degrees C
7. Electrical Characteristics: Maximum attenuation of 20 dB per 100 meters at 100 MHz and 33 dB per 100 meters at 250 MHz
8. Terminations/Connectors: Cables shall terminate in Category 6 RJ-45 crimp connectors with strain-relief boots, or at Category 6 punch down blocks at both ends.
9. Cable shall be plenum-rated for flammability in accordance with NFPA 262, and suitable for use as riser cable.
10. Ethernet cable installed in underground conduits shall be rated as suitable for the application.
11. Office/Admin area Ethernet cable shall be Belden 1874A or approved equal.

B. Industrial use, unshielded:
1. Provide UL listed, Category 6 unshielded twisted pair (UTP) Ethernet cable conforming to ANSI/TIA-568-C.2 and suitable for use in harsh environments.
2. Conductors: 4 pairs of #23 AWG solid bare copper
3. Conductor insulation: Fluorinated Ethylene Propylene, minimum thickness 0.01 inches
4. Jacket material: Fluorinated Ethylene Propylene, factory marked at regular intervals indicating verifying organization and performance level. Minimum thickness 0.03 inches.
5. Insulation shall be 300 volt class.
6. Insulation temperature range: -55 to +150 degrees C

7. Electrical Characteristics: Cable shall have a maximum attenuation of 20 dB per 100 meters at 100 MHz and 33 dB per 100 meters at 250 MHz
8. Terminations/Connectors: Cables shall terminate in Category 6 RJ-45 crimp connectors with strain-relief boots, or at Category 6 punch down blocks at both ends.
9. Cable shall be plenum-rated for flammability in accordance with NFPA 262, and suitable for use as riser cable.
10. Ethernet cable installed in underground conduits shall be rated as suitable for the application.
11. Industrial, unshielded Ethernet cable shall be Belden 7931A or approved equal.

C. Industrial use, shielded:
1. Provide UL listed, Category 6 shielded twisted pair (STP) Ethernet cable conforming to ANSI/TIA-568-C.2 and suitable for use in electrically noisy environments.
2. Conductors: 4 pairs of #23 AWG solid bare copper
3. Conductor insulation: Polypropylene, minimum thickness 0.01 inches
4. Inner jacket material: Polyvinyl Chloride, minimum thickness 0.02 inches
5. Shield: Aluminum Foil, 100 percent coverage
6. Drain wire: #24 AWG, stranded, tinned copper
7. Outer jacket material: Industrial grade Polyvinyl Chloride, factory marked at regular intervals indicating verifying organization and performance level. Minimum thickness 0.03 inches.
8. Insulation shall be 300 volt class.
9. Insulation temperature range: -25 to +75 degrees C
10. Electrical Characteristics: Cable shall have a maximum attenuation of 20 dB per 100 meters at 100 MHz and 33 dB per 100 meters at 250 MHz
11. Terminations/Connectors: Cables shall terminate in ruggedized Category 6 RJ-45 connectors, or at Category 6 punch down blocks at both ends. Connector body shall be diecast zinc alloy, and nickel plated for corrosion resistance. Contacts shall be gold plated.
12. Cable shall be riser-rated for flammability in accordance with UL 1666, not suitable for use in plenum spaces.
13. Ethernet cable installed in underground conduits shall be rated as suitable for the application.
14. Industrial, shielded network cable shall be Belden 7953A or approved equal.

2.03 SPECIAL CABLES

A. Cables for proprietary control or fieldbus protocols over a TCP/IP network shall be Ethernet cables.

B. Cables required for computer systems, control equipment, or other special systems not listed above shall be provided in accordance with the system manufacturer’s requirements.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Signal cable shall be installed by personnel who have a minimum of 3 years' experience in terminating and splicing shielded twisted pair cables and coaxial cables.

B. Adequate care shall be exercised by the installers to prevent cable damage or sheath distortion. Bending radius shall not be less than 10 times the cable outside diameter.

C. Raceways shall be swabbed before installation of cable to remove moisture and debris.

D. Cables shall be continuous from initiation to termination without splices except where specifically indicated.

E. Cable shielding shall be grounded at one end only of the cable. Bonding shall be to a single ground point only. Bonding from cable to cable in multiple run installations shall not be permitted.

F. Heat shrinkable sleeving shall be installed on all cables to insulate shielding at the ungrounded cable terminations.

G. Signal cable shall not be run in the same raceway with power and control wiring except where specifically indicated.

H. Where installed in control consoles containing power circuits, cables shall be routed a minimum of 2 inches distant. Color coding shall be strictly observed throughout the installation.

I. Cable in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be fanned out to terminals.

J. For telephone cables, provide station cable to outlets. Use backbone cable for connection between telephone patch panels. Allow at least 25% spare capacity between patch panels.

K. Manufacturer's cable pulling tension shall not be exceeded.

L. Pulling lubricant shall be UL approved.

3.02 CONDUCTOR SPLICES AND TERMINATIONS

A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Engineer. Splices, where approved, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions.

B. Terminations:
   1. Crimp-type terminals shall be UL listed, self-insulating, sleeve type with ring or rectangular tongue, suitable for size and material of the wire to be terminated and for use with either stranded or solid wire. Spade type lugs are acceptable with telephone cable systems only.
   2. Crimp with manufacturer's recommended ratchet-type tool with calibrated dyes. Hand crimping tools are not acceptable.
   3. Coaxial cable and connectors shall be terminated in accordance with the manufacturer's instructions.

3.03 CONDUCTOR IDENTIFICATION

A. Identify each wire or cable at each termination, in each pullbox, and in each handhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule or as favorably reviewed by the Engineer. Conductor numbering shall be coordinated with the Interconnection Diagrams specified in Division 40.

B. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 05 26

ELECTRICAL GROUNDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 become a part of this Section as if repeated herein.

B. Work Included: Furnish all labor, material, equipment, tools and services necessary for the installation, connection and testing of all grounding as specified herein and as shown on the Drawings.

1.02 REFERENCE STANDARD

A. American Society for Testing and Materials (ASTM) Publication:
   1. B228 Copper Clad Steel Conductors Specification
   2. D178 Specifications for Rubber Insulating Matting

B. Institute of Electrical and Electronics Engineers:
   1. 142 Grounding of Industrial and Commercial Power Systems (Green Book)

C. International Electrical Testing Association (NETA) Publication:
   1. ATS Acceptance Testing Specifications for Electrical Equipment for Power Systems

D. National Fire Protection Association (NFPA):
   1. 70 National Electrical Code (NEC)
   2. 780 Standard for the Installation of Lightning Protection Systems

E. Telecommunications Industry Association (TIA)
   1. 607 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

F. Underwriters Laboratories (UL) Standards:
   1. 467 UL Standard for Safety Grounding and Bonding Equipment
   2. 96 Lightning Protection Components
   3. 96A Installation Requirements for Lightning Protection Systems

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 26 05 00.

PART 2 - PRODUCTS

2.01 GENERAL

A. The grounding systems shall consist of the ground rods, grounding conductors, ground bus, ground fittings and clamps, and bonding conductors to water piping, structural steel and UFER grounding as shown on the Drawings. One system

shown provides service and separately derived system grounds. A second system is an electronic ground system to provide for the discharge of static electricity.

2.02 SYSTEM COMPONENTS

A. Ground Rods: Ground rods shall be cone pointed copper clad Grade 40 HS steel rods conforming to UL 467. The welded copper encased steel rod shall have a conductivity of not less than 27% of pure copper. Rods shall be not less than 3/4-inch in diameter and 10 feet long, unless otherwise indicated. Rods longer than 10 feet shall be made up of 10-foot units joined together with threaded couplings. The manufacturer's trademark shall be stamped near the top.

B. Ground Conductors: Buried conductors shall be medium-hard drawn bare copper; other conductors shall be soft drawn copper. Sizes over No. 6 AWG shall be stranded. Coat all ground connections except the exothermic welds with electrical joint compound, non-petroleum type, UL listed for copper and aluminum applications.

C. Ground Connections: Connection to ground rods and buried connections shall be made by irreversible, compression connectors, constructed of high-copper alloy, and manufactured specifically for the particular grounding application. Connections to ground rods and buried connections shall be by exothermic weld. Lugs for attachment of cables to steel enclosures shall be of the binding post type with a 1/2-13NC stud. Each post shall accommodate cables from #4 AWG to #4/0 AWG.

D. Ground Rod Boxes: Boxes shall be a 9-inch-diameter (minimum) precast concrete traffic rated unit with concrete traffic rated lid. Units shall be 12-inches deep. Covers shall be embossed with the wording "Ground Rod."

E. Ground Bus:
   1. Provide ground buses where indicated on the Drawings for the power system and communication system. Ground buses which are integral to a piece of equipment (such as switchgear, switchboards, panelboards, and industrial control panels) shall be provided with the equipment in accordance with the respective equipment specification.
   2. Ground buses shall be UL-listed high conductivity copper alloy bar conforming to ASTM B187-C11000.
      a. Ground buses for power systems:
         1) Minimum dimensions: 1/4-inch thick x 4 inches wide x 12 inches long, or as shown on the Drawings.
         2) Busbar shall be predrilled at regular intervals to accept 1/4-inch and 3/8-inch diameter bolts.
         3) Bus shall be equipped with fiberglass-reinforced molded polyester UL-compliant standoff insulators rated for 600V.
         4) Bus shall be mounted with 1/8” thick stainless steel brackets and 3/8” stainless steel bolts. The standoffs and brackets shall provide a minimum 2-inch spacing between the back of the busbar and the mounting surface.

F. Equipment Grounding Plates: Equipment grounding plates shall be of the irreversible compression type suitable for embedment in cast concrete. Equipment grounding plates shall be made of high-strength, high-conductivity cast copper alloy body with a pure wrought copper compression element. Equipment grounding

plate shall be 4 hole and suitable for termination with size #2-250kcmil copper conductors. Ground Plates shall be Hubbell/Burndy Type YGF or approved equal.

G. Exothermic Welds: Exothermic welded connections shall be Erico CADWELD, Hubbell BURNDYWeld or approved equal.

H. Insulating Tape: Insulating tape for copper conductors passing through concrete slabs shall be UL Listed, premium grade, 10-mil thick, pressure-sensitive vinyl insulating tape. Tape shall have elastic backing with strong adhesive strength. Tape shall be 3M/Scotch Vinyl Insulation Tape 22 or approved equal.

I. Ground Enhancement Material (GEM): GEM must be permanent and maintenance free (no recharging with salts or chemicals which may be corrosive), maintain its earth resistance with time and not depend on water to maintain its conductivity. GEM in its set form shall have a resistivity of not more than 20 ohm-cm. GEM shall be suitable for installation in dry form or slurry form, set up firmly and not dissolve or decompose or otherwise pollute the soil or local water table. GEM shall be manufactured by Erico Products or approved equal.

2.03 LIGHTNING PROTECTION

A. Where called for on the Drawings, provide a lightning protection consisting of air terminals (lightning arresters) and a grounding system in accordance with NFPA 780.

B. Ground Rods: Ground rods shall be as specified in this Section in paragraph 2.02.

C. Roof-Mounting Air Terminals: NFPA Class I, copper, solid or tubular unless otherwise indicated.
   1. Solid Air Terminal shall not be less than 3/8-inch in diameter.
   2. Tubular Air Terminal shall not be less than 5/8-inch in diameter and wall thickness shall not be less than 0.033-inch.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ground all equipment for which a ground connection is required per NEC whether or not the ground connection is specifically shown on the Drawings.

B. Provide a ground wire in every conduit carrying a circuit of over 50 volts to ground.

C. Sizes shall be as indicated on the Conduit/Cable Schedule and in accordance with NEC Article 250.

D. Provide a grounding-type bushing for secondary feeder conduits that originate from the secondary section of each MCC section, switchboard, or panelboard.

E. Individually bond the raceway to the ground bus in the secondary section.

F. Provide a separate grounding conductor in each individual raceway for parallel feeders. Connect the parallel ground conductors together at each end of the parallel run, as required by the NEC.

G. Interconnect the secondary switchgear MCC or panelboard neutral bus to the ground bus in the secondary switchgear compartment only at the service entrance point. For wye connected, 3 phase, separately derived systems with 3 wire

distribution, connect the transformer neutral to the grounding electrode system at the transformer. Connections shall be in accordance with the NEC.

H. Provide a ground ring with minimum burial depth of 36 inches or as indicated on the Drawings, whichever is greater.

I. Embed a grounding conductor in every duct bank as indicated. The ground conductor shall be terminated at the ground grid at each end of the duct bank. Where no ground grid is installed, terminate at a suitable grounding electrode conductor near the end of the duct bank in accordance with the NEC.

J. Provide a ground rod box for each ground rod so as to permit ready access for the connection and/or removal of any pressure connectors to facilitate testing.

K. Install ground enhancement material around each ground rod per GEM manufacturer's installation instructions. GEM shall extend 6 inches in all directions around the ground rod surface. GEM shall extend from 8 inches below top of ground rod to bottom of ground rod.

L. Bond metallic water piping at its entrance into each building. Ground separately derived electrical system neutrals to the metallic water piping in addition to the system driven ground, per NEC requirements.

M. Make embedded or buried ground connections, taps and splices with irreversible, compression connectors or exothermic welds. Do not conceal or cover ground connections until the Engineer or an authorized representative has established that every grounding connection conforms to the requirements of the Contract Documents and has given the Contractor written confirmation.

N. Effectively bond structural steel for buildings to the grounding system using exothermic welds.

O. Where bare copper ground conductor is installed through a new concrete slab, wrap the conductor with insulating tape before pouring concrete. Apply tape in half-lapped layers with sufficient tension to produce a uniform wind, with no tension on the last wrap to prevent flagging.

P. Provide a separate grounding conductor for each motor and connect at motor box. Provide a supplemental ground connection for motor shaft grounding rings, where applicable.

Q. Provide supplemental external bonding jumpers from equipment to the grounding electrode system as shown on the Drawings.

R. Ground buses
   1. Clean copper busbars to remove oxidation and apply an anti-oxidant compound immediately prior to termination of lugs.
   2. Provide a separate connection bolt or screw for each termination. Lugs shall not be stacked.

S. Shielded instrumentation cable shall have its shield grounded at one end only unless the approved Shop Drawings indicate otherwise. The grounding point shall be at the control panel or at the receiving end of the signal carried by the cable. The termination of the shield drain wire shall be on its own terminal. Form a instrument signal ground block by jumping together the shield drain wire terminals, using manufactured terminal block jumpers or a #14 AWG green insulated conductor. Bond the instrument signal ground block to the main ground bus for the panel via a #12 AWG green insulated conductor.

3.02 TESTING

A. Furnish to the Engineer a test report with recorded data of each ground rod location.

3.03 INSTALLATION - LIGHTNING PROTECTION

A. The tip of an air terminal shall be not less than 10 inches above the area it is to protect.

B. Air terminals exceeding 24 inches in height above the area they are to protect shall be supported at a point not less than one-half their height.

C. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.

D. Conceal the lightning system and down conductors.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 05 33

ELECTRICAL RACEWAY SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 become a part of this Section as if repeated herein.

1.02 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the drawings and as specified herein.

B. Raceways and conductors that are listed on the conduit and cable schedules are generally not shown on the Drawings, except where they are required to pass through a restricted or designated space and the Contractor would benefit from additional information. Conduit block diagrams indicate exposed conduits as solid lines and shall be run near the ceilings or along walls of the areas through which they pass and shall be routed to avoid interferences with HVAC ducts, cranes and hoists, lighting fixtures, doors and hatches, etc. Conduit block diagrams indicate concealed or buried conduits as dashed lines and shall be run in underground duct banks, center of concrete floor slabs, in partitions, or above hung ceilings as required.

C. In the event that individual equipment loads provided are larger than indicated in the Contract Documents, revise raceways, conductors, starters, overload elements, and branch circuit protectors as necessary in order to control and protect the increased connected load in conformance to NEC requirements as part of the WORK.

1.03 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publications:
1. C80.1 Specification for Zinc Coated Rigid Steel Conduit
2. C80.5 Specifications for Rigid Aluminum Conduit

B. Federal Specifications (FS):

1.	FS W C 1094 W C 1094A	Conduit and Conduit Fittings, Plastic, Rigid
2.	FS WW C 540 WW C 540A	Conduit, Metal, Rigid, (Electrical, Aluminum)
3.	WW C 540C	Conduit, Metal, Rigid & Coupling, Elbow & Nipple, Electrical Conduit, Aluminum
4.	FS WW C 566 WW C 566C	Flexible Metal Conduit

C. National Electrical Manufacturers Association (NEMA) Publications:
1. RN 1 Polyvinyl Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
2. TC2 Electrical Polyvinyl Chloride (PVC) Conduit
3. TC3 Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
4. TC 6 PVC and ABS Plastic Utilities Duct for Underground Installation
5. TC14 Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

D. Underwriters Laboratories (UL) Standards:

1. 6 Rigid Metal Electrical Conduit
2. 6A Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless Steel
3. 360 Liquid-Tight Flexible Metal Conduit
4. 651 Electrical Rigid Nonmetallic Conduit and Fittings
5. 651A Type EB and A Rigid PVC Conduit and HDPE Conduit
6. 2515 Aboveground Reinforced Thermosetting Resin Conduit

1.04 SUBMITTALS

A. Submit complete catalog cuts of raceways, fittings, boxes, supports, and mounting hardware, marked where applicable to show proposed materials and finishes.

B. Prepare as-built drawings of encased concealed and exposed raceways, ducts, raceways, junction boxes, pull boxes, and electrical and instrumentation equipment.

1.05 LOCATIONS

A. Refer to Section 26 05 00 for definitions of types of locations.

PART 2 - PRODUCTS

2.01 GENERAL

A. Pull and junction boxes, fittings and other indicated enclosures that are dedicated to the raceway system shall comply with the requirements of this Section.

B. Provide exposed conduit of 3/4-inch minimum trade size and encased conduit of 1-inch minimum trade size. Provide 2-inch minimum trade size for conduits containing fiber optic cables.

C. The use of short sections of 1/2-inch flexible conduit for final termination of field control devices and instrumentation is permitted. They may not be longer than 36 inches in length, and may only transition to the smaller size junction boxes or condulets at the field device.

2.02 CONDUIT RACEWAYS

A. Galvanized Rigid Steel Conduit (GRS) shall be manufactured from mild steel, hot-dip galvanized inside and out, conforming to ANSI C80.1 and UL 6. Couplings shall be threaded type. Manufacturers shall be Allied Tube and Conduit, Wheatland Tube or approved equal.

B. Rigid Aluminum Conduit: Conduit shall be manufactured from 6063 alloy, temper T-1 and conform to FS WW C 540 OR ANSI C80.5 and UL-6A. Manufacturers shall be Allied Tube and Conduit, American Conduit OR approved equal.

C. PVC coated rigid steel conduit (PGRS) shall meet the requirements of GRS above. A PVC coating shall be bonded to the outer surface with a thickness not less than 40 mils. The inside surfaces and threads of the conduit shall be provided with a 2-mil urethane coating. PGRS shall be manufactured in accordance with UL-6, ANSO C80.1 and NEMA RN1. Manufacturers shall be Robroy Industries Perma-Cote or Plasti-Bond series, Thomas & Betts Ocal Blue or approved equal.

D. Liquidtight Flexible Conduit shall be constructed of a flexible galvanized metal core with a sunlight-resistant thermoplastic outer jacket. Conduit shall be

manufactured• in accordance with UL 360. Flexible conduit in hazardous areas shall be rated for the Class, Division and Group in which its installed. Manufacturers shall be Anaconda Sealtite, Electriflex Liquatite or approved equal.

E. Rigid Nonmetallic Conduit: Rigid nonmetallic conduit shall be PVC Schedule 40 (PVC 40) or PVC Schedule 80 (PVC 80) and sunlight resistant. Conduit shall be approved for underground use and for use with 90°C wires, and shall conform to NEMA TC-2 and UL 651. Manufacturers shall be Carlon, Cantex or approved equal.

F. Fiberglass conduit shall be manufactured using the single circuit filament winding process. The resin shall be epoxy-based, with no fillers. All additives for increasing flame spread and lowering smoke density shall be halogen free. Conduit shall be manufactured in accordance with NEMA TC 14. Manufacturers shall be Champion Fiberglass, United Fiberglass or approved equal.

2.03 CONDUIT SUPPORTS

A. For indoor, dry locations, supports for individual conduits shall be galvanized malleable iron one-hole type with conduit back spacer. All other locations shall be Type 316 stainless steel.

B. For indoor, dry locations, supports for multiple conduits shall be hot-dip galvanized Unistrut or Superstrut channels, or equal. All associated hardware shall be hot-dip galvanized. All other locations shall be Type 316 stainless steel.

C. All channels, strut, threaded rods, nuts and clamps in corrosive areas shall be of epoxy resin reinforced fiberglass material. Provide Robroy, Superstrut, or equal.

2.04 FITTINGS

A. General
   1. For use with metallic conduit, provide cast and malleable iron fittings of the threaded type with 5 full threads.
   2. Fittings
      a. Provide fittings with neoprene gaskets and non-magnetic stainless steel screws.
      b. Attach covers by means of holes tapped into the body of the fittings.
      c. Covers for fittings attached by means of clips or clamps will not be accepted.
   3. Terminations
      a. In outdoor areas, terminate conduit in rain-tight hubs as manufactured by Myers, O.Z. Gedney, Appleton or approved equal.
      b. In other than outdoor areas, provide sealed locknuts and bushings.

B. Fittings for use with rigid steel shall be hot dipped galvanized steel or galvanized cast ferrous metal; access fittings shall have gasketed cast covers and be Crouse-Hinds Condulets, Appleton Unilets, or equal. Provide threaded-type couplings and connectors; set-screw type and compression-type are not acceptable.

C. Fittings for use with aluminum shall be cast aluminum with less than 0.40 percent copper content, and suitable for use with aluminum conduit. Manufactures shall be O.Z. Gedney, Appleton, Crouse-Hinds or approved equal.

D. Fittings for use with PVC-coated GRS conduit shall be PVC-coated that are the products of the same manufacturer as the conduit. Both male and female threads and internal surfaces shall contain a 2-mil urethane coating.

E. Fittings for use with rigid nonmetallic conduit shall be PVC and have solvent-weld-type conduit connections. Boxes shall be manufactured of PVC or fiberglass reinforced polyester (FRP). Manufactures shall be Carlon, Crouse-Hinds, Hoffman or approved equal. If such are not available, then the Specification for PVC coated galvanized rigid steel fittings shall apply.

F. Fittings for flexible conduit shall be Appleton Type ST, O.Z. Gedney Series 4Q, or approved equal.

G. Fittings for use with fiberglass conduit shall be fiberglass and as recommended by the conduit manufacturer.

H. Combination expansion-deflection fittings with internal grounding shall be installed where conduit movement is expected in more than one dimension, and where conduits transition out of structures in locations where differential settlement may occur. Combination expansion/deflection fittings shall be manufactured by Crouse-Hinds Type XJGD or approved equal.

I. Expansion fittings with internal grounding shall be installed wherever exposed raceway cross building expansion joints. Expansion fittings shall be Crouse Hinds Type XLGSA or approved equal.

J. Union couplings for conduits shall be the Erickson type and shall be Appleton Type EC, O.Z. Gedney 3-piece Series 4, or approved equal. Threadless couplings shall not be used.

K. Bushings:
   1. Bushings shall be the insulated type.
   2. Bushings for rigid steel conduit shall be hot dip galvanized insulated grounding type, O.Z. Gedney Type HBLG, Appleton Type GIB, or approved equal.

L. Conduit seals in hazardous areas shall have zinc electroplate and shall be Crouse-Hinds Type EYS or EZS; Appleton Type EYS, ESU, or EY series; or approved equal.

M. Conduit seals in areas where chlorine, ammonia, sulfur dioxide and/or hydrofluosilicic areas shall be Link Seal or approved equal.

2.05 BOXES

A. Boxes specified herein are for use with raceway systems only. Boxes used for housing electrical and instrumentation equipment shall be as described elsewhere in these Specifications.

B. NEMA 1 Areas: NEMA 1 terminal boxes, junction boxes, pull boxes, etc. shall be either sheet or cast malleable iron or aluminum depending on raceway material. Boxes shall be suitable for wall mounting or have feet where self-standing. Boxes shall have continuously welded seams and welds shall be ground smooth. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All boxes shall have hinged gasketed doors with quarter turn latches or 3-point latch (single operator) system on enclosures larger than 36 inches wide or 32 inches tall. Terminal boxes shall be furnished with terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20A, 600V. Boxes shall be Concept Series as manufactured by Hoffman Engineering Co. or approved equal.

C. NEMA 4X Areas: NEMA 4X terminal boxes, junction boxes, pull boxes, etc. shall be Type 304 or 316 stainless steel. Boxes shall be suitable for wall mounting or have feet where self-standing. Boxes shall have continuously welded seams and welds shall be ground smooth. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All boxes shall have hinged gasketed doors with quarter turn latches or 3-point latch (single operator) system on enclosures larger than 36 inches wide or 32 inches tall. Terminal boxes shall be furnished with terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20A, 600V. Boxes shall be Concept Series as manufactured by Hoffman Engineering Co. or approved equal.

D. NEMA 7 Areas: Explosion-proof boxes shall be designed for the Class, Division and Group with which it is to be installed. Boxes shall have O-ring seals to meet NEM 4 requirements. Boxes shall be aluminum, with stainless steel hinged covers and stainless steel bolts. Boxes shall be as manufactured by Crouse Hinds Type EJB-N4, Appleton Electric, Adalet PLM or approved equal.

E. Boxes for use in chemically corrosive areas shall be of rigid PVC. Construction shall be the same as specified for NEMA 4X areas as specified above.

2.06 WIREWAYS AND AUXILIARY GUTTERS

A. General: Wireways shall consist of a prefabricated channel-shaped trough with hinged or removable covers, associated fittings, and supports. Straight sections shall not be longer than 5 feet. Separate power, control, signal and communications cables by grounded metallic dividers in wireways or run in separate wireways. Cross-sectional dimensions shall be as indicated on the Drawings. Fittings shall consist of elbows, tees, crosses, and closing plates as required.

B. Interior Locations: All components shall be constructed from sheet steel not less than 14 gauge and coated with a corrosion-resistant gray paint. Covers shall be held closed with hinges and clamps.

C. Exterior Locations: Wireway and associated fittings shall be NEMA rated for the area in which it is to be installed. Wireways shall be supplied with gasketed closing end plates and gasketed hinged covers.

D. Corrosive Locations: In corrosive locations provide enclosure type boxes for use as wireways. Enclosures and associated fittings shall meet NEMA 4X classifications and shall be manufactured from reinforced injection molded fiberglass or formed and welded stainless steel and shall have gasketed closing plates and hinged and gasketed covers with spring loaded latches.

E. Ground the steel and aluminum wireway bodies. Provide steel dividers with steel wireways or aluminum dividers with aluminum wireways, and ground by means of an individual grounding conductor.

F. Terminate conduits in all wet and damp locations with rain-tight hubs as manufactured by O.Z. Gedney, Myers or approved equal. In finished areas, provide sealed locknuts and bushings.

2.07 CONDUIT SEALANTS

A. Moisture Barrier Types: Sealant shall be a non-toxic, non-shrink, non-hardening, putty type hand applied material providing an effective barrier under submerged conditions.

B. Fire Retardant Types: Fire stop material shall be a reusable, non-toxic, asbestos-free, expanding, putty type material with a 3 hour rating in accordance with UL 1479. Provide products indicated by the manufacturer to be suitable for the type and size of penetration.

PART 3 - EXECUTION

3.01 CONDUIT, RACEWAY AND FITTING INSTALLATION

A. No wire shall be pulled until the raceway system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the raceway system has been completed in every detail.

B. From pull point to pull point, the sum of the angles of all of the bends and offsets shall not exceed 270 degrees.

C. Coat threads with a conductive lubricant before assembly.

D. Provide joints that are tight, thoroughly grounded, secure and free of obstructions by use of a mandrel. Adequately ream the conduit in order to prevent damage to the wires and cables inside. Use strap wrenches and vises to install the conduit in order to prevent wrench marks on the conduit. Any conduit with wrench marks shall be replaced.

E. The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction. Duxseal, or 3M seal spray shall be used in all applications. Plugging with tape is prohibited, even for short periods of time.

F. For power, control and signal circuits, provide conduit per Conduit Use Tables below, unless specifically indicated otherwise on the Drawings:
   1. Exception: For raceways leaving a building above grade and then going below grade, provide PVC-coated GRS from a point 3 feet above grade to a point 5 feet from the building wall.

G. Unless boxes have cast, threaded hubs, provide insulated type metallic grounding bushings for metallic conduits at all boxes. Bond together all conduits to provide continuity of the equipment grounding system. Size bonding conductor per NEC.

H. Provide flexible conduit in lengths of not more than 36 inches at connections to motors, valves and any equipment subject to vibration or relative movement. All flexible conduits, regardless of length or manufacturer rating, shall have a dedicated ground bonding conductor pulled through, whether it is included in the conduit fill schedules or not.

I. Conduits embedded in concrete floors on grade shall be installed between grids of reinforcing steel, or shall be encased below the floors, provided the concrete is thickened in a manner satisfactory to the Engineer. Installation of conduit below the bottom of this slab is not acceptable; embedding or encasing is required.

J. Damage to PVC coating of coated conduits or fittings shall be repaired with factory-approved PVC patching material to the original factory condition.

K. Install fiberglass conduit in accordance with the manufacturer's instructions. Connections between sections of conduit may be either glued or threaded, at the Contractor's option.

L. Underground Raceways: Slope all underground raceways to provide drainage; for example, slope conduit from equipment located inside a building to the handhole located outside the building. For additional requirements see Section 26 05 43.

M. Conduit Supports: Properly support all conduits as required by the NEC. Run all conduits exposed except where the Drawings indicate that they are to be embedded in the floor slab, walls, or ceiling, or to be installed underground.
   1. Exposed Conduits:
      a. Support exposed conduits within 1 foot of any outlet and at intervals not exceeding NEC requirements; wherever possible, group conduits together and support on common supports. Support exposed conduits fastened to the surface of the concrete structure by one-hole clamps, or with channels. Use conduit spacers with one-hole clamps. Coordinate conduit locations with piping, equipment, fixtures, and with structural and architectural elements. Conduits attached to walls or columns shall be as unobtrusive as possible and shall avoid windows. Run all exposed conduits parallel to building lines. No diagonal runs will be accepted. Bends in parallel runs shall be concentric and shall be run straight and true.
      b. Group together exposed conduits in horizontal runs located away from walls and support on trapeze hangers. Arrange such conduits uniformly and neatly. Trapeze hangers shall consist of channels of adequate size, suspended by means of minimum 3/8” diameter rods or other suitable means from the ceiling or from pipe hangers. Install such runs so as not to interfere with the operation of valves or any other equipment, and keep at least 6 inches clear of any pipe which may operate at more than 100°F. Treat cut surfaces or damaged ends with corrosion-resistant coatings such as "Devcon Z", prepared by Subox Coatings; "Galvanox Type I", prepared by Pedley-Knowles; or approved equal. Application shall follow manufacturer's recommendation.

N. All penetrations through walls into or out of corrosive locations, as defined in Section 26 05 00 shall be made gas-tight. In concrete walls, pour concrete after the conduit is in place, if possible. If not, core drill concrete or CMU walls, install conduit and caulk around it with non-shrink grout. Install conduit seal in each conduit near the penetration.

O. All conduit penetrations through interior walls and floors shall be sealed with fire retardant type conduit sealant.

P. Conduit Identification: In each handhole, pullbox, cabinet, motor control center or other equipment enclosure, identify each conduit using the conduit number shown on the Drawings by means of a stamped brass tag affixed with stainless steel wire; where affixing a tag is not feasible, identify conduits by affixing a brass tag with epoxy or other approved method of stenciling to the wall or structure adjacent to the conduit terminus.

Q. Conduit Seals:
   1. Moisture Seals: Provide in accordance with NEC Paragraph 300.5(g).
   2. Gas Seals: Provide in accordance with NEC Paragraph 501.5.

R. Aluminum conduit shall not be installed underground or encased in concrete. If necessary to run through concrete, install in a non-metallic conduit sleeve or use PVC coated conduit.

S. Rigid PVC conduit shall be stored on a flat surface and shielded from the sun.

CONDUIT USE TABLE 1

	Inside Buildings						
	Exposed			**Concealed**			
Circuit Type	Standard	Corrosive	Hazardous	Above Suspended Ceilings	In Stud Walls	Embedded In Concrete	Slab On Grade
Power & 120 Vac Control	GRS or Aluminum**	PVC Coated GRS or Aluminum**	PVC Coated GRS or Aluminum**	PVC-80 or GRS	GRS	PVC-40 or PVC-80	PVC-40 or PVC-80
Signal	GRS or Aluminum**	PVC Coated GRS or Aluminum**	PVC Coated GRS or Aluminum**	GRS	GRS	GRS	GRS
Fiber Optic Cable	GRS or Aluminum**	PVC Coated GRS or Aluminum**	PVC Coated GRS or Aluminum**	PVC-80 or GRS	GRS	PVC-80	PVC-80

CONDUIT USE TABLE 2

	Outside Buildings			**Transition**
Circuit Type	Exposed	Buried In Soil	Duct Bank Encased In Concrete	Within 5 Feet of Building
Power & 120 Vac Control	PVC Coated GRS, Aluminum** or Fiberglass**	PVC Coated GRS	PVC-40	PVC Coated GRS
Signal	PVC Coated GRS, Aluminum** or Fiberglass**	PVC Coated GRS	GRS	PVC Coated GRS
Fiber Optic Cable	PVC Coated GRS, Aluminum** or Fiberglass**	PVC Coated GRS or PVC-80	PVC-40	PVC Coated GRS

* Provide ground wire sized per NEC requirements for all circuits.

** Aluminum and/or Fiberglass may be used in corrosive locations where environmental conditions warrant its use.

Notes:
1. Generally, the Conduit Use Tables apply.
2. Signal circuits are those subject to RF interference or induced current. MSPs, TSPs, telephone cable, coaxial cable, and manufacturer's cables specially designed for low level signals are all presumed to be part of signal circuits.
3. Provide fiberglass conduit where indicated on the Drawings.

3.02 WIREWAY INSTALLATION

A. Straight sections and fittings shall be solidly bolted together to be mechanically rigid and electrically continuous. Dead ends shall be closed. Unused conduit openings shall be plugged.

B. Wireways shall be supported every 5 feet.

C. Wireways and auxiliary gutters shall not contain wiring or control devices and shall not extend over 30 feet in length.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 05 43

UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 become a part of this Section as if repeated herein.

1.02 APPLICABLE STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. American Concrete Institute (ACI) Publication:
      a. 318 Building Code Requirements for Structural Concrete
   2. American Society of Testing and Materials (ASTM) Publications:
      a. A36 Standard Specification for Carbon Structural Steel
      b. A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
      c. A615 Standard Specification for Deformed and Plain Carbon - Steel Bars for Concrete Reinforcement
      d. C33 Standard Specification for Concrete Aggregates
      e. C139 Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
      f. C150 Standard Specification for Portland Cement
      g. C478 Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
      h. C857 Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
      i. C858 Standard Specification for Underground Precast Concrete Utility Structures
      j. D882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting
   3. American Association of State Highway and Transportation Officials (AASHTO) Publication:
      a. HB Standard Specifications for Highway Bridges
   4. American National Standard Institute (ANSI) Publication:
      a. C2 National Electrical Safety Code
   5. National Fire Protection Association (NFPA) Publication:
      a. 70 National Electrical Code (NEC)

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 26 05 00.

B. Manufacturer's Data and Shop Drawings:
   1. Manhole and Handhole - Include a table of dimensions which shows proposed size of each manhole and handhole.

2. Manhole Frame and Cover
3. Handhole Frame and Cover
4. Sealing Material for Precast Manhole and Handhole Joints

C. Certificates
1. Test Reports: Submit for approval 30 days before the materials are used, copies of laboratory test reports for the following:
a. Arc-proofing test for cable fireproofing materials

D. As-Built Drawings
1. Prepare as-built drawings of encased, concealed and exposed raceways, ducts, junction boxes, pull boxes and electrical and instrumentation equipment.
2. Show routings, burial depths, manhole and handhole locations and sizes, and where applicable, connections to drainage systems.
3. Furnish the drawings to the Engineer in accordance with the requirements of Section 01 33 00.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated.

B. Conduit: Provide per Section 26 05 33.

C. Wire and Cable: Provide per Section26 05 19, Section26 05 13, and Section 26 05 20.

2.02 CAST-IN-PLACE AND PRECAST MANHOLES

A. Cast-in-place concrete manholes shall have a smooth trowel finish for floors and horizontal surfaces. Concrete shall conform to Division 3, Precast concrete manholes, risers and tops shall conform to ASTM C478, except that the spacing of manhole steps or ladder rungs shall not exceed 16 inches. Precast units (ACI 318) shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete manholes and handholes. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls, bottom and top of manholes shall be of monolithic concrete construction; sectionalized construction is not acceptable. Duct entrances and windows shall be located near the corners of structures to facilitate cable racking. Covers AND/OR Doors shall fit the frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair their strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide all necessary lugs, rabbets, and brackets. Set pulling-in iron shall be installed in the wall opposite each duct line entrance. The words "ELECTRICAL" shall be cast in the top face of all manhole covers. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable. Cable racking hardware shall be non-metallic and corrosion resistant as manufactured by Pacific Utilities Supply, or equal.

B. Metal Frames, Covers: Provide steel or malleable iron frames, Covers.

C. Manhole Covers:
   1. Manhole covers shall be hot-dipped galvanized steel after fabrication with spring operated hinged doors. Traffic doors shall be rated for HS 20-44 wheel loading as given in AASHTO HB**.**
   2. Covers: Prior to galvanizing, the covers shall have letters applied, "E" for power manholes and "S" for signal manholes. Letters shall be not less than 5 inches high formed by means of a welding bead in the center of the cover.

D. Complete manholes shall be rated for HS 20-44 wheel loading as given in AASHTO HB.

2.03 HANDHOLES

A. Provide handholes of reinforced precast concrete, or injection molded composite plastic material. Handholes shall include a base, a body, extensions, and a cover. Handholes with a perimeter of 10 feet or more (e.g., 3 feet by 2 feet) shall have both pulling irons and cable racks. All hardware shall be stainless steel, or hot-dip galvanized after fabrication; cable racking hardware, however, shall be non-metallic and corrosion resistant as manufactured by Pacific Utilities Supply (415) 495-4940 (see PG&E Standard Detail Drawing 028077), or equal. If no handhole size is shown on the Drawings, size units per NEC or provide 12 inches by 24 inches by 18 inches deep, whichever is larger. Handholes containing fiber optic cables shall be 32 inches by 48 inches by 36 inches deep at a minimum. Structure shall be fabricated in accordance with ACI 318.

B. Handholes shall be HS 20-44 as given in AASHTO HB. Handholes shall withstand 350 pounds loading per square foot.

2.04 WARNING TAPE

A. Provide plastic-metallic, detectable warning tape for installation above underground duct banks. Tape shall be designed for both conductive and inductive locating procedures.

B. Construction:
   1. Tape shall consist of a minimum of three layers: a polyolefin pigmented film, an aluminum foil core, and a clear encapsulating film.
   2. The tape material and ink shall be chemically inert and resistant to acids, alkalis, and other destructive substances likely to be encountered in soils.
   3. Thickness: 5-mil minimum.
   4. Width: 6-inches.
   5. Tensile strength: 130 pound-feet minimum, per ASTM D882.

C. Color coding and markings:
   1. For use above duct banks containing copper power, control, signal, and/or telecommunication cables: Red tape imprinted with “CAUTION BURIED ELECTRIC LINE BELOW.”
   2. For use above duct banks containing fiber optic cables: Orange tape imprinted with “CAUTION BURIED FIBER OPTIC LINE BELOW.”

D. Manufacturer: Terra Tape Sentry Line Diamond Detectable by Reef Industries, Inc.; Detectable Underground Warning Tape by Emedco; or approved equal.

2.05 TRACER WIRE SYSTEM

A. Provide #12 AWG copper clad steel wire. Insulation shall be red for power and control, orange for communication or fiber-optic, 45-mil thickness, high molecular weight polyethylene (HMWPE) conforming to ASTM D-1248.

B. Use waterproof, corrosion-proof connectors for all wire splices.

C. Provide two-terminal switchable lid that provides external connection for transmitter and ground connections. Accessibility points shall be located at either side of the duct bank run.

D. Ground tracer wire at each access terminal box with a 1.5lb, drive-in magnesium grounding anode with a minimum of 20 feet of lead wire.

E. Manufacturer: Copperhead Industries; 3M; or approved equal.

PART 3 - EXECUTION

3.01 TRENCHING, BACKFILL, AND COMPACTION

A. See Section 31 00 00.

B. Warning Tape:
1. Install warning tape in backfill material, 6-inches above top of conduit or top of encasement for all underground duct banks.
2. Use clips from the tape manufacturer to ensure that splices or lateral tees in warning tape are electrically continuous for the entire length between accessible pulling point locations along the duct bank.
3. In duct bank segments containing both copper and fiber optic cable types, install both types of warning tape.

C. Tracer Wire:
1. Install tracer wire in backfill material, 6-inches above top of conduit or top of encasement for all underground duct banks.
2. Tracer wire shall be installed as a single continuous wire. Splicing of wire, if necessary, shall be done in such a way to produce an electrically and mechanically sound connection.
3. Use lockable connectors specifically designed for direct burial, dielectric silicone gel-filled, designed to prevent uninsulated wire exposure.
4. Install grade-level access terminal boxes, minimum of two; one each at the beginning and end of the duct bank routing to be located.
5. Verify tracer wire installation by using a low frequency (512Hz or similar) line locating equipment. Tracer wire shall be verified upon completion of rough grading and again prior to final acceptance of project.
6. Continuity testing of the tracer wire system in lieu of using location equipment shall not be accepted.

3.02 WIRE AND CABLE INSTALLATION

A. See Section 26 05 19, Section 26 05 13, Section 26 05 20 and Section 27 13 23.

3.03 UNDERGROUND RACEWAYS WITH CONCRETE ENCASEMENT

A. All underground raceways shall be encased in concrete unless otherwise specifically shown otherwise on the Drawings.

1. Concrete encasement shall be minimum of 3 inches around outer walls of raceways and minimum of 3 inches between raceways. Conduits shall be PVC Type EB.
2. Concrete shall be portland cement type with 4 sacks cement per cubic yard of concrete, maximum coarse aggregate size of 3/8-inches and shall have minimum strength of 3,000 psi after 28 days. Amount of water shall not exceed slump required for placement.
3. The concrete shall be dyed red throughout the ducts; surface treatment will not be acceptable. Colorant shall consist of an integral red-oxide coloring pigment in the proportion of 8 pounds per cubic yard of concrete. The costs, if any, of cleaning coloring pigment from the concrete delivery equipment and other related cleanings shall be considered as part of the work.
4. Underground raceways shall slope toward manholes, pull boxes, etc., at minimum rate of 3 inches per 100 feet unless indicated otherwise on Drawings. Raceway entrances in manholes, handholes, etc., shall be by means of bell ends and shall be sealed against entry of silt, debris, rodents, etc., into raceways.
5. Top of concrete encasement shall be minimum of 24 inches below grade.
6. Minimum radius of all horizontal bends in underground duct banks shall be 12 times nominal size of conduit for conduit sizes 3-inches and below and 24 times nominal size of conduits for conduits larger than 3-inches. Bends shall be formed of factory-made sweeps or continuous assembly of bend segments or curved segments; except that polyvinyl chloride conduits may be field formed. Minimum radius of all vertical bends in underground raceways shall be ten times nominal size of conduit. Vertical bends shall be made of rigid steel or permanently coated aluminum conduit.
7. Underground raceways within roadways shall be run parallel or perpendicular to road centerline.
8. Pull ropes left in underground raceways:
    a. General purpose raceways:1/8-inch nylon or 3/16-inch polypropylene rope.
    b. Fiber optic raceways: Low friction, polyethylene jacketed polypropylene rope as specified in Section 26 05 33.
9. Terminate conduits in end-bells where duct lines enter manholes and handholes. Provide structural support for concrete encased duct banks at the point where they terminate. Separators shall be of precast concrete, high impact polystyrene, steel, or any combination of these. Stagger the joints of the conduits by rows and layers so as to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs. As each section of a duct line is completed, draw a brush through having the diameter of the duct, and having stiff bristles until the conduit is clear of all particles of earth, sand, and gravel; then immediately install conduit plugs. Unused conduits shall remain plugged.

B. Connections to Existing Ducts: Where connections to existing duct lines are indicated, excavate the lines to the maximum depth necessary. Cut off the lines and remove loose concrete from the conduits before new concrete encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct line, to take the shear at the joint of the duct lines. Remove existing cables that constitute interference with the work. Abandon in place those used ducts and cables that do not interfere with the work.

C. Removal of Ducts: Where duct lines are removed from existing manholes, close the openings to waterproof the manhole. Chip out the wall opening to provide a key for the new section of wall.

D. See Section 26 05 33 for additional requirements.

3.04 UNDERGROUND RACEWAYS WITHOUT CONCRETE ENCASEMENT

A. Provide raceways without concrete encasement only if specifically shown on the Drawings, otherwise, provide concrete encasement as above.

B. Provide sand backfill three inches all around the raceway.

C. Construct raceways per the applicable provisions above for underground raceways with concrete encasement.

D. See Section 26 05 33 for additional requirements.

3.05 MANHOLES AND HANDHOLES

A. Provide manholes and handholes complete with all accessories, as indicated. Provide additional handholes as needed so that the spacing between handholes does not exceed 300 feet.

B. Identification:
1. Identify each casting by having the manufacturer's name and address cast into an interior face or permanently attached thereto.
2. Stencil manhole and handhole structure identification tags as indicated on the Drawings with paint inside the neck or interior wall beneath the lid with 3-inch-high yellow letters.
3. For manholes and handholes within a controlled site (i.e., not within the public right-of-way): Permanently mark the exposed top of each lid with the structure identification tag as indicated on the Drawings. Markings shall be welded, etched, stamped, or cast into the metal cover. Painted markings are not acceptable.
4. Covers of dedicated fiber optic manholes and handholes shall have the words "Fiber Optic" in raised letters on the top.

C. Manhole, Handhole, or Concrete Pullbox Grounding: Ground rods installed in electrical distribution system manholes, handholes, or concrete pullboxes shall be properly connected to the cable shielding, metallic sheath, and armor at each cable joint or splice by means of No. 4 AWG or equivalent braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Ground wires shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Ground wires shall be neatly and firmly attached to manhole and handhole walls and the amount of exposed bare wire shall be held to a minimum.

D. Installation of Cable in Manholes and Handholes: Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form all cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators at a maximum of 18 inches. In existing manholes, handholes and vaults where new

ducts are to be terminated or where new cables are to be installed, provide cable supports and grounding as required for a neat and workmanlike installation with all cables properly arranged and supported. Support cable splices in underground structures by racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure. Provide additional cable racks in each existing underground structure through which new cable is run.

E. Fireproofing (Arc Proofing) of Cables in Manholes, Handholes and Vaults: All wire and cables which will carry current at 2,200 volts or more in manholes, handholes, and vaults shall be fireproofed.

1. Arc-proofing Test for Cable Fireproofing Materials: Test one sample assembly consisting of a 3-inch diameter lead tube with a 1/4-inch wall thickness, fireproofed as specified. Make tests at three different points. At each point the testing shall consist of an arc magnetically blown against the test assembly until melting occurs at the point of arc contact. The arc shall be struck between two 7/8-inch electrodes located one inch from the sample assembly. Electrodes must be electrodes located one inch from the sample assembly. Electrodes must be squared off after each test run. Arc current shall be between 195 and 210 amperes at 40 vdc. For each test the fireproofing shall prevent damage to the lead for at least 25 seconds at any point and an average time of no less than 30 seconds for the test. In lieu of the above test, the Contractor may submit copies of the report of such a test previously made for the manufacturer, with certification that the material supplied for this project is the same as that used in the test. Test elements and requirements shall be essentially as specified in the test above.
2. Fireproofing Tape: Strips of fireproofing tape approximately 1/16-inch thick by 3 inches wide shall be wrapped tightly around each cable spirally in half-lapped wrapping, or in two butt-joined wrappings with the second wrapping covering the joints in the first. The tape shall be applied with the coated side toward the cable and shall extend one inch into the ducts. To prevent unraveling, the fireproofing tape shall be random wrapped the entire length of the fireproofing with pressure sensitive glass cloth tape. The fireproofing tape shall consist of a flexible, conformable fabric having one side coated with flame retardant, flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050-inch thick and shall weigh not less than 2.5 pounds per square yard. The tape shall be noncorrosive to cable sheath, shall be self-extinguishing, and shall not support combustion. The tape shall not deteriorate when subjected to oil, water, gases, salt water, sewage and fungus.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 05 73

POWER SYSTEM STUDIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 become a part of this Section as if repeated herein.

1.02 SCOPE OF WORK

A. Obtain the services of an independent firm to provide complete Short-Circuit and Protective Device Coordination studies, and Arc Flash Risk Assessment for the electrical system as defined below. The firm performing the work shall have been regularly engaged in short-circuit and protective device coordination services for a period of at least 10 years.

B. The firm performing the work shall be responsible for the collection of all data required to perform the studies, including the electrical utility company's short-circuit current contribution.

C. For the purpose of this specification Section, the "Electrical System" shall be defined as the entire power distribution system, including the utility company's main service disconnect down through the main circuit breaker on each 480/277VAC VAC panelboard of all distributed branch circuits. Some equipment not modified as part of this contract is required to be included in the studies defined in this Section. Items within the "Electrical System" are comprised of:
   1. All utility transformers
   2. All medium voltage equipment
   3. All medium voltage to low voltage transformers
   4. All 480 VAC generators, transfer switches, switchboards, panelboards, distribution, power conditioning, motor control, and motors

D. The Short-Circuit Study shall provide for the calculation of fault currents at each piece of gear in the Electrical System for the entire Site. Fault currents shall be calculated for scenarios of utility and standby power, as outlined in this Section.

E. The Protective Device Coordination Study shall include trip characteristics for all protective devices in the Site Electrical System, from the utility company's main service disconnect through the main circuit breaker on each 480/277 VAC panelboard of all distributed branch circuits. Trip characteristics shall be analyzed for scenarios of utility and standby power, as outlined in this Section.

F. The Arc Flash Risk Assessment shall provide for arc flash incident energy calculations at all panels as required by IEEE 1584 (2018 Edition) and NFPA 70E.

G. Reports:
   1. Reports for the Short-Circuit Study, Protective Device Coordination Study, and Arc Flash Risk Assessment shall be stamped and signed by a Registered Electrical Engineer.
   2. Report calculations shall be generated by a software analysis application with proven accuracy and reliability at performing 3-phase fault calculations.

1.03 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

B. American National Standards Institute (ANSI)

C. The National Fire Protection Association (NFPA)

D. InterNational Electrical Testing Association (NETA) Standard for Acceptance Testing Specifications (ATS)

E. NFPA 70E, Standard for Electrical Safety in the Workplace

F. IEEE 1584 (2018 Edition), Guide for Performing Arc-Flash Hazard Calculations

G. Occupational Safety and Health Administration (OSHA) (29 CFR PART 1910), Occupational Safety and Health Standards for General Industry

1.04 SUBMITTALS

A. Submit data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 26 05 00.

B. Submit credentials of firm performing the studies to demonstrate sufficient experience with performing this type of work, as specified herein.

C. Preliminary: Preliminary Short-Circuit Study, Protective Device Coordination Study, and Arc Flash Risk Assessment shall be submitted to the Engineer for review prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

D. Results of the Short-Circuit Study, Protective Device Coordination Study, and Arc Flash Risk Assessment shall be summarized in a final report. Submit hardbound copies of the complete final report and one digital copy in PDF on a CD. Electronic delivery shall contain full searchable text, and include any computer models developed for the studies at no additional cost.

E. Sample arc flash warning labels for each piece of equipment. Submit copies of labels at full size, with all required information as calculated by the Arc Flash Risk Assessment.

1.05 DATA COLLECTION

A. The firm performing the Short-Circuit Study, Protective Device Coordination Study, and Arc Flash Risk Assessment shall furnish the Contractor with a listing of required data. The Contractor shall collect and furnish all required data. The Contractor shall expedite collection of the data to eliminate unnecessary delays and assure completion of the studies as required for final acceptance of the equipment shop drawings and/or prior to the release of the equipment for manufacturing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Short-Circuit Study and Protective Device Coordination Study shall be performed as outlined in InterNational Electrical Testing Association (NETA) Standard for Acceptance Testing Specifications, Section 6 with exceptions as included in this Section.

B. In order to select relays and fuse characteristics as required for optimum coordination, the coordination study shall be performed as soon as the vendors for the new electrical equipment are identified. Relays and fuse selection by the power distribution equipment suppliers shall be based on the results of the favorably reviewed study.

C. The studies shall be submitted to the Engineer for acceptance before final acceptance of power distribution equipment submittals and before any settings are made on equipment.

D. The final report for the Short-Circuit Study, Protective Device Coordination Study, and Arc Flash Risk Assessment shall be bound in a standard 8 1/2-inch by 11 inch sized report. The selection of all protective relay types, current transformers, and fuse types and ratings shall be the responsibility of the manufacturer and shall be based on the preliminary draft of the coordination study, which shall be submitted with the equipment shop drawings (or earlier). The studies shall be accepted by the Engineer before any equipment is shipped. See Paragraph 1.04 for submittal requirements.

E. The report shall include a single line diagram depicting the entire Electrical System included in the analysis. At a minimum, the single line diagram shall be on an 11-inch by 17-inch sheet, and include the following information:
   1. Equipment/bus tags which match the contract documents
   2. Equipment/bus ampacity ratings
   3. Motor horsepower
   4. Protective device frame rating, trip setting, and curve options, as applicable
   5. Transformer primary/secondary voltages, kVA rating, and impedance
   6. Conductor materials, insulation types, and lengths

F. The studies shall be run on each of the following scenarios:
   1. Utility power
   2. Generator power where applicable

3.02 SHORT-CIRCUIT STUDY

A. Provide a complete Short-Circuit Study. The study shall include, but shall not be limited to, the following, as applicable:
   1. Full compliance with applicable ANSI and IEEE Standards.
   2. Performed on nationally recognized computer software, such as ETAP or SKM Power Tools.
   3. Overall system impedance diagram. The diagram shall include the power company's impedance and X/R ratios and circuit element impedances (e.g., transformers, generators, motors, VFDs, feeders, distribution buses as applicable).

4. Available three phase and ground fault asymmetrical and symmetrical short-circuit fault currents at each piece of electrical equipment, bus, transformer, etc.
5. The momentary and interrupting rating of all elements of the distribution system shall be listed. The maximum available short-circuit fault current available at each element shall be calculated.
6. Executive summary describing the distribution system, the procedures used to develop the study, utility related information furnished by the utility company, including the name and telephone number of the individual supplying the information, identification of all assumptions made in the preparation of the study, identification of any problem areas, and a definitive statement concerning the adequacy of the distribution system to interrupt and withstand the maximum possible short-circuit fault current.
7. Computer printouts for the three phase, single phase and ground fault studies. Printouts shall indicate the short-circuit fault current available at each major equipment and distribution bus within the medium and low voltage distribution systems.

3.03 PROTECTIVE DEVICE COORDINATION STUDY

A. Provide a complete Protective Device Coordination Study. The Protective Device Coordination Study shall include, but shall not be limited to:
   1. Utility protective devices.
   2. Service entrance and distribution switchgear.
   3. Medium and low voltage power system transformers.
   4. Low voltage switchgear, switchboards, power distribution panels and motor control centers.
   5. Power factor correction and harmonic mitigation equipment.
   6. Motor starters and variable frequency drives.
   7. Standby generators.
   8. A tabulation of all the settings for every over current protective device, timer, power system relays (e.g., ANSI 50, 51), circuit breaker, recommended fuse and current transformer ratings, etc.
   9. Transformer excitation current.
   10. Motor and cable damage curves in accordance with the manufacturer's recommendations.
   11. Select relay types (e.g., inverse, very inverse, extremely inverse, overcurrent with or without voltage restraint, timers), current transformer ratings and types, fuse, residually or zero sequence connected ground faults protection, etc. that will allow the system to be protected within the equipment fault ratings and provide the maximum possible coordination between the protective devices.
   12. Provide recommended settings for protective devices, such as relays and circuit breakers, to achieve the best selectivity to minimize system disturbances during fault clearing.
   13. Provide a complete set of time-current coordination curves on log-log paper for every protective relay, circuit breaker, fuse, timer, etc. serving or located in the electrical equipment furnished for the project, including the utility protective devices. Provide a separate time-current curve for each unique feeder system, without displaying parallel devices powered from a common bus. The time-current curves shall display the coordination from the lowest device in the distribution system up through the utility's protective device. Clearly identify each device curve displayed on the graph, by color coding

and text callouts. Include specific settings used for the curve (as applicable) in the text callout. A single line diagram depicting the portion of the distribution system under study shall appear with each curve. The minimum size log paper to be submitted shall be 11-inch by 17-inch.

14. Time current curves shall include transformer ANSI damage and inrush curves, cable damage curves, circuit breaker and fuse ratings and settings, protective relay settings, and any other information required by ANSI and good design practices. As a minimum, provide curves for:
    a. Each medium voltage and low voltage feeder down to 480-volt motor control centers and panelboards.
    b. Each main, tie and feeder circuit breakers located in medium voltage and low voltage switchgear, motor control centers and panelboard. Include the largest feeder circuit breaker in each motor control center and panelboard.
    c. Each ground fault protective device provided for the medium voltage and low voltage power distribution systems.

B. The report shall include a reference to any part of the Electrical System where selectivity cannot be achieved, and a brief explanation of the cause. Provide recommendations where applicable for alternate methods that would improve selectivity.

3.04 ARC FLASH RISK ASSESSMENT

A. Provide a detailed Arc Flash Risk Assessment. The analysis shall include, but shall not be limited to:
    1. Determine potential arc flash incident energies, arc flash boundaries, shock hazard boundaries and proper personal protection equipment (PPE) for all energized electrical equipment.
    2. The study shall determine worst-case scenarios for the arc flash energy level calculations, and any suggested changes to the protection scheme or equipment selection that will result in improved system reliability and safety.
    3. The study shall indicate the worst-case values for each of the scenarios listed in Paragraph 3.01F. Provide values in tabular format including at a minimum, location of fault, incident energy, arc flash boundary, working distance, acting protective device, protective device activation time, and arcing fault current.
    4. Provide executive summary, including introduction, methodology, information sources, key assumptions, NFPA 70E considerations and calculations.
    5. Develop and install arc flash warning labels based on arc flash study results.

3.05 FIELD ADJUSTMENT

A. All field adjustment and modifications shall be performed in the presence of the Owner, before energizing equipment.

B. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments shall be completed by the equipment manufacturer.

C. Make minor modifications to equipment as required to accomplish conformance with Short-Circuit and Protective Device Coordination studies.

3.06 MODIFICATIONS

A. Notify the Owner in writing of any required major equipment modifications. Major modifications to the equipment shall not be allowed unless otherwise approved in writing by the Engineer and the Contracting Agency.

3.07 ARC FLASH WARNING LABELS

A. The vendor shall provide a 4 inch by 4 inch thermal transfer type label of high adhesion polyester for each work location analyzed. Labels shall be machine printed, with no field markings.

B. The label shall have an orange header, compliant with ANSI Z535, with the wording, "WARNING, SHOCK & ARC FLASH HAZARD", and shall include the following information:
   1. Location designation (equipment identification tag)
   2. Nominal voltage
   3. Arc flash boundary
   4. Incident energy at working distance (in calories/centimeter-squared)
   5. Working distance
   6. Shock boundaries
      a. Limited approach distance
      b. Restricted approach distance
   7. Required personal protective equipment,
   8. Engineering report number, revision number and issue date.
   9. Where voltage exceeds 600 VAC or incident energy is greater than 40 cal/cm2, label header shall be changed to "DANGER, SHOCK & ARC FLASH HAZARD."

C. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
   1. For each 600, 480 and applicable 240 and 208 VAC panelboards and disconnects, one arc flash label shall be provided.
   2. For each industrial control panel, provide one arc flash label.
   3. For each transformer, provide one arc flash label at both the front and rear access points, as applicable.
   4. For each low voltage motor control center, at least one arc flash label shall be provided. Motor control centers larger than five sections shall bear one arc flash label for each five sections. Back-to-back or turned corner configurations shall be treated as two motor control centers for the purpose of labeling.
   5. For each 96-inches of low voltage switchboard, one arc flash label shall be provided.
   6. For each standalone VFD or motor starter, one arc flash label shall be provided.
   7. For each switchgear, provide one arc flash label for each the front and rear of the incoming compartment and one arc flash label on each compartment that houses a draw-out device.
   8. For each medium voltage motor control center, provide one arc flash label each for the front and rear of the incoming compartment, one label for each individual starter or switch operating handle, and one label each for any draw-out power drawers.
   9. Where equipment includes a "maintenance mode" bypass setting on a protective device as a temporary arc-flash reduction measure, provide one

arc flash label at the applicable protective device which indicates the calculated values when maintenance mode is enabled. This label shall be clearly marked to indicate what it represents.

D. The Contractor shall affix the labels in accordance with the following:
   1. Labels shall be in a clearly visible location on the front panel of the equipment near the incoming service or main protective device. Labels on equipment with bottom-entry incoming service shall be placed a minimum of 60-inches from the bottom of the equipment.
   2. Labels affixed to outdoor equipment which includes an outer door and inner deadfront panel shall be placed on the deadfront panel to avoid fading due to exposure to the elements.
   3. For labels affixed to removable compartment doors or covers, the removable cover shall be clearly marked to identify the specific compartment for which it is intended to be used.

3.08 ARC FLASH TRAINING

A. The equipment manufacturer shall provide arc flash training to the Contracting Agency's staff. At a minimum, the training shall include potential arc flash hazards associated with working on energized equipment and maintenance procedures in accordance with the requirements of NFPA 70E, Standard For Electrical Safety Requirements For Employee Workplaces. The training shall be recorded in a video format and provided on a DVD or solid-state media to the Contracting Agency.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 become a part of this Section as if repeated herein.

B. Work Included:
1. Installation, connection and furnishing all single, duplex, GFI and special purpose receptacles complete with wall plates and/or covers as shown on the Drawings.
2. Installation, connection and furnishing of all single pole, three-way, pilot light and momentary position toggle switches complete with wall plates and or handle operators as shown on the Drawings.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publication:
1. C73 Plugs and Receptacles
2. C73a Plugs and Receptacles
3. 568 Communication Cables

B. Federal Specifications (FS):
1. W-C-596 D & E General Specifications for Cable Outlet Electrical Connector
2. W-S-896 D & E General Specifications for Flush Mounted Toggle and Lock Switches

C. National Electrical Manufacturers Association (NEMA) Publications:
1. WD 1 General Color Requirements for Wiring Devices
2. WD 6 Wiring Devices - Dimensional Specifications

D. Underwriters Laboratories (UL) Standards:
1. 20 General-Use Snap Switches
2. 498 Standard for Attachment Plugs and Receptacles
3. 514 Electrical Outlet Boxes
4. 943 Ground-Fault Circuit-Interrupters

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Requirements and the submittal requirements of Section 26 05 00.

B. Submit complete catalog cuts of switches, receptacles, enclosures, covers and appurtenances, marked to clearly identify the proposed materials.

C. Submit documentation showing that the proposed materials comply with the requirements of the NEC and UL.

1.04 LOCATIONS

A. Refer to Section 26 05 00, General Electrical Requirements, for definitions of types of locations.

PART 2 - PRODUCTS

2.01 RECEPTACLES

A. General: Receptacles shall be heavy duty, high abuse, grounding type conforming to NEMA configurations, NEMA WD1 and UL 514 Standards.

B. Single and Duplex Receptacles:
   1. Receptacles shall be of back and side wire design utilizing screw type terminals. Receptacles shall be rated 20 ampere, two-pole, 3-wire, 120-volt, NEMA 5-20 configuration, self-grounding. Color shall be brown in industrial areas and ivory or white in office and laboratory areas. Power contacts shall be a T-type design and shall be brass. Ground contacts shall be brass.
   2. Devices shall have a nylon composition face with a nylon or melamine body. Units shall comply with Federal Specification W-C-596E and meet UL 498 test requirements. Receptacles shall be Hubbell HBL Series; Daniel Woodhead; or equal.

C. Special Purpose Receptacles: Receptacles shall be of the amperage, voltage and NEMA configuration indicated on the Drawing. Compliance to standards and tests shall be as listed in Item B above.

D. GFI Receptacles:
   1. Device shall be rated 20 ampere, 2 pole, 3 wire, 120 volt, conforming to NEMA WD-1 configuration. Face shall be nylon composition meeting UL 498 test standards. Unit shall have test and reset push buttons. Reset push button shall have a visible indicator band to indicated tripped condition.
   2. GFCI component shall meet UL 498 Class A standards with a tripping time of 1/40 second at 5 milliamperes current unbalance. Operating range shall extend from 31°F to 158°F. Unit shall have transient voltage protection and shall be ceramic encapsulated for protection against moisture.
   3. Provide Hubbell 5362SG, Daniel Woodhead, or equal.

2.02 SWITCHES

A. Line Voltage Types: Switches shall be rated 20 amperes at 120 or 277 Volts ac only. Units shall be flush mounted, self-grounding, quiet operating toggle devices. Handle color shall be brown in industrial areas and white or ivory in office and laboratory areas. Units shall conform to Federal Specifications W-S-896 D and E, UL 20, and NEMA WD1 standards. Hubbell PRO Series; Daniel Woodhead; or equal.

2.03 PLATES

A. General: Plates shall be of the style and color to match the wiring devices, and of the required number of gangs. Plates shall conform with NEMA WD1, UL 514, and ANSI C73. Plates on finished walls shall be non-metallic or stainless steel. Plates on unfinished walls and on fittings shall be of zinc plated steel or cast metal having rounded corners and beveled edges.

B. Non-Metallic: Plates shall be smooth finish with contoured edges and shall be nylon or fiberglass.

C. Stainless Steel: Plates shall be 0.035 inches thick with beveled edges and shall be manufactured from No. 302 alloy having a brushed or satin finish.

D. Galvanized: Plates shall be galvanized sheet steel raised 1/2 inch, with rounded corners.

E. Cast Metal: Plates shall be cast or malleable iron covers with gaskets so as to be moisture resistant or weatherproof.

F. Damp or Wet and Corrosive Locations: Plates shall be provided with a hinged non-metallic cover/enclosure marked with “Suitable for Wet Locations when in use” and “UL Listed.” Provide a gasket between the enclosure and the mounting surface, and between the hinged cover and mounting plate/base. The cover shall be TayMac Specification Grade; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

A. Rigidly attach wiring devices in accordance with the NEC and as indicated, avoiding interference with other equipment.

B. Dry Locations: The device shall be installed in flush mounted boxes with washers as required to bring the device mounting strap level with the surface of the finished wall.

C. Damp or Wet Exterior Locations: Install only wiring devices approved for outdoor service in these locations.

D. Damp or Wet Interior Locations: Install only wiring devices approved for outdoor service. Adjust boxes so that front edge will be 1/4 inch beyond the rear edge of the finished wall. Use metal tubing sleeves to bring device mounting straps flush with the front edge of the finished wall.

E. Receptacles:
   1. Receptacles shall be grounded by a grounding conductor, not by a yoke or screw contact.
   2. Receptacles shall be oriented so that the grounding slot is located at the top of the outlet.
   3. Receptacles shall be installed with connections pigtailed (spliced) to the branch circuit wiring so that removal of the receptacle will not lose neutral continuity and branch circuit power will not be lost to other receptacles on the same circuit.

3.02 INSTALLATION OF WALL PLATES

A. General: Plates shall match the style of the device and shall be plumb within 1/16-inch of the vertical or horizontal.

B. Interior Dry Locations: Install plates so that all four edges are in continuous contact with the finished wall surfaces. Plaster filling will not be permitted. Do not use oversize plates or sectional plates.

C. Exterior and/or Wet Locations: Install plates with gaskets on wiring devices in such a manner as to provide a raintight weatherproof installation. Cover type shall match box type.

D. Future Locations: Install blanking cover plates on all unused outlets.

3.03 GROUNDING

A. Devices including switches and receptacles, shall be grounded in accordance with NEC, Article 250 and Specification 26 05 26.

B. Switches and associated metal plates shall be grounded through the switch mounting yoke, outlet box, and raceway system.

C. Flush Receptacles
   1. Flush receptacles and their metal plates shall be grounded through positive ground connections to the outlet box and grounding system.
   2. Maintain the ground to each receptacle by a spring-loaded grounding contact to the mounting screw, or by a grounding jumper, each making a positive connection to the outlet box and grounding system at all times.

D. Receptacles served from an uninterruptible power supply shall be provided with an isolated grounding conductor from the serving power panelboard

END OF SECTION

SECTION 26 28 00

PROTECTIVE DEVICES AND SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 become a part of this Section as if repeated herein.

B. Work Included: Provide all necessary labor, tools and material to install circuit protective devices as shown on the Drawings and as described in these Specifications.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publication:
   1. Z55.1 Gray Finishes for Industrial Apparatus and Equipment

B. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS 3 Industrial Systems
   2. ICS 6 Enclosures for Industrial Controls and Systems
   3. 250 Type 1 Enclosures for Electrical Equipment (1,000 Volts Maximum)

C. Federal Specifications (FS):
   1. W C 375 Circuit Breakers, Molded Case, Branch Circuit and Series Service, Series Trip
   2. W F 1726 Class H Cartridge Fuses

D. Underwriters Laboratories (UL) Standards:
   1. 50 Electrical Cabinets and Boxes
   2. 198C Fuses, High-Interrupting-Capacity-Current Limiting Types
   3. 489 Molded Case Circuit Breakers and Enclosures
   4. 698 Industrial Control Equipment for Use in Hazardous (Classified) Locations
   5. 894 Switches for Use in Hazardous (Classified) Locations

E. National Fire Protection Association (NFPA) Publication:
   1. 70 National Electric Code

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 26 05 00.

1.04 LOCATIONS

A. Refer to Section 26 05 00 for definitions of types of locations.

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCHES

A. Fusible switches shall be heavy duty safety switches with the voltage ratings, current ratings, and number of poles as indicated by the Drawings. The switches shall be horsepower rated. Auxiliary contacts shall be provided as indicated on the Drawings. Stationary contacts shall be equipped with arc chutes. Fuse clips shall accept only Class J current limiting cartridge fuses. Where indicated on the Drawings, units shall have service entrance labels and shall be equipped with an insulated neutral lug. Switches shall be Square D, Type HD; Westinghouse Type H600; or equal.

B. Enclosures shall be as follows:
   1. Dry Locations: NEMA Type 1.
   2. Corrosive Locations: NEMA Type 4X.
   3. Wet locations: NEMA Type 4.

C. Nameplates: Provide an engraved plastic nameplate for each disconnect switch identifying the equipment it protects.

D. Fuses:
   1. General: Provide one complete set of fuses of each ampere rating shown on the Drawings plus one spare set for each size shown.
   2. Fuse Type: Units shall be Class J current limiting, 700 volt, in the ampere ratings shown. Plug fuses are unacceptable. Barrels shall be non-hygroscopic with brass knurled ferrules.
   3. Fuses shall conform to FS W F 1726 and UL 198B, and shall carry labels showing UL class, interrupting rating, time delay characteristics, and voltage rating.

2.02 MANUAL TRANSFER SWITCH

A. Transfer switch shall be quick-make, quick-break, non-fusible, 3 pole, double throw, rated 600 Vac, with solid neutral, ampere rating as shown on the Drawings, and 10,000 RMS amperes symmetrical interrupting capacity. Enclosure shall be NEMA 3R. Provide Square D Class 82000 or 92000 Series; Westinghouse Type MTSS; or equal.

2.03 ENCLOSED CIRCUIT BREAKERS

A. Units shall be thermal-magnetic molded case circuit breakers in surface mounted non-ventilated enclosures conforming to the appropriate articles of NEMA 250, as follows:
   1. Indoor, Dry, Clean Locations: NEMA Type 1.
   2. Outdoor, Unprotected Locations: NEMA Type 3R/12.
   3. Wet Locations: NEMA Type 4.
   4. Corrosive Locations: NEMA Type 4X.

B. Each unit shall have an external operating handle with a cover interlocking mechanism which will prevent opening of the enclosure when the operating handle is in the "ON" position. The handle shall be capable of being padlocked in either the "ON" or the "OFF" position. A breaker "tripped" position shall be clearly indicated between the "ON" and the "OFF" position.

C. Where indicated on the Drawings, enclosed breakers used as service entrance equipment shall be so labeled for such service and shall contain an insulated neutral lug. The complete unit shall conform to UL 489.

D. The circuit breakers shall be of the voltage, number of poles, frame size and ampere rating shown on the Drawings. Units shall be manually operated, trip-free, thermal-magnetic, molded case, front mounted circuit breakers.
   1. Frame sizes larger than 100 amperes shall have adjustable instantaneous magnetic elements. Minimum interrupting rating shall not be less than 10,000 amps asymmetrical and the breaker shall conform to FS W C 375. Multiple breakers shall have a common trip single operating handle with three positions of indication. Circuit breaker shall be calibrated at 40°C (104°F).
   2. Each breaker shall be completely enclosed in a molded case with the calibrated sensing element factory sealed to prevent tampering.

2.04 DISCONNECT SWITCHES

A. Disconnect switches shall be heavy duty safety switches with the voltage ratings, current ratings, and number of poles as indicated by the Drawings. The switches shall be 600 volt type and horsepower rated. Auxiliary contacts shall be provided as indicated on the Drawings. Switches shall be Square D Type HD; Westinghouse HUN Series; or equal.

B. Enclosures shall be as follows:
   1. Dry Locations: NEMA Type 1.
   2. Corrosive Locations: NEMA Type 4X.
   3. Hazardous Locations (gases): NEMA Type 7.
   4. Hazardous Locations (dusts): NEMA Type 9.
   5. Wet Locations: NEMA Type 4X.

C. Nameplates: Provide an engraved plastic nameplate for each disconnect switch identifying the motorized equipment it controls.

2.05 CONTROL STATIONS

A. Control station shall be of copper-free aluminum finish for use with control devices. Unit shall include a lockout on "STOP" button, neoprene covers for front operated pushbuttons, and a lockout on selector switch covers (locks two- or three-position handle in any position). Receptacle housing shall be copper-free aluminum. Insulation shall be diallyl phthalate (DAP) and contacts shall be brass. Rocker handles, push buttons and guards shall be Type 6/6 nylon. Shaft and shaft bushings shall be stainless steel. Control stations shall be Crouse-Hinds, Series DSD; Westinghouse Type PB 1; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units plumb within 1/8 inch of vertical, and in accordance with manufacturer's instructions. Make sure that fuse ratings are as shown on the Drawings, and that breaker trip settings are per the Engineer's instructions.

3.02 MOUNTING HEIGHTS

A. Fusible switches and enclosed circuit breakers shall be centered 5' 0" above the floor.

3.03 FIELD TESTS

A. Insulation Resistance Tests: Perform insulation resistance tests on circuits to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests after all equipment has been connected, except that equipment which may be damaged by the test voltage shall not be connected. Test the insulation with a 500 Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 20 megohms or more. Submit results for review.

B. Continuity Tests: Perform circuit continuity tests from a low powered dc test source to operate a buzzer or bell. Tests shall be made prior to energizing the protected circuit.

C. Operating Tests: Demonstrate that the protected circuit can be manually controlled by the installed equipment.

END OF SECTION

SECTION 26 29 00

CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 and Section 40 78 00 become a part of this Section as if repeated herein.

B. Work Included: Furnish and install all control devices complete, including, as applicable, enclosures, engraved escutcheons or nameplates, gaskets, lenses, lamps and mounting provisions.

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS1 General Standards for Industrial Controls and Systems
   2. ICS2 Standards for Industrial Control Devices, Controllers and Assemblies
   3. ICS6 Enclosures for Industrial Controls and Systems

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 26 05 00.

PART 2 - PRODUCTS

2.01 GENERAL

A. All control devices shall conform to applicable provisions of NEMA Standards ICS1 and ICS2.

2.02 CONTROL AND TIMER RELAYS

A. General: Relays shall be provided as necessary to perform switching functions required of control panels and other control circuits. Relays shall be of the following types (abbreviations in parentheses correspond to labels on the Drawings):
   1. Size 0 Magnetic Contactors (MS): Provide Size 0 magnetic contactors for driving Size 4 and Size 5 ac operated motor starters. Provide Size 0 contactors of the same type and manufacture as the motor starter contactors.
   2. Relays (CR):
      a. Provide machine tool relays for the following applications:
         1) All relays driving 120 Vac motor starters up to and including Size 3.
         2) All relays driving non-motor loads up to 6 amps (or 720 VA).
      b. Provide machine tool type relays with convertible contacts rated 10 amperes continuous with NEMA Rating Designation A600 for ac applications and N600 for dc applications. Coils shall be designed for

continuous duty and shall have the voltage rating indicated on the Drawings.

c. Relays shall be the magnetically held type unless designated otherwise on the Drawings. For each relay provide one spare Form C contact over and above the number indicated on the Drawings. In addition, for latching relays, provide coil clearing contacts as necessary.

d. Manufacturer: Square D, Class 8501, Type X; General Electric CR120B; or equal.

3. General Purpose Control (GR) or (AR) Relays (plug-in):

a. Provide plug-in style 2-, 3-, or 4-pole enclosed relays with integral neon or LED indicators for the following applications:

1) Relay logic (relays driving other relays, including machine tool relays) operating at voltages up to 120 Vac.

2) Control power switching.

3) All relays driving non-motor loads up to 2 amps (240 VA) at 120 Vac.

b. Provide relay sockets rated for 10 amp, 240 Vac with screw-type barriered terminals.

c. Manufacturer: Square D, Class 8501, Type R; Allen-Bradley Bulletin 700; or equal.

4. Analog or Digital Signal Switching (SR) Relays: Provide plug-in style indicating type relays with gold plated silver contacts for switching low level currents (less than 100 mA). Provide relay sockets screw-type barriered terminals.

5. Latching Relays (LR):

a. Latching relay shall be 600 volt machine tool industrial relays, magnetically held, two-coil type. Relay shall have convertible contacts rated 10 amperes with NEMA rating design A600. Latching relay shall be Square D Class 8501; General Electric CR170BL; or equal.

b. Latching relay shall be general purpose plug-in relay, two-coil magnetically held with an integral neon or LED indicators. Relay contacts shall be rated for 10 amp, 240 volts with coil voltage as shown on the Drawings. Relay shall be complete with socket and shall be Square D, Class 8501, Type K; Idec RR2KP Series; or equal.

6. Timing Relays (TR) and (TD):

a. General: Relays designated TR shall be machine tool industrial relays, while those designated as TD shall be general purpose plug-in time delay relays.

b. Timing Relay (TR): Timing relay shall be industrial machine tool electro-pneumatic relay with an external dial for adjustment. Relay shall have contacts rated at 10 amp, 120 Vac, unless otherwise indicated. Provide a relay with a range of 5 to 50 seconds. Timing relay shall be "on delay" or "off delay" as indicated on the Drawings and shall be Agastat 7000 Series; or equal.

c. Time Delay Relays (TD): Relay shall be solid-state with multi-range programmable settings. The relays shall include a calibrated front dial and LED indicator and shall be complete with socket. Relays shall be "on delay" or "off delay" type as indicated on the Drawings. Provide an additional form C contacts over and above the number indicated on the Drawings. Relay contacts shall be rated 10 amp, 120 Vac. Relays shall be ATC Type 328; Idec Type RTEL; or equal.

7. General Requirements:

a. Provide relays rated for 1 million operations at 10 amp, 120 Vac, at power factor of 0.2.
b. Where timing relays are interfaced to motor starters or adjustable speed motor controllers, provide auxiliary machine-tool relays or Size 0 magnetic contactors. Refer to previous specifications for machine-tool relays and Size 0 magnetic contactors.
c. Where timing relays or control relays require additional contacts, provide auxiliary control relays, properly sized for the application as described previously in this Section.

2.03 ZERO-CROSSING RELAYS

A. General:
1. Provide solid state output zero-crossing relays where indicated on the elementary diagrams. Provide zero-crossing relays which actuate for any input control voltage between 10 and 120 Vac. Provide inverse-parallel dual SCR output rated for 10 amps at 120 Vac, suitable for low power factor inductive loads. Provide integral snubber circuit for SCR output to limit dv/dt to protect the triac from damage by highly inductive loads.
2. Provide 2,500 Vac isolation from input circuit to output circuit.

B. Installation: Mount zero-crossing relays on the rear panel of the control panel with panhead machine screws, using thermally-conductive heat sink compound. Remove excess compound to prevent accumulation of dirt and debris.

C. Manufacturer: Provide International Rectifier "Crydom" Model A1210; equivalent model as manufactured by Teledyne; or equal zero-crossing relays.

2.04 ROTARY-ACTION SOLENOID DRUM PROGRAMMER (DP)

A. General:
1. Provide 12-position solenoid driven rotary-action drum programmer (stepping switch) where shown on the elementary diagrams. Provide step switch which advances one position as the solenoid is de-energized.
2. Provide a rotary tap switch which provides an input circuit for each step switch position.
3. Provide easily removable stackable switch assemblies. Provide easily settable switch trip positions. Provide switch contacts rated for 10 amps resistive load at 120 Vac.

B. Manufacturer: Provide Eagle Signal Model MT12, ATC Series 1800; or equal.

2.05 ALTERNATOR RELAYS (ALT)

A. Alternator relay shall alternate the state of its contacts in response to impulses applied to its coil. Contacts shall be rated 5 amperes minimum at 120 Vac, 60 Hz. Coil shall be rated 120 Vac, 60 Hz. Provide stud terminals for all wiring. Alternator shall be Autocon 7101AA; Struthers Dunn B11AXA; or equal.

2.06 INTRINSICALLY SAFE RELAYS (ISR)

A. Unit shall be fixed sensitivity type and either UL or FM approved for use with a remote pilot device (dry contact) located in Class 1, Division 1, Groups C and D atmospheres. Supply power shall be 120 Vac, 60 Hz. Provide load contacts as shown on the Drawings, except provide a minimum of one single-pole double-

throw set. Contact ratings shall be 10 amperes or better at 120 Vac. Unit shall be BW Series 53; Warrick Series 7; or equal. See Section 16999.

2.07 INTERVAL TIMERS (IT)

A. Interval or SS (single shot) timers shall transfer their timed contacts immediately when energized by a control power pulse of 50 milliseconds minimum duration. The contacts shall remain transferred for the preset delay and then reset independently of the control input. A source of continuous operating power is required, if the control pulse is of shorter duration than the delay; interruption of this power shall reset the contacts at any time. Interruption of control power for 50 milliseconds maximum shall be required to initiate a new time cycle. Timer shall be ATC Series 305D; Eagle Signal; or equal.

2.08 RESET TIMER (RT)

A. General: Provide motor-driven reset timer with range of 0 to 99.9 hours. Timer shall reset from zero to the time set on the pointer by means of an external momentary dry contact closure.

B. Specifications: Provide reset timer with the following specifications:
   1. Models: Choice of on delay or off delay operation.
   2. Ranges: 16 standard ranges, from 6 seconds to 60 hours at 60 Hz.
   3. Repeat Accuracy:
      a. ac Models: ±0.2% of full scale.
      b. dc Models: ±1.75% of full scale at constant ambient temperature and ±20% voltage variation (48, 125 and 250 volt models); ±3.5% of full scale at constant voltage and 32 to 120°F ambient temperature
   4. Reset Time: 0.1 second, full scale.
   5. Minimum Setting: 1/60th of range.
   6. Dial Divisions:
      a. 6 sec, 60 sec, 120 sec, 240 sec, 6 min, 60 min, 120 min, 240 min, 6 hr, and 60 hr with 120 Dial Divisions.
      b. 15 sec, 30 sec, 15 min, 30 min, 15 hr, and 30 hr with 150 Dial Divisions.
   7. Life Expectancy:
      a. Mechanical: Over 5,000,000 operations (average.)
      b. Contacts: 3,000,000 operations under resistive or inductive load of 1 amp.
   8. Timing Motor: Synchronous, permanently lubricated.
   9. Timing Modes: Single cycle interval or delay.
   10. Load Switches:
      a. Instantaneous: Two, each SPDT; self-cleaning, heavy-duty silver contacts.
      b. Delayed: Two, each SPDT; precision type, silver contacts.
      c. Contact Rating (non-inductive):
         1) 10 amps: 120 Vac.
         2) 5 amps: 240 Vac.
         3) 1/4 amp: 115 Vac.
   11. Pilot Light: Wired in parallel with motor, standard with all ac models except explosion-proof.
   12. Terminals: Screw terminals accessible at rear, integral wiring diagram on timer housing.
   13. Housing: Plug-in design; completed gasketed, dust-tight when surface or panel-mounted.

14. Power Requirements:
    a. ac Models: 120 or 240 V, 50/60 Hz. (all ranges).
    b. dc Models: 48, 125 or 250 V with zener regulations; 28 V without zener regulation.
    c. ac Models:
        1) Running Current: 0.128 A (115 Vac).
        2) Inrush Current: 0.628 A (115 Vac).
15. Temperature Rating: 32° to 120°F (0 to 50°C).

C. Manufacturer: Provide reset timer as manufactured by ATC; Eagle Signal; or equal.

2.09 TIME CLOCKS

A. Time clocks shall be designed with a bezel for flush panel mounting with a hinged door for access to the adjustments. Time clocks shall have a 24-hour cycle, unless otherwise specified, and shall provide on/off contact operation adjustable in 15-minute increments. Adjustment may be by movable tabs. Adjacent tabs in like positions shall cause no contact operation. Adjacent tabs in opposite positions shall cause contact transfer. When specified in the Schedule, provision shall be made for skipping up to two days in a week. The output contacts shall be rated 10 amps at 120 Vac. Time clocks shall be driven by a 120 Vac, 60 Hz synchronous motor, and shall be as manufactured by Tork; Intermatic; or equal.

2.10 ELAPSED TIME METERS (ETM)

A. Elapsed time meters shall be of the synchronous motor-driven type having a minimum of six (6) decimal digits where the least significant digit shall represent tenths (1/10ths) of hours. Unless specified otherwise, they shall not be equipped with a reset button. They shall be for panel mounting with a square bezel approximately 2-1/2 inches on a side. Meter voltage shall be not more than 120 Vac for meters mounted in instrumentation panels. Elapsed time meters shall be ATC 5702; Yokogawa/General Electric Series 200; Type 240; or equal.

2.11 CONTROL PANEL ACCESSORIES

A. Relays, timers and other internally mounted equipment shall be of the types specified in other sections of these Specifications.

B. Panel face mounted equipment shall be of the types specified in other sections of these Specifications.

C. Standards: All control devices shall conform to applicable provisions of NEMA Standards ICS 1 and ICS 2.

D. Pushbuttons, Selector Switches and Pilot Lights:
1. Shall be heavy-duty oiltight units; each unit shall have an engraved escutcheon plate unless nameplates are indicated on the Drawings or are necessary because of length of identification. Pushbuttons and selector switches shall have contacts rated 10 amperes continuous, Rating Designation A600 in conformance with NEMA ICS 2.
2. Pushbuttons used as emergency stop devices shall have a padlockable means for maintaining an open circuit. Indicating lights shall be push-to-test transformer type with lenses of the colors shown on the Drawings.

E. Multiposition control switches shall have rotary action, round knurled handle and the number of positions and stages shown on the Drawings. They shall be suitable

for panel mounting. Each position shall have a positive detent. Contacts shall have a continuous current rating of 10 amperes at 300 Vac. Switches shall have integral indicator.

F. For 4-20 mAdc and 1 to 5 Vdc signal selector switches, provide oiltight selector switches with electronic duty gold contact blocks. Provide sliding contacts for reliable operation without benefit of thermal cleaning action.

G. Manufacturer: Provide Microswitch heavy-duty oiltight manual controls, Type PT, with electronic duty gold contact blocks; Allen-Bradley Bulletin 800T oiltight selector switch with stackable "Logic-Reed" contact blocks; or equal.

H. Colors and Descriptions:
   1. Indicating Lamps: Unless otherwise noted on the Drawings, the color code and inscriptions shall be as specified in Section 40 78 00, Colors and Descriptions for the lenses of all indicating lights.

I. Panel Lights and Receptacles: Panels shall be internally lighted by LED lamps, provided with guards and a toggle switch located convenient to each access door. One duplex GFI type receptacle shall be provided in each panel section. The lights and receptacles shall be wired to outgoing terminal blocks for 120 volt, 60 Hertz, single phase supply.

J. Nameplates: Unless specified otherwise in the Drawings, nameplates shall be black lamacoid with minimum 3/16-inch-high white letters for major area titles, 5/32-inch for component titles, and 1/8-inch for subtitles, and shall be fastened with a permanent but dissolvable adhesive or by screws.

2.12 PROBE RELAYS (PR)

A. Probe relays shall be solid state liquid level control relays suitable for use with water. The relays shall use an 8 Vac secondary circuit to sense the level of the water by means of electrodes. The relays shall have adjustable potentiometers for setting the sensitivity. Contacts shall be rated 230 volts, 10 amperes, 1/2 horsepower. The relays shall be Warrick Series 2; B&W Series 52; or equal.

2.13 PROBES AND HOLDER

A. Probes shall be 1/4-inch stainless steel rods, PVC insulated. Probe holder shall be case pressure tight, of sufficient size to accommodate all of the probes, threaded to match the probe well, and complete with pressure tight probe plugs. Probes and holder shall be as manufactured by B/W Controller Corporation; Warrick; or equal.

2.14 FLASHER

A. Flasher shall be induction disk motor type. Provide cams for pulse per minute operation as required. Flasher contacts shall be 1/2-inch-thick coin silver and shall be rated 15 amperes, 120 volts. Flasher shall be Eagle Signal HT7; Econolite; or equal.

2.15 CONTROL STATIONS

A. Provide control stations complying with NEMA ICS 6 for manual control functions as follows and as shown on the Drawings: start-stop pushbutton, hand-off-auto, forward-reverse-jog-stop, etc. Control stations shall include selector switches, pushbuttons, and indicators as specified in this Section.

B. Enclosures shall be as follows:
   1. Dry Locations: NEMA Type 12
   2. Corrosive Locations: NEMA Type 4X
   3. Hazardous Locations (Gases): NEMA Type 7
   4. Hazardous Locations (Dust): NEMA Type 9
   5. Wet Locations: NEMA Type 4X

C. Nameplates: Provide an engraved plastic nameplate for each control station and escutcheons or nameplates for devices mounted thereon.

D. Provide pushbuttons, selector switches, indicators, etc., as shown on the Drawings and as required. Provide control devices with NEMA ratings matching that of the control station.

E. Manufacturer: Provide Allen-Bradley; Westinghouse; Crouse-Hinds; or equal.

2.16 WATT AND VAR TRANSDUCERS

A. The transducers shall provide 4-20 mAdc output signals proportional to ac power input in watts or volt-ampere reactive (VAR). The units shall be capable of driving into a load of 750 ohms. The calibrated power range shall be as shown on the Drawing.

B. The units shall use all electronic design. Ambient temperature change influence shall be less than 0.5% over a range of -5° to 165°F. The units shall not drift more than ±0.25% per year. Accuracy shall be ±0.2% of full scale. Response time shall be less than 400 mS. The units shall be capable of operating with a power factor of unity to lead or lag zero.

C. Units shall be capable of meeting surge withstand criteria ANSI C37.90.1-1989 (IEEE SWC). Units shall be self-powered from the input circuit unless noted otherwise.

D. The number of phases, voltage level, current level, and number of wires shall be as required. The unit shall be enclosed in a NEMA 12 steel enclosure with mounting plate.

E. Unit shall be Rochester Instrument Systems Series PCE for watt and Series VCE for VAR transmitters; Crompton Industries; or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Identify all control devices with engraved plastic nameplates or escutcheons, as applicable. Install control devices as recommended by the manufacturer.

3.02 PROBES AND HOLDER

A. Adjust potentiometer to suit conductivity of water.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 29 33

VARIABLE FREQUENCY DRIVES (VFD)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Applicable provisions of Section 26 05 00 become a part of this Section as if repeated herein.

B. Work Included: Provide a VFD controller for each of those motors as shown on the Drawings.

C. Like products shall be the end product of one manufacturer in order to standardize appearance, operation, maintenance, spare parts, and manufacturer's services.

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS 1 General Standards for Industrial Controls and Systems
   2. ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies
   3. ICS 3 Industrial Systems
   4. ICS 3.1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-speed Drive Systems
   5. ICS 4 Terminal Blocks for Industrial Control Equipment and Systems
   6. ICS 6 Enclosures for Industrial Controls and Systems
   7. ICS 7 Industrial Control and Systems: Adjustable – Speed Drives

B. American National Standards Institute (ANSI) Publication:
   1. C37.90 Relays and Relay Systems Associated with Electric Power Apparatus

C. Institute of Electrical and Electronic Engineers (IEEE) Publication:
   1. 519 Harmonic Control and Reactive Compensation of Static Power

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Requirements and the submittal requirements of Section 26 05 00.

B. Submit shop drawings, including: complete elementary (ladder) diagrams; comprehensive interconnection diagrams for VFD, motor, external control devices and controllers, and other related devices; drawings showing physical arrangement of components; front elevation to scale with overall dimensions, conduit entrance spaces and weights; and Bill of Materials.

C. Submit written descriptions explaining ladder diagram operation, system operation and analog signal processing customized for the project.

D. Submit comprehensive interconnection diagrams for VFD, motor, wet well level controller, and other related devices.

E. Within 45 days following Notice to Proceed:
   1. Submit a Harmonic Analysis report documenting the results of computer or factory-based voltage distortion and commutation notch area simulations. Obtain all data needed for the report. Contact equipment manufacturers and Utility Company to obtain impedance and fault duty data. Obtain other data from the field, as necessary. The simulations shall model the effects of full load VFD operation on the line side of the VFD line during both utility and standby generator operation. Simulations shall demonstrate compliance with IEEE 519 for general systems.
   2. If simulations show that compliance with IEEE 519 cannot be achieved with the equipment shown on the Drawings, include in the report the manufacturer's recommended design modifications needed to ensure compliance with IEEE 519. Include additional simulation data for the recommended system demonstrating compliance. Simulation shall include specific filtering or impedance modifications necessary. Perform and submit a report on the results of a power factor analysis and document any special switching requirements necessary to eliminate filter induced leading power factors.
   3. Submit sketches of the revised single line diagram and a revised scale drawing of the equipment room layout. Room layout shall show location and mounting requirements for filters, reactors, or other devices required. All additional equipment shall meet the seismic anchorage requirements as described in Paragraph F of this Section.
   4. Simulation report, analysis, and design shall be included in the Contractor's bid price.
   5. Additional filters, reactors, enclosures, conduit, wire, and all other components necessary for a fully functioning system complying with IEEE 519 for general systems shall be included in the Contractor's bid price.

F. Submit certified factory test report before equipment is shipped.

G. Manuals: Provide in conformance with Section 26 05 00.

H. Submit certification that VFD, motor, and driven load are compatible throughout the specified speed range.

I. Submit list of manufacturer's recommended spare parts.

J. Submit certified statement from the manufacturer accepting responsibility for providing a fully functioning installation as specified herein.

K. Submit factory test data certifying compliance of similar equipment from the same manufacturer with requirements of this Section. Submit data and receive approval prior to shipment of the VFD.

L. Submit certified test reports of the VFD field tests.

1.04 COORDINATION

A. Motor: Obtain and review the appropriate data for the driven motor and load over the required speed range, for a complete system analysis. Verify that equipment is mutually compatible and free of resonance over the complete operating range. Coordinate the assignment of any critical frequencies with the motor supplier per Sections 26 05 10. Prepare the certificate required under the Submittals paragraph in this Section, the certificate shall specifically state whether the VFD equipment is

rated for variable torque or constant torque applications and compatible with the requirement of the driven equipment.

B. Instrumentation and Controls: Review and coordinate requirements with the instrumentation and controls work of Division 40. Provide all necessary interfacing to produce a complete, fully operational system.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide integrated, all solid-state variable frequency drives (VFD) complete with incoming line reactors. VFDs shall have a 6-pulse front end as indicated herein. Provide all additional components necessary to meet IEEE 519 as described below. System shall comply with NEMA ICS 1, 3, 4, 3.1, 4, 6, and 7.

B. Inverters shall be sized to match the KVA and inrush characteristics of the motors actually provided.

C. The Contractor shall be responsible for matching the controller to the load (variable torque or constant torque) as well as the speed and current of the actual motor being controlled.

D. VFD shall be tested to and UL listed as conforming to the requirements of UL 508C at rated load currents and ambient temperature per this Specification. Drive shall have a UL listed interrupting capacity as shown on Contract Drawings.

E. Manufacturers: Products of the following manufacturers are acceptable, subject to conformance with these Specifications:
   1. Allen-Bradley Power Flex 750 Series (6-pulse)
   2. Eaton, SVX-9000 (6-pulse).
   3. Or approved equal.

2.02 SYSTEM

A. Operation: Accomplish speed control by adjusting the output frequency according to the desired reference speed. Adjust ac voltage and frequency simultaneously to provide the constant volts/Hertz necessary to operate the motor at the desired speed. The VFD must use pulse width modulation (PWM) technology.

B. Rating:
   1. Line Voltage: 208 or 480 volts, as shown on Contract Drawings b+/- 10%, 3-phase.
   2. Line Frequency: 60 Hz, +/-5 Hz.
   3. Ambient Temperature: 0°C to 40°C.
   4. Altitude: Up to 3,300 feet above sea level without derating.
   5. Humidity: Less than or equal to 95%, non-condensing.
   6. Service Factor: 1.15. Service factor is defined as the AFD continuous current rating shall be 115% of actual motor full load current nameplate rating.
   7. Power Factor: Minimum .95 or better at rated load and nominal line voltage over the entire speed range.
   8. Overload Capability: 110% overload capability for up to one minute and 150% for up to 3 seconds.

C. Performance:
   1. Efficiency: Above 95% at 100% full speed and 100% motor load, and above 90% at 50% full speed and 50% motor load.
   2. Duty Cycle: Six (6) starts per hour.
   3. Speed Range: 34% to 100% full speed, with adjustable minimum and maximum speeds.

D. Features:
   1. Provisions to accept the following control signals for automatic and manual operation:
      a. Run signal from a single remote contact closure.
      b. A 4-20 mA dc signal for speed control. The VFD shall provide linear speed control of the motor from minimum speed to maximum speed as the adjustable speed input signal varies from its minimum to maximum. Input impedance shall be 250 ohms resistive.
   2. Selector switch for automatic, manual, or off.
   3. Potentiometer for manual speed control.
   4. Motor speed indicator calibrated in percent of full speed.
   5. Upon loss of input signal, the VFD shall operate at a preset speed.
   6. Incoming line circuit breaker.
   7. Fused 480-120V control power transformer to provide system control circuitry.
   8. Adjustable time delay for delaying motor drive restart after power failure; timer range shall be 0 to 120 seconds, with initial settings differing by 10 seconds for each drive; provide module which causes multiple attempts to restart.
   9. Provision for automatic emergency shutdown in any mode, actuated by the following:
      a. Motor thermal protection (see Section 26 05 10.
      b. Any additional abnormal conditions as shown on the Drawings. Provide for manual restart.
   10. Auxiliary contacts for remote indication of "Run", "Motor Fail" and "VFD Fail."
   11. VFD operable with motor disconnected, in order to test VFD.
   12. Linearity and repeatability accuracy of 3-phase output of 1% of analog input control signal regardless of input power voltage fluctuations between 437 and 505 volts.
   13. Independent acceleration and deceleration controls, adjustable from 2 to 30 Hz per second.
   14. Critical frequency lockout over a minimum of two bands. Both bands shall be independently adjustable over the operating range of the VFD.

E. Protection: Protect VFD against the following conditions:
   1. Reverse phase sequence and single phasing of input power.
   2. Input power failure.
   3. Input transient voltages, including peak suppression and snubbers, in accordance with ANSI C37.90.
   4. Radio and television interference.
   5. Output overcurrent.
   6. Instantaneous and electronic overcurrent.
   7. Motor overtemperature.
   8. Cabinet overtemperature.
   9. Ground-fault.
   10. Protection against internal faults.

11. Ability to start into a rotating motor (forward or reverse direction).
12. Undervoltage: VFD shall automatically shut down if input voltage falls below 414 volts with automatic restart upon return to a stable 437 volts or more.
13. Additional protection and control as indicated and as required by the motor and driven equipment.

F. Harmonics Mitigation:
1. All components necessary to ensure compliance with IEEE 519 for general systems: 5% Voltage Distortion limit for Individual Harmonic and 8% for Total Harmonic Distortion. It is the intent of this Specification to achieve a system that operates within the guidelines of IEEE 519 for general systems when operated from the utility and when operated from the standby generator.
2. Drive Input Line Reactor: Provide a drive input line reactor mounted within the drive system enclosure for drives that are less than 100 horsepower and meeting the following requirements:
    a. The construction shall be iron core with an impedance of 3-5 percent.
    b. Winding shall be copper.
    c. Insulation shall be Class H with a 115 °C rise over a 50 °C ambient.
    d. The unit shall be rated for the system voltage, ampacity, and frequency.

G. Construction:
1. Enclosure, housing controller modules and components shall be free-standing, floor-mounted, NEMA 4X Stainless Steel Type 316. The enclosure shall be dead front and dead back construction with all modules, components, load, line, and control terminations fully front accessible. The enclosure shall be completely self-ventilated and have provision for top and bottom entry of wiring and conduits. The controller enclosure shall have gasketed doors mounted on semi-concealed hinges, with lockable door latches.
    a. Door-mount the following devices:
        1) Power On indicating light.
        2) Manual-Off-Auto selector switch.
        3) On-Off switch.
        4) Trip reset pushbutton
        5) Manual Speed potentiometer.
        6) Speed Indicator calibrated in percent of full speed.
        7) Motor Run indicating light.
        8) Motor Overtemperature indicating light.
        9) Controller Failure indicating light.
        10) External operating handle for the incoming line circuit breaker.
        11) Cabinet overheat indicating light.
        12) Elapsed time meter.
        13) Some of these features may be a part of a keypad provided by manufacturer.
    b. Mount the following devices on the motor control panel:
        1) 4-digit display of process variable.
        2) 4-digit display of time-of-day or selected functional data.
        3) Power On indicating light.
        4) VFD Fail light.
        5) Common Alarm light.
        6) Required, Run, and Fail for each motor.
        7) Ready for transfer - VFD signal.
        8) High Alarm light.

9) Low Alarm light.
10) VFD run.
11) VFD fail.
12) Pump select for adjustable speed.
13) Pump select for line operation.
14) Pump cutout indication.
15) Other Pilot indicating or control devices as shown on Contract Drawings.

c. Paint finish shall be ANSI 61. Provide control components as specified in Section 26 09 00.

d. Components: Mount components on circuit cards or modules which can be adjusted or replaced in the field without the use of special tools.

H. Air Conditioner: For VFD located outside, provide an air conditioning system sized to maintain a temperature of 85°F inside the enclosure in an outside ambient temperature of 110°F. Submit supporting calculations for review.

I. Spare Parts: Furnish two sets of spare power fuses for each size and type of fuse used; furnish a minimum of five fuses of each size and type of control circuit fuse. Provide one spare printed circuit board for each different board in each size VFD supplied.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in conformance with Section 26 05 00.

B. Provide 3-inch-high concrete housekeeping pad under each VFD; coordinate dimensions to ensure conformance with the NEC 6'7" rule.

C. Properly level and plumb VFDs so that doors will open and close freely.

D. Clean and repair scratched or damaged surfaces to "new" condition.

E. Provide the services of a factory trained service technician to inspect and check out each system before energizing.

F. Lace power conductors to resist short circuit forces. Follow manufacturer's instructions.

G. The Contractor shall perform the programming of drive parameters required for proper operation of the VFDs included in this project. Submit records of programming data in the O&M Manual, including setup and protective settings.

3.02 MANUFACTURERS' SERVICES

A. An authorized service representative of the manufacturer shall be present at the Site to furnish the services listed below.

B. The authorized service representative shall supervise the following and shall certify that the equipment and controls have been properly installed, aligned, and readied for operation:
1. Installation of the equipment.
2. Inspection, checking, and adjusting the equipment.
3. Startup and field testing for proper operation.

4. Performing field adjustments such that the equipment installation and operation comply with requirements.

3.03 FIELD TESTING

A. Provide the services of a factory trained service technician to make final adjustments to equipment and carry out a full operational test in the presence of the Engineer.

B. Replace any failed or damaged parts at no cost to Contracting Agency.

C. Following installation and manufacturer's field test, perform a field test under utility and standby operating conditions. Operate the drive from no load to full load and perform a spectrum analysis to verify that the waveform on the line side of the line reactors and filters is in compliance with IEEE 519 for general systems. Submit a complete certified test report for review by the Engineer. Report shall include expected harmonic voltage (THD) through the 35^{th} harmonic, calculated with isolation transformers and actual RMS value and measured percentage of the THD in the field. If compliance has not been attained, provide additional equipment as specified herein and perform the test again.

3.04 TRAINING

A. The authorized representative shall instruct the Contracting Agency’s personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with test equipment.

B. Training shall be scheduled a minimum of 3 weeks in advance of the first session and pertain to the specific VFD models provided.

C. Proposed training materials shall be submitted for review and all approved training material remains the property of the Contracting Agency.

D. The Contracting Agency may choose to videotape the training for later use with Contracting Agency’s personnel.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 33 54

UNINTERRUPTIBLE POWER SUPPLY (UPS) 1.5 KVA AND SMALLER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 26 05 00 are part of this Section as if repeated herein.

B. Work Included: Provide two Uninterruptible Power Supply (UPS) systems in free standing enclosures as shown on the Drawings and specified herein.

C. Related Work Specified in Other Sections:
   1. Division 40: Instrumentation and Control Systems

1.02 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 26 05 00.

B. Shop Drawings: Submit shop drawings complete with a system single line diagram, equipment outline drawings, elementary diagrams, wiring diagrams, battery performance data and nameplate schedules.

C. Submit catalog cuts as required.

D. Spare Parts List: Submit a spare parts list showing recommended parts and quantities as well as complete ordering information for replacement components.

E. Manuals: Provide manuals as specified in Section 26 05 13.

1.03 QUALITY ASSURANCE

A. Comply with the following reference standards:
   1. Underwriter's Laboratories (UL): 1012 Power Supplies

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide a UPS system for 120VAC system monitoring and control panel and to aid VFD with ride through/automatic restart attempts without relays coils dropping out on power supply voltage transient. Unit shall be Phoenix Contact 120VAC 1ϕ IN/120VAC 1ϕ OUT, 5A QUINT 1AC/500VA 2320270 3.4 Ah OR EQUAL or equal.

2.02 DESCRIPTION OF OPERATION

A. The UPS shall be designed to operate as follows:
   1. Normal: The load is continuously supplied by the invertor. The rectifier/battery charger derives power from the normal ac source and supplies dc power to the invertor while simultaneously float charging the battery.

2. Emergency: Upon failure of the normal ac power, the critical load is supplied by the invertor, which without any switching obtains its power from the storage battery. There shall be no interruption to the critical load upon failure or restoration of the commercial ac source.
3. Recharge: Upon restoration of the commercial ac source, the rectifier/charger powers the invertor and simultaneously recharges the battery. This shall be an automatic function and shall cause no interruption to the critical load.

2.03 RATING

A. Input Voltage: 120 volts, 1 phase, 60 Hz.

B. Invertor Output Voltage: 120 volts, 1 phase, 60 Hz +0.5 Hz.

C. Output Capacity: As specified.

D. Output voltage waveform will be sinusoidal, 5% THD, 3% maximum single harmonic.

E. Audible noise level shall not exceed 50 dB.

F. Ambient Temperature: Equipment ratings shall be based on operation in an ambient temperature not exceeding 40°C at a site altitude of 100 feet.

PART 3 - EXECUTION

3.01 FACTORY TEST

A. Subject the UPS to a complete operational test and submit certified test report to the Engineer before equipment is shipped.

3.02 INSTALLATION

A. Installation shall be in conformance with Section 26 05 00.

B. Install UPS as shown on Contract Drawings.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

Section Includes: Perform all potholing, excavation, trenching, shoring, dewatering, backfilling, compaction, grading, and disposal of excess material necessary or required for the construction of the work as covered by these Specifications and indicated on the Drawings. Include in the excavation, without classification, the removal and disposal of all materials of whatever nature encountered, including water and all other obstructions that would interfere with the proper construction and completion of the required work.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

B. ASTM International (ASTM)

C. Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge and Municipal Construction (WSDOT Standard Specifications).

D. Washington Industrial Safety and Health Act (WISHA).

E. Washington Administrative Code (WAC) 296-155 Safety Standards for Construction Work.

F. Geotechnical Report included as Appendix A.

1.03 DEFINITIONS

A. Site: Property owned by the Contracting Agency, as shown on the Drawings.

B. Fill: Earth used to fill holes, pits, or depressions necessary to bring the final grade up to the specified elevation or contours.

C. Pipe Zone Bedding: Bedding material that extends from 6 inches below the bottom of pipe to 12 inches above the crown of the pipe.

D. Trench Zone: Zone of material that extends from the top of the pipe zone bedding to the bottom of the pavement subgrade in pavement areas or to the top of the trench in earth areas.

E. Subgrade: Zone of material that is improved to create a stable, suitable platform for subsequent layers.
   1. Finished Subgrade: Finished subgrade indicates the top of the subgrade section in a cut scenario.
   2. Fill Subgrade: Fill subgrade indicates the top of the subgrade section in a fill scenario.

F. Over excavation: Excavation beyond the limits shown on the Drawings.

G. Relative Compaction: In-place dry density divided by the maximum dry density laboratory compaction expressed as percentage.

1.04 SUBMITTALS

A. Submit in accordance with Specification Section 01 33 00.

B. Contractor shall not excavate, construct embankments, or fill until all the required submittals have been reviewed and approved.

C. Submittals for Informational Purposes:
   1. Excavation Protection Plan: Identify location, extent, and type of excavation protection. The Contractor shall review the geotechnical report provided as Appendix A of these Specifications for shoring, dewatering, and soils criteria. The Excavation Protection Plan shall meet all applicable local, state, and federal safety codes and shall be coordinated with the Dewatering Plan. Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations for cuts 20 feet, or greater, or for shoring systems that extend below the static groundwater level to support plan. Structural calculations shall be done under the supervision of a Professional Engineer experienced in the design of this work and licensed in the State of Washington. Identify haul routes, temporary storage, and disposal location.
   2. Dewatering Plan: Describe methods for dewatering including power source, size of pumps, dewatering point locations, appurtenances, settlement monitoring program, and dewatering water disposal. Include discussion of how dewatering plan integrates with the excavation protection plan. Include any SWPPP and NPDES Permit information relevant to discharge of water from dewatering.

D. Product Data:
   1. See Section Part 1.07 for potholing requirements.
   2. Gradation report(s) for bedding material and import backfill materials.
   3. Test results on bedding and import material indicating Sand Equivalent, R-value, Durability Index, Liquid Limit, Plastic Limit and Plasticity Index.
   4. Compaction Reports indicating results from QC testing.
   5. Geotextile fabric indicating fabric and installation procedure.

E. Samples and Test Results:
   1. Test bedding and import materials proposed for use demonstrating that the materials conform to the requirements specified herein. Perform tests no more than 60 Calendar Days prior to submission. Submit results to the Engineer at least ten (10) days prior to delivery.
   2. Submit certifications for each source of imported/borrow material to be used indicating the location where material will be obtained, including city and state.
      a. Contracting Agency may request a copy of the material delivery ticket at delivery of each load each day.
   3. Furnish without additional cost to the Contracting Agency, such quantities of Bedding material and Import materials, listed herein, as may be necessary for testing.
   4. Notify the Engineer a minimum of 48 hours before obtaining samples. The Engineer may choose to be present while samples are obtained.

1.05 QUALITY ASSURANCE / QUALITY CONTROL

A. All material furnished and all work performed is subject to inspection. Do not deliver material to the site until it has been favorably reviewed by the Engineer. Do

not use material in the construction work until it has been inspected in the field/source/quarry by the Engineer should the Contracting Agency choose to inspect.

B. Source Quality Control: Furnish all bedding material from a single source throughout the work unless otherwise approved.

C. Field Quality Control:
   1. The Contractor shall hire an independent soil testing laboratory approved by the Engineer to perform the following tasks for flatwork, pipeline installation, non-structural fill or items not requiring special inspection as outlined under Special Inspections:
      a. Test Pipe Zone Bedding and Trench Zone material for quality and in-place density requirements specified herein. Contractor shall test every 200 feet of trench.
      b. Where Special Inspections are not required, test fill materials to verify conformance with material quality every 5,000 cubic yard of materials delivered.
   2. Perform re-work and re-testing for non-compliant Work and demonstrate to the Contracting Agency non-compliant Work has been addressed. Contractor shall be responsible for costs of additional inspection, rework, and re-testing resulting from non-compliance.
   3. Material that does not meet the gradation, quality, or compaction requirements shall be removed and replaced with material that does comply at no additional cost to the Contracting Agency.

D. Field Quality Assurance:
   1. The Engineer will:
      a. Review materials, not covered under Special Inspections.
      b. Observe excavation, not covered under Special Inspections, and advise the Contractor should excavation beyond the limits shown on the Drawings be required.
      c. Review results of the Contractor’s independent testing laboratory tests and request additional testing at the Engineer’s discretion.
   2. At the Contracting Agency’s discretion, Quality Assurance (QA) testing may be conducted by the Engineer, or a separate independent testing laboratory acceptable to the Engineer, to verify results obtained by the Contractor’s QC third party independent testing laboratory. The Contractor shall provide adequate clearance of areas for testing as recommended by the Engineer. QA testing will be paid for by the Contracting Agency. Areas where QA testing indicates results that do not meet the project specification requirements shall be recompacted by the Contractor at no additional costs to the Contracting Agency and shall be retested by the Contractor’s QC testing laboratory to verify test results meet project specification requirements.
   3. The Contracting Agency will be responsible for special inspections in accordance with the building code and the Drawings. Special inspection is required for work related to constructing buildings, structures, structural work, and roadways, and includes but is not limited to:
      a. Verifying materials below foundations are adequate to achieve the design bearing capacity requirements.
      b. Verifying excavations are to the depth identified in the Contract Documents and the bottom of excavations are suitable materials.
      c. Perform classification and testing of compacted fill materials.

d. Verifying materials meet quality, lift thickness and in-place density requirements specified herein.
e. Prior to placement of compacted fill, inspect subgrade and verify the site has been prepared properly.

4. Testing will be performed at the frequency provided or as otherwise established by the Contracting Agency prior to Construction:
   a. Engineered Fill: Test every 500 square feet for each 2 feet of fill.
   b. Subgrade: Test every 200 square feet where in-place materials have been disturbed and recompacted or as recommended by the Engineer.
   c. Structural Backfill:
      1) Test every 200 square feet of building footprint, with no less than two tests per structure.
      2) Test every 200 cubic yards of material placed within 10 feet around the building.
   d. Crushed Surfacing Base Course (CSBC): Test every 500 square feet of each layer

E. Testing Methods:
1. Testing shall conform to the requirements of the WSDOT Standard Specifications.
2. Field testing procedures shall be a WSDOT Standard Operating Procedure or a Field Operating Procedure for an AASHTO, ASTM, or WAQTC test procedure. References to manuals containing all these tests and procedures can be found in the WSDOT Standard Specifications Section 1-06.2(1).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store earthwork materials in a location confirmed in writing by the Contracting Agency.

B. Stockpile material so that it is not contaminated, does not cause damage, does not become saturated, and is identifiable.

C. Storage of Excavated Materials:
1. Neatly place excavated materials far enough from the excavation to prevent stability problems. Keep the materials shaped to cause the least possible interference with boatyard operations and drainage.
2. Dispose of excavated materials unsuitable for backfill immediately.

1.07 EXISTING UTILITIES

A. General:
1. Existing utilities and pipelines are shown in the Drawings in their approximate location based on the best available information available. The actual location, size, type and quantity of utilities and underground facilities may differ from that shown and utilities or underground facilities may be present that are not shown.
2. Utilities are piping, valves, appurtenances, conduits, wire, cable, duct banks.
3. Exercise care in avoiding damage to all utilities. Contractor shall be responsible for repairing or replacing utilities, damaged during construction, in kind or better at no cost to the Contracting Agency.

B. Potholing:
1. Obtain best available current information for location, identification and marking of existing utilities before beginning any excavation. In areas where utilities

participate in Underground Service Alert, contact 1-800-424-5555, 811 OR DigAlert for information at least 48 hours in advance of beginning work. Give the Engineer 24 hours-notice before beginning work.

2. Contact all affected utility owners and request them to locate their respective utilities prior to the start of "potholing" procedures. The utility owner shall be given 3 days written notice prior to commencing potholing. If a utility owner is not equipped to locate its utility, the Contractor shall locate it.
3. When in pavement, clearly paint the location of all existing utilities where crossings, interferences, and/or connections to new pipelines or other facilities are shown on the Drawings, marked by the utility companies, or indicated by surface features. If utilities are not in pavement, identify the location with suitable markers.
4. After the utility survey is completed, and prior to preparing piping shop drawings, or the excavating for any new utilities or structures Contractor shall commence “potholing” or hand digging to locate and uncover existing utilities including services and laterals to a point 1 foot below the utility. Identify actual locations and elevations of all utilities where crossings, interferences, and/or connections to new pipelines or other facilities are shown on the Drawings, marked by the utility companies, or indicated by surface features.
5. Submit a report identifying each underground utility, location, at grade elevation, depth of cover, size, and material. Any variation in the actual elevations and the indicated elevations shall be brought to the Engineer's attention.
6. Excavations around underground electrical ducts and conduits shall be performed using extreme caution to prevent injury to workmen or damage to electrical ducts or conduits. Similar precautions shall be exercised around gas lines, telephone, and television cables.
7. Air spades and vacuum excavators shall be used to limit the size of the excavation and damage to adjacent facilities. Backfill after completing potholing. In existing paved areas, pave with 1 inch of cold mix asphalt concrete.
8. The Potholing Report shall be submitted prior to submission of pipe layouts and installation of piping.

C. Interferences:

1. If interferences occur at locations other than shown on the Drawings, notify the Engineer in writing. A method to correct the interferences shall be provided by the Engineer.
2. Any necessary relocations of utilities, whether shown on the Drawings or not, shall be coordinated with the affected utility owner. The Contractor shall perform the relocation only if instructed to do so in writing from the utility and the Contracting Agency.

1.08 SUBSURFACE INVESTIGATIONS

A. While the records of data obtained, including any geotechnical investigations and/or reports, may be considered by the Contractor to be correct, any conclusions or recommendations made in the reports are for information to the Engineer and are not a part of the Contract Documents. Copies of the boring logs are in the Appendix A of these Specifications.

B. The bidders may make additional subsurface investigations at the site prior to the bidding of the project at their cost. Prior to making any drillings or excavations, the bidder shall secure permission from the Contracting Agency, and property owners if on private property.

1.09 ADDITIONAL SAFETY RESPONSIBILITIES

A. Select, install, and maintain shoring, sheeting, bracing, and sloping as necessary to maintain safe excavations. Ensure such measures:
   1. Comply fully with 29 CFR Part 1926 OSHA Subpart P Excavations and Trenches requirements.
   2. Provide necessary support to the sides of excavations.
   3. Provide safe access to the Engineer's sampling and testing within the excavation.
   4. Provide safe access for backfill, compaction, and compaction testing.
   5. Otherwise maintain excavations in a safe manner that shall not endanger property, life, health, or the project schedule. Perform earthwork in strict accordance with applicable law, including local ordinances, applicable OSHA, and WA-OSHA.

B. The Contractor shall be responsible for the safety of workers and shall comply with safety and health standards such as Safety Standards for Construction Work (Chapter 296-155 WAC), General Safety and Health Standards (Chapter 296-24 WAC), General Occupational Health Standard (Chapter 296-62 WAC), and any other appropriate safety and health codes.

PART 2 - PRODUCTS

2.01 MATERIAL DEFINITIONS

A. General:
   1. All import materials shall be naturally occurring materials, free of organic matter and other deleterious materials, and sourced from a WSDOT approved pit source.
   2. Material generated from trench excavations in gravel surfaced areas must be stockpiled for potential reuse.

B. Crushed Surfacing Base Course (CSBC): WSDOT Standard Specification 9-03.9(3).

C. Pipe Zone Bedding: The following materials are acceptable for use as pipe zone bedding material, at the Contractor’s option:
   1. Gravel Backfill for Pipe Zone Bedding: WSDOT Standard Specification 9-03.12(3).

D. Salvaged Crushed Surfacing:
   1. Stockpiled material generated from trenching excavations.
      a. Where salvaged crushed surfacing meets gradation requirements for CSBC, the material may be reused as approved by the Engineer. Where salvaged crushed surfacing does not meet gradation requirements for CSBC but is free of deleterious materials (mud, topsoil, organics, debris), the material may be reused as Backfill Material as approved by the Engineer.
      b. Salvaged crushed surfacing for reuse must be stockpiled separately from material for reuse as Backfill Material.
      c. Material deemed unsuitable for reuse must be hauled and stockpiled or disposed of by the Contractor in accordance with 01 57 00.

E. Backfill Material:
   1. Gravel Borrow: WSDOT Standard Specification 9-03.14(1).

2. Salvaged native material generated from trench excavations that are free from deleterious materials (mud, topsoil, organics, debris) or rocks larger than 3 inches in greatest dimension may be reused as Backfill Material as approved by the Engineer.
    a. Onsite soils that contain more than 5 percent fine-grained material (smaller than No. 200 sieve) are moisture sensitive and shall only be used as Backfill Material during dry weather conditions.
    b. Native material shall not be reused in areas to be resurfaced with asphalt pavement.
    c. Material deemed unsuitable for reuse must be hauled and stockpiled or disposed of by the Contractor in accordance with 01 57 00.

F. Engineered Fill:
1. CSBC: WSDOT Standard Specification 9-03.9(3).
2. Permeable Ballast: WSDOT Standard Specification 9-03.9(2).

G. Quarry Spalls:
1. WSDOT Standard Specification 9-13.1(5).

H. Native Resurfacing Material: Native material such as soil and gravel prepared as necessary to be free from clods or rocks larger than 2 inches in greatest dimension. Material deemed unsuitable for reuse must be hauled and stockpiled or disposed of by the Contractor in accordance with 01 57 00.

I. Geotextile Fabric: Non-woven, non-biodegradable, needle punched geotextile comprised of polypropylene fibers. Install with a minimum 12-inch overlap, unless otherwise shown on the Drawings.

Apparent Opening Size	40	U.S. Sieve
Permittivity	1.0	sec^{-1}
Flow Rate	75	$gal/min/ft^2$
Tensile Strength @ 2% strain	1,000	lbs/ft
UV Resistance @ 500 hrs	90	%

1. Provide: Mirafi® Model RS 580i; or equal.
2. Acceptable Manufacturers:
    a. TenCate Geosynthetics Americas, Pendergrass, Georgia.

J. Water: The water used shall be reasonably free of objectionable quantities of silt, oil, organic matter, alkali, salts, and other impurities. Water quality must be acceptable to the Engineer.

K. Detectable Warning Tape: Plastic metallic type consisting of a blue color-coded polyethylene or melinex film, a solid core aluminum foil detection layer and other layers as required. The tape shall be resistant to acids, alkalines, and other components likely to be encountered in soils. It shall be designed for both conductive and inductive locating procedures. Detection tape colors shall follow the uniform color code per American Public Works Association (APWA).
1. Provide: Terra Tape® Sentry Line ® Detectable; T. Christy Enterprises, Inc. T A.DT.3-COLOR-CODE; or equal. Provide accessories as required by manufacturer.
2. Manufacturers: Reef Industries, Inc.; T. Christy Enterprises, Inc.; or equal.

PART 3 - EXECUTION

3.01 GENERAL CONSTRUCTION REQUIREMENTS

A. Barricades: Place Manual on Uniform Traffic Control Devices (MUTCD) compliant barricades at each end of trench excavations and along excavations as may be necessary to warn pedestrian and vehicular traffic of such excavations. Barricade lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely restored.

B. Access: Maintain access to all fire hydrants, water valves and meters, and private driveways.

C. Traffic Regulation: Provide such flagmen, patrols, pilot cars, drivers, lighted barricades, flares, lights, warning signs, and safety devices as may be required for control of traffic adjacent to all areas of work. Comply with Contracting Agency requirements.

D. Barricades: Barricades shall be placed at each end of all excavations and at such places along excavations as may be necessary to warn all pedestrian and vehicular traffic of such excavations.

E. Storage of Materials: Neatly place excavated materials far enough from the excavation to prevent stability problems. Minimize the material footprint so as to cause the least possible interference with site operations and drainage.

3.02 CONTROL OF WATER

A. Prepare and submit a Dewatering Plan in accordance with paragraph 1.04.C.
   1. Contractor shall read the geotechnical report and recommendations in Appendix A for soil, groundwater, and other parameters for dewatering system design.
   2. It shall be presumed that the presence of groundwater will require dewatering operations. Dewatering Systems shall be designed to:
      a. Prevent loss of ground as water is removed.
      b. Avoid inducing settlement or damage to existing facilities or completed work.
      c. Relieve artesian pressures and resultant uplift of excavation bottom.
      d. Accommodate a range of tide cycles for excavations in close proximity to the waterfront.

B. All excavations shall be kept free from water and all construction shall be in the dry.
   1. Furnish, install, maintain, and operate all necessary pumping and other equipment for dewatering excavations.
   2. Provide a sufficient number of pumps, including standby pumps, for use in case other pumps become inoperable, as to hold the groundwater level at an elevation of not less than 2 feet below the lowest elevation of the pipe, duct structure, required structural fill thickness or other material or feature to be placed.
   3. The dewatering operation shall be continuous, so that the excavated areas shall be kept free from water while concrete is setting and achieves full strength, and until backfill has been placed to a sufficient height to anchor the work against possible flotation.
   4. Continue dewatering during backfill operations.

5. If the subgrade becomes unsuitable due to failure of dewatering operations, the Contractor shall notify and coordinate with the Engineer as soon as failure is identified. The Engineer shall recommend remedial measures, if deemed necessary in the opinion of the Engineer, based on site conditions, proposed design elements for the area, and observations made in the field at the time.
6. If pumping is required on a 24-hour basis, requiring engine drives, then engines shall be equipped in a manner to keep noise to a minimum. Refer to Section 01 50 00 for noise control requirements.
7. Protect the Work against floatation.
8. Prior to excavating below the groundwater table, Contractor shall have onsite all necessary equipment and materials required for the work and in sufficient quantity, including but not limited to the dewatering system, cranes and all necessary lifting equipment, trench safety systems, precast concrete structures, structure subgrade materials, and backfill.

C. The Contractor shall be responsible for any damage to the Work or existing foundations and structures caused by dewatering operations. The Contractor shall repair damage and/or settlement at the Contractor's expense and to the Contracting Agency's satisfaction.

D. During rain events, the Contractor shall take necessary precautions to ensure safety of staff and the Work. Divert stormwater runoff away from the excavation. Direct precipitation within the excavation to a sump and pump it out.

E. The Contractor shall discharge dewatering water in accordance with local and state regulations.

F. Stormwater Management
1. It is the Contractor's responsibility to obtain all necessary Stormwater Discharge Permits, if required. Refer to Section 01 57 00.
2. A baseline Stormwater Pollution Prevention Plan (SWPPP) has been prepared in accordance with City of Port Townsend Municipal Code Chapter 13.32 and is included as Appendix C. Contractor shall review the SWPPP and be responsible for implementing, maintaining, updating, and modifying the documents as necessary based on intended construction operations and to meet their respective requirements.
3. Stormwater Rerouting
   a. The Contractor shall reroute all stormwater flows around existing storm drainage infrastructure designated for replacement while work is occurring.
   b. The existing stormwater drainage system must be kept in operation through the use of existing and temporary systems until the new facilities are inspected by the Contracting Agency and capable of accepting stormwater. The Contractor shall maintain existing stormwater system capacity during storm events.
   c. The Contractor shall execute work in such a way that normal maintenance and operation of the stormwater drainage system can be performed by the Contracting Agency.
   d. Access to existing stormwater drainage system facilities shall be provided at all times; switch-over to new facilities shall be fully coordinated with the Contracting Agency.
   e. Redundancy: Contractor shall provide onsite, and ready for operation, a redundant pump equal to or larger than the largest pump in the system used to provide the specified maximum pumping capacity.

f. Backup Power: If the maximum pumping capacity is being provided by electric motor drive pumps, an engine-driven generator or standby pump shall be provided and ready for operation.

3.03 SITE EXCAVATION

A. Provide erosion control protection in accordance with Section 01 57 00.

3.04 TRENCH EXCAVATION

A. Excavation for pipe and other utilities such as duct banks shall be in open cut. The trench shall be as wide as necessary for excavation shoring and the proper performance of the work up to the maximum width permitted as shown on the Drawings. The sides of the trenches shall be vertical in paved areas. The bottom of the trench shall be constructed to the grades and shapes indicated on the Drawings. Favorable review by the Contracting Agency is required prior to use of alternative methods of construction.

B. Do not advance open trench more than the length of pipe to be installed and backfilled or protected by the end of each day.

C. Accurately grade the bottom of the trenches to provide uniform bearing and support for each section of the pipe or conduit at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints, and as hereinafter specified. Dig bell holes and depressions for joints after the trench bottom has been graded. For the pipe to rest on the bedding for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the joint. Remove stones to avoid point bearing.

D. The trench shall not be backfilled until the Contracting Agency favorably reviews the pipe and bedding installation.

E. If no elevations are shown on the Drawings, provide 3 feet of minimum cover.

F. For all piping or conduits to be placed in any excavated and backfilled area, such as at manholes or for building connections, the initial lift of backfill shall be placed 2 feet thick over the top of the piping or conduit before compacting. Do not over compact or cause damage to pipe or conduit during compaction of initial lift.

G. Provide secured ladders for access to the trench by construction and inspection personnel. Additional secured ladders shall be provided to any structure or pipe that must be inspected and tested. Failure to provide safe inspection access shall void initial inspection and follow up inspection shall not be performed until proper safe access is provided to the items to be inspected.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to the dimensions and elevations indicated in the Drawings or specified herein. Include proper working methods, the erection of forms, and the protection of the work in excavation extents.

B. Preserve existing foundation surfaces shown on the Drawings in an undisturbed condition. If disturbances occur, replace such foundations in a manner approved by the Engineer.

C. Inspection of Excavation: Notify the Engineer when excavation for the structure is complete. Excavation must be inspected and approved by the Engineer prior to installing forms, reinforcing steel, concrete, or precast structures.

3.06 SUPPORT OF EXCAVATIONS

A. The Contractor alone shall be responsible for worker safety, including temporary shoring and excavation stability. The Contracting Agency and Engineer assume no responsibility.

B. Adequately support excavation for trenches and structures to meet all applicable requirements in the current rules, orders, and regulations. Adequately shore, brace, and sheet excavations so that the earth will not slide or settle and so that all existing structures and all new pipe and structures will be fully protected from damage. Keep vehicles, equipment, and materials far enough from the excavation to prevent instability.

C. Protect excavations and adjacent improvements from running, caving, boiling, settling, or sliding soil resulting from the high groundwater table and the nature of the soil excavated.

D. Maintain support for excavation in place until the pipeline or structure has been completed. Carefully remove shoring, sheeting, and bracing during backfilling of the trench or around structures so no voids are created and no caving, lateral movement, or flowing of the subsoils occurs.

3.07 EXCAVATION BEYOND THE LIMITS INDICATED

A. Excavate to limits shown in the Drawings or as specified herein. No payment will be made for excavation beyond the limits shown in the drawings or as specified that is done for the Contractor’s convenience, a result of the Contractor’s carelessness, or a result of the Contractor’s means and methods. If excavation beyond the limits indicated occurs, backfill with material approved by the Engineer and compact as specified herein.

3.08 UNSTABLE OR UNSATISFACTORY SOILS

A. If the bottom of the excavation is soft or unstable, and in the opinion of the Engineer cannot satisfactorily support the pipe, structure, or other related design elements, the Engineer will determine proper corrective methods.

3.09 SUBGRADE PREPARATION

A. Prepare subgrade to a minimum depth of 12 inches from the bottom of excavation.

B. If the subgrade is unstable, wet, or soft, coordinate with the Engineer for corrective methods prior to placing subsequent lifts.

3.10 SITE AND TRENCH BACKFILL

A. Backfill materials shall be compacted by vibrating, tamping, or a combination thereof. Compact materials in accordance with paragraph 3.12 unless otherwise specified or shown on the Drawings.

B. Site Backfill:
   1. Do not place any backfill material until the Engineer has inspected, tested and favorably reviewed the prepared subgrade.

C. Trench Backfill:
   1. Place trench materials true to the lines, grades, and details indicated on the Drawings.

2. Place trench materials in uniform, level layers, not exceeding 12 inches thick measured before compaction. The difference in level on either side of a pipe shall not exceed 4 inches.
3. Backfill material shall not be placed over the pipe or conduit until after the joints have been completed and inspected by the Engineer.
4. Protect the pipe or conduit from damage during the construction period. Repair broken or damaged pipe at no extra cost to the Contracting Agency. Once repair is inspected and approved by the Contracting Agency, the Contractor shall retest the line. Carefully place backfill around and over the pipe and do not allow it to fall directly upon the pipe. Tamping of backfill over the pipe shall be done with tampers, vibratory rollers, and other machines that will not injure or disturb the pipe.
5. Do not allow construction traffic over the pipe trench until the trench has been backfilled and compacted to be even with the existing adjacent grade, or a traffic rated metal plate has been placed over the trench.

D. Import Backfill: The quantity of import backfill material shall be coordinated and accepted by the Engineer prior to proceeding with the installation.

E. Geotextile Fabric shall be installed per the manufacturer's recommendations and as shown on the Drawings.

3.11 BACKFILL UNDER / ADJACENT TO STRUCTURES

A. Compact materials in accordance with Paragraph 3.12 unless otherwise specified or shown on the Drawings.

B. Structural Backfill shall be placed in uniform, level layers, not exceeding 6 inches thick measured before compaction under catch basins, storm drain drop inlets, manhole structures, meter vaults, valve vaults, electrical vaults and stormwater treatment system cells.

C. Backfill Adjacent to Structures:
1. Do not place backfill against structures until the concrete has been patched and cured.
2. Do not place backfill against structures until at least 28 calendar days after the concrete was placed, or until the concrete has achieved a strength of at least 2,500 psi, whichever is earlier. Concrete strength shall be demonstrated by field cured cylinders tested at the Contractor's cost, prepared and tested in accordance with ASTM C31 and ASTM C39.
3. Place structural backfill within 2 feet of a structure or as shown on the Drawings.
4. Place structural backfill in uniform, level layers, not exceeding 8 inches thick measured before compaction. Bring backfill up uniformly on all sides of the structure, and on both sides of buried walls.

D. Backfill for Walls Below Grade:
1. Backfill shall be placed in horizontal lifts not exceeding 12 inches in loose thickness. Only light, hand-operated compaction equipment (e.g., jumping jack, walk-behind vibratory plate compactor) shall be used within 10 feet of walls below grade.

E. Rock Subgrade Under Structures:
1. Place crushed rock under structures to the lines, grades, and minimum thicknesses shown on the Drawings. Unless shown specifically otherwise on

the Drawings, do not use rock as backfill above the elevation of the highest base slab of the structure.

3.12 COMPACTION

A. Add water to the backfill material or dry the material as necessary to obtain moisture content within 2 percent of optimum. Employ such means as may be necessary to secure a uniform moisture content throughout the material of each layer being compacted.
   1. Air-drying shall be used to reduce moisture content and/or achieve compaction before other methods may be considered. Or, where applicable, the Contractor shall demonstrate air-drying is not possible before other methods may be considered.

B. After the material has been moisture conditioned, compact it with compaction equipment appropriate for the use to achieve specified compaction.

C. If the backfill material becomes saturated or does not meet requirements specified through negligence, remove the faulty material and replace it in a manner approved by the Engineer/Contracting Agency. No additional payment will be made for such work.

D. Compact materials in accordance with AASHTO T99 OR ASTM D1557 (Modified Proctor) unless otherwise specified.

E. Compaction of embankment and backfill materials by flooding, ponding, or jetting is not permitted.

F. Material Requirements:

	Material	Minimum Relative Compaction[1]
1.	General Structural Backfill: Native Soil Import Soil	 95 percent 95 percent
2.	Lift Station Structural Backfill: CSBC	 98 percent
3.	Pipe Zone Bedding	85 percent
4.	Trench Zone Backfill	95 percent in paved areas 90 percent in unpaved areas
5.	Pipe Bedding	80 percent
7.	Subgrade	Compacted to provide unyielding, uniform density by method approved by the Engineer
8.	CSBC	95 percent
9.	Gravel	85 percent

[1] Modified Proctor Test (ASTM D 1557)

3.13 PROOF-ROLLING

A. Prior to placing CSBC in areas to receive asphalt pavement or gravel surfacing, the subgrade shall be proof-rolled using a fully loaded dump truck (10 cubic yard truck or equivalent). Any yielding areas shall be removed and replaced with

suitable Backfill Material and compacted to the specified relative compaction. Additional proof-rolling shall be performed on remediated areas.

3.14 SITE GRADING

A. Tolerances: Grade the site to the elevations shown on the Drawings within the tolerances provided here:
   1. Excavation:
      a. Plus or minus ½ inch.
   2. Backfill: Where backfilling due to excavation or temporary cut and fill operations, place lifts as specified herein with the following tolerance:
      a. Plus or minus 1 inch.
   3. Subgrade:
      a. Plus or minus ½ inch.
   4. Fine grading (finished surface):
      a. Asphalt pavement: ¼ inch when tested with a 10-foot straight edge.
      b. Concrete pavement: ¼ inch when tested with a 10-foot straight edge.
      c. Gravel areas: Plus or minus ½ inch.
      d. Landscaped areas: Plus or minus ½ inch.

B. Gravel Areas: Place gravel material onsite to finished grade elevations as shown on the Drawings, unless otherwise noted.

C. Except where shown otherwise on the Drawings, restore the finish grade to the original contours and to the original drainage patterns. Grade surfaces to drain away from structures at a minimum of 2 percent, unless otherwise noted on the Drawings.

END OF SECTION

SECTION 32 12 16

PAVING AND SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all labor, material, equipment, tools, and services required for removing, placing and compacting asphalt concrete pavement for roadways, parking lots, and walkways to the lines, grades, and dimensions shown on the Drawings and as specified herein.
   1. Demolish existing asphalt paving.
   2. Repair and resurface existing asphalt pavement damaged during construction.

1.02 REFERENCES SPECIFICATIONS

A. Whenever the words "Standard Specifications" are referred to, the reference is to the Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction, and Amendments (current edition).

B. ASTM International (ASTM):
   1. D422 Test Method for Particle-Size Analysis for Soils
   2. D1556 Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
   3. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (Modified Proctor)
   4. D2027 Specification for Cutback Asphalt (Medium Curing Type)
   5. D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

1.03 DEFINITIONS

A. Base (aggregate base): Layer of material of certain thickness placed under the pavement, constructed on subgrade. It provides a working surface for pavement placement, load distribution, and drainage.

B. Leveling course: Lift of asphalt concrete used to fill and level irregularities prior to placement of the wearing course.

C. PG: Performance graded. The PG system defines the asphalt binder based on the conditions in which it may be used.

D. Subgrade: See Section 31 00 00.

E. Tack Coat: Emulsified asphalt used to bond asphalt concrete to existing asphalt concrete, or to bond between asphalt concrete lifts.

F. Wearing course: Final lift of asphalt concrete.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

B. Submit the following under the Product Data:
   1. Submit a signed verification from each source of supply for each construction material employed on this project indicating that the materials meet the Specification requirements.
   2. Submit manufacturer's certification of the actual volatile organic compound (VOC) content for all pavement paints and bituminous pavement sealers proposed for use on this project. Submit certification of the actual VOC content for all coatings. VOC content shall be measured in grams per liter by weight of coating as applied excluding water and color added to the tint base.
   3. Submit verification that bituminous pavement sealers and paint products furnished meet applicable regulations as to allowable VOC content for the time and place of application and use intended.

C. Submit the following under Samples and Test Results:
   1. Furnish, without additional cost to the Contracting Agency, such quantities of construction materials as may be required by the Engineer for test purposes. The Contractor shall cooperate with the Engineer and furnish necessary facilities for sampling and testing of all materials and workmanship. All materials furnished and all work performed shall be subject to rigid inspection, and no materials shall be used in the construction work until it has been inspected by the Engineer.

D. The Contractor shall submit a mix design/Job Mix Formula (JMF) for this project, taking into account the specific equipment planned to be used, in accordance with WSDOT Standard Specification 5-04.3(7)A1. Submit test data showing that the JMF meets WSDOT Standard Specification 9-03.8(2) and 9-03.8(6).

E. JMF shall indicate the physical properties of the mixes as shown by tests of materials made in a commercial laboratory identical for this project.

1.05 TESTING REQUIREMENTS

A. Comply with WSDOT Standard Specification 9-03.8(2) and 9-03.20 and the requirements shown on the Drawings.

1.06 QUALITY ASSURANCE

A. Comply with WSDOT Standard Specifications and the requirements shown on the Drawings.

B. All pavement stripe painting shall be performed by competent and experienced Equipment operators and painters using proper equipment, tools, stencils, templates, and shields in a workmanlike manner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. ACP shall be Class ½" placed in lifts not exceeding more than 3 inches each. Total thickness shall be as shown on the Drawings.

B. Aggregate shall conform to WSDOT Standard Specifications 9-03.8 and tested in accordance with 9-03.8(6).

C. Aggregate Base shall be Crushed Surfacing Base Course conforming to WSDOT Standard Specifications 9-03.9(3). New or reused material from trench spoils as approved by the Engineer.

D. Asphalt shall be either PG 64-22 or PG 70-22 (as noted on Drawings) conforming to AASHTO M320.

E. Joint Sealant shall be PG 64-22 conforming to AASHTO M320.

F. Tack coat shall be CSS-1 conforming to WSDOT Standard Specification 9-02.1(6).

G. Mix Plant shall conform to WSDOT Standard Specification 5-04.3.

PART 3 - EXECUTION

3.01 GENERAL

A. Where trenching or other construction activity has resulted in damage to a localized area of pavement, or along a previously cut edge of pavement for trenching, the damaged pavement shall be cut back 6 inches, removed and replaced.

B. New and existing structures such as utility vault frames and covers shall be adjusted to be flush with the finished pavement surface after paving the paved areas.

3.02 PAVEMENT CUTTING

A. Where trenching or excavation occurs in paved areas, the existing pavement shall be scored and broken ahead of the trenching or excavation operation. The extent of paving removed shall be limited to the minimum necessary for the excavation. All existing asphalt or concrete surfacing shall be saw cut vertically in a straight line and removed from the jobsite prior to starting the trench excavation. This material shall not be used in any fill or backfill.

B. Pavement shall be cut accurately and on neat lines. The asphalt pavement shall be saw cut to a minimum depth equal to or greater than one-half the thickness of the pavement section. Any pavement damaged outside these lines shall be re-cut and restored at the expense of the Contractor. Should voids develop under existing pavements during construction, Contractor shall remove the affected pavement, repair voids and replacement pavement section at the expense of the Contractor.

C. Construct joints between successive runs that are vertical and at right angles to the line of the improvement. Exercise care in construction of all joints to ensure that the surface of the pavement is true to grade and cross-section. Lapped joints will not be permitted.

3.03 REMOVAL AND DISPOSAL OF PAVEMENT AND BASE COURSE

A. ACP demolished in the project shall be loaded onto trucks and hauled offsite for disposal.

B. Remove the materials beneath the ACP to the lines and grades necessary for full replacement of the ACP pavement section as shown on the Drawings or specified herein.

C. Excavated ACP subgrade materials shall be managed in accordance with Section 31 00 00.

3.04 PLACEMENT OF AGGREGATE BASE

A. Subgrade Preparation: Subgrade layers shall be placed as shown on the Drawings and specified in Section 31 00 00.

B. Aggregate Base Tolerance: The aggregate base shall not be placed before the subgrade is approved by the Engineer. The finished aggregate base shall not vary more than 0.05 foot above, nor 0.10 foot below, the planned grade. Provide not less than the total thicknesses of subgrade as shown on the Drawings.

C. Aggregate Base Placing: The aggregate base material shall be spread on the prepared subgrade by means of approved spreading devices subject to approval by the Engineer; the aggregate base material may be dumped in piles upon the subgrade and spread by bulldozing ahead from the dumped material. Each layer shall not exceed 12 inches. Segregation of large or fine particles of aggregate shall be avoided, and the material as spread shall be free from pockets of large and fine material.

D. Subgrade layers shall be compacted in accordance with Section 31 00 00.

3.05 TACK COAT APPLICATION

A. Tack Coat: In advance of spreading bituminous material upon an existing bituminous or portland cement concrete surface, a tack coat shall be applied to all areas to be surfaced and to all vertical surfaces of existing ACP, curb, gutters, and construction joints in the surfacing against which additional material is to be laced. When two or more lifts of ACP are required, a tack coat shall be applied between each lift.

1. Preparation: Immediately before applying a tack coat, the area to be surfaced shall be cleaned of all loose material.
2. Application: The tack coat shall be applied by means of pressure distributors by pressure hand-spray equipment. The rate of application shall be 1/20 gallon per square yard. Emulsified asphalt shall not be applied when the atmospheric temperature is below 40°F.

3.06 PLACEMENT OF ASPHALT CONCRETE

A. Delivery and Spreading Bituminous mixtures shall be delivered to the roadbed at temperatures specified in the WSDOT Standard Specifications. Spreading of the mixture shall be in accordance with the WSDOT Standard Specifications.

B. Compaction: Compaction: Compaction of each lift shall be a minimum of 91 percent of maximum density for base lifts, and 92 percent of maximum density for top lifts, in accordance with AASHTO T-99 unless otherwise specified or shown on the Drawings. Compaction by vehicular traffic shall not be permitted. The Engineer reserves the right to require an adjustment of the temperature of the asphalt concrete at the time of placement.

C. Pavement Thickness: See Drawings.

D. Joining Pavement: The joints between old and new pavements or between successive days' work shall be carefully made in such manner as to ensure a continuous bond between old and new sections of the course. Edges of existing pavement shall be exposed and cleaned, and edges cut to straight, vertical surfaces. All joints shall be painted with a uniform coat of tack coat before the fresh mixture is applied.

E. Protection of Pavement: After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened and in no case less than 6 hours.

3.07 JOINT SEAL

A. Apply joint sealer to all edges including edges of the interface between new and existing ACP.

3.08 PAVEMENT RESTORATION

A. ACP shall not be placed until the subgrade layers have been compacted and tested in accordance with Section 31 00 00.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 32 93 00

LANDSCAPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. New Plants: Seedlings
   1. Refer to Sheet L-001 Planting Plan, Details, and Notes for proposed plant species.

B. Mulch.

C. Maintenance.

1.02 DEFINITIONS

A. Weeds: Include dandelion, jimsonweed, quack grass, horsetail, morning glory, rush grass, mustard, lambs quarter, chickweed, cress, crabgrass, Canadian thistle, nutgrass, poison oak, blackberry, tansy ragwort, Bermuda Grass, Johnson Grass, poison ivy, nut sedge, nimblewill, bindweed, bent grass, wild garlic, perennial sorrel, and brome grass.

B. Plants: Herbaceous material, and groundcover specified in this section.

1.03 SUBMITTALS

A. Submit results of soil tests of imported bioretention soil mix.

B. Submit landscape installer qualifications 30 days before start. This shall include 3 to 5 projects with descriptions, photos, and contacts similar in material, design, and extent to that indicated for this project. Installer shall identify the Field Supervisor and provide a record of this individual's successful landscape installations.

C. Submit landscaping installation schedule 30 days before start, showing scheduled dates for all landscaping work. Update as needed to indicate changes in the schedule. Work done at an unscheduled time may be rejected by the Engineer. Schedule changes must be delivered to the Engineer 48 hours before the start of the indicated work.

D. Samples of each of the following:
   1. 2 lb. of wood fiber mulch required for project, in labeled plastic bag.

E. Submit names and location of preapproved nurseries within 5 days following the Notice to Proceed, and proof of deposit or other method of reserving all plant material as specified for this project within 10 days following the Notice to Proceed. Proof of non-availability and requests for plant material substitutions must be submitted in accordance with Section 01 33 00.

F. Submit a temporary irrigation plan:
   1. Contractor shall design and install a temporary irrigation system, ready for automatic operation to the satisfaction of the Engineer. System shall include, but not be limited to the following:
      a. Irrigation layout drawings.

b. Landscape hose, pipe and fittings, valves, outlets, emitters, bubblers, and accessories.
c. Testing and adjusting.
d. Control system.

G. Record Drawings: Upon completion of the project, submit a revised contract drawing on a reproducible plan, showing location, quantities, names, and sizes of all plant materials, planting beds, and lawn areas.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this project and with a record of successful landscape establishment.
1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site while landscaping is in progress.

B. Provide seedlings grown in a preapproved nursery in accordance with sound horticultural practice and sanitation practices. To add a nursery to the preapproved list, provide nursery name, address, phone number and contact person along with proof of availability of proposed plant material to Engineer for approval.

Preapproved nurseries include the following:

Sound Native Plants, Inc.
PO Box 7505
Olympia, Washington 98506
Phone: (360) 352-4122

Puget Sound Plants
3147 46th Avenue NE
Olympia, Washington 98506
Phone: (360) 943-0480

1. Provide healthy, vigorous stock grown under climatic conditions similar to conditions in the locality of the project and free of disease, insects, eggs, larvae, weeds in root balls, and defects such as knots, sunscald, injuries, abrasions, and disfigurement.
2. Sizes: Provide seedlings in the sizes specified. Larger seedlings may be used if acceptable to Engineer.

C. Observation: Engineer reserves the right to observe and approve plants, either at place of growth or at site, for compliance with requirements for name, variety, size, and quality prior to planting.

D. Work shall be performed by persons familiar with and experienced in doing similar projects. Work shall be done under the supervision of a qualified supervisor.

1.05 DELIVERY STORAGE

A. Seedlings: Do not prune before delivery, except as approved by Engineer. Protect bark, branches, stems, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Provide protective covering during delivery. Do not drop seedlings during delivery.

B. Protect and maintain plant life until it is planted. Do not remove container-grown-stock from containers before time of planting.

C. Deliver plant life materials immediately before placement. Water as often as necessary to maintain root systems in a moist condition. No plants shall be planted without approval of Engineer.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install plants when ambient temperatures may drop below 35°F or rise above 90°F.

B. Do not install plants when wind velocity exceeds 30 mph.

1.07 MAINTENANCE SERVICES

A. Maintain plant life immediately after placement and until date of Final Completion.

B. Maintenance to include:
   1. Cultivating and weeding all plant beds.
   2. Irrigate by use of temporary irrigation system during dry months until plants are established. Saturate root systems periodically to promote deep roots and drought tolerance. During establishment, at a minimum, 2 inches of water, including precipitation, shall be provided to planting areas every 2 weeks during dry periods, at a minimum June 1 through September 15. Ensure adequate watering for 100% of the plants to be alive, healthy, established and vigorously growing.
   3. Pruning, including removal of dead and broken branches, and treatment of pruned areas and other wounds.
   4. Disease control.
   5. Replacing mulch.

PART 2 - PRODUCTS

2.01 SEEDLINGS

A. Provide plant material of the species and size identified in the Plant Materials Schedule as indicated on the Drawings. Plant material shall be grown in climatic conditions similar to those in the locality of work.

B. Do not use plant materials that have been in cold storage or heeled-in. Do not prune before delivery. Do not bend or bind-tie plants in such a manner as to damage bark, break branches, or destroy natural shape.

C. Name and Variety: Provide plant materials true to name and variety established by the American Joint Committee on Horticultural Nomenclature’s "Standardized Plant Names."

D. Quality: Provide seedlings and all other plant material complying with the recommendations and requirements of ANSI Z60.1 "Standard for Nursery Stock" and as further specified.

E. Seedlings:
   1. Provide established and well-rooted seedlings from a preapproved nursery.
   2. Seedlings should be planted as soon as they are received from the nursery. If storing the seedlings is required before planting, keep seedlings in their original package until time for planting. Keep the bag or box tightly sealed to

keep moisture inside the package. Tape over any tears or holes in the packaging immediately.

3. Store seedlings in a cool, damp, and shaded location that is sheltered from the wind. Do not allow seedlings to freeze or to come into contact with direct sunlight.
4. Do not prune or cut off any parts of the seedling, especially their roots.
5. Examine each seedling before planting. Discard seedlings that have any of these characteristics:
    a. Broken stem or primary root
    b. Bark skinned off or easily rubs off
    c. Mold or mildew on the foliage
    d. Dried-out roots
    e. An undersized stem thickness at the stem/root transition

2.02 MULCH

A. Refer to Section 33 44 19.

2.03 BIORETENTION SOIL MIX

A. Refer to Section 33 44 19.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that prepared biofiltration tank is ready to receive work.

B. Saturate soil with water to test drainage.

C. Notify Engineer when conditions detrimental to plant growth, such as adverse drainage conditions, are encountered. Do not proceed with planting until situation has been resolved.

3.02 PLACING AND PREPARING SOIL MIX

A. Refer to Section 33 44 19.

B. Fine Grading: After soil preparation, bring all planting areas to a smooth, even surface with loose, uniformly fine texture. Remove ridges and fill depressions as needed in all areas to meet finish grades. Water thoroughly to ensure complete settling. Limit fine grading to areas that can be planted immediately after grading.

3.03 FERTILIZATION

A. Do not add fertilizer to biofiltration treatment system.

B. Integrated Pest Management (IPM) shall be implemented that avoids use of herbicides, fungicides, pesticides, and insecticides within biofiltration planters.

3.04 PLANTING

A. Lay out individual seedling areas for multiple plantings. Outline planted areas; and secure Engineer's acceptance before start of planting work. Make minor adjustments as requested.

B. The water source for irrigation must be in place and fully operating in areas where plant materials are to be installed.

C. Space plants as indicated on the Drawings, and at least 6 inches away from flow spreader piping.

D. Planting Seedling Plugs or Containers:
   1. Remove only one plant at a time. Gently loosen plant from container by pressing on the sides to loosen the plant and pulling at the base of the stem. Examine each seedling to confirm that it is a quality seedling (refer to 2.01-D above).
   2. Pull loose roots outward and cut or straighten any that are encircling the root ball.
   3. Place the plant in the hole at its original depth.
   4. Hold the seedling upright while gently closing the hole and packing the soil.

E. Planting Bareroot Seedlings:
   1. Dig a fairly straight hole that is deep and wide enough for all the seedlings' roots to fit without forcing them in.
   2. Remove only one seedling at a time from its package or planting bag. Carefully separate the seedlings to avoid damaging the roots. Examine each seedling to confirm that it is a quality seedling (refer to 2.01-D above).
   3. Insert the root system to the bottom of the hole, and then slightly lift up the seedling to its desired planting depth.
   4. Hold the seedling upright while gently closing the hole and packing the soil.

3.05 MULCHING

A. Place mulch in biofiltration tank at bases of plants. Do not cover crown or place mulch against canes or stems (refer to 3.04 above,) or block outlets of flow spreader piping.
   1. Thickness: 2 inches.

3.06 MAINTENANCE

A. Maintain plants until date of Final Completion.

B. Maintain plants by watering, pruning, cultivating and weeding as required for healthy growth and as needed to keep the area clean and tidy. Maintain mulch at specified depth and loosen to avoid compaction. (refer to 1.08 above).

3.07 CLEANUP AND PROTECTION

A. During landscape work and any Maintenance Period, store materials and equipment where directed. Keep pavements clean and landscape area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors, tradesmen, and trespassers. Maintain protection during installation and maintenance periods. Treat, clean up, repair, or replace landscape work as directed.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus landscaping soil and waste material, including excess bioretention soil, trash, and debris, and legally dispose of it off the Contracting Agency's property.

END OF SECTION

SECTION 33 05 33

FUSIBLE HDPE PIPE AND FITTINGS

1.01 SUMMARY

A. Section includes requirements for furnishing all labor, material and equipment to install high-density polyethylene (HDPE) pipe and fittings joined by means of butt fusion and mechanical joints meeting the requirements of AWWA C906.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM):

1.	ASTM D638	Standard Test Method for Tensile Properties of Plastics.
2.	ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
3.	ASTM D1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
4.	ASTM D1505	Standard Test Method for Density of Plastics by the Density - Gradient - 1 Technique.
5.	ASTM D1599	Standard Test Method for Short -Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
6.	ANSI/ASTM D1603	Standard Test Method for Carbon Black in Olefin Plastics.
7.	ASTM D1693	Standard Test Method for Environmental Stress - Cracking of Ethylene Plastics.
8.	ASTM D2122	Standard Method of Determining Dimensions of Thermoplastic Pipe and Fittings.
9.	ASTM D2290	Standard Test Method for Apparent Tensile Strength of Ring or Tubular Plastics and Reinforced Plastics by Split Disk Method.
10.	ASTM D2657	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
11.	ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
12.	ANSI/ASTM D2839	Standard Practice for Use of a Melt-Index Strand for Determining Density of Polyethylene.
13.	ASTM D3035	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR - PR) Based on Controlled Outside Diameter.
14.	ASTM D3261	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
15.	ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Material.
16.	ASTM D4218	Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
17.	ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR PR) Based on Outside Diameter.

18. ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Pipe and Tubing
19. ASTM F1056 Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining of Polyethylene Pipe or Tubing and Fittings
20. ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE)
21. ASTM F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

B. American Water Works Association (AWWA):
1. AWWA C906 Standard for Polyethylene (PE) Pressure Pipe and Fittings, through 63 inches OD for Water Distribution.
2. AWWA M55 Manual for the Design and Installation of Polyethylene Pipe in Water Applications.

C. Plastic Pipe Institute (PPI):
1. PPI TR-3 Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.
2. PPI TR-4 PPI Listing of Hydrostatic Design Bases (HDB), Strength Design Bases (SDB), Pressure Design Bases (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.
3. PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 - Submittals: Requirements for submittals.

B. Pipe and fitting materials submittal shall include:
1. Manufacturing method and material standards
2. Grade of material
3. Wall thickness and tolerances
4. Pressure rating
5. Fitting fabrication details.

C. Prior to each shipment of pipe, submit one electronic copy of the following certified test reports and certificates.
1. Certification that all materials delivered comply with the AWWA C906 Standards and these Specifications, including the testing requirements. Measurements of pipe dimensions performed as per AWWA C906.
2. Certified test reports for all the tests to be performed in accordance with these Specifications and the AWWA C906 Standards. Certified test reports shall be submitted to the Engineer prior to shipment of pipe.
3. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific product. Said certification shall include a stress life curve per ASTM D2837. The stress regression testing shall have been done in accordance with ASTM D2837 and PPI TR-3, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi, as determined in accordance with ASTM D2837.

4. The Manufacturer's certification shall state that the pipe was manufactured from one specific resin in compliance with these Specifications. The certificate shall state the specific resin used, its source, and list its compliance to these Specifications. Reuse of recycled product with not be allowed.

D. A detailed plan of method for assembly of the pipe. Any deviations from procedure as per the manufacturer's recommendations, the Plastic Pipe Institute guidelines or these Specifications shall be noted in the submittal and the submittal cover sheet. The procedures in the plan shall include:
   1. Checking condition of HDPE pipe inside and outside for manufacturing defects and damage not detected at the manufacturer's plant or that which occurred during shipping.
   2. Step-by-step description of pipe assembly procedure, which can be checked and verified in the field by the Contracting Agency, for butt fusion both at the surface and in the trench.
   3. Allowable tolerances for pipe wall mismatch or offset. Maximum offset or mismatch shall not exceed 10 percent of the supplied pipe minimum wall thickness. An offset or mismatch shall be defined as the measured distance of the profile between the outside walls from two conjoining pieces of fused pipe. For example, if the minimum pipe wall thickness is 2.57 inches, then the maximum allowable mismatch between two of pipes of the same thickness is 0.257 inch as measured from the outside of the pipe at the fused joint, perpendicular to the axis of the fused pipe joint.
   4. Method of checking and ensuring pipe wall mating profile matches or is within allowable tolerances.
   5. Method for matching pipe ends in the event pipe pieces to be joined are not round or will not match circumferentially on the initial attempt to join the pipes.
   6. Installation of the pipe including staging of pipe pieces, placement of lengths of fused pipe into the trench and length of open trench.

E. If HDPE pipe and fittings are manufactured/fabricated by different companies, then each company shall submit a written statement/certification that each manufacturer and fabricator is listed in and complies with the generic butt fusion joining procedure for polyethylene pipe in the Plastics Pipe Institute (PPI) TR-33 for the resin to be used. All pipe and fittings shall perform together in accordance with the requirements of the Specifications.

F. List of butt fusion machine(s) to be used, including the manufacturer's procedure for calibrating and checking the proper function of the machine(s).

G. Detailed computer printouts of fusion parameters at each fused joint. Hardcopy printouts shall be submitted to the Contracting Agency at the end of each day during pipe fusion work and additionally as requested by the Contracting Agency. The hard copy shall define the following for each fused joint.
   1. Heat of fusion
   2. Applied interfacial pressure
   3. Time of fusion, including melt and hold time
   4. Visual inspection comments.

H. Shop drawings or manufacturer's information on longitudinal and axial pipe rollers.

I. Certificates of qualifications of technicians/operators that will perform butt fusion for joining HDPE pipe and fittings. Operator/technician shall have the minimum experience as specified in this Section under Quality Assurance.

J. HDPE Fitting and Appurtenance Experience: Submit documentation verifying that the fitting and appurtenance fabricator that will be fabricating the HDPE pipeline fittings and appurtenances (HDPE Pipe Fabricator) meets the following minimum requirements:
   1. The HDPE Pipe Fabricator shall have completed five projects within the last five (5) years fabricating solid wall, pressure rated HDPE molded fittings meeting requirements similar to those required by this Section. Experience documentation for each project shall include: Client, project name, description of the project, project location, completion date, contact person, and telephone number.

1.04 QUALITY ASSURANCE

A. One size of pipe manufactured in 8-inch size for the particular standard material code designation (DR 11 wall thickness) shall be tested by the elevated-temperature, sustained- pressure test by the manufacturer. The particular standard material code designation to be used shall be tested in the specified size of pipe (8-inch) at the beginning of production.

B. Plant Inspection:
   1. The manufacturer is responsible for the performance of all testing and inspection requirements as specified in AWWA C906.
   2. All pipe and fittings to be installed under this Contract may be inspected at the plant by the Contracting Agency for compliance with these Specifications using an independent testing laboratory selected and paid for by the Contracting Agency.
   3. Manufacturer shall notify the Contracting Agency/independent testing laboratory at least 72 hours in advance, if plant is within 250 miles of the Contracting Agency’s office, or 10 Calendar Days in advance, if outside of 250 miles of the Contracting Agency's office, prior to beginning manufacture or fabrication of any pipe or fitting, requesting inspections or performing tests. The inspector shall have free access to those parts of a manufacturer's plant that are necessary to ensure that products comply with all requirements and may take photographs for his and the Contracting Agency’s use. Failure to comply with this notification requirement shall be cause for to Contracting Agency to reject any pipe manufactured without the Contracting Agency's Material Inspector present.
   4. The manufacturer shall make available for use by the inspector, without charge, such tools and assistance as are necessary for inspection and handling of materials.
   5. The Contractor will bear the cost of inspection for any one plant producing HDPE pipe and one plant fabricating HDPE fittings at any one time. Should two or more different manufacturing plants produce HDPE pipe or fittings at the same time, the Contractor shall bear the cost of labor, travel, and lodging associated with inspection for all but the closest manufacturing plant.

C. The Contracting Agency or Representative will make inspection of the pipe and fittings after delivery. The pipe is subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though other pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job immediately and shall not be allowed to be reworked or reused on any portion of the job.

D. Workmanship and Testing:
   1. The Contracting Agency may select the time and pipe or fitting piece to be tested for any required testing except at the beginning of production run, which will be conducted as specified herein.
   2. The manufacturer shall take adequate measures in the checking of incoming materials and in the production of pipe to ensure compliance with the requirements of these Specifications. The following tests relative to qualification of compounds and manufacturing processes and for quality assurance shall be conducted not less frequently than at the indicated intervals. Higher frequencies of these tests and additional tests shall be conducted, if necessary, and as determined by the manufacturer's quality control program, to ensure compliance with the requirements of the Contract Documents and AWWA C906.
      a. All incoming lots of raw polyethylene materials shall be sampled and tested for melt-flow index and density. The testing results shall fall within the limits established between the material supplier and piping manufacturer.
      b. Pipe inside and outside walls shall be smooth and free of surface abnormalities. Each length of pipe surface shall be visually checked inside and outside for defects. No abnormalities inside or outside of the pipe surface will be allowed and the presence of such defects shall be cause to reject the pipe.
      c. Dimensions and tolerances shall be measured once per hour or once per length of pipe, whichever is less frequent.
      d. Bend-back test shall be performed at the beginning of each production run and daily thereafter for each pipe size in accordance with AWWA C906. The specimens tested shall be representative of the entire inside surface of the pipe. The elongation-at-break test may be substituted for this test.
      e. Ring-tensile strength test shall be performed at least once per production run, at 2,500 feet and at every 5,000 feet thereafter. The quick burst test may be substituted for this test.
      f. Carbon black content shall be determined for each individual lot of pre-compounded black PE material.
      g. A 5-second pressure test shall be performed at least once per production run. The elevated-temperature sustained-pressure test may be substituted for this test. In lieu of performing the 5-second pressure test for fittings at four-times rated pressure as specified in ASTM D1598, the pressure may be reduced to two-times rated pressure with all other test requirements remaining the same. Tested fittings will not be allowed to be installed under this Contract.
      h. Melt-flow index test shall be run on samples from the pipe at least once per Calendar Day.
      i. Density test shall be run on samples from the pipe once per Calendar Day, or once per lot of pre-compounded black PE material, whichever is less.
      j. Marking on each length of pipe shall be visually examined and checked for marking accuracy and legibility.
      k. Each fitting shall be visually checked inside and outside for defects and the presence of defects shall be cause to reject the fitting. Should defects be found on the pipe and the manufacturer feels that such defects do not affect the structural integrity or longevity of the pipe, the

manufacturer must, in writing, explain the nature of the defects and provide positive witnessed test results which demonstrate that the integrity of the pipeline has not been compromised. It is the Contractor's responsibility to ensure that the proper documentation is submitted. The Contracting Agency and Engineer will be the determiners as to whether the documentation submitted is satisfactory and the pipe acceptable.

l. A 5-second pressure test shall be performed on the first fitting of a particular size and every fiftieth fitting thereafter in accordance with AWWA C-906 and ASTM D1598.

E. Heat Fusion Machine and Operator:

1. The heat fusion machine(s) shall be capable of providing a detailed computer-recorded report of fusion parameters at each joint. Pipe fusion will not be allowed if the computer-recorder is not functioning properly. Manually-kept records of fusion parameters for main line HDPE pipe will not be an acceptable substitute for computer generated reports submitted to the Contracting Agency.
2. All pipe fusion machine operator(s)/technician(s) shall have a minimum of 3 years' experience in the fusion of solid wall HDPE pipe, with a combined total length of pipe fused of at least 4,000 feet. Pipe fusion operator(s)/technician(s) shall have fused at least 2,000 feet of solid wall HDPE pipe 8 inches or larger within the last 3 years. Fusing of pipe will not be allowed unless the operator(s)/technician(s) performing the work meets these experience requirements.
3. Each fusion machine to be used by the Contractor shall be certified by the manufacturer or manufacturer's authorized agent (which shall not be the Contractor) as being in proper working order and capable of performing the work intended, excepting that the manufacturer's authorized agent cannot be an agent which, in addition to representing the manufacturer, provides HDPE pipe fusing services directly or indirectly to the Contractor. Certification shall be performed prior to scheduled HDPE pipe fusion training. Prior to certification, each fusion machine shall be checked and calibrated by the same company.
4. The Contractor shall submit certification from the fusion machine manufacturer that the operator is qualified to operate the machine to be used for fusion on this project.
5. Where not specified or shown otherwise in the Contract Documents, the requirements of AWWA M55 shall apply. If in the event there is a conflict between the Contract Documents and AWWA M55, the more stringent shall apply.

1.05 DELIVERY, STORAGE AND HANDLING

A. All pipe and fittings shall, unless otherwise specified, be prepared for standard commercial shipment.

B. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe. Pipe shall be placed on trucks and protected during transport so as to prevent damage or excessive ovaling of the pipe.

C. Pipe shall be stored on site, at the Contractor's own yard or staging/storage area, within the Contracting Agency’s designated construction easements, or as otherwise allowed by encroachment permits in a neat and orderly manner and on

flat level ground, properly supported throughout to prevent rolling, damage or ovaling over time.

D. In no case shall pipe be allowed to be rolled or dragged into place for storage. Handling of pipe for storage or staging shall be performed by lifting with appropriate equipment. Dropping of pipe from transport trucks will not be allowed. Additional requirements for storage of pipe shall be per manufacturer's recommendations.

E. Storage of pipe along the side and within the roadway right-of-way may be done in accordance with the Drawings. Regardless of approvals obtained, the Contractor shall not store pipe in such a manner as to expose an end of a pipe to the traveling public. All exposed ends shall be protected with barricades or protective covers (PVC sheeting) banded to the pipe.

F. The Contractor shall not be allowed to store or place pipe in drainage ditches, store without proper supports, or place otherwise in any location which may adversely affect the roundness or integrity of the pipe.

G. HDPE pipe shall not be dragged. The Contractor shall make use of rollers and lifting equipment to handle and transport pipe which has been fused. If, in the opinion of the Contracting Agency, the Contractor may be causing excessive damage to the pipe due to dragging into place, the Contracting Agency may require the Contractor to rotate the pipe such that the damaged portion of the pipe is exposed and can be inspected and measured. Sections of pipe failing the inspection will be cut out and removed from the pipeline. No extra time or compensation will be due the Contractor for rotating the pipe for inspection or for removing the failed section of pipe.

PART 2 - PRODUCTS

2.01 FUSIBLE HIGH DENSITY POLYETHYLENE PIPE

A. Pipe supplied shall be new and be from unused stock.

B. Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high density PE 4710 polyethylene resin meeting the ASTM D3350 property and pipe performance requirements.

C. The material shall be listed by PPI (the Plastics Pipe Institute, a division of the Society of the Plastics Industry) in PPI TR-4 with a 73°F hydrostatic design stress basis (HDB) rating of 1,600 psi at 73 °F, and a 104°F hydrostatic design stress basis rating of at least 400 psi. The PPI listing shall be in the name of the pipe manufacturer and shall be based on ASTM D2837 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.

D. Material shall contain no recycled compounds.

E. All pipe and fittings shall be manufactured in the United States of America or Canada.

F. The DR (Dimension Ratio) of the 8-inch pipe supplied shall be DR11. Measurements shall be made according to the methods specified in ASTM D2122. Variation of pipe wall thickness as measured and calculated according to ASTM D2122 in any diametrical cross section of the pipe shall not exceed 12 percent.

G. Pipe shall be homogeneous throughout and uniform in color, opacity, density, and free from sticky or tacky material. The pipe walls shall be free from cuts, cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the naked eye and that may affect the wall integrity. Any defects in the pipe wall will be considered as cause for rejection of either the entire pipe length or require the length of pipe which is suspect to be removed at the sole discretion of the Contracting Agency.

H. HDPE straight lengths of pipe shall be manufactured black. The black color of the pipe shall be derived from a well-dispersed and finely divided carbon black. Sufficient antioxiclant shall be added to meet thermal stability requirements contained in ASTM D3350.

I. Marking:
   1. Pipe and fittings shall bear identification markings that will remain legible during normal handling and storage. The marking shall be printed indelibly in ink, or molded thereon in a manner that will not reduce the strength or otherwise damage the pipe.
   2. Marking on the pipe shall be applied continually along the length of the pipe. Marking on the pipe and fittings shall include the following:
      a. Manufacturer's name or trademark
      b. Nominal size and OD base
      c. Standard material code designation
      d. Dimension ratio
      e. Pressure class
      f. AWWA designation number, AWWA C906
      g. Manufacturer's lot number, production code including day, month, and year. (Manufacturer's code must allow traceability to supplier of raw material.)
      h. Material test category.

J. Acceptable Manufacturers:
   1. Performance Pipe
   2. Uponor Sclairpipe
   3. ISCO
   4. JM Eagle
   5. Substitutions: Refer to Section 01 33 00.

2.02 FITTINGS

A. Fittings to be joined to polyethylene piping shall be manufactured for thermal heat fusion. Polyethylene fittings may be molded or thermoformed from pipe sections, prepared from pipe, molded fittings, thermoformed pipe, or polyethylene sheet or block. Fiberglass wrap or other similar wrap will not be allowed for the fabrication of fittings. Molded fittings shall meet the requirements of ASTM D3261 for butt-type fittings, and the requirements of this Specification.

B. Fittings for 8-inch HDPE pipe shall be molded and shall meet the requirements of ASTM D3261 for butt-fusion type fittings, and the requirements of this Specification.

C. Fittings shall be homogeneous throughout and essentially uniform in color, opacity, density, and other properties. The inside and outside surfaces shall be semi-matte to glossy in appearance and free from sticky or tacky material. The walls shall be

free from cuts, cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the naked eye and that may affect the wall integrity.

D. Molded fittings shall conform to the dimensional requirements set forth in the applicable ASTM fitting standard. Fabricated fittings shall meet the minimum dimensional requirements and tolerances of the pipe at the point of fusion.

E. Each polyethylene fusion fitting shall meet all the material requirements established for the pipe to which the fitting is to be joined.

F. The wall thickness of an outlet shall be, at a minimum, the same as the wall thickness of the pipe to which the outlet is to be joined. All fittings shall be properly rated according to the manufacturer's written recommendations, and clearly labeled on each fitting as such. In any event, after rating, each fitting shall be designed and manufactured to operate at not less than the design pressure of the pipe system for which it is intended with an included 2:1 safety factor.

G. Fittings shall meet the five-second-pressure test in accordance with AWWA C-906 and ASTM D1598. The first fitting of a particular size and configuration made during a production run of that fitting, and thereafter every fiftieth fitting of that production run shall be subjected to the 5-second-pressure test.

H. Standard fittings are tees, elbows, flange adapters, reducers, transition fittings, and branch and service saddles.

I. All fittings shall have product traceability. This shall be accomplished by the inclusion of markings as specified in this Section.

J. All fittings shall be fabricated, complete, at the manufacturer's facility unless otherwise allowed by the Contracting Agency in writing.

2.03 HDPE FUSION MACHINE

A. The HDPE fusion machine shall be a product of a manufacturer who has been in the regular business of manufacturing such machines for at least 5 years. Contractor fabricated fusion machines will not be acceptable.

B. Modifications made to a fusion machine shall not in any way interfere with the manufacturer's intended operation of the machine, nor shall the modifications affect the proper and correct recording or collection of data during the fusing process. Alterations and additions to the fusion machine including inserts and adapters shall be from the fusion machine manufacturer or approved in writing by the fusion machine manufacturer or manufacturer's authorized agent or representative.

C. Each fusion machine shall be supplied with a datalogger with printer supplied by the same manufacturer as the fusion machine and be compatible in all ways to record, store and print fusing parameters. The datalogger shall be capable of recording and storing all fusion parameters including, at a minimum, fusion temperature, fusion time, pressure, etc. pertinent to the fusion process. The printer shall be capable of printing out fusion parameters collected by the datalogger immediately after each joint fusion is completed.

D. During windy conditions where the winds may cause differential temperature variations during the fusion process, a shelter shall be provided which will adequately shield the fusion machine and fusion process from experiencing differential temperatures through the fusion process.

2.04 PIPE ROLLERS

A. Height adjustable longitudinal pipe rollers shall be supplied by the Contractor to facilitate movement of the pipe longitudinally along each side of the fusion machine. A minimum of two longitudinal pipe rollers are required and shall be designed to not only facilitate the longitudinal moving of the pipe, but also to stabilize the pipe from lateral movement. The Contractor shall be responsible for the design and proper function of the rollers as minimally set forth herein.

B. Height adjustable axial pipe rollers shall be supplied by the Contractor to facilitate axial rotation or rolling of the pipe during the fusion process where matching of the printlines or geometry of the pipes is required. At least two axial pipe rollers on each side of the fusion machine shall be supplied. The Contractor shall be responsible for the design and proper function of the rollers as minimally set forth herein.

2.05 JOINING

A. Polyethylene piping shall not be joined by solvent cements, adhesives (such as epoxies), electrofusion or threaded-type connections.

B. Unless otherwise shown on the Drawings or as approved by the Contracting Agency, all HDPE pipe shall be butt fused according to ASTM D2657, the manufacturer's recommendations and as specified herein.

C. HDPE flange adapter assemblies consist of an HDPE flange adapter and stainless steel backup ring. HDPE flange adapter assemblies shall be used at all locations where HDPE pipe connects to a flange.

D. Bolts, nuts, and washers for mechanical couplers and devices shall be stainless steel.

2.06 PIPE MATERIAL TRANSITIONS

A. HDPE to Ductile Iron transition:
   1. Fitting shall be suitable for connecting ASTM D3035 DR 11 HDPE pipe to Ductile Iron Pipe
   2. Coupling shall be rated for working pressures up to 150 psi.
   3. Fitting shall be stainless steel or epoxy coated and be suitable for buried service.
   4. Refer to Drawings for additional connection details.

2.07 BEDDING AND BACKFILL MATERIALS

A. As specified in Section 31 00 00

PART 3 - EXECUTION

3.01 LAYING PIPE AND FITTINGS

A. Handling and laying of pipe and fittings shall be in accordance with the manufacturer's instructions, PPI guidelines, as specified herein, and to line and grades as shown on the Drawings.

B. Pipe and fittings shall not be dropped. All pipe and fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the manufacturer and

approved by the Contracting Agency. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at the Contractor's own expense. Any pipe with gouges exceeding 10 percent of the nominal wall thickness will be rejected (e.g., 0.257 inches for 54-inch SDR 21 HDPE pipe).

C. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work and shall conform to the lines and grades required when laid. Good alignment shall be preserved in laying. Fittings, in addition to those shown on the Drawings, shall be provided, if required, for crossing utilities or other obstructions that may be encountered upon opening the trench.

D. The Contractor shall not drag the pipe. Rollers or other such devices shall be used to reduce dragging of the pipe. Continuous dragging of long lengths of pipe for transport or installation will not be allowed. Damage to pipe caused by dragging is the responsibility of the Contractor and may be cause for replacement of damaged portion as determined by the Contracting Agency. If, in the opinion of the Contracting Agency, the pipe may have been dragged to an extent where damage may have occurred to the pipe wall, the Contractor may be asked to install or rotate the pipe such that the section of the pipe which was dragged on the ground be placed in the trench in a manner which will facilitate inspection. The Contracting Agency will determine the best orientation of the pipe for inspection. Orientating the pipe for inspection shall be done at no additional cost to the Contracting Agency. Any pipe with damage exceeding 10 percent of the nominal wall thickness will be rejected.

E. Pipe shall be installed on grade as shown on the Drawings. Elevation at each joint shall not deviate from that shown on the Drawings by more than 0.5 inch for 1,000 feet of pipe and at all times must slope in the same direction as shown on the Drawings.

F. As much as practicable, the print line on the pipe shall be installed facing upward to facilitate identification of the pipe when initially installed.

G. Except for short runs, which may be permitted by the Contracting Agency, pipes shall be laid uphill on grades exceeding 10 percent. Pipe which is laid on a downhill grade shall be blocked and held in place until the downgradient pipe is installed to prevent movement which furnishes sufficient support. All bends shall be properly installed as shown on the Drawings.

H. Pipe fused above ground shall be carefully handled to avoid damage to the pipe. Chains or cable type chokers will not be allowed when lifting fused sections of pipe. Nylon or other wide fabric slings or other similar lifting apparatus with spreader bars shall be used where necessary.

I. The length of open trench required to construct the pipeline shall be kept to a minimum. Lengths of open trench not required for construction of the pipe shall be backfilled and paved such as to allow that portion of the roadway to be opened to the public. The maximum length of open trench shall not exceed that which is shown on the Drawings, unless otherwise accepted by the Contracting Agency.

J. Prior to installing a pipe section, the bedding material shall be brought to grade along the entire length of the section to be installed. The pipe bedding materials shall be as specified in the Contract Documents.

K. Bending of the pipe to achieve horizontal or vertical changes in direction is allowed. The minimum bending radius, measured along the centerline axis of the pipe is 50 times the nominal pipe size.

L. Vertical pipe deflections shall be checked in the presence of the Contracting Agency as soon as practicable after backfill has reached ground elevation with the use of a suitable mandrel measuring device approved by the Contracting Agency. Measurement of inside diameter of pipe shall be true vertical and shall be between pipe soffit and pipe invert (12 and 6 o'clock positions). Percentage deflection of pipe shall be calculated as:

1. Percent Deflection = (Base ID - Measured Vertical ID) x 100 Base ID

A maximum 5 percent deflection of pipe will be allowed. Contracting Agency may measure pipe deflection at later date. Where pipe deflection is found to be more than 5 percent (2.70 inches), the pipe will be rejected. The Contractor shall perform all corrective measures as agreed upon with the Contracting Agency.

M. The Contractor shall excavate additional trench holes as required to permit removal of the slings, install flanges and providing coating and protective covers.

N. As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, and any other debris following completion of pipe laying and fusing of joints prior to testing the completed pipeline.

O. Until the pipe is backfilled, trench shall be free of water and kept dry to avoid floatation of the pipe. Laying of pipe with water in trench shall not be allowed.

P. The Contractor shall provide anchors if required and as recommended by the pipe manufacturer and approved by the Contracting Agency to avoid flotation of pipe until the pipe is backfilled at no additional cost to the Contracting Agency.

Q. Install tracer wire and warning tape as shown on the Drawings.

R. Backfill trench in accordance with the Contract Documents.

S. All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.

3.02 HEAT FUSION OF PIPE

A. The joining method shall be the thermal butt fusion method and shall be performed in strict accordance with these Specifications, PPI guidelines, and the pipe manufacturer's recommendations. Should there be a conflict between these Specifications and the pipe manufacturer's recommendations, the more stringent requirement shall govern. The butt fusion equipment used in the joining procedures shall be capable of meeting all conditions and procedures recommended by the pipe manufacturer, including but not limited to, temperature requirements, alignment, and interfacial fusion pressure and automatic recording of parameters for joining.

B. Sections of polyethylene pipe should be joined into continuous lengths on the work site above ground or in the pipe trench as applicable or required.

C. Heat fusion joining shall be complete, efficient, and match the outer diameter of the two pipe being heat fused. Any offset or mismatch shall not exceed the requirements of this Specification. In all cases, heat fusion pipe joints shall have a joint weld strength equal to or greater than the tensile strength of the pipe. Socket

fusion shall not be used. Extrusion welding or hot gas welding of HDPE shall not be used.

D. Butt fusion procedure shall include the following steps:
   1. Fill out an inspection record sheet for this joint. Each joint shall have a separate inspection record sheet. Include the fusion machine datalogger joint number on the separate inspector sheet so matching the records can be done later if require.
   2. Support the pipe on each end of the fusion machine on longitudinal pipe rollers not less than the height of the fuser bed for three pipe lengths each end of the machine.
   3. Clamp down the pipes to be joined.
   4. Verify that both pipe ends to be joined are round.
   5. Face the pipe ends.
   6. Inspect the inside of each pipe prior to fusion welding and make sure that no defect will interfere with the welding and that there are no surface anomalies anywhere on the inside of the pipes. Check that the cutting blades have not been dulled and damaged the sharp edges of the cut.
   7. Align the pipe profile so that pipes are properly aligned around the entire circumference.
   8. Melt the pipe interfaces at recommended temperature for the recommended time.
   9. Remove the heater plate.
   10. Join the two profiles together.
   11. Hold under recommended pressure for the cool down period.
   12. Mark each welded joint with a joint number matching the inspection sheet record.

E. Should the Contractor be unable to maintain less than 10 percent offset or mismatch at the joint as specified herein, irregular curvature of the pipe joints or irregular toe-in of the ends should be checked by the Contractor. The use of internal hydraulic jacks will be allowed to round the pipe as will cutting the pipe ends and spinning of the pipe to match the profile, but in no case, shall polyethylene pipe be fused if it cannot meet any of the fusing parameters as specified herein, without written consent by the Contracting Agency and pipe manufacturer. Any such consent shall not void any warranty or reduce the pressure rating of the pipe.

F. In situations where different polyethylene piping materials must be joined, both pipe manufacturers should be consulted to determine the appropriate fusion procedures.

G. Submit detailed fusion joint reports as recorded by the heat fusion machine for all joints. Submit a report to the Contracting Agency's Inspector the same day the fusion is made. Submit a formal report of all fusions to the Contracting Agency's Project Manager on a weekly basis, no later than 4:00 p.m. each Friday. If any joint as indicated by these reports is found to be unsatisfactory, the Contractor shall remove portions of the pipe containing such joint and install a new pipe piece as required and approved by the Contracting Agency.

H. The first fusion shall be a trial fusion to be performed in the field in the presence of the Contracting Agency. The trial fusion shall be allowed to cool completely, then fusion test straps shall be cut out. The test strap shall be the longer of 12 inches or 30 times the wall thickness in length with the fusion in the center, and 1-inch minimum or 1.5 times the wall thickness in width. The test strap shall then be bent

until the ends of the strap touch. If the fusion fails at the joint, or if the joint exhibits cracking or crazing, a new trial fusion shall be made, cooled completely and tested. Butt fusion of the pipe to be installed shall not commence until the trial fusion has passed the bend back test.

I. Following the successful initial trial fusion, the bend back test shall be performed once every fiftieth joint or once per week, whichever is more frequent.

J. Optional limited access fusion machine may be used for joining of HDPE pipe by butt fusion. Limited access fusion machines must meet the same certification, quality, and capability requirements of the regular fusion machines specified herein.

3.03 THERMAL EXPANSION AND CONTRACTION

A. The contractor's attention is directed to the table below showing the increase or decrease in length for a given change in temperature in HDPE pipe. The table presents length changes based on the temperature differentials of ambient temperature when fused minus the installed in-use temperature. The coefficient of thermal expansion for HDPE is 0.000067 inch per inch of pipe length, per degree F.

EXPANSION AND CONTRACTION

	Change in Temperature		
Length in Feet	**10°F**	**30°F**	**50°F**
10	0.08 inches	0.24 inch	0.40 inch
50	0.40 inches	1.2 inches	2.0 inches
100	0.80 inches	2.4 inches	4.0 inches

B. The Contractor shall be responsible for the effects of accommodating the change in length of HDPE pipe during HDPE pipe installation. Care shall be taken to bury HDPE at the coolest time in the morning to avoid pipe shrinkage following placement.

3.04 PIPE REPAIR AND REPLACEMENT

A. If pipeline fails any of the requirements specified herein, including deflection, physical damage, inadequate beading of joints, etc., the affected length of pipe, as determined by the Contracting Agency, shall be re-fused or removed and replaced. The option of repair or removal and replacement shall be at the discretion of the Contracting Agency and at no additional cost to the Contracting Agency.

3.05 CLEANING

A. At the conclusion of the work, thoroughly clean all of the new pipelines to remove all dirt, dust, stones, pieces of wood, HDPE waste product, or other material which may have entered during the construction period.

3.06 HYDROSTATIC PRESSURE TESTING

A. Hydrostatic pressure test in accordance with Section 7-09 of WSDOT Standard Specifications.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 33 42 20

SUBMERSIBLE STORMWATER PUMPS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish and install submersible non-clog wastewater-type pump assemblies, designed for wet well application, complete with pump bodies, pump bases, submersible motors, discharge connections, guided rails, hoists, and all other accessories, in accordance with the Drawings and these Specifications.

1.02 REFERENCES

A. Hydraulic Institute Standard 11.6 – Rotodynamic Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, and Electrical Acceptance Tests.

1.03 SUBMITTALS

A. Shop Drawings: The Contractor shall submit shop drawings for favorable review of the pumps and accessories. Include sufficient data to show that equipment conforms to Specification requirements as indicated herein and in Related Sections. Submit per Section 01 33 00 in a single complete initial package under the Product Review category. Include the following:
   1. Pump and motor product and performance data, including a prototype pump performance curve for each application and indicate minimum continuous stable flow (MCSF). Indicate impeller trim.
   2. Typical wet well installation drawings indicating dimensions and minimum clearances.
   3. Guide rail and other accessory data.

B. Manuals: The Contractor shall furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

C. Affidavits: The Contractor shall furnish affidavits from the manufacturer stating that the pumps have been properly installed and tested and each is ready for full time operation.

D. Performance Testing: Certified non-witnessed factory performance tests in accordance with Hydraulics Institute Standard 11.6 are required for each pump shall be not less than Grade 1U unless noted elsewhere in this specification. Obtain favorable review from the Engineer prior to shipment of the pumps.

1.04 QUALITY ASSURANCE

A. All equipment furnished under this Section shall: 1) be of a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years; and 2) be demonstrated to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers specifically named herein.

PART 2 - PRODUCTS

2.01 SUBMERSIBLE STORMWATER PUMPS

A. General: All pumps shall be heavy-duty, submersible, non-clog, centrifugal, quick disconnect wastewater pumps. The pumps shall be capable of operating in the range of capacity specified on a continuous basis with no detrimental effects to the pump or motor.

B. Pump Schedule: The pump operating characteristics shall be as follows:

Parameter	Pumps 201/202
Guaranteed Operating Condition at Full Speed (gpm @ TDH)	846 @ 39.6 ft
Maximum Capacity at Full Speed (gpm @ TDH)	2,000 @ 8 ft ± 1 ft
Minimum Capacity at Full Speed (gpm @ TDH)	0 @ 71 ft ± 1 ft
Secondary Point at Reduced Speed (gpm @ TDH @ rpm, minimum efficiency)	515 @ 24.5 ft ± 1 ft @ 1260 rpm, 72%
Minimum Shutoff Head	71 feet ± 1 ft
Maximum Synchronous Speed	1,755 rpm
Pump Drive Type	Variable Speed
Minimum Operating Speed	878 rpm
Motor Horsepower	15 HP
Required minimum efficiency at Primary Point	77%
Minimum Solids sphere passage	2.5 inches
Minimum Size Suction x Discharge (inches)	6 x 6
Discharge pressure gauge range (see Section 40 73 00)	0 to 30 psig
Manufacturer and Model No.	Flygt NP 3153 MT 3435 or equal

C. Pump Construction:

1. General:

a. The pumps shall be designed to permit sump-top removal of pumping units from the wet well for inspection or service without disconnecting or disturbing the discharge piping. The pump connection shall be metal to metal. The design shall permit the pumps when lowered into place to be automatically connected to the discharge piping by positively locking the volute in position to prevent any axial or lateral movement. There shall be no need for personnel to enter the wet well when pump inspection or service is required.

b. Pump assembly, including motor, pump, and cable accessories must be rated for Class 1, Division 2 hazardous environment, explosion proof, Group D.

2. Pump Castings: Major pump components shall be of grey cast iron, ASTM A48, Class 30B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of AISI 316 stainless steel construction. All metal surfaces coming into contact with the pump, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
3. The casings shall be designed to permit replacement of wearing parts. Joints shall be properly sealed with O-rings and shall not leak under a test pressure equal to 50% greater than the pump discharge pressure or the total dynamic head, whichever is greater. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Passageways shall permit smooth flow and shall be free from sharp turns and projections.
4. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.
5. Impellers: Impellers shall be of cast-steel, or an alloy suitable for the service required. The impellers shall be smooth and free flowing and shall have sufficient clearance to permit objects in the sewage that enter the pump to pass into the discharge pipe. Each impeller shall be accurately fitted and keyed, splined, or threaded on the shaft, and locked in such a manner that lateral movement will be prevented and reverse rotation will not cause the impeller to loosen. The impeller to volute clearance shall be adjustable by the means of a single trim screw. Balance: All rotating parts of the equipment hall be in such balance, mechanically and hydraulically, as to operate throughout the required range without excessive end thrust, vibration, or noise.
6. Balance: All rotating parts of the equipment shall be in such balance, mechanically and hydraulically, as to operate throughout the required range without excessive end thrust, vibration, or noise.
7. Shafts: Shafts shall be stainless steel, shall be of sufficient size and strength to perform the work required, and shall be adequately provided with alignment bearings.
8. Bearings: Bearings subject to submersion shall have a minimum B-10 life of 30,000 hours.
9. Electrical Motors: Submersible, 60 Hertz, oil filled. Motor shall be capable of continuous operation over the entire range of operating liquid levels shown on the Drawings and in the Specifications. Rated motor horsepower shall be non-overloading throughout the entire pump curve.
10. Pump and motor protection:
    a. Provide the following devices for each pump:
        1) Moisture detection probe between the mechanical seals.
        2) Thermal sensors embedded in the motor windings.

3) Pump supplier shall furnish pump protection relay and relay socket for each pump. Relay shall be 120VAC powered for monitoring of seal fail and motor winding overtemperature condition. Relay and socket shall be furnished to panel builder for installation into pump control panel. Relay shall be Flygt MiniCAS/MiniCAS II or approved equal manufacturer's standard equivalent relay where other than Flygt pumps are approved and used. Relays for the protection devices shall be provided by the pump manufacturer or shall be guaranteed by the Contractor to be compatible with each pump in accordance with the pump manufacturer requirements. Install in the pump starter enclosure.

11. Shop Coating: Pump, motor, and accessories shall be factory applied and finish coated in accordance with the manufacturer's standard.

2.02 ACCESSORIES

A. Piping, Fittings, and Appurtenances: Each pump shall be furnished with quick-disconnect discharge elbow, two Schedule 40 pipe rails, upper guide rail bracket, intermediate guide rail bracket, rail-guided lifting assembly, and stainless steel chain of sufficient strength to raise and lower pump. All guide rail components and fasteners shall be Type 316 stainless steel. Provide intermediate guide rail support brackets as recommended by the pump manufacturer. Guide cable system of stainless steel will be acceptable in lieu of pipe rails.

1. Each pump shall be provided with 18 inches of lifting chain connected to the pump. Lifting cable shall be connected to the end of the lifting chain. The lifting cable shall be of sufficient length to extract the pump from the installation. Both the lifting chain and lifting cable shall be Type 316 stainless steel. Ends of the lifting chain and one end of the lifting cable shall be provided with shackles for connecting. The other end of the lifting cable shall have a loop for hooking on the cable holder. The loop shall fit through the large eye of the Grip-Eye.
2. Provide a Type 316 stainless steel cable holder.
3. Furnish each submersible pump with a stainless steel Grip-Eye, or approved equal, for use with a mechanical lifting device. Grip eye shall be appropriately sized for weight of pump to be lifted and size of lifting chain.

B. Access Frame and Cover: Provide access hatches and accessories for pump installations as shown on the Drawings and in accordance with Section 33 49 20.

C. Pressure Gauges: Provide discharge pressure gauges for each pump with features and accessories in accordance with Section 40 73 00. Gauge range is indicated in the Pump Schedule.

D. Miscellaneous Materials:

1. Bolts, nuts, anchors, washers, and all other types of supports necessary for the installation of the pumps, drive units, and all other accessories within the wet well shall be furnished and shall be of Type 316 stainless steel.
2. Elastomers: Nitrile (Buna-N).
3. Miscellaneous metal items permanently installed within the wet well: Type 316 stainless steel. Type 304 stainless steel or galvanized steel is not acceptable.
4. Protective coatings: Discharge piping and other items within the wet well requiring protective coatings per Section 09 96 00 shall be coated in accordance with the requirements for “submerged service.”

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions.

3.02 FIELD PAINTING

A. Pumps and appurtenances shall be touched up as required, per Section 09 96 00.

3.03 FIELD TESTING

A. Each pump shall be field tested to verify that they are operating properly and are able to pump the design flow rate. Field testing shall be observed by the Engineer. For further requirements on performance tests, refer to Section 11 00 00.

3.04 FIELD SERVICE

A. The equipment manufacturer shall supply a competent field service engineer to thoroughly check and inspect the equipment after installation, place the equipment in operation, make necessary adjustments, calibrate instruments, and conduct field tests.

B. The services required shall include on-the-job training of operators including safety procedures, operating instructions, and preventive maintenance procedures. Furnish a minimum of 8 man-hours of field services.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 33 44 19

BIOFILTRATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This section describes work consisting of the sourcing, quality assurance and control, and installation of filtration media to be used within the biofiltration system.

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 00.
   1. Reports of results of required tests by an independent, accredited laboratory demonstrating material conformance to requirements of Part 2.
   2. Samples for Contracting Agency's Quality Assurance Testing Purposes:
      a. Provide, without additional cost to the Contracting Agency, 1-gallon samples of each of the products listed in Part 2.
      b. Provide, without additional cost to the Contracting Agency, up to 1 cubic yard of Biofiltration Soil Mix and up to 1 cubic yard of pea gravel to the Contracting Agency for quality assurance testing purposes. No material, aside from sample materials, shall be delivered to the site until the Contracting Agency has completed its quality assurance tests and the Engineer has approved the material.
   3. A description of the equipment and methods used to mix, handle, transport, and place filtration media.
   4. For compost, the following shall be submitted to the Engineer for approval:
      a. A copy of the Solid Waste Handling permit issued to the Supplier by the Jurisdictional Health Department, as per WAC 173-350 (Minimum Functional Standards for Solid Waste Handling).
      b. A copy of the producer's current Seal of Testing Assurance (STA) certification, as issued by the U.S. Composting Council.
      c. A written statement from the producer and laboratory analytical reports from an independent STA Program certified laboratory, demonstrating that the compost complies with the requirements specified herein, and with the processes, testing, and standards specified in WAC 173-350.
   5. The following information about the testing laboratory(ies):
      a. Name of laboratory(ies) including contact person(s),
      b. Address(es),
      c. Phone contact(s),
      d. E-mail address(es),
      e. Qualifications of laboratory and personnel including date of current certification by STA, ASTM, AASHTO, or equal.
   6. The name and address of all suppliers of filtration media.

1.03 QUALITY ASSURANCE

A. Source Quality Control: Test import materials proposed for use to demonstrate that the materials conform to the specified requirements. Tests shall be performed by an independent accredited testing laboratory.

B. Field Quality Assurance:
   1. The Engineer will:

a. Review materials proposed for use.
b. Review results of independent testing laboratory tests.
c. Conduct quality assurance testing of the samples provided by the Contractor if determined to be necessary.
d. Inspect the empty filtration basins prior to placement of filtration media.
e. Inspect delivered filtration media prior to placement within the filtration basins.
f. Stop media delivery or placement if it is determined that the delivered media does not appear to match the submittals. Contractor shall be required to demonstrate that the media in question meets the specifications of Part 2.

C. All filtration media shall be thoroughly mixed to a homogenous consistency before placement.

D. Bioretention media shall be tested prior to installation for infiltration rate compliance.
1. A constant head test shall be performed on a representative media sample. The final media installed in the bioretention basin shall be from the same batch as the representative sample tested. Tests shall be observed by the Engineer.
a. A 4-foot long by 24-inch diameter section of corrugated HDPE pipe, 4-foot long 48-inch manhole section, or equivalent watertight container shall be used. The minimum surface area for the test container is 450 square inches.
b. The container shall be placed with one open end on hardware cloth or equivalent screen with a screen opening of approximately ¼ inch, supported at the sides of the container to maintain a minimum of 2 inches open space below the hardware cloth to allow free water flow out the bottom of the test media.
c. The container shall be filled with a 12-inch layer of pea gravel, followed by a 24-inch thick layer of bioretention media. Installation of media shall be performed similar to the method defined in Section 3.01.
d. The test media shall be saturated prior to testing by adding water at a flow rate sufficient to maintain a minimum 3-inch ponding depth above the media surface for at least 20 minutes. Flow should be introduced to the container such that disturbance of the media surface is minimized.
e. The flow rate will be adjusted to a flow rate corresponding to an infiltration rate of 24 inches per hour. This flow rate will be maintained for minimum of 40 minutes, or until the container overflows. If the container overflows the media will have failed. If no ponding occurs after 40 minutes the material will have passed.
f. After 40 minutes, the flow rate will be adjusted to maintain steady state head conditions for an additional 20 minutes. Ponding depth shall not exceed 12 inches. If the media does not yield the required infiltration rate at a ponding depth of 12 inches or less the material will have failed. The saturated media shall be removed, and additional media shall be added and retested.

E. The constant head infiltration rate shall be a minimum of 24 inches per hour field-measured.

F. Contractor shall provide, at no additional cost to the Contracting Agency, maintenance of the biofiltration system until Physical Completion.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect all materials from damage during delivery and cover UV sensitive materials if materials will be stored for more than 1 week. Storage surfaces shall be free from dirt, mud, and debris.

B. Media shall be stored separately from each other and all other materials.

C. All media shall be protected from all sources of additional moisture, under cover at the site until incorporated into the work.

PART 2 - PRODUCTS

2.01 FILTRATION MEDIA

A. In general, filtration media shall be free of wood, waste, coating, or any other deleterious material, and all aggregate passing the No. 200 sieve size shall be non-plastic.

B. Stage 2 – Pea Gravel:
   1. Pea gravel as specified in Part 2.02.C.

C. Stage 3 – Biofiltration Soil Mix (BSM):
   1. BSM shall be sourced from suppliers that have an active solid waste handling permit from the local jurisdictional Health Department, as per WAC 173-350-220 or WAC 173-308.
   2. BSM shall be a well-blended homogenous mixture of mineral aggregate and compost consisting of approximately two parts compost (approximately 35 to 40 percent) by volume, as specified in Part 2.02.A and 3 parts Mineral Aggregate (approximately 60 to 65 percent) by volume, as specified in Part 2.02-B.

2.02 FILTRATION MEDIA COMPONENTS

A. Medium Compost for BSM:
   1. Compost shall be manufactured by facilities that have an active solid waste handling permit from the local jurisdictional Health Department, as per WAC 173-350-220 or WAC 173-308.
   2. Compost production and quality shall comply with Chapter 173-350 WAC.
   3. Compost products shall be the result of the biological degradation of Type I or III Feedstocks, as specified below, under controlled conditions designated to promote aerobic decomposition, per WAC 173-350-220, which is available at http://www.ecy.wa.gov/programs/swfa/compost.
   4. Compost shall be stable with regard to oxygen consumption and carbon dioxide generation.
   5. Compost shall be mature with regard to its stability for serving as a soil amendment as defined below.
   6. The compost shall have a moisture content that has no visible free water or dust produced when handling the material.
   7. Compost production and quality shall comply with Chapter 173-530 WAC and meet the following physical criteria:
      a. Compost material shall be tested in accordance with the U.S. Composting Council “Testing Methods for the Examination of Compost and Composting” (TMECC) Test Method 02.02-B, “Sample Sieving for Aggregate Size Classification,” to meet the size gradations established in

the U.S. Composting Council's "Seal of Testing Assurance" (STA) program, as follows. Medium compost shall meet the following gradation by dry weight:

US Sieve Size	Percent Passing (%)
2"	100
1"	95-100
5/8"	85-100
1/4"	50-80
200	0-3

b. The pH shall be between 6.0 and 8.5 when tested in accordance with TMECC 04-11-A, "1:5 Slurry pH."
c. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0% by weight as determined by TMECC 03.08-A "percent dry weight basis."
d. Minimum organic matter content shall be 40 percent by dry weight basis as determined by TMECC 05.07-A, "Loss-On-Ignition Organic Matter Method."
e. Soluble salt contents shall be less than 4.0 mmhos/cm tested in accordance with TMECC 04.10-A, "1:5 Slurry Method, Mass Basis."
f. Maturity shall be greater than 80% in accordance with TMECC 05.05-A, "Germination and Vigor."
g. Stability shall be 7 or below in accordance with TMECC 05.08-B, "Carbon Dioxide Evolution Rate."
h. The compost product must originate a minimum of 65 percent by volume from recycled plant waste as defined in WAC 173-350-100 as "yard debris," "crop resides," and "bulking agents." A maximum of 35 percent by volume of "post-consumer food waste" as defined in WAC 173-350-100 may be substituted for recycled plant waste. The supplier shall provide written verification of feedstock sources.
i. Medium Compost shall have a carbon to nitrogen ratio of less than 25:1 as determined using TMECC 04.01 "Total Carbon" and TMECC 04.02D "Total Kjeldahl Nitrogen."
j. The Engineer may also evaluate compost for maturity using the Solvita Compost Maturity Test at time of delivery. Medium Compost shall score a number 6 or above on the Solvita Compost Maturity Test.

8. Acceptable manufacturer for compost is Cedar Grove Composting, or equal.

B. Mineral Aggregate for BSM:
1. Mineral Aggregate for BSM shall be analyzed by an accredited laboratory using the sieve sizes noted below and shall meet the following gradation:

US Sieve Size	Percent Passing (%)
2"	100
3/4"	85-100
1/2"	65-95
No. 4	40-70
No. 40	10-40
No. 100	0-5
No. 200	0-1.5

C. Pea Gravel:
   1. Pea gravel shall be the type commonly referred to as “buckshot.”
   2. Pea gravel shall be river run, washed, pea gravel graded from ¼ inch to 3/8 inch.

PART 3 - EXECUTION

3.01 MEDIA INSTALLATION

A. Grading or placement of aggregates or filtration media within the filtration basins shall not begin until authorization is given by the Engineer.

B. Runoff shall not be allowed to enter the filtration basins until authorization is given by the Engineer.

C. Placement shall not occur if any of the media are wet. The Engineer will have final authority to determine if wet conditions exist.

D. Mixing or placing filtration media shall not be allowed if the area receiving filtration media is wet or saturated or has been subjected to more than ½-inch of precipitation within 48-hours prior to mixing or placement. The Engineer will have final authority to determine if wet or saturated conditions exist.

E. All filtration media shall be thoroughly mixed to a homogenous consistency before placement.

F. Work areas shall be roped off and flagged around perimeters using high-visibility construction fencing placed as a temporary protection measure.

G. No heavy equipment shall operate within the filtration basin perimeters once excavation has begun, including during placement of filtration media, planting, or mulching of the facility.

H. No materials or substances shall be mixed or dumped within filtration basin areas that may be harmful to plant growth or prove a hindrance to the planting or maintenance operations.

I. At the locations shown on the Drawings, filtration basins shall be constructed to accommodate the placement of filtration media and drainage aggregate (BSM and pea gravel) as shown on the Drawings.

J. The grades shall be constructed in accordance with the lines, grades, depth, and typical cross-sections shown on the Drawings.

K. If any sediment laden runoff has entered the filtration basins prior to Contracting Agency authorization, the sediment deposition shall be removed at no cost to the Contracting Agency.

L. Upon completion of finish grading work, all excess material shall be removed from the site and disposed of accordingly.

M. The Contractor shall place all filtration media loosely with a conveyor belt, unless otherwise approved by the Engineer.

N. The finished surface of the filtration media shall be inspected and approved by Engineer prior to planting.

O. A licensed surveyor shall verify elevations to demonstrate that the final grades of the media vary no more than 1 inch from elevations specified in the Drawings, prior to planting.

P. Prior to placement of mulch as defined in Section 32 93 00 Landscaping in each cell, the Engineer shall be notified to inspect the filtration basins. If any sediment laden runoff has entered the cell, the Contractor shall remove the top 3 inches of filtration media and replace per design, at no expense to the Contracting Agency.

3.02 FLOW DISTRIBUTION AND COLLECTION PIPING

A. Refer to the Drawings.

3.03 LANDSCAPING

A. Refer to Section 32 93 00.

END OF SECTION

SECTION 33 49 20

PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for precast reinforced concrete structure bases, tops, walls, sections, and adjustment risers.
   2. Requirements for handling, installation, and testing specific to precast concrete manholes and vaults and associated appurtenances, including, but not limited to, grade rings, inserts, hardware, sealant gaskets, frames and covers, ladder rungs (where specifically called for), and baffles.

1.02 REFERENCES

A. ASTM International (ASTM) Standard Specifications:
   1. ASTM A36: Carbon Structural Steel
   2. ASTM A48: Gray Iron Castings
   3. ASTM C150: Portland Cement
   4. ASTM C478: Circular Precast Reinforced Concrete Manhole Sections
   5. ASTM C827 Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
   6. ASTM C857: Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
   7. ASTM C858: Underground Precast Concrete Utility Structures
   8. ASTM C891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
   9. ASTM C923: Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
   10. ASTM C1107: Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

B. U.S. Army Corps of Engineers Standard (CRD):
   1. CRD C-621 Corps of Engineers Specification for Non-shrink Grout.

C. Washington State Department of Transportation (WSDOT):
   1. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, and Amendments (current edition).

D. Federal Specification: SS-S-210: Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

E. Geotechnical report and recommendations for this project are provided for reference in Appendix A. While the geotechnical records of data obtained may be considered by the Contractor to be correct, any conclusions or recommendations made in the geotechnical report are for information to the Engineer and are not a part of the Contract Documents.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. Product Data:

1. Contractor shall submit shop drawings prepared by the precast concrete structure manufacturer. Prior to submittal of manhole shop drawings, verify the invert elevations, alignment, outside diameter, location, and material of all existing pipelines to which new manholes will be connected. Shop drawings shall be submitted and approved by the Engineer prior to fabrication, and include the following information:
    a. Plan and section drawings including the location, size, dimensions, orientation, quantities, material types, and other information necessary to sufficiently describe the required internal components.
    b. Parts list including item descriptions, quantities, and sizes of the required internal components.
    c. Design criteria listing the criteria in these specifications and applicable criteria from the reference documents stated above.
    d. Signed and sealed design calculations performed by a Structural Engineer registered in the State of Washington in accordance with the reference documents and additional requirements stated in these specifications.
        1) The Contractor shall provide underground structures, hatches, covers, and frames capable of supporting a 300MT Travelift as indicated on Drawing G-003.
        2) Buoyancy calculations shall be provided using groundwater data established in the Geotechnical Report provided in Appendix A.
    e. Structural Components, including but not limited to:
        1) Precast walls and sections.
        2) Precast top slab.
        3) Precast base slab.
        4) Steps, ladder rungs and other hardware.
        5) Minimum concrete 28-day compressive strength.
        6) Cement certification.
        7) Grade rings, hatches, access riser covers and frames.
        8) Reinforcing steel location and concrete cover.
        9) Precast structure section weights.
        10) Layout of all inserts, attachments and openings.
        11) Location and type of joints.

C. Submit a description of the equipment and methods used to offload and install precast concrete structures. Crane pads shall be required for all outrigger equipped equipment that may be necessary for offloading purposes. See Drawings and conduct site visit to determine crane zone clearances. Determining and verifying crane zone clearances is the responsibility of the Contractor.

D. Submit detailed recommended precast concrete structure installation instructions prepared by the precast concrete structure manufacturer.

E. Submit leakage test reports as required in Part 3.

1.04 QUALITY ASSURANCE

A. Provide products of a manufacturer who has been regularly engaged in the design and manufacture of the product.

B. Demonstrate to the satisfaction of the Engineer that the quality is equal to the product made by those manufacturers specifically named herein, if an alternate product manufacturer is proposed.

C. Field Quality Control:
   1. The Engineer will:
      a. Observe leakage test.
      b. Inspect cleaning work.
   2. The Contractor shall:
      a. Verify all precast sections are continuously sealed with gaskets.
      b. Verify all covers fit quietly in the frames.
      c. Provide seven (7) days' notice to the Engineer prior to leakage testing.
      d. Perform leakage tests as noted herein.
      e. Perform cleaning work as noted herein.
      f. Be responsible for the costs of additional inspection, testing, and cleaning resulting from non-compliance.
      g. Be responsible for arranging a licensed surveyor to verify the precast concrete structures and associated appurtenances are level to within tolerance and all elevations and final grades vary no more than 1 inch from the elevations specified in the Drawings.

PART 2 - PRODUCTS

2.01 MATERIAL REQUIREMENTS

A. Design Criteria:
   1. General: ASTM C478, C857, C858, and also:
      a. Backfill material: See Section 31 00 00, Earthwork.
      b. Buoyancy: Design precast concrete structure using groundwater data established in the Geotechnical Report provided in Appendix A.
   2. Structure live load:
      a. Live load scenarios shall be per the design criteria standards stated on Drawing G-003.
   3. General:
      a. Concrete: Provide Class 4000 meeting WSDOT Standard Specifications.
      b. Cement: ASTM C150, Type II, low alkali.
      c. Top slab openings: Size to support the riser frame and cover.
      d. Manhole and vault sections shall be delivered to the site with cast pipe penetrations and flexible pipe-to-structure connectors installed where shown on the Drawings.
      e. Lifting eyes: Provide for each section.
   4. Precast Concrete Structure Manufacturer: Oldcastle Precast, Auburn, WA; Granite Precast, Bellingham, WA, Pacific Precast, Vancouver, WA; Wilbert Precast, Yakima, WA; or equal.

B. Sealant Gaskets:
   1. Type: Preformed, continuous rope form plastic material, protected by removable two-piece wrapper.
   2. Sealing Compound: Reinforced hydrocarbon resins blended with plasticizing compounds and reinforced with inert mineral filler. No solvents, irritating fumes, or obnoxious odors.
   3. Adhesive and Cohesive Strength: Not dependent on oxidizing, evaporating, or chemical action.
   4. Conform to Federal Specification SS-S-210.

5. Provide: RAM-NEK as manufactured by K. T. Snyder Company, Inc., Houston, TX; QUIKSEAL as supplied by Associated Concrete Products, Santa Ana, CA; JP Specialties, Lake Elsinore, CA; or equal.

C. Non-shrink Grout:
1. Non-shrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Non-shrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.
   a. General purpose non-shrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Euco NS by The Euclid Chemical Co.; Five Star Grout by Five Star Products, Inc.; or approved equal.
   b. Flowable (Precision) non-shrink cementitious grout shall conform to the standards stated above and shall be Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Five Star Grout by Five Star Products, Inc.; or approved equal.

D. Frames and Covers:
1. Material: Cast iron or ductile iron; ASTM A48, Class 30B (Heavy Duty / Airport or rated to meet live loads defined above).
2. Solid Cover Marking: In raised letters, as specified, on access riser cover and manhole cover. Covers shall be marked "STORM."
3. Manhole Cover Style: Solid or Slotted cover. See Drawings.
4. Manhole Cover Size: 24 inch-diameter.
5. Coating: Bituminous paint, black.
6. Size: Varies, see Drawings.
7. Solid Cover Lock Type: APT bolting, bolt shall pass fully through a countersunk drilled or cast hole into receiving threads.
8. Seal: Provide continuous ¼-inch-diameter neoprene O-ring between frame and cover.
9. Manufacturer: D&L Foundry, Moses Lake, WA; Olympic Foundry, Seattle, WA; EJCO, Marysville, WA; or equal.

E. Hatches:
1. Minimum clear opening dimensions of each hatch shall be as shown on the Drawings. Provide single leaf or double leaf hatches as indicated on the Drawings.
2. Live load: Provide hatches to withstand the loads indicated in the design criteria above.
3. Door Leaves: ¼-inch minimum (6.35 mm) thick ductile iron, diamond pattern, reinforced as required to withstand the specified loads.
4. Frame: ¼-inch (6.35 mm) minimum thick ductile channel with anchor flange around perimeter for embedment into concrete. Frame shall allow water to drain to space below freely without ponding either on the surface of the hatch or at the frame elevation. Doors shall allow water to pass at the edges of the door or through ¼-inch maximum width slots provided for drainage.
5. Doors shall open to 90 degrees and shall include an automatic hold-open arm with a positive automatic latch that will secure the door in the open position until the release handle is activated. Provide stainless steel hold-open pin through holes in hold-open arms to insure against accidental hatch closure.

Attach pin to hatch with a short stainless steel chain to prevent loss. Submit details of latch for review. Door hinges shall be recessed or flush.

6. Lift-Assist Mechanism: Provide stainless steel compression spring(s) or pneumatic spring(s) enclosed in sealed telescoping tube(s).
7. Safety Chain: For double leaf doors, provide a stainless-steel safety chain between doors at the opposite end from the latch to form a barrier when the doors are locked in the open position.

F. Ladder Rungs:
1. General: ASTM C478.
2. Material: Copolymer polypropylene plastic molded on galvanized steel reinforcing bar per ASTM A36.
3. Conform to Washington Department of Labor and Industries Division of Occupational Safety and Health (DOSH) requirements.

G. Pipe-to-Structure Connections:
1. Provide water-tight flexible pipe-to-structure connector where pipe is shown to penetrate structures on the Drawings. Product shall be compatible with the pipe material and size specified. Product shall meet the requirements of ASTM C923. Product material of construction shall be resistant to hydrocarbons. Provide all appurtenances and accessories including band clamps, fasteners, and wedge connectors. All appurtenances and accessories shall be Type 316 stainless steel.
   a. The pipe material and external diameter must be measured and reported to the manufacturer prior to procurement.
   b. The structure opening diameter must be measured and reported to the manufacturer prior to procurement.
   c. Water-tight flexible pipe-to-structure connectors shall meet the following performance requirements.

Test	ASTM Method	Product Test Performance
Head Pressure	C923 – 7.1	+13 psi for 10 minutes
Deflection Test	C923 – 7.2.2	+7°
Load Test	C923 – 7.2.3	Over 150 lbs/in. pipe diameter
Tensile Strength	D412	1580 psi
Hardness	D2240 (shore A durometer)	48 ± 5
Accelerated Oven-Aging	D573 70± 1°C for 7 days	10.1% tensile decrease 14% elongation decrease
Compression Set	D395, method B, at 70°C for 22 hours	13% increase
Water Absorption	D471	0.8% increase
Ozone Resistance	D1171	Rating 0
Low-temperature Brittle Point	D746	No fracture at -40°C
Tear Resistance	D624, method B	No tear at 210 lbf/in

2. Manufacturer: Trelleborg Kor-N-Seal, or equal.

2.02 SOURCE QUALITY CONTROL

A. Precast Sections:
   1. Verify per the requirements of the reference documents that the concrete compressive strength test results are satisfactory for the sections supplied.
   2. State the curing method. Identify the start and end dates for the sections supplied and provide documentation verifying the precast concrete components are not cracked, chipped, or otherwise broken.

B. Hatches, Frames and Covers:
   1. Verify cast test bar tensile strengths are satisfactory.

PART 3 - EXECUTION

3.01 OFFLOADING AND CRANE TRANSPORT

A. The Contractor shall notify the Engineer immediately of any equipment which is damaged during offloading. The damaged equipment shall be repaired or replaced at the Contractor's expense.

B. Offloading and handling of precast concrete structures and associated appurtenances shall be performed in accordance with the manufacturer's recommendations.

C. Coordinate all crane movements and clearances with the Engineer. Crane pad shall be provided for all crane operations.

D. Contractor shall ensure that sequencing of transport and offloading work shall not compromise or damage the precast concrete structures and associated appurtenances.

3.02 PROTECTION

A. Protect precast concrete structures and associated appurtenances from damage during transport and storage, and cover UV sensitive materials. Storage surfaces shall be free from dirt, mud, and debris.

B. Store and protect precast concrete structures and associated appurtenances in accordance with the manufacturer's recommendations.

C. Use of chains or cable type chokers is not allowed when lifting precast concrete structures. Nylon or other wide fabric slings or other similar lifting apparatus with spreader bars shall be used where necessary.

D. The Contractor is advised that precautions taken to keep precast concrete structures clean during construction will facilitate achieving the cleaning requirements of this project with a minimum of effort and expense. Compliance with these suggested minimum procedures will not relieve the Contractor of the cleaning requirements.

3.03 INSTALLATION

A. General: ASTM C478, ASTM C858, and ASTM C891 as applicable.

B. See Sections 01 57 19 and 31 00 00 for requirements specific to work below the groundwater table. Contractor shall pre-assemble portions of the precast concrete structures above ground with the intent of limiting the volume of groundwater discharged for dewatering purposes.

C. Subgrade shall be prepared and compacted as shown on the Drawings and in accordance with Section 31 00 00.

D. Set precast concrete sections in a concrete base joint groove, formed in the precast concrete base slab.

E. Install internal appurtenances in accordance with the manufacturer's recommendations.

F. Apply primer to joint surfaces in accordance with manufacturer's instructions. Make all joints watertight with sealant gaskets.

G. Make all internal precast concrete section joints watertight with non-shrink grout.

H. Backfill and compaction around the structures shall comply with Section 31 00 00.

I. Precast concrete structures shall be set level to within 0.5%.

J. Frames and Covers:
   1. Accurately locate and place the frames to within 1/8-inch vertical elevation in accordance with the Drawings. Coordinate the activities of all trades so that this tolerance is achieved.
   2. Install covers in the frames. Machine covers if necessary to obtain a solid fit, without rattling under load.

K. After manhole frames and covers are installed, Contractor shall fill all pick holes with non-shrink grout.

3.04 CORING

A. Contractor shall coordinate with the precast concrete structure manufacturer to have all utility openings pre-cored and fixed with flexible pipe-to-structure connectors in the factory.

3.05 REPAIR

A. Precast concrete structures and associated appurtenances shall not be dropped or mishandled. All materials and equipment shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to precast concrete structures or associated appurtenances shall be repaired in accordance with manufacturer's recommendations and approved by the Engineer. If any defect is discovered after it has been installed, it shall be removed and replaced in a satisfactory manner at the Contractor's expense.

3.06 LEAKAGE TEST FOR PRECAST CONCRETE STRUCTURES

A. Furnish, collect, and dispose of all water used for testing. Leakage test work shall comply with all applicable laws and regulations.

B. If the Contractor elects to conduct an alternate method of leakage testing, the proposed method shall be submitted to the Engineer for review and approval.

C. After all pipe has been laid, backfilling has been completed, and after the testing of the pipes, plug the end of the pipe stubs in the structures with flexible-joint caps, or acceptable alternate, securely fastened.

D. Fill the precast concrete structure with water and wait thirty (30) minutes for initial concrete absorption to take place. After the thirty (30)-minute wait period is over, Contractor shall measure leakage over a period of not less than 1 hour.

E. Allowable Leakage: Less than one (1) inch drop in water surface elevation over the duration of the test.

F. If leakage from precast concrete structures exceeds the above amount, determine the source or sources of the leakage, and repair or replace defective materials and workmanship at no additional cost to the Contracting Agency.

G. The completed precast concrete structure installation shall pass this test before the project can be accepted.

H. Reports: The Contractor shall keep records of each precast concrete structure leakage test, including:
   1. Description and identification of precast concrete structure tested.
   2. Date of test.
   3. Duration of test.
   4. Witnessing by Contractor and Engineer.
   5. Test evaluation description including water surface elevation measurements.
   6. Remarks, to include such items as:
      a. Leaks (type, location).
      b. Repairs made on leaks.
   7. Test reports shall be submitted to the Engineer.

3.07 CLEANING

A. After leak testing is complete, thoroughly clean the inside of precast concrete structures of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, vacuum, flushing with water or blowing with compressed air or oil-free nitrogen gas, as appropriate for the size of the structure and the various internal components. The Contractor shall take appropriate measures to protect all internal components while cleaning the structure. Cleaning shall be completed after any repairs.

B. Furnish, collect, and dispose all water used for cleaning. Cleaning work shall comply with all applicable laws and regulations.

END OF SECTION

SECTION 40 27 00

PIPING, VALVES, AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide all storm drain gravity and force main piping, including fittings, valves, supports, and accessories as shown on the Drawings, described in the Specifications and as required to completely interconnect all structures and equipment for complete and operable systems.

1.02 REFERENCES

A. ASTM International (ASTM)

B. American Society of Mechanical Engineers (ASME)

C. American National Standards Institute (ANSI)

D. American Water Works Association (AWWA)

E. American Welding Society (AWS)

F. Cast Iron Soil Pipe Institute (CISPI)

G. Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge and Municipal Construction (WSDOT Standard Specifications).

H. U.S. Department of Transportation (DOT)

I. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

J. National Fire Protection Association (NFPA)

1.03 SUBMITTALS

A. Shop Drawings:
   1. Verify by excavation, inspection and measurement all installation conditions, including existing utilities and structures, for all pipe before preparation of Shop Drawings. Submit field measurements and photos with Shop Drawings where exposed conditions are significantly different than indicated on the Drawings.
   2. Layouts and Schematics: Submit installation drawings of force main piping through the lift station, valve vault, and chitosan contact manifold. Schematics may be submitted for piping 4 inches and smaller. The Drawings and schematics shall include: pipe support locations and types, fittings, valves, other appurtenances.

B. Submit data to show that the following items conform to the Specification requirements:
   1. Pipe, fittings and accessories.
   2. Pipe couplings and flexible pipe pieces.
   3. Valves and Accessories.

C. Submit certified test reports as required herein and by the referenced standard specifications.

D. Submit leak and pressure testing plan in accordance with the requirements in 3.08.

E. Manuals: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for the following items:
   1. Valves 4 inches and larger.
   2. Flowmeters.

F. Affidavits: Furnish affidavits from the manufacturers for the following equipment:
   1. Valves, motorized
   2. All motorized or calibrated equipment.

G. Field test reports as required in Part 3.

1.04 DELIVERY, HANDLING AND STORAGE

A. Exercise great care to prevent injury to or scoring of the pipe lining and coating, as applicable, during handling, transportation or storage. Handle fusion epoxy coated pipe and ceramic epoxy lined pipe in accordance with AWWA C213. Do not store pipe on rough ground and do not roll, drag, or otherwise handle the pipe in a manner damaging to the coating.

B. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

C. Store pipe so that it’s off the ground, adequately supported on suitable supports such as wooden sleepers, rubber tires or sandbags and securely blocked. Avoid compression damage or deformation to the ends.

D. Where possible, store pipe in unit packages provided by the Pipe Manufacturer.

E. Stack pipe in accordance with the Pipe Manufacturer’s recommendations.

F. Store gaskets in a cool, dark place, out of direct sunlight, preferably in original cartons.

G. Damaged pipe, lining, and coatings shall be repaired or replaced at the expense of the Contractor to the Contracting Agency’s satisfaction.

1.05 QUALITY ASSURANCE

A. Materials and equipment under this Section shall be furnished by manufacturers regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years.

B. Pipe installed under this contract may be inspected for compliance by the Engineer, Contracting Agency and/or an independent testing laboratory selected by the Contracting Agency.
   1. Pipe rejected by the Engineer or Contracting Agency shall be immediately removed from the job site.

C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified hereinafter.

D. Factory Quality Control: The Contractor shall test all products as required herein and by the reference specifications.

E. Field Quality Control:
   1. The Contractor shall:

a. Perform leakage tests
b. Be responsible for the costs of additional inspection and retesting by the Contracting Agency resulting from noncompliance.

1.06 SHUTDOWN OF EXISTING UTILITIES, SERVICES OR OPERATIONS

A. Refer to Section 01 11 00.

1.07 POTHOLING

A. Refer to Section 31 00 00. Do not prepare shop drawings, order, or design any piping until potholing has been completed and a potholing report has been favorably reviewed in accordance with Section 01 11 00 and the General Conditions.

PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.

B. Cutoff Flanges: Provide at all pipe or sleeve penetrations where cast into wall for pipes 4 inches and greater in nominal diameter, and at all penetrations of 3-inch and smaller nominal diameter pipe in wet or potentially wet locations as indicated on the Drawings. Cutoff flange outside diameter shall be at least a standard connection flange's outside diameter except that for pipe 30-inch-diameter and larger, nominal size, cutoff flange outside diameter may be 6 inches greater than outside pipe diameter. Cutoff flange shall be at least ¼ inch thick and shall be continuously welded (or cast) onto the pipe.

2.02 GENERAL MATERIAL REQUIREMENTS

A. Gaskets: Except where specified otherwise, gaskets shall be NBR (Nitril or Buna N).

B. Bolts and Tie Rods: Unless specified otherwise herein, flange bolts and nuts, coupling bolts and nuts, tie rods, and other hardware shall be as follows:
1. Buried: Type 304 stainless steel, minimum tensile strength: 60,000 psi. Submerged: Type 316 stainless steel except use Monel, Hastelloy, or approved equal for seawater, minimum tensile strength: 60,000 psi.
2. Exposed: Type 304 stainless steel Electroplated zinc or cadmium steel.
3. Apply an anti-galling compound to the threads of stainless steel bolts.
4. Coat bolts on buried flanges or other buried appurtenances in accordance with Section 09 96 00.

C. Flexible Sealant: Flexible sealant for pipe joints, where shown on the Drawings, shall be a two-component polysulfide, non-sag; Sikaflex 2C, Dualthane, or equal.

D. Coating system shall be in accordance with Section 09 96 00.

2.03 PIPING MATERIALS

A. Pipe and Fitting Designation: Piping materials are identified by a "Type" designation in these Specifications. The "Type" designation identifies not only the pipe itself but the associated fittings and appurtenances and the installation and test procedures described for that "Type." The designation of a particular type shall

indicate a complete installation including fittings, joints, cleaning and testing. The pipe and fitting materials for each type designation shall be as specified herein and summarized in the Pipe Type Schedule.

B. Pipe Schedule: Piping systems and their corresponding piping and valve systems are listed on the Drawings.

C. Pipe Type Schedule: Pipe material, joints, and fittings shall be as summarized below. A detailed specification of each pipe type follows. The detailed specification supersedes the schedule in case of any conflicts.

Pipe Type	Pipe Description	Field Joints	Fittings
DIPB SDFM (Buried)	Ductile Iron Pipe, storm drain force main, AWWA C151	Push-On or Mechanical	Ductile Iron
DIPF SDFM (Aboveground and/or Exposed)	Ductile Iron Pipe, storm drain force main, AWWA C151	Flanged	Ductile Iron
HDPE-1 SDFM	See Specification Section 33 05 33.		
HDPE-2 SD	Corrugated Dual-Wall Polyethylene, stormwater treatment system gravity pipe, ASTM F2648	Integral Bell and Spigot	Polyethylene
PVC-1 SD	PVC, gravity storm drain where indicated on drawings, SDR 35	Bell and Spigot	PVC
PVC-2 SD	PVC, gravity storm drain where indicated on drawings, SCH 80	Solvent Welded, Threaded, or Flanged	PVC
RCSD	Reinforced Concrete Storm Drain Pipe	Bell and Spigot	NA

D. DIPB SD:
1. Pipe: Ductile iron bell and spigot pipe, buried, AWWA C115.
   a. Thickness Class: 54.
   b. Minimum Pressure Class: 350.
2. Fittings: Ductile iron with push-on joints, AWWA C110 and AWWA C153.
3. Joints: Push-on, AWWA C111.
4. Gaskets: US Pipe Field Lok, or equal.
5. Provide joints compatible with cathodic test stations for buried ductile iron pipe.
6. Lining: Standard thickness cement mortar lining for pipe and fittings, AWWA C104. Cement mortar linings shall be seal coated.
7. Piping shall be asphalt coated per AWWA C151. Pipe shall be factory finished.
8. Protection for Buried Pipe with Joints: Double-wrap with polyethylene encasement, AWA C105 and tape the edges of the encasement with PVC tape.

E. DIPF SD:
1. Pipe: Ductile iron flanged pipe, AWWA C115 including Appendix A.
   a. Thickness Class: 54.
   b. Minimum Pressure Class: 350.

2. Fittings: Flanged Ductile Iron AWWA C110 or AWWA C153.
3. Joints:
    a. Flanges: Ductile iron, plain faced, AWWA C115. Submit certification that flanges comply with AWWA C115. Provide insulating flanges compatible with cathodic test stations for buried ductile iron.
4. Lining: Standard thickness cement mortar lining for pipe and fittings, AWWA C104. Cement mortar linings shall be seal coated.
5. Exposed or submerged piping: Refer to Section 09 96 00. Ship bare or factory primed compatible with selected field paint system.
6. Gaskets: Flanged: Full face, 1/8-inch-thick NBR (Nitril or Buna N), AWWA C115, Appendix A.
7. Flange Bolts: AWWA C115, Appendix A.
8. Field Closure Connections for Restrained Joints: Pipe cut in the field where necessary and when favorably reviewed by the Engineer shall be connected by one of the following methods:
    a. Series 3800 Mega-Coupling by EBAA Iron, Inc.; or equal.
    b. Mechanical Joint Sleeve with two Series 1100 Megalug Restraints by EBAA Iron, Inc.; or equal.

F. HDPE-2 SD:
1. Pipe shall conform to ASTM F2648, minimum 2% carbon black. Pipe shall have smooth interior and annular exterior corrugations, and joints shall be watertight in accordance with ASTM D3212.
    a. Manufacturer: Advanced Drainage Systems (ADS) N-12 WT (IB) or approved equal.
2. Gaskets shall conform to ASTM F477. NBR (Nitril or Buna N).
3. Fittings shall conform to ASTM F2306.
4. See Drawings for perforation requirements for flow distribution and collection piping within the biofiltration system.

G. PVC-1 SD:

1. Pipe and Fittings: Polyvinyl chloride sewer pipe:
    a. 4-inch through 15-inch nominal size: ASTM D3034, SDR 35.
    b. 18-inch through 48-inch nominal size: ASTM F679.
2. Joints: Elastomeric gasket joints, ASTM D3212.
3. Gaskets: NBR (Nitril or Buna N).

H. PVC-2 SD:

1. Pipe: Schedule 80 polyvinyl chloride (PVC), gray, normal impact, Type 12454 B, ASTM D1784 and ASTM D1785. Pipe shall bear the National Sanitation Foundation (NSF) label.
2. Joints: Solvent weld, except flanged OR threaded permitted where required at equipment connections and where required on the Drawings. Use Military Specification T 27730A tape for threaded joints.
3. Fittings: Solvent weld, socket type, of same material as the pipe, Schedule 80, ASTM D2467.
4. Cement: Solvent weld, ASTM D2564, as recommended by the pipe manufacturer for the schedule and size to be joined, PVC 724 by Weld-On; no equal.
5. Pipe Cleaner: As recommended by the pipe manufacturer for the schedule and to be joined.
6. See Drawings for PVC slot size, location, and spacing requirements for flow distribution piping within the biofiltration system.

I. RCSD Pipe:
1. Pipe: Reinforced concrete storm drain and sewer pipe, ASTM C76 except as modified herein.
2. Manufacture:
a. 12-inch and 15-inch pipe: Wet cast, centrifugally spun or machine made.
b. 18-inch and larger: Wet cast or centrifugally spun.
3. Joints: O-Ring Gasketed bell and spigot, all concrete, with bell cast integrally with the pipe, ASTM C443.
4. Joints: Tongue and groove, cement mortared.
5. Cement: Type II Portland Cement.
6. Mortar: One part Type II Portland Cement to two parts sand.
7. Gaskets: NBR (Nitrile or Buna N)
8. Factory Tests:
a. Pipe Tests: Perform the tests specified in Paragraph 5.1.1 of ASTM C76. Perform both the ultimate strength test and the .01 inch crack test for not less than one piece for each pipe size and class. Provide certification that three-edge-bearing load testing devices have been calibrated to 2% of the specified test load. Notify Contracting Agency 24 hours in advance of any test to allow scheduling of witness personnel.
b. Joint Tests: Assemble two sections of pipe of each size and class. Test in accordance with Section 10 of ASTM C443.
c. Gasket Tests: Test three gaskets of each size in accordance with Section 9 of ASTM C443.

2.04 PIPE COUPLINGS AND FLEXIBLE PIECES

A. General: For typical pipe joints, refer to pipe material specifications. Other joint devices shall be furnished where called for on the Drawings and as specified below.

B. Flexible Couplings and Flange Coupling Adaptors:
1. Sleeve: Cast iron or fabricated steel.
2. Followers: Cast iron, ductile iron, or steel.
3. Sleeve Bolts: ASTM A325, Type 3; malleable iron; or equivalent, except for buried and submerged, which shall be Type 304 stainless steel and Type 316 stainless steel, respectively.
4. Coating: Fusion epoxy line and coat sleeve and followers.
5. Pressure Rating: The test pressure of the applicable service or 150 psi, whichever is greater.
6. Performance: Longitudinal movement and angular deflection capabilities shall meet AWWA C219.
7. Flanged Coupling Adaptor Flanges: Match mating flanges. If required by connecting valve or other device, provide flanges with inside diameter equal to nominal pipe diameter.
8. Buried Flexible Coupling Sleeve: Long barrel; Smith-Blair 442, Dresser Style 40; or equal.
9. Manufacturers:
a. Flexible Couplings:
1) Connecting Pipe with Identical Outside Diameters: Smith-Blair 411 or 441; Dresser Style 38 or 138; Romac RC501 or RC400, or equal.

2) Connecting Pipe with Slightly Different Outside Diameters: Smith-Blair 413 or R441; Dresser Style 62; Romac Style 400 or 501, or equal.
3) Flexible Coupling with Pipe Restraint: Romac Style 400RG, or equal

b. Flange Coupling Adaptors: Smith-Blair 912 or 913; Dresser Style 128 W; Romac FC400 or FCA, or equal.

10. Gaskets: NBR (Nitril or Buna N).
11. Joint Restraint: Provide joint harnesses (tie rod lug or attachment plate assemblies) designed for the test pressure or 50 psi, whichever is greater, across all flexible couplings and flange coupling adaptors, except where specifically indicated otherwise on the Drawings. For steel pipe, the joint harness shall conform to the requirements of Chapter 13 of AWWA M11, Table 13-4 - Tie Bolt Schedule for Harnessed Joints. Anchor studs may be used on flange coupling adapters for pipe up to 12 inches in diameter.
12. Protection for Buried Couplings, Dismantling Joints, and Adaptors:
    a. Double-wrap with polyethylene encasement, AWWA C105 and tape the edges of the encasement with PVC tape.

2.05 DRAIN BASINS

A. Drain basins shall be Nyloplast 18” Drainage Basin 2818AG with a solid cover (H-20), or equal.

2.06 VALVES AND ACCESSORIES

A. General Requirements for Valves:
1. All valves of each type shall be the product of one manufacturer.
2. All exposed valves shall be furnished with operators, handwheels, levers, or other suitable type wrench including handles as specified herein or as shown on the Drawings. Valves 4-inch and larger located more than 7 feet above the floor level shall be furnished with chain operators. Chains shall be stainless steel and shall extend to within 3 feet of the floor. Provide hook so that chain may be stored clear of walkways. All buried valves shall be provided with 2-inch-square operating nut and valve boxes.
3. All threaded stem valves shall open by turning the valve stem counter-clockwise.
4. All exposed valves and valve operators shall have a non-bleeding shop coat, unless otherwise specified. Buried valves and operators shall be coated specified in Section 09 96 00.

B. General Requirements for Accessories: Provide pressure gauges with features and accessories in accordance with Section 40 73 00. Provide shutoff valves for all pressure gauges. Conform to additional requirements in this Section below.
1. Drain Check Valves through size 2-inch:
    a. Performance: Reliable, without clogging. Seals 100% reverse flow. Low cracking pressure (less than 4 inches water column).
    b. Connections: NPT; can be mounted in any position.
    c. Materials: PVC body with Buna-N elastomer.
    d. Manufacturers: TideFlex Technologies, Series 2633; or equal.
2. Check Valves through size 18-inch:
    a. Performance: Reliable, silent operation without clogging. Low wear and maintenance free.

b. Standards: Designed, manufactured, tested, and certified in accordance with AWWA C508.
c. Connections: Flanged, 125-LB ANSI.
d. Materials: Cast iron body with Buna-N (NBR) disc per ATEM D20000 BG
e. Design:
    1) Full flow body type, with a domed access cover and only on moving part, the flexible disc.
    2) Top access port shall be full size, allowing removal of disc without removing valve from valve body.
    3) A threaded port with pipe plug shall be provided to allow for field installation of a mechanical, disc positing indicator.
    4) Non-Slam closing characteristics shall be provided through a short 35 degree disc stroke and a memory disc return action to provide a cracking pressure of 0.25 psig.
    5) A mechanical indicator shall be provided to provide disc position indication. The indicator shall have continuous contact with the disc under all operating conditions to assure accurate disc position indication.
f. Manufacturers: Val-Matic Swing-Flex, Series # 500; or equal.

3. In-Line Check Valves:
    a. Valve shall provide 100% continuous backflow prevention in accordance with CE 13564-1 under DN200.
    b. Valve fasteners and pipe shall be marine grade AISI 316 stainless steel.
    c. Valves shall produce pulsating flow to remove debris from between valve membrane and valve seat.
    d. Manufacturer shall provide published head loss curves for each valve demonstrating the valve's hydraulic characteristics.
    e. Manufacturers: WaStop Inline Check Valve (Short Body) by Wapro, or equal.
4. Plug Valves:
    a. General: Pressure reducing/regulating valves shall be self-contained with field adjustable downstream pressure setting.
    b. Non-Buried, Manual Operator:
        1) Rating: 175 psi.
        2) Type: Resilient faced eccentric plug. Valves shall provide drip-tight shutoff in both directions.
        3) Connections: Flanged, 125-pound ANSI, except threaded connections may be used for valves under 3-inch.
        4) Materials: Cast iron body, welded nickel seat, NBR or Buna-N coated plug, NBR or Buna-N packing or U-cup stem seal. Valves shall have interior and exterior metal surfaces other than the plug and valve seat coated with two coats of high-solids epoxy with total dry film thickness 12 mils minimum.
        5) Shaft Configuration: Shall be installed with shaft horizontal and with plug in upper half of body.
        6) Actuator: Manual, worm gear handwheel. Provide valve position indicators on all actuators. Manual actuator construction shall be completely enclosed and sealed, protecting moving parts from damage and corrosion.
        7) Manufacturers: DeZurik PEC or equal.
5. Resilient Seated Gate Valves, 2-inch through 16-inch

a. General: Comply with AWWA C509 or C515 except where otherwise specified herein. Valve shall be epoxy lined and coated.
1) Rating: 200 psi.
2) Type: Non-rising stem, handwheel or nut operated, see Drawings
3) Connections: Flanged.
4) Manufacturers: U.S. pipe Metroseal; Clow; or equal.

6. Pressure Gauges:
a. Refer to Section 40 73 00.

2.07 PIPE SUPPORTS

A. Manufacture and Design: Pipe supports shall to the maximum extent possible be standard factory fabricated units conforming to the typical supports and braces shown in the Drawings and as specified below. Where required support cannot be provided by standard factory fabricated units, and is not detailed on the Drawings, the Contractor shall provide special pipe supports. Supports shall be manufactured, or special fabrications or combination as shown on the Drawings or specified. Special fabrications shall be in conformance with Specification Section 05 50 00. Provide ¾-inch chamfer on corners of all support elements and file or grind smooth. Supports designated to allow axial pipe movement shall have smooth and even contact surfaces.

B. Materials: All support systems shall be Type 316 stainless steel.

C. Provide plastic caps with rounded corners on all exposed ends of channels.

2.08 APPURTENANCES

A. Provide all necessary assembly bolts, washers and nuts, thrust blocks, supports, gaskets, flanges, and all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping, and devices included in or on the piping, equipment, and piping accessories.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. General Handling and Placing:
1. Carefully inspect each pipe, fitting, valve and accessory before installation to insure there is no defective workmanship or obstructions. Inspect the interior and exterior protective coatings and patch all damaged areas in the field or replace to the satisfaction of the Engineer.
2. Exercise great care to prevent injury to or scoring of the pipe lining and coating, as applicable, during handling, transportation or storage. Handle coated and lined pipe in accordance with AWWA C213. Do not store pipe on rough ground and do not roll the pipe on the coating. Any damaged pipe sections, specials, or fittings shall be repaired or replaced at the expense of the Contractor as satisfactory to the Engineer.
3. Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.
4. Use reducing fittings where any change in pipe size occurs. Do not use bushings unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.

5. The Contractor is advised that precautions taken to keep the pipeline clean during construction will facilitate achieving the cleaning requirements of this project with a minimum of effort and expense. Compliance with these suggested minimum procedures will not relieve the Contractor of the cleaning requirements.
6. Pipe and fittings shall not be dropped. All pipe and fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the manufacturer and approved by the Engineer. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at the Contractor's expense. Any pipe with gouges exceeding 5% of the nominal wall thickness will be rejected.
7. The Contractor shall not drag the pipe. Rollers or other such devices shall be used to reduce dragging of the pipe. Damage to pipe caused by dragging is the responsibility of the Contractor and cause for replacement of damaged portion as determined by the Engineer. If, in the opinion of the Engineer, the pipe may have been dragged to an extent where damage may have occurred to the pipe wall, the Contractor will rotate the pipe in a manner which will facilitate inspection.
8. Steel plates shall be provided over trenches or shore zones if no work is being performed within.
9. Cover polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC) and polyethylene (PE) pipe stored outside for more than two months with canvas or other opaque material. Provide for air circulation under the covering.
10. Prevent damage to the pipe, lining and coating during handling and placement.
11. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.
12. Connections between ferrous and non-ferrous piping and accessories shall be made using a dielectric coupling, union, or flange.

B. General Buried Piping Installation:
1. Concrete Encasements: All piping and conduits installed under slabs or footings on earth or crushed rock shall be encased in concrete not less than 6-inch thickness on all sides and extending up to the bottom of the slab or footing, unless otherwise specifically noted on the Drawings. Encasement shall extend to within 6 inches of the first pipe joint beyond the slab or footing. Provide concrete encasement whether or not the encasement is shown on the Drawings. Provide encasement under slabs on earth or crushed rock even if the structure is supported on piles, caissons, or footings. Provide continuous concrete cradles where shown.
2. Once Work is started on a connection, it shall proceed continuously without interruption and as rapidly as possible until completed.
3. Whenever pipe laying is discontinued for short periods, or whenever work is stopped at the end of the day, close the open ends of the pipe with watertight plugs or bulkheads.
4. Where pipe grade elevations are shown on the Drawings, install the pipe with straight grades between the indicated elevations.
5. Install push-on joints in accordance with manufacturer’s instructions. Pull the slack out of restrained joints after they are made up.
6. Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 31 00 00.

7. Prior to installing a pipe section, the bedding material shall be brought to grade along the entire length of the section to be installed.
8. Install buried pipe in accordance with ASTM D2321 and manufacturer recommended installation guidelines.
9. Where pipe grade elevations are shown on the Drawings, install the pipe with straight grades between the indicated elevations.
10. Where no pipe grade elevations are shown on the Drawings, install buried piping with at least 3 feet of cover to finished grade. Where piping crosses under buried electrical ducts, provide at least 4 feet 6 inches of cover. Where piping crosses under existing or proposed buried utilities, provide 12 inches minimum separation between piping and utility.
11. Provide 12 inches minimum separation between the buried pipes and ducts.
12. Provide each pipe with a firm, uniform bearing for its full length in the trench except at field joints. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work.
13. All pipe and fittings shall be thoroughly cleaned before laying and shall be kept clean until they are used in the work.
14. As much as practicable, the print line on the pipe shall be installed facing upward to facilitate identification of the pipe when initially installed.
15. Protect buried piping against thrust by use of restrained pipe joints.
16. Where piping leaves a structure or concrete encasement, provide a joint capable of angular deflection within 12 inches of the structure for pipes 12-inch and smaller, or 1-1/2 times the nominal diameter for larger pipe sizes. Conform to details on the Drawings where such details are shown.
17. Snake buried PVC pressure pipe from side to side in the trench in long sweeps.
18. For dissimilar pipe connections, support and brace encased pipe to support the pipe and to prevent movement during testing and placement of the concrete encasement. The braces and supports shall be erected of materials and by methods that will prevent any future contact of the pipe with the environment surrounding the encasement.
19. Do not pull bell and spigot, gasketed joints more than 75% of the maximum deflection permitted by the pipe manufacturer.
20. Coat bolts on buried flanges or other buried appurtenances in accordance with Section 09 96 00. Wrap the appurtenance with polyethylene encasement and tape the encasement tightly closed to the pipe.
21. Existing storm drains shall be cut by the Contractor unless otherwise specified. The Contractor shall remove the portions of pipe to provide for the installation of the required fittings at the points of connection. Damage caused by the Contractor's operations to existing joints in piping to remain in service shall be repaired by the Contractor at no additional expense to the Contracting Agency. The Contractor shall determine the exact length of the existing storm drain that must be removed. The pipe ends shall be beveled to prevent damage to the transition coupling gasket during installation of the coupling.
22. When making the connection between a new storm drain and an existing storm drain, or when repairing a damaged pipe, take the following extra precautions:
    a. Clean the exterior of the existing storm drain of all dirt and debris and provide a sound, smooth finish before installation of the coupling.
    b. Clean equipment and materials, including new pipe and fittings, to be used in making these connections, of all dirt and debris.

23. Underground warning tape shall be installed in accordance with Section 31 00 00.
24. Pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.

C. General Exposed Piping Installation:
1. Unless shown otherwise, install piping parallel to building lines, plumb and level.
2. Install piping without springing or forcing the pipe in a manner that would set up stresses in the pipe, valves, or connected equipment.
3. Chains or cable type chokers will not be allowed when lifting sections of pipe. Nylon or other wide fabric slings or other similar lifting apparatus with spreader bars shall be used where necessary.
4. Set all pipe flanges level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.
5. Flexibility and Expansion: Provide flexible couplings, flexible hose, or flexible spools for all piping connections to motor driven equipment and where otherwise shown. The Contractor may install additional flexible couplings at favorably reviewed locations to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection. Anchor piping subject to expansion or contraction in a manner permitting strains to be evenly distributed. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeves.
6. Install unions or flexible connections where shown on the Drawings, and at all non-motor-driven equipment to facilitate removal of the equipment.
7. Provide valves wherever equipment drain connections are furnished and carry the discharge pipe to the nearest floor drain, drain trench or sump. Where no receptacle for drain exists, install drain piping to 1-inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.
8. Where piping conveying liquids passes over motor control centers, electrical panels and other electrical devices, install a protective drainage tray below the piping.
9. Provide a vent valve at all piping high spots if air release valves or other venting means are not shown.

D. Installation Specifics:
1. PVC:
    a. Install piping in accordance with AWWA M23, Chapters 6 and 7 except as modified herein.
    b. Place PVC pipe within the installation areas at least 24 hours prior to installation to permit temperature equalization.
    c. Cut pipe ends squarely, ream and deburr inside and out.
    d. Clean pipe ends and bells of dirt, grease and other foreign materials prior to making the joint.
    e. Solvent Weld Joints: Clean pipe ends and sockets and join in strict conformance with the pipe manufacturer's instructions. Make joints in accordance with ASTM D2855. Handle solvent cements and primers in accordance with ASTM F402.
2. DIP:
    a. Install ductile iron piping and fittings in accordance with AWWA C600.

1) Push on: Install piping in accordance with Installation Specifics for bell and spigot and per manufacturer's assembly instructions.
2) Mechanical joint: Install mechanical joint piping in accordance with AWWA C600.
    a) Lubrication of the plain end, socket and gasket during assembly shall follow AWWA C111, AWWA C600 and manufacturer's recommendations.
3) Flanged: Install flanged piping in accordance with AWWA C110, C115 and C153.

3. RCSD:
    a. Unless specifically otherwise shown, lay each length of pipe on a firm bed with a true bearing for its entire length between bell holes. Excavate holes of only sufficient size to accommodate the bell at each joint location. Adjust line and grade by scraping away, filling in, and tamping the backfill material to provide true grade to fit the barrel of the pipe. No wedging or blocking up of the pipe is permitted.
    b. Clean both bell and spigot before the joint is made and take care that nothing but the joint material and lubricant enters the joint. Lubricate pipe spigot, bell, and gasket in accordance with the manufacturer's recommendations. Properly place gasket into the groove on the spigot before joining. Pipe shall be joined together to provide the proper space between abutting ends of pipe. Joints may be pulled to compensate for slight grade and alignment changes. In no case shall the joint pull exceed ½-inch or one-half the manufacturer's recommended value, whichever is smaller. In pipelines 24 inches or larger, wooden spacers shall be placed against the inside shoulder of the bells at the springline.
    c. After a joint is assembled, insert a thin metal feeler gauge between bell and spigot and check the position of the rubber gasket around the complete circumference of the pipe. If gasket is not in proper position, the pipe shall be withdrawn, the gasket checked to see that it is not cut or damaged, the pipe re-laid, and the gasket position again checked.
    d. Thoroughly clean the groove and tongue ends of the pipes to be joined with a wet brush. Place a layer of soft mortar on the lower half of the groove and the upper half of the tongue. Insert the tongue end into the groove end until the mortar is squeezed out on the interior and exterior surfaces. Brush the interior surface of the pipe at the joint smooth.
    e. Immediately backfill the joint or cure the joint with moist burlap for 48 hours.
    f. After making the joint, rigidly secure the pipe in place by backfilling to the top of the pipe on each side of the pipe at the center section, but not as to fill the bell hole nor interfere with the next jointing operation and compacted in such a manner as not to disturb the pipe.
    g. When pipe laying is not in progress, keep the forward end of the pipe effectively closed with a temporary plug.

3.02 COUPLING INSTALLATION

A. Flexible Couplings and Flange Coupling Adaptors: Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Wipe gaskets clean before they are installed. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Tighten bolts progressively,

drawing up bolt on opposite sides a little at a time until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other favorably reviewed type. Anchor studs on restrained flanged coupling adaptors shall be installed so as to lock into holes drilled through the pipe wall in accordance with manufacturer's recommendation.

B. Transition couplings shall be installed by the Contractor and shall be provided with a plastic film wrap. The plastic film wrap shall be wrapped loosely around the pipe, fittings, and couplings, and secured with 2-inch-wide polyethylene adhesive tape. Pipelines in which the couplings are installed shall be wrapped a minimum of 3 feet on each side of the coupling. Joints or seams in the plastic film wrap shall be made using the 2-inch-wide polyethylene adhesive tape. The plastic film wrap need not be watertight, but no part of the pipe or coupling shall be exposed to the backfill. Care shall be exercised during backfilling to prevent the plastic film wrap from being punctured or otherwise damaged. Plastic film wrap and its installation shall conform to AWWA C105.

C. Flanged joints shall be made up tight with care being taken to avoid undue strain in the flanges, fittings, and other accessories. Bolt holes shall be aligned for each flanged joint. Bolts shall be full size for bolt holes; use of undersize bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Adjoining flange faces shall not be out of parallel to such a degree that the flanged joint cannot be made watertight without overstraining the flange. Any flanged pipe or fitting whose dimensions do not allow the making of a proper flanged joint as specified herein shall be replaced by one of the proper dimensions. Clean flanges prior to making joints.

D. Flange connections shall be in accordance with the manufacturer's requirements. Flange bolts shall not be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers shall be used under nuts. Tighten bolts evenly according to the pipe manufacturer's tightening pattern and torque step recommendations. Retighten flange connections at least one hour after the initial tightening using the pipe manufacturer's tightening pattern and torque step recommendations.

E. Tie Rods: Except where double-nutting is required, install the nuts snug. Tighten the nuts gradually and equally at opposite sides of the pipe until snug to prevent misalignment and to ensure that all rods carry equal loads. If double-nutting is required, double-nut each end of each tie rod. The space between the pairs of nuts shall be ½ inch greater than the distance between the lugs. Provide double-nutting at buried locations and where otherwise required on the Drawings.

3.03 INSTALLATION OF PIPE SUPPORTS

A. Install and adjust supports for each pipeline such that the pipeline is true to the indicated line and grade.

B. Locate anchors and braces for any single support on a continuous structure; that is, not on two sides of a structural expansion joint.

C. Tighten clamps to develop full friction along the pipeline except where loose fitting clamps are called for.

3.04 INSTALLATION OF VALVES AND ACCESSORIES

A. Wrap buried valve bodies as specified for flexible couplings and flanged coupling adapters.

B. Install valves and accessories such that all parts are easily accessible for maintenance and operation.

C. Where valve handwheels are shown on the Drawings, valve orientation shall be as shown. Where valve handwheels are not shown, orient valves to permit easy access to the handwheels or handles and to avoid interferences.

D. Install pressure gauges and thermometers in a position to permit reading them from a point approximately 5 feet above floor level, except that pump pressure gauges shall be installed close to the pump elevation.

E. Rigidly support pressure switches and connect them to piping and equipment using a suitable flexible linkage that will not permit transmission of vibrations from the piping or equipment to the pressure switches.

F. Provide a union adjacent to each screwed end valve and accessory with additional unions as necessary to facilitate removal.

G. Provide a shutoff valve below each pressure gauge, protective device or air valve unless otherwise specified.

H. Connections between ferrous and non-ferrous piping, valves, accessories or pipe supports shall be made using a dielectric coupling, union, or flange.

I. Where valves or other pipeline items require metal full-face connecting flanges, provide transition flanges if the connecting flange is not adequate.

J. All insulated piping passing through walls or slabs shall be sleeved and insulation shall run continuously through the sleeves and shall allow for 1/8-inch annular clearance between outside of insulation and sleeve wall.

K. Provide a suitable chrome plated escutcheon on pipes passing through walls, floors, ceilings and partitions in finished areas.

L. Install link-type seals in cast-in-place metal sleeves or in smooth core drilled holes.

M. Install thermometer wells in piping tees in vertical position. Fill with oil. Where wells are in lines 2 inches and smaller, increase line size so that velocity at well section is not increased.

N. Provide test plugs on all closed water systems and condenser water systems located in inlet and outlet of coils, heat exchangers, cooling towers, and where indicated on Drawings. Locate test plugs where they will be easily accessible, have adequate clearance for insertion and removal of gage needles and thermometer stems, and position to allow unobstructed viewing of gages and thermometers.

3.05 PIPE AND VALVE IDENTIFICATION

A. General: Identify all exposed piping in this project by painting, banding, system name labels, and direction arrows. The color and banding shall be as selected by the Engineer. Identify all exposed valves with tags as specified below.

B. Exposed Pipe Identification: Before painting, banding and labeling, pipes shall be identified by the Contractor with temporary wired-on cardboard tags showing the proposed marking for review by the Engineer.

C. Piping: Paint all exposed pipes with the appropriate paint system as specified in Section 09 96 00.

D. Valves: Provide each valve with a valve tag identifying the pipeline contents, and either its valve number, or the area or item served by the valve for valves without a valve number. Contents shall be as designated in the Piping Schedule.

3.06 FIELD QUALITY CONTROL

A. The Contractor shall test all products as required herein and by the reference specifications.

B. The Contractor shall:
   1. Perform leakage tests.
   2. Be responsible for the costs of additional inspection and retesting by the Contracting Agency resulting from non-compliance.

3.07 CLEANING

A. Prior to testing, thoroughly clean the inside of each completed piping system of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water or blowing with compressed air, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment, or take other appropriate measures to protect equipment while cleaning piping. Cleaning shall be completed after any pipeline repairs.

3.08 FIELD TESTING

A. Piping shall be tested as indicated in the following Schedule.
   1. Gravity Piping: Storm drainage exfiltration test or air pressure test in accordance with Section 7-04 of WSDOT Standard Specifications.
   2. Force Main Piping: Hydrostatic pressure test in accordance with Section 7-09 of WSDOT Standard Specifications.

END OF SECTION

SECTION 40 60 00

INSTRUMENTATION AND CONTROLS, GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope of Work: The following list is a summary of the work required by the plans and specifications. The list is not comprehensive or in any specific order and is provided as an aid to the bidder. Work not included here but shown in the drawings or specifications is part of the scope of work.
   1. Project.
      a. Stormwater Lift Station
   2. PLC Control Panel
      a. Stormwater Lift Station Control Panel
   3. Field instruments
      a. Install and configure all instrumentation.
      b. Verify calibration of instrumentation after installation.
      c. Document the calibration, and testing.
   4. General
      a. Provide all tools, equipment, materials, development software, and supplies and be responsible for all labor required to complete the installation, startup and operational testing of a complete and operable Instrumentation and Control (I&C) System as indicated on the Drawings and as specified herein.
      b. Provide all the necessary equipment components and interconnections along with the services of manufacturers' engineering representatives necessary to ensure that the Owner receives a completely integrated and operational I&C system as herein specified.
      c. Provide all terminations for wiring at field mounted instruments, equipment enclosures including instrument power, instrument signals, network connections, alarm contacts and status contacts as indicated on the P&IDs.
      d. Provide all Instrumentation and Control wire required for a fully functioning Instrumentation and Controls System as shown on the Drawings except for wire specifically specified in Division 16. See Section 26 05 00.
      e. Provide submittals as herein specified.
      f. Provide factory and field testing, start-up and training as specified herein.
         1) Certify and document loop testing.
         2) Certify and document the PLC system.
         3) Functional Testing of the complete installation.
            a) Provide corrective action as required for the electrical and control system to be complete and fully operational.
      g. Provide training classes.
      h. The specifications and drawings are based the first named manufacturers and provides the minimum scope of supply for electrical, instrumentation and control equipment. If contractor provides other than the first named manufacturers or approved “or equals), any associated additional work shall be provided at no additional cost to the owner.

B. Work Specified in Other Divisions:
   1. Process piping, installation of inline instrumentation, gas monitors, chlorinators and sulfonators, air compressors, main air supply headers, and other mechanical work and equipment as specified in Divisions 11.
   2. Instruments and controls which are not directly used for process control, i.e., those provided as part of a package system, such as a boiler, air compressor, etc. as specified in Divisions 11, or 26.
   3. Division 26 work, including all instrumentation and controls conduit, and only that wire specified in Division 26. Refer to Division 26 Specifications for specific requirements for wire, conduit, grounding, and other electrical equipment.
   4. Final control elements as specified in Section 40 27 00.
   5. General mechanical requirements as specified in Section 11 00 00.

1.02 REFERENCE STANDARDS

A. American National Standard Institute (ANSI) Publications:
   1. Y14.5 & 14.100 Drafting Practice
   2. C62.41 Surge Arrestors

B. Instrumentation Society of America (ISA) Publications:
   1. S5.1 Instrumentation Symbols and Identification
   2. S5.4 Instrument Loop Diagrams
   3. S20 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

C. National Electrical Manufacturers Association (NEMA):
   1. 250 Enclosures for Electrical Equipment (1000 V Maximum).

D. National Fire Protection Association (NFPA).

E. Underwriters Laboratories, Inc. (UL):
   1. 508 Standard of Safety for Industrial Control Equipment.
   2. 508A Standard of Safety for Industrial Control Panels

1.03 I&C SUBCONTRACTOR QUALIFICATIONS

A. The I&C Subcontractor shall be an electrical contractor who has demonstrated experience in purchasing, calibrating, fabricating, installing, and testing the Instrumentation and Control (I&C) products listed in this Specification Section. Normally, the I&C Subcontractor is a systems house regularly engaged in the business of panel fabrication, control component procurement, programmable logic controller and personal computer (PC) application programming in the process control industry.

B. The I&C Subcontractor has been regularly engaged with PLC based control and instrumentation systems for the water and wastewater industry, for a period greater than five years in performing all aspects of the type of work specified in this Section and shown on the Drawings. Have documentation showing an acceptable organization, facilities, and expertise to properly conduct the work specified in these specifications.
   1. Have a permanent service facility with test equipment, tools and permanent employees that can conduct programming, hardware and software testing and startup of the control and instrumentation systems furnished under this contract.

2. Shall employee an Electrical Engineer registered in the state of Washington as a Professional Engineer.
3. Documentation showing the I&C subcontractor is certified or has a similar qualification for the PLC and SCADA system provided.

1.04 I&C SUBCONTRACTOR SYSTEM RESPONSIBILITIES

A. General: The I&C equipment as specified in this Division shall be considered an integrated system. Entire system installation including calibration, verification, startup, operation testing, and training shall be performed by qualified personnel, possessing all the necessary skills and equipment, and who have had experience performing similar installations. Instrumentation and control systems drawings are diagrammatic only; it is the responsibility of the Contractor to obtain technical data, determine performance requirements, develop instrumentation detail installation designs, and coordinate the selection of specified equipment with Contractor supplied equipment to meet the design conditions stated.

System Responsibilities:

1. Instrumentation and control system drawings are diagrammatic only. Obtain technical data, determine performance requirements, develop installation details, and integrate I&C subcontractor supplied equipment with Contractor supplied equipment where depicted on the Drawings.

2. Compatibility: See that all components of the instrumentation system, including equipment specified under other Divisions, are completely compatible and function properly as a system. Provide such additional equipment, accessories, etc., as are necessary to meet these objectives at no cost to the Owner.
3. Coordination: For control components, devices, and systems specified in Divisions 11, 26, and 40 or shown on the Drawings.
    a. Provide technical advice to mechanical and electrical subcontractors as necessary regarding their installation of instruments.
    b. When interfacing to operational facilities, the Contractor shall schedule the required work with the Engineer.
        1) Submit power shutdown plans at least 2 days in advance of the shutdown.
        2) Temporary power shall be provided for shutdowns if determined to be necessary by the Engineer and be provided continuously for the duration of the power outage. The contractor shall provide the labor, equipment and fuel needed to provide temporary power.
        3) The Engineer may delay, change the scheduled shutdown anytime, at no additional cost, when the shutdown would cause a problem for plant operation.
    c. Verify the correctness of installation of all instruments.
    d. Verify that the proper type, size, and number of control wires with their conduits are provided.
    e. Verify that the proper type, size, and number of pneumatic tubes with their conduits are provided.
    f. Verify that proper electric power circuits provided for all components and systems.

g. Resolve all manufacturers' installation discrepancies between requirements and the detail requirements of the Drawings and Specifications.
h. Supervise final signal connections, both electric and pneumatic, to all process instrumentation and control equipment.
i. Adjust, startup, and test all process instrumentation and control equipment.
j. Provide specified documentation and training.

4. Performance: While the Drawings provide enough information to establish the form and function of the systems and their relationships, the responsibility for system integration and performance rests solely with the Contractor. The Engineer provides technical instruction and guidance where needed.
5. Site and Instrument Inspection: Inspect site for conformance to Drawings, paying special attention to space allocation and dimensions shown or required on Drawings. Inspect completed work and verify that it is ready for installation of instruments and equipment. Inspect each instrument and piece of equipment for damage, defects, completeness, and correct operation before installing.

1.05 SUBMITTALS

A. Refer to Section 01 33 00 for required method of preparation and transmittal and conform to requirements herein.

B. Comment Letter:
1. Proposed exceptions to the plans and specs shall be listed a detailed explanation of each explanation of each. Acceptance of any exception is at the sole discretion of the Engineer.
2. The I&C Subcontractor may use this medium to inform the Engineer of important information relating to the submittal.

C. For the duration of the submittal review period, the Contractor shall permit informal communication between the I&C Subcontractor and the Engineer.
1. During this timeframe, no statement by the Engineer shall be interpreted to give formal approval of any type or provide variance to these plans and specs.

D. Use tags as represented on the P&IDs for equipment and instrument in all submittals.

E. The submittals expected to be provided under this specification section are listed below. This list is intended as a guideline and not to be a specific list of all submittals required:
1. Control Panel
2. Interconnection Diagrams
3. Instrumentation
4. Factory Testing
5. Field Testing
6. O&M Manuals

F. Shop Drawings: Submit shop drawings (diagrams) for review in complete bound sets indexed by Specification number, with exterior tabs marked by subject.
1. Submit manufacturer's catalog cuts for each item for which shop drawings are not required. Manufacturer's catalog cuts, specifications or data sheets shall be clearly marked to delineate the options or styles to be furnished .

2. Front, side, and bottom views, showing all dimensions, finish, weight, and nameplates.
3. System Diagram showing Workstations, PLC's, printers, network switches, fiber patch panels, radios, and communication links. Identify all cable types and communication protocols.
4. Schematic Diagrams shall be complete with device tag numbers, wire numbers and terminal board numbers. Schematics shall be in a ladder diagram format with numbered rungs. Cross reference rung numbers between relay coils and contacts.
5. Submit fabrication details, nameplate legends, and control panel internal wiring and piping schematic drawings .
6. Radio communication hardware installation drawings, including radio, mast, and antenna.
7. Include material lists and/or bills of material.
8. All diagrams that depict modifications and interfaces with existing equipment shall be furnished by the Contractor. The Contractor may request copies of as built drawings from the Owner to show existing conditions. Lack of such drawings does not alleviate the Contractors responsibility to ascertain and implement connections to existing equipment as required.

G. Instrumentation:
1. Instrumentation list, or Instrumentation Bill of Materials including Manufacturer, Model Series and Part Numbers
2. For each instrument, submit completed Specification Forms per ISA S20, including those instrumentation and control components directly related to process control, but specified in other Divisions of these Specifications.
3. Include on each form the assigned tag numbers, manufacturer's part numbers, and device data.
4. Provide manufacture catalog information (cut sheet) for each instrument. Only one cutsheet is required for like models used in two or more applications. Cross out features, accessories and options that are not being provided.

H. As-Built Drawings: Submit a revised set of shop drawings that incorporates all change orders and modifications made during performance of the work. In addition to updated loop diagrams, interconnect diagrams and elementary diagrams, submit equipment and device wiring diagrams (see Sketch 17010-4) and other drawings as necessary to depict the "as-built" condition of equipment. Include all installed field and panel conduit and piping/tubing runs and routing, tray systems, supports, mounting details, interconnection diagrams with cable, wire, tube, and termination numbers. Coordinate all drawings with the conductor identification requirements in Section 26 05 19. Submit a copy of CAD produced drawings on magnetic media in AutoCAD DWG format.

I. Operation and Maintenance Manuals: Furnish Operation and Maintenance Manuals, including Instruction Manuals and Part Lists, for equipment provided under Division 40 as required by Division 1. Obtain data from manufacturers, and format and bind as specified. Obtain distribution method instructions from the Owner or his representative.
1. Schedule: Deliver at least two (2) copies of manuals in 3-ring binders (8-1/2 by 11-inch format) not later than the equipment shipment date. Deliver at least two (2) electronic searchable/indexed PDF copies of Manuals.
2. Contents: Include in manuals not less than the following information, as applicable, for each instrument, equipment, subsystem and/or control loop:

a. A comprehensive Table of Contents.
b. General, introduction and overall description, purpose, functions, simplified theory of operations, etc.
c. Specifications (including completed Specification Forms per ISA S20, equipment specification data sheet as described above under Shop Drawings), sufficiently detailed for reordering exact duplicates of the original items.
d. Installation instructions, procedures, sequences, tolerances, and precautions.
e. Operational procedures.
f. Shutdown procedures.
g. Maintenance, calibration, and repair instructions.
h. Parts list and spare parts recommendations.
i. Calibration curves, rating tables, and any other data showing the relationship of the variable inputs and the calibrated output of all measuring devices and controlled equipment.
j. Final signed test reports.

3. Format:
a. Use drawings and pictorials to illustrate the text to the extent necessary to insure a clear, concise presentation. If manuals have been written to cover a family of similar instruments or equipment, strike out inapplicable information in a neat fashion or emphasize applicable portion by heavily weighted arrows, circles or boxes; whichever provides the clearest and neatest presentation.
b. Group manuals by system control panels, including field instrumentation connected or associated with the panel. Where identical instruments are used in more than one control loop or subsystem, include only one instruction manual, per panel grouping; however, an index by tag number for all instruments shall identify its location in that manual.
c. Provide control loop and/or subsystem operational descriptions to identify the function of each instrument and its relation to the other instruments in the loop.

4. Binding: Bind each manual in a cover which indicates the panel or process area to which it applies, manufacturer's name, local address and telephone number, and year of purchase. Punch and bind manuals in standard three ring binders and include system name and subcontractor's name on binding.

J. Accessory and Maintenance Materials: Submit data for the following items:
1. Special Tools and Accessories: Special tools, instruments, and accessories for maintaining instruments and equipment requiring periodic repair and adjustment as specified elsewhere herein. Also, furnish special lifting and handling devices for equipment requiring such devices.
2. Maintenance Materials and Spare Parts: Submit a list of manufacturer recommended spare parts for each item specified. Refer to other sections of these Specifications.

K. Test Reports: Submit the following test reports as described herein:
1. Instrument Calibration Data Sheets (para. 2.13)
2. Factory Testing (para. 2.14)
3. Instrument Verification Report (para. 3.08.B)
4. Final Operational Testing (para. 3.08.C)

L. Demonstration and Final Operation Test Plan and Results: Submit a document that outlines all procedures to be used in final operational testing of instrument and

control systems. Include a description of each system, the scope of testing, test methods and materials, testing instruments and recorders, a list of functional parameters to be recorded on each item, and Shop Drawings showing temporary bypasses, jumpers, and devices.

M. Training submittals:
   1. Provide a preliminary training submittal for approval from the owner within 30 calendar days from the Notice to Proceed.
   2. Training schedule.
   3. Description of training classes.
   4. Instructor qualifications.
   5. Provide the final training submittal for approval, 30 days prior to the scheduled training.

1.06 QUALITY ASSURANCE

A. Standard of Quality: The Contractor shall provide equipment of the types and sizes specified which has been demonstrated to operate successfully. Provide equipment which is new and of recent proven design.

B. All equipment shall be UL listed or bearing the label of an independent laboratory acceptable to the Authority Having Jurisdiction and the Engineer.

1.07 INSPECTIONS

A. The I&C subcontractor is encouraged to visit the site and be fully familiar with local requirements and existing conditions.

B. The Engineer may inspect the work or materials at any time. Work shall not be covered over or closed in prior to inspection. Inspection Milestones may include:
   1. Conduits installed and labeled with temporary tags. Underground conduits not covered.
   2. Factory Testing as specified herein.
   3. Equipment Installation. No wire pulled, equipment is properly anchored, conduit connections completed and conduit tags in place.
   4. Wire Terminations (prior to energization). All wires are labeled and ready for testing.
   5. Field testing as specified herein.
   6. Punch list and final inspection. All items on the punch list must be completed prior to the final walkthrough.

C. Fabricated equipment at the factory may be inspected before shipment to job site. Provide the Engineer with enough prior notice so that an inspection can be arranged at the factory.

D. Inspection of the equipment at the factory by the Engineer will be made after the manufacturer has performed satisfactory checks, adjustments, tests, and operations.

E. Favorable review of the equipment at the factory only allows the manufacturer to ship the equipment to the project site. The Contractor shall be responsible for the proper installation and satisfactory startup operation of the equipment to the satisfaction of the manufacturer and the Engineer.

1.08 DRAWINGS

A. The specifications and drawings are paired and intended to be used jointly for the description of work.

B. Drawings: The Instrumentation Drawings are diagrammatic; exact locations of instrumentation products shall be determined in the field by the Engineer. Except where special details are used to illustrate the method of installation of a piece or type of equipment or material, the requirements or descriptions in this Specification shall take precedence in the event of conflict.
   1. Locations of equipment, inserts, anchors, motors, panels, pull boxes, manholes, conduits, stub-ups, fittings, power and convenience outlets, and ground wells are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.
   2. Review the Drawings and Specification Divisions of other trades and perform the instrumentation work that will be required for the installations.
   3. Should there be a need to deviate from the Instrumentation Drawings and Specifications, submit written details and reasons for all changes to the Engineer for favorable review.
   4. Resolution of varying interpretations of the Contract Documents shall conform to Division 0, General and Supplementary Conditions.
   5. The Drawings provide details of installation and supersede the manufacturer's recommendation where a conflict exists. For cases where a standard detail does not exist, or is not compatible, create and submit the required installation detail for review by the Engineer.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Box, crate, or otherwise enclose and protect instruments and equipment during shipment, handling, and storage. Keep all equipment dry and covered from exposure to weather, moisture, corrosive liquids and gases or any element that could degrade the equipment. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Notify the Engineer in writing if any equipment or material is damaged. Obtain prior favorable review by the Engineer before making repairs to damaged products. Equipment shall be stored in dry permant shelters and not be stored outdoors.
   1. Instrument and control system equipment shall not be delivered to the job site until required for installation or accommodation with other construction.
   2. When the CONTRACTOR is obliged to take delivery in advance of this time, the CONTRACTOR shall do so at a bonded air-conditioned warehouse and shall provide for storage at the warehouse and transport of the equipment to the jobsite by suitably moving equipment as recommended by the manufacturer.
   3. If the equipment is stored in adverse conditions or installed in improper environmental conditions, then at the ENGINEER's discretion, prior testing may be declared void. The prior testing (e.g., factory acceptance testing) shall be repeated and/or, at the discretion of the ENGINEER, a reduced value dollar credit shall be provided by the CONTRACTOR. The equipment shall still be required to satisfy site testing performance criteria

1.10 INSTRUMENT SCHEDULE

A. Instruments Schedule attached.

1. If discrepancies are found between the P&ID drawings and the instrument schedule, the P&ID's shall take precedence.

B. Instruments Schedule is for reference only, not a material take-off list.
   1. This schedule lists pertinent information about instruments identified for the contract. The Schedule is a comprehensive listing of devices but shall not be construed as a Bill of Materials or as a complete listing.
   2. The schedule supplements the P&I diagrams. Refer to the P&I diagrams for additional context.

PART 2 - PRODUCTS

2.01 MATERIALS AND STANDARD SPECIFICATIONS

A. Provide instruments, equipment, and materials shall be new and suitable for service conditions and meeting standard specifications such as ANSI, ASTM, ISA, and SAMA. The intent of this Specification is to secure instruments and equipment of a uniform quality and manufacture throughout the plant. All instruments in the plant of the same type shall be made by the same manufacturer.

2.02 NAMEPLATES

A. For each piece of equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings, and the model designation.

B. Identify each piece of equipment and related controls with a rigid laminated engraved phenolic nameplate. Nameplates shall have white lettering on a black background and similar style throughout the facility. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name and P&ID Instrument Tag. Securely fasten nameplates in place using two stainless steel screws or, where favorably reviewed by the Engineer, with epoxy cement. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the Engineer upon prior request by the Contractor.

C. Each control device, including pushbuttons, control switches, and indicating lights, shall have an integral legend plate or nameplate indicating the device function. These shall be inscribed as indicated on the Drawings or as favorably reviewed by the Engineer.

D. Provide CAUTION or SAFETY nameplates to alert operators of special conditions that may result in faulty equipment operations. Devices containing batteries that must be replaced periodically must be clearly identified. Nameplates are not required if the device senses and displays a low battery warning.

2.03 EQUIPMENT TAGS

A. All instrumentation and equipment items or systems shall be identified by name tags. Field equipment shall be tagged with the assigned instrumentation tag number listed in the Instrument Schedule.

B. Name tags shall be stainless steel with engraved or stamped black characters of 3/16 inch minimum height. Tags shall be attached to equipment with a tag holder and stainless steel band with a worm screw clamping device. Use 20-gauge stainless steel wire where banding is impractical. For field panels or large

equipment cases use stainless steel screws; however, such permanent attachment shall not be on an ordinarily replaceable part.

2.04 FIELD-MOUNTED EQUIPMENT

A. All instrument and control equipment mounted outside of protective structures shall be equipped with suitable surge arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges or nearby electrical devices.

2.05 EQUIPMENT OPERATING CONDITIONS

A. All equipment shall be rated for normal operating performance with varying operating conditions over the following minimum ranges:
   1. Electrical Power: 120 Vac ±10%, 60 Hz, unregulated, except where specifically stated otherwise on the Drawings or in the Specifications, or when two-wire, loop-powered devices are specified.
   2. Provide flow conditioning or other accessories needed to meet accuracy requirements.
      Environmental conditions
      a. Wastewater treatment facility
   3. Field Equipment:
      a. Outdoor Areas:
         Ambient Temperature: +15°F to +120°F
         Ambient Relative Humidity: 5% to 100%
         Weather: Rain, sleet, snow and ice
      b. Indoor Unheated Areas:
         Ambient Temperature: +40°F to +120°F
         Ambient Relative Humidity: 5% to 95%, non-condensing
      c. Indoor Environmentally Controlled Areas:
         Ambient Temperature: +60°F to +104°F
         Ambient Relative Humidity: 10% to 90%, non-condensing

2.06 EQUIPMENT LOCATIONS

A. Provide equipment and materials suitable for the types of locations in which they are located as defined under Division 16 . All equipment specified for field mounting shall be weatherproof and splash proof as a minimum. If a field-mounted instrument has a digital display provide a sun-shield to protect the display. If electrical or electronic components are contained within the equipment, they shall be housed in NEMA 3R gasketed cases unless noted otherwise on the Drawings.

2.07 ANALOG SIGNAL INDICATED UNITS

A. For all instruments with local or remote indicators, provide indicators scaled in actual engineering units, i.e., gallons per minute, feet, psi, etc., rather than 0 to 100%, unless noted otherwise on the Drawings or Instrument Schedule.

2.08 SIGNAL TRANSMISSION

A. Analog:
   1. Unless otherwise indicated, signal transmission between electric or electronic instruments shall be 4-20 mA and 2-wire devices shall operate from a 24 Vdc power supply. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by changes in load resistance

within the unit's rating. Where indicated, these devices should also furnish HART communication over the 4020 ma loop. Where practical, milliampere signals from the field shall be converted to a voltage signal at the external terminals of each panel, and all instruments within a panel shall be parallel wired.

2. Nonstandard transmission systems such as impulse duration, pulse rate, and voltage regulated will not be permitted except where specifically noted in the Instrument Schedule or shown on the Drawings. When transmitters with nonstandard outputs do occur, their output shall be converted to 4-20 mA prior to transmission.

B. Discrete: All alarm and status signals shall be 120 Vac [24 Vdc] unless specified otherwise on the Instrument Schedule. Proprietary data highway or serial bit transmissions such as RS232C shall be allowed to the extent shown on the Drawings.

2.09 LOOP ISOLATORS AND CONVERTERS

A. The Contractor is responsible to resolve any signal level incompatibilities when required.

2.10 PAINTING

A. Factory paint all instruments and equipment except where installed in pipelines. Where instrument panels are installed adjacent to electrical control panels provided under Division 26, provide instrument panels of identical color to that of electrical control panels. Paint as required in Division 09 for structural supports, brackets, etc. Repair damaged factory paint to satisfaction of the Engineer Feathering, priming, and painting shall produce a reasonable match to the surrounding paint work.

2.11 FASTENERS

A. Fasteners for securing equipment to walls, floors and the like shall be either hot dip galvanized after fabrication or stainless steel. Provide stainless steel fasteners in corrosive locations. When fastening to existing walls, floors, and the like, provide capsule anchors, not expansion shields. Size capsule anchors to meet load requirements. Minimum size capsule anchor bolt is 3/8 inch.

2.12 PROCESS TUBING

A. General: Instrument tubing required for all instruments and control valves . Select the appropriate tubing materials to satisfy service conditions except where specifically shown on Installation Detail Drawing.
   1. Use stainless steel tubing unless otherwise indicated on the Drawings.
   2. Provide bulkhead fittings for tubing entry into panels.

2.13 INSTRUMENT CALIBRATION

A. Each field instrument shall be calibrated at 0%, 25%, 50%, 75% and 100% of span using test instruments to simulate inputs and read outputs that are rated to an accuracy of at least 5 times greater than the specified accuracy of the instrument being calibrated. Such test instruments have accuracies traceable to the National Institute of Standards and Technology (NIST).

B. Submit a written report to the Engineer on each instrument . This report shall include a laboratory calibration sheet or the manufacturer's standards calibration sheet on each instrument and calibration reading as finally adjusted within tolerances.

C. The Contractor may, at his option, choose to perform calibration on an instrument by acquiring the services of an independent test lab, or by obtaining the required test instruments and performing the calibration.

2.14 FACTORY TESTING

A. All fabricated equipment shall be tested before it leaves the factory. Include all panels, PLC and SCADA system components and software, all panels, network, and communications equipment, etc. provided under this Division. At the factory verify wiring continuity and equipment operation by simulating input and output.

B. To minimize testing time, the Contractor and I&C Sub contractor shall pretest, troubleshoot, and debug the complete system prior to the witnessed test. Pretesting shall be conducting even if there is no witnessed factory testing.

1. Once the witnessed test is scheduled the system is considered fully pretested and debugged. During testing, if the Engineer determines that the system is not ready, or has failed, the Engineer may stop the test. The witness factory test, then shall be rescheduled for another time. The Owner reserves the right to withhold payments due to the Contractor to cover the additional cost for the Owners and Engineers time, travel, food, and lodging associated with the rescheduled test.

C. The factory test shall be conducted at the facility where the system was manufactured and programmed.

D. Upon completion of factory testing, submit a report certifying the control panels/devices/equipment are operable and meet the Specifications. The Engineer will provide a list of deficiencies that shall be corrected prior to shipment of the equipment.

E. Factory as-built shop drawings for each PLC Control Panel shall be included with the equipment.

PART 3 - EXECUTION

3.01 MOUNTINGS

A. Mount and install equipment as indicated on the drawings. Mount field instruments on pipe mounts or other similar means in accordance with suppliers' recommendation. Where mounted in control panels, mount according to requirements of that section. Provide sun shields for outdoor instruments in direct sunlight.

B. Equipment specified for field mounting shall be suitable for direct pipe mounting or surface mounting, surface-mounted indicators and equipment with calibration adjustments or requiring periodic inspection shall be mounted not lower than 3 feet 6 inches nor higher than 6 feet above walkways, platforms, catwalks, and the like.

C. Note that applicable specifications require detail drawings showing seismic sway bracing design and anchorage requirements for their equipment. Seismic zone requirements are specified in Division 01.

D. All devices shall be accessible to operators for servicing, operating, reading, etc. Provide permanent platforms to assure devices are continuously accessible.

E. Final connections from rigid conduits to the instrument shall be flexible PVC coated conduit, type as required by area classification, having a maximum length of 24 inches.

F. All control panels shall be permanently mounted to structures and anchored by methods that comply with seismic and wind bracing requirements applicable to the installation.

3.02 PROCESS CONNECTIONS

A. Provide instrument impulse tubing (see Part 2) to meet the intended process service and ambient environmental condition for corrosion resistance, etc. Install impulse tubing with a continuous slope according to service to promote self-draining or venting back to the process. Terminate connection to process lines or vessels at a service rated valve, provided under other Divisions, that will permit closing off the impulse line or removal of the element without requiring shut down of the process. Include blowdown of drip legs and valves for terminations of impulse lines at the instruments.
   1. Ensure all process connections are free of leaks.
   2. Support rigid tubing at 3ft. (max) intervals.
   3. Use a 1/16 inch per foot slope for horizontal runs.
   4. Bends for parallel lines shall be symmetric without deforming tubing walls.

B. Process vessels, line penetrations, and valves shall be furnished and installed under other Divisions of these Specifications. Instrument tubing and valve manifolds are installed as part of this Specification.

3.03 FIELD WIRING

A. Ring out signal wiring prior to termination and perform surge withstand tests where required. Verify wire number and terminations are satisfactory as designated on the Loop and Interconnect Diagrams. Verify all terminations are tight and shields are uniformly grounded at one location.

3.04 ELECTROMAGNETIC INTERFERENCE (EMI)

A. Construction shall proceed in a manner which minimizes the introduction of noise (RFI/EMI) into the I&C System.

B. Cross signal wires and wires carrying AC power or control signals at right angles.

C. Separate signal wires from wires carrying ac power or switched ac/dc control signals within control panels, network racks, and telemetry equipment, as much as possible. Provide the following minimum separations within such equipment unless indicated otherwise on the Drawings:

Power Wiring Capacity	Separation (Inches)
120 volts ac or 10 amps	12
240 volts ac or 50 amps	18
480 volts ac or 200 amps	24
4,160 volts ac or 800 amps	48

3.05 SIGNAL GROUNDING

A. Proper grounding of equipment and systems in this Division is critical for control signals and communication networks. The Drawings and Division 26, Section 26 05 26, specify safety grounding for all equipment in this Division.

B. Provide an isolated ground bus isolated from the power ground bus for all control panels. This single point grounding system does not use building steel or conduit systems for its ground path.
   1. Ground all signal shields, signal grounds, and power supplies at an isolated signal bus within each instrument panel, rack, or enclosure. See Section 40 67 00 for isolated bus requirements. The shields at the far ends of these signal cables must be disconnected (floated) from any ground to prevent ground loops.
   2. Do not connect the rack or enclosure frames to the signal grounding buses.
   3. Connect each isolated signal ground bus within each panel using a stranded, insulated copper wire of size 6 AWG or larger directly to a system ground rod installed per the Drawings.

3.06 PREPARATION

A. Ensure that installation areas are clean, and that concrete or masonry operations are completed prior to installing instruments and equipment. Maintain the areas in a broom-clean condition during installation operations.

B. Panels shall be protected during construction and until the date of final completion to prevent damage to front panel devices and prevent dust accumulation in the intervals. Other protective measures (lamp, strip heaters, etc.) shall be included as weather conditions dictate.
   1. Daily, remove trash and debris from the work area and cabinet interiors.
   2. Vacuum all enclosures at the beginning of start up, and after final completion of the project.
      a. At final completion, clean all panel surfaces and wipe all instrument displays and housings.
   3. Replace any products that have been damaged and cannot be repaired to new conditions. All materials shall be in like new condition at start up and commissioning.
      a. Touch up any minor scratches and repair or other flaws.
   4. Coil and label spare conductors, and shorten, re-terminate and label excessive cables and conductors as needed.

3.07 FIELD TESTING

A. General: The purpose of the field testing is to verify instruments are calibrated and operationally performing their intended function. Provide the services of factory trained and experienced engineers to perform verification and operational testing as prescribed below. Since the initial calibration of instruments may not satisfy the final operation of system, perform recalibration, or adjust setpoints as required to satisfy the performance requirements of the system. Notify the Engineer and Owner in writing a minimum of 48 hours prior to the proposed date for commencing final operational testing and acceptance.

B. System Verification Testing: Verify that each instrument shown on the Instrument Schedule is operating and calibrated as specified in the Instrument Schedule by simulating inputs at the primary element in each system loop and verify

performance at loop output devices (i.e. recorder, indicator, alarm, etc., except controllers). Simulate inputs at 0%, 25%, 50%, 75%, and 100% of span or with on-off inputs, as applicable. During system verification:

1. Make initial or provisional settings on levels, alarms, etc. listed in the Instrument Schedule.
2. Verify controllers by observing that the final control element moves in the proper direction to correct the process variable as compared to the set point.
3. Cause malfunctions to sound alarms or switch to standby to check system operation.
4. Check all loop instruments thoroughly for correct operation. Document loop validation using Loop Test Forms which included descriptive information, space for comments and spaces for signatures of the I&C Subconsultant and witnessing Engineer.
5. Immediately correct all defects and malfunctions disclosed by tests.
6. Submit a report certifying completion of verification of each instrument system. This report shall include a data sheet on each instrument tested that indicates instrument tolerances, instrument calibration verification, data and initial settings made to devices.

C. Final Operational Testing: Upon completion of instrument verification, test all systems under process conditions in the presence of the Owner or designated representative. System testing shall be accomplished in accordance with the approved Test Plan. The test for each portion thereof shall be witnessed, documented and signed off upon completion by the Engineer. The intent of this test is to demonstrate and certify the operational interrelationship of plant instrumentation and control systems. This testing shall include, but not be limited to:

1. Making final adjustments to levels, alarms, etc.
2. Optimum tuning of controllers.
3. Checking all alarms, failure interlocks, and operational interlocks.
4. Immediately correcting all defects and malfunctions and retesting.
5. Submit the witnessed test results and a transmittal letter indicating that all required systems have been tested satisfactorily and the systems meet all the functional requirements of their applicable specifications.

3.08 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of a factory trained and field experienced instrumentation engineer to conduct group training of up to five of the Owner's designated personnel in the operation of each instrument system. This training shall be for the time period of one working days and shall be performed during the operational testing period. Include instruction covering basic system theory, operating principles and adjustments, routine maintenance, and repair, and "hands on" operation. The text for this training shall be the Operation and Maintenance Manuals furnished under these Specifications.

B. Classroom sessions shall be interspersed with field instruction in a logical sequence. Due to possible staff limited availability, training sessions shall be coordinated to prevent overlapping sessions. Sessions shall be arranged so that technicians and operators do not attend more than two sessions per week, or more than four hours per day.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 40 67 00

PANELS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provisions: Requirements of Division 1 and Section 40 60 00 form a part of this Section.

B. Work Included: This Section covers control panels shown on the Electrical or Instrumentation Drawings, or as specified in either Division 26 or 40, and sets minimum standards for all packaged unit panels specified in Divisions 11 to 15, unless modified under those sections.

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS 1 General Standards for Industrial Controls and Systems
   2. ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies
   3. ICS 4 Terminal Blocks for Industrial Control Equipment and Systems
   4. ICS 6 Enclosures for Industrial Controls and Systems

B. Underwriters Laboratories (UL) Publication:
   1. 508 Industrial Control Equipment

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00. Shop drawings to be submitted in this Section shall be made in one package under the Product Review Category of Shop Drawings.

B. Shop Drawings: Submit shop drawings for all control panels, including details for the following items:
   1. Electric power wiring schematics. Wire tags must be shown.
   2. Electric signal wiring schematics. Wire tags must be shown.
   3. Elementary control diagram.
   4. Fabrication drawings, including a dimensioned outline drawing to scale, showing space for conduits, etc. Shop drawings for fabrication shall include:
      a. Layout drawings for each interior panel wall, subpanel, back apanel, ceiling, floor, or other interior surface upon which components are mounted which shows the arrangement of all components and the planned routing for their wiring. Identify each component with a part number bubble which corresponds to the Bill of Materials. Show dimensions between wireways and the nearest mounted components. Show dimensions between wireways of different voltage levels to demonstrate proper distancing.
      b. Dimensioned elevation drawings showing the panel's exterior.
         1) Include top, right, left, front views.
         2) Include a dimensioned panel lineup drawing for multiple adjacent panels, if applicable. This also applies to a cluster of wall mounted panels, such as Analyzer Panels, though they may not be

arranged in a straight line. Show dimensions between panels in a cluster, if applicable.

3) Show door swing arcs.

c. Views sufficient to prove clearance between internally mounted components. Show dimension of clearance gaps.

1) Submittal must include a top-down “bird’s eye” view which demonstrates the non-interference of all interior components (the panel enclosure’s top surface is transparent or removed to generate this view).

2) If the panel includes a mechanism to hold the door(s) in a given position, include a view demonstrating that the door holder mechanism listed on the Bill of Materials does not interfere with the full opening or closing of the door(s).

d. Lifting drawing or drawing detail showing how panels are to be moved during installation.

5. Details of all panel accessories. Provide a cut sheet, data sheet, or manufacturer's report for each component listed in the Bill of Materials. If data sheets for multiple panel components are compiled into a single submittal, the compiled document shall be in pdf file format, have a table of contents, page numbers, and have navigable bookmarks delineating each data sheet section within the compilation. Use red arrows, text boxes, and other legible markups to clearly indicate which product configuration is being proposed.
6. A detailed Bill of Materials listing quantities which match the instances of part usage shown in the fabrication drawings.
7. Nameplate inscriptions. Show location of nameplates in layout drawings.
8. Connections to external equipment.
9. Wire marking scheme. It is recommended to receive approval on items a & b below before generating the fabrication drawings.
   a. Description of what each field in a wire’s tag name represents.
   b. List in MS Excel file format of the proposed tag names for wires which terminate at an I/O device.
   c. Submit the wire label materials and label maker for approval before creating and attaching labels to wires.
10. Heat load and cooling calculations (see Paragraph 2.01-J).
    a. For each panel submit an analysis of the heat given off by internal components, demonstrate the need for cooling or that cooling is not necessary, and state the expected internal panel temperature with the proposed cooling system in operation.
11. Heat dissipation and heating calculations (see Paragraph 2.01-J)
    a. For each panel submit a calculation of the expected internal panel temperature which demonstrates the need for heating and sizes the heater or which demonstrates that heating is not necessary. Consider the heat given off by internal panel components and the minimum expected ambient temperature.

C. Arrange submissions in a logical manner and on the shop drawings use the device abbreviation identifications and equipment names as shown on the Drawings, in order to expedite and facilitate review by the Engineer.

D. Where unit arrangement or wiring deviates in any way from that shown on the Drawings, provide a complete record and explanation of such deviations.

E. Spare Parts List: Include a spare parts list showing recommended parts and quantities as well as complete ordering information for replacement components.

F. Provide instruction books for special control devices and special equipment installed in the control panels. Submit these to the Engineer prior to installation of the equipment.

G. Manuals: Provide manuals as specified in Section 40 60 00.

1.04 UL LABEL

A. Each control panel and terminal cabinet shall bear the UL label except as noted in the following paragraph. The UL label shall apply to the enclosure, the specific equipment supplied with the enclosure, and the installation and wiring of the equipment within and on the enclosure. If required for UL labeling, provide ground fault interrupters, isolation transformers, fuses, and any other necessary equipment, even though such equipment is not indicated on the Drawings. The fabricator shall be an approved UL listed manufacturer.

B. Control panel enclosures containing instruments mounted through the enclosure walls or door shall meet all requirements for UL labeling as above, but no UL label is required. This exception applies only if UL Recognized instruments for the intended purpose are not made.

1.05 PRODUCT DELIVERY AND HANDLING

A. Ship assembled control panels in sections that facilitate handling and field installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide panels as shown on the Drawings. Panels include but are not limited to:

Eqpm Tag	Eqpm Name	Location	Freestanding or Wall-Mounted

B. Panels shall conform to the requirements of NEMA ICS 1 (General Standards for Industrial Controls and Systems) and ICS 2 (Standards for Industrial Control Devices, Controllers and Assemblies). The panels shall be wall-mounted or freestanding floor mounted, as indicated.

C. Safety Requirements: The electrical supply to each control panel shall be arranged to be disconnected by a single switch or circuit breaker, except for necessary foreign circuits. Any live parts within the control panel fed from foreign control or signal circuits shall be covered or arranged to be disconnected by one of the following methods:
   1. Enclosed relays, which are automatically de-energized when the main disconnecting switch is opened.
   2. Door-operated enclosed disconnect switches.
   3. Clearly identified enclosed manually operated disconnect switches, which may be located inside the control panel door, provided the operating handles are isolated or barriered from all open live parts. Each control panel shall be arranged so that adjustments to timing relays or replacement of fuses can be done without exposure to live parts.

2.02 CONSTRUCTION

A. Enclosure - Freestanding
   1. Provide a latch or slider arm to hold the enclosure front door open.
   2. Where indicated on the Drawings, provide floor stand kit to raise enclosure above surrounding grade. Floor stand kits shall not exceed 24 inches in height nor cause the panel to exceed 84 inches in overall height.
   3. Hardware:
      a. Provide full-length, stainless steel piano type hinges.
      b. Provide three-point vault-type key-locking latches with pad-lockable handle. All locking system hardware shall be stainless-steel Provide two sets of keys minimum.
      c. Provide stainless steel leveling hardware.
      d. Cable Entry Plates:
         1) For top entry panels, a gasketed 10-gauge steel cover plate shall be cut that is suitable for the number of conduits. Cable entry plates are not required for bottom, side or back conduit entry unless the Contractor must specifically control the position, size, and location of cutouts.
         2) Cable entry plates shall mount to and be fastened along panel stiffeners and framing segments. Tee nut fasteners are preferred.
   4. Manufacturer: Hoffman/Nvent; Circle A-W Products Company; Gibbons Metal Products; or approved equal.

B. Enclosure – Wall-Mounted
   1. For outdoor wall-mounted panels, provide a latch or slider arm to hold the enclosure front door open.
   2. Hardware:
      a. Provide full-length, stainless steel piano type hinges.
      b. Cable Entry Plates:
         1) For top entry panels, a gasketed 10-gauge steel cover plate shall be cut that is suitable for the number of conduits. Cable entry plates are not required for bottom, side or back conduit entry unless the Contractor must specifically control the position, size, and location of cutouts.
         2) Cable entry plates shall mount to and be fastened along panel stiffeners and framing segments. Tee nut fasteners are preferred.
   3. Manufacturer: Hoffman/Nvent; Circle A-W Products Company; Gibbons Metal Products; or approved equal.

C. Finish:
   1. After fabrication all external welds shall be ground smooth. The entire unit shall be thoroughly degreased, then filled and sanded. All metal surfaces shall be given a rust-inhibiting treatment or passivator, then one coat of synthetic primer, followed by two coats of synthetic enamel. The average overall finish shall be at least 3 mils in thickness. All damage to the finish during installation shall be touched up at the jobsite as approved.
   2. Exterior panel color shall complement adjacent panels and shall be approved by the Owner. Sharp angled horizontal front edges of panels shall be protected by brushed and coated stainless steel angled strip with concealed fasteners.

D. Components

1. Each component within the panel shall be securely mounted and arranged for easy servicing, such that all adjustments and component removal can be accomplished without disturbing other components or accessories. No fastening devices shall project through the outer surfaces of the cabinet and all components shall be mounted on mounting pans within the panels.
2. Piping and Wiring: Factory wire and pipe control panels. Cable all panel wiring by securing to the panel surfaces with plastic cable ties. Permanently identify each wire at each termination by means of a heatshrink numbered sleeve. Number all electrically common wires the same, and number each electrically different wire uniquely. Provide red wire color for ac wiring, with white neutral and green ground. Provide blue wiring for dc wiring. Wiring shall be 14-gauge, Type MTW or THHN, 600 volt, stranded copper wire. Where wiring crosses hinged surfaces, provide an 18-inch "U" shaped hinge loop of extra flexible wires secured at both ends. Provide ring-type lugs for all panel wiring; spade-type lugs are unacceptable. Use ratchet type crimping tools, which do not release until proper crimp pressure has been applied.
3. Terminal Blocks: Terminal blocks shall be rated 600 volts for signals greater than 30 V and 300 volts for signals less than 30 V, and shall conform to requirements of NEMA Standard ICS 4 (Terminal Blocks for Industrial Control Equipment and Systems). The terminal block and terminal lug shall be compatible. Provide disconnecting terminals for any circuit within the control panel, which can be energized when the branch circuit feeding the control panel, if any, is off. Provide terminals for all external (field) connections and provide at least 15% spare terminals. Identify each terminal permanently with the same number as the wire being terminated. Terminals shall be Allen-Bradley 1492 Series; Buchanan; or equal.
4. Signal Ground Buses:
    a. Provide each panel with at least one isolated signal ground bus. Provide a bus 1-inch wide by 1/4-inch thick, running from top to bottom. Provide the bus with tapped holes to accommodate ground connections from various devices in the rack. Provide separate ground buses for analog and discrete/digital signals.
    b. Connect all signal shield grounds within the panel to the ground bus(es) with ring-tongue connectors that bolt to the bus(es).
5. Signal Ground Plate: For rack, multiple enclosure, or bay systems provide a separate 1/4-inch-thick isolated copper system ground plate. Mount this plate in a location central to all system components.
6. Status lights, selector switches, and pushbuttons shall be as specified in Section 26 09 00.
7. Provide door-operated switches and accessories (for remote status or alarming) where indicated on the Drawings and as specified in Sections 40 78 00 and 26 09 00.
8. Where noted on the Drawings, provide rack-out devices and access plates to make panel access easier and safer. Provide full extension drawer slides and adjust width of front access plates to assure access to all components and hardware.

E. Accessories
1. Each accessory within the panel shall be securely mounted and arranged for easy servicing, such that all adjustments and accessory removal can be accomplished without disturbing other components or accessories. No fastening devices shall project through the outer surfaces of the cabinet.

2. Panel Service Receptacle: Provide one NEMA-20R duplex GFCI type receptacle in each panel. The receptacle shall not be powered by the UPS.
3. Provide drawing pockets mounted to the inside of the front door (analyzer panels excluded).
4. Label the exterior of each panel door with "AUTHORIZED PERSONNEL ONLY" in 1-inch letters.
5. Nameplates: Provide nameplates as shown on the Drawings, and as specified in Section 40 60 00. A "CAUTION" nameplate shall be attached to the outside of access doors warning of foreign voltages inside the panel (see "Safety Requirements").

F. Size and Supports:
1. Panels shall be of sufficient size to adequately enclose all instruments designated as "panel-mounted" plus ample interior clearance to allow for installation, general servicing, and maintenance of the instruments. Weight of instruments shall be supported by Unistrut; Famet; Caine; or equal, channel supports. Panel size shall be as indicated on the Drawings.
2. Provide rigid supports for all devices. Supports shall not cause warping or bowing sides or mounting plates.

G. Mounting:
1. Attachment methods shall be detailed on panel fabrication drawing submittals. Heavy panels shall be attached by anchor bolts embedded in beams supporting the floor. See the Structural Drawings for location of beams. Seismic restraints shall be installed as specified by the manufacturer.
2. Mounting pans of rigid sheet steel shall be provided for interior components and accessories as required. A steel divider shall separate pneumatic sections from electrical sections. Devices having both electric and pneumatic connections shall be in the pneumatic section and connected to the electric section with waterproof flexible conduit.

H. Arrangement:
1. The instruments mounted in the panels shall have the nominal size and general arrangement shown. Panel layouts and nameplates shall conform to the approved submittal.
2. Space shall be provided for instruments indicated as furnished by others to be mounted and wired by the control panel manufacturer. These units shall be shipped to the control panel manufacturer in sufficient time for wiring. Coordination of instrument delivery shall be the responsibility of the Contractor. The instruments and controls to be located on each panel are shown on the instrumentation drawings, electrical schematics, and/or in the individual Specification.

I. Ventilation:
1. For outdoor enclosures, assume a maximum ambient temperature of 113°F. For panels located indoors, assume a maximum ambient temperature of 85 degrees Fahrenheit.
2. For all panels, assume a minimum ambient temperature of 13 degrees Fahrenheit.
3. Ventilation shall be provided to prevent internal panel temperatures from exceeding 100°F.
4. Louvers shall be provided, when required for cooling, near the bottoms and tops on the rear doors and side of panels. 80-mesh screens shall cover the insides of louvers. Louvers on outdoor enclosures must also be covered with

dust filters; the resulting reduction in airflow must be accounted for in the submitted calculations.

5. Provide a thermostatically controlled fan in each enclosure when louvers cannot dissipate heat adequately or cause sufficient flow to all panel areas. Ventilation fans shall be low acoustic type suitable for control rooms. Fans shall blow air out of the panel. Provide removable cleanable or disposable dust filter for fans in outdoor enclosures. A fan and its associated louver shall be located on opposite panel walls from each other and at opposite latitudes to maximize cooling airflow across internal components. Provide a disconnect switch to prevent the fan from running.
6. Equip fans and louvers of outdoor enclosures with rain hoods certified to maintain the NEMA rating.
7. Provide adjustable thermostat-controlled heaters and circulating fans in all outdoor panels to prevent condensation.
8. For panels requiring less than 1,500 Btu/hr heat dissipation, provide either an air control cooling system or ventilation fan(s) and associated louver(s).
9. Provide air conditioning for panels requiring high heat removal.

2.03 CONTROL PANELS AND ELECTRONIC RACKS

A. General:

1. Control panels of steel shall be formed of cold-rolled sheet steel of sufficient thickness and with stiffening as required for fabrication, shipping, erection, and service.
2. Panels shall be fully enclosed, including top, with no visible seams on the front. Panel front construction shall be minimum 3/16-inch stretcher-leveled, cold-rolled steel with stiffeners as necessary to maintain a flatness of ±1/16-inch of any 2-foot span and ±1/8-inch over any 8-foot span with all equipment installed. All other sections shall be 12 gauge except doors shall be minimum 14 gauge and shall maintain the same specified flatness when closed and latched. When shown on the Drawings, filler panels shall extend to the ceiling.
3. Cabinets shall be freestanding with adequate internal bracing to support the weight of instruments and wiring. The cabinet design shall be for front access. Doors shall be key locked with a minimum of two sets of keys supplied. Connections to and from the cabinets shall be through conduit through the bottom except when otherwise indicated on the electrical drawings.
4. Heavy-duty industrial quality racks shall be 19- or 24-inch panel. Framing shall be at least 14-gauge cold rolled steel, and continuously welded, rather than spot welded, at the seams of each intersecting joint.

B. Finish: After fabrication, all external welds shall be ground smooth. The entire unit shall be thoroughly degreased, then filled and sanded. All metal surfaces shall be given a rust-inhibiting treatment or passivator, then one coat of synthetic primer, followed by two coats of synthetic enamel. The average overall finish shall be at least 3 mils in thickness. All damage to the finish during installation shall be touched up at the job site as approved.

C. Exterior panel color shall complement adjacent panels and shall be approved by the Owner. Sharp angled horizontal front edges of panels shall be protected by brushed and coated stainless steel angled strip with concealed fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation, testing, calibration, validation, startup and instruction shall be in accordance with Section 40 60 00.

B. Install each control panel level and plumb, and secure by the favorably reviewed seismic mounting method. Doors shall swing freely and close tightly.

C. Provide a 3-inch-high concrete pad for each field-mounted, freestanding control panel. Provide a 3-1/2-inch-high I-beam kick panel for each control-room mounted, freestanding panel.

D. Carefully repair any damage to the structure, components or finish to the satisfaction of the Engineer. Clean all nameplates.

E. Exercise care at all times after installation of control panels to keep out foreign matter, dust, dirt, debris, or moisture. Use protective sheet metal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

F. For all metal panels mounted on concrete walls or floors, install 1/8-inch shims, and paint the back sides and bottom of the panels with Mobil Hi-Build Bituminous Coating 35-J-10; Koppers Bitumastic Super Tank Solution; or equal. Film thickness shall be 10 mil minimum.

G. For cabinets and control panels without a solid bottom and mounted on a concrete pad, bolt the enclosure to the pad and seal the bottom of the cabinet to protect against water and dust intrusion. Apply joint sealant (Sikaflex 1A or approved equal) on both the exterior and interior seams of the enclosure where it meets the concrete pad.

H. Provide a copy of the as-built shop drawings, including power distribution and elementary control diagrams for the control panel, enclosed in plastic and mounted inside the panel.

END OF SECTION

SECTION 40 71 00

FLOW MEASUREMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Requirements of Division 1 and Sections 40 60 00 and 11 00 00 form a part of this Section. This Section specifies flow measurement devices for process instrumentation, auxiliary equipment, and supplies directly related to the installation of and operation of these flow measurement devices, to perform the required functions in conjunction with information and equipment specified in other sections of Division 40.

B. Provide all instruments identified in the Contract Drawings.

1.02 SUBMITTALS

A. Shop drawings and product data to be submitted in this Section shall be made in one package under the Product Review Category of Shop Drawings.

B. Shop Drawings and Product Data:
   1. In addition to the requirements of section 40 60 00, shop drawings shall include for each type of instrument: supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.
   2. Furnish Shop Drawings and Product Data for each item of mechanical equipment presenting sufficient data to determine compliance to these Specifications. Submit completed ISA S20 forms for each device and physical dimensions. Also submit manufacturer's recommended upstream and downstream straight piping lengths, recommended location of any pressure taps, and estimates of pressure losses through the device.

C. Installation Method: The proposed method of mounting sensors and instruments shall accompany all shop drawings.

D. Parts List: Submit a Parts List with current net prices and a list of recommended spares.

E. Factory Testing and Calibration:
   1. All meters shall be factory tested. Perform a factory test and/or provide certification of calibration from an independent test laboratory. Calibration curves based on factory and/or laboratory testing (see option below) shall be provided for the Engineer's favorable review. Furnish calibration curves in units of output (inches or rpm/gpm) versus measured flow. Upon receipt of the Engineer's favorable review, the Contractor may have the meters shipped to the job site.
   2. As an option to laboratory testing each meter, the calibration curves of six (6) “like devices” may be substituted provided the calibration data is available from at least one identical device (pipe size, flow range, and type plus accessories such as extension registers).
   3. The flow tube supplier shall provide laboratory calibration data to the transmitter supplier or, where practical, test the flow tube and transmitter as

an integral assembly. The integral test shall be accomplished at no extra cost to the customer.

F. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

G. Affidavits: Furnish affidavits from the manufacturers stating that the meters have been properly installed and tested and each is ready for full time operation.

1.03 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements of Section 40 60 00, flow measurement devices furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or as specified.

1. Provide instruments suitable for the site conditions including, but not limited to, ambient temperatures, altitude, humidity, material compatibility, and process conditions.

1.04 INDICATING UNITS

A. Provide flow indication in engineering units (GPM, CFS, MGD, etc.). Indicators which read 0 to 100%, 4-20 mA, etc. shall not be acceptable.

PART 2 - PRODUCTS

2.01 PROPELLER FLOWMETER

A. Propeller meters shall feature a magnetic drive which shall prevent the process fluid from contacting any gears, bearings, shafts, etc., within a hermetically meter register. The rotation of the propeller shall be transmitted via the magnetic drive to the register and transmitter (where required) by means of a rigid shaft. The propeller shall be of 3-bladed conical design, constructed of rigid plastic that will not flex or otherwise change in dimension under maximum fluid velocity through the meter. The register case shall be hermetically sealed with a hinged lens cover and clasp.

B. Propeller Meter:

1. All wetted parts of meters and straightening vanes shall be corrosion resistant and compatible with the fluid. The fluid shall be water stormwater. Meters shall be manufactured to comply with all applicable requirements of AWWA C704. All flanged-tube type meters shall mate with 150-pound flanges.

2. Straightening vanes shall be furnished and installed upstream from the meter according to the manufacturer's recommendations. Each propeller meter shall register flow to within ±2% of actual flow rate. Meters shall be provided a watertight or hermetically sealed register consisting of a rate indicator and 6-digit totalizer. The register shall be connected to the tube by means of flanged connection designed for easy removal for inspection or repair. A compression seal shall be used to seal the register to the tube.
3. A certified copy of the calibration taken at or near minimum flow rating, at midrange, and at the highest flow rate within the range attainable by the test facility shall be furnished to the Engineer for favorable review.

C. Manufacturer: Water Specialties Model ML04-D; Sparling; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide installation, testing, calibration, verification, and startup instructions in accordance with Sections 40 27 00 and 40 60 00. Coordinate the installation with all trades to ensure the mechanical system is proper for the instrument.

B. Where instruments are located outdoors provide surge protectors at the transmitters. Provide isolators, relays, conditions, or other devices as required for a functional system.

C. Instruments without approved submittals shall not be installed.

D. The Contract Drawings and Specifications are intended show basic functional requirements. Insufficient detail does not relieve the Contractor from the responsibility to provide a complete and functioning system.

3.02 FIELD TESTING

A. The installation shall be examined to verify the instrument will work properly when installed and the Engineer promptly notified if it does not meet manufacturer recommendations or the Specifications.

B. Verify factory calibration of instruments in accordance with the manufacturer’s instructions.

C. All instrumentation calibration and configuration shall be completed prior to the start of field testing.

D. Totalizer tests are not to be performed in the field.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 40 72 00

LEVEL MEASUREMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Requirements of Division 1 and Section 40 60 00 form a part of this Section.

B. Work Included: Level measurement devices for process instrumentation, auxiliary equipment, and supplies directly related to the installation of and operation of these level measurement devices, to perform the required functions in conjunction with information and equipment specified in other sections of Division 40. Refer to the Instrument List for a listing of required devices.

1.02 SUBMITTALS

A. Shop Drawings:
   1. Shop drawings to be submitted in this Section shall be made in one package under Product Review category of shop drawings.
   2. In addition to the requirements of Section 40 60 00, shop drawings shall include for each type of instrument: physical dimensions, supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.
   3. All shop drawings, catalog pages, and cut sheets shall be clearly marked with the unique tag for the instrument(s) to which they apply.
   4. Shop drawings shall include a completed ISA S20 form for each device.
   5. Installation Method: The proposed method of mounting sensors and instruments shall accompany all shop drawings.

B. Manuals:
   1. Submit manuals in accordance with the requirements of Section 40 60 00.
   2. ISA S20 forms: Include a completed final S20 form for each device with the manuals. S20 forms shall be updated to include final values or notes from testing, startup, and commissioning.
   3. Parts List: Include a parts list showing current net prices and a list of recommended spares with the manuals.

1.03 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements of General Requirements, level measurement devices furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the

minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Instrument List.

PART 2 - PRODUCTS

2.01 LEVEL SENSOR/SWITCH – CONDUCTANCE PROBE SENSOR

A. General:
   1. This type of switch shall activate isolated contacts when a conductive liquid completes a circuit between electrodes. Unit shall consist of electrode holder, electrode(s), and control relays with enclosure.

B. Specific Requirements:
   1. The number and length of electrodes, and the configuration of contacts shall be as required to accommodate the noted set points.

C. Construction:
   1. Electrode holders shall be pressure-tight Type 316 stainless steel assemblies.
   2. Electrode material shall be Type 316 stainless steel.
   3. Enclosure shall be NEMA 4 and shall be equipped with an induction relay or solid state control relay, suitable for the noted process liquid.
   4. Solid state relays shall have adjustable potentiometers for setting the sensitivity.

D. Mounting: 2-inch NPT.

E. Signal/Outputs: Dry contacts (number as indicated on the Drawings or Instrument List), rated for 10 amperes at 120 Vac.

F. Power: 120 Vac.

G. Manufacturer: Flygt Level Probe; B/W Controls, Inc.; Gems Sensors/Warrick; or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation, testing, calibration, validation, startup, and instruction shall be in accordance with Section 40 60 00.

B. Suspended Cables and Instruments:
   1. Unless shown otherwise on the Drawings, provide a stainless steel anchor/hook and strain relief device for each cable or instrument. Strain relief device shall be as manufactured by Hubbell/Kellems or equal.
   2. Excess cable shall be neatly coiled and suspended from anchor/hook. Plastic ties are not allowed.

C. Where instrument cables exit the open end of a conduit into a tank or wet well, provide a removable bushing around the cable at the conduit opening. The bushing shall support the cable to prevent chafing and seal the opening to reduce moisture

accumulation in the conduit. Bushings shall be Emerson/OZ Gedney Type CSBI or equal.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 40 73 00

PRESSURE MEASUREMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Requirements of Division 1 and Section 40 60 00 form a part of this Section.

B. Work Included: Pressure measurement devices for process instrumentation, auxiliary equipment and supplies directly related to the installation of and operation of these pressure measurement devices, to perform the required functions in conjunction with information and equipment specified in other sections of Division 40. Refer to the Instrument List for a listing of required devices.

1.02 SUBMITTALS

A. Shop Drawings:
   1. Shop drawings to be submitted in this Section shall be made in one package under Product Review category of shop drawings.
   2. In addition to the requirements of Section 40 60 00, shop drawings shall include for each type of instrument: physical dimensions, supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.
   3. All shop drawings, catalog pages, and cut sheets shall be clearly marked with the unique tag for the instrument(s) to which they apply.
   4. Shop drawings shall include a completed ISA S20 form for each device.
   5. Installation Method: The proposed method of mounting sensors and instruments shall accompany all shop drawings.

B. Manuals:
   1. Submit manuals in accordance with the requirements of Section 40 60 00.
   2. ISA S20 forms: Include a completed final S20 form for each device with the manuals. S20 forms shall be updated to include final values or notes from testing, startup, and commissioning.
   3. Parts List: Include a parts list showing current net prices and a list of recommended spares with the manuals.

1.03 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements of Section 40 60 00, pressure measurement devices furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the

minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated in the Instrument List. Verify the instruments are compatible with the process such as flows, fluids, temperature and pressures, etc. and the physical requirements of the installation, such as temperature, humidity, altitude, mounting requirements, and accessories. Notify the Engineer if conditions are found not to meet the manufacturers recommendations.

PART 2 - PRODUCTS

2.01 PRESSURE MEASUREMENT ASSEMBLY

A. Provide complete assemblies as shown on the Drawings, consisting of the below referenced devices, factory assembled and if required, vacuum bled to form a complete pressure measurement assembly.

2.02 PRESSURE AND VACUUM GAUGES

A. Pressure and Vacuum Gauges: Pressure and vacuum gauges shall be of the local mounting type unless panel mounted type is shown on the Drawings.

B. Construction:
   1. Gauges shall be of the bourdon tube, bellows type, or compound type with 270 degrees clockwise pointer travel. Compound gages shall have clockwise travel on gage pressure and counterclockwise travel on vacuum.
   2. Gauges shall be 4-1/2 inch diameter. Smaller gages may be accepted on a case-by-case bases in packaged systems.
   3. Case shall be aluminum.
   4. Process gages supported by the process connection shall be filled with an inert fill liquid. Panel-mounted gauges shall have round bezels for flush mounting and rear connection.
   5. Dial face shall be white background with black numerals and polycarbonate shatterproof glass.
   6. Gauge shall have safety blow out through the back or top of the unit.
   7. Pointer shall be externally adjustable.
   8. Accuracy shall be Grade 2A, 0.5% of full-scale maximum and readable to 1%.
   9. Connection for all gauges shall be male 1/2-inch NPT with square wrench flats. Provide diaphragm seals on corrosive fluid and gas lines or if shown on the Drawings.

C. Manufacturers: Gauges shall be Ashcroft; Ametek/U.S. Gauge; or equal.

2.03 DIAPHRAGM PRESSURE SEALS

A. General:
   1. Units shall consist of corrosion-resistant lower housing and metallic diaphragm welded to upper housing, and instrument mounting upper housing.
   2. Lower housing shall have a 1-inch NPT female process and a 3/8-inch flushing connection and shall be constructed from material indicated on Instrument List.
   3. Diaphragm shall be constructed from material indicated on Instrument List.

4. Upper housing shall have filling connection, NPT female instrument connection, and shall be constructed from material indicated on Instrument List.
5. Filling fluid shall be suitable for a temperature range of -17° to +260°F.
6. Provide Type 316 stainless steel armored capillary for all remote installations.

B. Manufacturer:
1. Ashcroft: (Type 741 with flushing connection), (Type 740 without flushing connection)
2. Ametek/Mansfield & Green: (Type SG with flushing connection), (Type SB without flushing connection) or equal.

2.04 PULSATION DAMPENERS/SNUBBERS

A. Provide pressure snubbers as shown on the Drawings, or at a minimum for each positive displacement metering pump.

B. General: Porous pressure snubbers shall be stainless steel for the specific service involved. Porosity of media shall be suitable for the fill fluid and range of operating pressures.

C. Manufacturer: Ashcroft 1112 series; Trerice 872 series; WIKA Type 910.12.100 or equal.

2.05 INSTRUMENT VALVES AND VALVE MANIFOLDS

A. General:
1. Gauge valves shall provide isolation of the process and shall be Type 316 stainless steel with a Teflon O-ring.
2. Block and bleed valves shall provide isolation of the process with draining ability. Shall not be used for raw sewage or other fluids with a high solids content. Materials of construction shall be type 316 stainless steel with a Teflon O-ring.
3. Valve Manifolds shall be Type 316 stainless steel with an O-ring for the specific service involved. May be 2 or 3-valve, or 5-valve blowdown or metering type as indicated on the Drawings. Provide one piece bonnet with a metal seal and lock pin. Manifolds shall allow integral or remote mounting and shall be designed for easy cleaning.
4. Level sensor isolation valves shall provide isolation from the process and constructed with Type 316 stainless steel, with a 3-inch flange diameter.

B. Manufacturer:
1. Gauge valve: Anderson Greenwood; Hex Valve; or equal.
2. Block and bleed valve: Anderson Greenwood; Hex Valve; or equal.
3. Valve manifold: Anderson Greenwood; Hex Valve; Emerson/Rosemount; or equal.
4. Tank level sensor isolation valve: DeZURIK Level Sensor Isolation Valve; SCG Indu-Tech Level Sensor Isolation Valve; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s requirements and applicable detail.

B. On systems requiring seals, the Contractor shall order (or assemble) a completely filled system. The filling fluid shall be silicone oil. The filled system shall retain the same calibration requirements of the individual components.

C. Install pressure snubber(s) on sealing fluid in sealed assemblies, or on process fluid if no seal.

D. Installation, testing, calibration, validation, startup, and instruction shall be in accordance with Section 40 60 00.

E. When process piping system pressure testing exceeds the rated capacity of instruments connected to the process, ensure all instruments are isolated prior to and during testing.

END OF SECTION

SECTION 40 78 00

PANEL MOUNTED AND MISCELLANEOUS FIELD INSTRUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Requirements of Division 1 and Sections 40 60 00 and 26 09 00 form a part of this Section.

B. Work Included: This Section specifies the panel mounted and miscellaneous field instruments and equipment to perform the required functions in conjunction with information and equipment specified in other sections of Division 40. Refer to the Instrument Schedule in Section 40 60 00 for a list of required devices. This Schedule shall not be construed as complete bills of material.

C. Unit Responsibility: It shall be the responsibility of the qualified single firm as described in Section 40 60 00 of this Division to ensure that the instruments and equipment furnished under this Section are compatible with the equipment furnished under sections of this Division and other Divisions of these Specifications, and that the signal transmission methods are compatible.

D. Control and Performance Terminology used hereinafter in this Section shall be as defined in SAMA Standard PMC20-2-1970, "Process Measurement and Control Terminology."

E. Cases: Cases of front of panel mounted instruments shall be of uniform design and color scheme wherever possible. Front of case colors shall be compatible with panel colors, subject to final approval by the Owner. Normally, compatible standard colors of the manufacturer shall be acceptable.

F. Panel Mounted Equipment:
   1. All flush mounted miniature electronic controllers, recorders, and stations shall be a matching style family of instruments utilizing multiple unit mounting cases and back of panel plug-in cable connections. The overall height shall be 6 inches. A nine station multi-unit case shall fit standard 19-inch rack spacing. Each multi-unit case and instrument shall be equipped for standby manual operation.
   2. All front panel mounted instruments shall be capable of withdrawing chassis to all service and test positions without affecting operation, and complete removal by a single plug connection from the front.
   3. All back of panel mounted signal conditioners and auxiliaries shall be mounted in plug-in card files with labeled adjustment and test point at front of card edge.
   4. All instruments shall accept 4-20 mAdc or 1 to 5 Vdc input signals and shall produce 4-20 mAdc or 1 to 5 Vdc output signals as specified in the Schedules. Internal panel signals may be of either type. All signals coming to or leaving the panel shall be 4-20 mAdc.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Panels: Section 40 67 00.

1.03 SUBMITTALS

A. Shop drawings to be submitted in this section shall be made in one package under the Product Review Category of Shop Drawings.

B. Refer to Section 40 60 00 for additional submittals required for each item herein.

1.04 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements of Section 40 60 00, instrumentation and control equipment furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of the most recent design. Except where specified otherwise, the instruments furnished under this Section shall be as manufactured by Fischer & Porter; Foxboro; or equal. Behind-the-panel equipment shall be as manufactured by the above or by AGM Electronics; Moore Products; or equal.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or specified.

PART 2 - PRODUCTS

2.01 CONTROLLERS AND MANUAL CONTROL STATIONS

A. General: Controllers shall compare a process variable input signal with a remote or locally adjusted set point and shall produce a control output signal to correct any deviation of the process variable from the set point by means of a final control element. Manual control stations shall convert a remote or locally adjusted set point value to an output control signal to control a process variable by means of a final control element.

B. Controllers shall have the following features:
   1. Auto-Manual Switching shall be provided on the front panel of each controller except for controllers with manual control action only or two-position control action. Switching from automatic to manual control shall be without an intermediate "Balance" position and shall cause no change in the controller output (bumpless transfer).
   2. Remote Set Point shall be provided where indicated on the "Controller and Manual Control Station Schedule." A switch for transfer from remote to local and vice-versa shall be mounted on the front of the controller panel. When in the remote set point mode, the scale of the controller shall be servo motor positioned so that the value of the set point is always indicated.
   3. Reference Accuracy for the automatic controllers shall be at least ±0.5% of span. All automatic controllers shall have provision for manually overriding

and adjusting the controller output signal. Adjustable output limiting shall be furnished on all automatic controllers with integral control.

4. Replacement: Each automatic controller shall have provision for replacement by a manual control plug-in module. If this feature is not available in the manufacturer's line of equipment, manual control stations shall be mounted on the front of each local control panel with patch cords or other connecting devices necessary to reach the terminals of all automatic controllers mounted on that panel. In no case shall the manual control be mounted more than 2 feet from its associated automatic control station.
5. Indicating Scales: Scales of control stations shall be the center deviation indication type. A set point scale on the front of the instrument shall display the process variable and its deviation from set point. The set point scale shall be at least 4-1/2 inches long and shall be vertically oriented. A separate scale shall display the control output signal to the final control element as 0 to 100%. Set point scale graduation shall be readable to the nearest 1%.
6. Cases: Cases of control stations shall have front dimensions with a maximum of 4 inches wide by 6 inches high.
7. Signals: Process variable and analog remote set point input and control output signals shall be 4-20 mAdc except that two-position and proportional speed floating control output signals shall be contacts rated for a minimum of 5 amperes at 120 Vac. Signals between units mounted in a single panel may be 1 to 5 Vdc.
8. Control Algorithms shall be available in controllers with the following control actions:
    a. Proportional speed floating (integral).
    b. Proportional with manual bias.
    c. Proportional plus integral with adjustable output limiting.
    d. Proportional plus integral plus derivative with adjustable output limiting.
    e. Manual.
    f. Two-position with adjustable "dead zone."
    g. Feed forward in addition to "c" or "d" above.
9. Control Action provided for each controller shall be as indicated on the "Controller and Manual Control Station Schedule." Tuning adjustment of the control actions shall be integral to the control station and shall be accessible from the front of the control panel without disconnecting the controller from the process. When provided, control actions shall be continuously adjustable over the minimum ranges listed below:
    a. Proportional Speed Floating: 0.1 to 25 seconds repetition period, 0 to 10% dead zone, 0 to 100 speed factor.
    b. Gain: 0.2 to 33.
    c. Integral: 0.04 to 30 repeats per minute.
    d. Derivative: 0.01 to 8 minutes per repeat.
    e. Two Position: 0 to 10% dead zone.
    f. Feed Forward: 0.5 to 5 gain.

C. Schedule Abbreviations are listed below:
1. MA - Analog, Manual-Automatic.
2. Control Algorithms:
    a. I - Proportional Speed Floating
    b. P - Proportional
    c. PI - Proportional plus integral
    d. PID - Proportional gain plus integral plus derivative
    e. M - Manual

f. TP - Two-position
g. FF - Feed forward

2.02 DIGITAL PUMP CONTROLLERS

A. General: Furnish, install, test and place into satisfactory operation, level controls complete with digital pump controllers to operate in conjunction with the bubbler type level sensing system specified in Section 40 72 00.

B. Digital pump controllers shall be all solid state, integrated circuit to control two or more pumps in lead/standby, lead/lag/standby, lead/lag/follow/standby or lead/lag/follow/2nd follow/standby configuration, as shown on the P&ID and elementary control diagrams, plus high and low level alarms with individual start and stop points for each pump. Controllers shall utilize noise immune CMOS digital logic for maximum security. Individual set points for each pump start and stop plus high and low level alarms shall be accomplished using three-digit rotary thumbwheel switches for each level point for trip-point selection to the nearest tenth of a foot. A three-digit digital display shall be provided for level indication in tenths of a foot. Digits shall be not less than 1/2-inch high and shall be clearly visible in a high ambient light. Controllers shall have a 4-20 mA output for use by the adjustable frequency drives (AFDs) for the pumps. Controllers shall convert bubbler gauge pressures to process variables using either integral or separate gauge pressure transducers. Contact outputs for high alarm, low alarm, lead, lag, follow, 2nd follow and standby pump start shall all be rated 10 amps at 120 volts. LEDs shall be provided to indicate high level, low level, lead pump required, lag pump required, follow pump required, 2nd follow pump required, and standby required. On restoration of power, pumps shall start in a timed sequence starting with the lead pump. Include manual simulator to bypass automatic controls for testing, and control disconnect. Low level alarm shall be capable of inhibiting all pump run relays in the event of low level and be capable of low level indication without pump shutdown if desired by operating personnel. Complete control shall be easily removable so that a replacement can be installed. Printed circuit cards of one pump controller shall be interchangeable with cards of any other pump controller.

C. Supplier of digital controllers shall maintain a service organization within the State of Washington consisting of factory trained service engineers. They shall have oscilloscopes, digital meters and all other necessary testing equipment. Parts for this equipment shall be stocked at the service organization and the service engineer shall have enough parts with him on a service call to remedy the problem in the one trip. Supplier shall submit, on request by the Port, a list of spare parts for this equipment carried in his local stock.

D. Digital pump controllers shall be provided with tees and purge valves to facilitate manual blowdown of the bubbler sensing lines.

2.03 SIGNAL CONDITIONERS AND CONVERTERS

A. General: Signal conditioners and converters shall be provided as shown on the Drawings and/or as specified herein. They shall have all solid state circuits on plug-in printed circuit boards and housed in card cases or single cases for in-panel mounting and weatherproof or explosion-proof cases for field mounting depending on the area rating. Accuracy shall be ±0.25% unless shown otherwise. They shall be as manufactured by AGM Electronics; Rochester Instruments; or equal.

B. Signal Selectors: Signal selectors, if required, shall receive up to four dc control signals and shall retransmit the lower, the intermediate, or the higher of the signals. Signal selectors shall be back-of-panel mounted.

C. Signal Isolators and Impedance Converters: Signal isolators and impedance converters shall be provided for all field-located transmitters to prevent ground loops and ensure system compatibility and shall be either field-mounted or back-of-panel mounted in the control panels.

D. Scale and Bias Transmitter:
1. Provide a solid state scale and bias transmitter signal interface instrument, designed to accept voltage or current inputs and provide a current or voltage output. The basic ranges of the standard instrument shall be 1 to 5 Vdc input and 4-20 mA output. Current inputs and voltage outputs shall be obtained through the application of proper resistor shunts. Zero suppression shall be provided for true zero input and/or true zero output operation.
2. A full 100% of the input signal shall be available as an input bias adjustment in this instrument. Provide ratio ability, "K", of 0.1 to 10.0.
3. Provide scale and bias calculating equation as follows:
   a. Voltage Input K(Vi - 1) + Vb = Vo - 1 Voltage Output
   b. Current Input K(Ii - 4) + Ib = Io - 4 Current Output
4. Where:
   K = ratio Ib = current bias
   Vi = voltage input Vo = voltage output
   Ii = current input Io = current output
   Vb = voltage bias
5. Provide all circuitry packaged on high-quality, military-grade, epoxy fiberglass printed circuit boards. All semiconductor elements used shall be silicon.
   a. Input Signal (as required):
      1) 1 to 5 Vdc (Zin greater than 5 megohms)
      2) 4-20 mA (Zin 250 ohms)
   b. Input Bias Range: ±100% of full scale
   c. Output Bias Range: 0 to 50% of full scale
   d. Ratio (gain) Range: 0.1 to 10.0 (100:1)
   e. Output Signals (as required):
      1) 4-20 mA
      2) 1 to 5 Vdc
6. Output Drive Capability:
   a. 4-20 mA into 0 to 800 ohms with any available supply ±20%
   b. 4-20 mA into 0 to 950 ohms with any available supply ±2%
7. Output Limiting: 130% of full-scale maximum output
8. Computing Linearity: ±0.1%
9. Repeatability: ±0.1% of span
10. Response Time: less than 50 milliseconds
11. Stability and Drift (with 1 to 5 Vdc input, 4-20 mA output): ±0.5% change for a 50°F (28°C) change in ambient temperature maximum; ±0.2% typical
12. Ambient Temperature Range: 0° to 140°F (-18° to 60°C)
13. Power Input:
   a. 115 Vac, ±20%, 50/60 Hz., 5 watts
   b. 230 Vac, ±20%, 50/60 Hz., 5 watts
   c. 24 Vdc, ±20%, 4 watts
   d. 48 Vdc, ±20%, 8 watts

14. Power Supply Effect (with 800 ohm output load, 4-20 mA signal): ±0.3% for a ±20% power variation maximum; ±0.15% typical
15. Controls: multiturn input bias, output bias, and gain potentiometers
16. Connection: barrier terminal strip
17. Mounting: surface
18. Electrical Classification: general purpose, CSA approved

E. Signal Rate Limiters: Signal rate limiters shall be provided where indicated or as required for system stability. Rate limiters shall accept a 4-20 mA input signal and output a 4-20 mA rate limited signal such that if the input varies at a rate in excess of preset rate, the output will change linearly at the preset rate. The output signal increase and decrease rates shall be independently adjustable within the range specified.

F. Signal Peak Limiter: The signal peak limiter shall accept a 4-20 mA signal and reproduce a 4-20 mA signal limited to a preset peak value. The peak value shall be adjustable over the upper 50% of the range as a minimum. The output until limited shall be identical to the input within the reference accuracy. The reference accuracy and repeatability of the limiting shall be 0.25%. The limiter shall be mounted within the control panel.

G. Signal Summators: The signal summators shall accept the specified number of 4 to 20 mA signals, A, B, C, etc., and produce a sum equal to A + k1B + k2C, etc., where the ks are adjustable fractional constants equal to or less than one. Adjustment may be internal. The output shall be another 4 to 20 mA signal linear and proportional to the sum. The reference accuracy shall be 0.25% or better. The units shall be mounted within the control panels. Operating power, if required, shall be 120 Vac, 60 Hz. commercial power..

H. Volt-to-Current Converters: Volt-to-current converters shall be provided where indicated to receive a 1 to 5 Vdc input and convert this signal to a 4-20 mAdc current output, proportional to the sensed variable. Zero and span adjustment shall be provided. Unit shall be back-of-panel mounted.

2.04 CONTROL PANEL ACCESSORIES

A. Relays, timers and other internally mounted equipment shall be of the types specified in other sections of these Specifications.

B. Panel face mounted equipment shall be of the types specified in other sections of these Specifications.

C. Standards: All control devices shall conform to applicable provisions of NEMA Standards ICS 1 and ICS 2.

D. Pushbuttons, selector switches and pilot lights shall be heavy-duty oiltight units. Pushbuttons and selector switches shall have contacts rated 10 amperes continuous, Rating Designation A600 in conformance with NEMA ICS 2.
1. Pushbuttons used as emergency stop devices shall have a padlockable means for maintaining an open circuit. Indicating lights shall be push-to-test transformer type with lenses of the colors shown on the Drawings.
2. Multiposition control switches shall have rotary action, round knurled handle and the number of positions and stages shown on the Drawings. They shall be suitable for panel mounting. Each position shall have a positive detent. Contacts shall have a continuous current rating of 10 amperes at 300 Vac. Switches shall have integral indicator.

3. For 4-20 mAdc and 1 to 5 Vdc signal selector switches, provide oiltight selector switches with electronic duty gold contact blocks. Provide sliding contacts for reliable operation without benefit of thermal cleaning action.
4. Manufacturer: Allen-Bradley Bulletin 800T oiltight selector switch with stackable "Logic-Reed" contact blocks; or equal.

E. Colors and Descriptions:
1. Indicating Lamps: Unless otherwise noted in the individual Loop Specifications, the following color code and inscriptions shall be followed for the lenses of all indicating lights and annunciators.

Indicating Lamp Inscription	Color	Annunciator Lamp Inscription
ON/START	Red	Refer to Instrument Schedule and Panel Elevation Drawings and Elementary Drawings
OFF/STOP	Green	
CLOSED	Green	
LOW	Amber	
FAIL	Red	
HIGH	Amber	
OPEN	Red	
POWER ON	White	
RESET	Red	
AUTO	Blue	

2. Lettering shall be black on white and amber lenses. Lettering shall be white on red and green lenses.
3. Pushbuttons: Follow color coding for indicating lamp above. All unused or noninscribed buttons shall be black. Lettering shall be black on white and yellow buttons. Lettering shall be white on black, red and green buttons.

F. Nameplates: Unless specified otherwise in the Drawings, nameplates shall be black lamacoid with minimum 3/16-inch-high white letters for major area titles, 5/32-inch for component titles, and 1/8-inch for subtitles, and shall be fastened with a permanent but dissolvable adhesive or by screws.

2.05 INSTRUMENT LOOP POWER SUPPLIES

A. General:
1. For each two-wire transmitter, provide a 24 Vdc regulated 50 mA power supply with 120 Vac input. Output voltage may be 24 Vdc ±5% manufacturing tolerance at no load, but shall hold within 1% from no load to full load at 120 Vac ±10% input.
2. Line-to-load regulation shall be within 0.1% from no-load to full load. Ripple shall be less than 15 mV peak-to-peak.

B. Manufacturer: Provide Model AP9046 instrument loop power supply as manufactured by Action Instruments with plug-in mounting base; equivalent

capacity Lambda power supply with terminal blocks for external connections; or equal.

2.06 MOISTURE ALARM SENSORS AND POWER SUPPLY PANEL

A. General: Provide moisture alarm sensors to sense seeping water and mixtures of water and ethylene glycol. Provide sensors that are adjustable to allow detection of a film of water from 0 to 1/8-inch thick. Provide sensors that will not go into alarm during periods of high humidity. Provide sensors with DPDT contacts rated 2 amps at 24 Vdc. Provide an external/remote power supply panel; units relying on battery power are not acceptable.

B. Construction: Provide moisture alarm with circuitry that is impervious to water immersion. Sensing probes shall be non-corrosive and capable of prolonged reliable operation.

C. Quality: Provide moisture sensors as manufactured by Dorlen, Water Alert Series; Devoke; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation, testing, calibration, verification, startup and instruction shall be in accordance with Section 40 60 00.

B. Wiring: Refer to Section 40 60 00, Part 3.

C. Switching Circuit Schematics: Schematics shown are illustrative of the desired function only, the Contractor may elect to perform the required functions by other standard logic techniques. Components and circuits used shall be subject to review and approval. All switching circuits shall be checked and verified by testing before shipment.

D. Control Voltage:
1. When the control voltage is not specified in the schematics, the Contractor may elect to use the 120 Vac power, as supplied from the power panels supplies under Division 16; however, he shall provide a separate low voltage circuit for the indicating lamps or provide individual transformers with lamps. In any event the lamp voltage shall not exceed 30 Vac or dc.
2. Manual disconnect switches (and relays if necessary) shall be provided internal to the panel to isolate process related groups of circuit elements from panel power and foreign voltages to permit troubleshooting without disabling controls for other processes. Safety interlock switches shall be provided on access doors to disconnect local and foreign voltages if required by safety codes of applicable regulating authorities.

END OF SECTION