GROUNDWATER EXTRACTION AND TREATMENT SYSTEM COMBINED REMEDY
ROCKETS, FIREWORKS, ANF FLARES SUPERUND SITE
SOURCE AREA OPERABLE UNIT
RIALTO, CALIFORNIA

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PART 1 General

1.01 Description of the Work

A. OWNER has received a Consent Decree which describes a number of requirements regarding the remedial design and remedial action of the site agreed to by the OWNER and the United States Environmental Protection Agency (USEPA). This document establishes that certain requirements of the Consent Decree described in the following paragraphs, are conditions of the Contract and the responsibility of the CONTRACTOR. By execution of the Contract, CONTRACTOR pledges adherence to all provisions of the Consent Decree applicable to the Work. A copy of the Consent Decree is attached as Appendix A to this document.

1.02 Related Work Described Elsewhere

A. The provisions and intent of this Contract, including the General Conditions, Supplementary Conditions and General Requirements, apply to this Work as if specified in this Section. Work related to this Section is described in:

1. Section 01 31 00 Project Management and Coordination
2. Section 01 33 00 Submittals
3. Section 01 32 16 Construction Progress Schedule
4. Section 01 40 00 Quality Requirements
5. Section 01 41 00 Regulatory Requirements
6. Section 01 66 00 Product Storage and Handling Requirements
7. Section 01 78 39 Project Record Documents

1.03 Definitions

A. Consent Decree: A court order, the provisions of which were agreed between the OWNER and USEPA, which has been filed in Federal court and which is binding upon the OWNER and USEPA.

B. USEPA: The United States Environmental Protection Agency

PART 2 Products – Not Used

PART 3 Execution

3.01 Performance of the Work

A. CONTRACTOR shall comply with all provisions of the Consent Decree applicable to the Work.

3.02 Notifications

A. CONTRACTOR's USEPA contact person for the OWNER is:

Heather Balfour
Program Director
ERM
2525 Natomas Park Drive, Suite 350
Sacramento, California 95833
Telephone: (916) 999-8944

B: CONTRACTOR's contact person at USEPA is:

Wayne Praskins
Project Manager
USEPA Superfund Program
75 Hawthorne Street
San Francisco, California 94105
Telephone: (415) 972-3181

C. CONTRACTOR shall direct all inquiries to USEPA through the OWNER.

D. CONTRACTOR shall notify the OWNER by telephone of discovery of any unanticipated or changes circumstances at the site.

3.03 Reporting

A. CONTRACTOR shall provide the OWNER with a copy of data obtained from chemical analysis of soil, sludges, products, storm water, decontamination water, construction debris, spent media, and other wastes associated with the Work, as described in the Specifications.

END OF SECTION

PART 1 General

1.01 General Conditions

A The General Conditions apply to all divisions and sections of this engineering Specification, which shall be used to perform work as shown on the plans and as specified, and shall be properly coordinated with work as described in the related Specifications.

B. The Drawings and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the drawings and what is written in the Specifications, the details described on the drawings shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to the regulations of the "OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction," and other applicable state and municipal standards and regulations.

1.02 Referenced Sections – None

1.03 Cited Standards

A. Standards listed as "Reference Standards" in the various sections of these Contract Documents are hereby incorporated into these Specifications by reference.

B. Referenced documents shall include all revisions, amendments, supplements, or Addenda issued on or before the date of advertising for bids.

C. All specification sections included shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. State Standard Specifications, Issue by: Department of Transportation, 2010.

2. NSF 60 Drinking Water Treatment Chemicals - Health Effects

3. NSF 61 Drinking water system components - Health effects, Revision to NSF/ANSI 61 - 2012

1.04 Noted Restrictions - None

1.05 Quality Control

A. Best Management Practices (BMPs)

1. Best Management Practices (BMPs) related to the Work are found in the following sections and their sub-sections:

a. SECTION 01 40 00 – QUALITY REQUIREMENTS

b. SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

c. SECTION 01 57 19 – TEMPORARY ENVIRONMENTAL CONTROLS

2. Additional BMPs may also be included throughout specific sections of each Division of these Specifications in order for the CONTRACTOR to conduct work in an environmentally responsible manner.

B. The CONTRACTOR shall be responsible for obtaining necessary permits for the Work. The ENGINEER will be responsible for obtaining operational permits for the groundwater treatment system through the California Department of Public Health (CDPH).

C. The ENGINEER will be responsible for submitting Notice of Intent (NOI) to State Water Resources Control Board for coverage under the most recent Construction General Permit for the discharge of storm water.

D. Storm Water Pollution Prevention Plan

1. The CONTRACTOR shall be responsible for preparing a site-specific Storm Water Pollution Prevention Plan (SWPPP) for all aspects of the Work.

2. The CONTRACTOR shall be responsible for implementation of the SWPPP.

E. Standard Urban Storm Water Mitigation Plan

1. This Project is subject to the requirements of the County's Storm Water and Urban Runoff Control Regulation Ordinance which implements the requirements of the Regional Water Quality Control Board's Standard Urban Storm Water Mitigation Plan (SUSMP) Prior to the issuance of any demolition, grading or construction permits for the Project, the ENGINEER must receive approval of the SUSMP. A SUSMP will be submitted by the ENGINEER to the appropriate permitting agency. The Contractor shall coordinate its efforts in compliance with the substantial requirements of the SUSMP.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. Treatment Plant Expansion and Extraction Well House Summary of Work

1. Treatment plant expansion will include the construction of a 2,040 gpm capacity treatment plant facility to remove primarily perchlorate and trichloroethene from groundwater. Treated groundwater will be chlorinated and pumped to a reservoir within the city of Rialto municipal water system. The expansion treatment facilities will include three fixed ion exchange resin (IX) vessels and four fixed bed carbon adsorber (GAC) vessels supported on a new concrete slab, one booster pump supported on an existing concrete slab, a cartridge filter unit, instrumentation, controls, electrical, and all appurtenant piping as shown on the Drawings. Existing treatment plant facility upgrades will include the installation of one IX vessel supported on a new concrete pad, a bag filter unit, instrumentation, controls, electrical, and all appurtenant piping as shown on the Drawings.

2. The extraction well house enclosure work will include the construction of a well house and compound to house a new 2,040 gpm capacity groundwater extraction pump and well. The extraction well will be installed by Others. The extraction well house and compound work will include electrical utilities and controls, electrical power drop, construction of the extraction well concrete slab, security fencing, driveways, and gates, placement of a pre-fabricated well house, landscaping improvements, and installation of associated infrastructure and piping as shown on the Drawings.

B. Water Conveyance Pipeline Summary of Work

1. The water conveyance pipeline work will include the construction of three separate segments of water conveyance pipelines: untreated groundwater conveyance pipeline between the extraction well and the treatment plant, treated groundwater conveyance pipeline between the treatment plant and the City of Rialto water distribution system, and municipal water distribution conveyance pipeline between the cities of Rialto and Colton.

a. The untreated groundwater conveyance pipeline work between the extraction well and the treatment plant will include installation of above and below grade sections of pipe extending from the extraction well to Ayala Drive then south to the Miro Way extension then west to the treatment plant, including all necessary fittings, couples, valves, instrumentation and controls, and all other piping appurtenances as shown on the Drawings.

b. The treated groundwater conveyance pipeline work between the treatment plant and the City of Rialto water distribution system is to be determined, and will include installation of below grade sections of pipe extending from the treatment plant along North Linden Avenue to the point of connection with the City of Rialto municipal water distribution system, including all necessary fittings, couples, valves, instrumentation and controls, and all other piping appurtenances as shown on the Drawings.

c. The municipal water distribution conveyance pipeline work between the cities of Rialto and Colton will include installation of a below grade section of pipe extending east along Randall avenue between Pine Avenue and Altissimo Lane, including all necessary fittings, couples, valves, instrumentation and controls, sample box, and all other piping appurtenances as shown on the Drawings.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section provides a description of the Work Covered by the Contract Documents.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 00 70 00 - CONDITIONS OF THE CONTRACT

1.03 Cited Standards – none

1.04 Noted Restrictions

A. For the purposes of this project, all work to be performed shall be as described in Section C. – Bid Forms of the associated Construction Contract, and will not be included in this section.

1.05 Quality Control

A. Work Covered by the Contract Documents requires purchase, furnishing of all labor, material, and equipment to perform installation of all equipment and materials as necessary to complete the work as shown on the drawings, described in the Specifications, and as specified herein.

B. The CONTRACTOR shall include anticipated costs for obtain the necessary permits for the Work to be performed.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section provides a description of the CONTRACTOR's responsibilities and restrictions related to site access.

1.02 References Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, utility right-of-way or the site of the Work during the performance of the Work.

B. The CONTRACTOR shall complete all Work within public right-of-ways in accordance with the applicable permit(s) issued by the cities of Rialto and Colton, including, but not limited to, any restrictions on work hours.

C. Below includes anticipated work hours for reference by the CONTRACTOR.

The CONTRACTOR shall confirm "actual" specific work hours with the city prior to performing work.

1. City of Colton Work Hours

a. General work hours: 7am to 8pm Monday through Saturday.

b. No work shall be performed on Sundays

c. Decisions for restrictions to work hours, and exceptions for extended hours, are made on an individual basis

2. City of Rialto Work Hours

a. The permitted hours of construction work are as follows:

1. October 1st through April 30th

Monday – Friday	7:00 am to 5:30 pm
Saturday	8:00am to 5: 00 pm
Sunday	No permissible hours
State holidays	No permissible hours

2. May 1st through September 30th

Monday – Friday	6:00 am to 7:00 pm
Saturday	8:00 am to 5:00 pm
Sunday	No permissible hours
State Holidays	No permissible hours

b. Decisions for restrictions to work hours, and exceptions for extended hours, are made on an individual basis.

D. The CONTRACTOR shall use the driveway located approximately 100 feet north of Fitzgerald Avenue along W. Ayala Drive to access Jerry Eaves Park for extraction well compound construction work. No construction access shall be allowed by the CONTRACTOR into Jerry Eaves Park using other ingress points unless otherwise approved in writing by the ENGINEER.

1.05 Highway and Street Limitations

A. The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the CONTRACTOR's responsibility to construct and maintain any haul roads required for its construction operations.

B. Where excavation is being performed in primary streets or highways one (1) lane in each direction shall be kept open to traffic at all times unless otherwise provided or shown. Fire hydrants on or adjacent to the Work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks, access routes and the proper functioning of all gutters, sewer inlets and other drainage facilities.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section provides a description of how the General Construction CONTRACTOR shall coordinate construction activities with the OWNER.

1. The CONTRACTOR shall develop and implement a plan to minimize the effect of construction activities on surrounding areas affected by this project.

2. The CONTRACTOR shall be responsible for providing prior notice to the owners of all business and residential properties where access to the properties may be restricted.

3. The CONTRACTOR shall restrict access to businesses within the affected area during normal business hours.

4. The CONTRACTOR shall minimize restriction of access to residential properties to the extent practicable.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. The CONTRACTOR shall conduct its operations so as not to interfere unnecessarily with the authorized work of utility companies, other agencies, or the City's plant personnel. No street or access shall be closed without first obtaining permission of the proper authority.

1.05 Quality Control

A. The CONTRACTOR shall comply with all applicable federal, state and local standards, codes, permitting and other restrictions in effect for construction activities.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section provides a description of how the CONTRACTOR shall use the designated site area.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. "Use of the Site" will be in accordance with the access agreements agreed to for each specific site/property owner that the project is worked on.

B. The CONTRACTOR shall limit work activities to the construction site and shall restrict storage of construction materials, equipment, etc. to a site (or sites) designated by the ENGINEER.

C. Excavations, holes and/or trenches shall not be left in any locations unguarded. If it is necessary to do so, the CONTRACTOR shall provide suitable protection and warning signs to prevent unauthorized access or injury.

1.05 Quality Control

A. The CONTRACTOR shall assume full responsibility for protection and safekeeping of products and other items under this contract.

B. The CONTRACTOR shall determine if there are underground utilities, wires, pipelines, or other apparatus in the work area prior to excavation.

C. The CONTRACTOR shall be liable for any damage to underground utilities caused by excavation or other subsurface disturbance work.

1.06 CONTRACTOR's Work and Storage Area

A. The ENGINEER will designate and arrange for the CONTRACTOR's use a portion of the property adjacent to the Work Area for its exclusive use during the term of the Contract as an office and storage and shop area for its construction operations relative to this contract.

B. The CONTRACTOR shall be solely responsible for the security of its tools, supplies and equipment at the site.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes Specifications for measurement and payment as they apply to the work, and includes provisions applicable to lump sum prices.

1.02 Referenced Sections – None

1.03 Lump-Sum Measurement

A. The CONTRACTOR shall construct the work under a single lump sum fixed price contract. Lump-sum measurements will be for the entire item, unit of work, structure, or any combination of these described, as specified and as indicated in the Bid Schedule of the Bid Form.

B. If the CONTRACTOR requests progress payments for lump sum items or amounts in the Bid Schedule, such progress payments will be made in accordance with a well-balanced, detailed program of payment-apportioning, prepared by the CONTRACTOR and submitted to the ENGINEER for approval. Such payment-apportioning may require modifications during the Contract, as determined by the ENGINEER.

C. Such a program for each applicable lump-sum item shall show fixed definable and measurable quantities where possible and unit prices therefore as developed and assigned by the CONTRACTOR to the different features of the work and major subdivisions thereof. The summation of extensions of quantities and unit prices and related costs shall equal the amount of the lump-sum Contract Price or lump sum bid item indicated in the Bid Schedule.

D. Following the ENGINEER's approval, progress payments will be made in accordance with the CONTRACTOR's payment-apportioning program and from the approved progress schedule, reflecting the progress which occurred during the payment period as approved by the ENGINEER.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section specifies the general methods and requirements of submissions applicable to shop drawings, product data and samples, and operations and maintenance manuals. Detailed submittal requirements will be specified in the technical Specifications sections.

B. The term "submittal" as used herein shall be understood to include working drawings, detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, operating instructions, catalog sheets, data sheets, samples, and similar items.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 01 33 16 – CONSTRUCTION PROGRESS SCHEDULES

2. SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

3. SECTION 01 45 00 – QUALITY CONTROL

4. SECTION 01 77 19 – CLOSE OUT PROCEDURES

1.03 Cited Standards - None

1.04 Noted Restrictions

A. All submittals shall be complete, clearly typed, and legible. Incomplete submittals will be returned without review comments and no time extensions will be granted.

B. It is the CONTRACTOR's responsibility to review submittals made by his Suppliers and Subcontractors before transmitting them to the ENGINEER to assure proper coordination of the work and to determine that each submittal is in accordance with his desires and that there is sufficient information about materials and equipment for the ENGINEER to determine compliance with the Contract and/or Procurement Documents.

Incomplete or inadequate submittals will be returned to CONTRACTOR for revisions without review.

1.05 Quality Control

A. CONTRACTOR's Responsibilities

1. The CONTRACTOR shall have each submittal reviewed, stamped, and signed as reviewed and approved prior to submission to ENGINEER and/or OWNER, and shall be responsible for the following:

a. The correctness of the drawings, for shop fits and field connections, and for the results obtained by the use of such drawings.

b. Verification of catalog numbers, and similar data.

c. Determination and verification of field measurements and field construction criteria.

d. Checking and coordinating information in the submittal with requirements of the Work and of the Contract and/or Procurement Documents.

e. Determination of accuracy and completeness of dimensions, quantities, and field conditions at the site.

f. Safety precautions.

g. Errors or omissions on submittals.

h. Coordination and performance of work of all trades.

i. Identification and notification to the ENGINEER of deviation(s) from Contract requirements, and Conformance with the Specifications.

2. A submittal cover sheet shall accompany each submittal. The submittal cover sheet shall clearly indicate the names of the Project, OWNER, ENGINEER, CONTRACTOR, and Subcontractor or supplier (if appropriate), as well as the date,

submittal number and contract number. Each item included in the submittals shall be listed on the cover sheet with a description, applicable project specification section including specification section and paragraph numbers, drawing number (if appropriate), location in the Work, quantity required, and whether the item is being submitted as a product listed in the Contract and/or Procurement Documents or as an equivalent substitution.

3. The CONTRACTOR shall coordinate each submittal with the requirements of the Work, placing particular emphasis upon assuring that each submittal of one trade is compatible with other submittals of related work.

4. All submittals shall bear the stamp of approval and signature of CONTRACTOR as evidence that CONTRACTOR has reviewed them. CONTRACTOR's stamp shall contain the following minimum information:

   PROJECT NAME
   CONTRACTOR'S NAME
   Date:
   Submittal No.:
   Approved By:

5. The CONTRACTOR stamp and signature certify the following:

   a. The dimensional compatibility of the product with the space in which it is intended to be used.

   b. The review of submittal for compliance with Contract requirements.

6. A number shall be assigned to each submittal by the CONTRACTOR starting with No. 1 and thence numbered consecutively. Re- submittals shall be identified by the original submittal number followed by the suffix "A" for the first resubmittal, the suffix "B" for the second resubmittal, etc.

7. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction

accomplished which does not conform to approved shop drawings and data shall be at the CONTRACTOR's risk. The CONTRACTOR shall be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

8. Approval of drawings and associated calculations by the ENGINEER shall not relieve the CONTRACTOR from the responsibility for errors or omissions in the Drawings and associated calculations, or from deviations from the Contract and/or Procurement Documents, unless submittals containing such deviations were submitted to the ENGINEER and the deviations were specifically called to the attention of the ENGINEER in the letter of transmittal and within the submittal, and approved specifically by the ENGINEER as a Contract change.

9. Approval of the CONTRACTOR's submittal by the ENGINEER shall not relieve the CONTRACTOR of any responsibility, including responsibility for accuracy and agreement of dimensions and details.

10. The CONTRACTOR shall be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

11. After submittal review by the ENGINEER, one marked up reproducible set of drawings, one copy of product data, and one sample will be returned to the CONTRACTOR.

12. After submittal review, the CONTRACTOR shall distribute prints or copies of approved submittals, bearing the OWNER's or designated approval authority's stamp and signature, to the CONTRACTOR's field office, the ENGINEER's field office, and any affected and concerned subcontractors, suppliers, fabricators, or members of the CONTRACTOR's workforce.

B. Review by OWNER/ENGINEER

1. Submittals will be reviewed for conformance with requirements of the Contract and/or Procurement Documents. Review of a separate item will not constitute review of an assembly in which the item functions. Review will not relieve the CONTRACTOR from CONTRACTOR's responsibility for accuracy of submittals, for conformity of submittals to requirements of Contract and/or

Procurement Documents, for compatibility of described product with other provided products and the rest of the system, or for prosecution and completion of the Construction Contract in accordance with the Contract and/or Procurement Documents.

2. The review of shop drawings, data, and samples will be general. The review shall not be construed:

   a. As permitting any departure from the Contract requirements;

   b. As relieving the CONTRACTOR of responsibility or any errors, including details, dimensions, and materials;

   c. As approving departures from details furnished by the ENGINEER.

3. The ENGINEER shall indicate its reviews of submittals and the action taken by means of its review stamp. The review stamp will be affixed by the OWNER, the action block will be marked, and the stamp will be signed and dated.

4. The review-stamp action-block marks shall have the following meanings:

   a. The mark REVIEWED (or “NO EXCEPTIONS TAKEN”) means that the submittal appears to conform to the respective requirements of the Contract and/or Procurement Documents; that fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed; and that the submittal need not be resubmitted.

   b. The mark FURNISH AS CORRECTED (or “MAKE CORRECTIONS NOTED”) means there are minor clarifications or changes required on the submittal, but the submittal appears to conform to the respective requirements of the Contract and/or Procurement Documents upon incorporation of the reviewer's corrections, and that fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed. Submittals so marked need not be

resubmitted unless the CONTRACTOR challenges the reviewer's exception.

c. The mark REVISE AND RESUBMIT (or "AMEND AND RESUBMIT") means that the submittal is in noncompliance with the Contract and/or Procurement Documents and must be corrected and the entire package resubmitted. Fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed after incorporation of the reviewer's corrections and verification by the OWNER's ENGINEER that the reviewer's corrections have been properly incorporated in the submittal. Resubmission within the time period specified is also required if the CONTRACTOR challenges the reviewer's corrections.

d. The mark "REJECTED" (or "REJECTED-SEE REMARKS") means that the submittal is deficient to the degree that the reviewer cannot correct the submittal with a reasonable degree of effort, and the submittal does not meet the intent of the Contract and/or Procurement Documents. The CONTRACTOR has not made a thorough review of the submittal, and that the entire submittal package needs revision to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract and/or Procurement Documents.

5. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the CONTRACTOR shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the ENGINEER, on previous submissions. Any such revisions that are not clearly identified shall be made at the risk of the CONTRACTOR. The CONTRACTOR shall make corrections to any work done because of this type revision that is not in accordance to the Contract and/or Procurement Documents as may be required by the ENGINEER.

6. Partial submittals will not be reviewed. The ENGINEER shall be the only judge as to the completeness of a submittal. Submittals not

complete shall be returned to the CONTRACTOR, and will be considered "rejected" until resubmitted. The ENGINEER may at his option provide a list or mark the submittal directing the CONTRACTOR to the areas that are incomplete.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section provides a description of the construction progress documentation.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 00 70 00 - GENERAL CONDITIONS

2. MASTER CONSTRUCTION CONTRACT

1.03 Progress Schedules

A. Progress schedules shall represent a practical plan to complete the Work within the Contract and/or Procurement Document time(s) of completion indicated, and shall convey the CONTRACTOR's intent in the manner of execution and progress of the Work.

B. The scheduling and execution of construction in accordance with the Contract and/or Procurement 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.

C. The submittal of progress schedules shall be understood to be the CONTRACTOR's representation that the progress schedule meets the requirements of the Contract and/or Procurement Documents and that the Work will be executed in the sequence and duration indicated in the progress schedule.

D. CONTRACTOR shall revise and resubmit the progress schedule to ENGINEER on a bi-weekly basis, and as required by OWNER and ENGINEER.

E. Scheduling Format

1. The Project Schedule shall be computer produced by utilizing project scheduling software Microsoft Project or other equivalent software as approved by the ENGINEER.

2. The Project Schedule shall be updated biweekly and shall show Contract and/or Procurement tasks, the percent complete, progress bars (Gantt chart), baseline schedules, milestones, critical path items, start and finish dates, and other breakdowns as required by the OWNER and ENGINEER. The schedules shall show clearly the sequence of activities and shall list specifically the following activities:

    a. Interim milestone completion dates. Phasing and staging of the Work as specified shall be prominently identified.

    b. Submittals and the ENGINEER's review of submittals.

    c. Any long lead time (over 60 days) orders for material and equipment.

    d. Work to be performed by subcontractors, ENGINEER, OWNER, or other agencies. It is the CONTRACTOR's responsibility to clearly identify items in the Project Schedule that are to be performed by Others, and that require OWNER or ENGINEER responses necessary for CONTRACTOR to meet and maintain the dates shown in the Project Schedule.

3. Descriptions of scheduled activities shall include sufficient detail to identify the work that is to be accomplished.

    a. The Project Schedule shall contain sufficient activities to clearly show the sequence and interdependencies of the Work. The Project Schedule shall be prepared in such a way that an activity or group of activities will correspond directly with the bid item breakdown and/or the breakdown of lump sum bid items. The ENGINEER may request that additional activities be added.

    b. Activity durations shall be expressed in whole days. Work that is to be performed by CONTRACTOR or others shall be clearly defined.

c. Float suppression techniques, such as preferential sequencing (crew movement, equipment use, and form reuse), extended duration, imposed dates, scheduling of work not required for under the Contract, and others, shall not be used to affect or limit float in the schedule. The use of constraint dates should be minimized, and must be approved by the OWNER.

4. A schedule showing Work that is completed in less than the completion time specified may be found to be impractical by the ENGINEER.

5. A schedule showing Work that is completed in less than the completion time specified, that is found to be practical by the ENGINEER, shall be considered to have float. The float shall be the time between the scheduled completion of the Work and the Construction Contract completion date. Float time shall not be for the exclusive benefit of the CONTRACTOR.

6. A schedule found to be impractical for the preceding reasons or any other reasons shall be revised by the CONTRACTOR and resubmitted.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes information regarding shop drawings, product data, and samples.

B. The OWNER or ENGINEER shall review shop drawings, product data, and samples and return the submittals within working 15 days.

C. Definitions:

1. Shop Drawings

   a. Shop drawings, also known as record drawings, include fabrication, erection and installation, application, layout, and setting drawings, lists or schedules of materials and equipment, manufacturer's standard drawings, wiring and control diagrams, and all other drawings that may be required to show that the materials, equipment, and systems, and the positions these items, comply with Construction Contract requirements.

2. Product Data

   a. The term "product data" includes manufacturer-prepared descriptive literature, catalog sheets, brochures, performance data, test data, printed diagrams, schedules, illustrations, and other information furnished by the CONTRACTOR or the various product and materials suppliers to illustrate and describe a product, material, system, or assembly for some portion of the work.

3. Samples

   a. Samples are physical examples which illustrate materials, equipment, colors, textures, finishes, functions, configuration, and work quality, and establish the standards of quality and utility by which the Work will be judged for acceptance.

1.02 Referenced Sections

A. Related Sections are listed below:

1. MASTER CONSTRUCTION CONTRACT

2. SECTION 01 33 00 – SUBMITTAL PROCEDURES

3. SECTION 01 60 00 – PRODUCT REQUIREMENTS

4. SECTION 01 77 00 – CLOSEOUT PROCEDURES

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Shop Drawings

1. Drawings shall be prepared in accordance with ANSI Y14, Drafting Standard Manual, and the following requirements (unless recommended otherwise by the ENGINEER):

a. Drawings shall be limited to the following standard sizes in inches:

Width	Length
8 ½ inches	11 inches
11 inches	17 inches
17 inches	22 inches
22 inches	34 inches
24 inches	36 inches

b. Each drawing shall have the following information in the title block.

1) Drawing number, date, title, revision number, and sheet number.

2) Contract number, Contract sheet number, Contract page number.

3) CONTRACTOR's name.

4) Subcontractor/manufacturer name (if applicable)

5) Name of installation location.

c. Each drawing task shall use symbols from one standard reference source. The CONTRACTOR shall furnish a complete symbol list that includes non-standard symbols used on the drawing.

d. Each drawing shall include details necessary for the procurement, installation, maintenance, and repair of all components or facilities equipment provided. Change Order notices that are attached to drawings shall not constitute revised drawings. Each drawing shall include all changes and be upgraded to reflect the latest configuration.

e. When specified, shop drawings shall be prepared and submitted electronically. Such drawings shall be created using AutoCAD or Microstation if approved by the ENGINEER. Shop drawings to be prepared and submitted electronically include shop drawings which will be utilized as illustrations and drawings in Operation and Maintenance Manuals.

B. Product Data

1. The CONTRACTOR shall modify manufacturers' standard diagrams, charts, illustrations, brochures, calculations, schematics, catalog cuts, and other descriptive data to delete information which is not applicable to the Construction Contract. The CONTRACTOR shall supplement standard information with additional information applicable to this Construction Contract, and indicate dimensions, clearances, performance characteristics, capacities, wiring and other diagrams, and controls.

2. If the CONTRACTOR utilizes drawings prepared by others, such drawings may include the standards and symbols of others if the drawings are a mix of existing product drawings and drawings prepared specifically for this Construction Contract. In the event

others provide drawings prepared specifically for this Construction Contract, such drawings shall conform in symbols, media and standards to the CONTRACTOR's drawings.

3. The CONTRACTOR shall modify the manufacturer's printed installation, erection, application, and placing instructions to delete information which is not applicable to the Construction Contract.

4. Product Data shall include the following:

   a. Dates and revision dates.

   b. Contract title and number.

   c. Reference Contract Drawing numbers.

   d. Applicable Contract Specification Section numbers.

   e. Identification of product by description, model number, style number, serial number, or lot number.

   f. The names of the CONTRACTOR, Subcontractors, Suppliers, and manufacturers as applicable.

   g. Applicable standards, such as ASTM or Federal specification numbers.

5. Certificates of Compliance:

   a. The ENGINEER may permit the use of certain materials prior to sampling and testing if accompanied by a certificate of compliance stating that the materials involved comply in all respects with the requirements of the Contract and/or Procurement Documents. The certificate shall be signed by the manufacturer of the material. A certificate of compliance shall be furnished with each lot of material delivered to the Work, and the lot so certified shall be clearly identified in the certificate.

   b. All materials used on the basis of a certificate of compliance may be sampled and tested at any time. The fact that material is used on the basis of a certificate of

compliance shall not relieve the CONTRACTOR of responsibility for incorporating material in the Work which conforms to the requirements of the Contract and/or Procurement Documents. Any such material not conforming to such requirements shall be subject to rejection whether in place or not.

c. The ENGINEER shall reserve the right to refuse the use of material submitted for approval solely on the basis of a certificate of compliance.

d. The form of the certificate of compliance and its disposition shall be as approved by the ENGINEER.

C. Samples

1. The CONTRACTOR shall furnish to the ENGINEER samples required by the Contract and/or Procurement Documents. Samples shall be submitted without charge, with shipping charges prepaid. Materials for which samples are required shall not be used in the Work until approved in writing by the ENGINEER.

2. Each sample shall be labeled with the following data:

a. Name, number, and location on project;

b. Name of CONTRACTOR;

c. Material or equipment represented, and location in the project;

d. Name of producer, brand, trade name if applicable, and place of origin; and

e. Date of submittal.

3. The CONTRACTOR shall forward a letter to the ENGINEER submitting each shipment of samples and containing the information listed on the Sample Label specified herein. Approval of a sample shall be only for the characteristics and use named in the submittal and approval, and shall not be construed to change or modify any Construction Contract requirement. Before submitting

samples, the CONTRACTOR shall assure itself that the materials or equipment will be available in the quantities required in the Construction Contract, as no change or substitution shall be permitted after a sample has been approved unless such change or substitution is approved by the ENGINEER in writing.

4. Samples of material from local sources shall be taken by or in the presence of the ENGINEER unless otherwise approved in writing. Samples taken otherwise shall not be considered for testing.

5. Inspection and tests will be made, but it is understood that such inspections and tests, if made at any point other than the point of incorporation in the work, in no way shall be considered as a guaranty of acceptance of any material which may be delivered later for incorporation in the work.

6. Approved samples not damaged in testing may be incorporated in the finished work if marked for identification and approved by the ENGINEER. Materials incorporated in the Work shall match the approved samples.

7. Failure of any material to pass the specified tests shall be sufficient cause for refusal to consider, under the Construction Contract, any further samples of the same brand, make, or source of that material. The ENGINEER reserves the right to disapprove any material which has previously proven unsatisfactory in service.

8. Samples of material delivered to the site or installed in place may be taken by the ENGINEER for testing. Failure of samples to meet Contract requirements shall annul previous approvals of the item tested.

1.06 Submittals

A. Submittal Procedures are described in Section 01 33 00.

B. Unless notified otherwise by the OWNER or ENGINEER, the quantities for the applicable submittals shall be as specified below:

1. The original and five (5) copies of the drawings.

2. Six (6) copies of manufacturers' standard schematic drawings.

3. Four (4) copies of CONTRACTOR's or manufacturers' calculations and six copies of manufacturers' standard data.

4. Six (6) copies of manufacturers' printed installation, assembly, erection, application, and placement instructions.

5. Three of each sample item specified in the various Specification Sections (where applicable), unless otherwise specified by the ENGINEER.

6. Six (6) copies of inspection reports, test reports, and certificates of compliance.

7. Where submittals are submitted to the ENGINEER for information or record purposes, submit two copies.

8. The original and one copy of permits and licenses and other such documents obtained.

C. Other Submittals

1. Other submittals shall be furnished by the CONTRACTOR upon request for the ENGINEER approval to verify compliance of all equipment and materials with the Contract and/or Procurement Documents. These submittals shall include in addition to drawings: catalog cuts, certifications of compliance, or any other substantiating information or samples of material items as necessary.

D. Distribution

1. The CONTRACTOR shall duplicate and distribute reproductions of shop drawings, copies of product data, and samples, which bear company stamp of approval, to job site file, record documents file, subcontractors, suppliers, and any other entities requiring information.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section specifies the general requirements for submission of the CONTRACTOR's sources of materials, to be prepared and submitted to the ENGINEER.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall submit to the ENGINEER a list of the CONTRACTOR's sources of materials. The list shall be submitted in sufficient time to permit proper inspections and testing of materials to be furnished from such listed sources in advance of their use.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes a brief description of general quality control, workmanship in relation to industry standards, and compliance with manufacturer's instructions.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 00 70 00 – CONDITIONS OF THE CONTRACT
2. SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.03 Cited Standards

A. Related reference standards are listed below:

1. Sampling and Analysis Plan, ERM

1.04 Noted Restrictions – None

1.05 Quality Control

A. Verification of Dimensions

1. The CONTRACTOR shall lay out all work and shall be responsible for all lines, levels, grades, elevations and measurements of structures, and other work required under this contract.
2. The CONTRACTOR shall verify all site dimensions, project layout dimensions, setbacks, etc., shown on the drawings before laying out the work.
3. The CONTRACTOR shall notify the ENGINEER in writing of any error or discrepancy found and shall not proceed until the error or discrepancy is resolved.
4. The CONTRACTOR shall be responsible for correction of any work, which is done in error because of failure to verify dimensions.

B. Tests

1. The CONTRACTOR shall comply with any tests required by law, ordinance, rule, regulation, or order of any public authority having jurisdiction.

2. Special tests may be ordered by the ENGINEER in accordance with the contract documents or as agreed between the ENGINEER and CONTRACTOR in writing.

3. If the Specifications require testing by an independent testing laboratory, the CONTRACTOR shall select the testing laboratory and receive approval from the ENGINEER. After approval, the CONTRACTOR shall schedule all tests and shall deliver all test reports to the ENGINEER.

4. The CONTRACTOR is responsible for all costs involving testing with the exception of the following:

5. Special tests required by the ENGINEER. Special tests are to be paid for as stipulated in the contract documents or as otherwise agreed between the ENGINEER and CONTRACTOR in writing.

C. In order to produce work of the specified quality, the CONTRACTOR shall maintain quality control over supplies, manufacturers, products, services, site conditions, and workmanship.

1.06 Workmanship

A. The CONTRACTOR and his/her workers shall comply with the highest prevailing industry standards in regard to work and safety.

B. The CONTRACTOR shall provide workers who are qualified to perform all work to the specified quality.

1.07 Manufacturer’s Instructions

A. The CONTRACTOR shall comply with the manufacturer’s instructions in full detail, including each step in sequence. If the manufacturer’s instructions conflict with the Contract Documents, the CONTRACTOR shall request clarification from the ENGINEER before proceeding.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Work Included

A. Regulatory Requirements consists of obtaining permits, including fee payments, unless otherwise specified, performing governmental agency notifications, and satisfying regulatory requirements.

B. Secure and pay for other permits not specifically listed in this Section required by governmental agencies having jurisdiction and governmental fees and licenses necessary to construct and complete the Project unless otherwise specified.

C. Submit copies of permits and notifications to the ENGINEER prior to performing Work.

D. CONTRACTOR shall pay costs of fines, including fines against OWNER, resulting from CONTRACTOR's non-compliance with permit requirements or failure to procure appropriate permits.

1.02 Permits

A. CONTRACTOR shall pay for and obtain all permits required by the City of Rialto, City of Colton, and County of San Bernardino necessary to perform the Work. The ENGINEER will assist CONTRACTOR with plan check approvals prior to construction, unless specified otherwise.

1. Cities of Rialto and Colton and County of San Bernardino permit applicants are required to present the following prior to the issuance of permits:

   a. Worker's Compensation Insurance Certificate.

   b. Valid Contractor's license.

   c. Business Tax Identification Number.

2. Coordinate payment associated with the following permits with Engineer. Permits required include but are not limited to the following:

a. Building Permit: Approval of treatment system and extraction well compounds, and pipeline layouts.

b. Demolition Permit: Approval/coordination with various utility owners to remove, relocation, or adjust their facilities, tree removal, and pavement removal.

c. Grading Permit: Approval of site grading and drainage on site.

d. Mechanical Permit: Approval of major equipment on site.

e. Electrical Permit: Provides electrical service for the building, pumps, on-site lighting.

B. Submit and obtain plan check as applicable.

1.03 South Coast Air Quality Management District (SCAQMD) Requirements

A. Obtain all pertinent SCAQMD permits and comply with rules and permit requirements, including, but not limited to, the following:

1. Comply with Rules 401, Visible Emissions and 402, Nuisance.

2. SCAQMD Rule No. 403, Fugitive Dust.

a. Contractors performing Large Operations, as defined by SCAQMD Rule No. 403, shall obtain SCAQMD approval of a fugitive dust emissions control plan within seven (7) Calendar Days after the operation begins.

3. Comply with SCAQMD Rule 1166 Volatile Organic Compound Emissions from Decontamination of Soil.

1.04 Occupational Safety and Health Administration (OSHA), Fire, and other Safety Requirements

A. CONTRACTOR shall comply with State of California Construction Safety Orders and General Industry Safety Orders issued by The Department of Industrial Relations, Division of Occupational Safety and Health; and the Safety and Health Regulations for Construction

administered by United States Department of Labor, Occupational Safety and Health Administration (OSHA).

B. Hazardous Substances: Also known as hazardous materials, are defined in California Health and Safety Code 25501 (k). Hazardous substances include those shown in the "Director's List" from The Department of Industrial Relations pursuant to the Hazardous Substances Information and Training Act, and those described in Part 172 of Title 49 of the Code of Federal Regulations (CFR), Department of Transportation Hazardous Materials List.

1. Examples of hazardous substances commonly used in construction projects include, but are not limited to, the following:

    a. Toxic products (pesticides, herbicides, epoxies, curing compounds, and paints),

    b. Corrosive products with pH of 2 or less (muriatic and other acids),

    c. Corrosive products with pH of 12.5 or more (soda lye and lime),

    d. Ignitable products (gasoline and diesel fuel, propane, and solvents),

    e. Reactive products (chlorine), or

    f. Any other product for which a Material Safety Data Sheet (MSDS) has been prepared.

2. Handle hazardous substances in conformance with applicable federal, state, and local regulations.

3. Make current and accurate copies of the MSDS available at the jobsite for each hazardous substance to be used in performance of the Work.

    a. CONTRACTOR shall train employees that handle hazardous substances and hazardous wastes in procedures for handling such materials.

4. CONTRACTOR shall store hazardous substances in conformance with the California Health and Safety Code and all applicable Fire Code requirements.

   a. CONTRACTOR shall comply with California Health and Safety Code, Division 20, Chapter 6.95, Section 25500.

   b. On-site storage refers to the uninterrupted presence of hazardous substances at the site for 30 Calendar Days or more, including refills or replacement of stock.

5. CONTRACTOR shall protect hazardous substance storage containers from wind and rain. CONTRACTOR shall place secondary containment beneath containers or equipment to capture drips and spills.

6. CONTRACTOR shall clean up spills immediately. Place absorbent material on residue from small spills and dispose of wastes in conformance with federal, state and local regulations. Submit spill cleanup method to the ENGINEER upon request.

1.05 Chemically Impacted Soil and Water

A. CONTRACTOR shall notify the ENGINEER of observances or occurrences of soil and groundwater contamination. Continued work at the affected area of the site will require written approval of the ENGINEER.

B. CONTRACTOR shall remove chemically impacted soil and groundwater as directed by the ENGINEER and in conformance with applicable federal, state, and local regulations, including, but not limited to, South Coast Air Quality Management District (SCAQMD); California Environmental Protection Agency (EPA), Department of Toxic Substances Control (DTSC); U.S. Environmental Protection Agency (USEPA), and California Regional Water Quality Control Board (RWQCB). CONTRACTOR shall dispose of chemically impacted soil and groundwater as directed by the ENGINEER.

C. CONTRACTOR shall obtain permits, as applicable for excavation and disposal of chemically impacted soil and water prior to removing chemically impacted soil and water.

1.06 Off-Site Traffic Requirements

A. CONTRACTOR shall minimize interference with the existing traffic patterns on surrounding publicly traveled streets and access roads.

1. CONTRACTOR shall provide traffic control barriers, lights, detours, markings, Flagmen, advanced sign language, and construction signage on publicly traveled streets advising of construction in conformance with the Work Area Traffic Control Handbook (WATCH) published by Building News, Inc., (888) 264-2665.

2. CONTRACTOR shall route vehicles hauling materials to minimize traffic conflicts and congestion.

3. Trucks hauling dirt, sand, or gravel shall comply with SCAQMD Rule 403 Best Available Control measures and the following additional requirements:

a. Maintain at least 2 feet of freeboard.

4. Install shaker plates and wheel washers where vehicles enter and exit unpaved roads onto paved roads, or wash off tires of vehicles and any equipment leaving the construction site.

5. Stabilize the materials while loading, unloading, and transporting to reduce fugitive dust emissions.

6. Belly-dump truck seals shall be checked regularly to remove trapped rocks to prevent spillage.

7. CONTRACTOR shall comply with track-out regulations in conformance with SCAQMD Rule 403, regardless of project size.

1.08 Construction Storm Water Pollution Control

A. Minimum Water Quality Protection Requirements:

1. CONTRACTOR shall comply with the following minimum standards of good housekeeping:

a. Earth, construction materials, sediments, trash, construction-related wastes, other potential pollutants, or stockpiles of these materials shall not be transported by wind or blower, storm or wash water from the site via sheetflow, swales, area drains, natural drainage, storm drains, or streets.

b. Handle hazardous materials in conformance with the Occupational Safety and Health Administration (OSHA), Fire, And Other Safety Requirements Article of this Section, and applicable federal, state, and local regulations.

c. Deposit trash and construction-related solid wastes in covered receptacles. Prevent dispersal of trash by wind and prevent rainwater percolation through trash.

d. Handle and dispose of hazardous wastes in conformance with applicable federal, state, and local regulations.

e. Prevent tracking of sediments and other materials from the site by vehicle traffic. Stabilize construction entrance roadways to inhibit sediments from being deposited into the public ways.

f. Non storm water runoff from equipment and vehicle washing and any other activity shall be contained at the site.

g. Best Management Practices (BMPs) Requirements: Installed BMPs shall be as defined by and in conformance with “California Stormwater Best Management Practices Handbook” and California State Water Resources Control Board (SWRCB). CONTRACTOR shall obtain a copy of the “California Stormwater Best Management Practices Handbook”. Visit http://www.casqa.org.

h. Inspect site prior to storm event predictions to ensure that BMPs are properly installed.

1.09 Construction General Stormwater Permit and Stormwater Pollution Prevention Plan (SWPPP)

A. This Project has one (1) acre or more of disturbed soil and is subject to the California Construction General Permit (CGP) Order No. 2009-0009-DWQ for storm water discharges associated with construction activity. CONTRACTOR shall comply with the requirements of the CGP.

B. Stormwater discharges and authorized non-storm water discharges shall not contain a hazardous substance equal to or in excess of a reportable quantity listed in 40 CFR Part 117.3 and 40 CFR 302.4.

C. For more information on the CGP go to: http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.html

D. Storm Water Pollution Prevention Plan

1. Plan Description:

a. Design, submit, implement, and document a SWPPP plan in conformance with CGP to control storm water pollution from sediments and construction materials leaving the site. For additional information on plan preparation, visit the California State Water Resources Control Board (SWRCB) website at www.swrcb.ca.gov. Refer also to California Storm water Quality Association (CASQA), "California Storm Water Best Management Practice Handbooks", telephone number (650) 366-1042. Website address: http://www.casqa.org.

2. Plan Requirements:

a. CONTRACTOR shall prepare a SWPPP as follows:

1) Supply information required by SWRCB in the SWPPP and submit to the ENGINEER, for information only, 30 Calendar Days prior to and grading or other soil disturbance. Include BMP layout map.

2) Failure to submit the SWPPP to the ENGINEER may be cause for withholding of payment.

b. Construction Site Monitoring Program

1) Develop and implement a Construction Site Monitoring Program (CSMP) as part of the SWPPP in conformance with the requirements of the CGP. CSMP shall be site-specific and shall include monitoring procedures and instructions, location maps, forms, and checklists.

2) Perform required monitoring and inspections, including non- compliance reporting, according to the Project's Risk Level.

c. Submit to ENGINEER the names and qualifications of the Qualified SWPPP Developer and the Qualified SWPPP Practitioner within 14 Calendar Days after issuance of Notice to Proceed.

1) The Qualified SWPPP Developer shall write, amend, and certify the SWPPP documents.

2) The Qualified SWPPP Practitioner shall perform visual observations of discharges, field BMP inspections, perform sampling and analysis, and train employees on BMPs.

d. Maintain a copy of the reviewed SWPPP plan at the site.

3. CONTRACTOR shall electronically submit the Notice of Intent (NOI) form to ENGINEER listing only the name and phone number of the person responsible for monitoring plan implementation under Section VIII, Implementation of NPDES Permit Requirements, subsection B, Monitoring Program. Electronically submit other Permit Registration Documents (PRDs) to ENGINEER, including Site Map; Storm Water Pollution Prevention Plan; and Signed Certification Statement.

a. Contact the Engineer to obtain the Waste Discharge Identification (WDID) number.

b. Instructions for filling out NOI, electronic file of NOI and listing of fees can also be found at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/finalconstpermit.pdf

4. Inspection, Maintenance and Repair:

a. CONTRACTOR shall implement and maintain the reviewed SWPPP BMPs at the site year-round in conformance with SWRCB requirements.

b. Perform self-inspection of BMPs prior to and during anticipated storm events. Complete self-inspection checklists and logs required by SWRCB for each inspection and maintain at site for ENGINEER's review for Contract duration.

1) Adequate checklist and log maintenance, and approval of them, will be a condition to approval of rain delay schedule extensions.

E. Rain Event Action Plan (REAP)

1. For Risk Levels 2 and 3, Qualified SWPPP Developer (QSD) shall develop and submit a rain event action plan (REAP) to the ENGINEER 48 hours prior to any likely precipitation event.

2. For Risk Levels 2 and 3, submit REAPs to the ENGINEER for all phases of construction.

F. Maintain a paper or electronic copy of all General Permit records at the site. Submit records on a monthly basis to ENGINEER during the course of the work and, for the Annual Report, prior to September 1 of each year the collection of the year's records since September 1 of the previous year and, upon substantial completion of Project, remaining unsubmitted records for the Project. Include:

1. A summary and evaluation of all sampling and analysis results, including original laboratory reports.

2. The analytical methods, method reporting units and method detection limits of each analytical parameter (analytical results that are less than the method detection limit shall be reported as "less than the method detection limit").

3. A summary of all corrective actions taken during the reporting period.

4. Identification of any compliance activities or corrective actions that were not implemented.

5. A summary of all violations of the General Permit.

6. The individuals who performed the facility inspections, sampling, visual observation (inspections), and measurements.

7. The date, place, time of facility inspections, sampling, visual observation (inspections), and measurements including precipitation (rain gauge).

8. The visual observations and sample collection exception records and reports.

9. Training information consisting of:

   a. Documentation of all training for individuals responsible for all activities associated with compliance with the Construction General Permit.

   b. Documentation of all training for individuals responsible for BMP installation, inspection, maintenance, and repair.

   c. Documentation of all training for individuals responsible for overseeing, revising, and amending the SWPPP.

10. Photographs of BMPs before, during, and after storm events.

11. Chain of custody forms.

1.10 California Regional Water Quality Control Board (CRWQCB) Waste Discharge Requirement Permit

A. Comply with the special conditions and requirements of the California Regional Water Quality Control Board (CRWQCB) Waste Discharge Requirements. CONTRACTOR shall submit application and obtain the permit for dewatering. CONTRACTOR shall perform the monitoring, sampling, testing, reporting, and other incidentals that are required to comply with the CRWQCB Waste Discharge Requirements for dewatering operations including collection and disposal of water. Results and reports shall be submitted to the ENGINEER at the same time it is submitted to CRWQCB. CONTRACTOR shall coordinate with the ENGINEER to facilitate the performance of the monitoring, sampling, and reporting work required by the CRWQCB.

1.11 Mitigation Monitoring and Reporting Program

A. Comply with City and County Noise Mitigation Requirements and allowable hours of construction.

PART 2 Products - Not Used

PART 3 Execution - Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes details pertaining to the referenced standards used in these Specifications and their abbreviations.

B. In these Specifications, whenever references are made to published specifications, codes, standards or other requirements, it shall be understood that only the latest published specifications, standards or requirements of the respective issuing agencies, as of the date that the work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes.

1.02 Referenced Sections – None

1.03 Cited Standards

A. The Contract Documents contain references to various standard specifications, codes, practices, and requirements for materials, equipment, work quality, installation, inspections, and tests, which references are published and issued by the organizations, societies, and associations listed in 1.05 Abbreviations by abbreviation and name. These references are hereby made a part of the Contract Documents.

1.04 Noted Restrictions

A. No requirements set forth herein or shown on the drawings shall be waived because of any provision of, or omission from, said standards or requirements.

B. Whenever a referenced standard contains administrative requirements, including measurement and payment provisions, such as the standard specifications of various government entities, utility districts, and other agencies, such administrative requirements shall not apply to the Work of this Contract. References to such standards shall be applicable to the pertinent technical provisions only.

1.05 Quality Control

A. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern.

All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor. The CONTRACTOR shall bid the most stringent requirements.

B. References in the Specifications to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments.

C. References in the Specifications to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments.

D. References in the Contract Documents to "Standard Specifications" shall mean the Manual of Standard Specifications as Published by the American Public Works Association, including all current supplements, addenda and revisions thereof.

1.06 Abbreviations

A. When an organization's abbreviation or acronym is used in the Contract Documents and throughout the Specifications, it shall be understood to mean the full name of the respective organization as shown below:

1. AASHTO American Association of State Highway and Transportation Officials
2. ACI American Concrete Institute
3. AFPA American Forest and Paper Association
4. AISC American Institute of Steel Construction
5. AISI American Iron and Steel Institute
6. ANSI American National Standards Institute
7. APA American Plywood Association
8. ASME American Society of Mechanical Engineers
9. ASTM American Society for Testing and Materials
10. AWPA American Wood Preservers Association
11. AWPI American Wood Preservers Institute
12. AWS American Welding Society

13. AWWA American Water Works Association
14. CBC California Building Code
15. CRSI Concrete Reinforcing Steel Institute
16. EJCDC Engineers Joint Contract Documents Committee
17. IBC International Building Code of the International Conference of Building Officials (ICBO)
18. NACE National Association of Corrosion Engineers
19. NCMA National Concrete and Masonry Association
20. NEC National Electrical Code
21. NEMA National Electrical Manufacturers Association
22. NFPA National Fire Protection Association
23. NSF National Sanitation Foundation
24. OSHA Occupational Safety and Health Administration
25. SSPC Steel Structures Painting Council
26. UL Underwriters Laboratories Inc.
27. USACE U.S. Army Corps of Engineers
28. WIC Woodwork Institute of California

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section describes field quality control procedures to be performed by the CONTRACTOR.

1.02 Referenced Sections – None

1.03 Cited Standards

A. Related reference standards are listed below:

1. Sampling and Analysis Plan, ERM

1.04 Noted Restrictions

A. Explosives and Blasting

1. The use or storage of explosives on the work or site will not be permitted.

1.05 Quality Control

A. Chemicals

1. All chemicals used during project construction or furnished for project operation, whether soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval for use by either the U. S. Environmental Protection Agency or the U. S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

B. Cultural Resources

1. The CONTRACTOR's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archeological or cultural resources (hereinafter called "cultural resources"). Equipment operators will be directed to watch for arrow points, pottery fragments, stone tools, and other archaeological or cultural artifacts during excavation of native soils. If potential cultural resources are discovered during

subsurface excavations at the site of construction, the following procedures shall be instituted:

a. The CONTRACTOR shall immediately notify the ENGINEER.

b. The ENGINEER will issue a Field Order directing the CONTRACTOR to cease all construction operations at the location of such potential cultural resources find.

c. Such Field Order shall be effective until such time as a qualified archeologist (one meeting the Secretary of Interior qualification standards) can be called to assess the value of these potential cultural resources and make recommendations to the ENGINEER.

d. The ENGINEER will notify the USEPA.

2. If the archeologist determines that the potential find is a bona fide cultural resource, at the direction of the qualified Archeologist, the CONTRACTOR shall suspend work at the location of the find under the provisions for changes contained in Articles 13, 14 and 15 of the General Conditions.

PART 2 Products – Not Used

PART 3 Execution

3.01 Dust Abatement and Rubbish Control:

A. The CONTRACTOR shall comply with all applicable SCAQMD requirements as described in the Specifications, and provide under the Contract all necessary measures to prevent its operation from producing dust in amounts damaging to property or causing a nuisance to the plant personnel and operations or to persons living in or occupying buildings in the vicinity. The CONTRACTOR shall be responsible for damage resulting from any dust originating from its operations. The dust abatement measurers shall be continued throughout the length of the contract.

B. During the progress of the work the CONTRACTOR shall keep the site of the work and other areas used by it in a neat and clean condition and free from any accumulation of rubbish.

C. The CONTRACTOR shall dispose of all rubbish and waste materials of

any nature occurring at the work site, and shall establish regular intervals of collection and disposal of such materials and waste. The CONTRACTOR shall also keep its haul roads free from dirt, rubbish and unnecessary obstructions resulting from its operations.

D. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal and in conformance with all applicable Safety Laws and Health Standards for Construction. The City's dumpster(s) shall not be used by the CONTRACTOR.

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section describes CONTRACTOR Quality Control requirements.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions - None

1.05 Quality Control

A. The CONTRACTOR shall be licensed by the State of California, and shall maintain workers' compensation insurance, general liability insurance and a valid City business license.

B. They must provide the Licensing Division with their Federal Employer I.D. # and or their Social Security Number.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes details pertaining to temporary utilities to be used by the CONTRACTOR. It shall be the CONTRACTOR's responsibility to provide equipment that is adequate for the performance of the Work under this Contract within the time specified.

B. All equipment shall be kept in satisfactory operating condition, shall be capable of safely and efficiently performing the required Work and shall be subject to inspection and approval by the ENGINEER at any time within the duration of the Contract. All work hereunder shall conform to the applicable requirements of the OSHA Standards for Construction.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 01 11 00 – SUMMARY OF WORK
2. SECTION 01 51 13 – TEMPORARY ELECTRICITY
3. SECTION 01 51 16 – TEMPORARY FIRE PROTECTION
4. SECTION 01 51 23 – TEMPORARY HEATING, COOLING, AND VENTILATING
5. SECTION 01 51 33 – TEMPORARY TELECOMMUNICATIONS
6. SECTION 01 51 36 – TEMPORARY WATER
7. SECTION 01 70 00 – CLOSEOUT PROCEDURES

1.03 Cited Standards – None

1.04 Noted Restrictions

A. The CONTRACTOR shall not make connections to, or draw water from any fire hydrant or pipeline without first obtaining permission of the authority having jurisdiction over the use, and from the agency owning the electrical or water system.

B. For each of such connection made to a water system, the CONTRACTOR shall first attach to the fire hydrant or pipeline a valve, backflow preventer,

and a meter, if required by the said authority, of a size and type acceptable to said authority and agency.

C. The OWNER or ENGINEER's telephone system shall not be used by the CONTRACTOR's work force.

1.05 Quality Control

A. Please see the quality control requirements under the individual sub-sections.

PART 2 Products – Not Used

PART 3 Execution

3.01 Cleanup

A. Before final acceptance of work, the CONTRACTOR shall remove all materials and equipment related to temporary facilities and controls. Affected improvements shall be restored to their original condition, or better, to the satisfaction of the ENGINEER and to the agency owning the affected utility.

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes the CONTRACTOR's responsibilities in regard to temporary electricity. All work shall conform to the applicable requirements of the OSHA Standards for Construction.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. The CONTRACTOR shall not make connections to electrical power service without first obtaining permission of the authority having jurisdiction over the use, and from the agency owning the electrical or water system.

1.05 Quality Control

A. Temporary Electrical Power and Lighting

1. The CONTRACTOR shall connect to an existing power service to perform site work. The CONTRACTOR is responsible for providing branch wiring, feeders, connections, and distribution boxes to provide service and lighting.

2. The CONTRACTOR may request the installation of temporary power poles (if necessary) in locations where electricity is required. The CONTRACTOR shall contact the utility company upon the ENGINEER's approval.

3. The CONTRACTOR shall pay the costs of energy used, and shall maintain all temporary power systems required to perform the work in a safe and satisfactory manner.

PART 2 Products – Not Used

PART 3 Execution

3.01 Cleanup

A. The CONTRACTOR shall remove all materials and equipment used. Affected improvements shall be restored to their original condition, or better, to the satisfaction of the ENGINEER.

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes the CONTRACTOR's responsibilities in regard to temporary fire protection. All work shall conform to the applicable requirements of the OSHA Standards for Construction.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Fire Protection

1. The CONTRACTOR shall provide fire extinguishers and other fire protection equipment to adequately protect new and existing facilities and temporary facilities against damage by fire.

2. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the new, existing and temporary structures and other portions of the work.

3. Responsible personnel shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The CONTRACTOR's fire protection program shall conform to the requirements of the OSHA Standards for Construction. The CONTRACTOR shall employ every reasonable means to prevent the hazard of fire.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

SECTION 01 51 23 – TEMPORARY HEATING, COOLING, AND VENTILATING

PART 1 General

1.01 Section Includes

A. This section includes the CONTRACTOR's responsibilities in regard to temporary heating, cooling, and ventilating. All work shall conform to the applicable requirements of the OSHA Standards for Construction.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Temporary Heating (if necessary)

1. If temporary heating is needed, the CONTRACTOR shall pay the costs for temporary heat as necessary for drying out facilities and other structures, curing of concrete, the proper installation of materials, and the protection of the work, materials, and workers against injury from dampness or cold.

PART 2 Products – Not Used

PART 3 Execution

3.01 Cleanup

A. The CONTRACTOR shall remove all materials and equipment used. Affected improvements shall be restored to their original condition, or better, to the satisfaction of the ENGINEER.

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes the CONTRACTOR’s responsibilities in regard to temporary telecommunications.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. The OWNER or ENGINEER’s telephone system shall not be used by the CONTRACTOR's work force.

1.05 Quality Control

A. Communications

1. The CONTRACTOR shall provide and maintain at all times during the progress of the work no less than one telephone (land line or cell) in good working order, at its own field construction office.

2. Each telephone shall be connected to an established exchange for toll service and with all other telephones utilized by the CONTRACTOR.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes the CONTRACTOR's responsibilities in regard to temporary water.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. The CONTRACTOR shall not make connections to, or draw water from any fire hydrant or pipeline without first obtaining permission of the authority having jurisdiction over the use, and from the agency owning the electrical or water system.

B. For each of such connection made to a water system, the CONTRACTOR shall first attach to the fire hydrant or pipeline a valve, backflow preventer, and a meter, if required by the said authority, of a size and type acceptable to said authority and agency.

1.05 Quality Control

A. Temporary Water Supply

1. The CONTRACTOR shall obtain water from an existing source with adequate supply and quality suitable for all domestic and construction purposes as instructed by the ENGINEER.

2. The CONTRACTOR shall be responsible for furnishing any required extension cords, hoses, etc., and all water used shall be potable water, unless noted otherwise by the ENGINEER.

3. The CONTRACTOR shall pay the costs for water used for construction purposes. However, abuse of this privilege by the CONTRACTOR will warrant the water supply OWNER the right to discontinue use of this water supply and make the CONTRACTOR responsible for supply of his/her own needs.

4. Utility or plant effluent water may be used for hydraulic structures and pipeline testing as approved by the ENGINEER.

PART 2 Products – Not Used

PART 3 Execution

3.01 Cleanup

A. The CONTRACTOR shall remove all materials and equipment used. Affected improvements shall be restored to their original condition, or better, to the satisfaction of the ENGINEER.

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes details pertaining to temporary construction facilities such as storage facilities, facilities for installed products, and sanitary facilities.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 01 11 00 – SUMMARY OF WORK
2. SECTION 01 52 19 – SANITARY FACILITIES
3. SECTION 01 70 00 – CLOSEOUT PROCEDURES

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall provide temporary facilities for installed products or storage of tools, materials, and equipment. The CONTRACTOR shall control traffic in the immediate area of these facilities to minimize damage, and shall construct such facilities in locations indicated or approved by the ENGINEER.

PART 2 Products – Not Used

PART 3 Execution

3.01 Cleanup

A. The CONTRACTOR is responsible for removing and disposing off-site all accumulated waste, materials, and equipment as a part of final cleanup.

B. The CONTRACTOR shall clean and repair any damages caused by installation or use of temporary facilities. Any existing facilities used shall be restored to its original condition.

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes details pertaining to temporary sanitary facilities to be used during the by the CONTRACTOR during the construction period.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – none

1.05 Quality Control

A. The CONTRACTOR shall provide separate sanitary facilities during the entire construction period unless noted otherwise by the OWNER or ENGINEER.

B. The CONTRACTOR shall provide clean and sanitary temporary toilet conveniences, washing facilities, and potable drinking water for the use of all people engaged with the work.

C. The CONTRACTOR shall supply sanitary facilities with toilet paper, paper towels, paper cups, and any related supplies as required.

D. Toilet Facilities

1. Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for Construction.

E. Sanitary and Other Organic Wastes

1. The CONTRACTOR shall establish adequate and regular collection of all sanitary and organic wastes.

2. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR's operations shall be disposed of in a manner satisfactory to the ENGINEER and in accordance with all laws and regulations pertaining thereto.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section provides a description of the CONTRACTOR's responsibilities and restrictions related to traffic control.

1.02 References Sections

A. Related Sections are shown below.

1. SECTION 01 14 13 – ACCESS TO SITE

1.03 Cited Standards – None

1.04 Noted Restrictions

A. ALL CONSTRUCTION TRAFFIC shall utilize Linden Road for access for Treatment Plant work.

B. ALL CONSTRUCTION TRAFFIC shall utilize Jerry Eaves Park for Well Site Construction. NO CONSTRUCTION ACCESS and parking shall be allowed on Ayala Drive.

C. Contractor shall prepare Traffic Control Plans and submit to the applicable City and or County for approval to work in Well Site, Ayala-Miro-Linden, and Randall Avenue.

1.05 Traffic Control

A. For the protection of traffic in public streets and plant operating personnel at the site of the Work, the CONTRACTOR shall provide, place and maintain all necessary barricades, flagmen, traffic cones, warning signs, lights and other approved safety devices. The CONTRACTOR shall take all necessary precautions for the protection of the Work and the safety of the OWNER's and ENGINEER's personnel and the public. All barricades and obstructions shall be illuminated at night.

1.06 Submittals

A. The CONTRACTOR shall provide a written Traffic Control Plan for the ENGINEER and City for approval seven (7) days prior to beginning work on the respective project site. Plans and impacts to treatment plant operations and access requirements shall receive prior approval.

B. The CONTRACTOR shall provide a written Traffic Control Plan for the ENGINEER and City/County for approval four (4) weeks prior to beginning on respective pipeline project sites and traffic notification shall be placed at least 2 weeks prior to the construction activity or as required by the City. Plans and impacts to water delivery/distribution shall receive prior approval.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

DIVISION 1: GENERAL REQUIREMENTS
SECTION 01 56 26 – TEMPORARY FENCING

PART 1 General

1.01 Section Includes

A. This section provides a description of the CONTRACTOR's responsibilities related to temporary fencing.

1.02 References Sections

A. Related Sections are shown below.

1. SECTION 01 14 13 – ACCESS TO SITE

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Temporary Fencing

A. The CONTRACTOR shall provide temporary fencing and/or security measures should existing fencing need to be temporarily removed.

B. Installation of temporary security measures shall obtain ENGINEER's approval prior to removal of existing fencing. The CONTRACTOR shall provide ENGINEER with access to gate as appropriate.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section covers the CONTRACTOR'S responsibilities in regard to diversion and control of surface water runoff, dewatering of pipeline trenches and structural excavations, and other elements required for control of water if the site conditions should dictate the need.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Prior to the CONTRACTOR performing any excavation, the CONTRACTOR shall submit his/her proposed dewatering diversion plan to the ENGINEER a minimum of 17 days prior to starting excavation, for review. The submittal shall include method, installation, water handling, and details of the proposed dewatering diversion system.

PART 2 Products

2.01 Materials

A. Materials and equipment required for control of water shall be furnished and maintained by the CONTRACTOR, as required to perform the construction.

PART 3 Execution

3.01 Preparation

A. Perform all permanent construction in area free from water.

B. The necessary machinery, appliances and equipment shall be provided and operated to keep excavations free from water during construction, and to dispose of the water so as not to cause injury to public or private property or to cause a nuisance or a menace to the public.

C. During excavation, construction of structures, installation of pipelines and sewers, placing of structural and trench backfill, and the placing and

setting of concrete, excavations shall be kept free of water except as specified or allowed by ENGINEER. Surface runoff shall be controlled so as to prevent entry or collection of water in excavations.

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes details pertaining to products, the quality of materials to be used, and appurtenances and accessories.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 01 40 00 – QUALITY REQUIREMENTS

1.03 Quality of Materials

A. Materials, equipment, appliances, fixtures, and fabricated assemblies to be incorporated in the work shall be new unless indicated or specified otherwise in the Contract Documents.

B. Additional quality assurance provisions for materials and equipment are specified in **Section 01 40 00 - Quality Requirements**.

1.04 Products

A. General

1. All products including but not limited to material, equipment, and systems, shall comply with the Specifications and referenced standards as minimum requirements.

2. Fifteen (15) days after the date established in notice to proceed, the CONTRACTOR shall submit a complete list of major products proposed for use including the name of the manufacturer and model number of each product.

B. Product Substitutions

1. The CONTRACTOR may submit a request for substitution for any products specified by only one manufacturer. Products specified by naming several manufacturers shall have NO substitutions allowed.

2. The ENGINEER shall only consider requests from the CONTRACTOR for substitution if the request is made within fifteen (15) days after the date established in notice to proceed.

3. The CONTRACTOR shall document each request with complete data substantiating compliance of the proposed substitution with the Contract Documents.

4. Prior to requesting a product substitution the CONTRACTOR shall do the following:

   a. Investigate the proposed product and determine that it meets or exceeds the specified product in all respects.

   b. Make sure that the proposed product will provide the same warranty as the specified product.

   c. Coordinate installation and make sure that changes do not require substantial additions to the work to be performed.

   d. Waive claims for additional costs, which may subsequently become apparent.

C. Product substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals without a separate written request, or when acceptance requires substantial revision of the Contract Documents.

D. The ENGINEER will determine acceptability of a proposed substitution, and will notify the CONTRACTOR of acceptance or rejection in writing within a reasonable time.

E. The CONTRACTOR shall make only one request for substitution for each product and if the proposed substitution is rejected, the CONTRACTOR shall provide the specified product.

1.05 Appurtenances and Accessories

A. Products to be incorporated in the Work shall be furnished as complete assemblies or systems with all appurtenances and installation anchors, fasteners, and accessories as required to provide a complete and finished product installation.

B. Installed products with moving parts shall be fully operable at proper settings and levels in accordance with the respective manufacturers' instructions and recommendations.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 SECTION INCLUDES

A. This section includes details pertaining to packaging and handling, transportation and delivery, and storage and protection of the products to be used at the site.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 01 33 16 – CONSTRUCTION PROGRESS SCHEDULE

1.03 Cited Standards – None

1.04 Noted Restrictions

A. Products, materials and equipment not stored in a manner that will insure the maintaining of a new condition will be rejected by the ENGINEER. Such rejected products, materials and equipment shall be immediately removed from the work site.

1.05 Packaging and Handling

A. The CONTRACTOR shall avoid bending, scraping, or overstressing materials and equipment. Projecting parts shall be protected by blocking with wood, by providing bracing, or by other methods approved by the ENGINEER.

B. Materials and equipment shall be protected from soiling and moisture by wrapping or by other methods approved by the ENGINEER.

C. Small parts shall be packaged in containers such as boxes, crates, or barrels to avoid dispersal and loss. The CONTRACTOR shall firmly secure an itemized list and description of contents to such a container.

1.06 Transportation and Delivery

A. Arrange deliveries of materials and equipment in accordance with the Project Schedule specified in **Section 01 33 16 - Construction Progress Schedule**, and coordinate to avoid conflict with work and conditions at the site.

B. Deliver materials in undamaged condition, in manufacturers' unopened containers or packaging (where applicable), dry, with identifying labels intact and legible.

C. The CONTRACTOR shall provide the equipment and personnel to handle products by methods to prevent soiling or damage.

D. Deliver cement, prepared dry mortar mixes, grouting material, plaster, and coloring material in original, unopened and sealed containers, bearing the brand and manufacturer's name.

E. Refer also to the individual Specifications Sections for detailed requirements as applicable.

1.07 Storage and Protection

A. The receiving, storage, quality, and inventory control of equipment and materials required for the work of this Contract shall be the sole responsibility of the CONTRACTOR. Storage shall be arranged to provide easy access for inspection and identification of each shipment.

B. Materials shall be stored in such a manner as to ensure the preservation of their quality and fitness for the work and to facilitate inspection.

C. Sheltered, weather tight, or heated weather tight storage shall be provided as required to protect materials and equipment from weather damage and corrosion.

D. The CONTRACTOR shall store manufactured materials in accordance with the various manufacturers' instructions. The temperature and humidity shall be maintained within the ranges required by the various manufacturers' instructions.

E. Blocking, platforms, pallets, or skids shall be provided for materials and equipment subject to damage by contact with earth or pavement. Clearances shall be provided from adjacent surfaces for stored materials requiring natural ventilation.

F. Packaged materials shall be stored in their original unbroken packages or containers. Protect materials and equipment from damage and corrosion during warehousing operations.

G. For exterior storage of fabricated products, the products shall be placed on sloped supports aboveground. Products subject to deteriorations shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

H. Loose granular materials shall be stored on solid surfaces in a well-drained area to prevent mixing with foreign matter.

I. Perform periodic inspections of stored materials to assure that materials are maintained under specified conditions, and are free from damage or deterioration.

J. Fabricated structural components shall be stored on supports above ground and in a manner to prevent accumulation of water and warping. Products subject to deterioration from atmospheric conditions shall be covered in a manner that will provide adequate ventilation to avoid condensation.

K. Continue protection of materials and equipment from damage and corrosion after installation until final acceptance of the work. Refer also to the individual Specifications Sections for detailed requirements, as applicable.

Part 2 Products – Not Used

Part 3 Execution – Not Used

END OF SECTION

PART 1 GENERAL

1.01 Section Includes

A. This section includes requirements for closeout procedures, final cleaning, and project record documents.

1.02 Referenced Sections – None

A. Related Sections are listed below:

1. SECTION 01 78 00 – CLOSEOUT SUBMITTALS
2. SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Closeout Procedures

1. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from the ENGINEER. If the CONTRACTOR fails to make such repairs or replacements promptly the ENGINEER reserves the right to do the Work and the CONTRACTOR and his/her surety shall be liable to the OWNER for the cost thereof. Replacement of earth fill, backfill or resurfacing where it has settled below the required finish elevations shall be considered as part of such required repair work.

B. Final Cleaning

1. Final cleaning shall be executed prior to the final inspection.
2. The CONTRACTOR shall clean the site, sweep paved area, and clean any other surfaces.
3. Waste and surplus materials, rubbish and construction facilities shall be removed from the project and from the site.

C. Project Record Documents

1. Documents shall be stored separate from those used for construction.

2. The CONTRACTOR shall keep documents current and shall not conceal any work until required information has been recorded.

3. At Contract Closeout, the CONTRACTOR shall submit documents with a transmittal letter containing the date, project title, CONTRACTOR's name and address, list of documents, and the signature of the CONTRACTOR.

1.06 Submittals

A. When the CONTRACTOR considers his/her work has reached final completion, the CONTRACTOR shall submit a certification that states that the Contract Documents have been reviewed, work has been inspected, and that the work is complete in accordance with the Contract Documents and is ready for the ENGINEER's inspection. The inspection shall include start-up and testing of all installed equipment.

B. The request shall be made in writing, addressed to the ENGINEER, at least seven (7) days in advance of the requested date of the final inspection.

C. In addition to submittals required by the Conditions of the Contract, the CONTRACTOR shall provide submittals required by governing authorities, and shall submit a final statement of accounting giving the total adjusted contract sum, previous payments, and the sum remaining due.

D. The OWNER will issue a final change order reflecting approved adjustments to the contract sum not previously made by change order.

PART 2 Products – Not Used

PART 3 Execution

A. Final Cleanup

1. The CONTRACTOR shall promptly remove, from the vicinity of the completed work, all rubbish, unused materials, concrete forms, construction equipment and temporary structures and facilities used during construction. Final acceptance of the Work by the ENGINEER will be withheld until the CONTRACTOR has satisfactorily complied with the requirements for final cleanup of the project site.

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section describes the Checkout Procedures to be performed by the CONTRACTOR. Equipment testing and plant startup are required for satisfactory completion of the contract and shall be scheduled and completed within the contract time.

1.02 Referenced Sections – Division 26 – Electrical

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Equipment Testing

1. The CONTRACTOR shall provide the services of an experienced and authorized representative of the manufacturer of each item of equipment indicated in the equipment schedules that shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation.

2. The CONTRACTOR shall have the manufacturer's representative revisit the Work site as often as necessary until any and all problems are corrected.

3. The CONTRACTOR shall require that each manufacturer's representative furnish to the ENGINEER a written report addressed to the OWNER certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts and has been operated satisfactorily under full-load conditions.

4. The CONTRACTOR shall be responsible for scheduling all operations testing. The CONTRACTOR shall furnish all personnel, power, water, chemicals, fuel, oil, grease and all other necessary equipment, facilities and services required for conducting the tests.

5. The CONTRACTOR is advised that the ENGINEER and operating personnel will witness operations testing and that the manufacturer's representative shall be required to instruct the operating personnel in correct operation and maintenance procedures.

6. This instruction shall be scheduled with the ENGINEER at least ten (10) days in advance and shall be provided while the equipment is fully operational. The CONTRACTOR shall have previously furnished the technical manuals required under **Sections 01 33 00 - Submittal Procedures** and **01 78 00 – Closeout Submittals**.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes the CONTRACTOR's requirements in regard to the facility's Operation and Maintenance Data. The CONTRACTOR has overall responsibility to obtain the necessary data from and compile the data as set forth in this specification, including items or equipment purchased by the OWNER and delivered to the CONTRACTOR for installation.

B. The Operating and Maintenance (O&M) Manual is prepared to provide a ready reference to all important pieces of mechanical and electrical equipment installed on the project. It is also to provide the necessary operating and maintenance data for use by service personnel. It is also to provide information required for checking equipment performance or for planning of plant expansion or redesign.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. The O&M Manuals shall be submitted in three-ring binder with insert labels in the cover and spine identifying the project and device name. Stick-on, taped or pasted labels are not acceptable.

B. Equipment will not be accepted by OWNER until ENGINEER's approval and CONTRACTOR submittal of final O&M manuals.

1.05 Quality Control

A. Operation and Maintenance (O&M) Manual

1. For the O&M Manual, CONTRACTOR shall provide, at a minimum, the following:

a. A comprehensive and applicable operating and maintenance manual.

b. Nameplate data including equipment identification number (as identified on the Drawings), model number, serial number, operating range, and power supply.

c. Manufacturer's instruction, description of system operation, start-up data, and troubleshooting lists.

d. Manufacturer's instructions, calibration schedule and instructions, lubrication schedule, and type and cleaning procedures.

e. Electrical wiring diagram and schematic.

f. Complete parts list identifying material of construction, and the manufacturer's recommended repair parts listing.

g. Name, address and phone number for manufacturer, sales representative and nearest parts warehouse.

B. All information included shall be legible and sufficiently marked to indicate the exact size, model, type, etc., of equipment furnished and installed.

C. The number of binders (or "volumes") required will depend on the amount of information to be catalogued.

1.06 Submittals

A. The CONTRACTOR shall submit all approved O&M technical manuals to the ENGINEER. The ENGINEER will then incorporate those materials into the facility O&M Manual.

B. Manuals from the CONTRACTOR shall contain descriptive drawings and data which identify equipment installed at the project and detail the procedures and parts required to maintain and repair the equipment. Copies of approved submittals shall be included for all equipment.

C. CONTRACTOR submittals to ENGINEER shall include the following:

1. Two sets of the draft O&M manual shall be submitted for review.

2. Four sets of the final O&M manual and an electronic copy on compact disc shall be submitted to the following:

   a. Three sets and CD to the OWNER.

   b. One set for the ENGINEER.

3. The manuals shall be submitted by CONTRACTOR in a three-ring binder with insert labels in the cover and spine identifying the project and device name. Stick- on, taped or pasted labels are not acceptable.

4. The quantities of drawings, manufacturer's literature, or other data required for these manuals are in addition to those otherwise required for normal distribution for approval during the construction period.

D. Equipment will not be accepted by OWNER and ENGINEER until approval and submittal of final O&M Manuals by CONTRACTOR.

PART 2 Products

2.01 O&M Manual Components

A. Page Size

1. All pages shall be standard 8-1/2 x 11 inches size or approximate multiples (preferably 17 x 11 inches) folded to 8-1/2 x 11 inch manila pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manila pocket.

B. Drawings

1. All drawings larger than 8-1/2" x 11" shall be folded and inserted in individual 8-1/2" x 11" manila pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manila pocket.

C. Binders

1. Binders shall be Buckram binders with block lettering for sheet size 8-1/2 x 11 inches with 2" to 3-1/2" expandable metal capacity as required for the project. The number of binders, however, shall be based on not filling them beyond 4".

D. The following information shall appear on the front cover and backbone of the O&M Manual, as applicable:

1. "Operation and Maintenance Manual".

2. Project Name (and volume number if more than one volume).

3. OWNER’s name

4. ENGINEER's name.

5. CONTRACTOR's name.

E. Contents and Indexing:

1. Operations and Maintenance Manual shall contain descriptions of the treatment system in sufficient detail to adequately indicate the type of system installed and the basic details of their operation.

2. All purchased equipment data shall be used to designate the sections. Within each section additional indexing of component parts may be required.

3. Operation and Maintenance Manual shall contain to the fullest extent all possible information pertinent to the equipment. The arrangement and type of information to be filed shall be as follows:

a. Copy of purchase order change (if any).

b. Outline drawings, special construction details, "as built" electrical wiring and control diagrams for all major and supplementary systems.

c. Manufacturer's test or calculated performance data and certified test curves.

d. Installation, operating, and maintenance instructions, including a complete parts list and sectional drawing with parts identification numbers. Mark with model, size and plan number.

e. Manufacturer's brochure marked to indicate exact equipment purchased. Brochures on component parts supplied by a manufacturer with his equipment, but not manufactured directly by him, shall also be included.

f. The serial numbers of each item of equipment installed are to be listed with the model numbers and plan symbols.

g. Written warranties.

h. Table of Contents.

i. A copy of the approved submittals for each piece of equipment, and a copy of all testing, adjusting and balancing reports, and wiring diagrams marked with model and size and plan symbol.

j. The index shall contain the name and address of the manufacturer and, if different, where replacement and repair parts may be obtained.

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section includes

A. PROJECT RECORD DOCUMENTS consists of furnishing a set of Record Documents showing changes made to the Project and representing an “As-Built” set of Drawings. Upon completion, and prior to acceptance of the Work, CONTRACTOR shall submit a set of final Record Documents to ENGINEER. Record Documents include, but are not limited to, Drawings and Specifications.

1.02 Submittals

A. ENGINEER's approval of the up-to-date status of the Record Documents is a prerequisite for the approval of requests for progress payments.

B. Submit the final Record Documents to ENGINEER for approval prior to submitting Affidavit of Completion.

1.03 Job Set Record Documents

A. Following Award of Contract, CONTRACTOR shall secure from ENGINEER (at no charge) one complete set of “As Bid” drawings and conformed Specifications to be the basis of the job set Record Documents.

1.04 Identification

A. The job set Record Documents shall be identified with the title "RECORD DOCUMENTS - JOB SET". The job set shall be used for no purpose other than the entry of data and review by ENGINEER. CONTRACTOR shall maintain job set at site in a location approved by ENGINEER.

1.05 Entries on Job Set

A. CONTRACTOR shall use erasable color pencils to describe and date changes by note and graphic line. Call attention to the entry by a "cloud" around the area or areas affected. In the event of overlapping changes, different colors may be used for each change.

B. Note authority and reason for each change.

C. Reference change on any other affected sheets.

D. Note actual location (dimension, elevations, depths, stations, controls, coordinates or staking information) of substructures and pipelines constructed (including pile tip elevation, sewer wyes and laterals, utility stubouts, and work shown schematically) and existing and utilities encountered during the Work. Call for survey as required before concealing work.

E. Enter changes on Drawings and Specification, as applicable.

F. Maintain record documents "as-current" at all times and available for examination by the ENGINEER, upon request.

1.06 Conversion of Schematic Layouts to As-Built Drawings

A. Where work is shown on Drawings by use of a schematic diagram, CONTRACTOR shall supplement the diagram or provide a new drawing, in a manner approved by ENGINEER, to show the actual dimensioned locations, elevations, and details of the work.

1.07 Final Record Documents

A. CONTRACTOR shall submit to ENGINEER for approval final Record Documents consisting of marked up drawings, specification, and additional drawings, if required, prior to submitting the Affidavit of Completion.

PART 2 Products – Not Used

PART 3 Execution - Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes a description of how the General Construction CONTRACTOR (CONTRACTOR) shall address the construction practices that relate to items at the site at the commencement of work.

B. All site work such as conflicts with existing utilities, additional subsurface investigation, and surveying shall be included in this section.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. It is not the responsibility of the OWNER to maintain the most accurate and most recent record DRAWINGS. The OWNER is not responsible for any costs of the items disturbed or damaged by the CONTRACTOR's operation.

B. If interruptions to County's operations results from damage to existing underground/above-ground utilities, restoration of utility service shall be completed AS SOON AS POSSIBLE by the CONTRACTOR and shall be included as part of the project's costs.

C. The CONTRACTOR will not be permitted to use existing sewer systems (if any) as drain lines for the construction work. The CONTRACTOR shall be responsible for all surface water runoff and/or groundwater tributary to the pipeline and/or trenches constructed and shall supply the necessary dewatering and pumping equipment for handling those flows during construction.

D. Existing Utility Lines

1. The CONTRACTOR is responsible for locating any possible existing underground utilities in order to properly complete site work. The CONTRACTOR shall contact the OWNER or ENGINEER immediately upon discovery of additional utilities in the area prior to starting and during the performance of the work.

2. Water, sewer, gas, power and telephone service to buildings shall be maintained with a minimum of interruption throughout the construction of the contract work. No such service shall be intentionally interrupted without the approval of the respective utility company concerned, and without first giving due warning to the occupants of said dwelling or business establishment.

3. The CONTRACTOR shall avoid disturbance and/or displacement of existing utilities and shall provide all temporary and permanent supports and other required protection.

E. Existing Power Lines

1. If the proposed work is in close proximity to overhead and underground power lines which could be hazardous to construction personnel and/or other persons, the CONTRACTOR shall properly protect the wires, pole supports, or other power line appurtenances to avoid disturbances to those facilities.

2. The CONTRACTOR shall also operate all machinery and conduct all other construction activities in a manner, which will assure protection of all construction personnel and other persons against the described hazard.

F. Existing Gas Lines

1. The CONTRACTOR shall avoid disturbance and/or displacement of underground gas lines and their associated facilities and shall provide all temporary and permanent supports required to protect and prevent exposure to construction personnel and/or other persons.

2. If gas lines are exposed during construction and leakage is detected, the CONTRACTOR shall suspend all construction work in those areas immediately. The OWNER of the pipeline shall be immediately advised of the condition, and construction shall not resume until all repairs have been properly completed.

G. Landscaping, Existing Trees, and Vegetation

1. The CONTRACTOR shall protect existing trees, shrubbery, and other vegetation that is to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials, excess foot or vehicular traffic, or improper parking of vehicles on vegetation. Temporary fences, barricades or guards are to be provided as required to protect trees and vegetation to be left standing.

2. Trees and other vegetation to remain within limits of contract work shall be watered as required to maintain their health during course of construction operations.

3. Protection shall be provided for roots over 1 ½” diameter cut during construction operations. Coat cut faces with a wound paint formulated for use on damaged plant tissues. Temporarily cover

exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

4. The CONTRACTOR shall repair or replace trees and vegetation that will remain, which are damaged by construction operations, in a manner acceptable to the ENGINEER and property OWNER if work is performed on private property. The ENGINEER may employ an Arborist to repair damages to trees and shrubs at the CONTRACTOR's expense when deemed necessary.

H. Existing Valves and/or Other Existing System Appurtenances

1. The CONTRACTOR shall not operate existing system valves, hydrants or other appurtenances at any time. If the existing items described are required to accommodate construction, the CONTRACTOR shall provide the OWNER with an advance notice and shall receive approval from the OWNER before use of the existing appurtenances.

1.05 Quality Control

A. The CONTRACTOR shall conduct all work in accordance with the applicable rules and regulations of specified governing agencies, and in accordance with the laws, rules, and/or regulations of all other authorities having jurisdiction over the required construction work. Any required permits shall be obtained and paid for by the CONTRACTOR (including all city permit fees and charges).

B. The CONTRACTOR shall determine the exact location of existing structures, underground piping, or conduit which would be in the vicinity or possibly affected by the CONTRACTOR's operation.

C. The CONTRACTOR shall relocate existing items or mark these existing items if removal is not required, and shall protect any underground facility.

D. The CONTRACTOR shall schedule and coordinate all construction activities and shall cooperate with the OWNER's operating personnel to provide a minimum of interruptions to the operations of other present facilities.

E. Property Restoration

1. CONTRACTOR shall restore landscaping to original condition.

2. The CONTRACTOR shall assume all responsibility and liability for property damages, bodily injury, or financial losses and interruptions of service that may result from his/her construction activities which affect structures, facilities, water lines, gas lines,

power lines, electric conduits, sewer lines, telephone lines, cable TV lines, and all service facilities connected thereto.

3. The CONTRACTOR shall be responsible for the relocation, repairing, reconstruction, and re-installation of damaged or disturbed items due to his/her construction activities.

4. Damaged or disturbed items shall be re-installed or restored to their original condition as soon as possible and prior to completion of work. Restoration shall be approved by the authority having jurisdiction over the disturbed items. There shall be no extra cost to the OWNER.

5. Items not specifically stated in the Specifications that are removed, damaged, destroyed, or defaced due to neglect or carelessness on the part of the CONTRACTOR shall be repaired or replaced by the CONTRACTOR if determined so by the ENGINEER.

1.06 Submittals

A. Record DRAWINGS

1. The CONTRACTOR is responsible for maintaining accurate record DRAWINGS, also known as “As-Built” DRAWINGS. Record DRAWINGS shall consist of red lined marked Contract DRAWINGS and shall be available to the OWNER or ENGINEER at any time upon request. The record DRAWINGS shall be delivered to the OWNER upon completion of the project.

2. Record drawing mark-ups are defined as design DRAWINGS whether provided by the Company, the CONTRACTOR, or others, upon which the CONTRACTOR has recorded all variations or changes between the work as built and observed by the CONTRACTOR, and the work as shown in the design DRAWINGS provided at the time of award or approval by the Company.

3. The CONTRACTOR shall keep one up-to-date record copy of all DRAWINGS for all deviations or modifications in location or elevation of any underground installation from that shown on the Contract DRAWINGS.

4. All As-Built drawing mark-ups submitted by the CONTRACTOR shall be provided on the latest issue "Approved for Construction," "D" size paper.

5. The As-Built DRAWINGS shall include, but not be limited to, the following: location of all underground pipes, fittings, valves, stub-outs, plugs, and service lines, as constructed.

6. As-Built mark-ups provided by the CONTRACTOR shall include final well locations, pipeline routings and the lateral and vertical extent of trench excavation. All locations and elevations shall be identified by qualified survey crews and tied to the California Coordinate System NAD 83 in feet. Survey shall be in accordance with the respective pipeline and well installation Specifications.

7. As-Built DRAWINGS kept by the CONTRACTOR are considered as part of the work such that any application for payment, approved percentage of completion, etc., is contingent upon the As-Built DRAWINGS being up-to-date with that portion of the construction.

PART 2 Products

2.01 Materials

A. Replacement in Kind

1. Except as indicated on the DRAWINGS or as specifically authorized by the utility OWNER, reconstruct utilities with new material of the same size, type, and original quality as that removed.

PART 3 Execution

3.01 Preparation

A. Replace in kind improvements that are cut, removed, damaged, or otherwise disturbed by the construction.

B. Where utilities are parallel to or cross the pipeline trench but do not conflict with the permanent work to be constructed, follow the procedures given below and as indicated on the DRAWINGS. Notify the utility OWNER 48 hours in advance of the crossing construction and coordinate the construction schedule with the utility OWNER's requirements.

C. Determine the true location and depth of utilities and service connections which may be affected by or affect the work. Determine the type, material, and condition of these utilities. The CONTRACTOR shall pothole all utilities, except those listed in the contract documents as already being potholed, prior to submitting pipe laying DRAWINGS. The CONTRACTOR shall submit a set of potholing plans to the OWNER prior to submitting laying diagrams. In addition, the CONTRACTOR shall expose all utilities at least 500 lineal feet in advance of the start of pipeline excavation.

3.02 Procedures

A. Protect in Place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified on the DRAWINGS or in the Specifications.

B. Adjacent Existing Underground Utilities

1. Whenever possible, environmental piping should be laid at least 10 feet, horizontally, from any existing or proposed water mains. If local conditions prevent a lateral separation of 10 feet, environmental piping may be laid closer than 10 feet to a water main as long as one of the following are performed:

a. It is laid in a separate trench.

b. It is laid in the same trench with the water main located at one side of a bench of undisturbed earth.

c. In either case (a or b) the elevation of the top (crown) of the environmental pipe line is at least 18” below the bottom (invert) of the water main.

2. Whenever the environmental pipeline must cross under existing water mains, pipeline shall be laid at such an elevation that the top of the pipeline is at least 18” below the bottom of the water main.

3. Where significant utility conflicts are to be encountered, each pipeline shall be installed with a steel casing pipe at all such locations.

4. CONTRACTOR shall provide temporary support for all pipelines crossing the proposed trench. All pipelines 18 inches in diameter or larger crossing over the proposed water main with less than 4 feet of clearance shall have a temporary support. CONTRACTOR shall submit DRAWINGS of his method of temporary support to the ENGINEER for review. All pipelines less than 18 inches in diameter and crossing over the proposed water main with less than 2 feet of clearance shall be protected by pouring one (1) sack of sand/cement slurry from the top of the water main to the bottom of the crossing pipeline.

C. Lines and Grades for Water Lines and Underground Electrical Conduit

1. The CONTRACTOR shall employ a competent survey crew, approved by the ENGINEER, to lay out the work from the initial points of instruction as given by the ENGINEER. They shall set all offset stakes, set, test, and check all elevations and levels and other parts of the construction as the work progresses.

2. The CONTRACTOR shall furnish all flagging, nails, spikes, stakes, paint, and marking devices required for the survey and layout work. The CONTRACTOR shall also furnish personnel to assist the ENGINEER in checking the survey and layout work if required throughout the entire Contract period.

3. The ENGINEER will not provide surveying services to the CONTRACTOR. The CONTRACTOR shall retain the services of a qualified instrument man to perform the required survey work.

4. The CONTRACTOR shall furnish personnel to assist the ENGINEER for checking grades and locating existing facilities if requested.

5. The CONTRACTOR shall be responsible for protecting and safeguarding all benchmarks established by the ENGINEER and all existing property stakes, pins, monuments, etc. Any benchmarks, property stakes, pins, or monuments disturbed during construction activities shall be re-established and replaced by the CONTRACTOR's survey crew at no additional cost to the OWNER.

6. Property corner markers, boundary monuments, etc., disturbed or moved shall be restored, in conformance with the property deed description by a licensed land surveyor. Restoration of the markers or monuments shall be certified by said surveyor on a map prepared and stamped by him which shows the work accomplished. One copy of the map will be given to the property OWNER and one copy given to the ENGINEER.

D. Abandoned Utilities

1. Cut and Plug Ends: Cut abandoned utility lines (conduits) and plug the ends with brick and mortar or concrete plug. Plug utility lines with an 8-inch wall of brick and mortar or 8 inch concrete plug from the cut end of the pipe. Remove and dispose of abandoned utilities within the trench excavation.

E. Temporary Relocations

1. The CONTRACTOR, with the approval of the ENGINEER, shall remove items, which would interfere with his/her pipe installation operations, and shall re-install these items after construction is complete.

2. The CONTRACTOR shall disassemble items and store items for later reinstallation, as required. The CONTRACTOR shall disassemble the items carefully and store them in a safe location, and in a manner to prevent damage. Any damage to the items, as a

result of the CONTRACTOR's neglect during removal, disassembly, storage, and/or reinstallation shall be replaced or repaired to the satisfaction of the ENGINEER at the CONTRACTOR's expense.

3.03 Testing – None

3.04 Cleanup

A. Immediately after all construction operations have been completed, the CONTRACTOR shall thoroughly clean the area of all excess materials, debris, plant and equipment for which he or she is responsible. The CONTRACTOR shall also restore grounds, lawns, driveways, streets, roadways, pipes, drain lines, banks, ditches, and all other areas to their original condition and to the satisfaction of the ENGINEER and shall leave the premises in a neat and operable condition.

B. Cleanup and restoration operations must be completed within a reasonable time following installation of any particular section of pipeline.

END OF SECTION

DIVISION 2: EXISTING CONDITIONS
SECTION 02 05 00 – COMMON WORK RESULTS FOR EXISTING CONDITIONS

PART 1 General

1.01 General Conditions

A. The General Conditions apply to all sections of this specification, which shall be done as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the Specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

1.02 Referenced Sections – None

1.03 Cited Standards

A. Standards listed as "Reference Standards" in the various sections of these contract documents are hereby incorporated into these Specifications by reference.

B. Referenced documents shall include all revisions, amendments, supplements, or addenda issued on or before the date of advertising for bids.

1.04 Noted Restrictions – None

1.05 Quality Control – None

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

PART 1 GENERAL

1.01 General Conditions

A. The General Conditions apply to all work of this specification, which shall be done as shown on the plans, and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 01 33 00 – SUBMITTAL PROCEDURES

1.03 Cited Standards

A. All concrete work shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ASTM C31 / C31M - 09 Standard Practice for Making and Curing Concrete Test Specimens in the Field

2. ASTM C39 / C39M - 05e2 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

3. ASTM C143 / C143M - 08 Standard Test Method for Slump of Hydraulic-Cement Concrete

4. ASTM C172 - 08 Standard Practice for Sampling Freshly Mixed Concrete

5. ACI 318-11 - Building Code Requirements for Structural Concrete and Commentary

1.04 Noted Restrictions

A. Compaction testing results shall be made available to OWNER or its ENGINEER.

1.05 Quality Control

A. Any change in configuration or design of the concrete foundations or structural elements which is required to accommodate any construction procedure or operation shall be done only on approval of, and at no additional cost to, the OWNER.

B. The CONTRACTOR shall accompany any request for a design change in the concrete work with design calculations, prepared by a qualified registered professional ENGINEER, which shall show the effect of the proposed changes on the elements to be revised and on all supporting elements.

C. The CONTRACTOR shall adhere to any applicable part of the specifications in this division as it relates to the work to be done.

D. CONTRACTOR shall apply all drawing notes to unlisted concrete mix designs.

1.06 Submittals

A. The CONTRACTOR shall submit manufacturer's catalog data and descriptive literature for form ties, spreaders, corner formers, form coatings and curing compound, bond breakers, joint sealant, backing rod, joint filler, epoxy bonding compound, and color additive.

PART 2 PRODUCTS

2.01 Concrete and Related Components

A. All concrete, grout, and all ingredients including water shall be as approved by the ENGINEER.

B. All concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, and water so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements of these Specifications and suitable to the specific conditions of placement. The proportions of materials shall be such as to secure the lowest water/cement ratio which is consistent with good workability, a plastic, cohesive mixture, and one which is within the specified slump range. The proportion of fine and coarse aggregate shall be such as not to produce harshness in placing or honeycombing in the structures.

PART 3 EXECUTION

3.01 Preparation

A. Workmanship and Methods

1. Concrete work, including detailing of reinforcing, shall be in accordance with the best standard practices as set forth in the ACI Building Code, Manuals, and Recommended Practices.

2. All concrete materials shall be so delivered, stored, and handled as to prevent damage to the materials and the inclusion of foreign substances. Packaged materials shall be delivered and stored in original containers until ready for use. Material containers or materials showing evidence of water or other damage shall be rejected.

3.02 Installation

A. Concrete work shall be constructed as a monolith as feasible. Every part of the work concrete and grout of homogeneous structure, when hardened, shall have the required strength, watertightness, and resistance to weathering.

B. Watertightness of Concrete Work

1. It is recognized that some surface hairline cracks and crazing will develop in the concrete surfaces. Construction, contraction, and expansion joints shall be positioned in structures, and curing methods shall be specified, for the purpose of reducing the number and size of these expected cracks (due to the normal expansion and contraction expected from the specified concrete mixes).

2. Cracks which develop in walls or slabs shall be repaired, and cracks which show any signs of leakage shall be repaired until all leakage is stopped. Visible cracks, other than hairline cracks and crazing, shall be pressure grouted with low viscosity epoxy as specified herein.

3. Epoxy Injection System shall be used for walls and overhead slabs of passageways or occupied spaces, the outside of which are exposed to weather or may be washed down and are not specified to receive a separate waterproof membrane; and other similar surfaces not specified to receive a separate waterproof membrane.

4. Walls or slabs, as above, that leak or sweat because of porosity or cracks too small for successful pressure grouting, shall be sealed on the water or weather side by coatings of a surface sealant system, as specified elsewhere herein.

5. Grouting or sealing as specified above shall be continued until the structure is watertight and shall remain watertight for not less than one

year after final acceptance or date of final repair, whichever occurs later in time.

C. Joints and Bonding

1. The locations of contraction, construction, and other joints are indicated on the DRAWINGS and/or specified herein. Where not specified or indicated otherwise, all slabs and walls shall have construction joints at intervals no greater than 30 feet. There shall not be less than 14 days between placement of concrete in adjacent concrete wall placements.

2. At construction joints, the concrete in place shall be thoroughly cleaned of laitance, grease, oil, mud, dirt, curing compounds, mortar droppings, or other objectionable matter by means of heavy sandblasting, after which the surfaces shall be washed just prior to the succeeding concrete placement. Immediately prior to resuming concrete placing operations, a bed of grout not less than ½ inch in thickness nor more than 1 inch in thickness shall be thoroughly spread over the horizontal joint surfaces.

3. Keyways

   a. Material for keyways shall be steel, plastic or lumber treated with form release coating, applied in accordance with the manufacturer's published instructions.

4. Construction joints shall be washed free of sawdust, chips, and other debris after forms are built and immediately before the concrete placement. Should formwork confine sawdust, chips, or other loose matter in such manner that it is impossible to remove them by flushing with water, a vacuum cleaner shall be used for their removal, after which the cleaned surfaces shall be flushed with water. A cleanout hole shall be provided at the base of each wall and column for inspection and cleaning.

5. The CONTRACTOR shall schedule the placing of concrete in such a manner as to complete any single placing operation to a construction, contraction, or expansion joint. Special care shall be taken to insure that concrete is well consolidated around and against waterstops and that waterstops are secured in the proper position.

6. In any case where it is necessary to repair concrete by bonding mortar or new concrete to concrete which has reached its initial set, the surface of the set concrete shall first be coated with epoxy bonding agent.

D. Measurements of Materials

1. Materials shall be measured by weighing unless other methods are specifically authorized in writing by the ENGINEER. The apparatus provided for weighing the aggregates and cement shall be suitably

designed and constructed for this purpose. Cement shall be weighed separately. The accuracy of all weighing devices shall be such that successive quantities of the individual item can be measured to within 1% of the desired amount of that item. Cement in unbroken standard packages (sack) need not be weighed, but bulk cement and fractional packages shall be weighed. The mixing water shall be measured by volume or by weight. The water measuring device shall be capable of control of water quantities to accuracy of 1% of the desired amount. All measuring or weighing devices shall be subject to review and acceptance by the ENGINEER, and shall bear a valid seal of the Sealer of Weights and Measures having jurisdiction.

E. Concrete Proportions and Consistency

1. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around the reinforcement without excessive vibration and without permitting the materials to segregate or free water to collect on the surface.

2. The ratio of coarse aggregate to fine aggregate shall be no less than 1.0 or more than 2.0 for all concrete with the exception of Class CE.

3. The CONTRACTOR shall prevent unnecessary or haphazard changes in consistency of the concrete. Aggregate shall be obtained from a source which shall provide uniform quality, moisture content, and grading during any single day's operation. Aggregate shall be delivered to the mixing site and handled in such a manner that variations in moisture content will not interfere with the steady production of concrete of the specified degree of uniformity and slump.

4. The concrete mix water to cement ratio, minimum cement content, and slump range shall conform to the values specified in Table A below.

TABLE A

Type	Max. W/C ratio	Min. Cement Factor	28-day Strength	Max. Slump (in)
Class AA	0.42	6 ¾	4500 psi	3 ± 1
Class A	0.45	6	4000 psi	3 ± 1
Class C	0.59	5	2800 psi	3 ± 1
Class CE	0.6	4.5	2500 psi	4 ± 1

5. The CONTRACTOR shall control and adjust the concrete batch weights so as to secure the maximum yield and shall also maintain the proportions of the concrete mix within the specified limits.

6. If designated by the ENGINEER, the mixture shall be modified within the limits set forth in these specifications.

F. Concrete Mixes

1. Prior to placement of concrete, the CONTRACTOR shall mix design calculations for the concrete mix he proposes to use for each class of concrete. The concrete mix shall be proportioned based on the required average compressive strength f'cr defined in the following sections.

G. Required Average Compressive Strength

1. The required average compressive strength, f'cr for the selection of concrete proportion for the mix design, for each class of concrete, shall be determined using the calculated standard deviation and its corresponding specified compressive strength f'c, in accordance with ACI 318, Part 3, Chapter 5.

2. Where the CONTRACTOR has a test record of at least 30 consecutive tests that span a period of no less than 45 calendar days, a standard deviation shall be established as described in ACI 318, Part 3, Chapter 5 and as modified herein. Test records from which the standard deviation is calculated shall represent materials and conditions similar to the materials, quality control procedures, and conditions expected to apply in the preparation of concrete for the work. Changes in materials and proportions within the test records shall be more restricted than those for the work. The specified compressive strength f'c of concrete used in the test records shall be within 1,000 psi of that specified for the Work.

3. The CONTRACTOR shall include the test records with the mix design submittal.

4. Where the CONTRACTOR does not have a test record for calculation of standard deviation meeting requirements specified herein, the required average compressive strength f'cr shall be determined from Table B.

TABLE B	
Specified Compress Strength f’c (psi)	**Required Avg. Compressive Strength f’cr (psi)**
Less than 3,000	f’c + 1,000
3,000 to 5,000	f’c + 1,200
Over 5,000	f’c + 1,400

H. Enforcement of Strength Requirement

1. Concrete is expected to reach a higher compressive strength than that which is indicated in Table B as the specified compressive strength f'c. The strength level of the concrete will be considered acceptable if all of the following conditions are satisfied.

a. The averages of all sets of three consecutive strength test results shall be greater or equal to specified compressive strength f'c. No individual strength test (average of two cylinders) shall fall below specified compressive strength f'c by more than 500 psi.

b. Whenever one, or both, of the two conditions stated above is not satisfied, the CONTRACTOR shall provide additional curing of the affected portion followed by cores taken in accordance with ASTM C 42 and ACI 318. If the additional curing does not bring the average of three cores taken in the affected area to at least the specified compressive strength f'c, all concrete in the affected area shall be designated as defective. The ENGINEER may require the CONTRACTOR to strengthen the defective concrete by means of additional concrete, additional reinforcing steel, or replacement of the defective concrete, all at the CONTRACTOR'S expense.

3.03 Testing of Concrete

A. During the progress of construction, the ENGINEER will have tests made to determine whether the concrete, as being produced, complies with the requirements specified herein. These tests shall be made in accordance with ASTM C 31, ASTM C 39, and ASTM C 172. Test cylinders will be made and delivered to the laboratory by the ENGINEER and the testing expense will be borne by the OWNER.

B. Not less than three cylinder specimens, 6" D x 12" L, will be tested for each 150 yd^3 of each class of concrete with a minimum of three specimens for each class of concrete placed and not less than three specimens for each half day's placement. One cylinder will be broken at 7 days and two at 28 days.

C. The CONTRACTOR shall test the slump of concrete using a slump cone in accordance with the requirements of ASTM C 143. The CONTRACTOR shall provide the test equipment. Concrete that does not meet the specification requirements as to slump shall not be used and shall be removed. The CONTRACTOR shall test the slump at the beginning of each placement, as often as necessary to keep the slump within the specified range, and when requested to do so by the OWNER.

D. The CONTRACTOR shall make provisions for and furnish all concrete for the test specimens, and provide manual assistance to the OWNER in preparing said specimens. The CONTRACTOR shall be responsible for the care of and providing curing conditions for the test specimens in accordance with ASTM C 31.

3.04 Tests for Watertightness

1. All concrete structures which are designed or intended to hold water shall be tested for watertightness in the following manner:

2. After the structure has been completed, all drain valves and other valves or openings into the tanks shall be closed and all stop plank openings, etc., shall be sealed or plugged so as to be made watertight. Any leaking valves shall be conditioned or repaired so that they are watertight.

3. The basin shall then be filled with water to the approximate average flow line and left to stand for 24 hours to permit the concrete to absorb any moisture, after which time the basin level shall be brought up to the average flow line and readings shall be taken by means of a hook gage as to the exact depth of water in the basin. The basin shall stand thus for 24 hours and a reading shall then be taken.

4. At the beginning of the test, a flat pan shall be floated in the basin containing approximately 1 in. depth of water. The exact depth of the water in the pan shall be measured. At the conclusion of the test the amount of water that has been lost or gained by the pan shall be determined in a similar manner in order to determine the amount of precipitation or evaporation from the surface of the tank or basin to be tested.

5. The maximum allowable loss for the basin that will be permitted will be 0.25% of the volume of the water in the basin. However, any damp places, leaks or other locations indicating seepage shall be repaired. All structures requiring water tests shall not be backfilled until after the test has been completed so that the locations of any or all points where leakage may occur will be visible.

END OF SECTION

Item	***No.***	***Ref. Drawing No.***	***Size (ft.)***	***Concrete Type***	***Strength (28 day)***
Well Pedestal		M-2		A	4500
Well Equipment Pad, compete with curb, sump equipment and lighting foundations and reinforcing.	1			A	4000 psi
Fence Column Foundations		Detail DRAWINGS	Per DRAWINGS	A	3250 psi
Well Building Foundation	1	Detail DRAWINGS	Per DRAWINGS	A	3250 psi
Treatment Plant Equipment Pad, and lighting foundations, reinforcing and water stops.	1			A	4000 psi
Transformer Pad	1		Per Southern CA Edison	A	4000 psi

END OF SECTION

Item	***No.***	***Ref. Drawing No.***	***Size (ft.)***	***Strength (28 day)***
PRV Vault. Precast by Jensen Precast, Fontana CA .	1	Detail DRAWINGS	See DRAWINGS	5500 psi

Note: ID shown here stand for “inside dimensions” of vault

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 11 00 – CONCRETE FORMING

PART 1 GENERAL

1.01 Section Includes

A. This section includes a description of how the General Construction CONTRACTOR (CONTRACTOR) shall address the construction practices that relate to concrete forming.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

1.03 Cited Standards

A. All concrete forming shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ACI International 347 - Guide to Formwork for Concrete

2. APA PS1 (1995) - Construction and Industrial Plywood (APA V995)

3. ASTM C31/C31M-06 - Standard Practice for Making and Curing Concrete Test Specimens in the Field

4. ASTM C39/C39M-05e1 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

1.04 Noted Restrictions

A. Failure of any supporting surface either due to surface texture, deflection or form collapse shall be the responsibility of the CONTRACTOR.

1.05 Quality Control

A. Forming systems shall be performed by manufacturers with a minimum of 5 years of experience. Forms for all exposed concrete shall be carefully built to produce the contour and design indicated. Care shall be taken to assure that all form joints are truly vertical or horizontal. No sloping joints will be accepted.

B. Formwork shall be designed as a complete system with consideration given to the effects of cementitious materials and mixture additives such as fly ash, cement type, plasticizers, accelerators, retarders, air entrainment, and others. The adequacy of formwork design and construction shall be monitored prior to and during concrete placement.

C. Formwork shall be designed for anticipated live and dead loads, and shall comply with the tolerances specified in **SECTION 03 30 00 – CAST-IN-PLACE CONCRETE.**

1.06 Submittals

A. The CONTRACTOR shall submit, manufacturer's catalog data and descriptive literature for form ties, spreaders, corner formers, form coatings and curing compound, bond breakers, joint sealant, backing rod, joint filler, epoxy bonding compound, and color additive to the ENGINEER.

B. The shop DRAWINGS and data submitted shall include the type, size, quantity, and strength of all materials of which the forms are made, the plan for jointing of facing panels, details affecting the appearance, and the assumed design values and loading conditions.

C. Manufacturer's literature shall be submitted for plywood, concrete form hard board, form accessories, prefabricated forms, form coating, and form-lining materials.

PART 2 PRODUCTS

2.01 Forms and Form Liners

A. All forms and form liners shall be fabricated as defined in ACI 347. Forms shall conform to the shape, lines, grades and dimensions of the concrete as called for on the DRAWINGS. All lumber used for forms shall be thoroughly cleaned and free from dirt, debris, concrete, etc. and treated with an approved form oil. Lumber used in forms for exposed surfaces shall be dressed to a uniform thickness and shall be free from loose knots or other defects.

B. For a smooth, hard, and dense finish, a sufficient number of forms shall be provided so that the work may be completed rapidly and present a uniform appearance in form patterns and finish.

C. For unexposed surfaces and rough work, undressed lumber free of nails and clean of hardened concrete or other foreign material may be used. Lumber once used in forms shall have nails withdrawn, and surfaces to be in contact with concrete shall be thoroughly cleaned before being used again.

D. Form sheathing for exposed surfaces may be composed of tongue and groove lumber, shiplap, plywood, concrete form board, or steel. Steel lining on wood lagging will not be permitted. Tongue and groove shiplap when used shall conform to the American Lumber Standards for No. 2 boards.

E. Forms and form liners for this project shall be fabricated with a Class A or B Finish. Plywood used for sheathing or lining shall be Grade B-B exterior or better as described in the Commercial Standards of the Douglas Fir Plywood Association. The forms used shall produce a concrete surface with "abrupt" irregularities less than ¼ in. and gradual irregularities less than ½ in. in 5 ft.

F. Forms shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain the desired position and shape during and after placing concrete and so they will not tremble or distort in a high wind.

2.02 Form Coatings

A. Forms for exposed or painted surfaces shall be coated with approved form oil before the form or reinforcement is placed in final position. Forms for unexposed surfaces may be wet with water in lieu of coating immediately before placing concrete in hot weather.

B. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

2.03 Keyways and Inserts (where necessary)

A. Material for keyways shall be steel, plastic, or lumber treated with form coating, applied according to label directions. Pipes, anchor bolts, steps, reglets, castings, and other inserts shall be encased in the concrete. Dovetail anchors or ties shall be used in conjunction with the slots or inserts for the various materials as may be necessary for the required work.

PART 3 EXECUTION

3.01 Preparation and Installation

A. Form Construction

1. The CONTRACTOR shall continuously monitor the alignment and stability of the forms during all phases to assure the finished product will meet the required surface class (or classes) specified in Part 2 of this section above.

2. When forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be re-used if there is any evidence of defects which would impair the quality of the resulting concrete surface. All surfaces

of used forms shall be cleaned of mortar and any other foreign material before reuse.

B. Chamfering

1. Where not otherwise indicated on the DRAWINGS, all external angles of walkways, slabs, walls, beams, columns, and openings shall have a ¾” bevel formed by utilizing a true dimensioned wood or solid plastic chamfer strip and external angles of walkways, walls, and slabs at expansion, contraction, and construction joints shall be a ½” bevel formed by utilizing a true dimensioned wood or solid plastic chamfer strip. Reentrant angles may be left square. Level strips shall be installed at the top of all wall concrete placements to maintain a true line at all horizontal construction joints.

2. Chamfered joints shall not be permitted where earth or rock fill is placed in contact with concrete surfaces. Chamfered joints shall be terminated 12” (30 cm) outside the limit of the earth or rock fill so that the end of the chamfers will be clearly visible.

C. Bracing and Alignment of Forms

1. All formwork shall be securely braced, supported, tied down, or otherwise held in place to prevent any movement of formwork.

2. When a second lift is placed on hardened concrete, special precautions shall be taken in the form work at the top of the old lift and bottom of the new lift to prevent spreading, vertical or horizontal displacement of forms; and to prevent grout "bleeding" on finished concrete surfaces. Pipe stubs, anchor bolts, and other embedded items shall be set in the forms where required.

3. No concrete shall be placed until all forms have been thoroughly checked by the CONTRACTOR for alignment, level, strength, and to assure accurate location of all mechanical and electrical inserts or other embedded items. All cracks, openings, or offsets at joints in the formwork which are 1/16 inch or larger shall be closed by tightening the forms or by filling with an acceptable crack filler.

D. Tolerances

1. It shall be the responsibility of the CONTRACTOR to comply with the intent of these specifications, but it is also recognized that there will be occasions when some deviation will occur or be required. It shall therefore be agreed that the maximum deviation from true line and

grade shall not exceed the tolerances listed below at the time of acceptance of the project.

2. All tolerances shall comply with ACI 117-81 (paragraphs 2.0 - 2.2, and paragraphs 4.0 - 4.5). All slabs shall be uniformly sloped to drain when a slope is indicated. Slabs which are indicated to be level shall have a maximum deviation of $^{1}/_{8}$" in 10 feet without any apparent changes in grade.

3. All inserts shall be set to the tolerances required for the proper installation and operation of the equipment or systems to which the insert pertains. The following shall be considered maximum tolerances.

Item	Max Tolerance (in)
Sleeves and inserts	+/- $^{1}/_{8}$"
Projected ends of anchor bolts	+/- $^{1}/_{4}$"
Anchor bolt setting	+/- $^{1}/_{16}$"

E. Removal of Forms

1. The CONTRACTOR shall remove forms in such a manner as to insure the complete safety of the structure. All forms supporting concrete and shoring shall remain in place as follows:

Form Type	Duration Period in Place
Vertical Forms	24 hours min
Sides of footings	24 hours min
Vertical sides of beams, girders, etc.	48 hours min
Slabs, beams, and girders	Until concrete reaches the specified strength or until shoring is installed
Shoring for slabs, beams, girders	Until concrete reaches the specified strength
Wall bracing	Until concrete beams and slabs laterally supporting the wall reaches the specified strength

2. No form or form support shall be removed from the formed surface for at least 24 hours. In case the CONTRACTOR shall remove any form before the above conditions have been met, the concrete elements may be condemned even though there is no apparent defect.

3. Factors related to form removal include ambient temperature, concrete lift heights, the type and amount of concrete admixture, and type and amount of cementitious material in the concrete. The CONTRACTOR is responsible for considering all of the applicable factors and for leaving the forms in place until it is safe to remove them.

4. Where forms support more than one element, the forms shall not be removed until the form removal criteria are met by all supported elements.

F. Control Cylinders

1. Evidence that the concrete has gained sufficient strength to permit removal of forms shall be determined by tests on control cylinders.

2. Control cylinders shall be stored in the structure or as near the structure as possible so they receive the same curing conditions and protection methods as given to the portions of the structure they represent.

3. Control cylinders shall be removed from the molds at an age of no more than 24 hours. All control cylinders shall be in accordance with ASTM C 31/C 31M and ASTM C 39/C 39M.

G. Form Ties

1. After the forms and the tapered ties are removed from the wall, tapered tie holes shall be plugged. Tie holes shall be heavy blasted, cleaned, and then shall have a rubber plug driven into each of the tapered tie holes with a steel rod. The steel rod shall be located in a cylindrical recess, made in the plug, during driving. At no time shall plugs be driven on the flat area outside the cylindrical recess. The rubber plug shall be sized so that after it is driven into the tapered tie hole, the plug will be located near the center of the wall.

2. After installing plugs in the tapered tie holes, the tie holes shall be coated with epoxy bonding agent and filled with dry-pack mortar with a dry consistency and with a mix of one part of Portland cement to one part of plaster sand. The amount of water to be added to the cement-sand mix shall be such that the mortar can be driven into the holes and will compact properly. The dry-pack mortar shall be heavily compacted in the holes and shall be placed in layers with a thickness not exceeding the tie hole diameter. Admixtures or additives shall not be used in the dry-pack mortar.

3. The wall surfaces in the area of the dry-packed tie holes shall be covered with a minimum of 10 mils of epoxy gel. The epoxy gel

coating on the wall surface shall extend a minimum of 2 inches past the dry-pack mortar filled tie hole. The finish surfaces shall be free from sand streaks or other voids.

3.02 Testing

A. Forms and embedded items shall be inspected in sufficient time prior to each concrete placement by the CONTRACTOR. The results of each inspection shall be reported to the ENGINEER.

B. Tests for Watertightness shall be as described in Section 3.04 of **03 05 00 Common Work Results for Concrete**.

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 15 13 – WATERSTOPS

PART 1 GENERAL

1.01 Section Includes

A. This section includes a description of how the General Construction CONTRACTOR (CONTRACTOR) shall proceed to furnish all material, equipment, labor, services, etc., to complete and install waterstops that shall provide a lasting, watertight, bond to fresh and cured concrete surfaces, and vertical, horizontal, and sloping cast-in-place concrete joints.

B. Waterstop shall be installed in concrete joints where indicated on the DRAWINGS.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 07 90 00 - JOINT PROTECTION

1.03 Cited Standards

A. All waterstops shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. International Federal Specifications SS-S-210A "Sealing Compound for Expansion Joints" (1975)

2. U.S. Army Corps of ENGINEERs (USACE) - COE CRD-C 572 Specifications for Polyvinylchloride Waterstops (1974)

1.04 Noted Restrictions

A. Split-leg waterstops will not be permitted.

1.05 Quality Control

A. Waterstops shall meet or exceed all requirements of Federal Specifications SS-S-210A.

1.06 Submittals

A. Shop DRAWINGS

1. The CONTRACTOR shall submit DRAWINGS showing the locations of all joints that are to receive waterstops and the methods of supporting the waterstops in the forms without creating displacement due to pressure from concrete placement.

B. Product Data

1. The CONTRACTOR shall submit the Manufacturer's product data of the proposed waterstops for review by the ENGINEER.

C. Samples

1. The CONTRACTOR shall also submit a 12-inch long sample of a typical waterstop.

D. Certificates

1. The CONTRACTOR shall submit a certificate of compliance stating that the waterstops, joint filler, and sealant materials to be used conform to the requirements specified.

1.07 Delivery and Storage

A. Materials delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. The waterstops shall be stored out of direct sunlight.

B. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.01 Materials

A. Waterstop shall be polyvinyl chloride and shall be manufactured by:

1. Burke Concrete Accessories Inc.;

2. Greenstreak Plastic Products Division of Western Textile Products Company,

3. Kirkhill Rubber Company; Williams Products Inc.; or equal.

B. Waterstops shall be manufactured by such a process that they will be dense, homogenous, and free from holes and other imperfections. The cross-section of the waterstop shall be uniform and symmetrical along its entire length.

C. The waterstops and the codes they shall conform to are described below:

1. Polyvinylchloride waterstops shall conform to COE CRD-C 572.

D. Material for PVC waterstops shall be of an elastomeric plastic compound, the basic resin of which shall be polyvinyl chloride.

E. Preformed Plastic Adhesive Waterstops (recommended where applicable)

1. Preformed plastic adhesive waterstops are recommended where applicable and shall be single-component, self-sealing strip applied plastic waterstops extruded in a "rope" form between two "quick-release" papers.

2. Preformed Plastic Adhesive Waterstop shall have an indefinite shelf life and shall contain no solvents, irritating fumes, or obnoxious odor.

3. The waterstop shall be a single-component, self-sealing plastic adhesive type. It shall also have non-oxidizing, non-evaporating, non-expanding, non-shrinking and with water, chemical and saturated hydrogen sulfide resistant characteristics.

F. Unless otherwise specified or indicated on the DRAWINGS, polyvinyl chloride waterstop shall be 6 inch flat ribbed, centered, at construction and contraction joints, and 9 inch wide ribbed with a 1 inch diameter hollow center bulb centered at expansion joints. The waterstop shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material.

G. The CONTRACTOR shall submit samples, prints, and complete physical property data covering the waterstop. The CONTRACTOR shall submit written certifications that all of the material supplied on this project meets or exceeds the physical property requirements of the current U.S. Army Corps of ENGINEERs Specification No. CRD-C572 and shall submit laboratory test reports indicating that the average properties of all the materials and finished waterstops conform to the following:

TEST	LIMIT	TEST METHOD
Specific gravity - not less than	1.35	ASTM D 792
Type A shore durometer hardness	70 to 80	ASTM D 2240
Tensile strength - not less than	2,250 psi	ASTM D 638
Ultimate elongation - not less than	350 percent	ASTM D 638
Alkali extraction, 7 day weight change between	-0.1 percent to +0.25 percent	CRD-C-572
Low temperature brittle point - not more than	-35 degrees F	ASTM D 746
Water absorption - 24 hours - not more than	0.15 percent	ASTM D 570
Accelerated extraction tensile - not less than	1,500 psi	ASTM D 412
Stiffness in flexure - not less than	750 psi	ASTM D 747
Tear resistance - not less than	350 lbs/in	ASTM D 624

1. 6-inch waterstop shall weigh not less than 130 pounds per 100 linear feet.

2. 9-inch waterstop shall weigh not less than 220 pounds per 100 linear feet.

3. Thickness shall be 3/8 inch. Center bulb shall be 1 inch nominal outside diameter. Allowable tolerances are width plus or minus 3/16 inch; thickness plus or minus 1/32 inch.

PART 3 EXECUTION

3.01 Preparation

A. The CONTRACTOR shall review the manufacturer's specifications and recommendations prior to installation.

3.02 Installation

A. Waterstop shall be installed so that all joints are watertight. All joints such as unions, crosses, ells and tees for polyvinyl chloride waterstop shall be field welded with thermostatically controlled equipment recommended by the waterstop manufacturer. The CONTRACTOR shall demonstrate the ability to weld acceptable joints in the polyvinyl chloride waterstop before installing waterstop in the forms. Quality of welded joints will be subject to the approval of the OWNER.

B. Exposed waterstops shall be protected during applications of form release agents to avoid being coated.

C. The CONTRACTOR shall protect exposed projecting edges and ends of partially embedded waterstops from damage.

D. If splices are to be used, they shall be made by certified trained personal using equipment and procedures approved by the ENGINEER.

E. Waterstops in the walls shall be carried into lower slabs and shall join the waterstops in the slabs with appropriate types of fittings. All joints in water bearing structures shall have waterstops, whether indicated on the DRAWINGS or not. All waterstops shall be continuous. Waterstops shall be set accurately to the position and line indicated on the DRAWINGS. Edges shall be held and securely fixed in position at intervals of not more than 12 inches so that they will not move during the placing of concrete. No nails shall be driven through waterstops in the vicinity of construction joints. Wires at not more than 12 inches on centers near the outer bulbs shall be used to tie the waterstops into position. Special clips may be used in lieu of wires, at the

CONTRACTOR'S option. Waterstops shall be terminated 3 inches from the top of finished surfaces of walls and slabs unless otherwise specified or indicated on the DRAWINGS.

F. Preformed Plastic Adhesive Waterstop Installation

1. Installation for preformed plastic adhesive waterstops shall be a prime, peel, place, and pour procedure.

2. Joint surfaces shall be clean and dry before priming and just prior to placing of the sealing strips. If conditions are damp or cold, the joint surface shall be flashed with a direct flame to warm and dry the surface. The sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

3. The CONTRACTOR shall strip the protective paper wrapper from one side only of the waterstop material then press waterstop material strip firmly against primed surface throughout length and width of strip.

4. The CONTRACTOR shall then join the strips together with a 1" overlap to form a continuous waterstop. The CONTRACTOR shall remove the remaining protective paper when ready to install forms and pour concrete.

3.03 Testing – None

3.04 Cleanup

A. The CONTRACTOR shall immediately remove all spots, smears, stains, residues, and adhesives, etc. which result from the work.

B. Upon completion of the work, the CONTRACTOR shall properly dispose of (away from the site unless specified otherwise) all debris, trash, containers, residue, remnants, and scraps which results from the work.

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 15 13.13 – LINK-SEAL FLOOR AND WALL PENETRATION SEALS

PART 1 GENERAL

1.01 Section Includes

A. This section includes the CONTRACTOR'S responsibilities regarding watertight seals for all concrete penetrations for pipe and conduit.

1.02 Referenced Sections

A. Related Sections are shown below.

1. DIVISION 40 - PROCESS INTEGRATION

2. DIVISION 26 - ELECTRICAL

1.03 Cited Standards

A. All work specified herein shall conform to or exceed the applicable requirements of the referenced standards. Wherever the provisions of said publication are in conflict with the requirements specified herein, the more stringent requirement shall apply.

1.04 Noted Restrictions

A. Link-Seal Modular Seals are specifically designed as hydrostatic and/or fire-rated seals and are not considered to be pipe supports. When appropriate, Link-Seal Modular Seals should be used with proper pipe supports on both ends.

1.05 Quality Control

A. Each individual link shall be conspicuously and permanently identified with the name of the manufacturer and model number. Manufacturers other than the above-named company wishing to quote equipment in this section shall submit detail DRAWINGS of their proposed equipment and suitable evidence of a minimum of 25 years of experience and results to the ENGINEER to obtain written approval to quote at least ten (10) days prior to bid opening.

B. Link-Seal® Modular Seal components and systems shall be domestically manufactured at a plant with a current ISO-9001:2000 registration. Copy of ISO-9001:2000 registrations shall be a submittal item.

1.06 Submittals

A. The CONTRACTOR shall submit DRAWINGS showing the locations of all penetrations that are to receive the specified seals.

B. The CONTRACTOR shall submit the Manufacturer's product data of the proposed seals for review by the ENGINEER.

C. The CONTRACTOR shall submit a certificate of compliance stating that the seals to be used conform to the requirements specified.

1.07 Delivery and Storage

A. Materials delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. The seals shall be stored out of direct sunlight.

PART 2 PRODUCTS

2.01 Link-Seal® Modular Seal Assembly

A. The CONTRACTOR shall be furnish and install a complete Link-Seal® modular seal assembly, manufactured by PSI-Thunderline/Link-Seal® located at 6525 Goforth Street, Houston, TX 77021. For clarification, complete assembly is defined as a combined:

1. Wall or floor opening (i.e. steel sleeve, Thermoplastic (HDPE) sleeve, cored hole or formed hole). The opening size and/or type shall be selected according to information found in the most recent Link-Seal® modular seal catalog.

2. Sufficient quantity and type of Link-Seal® modular seals required to effectively provide a hydrostatic and/or fire-rated seal.

2.02 Link-Seal® Modular Seal Rubber Links

A. Shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer’s sizing procedure and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection. Each link shall have a permanent identification of the size and manufacturer’s name molded into it.

1. For Standard Service Applications (Pipe) = Model C -40

a. to +250ºF (-40 to +121ºC)

b. EPDM = ATSM D2000 M3 BA510

c. Color = Black

2. For Thin Walled Pipe Applications (Conduit) = Model L

a. -40 to +250ºF (-40 to +121ºC)

b. EPDM = ATSM D2000 M3 BA510

c. Color = Blue

2.03 Link-Seal® Modular Seal Pressure Plates

A. Link-Seal® modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:

1. Izod Impact - Notched = 2.05ft-lb/in. per ASTM D-256

2. Flexural Strength @ Yield = 30,750 psi per ASTM D-790

3. Flexural Modulus = 1,124,000 psi per ASTM D-790

4. Elongation Break = 11.07% per ASTM D-638

5. Specific Gravity = 1.38 per ASTM D-792

B. Models LS200, 275, 300, and 315 shall incorporate the most current Link-Seal® Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits increased compressive loading of the rubber sealing element.

C. Models 315, 325, 340, 360, 400, 410, 425, 475, 500, 525, 575, and 600 shall incorporate an integral recess known as a “Hex Nut Interlock” designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware.

D. All pressure plates shall have a permanent identification of the manufacturer’s name molded into it.

2.04 Link-Seal® Modular Seal Hardware

A. All fasteners shall be sized according to latest Link-Seal® modular seal technical data. Bolts, flange hex nuts shall be 316 Stainless Steel per ASTM F593-95, with a 85,000 psi average tensile strength.

2.05 Wall Opening

A. Century-Line® Sleeves - for openings to 24.81” diameter.

1. Where pipes must pass through walls and floors of new structures, unless otherwise shown or specified, install molded non-metallic high density polyethylene Model CS Century-Line® sleeves as manufactured by PSI Thunderline/Link-Seal®. Model CS sleeves shall have integrally formed hollow water stop sized having a minimum of four inches larger than the outside diameter of the sleeve itself and allowing 1/2” movement between wall forms to resist pour forces. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve itself and installed at exposed ends of the sleeve so as to prevent deformation during the initial concrete pour. End caps shall remain in place to protect the opening from residual debris and rodent entry prior to pipe insertion.

PART 3 EXECUTION

3.01 Preparation

A. The CONTRACTOR shall assure that the proper-sized sleeve with protective covers, is in place as detailed on the DRAWINGS, prior to pouring concrete floors, slabs, etc., and shall follow manufacturer’s recommendations during installation.

3.02 Installation

A. The CONTRACTOR shall install the seal between the pipe and sleeve in accordance with manufacturer’s recommendations.

3.03 Testing – None

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 15 13.14 – LOK FLOOR AND WALL PENETRATION SEALS

PART 1 GENERAL

1.01 Section Includes

A. The CONTRACTOR shall provide the watertight seals for concrete penetrations, for pipe and conduit, specified herein, as specifically called out on the DRAWINGS. The CONTRACTOR is specifically directed to the call-outs on the DRAWINGS. All other concrete penetrations for pipe and conduit in the project shall be provided with Link-Seal seals as specified in **Section 03 15 13.13**.

B. The CONTRACTOR shall be furnish and install a complete Z•LOK Connector as manufactured by A•LOK Products, Inc., Tullytown, PA, as shown on DRAWINGS and specifications.

1.02 Referenced Sections

A. Division 40 - Process Integration

B. Division 26 - Electrical

1.03 Cited Standards

A. All liquid transfer pump shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ASTM C-923-00 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals

B. All work specified herein shall conform to or exceed the applicable requirements of the referenced standards; provided, that wherever the provisions of said publication are in conflict with the requirements specified herein, the more stringent requirement shall apply.

1.04 Noted Restrictions

A. Z-LOK connectors are specifically designed as hydrostatic seals and are not considered to be pipe supports.

1.05 Quality Control

A. The connector shall be made from materials that conform to the physical and chemical requirements outlined in Section 4, *"Materials and Manufacture"* of ASTM C-923-00 *"Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals"*, and the overall design will meet or exceed Section 7, *"Test Methods and Requirements"* of ASTM C-923-00.

1.06 Submittals

A. Shop DRAWINGS

1. The CONTRACTOR shall submit DRAWINGS showing the locations of all penetrations that are to receive the specified seals.

B. Product Data

1. The CONTRACTOR shall submit the Manufacturer's product data of the proposed seals for review by the ENGINEER.

C. Certificates

1. The CONTRACTOR shall submit a certificate of compliance stating that the seals to be used conform to the requirements specified.

1.07 Delivery and Storage

A. Materials delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. The seals shall be stored out of direct sunlight.

PART 2 PRODUCTS

2.01 Z•LOK Connector

A. The connector to be used shall be the Z•LOK CONNECTOR as manufactured by A•LOK PRODUCTS, INC., Tullytown, PA, or approved equal.

B. The design of the connector shall provide a flexible, watertight seal between the pipe and concrete structure. The connector shall assure that a seal is made between:

1. The connector and the structure wall by casting the connector integrally with the structure wall during the manufacturing process in a manner that it will not pull out during pipe coupling.

2. The seal between the connector and the pipe shall be made by compressing the connector against the outside circumference of the pipe by means of a stainless steel take-down band.

C. The connector shall be sized specifically for the type of pipe being used.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. The connectors shall be installed by the vault and box manufacturer as called for in the DRAWINGS during forming and pouring the concrete in accordance with the recommendations of the manufacturer.

B. The CONTRACTOR shall install the pipe and take-down band and shall tighten the band in accordance with the manufacturer's recommendations.

3.03 Testing – None

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 15 15 – MISCELLANEOUS JOINT AND CRACK FILLERS

PART 1 GENERAL

1.01 Section Includes

A. This section includes a description of how the General Construction CONTRACTOR (CONTRACTOR) shall proceed to furnish all material, equipment, labor, services, etc., to complete and install miscellaneous joint and crack filler compounds.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 07 90 00 - JOINT PROTECTION

2. SECTION 03 15 13 - WATERSTOPS

3. SECTION 03 60 00 - GROUTING

1.03 Cited Standards – Not Used

1.04 Noted Restrictions – Not Used

1.05 Quality Control – Not Used

1.06 Submittals

A. Shop DRAWINGS

1. The CONTRACTOR shall submit DRAWINGS showing the locations of all joints that are to receive these materials.

2. The CONTRACTOR shall submit DRAWINGS showing the location of filled cracks and materials used.

PART 2 PRODUCTS

2.01 Joint Materials

A. Preformed Expansion Joint Material

1. Preformed expansion joint material shall be sponge rubber or bituminous fiber types as specified herein. Specific type to be used in any application shall be as indicated on the DRAWINGS. The CONTRACTOR shall submit sufficient information on each type of material to the OWNER for review to determine conformance of the material to these Specifications.

2. Thicknesses and dimensions of the materials shall be as indicated on the DRAWINGS or as required according to the way it is used. Expansion joint strips shall be fastened to concrete, masonry, or forms with adhesive. No nailing will be permitted, nor shall expansion joint strips be placed without fastening.

B. Synthetic Sponge Rubber Expansion Joint Material

1. Synthetic sponge rubber expansion joint material shall be Cementone Code 3329 as manufactured by W. R. Grace and Company; neoprene sponge rubber expansion joint as manufactured by Burke Concrete Accessories Inc.; or equal.

C. Bituminous Fiber Expansion Joint Material

1. Bituminous fiber expansion joint material shall be Cone Fiber Expansion Joint Fillers Code 1390 as manufactured by W. R. Grace and company; Burke Fiber Expansion Joint; or equal.

2.02 Synthetic Sponge Rubber Filler

A. Synthetic sponge rubber filler shall be an expanded closed-cell sponge rubber backer rod manufactured from a synthetic polymer neoprene base; or a resilient closed-cell polyethylene foam backer rod. The synthetic sponge rubber filler shall have characteristics suitable for the application intended, including the following:

1. Necessary strength for supporting the sealing compound during application.

2. Sufficient resiliency to prevent significant load transfer across the joint.

3. Resistance to the environmental conditions of the installation.

4. No bonding to the sealing compound.

5. A cellular structure that shall prevent wicking or absorption of water.

6. Compatibility with other materials in the joint, and acceptance by the manufacturer of the sealing compound.

B. The size of the synthetic sponge rubber filler shall be 25 percent greater than the nominal joint width.

C. Acceptable products include No. 750.3 Ropax Rod Stock manufactured by the Presstite Division of Interchemical Corporation; Rubatex-Cord manufactured by the Rubatex Corporation; or equal.

D. Surface preparation and installation of the synthetic sponge rubber filler shall be as recommended by the manufacturer in published instructions. The synthetic sponge rubber filler shall not be stretched beyond its normal length during installation.

2.03 Caulking, Joints and Sealing

A. General

1. Expansion, contraction, and construction joints shall be constructed as indicated on the DRAWINGS, and materials used shall be as specified herein.

2. Pipe and conduit shall be installed in structures as indicated on the DRAWINGS, and shall be sealed with the materials specified herein. Doors, windows, louvers, and other items installed in or over concrete openings shall be caulked inside and out with the materials specified herein.

B. Caulking

1. All caulking where indicated on the DRAWINGS or as specified, except for masonry construction and where specified otherwise, shall be done with synthetic rubber sealing compound. Caulking shall be completed prior to painting.

C. Synthetic Rubber Sealing Compound

1. Synthetic rubber sealing compound shall be a multi-part polyurethane designed for continuous submerged condition in water or sewage and exposed to direct sunlight in a dry condition. Synthetic rubber sealing compound shall be PRC 270 as manufactured by Products Research and Chemical Company; Elastothane 227R as manufactured by Pacific Polymers Inc.; or equal. Sealing compound shall comply with Federal Specification TT-S-00227e, Type I (pourable grade) and Type II (non-sag), Class A, and the following requirements.

2. Polyurethane sealant shall have the following properties determined at 75 degrees F and 50 percent relative humidity:

a. Base - polyurethane rubber

b. Solids - not less than 97 percent

c. Application Time - not less than 2 hours

d. Cure Time - not more than 3 days

e. Tack Free Time - 24 hours

f. Ultimate Hardness - 35 plus or minus 5 (Shore A)

g. Tensile Strength (ASTM D 412) - 300 pounds per square inch minimum

h. Ultimate Elongation - not less than 550 percent (ASTM D 412)

i. Tear Resistance - not less than 85 pounds per inch (ASTM D 624 Die C)

j. Color shall be gray to match concrete, unless otherwise indicated, and the temperature service range shall be 50 degrees F to 200 degrees F.

k. Polyurethane sealant shall be a compound designed to cure at room temperature to a firm, highly resilient rubber.

2.04 Epoxy Materials

A. All epoxy materials shall be new and shall be used within the shelf life limitations set forth by the manufacturer.

B. Epoxy

1. Epoxy shall be a water-insensitive two-part type low viscosity epoxy adhesive material containing 100 percent solids and shall meet or exceed the following characteristics when tested in accordance with the standards specified:

a. ASTM D 638, Tensile Strength: 9,000 psi at 14 days and 77 degrees F cure.

b. ASTM D 790, Flexure Strength: 12,000 psi at 14 days and 77 degrees F cure.

c. ASTM D 695, Compressive Strength: 16,000 psi at 24 hours and 77 degrees F cure.

d. Bond Strength: Concrete shall fail before failure of the epoxy.

e. Gel Time In A 5-Mil Film: 4 hours maximum at 77 degrees F.

f. ASTM D 638, Elongation: 1 percent minimum at 14 days and 77 degrees F.

2. For dry and damp concrete, the epoxy shall be Sikadur Hi-Mod LV as manufactured by the Sika Chemical Corporation; Adhesive Engineering Company Concressive No. 1380; or equal.

C. Epoxy Gel

1. Epoxy gel shall be Sikadur Hi-Mod Gel manufactured by Sika Chemical Corporation; Concressive No. 1438 manufactured by Adhesive Engineering Company; or equal. Epoxy gel shall be used for vertical or overhead work, or where a high viscosity epoxy is required. Epoxy gel for vertical or overhead work may be used for horizontal work. All mixing, installing, and curing of epoxy shall conform to the manufacturer's published instructions.

D. Epoxy Bonding Agent

1. Epoxy bonding agent shall be Concressive No. 1001 LPL as manufactured by Adhesive Engineering; Sikadur Hi-Mod as manufactured by Sika Chemical Corporation; or equal. This material shall be applied in accordance with the manufacturer's published instructions. Bonding agent will not be required for filling form tie holes or for normal finishing and patching of similar sized small defects.

2.05 Expanded Polystyrene

A. When expanded polystyrene joint filler is indicated on the DRAWINGS or specified, the filler shall be placed in correct position before concrete is placed against the filler. Holes and joints in the filler shall be filled with caulking to prevent the passage of mortar or concrete from one side of the joint to the other.

B. Expanded polystyrene shall be a commercially available polystyrene board. Expanded polystyrene shall have a flexural strength of 35 pounds per square inch, minimum, determined in accordance with ASTM C 203, and a compressive yield strength of between 16 and 40 pounds per square inch, at 5 percent compression.

C. When indicated on the DRAWINGS, surface of expanded polystyrene shall be faced with hardboard. Hardboard shall be 1/8 inch minimum thickness, conforming to Federal Specification LLL-B-810, any type. Other facing materials may be used provided they furnish equivalent protection. All boards shall be held in place by nails, waterproof adhesive, or other means approved by the OWNER.

PART 3 EXECUTION

3.01 Caulking

A. Concrete must be thoroughly cured prior to caulking. All surfaces to be caulked shall be dry, clean, and free of dirt, grease, curing compounds, and other residue which might interfere with adhesion of the caulking compound.

B. Concrete, masonry, wood, and steel surfaces shall be cleaned and primed in strict accordance with the manufacturer's recommendations prior to caulking. Synthetic sponge rubber filler materials may be used as backing for caulking, if acceptable to the OWNER. Filler material, when used, shall be compressible and untreated.

C. Caulking shall be applied with a pneumatic caulking gun. Nozzles of the proper shape and size shall be used for the application intended. A continuous bond shall be maintained between the caulking and the sides of the joint to eliminate gaps, bubbles, or voids and to fill the joint in a continuous operation without layering of the compound. All joints and seams shall be caulked by experienced applicators in a neat workmanlike manner.

D. No caulking shall be applied when the temperature exceeds 120 degrees F to avoid sponging or bubbling of compound. To hasten curing of the compound when used on wide joints subject to movement, the CONTRACTOR shall apply heat with infra-red lamps or other convenient means.

E. Excess caulking shall be removed by soaking and scrubbing before caulking has cured with Chem Seal CS9900; equivalent product of Products Research and Chemical Corporation; or equal. Excess cured material shall be removed by sanding with No. 80 grit sandpaper.

3.02 Synthetic Rubber Sealing Compound

A. All surfaces to which synthetic rubber must bond shall be dry and free of dust, dirt, and other foreign residue, heavy sandblasted caulking groove to provide a sound surface, and shall be primed with the manufacturer's recommended primer for the particular surface.

B. Application shall be in strict accordance with the manufacturer's published instructions. Application shall be by means of a pneumatic caulking tool or other acceptable method.

C. All packages shall be code dated. No material shall be more than six months old when used. Material shall have been kept at temperatures lower than 80 degrees F at all times.

3.03 Epoxy Injection System

A. Where epoxy injection is required to repair cracks in concrete material, information on the epoxy injection system shall be submitted.

B. Adequate surface seal shall be applied to the crack or joint to prevent escape of the epoxy. Entry points shall be established at a distance along the seal not less than the thickness of the cracked member.

C. A 100 percent solid epoxy adhesive as specified above shall be forced into the crack at the first port with sufficient pressure to advance the epoxy to the adjacent port. The original port shall be sealed and entry shifted to the port at which the epoxy appears. This manner of port-to-port injection shall be continued until each joint has been injected for its entire length.

D. Before processing, the space in the vicinity of a crack location receiving epoxy shall have been swept and left in a generally clean condition. All joints receiving epoxy under this section shall be cleaned free from dirt, laitance, and other loose matter.

E. Pump unit used for injection shall be a positive displacement type with interlock to provide an in-line mixing and metering system for the two component epoxy. The pressure hoses and injection nozzle shall be of such a design as to allow proper mixing of the two components of epoxy. The presence of a standby injection unit may be required.

F. For small amounts, or where excessive grout pressure developed by a pump unit might further damage the structure, premixed material and a hand caulking gun may be used if acceptable to the OWNER.

G. Seal all ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out. Any condition other than normal shall be reported to the OWNER. Solvents may not be used to thin the epoxy system introduced into the cracks or joints. All work under this Specification shall be performed and conducted in a neat orderly manner.

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 21 00 – REINFORCING STEEL

PART 1 GENERAL

1.01 Section Includes

A. This section includes a description of how the General Construction CONTRACTOR (CONTRACTOR) shall proceed to furnish all material, equipment, labor, services, etc., to provide steel reinforcing bars for concrete reinforcement.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 03 40 00 – PRECAST CONCRETE

1.03 Cited Standards

A. All reinforcing steel shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ACI 315 – Details and Detailing of Concrete Reinforcement

2. ACI 318 – Building Code Requirements for Structural Concrete

3. ASTM A82 / A82M - 07 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

4. ASTM A185 / A185M - 07 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

5. ASTM A370 - Test Methods and Definitions for Mechanical Testing of Steel Products

1.04 Noted Restrictions – none

1.05 Quality Control

A. The CONTRACTOR shall receive approval from the ENGINEER prior to movement or rearrangement of reinforcement bars if any adjustments need to be made in order to avoid interference with other embedded items.

1.06 Submittals

A. The CONTRACTOR shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown on the plans and as specified. Calculated weights of the bars shall be as specified in ACI 318. Detailing of the reinforcing steel shall be in accordance with ACI 315.

B. Product Data

1. The CONTRACTOR shall submit the Manufacturer's product data for reinforcement materials and accessories.

C. Certificates

1. The CONTRACTOR shall also submit a certificate of compliance stating that the grades and properties of the reinforcing steel are in conformance with ASTM A370, and any other applicable ASTM Standards.

1.07 Delivery and Storage

A. Reinforcing bars shall be delivered in bundles limited to one size and length of bar, securely tied and identified with plastic tags including the mill, heat number, and grade and size of the bars. The bars shall be placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants that could cause an impaired bond with concrete.

PART 2 PRODUCTS

2.01 Reinforcement Bars

A. Reinforcing bars shall conform to the requirements of the "Standard Specifications for Deformed Billet Steel Bars for Concrete Reinforcement" (ANSI/ ASTM A6l5). Reinforcing bars shall be Grade 60.

B. Bars shall be delivered bundled and tagged with identifying tags, and shall be of new material, of the quality specified, free from excessive rust or scale or any defects affecting its usefulness.

C. Bars shall be cut and bent in accordance with the provisions of ACI 315 and ACI 318. All bars shall be bent cold. Bars shall be free from defects and kinks and from bends not indicated on the DRAWINGS. Reinforcing bars shall be welded where indicated on the DRAWINGS or acceptable to the OWNER. Welding shall be performed in accordance with AWS D1.4 "Structural Welding Code-Reinforcing Steel.

2.02 Fabrication

A. Reinforcement shall be accurately formed to the dimensions indicated on the DRAWINGS. All bars shall be bent cold. Diameter of bend measured on inside of bar, other than for stirrups and ties in sizes No. 3 through No. 5, shall not be less than specified in Table 3E-1. Inside diameter of bends for stirrups and ties shall not be less than 4 bar diameters for No. 5 bar and smaller. For bars larger than No. 5, diameter of bend shall comply with Table 3E-1.

Table 3E-1 – Min. Diameters Of Bend	
Bar Size	**Minimum Diameter**
Nos. 3 through 8	6 Bar Diameters
Nos. 9, 10, and 11	8 Bar Diameters
Nos. 14 and 18	10 Bar Diameters

B. Metal reinforcement shall not be straightened or re-bent in a manner that will injure the material. Bars with kinks, or bends not shown on the DRAWINGS, shall not be used. Heating of the reinforcement or welding to the reinforcement shall not be permitted.

2.03 Bar Supports

A. Bar supports shall be hot-dip galvanized steel, shall conform to ACI 315, and shall be furnished in sufficient number to prevent sagging and to support loads during construction. Bar supports, where used in slabs which will be exposed to view, shall be equipped with plastic tips. Reinforcing for concrete placed on the ground shall be supported by standard manufactured chairs, with steel plates for resting on the ground. No use shall be made of brick, broken concrete masonry units, spalls, rocks, or similar material for supporting reinforcing steel.

B. The CONTRACTOR shall submit samples of all chairs he proposes to use along with a letter stating where each type chair will be used. No concrete shall be placed until this prior acceptance has been obtained.

2.04 Welded Wire Fabric

A. Welded wire fabric shall be in accordance with ASTM A185. All necessary wiring, spacing chairs, or supports shall be installed to keep the welded wire fabric in place while concrete is being placed. The welded wire fabric shall be bent as shown or required to fit the work. Welded wire fabric shall be rolled or otherwise straightened to make a perfectly flat sheet before placing in the Work. Welded wire fabric shall be lap spliced as indicated on the DRAWINGS. If the lap splice length is not indicated on the DRAWINGS, the welded wire fabric shall be spliced in accordance with ACI 318.

B. Welded wire fabric may be used in place of reinforcing bars if accepted by the OWNER. The welded wire fabric shall be furnished in flat sheet form. The cross-sectional area per linear foot of wire fabric shall be not less than the cross-sectional area per linear foot of reinforcing bars indicated on the DRAWINGS.

2.05 Spiral Reinforcement

A. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.

2.06 Accessories

A. The CONTRACTOR shall furnish and install all accessories including necessary chairs or bolsters, concrete blocks (dobies), tie wires, supports, spacers and other devices to position reinforcement during concrete placement.

B. Wire bar supports shall be made of plain cold-drawn steel wire with pre-molded, gray-colored, plastic tips to the legs of the support. The plastic shall have a thickness of 1/8” or greater at points of contact with formwork and extend upward on the wire a minimum of ½”. Wire sizes and geometric dimensions shall be made in accordance with Table II of the latest edition of CRSI Manual of Standard Practice.

C. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Where the concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.

D. The wire tie shall be 16-gauge or heavier, black annealed.

2.07 Mechanical Couplers

A. Mechanical couplers shall be provided where shown and where approved by the ENGINEER. The couplers shall develop a tensile strength which exceeds one hundred and fifty percent (150%) of the yield strength of the reinforcement bars being spliced at each splice.

PART 3 EXECUTION

3.01 Preparation – none

3.02 Installation (Placing Reinforcement)

A. Metal reinforcement shall be placed in accordance with ANSI/ACI 318, except as otherwise noted herein and accurately positioned in accordance with the information on the DRAWINGS. Protective concrete cover shall be as required in ANSI/ACI 318. Reinforcement shall be secured against displacement by using annealed iron wire-ties or suitable clips at intersections, and shall be supported by concrete or metal supports, spacers, or metal hangers.

B. Bars at lap splices shall be in contact with each other and the bars shall be fastened together with tie wire. When it is necessary to splice reinforcement at points other than shown on the DRAWINGS, the character of the splice shall be determined by the ENGINEER. The overlap in splices in reinforcing steel shall be as specified in accordance with ACI 318. Lap splices for masonry, shall be in accordance with the Uniform Building Code.

C. Bars shall be fastened securely in place with annealed steel wire ties. Bars shall be tied sufficiently often to prevent shifting. There shall be at least three ties in each bar length (does not apply to dowel laps or to bars shorter than 4 ft, unless necessary for rigidity). Slab bars shall be tied at every intersection around the periphery of the slab. Wall bars and slab bar intersections other than around the periphery shall be tied at not less than every fourth intersection, but at not greater than the following maximum spacings:

Maximum Spacing		
Bar No.	**Slab Bars, (in)**	**Wall Bars, (in)**
Bars No. 5 and smaller	60	48
Bars No. 6 through No. 9	96	60
Bars No. 10 and No. 11	120	96

Note: The above tying requirements do not apply to reinforcement for masonry.

D. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

E. Placing Tolerances shall be within the limits specified in ACI 318, except where in conflict with the requirements of The Building Code. Where reinforcement in beams or girders is placed in two (2) or more layers, the clear distance between layers shall be not less than 1”.

F. Bars may need to be moved to avoid interference with other reinforcement steel, conduits or embedded items. If bars are moved enough to exceed the above tolerances, the resulting arrangement of bars shall be as acceptable by the ENGINEER. Additional bars may be necessary to prevent cracking or provide additional reinforcement in this case and shall be provided by the CONTRACTOR at its own expense.

G. Metal reinforcement before being positioned, shall be free from loose mill and rust scale, and from coatings including ice that destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement shall be re-inspected and cleaned when necessary.

H. All laps of wire mesh shall be one width of wire spacing, and adjoining sheets

shall be securely tied together with No. 14 tie-wire, one tie for each 2 running feet. At laps, wires shall be staggered and tied in such a manner that they cannot slip.

I. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than three (3) feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

3.03 Testing – None

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 30 53 – MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 Section Includes

A. The General Construction CONTRACTOR shall furnish all material, equipment, labor, services, etc., to complete and install all cast-in-place concrete work as specified in this section.

1.02 Referenced Sections

A. Related Sections are listed below.

1. 03 05 00 Common Work Results for Concrete

1.03 Cited Standards

A. All cast-in-place concrete shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ACI 301 - Specifications for Structural Concrete for Buildings

2. ACI 318 - Building Code Requirements for Reinforced Concrete

3. ACI 350R - Environmental Engineering Concrete Structures

4. ACI SP-15 - Field Reference Manual. A copy of this publication must be kept in the field office at all times during concrete construction.

5. ASTM C94 / C94M - 09a Standard Specification for Ready-Mixed Concrete

6. CRSI - Manual of Standard Practice

1.04 Noted Restrictions – none

1.05 Quality Control

A. All work shall be performed to secure for the entire job homogeneous concrete having required strength, durability, and weathering resistance, without planes of weakness and other structural defects and free of pronounced honeycombs, air pockets, voids, projections, offsets of plane, and other defacements on exposed surfaces.

B. The concrete to be used in this project shall be ready-mixed concrete in conformity with ANSI/ASTM C94 except as revised or amended hereinafter or with approval of the ENGINEER.

C. The sizes of coarse aggregate for the type of concrete being used in this work shall be Class B, ASTM Size 67.

1.06 Submittals

A. Shop DRAWINGS for reinforcing steel and accessories shall be prepared in accordance with "Details and Detailing of Concrete Reinforcement," ACI 315.

B. Manufacturer's Data

1. For information only and as requested by the ENGINEER, submit two (2) copies of manufacturer's data with application and installation instructions for all proprietary materials.

C. Substitutions

1. Any request for product substitution must be submitted for review, with all necessary documentation, prior to time of bid. No requests for substitutions will be considered after bid has been received.

1.07 Storage of Materials

A. Cement and aggregates shall be stored in such a manner as to prevent deterioration of or contamination with foreign matter.

B. Fine and coarse aggregate shall be stored separately and in such a manner as to avoid segregation. Cement, which has become caked, partially set, or otherwise deteriorated, or any material, which has become damaged or contaminated, shall be rejected for use.

PART 2 PRODUCTS

2.01 Concrete

A. Concrete shall be of four classes, herein referred to as Classes AA, A, C, and CE which shall be as specified herein and which shall be used where specified or indicated on the DRAWINGS.

B. These classes of concrete shall have a minimum weight of 140 pounds per cubic foot. Class C concrete may be used for fill for unauthorized excavation, for thrust blocks and ground anchors for piping, for bedding of pipe, and where indicated on the DRAWINGS.

C. Class CE shall be used for electrical conduit encasements.

D. All other concrete, unless specified or otherwise indicated on the DRAWINGS, shall be Class A concrete.

CONCRETE WITHOUT AIR ENTRAINMENT				
Class	**Specified Compressive Strength f'c at 28 Days (psi)**	**Max Net W/C Ratio by Weight**	**Min. Cement per yd^3 of Concrete (lbs)**	**Slump Range (In)**
A	4,000	0.45	564	2 to 4*
C	2,800	0.59	423	3 to 6

*Note: Slump for slabs, decks, walks, and beams shall be no more than 3 ½ in.

E. Concrete that is pumped shall meet all the requirements of these Specifications. Concrete with a slump outside the limits indicated in the above Table shall not be placed.

F. Classes A and C, concrete shall be made with Type V, Low Alkali Portland cement. Type I or Type II cement may be used if soil sulfate levels, as determined by a geotechnical ENGINEER, are sufficiently low. A document, signed by a licensed geotechnical ENGINEER stating that Type I or Type II cement may be used, shall accompany each mix design where the use Type I or Type II is proposed.

G. Fly ash (Alternate, if used)

1. Fly ash/pozzolan shall conform to ASTM C 618 and the following supplementary requirements:

a. Class C Fly Ash

Loss on ignition, maximum	1%
SO3 content, maximum	4%
Moisture content, maximum	1%
R = (CaO - 5%)/(Fe_2O_3), maximum	4.5

Class C Fly Ash, as a percent by weight of total cementitious material, shall not exceed 30%

b. Class F Fly Ash

Loss on ignition, maximum	1%
SO3 content, maximum	3%
Moisture content, maximum	1%
R = (CaO - 5%)/(Fe_2O_3), maximum	1.5

Class F Fly Ash, as a percent by weight of total cementitious material, shall not exceed 20%

H. All admixtures shall be approved by the OWNER and shall be added to the concrete in strict accordance with the recommendation of the manufacturer.

I. Water used in mixing and curing concrete shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, organic matter or other deleterious substances. Water shall be approved for human consumption.

J. Concrete aggregate shall conform to the "Specifications For Concrete Aggregate", ANSI/ASTM C33, except as revised. Aggregate shall be certified by an independent commercial testing laboratory to show compliance with the above-mentioned specifications.

2.02 Aggregates

A. All concrete aggregates shall be sound, uniformly graded, and free of deleterious material in excess of the allowable amounts specified.

B. Aggregate shall be sampled and graded in accordance with ASTM D 75 and C 136. Sieves for testing grading of aggregates shall have square openings.

C. If either fine or coarse aggregate is to be batched from more than one bin, analyses shall be furnished for each bin, and a composite analysis made up from these, using the proportions of materials to be used in the mix.

D. The unit weight of fine and coarse aggregate shall be of a unit weight which will produce in place concrete with a weight of not less than 140 lbs / ft^3.

E. Fine Aggregates

1. Only clean, natural sand shall be used. Artificial or manufactured sand will not be acceptable. The grading of the fine aggregate shall be as shown in the table below:

Sieve Designations	Percent Passing
3/8 in.	100
No. 4	95-100
No. 8	80-90
No. 16	50-75
No. 30	30-50
No. 50	10-20
No. 100	2-5

2. Deleterious substances shall not be present in excess of the following percentages by weight of contaminating substances. In no case shall the total exceed 3 percent.

Material	Test Method	Percent
Removed by decantation (dirt, silt, etc.)	ASTM C 1173	3
Shale or chert	ASTM C 2951	1
Clay Lumps	ASTM C 142	1

3. Fine aggregate shall not contain strong alkali or organic matter which gives a color darker than the standard color when tested in accordance with ASTM C 40. Fine aggregate shall be graded in accordance with the requirements of ASTM C 33, and its soundness shall comply with the requirements of ASTM C 33 when tested in accordance with ASTM C 88. Aggregate shall comply with the reactivity requirements contained in ASTM C 33 when tested in accordance with ASTM C-289.

F. Coarse Aggregate

1. Coarse aggregate shall consist of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances. Thin or elongated pieces having a length greater than five times the average thickness shall not exceed 15% by weight.

2. Coarse aggregate shall consist of crushed stone or crushed gravel conforming to the following limits:

a. Sodium sulfate test - 10% max loss

b. L. A. abrasion test - 35% max loss

c. Crushed particles (gravel) - 45% min loss

G. The sizes of coarse aggregate for the type of concrete being used in this work shall be Class B, ASTM Size 67.

1. Deleterious substances shall not be present in excess of the following percentages by weight, and in no case shall the total of all deleterious substances exceed 2 percent:

Material	Test Method	Percent
Shale or chert	ASTM C 295	1
Coal and lignite	ASTM C 123	1/4
Clay lumps and friable particles	ASTM C 142	1/4
Materials finer than No. 200 sieve	ASTM C 117	1/2*

*Except that when material finer than No. 200 sieve consists of crusher dust, the maximum amount shall be 1 percent.

2. The coarse aggregate shall conform to the following limits:

   a. Sodium sulfate test - 10% max loss

   b. L. A. abrasion test - 35% max loss

   c. Crushed particles (gravel) - 45% min loss

3. Except as otherwise specified or authorized in writing by the OWNER, coarse aggregate shall be graded as specified in ASTM C 33. Coarse aggregate for Class CE concrete for encasement of electrical conduits shall be graded as specified in ASTM C 33, Size No. 8. Concrete utilizing this aggregate will be equal to Class C concrete in all other respects, and will be designated as Class CE.

4. The gradations required for the coarse aggregate are 8 to 18 percent for the top size aggregates and 8 to 22 percent for smaller top size aggregates retained on each sieve.

2.03 Water

A. Water for concrete, washing aggregate, and curing concrete shall be clean and free from oil and deleterious amounts of alkali, acid, organic matter, or other substances. Water shall not contain the following:

   1. More than 1,000 mg/l liter of chlorides calculated as chloride ion

   2. More than 1,000 mg/l liter of sulfates calculated as sulfate ion for conventional reinforced concrete

B. Water for pre-stressed or post-tensioned concrete shall not contain the following:

   1. more than 650 mg/l of chlorides calculated as chloride ion

   2. more than 800 mg/l of sulfates calculated as sulfate ion.

2.04 Portland Cement

A. All Portland cement shall conform to ASTM C 150, Types V, Low Alkali. Low alkali Portland cement shall contain no more than 0.6 percent total alkali. The word "alkali" shall be taken to mean the sum of sodium oxide and potassium oxide calculated as sodium oxide. The determination for total alkali shall be made by the method set forth in ASTM C 114. Only one brand of Portland cement shall be used for exposed concrete in any individual structure.

2.05 Admixtures

A. Admixtures of any type, except as otherwise specified, shall not be used unless written authorization has been obtained from the OWNER.

B. Admixtures shall be used in accordance with the admixture manufacturer's recommendations and shall be added separately to the concrete mix. The admixture shall conform to ASTM C494, Type A, and not contain more chloride ions than are present in municipal drinking water.

C. Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.

D. Written conformance to the above-mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the OWNER or the ENGINEER.

2.06 Concrete Mixes

A. All mixes shall be approved by the OWNER or the ENGINEER prior to use on the job. No deviations from the approved mixes shall be permitted without prior approval from the OWNER or the ENGINEER.

B. Where the concrete production facility can establish the uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a basis for determining mix design proportions shall exceed the specified design strength by the requirements of ACI 318, Section 4.3 or ACI 301, Section 3.9.

C. When a concrete production facility does not have field test records for calculation of standard deviation, the required average strength shall be at least 1200 psi greater than the specified design strength.

D. The CONTRACTOR shall submit the mix design accompanied by complete standard deviation analysis or trial mixture test data.

E. Concrete mixes shall be designed and proportioned in such a manner that required minimum ultimate strength, compressive strength, minimum shrinkage and optimum workability will be obtained. The concrete shall be of such consistency and composition that it can be worked readily into all corners and angles of the forms and around reinforcement or other objects without permitting materials to segregate or free water to collect on the surface.

F. Concrete for engine foundations shall contain polypropylene fibers (fibermesh or approved equal). The application rate, mixing procedures, finishing, etc., shall be per the manufacturer’s written instructions.

G. All concrete used for the encasement of electrical ducts, conduits, etc. shall be colored red by mixing into each cubic yard of concrete 10 pounds of red oxide No. 1117 as manufactured by the Frank D. Davis Company; equivalent product by I. Reiss Company, Inc.; or equal.

PART 3 EXECUTION

3.01 Preparation

A. Submit information on mixing equipment. Mixers may be of the stationary plant, paver, or truck mixer type. Adequate equipment and facilities shall be provided for accurate measurement and control of all materials and for readily changing the proportions of the material.

B. The mixing equipment shall be capable of combining the aggregates, cement, and water within the specified time into a thoroughly mixed and uniform mass and of discharging the mixture without segregation.

3.02 Mixing Concrete

A. The concrete shall be mixed in a batch mixer until there is a uniform cement and aggregate shall be proportioned by weight distribution of the materials, and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at the speed recommended by the manufacturer and mixing shall be continued as follows for various sizes of mixers:

1. 1/2 cubic yd mixer or smaller at 1-1/4 minutes
2. 3/4 to 1-1/4 cubic yd mixer at 1-1/2 minutes
3. Larger than 1-1/4 cubic yd mixer at 2 minutes
4. For each additional cu yd over 2 cu yd add 1/4 minutes

B. The ready-mixed concrete shall be mixed and delivered in accordance with the requirements of "Standard Specifications For Ready-Mixed Concrete" ANSI/ASTM C-94 or as modified by these specifications. During a continuous pour, the interval between loads shall not be greater than 20 minutes, or in any case be so great as to allow the concrete in place to become partially hardened. Water used to flush the mixer or agitator between loads shall not be allowed to become a part of any concrete in the work.

C. The batch plant shall be capable of controlling the delivery of all material to within 1 percent by weight of the individual material. If bulk cement is used, it shall be weighed on a separate visible scale which will accurately register the scale load at any stage of the weighing operation from zero to full capacity.

D. Cement shall not come in contact with aggregate or with water until the materials are in the mixer ready for complete mixing with all mixing water. The procedure of mixing cement with sand or with sand and coarse aggregate for delivery to the jobsite for final mixing and addition of mixing water will not be permitted. Retempering of concrete will not be permitted. The entire batch shall be discharged before recharging. The volume of the mixed material per batch shall not exceed the manufacturer's rated capacity of the mixer.

E. Each batch mixer shall be equipped with a device for accurately measuring and indicating the quantity of water entering the concrete, and the operating mechanism shall be such that leakage will not occur when the valves are closed. Each mixer shall be equipped with a device for automatically measuring, indicating, and controlling the time required for mixing. This device shall be interlocked to prevent the discharge of concrete from the mixer before the expiration of the mixing period.

F. Transit-mixed concrete shall be mixed and delivered in accordance with ASTM C 94. The total elapsed time between the addition of water at the batch plant and discharging the completed mix shall not exceed 90 minutes or shall the elapsed time at the jobsite exceed 30 minutes. Under conditions contributing to quick setting, the total elapsed time permitted may be reduced by the OWNER. Each truck mixer shall be equipped with a device for counting the number of revolutions of the drum which device shall be interlocked so as to prevent the discharge of concrete from the drum before the required number of turns. After the drum is once started, it shall be revolved continuously until it has completely discharged its batch. Water shall not be admitted to the mix until the drum has started revolving. The right is reserved to increase the required minimum number of revolutions or to decrease the designated maximum number of revolutions allowed, if necessary, to obtain satisfactory mixing, and the CONTRACTOR will not be entitled to additional compensation because of such increase or decrease.

G. When the temperature is below 40°F, adequate equipment shall be provided for heating the component materials of the concrete so that the concrete being deposited can be maintained at a temperature of 50°F minimum to 90°F maximum. When the air temperature is above 90°F, the temperature of the concrete being deposited shall not exceed 90°F, and adequate means of cooling the concrete mix shall be provided.

H. Truck mixers shall be revolving-drum type and shall be equipped with a mixing water tank. Only the prescribed amount of mixing water shall be placed in the tank for any one batch, unless the tank is equipped with an approved device by which the amount of water added to each batch can be readily verified by the ENGINEER.

I. Delivery tickets shall be prepared for each load of ready-mixed concrete delivered. In the event a laboratory representative is designated to inspect the batching operation, he shall prepare the ticket. In the event no laboratory representative is required for the project, the batch plant operator shall prepare the ticket. The drivers of the trucks shall deliver the tickets to the ENGINEER at the site at the time of delivery. The tickets shall contain the following information:

1. Number of yards delivered on this truck.
2. Quantities of materials in the batch.
3. The time at which the truck left the batching plant.
4. The time at which the cement was added.
5. The outdoor temperature in the shade.
6. The numerical sequence of the delivery.
7. The Date.

J. Hand mixed concrete shall be prepared on a watertight level platform in batches of not to exceed 1/3 cubic yard each. The required amount of coarse aggregate shall first be spread on the platform in an even and uniform layer, over which the proper proportion of fine aggregate shall then be likewise spread. The combined depth of both such layers shall not be greater than 1 foot. The required quantity of cement shall then be evenly distributed over the fine aggregate; following which the entire batch shall be turned with shovels at least twice before the water is added. The proper amount of water shall then be uniformly sprinkled or sprayed over the batch which shall thereafter be turned with shovels not less than three times before being removed from the platform.

3.03 Placing Concrete

A. The CONTRACTOR shall submit a proposed sequence of placing concrete showing proposed beginning and ending of individual placements. After acceptance, this sequence shall be adhered to except when specific changes are requested by the CONTRACTOR and accepted by the OWNER.

B. The CONTRACTOR shall notify the OWNER by written memorandum of his readiness (not just his intention) to place concrete in any portion of the work. This notification shall be such time in advance of the operation as the OWNER deems necessary for him to make final inspection of the preparations at the location of the proposed concrete placing. All forms, steel, screeds, anchors,

ties, and inserts shall be in place before the CONTRACTOR'S notification of readiness is given to the OWNER.

C. Placing of the concrete shall be done in accordance with ANSI/ACI 304, "Recommended Practice for Measuring, Mixing, and Placing Concrete".

D. Placement of concrete in which initial set has occurred or of retempered concrete will not be permitted.

E. Before depositing concrete all debris shall be removed from the space to be occupied by the concrete. Forms, if constructed of lumber, shall be thoroughly wetted, except in freezing weather. Reinforcement, pipe sleeves and other materials to be embedded in the concrete shall be thoroughly secured in position. Water shall be removed from the space to be occupied by the concrete before concrete is deposited.

F. Concrete shall be handled from the transporting vehicle in such a way as to prevent the separation or loss of the ingredients. Under no circumstances shall concrete that has partially hardened be deposited in the work. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid re-handling. It shall be so deposited as to maintain, until the completion of the unit, a plastic surface approximately horizontal.

G. Where concrete is conveyed to chutes, the equipment shall be of such size and design as to insure a continuous flow in the chute. The chutes shall be of metal, or metal-lined, and if two or more lengths are used, they shall have approximately the same slope. The slope shall not be less than 1 vertical to 2 horizontal and shall be such as to prevent the segregation of the ingredients. The discharge end of the chute shall be provided with a baffle plate to prevent segregation. If the distance of the discharge end of the chute above the surface of the concrete is more than 3 times the thickness of the layer being deposited, or more than 4 ft above the surface of the concrete, a spout or "elephant trunk" shall be used and the lower end maintained as near to the surface of deposit as practicable. When the operation is intermittent, the chute shall discharge into a hopper. The chute shall be thoroughly cleaned before and after each run and the debris from any water used shall be discharged outside the forms.

H. Concrete shall be deposited at or near its final position to avoid segregation caused by rehandling or flowing. Concrete shall not be deposited in large quantities in one place and worked along the forms with the vibrator or otherwise. No concrete shall be dropped freely into place from a greater height than 5 feet. Tremies shall be used for placing concrete where the drop is over 5 feet. Placement of concrete on slopes shall commence at the bottom of the slope.

I. If more than 20 minutes lapse prior to placement of new concrete over concrete previously placed, the depth of the layers being placed at one time shall be reduced, and/or placing equipment increased, until it is possible to return with the placing operation to previously placed concrete within 20 minutes. If concrete is to be placed over previously placed concrete and more than 20 minutes have elapsed, then a layer of grout not less than 1/2 inch thick nor more than 1 inch in thickness shall be spread over the surface before placing the additional concrete.

J. Concrete shall be placed in approximately horizontal layers not to exceed 24 inches in depth and shall be brought up evenly in all parts of the forms. Concrete placement shall continue without avoidable interruption, in a continuous operation, until the end of the placement is reached.

K. The placement of concrete for slabs, beams, or walkways cast monolithically with walls or columns shall not commence until the concrete in the walls or columns has been allowed to set and shrink. The time allowed for shrinkage shall be not less than one hour.

L. Before depositing new concrete on or against concrete which has hardened and to which it is to bond, the forms shall be re-tightened. The surface of the hardened concrete shall be roughened in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance, and saturated with water.

M. Consolidating Concrete

1. Concrete during and immediately after depositing shall be thoroughly compacted by means of vibration.

2. The number of vibrators used shall at all times be subject to the approval of the OWNER. Sufficient vibrators shall be on hand at all times to vibrate the concrete as placed. In addition to the vibrators in actual use while concrete is being placed, the CONTRACTOR shall have on hand one spare vibrator in serviceable condition. No concrete shall be placed until it has been ascertained that all vibrating equipment, including spares, is in serviceable condition

3. The concrete shall be thoroughly worked around the reinforcement, and around embedded fixtures, and into the corners of the forms. The vibration shall be sufficiently intense to cause the concrete to flow and settle readily into place and to visibly affect the concrete over a radius of at least 18 inches. Attention is directed to the fact that manhole bottoms, pipe cradle and encasement, and similar concrete work are required to be thoroughly vibrated.

4. Special care shall be taken to place the concrete solidly against the forms so as to leave no voids. Every precaution shall be taken to make all concrete solid, compact, and smooth, and if for any reason the surfaces or interiors have voids or are in any way defective, such concrete shall be repaired in a manner acceptable to the OWNER.

N. The accumulation of water on the surface of the concrete due to water gain, segregation, or other causes, during placement and compacting, shall be prevented as far as possible by adjustments in the mixture. Provision shall be made for the removal of such accumulated water so that under no circumstances will concrete be placed in such accumulation.

O. To minimize the formation of laitance, great care shall be exercised to disturb the concrete as little as possible while it is being deposited. Upon completion of a section of concrete, all laitance shall be entirely removed before work is resumed. The CONTRACTOR shall submit to the OWNER, prior to start of work, the details of procedures he proposes to minimize and control the development of shrinkage cracks.

3.04 Placing Concrete in Extreme Weather Conditions

A. Concrete shall be placed in hot weather in accordance with "Hot Weather Concreting" (ACI 305) latest revision, except as modified or revised by these specifications.

B. The CONTRACTOR shall submit information on the type of equipment to be used for heating materials and/or new concrete in the process of curing during excessively cold weather.

C. For concrete placed below an ambient air temperature of 40°F, or 45°F and falling, provision shall be made for heating the water. If materials have been exposed to freezing temperatures to the degree that any material is below 35°F, the material shall be heated. Water, cement, or aggregate materials shall not be heated in excess of 160°F. Concrete in the forms shall be protected by means of covering with tarpaulins, or other acceptable covering, and a means shall be provided for circulating warm moist air around the forms to maintain a temperature of 50°F for at least five days.

D. For conditions which promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind, the CONTRACTOR shall take corrective measures to minimize the rapid water loss from the concrete. The CONTRACTOR shall submit the corrective measures he plans to use prior to placing concrete.

E. The CONTRACTOR shall provide and use a sufficient number of maximum and minimum self-recording thermometers to adequately indicate the temperature around the concrete.

3.05 Footings and Slabs on Grade

A. Concrete to be placed on ground or compacted fill shall not be placed until the subgrade is in a moist condition acceptable to the OWNER. If necessary, the subgrade shall be well sprinkled with water not less than 6 nor more than 20 hours in advance of placing concrete. If it becomes dry prior to the actual placing of concrete, it shall be sprinkled again, without forming pools of water. No concrete shall be placed if the subgrade is muddy or soft.

3.06 Repair of Defects

A. If after stripping of forms any concrete is found to be not formed as shown on the DRAWINGS, out of alignment or not level, or shows a defective surface, it shall be considered as not conforming with the intent of these specifications and shall be removed and replaced by the CONTRACTOR at his expense unless the OWNER grants permission to patch the defective area, in which case patching shall be done as hereinafter described.

B. No defective work shall be patched, repaired, or covered without inspection by the OWNER. Repair shall have strength equal or greater than the specified concrete for the area. The CONTRACTOR shall submit a mix design for the grout which is proposed for use. All imperfections in the work shall be chipped out and keyed ready for repair.

C. Defects that require replacement or repair are those that consist of honeycomb, damage due to stripping forms, loose pieces of concrete, surface holes caused by bolts and ties, excessive ridges at form joints and bulges due to movement of the forms. Ridges and bulges shall be removed by chipping, tooling or grinding on finished surfaces. Honeycomb and other defective concrete shall be chipped out, and the chipped openings having sharp edges shaped so that the mortar filling will be keyed in place. All holes shall be kept thoroughly moistened for several hours before mortar filling is placed. The area to be patched shall be filled with the specified repair material.

D. Imperfections, bolt and tie-rod holes, and chipped-out honeycomb areas to be repaired shall be filled with dry-patching mortar composed of 1 part of Portland cement to 2 parts of regular concrete sand (volume measurement) and just enough water so that after the ingredients are mixed thoroughly the mortar will stick together on being molded into a ball by slight pressure of the hands, and will not exude free water.

E. The CONTRACTOR shall take care in filling rod and bolt-holes so that the

entire depth of the hole is completely filled with compacted mortar. "EMBECO", Five Star, or equal, shall be added to all patching mortar in an amount as recommended by the manufacturer for the mix to be used except for unpainted, exposed surfaces, or surfaces which are specified to be waterproofed or damp-proofed with a chemical-type protective coating. For surfaces on which the chemical-type protective coatings are specified, only materials recommended by the coating manufacturer shall be used for repairs.

F. The mortar method of replacement shall be used for holes too wide to dry pack and too shallow for concrete replacement and shall be used for comparatively shallow depressions, large or small, which extend no deeper than the reinforcement nearest the surface. Mortar repairs shall be placed in thin layers and thoroughly compacted by suitable tools.

G. Materials for exposed surfaces not requiring painting or waterproofing shall not cause discoloration of the proposed patch or the surrounding concrete surfaces. All honeycomb areas, bolt-holes and other imperfections shall be repaired with Master Builders, Cleveland, OH, "Set 45" or U.S. Grout Corporation, Old Greenwich, CT, Five Star structural concrete, or an approved equal which shall be installed according to the manufacturer's recommendations.

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 35 00 – CONCRETE FINISHING

PART 1 GENERAL

1.01 Section Includes

A. This section shall describe how the CONTRACTOR shall perform work in regard to concrete finishing.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. The well site concrete slab shall be trowel finished smooth. The rest of the pad and all other concrete structures shall have a final brush finish on exposed surfaces.

B. All concrete surfaces shall be finished by experienced finishers, as specified, as soon after placing the concrete as conditions will permit. The placing of concrete and the removal of forms shall be scheduled so that finishing the surfaces can be completed before the concrete reaches a final hard set. No cement plaster or cement brush-coats will be acceptable.

C. Unformed concrete surfaces shall be struck off to established grade and floated with a wood float until all irregularities are removed. Where required the surface shall then be troweled either with a wood trowel or a steel trowel, depending on the finish requirement of the area to be troweled, until a smooth dense finish is obtained. Troweling of the floated surface shall not be done until all excess water has evaporated.

PART 2 PRODUCTS

2.01 Sealer

A. Where specified, the sealer shall be Conspec #1, or Thomson's Water Seal 201 applied at a rate of 300 square feet per gallon for each coat.

PART 3 EXECUTION

3.01 Preparation

3.02 Installation

A. Concrete surfaces shall be finished as indicated on the DRAWINGS. Where not specified or indicated on the DRAWINGS, the surfaces shall be finished as follows:

B. Concrete surfaces which are specified or indicated to be painted, and all concrete surfaces, interior or exterior, exposed to view shall have fins removed and joints ground smooth, and shall be "sacked" with cement mortar so that all pits and holes are filled. Surfaces in open channels, basins, and similar structures, which are normally below the water surface shall have fins removed, but need not have joints ground. However, surfaces in such locations which are above the normal water surface and exposed to view shall have fins removed and joints ground smooth, and shall be "sacked" with cement mortar so that all pits and holes are filled. Concrete surfaces in closed boxes or channels where there is normally no access or passageway shall have the fins removed. All form ties shall be removed from all surfaces, and holes shall be filled after being cleaned and roughened by heavy sandblasting.

C. The following surfaces (as applicable) shall be troweled, then given a light hairbroom finish:

1. Exterior walkways

2. Tops of exterior walls or beams which are to serve as walkways

3. Tops of exterior walls or beams which are to support grating

D. The following surfaces (as applicable) shall be screened off to grade and left rough:

1. Projecting footings which are to be covered with dirt

2. Slab surfaces which are to be covered with concrete fill or equipment pads

E. The following surfaces (as applicable) shall receive a smooth steel trowel finish:

1. Tops of corbels, walls and beams not covered above

2. Tops of all slabs not covered above herein

3. All other surfaces not specified to be finished otherwise

F. The final steel trowel finish shall be uniformly smooth and free of all irregularities. Building and machine room floors which are not to be covered with surfacing material shall be free from trowel marks. Trowel marks will be permitted in other locations. Concrete floor surfaces to which a surfacing material is to be applied shall be finished level and smooth with a tolerance of not over 1/8 inch in 10 feet in any direction.

3.03 Concrete Sealer

A. The following floors and slabs shall be sealed:

1. All exterior slabs.

2. See **Section 09 06 00** for requirements for epoxy slab coatings per plan.

3. Sealant shall be applied to any and all other floor slabs, except those to receive a seamless floor surfacing or any slab which will receive epoxy surfacing.

B. Sealant shall be applied at a coverage not to exceed 300 square feet per gallon and shall be applied as soon as the slab or floor will bear weight. The entire surface to be sealed shall be swept clean with a very soft bristled brush which will not mark the finish. The sealer shall then be applied with a large, clean, sheepskin mop type applicator. Paint rollers are not acceptable. Workmen shall wear flat soled shoes which will not mark or scar the surface.

C. Apply two (2) coats of concrete sealer on top surfaces of the concrete floor. Sealer shall be clear of color and non-staining. The sealer shall be Conspec #1, or Thomson's Water Seal 201 applied at a rate of 300 square feet per gallon for each coat.

D. No traffic shall be allowed on floors and slabs until sealer has dried and hardened.

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 39 00 – CONCRETE CURING

PART 1 GENERAL

1.01 Section Includes

A. This section shall describe how the CONTRACTOR shall perform work in regard to concrete curing.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Protection against loss of moisture from the surface of the concrete shall be accomplished by the following:

1. Keeping the surface cured for a minimum period of 7 days.

2. Keeping the surface in contact with the form.

3. Covering with burlap or cotton mats kept continuously wet and covered with polyethylene plastic.

4. Continuously sprinkling the exposed surfaces.

5. Applying a curing and sealing compound as specified herein.

PART 2 PRODUCTS

2.01 Curing and Sealing Compound

A. Clear Curing and Sealing Compound (VOC compliant) shall comply with ASTM C309, Type 1D. The compound shall have 30 percent solids content minimum, and will not yellow under ultraviolet light after 500 hours of test and will have test data from an independent testing laboratory indicating a maximum moisture loss of 0.040 grams per sq cm when applied at a coverage rate of 300 sq ft per gallon.

B. Compound shall be "Super Aqua Cure VOX" or "Super Diamond Clear VOX" by The Euclid Chemical Co. or an equal approved by the OWNER or ENGINEER.

C. No curing compounds shall be used on any surfaces to which pneumatic mortar is to be applied, or on which any other type of concrete mortar or chemical waterproofing coating is to be used. They may be used in other

places, however, upon the approval of the compound and its location by the OWNER.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. All concrete shall be cured by the methods specified herein for a minimum of seven days.

B. All concrete that is to be painted shall be water or plastic membrane cured. No curing compound shall be used on any concrete surface that is to receive paint or upon which any material is to be bonded. All other concrete shall be cured by water curing or sprayed curing membrane at the CONTRACTOR'S option, except floors and slabs which are specified to be sealed with a concrete sealer. Floor slabs may be cured using a plastic film membrane curing.

C. Water Curing

1. All surfaces of concrete being water cured shall be kept constantly and visibly moist day and night for a period of not less than seven days and nights. Each day the forms remain in place may count as one day of water curing. No further curing credit will be allowed for forms in place after contact has once been broken between the concrete surface and the forms. Ties shall not be loosened during the period when concrete is being cured by leaving the forms in place. The top of walls shall be flooded with water at least three times per day, and the concrete surface shall be kept moist at all times during the seven day curing period.

D. Sprayed Membrane Curing

1. The curing compound shall be applied to the concrete surface after repairing and patching, and within one hour after the forms are removed. If more than one hour elapses after the removal of the forms, membrane compound shall not be used and water curing shall be applied for the full curing period. If the surface requires repairing or painting, the concrete shall be water cured.

2. Curing compound shall not be removed from the concrete in less than seven days. Curing compound may be removed by the CONTRACTOR only upon written request by the CONTRACTOR and acceptance by the OWNER, stating what measures the CONTRACTOR shall take to adequately cure the structure.

3. Care shall be taken to apply curing compound in the area of the constructions joints to see that curing compound is placed within the construction joint silhouette. The curing compound placed within the construction joint silhouette shall be removed by heavy sandblasting prior to placing any new concrete. The CONTRACTOR has the option of water curing the construction joint.

4. Curing compound shall be applied by a mechanical, power operated sprayer and mechanical agitator that will uniformly mix all pigment and compound. The compound shall be applied in at least two coats. Each coat shall be applied in a direction opposite to the preceding coat.

5. The compound shall be applied in sufficient quantity so that the surface will have a uniform appearance and will effectively and completely conceal all natural color of the concrete at the time of the spraying. The CONTRACTOR shall continue to coat and recoat the surface until the specified coverage is achieved and until a coating film remains on the surface of the concrete. The thickness and coverage of the compound shall be such that the film can be scraped from the surface at any and all points after drying for at least 24 hours.

6. The CONTRACTOR is cautioned that the method of applying curing compound specified herein may require more compound than normally suggested by the manufacturer of the compound and also more than is customary in the trade.

7. If the CONTRACTOR desires to use a curing compound other than the specified compound, the CONTRACTOR shall coat sample areas of concrete wall with the proposed compound and also a similar adjacent area with the specified compound in the specified manner for comparison. Complete data on the proposed compound shall also be submitted for review. If the proposed sample is not equal or better, in the opinion of the OWNER, in all features, the proposed substitution will not be allowed.

8. Prior to final acceptance of the work, the CONTRACTOR shall remove, by sandblasting or other acceptable method, any curing compound on surfaces that will be exposed to view, so that only the natural color of the finished concrete will be visible uniformly over the entire surface.

9. When concrete slab placements are subject to high temperatures, wind and/or low humidity, the OWNER or the ENGINEER may require the use of the evaporation retarder to minimize plastic cracking. The

compound may be required to be applied one or more times during the finishing operation.

10. At air temperatures of 90°F or above, concrete shall be kept below 90°F during placing and curing. Concrete surfaces shall be kept continuously moist by wet-curing for at least 24 hours after the concrete has been placed, and water shall be applied to formed surfaces while forms are still in place. After the period of wet-curing, a suitable heat-reflecting plastic membrane or white-pigmented curing compound or immediate membrane curing shall be used.

E. Plastic Membrane Curing

1. Polyethylene film may be used to cure slabs, and shall be sealed at joints and edges with a small sand berm. The plastic membrane shall be installed as soon as the concrete is finished and can be walked on without damage. The concrete shall be kept moist under the plastic membrane.

3.03 Testing – None

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 41 00 – PRECAST STRUCTURAL CONCRETE (VAULTS)

PART 1 GENERAL

1.01 Section Includes

A. The General Construction CONTRACTOR shall furnish all material, equipment, labor, services, etc., to fabricate and install all concrete work as specified in this section and the respective DRAWINGS.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All work specified herein shall conform to or exceed the applicable requirements of the referenced standards; provided, that wherever the provisions of said publication are in conflict with the requirements specified herein, the more stringent requirement shall apply

1.04 Noted Restrictions – None

A. All vaults covers shall be lockable and H20 Traffic Rated.

1.05 Quality Control

A. All vaults shall be set plumb with the cover flush with the surface of the finished pavement, surface, or at such other level as may be directed by the ENGINEER.

B. All well vaults shall be set with bottom opening centered on well casing.

C. The vaults shall not transmit shock or stress to the valves, pipelines or well casings.

D. Valve boxes shall be located so that the valve operating nut is readily accessible for operation through an opening in the vault cover.

1.06 Submittals

A. CONTRACTOR shall submit detail plans for the vaults and structural calculations stamped and signed by a registered civil or structural ENGINEER licensed in the State of California for review by the OWNER in accordance with **Section 01 33 00**.

B. The CONTRACTOR shall furnish complete shop DRAWINGS for all pre-cast manhole sections and catch basins including cast iron rings, frames, covers and grates for review by the OWNER in accordance with **Section 01 33 00**

PART 2 PRODUCTS

2.01 PRESSURE AND FLOW REGULATING VAULTS

A. Each vault shall be constructed of precast concrete designed for *AASHTO H-20-44* traffic bridge loading with 30% impact using 5,500 psi [37.92 MPa] 28-day compressive strength concrete and 60,000 psi [413 MPa] yield strength ASTM A-615 steel reinforcement.

B. Each vault will be placed on a 6” base of crusher run for ease of installation, and shall include two water-tight 32” manhole covers and frames as specified in Division 05.

C. All castings shall be made accurately to all required dimensions and shall be smooth, sound, and free of any blemishes or other defects. Defective castings, which have been plugged or otherwise treated to remedy defects, shall be rejected. Contact surfaces of frames and covers are to be machined so that the covers rest securely in the frame with no rocking.

D. The vaults shall be constructed such as the Jensen Model 4686FM54-S09A-TOM Vault with manhole cover holes and pipe penetration holes or an OWNER or ENGINEER approved equal.

E. The vaults shall be placed as detailed in the location and detail DRAWINGS. A base shall be prepared for each vault as detailed in the detail drawing for same.

F. Vault floor and wall penetrations shall be provided with watertight seals as called out on the DRAWINGS and as specified in **Section 03 15 13.13** and **03 15 13.14**.

PART 3 EXECUTION

3.01 Preparation – Not Used

3.02 Installation

A. Installation shall be performed per the appropriate American Concrete Institute (ACI) standards.

B. Sectional pre-cast concrete vault structures shall be sealed on the outside with a polyurethane sealant.

C. Sealing of Joints: CONTRACTOR shall seal all concrete joints with a polyurethane sealant to be approved by the OWNER and ENGINEER.

D. All piping penetrations shall be sealed with a non-shrink grout placed in the annular space between the pipe O.D. and the vault opening.

3.03 Testing (for Watertightness)

A. All concrete structures which are designed or intended to hold water shall be tested for watertightness in the following manner:

1. After the structure has been completed, all drain valves and other valves or openings into the tanks shall be closed and all stop plank openings, etc., shall be sealed or plugged so as to be made watertight. Any leaking valves shall be conditioned or repaired so that they are watertight.

2. The basin shall then be filled with water to the approximate average flow line and left to stand for 24 hours to permit the concrete to absorb any moisture, after which time the basin level shall be brought up to the average flow line and readings shall be taken by means of a hook gage as to the exact depth of water in the basin. The basin shall stand thus for 24 hours and a reading shall then be taken.

3. At the beginning of the test, a flat pan shall be floated in the basin containing approximately 1 in. depth of water. The exact depth of the water in the pan shall be measured. At the conclusion of the test the amount of water that has been lost or gained by the pan shall be determined in a similar manner in order to determine the amount of precipitation or evaporation from the surface of the tank or basin to be tested.

4. The maximum allowable loss for the basin that will be permitted will be 0.25% of the volume of the water in the basin. However, any damp places, leaks or other locations indicating seepage shall be repaired. All structures requiring water tests shall not be backfilled until after the test has been completed so that the locations of any or all points where leakage may occur will be visible.

END OF SECTION

DIVISION 03: CONCRETE
SECTION 03 62 00 – NON-SHRINK GROUTING

PART 1 GENERAL

1.01 Section Includes

A. The CONTRACTOR shall furnish all material, equipment, labor, services, etc., for grouting as specified in this section and the respective DRAWINGS.

1.01 Referenced Sections – None

1.02 Cited Standards – None

1.03 Noted Restrictions

A. In no case shall the water/cement ratio be more than that specified for the concrete being repaired. In the case of mortar being used for patching or repairing exposed concrete surfaces which are not to be painted or which will not be submerged in water, sufficient white cement shall be used to make the color of the finished patch match that of the surrounding concrete.

1.04 Quality Control

A. Cement mortar or grout for the repair of imperfect concrete work, filling of holes left by form bolts or ties, and the filling of voids around items through the concrete, and grout for spreading over construction joints and cold joints etc., shall consist of Portland cement and sand mixed in the same proportions used for the concrete being repaired, with only sufficient water to give the required consistency. Essentially, this would consist of the concrete mix with the coarse aggregate removed and water quantity adjusted as required.

B. Grout to fill the void between the steel casing and the carrier pipe of jacked pipe shall have the concrete mix of Class C concrete with the coarse aggregate removed.

C. Grout for which the mix is not otherwise specified shall be mixed in the proportions by weight of one part cement to four parts of concrete sand.

PART 2 PRODUCTS

2.01 Non-Shrink Grouting

A. Nonshrink grout shall be made with a hydraulic cement, which when mixed with water will harden rapidly to produce a permanent high strength material suitable for exterior use.

B. All grout utilized shall be durable, nonstaining, nonshrink, nonmetallic grout. The grout shall show no shrinkage in accordance with ASTM C-827 prior to initial setting and shall show no shrinkage in the hardened state under ASTM

C-157; Corps of ENGINEERs Specification CRD-C-588 and the field cylinder tests.

C. The grout shall conform to ASTM-C-191 concerning time of initial set. All grouting operations shall be completed in accordance with the recommendations of ACI, CSI, and the grout manufacturer's published specifications for mixing and placing.

D. All grout utilized shall be "Five Star Grouts" as manufactured by U.S. Grout Corporation, Greenwich, Connecticut; "Masterflow 713 Grout" as manufactured by Master Builders, Cleveland, Ohio; or an OWNER approved equal.

E. Where nonmetallic grout is nonessential, grout shall be a nonshrink, noncatalyzed, metallic grout such as Embeco 636 Grout, as manufactured by Master Builders, Cleveland, Ohio or OWNER approved equal.

F. When mixed in accordance with manufacturer's published instructions, the nonshrink grout shall be semi-fluid and suitable for placing by pouring into place when mixed to a flowable consistency. The compressive strength tested in accordance with ASTM C 109 shall be not less than 3,000 psi at 1 day and not less than 6,000 psi at 28 days. Setting time tested in accordance with ASTM C 191 shall be not less than 30 minutes.

2.02 Epoxy Grout

A. Epoxy grout shall be made by mixing one part epoxy with not more than two parts sand. The sand shall be clean, bagged, graded, kiln dried silica sand. The prepared grout shall wet the contact surface and provide proper adhesion or a coat of epoxy shall be applied prior to placing the epoxy grout. Manufacturer's published instructions for mixing and application shall be followed.

PART 3 EXECUTION

3.01 Preparation

A. Bolt and tie holes shall be cleaned and roughened by heavy sandblasting and filled with dry-pack mortar, well tamped into the holes. For dry-pack mortar, only enough water shall be used so that the resulting mortar will crumble to the touch after being formed into a ball by hand.

B. Concrete surfaces shall be cleaned and roughened by a heavy sandblasting and thoroughly damp before grout or mortar is placed, or, where indicated on the DRAWINGS or specified, an epoxy bonding agent shall be applied to the clean, roughened, dry surface before placing the mortar or grout.

3.02 Installation

A. Grout for spreading over the surfaces of construction joints or cold joints shall consist of sand and cement with no more water used than allowed by the water/cement ratio specified for the concrete.

B. Particular care shall be exercised in placing cement mortar or grout since it will be expected to furnish structural strength or an impermeable water seal or both. Cement mortar or grout that has not been placed within 30 minutes after mixing shall not be used.

C. Epoxy grout shall be used where specified herein or where indicated on the DRAWINGS. Epoxy grout may be used to repair surface defects in concrete work.

D. For vertical or overhead work, epoxy gel shall be used. For horizontal work, epoxy shall be used. Epoxy grout for vertical or overhead work may be used for horizontal work.

3.03 Testing – None

END OF SECTION

DIVISION 04: MASONRY
SECTION 04 05 00 – COMMON WORK RESULTS FOR MASONRY

PART 1 General

1.01 General Conditions

A. This section includes all labor, materials, equipment, and appliances required to complete the masonry work as indicated on the DRAWINGS and specified herein. The General Conditions apply to all sections of this specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 01 33 00 - SUBMITTAL PROCEDURES

2. SECTION 07 00 00 – THERMAL AND MOISTURE PROTECTION

3. SECTION 32 31 00 - FENCES AND GATES

1.03 Cited Standards

A. All masonry shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ASTM C90 Concrete Masonry Units Using Lightweight Aardelite Aggregate

2. The Masonry Standards Joint Committee's (MSJC) 2008 Building Code Requirements and Specification for Masonry Structures (TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530.1/ASCE 6)

3. "GREENBOOK" Standard Specifications for Public Works Construction, 2006 Edition written by Public Works Standards, Inc. Vista, CA.

1.04 Noted Restrictions

A. Waterproofing shall be performed on block units, mortar with Sikagard 704W, Chemstop Barricade, or an equal approved by the ENGINEER.

B. Sealer may also be used on the exterior of concrete masonry unit (CMU) to block out moisture and to preserve the blocks.

1.05 Quality Control

A. Masonry Work shall include, but is not limited to, concrete masonry units, mortar, grout, and miscellaneous materials, complete in place.

B. CONTRACTOR shall subject all masonry work to a Level II International Building Code (IBC) or Level C Masonry Building Standards Joint Committee (MSJC) inspection per cited standards.

C. Masonry Inspection shall be conducted by an International Code Council (ICC) certified inspector for cast-in-place and post-installed anchors.

1.06 Submittals

A. Before moving any materials to the site or commencing any of the work in this section, the CONTRACTOR shall submit the following items:

1. Provide submittals in accordance with Section **01 33 00 Submittal Procedures**.

2. CONTRACTOR shall submit two samples of each size and type of concrete masonry units to be used on the Work. Samples shall show the range of texture and color of the exposed surface for all units, and all units delivered to the job shall fall within this range. Samples shall include special units such as bond beam units, pilaster units, units with an end web removed, and other special units.

3. CONTRACTOR shall submit certified test reports of three sample concrete masonry units of each type proposed to be used on the job, performed by an independent testing laboratory acceptable to the OWNER indicating that the materials proposed for use meet the requirements of these Specifications. Test results shall include, but not be limited to, compressive strength, linear shrinkage, total absorption, moisture content as a percent of total absorption, and unit weight. Tests shall be performed in accordance with ASTM C 90, ASTM C 140, and ASTM C 426.

4. The CONTRACTOR shall submit a wall elevation drawing for each wall, indicating the type of masonry unit to be used and layout of masonry units. Special units such as bond beam units, open ended web units, pilaster units, and other special units shall be identified.

5. CONTRACTOR must provide product literature with submittals.

PART 2 Products

2.01 Waterproofing

A. Waterproofing application shall be Sikagard 704W, Chemstop Barricade, or approved equal.

2.02 Sealant

A. Sealant application shall be Sikaflex Textured Sealant or approved equal.

PART 3 Execution – Not Used

END OF SECTION

DIVISION 04: MASONRY
SECTION 04 05 13 – MASONRY MORTARING

Part 1 General

1.01 Section Includes

A. This specification covers mortars for use in the construction of non-reinforced and reinforced unit masonry structures. The CONTRACTOR shall perform all Masonry Mortaring work as described below and as indicated on the DRAWINGS.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All masonry mortaring shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ASTM C 144 – Standard Specification for Aggregate for Masonry Mortar

2. ASTM C207-06, Type S – Standard Specification for Hydrated Lime for Masonry Purposes

3. ASTM C270-08a – Standard Specification for Mortar for Unit Masonry

1.04 Noted Restrictions

A. Sills, ledges, offsets, and other projections shall be protected from droppings of mortar, and the construction of other trades shall be protected from effects of masonry work.

1.05 Quality Control

A. The CONTRACTOR shall provide mixes which comply with the specified strength requirements.

B. Cement mortar shall consist of Portland cement, sand, and water. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.

C. The quantity of water to be used in the preparation of the mortar shall be the minimum required to produce a mixture sufficiently workable for the purpose intended.

D. Mortar color is to be selected by OWNER

Part 2 Products

2.01 Mortar

A. Mortar for concrete masonry units shall be Type S mortar in accordance with ASTM C 270 and shall consist of 1 part of Portland cement, 1/4 part to 1/2 part of lime putty or hydrated lime, sand equal to not less than 2-1/4 and not more than three times the sum of the separate volumes of the cementitious materials, and water repellent admixture.

B. Water repellent admixture shall be added to all mortar in the quantity recommended by the water repellent manufacturer.

C. The mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Retempering of mortar shall not be permitted.

D. Mortar shall attain a minimum compressive strength of 13MPa (1,800 psi) in 28 days.

E. CONTRACTOR shall have compressive strength tests performed on trial batches of mortar in accordance with California Building Code Standard 24-22 by an independent testing laboratory acceptable to the OWNER. Certified copies of test results shall be submitted by CONTRACTOR. Cost of tests shall be paid by the CONTRACTOR.

F. All mortar shall be mixed on the job site. No mixing off the job site, either complete or in part, will be allowed, except that lime putty may be mixed off the job site. Materials for mortar shall be measured by volume. Mortar shall be mixed in a mechanical mixer and only in such quantities as are needed for immediate use. Mortar shall be mixed for at least five minutes after all materials have been added to the mixer. No mortar which has been mixed for more than one hour shall be used. The mixer drum shall be completely emptied of materials and washed down before the next batch of materials is placed therein whenever the mix time has exceeded 90 minutes.

2.02 Water

A. The water used for concrete shall be clean, potable water, free from oil, soluble salts, chemicals, and other deleterious substances.

B. Water shall not contain an amount of impurities that will cause a change in the time of setting of Portland cement of more than 25 percent nor a reduction in relative mortar strength at 7 and 28 days of more than 10% compared to results obtained with distilled water.

2.03 Hydrated Lime

A. Hydrated lime shall conform to ASTM C 207, Type S.

2.04 Sand

A. Except as specified elsewhere, sand for mortar shall conform to ASTM C 144.

PART 3 Execution – Not Used

END OF SECTION

DIVISION 04: MASONRY
SECTION 04 05 16 – MASONRY GROUTING

Part 1 General

1.01 Section Includes

a. The following sections establish the minimum requirements for masonry grout. CONTRACTOR shall provide mixes which comply with the specified strength requirements and shall perform all masonry grouting work as described below and as indicated on the DRAWINGS.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All grouting shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ASTM C207-06, Type S – Standard Specification for Hydrated Lime for Masonry Purposes

2. ASTM C 404 – Standard Specification for Aggregates for Masonry Grout

3. ASTM C 476 – Standard Specification for Grout for Masonry

4. GREENBOOK – Standard Specifications for Public Works Construction, 2006 Edition written by Public Works Standards, Inc. Vista, CA.

1.04 Noted Restrictions

A. Mortar, mortar droppings, or other materials that may prevent the grout from bonding directly to the concrete foundation shall be removed before the grouting operation begins.

1.05 Quality Control - None

PART 2 Products

2.01 Masonry Grout

A. Measured by volume, grout shall consist of 1 part Portland cement, not more than $^{1}/_{10}$ part lime putty or hydrated lime, and fine

aggregate equal to 2-¼ to 3 times the sum of the volumes of the cementitious materials. Sufficient water shall be added to produce consistency for pouring without segregation of the constituents of the grout.

B. Grout which is used in grout spaces 4 inches or more in both horizontal dimensions may contain an addition of pea gravel equal to 1 to 2 times the sum of the volumes of the cementitious materials.

C. Grout shall attain a minimum compressive strength of 14MPa (2,000psi) in 28 days.

D. Tests to verify compressive strength in accordance with California Building Code Standard 24-28 shall be performed by an independent testing laboratory acceptable to the ENGINEER. Certified copies of test results shall be submitted by CONTRACTOR. Cost of tests shall be paid by the CONTRACTOR.

2.02 Water

A. The water used for concrete shall be clean, potable water, free from oil, soluble salts, chemicals, and other deleterious substances.

2.03 Hydrated Lime

A. Hydrated lime shall conform to ASTM C 207, Type S.

2.04 Aggregate

A. Except as specified elsewhere, and fine aggregate for grout shall conform to ASTM C 404.

B. Coarse aggregate (pea gravel) for grout shall be clean, hard, fine grained, and shall be free of flat, chip-like, thin, elongated, friable, or laminated pieces.

C. Pea gravel shall be uniformly graded with not more than 5 percent passing the No. 8 sieve and with 100 percent passing the $^{3}/_{8}$-inch sieve. Coarse grout and fine grout are defined by aggregate size in accordance with ASTM C 476.

PART 3 Execution

3.01 Preparation

A. Reinforcing bars shall be in place and reviewed by the OWNER before grouting shall begin.

3.02 Grouting and Reinforcement

A. All spaces and cells shall be filled solidly with grout. Vertical cells to be grouted shall be filled solidly with grout in lifts not exceeding 8 feet in height.

B. When the grouting is stopped for one hour or longer, horizontal construction joints shall be formed by stopping the placement of grout 1-1/2 inches below the top of the uppermost unit containing grout.

C. Vertical cells to be filled with grout shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell measuring not less than 2 inches by 3 inches. The grout in the cells shall have full contact with the concrete foundation.

E. Mortar, mortar droppings, or other materials that may prevent the grout from bonding directly to the concrete foundation shall be removed before the grouting operation begins.

F. For grout pours in excess of 4 feet in height, cleanouts shall be provided at the bottom of each pour for each cell to be filled with grout. Overhanging mortar or other obstruction or debris shall be removed from the inside of such cell walls. The cleanouts shall be sealed after inspection and before grouting.

G. After grout has been placed, it shall be consolidated by use of a mechanical immersion vibrator designed for the purpose.

3.03 Testing – None

END OF SECTION

DIVISION 04: MASONRY
SECTION 04 05 19.13 – CONTINUOUS JOINT FILLER

PART 1 General

1.01 Section Includes

A. The following sections establish the minimum requirements for continuous joint filler for masonry. The CONTRACTOR shall perform all continuous joint reinforcing work as described below and as indicated on the DRAWINGS.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. Cutting or reaming of members being anchored or other means of accommodating misaligned anchor bolts in support angles will not be accepted.

1.05 Quality Control – None

PART 2 Products

2.01 Control Joint Filler

A. Premolded joint filler shall be wide flange Rapid Poly-Joint manufactured by Dur-O-Wal; wide flange Vert-A-Joint manufactured by Vert-A-Joint Company, or an ENGINEER approved equal.

2.02 Caulking

A. Caulking for masonry control joints, around door jambs, window frames, at roof decks, and at other locations in masonry construction shall be done with a 1 part, non-sag, high performance, polysulfide base sealant.

B. Caulking shall conform to requirements of Interim Federal Specification TT-S-00230C, Type 2, Class A, and shall be Chem Calk 100 manufactured by Woodmont Products, Inc.; PRC 7000 manufactured by Products Research and Chemical Corp.; or an ENGINEER approved equal.

C. Color shall be selected by the ENGINEER from the Manufacturer's standard colors.

D. Application, including necessary primer and backer rod, shall be in accordance with Manufacturer's recommendations.

E. Sealant shall not be applied on wet or frosty surfaces or when surface temperature is higher than 130 degrees F. The depth of sealant in a joint shall not be greater than its width nor less than 1/4-inch.

F. Sealant depths shall be as follows:

Joint Width	Sealant Depth
1/4 inch to 3/8 inch	1/4 inch
1/2 inch to 1 inch	3/8 inch

PART 3 Execution – Not Used

END OF SECTION

DIVISION 04: MASONRY
SECTION 04 05 19.16 – MASONRY ANCHORS

PART 1 General

1.01 Section Includes

A. The following sections establish the minimum requirements for masonry reinforcing bars. The CONTRACTOR shall perform all masonry reinforcing work as described below and as indicated on the DRAWINGS.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. Cutting or reaming of members being anchored or other means of accommodating misaligned anchor bolts in support angles will not be accepted.

1.05 Quality Control – None

Part 2 Products – Not Used

Part 3 Execution

3.01 Preparation – None

3.02 Anchoring Bolts

A. A 6-inch minimum width of grouted hollow masonry shall be provided all around anchor bolts and other attachment locations.

B. Anchor bolts shall be held in place by a template to assure precise alignment of anchor bolts. Cutting or reaming of members being anchored or other means of accommodating misaligned anchor bolts in support angles will not be accepted.

3.03 Testing – None

END OF SECTION

DIVISION 04: MASONRY
SECTION 04 05 19.26 – MASONRY REINFORCING BARS

PART 1 General

1.01 Section Includes

A. The following sections establish the minimum requirements for masonry reinforcing bars. The CONTRACTOR shall perform all masonry reinforcing work as described below and as indicated on the DRAWINGS.

1.02 Referenced Sections

A. Related sections are shown below.

1. SECTION 03 20 00 – CONCRETE REINFORCING

1.03 Cited Standards – None

1.04 Noted Restrictions

A. Reinforcing bars shall be in place and reviewed by the ENGINEER before grouting shall begin.

1.05 Quality Control – None

PART 2 Products

2.01 Reinforcing Bars

A. Reinforcing bars in masonry shall be as specified in SECTION 03 20 00 – CONCRETE REINFORCING.

2.02 Wire Joint Reinforcement

A. Wire joint reinforcement shall be Ladder type manufactured by Masonry Reinforcing Corporation of America; Ladur-type manufactured by Dur-O-Wall Inc.; or equal. Wire joint reinforcement shall consist of side wires and cross wires of No. 9 gauge galvanized steel unless otherwise indicated on the DRAWINGS.

B. Wire shall conform to the requirements of ASTM A 82 and shall be galvanized in accordance with ASTM A 641, Class 1. Side wires for 8-inch wide masonry units shall be 6 inches wide and cross rods shall be 16 inches on center.

PART 3 Execution

3.01 Preparation – None

3.02 Reinforcement

A. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 200 diameters of the reinforcement, not 10 feet. Bars shall be held in position by steel wire bar positioners or tied to dowels with wire ties.

B. Where horizontal and vertical bars are spliced and adjacent lap splices are separated by more than 3 inches, the lap splice length shall not be less than 72 bar diameters. Where adjacent lap splices are separated by 3 inches or less, the lap splice length shall be increased by 1.3 times or the lap splices may be staggered at least 24 bar diameters with no increase in length.

C. Reinforcing bars shall be in place and reviewed by the OWNER before grouting shall begin.

3.03 Testing – None

END OF SECTION

DIVISION 04: MASONRY
SECTION 04 06 20 – SCHEDULES FOR UNIT MASONRY

Item	***No.***	***Ref. Drawing No.***	***Approx. Structure Size***	***Block Size***	***CMU Type***
Masonry Block Wall	2	Masonry Wall Plan & Elev. and Detail DRAWINGS	As per DRAWINGS	8”x8”x16”	OWNER’s Choice Split Face Architectural
Masonry Block Fence Base and columns	1	Fence Layout and Detail DRAWINGS	As Per DRAWINGS	8”x8”x16”	OWNER’s Choice Split Face Architectural

END OF SECTION

DIVISION 04: MASONRY
SECTION 04 22 23.29 – SPLIT-FACE CONCRETE UNIT MASONRY

PART 1 General

1.01 Section Includes

A. The CONTRACTOR shall perform all Masonry work as described below and as indicated on the DRAWINGS.

1.02 Referenced Sections

A. Related Sections are shown below:

1. SECTION 04 05 13 - MASONRY MORTARING

2. SECTION 04 05 16 - MASONRY GROUTING

3. SECTION 04 05 19.13 - CONTINUOUS JOINT REINFORCING

4. SECTION 04 05 19.16 - MASONRY ANCHORS

5. SECTION 04 05 19.26 - MASONRY REINFORCING BARS

1.03 Cited Standards – None

1.04 Noted Restrictions

A. Chipped, cracked, or otherwise defective masonry units shall be removed from the work. Units that are chipped, cracked, broken, or otherwise defective, whether before or after setting, will be rejected and shall be removed and replaced.

B. During installation, temporary protection shall be provided for all exposed masonry corners subject to injury. Concrete scum and grout stains on masonry shall be removed immediately.

C. Concrete and grout spilled on the wall shall be washed off before it sets. Grout stains shall be removed from walls.

D. The CONTRACTOR shall be responsible for correcting any efflorescence on exposed masonry units or joints.

1.05 Quality Control – None

1.06 Submittals – None

1.07 Deliverables

A. Handling of Masonry Units

1. All masonry units shall be transported and handled as required to prevent discoloration, chipping and breakage.

2. Storage piles, stacks, or bins shall be located to protect materials from heavy traffic.

PART 2 Products

2.01 Concrete Masonry Units

A. Interior Walls

1. Concrete masonry units shall be manufactured to meet ASTM C 90, Grade N-1 with minimum compressive strength of 1,900 psi and CBC (Chapter 24) requirements for hollow load bearing concrete masonry units.

2. Concrete masonry units shall be medium weight type having a dry density of not more than 105 pounds per cubic foot of concrete. Where indicated on the DRAWINGS or specified herein, masonry units shall be integrally colored.

3. Color shall be as selected by the ENGINEER from the Manufacturer's standard colors. All masonry units for new above ground structures shall be integrally colored.

4. A water repellent admixture shall be used for the CMU block. Rainbloc or Dry-block systems or approved equal shall be used.

B. Exterior Walls

1. Concrete masonry units: shall be Orco Block-Tan or OWNER Selected, ASTM C90 Grade N-1 medium weight units with minimum face shell thickness of 1-1/4-inches. Size as indicated on DRAWINGS. CMU to be 16" x 8" x width as shown on DRAWINGS.

2. The width of masonry units shall be as indicated on the DRAWINGS. Proper sizes shall be used to provide for all window and Masonry Door Openings, bond beams, piers,

lintels, and other special applications with a minimum of block cutting.

3. A water repellent admixture shall be used for the CMU block. Rainbloc or Dry-block systems or approved equal shall be used.

2.02 Aggregate

A. Aggregate shall conform to ASTM C 331 for lightweight and ASTM C 33 for aggregate other than lightweight. Units shall be uniform in form and dimension.

B. Unit moisture content as delivered shall not exceed 25 percent of total absorption. Units shall have a maximum linear shrinkage not to exceed 0.05 of 1 percent from a saturated to oven dry condition when tested in accordance with ASTM C 426. Units shall be ordered well before commencement of work to assure adequate time for manufacturing and not less than 28 days of curing before use. Units shall be from a uniform run.

2.03 Cement

A. Portland cement shall conform to ASTM C 150, Type II, low alkali. Low alkali cement shall contain not more than 0.6 percent total alkali. The alkali shall mean the sum of sodium oxide and potassium oxide calculated as sodium oxide.

2.04 Lime

A. Hydrated lime shall conform to ASTM C 207, Type S.

2.05 Water

E. All water used shall be clean, potable water, free from oil, soluble salts, chemicals, and other deleterious substances.

PART 3 Execution

3.01 Preparation

A. All work shall be executed in a workmanlike manner and in full compliance with all applicable codes and local ordinances.

B. Sills, ledges, offsets, and other projections shall be protected from droppings of mortar, and the construction of other trades shall be

protected from effects of masonry work.

3.02 Installation

A. General

1. Concrete masonry walls shall be laid in uniform and true courses, level, plumb and without projection or offset of adjacent block. The foundation shall be thoroughly cleaned of laitance, grease, oil, mud, dirt, mortar droppings, or other objectionable matter by means of heavy sandblasting before placing the first course of masonry units.

2. Full mortar coverage of joints shall be provided on webs of cells that will be grouted solid and all face shells. Vertical head joints shall be buttered for a thickness equal to the face shell thickness of the masonry unit, and these joints shall be shoved together tightly so that the mortar bonds to both masonry units. Joints shall be solidly filled from the face of the masonry units to the inside face of the face shell.

3. Masonry units shall be laid in the wall to the desired height with joints of uniform thickness. Units shall be leveled, plumbed, and straightened before the mortar has stiffened. Bond shall be plumb throughout.

4. Masonry units shall be laid to preserve the unobstructed vertical continuity of the cells to be filled with grout or insulation.

5. Masonry units shall be laid so that cracks are not formed at the time the masonry unit is placed in the wall.

6. Masonry units shall be adjusted to their final position in the wall while the mortar is still soft and plastic enough to insure a good bond. If the position of the masonry unit is shifted after the mortar has stiffened, or bond is broken or cracks are formed, the masonry unit shall be relaid in new mortar.

7. Masonry units shall be cured and dried before being used and the surface of the units shall be clean and free from dirt when laid in the walls. Masonry units shall not be wetted before use, but shall be laid dry.

8. Exterior building color must meet City’s review requirements.

B. Mortar Joints

1. Mortar joints shall be straight, clean, smooth, and uniform in thickness and, unless otherwise indicated on the DRAWINGS, shall be tooled slightly concave. Joint thickness shall be 3/8-inch for both vertical and horizontal joints unless otherwise indicated on the DRAWINGS. Where fresh masonry joins totally or partially set masonry, the set masonry shall be cleaned and roughened before laying new work.

C. Wire Joint Reinforcement

1. Longitudinal wire joint reinforcement shall be lap spliced at least 75-wire diameters.

2. Longitudinal wires shall rest in the approximate centers of the mortar beds and shall have not less than 5/8-inch mortar cover on the exposed face.

3. Intersecting masonry walls shall be provided with prefabricated wire joint reinforcement tees. Intersecting wall joints shall be raked ½ inch and caulked.

D. Bond Pattern

1. Bond pattern shall be as indicated on the DRAWINGS. Where no bond pattern is indicated, the wall shall be laid up in a straight, uniform course with regular running bond.

E. Bond Beams

1. Bond beams shall be made up of special bond beam block with horizontal bar reinforcement.

2. Horizontal bar reinforcement shall be solidly grouted in place. Wire mesh shall be provided at openings in the bottom of bond beams to support the grout.

F. Cutting of Masonry Units

1. Concrete masonry units shall be cut as required to form chases, for anchorage, or for other appurtenances. All cutting and fitting of exposed block units shall be done with a power driven carborundum or diamond disc blade saw.

G. Control Joints

1. Control joints shall be full height and continuous in appearance. Bond beams and bond beam reinforcing bars shall be continuous through the control joint.

2. The control joint shall be caulked and shall be mortar joint in appearance. Fill material for control joints shall be premolded, wide flange control joint filler as specified elsewhere herein. Caulking shall also be as specified elsewhere. All joints shall be caulked to produce a weathertight structure.

H. Openings and Lintels

1. Openings in masonry walls, unless indicated on the DRAWINGS or specified otherwise, shall have lintels made up of like units (bond beam units) reinforced and filled solidly with grout to properly span the opening. Solid bottom bond beam block shall be used where the underside of lintel is exposed.

2. CONTRACTOR shall provide a minimum of 8 inches bearing at each end of lintel. Reinforcing bars shall extend not less than 24 inches nor less than 40 bar diameters into the wall past the edge of the opening, on each side of the opening unless a greater length is indicated on the DRAWINGS. At corners, CONTRACTOR shall provide a 90 degree bend with an equivalent total embedment.

I. Masonry Door Frames

1. Jambs and head of metal door frames connected to masonry shall be anchored and fully grouted. Filling of frames shall be done as each 2 feet lift of masonry is laid. Door, window, and lower openings shall be precision block surfaces.

J. Bearing Plates

1. A 12-inch minimum depth of grouted hollow masonry shall be provided below all steel bearing plates or beams bearing on masonry walls.

K. Ties

1. Where two or more units are used to make up the thickness of a wall, the units shall be bonded with 3/16-inch diameter hot-dip

galvanized steel rods or metal ties of equivalent stiffness embedded in the horizontal joints.

2. Rods shall be bent in a rectangular shape. There shall be one metal tie for every 4 ½ square feet of wall area. Ties in alternate courses shall be staggered and the maximum vertical distance between ties shall not exceed 18 inches and the maximum horizontal distance shall not exceed 36 inches.

L. Enclosures

1. Where concrete masonry is to enclose conduits, pipes, stacks, ducts, and similar items; chases, cavities, and similar spaces shall be constructed as required, whether indicated on the DRAWINGS or not.

2. Openings around flush mounted electrical outlet boxes, including the flush joint above the box, shall be pointed with mortar. No such work shall be covered until advised by the OWNER that the work has been inspected and tested.

M. Patching

1. Patching of exposed concrete masonry units shall be done at the conclusion of the general work and shall be done so the patching will be indistinguishable from similar surroundings or adjoining work.

N. Protection of Masonry

1. Temporary protection shall be provided for all exposed masonry corners subject to injury. Concrete scum and grout stains on masonry shall be removed immediately.

2. The wall shall be adequately braced against wind and other forces during construction and bracing shall remain in place until the roof has been erected. When rain or snow is imminent, the tops of unfinished walls shall be fully covered and protected with waterproof paper, polyethylene, or other means acceptable to the OWNER.

O. Water Curing

1. Masonry shall be protected against too rapid drying by frequently fogging or sprinkling so that walls will always be visibly damp for a period of not less than three days.

P. Miscellaneous

1. All items as required, including all anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, miscellaneous iron, and all other items required shall be built in for a complete job.

Q. Cold Weather Protection of Masonry

1. Masonry work to be done when the mean daily air temperature is 40 degrees F, or less, shall comply with the following requirements: mixing water and aggregate shall be heated to a minimum of 70 degrees F and a maximum of 160 degrees F. Temperature of masonry units shall be a minimum of 35 degrees F when laid. Masonry temperature shall be maintained above 50 degrees F for three days by use of enclosures and supplemental heat.

R. Cleanup

1. Extreme care shall be taken to prevent mortar splotches. No construction supports shall be attached to the wall except where specifically permitted by the OWNER.

2. Concrete and grout spilled on the wall shall be washed off before it sets. Grout stains shall be removed from walls. At the conclusion of the masonry work, the CONTRACTOR shall clean all masonry walls, remove scaffolding and equipment used in the work, clean up all debris, refuse, and surplus material, and remove them from the premises. The CONTRACTOR shall be responsible for correcting any efflorescence on exposed masonry units or joints.

3.03 Testing

A. The CONTRACTOR shall inspect textured faces to see they are free from chips, cracks, crazes or any other imperfection that would detract from the overall appearance of the finished wall when viewed from a distance of twenty (20) feet at right angles to the wall with normal lighting.

B. If the ENGINEER does not approve the work performed upon inspection, the CONTRACTOR shall perform/re-perform work as requested by the ENGINEER.

END OF SECTION

PART 1 General

1.01 General Conditions

A. This section includes all labor, materials, equipment, and appliances required to complete Miscellaneous Metal Work. The General Conditions apply to all sections of this Specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the Specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

1.02 Referenced Sections

A. Related Sections are shown below:

1. SECTION 01 33 00 – SUBMITTAL PROCEDURES

2. SECTION 09 90 00 – PAINTING AND COATING

1.03 Cited Standards

A. All work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section.

B. Products and their delivery, handling and installation shall be in accordance with the following trade standards, codes or specifications:

1. Aluminum Association AA-M32 C22 A41

2. AISC - Specifications and Commentary

3. AISI - Specifications and Commentary

4. ASTM A 36/A36M - Specification for Structural Steel

5. ASTM A 48 - Specification for Gray Iron Castings

6. ASTM A 53 - Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless

7. ASTM A 123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip

8. ASTM A 153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

9. ASTM A 307 - Specification for Carbon Steel Externally Threaded Standard Fasteners

10. ASTM A 563 - Specification for Carbon and Alloy Steel Nuts

11. ASTM A 575 - Specifications for Steel Bars, Carbon, Merchant Quality, M-Grades

12. ASTM F1554 - 07a Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

13. ANSI/AWS D1.1 - Structural Welding Code - Steel

14. NFPA 101 - Life Safety Code

15. NAAMM - Metal Stairs Manual

1.04 Noted Restrictions

A. The CONTRACTOR shall furnish, fabricate and install miscellaneous metalwork and appurtenances, complete and in accordance with the requirements of the Contract Documents.

1.05 Quality Control

A. For welding operations, the CONTRACTOR shall provide for continuous inspection of welding by International Code Council certified inspector.

1.06 Submittals

A. Shop DRAWINGS

1. Shop DRAWINGS of all miscellaneous metalwork shall be submitted to the ENGINEER for review in accordance with **Section 01 33 00 Submittal Procedures**.

B. Welders Qualifications

1. Welders shall submit certified qualifications for the type of welding being performed.

PART 2 Products

2.01 Materials

A. All structural steel shapes, plates, bars and their products shall conform to the requirements of ASTM A 36.

B. Corrosion Protection

1. Unless otherwise shown, miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment and/or will be submerged in water/wastewater shall be coated in accordance with **Section 09 90 00 Painting and Coating**, and shall not be galvanized prior to coating.

2. All other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication as specified herein.

C. Stainless Steel

1. Stainless steel metalwork shall by of Type 316 stainless steel.

2.02 Seat Angles and Supports

A. Seat angles for grating shall be aluminum or stainless steel. All support angles buried, submerged or below top of hydraulic structures shall be stainless steel.

2.03 Bolts and Anchors

A. Except as otherwise specified herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A 307 Grade B, or threaded parts of ASTM A 36 and shall meet the following additional requirements:

1. The nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

3. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than ½-inch beyond the nut.

B. Galvanized Bolts

1. Except where otherwise shown or specified, all bolts, anchor bolts and nuts shall be steel, galvanized after fabrication as specified herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing.

C. Stainless Steel Bolts

1. Unless otherwise shown, all bolts, anchor bolts, washers and nuts which are buried, submerged or below the top of the wall inside any hydraulic structure shall be of Type 316 stainless steel. A non-seize compound shall be applied to the threads when attaching stainless steel bolts.

D. Anchors

1. Unless otherwise shown, expanding-type anchors shall be steel expansion type Phillips Drill Company "Red Head" anchors; McCullock Industries "Kwick-Bolt"; or equal. Lead caulking anchors will not be permitted. Size shall be as shown. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded buried, submerged or below top of hydraulic structure anchors shall be entirely stainless steel.

E. Power-Driven Pins

1. Power-driven pins shall not be used unless specifically approved by the ENGINEER.

PART 3 Execution

3.01 Preparation – None

3.02 Installation

A. Fabrication and Installation Requirements

1. Fabrication and Erection: Except as otherwise shown, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction".

B. Welding

1. Method: All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

2. Quality: In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified for the AWS Code. Upon completion of welding, all weld splatter, flux, slag and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. All burrs, spatter and sharp corners of material shall be ground smooth prior to coating.

C. Galvanizing

1. All structural steel plates, shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153. Field repairs to galvanizing shall be made using "Galvinox", "Galvo-Weld", or approved equal.

3.03 Testing – None

END OF SECTION

PART 1 General

1.01 Section Includes

A. This Section describes the metal ladders that are to be used for the project. The CONTRACTOR shall furnish and install all metal ladders as per the specifications contained herein.

1.02 Referenced Sections – None

1.03 Cited Standards – No Additional Requirements

1.04 Noted Restrictions – No Additional Requirements

1.05 Quality Control

A. Ladders shall be safety ladders, 18 inches wide between side rails, conforming to local, State, and OSHA standards as a minimum. Stair and ladder wells shall be adequately guarded as specified or as indicated on the DRAWINGS.

B. Ladders shall be secured to the supporting surface by bent plate clips providing not less than 8 inches between the supporting surface and center of rungs. Where exit from the ladder is forward, over the top rung, permanent side rails shall be extended not less than 3 feet 6 inches above the roof and be returned with a radius bend to the roof.

C. Ladders more than 12 feet tall shall be equipped with a fall prevention system. The fall prevention system shall include but not be limited to the rail, brackets, clamps, two sleeves and two belts. The system shall be completed and shall satisfy the requirements of OSHA safe climbing regulations. The fall prevention system shall be Saf-T-Climb fall prevention device by North Consumer Products, Cerritos, California; Climbers Buddy System manufactured by Swager Communications, Angola, Indiana; or equal.

PART 2 Products

2.01 Aluminum Ladders

A. Aluminum ladders shall be made of 6063-T5 aluminum alloy, of welded construction. Rungs shall be not less than 1½-inch round bar with $^{1}/_{8}$-inch grooves in the top and deeply serrated on all sides. Rungs shall withstand a load of 1,000 pounds without failure. Side rails shall be not lighter than 2 ½ inches by ½-inch flat bars. Ladders shall be of the size, shape, location, and details indicated on the DRAWINGS.

B. Ladders greater than 20 feet in height shall have standard ladder cages or a fall prevention system designed in accordance with State and OSHA requirements.

2.02 Stainless Steel Ladders

A. Stainless steel ladders shall be made of 316L stainless steel, of welded construction. Rungs shall be not less than 1-inch square bar with $^{1}/_{8}$-inch grooves in the top and deeply serrated on all sides. Rungs shall withstand a load of 1,000 pounds without failure. Side rails shall be not lighter than 3 inches by $^{3}/_{8}$-inch flat bars. Ladders shall be of the size, shape, location, and details indicated on the DRAWINGS.

B. Ladders greater than 20 feet in height shall have standard ladder cages or a fall prevention system designed in accordance with State and OSHA requirements.

2.03 Partial or Wholly Submerged Ladders

A. Ladders which may be partially or wholly submerged or which are located inside a hydraulic structure shall be entirely of Type 316 stainless steel. All other ladders shall be of aluminum after fabrication.

PART 3 Execution – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section includes the specifications for the vault watertight frames and covers.

B. The CONTRACTOR shall furnish and install the frames and covers on the vaults described in **Section 03 41 00** and the DRAWINGS.

C. The cove shall be level with the adjacent site shown in the plan.

1.02 Referenced Sections

A. Related Sections are shown below;

1. **03 41 00 Pre Cast Structural Concrete**

1.03 Cited Standards

A. All metal castings shall conform to the following standard specifications, of the latest revisions, as applicable:

1. ASTM A-48, for Class 35B Gray Iron Castings.

1.04 Noted Restrictions – No Additional Requirements

1.05 Quality Control – No Additional Requirements

PART 2 Products

2.01 Manhole Frames and Covers

A. Manhole frames, and covers shall be cast iron conforming to minimum requirements of latest ASTM A-48, for Class 35B Gray Iron Castings.

B. Manhole frames, and covers shall be of heavy-duty watertight construction complete with cover gaskets glued to the frame and stainless steel bolts.

C. Assembly shall be rated for AASHTO H-20, live loads of 16,000 lbs. with a 30% impact factor.

D. Castings shall be made accurately to required dimensions, fully interchangeable, sound, smooth, clean and free from blisters or other defects. Defective castings which have been plugged or otherwise treated shall not be used.

E. Contact surfaces of all manhole covers and corresponding supporting rings in rims shall be machined to provide full perimeter contact.

F. Manhole frames and covers shall be of size and location as shown on DRAWINGS.

G. Manhole frame and cover assemblies shall be R-1916-H with 30” opening as manufactured by Neenah Foundry Co. or OWNER-approved equal.

PART 3 Execution

3.01 Preparation – None

3.02 Installation

A. The CONTRACTOR shall install the manhole assemblies on the vault covers in accordance with DRAWINGS and the manufacturer’s recommendations.

B. The CONTRACTOR shall provide a watertight seal between the manhole frame and the vault cover utilizing an approved gasket and/or joint compound.

3.03 Testing – None

PART 4 Measurement and Payment – Not Used

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section describes materials, fabrication, and installation of aluminum and miscellaneous nonferrous metals, anchor bolts, bolts, cast iron frames and covers, grating and frames, hatches, ladders, manhole frames and covers, metal fasteners and welding, metal roof decking, miscellaneous aluminum, miscellaneous cast iron, miscellaneous other metal items, miscellaneous structural steel, pipe handrails, pipe sleeves, inserts, and gates, structural steel, sheet metalwork, and tread plates and frames.

1.02 Referenced Sections

A. Related Sections are shown below:

1. **Section 01 33 00 - Submittal Procedures**.

1.03 Cited Standards

A. Structural Connections and Framing: AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings (Eighth Edition), except delete Section 1.1, the last sentence of Sections 1.26.1 and 1.26.3, and Part 2 in its entirety.

B. Handrails, Walkways, Ladders, Personnel Platforms: OSHA, California State Safety Standards or UBC, whichever is more stringent.

C. Grating, Floor Plates, and Miscellaneous Cover Plates: Minimum design live load of 150 psf, maximum deflection of $^{1}/_{240}$ of span.

1.04 Noted Restrictions

1.05 Quality Control

A. For Welding, the CONTRACTOR shall provide for continuous inspection of welding by International Code Council certified inspector.

1.06 Submittals

A. Submit shop DRAWINGS in accordance with **Section 01 33 00 Submittal Procedures**.

B. Submit DRAWINGS of fabricated items, such as grating, bolts, handrail, ladders, concrete anchors, and access hatches. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 Products

2.01 Materials

A. Unless otherwise specified or indicated on the DRAWINGS, structural and miscellaneous metals shall conform to the standards of the American Society for Testing and Materials (ASTM), including the following:

Item	ASTM Standard	Type or Alloy No.	Class, Grade, No.
Cast Iron			
Cast Iron	A 48		Class 40B
Steel			
Galvanized sheet iron or steel	A 446		Coating G90
	A 525		
	A 526		
Black steel, sheet or strip	A 569		
	A 570		
Coil (plate)	A 635		
Steel rolled shapes	A992		
Structural plate, bars, and miscellaneous steel items	A36		
Standard bolts, nuts, and washers	F1554		Grade 36
High strength bolts, nuts, and hardened flat washers	A 325		
	A 490		
Eyebolts	A 489	Type 1	
Tubing, cold-formed	A 500		Grade B
Tubing, hot-formed	A 501		
Steel pipe	A 53		Grade B
Stainless steel			
Plate, sheet and strip	A 167	Type 316	
Bars and shapes	A 276	Type 316	
Aluminum			
Sheet aluminum-flashing, 0.032 inches min. thickness	B 209	Alloy 5005-H14,	
Sheet aluminum-structural	B 209	Alloy 6061-T6	
Structural aluminum	B 308	Alloy 6061-T6	
	B 209		
Extruded aluminum	B 221	Alloy 6063-T42	

Stainless steels are designated by type or series defined by AISI.

B. Metal Fastening

1. General

a. Unless otherwise indicated on the DRAWINGS or specified, metal fastening shall be as follows.

2. Bolting

a. Bolts, except high strength bolts, shall be provided with flat washers and self-locking nuts, or lock washers and nuts.

1) Bolt heads and nuts shall be hex-type.
2) Bolts, nuts, and washers shall be of domestic manufacture

b. Bolts, including anchor bolts, nuts, washers, Simpson clips, hangers and similar fasteners in contact with PTDF are specified to be galvanized, shall be galvanized in accordance with ASTM A 153.

c. After installation, bolts, including anchor bolts and concrete anchors, shall project a minimum of two threads but not more than ½-inch beyond the nut.

d. Unless otherwise specified, bolts, including anchor bolts and concrete anchors, shall be tightened to the snug-tight condition. The snug-tight condition shall be defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.

3. High Strength Structural Bolts

a. High strength bolts, nuts, and hardened flat washers shall conform to ASTM A 325 or ASTM A 490, as indicated on the DRAWINGS.

b. Connections with high strength bolts shall be considered to be slip critical structural connections unless otherwise indicated on the DRAWINGS. Connections with high strength bolts shall conform to the requirements of the AISC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1) A hardened flat washer shall be provided under the element, nut or bolt head, turned in tightening. On outer plies for short slotted holes.
2) CONTRACTOR shall notify OWNER in advance of the method selected for tightening and verification pursuant to the referenced AISC Specification.

4. Assembly Bolts - Bolts, nuts, and washers for field assembled construction shall be as follows:

   a. Type 316 stainless steel in wet and moist locations, including:

      1) Dry side of walls of water containing structures.

      2) Pump and equipment bases.

      3) Aluminum assemblies.

      4) Dry or exposed sides of walls of earth supporting structures.

      5) Buried locations.

   b. A non-seize compound shall be applied at all times when attaching stainless steel bolts.

   c. Hot-dip galvanized ASTM A 307 steel for galvanized assemblies and for applications other than those specified hereinbefore.

5. Eyebolts

   a. Eyebolts shall be Type 316 stainless steel.

C. Fasteners for Use in Concrete

1. General

   a. Fasteners for use in concrete shall be as specified hereinafter. "Slug-in," lead cinch, and similar systems relying on the deformation of lead alloy or similar materials in order to develop holding power shall not be used.

2. Anchor Bolts

   a. Anchor bolts shall be cast in place when concrete is placed. Anchor bolts embedded in concrete shall be accurately located and with bolts perpendicular to the surface from which they project.

   b. Anchor bolts, nuts, and washers shall be as follows:

      1) Type 316 stainless steel.

c. Anchor bolts shall not touch reinforcing steel. Where anchor bolts are within 1/4 inch of reinforcing steel, anchor bolts shall be insulated with not less than four wraps of 10-mil PVC tape in the area adjacent to the reinforcing steel.

d. In anchoring machinery bases subject to heavy vibration, two nuts shall be used, one serving as a locknut.

e. Bolts, when indicated on the DRAWINGS for future use, shall be first coated thoroughly with non-oxidizing wax, followed by turning nuts down to the full depth of thread. Exposed thread shall then be neatly wrapped with a waterproof polyvinyl tape.

f. Anchor bolts shall be embedded not less than 10 diameters and shall have a standard hex bolt head or a 90-degree hook not less than 4 diameters in length. Where indicated on the DRAWINGS, anchor bolts shall be set in metal sleeves having an inside diameter approximately 2 inches greater than the bolt diameter and not less than 10-bolt diameters in length. Sleeves shall be filled with grout when the machine or other equipment is grouted in place.

D. Concrete Inserts

1. Concrete inserts for supporting pipe and other applications shall be as specified elsewhere in these Specifications. Unless otherwise specified, concrete inserts shall be Type 316 Stainless Steel.

E. Preformed Channel Pipe Supports

1. Preformed channel pipe supports for pipe supports and other applications shall be as specified elsewhere in these Specifications.

2. Chemical anchors for installation in concrete shall contain vinyl ester resin in the composition of the adhesive. Chemical anchors shall be Hilti HVA Adhesive Anchor System manufactured by Hilti, or equal. The adhesive shall be packaged in pre-measured capsules. The chemical anchor shall have a current ICBO Evaluation Report. Installation shall be in accordance with manufacturer's recommendations. Special inspection of the installation of the chemical anchors is required and shall be in accordance with UBC 306. Thread rods shall conform to ASTM A 36 and shall be zinc plated or hot-dip

galvanized. Stainless steel all-thread-rods conforming to ASTM F 593 shall be used for corrosive conditions where indicated on the DRAWINGS. Reinforcing bars shall be used in lieu of the all-thread-rods where indicated on the DRAWINGS. All-thread-rods and reinforcing bars used with the adhesive capsules shall have a chisel point and shall be free of oil or other coatings that may reduce bond. Chemical anchors shall not be used to resist tension in overhead installations.

F. Miscellaneous Metal

1. Miscellaneous Aluminum

a. Structural and other metal items fabricated from aluminum, not covered separately herein shall be fabricated in accordance with the best practices of the trade and shall be field assembled by riveting or bolting with no welding or flame cutting permitted.

b. Aluminum in contact with other metal or concrete shall have the contact surface shop-painted as specified under **Section 09 00 00** entitled, "Finishes".

2. Miscellaneous Stainless Steel

a. All stainless steel unless noted otherwise in the Specifications or on the Plans, shall be stainless steel 316L.

3. Miscellaneous Structural Steel

a. Miscellaneous steel items not specified herein shall be as indicated on the DRAWINGS or specified elsewhere in these Specifications and shall be fabricated and installed in accordance with the best practices of the trade.

G. Sheet Metal

1. General

a. Sheet metal flashing, counterflashing, facia, gravel stops, and other roofing accessories shall be in accordance with these Specifications.

b. Sheet metal items not covered elsewhere shall be as indicated on the DRAWINGS and as required to provide

a watertight installation. Formed sheet metal for metal covered work shall accurately reproduce the detail as indicated on the DRAWINGS; profiles, bends, and intersections shall be sharp, even, and true.

2. Aluminum Sheet Metal Work

a. Except as otherwise specified or indicated on the DRAWINGS, sheet aluminum shall be alloy 5005-H14 conforming to the requirements of ASTM B 209 and shall be not less than 0.032-inch in thickness. Extruded aluminum shall be 6063-T4, conforming to the requirements of ASTM B 221.

PART 3 Execution

3.01 Preparation – None

3.02 Installation

A. Fabrication and Erection

1. Fabrication and erection of steel items shall conform to AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings wherever applicable, except as the same may be modified by applicable building codes and these Specifications. Where anchors, connections or other details of miscellaneous metalwork are not definitely indicated on the DRAWINGS, or specified in the Specifications, their material, size, form, attachment, and location shall be equivalent in quality and workmanship to items specified herein.

2. Structural members such as W shapes, S shapes, channels, angles, and similar members which are not available in the quantity, size, and type of stainless steel specified or indicated on the DRAWINGS, shall be fabricated by welding together pieces of stainless steel plate. The stainless steel plate shall be low carbon stainless steel plate such as 316L. All welds between pieces of plate shall be full penetration welds. The fabricated members shall have the same or higher section modulus and moment of inertia as the indicated members. Submit the design of the fabricated members before fabricating of the members.

3. Galvanized structural steel or iron shall be hot-dip galvanized after fabrication in accordance with ASTM A 123. Electro-galvanizing shall not be used unless specified. Galvanized items that bend or twist during galvanizing shall be restraightened. Cut or otherwise damaged galvanized surfaces

shall be field repaired to equivalent original condition using Galvinox; Galvo-Weld; or equal.

4. The CONTRACTOR shall take all measurements necessary to properly fit his work in the field, and he shall be governed by and be responsible for these measurements and the proper working out of all details. The CONTRACTOR shall be responsible for the correct fitting of all metalwork in the field. Sharp or hazardous projections shall be rounded off and ground smooth. The CONTRACTOR shall paint steel and miscellaneous ferrous metal items in accordance with these Specifications.

5. Where aluminum comes in contact with dissimilar metals, except stainless steel, it shall be bolted with stainless steel bolts and separated or isolated from the dissimilar metals, with neoprene gaskets, sleeves, and washers. Those parts of aluminum which will be cast into concrete or which will be in contact with concrete, masonry, or wood shall be coated as specified elsewhere in these Specifications.

6. The threads of stainless steel bolts shall be coated, prior to installing the nut, with Never-Seez manufactured by Never Seez Compound Corporation; WLR No. 111 manufactured by Oil Research, Inc.; or equal.

B. Welding

1. General

a. Welding of structural metals shall be done by welders who have a current American Welding Society (AWS) certificate for the type of welding to be done by the welder. The CONTRACTOR shall notify the OWNER at least 24 hours before starting shop or field welding. The ENGINEER may check the materials, the equipment, and the qualifications of the welders. Welders doing unsatisfactory work shall be removed from the Work, or may be required to requalify.

b. The OWNER may use gamma ray, magnetic particle, dye penetrant, trepanning, or any other aid to visual inspection which he may deem necessary on any part or all welds to examine the welds.

c. The cost of retests on defective welds shall be borne by the CONTRACTOR. Cost in connection with qualifying welders shall also be borne by the CONTRACTOR.

d. Welds shall be full penetration welds unless otherwise indicated on the DRAWINGS.

2. Welding Aluminum

a. Welding of aluminum shall be in accordance with AWS D1.2, Structural Welding Code - Aluminum. Detail requirements for welding aluminum alloy 6061-T6 shall be as specified in the following paragraphs.

b. Filler metal for welding aluminum shall be aluminum alloys conforming to the requirements of AWS A5.10 and shall be AWS classification ER 4043, ER 5654, ER 5554, ER 5183, ER 5356, or ER 556.

c. Welding of structures which are to be anodized shall be done using filler alloys which will not discolor when anodized. ER 5654, ER 5554, ER 5183, ER 5356, or ER 5556 filler alloys shall be used.

d. Dirt, grease, forming or machining lubricants, and organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing. Additional operations to remove the oxide coating just prior to welding shall be performed when the inert gas tungsten arc welding method is used. This may be done by etching or by scratch brushing. The oxide coating may not need to be removed if the welding is done with the automatic or semi-automatic inert gas shielded metal arc.

e. Suitable edge preparation to assure 100 percent penetration in butt welds shall be used. Oxygen cutting shall not be used. Sawing, chipping, machining, or shearing may be used.

f. Welding of aluminum shall be done using a nonconsumable tungsten electrode with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert gas atmosphere (MIG). No welding process that requires the use of a welding flux shall be used.

3. Welding Stainless Steel

a. The general requirements of AWS D1.1, Structural Welding Code - Steel, shall apply to the welding of stainless steel. Welding of stainless steel shall be done with electrodes and techniques recommended in

"Welded Austenitic Chromium-Nickel Stainless Steel - Techniques and Properties" distributed by the Nickel Development Institute, Toronto, Canada, and in accordance with AWS D10.4 Recommended Practice for Welding Austenitic Chromium - Nickel Stainless Steel Piping and Tubing.

4. Welding Steel

a. Welding of steel shall conform to AWS D1.1 "Structural Welding Code - Steel."

b. Welding of ASTM A 36 structural steel, ASTM A 500 and A 501 structural tubing, and ASTM A 53 pipe shall be with electrodes conforming to AWS A5.1 "Specification for Carbon Steel Covered Arc Welding Electrodes," using E70XX electrodes; AWS A5.17 "Specifications for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding," using F7X-EXXX electrodes; or AWS A5.20 "Specifications for Carbon Steel Electrodes for Flux Cored Arc Welding," using E7XT-X electrodes.

C. Structural Metals

1. General

a. Structural or foundry items shall be carefully fabricated to true dimensions without warp or twist. Welded closures shall be neatly made; and where weld material interferes with fit or is unsightly in appearance, it shall be ground off smooth.

b. Structural items shall be installed accurately and securely, true to level, plumb, in correct alignment and grade, with all parts bearing or fitting the structure or equipment for which intended. Cocking out of alignment, redrilling, reshaping, or forcing to fit fabricated items will not be permitted. CONTRACTOR shall place anchor bolts or other anchoring devices accurately and shall make surfaces which bear against structural items smooth and true to level to preclude the necessity of springing, redrilling, or reshaping.

c. Structural items needing a special alignment to preserve straight, level, even, smooth lines shall be rigidly supported and braced and kept braced until concrete, grout, or dry pack mortar has hardened for a period of not less than 48 hours.

d. The CONTRACTOR shall submit certified copies of mill tests or reports from a recognized commercial laboratory and they shall include chemical and tensile properties of each shipment of structural metal or part thereof having common properties. Tests and analyses shall be made in accordance with the applicable ASTM Standards.

2. Structural Aluminum

a. The CONTRACTOR shall furnish and install structural aluminum items as indicated on the DRAWINGS and as specified. He shall provide supplementary parts necessary to complete each item even though such work is not definitely indicated on the DRAWINGS and specified in the Specifications. Their size, form, attachment, and location shall be such as to conform to the best of current practice.

b. Materials not otherwise specified shall conform to the applicable ASTM Standards.

c. Hole centers may be center punched and cutoff lines may be punched or scribed. Center punching and scribing shall not be used where such marks would remain on fabricated material.

d. A temperature correction shall be applied where necessary in the layout of critical dimensions. The coefficient of expansion shall be considered to be 0.000013 per degree F.

e. Material ½-inch thick or less may be sheared, sawed, or cut with a router. Material more than ½-inch thick shall be sawed or routed. Cut edges shall be true and smooth, and free from excessive burrs or ragged breaks. Reentrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting. Flame cutting of aluminum alloys is not permitted.

f. Rivet or bolt holes may be punched or drilled to finished size before assembly. The finished diameter of holes for bolts shall be not more than $^{1}/_{16}$ inch larger than the nominal bolt diameter. Holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as to distort the metal.

g. Structural material shall not be heated, with the following exceptions:

h. Aluminum material may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 30 minutes to facilitate bending or welding. Such heating shall be done only when proper temperature controls and supervision are provided to ensure that the limitations on temperature and time are observed.

i. Chips lodged between contacting surfaces shall be removed before assembly.

3. Structural Steel

a. Structural steel shall be delivered free from mill scale, rust, or pitting. Items not galvanized or protected by a shop coat of paint shall be protected from the weather until erection and painting. CONTRACTOR shall provide supplementary parts required for a complete structural steel erection even where such supplementary parts and work are not specified in detail in the Specifications or indicated on the DRAWINGS.

3.03 Testing – None

END OF SECTION

SECTION 07 05 00 – COMMON WORK RESULTS FOR THERMAL AND MOISTURE PROTECTION

PART 1 General

1.01 General Conditions

A. The General Conditions apply to all work of this specification, which shall be done as shown on the plans, and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the Specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

DIVISION 07: THERMAL AND MOISTURE PROTECTION
SECTION 07 20 00 –THERMAL PROTECTION

PART 1 General

1.01 Section Includes

A. Extent of insulation work is shown on DRAWINGS and indicated by provisions of this section.

B. Applications of insulation specified in this section include the following:

1. Rigid insulation.

2. Roof corner insulation.

3. Roof insulation is specified in the Division-7 section in which other roofing products, including roofing membrane is covered.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All thermal protection shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ASTM E84 - 09 Standard Test Method for Surface Burning Characteristics of Building Materials

2. ASTM E119 - 08a Standard Test Methods for Fire Tests of Building Construction and Materials

3. ASTM E136 - 09 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C (Combustion Characteristics)

1.04 Noted Restrictions – None

1.05 Quality Control

A. Thermal Resistivity

1. Where thermal resistivity properties of insulation materials are designated by r-values they represent the rate of heat flow through a homogenous material exactly 1" thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

B. Fire Performance Characteristics

1. Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

C. Maximum Allowable Asbestos Content of Inorganic Insulations

1. Provide insulations composed of mineral fibers or mineral ores which contain less than 0.25% by weight of asbestos of any type or mixture of types occurring naturally as impurities as determined by polarized light microscopy test per Appendix A of 40 CFR 763.

1.06 Submittals

A. Product Data

1. Submit manufacturer's product literature and installation instructions for each type of insulation and vapor retarder material required.

B. Certified Test Reports

1. With product data, submit copies of certified test reports showing compliance with specified performance values, including r-values (aged values for plastic insulations), densities, compression strengths, fire performance characteristics, perm ratings, water absorption ratings and similar properties.

1.07 Deliverables

A. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. Protection for Plastic Insulation:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

PART 2 Products

2.01 General

A. The CONTRACTOR shall provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

B. Preformed Units shall be sized to fit applications indicated, selected from manufacturer's standard thicknesses, widths and lengths.

C. Manufacturers

1. Manufacturer of Extruded Polystyrene Board Insulation shall be one of the following, or an ENGINEER approved equal:

a. Amoco Foam Products Co.

b. Dow Chemical U.S.A.

c. Minnesota Diversified Products, Inc.

d. UC Industries

2.02 Extruded Polystyrene Board Insulation

A. Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578 for Type indicated; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg. F (4.4 and 23.9 deg. C), respectively; and as follows:

1. Type IV, 1.6 lb./cu. ft. min. density, unless otherwise indicated.

B. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 5 and 165, respectively.

2.03 Roof Corner Joint Sealant:

A. At junction of all metal roof deck and exterior masonry walls, apply urethane foam insulation to a maximum depth of 3" in the corner to uniformly seal this junction air tight. Use 2 lbs. density foam.

B. Apply over foam after proper curing a coating of U.L. approved fire proofing of a tested thickness to achieve a one-hour fire protection rating.

2.04 Auxiliary Insulating Materials

A. Mechanical Anchors

1. Type and size indicated or, if not indicated, as recommended by insulation manufacture for type of application and condition of substrate.

B. Mastic Sealer

1. Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

PART 3 Execution

3.01 Preparation

A. Require installer to examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified. Obtain Installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

B. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections which might puncture vapor retarders.

C. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer’s technical representative for specific recommendations before proceeding with work.

D. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

E. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.02 Installation

A. Installation of Perimeter And Under-Slab Insulation

1. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of insulation.

B. Installation of General Building Insulation:

1. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

2. Seal joints between closed-cell (non-breathing) insulation units by applying mastic or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with mastic or sealant.

3. Set vapor retarder faced units with vapor retarder to war side of construction, except as otherwise indicated. Do not obstruct ventilation spaces, except for fire stopping.

4. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure air-tight installation.

a. Set reflective foil-faced units accurately with air pace in front of foil as shown. Provide not less than 0.75" air space where possible.

C. Installation of Safing Insulation

1. Cut safing insulation wider than gap to be filled to ensure compression fit and seal joint between insulation and edge of wall and metal deck or other material with caulking approved by safing insulation manufacturer for this purpose. Leave no voids in completed installation.

D. Protection

1. Protect installed insulation and vapor retarders from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

3.03 Testing – None

END OF SECTION

DIVISION 07: THERMAL AND MOISTURE PROTECTION
SECTION 07 60 00 –FLASHING AND SHEET METAL

PART 1 General

1.01 Section Includes

A. The CONTRACTOR shall furnish and install all sheet metal and appurtenant work, complete and in accordance with the requirements of the Contract Documents.

B. The principal items of sheet metal work shall include, but not be limited to, the following: sheet metal flashings, collars and all roof penetrations.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 00 90 00 – Finishes

1.03 Cited Standards

A. All work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section.

B. Products and their installation shall be in accordance with the following trade standards, as applicable.

1. Manufacturer's printed recommendations and specifications

2. Sheet Metal and Air Conditioning CONTRACTORs National Association "Architectural Sheet Metal Manual" (ASMM)

3. The Aluminum Association "Specifications for Aluminum Sheet Metal Work in Building Construction"

4. American Society for Testing and Materials (ASTM)

5. American Welding Society (AWS)

1.04 Noted Restrictions – None

1.05 Quality Control – None

1.06 Submittals

A. Shop DRAWINGS showing materials, gages, finishes, layout, jointing, profiles, fasteners, fabrication of special shapes and method of attachment to adjacent Submittal Procedures.

B. Material and color samples shall be submitted where required for appearance and color selections by the ENGINEER.

PART 2 Products

2.01 Sheet Metal

A. Sheet metal shall be galvanized steel unless otherwise indicated. Sheet metal work in connection with roofing shall be in accordance with roofing manufacturer's published specifications and as shown on the DRAWINGS.

B. All sheet metal flashings necessary to make building weathertight shall be provided, whether or not shown or specified.

C. Ferrous Metals:

1. Galvanized steel shall be 24-gage minimum thickness conforming to ANSI/ASTM A 526 with coating designation conforming to G90, ANSI/ASTM A 525M.

D. Lead and Soldering Materials:

1. Lead shall be 4-6% antimony and remainder shall be lead. Lead sheet shall be soft temper, except hard temper for flanges. Weight shall be not less than 4-lb. per sq. ft. unless shown otherwise.

2. Solder shall conform to ANSI/ASTM B 32-76 Alloy 5b, 50% tin, 50% lead.

3. Soldering flux shall meet FS O-F-506c, or a type not injurious to metal surface being treated.

E. Fasteners

1. Fastening devices shall be galvanized or stainless steel. Fasteners shall have neoprene washers where water tightness is required.

F. Plastic Cement

1. Plastic cement shall conform to ANSI/ASTM D 2822.

2.02 Equipment – None

2.03 Fabrications

A. Shop Fabrication Requirements

1. Galvanized steel corner joints and other joints where specified or shown shall be soldered.

2. All reglets and counter-flashing and associated flashings shall be fabricated by the same manufacturer and be installed as a complete flashing system. All flashings shall be creased longitudinally or otherwise formed with sufficient spring action to hold bottom edges firmly against base flashing or similar material.

3. Intersecting corners of coping shall be accurately fitted and soldered. Coping shall be per ASMM Plate 68, except modified as shown.

4. Dryer vents shall be fabricated or stainless steel and be provided with rainhood and self-closing flap and interior and exterior escutcheon plates.

5. Flashing required through concrete or clay tile shall be flexible flashing in order to assure against undue separation between tiles on account of rigidity or the flashing material.

6. Flashing around pipes, drains, vents, flues, chimneys, etc. shall be of lead or galvanized steel.

B. Fabricated Sheet Metal Work

1. Scuppers in walls shall be constructed of 20-gage galvanized steel with all joints soldered.

2. Pitch pockets and equipment supports conforming to reference standards shall be provided where required or necessary and may be of galvanized steel construction unless shown otherwise. Pitch pockets shall be designed per ASMM Plate 61. Equipment support (sleeper) caps shall be designed per ASMM Plate 61, Figure B.

3. The roof penetrations shall be provided with the following flashing:

a. Vent Pipes or Multi-Pipes: Sheet metal with w/Curb: sealant and draw bands. Ref. ASMM 59.

b. Equipment Support: Sheet metal. Ref. ASMM Plate 60 & 61.

c. Sleeper Covers: Sheet metal. Ref. ASMM Plate 60, Figure C & D.

d. Ducts w/Curb - 113 (similar): Sheet metal. Ref. ASMM

e. Equipment Platform: Sheet metal. Ref. ASMM Plate 101, Figure B (similar).

PART 3 Execution

3.01 Preparation

A. The CONTRACTOR shall coordinate the flashings necessary with the different trades to make sure all items which penetrate the roof are provided with all necessary sheet metal items and work, such as, but not limited to, the following: pipes, ducts, support racks, equipment platforms or sleepers and supports.

B. All work shall conform to reference standards. Flashing work shall be coordinated with roofing work. Sheet metal and roofing shall provide a weather-tight and watertight assembly.

3.02 Installation

A. Sheet metal work shall be accurately formed to dimensions and shapes shown. Work shall be fitted snugly, with straight, true lines with exposed faces aligned in proper plane, free from waves and buckles. Arises and angles shall have true and sharp lines and surfaces shall be free from waves and buckles. All exposed edges shall be hemmed. Holes for fasteners within sheet metal work exposed to temperature changes shall be elongated holes for material expansion and movement.

B. All sheet metal work shall be furnished complete with supports, hangers, bracing, anchors and other devices as required for reinforcement and proper attachment to adjacent construction. Fastenings shall be concealed wherever possible. Joints, fastenings, reinforcements and supports shall be sized and located as required to preclude distortion or displacement due to thermal expansion and contraction.

C. Dissimilar materials shall be isolated with two (2) coats of asphaltic paint, asphaltic coating compound, or sealer tape. Only stainless steel fasteners shall be used to connect isolated dissimilar metals.

D. Joints shall be sized and spaced to permit sheet movement for thermal expansion and contraction of 1/4-inch per 10-foot length on 100 deg. F

temperature difference. Holes for fasteners or anchors shall be elongated to provide for movement.

E. Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof. Corner units shall be factory-fabricated and shall have mitered soldered or welded corner joints and shall be installed with 3-inch (min) lap joint over flashings on each side.

3.03 Testing – None

END OF SECTION

DIVISION 07: THERMAL AND MOISTURE PROTECTION
SECTION 07 92 22 – SEALANTS, CAULKING AND BELOW GRADE WATERPROOFING

PART 1 General

1.01 Section Includes

A. The CONTRACTOR shall perform all caulking, sealing, moisture protection and appurtenant work complete and in accordance with the requirements of the Contract Documents.

1.02 Referenced Sections

A. Related Sections are shown below.

1. SECTION 03 15 15 - MISCELLANEOUS JOINT AND CRACK FILLERS

1.03 Cited Standards

A. all sealants, caulking and below grade waterproofing shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. Federal Specifications:

a. TT-S-00230C(2) - Sealing Compound, Elastomeric Type, Single Component, (For Caulking, Sealing and Glazing in Buildings and Other Structures).

b. TT-S-001543A - Sealing Compound, Silicone Rubber Base, (For Caulking, Sealing and Glazing in Building and Other Structures).

2. Commercial Standards:

a. ASTM D41 - 05 Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

b. ASTM D226 - 06 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

c. ASTM D312 - 00(2006) Standard Specification for Asphalt Used in Roofing

1.04 Noted Restrictions – None

1.05 Quality Control – None

1.06 Submittals

A. Samples

1. The CONTRACTOR shall submit samples to the ENGINEER for review, including color samples of all the caulking and sealant materials and other moisture protection materials he proposes to use. The samples shall be clearly marked with the manufacturer's name and product identification and shall be submitted along with the manufacturer's technical data and application instructions.

2. The CONTRACTOR shall submit copies of the manufacturer's technical literature, specifications, warranty, and installation instructions.

PART 2 Products

2.01 Sealants and Caulking Materials

A. All caulking and sealing materials shall conform to the requirements of sealant for joints in concrete as specified under **03 15 15 Miscellaneous Joint and Crack Fillers**

B. Sealant for general exterior and/or interior architectural use shall be 2-part polyurethane, gun-grade, such as Products Research Corp "210"; Progress Unlimited "Iso-Flex 2000"; or equal. Sealant for interior use may be 1-part acrylic trypolymer sealant, such as Tremco's "Mono"; Dap One-Part Acrylic; or equal.

C. The sealants used with aluminum doors, windows, storefronts and frames shall be silicone sealant conforming to Federal Specifications TT-S-001543A (Class A) and TT-S-00230C(2) (Type II, Class A).

D. Filler material shall be resilient, closed-cell polyethylene foam and/or bond breakers of proper size for joint widths. It shall be compatible with sealant manufacturer's product.

E. Primers shall be as recommended in the manufacturer's printed instructions for caulking and sealants.

F. Cleaning and cleanup solvents shall be as recommended in the manufacturer's

printed instructions for caulking and sealants.

PART 3 Execution

3.01 Preparation

A. All work under this Section and all testing, where applicable, shall be performed in accordance with manufacturer's printed recommendations, specifications and installation instructions except where more stringent requirements are shown or specified herein; and, except where project conditions require extra precautions or provisions to assure performance of the waterproofing system.

B. Authorized Installers: Caulking, sealants and moisture protection shall be complete systems and installed only by installers authorized and approved by the respective manufacturers.

3.02 Installation

A. The CONTRACTOR shall be responsible for providing the on-site services of the sealant manufacturer’s representative prior to sealant work to inspect the joints to be sealed and to instruct the installer in the proper use of the materials. Joints and spaces to be sealed shall be clean, dry and free of dust, loose mortar and other foreign materials. Ferrous metal surfaces shall be cleaned of all rust, mill scale and other coatings by wire brush, grinding or sandblasting.

B. Oil and grease shall be removed by cleaning in accordance with sealant manufacturer's printed recommendations. Protective coatings shall be removed from all aluminum surfaces against which caulking or sealing compound is to be placed. Bituminous or resinous materials shall be removed from surfaces to receive caulking or sealants. Where required by the manufacturer, sides of joints of porous materials shall be primed immediately prior to caulking or sealing.

C. Sealant depth in expansion joints shall be 1/2 of the width of joint, but not less than 1/8-inch deep and 1/4-inch wide nor more than 1/2-inch deep and 1-inch wide. All joints shall have a rigid filler material installed to proper depth prior to application of sealant.

D. A full bead of sealant shall be applied into the joint under sufficient pressure with the nozzle drawn across sealant to completely fill the void space and to ensure complete wetting of contact area to obtain uniform adhesion. Sealants shall be tooled immediately after exposure with caulking tool or soft bristled brush moistened with solvent. The finished sealant filled joint shall be slightly

concave unless detailed otherwise.

E. After application of sealant and caulking materials, adjacent materials which have been soiled shall be cleaned and left in a neat, clean, undamaged or discolored condition. On porous surfaces, excess sealant shall be removed per sealant or caulking manufacturer's printed instructions.

3.03 Testing – None

END OF SECTION

DIVISION 08: OPENINGS
SECTION 08 05 00 – COMMON WORK RESULTS FOR OPENINGS

PART 1 General

1.01 General Conditions

A. The General Conditions apply to all sections of this specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the Specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the Design ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

1.02 Referenced Sections – none

1.03 Cited Standards

A. All openings shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response

2. NFPA 80 - Standard for Fire Doors and Other Opening Protectives

1.04 Noted Restrictions

A. The CONTRACTOR shall provide appropriate NFPA 704 Hazardous Material and Warning Signage at the entrances to the chlorine room and sodium hypochlorite tank storage rooms.

B. The storage room shown on the DRAWINGS shall have a 1-hour fire

separation wall from the control room or be equipped with a sprinkler system. If the 1-Hour separation wall is provided, the door between the Control Room and the Storage Room shall have a minimum 3 to 4-hour fire rating.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

DIVISION 08: OPENINGS
SECTION 08 06 00 – SCHEDULES FOR OPENINGS

See DRAWINGS for description, size and quantity of openings materials.

END OF SECTION

DIVISION 08: OPENINGS
SECTION 08 11 00 – METAL DOORS AND FRAMES

PART 1 General

1.01 Section Includes

A. This section specifies the furnishing and installing of doors and hardware.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control – None

1.06 Submittals

A. Submittals shall be in accordance with Section 013300 and shall include manufacturers' literature on door construction, installation details, and a schedule showing quantity, size and location of doors and frames to be provided. Manufacturer must be a current member of the Steel Door Institute.

C. A full range of color samples shall be provided for the City's selection; two samples, 6-inch square minimum, of each color and texture selected for factory-finished doors and frames.

PART 2 Products

2.01 Hollow Metal Doors and Frames

A. General

1. Hollow metal doors and frames shall conform to the standards of the National Association of Architectural Metal Manufacturers Specification CHM-l; the standards and specifications of the Steel Door Institute for Grade 3, Model 2 – seamless hollow steel construction; and the project requirements detailed on the DRAWINGS and specified herein.

B. Materials

1. Material for doors and frames shall be commercial quality, level, cold-rolled steel conforming to ASTM A366 or hot-rolled, pickled and oil-rolled steel conforming to ASTM A569.

Face sheets of exterior doors and frames shall have a zinc coating applied by the hot-dip process conforming to ASTM A526 (A60 or G60) with a coating weight of not less than 0.60 ounces per square foot (0.30 ounces per square per side). Internal stiffeners and anchors may be plain sheet steel.

C. Doors

1. Steel doors shall be 1 3/4 inch thick flush type, constructed of two steel sheets not less than 16-gauge steel for interior doors and 16-gauge steel for exterior doors. Face sheets shall be stiffened by vertical steel ribs. Stiffeners shall be formed from not less than 22-gauge steel, spaced not more than 6 inches apart and securely attached to the face sheets by spot welds, not more than 5 inches on center (O.C.). The spaces between the stiffeners shall be insulated the full height of the door with a minimum 0.6 pound density, non-combustible insulation. Doors shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Top and bottom edges of all doors shall be closed with a continuous recessed steel channel not less than 16-gauge, extending the full width of the door and spot-welded to both faces. Exterior doors shall have additional flush closing channels at the top edge. Hinge reinforcements shall be 7-gauge; lock, closer and flush bolt reinforcements shall be 12-gauge; and reinforcement for all other surface mounted hardware shall be 16-gauge. Loose stops for glazing shall be not less than 20-gauge; secured to the opening by cadmium or zinc-coated countersunk screws. Louvers shall be of the welded blade, sightproof type. Doors scheduled as being labeled to meet specific fire rating requirements shall bear the appropriate UL label.

D. Fire-Rated Door Assemblies

1. Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 “Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

2. Door Assemblies shall be rated for a minimum of 3 hours (180 minutes).

E. Frames

1. Frames for doors, windows, transoms, sidelights and louvers shall be of pressed steel construction. Frame profiles shall be as indicated on DRAWINGS. Where not otherwise indicated, frame depth shall be 6 inches, frame width shall be 2 inches and stop depth shall be 5/8 inch. Frames for interior doors shall be constructed of not less than 16-gauge steel. Frames for exterior doors and for frames in openings greater than 4 foot 0 inches in width shall be constructed of 14-gauge steel. Frames shall be of welded unit construction, assembled and welded in the shop. Welding shall be to a hairline joint with all exposed heads ground smooth. Concealed reinforcing of frames for mortised hardware shall be not less than 7-gauge at hinges and 12-gauge at strikes, flush bolts, closers, panic devices and all other applied hardware. Floor anchors of 14-gauge steel shall be securely welded inside each jamb and secured to floor with two fasteners. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the strap and stirrup type. Anchors shall be not less than 16-gauge steel spaced at a maximum of 30 inches O.C. Frames in masonry shall be fully grouted as the Work progresses. Provide for installation of door mutes (silencers) minimum of 3 per frame.

2. All frames shall be provided with a steel spreader temporarily attached to the feet of both jambs to serve as a brace during shipping and handling. Frames scheduled as being labeled to meet specific fire rating requirements shall bear the appropriate UL label.

2.02 Hardware

F. General

1. Items of hardware required for completion of work, but not specifically mentioned herein, shall be provided by the CONTRACTOR, and shall be suitable for the required service and comparable to those specified. The CONTRACTOR shall provide any auxiliary or interconnecting devices necessary to the proper function of items specified.

2. Necessary screws, bolts or other fastenings of suitable size and type to secure hardware in position shall be provided by the CONTRACTOR and shall match hardware in material and

finish. Where screws are required, Phillips head type shall be provided. The CONTRACTOR shall provide expansion bolts, sex bolts, toggle bolts or other approved anchors as applicable to each setting condition.

3. Hardware finish shall be as indicated in the Hardware List which follows. Fasteners shall be stainless steel unless otherwise required to match a plated finish.

4. The CONTRACTOR shall submit a complete hardware list for the OWNER's review. Masonry Door openings shall be identified with numbers corresponding to those on the DRAWINGS.

5. The CONTRACTOR shall require hardware supplier to furnish the proper templates to the door and frame manufacturer, along with a complete hardware schedule, so that he may prepare doors and frames to suit the scheduled hardware.

G. Hardware Description

1. Hardware shall be as indicated below and shall be the product of the following named manufacturers; or equal. Some items listed below may not apply to this project. Specific hardware requirements are given in the Door Schedule on the DRAWINGS and the Hardware List hereinafter. Only one manufacturer's model number is listed. Other manufacturers to match.

2. PANIC style hardware (also known as “CRASH BAR”) shall be installed for egress on all doors in accordance with Uniform Statewide Building Code (USBC) and Statewide Fire Prevention Code (SFPC).

H. Hinges

1. Hinges shall be full mortise type with non-rising pins, ball or oilite bearings and flat button tips. Hinge height shall be 4½-inch to 36-inch door width, 5 inch over 36 inch to 48 inch, and 6 inch over 48 inch door width. Provide one hinge for each 2ft-6in. part thereof of door height. Hinge width shall allow door swing to 180 degrees. Provide non-removable pins at exterior doors opening out. Hinges shall be as manufactured by Hager; McKinney; or equal.

I. Door Closers

1. Closers shall have fully hydraulic, full rack and pinion action with high strength cast iron cylinder. Closers shall be non-handed and adjustable from size 2 to 6.

2. Provide both standard and parallel arm-type closers per Hardware List. Include hold-open feature where indicated. All fire rated doors shall be provided with closers. Where the hold-open feature is indicated at fire rated doors, they shall be provided with a fusible link. Door closers shall be as manufactured by Norton; LCN; Corbin; Yale; or equal.

J. Thresholds

1. Thresholds shall be extruded aluminum fastened to concrete by means of 5/16-inch stainless steel flat head countersunk machine screw and expansion anchors into the concrete slab at 8-inch centers. Unless indicated to be set in grout, thresholds shall be set in a double bead of sealant. Cope thresholds to fit door frame profile and drill to suit required flush bolts and panic bolts. Thresholds shall not be installed until construction of the project is substantially complete, unless satisfactory precautions can be taken against damage by heavy traffic during construction. Thresholds shall be as manufactured by Pemko; Reese; or equal.

K. Weatherstripping

1. Weatherstripping shall be shop applied at door jambs and head. Assembly shall consist of a continuous silicone rubber seal retained and fastened to the stop through a continuous aluminum extrusion. Size shall be as required to suit door size. Weatherstripping may also be used on interior doors to seal for light, sound or smoke. Weatherstripping shall be as manufactured by Pemko; Reese; or equal.

L. Stops

1. Wall stops shall be provided except where they cannot be satisfactorily used, then floor stops shall be provided. Machine screws in threaded expansion anchors shall be provided for installation in concrete or masonry and self-tapping screws shall be provided for installation in stud walls. Height of floor stop

shall be as required to suit specific floor conditions. Stops shall be as manufactured by Quality; Ives; Glynn-Johnson; or equal.

M. Overhead Door Holders

1. Door holder shall include an integral spring which shall absorb and dampen shock. Holder shall be surface-mounted to the door with machine screws and shall be as manufactured by Sargent; or equal.

N. Flush Bolts

1. Flush bolts shall be mortise type and shall be provided at top and bottom of inactive leaf of double doors when not equipped with exit devices. Provide dustproof strike at floor and standard strike at head. Rod length shall be provided so that top lever in door edge is not more than 6 feet 6 inches above the floor. Flush bolts shall be as manufactured by Quality; Ives; or equal.

O. Astragals

1. Astragals at meeting edge of double doors shall be full length extruded aluminum with vinyl insert, except at fire rated doors where astragal shall be steel 2 inch wide by 3/16-inch thick screw attached to door. Astragal shall be as manufactured by Pemko; or equal.

P. Exit devices

1. Exit devices at single door shall be rim type (Panic/Fire Exit Device). At double steel doors with both doors active, provide two vertical rod type exit devices with two-part locking and no astragal. Function and trim shall be as indicated on the hardware list. Exit devices shall be as manufactured by Sargent, Von Duprin; Corbin or equal.

Q. Door Bottoms

1. Door bottom shall be extruded aluminum with a vinyl insert. Length shall be equal to door width minus 2 inches. Automatic door bottoms shall be provided where indicated. Door bottoms shall be as manufactured by Pemko; Reese; or equal.

R. Locksets

1. Locksets shall be bored type with function as indicated on the Hardware List. Backset shall be 2 ¾ inches. Lockset shall be completely reversible and shall include anti-friction and guarded latch bolt, seamless brass latch tube and stainless steel springs and retractors. Latch bolt shall be ½-inch throw except where ¾-inch throw is required for labeled doors. Locksets shall be Cyer Locks.

2.03 Hardware List

S. The various hardware items required for the doors on this project shall be as tabulated below. See DRAWINGS for information regarding material quantities.

T. Manufacturer's names are listed to establish a standard of quality, appearance and function for hardware required on this project. Equal products by alternate manufacturers may be submitted for OWNER's review:

Hardware List

Locksets	Types shall be as follows:
L-1	Schlage Level ND40S-RH0625
Hinges	Types shall be as follows:
H-1	McKinney TA2314 32D 4-1/2 x 4-1/2 NRP
H-2	McKinney TA2314 32D 5 x 4-1/2 NRP
H-3	McKinney TA2314 32D 6 x 4-1/2 NRP
Closers	Types shall be as follows:
C-1	Sargent EN350 Parallel Arm
Thresholds	Types shall be as follows:
T-1	Pemko 170A
Weatherstripping	Types shall be as follows:
W-1	Pemko 303AS
Door Bottoms	Types shall be as follows:
D-1	Pemko 222AV
Exit Devices	Types shall be as follows:
E-1	Von Duprin Series 22 (rim type)
Stops	Types shall be as follows:
S-1	Quality 307 32D

PART 3 Execution

3.01 Preparation

A. General

1. Doors and door frames shall be fabricated and installed in a workmanlike manner. Doors and hardware shall be adjusted so that operation will be smooth, free, and easy, and with no binding in the hardware, or between doors and frames. Doors shall be set plumb, square, and level at their proper elevation and in their proper plane. Hardware shall be adjusted to operate smoothly, freely, and properly. Doors and frames shall be protected during shipment and storage to prevent warping, bending, or corrosion.

2. Doors and frames shall be prepared and reinforced for hinges, locksets, strikes, closers, and other items as required. Doorknobs or levers shall be 40 inches above the floor to the center line of the knob. Preparations in pressed steel frames for hinges, strikes, flush bolts, and other items shall be protected with dust boxes.

3. Door sizes, leaf types, door frames, and window type and size shall be as indicated or scheduled on the DRAWINGS. Aluminum shall be insulated as specified under Section 05 80 00, Structural and Miscellaneous Metals. Shop DRAWINGS shall be submitted to the OWNER for review

3.02 Installation

A. Hollow Metal Doors and Frames

1. Finish

a. Doors and frames shall be mortised, drilled and tapped to template requirements in preparation for finish hardware. After shop assembly, doors and frames shall have all tool marks and surface imperfections dressed, filled and sanded as required to make faces and vertical edges smooth, level and free of irregularities. They shall then be chemically treated for maximum paint adhesion and shall be coated, on all exposed surfaces, with a rust-inhibitive primer which shall be fully cured before shipment. Doors and frames shall be shop painted.

2. Shop Painting

a. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

b. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

c. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

3. Installation

a. Doors and frames shall be installed per manufacturers' recommendations and shop DRAWINGS. Doors shall operate smoothly and with no binding. Clearance between door and frame at head and jambs shall be 1/8 inch. Clearance between meeting edges of pairs of doors shall be 1/8 inch. At door sills where no threshold is used, clearance shall be 3/8 inch above finished floor. Where threshold is used, sill clearance shall be 3/4 inch above finished floor.

b. Doors and frames installation shall conform to National Fire Protection, NFPA 80 - “Standard for Fire Doors and Fire Windows”

B. Hardware

1. Installation

a. Hardware installation shall be coordinated with other work requiring door hardware or attaching to it. The CONTRACTOR shall submit necessary copies of schedules, templates, etc. in ample time to avoid fabrication and construction delays. Hardware shall be delivered to the site in unopened packages bearing the manufacturers' labels. Each item or group of items shall be identified according to the accepted submittal schedule, and shall be installed per manufacturers' recommendations.

b. Each hardware item shall be fitted, adjusted and secured neatly and firmly in place and shall be in perfect

working order. Latch bolts shall be adjusted to automatically engage in keepers, whether activated by closers or by a manual push. In no case shall additional manual pressure be required to accomplish positive latching. Closers shall be carefully adjusted to operate noiselessly and evenly.

c. Hardware shall be dismantled and rehung as required to complete finish painting. Protect hardware from finish painting by use of a strippable coating, removable tape or other means to prevent damage or staining. Protective measures shall be removed prior to final inspection for OWNER's acceptance of project.

d. All work shall be guaranteed for two years from date of acceptance of the work, against defects in materials and workmanship in accordance with the General Provisions.

2/ Keying

a. All door locks shall be cyber locks.

b. The hardware supplier shall prepare and submit a lock schedule which complies with the above directions.

3.03 Testing – None

END OF SECTION

SECTION 08 90 00 - LOUVERS AND VENTS

Please See Division 23

END OF SECTION

DIVISION 09: FINISHES
SECTION 09 06 90 – SCHEDULES FOR PAINTING AND COATING (TREATMENT PLANT)

PART 1 General

1.01 General Conditions

A. The General Conditions apply to all sections of this specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the Design ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

1.02 Referenced Sections - none

A. Related Sections are listed below:

1. SECTION 01 33 00 - SUBMITTAL PROCEDURES

2. DIVISION 05 00 00 - METALS

1.03 Cited Standards – none

1.04 Noted Restrictions

A. No lead or chromate containing paints shall be used.

1.05 Submittals

A. The CONTRACTOR shall submit, for the OWNER's approval, a proposed plan for accomplishing the required surface preparation and painting work. The plan shall include, as a minimum, the following:

1. A schedule for accomplishing the surface preparation, priming and painting within each area of work.

2. A plan for protecting areas just painted from damage during sandblasting.

3. A plan for protecting surrounding areas, structures, and equipment from damage during sandblasting and/or painting.

4. Submit in accordance with Section **01 33 00 Submittal Procedures**.

PART 2 Products

2.01 Paint

A. All paint for concrete and metal surfaces shall be especially formulated for the intended use and shall be applied in conformance with the manufacturer's published specifications.

B. All paint for final coats shall be fume resistant. If a paint manufacturer proposes use of paint which is not designated "fume resistant" in its literature, it shall furnish full information concerning the pigments used in this paint.

C. Coatings used in conjunction with potable water supply systems shall have FDA, NSF, and California State DOHS approval for use with potable water and shall not impart a taste or odor to the water.

D. Complete data on each type and kind of paint and primer shall be submitted to the OWNER for review. Submittals shall be reviewed and approved by the OWNER before the paint is purchased and delivered to the jobsite. This procedure shall be followed whether or not the paint that the CONTRACTOR proposes to use is named in the Specifications. Review data shall show where and for what uses each paint product is proposed to be used with cross reference made to paragraphs of the Specifications or Painting Schedule. Data submitted on each proposed type and kind of paint shall include data to show that the paint meets the requirements of these Specifications.

E. Paints not listed in the Specifications and which are submitted for review shall be submitted with a certified ingredients analysis. Data shall include sufficient information for making a complete comparison between specified and proposed paint.

F. Colors shall be as specified or as selected by the OWNER. Colors will not necessarily be standard colors with all suppliers, and colors shall be mixed by the manufacturer to secure desired color when not standard. The CONTRACTOR shall prepare and submit color chip samples for all items which require color selection by the OWNER. If requested for special architectural finishes, the CONTRACTOR shall also submit 6-inch by 6-inch samples similar to the intended coated surfaces and coated with the selected color. No color selection will be made until all samples of all paints have been submitted. After all samples of all paints have been submitted, the OWNER will prepare a color scheme using the submitted colors.

G. All paint shall comply with all requirements of the Air Pollution Regulatory Acts concerning the application and formulation of paints and coatings for an area in which the paints are applied. Specifically, paints shall be reformulated as required to meet the local, State, and Federal requirements.

H. Specified Products List

1. The CONTRACTOR shall use paint from one of the following Manufacturer's, unless approved otherwise by the ENGINEER.

Brand Name	**Manufacturer**
Amchem	Amchem Products Fremont, California
Amercoat	Ameron Corporation Brea, California
Borden	Borden Chemical Company 50 West Broad Street Columbus, Ohio 43215
Carboline	Carboline Company St. Louis, Missouri 63144
Kop-Cote	Koppers Company, Inc. Koppers Building Pittsburgh, Pennsylvania 15219
Sherwin-Williams	The Sherwin-Williams Company 101 Prospect Avenue, N.W. Cleveland, Ohio 44115
Sinclair Paint Co.	Sinclair Paint Co. 6100 South Garfield Avenue Los Angeles, CA 90040

Brand Name	Manufacturer
Tnemec	Tnemec Company, Inc. 123 West 23rd Avenue North Kansas City, Missouri 64116
International	International Louisville, KY (800) 284-2994
Glidden	Akzo Nobel Coatings Inc. Louisville, KY (502) 254-0470

I. Painting Systems

1. Waterproofing sealer for concrete shall be Sikagard 704W, Conspec No. 1, Thompson's No. 201, or ENGINEER approved equal.

2. Coatings of Dissimilar Metals

a. Where aluminum surfaces come in contact with dissimilar metals, aluminum surfaces shall be kept from direct contact with said metal by use of neoprene gaskets or washers, polyethylene self-adhesive tape (two wraps of 20-mil tape), or washers. Galvanizing or paint will not be considered as adequate protection.

b. Aluminum surfaces to be placed in contact with wood, concrete, or masonry construction shall be given a heavy coat of an alkali-resistant bituminous paint before installation. The bituminous paint shall be Koppers Bitumastic Black Solution, International: Intertuf 100, Tnemec 46-465 HB Tnemecol, or equal. The paint shall be applied as it is received from the manufacturer without the addition of any thinner, and the surface shall be cleaned according to the manufacturer's instructions. Not less than two coats shall be applied. All exposed surfaces shall be cleaned of any coating before installation. Coatings shall be continuous and holiday free.

c. All stainless steel bolt and screw surfaces in contact with aluminum shall be coated with Never-Seez by Never

Seez Compound Corp., WLR No. 111 by Oil Research Inc., or equal.

3. Hot-Dip Galvanizing

a. Area of Application: includes but not limited to stair stringers, grating embeds, fasteners, support members, and interior structural members not epoxy coated.

b. Fabricator Preparation

i. The Fabricator shall consult with the hot dip galvanizer to insure that materials, fabrication, and prep work will prevent potential problems during the galvanizing process

ii. The Fabricator shall remove all welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing. Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil paint and other deleterious material prior to fabrication. Remove by blast cleaning or other methods surface contaminants and coatings, which would not be removable by the normal chemical cleaning process in the galvanizing operation.

c. Hot-Dip Galvanizing

i. Pre-clean steelwork in accordance with accepted methods to produce an acceptable surface for quality hot dip galvanizing.

ii. Galvanize steel members, fabrications, and assemblies after fabrication by the hot dip process in accordance with ASTM A123. Galvanize bolts, nuts and washers and iron and steel hardware components in accordance with ASTM A153.

iii. Safeguard products against steel embrittlement in conformance with ASTM A143.

iv. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

v. Coating Weight: Conform with paragraph 5.1 of ASTM A123, Table 1 of A767, or Table 1 of ASTM A153, as appropriate.

vi. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.

vii. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

d. Testing

i. Inspection and testing of hot dip galvanized coatings shall include visual examination and tests in accordance with ASTM A123, A767 or A153 as applicable to determine the thickness of the zinc coating on the metal surface.

ii. Furnish Notarized Certificate of Compliance with ASTM Standards and Specifications herein listed. The Certificate must be signed by the galvanizer and contain a detailed description of the material processed. The Certificate shall include information as to the ASTM standard used for the coating.

J. Painting Schedules

1. General

a. Painting shall be as specified in this section of the Specifications and as indicated on the Plans and specified herein.

b. In general, all steel, iron, gypsum board and wood surfaces shall be painted unless specifically indicated or specified otherwise. Concrete surfaces shall be painted only where indicated or specified. Aluminum surfaces shall not be painted unless specifically indicated or specified.

c. The Painting Schedule sets forth a listing of the type of items and type of paint system which they shall receive. This Schedule shall compliment the lists of items to be painted listed hereinbefore. This listing is not necessarily complete, and items of a like nature to those shown on the Painting Schedule shall be painted the same as if they were included in the Painting Schedule. In case of question as to whether an item is to be painted, or as to type of paint system to use, the City shall be consulted to render a judgment.

2. Exterior paint colors shall closely match adjacent housing units. All paint colors shall be selected by the City.

PART 3 Execution

3.01 Preparation

A. Manufacturer's Instructions

1. The manufacturers' published instructions for use as a guide in specifying and applying the manufacturers‘ proposed paint shall be submitted to the OWNER. Paint shall not be delivered to the job before approval of the manufacturer's instructions is given by the OWNER.

2. A manufacturer's paint will not be considered for review unless that manufacturer's published instructions meet the following requirements:

3. The instructions must have been written and published by the manufacturer for the purpose and with the intent of giving complete instruction for the use and application of the proposed

paint in the locality and for the conditions for which the paint is specified or shown to be applied under this Contract.

4. All limitations, precautions, and requirements that may adversely affect the paint; that may cause unsatisfactory results after the painting application; or that may cause the paint not to serve the purpose for which it was intended, that is, to protect the covered material from corrosion, shall be clearly and completely stated in the instructions. These limitations and requirements shall, if they exist, include, but not be limited to the following list:

   a. Methods of application.

   b. Number of coats.

   c. Thickness of each coat.

   d. Total thickness.

   e. Drying time of each coat, including primer.

   f. Primer required to be used.

   g. Primers not permitted.

   h. Use of a primer.

   i. Thinner and use of thinner.

   j. Temperature limitations during application and after application.

   k. Time allowed between coats.

   l. Protection from sun.

   m. Physical properties of paint including solids content and ingredient analysis.

   n. Surface preparation.

5. Concrete surfaces specified by the paint manufacturer to be acid etched shall be etched in Accord with the manufacturer's instructions. The surface shall then be thoroughly scrubbed

with clean water, rinsed, and allowed to dry. The surface shall be tested with a moisture meter to determine when dry before coating.

B. Preparation of Surfaces

1. Paint surface preparation shall be as specified in the following or as recommended by the paint manufacturer's published application instructions, whichever imposes the most stringent requirements.

2. All surfaces to be painted shall be clean and dry except that in some cases the paint manufacturer's directions may require wetting the surface before painting.

3. Except as otherwise provided, all preparation of metal surfaces shall be in Accord with Specifications SP-1 through SP-11 of the Steel Structures Painting Council (SSPC). Where Steel Structures Painting Council Specifications are referred to in this specification, the corresponding Pictorial Surface Preparation Standard shall be used to define the minimum final surface conditions to be supplied. Grease and oil shall be removed by wiping with mineral spirits or naphtha per Specification SP-1. Rust, scale, welding slag, and spatter shall be removed and the surface prepared by hand tool cleaning, power tool cleaning or blast cleaning in Accord with the appropriate Specifications SP-2 through SP-11.

4. Unless otherwise specified, all iron or steel surfaces which are to be painted as submerged or high temperature metal shall be sandblasted on the site in Accord with Specification SP-10, near white blast cleaning or better. All metal surfaces which are to be painted as unsubmerged metal shall be commercial blast cleaned per Specification SP-6 except as otherwise specified, in locations where sandblasting would damage previously coated surfaces and installed equipment, and in locations where dry blasting is prohibited. The above locations in which SP-6 commercial blasting is not possible shall be given a SP-3 power tool cleaning if interior mild environment and SP-11 if interior corrosive environment or exterior exposed. This blasting shall be done not more than 12 hours ahead of the painting, subject to humidity and weather conditions between the time of blasting and painting operations. If any rusting or discoloration of

blasted surfaces occurs before painting, such rusting or discoloration shall be removed. Prepared surfaces shall not be left overnight before painting. No surface which is to be blasted shall be given a coat of primer or paint in the shop or in the field before sandblasting. Blasting shall provide a roughened surface profile of not less than 2.0 mils in depth.

5. Surfaces to be painted at erection welds, surfaces exposed by damage to the coating, as during erections, shall be cleaned as above before painting.

6. Threaded portions of valve stems, machined surfaces which are intended for sliding contact, surfaces which are to be assembled against gaskets, surfaces or shafting on which sprockets are to fit, or which are intended to fit into bearings, machined surfaces of bronze trim, and similar surfaces shall be masked off to protect them from the sandblasting. Cadmium plated items shall not be sandblasted except that cadmium-plated, zinc-plated, or sherardized fasteners used in assembly of equipment to be sandblasted shall be sandblasted in the same manner as the unprotected metal. Galvanized items shall not be sandblasted except when otherwise specified. All installed equipment, mechanical drives, and adjacent painted equipment shall be protected from sandblasting. Protection shall prevent any sand or dust from entering the mechanical drive units or equipment where damage could be caused.

7. There will be some surfaces which cannot be sandblasted, or which cannot be sandblasted and painted, after the items of which they are a part have been assembled in final position. These surfaces shall be sandblasted, or sandblasted and painted, before the items are put into final position. In some cases while the painting could be done after the items concerned were in place, the limitation on time between sandblasting and painting may make it necessary to paint the surfaces before installation of the items concerned.

8. Sand from sandblasting shall be thoroughly removed, using a vacuum cleaner if necessary. No surface which has been sandblasted shall be painted until inspected by the OWNER.

9. All concrete to be painted or coated shall be prepared as specified in Section 03000.

10. Concrete and masonry surfaces shall be free of dust, mortar droppings and spatter, fins, loose concrete particles, form release materials, oil, grease, and other deleterious materials. If required by the coating manufacturer, such surfaces shall be etched as specified above or brush-off blast cleaned.

11. All painted surfaces shall be dusted between coats and high gloss finishes shall be lightly sanded and dusted between coats unless otherwise directed by the paint manufacturer.

12. Surfaces which are to be painted with other than bituminous paint and which have had a bituminous coating (such as coal-tar varnished pipe), shall be sealed with not less than two coats of Inertol Tar Stop, Sherwin-Williams Metalatex B-42 W100, Glidden Insulcap, or equal, in sufficient quantity to permanently prevent bleeding of the bituminous coating.

13. Galvanized surfaces which are to be painted shall first be treated with Koppers No. 40 Metal Conditioner; Amercoat No. 59, Galvaprep No. 5 as manufactured by Amchem Products; or equal. Pretreatment for galvanized metal shall be applied not more than 48 hours prior to coating.

14. All fiberglass to be painted shall be lightly sandblasted or sanded to roughen surfaces just prior to painting.

15. Plastic surfaces shall be solvent-washed to dull the surface, using a thinner approved by the finish coating manufacturer.

16. Aluminum, copper, and other metal surfaces shall be lightly sanded or receive surface preparation as specified in the following or as recommended by the paint manufacturer.

3.02 Installation

A. Application of Paint

1. The applicator of the paint shall have had at least two (2) years past experience in applying the type or types of coatings and under similar conditions that he will be required to meet in this Contract. The CONTRACTOR shall provide written verification, the paint applicator's qualifications, and past performance, which shall include a listing of projects completed

with names and telephone numbers of OWNERs, before subcontracting the work to him.

2. No painting shall be done under dusty conditions, during or immediately after a rain, during rainy weather, when surface temperature is less than 50 degrees F, or when the temperature exceeds that recommended for application by the paint manufacturer. Relative humidity shall be between 30 and 85 percent and the dew point shall not be within 5 degrees of the surface temperature.

3. Paint may be applied by brush, roller, trowel, or spray, unless the manufacturer's recommendations or these Specifications call for some particular type of application. Where spray application is used, each coat of paint shall be applied to a thickness equivalent to a brush coat application at a coverage not greater than that specified by the manufacturer for a brush coat application. All spray painting shall be by the airless method except where specifically allowed by the OWNER for architectural painting. All air spray units shall have operable line filters for removal of all oil and moisture. The CONTRACTOR shall demonstrate the efficiency of the line filters before applying any paint.

4. Spray painting shall be conducted under controlled conditions and the CONTRACTOR shall be fully responsible for any damage to adjacent work or adjoining property occurring from spray painting.

5. All work shall be done leaving the finished surfaces free from drops, ridges, waves, holidays, laps, or brush marks. Drop cloths and other coverings shall be so placed at all times as to protect floors, other surfaces, and equipment from spatter and droppings. Hardware, plates, lighting fixtures, nameplates, and similar articles which are not to be painted shall be masked off or removed completely. After completion of painting, any spatter or droppings shall be removed.

6. Primer and intermediate coats of paint shall be unscarred and completely integral at the time of application of each succeeding coat. Each coat shall be subject to the inspection and approval of the OWNER the next succeeding coat is applied. Defective work of any kind shall be deemed sufficient

cause for stripping, removal, and re-preparing if required by the OWNER followed by recoating the entire surface involved at no additional cost to the OWNER.

7. Except as otherwise provided in these Specifications, or approved in writing by the OWNER, prime coats, undercoats, and finish coats on any one item shall be of the same manufacturer. If the incorrect prime coat is applied for any reason, it shall be blasted off and replaced with the specified primer at no additional cost to the OWNER.

8. When multiple coats of the same material are specified, the prime coat and undercoats applied shall be tinted to distinguish each from the following coat and finish coat.

9. Sufficient time shall be allowed between coats to insure proper drying unless these Specifications or manufacturer's recommendations specifically state otherwise. Excessive time or exposure between coats shall not occur in cases where such excessive time or exposure will impair the bond between coats. To prevent impairment of bond between coats, space heaters shall be provided to dry the coat or keep the coating dry, if recommended by the paint manufacturer or required by the OWNER at no additional cost.

10. The number of coats specified is the minimum to be applied. Suction spots between coats shall be touched up, and additional coats shall be provided if required to produce a finished surface of solid, even color, free from defects. The total thickness of the coating shall be as specified. Additional coats of paint shall be added if necessary to bring the total thickness up to not less than that specified. No holidays shall be left. Particular care shall be used to assure that the specified coverage is secured on the edges and corners of all surfaces. Additional brush coats shall be applied if necessary to cover the edges and corners. The CONTRACTOR shall control and check the dry film thickness of all coatings. The CONTRACTOR shall control and check the dry film thickness on metal surfaces with a correctly calibrated thickness meter and shall check for holidays with a low voltage holiday detector. The OWNER may use the CONTRACTOR's detector for additional checking. However, the OWNER will use an Elcometer to inspect the dry film

thickness of the coatings, and its findings utilizing this meter will be final as to the dry film thickness of the applied coatings.

11. Damaged paint or scratched painted surfaces shall be sanded smooth before repainting. Sanding and repainting shall be done to such a degree and in such a manner that all evidence of the scratches or damages are obscured.

B. Factory-Painted Equipment

1. Except as otherwise noted on the Painting Schedule or specified, the following items shall receive final finish coats at the factory and shall be protected against damage during transit, storage, and erection. Damaged areas must be refinished as the original. Factory-painted items shall be of a color specified, selected, or approved by the OWNER.

a. Air conditioning and heating units

b. Chlorinators

c. Electric distribution centers

d. Gauges and meters

e. Instrument and control panels

f. Instruments

g. Light fixture not specified to be field painted

h. Meter panels

i. Motor control centers

j. Transformers

k. Transmitters

l. HVAC equipment

C. Items Not Painted

1. The following items shall not be painted, unless specifically called for:

a. Aluminum, galvanized steel, or fiberglass grating

b. Aluminum, brass, bronze, copper, plastic, rubber, stainless steel, chrome, everdur, or lead

c. Buried or encased piping or conduit Exterior concrete

d. Galvanized pipe trays and cable trays (supports or hangers for these shall be painted)

e. Galvanized steel framing

f. Grease fittings

g. Galvanized or aluminum ducting Nameplates

h. Serial numbers

i. Steel encased in concrete or masonry

j. Warning or operating instruction labels.

D. Painting Concrete, Masonry

1. General

a. Except as otherwise noted on the Painting Schedules or specified herein, exterior concrete shall not be painted. Interior floors shall be sealed and painted as noted in Section 03000 and as shown on the plans. Form release agents shall be removed from poured or precast surfaces by sandblasting or as recommended by the paint manufacturer and approved by the OWNER. Review surface preparation for concrete and masonry under Preparation of Surfaces. Concrete masonry, plaster, shall he coated as specified in the following. Exterior masonry shall be sealed with a waterproofing sealer as specified.

2. Exterior above Grade

a. Exterior masonry surfaces shall be water roofed per the architectural plans, painting schedule, Section 09900.

E. Painting Metal Surfaces

1. General

a. Except as otherwise specified or indicated on the Painting Schedule, all metal shall be painted. Metal surfaces shall be primed and painted as specified in the following paragraphs.

b. Steel and miscellaneous iron items which are to be built into masonry or concrete shall, unless otherwise noted, have no field painting. Steel and miscellaneous iron items which have had a shop primer and which will be concealed above the ceilings shall be field primed. This includes but is not limited to the unexposed underside of steel roof decks and structural steel items such as beams, channels, and angles above ceilings. Touching up of these items shall be done after erection but before installation of the ceiling system. No further painting of these items will be required.

2. Shop Priming of Metals

a. Certain items have been listed to receive complete finish at the factory. Surfaces specified to be field sandblasted and galvanized surfaces shall not be shop coated. All other ferrous surfaces, except stainless steel and surfaces specified or shown to receive epoxy or grease type coatings, shall receive a shop coat of primer as specified compatible with the finish coats specified.

3. Field Priming of Metals

a. All abraded, scratched, or otherwise damaged areas in the shop prime coat shall be sanded smooth or receive power tool cleaning SP-3 and then spot primed. Where 20 percent or more of the shop priming is failing, weathered excessively, or where recommended by the paint manufacturer's representative, the entire shop prime coat shall be removed with SP-6 commercial sandblast surface preparation before re-priming at no additional cost to the OWNER.

b. Paint manufacturer's representative shall recommend changes in metal primers where specified primers and finish coats are not compatible. Changes shall be submitted for review and approval by the OWNER. Where the shop primer is not compatible with field primer and/or finish coats, the shop primer shall be removed by sandblasting to not less than SP-6 commercial sandblast. All shop primer shall be removed from all metal to be installed as submerged metal by sandblasting to near white SP-10 at no additional cost to the OWNER.

c. Primer shall be finish coated within the time recommended in writing by the paint manufacturer. Primed surfaces exposed longer than this recommended period shall be SP-7 sandblasted and re-primed prior to finish painting at no additional cost to the OWNER.

d. Galvanized, sherardized, aluminum, copper, or bronze surfaces to be painted shall be solvent cleaned and receive a surface preparation as specified hereinbefore, then either wash coated and primed or primed with a special primer in Accord with the directions of the manufacturer of the finish coats.

F. Painting Architectural and Process Metals

1. Doors, frames, ventilators, louvers, grilles, roof framing exposed sheet metal, exposed flashing, and other architectural metals, structural or nonstructural, that on integral parts of the structure or building shall be painted as specified or as indicated on the Architectural Painting Schedule. Piping, valve, pumps, motors and other process equipment and metals shall be painted or coated as specified or indicated in the Painting Schedule. All metal shall be primed as specified.

G. Field Quality Control

1. Verify coating thickness and penetration value immediately before installation and as required by OWNER.

H. Extra Paint

1. At the end of the project, the CONTRACTOR shall turn over to the OWNER a gallon can of each type and color of paint, primer, thinner, and other coating used in the field painting. If the manufacturer packages the material concerned in gallon cans, then it shall be delivered in unopened labeled cans as it comes from the factory. If the manufacturer does not package the material in gallon cans, and in the case of special colors, the materials shall be delivered in new gallon containers, properly closed with typed labels indicating brand, type, color, etc. The manufacturer's literature describing the materials and giving directions for their use shall be furnished in three bound copies. A typewritten inventory list shall be furnished at the time of delivery. The CONTRACTOR shall also submit a list by name, code number and composition of all colors used in the Work.

3.03 Testing

A. Testing

1. Holiday Testing. Test all coated ferrous surfaces which will be submerged in water or other liquids for pinholes in the coating using an approved holiday detector. Additionally, test any other ferrous surfaces required elsewhere in these specifications to be tested for holidays, in accordance with the provisions of this Section. Repair or recoat areas found to contain pinholes in accordance with the coating manufacturer's instructions and retest.

a. COATINGS WITH THICKNESS EXCEEDING 20 MILS. For surfaces having a total dry film coating thickness exceeding 20 mils; pulse-type holiday detector, Tinker & Rasor Model AP-W, D.E. Stearns Co., Model 14.20 or equal, adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

b. COATINGS WITH THICKNESS OF 20 MILS OR LESS. For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model Ml non-destructive type holiday detector, K-D Bird Dog, or equal, operating at less than 75 volts. For thickness between 10 and 20 mils, a non-sudsing type wetting

agent, Kodak Photo-Flo, or equal, shall be added to the water prior to wetting the detector sponge.

2. Testing dry film thickness. On ferrous metals, coating thickness shall be measured with a magnetic type dry film thickness gauge such as Mikrotest Model FM, Elcometer Model 11 l/lEZ, or equal. Each coat shall be checked for the correct thickness. No measurement will be made until at least 8 hours after application of the coating.

3. CONTRACTOR shall supply the testing equipment along with proper calibration devices.

B. Cleanup

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

Application	**# of Coats**	**Type**	**Product***	**Color**	**VOC #/gal**
Ferrous Piping and structural steel, pipe supports, anchor bolts and threaded surfaces subject to rusting.	Per Mfgr.	Primer Paint	Carboguard 890 VOC Carbothane 133 MC	Blue (Fed. Std. 15052)	0.8 0.81
Tank Exterior	Per Mfgr.	Primer Paint	Carboguard 890 VOC Carbothane 133 MC	Blue (Fed. Std. 15052)	0.8 0.81
Tank Interior	Per Mfgr.	Paint and Primer	Per Tank Spec	N/A	N/A
Installed Equipment – Touch-up after installation	Per Mfgr.	Paint and/or Primer	Touch-up paint to be supplied by equipment manufacturer	Per Mfgr.	N/A

END OF SECTION

DIVISION 09: FINISHES
SECTION 09 90 00 – PAINTING AND COATING

PART 1 General

1.01 Section Includes

A. This section includes materials and application of painting and coating systems for multiple surfaces such as exposed metal, buried metal, metal in contact with concrete, masonry surfaces, wood surfaces, drywall surfaces, and concrete surfaces.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 01 33 00 - SUBMITTAL PROCEDURES

1.03 Cited Standards

A. All surface preparation, coating, and painting shall conform to the following standard specifications, of the latest revisions, as applicable:

1. Requirements of the Steel Structures Painting Council

2. Requirements of the National Association of Corrosion ENGINEERs

3. The paint manufacturer's printed application instructions

1.04 Noted Restrictions

A. All exposed wood surfaces should be covered with aluminum sheeting.

1.05 Quality Control – see information under **Part 2 Products**.

1.06 Submittals

A. The CONTRACTOR shall submit shop DRAWINGS in accordance with **Section 01 33 00 - Submittal Procedures**.

B. Submit manufacturer's data sheets showing the following information:

1. Percent solids by volume.

2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.

3. Recommended surface preparation.

4. Recommended thinners.

5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

6. Application instructions including recommended equipment and temperature limitations.

7. Curing requirements and instructions.

8. Verification from the manufacturer that the product meets current California VOC requirements.

C. Submit color swatches.

D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.

1.07 Deliverables

A. All materials specified by name, brand, or manufacturer, or selected for use under these specifications shall be delivered unopened at the jobsite in their original containers bearing the manufacturer's label.

PART 2 Products

2.01 Painting and Coating Systems

A. The following index lists the various painting and coating systems by service and generic type:

1. Exposed Metal Coating Systems

No.	Title	Generic Coating
7.	Submerged Metal	Epoxy
10.	Exposed Metal, Below Grade	Zinc prime coat, high-build in vaults epoxy intermediate and finish coat
15.	Exposed Metal, Atmospheric Weathering Environment	Zinc prime coat, high-build epoxy intermediate and finish coat

2. Buried Metal Coating Systems

No.	Title	Generic Coating
21.	Buried Metal	Coal-tar epoxy

3. Coating Systems for Nonferrous Metals

No.	Title	Generic Coating
51.	Aluminum and Concrete	(See Below)

4. Coating Systems for Wood and Masonry Surfaces

No.	Title	Generic Coating
61.	Interior and Exterior	(See Below)

B. These systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

C. Exposed Metal Coating Systems

1. System No. 7 – submerged Metal (Epoxy)

a. Type: Epoxy.

b. Service Conditions: For use with structures, piping, or equipment immersed in water.

c. Surface Preparation: SSPC SP-10.

d. Coating System: Apply three or more coats of Tnemec Series 20, Engard 460 HS, or equal; 15 mils total. Color of topcoat: White.

2. System No. 10--Exposed Metal, Corrosive Environment:

a. Type: High-build epoxy intermediate and finish coat having a minimum volume solids of 60 percent, with an inorganic zinc prime coat.

b. Service Conditions: For use with metal structures or pipes located in vaults, manholes or structures, subjected

to water condensation; chemical fumes, such as hydrogen sulfide; salt spray; and chemical contact.

c. Surface Preparation: SSPC SP-6.

d. Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 14 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec 90-97 or equal.

e. Intermediate and Finish Coat: Tnemec Series 69 Epoxoline II, 5-mils each coat, or equal.

3. System No. 15 -- Exposed Metal, Atmospheric Weathering Environment:

a. Service Conditions: For use on the exterior of metal and piping.

b. Surface Preparation: SSPC SP-3.

c. Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 14 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec 90-97 or equal.

d. Intermediate and Finish Coat: Tnemec Series 69 Epoxoline II, 5-mils each coat, or equal.

D. Buried Metal Coating Systems

1. System No. 21--Buried Metal:

a. Type: Coal-tar epoxy having a minimum volume solids of 68 percent (ASTM D 2697).

b. Service Conditions: Buried metal, such as valves, flanges, bolts, nuts, structural steel, and fittings.

c. Surface Preparation: SSPC SP-10.

d. Prime Coat: Ameron 78 HB, 16 mils; Tnemec 46H-413, 16 mils; Porter 7080, 16 mils; or equal.

e. Topcoat: Ameron 78 HB, 16 mils; Tnemec 46H-413, 16 mils; Porter 7080, 16 mils; or equal.

E. Coating Systems for Nonferrous Metals

1. System No. 51 -- Aluminum and Concrete Insulation:

a. Type: Bituminous paint having a minimum volume solids of 68 percent coal-tar pitch based.

b. Surface Preparation: Dust blast.

c. Prime Coat: Apply synthetic resin primer to metal surface before finish coats. Products: Koppers 40, Tnemec 32-1210, Porter VC 1799, or equal.

d. Finish Coat: Two coats of Koppers Bitumastic Super Service Black, 12 mils each; two coats of Tnemec 46-450 Heavy Tnemecol, 12 mils each; two coats of Porter Tarmastic 100, 12 mils each; or equal.

F. Wood and Masonry Surfaces

1. System No. 61 – Interior and Exterior:

a. All exterior wood surfaces should be covered with aluminum sheeting. All interior wood surfaces coated with a prime coat and two finish coats selected by the City. The prime and two finish coats shall be oil-based enamel, earth-tone colors which shall be submitted to the City for approval. Paint shall be Sherwin Williams, Dunn-Edwards, Sinclair or ENGINEER approved equal suitable for interior applications. Surface preparation shall be as per the paint manufacturer's written recommendations.

b. All masonry surfaces as indicated on the DRAWINGS shall be waterproofed per Division 04.

G. Abrasives for Surface Preparation

1. Abrasives used for preparation of iron and steel surfaces shall be one of the following:

   a. 16 to 30 or 16 to 40 mesh silica sand or mineral grit.

   b. 20 to 40 mesh garnet.

   c. SAE Grade G-40 or G-50 iron or steel grit.

H. Organic Zinc Primer for Field Touch-Up and Shop Coating

1. Organic zinc coating system shall have a minimum zinc content of 14 pounds per gallon. Coating shall be of the two- or three-component converted epoxy, epoxy phenolic, or urethane type. Products: Tnemec 90-97, or equal; applied to a minimum dry-film thickness of 3 mils. Organic zinc primer shall be manufactured by the prime coat manufacturer.

2. Where shop-applied inorganic zinc primers cannot be used because of volatile organic compound (VOC) regulations, the above organic zinc primers may be substituted for the specified inorganic zinc primers.

I. Masonry Surfaces:

1. Concrete Sealer: Conspec #1

2. Interior Walls and Exterior Walls above grade: Sikagard 704W, Chemstop Barricade, or approved equal.

J. The painting CONTRACTOR shall be capable of performing the various items of work as specified. He will be required to furnish a statement covering experience on similar work, a list of machinery, plant and other equipment available for the proposed work, and a financial statement, including a complete statement of the CONTRACTOR's financial ability and experience in performing similar painting and coating work. The CONTRACTOR shall have a minimum of five (5) years practical experience and a successful history in the application of the specified products to metal surfaces. Upon request, the CONTRACTOR shall substantiate this requirement by furnishing a list of references. Those references shall include jobs of a similar nature.

Part 3 Execution

3.01 Preparation

A. Weather Conditions

1. Do not paint in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5 degrees F above the dew point.

2. Do not apply paint when the relative humidity is above 80 percent or the temperature is above 90 degrees F.

3. Do not paint when temperature of metal to be painted is above 120 degrees F.

4. Do not apply paint on an exterior or interior surface if air or surface temperature is below 60 degrees F or expected to drop below 60 degrees F in 24 hours.

B. Surface Preparation

1. Do not sandblast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove all sharp edges, burrs, and weld spatter. Do not sandblast PVC, CPVC, or FRP piping or equipment. Do not sandblast epoxy- or enamel-coated pipe that has already been factory coated, except to repair scratched or damaged coatings.

2. Surface preparation shall conform with the SSPC specifications as follows:

a.	Solvent Cleaning	SP-1
b.	Hand Tool Cleaning	SP-2
c.	Power Tool Cleaning	SP-3
d.	White Metal Blast Cleaning	SP-5
e.	Commercial Blast Cleaning	SP-6
f.	Brush-Off Blast Cleaning	SP-7
g.	Pickling	SP-8

h. Near-White Blast Cleaning SP-10

3. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or " blast cleaning" or similar words are used in these specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Steel Structure Painting Council, Surface Preparation Specifications, ANSI A159.1) specifications listed above.

4. Dust blasting is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Apply a fine etch to the metal surface to clean the surface of any a contamination or oxide.

5. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before sandblasting.

6. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3.

7. Neutralize welds with a chemical solvent that is compatible with the specified coating materials. Use clean cloths and chemical solvent. Wipe dry with clean cloths. Do not leave a residue on the cleaned surfaces.

8. Masonry Surfaces:

a. All concrete surfaces shall be prepared in accordance with the recommendations of the coating manufacturer.

b. All concrete and masonry surfaces shall have cured for not less than 14 days, prior to application of coatings.

c. Surfaces shall be clean and dry.

9. Wood Surfaces: All surfaces shall be clean and dry.

C. Procedures for Items Having Shop-Applied Prime Coats

1. After application of primer to surfaces, allow coating to cure for a minimum of two hours before handling to minimize damage.

2. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.

3. Cover shop-primed items 100 percent with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

4. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

D. Field touch-Up of Shop-Applied Prime Coats

1. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.

2. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisodium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.

3. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-3. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

4. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-3.

Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

5. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer to cover all scratches or abraded areas.

6. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

E. Painting Systems

1. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the painter manufacturer for the particular coating system.

2. Deliver paints to the jobsite in the original, unopened containers.

F. Paint Mixing

1. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.02 Installation

A. Procedures for the Application of Coatings

1. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

2. Stir, strain, and keep coating materials at a uniform consistency during application. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

3. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

4. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.

5. Apply coating systems to the specified minimum dry-film thicknesses as measured from above the peaks of the surface profile.

6. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign mater has accumulated. Re-clean surfaces by blast cleaning that have surface colored or become moist prior to coating application.

7. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. The brush coat shall be done prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

B. Surfaces Not To Be Coated

Do not paint the following surfaces unless otherwise noted on the DRAWINGS or in other specification sections. Protect during the painting of adjacent areas:

1. Concrete sidewalks.

2. Mortar-coated pipe and fittings.

3. Stainless steel.

4. Metal letters.

5. Glass.

6. Roofing.

7. Chain link fencing.

8. Copper tubing, red brass piping, and PVC piping except where such piping occurs in rooms where the walls are painted, or required for color coding.

9. Electrical fixtures except for factory coatings.

10. Nameplates.

11. Grease fittings.

12. Brass and copper, submerged.

13. Buried pipe, unless specifically required in the piping specifications.

14. Fiberglass items, unless specifically required.

15. Aluminum handrail, stairs, and grating.

C. Protection of Surfaces Not To Be Painted

1. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

D. Surfaces To Be Coated

1. Coat Surfaces as described below:

   a. Coat mechanical equipment as described in the various mechanical equipment specifications. Color shall be selected by OWNER.

   b. Coat aboveground and exposed piping or piping in vaults and structures as described in the various piping specifications. Color shall be as selected by the OWNER.

   c. Coat valves as described in the various valve specifications. Aboveground valves, or valves in vaults and structures, shall match the color of the connecting piping.

   d. Coat aluminum surfaces in contact with concrete per system No. 51.

   e. Coat buried flanges, nuts and bolts, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes per System No. 24.

   f. Coat aboveground structural steel or structural steel located in vaults and structures as System 15.

E. Concrete Surfaces

1. For concrete floor and landings:

F. Epoxy Floor Coating

1. Apply epoxy coatings to all floor surfaces including the, chlorine storage room floor, and 6" up the masonry walls as follows:

2. Provide a 2-part epoxy coating system in two coats. Minimum dry film thickness of the finished system shall be 15-mils. Apply epoxy coating in strict accordance with the coating manufacturer’s written instructions.

3. Bead blast all areas to be coated in conformance with the coating system manufacturer’s written instructions and Section 099000 of these specifications.

4. Apply one coat of Res-Crete RH20 to the specified areas at a rate of 300 square feet per gallon.

5. Apply a second coat of Res-Crete RH20 to the specified areas at a rate of 300 square feet per gallon. Colors shall be selected by the City.

6. Res-Crete RH20 epoxy floor coating is available through Pacific Polymers International, Inc 12271 Monarch Street, Garden Grove, Ca. 92841 (714) 898-0025.

7. All exterior portions of the walls (both concrete and masonry) below grade and adjacent to pipe trenches shall be coated with a minimum of two (2) coats of cold applied, coal tar type coating. (The coating shall be carried a minimum of 6" above the surrounding finished grade.) The coating shall be applied per manufacturer's instruction and shall be Bitumastic Plastic No. 505 as manufactured by Kopper's Company, Inc., or approved equivalent.

8. All masonry interior surfaces of the Chlorine Building shall receive two (2) coats each of Chemstop "Barricade", or approved equivalent, applied with airless spray or roller at maximum rate of 150 square feet per gallon per coat to full coverage.

G. Wood Surfaces

1. All exposed surfaces, including the underside of the roof and rafters.

2. The color shall be as selected by the OWNER. The CONTRACTOR shall submit to the OWNER, for approval, color chips of all finish paints to be used prior to application.

H. Dry-Film Thickness Testing

1. Measure coating thickness specified for metal and concrete surfaces with a calibrated magnetic-type dry-film thickness gage. Test the finish coat (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holidays detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide detector as manufactured by Tinker and Rasor or K-D Bird Dog. Provide dry-film thickness gage as manufactured by Mikrotest or Elcometer. Check each coat for

the correct dry-film thickness. Do not measure within eight hours after application of the coating.

2. Make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three gage readings for each spot measurement of either the substrate or the paint. Move the probe a distance of 1 to 3 inches for each new gage reading. Discard any unusually high or low gage reading that cannot be repeated consistently. Take the average (mean) of the three gage readings as the spot measurement. The average of five spot measurements for each such 100 square foot area shall not be less than the specified thickness. No single spot measurement in any 100 square foot area shall be less than 80 percent, nor more than 120 percent, of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount.

I. Repair of Improperly Coated Surfaces

1. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.03 Testing – None

END OF SECTION

PART 1 General

1.01 System Description

A. Building Name: Well Site Building

1. Size:

a. Exterior Width: 18’

b. Exterior Length: 24’

c. Wall Height: 8’ Wall

2. Removable: Half of the roof shall be completely removable for access to well head equipment.

3. Roof Slope: Sufficient to allow rain drainage, 12° – 17° pitch.

4. Roof Type: Roof shall be wind-resistant “hip” design sloping up from all four sides. Roof shall form a permanent weather-proof connection with a seamless exterior appearance that uses low-maintenance silicone caulk matching the shelter’s exterior color.

B. Building Name: UV Building

1. Size:

a. Exterior Width: 8 feet

b. Exterior Length: 14 feet

c. Wall Height: 8’

2. Roof Slope: Sufficient to allow rain drainage, 12° – 17° pitch.

3. Roof Type: Roof shall be wind-resistant “hip” design sloping up from all four sides. Roof shall form a permanent weather-proof connection with a seamless exterior appearance that uses low-maintenance silicone caulk matching the shelter’s exterior color.

C. Building Name: Control Building

1. Size:

a. Exterior Width: 4 feet

b. Exterior Length: 5 feet

c. Wall Height: 8’

2. Roof Slope: Sufficient to allow rain drainage, 12° – 17° pitch.

3. Roof Type: Roof shall be wind-resistant "hip" design sloping up from all four sides. Roof shall form a permanent weather-proof connection with a seamless exterior appearance that uses low-maintenance silicone caulk matching the shelter's exterior color.

D. System: Design, furnish, and install complete building package using manufacturer's standard components.

E. Structure Type: Fiberglass Reinforced Polymer (FRP) shelter on a formed and poured concrete pad as specified herein.

1.02 Submittals

A. Submit six (6) complete sets of shop DRAWINGS and manufacturer's data including the following:

1. Complete set of structural calculation prepared by California Registered Engineer

2. Installation instructions.

3. Dimensions, weight, materials, parts, devices, and all other information required to verify compliance with these Specifications.

4. Manufacturer's Literature and Technical Data: DRAWINGS and Specifications for proposed building system.

B. DRAWINGS prepared specifically for this Project:

1. Materials and Details: Show materials, details of components (including doors and other accessories), finishes, fastenings, methods of joining, sealants, anchor bolt details, structural members and bracing, and openings.

2. Anchorage details of structure to foundation.

1.03 Quality Assurance

1. Qualifications:

a. Designers: Shop DRAWINGS and all calculations shall be sealed and signed by a Professional Engineer (PE) licensed in the state of California where the shelter will reside.

2. Manufacturer: Shelter Works or Approved Equal

a. At least 10 years' experience in work of the type required in this section.

b. Production capacity to provide work required for this Project without delay.

c. Certified Test Results: The manufacturer shall have an entire fiberglass panel destructive tested by an accredited Testing Laboratory and Third Party Quality Control Agency and upon request shall furnish to the engineer the certified and stamped test results of the laboratory testing. The accredited Testing Laboratory must be accredited to ISO 17020 and 17025. The manufacturer shall maintain a quality assurance program that is also certified by an accredited Testing Laboratory and Third Party Quality Control Agency and shall furnish to the engineer the certified and stamped quality assurance program by an accredited Testing Laboratory and Third party Quality Control Agency.

3. Erector/Installer:

a. Not less than 2 years' experience in the offloading and installation of prefabricated structures.

4. Material Properties:

a. Fiberglass Laminate Properties:

1) Tensile Strength (ASTM D 638) 12,458 (psi)

2) Flexural Strength (ASTM D 790) (psi) 20,386

3) Flexural Modulus (ASTM D 790) (psi) 920,271

4) Tensile Modulus (ASTM D 638) (psi) 1,277,218

5) Barcol Hardness 45

6) Burning Characteristics (ASTM E84) Flame Spread <150

7) <1,000 Smoke Density

8) Izod Impact – Notched ((ft.-lbs)/in) 16.30

9) Izod Impact – Unnotched ((ft.-lbs)/in) 21.79

b. Foam shall be rigid closed cell, self-extinguishing, polyisocyanurate with a density of minimum 2.0 pounds per cubic foot.

1) Flame Spread (ASTM E 84) <75

2) Smoke Development (ASTM E 84) <450

1.04 Delivery, Storage, and Handling

A. The fiberglass shelter and the accessory items shall be carefully transported, stored, handled and set in place in a manner that will prevent distortion, misalignment or other damage to the units.

B. During storage prior to installation and following installation, but prior to placing in service, the manufacturer's recommendations regarding handling shall be followed.

C. After installation of the building, manufacturer inspect whether the building has been installed properly as recommended or not. The CONTRACTOR shall correct the deficiency if any found during inspection. After final inspection, the manufacturer shall furnished a certification that the building has been installed properly and warranty is effective as listed in sub section 1.05/

1.05 Manufacturer’s Warranty

A. Manufacturer shall provide a twenty-five (25) year warranty on the enclosure materials and workmanship, according to the following specifications:

B. Any shelter penetrations made by shelter manufacturer must be maintained by the Customer to ensure proper sealing. Suggested intervals is every (2) two years. All penetrations made by the contractor during shelter installation shall be inspected by the manufacturer and shall not void or limit the warranty.

C. Component Parts incorporated into the design of the shelter are purchased from reputable manufacturers and may carry their own warranties.

PART 2 Products

2.01 Building System Manufacturers

A. Products of the following, meeting these Specifications, may be used on this Project:

1. Shelter Works, St. Louis, MO as represented by Charles P. Crowley Company (626-856-5656).

B. Products from other manufacturers will be considered for substitution. Requests for substitution must include the following information in order to be considered:

1. Formal written request certifying that products to be substituted will match specified products in terms of structural properties, dimensions, physical appearance, quality level and quantities and that they will perform the same function in the same manner and will achieve the same end result.

2. Manufacturer's and supplier's material data sheets, specifications and performance data.

3. A list of ten (10) projects in California satisfactory service for not less than three years with enclosures similar to those being proposed for substitution. For each project, include name, address and telephone number of the engineer, the CONTRACTOR and the plant manager.

2.02 System Performance

A. Structural Loading:

1. Building: Own dead load.

2. Roof Live Load: 30 psf

3. Wind Load: 120 mph.

4. Seismic Load: Per local building code

2.03 Components

A. U-BOLTS. Through-wall lifting/tie-down eyes at the top of each corner to facilitate handling.

B. CONNECTIONS. Wall panels shall overlap to form a permanent weather-proof connection with a seamless exterior appearance that uses low-maintenance silicone caulk matching the shelter's exterior color. Internal connections shall use stainless steel hardware spaced no more than 12" on center.

C. EXTERIOR. All exterior surfaces shall be brick textured with 18-20 mils of high quality Polycor 944 isopthalic gel coat, incorporating ultra-violet inhibitors. Exterior color shall be selected by the OWNER during submittal process. Submit color chart to select the color.

D. INTERIOR. All interior surfaces shall be sprayed with 18-20 mils of Polycor 944 high quality isophthalic white gel coat finish offering the same characteristics as the exterior surfaces without ultra-violet inhibitors

E. BASE FLANGE. Shelter shall have a minimum 4 ¾" interior fiberglass base with minimum 2" reveal for mounting to the concrete slab. To facilitate future removal of shelter, non-tacky sealant such as neoprene shall be provided for a weather-proof connection between the shelter and base. Shelter manufacturer shall provide flange pre-drilled with 7/16" diameter holes 12" on center.

F. DOORS

1. Doors shall be made of fiberglass reinforced polymer (FRP) using exclusive FiberWrap technology to eliminate the possibility of delamination during the shelter's entire lifespan.

2. Doors shall be hung with stainless steel ball bearing type hinges equipped with tamper-resistant, non-removable pins. Hinges shall be oriented with no fasteners exposed when door is closed.

3. Doors shall be sealed with a weather-tight neoprene gasket along the entire perimeter of the door.

4. A rain drip molding shall be located above each door.

5. Per door schedule in construction plan.

1) Door must be able to be set in 'open' position with no hands. Door must be able to be removed from 'open' position and closed with no hands. Door must have hydraulic closer to prevent wind damage to door.
2) Closure system is 3-point, pad-lockable with anti-entrapment.
3) Threshold is raised step-over.

G. VENTILATION

1. Two (2) manually adjustable aluminum white vents 12" square with insect screen as shown in construction DRAWINGS.

2. Ventilation through-wall openings shall be protected from the elements with a weather-tight fiberglass hood the same color as the shelter itself.

H. LIGHTING – Per Electrical DRAWINGS.

2.04 Materials

A. Walls, roof and doors shall be seamless, one-piece panels laminated with 1/8" thick sprayed fiberglass outside surface, core material, and 1/8” thick sprayed fiberglass inside surface. Walls, roof and doors shall have vertical FiberBeam laminations every 12” to permanently bond inner FRP surface with outer FRP surface to provide structural integrity and prevent de-lamination of the fiberglass from the core material.

B. Walls and roof shall have minimum R-19 insulation with core consisting of minimum 3.0” thick foam.

PART 3 Execution

3.01 Examination

A. Investigate site, including soils, to determine effect on proposed building.

3.02 Preparation

A. Install concrete slab true and level to a maximum surface variance of 3/16” where the building interfaces with the slab. The slab immediately surrounding the building perimeter shall be sloped away at a pitch of ½” per foot to promote proper drainage and eliminate the potential of standing water around the building.

3.03 Erection

A. At the time of installation the slab shall be clean and dry.

B. Follow written offloading and installation instructions provided by shelter manufacturer.

C. CONTRACTOR shall provide any required Type 316 stainless steel expansion anchors.

D. Install and make final electrical connections to all equipment shipped loose with water-tight flexible conduit and fittings.

3.04 Heating and Ventilation

A. Building Manufacturer shall provide and install AC unit specified in HVAC schedule in construction drawing (Sheet S-6).

3.05 Electrical systems

A. Wire per latest version of National Electric Code (NEC).

3.06 Field Quality Control

A. Manufacturer shall provide field service representative during installation of the building and provide certification that the Building has been installed as per the Manufacturer's instruction. Any correction deemed necessary shall be the responsibility of the CONTRACTOR with no extra cost to OWNER.

3.07 Manufacturer's Services

A. Provide field service technician during erection and shall provide certification after installation.

END OF SECTION

PART 1 GENERAL

1.01 General Conditions

A. The General Conditions apply to all sections of this specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

See Construction DRAWINGS for schedules.

END OF SECTION

PART 1 GENERAL

1.01 Section Includes

A. This section describes plumbing fixtures and trim which includes hose bibbs, non-freeze wall hydrant, cleanouts, and utility hose bibbs.

1.02 Referenced Sections - None

1.03 Cited Standards - None

1.04 Noted Restrictions

A. Schedule rough-in installations with the installation of other building components.

1.05 Quality Control

A. Codes and Standards:

1. Uniform plumbing code.

2. Ari standard 1010: "drinking fountains and self-contained mechanical-refrigerated drinking water coolers"

1.06 Submittals

A. Product data: submit product data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers.

B. Shop DRAWINGS: submit rough-in DRAWINGS. Detail dimension, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with fixtures installed in countertops and cabinets. Furnish templates.

C. Maintenance data: include data in maintenance manuals specified in section 01730.

1.07 Deliverables

A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.

B. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture on trim.

PART 2 PRODUCTS

2.01 Hose Bibb

A. Hose Bibbs shall be chrome plated brass with a removable key, vacuum breaker, and 3/4" inlet and outlet such as Chicago faucet no. 998, or an ENGINEER approved equal

2.02 Cleanouts:

A. Finished floors:

1. Approved manufacturers:

a. Zurn no. Z-1400-2.

b. J.R. Smith no. 56010.

c. Wade no. W-7000.

d. Josam no. 56010.

2.03 Utility Hose Bibb

A. At locations shown on DRAWINGS provide utility water hose bibb. Hose bibb and valving shall be as shown on the DRAWINGS. At each utility water hose bibb location provide and install hose rack assembly either wall mounted or free standing. Hose rack shall be as detailed on the DRAWINGS.

PART 3 EXECUTION

3.01 Preparation

A. Verify all dimensions by field measurements.

B. Examine existing rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

3.02 Installation

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in DRAWINGS, and pertinent codes and regulations, the original design, and the referenced standards.

B. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

C. Install stop valves in an accessible location in the water connection to each fixture.

D. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations.

E. Seal fixtures to walls and floors using silicone. Match sealant color to fixture color.

F. Encase catch basins and trench drains in concrete to a minimum depth and encasement as per manufacturer's instructions.

3.03 Testing and Quality Control

A. Field quality control

1. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Repair malfunctioning units, the retest.

B. Adjusting

1. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream.

2. Replace washers of leaking or dripping faucets and stops.

3. Clean all aerators.

C. Cleaning

1. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.

D. Protection

1. Provide protective covering for installed fixtures and trim.

2. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the owner.

END OF SECTION

PART 1 GENERAL

1.01 Section Includes

A. This section describes the emergency shower and eyewash station to be furnished and installed by the CONTRACTOR.

1.02 Referenced Sections – None

1.03 Cited Standards – None

A. All emergency shower and eyewash station(s) shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

1.04 Noted Restrictions – None

1.05 Quality Control - None

PART 2 PRODUCTS

2.01 Shower and Eyewash Station

A. The emergency shower and eyewash station shall be a Haws Model 8300 manufactured by Haws Corporation as furnished by Winnelson Company, El Monte, CA, or an ENGINEER approved equal.

B. The station shall have a plastic shower head with a stay-open ball valve and pull rod and, a stainless steel eyewash receptor containing twin eyewash heads with a foot treadle and hand operated stay-open ball valve.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. The CONTRACTOR shall install the safety shower and eyewash station as per applicable OSHA requirements.

B. The station shall be connected to the City of Rialto water supply.

3.03 Testing – None

END OF SECTION

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
SECTION 23 05 00 – COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 General Conditions

A. The General Conditions apply to all sections of this specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

1.02 Referenced Sections – None

1.03 Cited Standards

A. Refrigeration systems shall be constructed in accordance with ASHRAE Standard ASHRAE 15 "Safety Code for Mechanical Refrigeration".

B. Refrigeration systems shall meet or exceed the minimum COP/Efficiency levels as prescribed in ASHRAE 90A "Energy Conservation in New Building Design".

C. Refrigeration units shall be listed by UL and have UL label affixed.

1.04 Noted Restrictions – None

1.05 Quality Control

A. The following HVAC equipment will be provided and installed by the CONTRACTOR per this section and as shown in the DRAWINGS.

1. Provide aluminum dampers with actuators, as shown on the DRAWINGS.

2. Provide electric unit heater as noted in DRAWINGS, as shown on the DRAWINGS.

3. Provide air conditioner/heat pump split unit as noted in DRAWINGS.

4. Provide gas furnace and air conditioning units along with ductwork and all other accessories capable of heating and cooling, as noted on the DRAWINGS.

B. Manufacturer's Qualifications

1. Firms regularly engaged in manufacture of HVAC equipment of the types of materials, and sizes required, whose products have been in satisfactory use in similar services.

C. Installer's Qualifications

1. A firm with at least 3 years of successful installation experience on projects with HVAC equipment work similar to that required for this project.

1.06 Submittals

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model, clearly indicated weights, dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories; and installation and start-up instructions.

B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation equipment and control. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

C. Shop DRAWINGS: Submit manufacturer's assembly-type shop drawing for each type of HVAC equipment, indicating materials and methods of assembly of components.

D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes and spare parts lists. Include this data, product data, and shop DRAWINGS in maintenance manuals; in accordance with requirements of Division 01730.

1.07 Deliverables

A. Handle HVAC equipment and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged packaged equipment or components; replace with new.

B. Store packaged HVAC equipment and components in clean dry place off the ground. Protect from weather, dirt, fumes, water construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading packaged HVAC equipment and moving them to final location for installation.

PART 2 Products

2.01 Materials

A. All HVAC equipment is located in the HVAC SCHEDULE in the DRAWINGS. The schedule contains the location, service, capacity/size, and models. Where no model is indicated, the CONTRACTOR shall appropriately size the equipment and submit it to the ENGINEER for approval.

PART 3 Execution

3.01 Preparation - None

3.02 Installation

A. General: Install HVAC equipment in accordance with manufacturer's installation instructions. Install units plumb and level, unless otherwise recommended by manufacturer, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Install AC unit on concrete pad as indicated in DRAWINGS. Coordinate installation of anchoring devices.

3.03 Testing

A. Start-Up:

1. Provide the services of a factory-authorized service representative to start-up air conditioning equipment in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

B. Operating and Maintenance Training:

1. Provide services of manufacturer's service representative to instruct OWNER's personnel in operation and maintenance of HVAC equipment. Training shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and troubleshooting procedures plus procedures for obtaining repair parts and technical assistance.

END OF SECTION

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
SECTION 23 06 00 – SCHEDULES FOR HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

Mechanical Sheets for HVAC units schedules.

END OF SECTION

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
SECTION 23 34 00 – HVAC FANS (EXHAUST AND VENT FANS)

PART 1 General

1.01 Section Includes

A. This section includes the extent of power and gravity ventilator work required by this section is indicated on DRAWINGS and schedules, and by requirements of this section.

1.02 Referenced Sections - None

1.03 Cited Standards - None

1.04 Noted Restrictions

A. Rooms do not require heating or cooling per code. Ventilation shall be provided as a matter of practice to provide 30 air changes per hour.

1.05 Quality Control

A. Providing and Installation of:

1. Direct drive propeller roof fan (ACME Fan Model LQ 16D6 or equal)

2. Electrical room fan (ACME Model VQ0100 or equal)

PART 2 Products

2.01 Ceiling Exhaust Fans

A. Material of construction shall be aluminum or other material resistant to chlorine vapor corrosion.

B. Ceiling mounted fans shall have acoustically insulated housings and a maximum sound level rating of 4.6 sones. Integral backdraft damper shall be totally chatter-proof with no metal to metal contact. Fans shall have true centrifugal wheels. Entire fan, motor and wheel assembly shall be easily removable without disturbing the housing. Furnish unit with appropriate ceiling grille having a minimum 85% free open area. Motor speed shall not exceed 1050 rpm. All motors shall be suitably grounded and mounted on rubber in shear vibration isolators.

C. Furnish each fan with a solid state speed controller similar to Penn Leektrol.

D. Ceiling exhaust fans shall be provided by of one of the following, or an ENGINEER approved equal.

1. Penn Zephyr
2. Tradewind
3. Broan
4. Jenn-Fan
5. Greenheck
6. Cook

2.02 Ventilating Fans

A. Material of construction shall be aluminum or other material resistant to chlorine vapor corrosion.

B. Panel mounted, propeller type, balanced steel blades, steel panel frame, venturi orifice, v-belt drive with variable pitch sheave, adjustable motor mounted, zerk type grease fittings, ball bearing shaft, steel angle frame. Provide discharge or inlet wire guard as required for protection. Finish housing with baked enamel finish, and finish blades and hub with epoxy. Maximum allowable fan tip speed - 6,000 fpm. Note required direction of air flow on DRAWINGS. Air flow shall accomplish 30 air volume exchanges.

C. Propeller fans shall be provided by of one of the following, or an ENGINEER approved equal.

1. Cook
2. ACME
3. Penn
4. Greenheck
5. Jenn-Fan

2.03 Roof Mounted Exhaust Fans

A. Provide exhaust fan of type, size and capacity as scheduled and as specified herein.

B. Roof curb mounted, U.L. listed, factory-fabricated, aluminum construction, backward inclined centrifugal fan wheel, direct drive design motor and fan assembly mounted on vibration isolating mounts, 120 V motorized backdraft damper furnished with fan to open when fan runs. Furnish with insulated curb.

C. Exhaust fans shall be provided by of one of the following, or an ENGINEER approved equal.

1. Cook

2. Penn

3. Greenheck

4. ACME

PART 3 Execution

3.01 Preparation

A. Examine areas and conditions under which exhaust and vent fans are to be installed.

3.02 Installation

A. Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to insure that products serve the intended function.

B. Coordinate work with work of roofing, walls and ceilings, as necessary for proper interfacing.

C. Ductwork: Refer to Division-15 section "Ductwork." Connect ducts to fan.

D. Roof Curbs: Install roof curbs. Flash and seal into roof.

E. Control Dampers: Install control dampers and mount damper motors.

3.03 Testing

A. Cleaning: Clean factory-finished surfaces.

B. Adjust and tighten belts and sheaves.

C. Check and adjust clearances between fan and fan housing.

D. Provide lubrication.

END OF SECTION

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
SECTION 23 37 00 – AIR OUTLETS AND INLETS

PART 1 General

1.01 Section Includes

A. Extent of air outlets and inlets work is indicated by DRAWINGS and schedules, and by requirements of this section.

B. Types of outlets and inlets required for project include the following:

1. CONTRACTOR furnished and installed.

a. Louvers and Dampers called for on the DRAWINGS.

C. Refer to other Division 23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.

D. Refer to other Division 23 sections for balancing of air outlets and inlets; not work of this section.

1.02 Referenced Sections - None

1.03 Cited Standards – None

A. All air outlets and inlets shall comply with the following, or the latest revisions of, as applicable:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".

2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".

3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test method for Louvers, and Dampers and Shutters".

4. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.

1.04 Noted Restrictions - None

1.05 Quality Control

A. Manufacturer's Qualifications

1. Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service.

1.06 Submittals

A. Product Data

1. Submit manufacturer's technical product data for air outlets and inlets including the following:

a. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

b. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

c. Performance Data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

B. Samples

1. Three (3) samples of each type of finish furnished.

C. Shop DRAWINGS

1. Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

D. Maintenance Data

1. Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop DRAWINGS in maintenance manuals; in accordance with requirements of Division 16195.

1.07 Deliverables

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 Products

2.01 Materials

A. Grilles And Diffusers:

1. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

2. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

3. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction DRAWINGS and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

4. All grilles and diffusers shall be adjusted to fit neatly in the room ceiling pattern. Final location shall be per architectural reflected ceiling plans.

5. Volume Control Dampers: Provide integral dampers of the externally adjustable opposed blade type where more than one grille or register is on a common duct.

6. Sound Level in Office Areas: The diffuser or grille generated noise shall not exceed an NC-35 sound power level curve at a point five feet away from the diffuser or grille.

7. Fire Dampers: Install at the diffusers, registers and grilles as indicated on DRAWINGS or required by code.

8. Manufacturers: Subject to compliance with requirements, provide grilles and diffusers of one of the following:

   a. Metal Aire

   b. Krueger

   c. Carnes

   d. Titus

   e. Tuttle and Bailey

   f. Anemostat/Waterloo

   g. Environmental Air Products

   h. EH Price

   i. or equal

9. Supply Diffusers:

   a. Symbol S-1 Double deflection, aluminum construction, adjustable vertical front with horizontal rear deflection vanes. Satin aluminum finish. Size as indicated on DRAWINGS. Krueger 56880-15.

   b. Symbol S-2 Four-way blow, steel construction. Size as indicated on DRAWINGS. White baked enamel finish. Krueger 1400.

10. Return Register:

   a. Symbol R-1 Krueger Series 1190 for 12" x 24" panel, Krueger Series 6290 for 24" x 24" panel. Concealed hinge frame, sponge rubber gasket, white baked-on enamel, size as indicated on drawing.

b. Symbol E-1 All aluminum construction with 1" square core, appropriate mounting frame, sponge rubber gaskets, satin aluminum finish, 90% minimum free area, size as shown on DRAWINGS. Krueger EGC-10.

B. Louvers:

1. Extent of Work: At air openings in the outside wall where indicated on the DRAWINGS, install AMCA rated drainable stationary extruded aluminum 4" or 6" deep weather louvers.

2. Material: Blades shall be on 3-1/2" centers with integral downspouts to drain the water from the louver blades.

3. Performance: Stationary louvers shall pass 1000 fpm free area velocity with less than 0.2" static pressure drop and shall carry less than .03 ounces of water per square foot when tested in accordance with AMCA Standard 500.

4. Louver Screens: Install 1/2" square mesh anodized aluminum wire bird screens mounted on removable extruded aluminum frames on interior face and louver.

5. Substrate Compatibility: CONTRACTOR must coordinate louver size, flange type, and construction with structural and architectural openings to assure fit and appearance.

6. Finish: Clear anodize aluminum.

7. Manufacturer: Subject to compliance with requirements. Provide louvers of one of the following:

a. Dayton

b. American Warming and Ventilating

c. Krueger

d. Louvers and Dampers

e. Ruskin Manufacturing Co.

f. or equal

PART 3 Execution

3.01 Preparation

A. Examine areas and conditions under which air outlets and inlets are to be installed.

3.02 Installation

A. General: Install air outlets and inlets in accordance with manufacturer's instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction plans unless otherwise indicated.

3.03 Testing - None

END OF SECTION

DIVISION 26: ELECTRICAL
SECTION 26 22 00 – VOLTAGE TRANSFORMERS

PART 1 General

1.01 Summary

A. Section Includes: This specification covers single-phase and three-phase general purpose individually mounted dry-type transformers, 600 V maximum, for power and lighting applications. It includes transformers as specified and as indicated on Drawings.

B. Work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.

C. Related Requirements:

1. Division 01 - General Requirements.

2. Section 26 05 00: Common Work Results for Electrical.

3. Section 26 05 13: Basic Electrical Materials and Methods.

4. Section 26 05 26: Grounding and Bonding.

5. Section 26 05 19: Low-Voltage Wires (600 Volts AC)

6. Section 26 05 33: Raceways and Boxes, Fittings and Supports.

7. Section 26 26 00: Power Distribution Units.

8. Division 27: Communications.

D. Codes and Applicable standards: Products and installation shall meet or exceed the latest edition of the following standards.

1. ANSI/IEEE C57.96, Distribution and Power Transformers, Guide for Loading Dry-Type Transformers; Appendix to ANSI C57.12 Standards.

2. Department of Energy, Energy Act of 2005.

3. International Electrical Code adopted by the State of California.

4. ANSI/NEMA 250 Enclosure for Electrical Equipment (1000 Volts Maximum)

5. IEEE C57.12.91, Test Code for Dry-Type Distribution and Power Transformers.

6. IEEE C57.110 – IEEE Recommended Practice for establishing liquid-filled and dry-type power and distribution transformer capability when supplying nonsinusoidal load currents.

7. 1100-IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.

8. NEMA standard 20, Dry-Type Transformers for General applications.

9. UL 506, Specialty Transformers.

10. UL 1561, Dry-Type General Purpose and Power Transformers.

11. NEMA TP-1, Guide for Determining Energy Efficiency for Distribution Transformers.

12. NEMA TP-2, Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.

13. NEMA TP-3, Standard for the Labeling of Distribution Transformer Efficiency.

14. CSA 802.2-00 Minimum Efficiency Values for Dry Type Transformers

15. California Building Code (CBC)

16. Tri-axial shake test results conducted in accordance with AC156 test protocol.

17. NFPA 70 National Electric Code

E. No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the ENGINEER by the CONTRACTOR.

F. ACRONYMS

ANSI	American National Standards Institute
AOR	Architect of Record
CEC	California Electrical Code
EOR	Engineer of Record
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical manufacturers Association

1.02 Design Requirements

A. Premium Efficiency transformers with internal losses at 35 percent loading reduced by 30 percent when using temperature and material correction factor to 75 degrees C per NEMA Standard TP1

B. Load Mix: Transformer shall be UL 1561 listed to feed a mix of equipment load profiles such as computer without detracting or significant degradation of efficiency.

C. The transformer shall be UL 1561 listed and labeled with a K-9 Rating. (per UL 1561 35.21 and 34.2)

D. K-7 rating is not allowed.

E. Construction: Windings shall be continuous wound copper with brazed or welded terminations.

1. Insulation and Varnish Systems: Epoxy Polyester impregnation

2. Terminals, including those for changing taps must be readily accessible by removing a front cover plate.

F. Performance of transformers shall meet or exceed the requirements of applicable codes and standards, the DOE Energy Policy Act of 2005 - Public Law 109-58 and the latest requirements of the California Energy Commission Appliance

Efficiency Regulations. In addition; transformers shall be designed to an efficiency standard higher than the lowest legal standard for the purpose of contributing to LEED Energy and Atmosphere (Optimized Energy Performance) and Utility Rebates.

G. Transformers shall be self-cooled type with 220 degrees C. insulation and a maximum temperature rise of 130 degrees C. under continuous full load conditions with an ambient of 40 degrees C.

H. Transformers shall be furnished with four 2.50 percent (two above and two below normal voltage) taps. Windings shall be of fire-resistant type, designed for natural convection cooling through normal air circulation.

I. Core mounting frames and enclosures shall be of welded and bolted construction with sufficient mechanical strength and rigidity to withstand shipping, installation, and short circuit stresses.

J. Enclosure cover plates shall be sheet steel, captive bolted to enclosure framework. Enclosure shall provide suitable ventilating openings with rodent-proof screens, NEMA 1 enclosure. Enclosure shall be provided with lifting lugs and jacking plates as required. Transformers installed outdoors shall be provided with weatherproof NEMA 3R enclosure and weather proof kit.

K. Transformers shall be furnished complete with mounting channels and mounting bolts. Metal parts, excepting cores and core mounting frames shall be furnished clean, rust-proofed, and provided with a coat of an inert primer.

L. Transformers up to 35 KVA shall not exceed 40 decibels. Transformers 36 KVA or more shall be a minimum of 5 decibels below NEMA standards per unit. Transformers shall be provided with vibration dampers consisting of California Dynamic, Mason Industries, Korfund or equal neoprene mounting pad and Elastorib sheeting. Size and number of shock mounts shall be in accordance with manufacturer's recommendations.

M. Transformers shall be UL listed.

N. Each transformer to be installed under this section shall be sound tested at the factory. CONTRACTOR shall provide two copies of transformers tests reports for EOR’s review.

O. Equipment shown on drawings to scale is approximate only and based upon a general class of equipment specified. The CONTRACTOR shall verify dimensions and clearances prior to commencement of work.

P. Verify points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. Actual dimensions, weights, clearances and installation requirements shall be verified and coordinated by the CONTRACTOR.

Q. Provide transformers with a K rating as indicated on drawings. K-rated transformers shall be type NL-UL or NLP-UL as indicated on drawings and be equipped with the following features:

1. Electrostatic shield.

2. NLP series shall have a maximum sound level of 3 dB below NEMA standards.

3. Double-size neutral terminal.

4. Additional coil capacity to compensate for higher non-linear load loss.

5. Heavy-gage ventilated indoor enclosures (provide weather shields where installed indoors).

6. K-rated transformers shall meet other requirements of this section.

1.03 Submittals

A. Provide in accordance with Division 01.

B. Shop Drawings: Include make, catalog number, dimensions, weight, KVA Rating, Percent Impedance, finish, type, insulation class, design temperature, sound levels, efficiency and taps provided. Include regulation at 80 percent and 100 percent of full load, no-load loss, full-load loss, percent efficiency, percent impedance, noise level and continuous capacity rating.

C. Provide manufacturers data and inspection report that confirms transformers to be UL 1561 listed with K rating equal to that indicated on drawings.

D. Provide a connection schematic diagram.

E. Provide the following tests reports: Project Inspector will review the reports for conformance with specified criteria, and compliance with the applicable standards. Submit one copy for each set of shop drawings being submitted.

1. Load Losses: Measurements shall be taken at multiple load levels and plotted to show compliance with specifications and correlated to efficiency curve for the transformer size and type.

2. Provide No-Load and Total Losses report.

3. Applied Voltage.

4. Temperature Rise.

5. Induced Voltage.

6. Sound Level.

7. Impulse Test.

8. Manufacturer's nonlinear load test representing real world load mix. Transformers not meeting this requirement shall not be installed.

F. Submit harmonics test plan as follows:

1. NEMA ST-20.

a. Open Circuit Test (no load losses):

1) Use for both Linear and non-Linear.

2) Measure Power.

b. Short Circuit Test (load losses):

1) Short Primary Winding.

a) Linear Test – complete with linear profile through secondary winding.

Harmonic Profile (K-7 Load)				
Harmonic Number	Rated % Current	Phase Shift		
		A	B	C
1	100.0	0	120	240
3	81.0	0	0	0
5	60.6	0	240	120
7	37.0	0	120	240
9	15.7	0	0	0
11	2.4	0	240	120
13	6.3	0	120	240
15	7.9	0	0	0

c. Non-Linear Test.

1) Complete with non-linear profile through secondary windings.

2) Measure Power.

2. Take data and graph efficiency per NEMA ST-20.

a. Graph-1 – Linear Loads 0 to 100 Percent Loads.

b. Graph 2 – Non-Linear Profile K-9 0 to 100 Percent loads.

3. Test Plans measuring Power IN and Power Out will not be accepted since procedures are not covered by any standard.

1.04 Warranty

A. Transformers shall be warranted to be free from defects in materials, fabrication and execution for a period of three years from the date of substantial completion.

PART 2 Products

2.01 Equipment

A. Transformers manufactured by Siemens, Square D, General Electric, PowerSmiths, MGM, and Cutler Hammer or equal.

B. There shall be no openings through which foreign objects such as sticks, rods, wires, or the like might contact live parts. Provide means for padlocking compartment doors.

PART 3 Execution

3.01 Delivery and Storage

A. Deliver, storage, protect and handle products in accordance with the manufacturer's recommendations.

3.02 Installation

A. Transformer core frame shall be installed level on shock absorbing pads within enclosure. Comply with seismic requirements of CBC.

B. Mounting bolts on floor mounted transformers shall be extended into pads only and shall not be in direct contact with building structural members.

C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits or bus ducts where required.

D. Transformers installed outdoors or below grade shall be mounted on concrete pads as specified in Section 03 3000: Cast-In-Place Concrete.

E. Install transformer ventilation openings not closer than 6 inches from wall surfaces.

F. Do not install transformers in corrosive environments such as swimming pool pump and boiler rooms, or similar areas.

3.03 Voltage Check

A. Set taps on transformers to provide satisfactory operating voltages with present loads energized, including new loads and existing loads. A check shall be performed in the presence of the Project Inspector at a panel fed from each transformer, which is farthest from transformer. Voltages at transformers ranging from 118 to 122 volts inclusive, for 120 volt systems and proportionately equivalent for higher voltage systems are permitted.

B. Provide instruments and accessories required to perform checks. Voltmeters shall be accurate within .075 percent or one percent and shall have scales permitting voltage readings to be performed on upper half of scale. Calibration of the meters shall be observed by the Project Inspector.

C. Adjust transformer taps under full load operating conditions, to provide normal operating voltages at the loads.

3.04 Protection

A. Protect the Work of this section until Substantial Completion.

3.05 Cleanup

A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

B. Repair scratched or marred surfaces affected during the execution of work. Repair surfaces shall match original finish.

END OF SECTION

PART 1 General

1.01 Summary

A. Section Includes:

1. Main switchboard, including metering facilities required by the utility company.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 30 00: Cast-In-Place Concrete.
3. Section 26 05 00: Common Work Results for Electrical.
4. Section 26 05 13: Basic Electrical Materials and Methods.
5. Section 26 05 26: Grounding and Bonding.
6. Section 26 05 19: Low-Voltage Wires (600 Volt AC).
7. Section 26 10 00: Service Entrance.

1.02 Submittals

A. Provide in accordance with Division 01.

B. Shop Drawings:

1. Include a front elevation indicating dimensions and locations of equipment on switchboard, make, kind and size or capacity of equipment and bussing, location of each service conduit entering switchboard, barriers, nameplate inscriptions, finish, total weight and size of switchboard and locations and sizes of anchor bolts.
2. Submit short-circuit and coordination studies signed and stamp by a registered electrical engineer. Studies shall be in accordance with IEEE guidelines. Submit two copies of each study for review prior to ordering and installing equipment.
3. Provide coordination study for main and branch circuit protective devices including transformers secondary protective devices. Study shall be recorded on log paper. The circuit protective devices shall

be set based on the coordination study. A final written record of protective device settings shall be submitted.

4. Provide installation detail and seismic anchorage notes for switchboards.

PART 2 Products

2.01 Switchboards

A. General Description: Switchboards shall be product of W.A. Benjamin Electric, Eaton, General Electric, Siemens, or equal, and shall conform to the following requirements:

1. Complete assembly, including steel framing and covers, bus system, and breaker mounting, shall satisfy applicable provisions of UL 891 and NEMA PB-2 and the California Electrical Code for low-voltage distribution switchboards. Switchboards shall be furnished with UL labels.

2. Switchboards shall be floor standing, dead front, dead rear, line bussed, front operated and connected, circuit-breaker type, unless otherwise indicated and shall contain equipment indicated and specified. Switchboard shall be complete with pull, service, and distribution sections as required.

3. Required equipment shall be enclosed in fully interchangeable die formed steel sectional cabinets with top and bottom plates and required braces and gussets so that cabinets will be absolutely rigid, plumb and uniform in size. Each cabinet shall be a separate and independent unit with assembly holes die-stamped or jig drilled; openings for interconnections shall be so placed that cabinet can be located in any position in assembly without drilling or cutting holes on job. Deliver switchboard to Project site in completely assembled sections and provide required assembly bolts and blanking plates. Front plates and doors shall be of not less than 12 gage furniture steel, completely removable, secured to cabinet with machine screws, with cup washers uniformly and symmetrically spaced. Provide hinged wire gutter covers for distribution sections. Equipment shall meet NEMA and UL standards.

4. Main circuit breaker:

   a. Main circuit breakers shall be automatic, one-piece molded-case, trip-free, common trip, quick-make, quick-break, thermal-magnetic with solid state trips, bolted to bus with frame size and trip ratings as indicated on drawings. Voltage, amperage ratings and number of poles shall be as indicated on breakers. Main breaker shall provide a minimum short-circuit interrupting capacity as determined by utility company. Provide shunt-trip and integral ground fault devices, as indicated on drawings. Breakers shall be furnished with lockout provisions.

5. Feeder circuit breakers shall be automatic, one-piece molded-case, trip-free, common trip, quick-make, quick-break, thermal-magnetic or solid state type bolted to bus, with handles clearly indicating tripped position. Breakers shall be furnished with a single handle with no tie-bar. Voltage, amperage, and number of poles shall be as indicated on Drawings. Breaker ratings shall be on handle or label. Breakers shall be furnished with lockout provisions approved by the State of California for padlocking and shall provide a minimum symmetrical short-circuit interrupting rating, as indicated on Drawings. Series rated circuit breaker combinations are not acceptable.

6. Utility metering provisions shall meet requirements of serving utility and shall be furnished with necessary fittings.

7. Provide switchboard silver-plated copper bus bars of same capacity as main breaker, or as indicated on Drawings, between current transformer and main section and distribution sections; also, full height of breaker space in distribution portions. Copper bus shall have current density of 1000A per square inch of cross section. Bus structure shall be free-fitted, and shall have sufficient strength to withstand short-circuit as indicated on drawings. Connections shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices. Bus bar bracing shall be designed to withstand maximum available short-circuit current. Connections for cables to circuit breakers, switches and motor control devices shall be heavy-duty mechanical pressure type terminal lugs. Provide service cable lugs as required by utility company. Cables and internal wiring shall be supported with suitable cleats.

8. Switchboard distribution sections shall be furnished with full height bussing. Unused spaces shall be provided with blank covers. Switchboards, as complete units, shall be given single short-circuit current ratings by manufacturer. Such ratings shall be established by actual tests by manufacturer, in accordance with UL specifications, on equipment constructed similarly to the furnished switchboard.

9. Provide a large nameplate identifying switchboard, indicating service voltage, originating power source, function and current rating. Nameplate shall be furnished with 3/16 inch engraved black letters on white background. Name plate shall be mechanically fastened to switchboard.

10. Provide labels for circuit breakers, disconnect switches, and or other disconnecting means in switchboards. Labels shall be a P-Touch type or equal, with a minimum width of 3/8 inch with black letters on white background. Label shall indicate name of load served, name or room number and if in different building, name of building. If equipment is installed in same room as source, label should indicate source name and “in this room”.

11. Paint cabinets, framework and plates inside and out with one coat of rust-resistant metal primer and one coat of gray enamel, baked on, or lacquer sprayed on.

12. Manufacture boards according to reviewed Shop Drawings. Switchboard shall meet requirements of legally constituted authorities having jurisdiction, and respective serving utility.

13. Switchboards installed outdoors shall be weatherproof NEMA Type 3R enclosure. Enclosure construction shall be formed of code gage galvanized steel with ANSI No. 61 gray enamel finish. Heavy-duty, three-point latching, vault type door handles with padlocking provisions shall be furnished on doors. Padlocks shall be furnished keyed to Corbin No. 60 keys. Switchboards installed outdoors shall be specifically required to maintain service during extreme outdoor ambient temperatures of a minimum of 150 degrees Fahrenheit in NEMA Type 3R enclosures.

14. For grounded wye electrical service switchboards rated more than 150 volts, to ground and 1,000 amperes or more, provide ground fault protection for main protective device. Ground fault protection shall be UL listed, with ground sensor encircling phase conductors and neutral conductors integral with the main protective device.

Provide testing of ground fault protection system by an independent recognized testing laboratory. Testing lab shall provide necessary testing equipment at the Project site and perform a certified test on ground protection system in presence of the Project Inspector. The ground fault setting shall be selected to coordinate with downstream circuit protective devices. Verify that the system neutral is grounded at the service entrance switchboard only, except neutrals of step down distribution transformers. For branch circuit protective devices, rated 800 amps or more, provide ground fault protection where shown on the drawings, or as described above, for main protective device. Coordinate settings with main protective device ground fault protection.

15. Connections to bussing shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

PART 3 Execution

3.01 Installation

A. Switchboards shall be located so that they are readily accessible and not exposed to physical damage.

C. Switchboard locations shall provide sufficient working space around the switchboard to comply with the California Electrical Code.

D. Switchboards shall be securely fastened to the mounting surface.

E. Switchboard cabinets shall be grounded as specified in Article 250 of the California Electrical Code.

F. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.

G. Lugs shall be suitable and as required for installation with the conductor being connected.

H. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

I. Maintain the required bending radius of conductors inside the cabinet.

J. Distribute and arrange conductors neatly in the wiring gutters.

K. Tightening the wire lugs or conductor connections shall be performed in the presence of the Project Inspector. Torque values shall be those recommended by manufacturer.

L. Remove shipping blocks from component devices.

M. Manually exercise circuit breakers to verify they operate freely.

N. Remove debris from switchboard interior.

O. Follow manufacturer's instructions for installation.

P. Furnish one spare fuse for each fusible switch installed. Spare fuses shall be of the same type and rated as those installed.

Q. Do not install in highly corrosive environments such as pool equipment, boiler, chemical and corrosive materials storage rooms, and similar areas. When equipment is installed in such areas, it shall be labeled and listed for the application.

R. Switchboard equipment and system components shall be free from short circuits and grounds, other than required grounds. The CONTRACTOR shall be responsible for the testing of bolted electrical connections, and perform insulation resistance tests on each bus section, phase-to-phase and phase-to-ground for one minute in accordance with requirements stated in NETA-ATS 2007 table 100.1. Test shall be performed in the following manner:

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of bussing, circuit breakers and/or fused switches. The fused switches shall be equipped with fuses or temporary jumpers in place of fuses. Breaker and fused switches shall be tested in the closed position. No wiring shall be connected to the line or load side of the switchgear during testing.

   a. Provide calibration program records to assure the testing instruments to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).

   b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.

c. Test reports shall include the following:

1) Identification of the testing organization.

2) Equipment identification.

3) Ambient conditions.

4) Identification of the testing technician.

5) Summary of project.

6) Description of equipment being tested.

7) Description of tests.

8) Test results.

9) Analysis, interpretation and recommendations.

2. Perform tests in the presence of the Project Inspector.

3. During testing, provisions shall be made to prevent damage to solid state components, or electronic equipment such as TVSS equipment that may be tied onto switchboard bussing.

4. Test results shall meet manufacturer's recommendations or NETA ATS- 2007 recommendations, whichever is more stringent.

3.02 Pads and Anchoring

A. Where free-standing equipment is installed at exterior locations or in locations below grade, concrete pads shall be provided as specified in Section 03 3000: Cast-In-Place Concrete.

B. Where a utility meter is installed in a switchboard, concrete pad shall extend three feet from face of switchboard door or board, whichever is greater. Concrete pad installation shall comply with electric utility company requirements.

C. Anchor bolts for freestanding equipment shall meet CBC Seismic design requirements, and manufacturer's installation recommendations. The more stringent requirements will be enforced.

D. Project Record Documents: Provide project record drawings of switchboards as installed, indicating main and branch circuit ratings, circuit numbers and part numbers.

E. For ground fault relays and sensors, the following information shall be provided:

1. Certified Calibration and Acceptance Test.

2. Installation Instructions.

3. Operating Instructions.

4. Maintenance Instructions.

5. Replacement Parts List.

6. Final Test Report.

F. Test information shall be submitted to the Architect. Nameplates may be fabricated of engraved laminated plastic or etched metal and shall be permanently attached with escutcheon pins or screws.

3.03 Protection

A. Protect the Work of this section until Substantial Completion.

3.04 Cleanup

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

PART 1 General

1.01 Summary

A. Section Includes: Lighting and power distribution facilities, including panelboards.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 26 05 00: Common Work Results for Electrical.

3. Section 26 05 13: Basic Electrical Materials and Methods.

4. Section 26 26 00: Power Distribution Units.

5. Section 26 50 00: Lighting.

1.02 Submittals

A. Provide in accordance with Division 01.

B. Shop Drawings: Include a front elevation indicating cabinet dimensions, make, location and capacity of equipment, size of gutters, type of mounting, finish, and catalog number of locks.

C. Installation Instructions: Submit manufacturer's written installation instructions.

1.03 Design Requirements

A. Panelboards:

1. Panelboards shall be wall-mounted, enclosed safety type with 120/240 volt, three-wire solid neutral, 277/480 volt, four-wire or 120/208 volt, four-wire solid neutral mains as indicated on Drawings or specified. First panelboard of each building shall be provided with main or sub-feeder circuit breakers where so indicated.

2. Single pole branches shall be molded case, thermal magnetic circuit breakers with inverse time delay, trip free, quick-make, quick-break mechanism and silver alloy contacts. Circuit breakers shall be fully rated, with ampere rating marked on handle and shall indicate on/off

and tripped positions. Ground fault interrupters shall be incorporated into circuit breakers where indicated. They shall be listed by UL, or other NRTL as ground fault devices. Provide appropriate lug kit of sufficient size to accommodate the feeders.

3. Two- and three-pole branches shall be enclosed, and shall be thermal magnetic circuit breakers with inverse time delay, tamper-proof, ambient compensated, single handle, internal common trip, and quick-make, quick-break mechanism with silver alloy contacts. Circuit breakers shall be fully rated or as otherwise indicated on the Drawings.

4. Main and subfeeder circuit breakers shall be enclosed, thermal magnetic type with inverse time delay, single handle common trip, quick-make, quick-break mechanism, corrosion-resistant bearings and silver alloy contacts. Ampere frame size and trip rating shall be as indicated on Drawings. Breakers over 225 amperes shall be furnished with interchangeable trip units. Handles of main and subfeeder circuit breakers shall be provided cabinet door. Voltage rating shall be as indicated on Drawings.

5. Circuit breakers shall be fully rated and of one-piece, bolt-on type and shall meet short-circuit interrupting capacity requirements indicated on Drawings. Series rated circuit breaker combinations are not acceptable.

6. Internal connections shall be fabricated with plated copper bus bars and the busses shall extend for full length of space available for branch circuit breakers. Feeder cable connectors shall be installed at point of feeder entrance. Terminals shall be furnished with copper conductors. Panelboards fed by conductors having over-current protection greater than 200 amperes shall be protected on supply side by over-current devices having a rating not greater than that of panelboards. Copper bussing shall be fully rated. Heat rated bussing is not acceptable.

7. Except where otherwise indicated, circuit breakers shall be in two vertical rows connected to bus bars in a distributed phase arrangement. Two-pole branches shall be balanced on busses. Single pole branches shall be numbered adjacent to its circuit breaker, with odd numbers on left and even numbers on right.

8. Specified circuit breaker spaces shall be furnished with hardware required for future installation of circuit breakers.

9. Provide locking devices for individual circuit breakers. Padlocking devices shall be secured to circuit breakers and by panel dead front plates.

B. Surge Suppressors: Where indicated on Drawings, provide transient voltage surge suppressors as an integral part of panelboards. Panelboards shall be complete with 200 percent rated copper neutral bus, ground bus and isolated ground bus in addition to requirements of this section. Surge suppressors shall be as follows:

1. Surge Capacity:

a. Line-to-neutral for wye systems: 80 KA.

b. Line-to-ground: 80 KA.

c. Neutral-to-ground: 80 KA, three-phase wye.

d. Line-to-neutral plus line-to-ground: 160 KA.

2. UL 1449 2nd Edition Suppressed Voltage Rating for 208/120 Wye System:

a. Line-to-neutral: 400 volts.

b. Line-to-ground: 400 volts.

c. Neutral-to-ground: 400 volts.

d. Maximum continuous over-voltage: 150 volts.

3. EMI/RFI High-Frequency Noise Power Filter (Characteristics):

a. 100 KHz at 444 dB.

b. 100 MHz at 44 dB.

c. 10 MHz at 44 dB.

d. 100 MHz at 444 dB.

4. MOVs shall be thermally protected for low current faults and shall be fused with surge-rated fuses. The surge-rated surge current passes and clears the circuit safely if the surge capacity is exceeded. Enhanced diagnostics shall continuously monitor the unit's status and shall include LEDs to signal a reduction in surge capacity or the

loss of a suppression circuit. An audible alarm, with test and silence features, shall be furnished in diagnostic package.

5. Each phase or the entire unit shall be replaceable and have bolted-on, tin-plated copper connections. Unit to have UL witnessed fault current rating of 65,000 symmetrical amperes.

6. Surge suppression units shall comply with the following:

   a. UL certified.

   b. UL 1283.

   c. UL 1449.

   d. IEEE C 62.45.

   e. IEEE C 62.41.

   f. Nationally Recognized Testing Laboratory (NRTL) or equal.

C. Panelboard Cabinets:

1. Panelboard cabinets shall be code gage galvanized steel or blue steel; fronts, doors, and trims shall be code gage furniture steel. Cabinets shall be furnished with at least six-inch high gutters at top and bottom where feeder cable size exceeds four gage or where feeder cable passes through cabinet vertically. Cabinets shall be furnished with top and bottom gutters sized as required by inspection department having jurisdiction, but never less than six inches where more than one feeder enters top or bottom of cabinets. Side gutters shall not be less than four inches wide. Width of cabinets shall be 20 inches, unless otherwise indicated on Drawings.

2. Doors shall be cut true, shall accurately fit opening and finish smooth across joints. Rabbets shall be inside. Hinges shall be entirely concealed except for barrels and pins. Hinge flanges shall be welded to door and trim. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors, keyed to Corbin No. 60 keys.

3. Where contactors, time switches, and control devices are specified or indicated to be installed within panelboard cabinets, a separate compartment and door shall be provided at top of cabinet for such devices. Door shall be sized as required to permit removal of

contactor and other devices intact. Gutters shall be provided at sides and top of compartment. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors keyed to Corbin No. 60 keys.

4. Provide and install panelboard manufacturer's permanent circuit number kit option.

5. Panelboards with control devices in compartment shall arrive at the Project site completely assembled with control devices installed and wired.

6. Outdoor cabinets shall be NEMA Type 3R. Construction shall be formed from code gage galvanized steel with ANSI No. 61 gray enamel finish. Provide heavy-duty, three point latching, vault type door handles with padlocking provisions. Provide stainless steel or galvanized butt hinges on doors. Padlocks shall be furnished, keyed to Corbin No. 60 keys.

7. Self-tapping screws and bolts not permitted.

D. Panelboard Schedule: Provide a neatly typewritten schedule with number or name of room or area, or load served by each panelboard circuit. Room numbers or names shall be determined at the Project site and shall not necessarily be those indicated on the Drawings. Schedule shall also indicate panel designation, voltage and phase, building and distribution panel or switchboard from which it is fed. Schedule shall be installed in a frame under transparent plastic 1/32 inch thick on inside of each panelboard cabinet door.

E. Panelboard nameplate: Provide a nameplate identifying panelboard. Plates shall be black and white plastic nameplate stock, with character cut through white exposing black and shall bare designation of service. Name plate shall be mechanically fastened to switchboard.

F. Provide additional labeling on dead-front of panelboard. Label shall be a P-Touch or equal with a minimum width of 3/8 inch with black letters on white background. Label shall re-identify panelboard and also identify name and location of power source feeding this panel. Location information shall include building name if located in different building and name or room location. If power source is installed in same room, label should indicate source name and "In this Room"

G. Panelboard Standards: Panelboards shall be UL, or other NRTL listed and labeled. Panelboards shall meet latest revisions of following standards:

1. California Electric Code, Article 384.

2. UL 67, Panelboards.

3. UL 50, Cabinets and Boxes.

4. UL 943, GFCI.

5. UL 489, Molded Case Circuit Breakers.

6. NEMA PB1.

7. Federal Specifications W-P- 115C and WC-375B.

PART 2 Products

2.01 Manufacturers

A. Panelboards shall be manufactured by Siemens, W.A. Benjamin, General Electric, Square D, Eaton or equal.

PART 3 Execution

3.01 Installation

A. Panelboards shall be located so they are readily accessible and not exposed to physical damage.

B. Panelboards installed outdoors shall be specifically listed for wet locations and shall be weatherproof in NEMA Type 3R cabinets.

C. Panelboard locations shall provide sufficient working space around panels to comply with the California Electrical Code.

D. Panelboards shall be securely fastened to structure and mounted on surface by at least four points.

E. Unused openings in cabinets shall be effectively closed as required by the manufacturer.

F. Cabinets shall be grounded as specified in Article 250 of the California Electrical Code.

G. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.

H. Lugs shall be suitable and listed for installation with the conductor being connected.

I. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

J. Maintain the required bending radius of conductors inside the cabinet.

K. Clean the cabinet of foreign material such as cement, plaster, and paint.

L. Distribute and arrange conductors neatly in the wiring gutters.

M. Use the manufacturer's torque values to tighten lugs.

N. Before energizing panelboards, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been provided.

2. Remove shipping blocks from component devices and panelboard interiors.

3. Manually exercise circuit breakers to verify they operate freely.

4. Remove debris from panelboard interior.

O. Follow manufacturer's instructions for installation.

P. Do not install in highly corrosive environments, unless rated for the application.

3.02 Protection

A. Protect the Work of this section until Substantial Completion.

3.03 Cleanup

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

DIVISION 31: EARTHWORK
SECTION 31 05 00 – COMMON WORK RESULTS FOR EARTHWORK

PART 1 GENERAL

1.01 General Conditions

A. The General Conditions apply to all work of this specification, which shall be done as shown on the plans, and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the "OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction," and other applicable state and municipal standards and regulations.

2. The CONTRACTOR shall be familiar with, and shall at all times conform to California Code of Regulations, Title 8, Chapter 4, Subchapter 4 —Construction Safety Orders.

1.02 Referenced Sections

1.03 Cited Standards

A. All earthwork specifications shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. State of California Standard Specifications, Issued by: Department of Transportation, 2010.

1.04 Noted Restrictions – none

1.05 Quality Control

A. Quality Control: The CONTRACTOR shall provide proper quality control measures to assure compliance with specified requirements.

B. The OWNER will engage the services of an approved independent soils testing laboratory to perform tests as necessary to demonstrate compliance with these specifications.

C. Tolerances:

1. Construct finished surfaces to plus or minus 2 inches of the elevations indicated.

2. Complete embankment slopes to plus or minus 6 inches of the slope line indicated.

3. Maintain the moisture content of fill material as it is being placed within plus or minus three percent of the recommended moisture content of the material.

4. Maintain existing overall site drainage slope.

5. Maintain a minimum slope of 5” per 10 feet in the first 10 feet around structures.

1.06 Antipollution Measures

A. The CONTRACTOR shall conduct his activities and shall program his operations in such a manner as to minimize stream pollution from erosion of cleared soil surfaces and freshly excavated or backfilled material during periods of surface water runoff.

B. The CONTRACTOR shall reduce the area and duration of exposure of all erodible soils by the greatest extent practicable, and to that end hydro-mulching, reseeding and other specified surface restoration shall be required to closely follow backfilling and final grading operations.

C. Where the ENGINEER so directs in the field, sediment traps and other means to retard runoff rates shall be installed. Similar holding basins or other sediment traps arrangements shall also be required to be installed at the discharge of dewatering pumps.

D. The CONTRACTOR shall provide noise and dust abatement as necessary to minimize impact on surrounding areas.

END OF SECTION

DIVISION 31: EARTHWORK
SECTION 31 11 00 – CLEARING AND GRUBBING

PART 1 GENERAL

1.01 Section Includes

A. This sections describes how the General Construction CONTRACTOR shall furnish complete all materials necessary to perform work related to all clearing, grubbing, scalping, removing of trees and stumps, and removing of all vegetation and construction debris from the limits shown on the DRAWINGS.

B. The method of clearing, including the use of bulldozers, shall be at the option of the CONTRACTOR. However, he or she will not be permitted to cover up brush and similar debris with earth. All work under this heading shall be done sufficiently ahead of topsoil removal and excavation so as not to interfere with those operations. The CONTRACTOR shall remove stumps and large roots and refill the depression with suitable compacted earth fill where necessary to bring the grade back to its original elevation or final grade.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All clearing and grubbing shall conform to federal, state and local codes and standards.

1.04 Noted Restrictions

A. The CONTRACTOR shall protect survey markers and monuments, existing improvements, and adjacent properties from removal and damage.

B. Protect existing utilities indicated or made known.

C. The CONTRACTOR shall notify all utilities of the intent to begin work at the site and shall locate all such utilities, including storm water drainage piping prior to commencing work.

D. The CONTRACTOR shall give written notices to utility companies and municipal departments requesting discontinuance of services to areas that will be affected by the site clearing and grubbing work.

E. Protection of persons and property:

1. Barricade open depressions and holes occurring as part of this work, and post warning lights on property adjacent to or within public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this section.

F. No burning or burying of brush, roots, stumps, etc. shall be permitted at the site. Such materials shall be disposed off-site in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.

G. All vegetation and objects not designated for removal shall be protected.

H. Protection of Existing Trees

1. The CONTRACTOR shall protect existing trees, shrubbery, and other vegetation that is to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Temporary fences, barricades or guards are to be provided as required to protect trees and vegetation to be left standing.

2. Trees and other vegetation to remain within limits of contract work shall be watered as required to maintain their health during course of construction operations.

3. Protection shall be provided for roots over 1 ½” diameter cut during construction operations. Coat cut faces with a wound paint formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

4. The CONTRACTOR shall repair or replace trees and vegetation that will remain, which are damaged by construction operations, in a manner acceptable to the ENGINEER, and property OWNER if work is performed on private property. The ENGINEER may employ an Arborist to repair damages to trees and shrubs at the CONTRACTOR’s expense when deemed necessary.

I. Depressions caused by clearing and grubbing operations shall be filled with suitable soil material, unless further excavation or earthwork is indicated. Fill material shall be placed in horizontal layers not exceeding 6” loose depth, and thoroughly compacted to a 90% modified proctor density equal to or better than the adjacent original ground.

J. Use means necessary to prevent dust from becoming a nuisance to the public,

to neighbors, and to other work being performed on or near the site.

K. Maintain access to the site at all times.

1.05 Quality Control

A. The CONTRACTOR shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 PRODUCTS

2.01 Materials And Equipment

A. The CONTRACTOR shall furnish all materials, tools, equipment, facilities, and services as required to complete the work described herein.

B. Fill material required for depressions created through clearing and grubbing shall be clean, dry earthen material common to the site. The material shall not contain rocks or lumps larger than 5 inches in greatest dimension, with no more than 15 percent by weight larger than 3 inches.

PART 3 EXECUTION

3.01 Preparation

A. The CONTRACTOR shall notify all utilities of the intent to begin work at the site and shall locate and mark all underground utilities, including storm water drainage piping prior to commencing work.

B. The CONTRACTOR shall obtain all necessary permits prior to commencing work.

C. Protection of landscape features to be preserved shall be by fencing, barricades, or wrapping as required by the ENGINEER.

3.02 Clearing and Grubbing

A. The CONTRACTOR shall remove trees, including stumps and roots, shrubs, grass, flowers and any other vegetation interfering with installation of new construction. The CONTRACTOR shall carefully and cleanly cut roots and branches of trees that will remain where such roots and branches obstruct new construction.

B. Grubbing shall consist of the removal and disposal of stumps, roots, root mats and other debris to a depth of not less than 18 inches below existing ground elevation.

C. The CONTRACTOR shall remove existing footers and foundations within the work site area that will interfere with excavation and construction activities. Such structures shall be removed to a minimum depth of 24". Such materials of construction shall not be used for backfill and shall be properly disposed offsite.

D. In locations to be seeded, the CONTRACTOR shall remove stumps at least 6 inches (150 mm) below ground surface. In unseeded areas to be rounded at the top of backslopes, stumps shall be cut flush with or below the surface of the final slope line.

E. The CONTRACTOR may leave undisturbed stumps and roots, and nonperishable solid objects 6 inches (150 mm) above the existing ground surface in the plan embankment construction locations where the embankment height is greater than 9 feet (3 m) from the subgrade elevation and when the existing side slope is 8:1 or flatter.

F. If existing pipelines are constructed throughout the site to be cleared, a minimum of such areas shall be disturbed.

G. Except in areas to be excavated, backfill stump holes and other holes created by removing obstructions with Item 2.03B embankment material. Place and compact according to Item 2.01B.

H. The CONTRACTOR shall remove low hanging, unsound, or unsightly branches on trees or shrubs designated to remain. The CONTRACTOR shall trim branches of trees extending over a roadbed to provide a clear height of 20 feet (6 m) above the roadbed surface. Cut off branches neatly and close to the tree boles. Remove other branches as necessary to present a balanced appearance. Treat scars resulting from tree branch removal with a heavy coat of an approved asphaltic tree paint.

3.03 Conservation of Topsoil and Existing Landscaping/Groundcover.

A. After the area has been cleared of vegetation, strip the existing topsoil to the depth necessary to provide at least 6-inch depth of topsoil in areas shown on the DRAWINGS to be turfed or planted, without contamination with subsoils.

B. Stockpile in an area clear of new construction.

C. Maintain the stockpile in a manner which will not obstruct the natural flow of drainage.

1. Maintain stockpile free from debris and trash.

2. Keep the topsoil damp to prevent dust and drying out.

D. Disturbed vegetation shall be replaced in kind approved by the OWNER.

3.04 Cleanup

A. The CONTRACTOR shall dispose of debris contaminated with garbage, solid waste, or hazardous waste or material according to other contract items.

B. Salvageable Material

1. Any material, resulting from clearing operations on private property not desired by the property OWNER shall become property of the CONTRACTOR and shall be properly disposed of by the CONTRACTOR off site at no additional cost to the OWNER. Weather permitting, the CONTRACTOR shall remove and dispose of all waste material weekly.

END OF SECTION

DIVISION 31: EARTHWORK
SECTION 31 22 13 – ROUGH GRADING

PART 1 GENERAL

1.01 Section Includes

A. This Section defines the requirements for earthwork and shall include, but not be limited to, providing labor, materials, equipment, and supplies necessary to perform.

1. Grading of the existing subgrade surface; and,

2. Fill and grading of the proposed subgrade/structural fill material

B. Definitions

1. Structural Fill. Clean and dry fill material removed from site excavation suitable for use in backfilling and compaction.

2. Unsuitable Fill. Material which, because of chemical contamination or structural characteristics, is judged to be unsuitable for use as structural fill at the site.

3. Topsoil. Topsoil is the top layer of soil from vegetative cover areas which is suitable for plant growth.

1.02 Referenced Sections – none

1.03 Cited Standards – none

1.04 Noted Restrictions

A. Site Investigations

1. The CONTRACTOR shall carefully examine the site, test the soils, and make inspections necessary in order to construct the earthwork as indicated by the DRAWINGS. The CONTRACTOR shall satisfy himself as to the nature and physical properties of the soils, the condition of the existing ground surface, and the character of equipment and facilities needed prior to and during execution of the work. Inaccuracies or discrepancies between the actual field conditions and the DRAWINGS, or between the DRAWINGS and Specifications, shall be brought to the attention of the ENGINEER in order to clarify the exact nature of the work to be performed.

1.05 Quality Control

A. It shall be the CONTRACTOR's responsibility to maintain adequate safety measures and working conditions and to take measures necessary during the performance of the work to protect the entire project area and adjacent

properties which would be affected by this work from storm damage, flood hazard, caving of trenches and embankments, and sloughing of material until final acceptance by the ENGINEER

B. The CONTRACTOR shall account in the construction Schedule for delays caused by weather, including time for dewatering, drying–moisture conditioning, and sample testing.

1.06 Submittals

A. CONTRACTOR submittals required under this Section shall be made (1) only if off-site imported fills are provided by the CONTRACTOR and (2) in accordance with requirements set forth in the Specifications unless stated otherwise. Submittals under this Specification include, but are not limited to, test results for fill material, together with other information, to be submitted at least seven days before scheduled delivery of the material, as detailed in this Section.

B. CONTRACTOR shall provide compaction testing results to OWNER or its representative or Designate.

PART 2 PRODUCTS

2.01 Materials

A. Structural fill material for use at the site shall be subject to approval by the ENGINEER. Structural fill material shall not contain rocks or lumps larger than 5 inches in greatest dimension, with no more than 15 percent by weight larger than 3 inches. The CONTRACTOR shall provide equipment and manpower to obtain representative samples from the identified borrow sources 10 days prior to material use. Testing of structural fill samples will be performed in accordance with the applicable standards. The CONTRACTOR shall compact and moisture condition (including discing of the material to provide a homogeneous soil and moisture mix) the structural fill to achieve at least 95 percent of its standard Proctor maximum dry density.

2.02 Equipment

A. Use compaction equipment to achieve the required minimum soil dry density within the range of acceptable moisture contents.

B. Use hand compaction equipment such as walk-behind pad-foot compactors, hand tampers, or vibratory plate compactors for compaction in areas inaccessible to large compaction equipment.

C. Use water tank trucks, pressure distributors, or other equipment designed to

apply water uniformly and in controlled quantities to variable surface widths to provide the required in-place moisture content.

D. Use miscellaneous equipment such as scarifiers, disks, spring tooth or spike tooth harrows, earth hauling equipment, and other equipment, as necessary for earthwork construction.

PART 3 EXECUTION

3.01 General

A. Before beginning backfilling, foreign material, including surface water and loose organic material shall be removed from the space to be backfilled and the area to be backfilled shall be inspected and approved by the ENGINEER. If deemed necessary, the existing area will be compacted prior to placement of the backfill. Backfill materials shall be placed "in-the-dry" on subgrades acceptable to the ENGINEER. A 2-foot maximum bridge lift will be permitted in the trough areas in Landfill 3.

B. The CONTRACTOR shall prepare and proof-roll the subgrade as described within the CQA Plan and within this Specification.

3.02 Grading

A. Grade designated areas to the subgrade elevations and excavation limits indicated on the Project DRAWINGS. Stockpile excavated material in designated areas only. Prepare the subgrade in accordance with this Section.

B. Do not remove soil or waste material from the site or dispose of soil or waste material included in this Contract except as indicated in these Specifications, on the DRAWINGS or as approved in writing by the ENGINEER.

3.03 Stockpiling

A. Stockpile required soils at the areas indicated on the Project DRAWINGS or as directed by the ENGINEER.

B. Construct stockpiles no steeper than 3H:1V (horizontal to vertical ratio), grade to drain, seal by tracking perpendicular to the slope contours with a dozer, and dress daily during periods when fill is taken from the stockpile. Install erosion and sediment control measures around stockpile areas.

3.04 Subgrade Preparation

A. Subgrade surface shall be relatively free of debris, foreign objects, loose organics, and other deleterious materials.

B. In areas of subgrade preparation where soft soils are encountered, remove and replace the soil to a minimum depth of 1 foot below the proposed subgrade elevation. Fill the area with structural fill in accordance with the requirements of this Section. Compact the fill material to at least 95 percent standard Proctor maximum dry density and within an appropriate moisture range based on laboratory test data (ASTM D 698).

C. In excavations or other areas where water accumulates, implement measures to remove the water in accordance with this Section. Maintain the subgrade surface free of standing water and firm. Maintain dewatered areas in this condition until overlying construction is complete. Surface water that comes into contact with exposed waste shall be contained and disposed of.

3.05 Fill

A. Place fill material on surfaces which are relatively free of debris, branches, vegetation, mud, ice, or other deleterious material as approved by the ENGINEER.

B. Place structural fill material in compacted lifts with a thickness of 8 inches (maximum). Place low permeable soil in compacted lifts with a thickness of 6 inches (maximum). In areas where compaction is to be performed using hand-operated equipment, place the fill material in loose lifts with a loose thickness of 4 inches ±1 inch. Place low permeable soil material in compacted lifts with a thickness of 6 inches (maximum).

C. Remove rock and soil clod particles not conforming with Paragraph 2.01 of this specification.

D. Prior to placing a succeeding lift of material over a previously compacted lift, thoroughly scarify the previous lift to a depth of 2 inches by discing, raking, or tracking with a dozer. Moisture condition the preceding lift in accordance with this Section if the moisture content of the surface of the preceding lift is not within the range of acceptable moisture contents for the fill.

E. Reduce clod size by discing, raking, or tracking with a dozer or other means to achieve the required maximum soil clod size as defined in Paragraph 2.01 of this specification.

F. Structural fill material in each lift shall be compacted to at least 95 percent of its standard Proctor maximum dry density and within a moisture content range determined by the ENGINEER based on testing results (ASTM D 698).

G. Low permeable soil material in each lift shall be compacted to at least 95 percent of its standard Proctor maximum dry density and within a moisture content range determined by the ENGINEER based on testing results (ASTM

D 698). Samples of low permeable soil material will be remolded by the ENGINEER defined soils laboratory to define an Acceptable Permeability Zone (APZ) which will be used to qualify field nuclear density test results and the acceptance criteria to achieve a permeability of 1×10^{-5} cm/sec or less for each material type and source.

H. Do not compact fill material at temperatures below 32°F, unless otherwise authorized in writing by the Supervising CONTRACTOR.

I. Do not place fill during periods of precipitation. Placement may occur during periods of misting or drizzle, if authorized by the ENGINEER.

3.06 Care Of Drainage Water

A. Grading shall be performed as shown on the DRAWINGS to prevent surface water from flowing into excavations or off-site.

B. The CONTRACTOR shall place silt fences as needed to control sediment runoff.

3.07 Clean Up

A. Upon completion of work in this Section, rubbish and debris shall be removed from the site. Construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean, and acceptable condition.

B. Excavated materials which are determined to be unsuitable for use as fill, or excavated material that is in excess of that required to be used for fill, shall be disposed of in the Industrial Landfill or in a manner approved by the ENGINEER at the CONTRACTOR's expense.

3.08 Erosion Control

A. The CONTRACTOR shall prevent erosion of exposed areas and newly deposited fill soil. The CONTRACTOR shall follow applicable federal and state regulations and these Specifications for erosion and sedimentation control.

END OF SECTION

31 22 19 Finish Grading

PART 1 GENERAL

1.01 Section Includes

A. Upon completion of the installation of structures and paved or graveled areas, the remaining disturbed area shall be final graded.

1.02 Referenced Sections

A. Related Sections are listed below:

1. SECTION 31 23 23 - FILL

1.03 Cited Standards – None

1.04 Noted Restrictions - None

1.05 Quality Control

A. The final grade shall, in general, slope away from the structures and paved or gravel areas and toward natural drainage areas.

B. The grading shall allow approximately 6 inches of curb exposure at the equipment pad and all other concrete structures shall have a minimum exposure of 2 inches.

C. Backfilled areas including trenches, paved or graveled areas, and around foundations, shall be compact filled as per the requirements in Section 31 23 23.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

DIVISION 31: EARTHWORK
SECTION 31 23 16 – EXCAVATION

PART 1 GENERAL

1.01 Section Includes

A. Under this section, the General Construction CONTRACTOR for this Contract shall furnish complete all materials, labor, and equipment necessary to perform work related to all excavation and backfill, as shown on the DRAWINGS or specified herein.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions

A. The total length of excavated trench open at any one time should not be greater than the total length of pipeline/utility line that can be placed in the trench and backfilled in one working day.

B. The CONTRACTOR shall use underground Service Alert (USA) notifications and shall utilize an underground utility locating service.

1.05 Quality Control

A. The CONTRACTOR is totally responsible for the design, purchase and installation of all construction aids. None of the structures or materials indicated on the DRAWINGS is intended for this use. (For example, if shoring is required for vertical excavation line(s) the design, purchase and installation of such shoring would be the CONTRACTOR's responsibility.)

B. Limits of Work

1. All work to be done is located as shown on the contract DRAWINGS. The CONTRACTOR shall confine his operations to designated areas of the sites shown on the DRAWINGS.

2. The CONTRACTOR shall occupy and cross only those portions of the site on which the actual work is located.

C. Antipollution Measures

1. The CONTRACTOR shall conduct his activities and shall program his trenching and restoration operations in such a manner as to minimize pollution from erosion of the freshly excavated or backfilled material during periods of excavation. The CONTRACTOR shall reduce the area and duration of exposure of all erodible soils by the greatest extent practicable. Where the ENGINEER so directs in the field, sediment

traps and other means to retard runoff rates shall be installed. Similar holding basins or other sediment traps arrangements shall also be required to be installed at the discharge of dewatering pumps. Discretion shall be exercised in selecting the number and location of encroachments during construction both in and along watercourses such that a minimum of disturbance and erosion pollution result.

2. During all construction activities, the CONTRACTOR shall also, wherever possible, make every effort to minimize noises caused by his activities, especially in populated residential areas. Equipment shall be equipped with mufflers or silencers designed to operate with the least possible noise levels.

D. Rights-of-Way

1. The OWNER will obtain all rights-of-way, which the OWNER deems necessary for construction of the pipelines and the CONTRACTOR shall confine all construction activities within the limitations of same. The CONTRACTOR, however, shall make his own arrangements for office space, materials storage yards, sanitary facilities, any utility services which may be desired, and for ingress and egress over any private property or land which he desires to use for which the OWNER has obtained no right-of-way for construction, operation and/or maintenance.

2. The CONTRACTOR shall not use any vacant lot, or private land as a plant site, depository for materials, or spill site, or for any other purpose without the written authorization of the OWNER (or an authorized agent) of the land, a copy of which authorization shall be filed with the ENGINEER.

PART 2 PRODUCTS

2.01 Excavation for Pipelines

A. The depth of trench for pipelines shall be such that the pipe in its installed position shall comply with the line and grades as shown on the plans, or with the line and grades established by the ENGINEER in the field.

B. The total length of excavated trench open at any one time should not be greater than the total length of pipeline/utility line that can be placed in the trench and backfilled in one working day. No more than 50 lineal feet of open trench should exist when pipeline/utility line installation ceases at the end of the workday.

C. In excavation for pipelines made in open cut trenches where space permits, the

sides of the trench from the ground surface to a depth not closer than 1 ft above the top of the pipe may be excavated to non-vertical and nonparallel planes. In no case shall the side walls of the trench in the pipe zone, defined as all that trench area below a point 12 inches above the top of the pipe in its installed position, be permitted to be other than vertical and parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes shall be no greater than the outside diameter of the pipe plus 24 inches, nor less than the outside diameter of the pipe plus 12 inches.

D. Where the available space does not permit and where existing or proposed above ground or underground structures may be endangered, the sides of the trench above the pipe zone shall be excavated to vertical and parallel planes. The horizontal distance between the vertical planes shall be no greater than necessary to permit construction of the pipe-line with all required sheeting, shoring and bracing in place.

PART 3 EXECUTION

3.01 Preparation

A. Before beginning excavation or filling work, the topsoil (if any) from all areas to be affected shall be stripped to a depth of 6 inches and shall be properly stored and protected at a location approved by the ENGINEER. After completion of the major construction work, the topsoil shall then be replaced as the upper layer of backfill to a depth of no less than 6 inches so that the final grade shall be as required by the DRAWINGS. If additional topsoil over and above that salvaged from the site is required in order to maintain the 6-in. depth specified, the CONTRACTOR shall furnish and install same at no additional cost to the OWNER.

B. The CONTRACTOR shall use underground Service Alert (USA) notifications and shall utilize an underground utility locating service.

C. Concrete and/or other excavated surfacing materials shall be removed from the site and properly disposed at the CONTRACTOR's expense.

D. Backfill around all structures and in all trenches shall be carried to the grade existing before the installation of the improvement unless otherwise indicated on the DRAWINGS or specified hereafter. Backfilling shall follow immediately after construction of the pipe and appurtenances and in no case shall there be a finished installed pipe left uncovered at the end of the work day.

E. Each CONTRACTOR shall make personal examination of the sites in which the improvements are to be installed and determine for themselves the extent and character of any work that may be encountered. All work on the basic

contract will be performed on an unclassified basis. Unclassified excavation includes the removal and disposal of material of any kind, natural or man-made, without exception.

F. The CONTRACTOR shall provide adequate and suitable means of support to prevent failure of any excavation wall and to protect his personnel working in the excavation. The system of support shall be in accordance with current OSHA regulations.

3.02 Installation

A. All open excavation in the construction area shall be adequately barricaded and posted with battery operated warning lights, signs, etc., as required by any local, State, or Federal regulations, or by any published policy by the OWNER, or in the absence of any such regulation, to the satisfaction of the ENGINEER.

B. Should the CONTRACTOR's operations encounter foundations of new or existing structures, the CONTRACTOR shall perform excavation and backfill as per the pipe manufacturer’s specifications.

C. No excessively wet material will be permitted to be used as backfill. Suitable or selected backfill material shall be kept separated from the unsuitable types. If the CONTRACTOR allows suitable backfill material from his excavation to become excessively wet or mixed with unsuitable material, he shall not be allowed to use it as backfill material and he will be required to bring in material from an outside source at no additional cost to the OWNER.

D. The ENGINEER may require that sheeting, shoring or bracing installed for excavation be left in place in order to protect adjacent facilities or structures. Where such is not required in these specifications or on the DRAWINGS, the CONTRACTOR will be reimbursed as stipulated in the General Conditions section of these specifications. All other sheeting may be salvaged when the removal of same will not present a hazard to the adjacent facilities or to the safety of the CONTRACTOR's personnel. The CONTRACTOR shall be fully responsible and liable for any improper or premature removal of sheeting, shoring or bracing and any and all personal or property damages resulting therefrom.

E. All excavation materials not used in backfill or final grading operations shall be hauled to a specific site location as directed by the OWNER or ENGINEER at the CONTRACTOR’s expense. The CONTRACTOR shall not dispose of such material offsite or on the site of the work without the permission of the OWNER.

F. The CONTRACTOR shall prevent surface water and subsurface or groundwater from flowing into excavations and from flooding the project site.

The CONTRACTOR shall not allow water to accumulate in excavations to prevent softening of foundation bottoms and undercutting of footings. The CONTRACTOR shall provide and maintain pumps, sumps, suction and discharge lines, and other dewater system components necessary to convey water away from excavations.

3.03 Testing - None

END OF SECTION

31 23 19 Dewatering

PART 1 GENERAL

1.01 Section Includes

A. This section describes the general dewatering methods and equipment required to maintain a dewatered environment throughout the course of work.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall be responsible for keeping the excavation for which he is responsible dewatered throughout the course of the work, and failure of the CONTRACTOR to perform these tasks will not make the OWNER liable for any additional expenses incurred by the CONTRACTOR.

PART 2 PRODUCTS

2.01 Methods and Equipment

A. Dewatering methods shall be submitted to the ENGINEER for review and comment.

B. The CONTRACTOR shall provide and maintain in operation suitable and adequate pumping or well-point equipment for completely dewatering any and all trench excavations in such a manner as to permit the successful installation of the proposed improvements. No pipe shall be permitted to be constructed in a trench in which water flows or is pooled.

C. The CONTRACTOR shall take all necessary precautions to protect all construction, including partially installed piping, against flooding and/or floatation from hydrostatic uplift.

D. All water pumped or drained from the construction site shall be directed to a sedimentation control device and properly disposed of by the CONTRACTOR in accordance with all regulations and requirements of all governing authorities, including erosion and sedimentation control activities. No storm or surface water shall be disposed of in new or existing sewer facilities.

E. The dewatering of the excavation and trench shall be considered an integral part of the excavation work.

PART 3 EXECUTION

3.01 Drainage

A. Surface water shall be directed away from excavations and construction sites so as to prevent erosion and undermining of any nearby foundations. Diversion ditches, dikes, and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

B. Grading shall be done as may be necessary to prevent surface water from flowing into the excavations, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized over-excavation shall be backfilled with granular fill material and compacted, at no additional cost to the OWNER.

C. Groundwater flowing toward or into excavations or trenches shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction.

D. Provide and maintain means and devices to remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipelaying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. These provisions shall apply during the noon hour as well as overnight. Dispose of the water in a manner to prevent damage to adjacent property. Do not drain trench water through the pipeline under construction. Do not allow groundwater to rise around the pipe.

E. CONTRACTOR shall notify the OWNER 48 hours prior to commencement of dewatering. Methods employed shall be in conformance with the applicable discharge permits.

END OF SECTION

31 23 23.23 Compaction

PART 1 GENERAL

1.01 Section Includes

A. The CONTRACTOR shall compact during backfill as per the specifications contained herein.

1.02 Referenced Sections – None

1.03 Cited Standards

A. Testing for Compaction

1. Determine the density of soil in place by the Sand Cone Method ASTM D1556, or Nuclear Gage Method ASTM D2922 and D3017.

2. Determine laboratory moisture-density relations of soils by ASTM D1557.

3. Determine the relative density of cohesionless soils by ASTM D4253 and D4254

4. Sample backfill materials by ASTM D75.

5. Express "relative compaction" as the ratio, expressed as a percentage, of the in-place dry density to the laboratory maximum dry density.

6. Compaction shall be deemed to comply with the specifications when no test falls below the specified relative compaction. The CONTRACTOR shall pay the costs of any retesting of work not conforming to the specifications.

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall include all costs required for the compaction tests, including delivery of said certified results to the ENGINEER, in the total price bid for this Contract.

B. Subject to unsatisfactory test results not meeting specification compaction requirements, the ENGINEER reserves the right to order additional tests at no additional cost to the OWNER until satisfactory test results are reached in the affected areas.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 Preparation

A. Percentage of Maximum Density and Optimum Water Content Requirements

1. Compact soil to not less than the following percentages of maximum dry density for soils which exhibit a well-defined moisture density relationship, determined in accordance with ASTM D 1557, and not less than the following percentages of relative density, determined in accordance with ANSI/ASTM D2049, for soils which will not exhibit a well-defined moisture-density relationship.

B. For Structures

1. Compact the top 12 inches of subgrade and each layer of backfill or fill material at 95% maximum dry density at a moisture content that lies within 3% of the optimum moisture content or 90% relative density.

C. For Building Slabs and Steps

1. Compact the top 12 inches of subgrade and each layer of backfill or fill material at 95% maximum dry density at a moisture content that lies within 3% of the optimum moisture content or 95% relative density.

D. For Lawn or Unpaved Areas

1. Unless otherwise shown in DRAWINGS, compact the top 6 inches of subgrade and each layer of backfill or fill material at 90% maximum dry density at a moisture content that lies within 3% of the optimum moisture content.

E. For Walkways

1. Unless otherwise shown in the DRAWINGS, compact the top 6 inches of subgrade and each layer of backfill or fill material at 90% maximum dry density at a moisture content that lies within 3% of the optimum moisture content or 80% relative density.

F. For Roadways

1. Unless otherwise shown on the DRAWINGS, compact the top 12 inches of subgrade and each layer of backfill or fill material at 95% maximum dry density at a moisture content that lies within 3% of the

optimum moisture content or 80% relative density for cohesionless granular material.

G. For Pipe Trenches

1. Unless otherwise shown on the DRAWINGS or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:

a. Pipe trenches--90 percent relative compaction unless shown otherwise on the DRAWINGS.

b. Sand slurry refill for overexcavation--90 percent relative compaction.

3.02 Testing

A. In the event that the use of special vibratory and/or heavy-duty machinery is used for compaction, the following methods will be approved:

1. Proctor Density Tests

a. Subject to field conditions, Proctor Density Tests shall be used throughout the course of the project to determine the standard density of material. These tests, when required, will be performed in accordance with ASTM D 1557, unless otherwise specified.

2. Compaction Tests

a. Subject to field conditions and installation procedures Compaction Tests shall be required throughout the course of the project to verify the in-place density of compacted soil backfill. These tests will be performed at locations as determined in the field. These tests will be performed in accordance with ASTM D1556 or by nuclear methods designated as ASTM D6938-07b D2922, unless otherwise specified.

END OF SECTION

31 23 33 Trenching and Backfilling

PART 1 GENERAL

1.01 Section Includes

A. This section describes the general trenching and backfilling specifications for installation, and burial of conduit and environmental piping.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall verify all soil conditions and the trenches shall be dug according to the plan. The CONTRACTOR shall have all trenches dug and inspected prior to the arrival of the pipe installation crew.

B. Unless otherwise indicated, excavation shall be open cut.

C. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner, a distance back from the edges of the excavations specified by the governing safety agency. Materials unsuitable for backfilling shall be wasted as specified.

D. Caution shall be exercised in operating heavy equipment over pipelines. Leaks or breaks caused by the CONTRACTOR's operations shall immediately be repaired at no additional expense to the OWNER and in a manner acceptable to the ENGINEER.

E. The banks of excavated areas shall be controlled as is necessary to prevent movement of soil in areas supporting existing foundations, slabs, pole lines, underground power or telephone cables, trees, pipelines or other structures.

F. If, as a result of the excavation or through fault or neglect of the CONTRACTOR, the earth or ground under or around such foundations, slabs, pole lines, underground power or telephone cables, trees, pipelines or other structures, slips or is otherwise disturbed, corrective measures shall be taken as directed at no additional expense to the OWNER.

G. The bottom of the trench shall be excavated to the lines and grades shown with proper allowance for pipe thickness, and for foundation stabilization and special bedding when required. Material containing rocks or cobbles larger than 2 inches in maximum dimension shall not be permitted within 6 inches of

the pipe. Material of this type shall be removed from the bottom of the trench and replaced with backfill material. Parts of the trench excavated below grade shall be corrected with backfill as specified. The depth of trenches shall be as indicated on the DRAWINGS.

H. Measurements for cover requirements shall be taken from the existing grade. (It is the responsibility of the CONTRACTOR to maintain these cover requirements with any future grade changes that may occur.)

I. The pipe shall have a minimum vertical clearance of 18 inches from other underground utilities unless denoted otherwise on the DRAWINGS.

J. Pipe Base

1. The pipe base shall be defined as a layer of material immediately below the bottom of the pipe or conduit and extending over the full trench width in which the pipe is bedded. Thickness of pipe base shall be 6 inches or as otherwise shown on the DRAWINGS or otherwise described in the specifications for the particular type of pipe installed.

K. Safety

1. All excavations shall be performed, protected, and supported as required for safety and in the manner set forth in the operation rules, orders, and regulations prescribed by the Division of Industrial Safety of the State of California.

2. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrians and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.

1.06 Submittals

A. Submit excavation DRAWINGS for worker protection in accordance with **Section 01 33 00 Submittal Procedures**.

B. Submit six (6) copies of a report from a testing laboratory verifying that imported material conforms to the specifications.

PART 2 PRODUCTS

2.01 Materials

A. Backfill and Bedding

1. Backfill and bedding material shall be imported sand slurry delivered and placed by Readimix Truck.

2. Sand used for bedding and backfilling pipe and utilities shall have the following gradation:

Sieve Size	Percent Passing by weight
2 inch	-100
No. 4	70 - 100
No. 16	35 - 75
No. 50	10 - 40
No. 200	0 - 10

Minimum sand equivalent shall be 30 per ASTM D-2419.

B. Concrete for Pipe Encasement

1. Concrete for pipe encasement shall be 520C-2500 per the SSPWC, unless otherwise shown on the DRAWINGS.

C. Water for Compaction

1. Water used in compaction shall have a maximum chloride concentration of 500 mg/l, a maximum sulfate concentration of 500 mg/l, and shall have a pH of 7.0 to 9.0. Water shall be free of acid, alkali, or organic materials injurious to the pipe coatings.

PART 3 EXECUTION

3.01 Preparation

A. The CONTRACTOR shall prepare the trench width one foot wider than the width of the pipe to be buried unless specified otherwise in the design DRAWINGS. Where more than one pipe is specified for a given trench, the trench shall be at least one foot wider than the width of the combined piping.

B. Trench width at the top of the trench will not be limited except where the width of the excavation would undercut adjacent structures, footings or slopes. In such cases, trench width shall be such that there is at least 18 inches between the top of edge of the trench and the structure, footing or slope.

C. Excavate the trench to the lines and grades shown on the DRAWINGS with allowance for pipe thickness and for pipe base or special bedding. If the trench is inadvertently excavated below the required grade, refill any part of the trench excavated below the grade at no additional cost to the OWNER with

sand slurry. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade with allowance for the pipe base or special bedding.

D. The CONTRACTOR shall slope the sides of the trench at an angle above the highest point of the piping to assist in minimizing soil loads in loose soil conditions prior to compaction.

E. Dewatering shall be performed as needed per the requirements in **Section 31 23 19**.

F. The CONTRACTOR shall have the trench inspected by the OWNER or the ENGINEER.

G. If there is any conflict between the trenching and pipe bedding described and that of the detail DRAWINGS, the trenching and pipe bedding shall be performed in accordance with the design DRAWINGS.

H. Location of Excavated Material

1. During trench excavation, place the excavated material only within the working area. Do not obstruct any roadways or streets. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.

I. Length of Open Trench

1. Limit the length of open trench to 600 feet in advance of pipelaying or amount of pipe installed and backfilled in one working day.

J. Foundation Stabilization

1. After the required excavation has been completed, the ENGINEER will inspect the exposed pipe zone and trench subgrade to determine the need for any additional excavation. It is the intent that additional excavation be conducted in all areas within the influence of the pipeline where unacceptable materials exist at the exposed subgrade.

2. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the pipeline or within the pipe zone to the width shown on the DRAWINGS and to the depth required. This may require excavating a wider trench.

3. Backfill the trench to subgrade of pipe base with refill material for foundation stabilization. Place the foundation stabilization in layers not exceeding 6 inches deep to the required grade.

K. Refill material used by the CONTRACTOR for his convenience will not receive any additional payment.

3.02 Installation

A. Pipe Bedding

1. Bedding of the pipe shall be done only in the presence of the ENGINEER, and in accordance with the trench detail on the DRAWINGS. Bedding shall be done only after foundation preparation, laying of and jointing of the pipe.

2. As the pipe is installed it shall be bedded by hand with material as shown. Care shall be taken to prevent any damage or shifting of the pipe. The pipe bedding material shall be compacted into place to the same density as specified for backfill above the pipe bedding material with materials as specified.

3. Thickness of pipe base shall be 6 inches or as otherwise shown on the DRAWINGS or otherwise described in the specifications for the particular type of pipe installed.

4. Excavate coupling or bell holes at each joint to permit proper assembly and inspection of the entire joint.

B. After pipe has been bedded, place bedding material simultaneously on both sides of the pipe, keeping the level of bedding the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

C. The CONTRACTOR shall install a second layer of approved backfill material to a depth of approximately 12 inches unless specified otherwise in the DRAWINGS. Place the backfill material carefully onto the bedding material previously placed. Do not permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe. This second layer of backfill material shall be graded to provide an even bed and compacted as per the compaction requirements in **Section 31 23 23.23 Compaction.**

D. The pipe installation crew will install the warning tape in the trench not more than one foot below finish grade. The CONTRACTOR will provide the warning tape.

E. Tracer wire shall be installed on HDPE/PVC piping in accordance with

Division 43 specifications and as shown in the Detail DRAWINGS.

F. Continue backfill to grade in accordance with compaction requirements in **Section 31 23 23.23 Compaction**.

G. Throughout the installation process, the CONTRACTOR shall not allow newly installed piping to be left uncovered overnight without prior approval from the OWNER or the ENGINEER.

END OF SECTION

DIVISION 31 EARTHWORK

SECTION 31 23 23 - GRAVEL AND CRUSHED ROCK BASE FOR STRUCTURES

PART 1 - GENERAL

A. Description

This includes materials, testing, and installation of gravel and crushed rock bases for structures such as manholes and vaults.

B. Related Work Specified Elsewhere

1. Concrete: 03 05 00.

2. Earthwork: 31 05 00.

C. Submittals

Submit six copies of a report from a testing laboratory verifying that material contains less than 1% asbestos by weight or volume and conforms to the specified gradations or characteristics.

D. Testing for Compaction

1. The Owner will test for compaction or relative density as described below.

2. Determine the density of gravel and rock in place by the sand cone method, ASTM D1556 or 2167.

3. Determine the relative density of gravel and rock per ASTM D4253 and D4254.

4. Sample backfill materials per ASTM D75.

5. Compaction shall be deemed to comply with the specifications when no more than one test of any three consecutive tests falls below the specified relative compaction. The one test shall be no more than three percentage points below the specified compaction. The Contractor shall pay the costs of retesting work not conforming to the specifications.

PART 2 - MATERIALS

A. Crushed Rock and Gravel

1. Crushed rock base and gravel are defined as natural or crushed rock, free from organic matter and containing less than 1% asbestos by weight or volume, and meeting the following gradation:

Sieve Size	Percent Passing By Weight
1-1/2 inches	100
3/4 inch	90 to 100
No. 4	35 to 55
No. 30	10 to 30
No. 200	0 to 5

2. Durability Index shall be at least 40 per ASTM D3744.

PART 3 - EXECUTION

A. Placement of Crushed Rock or Gravel

1. Place crushed rock or gravel base beneath structures where shown in the drawings, 6 inches thick unless otherwise indicated. Excavate below the required grade for the bottom of the structure and refill with crushed rock or gravel as specified above. The rock base shall extend a minimum of 6 inches beyond the structure base, floor slab, or footing.

2. Compact base as follows unless otherwise indicated:

   a. Lower Lift: 85% relative density.

   b. Upper Lifts: 85% relative density.

3. Place base material in maximum lifts of 6 inches.

END OF SECTION

DIVISION 31: EARTHWORK
SECTION 31 41 33 – TRENCH SHIELDING

PART 1 GENERAL

1.01 Section Includes

A. This section provides information in regarding to trench shielding that shall be followed by the CONTRACTOR.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall be responsible for providing adequate lateral restraint for the walls of any excavation required to complete his work.

B. Shoring, sheeting and bracing shall be adequate to withstand all loads superimposed thereon and shall be furnished to protect personnel and existing or proposed structures, pipelines or other facilities.

C. The CONTRACTOR shall design the lateral restraint facilities to include any necessary sheeting, bracing or shoring to protect any facilities, stockpiled excavation or construction materials adjacent to the excavation and/or any personnel required to be in or near the excavation.

D. The methods proposed for providing the lateral support for any excavation shall be submitted to the ENGINEER on the site, for his review and/or comment.

E. Bracing elements shall not be cast into or included in permanent concrete work, except as specifically approved by the ENGINEER, in which case, the proper keys, cutoffs, waterstops, and waterproofing must be provided.

F. The CONTRACTOR shall save harmless the ENGINEER and the OWNER from any and all personal injuries or property damages resulting from his failure to provide and properly maintain the lateral restraints heretofore mentioned.

PART 2 PRODUCTS

2.01 Materials

A. Materials for walls and bracing shall be new or of sound material. If of steel, they shall be standard structural steel sections, as listed in the "Manual of Steel Construction", current edition, of the American Institute of Steel Construction. If timber, they shall be structural grade Southern Pine or Douglas Fir.

B. The steel sections used shall have no more than surface rust and shall conform to the requirements of the ASTM Specification A-36 or A-572, current edition, "Requirements for Delivery of Structural Steel", in respect to straightness, defect deformations, camber and any other condition which would affect their efficient performance in the bracing system.

PART 3 EXECUTION

3.01 Installation

A. Shoring, sheeting, and/or bracing shall be installed in accordance with OSHA regulations, current edition. All trenching and other excavations which present a hazard to personnel working in the excavated areas because of depth of trench embankments, stockpiling of excavated materials along the top of the trench or adjacent traffic shall be shored, sheeted or braced.

B. All shoring, sheeting and bracing, where necessary, shall be designed and installed by the CONTRACTOR for the materials and depths encountered. The CONTRACTOR shall be fully responsible for the adequacy of the system to withstand all loads imposed thereon, and shall save harmless the OWNER and ENGINEER in the field from any and all personal or property damages resulting from his failure to properly install and maintain sufficient sheeting, shoring and bracing.

C. The CONTRACTOR shall be fully responsible and liable for any improper or premature removal of sheeting, shoring or bracing and any and all personal or property damages resulting therefrom.

D. Should the CONTRACTOR's operations impair foundations for new or existing structures, he shall provide concrete underpinning piers or supports for such structures at no additional cost to the OWNER. The proposed underpinning methods shall be reviewed by the ENGINEER prior to installation. This, however, shall not relieve the CONTRACTOR of his responsibility to safeguard the structures.

END OF SECTION

PART 1 General

1.01 General Conditions

A. The General Conditions apply to all sections of this specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the Design ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All exterior improvement work shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. "GREENBOOK" Standard Specifications for Public Works Construction (SSPWC), 2006 Edition written by Public Works Standards, Inc. Vista, CA.

1.04 Noted Restrictions

A. If any Safeway Vons fences are breached, temporary fencing is required (6' height) to secure the site.

PART 2 Products – Not Used

PART 3 Execution – Not Used

END OF SECTION

32 06 30 Schedule for Site Improvements

32 06 30.12 Schedule for Asphalt Paving

Roads and driveways as per DRAWINGS and specifications.

32 06 31 Schedule for Fences and Gates

Item	**No.**	**Ref. Drawing No.**	**Length (ft.)**	**No. of Gates & Size**	**Mnfgr.**	**Style**
Perimeter Fence (Around Existing Valve Assembly)	1	Layout and Detail DRAWINGS	See Dwg	See Dwg	See Specs.	See DRAWINGS

END OF SECTION

PART 1 General

1.01 Section Includes

A. Provide asphaltic concrete paving where shown on the DRAWINGS, as specified herein, and as needed for a complete and proper installation.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.06 Submittals

A. Submit in accordance with Section **01 33 00 Submittal Procedures**.

B. Materials list of items proposed to be provided under this Section.

C. Certificates, signed by the materials producer and the asphalt paving subcontractor, stating that materials meet or exceed the specified requirements.

PART 2 Products

2.01 Aggregates

A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable, mineral materials processed and blended, and naturally combined.

1. Aggregate base material shall be crushed aggregate base (C.A.B.) per Section 400-2 of the SSPWC.

B. Base course aggregate maximum size:

1. Base courses over 6 inches thick: 1 1/2-inches;

2. Other base courses: 3/4 inch

C. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

Sieve sizes:	Percentage passing:
3/4"	100%
3/8"	70 – 94%
1/4"	44 – 72%
No. 8 mesh	30 – 54%
No. 30 mesh	10 – 34%
No. 200 mesh	2 – 10%

Plus 50/60 penetration liquid asphalt at 5 percent to 6.5 percent of the combined dry aggregates.

2.02 Weed Killer

A. Provide a dry, free-flowing, dust-free chemical compound containing not less than 30 percent sodium chlorate or a chlorate borate compound, non-flammable, not creating a fire hazard when applied in accordance with the manufacturer's recommendations, soluble in water, and capable of being spread dry or in solution.

B. Acceptable products:

1. "Chlorax 40": Chipman Chemical Company, Inc., Palo Alto, California.

2. "Monobar-Chlorate": U.S. Borax and Chemical Corp., Los Angeles, California.

2.03 Asphalts

A. The asphaltic concrete for this project shall be grade AR4000. Comply with provisions of Asphalt Institute Specification SS-2:

1. Asphalt cement: Penetration grade 50/60.

2. Prime coat: Cut-back type, grade MC-250.

3. Tack coat: Uniformly emulsified, grade SS-1H.

2.04 Sealer

A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.

B. Acceptable products:

1. "Laycold Walk Top": Chevron Asphalt Company, San Pedro, California.

2.05 Mixing Asphaltic Concrete Materials

A. Provide hot plant mixed asphaltic concrete paving materials.

1. Temperature leaving the plant: 290 degrees F minimum, 320 degrees F maximum.

2. Temperature at time of placing: 280 degrees F minimum.

2.06 Headers and Stakes

A. Provide redwood, construction grade, in dimensions shown on the DRAWINGS or as required for the particular use where dimensions are not shown on the DRAWINGS.

PART 3 Execution

3.01 Preparation

A. Surface Conditions

1. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Final Preparation of Subgrades

1. After preparation of subgrade as specified in another Section of these Specifications, thoroughly scarify and sprinkle the entire area to be paved, and then compact to a smooth, hard, and even surface of 95 percent compaction to receive the aggregates.

2. Apply weed killer to the entire area to be paved. Adhere to the manufacturer's application recommendations.

3.02 Installation

A. Placement of Base Courses

1. Subbase (when required):

a. Spread the specified subbase material to a thickness providing the compacted thickness shown on the DRAWINGS.

b. Compact to 95 percent.

2. Base

   a. Spread the specified base material to a thickness providing the compacted thickness shown on the DRAWINGS.

   b. Compact to 95 percent.

3. Thickness tolerance: Provide the compacted thicknesses shown on the DRAWINGS within a tolerance of minus 0.0 inches to plus 0.5 inches.

4. Smoothness tolerance: Provide the lines and grades shown on the DRAWINGS within a tolerance of 3/8-inch in ten feet.

   a. Deviations: Correct by removing materials, replacing with new materials, and reworking or recompacting as required.

5. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

B. Placement of Asphaltic Concrete Paving

1. Install the specified headers and stakes to achieve the arrangement of paving shown on the DRAWINGS.

2. Remove all loose materials from the compacted base.

3. Apply the specified prime coat, and tack coat where required, and allow to dry, in accordance with the manufacturer's recommendations. Tack coat shall be applied per Section 302-5.4 of the SSPWC, latest edition.

4. Prime coat may be omitted if all of the following conditions are met:

   a. Asphalt layer is placed within two weeks of completion of base course.

   b. Traffic is not routed over completed base before paving.

   c. Construction is completed during the dry season of May through October.

5. If construction is performed during the wet season of November through April, prime coat may be omitted if no rain occurs between completion of base course and paving and the time between completion of base and paving is reduced to three days.

6. Where prime coat has been omitted and 1) rain occurs, 2) traffic is routed over base course, or 3) paving is delayed, measures shall be taken to restore base course, subbase course and subgrade to conditions that will meet specifications, as directed by the OWNER.

7. Adjust manhole frames and covers and water valve box covers, as required, to meet final grades.

8. Receipt of asphaltic concrete materials:

    a. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.

    b. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F and falling, nor during fog, rain, or other unsuitable conditions.

9. Spreading:

    a. Spread material in a manner which requires the least handling.

    b. Where thickness of finished paving will be 3 inches or less, spread in one layer.

10. Rolling:

    a. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the DRAWINGS.

    b. Roll in at least two directions until no roller marks are visible.

    c. Finished paving smoothness tolerance:

        i. Free from birdbaths.

        ii. No deviations greater than 1/8-inch in six feet.

11. Where shown on the Plans, asphalt concrete berms shall be constructed per the detail on the Plan.

3.03 Testing

A. Application of Seal Coat (where shown on DRAWINGS)

1. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations.

2. Apply one coat of the specified sealer to the finished asphalt pavement surface.

3. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

B. Protection

1. Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

END OF SECTION

PART 1 General

1.01 Section Includes

A. Provide fabricated metal gates and fences, with appurtenances as shown on DRAWINGS and as specified.

B. Work within this Section includes Engineering of fabricated metal gates and fences, connections and fasteners, and foundations or footings; provision and installation of finish hardware; and coatings.

1.02 Referenced Sections – None

1.03 Cited Standards

A. International Building Code (IBC), most recent edition.

B. American Society for Testing and Materials (ASTM) standards, most recent edition:

1. ASTM A36: Specification for Carbon Structural Steel.

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

C. American Welding Society (AWS):

1. AWS D1.1: Structural Welding Code.

2. AWS Standard Qualification Procedures.

1.04 Noted Restrictions

A. Design all gate leafs and fence segments to be structurally stable vertically under own weight and laterally under following horizontal loads acting from any direction:

1. Wind load: Calculated over entire projected area normal to gate and fences, as defined in the IBC, 90 miles per hour.

2. Operator Load: Motive force necessary for operations to gates and fences.

3. Maximum deflection of 1/160 of the full span with a 200 pound live load at free end.

B. Apply loads to gates in the following positions:

1. Closed and engaged with lock assembly.

2. Closed but slightly ajar from lock assembly.

3. Partially closed/open.

4. Completely open.

C. Provide gates and fences which are rigid enough that horizontal or vertical deflection or distortion will not interfere with normal operation. Provide gates and fences which do not sag under their own weight.

D. Design gates and fences in accordance with applicable codes.

1.05 Quality Control

A. Comply with current editions of codes as adopted by local jurisdiction governing project and with the IBC.

B. Design calculations and fabrication details; reviewed and approved by professional ENGINEER licensed in the state of California.

1.06 Submittals

A. In accordance with Section 01 33 00.

B. Submit shop DRAWINGS of gates and fences prior to fabrication and construction. Include:

1. Complete description of materials, sizes, and thickness.

2. Connections and fasteners.

3. Post.

4. Bracing and corner construction.

5. Finish hardware and accessories.

C. Submit calculations necessary to structural performance of fabricated gates, fences, accessories, and connections to supporting structure.

D. Submit manufacturer's product literature on fence and gate system, hardware, and coating systems.

1.07 Deliverables

A. Prior to delivery to project site, ENGINEER will review completely fabricated gates and fences at fabricator’s shop. Deliver gates and fences only after such review and approval.

B. Delivery of Materials:

1. Deliver manufactured materials in containers or packages approved by product manufacturer.

2. Attach I.D. tags to gate and fence products bearing the name of item and manufacturer.

C. Storage:

1. Store products off ground in a manner acceptable to the manufacturer, and in an area protected from deleterious elements.

2. Store in a manner that will prevent damage or marring of products and finishes.

PART 2 Products

2.01 Materials

A. Manufacture posts, rails, and pickets for gates and fences from tubing meeting ASTM A500.

B. Manufacture solid steel bars, flat plates, and shapes from steel conforming to ASTM A36.

C. Manufacture miscellaneous shapes, angles, and reinforcing necessary to strengthen gates and fences or support hardware conforming to ASTM A36.

D. Welding: In accordance with AWS D1.1 and AWS Standard Qualification Procedures, as applicable.

E. Protective Coating: In accordance with Section 09 90 00.

1. Acceptable Manufacturers:

1) Builders Fence Company, Inc.

2) Crown Industrial Engineering.

3) Hy-Security Gate Operators.

4) Cushing Manufacturing & Equipment Co.

5) ENGINEER approved equal.

2.02 Equipment – Not Used

2.03 Fabrications

A. Fabricated Metal Gates and Fences:

1. Design as indicated on DRAWINGS.

2. Fabricate framed gate and fence units, accessories, and pivot assemblies with welded joints and connections.

a. Brace frames to form a rigid assembly.

b. Conform to ASTM standards for steel used in manufacturing of gates and fences.

c. Do not use wire rods, screws, or rivets to attach pickets to rails.

d. Layout and welding: performed by experienced craftsmen.

e. Use gas metal arc method for all welds; welds shall be neat and clean, and sizes shown on DRAWINGS.

f. Grind welds smooth prior to hot-dip galvanizing.

3. Brace, reinforce, and strengthen gates and fences as necessary to achieve structural capabilities indicated.

4. Provide drain holes along the bottom rail of each gate and fence.

5. Provide malleable iron or steel, tamperproof fittings and latches.

B. Swing Gates:

1. Provide with component materials of sizes and strengths appropriate to opening sizes and configurations; complete with required operating hardware.

2. Equip gates with pivot hinges allowing minimum 90 degree swing, and drop bar locking device with provision for padlocking. Provide stop to hold gate open and center rest with catch. All hardware to be tamperproof.

3. Clear space under gates: Minimum 4 inches: maximum 6 inches.

PART 3 Execution

3.01 Preparation

A. In accordance with applicable codes and manufacturer's published or written recommendations, specifications, and installation instructions for the type of Work being performed.

B. Verify grade changes and surface irregularities and make adjustments as needed.

C. Lay out gates and fences in accordance with DRAWINGS and approved submittals.

D. Review discrepancies between the approved shop DRAWINGS and field conditions and obtain approval from ENGINEER prior to proceeding with installation.

3.02 Installation

A. Install gates and fences plumb and level.

B. Install required gate stops.

1. Field attach padlock devices and strikes to assure alignment.

2. Lubricate hinges, rollers, and other gate hardware after installation and coating.

C. Thoroughly clean, pre-prime, and touch-up field welds and abrasions to factory coatings with approved coating system.

3.03 Testing – None

END OF SECTION

PART 1 General

1.01 Section Includes

A. This section describes the CONTRACTOR's requirements in regard to planting.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. All grounds disturbed by any of the operations necessary to complete the work for this project shall be restored by the CONTRACTOR. The CONTRACTOR shall utilize sod in the replacement activity and shall water the disturbed area(s) for at least one month to make sure grounds are restored to original condition.

PART 2 Products

2.01 Seed Mixture

A. The seed mixture shall be a permanent cover of fast growing and perennial grass seeds suitable for the local climate and conditions.

2.02 Mulch

A. The Mulch shall be as approved by the ENGINEER.

PART 3 Execution

3.01 Preparation - None

3.02 Installation

A. The grass seed shall be sowed in accordance with the seed manufacturer's directions. Acceptable methods include hand sowing, spreader application and hydroseeding.

3.03 Testing - None

END OF SECTION

PART 1 GENERAL

1.01 General Conditions

A. The General Conditions apply to all sections of this specification, which shall be completed as shown on the plans and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the Specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

PART 1 GENERAL

1.01 Section Includes

A. This section includes a description of reinforced concrete pipe manholes and catch basins.

1.02 Referenced Sections

A. Related Sections are shown below.

1. SECTION 01 33 00 - SUBMITTAL PROCEDURES

1.03 Cited Standards

A. All work specified herein shall conform to or exceed the applicable requirements of the referenced standards; provided, that wherever the provisions of said publication are in conflict with the requirements specified herein, the more stringent requirement shall apply.

1.04 Noted Restrictions

A. The CONTRACTOR shall furnish and install concrete piping and manholes complete, including connection to existing and new structures, all in accordance with the requirements of the Contract Documents, and as shown in DRAWINGS.

1.05 Quality Control

A. All reinforced concrete piping shall be installed to the lines and grades shown on the plans. Manholes and catch basins shall be installed level/plumb on properly prepared base and backfilled in accordance with the Contract Documents.

1.06 Submittals

A. The CONTRACTOR shall provide the ENGINEER with a Certificate of Compliance from the pipe manufacturer that the pipe and concrete mix conform in all respects to these Specifications and other non-conflicting requirements of the referenced ASTM Specification.

B. The CONTRACTOR shall furnish complete shop DRAWINGS for all pre-cast manhole sections and catch basins including cast iron rings, frames, covers and grates for review by the ENGINEER in accordance with **Section 01 33 00 Submittal Procedures**.

PART 2 PRODUCTS

2.01 Reinforced Concrete Pipe Materials

A. Reinforced concrete pipe shall be Class III bell and spigot joint design, conforming to the requirements of the latest revision of ASTM Designation C-76. Bell and spigot joints, including rubber gaskets, shall conform to the requirements of the latest revision of ASTM Designation C-443. The gasket shall be confined in a groove on the spigot so that pipe movement or hydrostatic pressure cannot displace the gasket. Each pipe section shall be identified with name of manufacturer, date manufactured, design pressure, D-loading and top of pipe.

B. Elbows for the pipe shall be shop fabricated of the same material, joint design and strength rating as the pipe.

C. Concrete pipe shall be manufactured using standard brand Portland Cement conforming to ASTM C150 for Type II, low alkali. The water/cement ratio shall not exceed 0.49.

2.02 Concrete Manhole Materials

A. All manhole sections shall be pre-cast, reinforced and manufactured in accordance with ASTM C478 except as may be modified by detailed DRAWINGS provided in the Contract Documents.

B. Manhole sections shall be manufactured using Type II low Alkali or Type V Portland Cement as specified in ASTM C150. All manhole bases shall have formed channels with inverts to match the adjoining pipes.

C. Manhole bases may be cast in place. Resilient connections between the pipe to manhole connection shall be per ASTM Specification C923. Voids between pipe and manhole base channels shall be grouted to form a smooth transition.

D. Manhole frames and covers shall conform to the requirements of ASTM A48 Class 30. Cast iron frames and covers shall be heavy traffic type, 30 inches in diameter to meet the requirements of the OWNER.

E. The CONTRACTOR shall furnish and place a plastic warning sign meeting OSHA requirements permanently fastened just inside the cover of each manhole with the inscription "CAUTION - VENTILATE BEFORE ENTERING". The sign shall be attached to the concrete with Type 316 stainless steel wedge anchors.

PART 3 EXECUTION

3.01 Preparation - None

3.02 Installation

A. All reinforced concrete pipe shall be installed in strict accordance to the lines and grades shown on the plans and per the requirements for bedding and

backfill under **Division 31 - Earthwork**. Variance from line and grade shall not be greater than 1/32 inch per inch of pipe diameter and not to exceed ½ inch.

B. All manholes and catch basins shall be installed to the lines and grades, level/plumb on properly compacted base and backfilled per **Division 31 - Earthwork**.

3.03 Testing – None

END OF SECTION

PART 1 GENERAL

1.01 Section Includes

A. The CONTRACTOR shall perform jacking and boring and related work as specified herein and as shown on the DRAWINGS.

1.02 Referenced Sections – none

1.03 Cited Standards

A. All jacking and boring shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. "GREENBOOK" Standard Specifications for Public Works Construction, 2006 Edition written by Public Works Standards, Inc. Vista, CA.

1.04 Noted Restrictions

A. When boring, the pipe/conduit shall at all times follow immediately behind the boring auger. The method of augering the entire hole and then pushing the pipe through will not be permitted.

1.05 Quality Control

A. All boring and jacking shall be unclassified and no extra payment will be made for rock, boulders, shale, timber, logs, old foundations, masonry, or other natural or artificial materials encountered in the boring and/or jacking operations. The CONTRACTOR shall not at any time claim a misunderstanding in regard to depth or character of the boring or jacking to be made or in the nature of the materials to be encountered.

B. When boring is employed, the CONTRACTOR shall be responsible for construction of the various crossings true to line and grade and shall be held fully responsible for protecting against surface subsidence damages or disturbances to adjacent property and facilities from his/her construction operations, and shall rectify resultant subsidence, damages, or disturbances to the satisfaction of the ENGINEER. Any allowable variance in grade and alignment both horizontally and vertically from that shown on the construction DRAWINGS shall be established by the ENGINEER in the field subject to specific conditions that may develop or exist.

C. All voids between casing pipe and undisturbed earth shall be pressure filled with a cement grout material approved by the ENGINEER. If required by the OWNER or ENGINEER, the space between the casing pipe and the carrier pipe shall be filled with an ENGINEER approved material to a depth not less than 9/10 of the outside diameter of the casing pipe. This space should not be

completely filled to prevent external loads from being transferred to the carrier pipe. Perform filling/grouting operations in a sequence to prevent floatation of the carrier pipe or deflection of the casing pipe. Stainless steel casing spacers, HDPE spacers, fusion bonded PVC coated steel casing spacers, or treated wood skids (or other ENGINEER approved material) shall be attached to the barrel of the carrier pipe (with stainless steel bands) to provide uniform support of the carrier pipe both during and after installation. The ends of the casing pipe shall be sealed with brick and mortar or by a method approved by the ENGINEER.

1. Spacing of casing spacers/treated wood skids shall be as recommended by the spacer manufacturer. Casing spacers shall be in a centered, restrained, position configuration in the casing pipe.

2. CONTRACTOR shall provide shop DRAWINGS on casing spacers/treated wood skids including type, size, quantity, weight support, spacing, along with NOTARIZED CERTIFICATION by manufacturer that confirm design for conditions given.

D. Should an obstruction or misalignment be encountered during any boring or jacking so as to prevent continuation of operations, the auger shall be removed, and any excess pipe cut off and capped. The casing interior and any void spaces outside of the casing shall be pressure grouted with a cement grout approved by the ENGINEER prior to establishing a new boring or jacking site.

E. The grade may be critical at some of the crossing locations. At certain other locations, however, some latitude in required final elevation exists, and adjustment may be made to the pipes, provided that the crossings are installed prior to construction of said connecting lines. It is, therefore, suggested that the CONTRACTOR program his/her boring operations early in the construction schedule. The tolerance, which will be permitted in elevation of the pipes at the crossings, will be determined by the ENGINEER in the field.

F. Failure to comply with any of the foregoing, as well as damages to facilities and railroad and highway traffic interference or impedance, shall be the responsibility of the CONTRACTOR and he/she shall be required to rectify all such conditions to the satisfaction of the ENGINEER.

G. All sheeting, shoring and bracing required for the construction of portals and access shafts to the bore pits shall be furnished and installed by the CONTRACTOR and shall conform to the requirements set forth previously herein.

H. Because of the tendency for jacked pipe to set once forward motion is stopped for periods of time, all jacking operations shall continue 24 hours per day, once started, until the section is completed. The direction of the jacking operation shall be carefully established prior to beginning the operation including

erection and installation of guide rails in the bottom of the jacking pit or shaft.

I. The CONTRACTOR shall provide for all drainage and dewatering required during the tunneling/boring/jacking operation to provide a safe and stable work area and suitable foundation for all pipe, and furnish and maintain traffic control devices as required during all jacking, boring, or tunneling operations at no additional cost to the ENGINEER.

J. The CONTRACTOR shall comply with all applicable federal, state, and local ordinances, codes, statutes, rules, and regulations, and affected jurisdictional bodies. If the work be performed affects any state highway areas, the CONTRACTOR shall comply with the California Department of Transportation Specifications. For railroad areas, CONTRACTOR shall comply with the Union Pacific Railroad (UPRR) Specifications.

1.06 Submittals

A. Prior to delivery of pipe to the job site, the pipe manufacturer shall submit to the ENGINEER, six (6) notarized copies of certification stating minimum thickness of pipe supplied and that all pipe has been manufactured, inspected, and tested according to these Specifications and meets all requirements thereof, and all pipe delivered shall be so marked.

1.07 Delivery, Storage, and Handling Equipment

A. All pipe shall be transported, unloaded, handled, and installed in strict accordance with the recommendations of the pipe manufacturer.

PART 2 PRODUCTS

2.01 Steel Casing Pipe

A. The steel casing pipe shall be new, shall be visibly sound and round, and shall be suitable for the service intended. All joints shall be of metal and of leakproof construction, designed to carry the earth load and any other pressures present. It shall be welded steel pipe (full circumference welded joints), manufactured and tested in accordance with ASTM standards. The steel pipe shall have a minimum yield strength of 35,000 PSI. The ends of smooth steel casing pipe shall be beveled for field welding.

B. Minimum casing wall thicknesses shall be the following:

Coated or Cathodically Protected	Uncoated and Unprotected	Nominal Diameter of Casing Pipe (in inches)
0.188"	0.188"	10 and under
0.188"	0.250"	12 and 14

0.219"	0.281"	16
0.250"	0.312"	18
0.281"	0.344"	20
0.281"	0.344"	22
0.312"	0.375"	24
0.344"	0.406"	26
0.375"	0.438"	28
0.406”	0.469”	30
0.438"	0.500"	32
0.469"	0.532"	34 and 36
0.562”	0.625”	42
0.625”	0.688”	48

PART 3 EXECUTION

3.01 Preparation

A. Prior to excavation, the CONTRACTOR shall submit the DRAWINGS of jacking pit bracing, casing (or conduit), and jacking head proposed to be used.

B. Unless specified otherwise, the methods and equipment used in jacking casing or conduit shall be optional with the CONTRACTOR, provided that the proposed method is approved by the ENGINEER.

C. Workers with a minimum of five (5) years’ experience shall be used in performing the work.

D. Grouting equipment and material shall be on the work site before jacking operations and drilling of grout holes are completed.

E. Where jacking is employed, a minimum l/2-in. thick steel shield at least 24 in. long shall be required to extend beyond the forward end of the liner plate or conduit being jacked. The outside radius of this shield shall not exceed the outside diameter of the pipe by more than 1 in. Excavation ahead of the conduit shall not be permitted to progress beyond the end of the shield being used.

F. Where the boring method is used, it shall be mandatory to conduct said operation from the low end of the pipe. The pipe shall at all times follow immediately behind the boring auger. The method of augering the entire hole and then pushing the pipe through will not be permitted. The pipe shall be black steel ANSI/ASTM A-53, type S, grade B, Schedule 80.

3.02 Installation

A. The reading section of piping/conduit shall be equipped with a jacking head securely anchored thereto to prevent any wobble or variation in alignment during the jacking operation.

B. The driving ends of the conduit shall be properly protected against spalling and other damage, and intermediate joints shall be similarly protected by the installation of sufficient bearing shims to properly distribute the jacking stresses.

C. Any section of conduit showing signs of failure shall be removed and replaced with a new section of precast conduit, or with a cast-in-place section, which is adequate to carry the loads imposed upon it.

D. Excavation shall not be made in excess of the outer dimensions of the conduit being jacked unless approved by the ENGINEER. Every effort shall be made to avoid any loss of earth outside the jacking head. Excavated material shall be removed from the conduit as excavation progresses, and no accumulation of such material with the piping/conduit will be permitted.

E. Should appreciable loss of ground occur during the jacking operation, the voids shall be backpacked promptly to the extent practicable with soil-cement consisting of a slightly moistened mixture of 1 part cement to 5 parts granular material. Where the soil is not suitable for this purpose, the CONTRACTOR shall place as soon as possible after the loss of ground.

F. If required by the OWNER or ENGINEER, the space between the casing pipe and the carrier pipe shall be filled with an ENGINEER approved material to a depth no less than 9/10 of the outside diameter of the casing pipe. This space should not be completely filled to prevent external loads from being transferred to the carrier pipe.

3.03 Closeout Procedures

A. Once the jacking operation has commenced, it shall be continued uninterrupted around the clock until the conduit has been jacked between the specified limits. This requirement may be modified if the CONTRACTOR submits to the ENGINEER for prior approval methods and details that shall prevent the “freezing” of the conduit and ensure that the heading is stable at all times.

B. Upon, completion of the jacking operations, all voids around the outside face of the conduit shall be filled by grouting.

C. Grouting equipment and material shall be on the work site before jacking operations and drilling of grout holes are completed in the order that grouting around the jacked conduit may be started immediately after the jacking operations have finished.

END OF SECTION

Back Flow Preventers

Location	Type	Manufacturer and Model No.	Size	No. Required	Specifications
LGAC-Effluent for Backwash Water	Reduced Pressure Zone Double Check Valve Assembly	FEBCO Model 825YD or Approved Equivalent	6” Flanged ANSI B16.1	1	See Section 33 12 13.13

END OF SECTION

DIVISION 33 – UTILITIES
SECTION 33 12 13.13 WATER SUPPLY BACKFLOW PREVENTER ASSEMBLIES

PART 1 GENERAL:

1.01 Section Includes

A. The CONTRACTOR shall purchase and install reduced pressure zone backflow preventers as specified herein and as shown on the DRAWINGS.

1.02 Related Sections – None

1.03 Cited Standards

A. All reduced pressure backflow preventers shall conform to the following standard specifications, of the latest revisions, as applicable:

1. ANSI/AWWA Conformance (C511-89)

2. ASSE standard 1012. AWWA standard C511, and the USC Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California

1.04 Noted Restrictions – none

1.05 Quality Control - None

PART 2 PRODUCTS:

2.01 Reduced Pressure Zone Backflow Preventer Assemblies

A. The reduced pressure backflow preventer assemblies shall consist of two independent "Y" configured check valves and one differential relief valve.

B. By design, the assembly shall automatically reduce the pressure in the zone between the check valves. Should the differential between the zone and upstream pressure drop to 2psi, the differential relief valve will open, maintaining proper zone differential.

C. Valve bodies and covers shall be manufactured of ductile iron ASTM A536, Grade 65-45 12; ductile iron bodies shall be flanged, ANSI B16.1, Class125, epoxy coated.

D. The assembly shall be constructed so all internal parts, including seat rings, can be serviced from the top or side or removed while assembly is in line.

E. The assembly shall be rated for 175psi (12.1 bar) MWWP, hydrostatically tested to 350psi, with an operating temperature range of 32°F to 140°F.

F. The materials of construction shall be:

1. Main Valve Body – Ductile iron grade 65-45-12 fusion epoxy coated internal and external;
2. Main Valve Trim – Bronze;
3. Internal Check Assembly – Stainless Steel;
4. Relief Valve Body and Trim – Bronze;
5. Elastomers – Nitrile;
6. Diaphragms – Nitrile, fabric reinforced;
7. Springs – Stainless Steel;
8. Internal Check Assembly – Stainless Steel;
9. Shutoffs – Non-rising stem, resilient seated gates.

G. Relief valve assembly shall be of a modular design for ease of maintenance.

H. The assembly shall meet or exceed requirements of ASSE standard 1013, AWWA standard C511, and the USC Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.

I. Reduced pressure backflow preventer assemblies shall be FEBCO 825YD-OSY, or prior approved equal.

PART 3 EXECUTION

3.01 Preparation

A. Prior to installation, the supply lines shall be flushed of all foreign material. Failure to flush the supply line may cause the check valves to become fouled and require disassembly and cleaning.

B. The CONTRACTOR shall consult with local codes for specific installation requirements and restrictions applicable to the area.

3.02 Installation

A. The backflow preventers shall be installed by the CONTRACTOR in accordance with: the manufacturer’s recommendations; the flange connections, supports and testing requirements as detailed in Division 40, Section 40 23 33; and, as shown on the DRAWINGS.

B. The CONTRACTOR shall adhere to the manufacturer’s recommendations for

clearance around the backflow preventer.

C. The CONTRACTOR shall not lift the assembly by connecting to the gate valve handwheels or stems.

D. After installation the CONTRACTOR shall slowly fill the assembly with water and bleed air from the body using the #2, #3 and #4 test cocks, as per the manufacturer's installation instruction documents.

3.03 Testing – None

END OF SECTION

SECTION 33 20 00 - WELLS

PART 1 General

1.01 Section Includes

A. This section covers installation and development of extraction well EW-1 and piezometers PZ-1S/D, PZ-2S/D, and PZ-3S/D. CONTRACTOR shall furnish all materials, labor, equipment, tools, transportation, and services for drilling and construction EW-1 and PZ- 1S/D, PZ-2S/D, and PZ-3S/D as shown on the Drawings and specified herein.

1.02 Quality Assurance

A. System Description

1. The extraction well and piezometers shall be located as shown on the Drawings, and be constructed in accordance with these specifications.

B. Reference Standards

1. State of California, Department of Water Resources. Water Well Standards; State of California, Bulletin 74-90. June 1991.

2. American Water Works Association, Water Wells, ANSI/AWWA A100-06. 1 August 2006

3. Sampling and Analysis Plan, ERM, Inc. 2013.

4. California Code of Regulations Title 22, Section 64560(c).

C. Notifications

1. The OWNER and ENGINEER shall be notified five (5) working days prior to drilling. The ENGINEER will be responsible for contacting the USEPA in accordance with the applicable reporting requirements.

D. Well Installation Plan

1. CONTRACTOR shall submit a plan as specified herein describing the drilling methods, sampling, and well construction and well development 15 calendar days prior to beginning drilling operations. CONTRACTOR cannot commence mobilization activities prior to submittal of the plan, without prior approval by ENGINEER. The plan shall be approved and signed by an experienced geologist as specified in paragraph QUALIFICATIONS. The plan shall include, but not be limited to, a discussion of the following:

   a. Description of well drilling methods, type of rig and drilling equipment, and installation procedures, including any temporary casing used, placement of filter pack and seal materials, drill cuttings and fluids handling and disposal, and soil/rock sample disposition.

   b. Description of well construction materials, including well screen, riser pipe, centralizers, airline and gauge, tailpiece , filter pack and filter pack gradation, bentonite or drilling mud, drilling fluid additives (if used), drilling water, cement, and well protective measures.

   c. Description of quality control procedures to be used for placement of filter pack and seals in the boring, including depth measurements.

   d. Forms to be used for written boring logs, installation diagrams of wells, geophysical logs, well development records, well sampling data records, state well registration forms, and well abandonment records as applicable.

   e. Description of contamination prevention and well materials and equipment decontamination procedures.

   f. Description of protective cover surface completion procedures.

   g. Description of well development methods to be used.

   h. List of applicable publications, including state and local regulations and standards.

i. List of personnel assignments for this project, and personnel qualifications.

j. Description of well decommissioning/abandonment procedures.

k. Description of well capacity testing techniques.

l. Description and discussion of geophysical techniques to be employed at the site.

m. Description of specific methods to be employed to control potential contamination or pollution arising from well installation activities.

n. Description of site security measures and controls to be implemented during the performance of the Work.

o. Description of space requirements for laydown and staging areas.

p. CONTRACTOR health and safety plan.

E. Qualifications

1. CONTRACTOR shall submit personnel qualification documentation. Contractor shall have a valid California C57 water well drilling contractor's license in accordance with California Code of Regulations, Division 8, Title 16, Article 3, and such other licenses as may be required by the governmental agencies having jurisdiction over the work or the area in which the work is to be performed.

   Geophysical log interpretation shall be done by a qualified log analyst. The log analyst shall be able to demonstrate competence through background, training, and experience when so called upon. All CONTRACTOR personnel shall be OSHA health and safety HAZWOPER- trained per Title 29 Code of Federal Regulations (CFR), Section 1910.120, and qualified to perform the Work described in this section.

F. Sampling

1. CONTRACTOR shall assist ENGINEER in the collection of any samples collected as required by the site Sampling and Analysis Plan prepared by ENGINEER.

2. CONTRACTOR shall be responsible for all samples collected for Geotechnical analysis. Samples shall be taken of all materials penetrated by each drilled well/test hole. Soil sampling shall be done using standard sampling techniques in accordance with ASTM D1586 and ASTM D1587. Samples shall be extracted from their in-situ environment in as near an intact, minimally disturbed condition as technically practical. Samples shall be obtained continuously through the area expected to be screened. CONTRACTOR shall provide sieve analyses of all drive-sampled material. Sieve analyses shall be conducted in accordance with ASTM C136. The gradation of the natural formation shall be determined through the use of sieve analyses performed on formation samples taken from the areas to be screened. Drive-sampled materials shall be placed in airtight containers and labeled as specified in the site Sampling and Analysis Plan. Representative soil samples shall be tested for grain-size distribution by mechanical means (sieves down to the 0.074 mm No. 200 size according to ASTM C136), moisture content according to ASTM D2216 and Atterberg limits according to ASTM D4318. Description and identification of soils shall be done in accordance with ASTM D2488. Laboratory classification of soils shall be done in accordance with ASTM D2487.

G. Geophysical Logging

1. CONTRACTOR shall submit two (2) prints of the graphic boring log and one electronic copy prepared to scale showing the required details, within 2 working days after completion of the test hole. This drawing shall be used to confirm the well design, design of the filter pack, well screen location and screen openings. The total depth of each hole drilled shall be geophysically logged. Geophysical logging shall be performed and documented in accordance with this Section, as described herein.

1.03 Submittals

A. Provide submittals in accordance with Section 01 33 00.

B. CONTRACTOR shall submit two (2) copies and one electronic copy to ENGINEER of the following:

1. Shop drawings
2. Well installation plan
3. Well materials
4. Qualifications
5. Survey maps and notes
6. Well development records
7. Geophysical logs
8. Project photographs
9. Permits

1.04 Delivery, Storage, and Handling

A. CONTRACTOR shall store and maintain well materials in a clean, uncontaminated condition throughout the course of the Work.

1.05 Site Conditions

A. CONTRACTOR access to each well site, including any utility clearance, permits, licenses, or other requirements and the payment thereof necessary for execution of the work, is the responsibility of the CONTRACTOR unless otherwise specified in writing by ENGINEER. A copy of all permits, licenses, or other legal requirements necessary for execution of the work shall be furnished to ENGINEER five (5) working days before commencement of the work. Obtaining rights-of-entry is the responsibility of the OWNER. CONTRACTOR shall visit each proposed well location to observe any condition that may hamper transporting equipment or personnel to the site and provide written notice to ENGINEER. If clearing or relocation is necessary, the CONTRACTOR and the ENGINEER shall agree on a suitable clearing, or relocation plan, and the location of any required access road.

PART 2 Products

2.01 Extraction Well

A. Well casing:

1. CONTRACTOR shall furnish 18-inch minimum I.D. Grade B 0.2% copper bearing steel casing shall be fabricated in accordance with applicable parts of ASTM Standard A139 or ASTM A211. The steel plate used in the fabrication of the well casing shall be 5/16-inch in thickness and shall conform to ASTM A242-75 or ASTM A606-75, Type 4. CONTRACTOR shall submit certified test reports to the ENGINEER or OWNER's Representative to show compliance with both physical and chemical properties of the steel specified.

a. Casing shall be factory assembled in not less than 20-foot lengths and shall contain one longitudinal seam parallel to the casing axis and not more than one circumferential seam in 10 feet, or as otherwise approved by the ENGINEER.

2. For field assembly by welding: Ends of sections may be either belled or furnished with collars in accordance with the following standards:

a. Plain Ends Fitted with Collars - Collars shall be of the same thickness and have the same chemical and physical properties as the corresponding casing section; shall be 6-inches in width; shall be rolled to fit the outside diameter of the casing; and shall be welded to the casing section. Longitudinal welds on the plain end shall be ground or sufficiently scraped to remove sharp edges or burrs. Section ends shall be machined flat, perpendicular to the axis of the casing and shall not vary more than 0.010-inch at any point from a true plane at right angles to the axis of the casing. Three 1-inch x 3/8-inch alignment holes shall be provided in each collar to insure proper matching of the sections.

b. Bell Ends - The inside diameter of the bell of slip joint casing, for field welding, shall be 1/32 to 3/32-inch greater than the outside diameter of the plain end. The ends of each section shall not vary more than 0.010-inch at any point from a true plane at right angles to the axis of the casing.

3. The ends of the well casing shall be fitted with a dished head.

B. Extraction well screen

1. The production well screen shall be 18 inches I.D. fabricated in accordance with applicable parts of ASTM A139 Grade B 0.2% copper bearing well screen. The thickness of the screen casing shall be 3/16 inches. The openings of the screen casing shall be machine made, horizontal to the axis of the casing.

a. The screen casing shall be factory assembled in not less than 20-foot lengths and shall contain one longitudinal seam parallel to the casing axis and not more than one circumferential seam in 10 feet, or as otherwise approved by the ENGINEER.

2. For field assembly by welding, ends of sections may be either belled or furnished with collars in accordance with the standards in this Section.

C. Conductor casing

1. The conductor casing shall be 36 inches I.D. fabricated from 5/16-inch thick steel plate. The conductor casing shall be factory assembled in not less than 20-foot lengths and shall contain one longitudinal seam parallel to the casing axis and not more than one circumferential seam in 10 feet, or as otherwise approved by the ENGINEER. For field assembly by welding, ends of sections may be either belled or furnished with collars in accordance with the standards in this Section.

2.02 Piezometers

A. Well casing

1. The piezometer casing shall be 3-inch inside diameter, schedule 40 low carbon steel or equivalent and shall meet the requirements of the ASTM Specification D-1784 or approved equal. The casing shall be factory assembled in 5-, 10-, or 20-foot lengths or as otherwise approved by the ENGINEER.

B. Well screen

1. The piezometer screen shall be of horizontal machine slots. The well screen shall be 3-inch inside diameter, stainless steel wrapped screen with dielectric couples 0.020” slot and shall meet the requirements of the ASTM Specification D-1784 or approved equal. All screens shall be factory assembled in 5-, 10-, or 20-foot lengths or as otherwise approved by the ENGINEER.

C. Conductor casing

1. The conductor casing shall be 16 inches I.D. fabricated from 5/16-inch thick steel plate. The conductor casing shall be factory assembled in not less than 20-foot lengths and shall contain one longitudinal seam parallel to the casing axis and not more than one circumferential seam in 10 feet, or as otherwise approved by the ENGINEER.

2.03 Welding

A. All field welding shall be in performance with American Welding Society Standards.

2.04 Cement

A. All cement used on the work shall be a standard brand Portland Cement conforming to the “Specifications for Portland Cement” (ASTM Designation C -150 Type II) unless otherwise specified by the Specifications.

2.05 Sand and/or Gravel

A. Sand and/or Gravel shall be All American Aggregate Rancho Mix, Valley Sand and Gravel, Monterey Sand or approved equal. Gravel shall be thoroughly washed and kept in a clean condition at all times.

2.06 Drilling Fluid and Testing and Handling Facilities

A. Only fresh, potable water from a designated source shall be used in drilling fluids whether employed alone or in combination with drilling additives. Only high grade approved clays in common usage in this area shall be used in the make-up of any drilling fluid. The drilling fluid shall possess such characteristics as are required to adequately maintain the walls of the hole

to prevent caving as drilling progresses, and to permit recovery of representative samples of cuttings.

B. CONTRACTOR shall maintain complete control over drilling fluid characteristics during the entire operation of well construction. If proper control of the drilling fluid is not maintained to the satisfaction of the ENGINEER, CONTRACTOR shall be required, at CONTRACTOR's sole expense, to retain or employ an experienced and qualified individual on the job during all operations to supervise and maintain drilling fluid characteristics to the satisfaction of the ENGINEER.

C. CONTRACTOR shall properly containerize all drilling fluids, wastes, and soil cuttings. Adequate protection of the public shall be provided, such as fencing, signs, or planking when CONTRACTOR is not on site. Upon completion of the drilling, drilling mud and cuttings from the well shall be evaluated by the CONTRACTOR for hazardous materials, and reported to the ENGINEER. The CONTRACTOR shall coordinate removal and disposal of drilling mud and cuttings. The ground surface shall be restored to its original condition. CONTRACTOR shall notify ENGINEER 3 days in advance of any off-site disposal of any drilling fluids, wastes, soil cuttings or water.

D. CONTRACTOR shall maintain the minimum viscosity of the drilling fluid that will raise cuttings and adequately condition the walls of the hole. The mud cake remaining on the walls must be removed during the development of the well.

E. The use of drilling fluid containing bentonite, native clay, sand, or any "Circulation Loss Control Additive" shall not be permitted unless otherwise approved by the ENGINEER.

2.07 Filter Pack

A. Filter pack material shall be a product of a commercial sand and gravel supplier, shall be properly sized and graded for the surrounding soil encountered, and shall be composed of clean, round, hard, waterworn siliceous material, free of flat or elongated pieces, organic matter, or other foreign matter. CONTRACTOR shall submit filter pack material test results; sieve and chemical analyses, 10 working days working days prior to installation in the well for approval by ENGINEER. The gradation of the filter material shall be such that the uniformity coefficient is not more than 2.5. The filter material shall be thoroughly sterilized with chlorine or hypochlorite and placed as directed by ENGINEER.

2.08 Bentonite Seal

A. The bentonite seal, intended to keep grout from entering the filter pack, shall consist of hydrated granular, or pelletized, sodium montmorillonite furnished in sacks or buckets from a commercial source and shall be free of impurities which adversely impact the water quality. If the bentonite seal is located above any borehole fluid levels, a layer of fine sand shall be placed at the top of the bentonite seal, to provide an additional barrier to any downward migration of grout.

2.09 Cement and Bentonite Grout

A. Cement grout

1. Cement grout shall consist of Portland cement conforming to ASTM C150/C150M, Type I or II, sand and water. Cement grout shall be proportioned not to exceed 2 parts, by weight, of sand to 1 part of cement with not more than 23 liters (6 gallons) of water per 42.6 kg (94 pound) bag of Portland cement, with a mixture of such consistency that the well can be properly grouted. No more than 5 percent by weight of bentonite powder may be added to reduce shrinkage.

B. Bentonite grout

1. High-solids bentonite grout shall be made from sodium bentonite powder and/or granules. Water from an approved source shall be mixed with these powders or granules to form a thick bentonite slurry. The slurry shall consist of a mixture of bentonite and the manufacturer’s recommended volume of water to achieve an optimal seal. The slurry shall contain at least 20 percent solids by weight and have a density of 4.3 kg/L 9.4 pounds/gallon of water or greater.

2.10 Containerization of Development Water, and Drill Cuttings

A. Water removed during development and testing operations, and cuttings from the drilling operations shall be contained in D.O.T.-approved drums, containers, bins, or container vessels as specified in 49 CFR 172. Mark each container label in accordance with 49 CFR 172, in addition to the following information: container number, site name, well name and number, contents and date, approximate depth of material contained in each container, and the name and phone number of the OWNER. ENGINEER will furnish this information to CONTRACTOR.

PART 3 Execution

3.01 Protection of Existing Conditions

A. CONTRACTOR shall maintain existing survey monuments and wells, and protect them from damage from equipment and vehicular traffic. Any items damaged during this work by CONTRACTOR shall be repaired at the sole expense of CONTRACTOR. CONTRACTOR shall reinstall wells requiring replacement due to CONTRACTOR negligence according to these Specifications. Prior to drilling, CONTRACTOR shall obtain written approval from the local utility companies to drill at each site, to avoid disturbing buried utilities. ENGINEER may elect to waive this requirement if ENGINEER has already received approval from such utility companies.

3.02 Preparation

A. DECONTAMINATION

1. The drill rig, drill rods, drill bits, augers, temporary casing, well developing equipment, tremie pipes, grout pumping lines, and other associated equipment shall be cleaned with high-pressure hot water/steam prior to drilling at each well location. Decontamination shall be done in accordance with ASTM D5088 or ASTM D5608. Decontamination shall be performed at a central decontamination station constructed and managed by CONTRACTOR. Cleaning shall be performed in an area designated by the ENGINEER that is remote from, and cross- or down-gradient from the well being drilled. Screen and well casing shall be cleaned with high-pressure hot water immediately prior to installation in the well. The use of factory sealed (plastic wrapped) screen and well casing does not waive this requirement for pre-installation cleaning. Samplers shall be decontaminated in accordance with the Sampling and Analysis Plan. The water used for cleaning shall be from an ENGINEER-approved source. The water source used for cleaning shall be sampled and tested by CONTRACTOR for the constituents specified in the Sampling and Analysis Plan prior to use at the site.

B. Decontamination station

1. CONTRACTOR shall construct a temporary decontamination pad on site. The pad shall be bermed and slightly inclined towards a

sump located in one of the back corners of the pad. Plastic sheeting shall line the pad and berms to contain decontamination water. Plywood sheeting, exterior grade, shall be placed over the plastic sheeting to prevent damage to the plastic and allow the drill rig and heavy equipment to use the pad. The minimum dimensions of the pad shall be the length and width of the drill rig, plus 4 feet per side to allow access and steam cleaning. Yellow flagging shall be used to encircle the decontamination pad. Water collected in the sump shall be pumped using a “trash” pump to transfer water to 55-gallon drums or other appropriate container labeled “Decontamination Pad Sump Water.” Solid waste shall be transferred to a separate 55-gallon drums or other appropriate container labeled “Decontamination Pad Sump Sludge.”

C. Water Source

1. If well drilling/installation requires the use of water, prior to its use at the site, the water source shall be sampled and tested by CONTRACTOR, and approved by the ENGINEER for the constituents specified in the Sampling and Analysis Plan. Submit decontamination and drilling water source analytical test results, within 5 working days before beginning drilling operations. The CONTRACTOR is responsible for locating the source, obtaining the water from the source, transporting it to, and storing it at the site. A water sample shall be obtained by CONTRACTOR from the container used in transporting the water to the site before the water is used for decontamination. This sample shall be tested and approved in accordance with the above requirements.

3.03 Extraction Well EW-1

A. Pilot Hole

1. A pilot hole, having a minimum diameter of 12-inches, shall be drilled at the well site to an approximate depth shown on the Drawings.

2. In order to ensure the drilling of the pilot bore to alignment specifications, CONTRACTOR shall furnish and employ an appropriate, self-checking mechanical drift indicator to measure hole deflection. Drift indications shall be taken at intervals of not more than 80 feet. The drift from vertical shall not be more than one-half of one-degree. Any deviations greater than one-half of

one-degree shall be corrected by CONTRACTOR at CONTRACTOR's expense.

3. CONTRACTOR shall install the drilling fluid discharge piping in such a manner that representative drill cuttings can be adequately sampled and collected. At each change of formation, and at 10-foot intervals between changes in formation, CONTRACTOR shall take a representative sample of the cutting from the interval or new formation, and shall label and preserve each sample in a sturdy container with a tight lid. All containers are to be labeled to indicate the depth intervals of the collected sample and stored in a manner to prevent breakage or loss. Containers and lids shall be furnished by CONTRACTOR.

4. A complete lithologic drilling log, well construction diagram, and record of drilling activities shall be prepared by the CONTRACTOR's professional representative for the ENGINEER. Upon completion of each log, two copies and one electronic copy shall be furnished to the ENGINEER.

5. CONTRACTOR shall complete and file all reports required by the State of California Department of Water Resources and shall furnish ENGINEER with two (2) copies and one electronic copy of said reports.

B. Installation of Conductor Casing

1. The conductor casing shall be set in a reamed hole not less than 40-inches in diameter and shall be anchored securely. The conductor casing shall be set to an approximate depth as shown on the Drawings. However, the ENGINEER may elect the setting at a greater or lesser depth if found advisable after examining the log of the pilot hole.

2. Each section of the conductor casing shall be joined to another section as specified in this Section. Suitable steel guides or spacers similar to casing guides shall be provided to center and hold the conductor casing in its proper position until the cement grout has been placed. Field welding of the casing shall be done in accordance with this Section and in such a manner as to avoid any warping. Special care shall be exercised to ensure a straight and plumb casing.

3. After the conductor casing has been placed, it shall be sealed off by filling the annular space between the reamed bore wall and the conductor casing with a neat cement grout consisting of a mixture of API Specification No. 10, Class G Cement (or Class B similar to ASTM C 150, Type II) and water in the ratio of 5 gallons of water per 94-pound sack, weighing approximately 118 lbs/cubic foot. A maximum of 2% by weight of bentonite and 2% by weight of calcium chloride may be added. The cement grout shall be pumped under pressure from the bottom of the reamed hole. The seal shall be effective against infiltration of all water, from the surface down to the bottom of the conductor casing. The cement grout shall reach the surface of the ground around the entire perimeter of the conductor casing.

C. Reaming Pilot Hole for Well Casing

1. After conductor casing has been set in place and cemented, the pilot hole below the conductor casing shall be reamed to a final diameter and depth as shown on the Drawings. The exact depth of reaming shall be determined by the ENGINEER after the pilot hole is completed and drilling logs examined. It is the intent of these Specifications that reaming be conducted on a 24-hour per day basis until completed.

2. A record shall be kept showing any variation in the addition and amount of bentonite, water or other additive required during the reaming operation. The depths at which such changes are observed shall be shown in the daily reports.

3. If the reamed hole or any portion thereof is allowed to remain unattended for more than 5 days, the ENGINEER may require CONTRACTOR to re-ream the designated portion at no cost to OWNER.

D. Caliper Survey

1. Upon completion of the reaming operation, CONTRACTOR shall arrange for the reamed hole to be surveyed for hole cross-section. If the caliper survey shows the hole to be less than the specified diameter at any point, the hole shall be re-reamed and resurveyed by CONTRACTOR. If corrective measures are required, CONTRACTOR shall provide and pay for all corrective measures and additional surveys. After the caliper survey has been made and

approved in writing by the ENGINEER, installation of the well casing shall commence.

E. Geophysical Borehole Logs

1. Upon completion of the pilot borehole, a suite of geophysical borehole logs shall be run on the entire depth of the pilot bore by a firm retained by the CONTRACTOR and approved by the ENGINEER. There will be no additional payment for either rig time or standby time while logging is being performed or while the CONTRACTOR is waiting on the geophysical logging subcontractor.

2. The geophysical borehole logs shall be run by an experienced contractor approved by the ENGINEER, and shall consist of the following suite of logs:

   a. Spontaneous Potential (SP) log.

   b. 16-inch Short Normal and 64-inch Long Normal Resistivity Logs.

   c. Guard Resistivity Log.

   d. Natural Gamma-ray Log.

   e. Acoustic (Sonic) Log.

3. The above logs shall have appended to them such information as necessary for proper interpretation of the log (e.g., resistivity of the mud and mud filtrate, surface and bottom hole temperatures, etc.). They should also be scaled appropriately to the formation(s) in question to allow for adequate definition of the subsurface strata. The horizontal scale for the plot of the spontaneous potential log shall be capable of being displayed in the range from at least 5 to 20 millivolts per inch, as specified by the ENGINEER. The horizontal scale for the plot of each of the resistivity logs (16-inch and 64-inch normal, lateral or guard) shall be capable of being displayed in the range from at least 25 to 50 ohm-meters per inch, as specified by the ENGINEER. A vertical scale of 20 feet per inch is specified.

4. The logs shall become the property of the OWNER at the time logging is completed. The logs shall be run in the presence of the

ENGINEER or OWNER's REPRESENTATIVE. The logs shall be provided to the ENGINEER for interpretation immediately after completion. The CONTRACTOR shall provide the ENGINEER with four field copies of each log and one reproducible original at no additional cost. In addition, the CONTRACTOR shall provide the ENGINEER electronic copies of each log in a format suitable for inclusion into an AUTO/CAD drawing file (e.g., dxf or dwg files).

5. If the logging probe fails to descend to the desired depth, the CONTRACTOR, at its own expense, shall condition the hole to permit the logging probe to descend to the bottom of the hole. Standby time will not be paid for additional cleaning and conditioning of the hole to enable logging operations to proceed.

F. Installation of Well String

1. When the reaming operation has been completed to the satisfaction of the ENGINEER, the well string shall be installed. The well string shall be 18-inch ASTM A 139 Grade B 0.2% copper bearing casing, and 18-inch diameter ASTM A139 Grade B 0.2% copper bearing well screen, mild steel 3-inch diameter gravel feed tube, and 2-inch galvanized sounding tube attached to the string.

2. The casing shall be plumb and shall be centered in the hole. Three steel guides, attached to the casing at intervals of not more than 60 feet, shall be provided in order to center and hold the casing in its proper position until the gravel is in place. The casing shall be suspended in tension from the surface by means of a clamp. The bottom of the casing shall be at a sufficient distance above the bottom of the reamed hole as to ensure that none of the casing will be supported from the bottom of the hole.

3. If the casing should collapse prior to well completion, it shall be withdrawn and replaced at CONTRACTOR's expense.

4. All work required to be repaired or replaced and all additional materials, labor, and equipment required, shall be furnished at the expense of CONTRACTOR and no claim for additional compensation shall be made or be allowed therefore, except as specifically provided herein.

G. Installation of Filter Pack

1. With the assembled casing centered in the borehole tubing or drill pipe with two close-fitting swabs inserted into the casing, one located near the bottom of the perforations and the other near the top of the blank casing, clean, potable water shall be circulated while installing the filter pack material. The fluid properties shall be approved by the ENGINEER before the introduction of filter pack. The filter pack shall be placed by pumping through a feed line extending to the bottom of the casing hole annulus. The feeder line shall be gradually withdrawn as the filter pack is placed. Swabbing and circulating shall be continued during placement of filter pack. Filter pack shall be disinfected with chlorine during placement. Chlorine shall be added at a rate of 1-pound Chlorine HTH (Calcium hypochlorite) per cubic yard of gravel.

2. CONTRACTOR shall not stop circulating clean water until the filter pack is completely in place. Before the filter packing operations begin, CONTRACTOR shall make adequate preparations to ensure that circulation will be continuous.

3. After the filter pack is in place, circulation of clean water and swabbing shall continue in stages throughout the entire perforated section until the material is consolidated and cleaned. As filter pack material settles, more shall be added until the desired height is reached. Filter pack shall be installed to a height at least 5 feet above the top of the well screen as shown on the Drawings.

4. An accurate record shall be kept of the amount of filter pack added during placement and consolidation. The minimum amount of filter pack required shall be computed from the results of the caliper survey.

H. Alignment of Well

1. Tests to verify the plumbness and alignment of the casing shall be made by CONTRACTOR at no cost to OWNER after the well has been completed and before its acceptance by ENGINEER.

2. CONTRACTOR shall guarantee that the well, when completed, shall be sufficiently straight and plumb for the free installation and operation of a turbine pump. To demonstrate compliance with this requirement, CONTRACTOR shall furnish all labor, tools, and equipment, and make a casing test to the satisfaction of the ENGINEER. The test shall be performed after completion of the

well construction and before its acceptance. The completed well shall be drilled in such vertical alignment that a line drawn from the center of the well casing at ground surface to the center of the well casing to the bottom depth on the Drawings below the ground surface shall not deviate from the vertical more than 6-inches in 100 feet of length.

I. Time of Tests

1. After the well has been completely constructed in accordance with these Specifications, CONTRACTOR shall notify the ENGINEER and shall make the necessary arrangements for conducting the well development pumping and production tests.

2. The time required for development pumping, swabbing, surging and bailing will be recorded by the hour with one-half hour intervals as the smallest unit of time credited to CONTRACTOR. Fractions of an hour less than one-half hour but exceeding one-quarter hour will be considered to be one-half hour. The time to be recorded for well development, pumping, and production testing shall commence when the equipment is installed in the well and is placed in operation and shall end when development pumping or testing is stopped at the direction of the ENGINEER.

3. No time will be recorded for delays resulting from:

a. Equipment stuck in the hole;

b. Equipment breakdown;

c. Setup of major drilling, pumping or testing apparatus;

d. Failure to conduct the operation in a diligent and workmanlike manner by which the desired results could ordinarily be expected.

J. Equipment

1. CONTRACTOR shall furnish all material, equipment, and labor necessary to conduct development operations and test pumping operations in accordance with these Specifications and the directions of the ENGINEER. The pump for well development furnished shall be of the deep well turbine type capable of pumping not less than 2,400 gallons per minute against a total head of 700

feet, plus the friction loss in the discharge piping. Bowl setting shall be at approximately 00 feet below the ground surface in this area, unless otherwise ordered by the ENGINEER. A satisfactory throttling device shall be provided so that the discharge may be reduced to 400 gallons per minute. The pumping equipment, complete with motive power for development and testing of well, shall be delivered to the site prior to the completion of swabbing and bailing operations.

K. Well Development by Swabbing and Surging

1. Forty-eight hours after completion of filter packing operation, and prior to installation of the development pump, CONTRACTOR shall commence careful swabbing of the well to the satisfaction of the ENGINEER. If drilling fluid additives have been used, then at the time of commencement of swabbing, CONTRACTOR shall add approximately 300 pounds of sodium acid-pyrophosphate or equivalent material to aid in dispersing the drilling fluid and mud cake. These chemicals shall be added to the well and swabbing shall be continued until all fine sand and mud have been removed from the gravel filter pack materials to the satisfaction of the ENGINEER.

2. A continuous stream of clean, potable water shall be added to the gravel pack from the top and swabbing shall be continued until there is no further settlement of the filter pack, and until all sand, silt and mud have been washed from the gravel pack. Material drawn into the well shall be frequently removed. During swabbing a suitable device shall be employed to measure the level of the filter pack in the annulus. After swabbing, the filter pack level shall reach the base of the filter pack material feed line. The filter pack shall completely fill the annulus between the well casing-screen and the borehole. The quantity of filter pack placed in the annulus shall not be less than the computed volume of the annulus. A quantity less than the computed volume will be judged as an indication of voids and corrective measures shall be undertaken at the CONTRACTOR’s expense.

3. Upon completion of this operation, the well shall be bailed free and cleaned of all accumulations of mud, sand, rock, and sediment to its full depth prior to commencing the pumping of the well. The total amount of material removed from the well during bailing shall be recorded in the driller’s log.

4. Upon completion of the swabbing operations, the CONTRACTOR shall install the surging equipment and discharge facilities for well surging. The CONTRACTOR shall continue development until, in the opinion of the ENGINEER, the following conditions have been properly met:

   a. The quantity of filter pack material placed in the annulus shall be at least as great as the calculated volume of the annulus.

   b. There shall be no further settlement of the filter pack envelope.

L. Cement-Bentonite Grout Seal

1. After the filter pack has been swabbed into place to the depth specified, the annular space between the borehole and the well casing shall then be filled with cement grout from the top of filter pack to the ground surface.

M. Well Development by Pumping

1. Upon completion of the grouting operation, the CONTRACTOR shall install the pumping equipment, and discharge piping for well development by pumping and testing following procedures in ENGINEER's approved well development plan.

N. Well Testing

1. CONTRACTOR shall operate the pumping equipment, as directed by the ENGINEER, for well testing. The well testing shall include a step test for determining well characteristics and an aquifer performance test for estimating aquifer characteristics. The CONTRACTOR shall keep records of the operation of equipment during the tests, including engine rpm and horsepower, fuel use, and other essential information that is useful in designing a pump system. The CONTRACTOR shall also record sand production during the tests, as directed by the ENGINEER.

2. Step Test. The well shall be pumped for several steps at rates specified by the ENGINEER. The CONTRACTOR shall change the discharge rate as directed by the ENGINEER. Discharge rate from the pump shall be controlled by both a gate valve and engine speed. The discharge rate shall be controlled and maintained at

approximately the desired rate for each step with an accuracy of at least 5 percent. The CONTRACTOR shall collect sand production at 5-minute intervals for the first 15 minutes and 15-minute intervals thereafter for each step. Pumping rates and water levels will be collected by the ENGINEER.

O. Disposal of Drilling Wastes

1. CONTRACTOR shall provide all facilities, equipment and materials required for the proper containment of all drilling fluids and wastes and excess development materials from the well site. CONTRACTOR shall be responsible for the proper evaluation of such wastes and materials as potential hazardous materials. The CONTRACTOR shall coordinate removal and disposal of drilling wastes and materials as described in these Specifications.

P. Well Cleaning

1. Upon completion of the step test, the CONTRACTOR shall remove by bailing, sand pumping, or other methods, any sand, rocks or other foreign materials that may become deposited in the well. The well will not be considered clean if more than 2 feet of sand, rocks, or debris are observed during the video downhole survey.

Q. Down-Hole Video Survey

1. Following the step test, the pumping equipment shall be removed and a color video survey shall be run on the full depth of the well by a firm retained by the CONTRACTOR and approved by the ENGINEER. The camera used for the survey shall be equipped with a centralizer. The equipment used by the firm shall produce a tape with an automatic display of the depth in feet. The downhole camera survey shall be conducted in the presence of the ENGINEER.

2. The CONTRACTOR shall provide the ENGINEER with two DVD discs of the camera survey within 48 hours after the survey is completed. The CONTRACTOR shall be required to provide whatever assistance may be required to accomplish the video survey. There will be no additional payment for rig time or idle time while the survey is being run.

R. Preliminary Disinfection

1. Because there will be a delay between the end of testing and completion of the final well structure, only preliminary disinfection will be required. The CONTRACTOR shall provide this service. The disinfectant shall be calcium hypochlorite, 70 percent free chlorine, added to the well at the dosage of 2 pounds per 100 feet of water-filled casing and screen. A doubly capped, perforated pipe container filled with the granulated chlorine compound shall be moved up and down the entire water column in the well until all the chlorine compound has dissolved. The chlorinated water shall remain in the well. A residual chlorine level of not less than 2 parts per million (ppm) shall be attained in the well at the completion of disinfection procedures.

S. Capping of Well

1. Upon completion of all work associated with well development and test pumping, the well casing shall be extended 24 inches above presently existing grade, and shall be capped by tack-welding a 1/4-inch steel plate over the top of the casing.

T. Final Cleanup

1. The CONTRACTOR shall thoroughly clean the well site after completion of its operation in accordance with the Specifications.

3.04 Piezometers PZ-1S/D, PZ-2S/D, AND PZ-3S/D

A. Piezometers shall be constructed as shown on Attachment 1 and described in this Section.

B. Borehole

1. The CONTRACTOR shall drill the borehole using the reverse rotary method or equivalent approved for well drilling and construction. The diameter of the borehole shall be as shown on Attachment 1. The actual location and depths of the borehole may be specified at the site by the ENGINEER.

2. While drilling the borehole, the CONTRACTOR shall assist the ENGINEER who will log the soil cuttings at every 5 feet and at formation changes and monitor the moisture or water content of the soil cuttings. The CONTRACTOR shall collect representative cutting samples in order to provide an indication and proper

classification of geological formations penetrated. CONTRACTOR shall prepare completed geologic logs and well construction diagram for the completed piezometer, for delivery to ENGINEER. The CONTRACTOR shall take a one-quart minimum representative sample of the cutting from the interval and shall label and preserve each sample in an appropriate container. All sample containers shall be labeled to indicate well name, date, and exact depth interval from which the sample was taken. Samples shall be stored in a manner to prevent damages or loss, and shall be available to the ENGINEER at all times.

C. Geophysical Borehole Logs

1. Upon completion of the borehole for each piezometer, the CONTRACTOR shall conduct geophysical borehole logs in accordance with the standards as described in this Specification.

D. Installation of Deep Piezometer

1. Upon completion of drilling and logging of the borehole to total depth as specified on Attachment 2, the CONTRACTOR shall install the deep zone well-string as specified in Attachment 1.

2. The slot opening of well screen is estimated at 0.020 inch. The actual slot size will be determined by the ENGINEER based on geologic information obtained during drilling.

E. Installation of filter Pack for Deep Piezometer

1. Upon completion of the installation of the 3-inch diameter casing string, the CONTRACTOR shall install the filter pack between the 3-inch screen section and the 12-inch borehole to the depth interval specified on Attachment 2. The filter pack will extend to at least 3 feet above the top of the 50-foot well screen.

F. Swabbing, Surging, and Developing

1. CONTRACTOR shall containerize all pumped water for OWNER’s disposal.

2. Upon completion of filter pack placement, the CONTRACTOR shall set-up the necessary equipment with sufficient horsepower to swab, surge, and develop the well in accordance with the procedures provided by ENGINEER.

G. Cement-Bentonite Grout Seal

1. After the filter pack has been swabbed into place to the depth specified, the annular space between the 12-inch borehole and the well casing shall then be filled with cement grout from the top of filter pack a depth specified in Attachment 2.

H. Installation of Shallow Piezometer

1. Upon installation of the seal and grouting to a depth specified in Attachment 1, the CONTRACTOR shall install the upper, shallow well-string that will consist of 50 linear feet 3-inch stainless steel wire wrapped well screen (with plug in bottom) from a depth interval specified in Attachment 2, and the appropriate length of 3-inch Schedule 40 low carbon steel blank well casing to the surface.

2. The slot opening of well screen is estimated at 0.020 inch. The actual slot size will be determined by the ENGINEER based on geologic information obtained during drilling.

I. Installation of Filter Pack for Shallow Piezometer

1. Upon completion of the installation of the 3-inch diameter casing string, the CONTRACTOR shall install the filter pack in the annulus between the 3-inch well screen and the 12-inch borehole to a depth interval specified in Attachment 2 in accordance with this Section. The filter pack must extend at least 3 feet below and 3 feet above the screen section.

J. Swabbing, Surging, and Developing for Shallow Piezometer

1. CONTRACTOR shall containerize all pumped water on site for OWNER’s disposal, as described in these Specifications.

2. Upon completion of filter pack placement for the shallow piezometers, the CONTRACTOR shall set-up the necessary equipment for swabbing, surging, and development as described in these Specifications.

K. Cement-Bentonite Grout Seal for Shallow Piezometers

1. After the filter pack has been swabbed into place to the depth specified, the annular space between the 12-inch bore hole and the well casing shall then be filled with cement grout from the top of filter pack to a depth interval specified in Attachment 2.

L. Installation of Well Head Facilities

1. The CONTRACTOR shall provide all materials and equipment necessary for construction of all wellhead facilities, including but not limited to surface seals, vaults, locks, and well caps.

M. Final Cleanup

1. The CONTRACTOR shall thoroughly clean the well site after completion of its operation as described in these Specifications.

3.05 Surveying

A. Coordinates and elevations shall be established for each well. Horizontal coordinates shall be determined to the closest 1.0 foot and referenced to the State Plane Coordinate System, or Universal Transverse Mercator (UTM). If the State Plane Coordinate System/UTM is not readily available, an existing local grid system shall be used. A ground elevation to the closest 0.01 foot shall be obtained at each well. The highest point on the top of the riser pipe will serve as a measurement point. The elevation of the well shall reference this point, and shall be surveyed to the nearest 0.01 foot using the North American Vertical Datum of 1988. If the datum is not readily available, the existing local vertical datum shall be used. The location, identification, coordinates, and elevations of the well and monuments shall be plotted on maps and provided to the ENGINEER with a scale large enough to show their location with reference to other structures.

3.06 Documentation and Quality Control Reports

A. CONTRACTOR shall establish and maintain documentation and quality control reports for well construction and development to record the desired information and to assure compliance with contract requirements, including, but not limited to, the following:

1. Borehole logs

a. A borehole log shall be completed for each boring drilled. The log scale shall be 1-inch equals 10 feet. Copies of

complete well logs shall be kept current in the field at each well site and shall be available at all times for inspection by the ENGINEER. Information provided on the logs shall include, but not be limited to, the following:

1. Name of the project and site.

2. Boring/well identification number.

3. Location of boring (coordinates, if available).

4. Name of drilling firm.

5. Date boring was drilled.

6. Reference data for all depth measurements.

7. Name of driller and name and signature of geologist preparing log.

8. Nominal hole diameter and depth at which hole diameter changes.

9. Total depth of boring.

10. Method of drilling, including sampling methods and sample depths, including those attempted with no recovery. Indication of penetration resistance such as drive hammer blows given in blows per 6 inches of driven sample tubes. Information shall include hammer weight and drop distance. Information such as rod size, bit type, pump type, etc., shall be recorded. A description of any temporary casing used, drill fluids and fluid additives used, if any, including brand name and amount used, along with the reason for and start (by depth) of its use shall be included. If measured, mud viscosities and weight shall be recorded.

11. Depth of each change of stratum. If location of strata change is approximate, it shall be so stated.

12. Description of the material of which each stratum is composed, in accordance with ASTM D2488 and/or

standard rock nomenclature in accordance with CED TR GL-85-3, as necessary. Soil parameters for logging shall include, but shall not be limited to, classification, depositional environment and formation, if known, Unified Soil Classification Symbol, secondary components and estimated percentages, color, plasticity, consistency (cohesive soil), density (non-cohesive soil), moisture content, structure and orientation, and grain angularity. Rock core parameters for logging shall include, but shall not be limited to, rock type, formation, modifier denoting variety (shaly, calcareous, siliceous, etc.), color, hardness, degree of cementation, texture, crystalline structure and orientation, degree of weathering, solution or void conditions, primary and secondary permeability, and lost core. The results of any chemical field screening shall also be included on the boring log. Classification shall be prepared in the field at the time of sampling. The results of visual observation of the material encountered, and any unusual odor detected shall also be duly noted and recorded.

13. Depth of any observed fractures, weathered zones, or any abnormalities encountered.

14. Depth and estimated percent of drill fluid loss or lost circulation.

15. Measures taken to regain drill water circulation. Significant color changes in the drilling fluid return.

16. Depth to water, and any nonaqueous-phase liquids (NAPLs) and date measured before, during, and after each drilling shift, and prior to well installation. Provide and maintain at each well under construction a portable water and NAPL level measuring device of sufficient length to measure the water /NAPL level to 550 foot depth. The device shall be available on site. The method of measuring the liquid level shall be noted on the boring log. Water and NAPL level measurements shall be taken to the nearest 0.01 foot. It shall be noted on the boring log if the boring was purged and allowed to recover at intervals during the installation, or that

water used in drilling was allowed to dissipate into the formation prior to measuring the water level.

17. Box or sample number. Depths and the number of the core boxes and/or samples shall be recorded at the proper interval.

18. Percent Rock Core Recovery. The percent core recovery for the individual drill runs, if rock is cored, shall be shown.

2. Installation Diagrams

a. The well will not be accepted before the geologic logs and installation diagrams are received. Submit As-built installation diagram for each well installed, prepared by the geologist present during well installation operations, within five (5) working days of the completion of the well installation procedure. The diagram shall illustrate the as-built condition of the well and include, but not be limited to, the following items:

1. Name of the project and site.

2. Well identification number.

3. Name of driller and name and signature of the geologist preparing diagram.

4. Date of well installation.

5. Description of material from which the well is constructed, including well casing/riser pipe and screen material, centralizer composition, if used, diameter and schedule of casing and screen, gradation of filter pack, lithologic description, brand name (if any), source, and processing method, and method of placement of the filter pack, bentonite seal type (pellets, granules, chips, or slurry), grout type (cement or high-solids bentonite) and type of protective cover (protective casing or flush-to-ground), if used.

6. Total depth of well.

7. Nominal hole diameter.

8. Depth to top and bottom of screen, and filter pack.

9. Depth to top and bottom of any seals installed in the well boring (grout or bentonite).

10. Type of cement and/or bentonite used, mix ratios of grout, method of placement and quantities used.

11. Elevations/depths/heights of key features of the well, such as top of well casing/riser pipe, top and bottom of protective casing (if used), ground surface, the depth of maximum frost penetration (frost line), bottom of well screen, top and bottom of filter pack, and top and bottom of seal.

12. Other pertinent construction details, such as slot size and percent open area of screen, type of screen, and manufacturer of screen.

13. Well location by coordinates. A plan sheet shall also be included showing the coordinate system used and the location of each well. A plan sheet is not required for each well installation diagram; multiple wells may be shown on the same sheet.

14. Static water level upon completion of the well.

15. Special problems and their resolutions; e.g., grout in wells, lost casing, or screens, bridging, etc.

16. Description of surface completion.

3. Well Development Records

a. A well development record shall be prepared for each well, within five (5) working days of the completion of development under the supervision of the geologist present during well installation operations. Information provided on the well development record shall include, but not be limited to, the following:

1. Date, time, and elevation of water level in the well, before development.

2. Depth to bottom of well, name of project and site, well identification number, and date of development.

3. Method used for development, to include size, type and make of equipment, bailer, and/or pump used during development.

4. Time spent developing the well by each method, to include typical pumping rate, if pump is used in development.

5. Volume and physical character of water removed, to include changes during development in clarity, color, particulates, and odor.

6. Volume of water added to the well, if any.

7. Volume and physical character of sediment removed, to include changes during development in color, and odor.

8. Source of any water added to the well.

9. Clarity of water before, during, and after development. Nephelometric turbidity unit (NTU) measurements.

10. Total depth of well and the static water level as in accordance with ASTM D4750 from top of the casing, immediately after pumping/development, and 24 hours after development.

11. Readings of pH, specific conductance, DO, ORP, and temperature taken before, during, and after development.

12. Name and job title of individual developing well.

13. Name and/or description of the disposal facility/area, for the waters removed during development.

4. Geophysical Logs

a. Geophysical logs shall be prepared and completed for each well installed. Submit interpreted geophysical logs, within five (5) working days of the completion of said logging. Information provided on the logs shall include, as a minimum, the following:

1. Project name.

2. Well identification number.

3. Location of well (coordinates, and state, and county name).

4. Date(s)well was drilled.

5. Fluid level in well before logging.

6. Fluid type and temperature.

7. Fluid resistance in ohm-m.

8. Casing type, diameter, and elevation (top and bottom).

9. Cement type and elevation (top and bottom).

10. Screen type, diameter, and elevation (top and bottom).

11. Date and time test hole was logged.

12. Reference elevation for all depth measurements. m. Operator’s name.

13. Equipment name and address.

14. Logger type and number.

15. Tool type.

16. Detector type (Nuclear Log only).

17. Source type (Nuclear Log only).

18. Source size (Nuclear Log only).

19. Source spacing (Nuclear Log only).

20. Tool length, cable head to detector.

21. Calibration.

22. Logging speed cm/min ft/min.

23. Log vert. scale ft/in.

24. Module settings.

25. Recorder settings.

26. Document all field problems, including equipment malfunctions. This should include the steps taken to solve the problem and how the log might have been affected.

5. Survey maps

a. Submit Survey maps and notes, including a tabulated list of all wells and monuments, copies of all field books, maps showing the locations, and elevations of all wells, datum used (e.g. state plane NAD27, NAD83, UTM, etc.), elevation datum, units of measurement, and all computation sheets, within five (5) working days after completion of the survey. Also, submit a diagram showing where on the top of the well the elevation was determined by the surveyor. The tabulation shall consist of the designated number of the well or monument, the X and Y coordinates, and all the required elevations. Also, provide a diagram showing where on the top of the well the elevation was determined by the surveyor.

END OF SECTION

33 41 00 STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 Section Includes

A. This section includes a description of Sanitary and Storm Drainage System Testing.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall perform all pipeline flushing and testing, complete for sanitary sewerage and storm drainage system piping as specified herein and in accordance with the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 Materials

A. All test equipment, temporary valves, bulkheads or other water control equipment and materials shall be determined and furnished by the CONTRACTOR subject to the ENGINEER's review.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation – None

3.03 Testing

A. Leakage Tests

1. All gravity sewer pipes shall be tested for leakage by one of the following three test methods as directed by the ENGINEER and following the specific procedures outlined in the referenced sections of the "Standard Specification for Public Works Construction" (SSPWC) latest edition.

B. Deflection Test

1. All flexible and semi-rigid pipe shall be tested for deflection, joint displacement or other obstruction by passing a rigid mandrel through the pipe by hand, not less than 30-days after completion of the trench backfill, but prior to any resurfacing. The mandrel test shall comply with the specific procedures required in the SSPWC, except for the additional provision that the mandrel shall be a full circle, solid cylinder, or a rigid, non-adjustable, odd-numbered leg (9 leg minimum) steel cylinder, approved by the ENGINEER as to design and manufacture.

END OF SECTION

40 05 13 Common Work Results for Process Piping

PART 1 GENERAL

1.01 General Conditions

A. The General Conditions apply to all work of this specification, which shall be done as shown on the plans, and as specified, and shall be properly coordinated with work in other Specifications.

B. The DRAWINGS and these specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to, the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

D. Protection of Work Area

1. The CONTRACTOR shall be familiar with possible/potential utilities that may impact construction work, and plan work accordingly.

2. The CONTRACTOR shall verify the possible locations for all underground utilities before beginning excavation work for pipe installation.

3. The CONTRACTOR shall protect existing site improvements from damage during construction of underground pipeline.

E. Types of pipes and pipe fittings specified in this section include the following:

1. Steel Piping

2. Copper Piping

3. Cast-iron Pressure Piping

4. Cast-iron Soil Piping

5. Grooved Joint Piping

6. Miscellaneous Piping Materials/Products.

F. Pipes and pipe fittings furnished as part of factory-fabricated equipment are specified as part of equipment assembly in Division-43 sections.

1.02 Referenced Sections – None

1.03 Cited Standards

A. Codes and Standards:

1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.

2. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

3. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest edition of the Standard Specifications for Public Works Construction (SSPWC) ("Greenbook") together with any latest Supplement Amendment and State of California, Department of Health Services, Title 22 of the California Administration Code, the City of Rialto Municipal Code and the County of San Bernardino.

1.04 Noted Restrictions

A. All piping flange and equipment gaskets at the treatment system shall be constructed of Kel-F and/or Teflon. Products containing neoprene and silicone are not recommended for TCE & PCE use.

1.05 Quality Control

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications:

1. Firm with at least three years history of successful experience on projects of similar nature.

2. Licensed as a firm in the CONTRACTOR state of origin and in the State of California.

3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the CONTRACTOR.

4. All workmen employed on the project shall carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

C. Welding Certification:

1. Each welder shall have passed a qualification test within the past six months.

2. The test shall be in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", ASME Section VIII, and ANSI 313.

3. The test report shall certify that the welder is qualified to weld the material to be used at the job site.

4. The CONTRACTOR shall submit three copies of each welder's qualification test report to the Project Manager for approval prior to commencing the work. No welder shall be used on the project until so certified.

1.06 Submittals

A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned DRAWINGS for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.

B. Welding Certifications: Submit reports as required for piping work.

C. Brazing Certifications: Submit reports as required for piping work.

D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 1.

1.07 Deliverables

A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 PRODUCTS

2.01 Materials

A. Piping Materials

1. Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

B. Pipe/Tube Fittings

1. Provide factory fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

C. Steel Pipes and Pipe Fittings

1. Black Steel Pipe: Seamless or ERW, ASTM A 53.

2. Galvanized Steel Pipe: ASTM A 53.

3. Galvanized Seamless Steel Pipe: ASTM A 53.

4. Electric-Resistance-Welded Steel Pipe: ASTM A 135.

5. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.

6. Cast-Iron Flanged Fittings: ANSI B16.1, including bolting.

7. Cast-Iron Threaded Fittings: ANSI B16.4.

8. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.

9. Unions: ANSI B16.39; 300 lb. ground joint malleable iron, hexagonal, selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.

10. Dielectric Unions: 175 psig WSP at 250°F. Equal to Walter Vallet Company V-line insulating coupling.

11. Threaded Pipe Plugs: ANSI B16.14.

12. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.

    a. Material Group: Group 1.1.

    b. End Connections: Butt-welding.

    c. Facings: Raised-face.

    d. Steel Pipe Flanges For Waterworks Service: AWWA C207.

13. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.

14. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.

15. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

D. Cast-Iron Soil Pipes and Pipe Fittings

1. Hubless Cast-Iron Soil Pipe: FS WW-P-401.

2. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74.

3. Cast-Iron Hub-and-Spigot Soil Pipe Fittings: Match soil pipe units; complying with same standards (ASTM A 74).

4. Compression Gaskets: ASTM C 564.

E. Acid Resistant Cast Iron

1. Bell and spigot type, high silicon iron alloy "Duriron", with chemical resistant packing and caulked lead joints.

2. POLYPROPYLENE PIPE: Orion Blueline, flame retardant, Schedule 40, with Schedule 40 fittings, heat fusion welded joints. Alternate manufacturers, GSR, Enfield. Meet material standards of ASTM-D4101, joint standards of ASTM-D2657.

F. Grooved Piping Products (only where acceptable and as shown on plans.)

1. As Installer's option, mechanical grooved pipe couplings and fittings may be used for piping systems having operating conditions not

exceeding 230°F (110°C), excluding steam piping and any other service not recommended by manufacturer, in lieu of welded, flanged, or threaded methods, and may also be used as unions, seismic joints, flexible connections, expansion joints, expansion compensators, or vibration reducers.

2. Coupling Housings Description: Grooved mechanical type, which engages grooved or shouldered pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts. Permit degree of contraction and expansion as specified in manufacturer's latest published literature. (Victaulic style 77) For rigid joints (Victaulic "Zero Flex" style 07).

    a. Coupling Housings: Malleable iron conforming to ASTM A 47.

    b. Coupling Housings: Ductile iron conforming to ASTM A 536.

    c. Standard: Enamel coated, options hot dip galvanized.

3. Gaskets: Mechanical grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D 2000.

    a. Water Services: PTFE, with green color code identification.

    b. Other Services: As recommended by Manufacturer.

4. Bolts and Nuts: Heat-treated carbon steel, ASTM A 183, minimum tensile 110,000 psi.

    a. Exposed Locations: Tamper resistant nuts.

5. Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.

6. Fittings: Grooved or shouldered end design to accept grooved mechanical couplings.

    a. Malleable Iron: ASTM A 47.

    b. Ductile Iron: ASTM A 536.

    c. Fabricated Steel: ASTM A 53, Type F for 3/4" to 1-1/2"; Type E or S, Grade B for 2" to 20".

    d. Steel: ASTM A 234.

7. Flanges: Conform to Class 125 cast iron and Class 150 steel bolt-hole alignment.

   a. Malleable Iron: ASTM A 47.

   b. Ductile Iron: ASTM A 536.

8. Specialties:

   a. Inline strainers.

   b. Suction diffusers.

9. Grooves: Conform to the following:

   a. Standard Steel: Square cut.

   b. Lightweight Steel: Roll grooved.

   c. Ductile Iron: Radius cut grooved, AWWA C606.

10. Manufacturer: Subject to compliance with requirements, provide grooved piping products of one of the following:

    a. ITT Grinnell Corp.

    b. Stockham Valves & Fittings, Inc.

    c. Victaulic Co. of America.

    d. Gustin-Bacon

    e. Grippin.

G. Manufacturers:

1. Manufacturer uniformity: conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering piping materials and specialties which may be incorporated in the work include, but are not limited to, the following:

   a. Pipe Escutcheons:

      1. Chicago Specialty Mfg. Co.
      2. Sanitary-Dash Mfg. Co.
      3. Grinnell

   b. Dielectric Waterway Fittings:

      1. Epco Sales, Inc.

2. Victaulic Company of America

c. Dielectric Unions:

1. Eclipse, Inc.
2. Perfection Corp.
3. Watts Regulator Co.

d. Strainers:

1. Armstrong Machine Works.
2. Hoffman Specialty ITT; Fluid Handling Div.
3. Spirax Sarco.
4. Victaulic Co. of America. (low pressure applications only)
5. Watts Regulator Co.

e. Expansion Joints:

1. Flexonics Div.; UOP, Inc.
2. Hyspan Precision Products, Inc.
3. Keflex, Inc.
4. Metraflex Co.
5. Vibration Mountings and Controls, Inc.

f. Flexible Connectors:

1. Flexonics Div.; UOP, Inc.
2. Hyspan Precision Products, Inc.
3. Keflex, Inc.
4. Metraflex Co.
5. Vibration Mountings and Controls, Inc.

H. Piping Specialties:

1. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.

2. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.

3. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed,

soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.

4. Dielectric Waterway Fittings: electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.

5. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch.

   a. Provide strainers with 125 psi working pressure rating for low pressure applications, and 250 psi pressure rating for high pressure application.

   b. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.

   c. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

   d. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

   e. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EPDM gasket.

I. Expansion Joints

1. Rubber Expansion Joints: Construct of duck and butyl rubber with full-faced integral flanges, internally reinforced with steel retaining rings. Provide steel retaining rings over entire surface of flanges, drilled to match flange bolt holes, and provide external control rods.

2. Expansion Joints for Grooved Piping: Provide expansion joints constructed of cut grooved short pipe nipples and couplings, designed by manufacturer to suit intended service. Select couplings and gasket materials to match balance of piping system.

J. Flexible Connectors

1. Braided Flexible Pump Connector: Stainless steel annular corrugated metal surrounded with a woven braid of high tensile stainless steel flange connection. Minimum 125 psi pressure rating, similar to Keflex KSSPC.

2. Flexible Connector: Stainless steel annular, close pitch hose with stainless steel braid. Flanged or threaded connection, Minimum 125 psi pressure rating, similar to Keflex KFCS.

K. Sleeves

1. Sheet-Metal Sleeves: 10-gauge, galvanized sheet metal, round tube closed with welded longitudinal joint.

2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

L. Mechanical Sleeve Seals

1. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

M. Miscellaneous Piping Materials/Products:

1. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

   a. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

2. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements. Use no lead bearing solders in domestic water applications.

   a. Tin-Antimony Solder: ASTM B 32, Grade 95TA.

   b. Silver-Lead Solder: ASTM B 32, Grade 96TS.

3. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

   a. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

4. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.

5. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

   a. MANUFACTURER: Subject to compliance with requirements, provide piping connectors of the following:

1. Fernco, Inc.
2. Mission.

PART 3 EXECUTION

3.01 Preparation - None

3.02 Installation

A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently- leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible union, flanges, etc., for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Do not cold spring. Store filler weld materials in accordance with codes.

1. Comply with ANSI B31 Code for Pressure Piping.

2. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Provide high point vents, low point drains with valves and extension to drain for all piping.

3. All piping in press room, mechanical rooms, fan rooms, etc., shall be exposed. Do not conceal or imbed piping in walls, floors or other structures.

4. Make changes in direction or size with manufactured fittings. Anchor and support piping for free expansion and movement without damage to piping, equipment or to building.

5. Piping shall be arranged to maintain head room and keep passageways clear.

6. Provide unions at connections to equipment and elsewhere as required to facilitate maintenance.

7. Run full pipe size through shutoff valves, gas cocks, balancing valves, etc. Change pipe size within three pipe size diameters of final connection to equipment, coils, etc.

8. All piping shall be erected to insure proper draining. Air piping shall pitch down in the direction of flow a minimum of 1" per 40 feet. Domestic water and utility water shall slope down a minimum of 1" per 40 feet towards the drain (low point). Refrigerant suction line shall slope a minimum of 1" per 10 feet towards compressor. Soil, waste, vent, and roof drain lines shall slope in accordance with requirements of California Plumbing Code.

9. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.

10. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.

11. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.

12. Use fittings for all changes in direction and all branch connections.

13. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

14. Install unions adjacent to each valve and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

15. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.

16. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air).

17. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water). Insulating fittings are not required between bronze valves and steel pipe or between copper coil headers and steel pipe.

18. Electrical Equipment Spaces: Do not run piping in or through, electrical room, transformer vaults and other electrical or electronic equipment spaces and enclosures or above electrical gear unless authorized and directed. Install drip pan under piping that must be run through electrical spaces.

B. Expansion And Contraction

1. Make all necessary provisions for expansion and contraction of piping.

2. Use grooved joint couplings, expansion compensator, offsets or loops as required to prevent undue strain.

3. At piping connection to heat exchangers provide expansion (joint) as shown on DRAWINGS.

C. Flexible Connectors:

1. At pumps, engines and at all rotating or vibrating pieces of equipment, provide and install flexible connectors to accommodate alignment and vibration.

2. At pumps provide and install a series of three grooved joint couplings or braided flexible pump connectors.

3. At engines provide and install flexible connector. If necessary, install OWNER furnished flex connectors for digester gas and natural gas.

D. Protective Coatings

1. All underground steel pipes shall be wrapped with Scotchwrap No. 50 tape to give not less than two complete layers on the underground piping system, or piping shall have "X-tru Coat", factory applied plastic protective covering, or pipe shall be coated and wrapped with coal tar enamel and Kraft paper, all with coated and taped joints.

D. Piping System Joints

1. General: Provide joints of type indicated in each piping system.

2. Threaded: Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

3. Brazed: Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.

4. Soldered: Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will

draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

5. Welded:

   a. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.

   b. Weld pipe joints in accordance with recognized industry practice and as follows:

   c. Weld pipe joints only when ambient temperature is above 0°F (-18°C) where possible, with minimum pipe preheat to 50°F.

   d. Bevel pipe ends at a 37.5^{o} angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.

   e. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".

   f. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or un-fused metal, cracks, oxidation, blow-holes and non-metallic inclusions.

   g. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

   h. At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.

   i. At Installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.

6. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

7. Lead Joints: Tightly pack joint with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicated minimum depth measured from face of bell. After lead has cooled, calk joint tightly by use of hammer and caulking iron.

8. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.

9. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:

   a. Heat Joining of Thermoplastic Pipe: ASTM D 2657.

   b. Making Solvent-Cemented Joints: ASTM D 2235, and ASTM F 402.

10. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.03 Testing

A. Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

   1. Inspect pressure piping in accordance with procedures of ASME B31.

B. Disinfect water mains and water service piping in accordance with AWWA C601.

C. Note specific requirements in **Section 40 05 13.09**.

D. Note specific requirement in **Section 40 05 13.11.**

END OF SECTION

40 05 13.09 Flushing and Disinfection (Chlorination of Water Mains)

PART 1 GENERAL

1.01 Section Includes

A. This section describes requirements for disinfection of water mains, services, appurtenances and connections by chlorination.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All water mains, water services, attached appurtenances, and connections, if any, shall be disinfected in accordance with AWWA C651 and as specified herein.

1.04 Noted Restrictions

A. The CONTRACTOR shall make sure that the City's requirements are being met when performing flushing and disinfection methods.

1.05 Quality Control

A. Before being placed in service, all facilities shall be chlorinated.

1.06 Submittals – (See SECTION 40 05 13.11 paragraph 1.06)

PART 2 PRODUCTS

2.01 Materials Requirements

A. All temporary valves, temporary blow-offs, bulkheads, backflow devices, or other water control equipment and materials shall be determined and furnished by the CONTRACTOR. No materials shall be used which would be injurious to the pipeline or its future function.

PART 3 EXECUTION

3.01 Preparation

A. Procedure

1. Only a certified chlorination and testing CONTRACTOR shall perform the work specified herein. The CONTRACTOR shall furnish all equipment in good operating condition, labor and material, and water necessary for chlorinating and flushing the pipeline. Bacteriological testing after the disinfection will be performed by the CONTRACTOR.

2. In the event groundwater is encountered and it is impossible to prevent its entrance into the mains, or the mains are not free from dirt, they shall be thoroughly flushed prior to disinfection. After the required

period of retention of the chlorine solution and flushing, an CONTRACTOR will test the water for residual chlorine and will make any additional test that may be necessary.

3. The chlorine shall be applied at the beginning of the section to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected. All required corporation stops and other plumbing materials necessary for chlorination or flushing of the main shall be installed by and at the expense of the CONTRACTOR.

4. Every service connection served by a main being disinfected shall be tightly shutoff at the curb stop before water is turned into the main. Care shall be taken to expel all air from the main and services during the filling operation.

5. Water shall be fed slowly into the pipeline with chlorine applied in amounts to produce a dosage of not less than 50 ppm nor more than 100 ppm in all sections of the pipeline and appurtenances.

6. Methods of chlorine application are as follows:

   a. Chlorine shall be fed directly from the chlorine solution tank equipped with a suitable device for regulating the rate of flow and the effective diffusion of solution within the pipe.

   b. Note: For all mains, chlorination shall be applied only by a certified chlorination and testing company.

7. During the chlorination process, all valves and facilities shall be operated.

8. Treated water shall be retained in the system for a minimum of 24 hours and shall contain a chlorine residual of not less than 35 ppm at the end of the retention period in all sections being disinfected.

3.02 Installation – None

3.03 Testing

A. Concurrent Testing

1. Disinfecting the mains and appurtenances, hydrostatic testing, and preliminary retention may run concurrently for the required 24-hour period, but in the event there is leakage and repairs are necessary, additional disinfection shall be made by injection of chlorine solution into the line as provided hereinafter.

B. Additional Disinfection

1. If the tests are not satisfactory the CONTRACTOR shall provide additional disinfection as required. If the requirement for additional disinfection is due to any omission, negligence, or nonconformance with these specifications on the part of the CONTRACTOR, or because of repairs made to the pipeline after its initial filling with water for disinfection, the CONTRACTOR shall provide such additional chlorination at his expense.

C. Flushing

1. After chlorination, the water shall be flushed from the line at its extremities until the replacement water tests are equal chemically and bacteriologically to those of the permanent source of supply. The chlorinated water may be used later for testing other lines, or if not so used, shall be disposed of by the CONTRACTOR. The OWNER will not be responsible for loss or damage resulting from such disposal.

2. The CONTRACTOR shall de-chlorinate the test water in accordance with ANSI/AWWA C651, Appendix B, or otherwise make the water safe for disposal prior to disposal.

END OF SECTION

40 05 13.10 Flushing and Testing

PART 1 GENERAL

1.01 Section Includes

A. This Section includes flushing of all pressure pipelines, and testing of all pipelines, complete. The CONTRACTOR shall flush and test all pipelines as per the Specifications contained herein.

B. Each pipeline shall be flushed in accordance with these procedures and, tested as per the general requirements of this section and more specific testing procedures in following sections.

C. The CONTRACTOR may include equipment flushing and testing while performing same on pipelines. The requirements for equipment testing are in Division 43 and must be included in the written plan required herein.

1.02 Referenced Sections

A. Related Sections

1. SECTION 40 05 13.11 - LEAK TESTING OF PIPING

1.03 Cited Standards – None

1.04 Noted Restrictions

A. The CONTRACTOR shall make sure that the city's requirements are being met when performing flushing and testing methods.

1.05 Flushing, and Testing Requirements and Results

A. A written plan for proper flushing and testing of each pipeline shall be submitted to the ENGINEER for approval prior to start of work. The plan will address how the CONTRACTOR will meet the requirements of this specification. At a minimum, it will include:

1. Schematic map(s) of the project showing points of connection and flushing points.

2. Mechanical flow diagram(s) marked to identify the boundaries of the test and valve line-up.

3. A completed Hydrostatic and Pneumatic Test Data Sheet (Attachment 1 at the end of this Section) including pretest release signatures. Alternate Data Sheets shall be considered by the ENGINEER.

4. The type of pipeline being flushed and tested with a notation of whether it is above or below ground.

5. Make and model number of backflow prevention device(s) and flow meter used to connect to the water system for flushing and testing.

6. Calculations for sizing of source water connection(s), flushing velocities and total quantity.

7. A detailed work schedule listing the approximate dates for each activity covered in this specification.

8. Detailed procedures for each activity.

9. NPDES permit and compliance procedures for flushing.

10. Emergency contact information.

B. The written plan for installation, flushing, testing, shutdowns, tie-ins, and activation will be submitted to the ENGINEER two weeks prior and returned to the CONTRACTOR one week prior to the activity.

C. Protection of the potable water distribution system is the ultimate responsibility of the City. No entity or agent other than City staff will be allowed to operate any valve or facility of the approved distribution system without the written consent and direct supervision of the City.

D. Flushing

1. The minimum flushing velocity will be 5.0 fps.

2. The backflow device and metered connection to the potable supply will be sized to meet the minimum flow requirement based on 5.0 fps. Supporting calculations will be submitted with the flushing plan.

3. The pipeline(s) and equipment shall be flushed for sufficient time to achieve two (2) exchanges of the total volume of the pipeline as a minimum and until the water flushed runs clear. Clear means not more than two (2) NTU turbidity as measured with a potable turbidity meter and a maximum of 0.5 mg/L suspended solids as measured in an Eimhoff cone at all outlets.

E. Testing shall be performed in accordance with the Specifications in **Section 40 05 13.11.**

PART 2 PRODUCTS

2.01 Materials Requirements

A. All temporary valves, temporary blow-offs, bulkheads, backflow devices, or other water control equipment and materials shall be determined and furnished by the CONTRACTOR. No materials shall be used which would be injurious to the pipeline or its future function.

B. All pressurizing equipment and measuring devices required for testing shall be determined and furnished by the CONTRACTOR. No materials shall be used which would be injurious to the pipeline or its future function.

PART 3 EXECUTION

3.01 General

A. Unless otherwise indicated, potable water for flushing and testing will be furnished by the CONTRACTOR. The CONTRACTOR shall furnish and install all materials including, but not limited to, approved backflow devices and also make all necessary arrangements for conveying the water to the points of use.

B. All pressure pipelines shall be tested per the requirements of this division. Equipment testing requirements are as stipulated in Division 43.

3.02 Flushing

A. The CONTRACTOR shall flush each pipeline at a minimum flushing velocity of 5.0 fps, utilizing potable water as per the written plan.

B. The CONTRACTOR shall continue flushing for sufficient time to achieve two (2) exchanges of the total volume of the pipeline as a minimum and until the water flushed runs clear.

C. Leak testing shall be conducted following flushing and shall be performed in a accordance with the Specifications in **Section 40 05 13.11.**

END OF SECTION

40 05 13.11 Leak Testing of Piping

PART 1 GENERAL

1.01 Section Includes

A. This specification identifies the minimum requirements for leak testing of all piping performed by the CONTRACTOR.

B. This section describes the requirements and procedures for pressure and leakage testing of transmission pipelines, pump station and vault piping, and pressure distribution mains. This includes all suction, discharge, and drain piping. Testing shall be performed concurrent with installation.

C. The CONTRACTOR shall develop detailed procedures for leak testing based on the minimum requirements of this specification, and manufacturer's instructions. All leak testing procedures shall be submitted to the ENGINEER for review and approval.

D. All leak testing shall be witnessed by the OWNER or ENGINEER.

E. Requirements Prior to Testing

1. All concrete anchor blocks shall be allowed to cure a sufficient time to develop a minimum strength of 3,000 psi before testing unless otherwise directed by the ENGINEER.

2. Steel pipelines shall not be tested before the mortar lining and coating on all pipe lengths in the line have attained an age of 14 days. Cement-mortar lined pipe shall not be filled with water until a minimum period of eight hours has elapsed after the last joint in any section has been made.

3. Submit test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excess pipe wall stresses.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control – None

1.06 Submittals

A. A written plan for proper flushing and testing of each pipeline shall be submitted to the ENGINEER for approval prior to start of work. The plan will address how the CONTRACTOR will meet the requirements of this specification. At a minimum, it will include:

1. Schematic map(s) of the project showing points of connection and flushing points.

2. Mechanical flow diagram(s) marked to identify the boundaries of the test and valve line-up.

3. A completed Hydrostatic and Pneumatic Test Data Sheet (Attachment 1 at the end of this Section) including pretest release signatures. Alternate Data Sheets shall be considered by the ENGINEER.

4. The type of pipeline being flushed and tested with a notation of whether it is above or below ground.

5. Make and model number of backflow prevention device(s) and flow meter used to connect to the water system for flushing and testing.

6. Calculations for sizing of source water connection(s), flushing velocities and total quantity.

7. A detailed work schedule listing the approximate dates for each activity covered in this specification.

    a. A detailed work plan listing procedures and approximate dates for each activity covered in the specification.

    b. Detailed procedures for each activity.

    c. NPDES permit and compliance procedures for flushing.

    d. Emergency contact information.

PART 2 PRODUCTS

2.01 General

A. All temporary test gauges, fittings, hoses, valves, pumps, compressors, test media, relief devices, and leak inspection materials, including soap solutions, shall be specified and provided by the CONTRACTOR.

B. Any replacement piping components required to repair leaks, shall be provided by the CONTRACTOR at no additional cost to the OWNER.

C. Water

1. The same water used for chlorination of the pipeline may be used to fill the line for testing.

2. Make-up water for testing shall be potable water.

D. Test Bulkheads

1. Design and fabricate test bulkheads per Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70 percent of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

E. Vents and Drain for Aboveground Piping

1. Install vents on the high points of above ground piping, whether shown on the DRAWINGS or not. Install drains on low points of aboveground piping, whether shown on the DRAWINGS or not. Provide a valve at each vent or drain point. Valves shall be 3/4-inch for piping 3 inches and larger and 1/2-inch for piping smaller than 3 inches.

F. Manual Air-Release Valves for Buried Piping

1. Provide temporary manual air-release valves for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and after use, seal with a blind flange, pipe cap, or plug and coat equal to the adjacent pipe.

2.02 Testing Equipment

A. The CONTRACTOR shall provide all equipment required for hydrostatic and pneumatic testing, including, but not limited to:

1. All fittings bleed points, pumps, flanges, connections, etc., necessary to perform hydrostatic test.

2. Clean water, with sufficient quantity to fill pipeline section under test.

3. A strainer on the inlet side of pump to prevent foreign matter from entering the pipeline.

4. Flange connections and/or valves suitable to isolate the pipeline section being tested without leaking.

5. A relief valve capable of permitting pressure relief if pressure exceeds 20 to 25 percent above required test pressure to prevent pipeline failure.

6. Testing pressure gauge(s)

a. Sufficient number of pressure gauges capable of measuring 50 percent over the intended test pressure. Pressure gauges shall be accurate within 1.0 percent.

b. Pressure gauges and relief valves shall be checked for accuracy prior to use during actual testing of the pipeline.

7. A booster pump with sufficient capacity to boost the source water pressure to the required test pressure.

8. An air compressor with sufficient capacity to provide air pressure to the required test pressure for the leak tests.

PART 3 EXECUTION

3.01 General Examination

A. The system or portion of the system to be tested shall be verified to determine that the system is mechanically completed and the following requirements have been met:

1. All solvent welded or bonded joints have cured for at least 8 hours unless the ambient temperature is less than 70°F. If the ambient temperature is less than 70°F, the cure time shall be in accordance with the manufacturer's instructions.

2. Assure that the “Requirements Prior to Testing” in Paragraph 1.01E are in place.

3. All welding has been completed, including the acceptance of all required nondestructive examinations on pressure retaining welds.

4. All fusion joints have been completed, including the acceptance of all required nondestructive examinations on pressure-retaining welds.

5. All flanged connections have been completed, including bolting and gaskets.

6. All expansion joints have been installed and suitably anchored or guided in accordance with the manufacturer's instructions.

7. All nipples and valves have been installed for vents, drains, and instrument connections as specified on the applicable design DRAWINGS.

8. All anchors and supports have been placed as specified on the applicable design DRAWINGS and that the pipeline is sufficiently restrained to prevent buckling during testing.

9. All joints, including welds, bonds, and piping joints have been left uninsulated and/or unburied and exposed for examination during testing.

B. Verification shall include a comparison of the system to be tested to the mechanical flow, piping, and other applicable design DRAWINGS and the requirements of Section **40 05 13 Common Work Results for Process Piping,** as applicable.

3.02 General Preparation

A. The CONTRACTOR shall have a written plan, approved by the ENGINEER, in place as required by **Paragraph 1.06** and shall follow the requirements of the plan.

B. Equipment or piping that is not to be tested shall either be disconnected or isolated by blinds or other means. A valve may be used in place of a blind if the valve is rated to the test pressure.

C. Instrumentation shall not be installed prior to testing unless the instrument is vented.

D. If the ENGINEER approves hydrostatic testing of vapor or gas lines, temporary supports shall be provided, if necessary, to support the weight of the test liquid.

E. Sufficient vents and drains shall be located and installed by the CONTRACTOR to allow the removal of air.

F. All temporary test connections shall be completed.

G. If impractical to test in place and if specifically approved by the OWNER or the ENGINEER, short runs or spools of piping may be interconnected and tested together.

H. Check valve internals shall be disassembled if the direction of the check valve does not allow complete filling or depressurizing of the system.

I. Booster pump(s) shall provide sufficient capacity to boost the source water pressure to the required test pressure.

J. Prior to testing the pipeline shall be properly flushed as per the flushing specifications in **Section 40 05 13.09 Flushing and Disinfection.**

3.03 Hydrostatic Leak Test

A. General Requirements

1. Hydrostatic leak tests shall conform to the requirements of this specification. Hydrostatic leak testing of piping shall also conform to the manufacturer's instructions.

2. Test pressures for all piping systems shall not exceed 150 percent of the design pressure for the least-rated pipe, fitting, or valve installed in the system.

3. Air vents shall be provided by the CONTRACTOR at high points in the system to ensure that all air is purged from the system during filling.

4. The CONTRACTOR shall conduct a leak test on installed piping. The CONTRACTOR shall also furnish all necessary equipment and materials, and make all taps in the pipe as required. The OWNER shall be notified at least 72 hours in advance of testing.

5. Drain valves shall be provided to facilitate filling and draining of all test liquid from the system. Drain valves may be omitted if the system is to operate liquid filled.

6. Tests shall not be performed unless weather conditions ensure a dry surface on the system to be tested or suitable weather protection can be provided.

7. Testing shall not commence until all sections of the pipeline to be tested have been secured to prevent damage to adjacent piping and equipment in the event of a joint failure. Any appurtenant instruments or devices that could be damaged by the test shall be removed from the piping or suitably isolated prior to applying the test. The CONTRACTOR will be held responsible for any damage caused by the testing.

8. During hydrostatic leak testing, joints shall be exposed for visual inspection. It is advised to cover the pipeline in intervals, especially at curves to hold the pipe in place during pressure testing.

9. Expansion joints and/or expansion compensators shall be restrained, isolated, or removed during pressurized leak testing.

10. All leaks identified shall be repaired and retested at no additional expense to the OWNER, including labor and replacement of any material. After repair, the system shall be retested.

11. A "leak" shall be defined as a measurable loss in system pressure during the test or the appearance of water at any location within the system.

12. After testing, the CONTRACTOR shall remove all temporary blinds and remake all connections disassembled for the leak test.

13. The pipe shall not be backfilled until visual inspection has been completed. Joints shall not be backfilled until successful completion of the leak test.

B. The hydrostatic test procedure developed by the CONTRACTOR shall include the following provisions:

1. Air vents shall be opened to allow elimination of air from the system.

2. The tested pipeline shall be slowly filled (<1fps) with test fluid at the lowest point in the system. The CONTRACTOR shall provide means for increasing pressure to the required test pressures.

3. On long straight runs of pipe, a soft pig shall be used ahead of the test fluid to ensure elimination of all air from the system.

4. The test section shall be completely filled with the test medium, taking care to bleed off any trapped air.

5. When the tested pipeline is completely filled with the test fluid, the vents shall slowly be closed and line pressure shall slowly be brought up to the indicated test pressure.

6. Piping shall be tested up to 150 percent of the MAOP of the lowest rated component of each specified line segment.

7. The primary system shall be pressure tested hydrostatically in two phases as follows:

    a. Initial Phase: Using clean water, the piping shall be tested up to 150 percent of the MAOP. Once the target is reached, allow 3 hours for diametric expansion.

    b. Test Phase: After the pipeline has had time for equilibration, the test section shall be returned to 150 percent of the MAOP, the pump turned off, and a final test pressure held for 2 to 3 hours. If there are no visual leaks or significant pressure drops during the final test period, the pipeline passes the test. If there is a leak observed, then the pipeline fails the test.

8. Examination for leakage shall be made of all welds, joints, and connections.

9. If a pressure test fails, the pipe shall be relieved, and the test section allowed to "relax" for a minimum of 8 hours before another test is attempted.

10. Upon satisfactory completion of the test, the system shall be slowly depressurized and completely drained. Air vents shall be opened as required to prevent inducing a vacuum on the system.

11. Provisions shall be made to divert draining test fluid from excavated and trenched areas and to maintain well-formed and supported excavations throughout the testing procedure.

12. Detailed procedures for hydrostatic leak testing of HDPE and PVC pipe shall be prepared by the CONTRACTOR in accordance with applicable portions of this specification and the manufacturer's instructions.

C. Test Records

1. Records shall be made of each piping system installation during the test. These records shall include:

a. Date of test.

b. Description and identification of piping tested.

c. Starting test pressure and end pressure.

d. Remarks, to include such items as:

1. leaks (type, location)
2. repairs made on leaks

e. Certification by the CONTRACTOR and signed acknowledgement by the ENGINEER.

3.04 Pneumatic Leak Test

A. General Requirements

1. The CONTRACTOR shall conduct pneumatic leak testing on the instruments, tubing and connections operating with an air or gaseous media.

2. The inner pipe of double walled HDPE piping shall remain full of water throughout the pneumatic testing of the outer pipe to prevent collapsing.

3. Pneumatic leak tests shall conform to the requirements of this specification and ANSI B31.3. Pneumatic leak testing of double-contained piping shall also conform to the manufacturer's instructions. Special precautions for pneumatic leak testing are identified in ANSI B31.3.

4. Test pressures shall not exceed 10 psig.

5. A pressure relief device shall be provided with a set pressure that does not exceed 110 percent of the test pressure. Sizing and selection of the pressure relief device shall be determined by the CONTRACTOR.

6. Tests shall not be performed unless weather conditions ensure a dry surface on the system to be tested or suitable weather protection can be provided.

7. All leaks shall be repaired at no additional expense to the OWNER, including labor and replacement of any material. After repair, the system shall be retested.

8. A "leak" shall be defined as a formation of bubbles observed when a soap solution is applied or as indicated by the criteria for double walled HDPE piping in Paragraph B. 5. below.

9. Upon satisfactory completion of the test, the pressure shall be slowly released.

ATTACHMENT 1
HYDROSTATIC AND PNEUMATIC TEST DATA SHEET

Project Number: Project Name:

Piping System/Equipment:

Description of Piping System/Equipment Being Tested:

Reference Criteria:	
Type of Test:	Test Medium:
Operating Pressure:	Operating Temperature:
Test Pressure:	Test Temperature:
Examination Pressure:	Examination Temperature:
Minimum Holding Time at Test Pressure:	Minimum Holding Time at Examination Pressure:
Allowable Leakage:	

Pressure Test Gauge(s) Identification Number: _____
Calibration Due Date: _____

Test Relief Valve(s) Identification Number: _____
Calibration Due Date: _____

PRETEST RELEASE SIGN-OFF

Mechanical	Eng. _____	Date: _____	Supt: _____	Date: _____
Welded Joints	Eng. _____	Date: _____	Supt: _____	Date: _____
Instrumentation	Eng. _____	Date: _____	Supt: _____	Date: _____

Time Test Started:	Time Test Completed:

Comments:

Performed by Name: Date:	Witnessed by Client Name: Date:
Verified by Name: Date:	Witnessed by ENGINEER Name: Date:

40 05 13.12 Tracer Wire and Marking Tape for Buried Piping

PART 1 GENERAL

1.01 Section Includes

A. This section includes specifications applicable to non-metallic buried piping unless specified otherwise by the ENGINEER.

B. During installation of buried non-metallic piping, the CONTRACTOR shall furnish and install tracer wire and detectable Mylar marking tape as per the DRAWINGS and the following specifications.

PART 2 PRODUCTS

2.01 Tracer Wire

A. Tracer wire shall be No. 14 AWG bare copper wire with TW insulation.

2.02 Detectable Mylar Marking Tape

A. The marking tape shall be 6” wide foil detectable Mylar marking tape. The detectable marking tape will bear the words "CAUTION - BURIED PIPELINE BELOW”, "CAUTION - BURIED WATER LINE BELOW” or “CAUTION - BURIED ENVIRONMENTAL LINE BELOW". The printing will be under Mylar so as to be readable through the clear Mylar.

B. Maximum spacing between the continuous warning messages shall be 16". The tape shall be a highly visible color and the tape will be color coded in accordance with the American Public Works Association and Utility Location Coordination Council Standards for non-potable water.

C. The tape shall be specially designed for prolonged underground use and shall be easily detectable with an electronic locator.

D. The Detection tape shall be as manufactured by Pollard Co. Inc., Long Island, NY (Model Nos. 802, 803, 804); Reef Industries, Inc., Houston, TX; Seton Identification Products, Branford, CT; or an approved equal.

PART 3 EXECUTION

3.01 Tracer Wire

A. Buried non-metallic utilities (electrical, mechanical, and civil) shall have a tracer wire along the entire length of the pipeline unless indicated otherwise. The tracer wire shall be installed in accordance with its corresponding DRAWING shown in the Standard Details.

B. The tracer wire shall be installed on top of the buried utility crown and shall be attached to the pipe line by taping or other suitable means approved by the OWNER at a maximum of 10 ft. intervals.

C. The tracer wire shall be positively attached to the non-metallic buried utilities by plastic wire ties of similar type of attachment at a maximum of every 10 feet for straight run of utility and at all changes of direction.

D. The ends of the tracer wire shall be exposed above the finished grade.

E. Concrete valve boxes shall be installed at the locations where the ends of the tracer wire are exposed above the finished grade.

F. Tracer wire shall be exposed above finished grade in the precast concrete boxes at the transition where the non-metallic buried utility connects to the existing metallic utility.

G. Tracer wire shall be continuous between boxes and shall be tested for continuity.

3.02 Detectable Mylar Marking Tape

A. General

1. The CONTRACTOR shall install a six-inch wide foil detectable Mylar marking tape over all nonmetallic water lines. It shall be inductively locatable and conductively traceable using standard pipe and/or cable locating devices.

2. Care shall be taken to insure that the buried marking tape is Mylar encased aluminum foil.

3. The detectable marking tape will be buried 8 in. below finish grade. The tape should be placed into backfill and allowed to settle into place in the backfill.

4. The marker tape shall be in accordance with its corresponding DRAWING shown in the Standard Details.

B. Installation Details:

1. The tape shall be laid directly above the piping or conduit and directly on top of the compacted earth subgrade immediately before restoring the pavement.

2. In open areas, the tape shall be laid during the backfilling operation on smooth, compacted backfill at a distance of 8 inches below the surface of the area.

3. The ends of the tape shall be lapped approximately six (6) inches.

3.03 Surface Restoration

A. All areas disturbed during construction, including, but not limited to, roads, curbs, sidewalks, open areas, and landscaped areas, shall be repaired in

accordance with the current City/County Standard DRAWINGS OR Public Works Standards.

3.04 Certification of Completion

A. Upon completion of the piping system, the CONTRACTOR shall certify the following to the Company:

1. The piping system has been constructed in accordance with the contract plans and specifications.

2. The piping system has been field flushed and tested and has passed all of the required tests in the approved project plans and specifications.

END OF SECTION

40 05 13.13 Steel Process Piping (Black and Galvanized)

PART 1 GENERAL

1.01 Section Includes

A. This section covers furnishing and installing all steel piping, fittings, accessories, and supports, etc., with the exception of any piping which is an integral part of any equipment assembly and which would be furnished by the manufacturer. Flushing and testing requirements for installed steel piping are specified in **Sections 40 05 13.09-11**.

B. Where piping connects to equipment, particular care shall be taken to see that pipe fittings are suitable for connection to the equipment fittings.

1.02 Related Sections - None

1.03 Cited Standards

A. All steel piping and fittings shall conform to the following standard specifications, of the latest revisions, as applicable:

1. ASME/ANSI B16.1 - 1998 - Cast Iron Pipe Flanges and Flanged Fittings

2. ASME/ANSI B16.3 - 1998 - Malleable Iron Threaded Fittings

3. ASME/ANSI B16.4 - 1998 - Cast Iron Threaded Fittings

4. ASME/ANSI B16.5 - 2003 - Pipe Flanges and Flanged Fittings

5. ASTM A53 / A53M - 07 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

6. ANSI B36.10 2004 Welded and Seamless Wrought Steel Pipe

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall furnish and install steel pipe and all appurtenances, complete in place, all in accordance with the standard DRAWINGS and as described in these specifications.

B. All pipes shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.

C. During the manufacture of the pipe, the OWNER or ENGINEER shall be given access to all areas where manufacturing and testing is in process and shall be permitted to make all inspections necessary to confirm compliance

with the Specifications.

D. Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with requirements as applicable.

PART 2 PRODUCTS

2.01 Steel Process Piping

A. The steel pipe shall consist of welded or seamless carbon steel type in accordance with ANSI B36.10. The steel pipe shall be black unless otherwise indicated or specified on the DRAWINGS. All pipe 12” and larger shall be standard weight. All steel pipe 10” diameter and smaller shall be Schedule 20, unless otherwise specified.

B. Where flanged pipe is required, the flanges shall be ANSI 150 lb. Flanges may be screwed on using tapered pipe threading, weld neck, or slip-on welded.

C. All flange gaskets on the piping at the treatment system shall be constructed of Kel-F or Teflon. Products containing neoprene and silicone are not recommended for TCE & PCE use.

D. Where threaded pipe is required, screwed fittings shall be Grinnell, Providence, RI, or equal. Where welded pipe is required, fittings shall be long radius type, Tube Turns Technologies, Louisville, KY, or equal.

E. Pipe sizes, joints, wall thicknesses, (or thickness schedule), shall be as indicated in the Pipe Schedule included with these specifications.

F. Cement Mortar Lining. Steel pipe specified or shown on the Plans to be cement mortar lined shall be shop lined in accord with AWWA C 205, or lined after installation by means of a pipe lining machine. Lining shall be 1/4-inch minimum thickness. If a lining machine is used, it must be approved by the OWNER and be capable of applying a lining comparable in density and smoothness and of the same thickness as the above specified shop applied lining. In-place lining shall conform to applicable portions of AWWA C 602.

G. Coating. Aboveground steel pipe shall be cement mortar lined per AWWA C205 and fusion bonded epoxied per AWWA C213. Belowground steel pipe shall be cement mortar lined and coated per AWWA C205.

H. Joints

1. Threaded Joints

a. Pipe screw threads to conform to ANSI B2.1. Ream pipe ends and remove all burrs and chips after cutting and threading. Protect pipe thread during assembly. Apply thread lubricant to male threads as follows: John Crane Co., Morton Grove, IL,

"Anti-Seize"; red lead graphite for vent lines and roof conductors and Teflon tape for all other services.

2. Flanged Joints

a. Steel pipe flanges shall conform to ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings". Cast iron pipe flanges shall conform to ANSI B16.1 "Cast Iron Flanges and Flanged Fittings". Steel flanges shall be raised face except when bolted to flat face cast iron flange.

b. Flanged joints shall be made with bolts, bolt studs with nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges.

c. SAE Grade 5 zinc coated bolts shall be used for above-ground joints. Threads shall be coated with an anti-seizing compound before nut installation.

d. 316 Stainless Steel per ASTM F593-95 with an 85,000 psi average tensile strength shall be used for buried joints. Threads shall be coated with an anti-seizing compound before nut installation.

e. Bolting for services up to 500 degrees F shall be ANSI/ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts". Bolt studs and studs shall be of the same quality as machine bolts.

f. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.

g. Gaskets for flat face flanges shall be full face type. Gaskets for raised face flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Gaskets shall be 1/8 in. thick minimum and of following types: Kel-F or Teflon.

h. All welded joints shall be electric welded. Welding shall be in accord with AWWA C 206. Qualification of welders shall be as covered in AWWA C 206. All testing of welders shall be at the CONTRACTOR’S expense, including cost of test nipples, welding rod, and equipment.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. The maximum spacing between pipe supports shall be in accordance with the following table.

Steel (Std. Weight or heavier) Cast Iron, Ductile Iron	**Max. Spacing**	
	Steam & Liquids	**Air & Gases**
1 ½ ” and smaller	7’-0”	7’-0”
2” - 3”	10’-0”	14’-0”
4” - 6”	14’-0”	20’-0”
8” and above	20’-0”	20'-0"

B. Additional supports shall be provided where the following occurs:

1. where the pipe changes direction
2. adjacent to flanged valves and strainers
3. at equipment connections and heavy fittings.
4. Where indicated on the DRAWINGS

C. The CONTRACTOR shall provide at least one hanger adjacent to each joint in cast-iron soil pipe and grooved-end steel pipe with mechanical couplings.

D. Vertical pipe runs shall be supported and laterally braced at every floor level in multistory structures and at intervals not exceeding 15 ft in other structures.

3.03 Flushing and Testing

A. Installed piping shall be flushed and tested as per the manufacturer’s specifications and the specifications contained in **Sections 40 05 13.09-11**.

END OF SECTION

40 05 13.14 Steel Wall Pipes, Seep Rings, and Penetrations

PART 1 GENERAL

1.01 Section Includes

A. This section includes materials, installation, and testing of steel wall pipes and sleeves (including wall collars and seepage rings), and penetrations.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control – None

1.06 Submittals

A. Submit shop DRAWINGS in accordance with Section 01 33 00.

B. Submit detail DRAWINGS for fabricated steel wall and floor pipes and sleeves, wall flanges, seep rings, and sealing materials. Show dimensions and wall thickness.

C. Show flange sizes and the appropriate ANSI or AWWA flange dimensional standard where flanges end wall pipes or penetrations are used.

D. Show grooved-end dimensions and AWWA grooved-end dimensional standard where grooved-end wall pipes or penetrations are used.

E. List coating systems to be applied, manufacturer, and dry thickness of coatings. Call out coatings where coatings are to be applied.

F. List materials of construction, with ASTM material reference and grade.

G. Submit manufacturer's instructions for installing rubber annular hydrostatic sealing devices.

1.07 Deliverables – None

PART 2 PRODUCTS

2.01 Materials

A. General

1. Use fabricated steel wall sleeves containing rubber annular hydrostatic sealing devices through which piping passes.

B. Rubber Annular Hydrostatic Sealing Devices

1. Rubber annular hydrostatic sealing devices shall be of the modular mechanical type, utilizing interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe sleeve and the passing pipe. Assemble links to form a continuous rubber belt around the pipe, with a pressure plate under each bolthead and nut. Rubber link seal shall be Linkseal manufactured by Thunderline Corporation; or ENGINEER approved equal.

2. Materials of construction shall be as follows:

Compound	Material
Pressure plate Stainless Steel	
Bolts and nuts for links	Type 316 stainless steel
Sealing element	EPDM rubber

3. The size of the wall sleeve needed to accommodate the passing pipe shall be as recommended by the rubber annular seal manufacturer.

C. Polyethylene Foam Filler for Pipe Penetrations

1. Packing foam shall be an extruded closed-cell polyethylene foam rod, such as Minicel baker rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware; Ethaform, as manufactured by Dow Chemical Company, Midland, Michigan; or equal. The rod shall be 1/2 inch larger in diameter than the annular space.

D. Painting and Coating

1. Coat penetrations and sleeves exposed, above ground, or in vaults and structures in accordance with Section 09 90 00.

2. Coat buried sleeves and penetrations per Section 09 90 00.

2.02 Equipment – None

2.03 Fabrications

A. Fabricated Steel Wall Flanges, Anchors, and Sleeves

1. Provide fabricated steel wall pipes with ends as shown on the DRAWINGS for connection to adjacent steel pipes, or for containing pipes, where they pass through concrete walls. Provide seepage ring or wall flange on wall pipes and sleeves passing through concrete walls and slabs which are to be watertight. Wall thickness shall be the same as the pipe wall thickness when connecting to steel pipe. Wall thickness for sleeves containing pipes shall be standard weight per ANSI B36.10.

2. Wall flanges shall be in the form of a steel wall collar welded to the steel sleeve or penetration. Cut welded wall collars from a steel ring of the size indicated on the DRAWINGS. Attach the collar to a steel wall pipe or sleeve with full circle fillet welds. Welding procedures shall be in accordance with ANSI B31.3, Chapter V.

3. Steel pipe used in fabricating wall sleeves containing pipes shall comply with ASTM A 53, Grade B; ASTM A 135, Grade B; ASTM A 139, Grade B; or API 5L or 5LX. Wall sleeves connecting to steel pipe shall be of the same material as the connecting pipe. Wall collar material shall comply with ASTM A 105, A 181, or A 182.

PART 3 EXECUTION

3.01 Preparation

A. Location of Pipes and Sleeves

1. Provide a wall or floor pipe where shown on the DRAWINGS.

2. Provide a floor sleeve where shown on the DRAWINGS and wherever plastic pipe, carbon steel or stainless steel pipe 3 inches and smaller or copper tubing passes through a floor or slab. Provide a rubber annular sealing device in the annular space between the sleeve and the passing pipe or tubing.

3. Provide wall sleeves where shown on the DRAWINGS and wherever plastic pipe, steel or stainless-steel pipe 3 inches and smaller, or stainless-steel or copper tubing passes through a wall. Provide a single rubber annular seal when the wall is 8 inches thick or less. Provide two rubber annular seals (one at each end of the sleeve) when the wall is more than 8 inches thick. Pack the annular space with polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure.

4. Where sleeves are installed in which water or soil is on one or both sides of the channel or wall, provide two rubber annular seals (one at each end of the sleeve).

5. Where pipes pass through walls or slabs and no sleeves or wall or floor pipe with seep ring is provided, pack the annular space with polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure.

3.02 Installation

A. Installation in Existing Concrete Walls and Slabs

1. Core drill holes 2 inches larger in diameter than the diameter of the wall flange or collar. Install wall pipe and collar assembly axially

aligned with the piping to which it will be connected or will contain. Pack the void space between the sleeve and concrete with waterproof epoxy grout.

B. Installation in New Concrete Walls and Slabs

1. Install wall pipes in walls before placing concrete. Do not allow any portion of the sleeve to touch any of the reinforcing steel. Install wall sleeve and collar assembly axially aligned with the piping to which it will be attached or will contain.

C. Installation of Wall Pipes Having Flanged End Connections

1. Check alignment before grouting in place or pouring concrete. Realign if the sleeve is not properly aligned.

2. Install flanged end wall sleeves or penetrations with bolt holes of the end flanges straddling the horizontal and vertical centerlines of the sleeve.

3. Lubricate flange bolts with oil and graphite prior to installation.

D. Qualifications of Welders

1. Welder qualifications shall be in accordance with AWS B3.0.

E. Installation of Rubber Annular Hydrostatic Sealing Devices

1. Install in accordance with the manufacturer's instructions.

3.03 Testing – None

END OF SECTION

40 05 13.15 Field Welded Steel Process Piping

PART 1 GENERAL

1.01 Section Includes

A. This section includes emplacement of welded steel pipelines and pipe bedding, pipeline closures, welding and welded connections, lining and coating at joints, and encasement.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control – None

1.06 Submittals

A. Submit shop DRAWINGS in accordance with the Section 01 33 00.

B. Submit installation schedule.

C. Submit weld procedure specifications, procedure qualification records, and welder qualification certificates.

D. Submit affidavit of compliance with standards referenced herein. All tests of material referenced shall be executed prior to fabrication and installation. Submit certified results with affidavits of compliance.

1.07 Deliverables - None

PART 2 PRODUCTS

2.01 Materials

A. Bolts and Nuts for Flanges

1. Bolts and nuts for buried flanges shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8 for bolts, and ASTM A 194, Grade 8 for nuts. Bolts and nuts for above ground flanges and flanges in vaults shall be Type 316 stainless steel. Fit shall be Classes 2A and 2B per ANSI B1.1 when connecting to valves with body bolt holes.

2. Bolts for flange insulation kits shall conform to ASTM A 193, Grade B7. Nuts shall conform to ASTM A 194, Grade 2H.

3. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.01 Equipment – None

2.02 Fabrications – None

PART 3 EXECUTION

3.01 Preparation

A. Existing Conditions

1. Location and invert elevations, materials of construction, and dimensions of existing pipelines and concrete encasements shown on the DRAWINGS are approximate.

B. Delivery and Temporary Storage of Pipe at Site

1. Limit onsite pipe storage to a maximum of one week.

2. For shop lined pipe keep plastic caps or plastic with steel straps placed over the ends of each pipe until immediately prior to installation. Add water to interior of pipe if plastic cap is temporarily removed and replaced or repaired.

3. Do not remove the plastic caps placed over the ends until the pipe is ready to be placed in the trench. Plastic caps may be opened temporarily to spray water inside the pipe for moisture control.

C. Handling of Pipe

1. Lift steel pipes with two 16-inch-wide belt slings and spreader bar or as recommended by the pipe manufacturer. Do not use cable slings. Avoid damage to coating.

2. Measure the outside diameter of bell and spigot to check that clearance between laying surfaces is within specified tolerance prior to joint assembly.

3. Where internal bracing is required, place in pipes prior to joint assembly and maintain internal braces placed in pipes 24 inches and larger until authorized by the OWNER to remove.

D. Sanitation of Pipe Interior

1. When pipe laying is not in progress, close the ends of the pipe by a vermin- and child-proof plug.

3.02 Installation

A. Placement of Pipe in Trench

1. Control water in trench per Section 31 23 00.

2. Lay pipes uphill if the pipe slope exceeds ±10% or otherwise hold in place by methods approved by the OWNER.

3. Excavate below the subgrade as shown on the construction plans. If in rock, complete excavation to a uniform foundation free of protruding rocks. Complete stabilization of foundation, per Section 31 23 00, then place and compact material specified for the bedding in Section 31 23 00 to bring the trench bottom to grade.

4. Place and compact the pipe base as specified in Section 31 23 00.

5. Cut a depression to accommodate the pipe bell and application of joint coating and spaces to permit removal of the pipe handling slings.

6. Each section of pipe shall be laid in the order and position shown on the pipe schedule as provided by the CONTRACTOR. Lower the pipe onto the pipe base and install it to line and grade along its full length on firm bedding except at the bell and at the sling depressions. Tolerances on grade are 1/4 inch. The tolerance on line is 1 inch.

7. When installing beveled pipe, do not deviate the pipe top mark by more than 1/2 inch from a vertical line passing through the pipe center.

8. Do not use dogs, clips, lugs or other devices welded to the pipe to force it into position.

B. Operations Incidental to Joint Completion

1. Plan joint completion to accommodate temporary test bulkheads for hydrostatic testing.

C. Flanged Connections

1. Inspect gasket seating surfaces, gasket, each stud or bolt, each nut, each washer, and the facing on which the nuts will rotate. Replace any damaged item.

2. Lubricate nuts and bolts and flange-to-nut contact surfaces with oil or graphite prior to installation.

3. Attach gasket with adhesive as recommended by gasket manufacturer.

4. Assemble all bolts in flange, then tighten bolts in the sequence and to the torque as recommended by the manufacturer. Retighten bolts after 24 hours. Replace galled, cracked, or distorted bolts and nuts. Do not reuse bolts or nuts.

5. Coat buried flanges with Coating System No. 24 (Division 09).

6. Lubricant for stainless-steel bolts and nuts shall be TRX-Synlub by Ramco, Anti-Seize by Ramco, Husk-It Husky Lube O'Seal or equal.

D. Field Welded Joints

1. Provide single-welded lap joints, double-welded lap joints, butt-welded joints, and butt-strap joints where detailed on the DRAWINGS. All joints shall be welded unless otherwise shown. The minimum overlap of the assembled bell-and-spigot sections of lap joints shall be as shown on the DRAWINGS. Steel pipe with wall thickness of less than ¼" shall not be butt-welded.

2. Field welding shall be in accordance with AWWA C206 except as modified herein. Welder's qualifications shall be in accordance with Section IX, Part QW, of the ASME Boiler and Pressure Vessel Code. Any welder performing work shall have been qualified for the process involved within the past three years.

3. Prior to welding interior joint shade pipe to 60 degrees except at the joints. Complete the interior weld prior to coating the outside joint.

4. If joint laying surfaces are rusted or pitted where weld metal is to be deposited, clean them by wire brushing or sand blasting.

5. Complete the butt-welded longitudinal seams of butt-straps before completing circumferential fillet welds. Grind the backing bar clear of abutting pipe section prior to completing circumferential fillet welds. Backing bars shall be left in place.

6. Completed fillet welds shall be convex with a maximum reinforcement of 1/8 inch. Minimum leg length shall be the sum of the greatest abutting plate thickness plus joint clearance. Equalize joint clearance around entire circumference prior to welding. Remove all tack welds prior to the start of joint welding.

7. Preheat the joints to be welded where required in accordance with Table 1 of AWWA C206.

8. Where weld metal is to be deposited, clean joints by wire brushing or sand blasting. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

9. No welding ground shall be made on the coated part of the pipe.

10. In all hand welding, the metal shall be deposited in successive layers so that there will be at least as many passes or beads in the completed weld as indicated in the following table:

Steel Cylinder Thickness (inches)	Fillet Weld, Minimum Number of Passes
3/16 or less	1
7/32 through 1/4	2
9/32 through 3/8	3
13/32 through 1/2	4
More than 1/2	1 for each 1/8 inch and any remaining fraction thereof

11. The plate edges shall be so prepared that there will be sufficient angle in the welding groove to prevent side arcing of the electrode and to permit penetration at the deepest point of the groove. All such welds shall be back-chipped with a round-nosed tool to clean metal on the reverse side from the side of the deepest penetration before any welding is done on said reverse side. Each hand pass and each back-chipped welding groove shall be subject to inspection before the ensuing pass is made. Each hand pass shall be the full width of the weld.

12. Not more than 1/8 inch of metal shall be deposited in each pass. Each pass, whether in butt or fillet welds, shall be thoroughly brushed or hammered to remove dirt, slag, or flux before the succeeding bead is applied. Each pass shall be thoroughly fused into the plates at each side of the welding groove or fillet and shall not be permitted to pile up in the center of the weld. Undercutting along either side will not be permitted.

13. Complete each pass around the entire circumference of the pipe before commencing the next pass. Use the electrodes recommended by the pipe fabricator. Do not deposit more than 1/8 inch of throat thickness per pass.

14. During welding exterior welds, the coating of welded steel pipe shall be protected by draping an 18-inch-wide strip of heat-resistant material over the top half of the pipe on each side of the coating holdback to avoid damage to the coating by hot weld splatter. No welding ground shall be made on the coated part of the pipe.

E. Pipeline Closure Assemblies

1. Use pipeline closure assemblies to unite sections of pipeline laid from opposite directions and to adjust the field length of the pipeline to meet structures, other pipelines, and points established by design stations. The minimum length of pipe closure sections shall be 4 feet.

2. Use pipeline closure assemblies between butt-welded pipeline sections and double-welded pipeline sections.

3. Center the shaped steel butt straps over the ends of the pipe sections they are to join as shown on the DRAWINGS.

4. Cement-mortar line closure assemblies to a mortar thickness at least equal to the adjoining standard pipe sections. Clean the steel with wire brushes and apply a cement and water wash coat prior to applying the cement mortar. Where more than a 4-inch joint strip of mortar is required, place welded wire mesh reinforcement in 2-inch by 4-inch pattern of No. 13 gage over the exposed steel.

   a. Install the mesh so that the wires on the 2-inch spacing run circumferentially around the pipe. Crimp the wires on the 4-inch spacing to support the mesh 3/8 inch from the metal surface. Steel-trowel finish the interior mortar to match adjoining mortar lined pipe sections.

   b. Coat the exterior of closure assemblies to match adjacent specified pipe joint coating.

5. Field trimming of pipe shall be normal to the axis of the pipe only.

6. No angular deflections will be allowed at butt strap joints.

F. Completion of Inside Mortar Joints

1. Cement mortar used for the joints shall be composed of a minimum of one part cement to not more than two parts sand, by weight, dry mixed, and moistened with sufficient water to permit packing and troweling without crumbling. Water shall be clean and free from injurious quantities of organic matter, alkali, salts, and other impurities.

2. Backfill the trench before applying interior lining at field welded joints.

3. Working inside the pipe, remove foreign substances which adhere to the steel joint rings, clean them, and pack cement mortar into each joint. Before placing the joint mortar material against the surfaces of the lining, the surfaces shall be carefully cleaned, have all soap removed, and then be wetted to provide a good bond between the lining and the joint mortar. Finish the surface with a steel trowel to match the adjoining pipes. For pipes of small diameter mortar the joint and pull the mortar across the inside of the joint with an inflated ball to adequately line the pipe.

4. Remove excess mortar and other construction debris from the pipe interior.

G. Completion of Exterior Pipe Joint

1. Coat the exterior of welded steel and concrete cylinder pipe joints as shown on the DRAWINGS.

2. Apply cement mortar coating and reinforcement to field joints as shown on the construction plans per AWWA C205. Before placing the reinforced mortar coating the braces in the bare end of the pipe shall be temporarily removed. Exterior coating at welded joints shall be applied within 1 day after weld testing. Field joints in exterior mortar coating shall be made either by pneumatically applying or by pouring mortar in a suitable diaper. Pneumatically applied mortar at field joints shall have a minimum thickness of 1 inch. Poured mortar at field joints shall overlap the adjacent pneumatically applied mortar coating a distance of not less than 5 inches, and the thickness of the poured mortar shall be not less than 1-1/4 inches. Diapers shall be polyethylene foam-lined fabric with steel strapping of sufficient strength to hold the fresh mortar, resist rodding of the mortar and allow excess water to escape. The foam plastic shall be 100 percent closed cell, chemically inert, insoluble in water and resistant to acids, alkalies and solvents. The ENGINEER may order the diapers to be removed for inspection prior to backfilling.

3. Above ground steel pipe shall be Fabricated and Coated in the shop. No field welding is allowed except with special permission from the ENGINEER.

4. Start the backfilling operations specified in Section 02223 immediately after coating the field joints.

5. Do not remove the cross bracing in pipe to be encased until the encasement has cured at least seven days and the subsequent backfill is completed.

H. Pipe Backfill

1. Provide thrust blocks for rubber gasket joints 16-inches in diameter or less per Standard DRAWINGS.

2. Provide sufficient space along each side of the pipe and the trench wall to observe that the backfill material fills all spaces below pipe spring line under the pipe haunches.

I. Protection of Mortar Lining

1. Until the pipeline is filled with water, install bulkheads and apply moisture inside the bulkheaded portions in a manner that will effectively prevent the drying out of the mortar lining.

3.03 Testing – None

END OF SECTION

40 05 13.19 Stainless Steel Process Piping

PART 1 GENERAL

1.01 Section Includes

A. This section covers furnishing and installing all stainless steel piping, fittings, accessories, and supports, etc., with the exception of any piping which is an integral part of any equipment assembly and which would be furnished by the manufacturer. Flushing and testing requirements for installed steel piping are specified in Sections 40 05 13.09-11.

B. Where piping connects to equipment, particular care shall be taken to see that pipe fittings are suitable for connection to the equipment fittings.

1.02 Related Sections – None

1.03 Cited Standards

A. All stainless steel piping and fittings shall conform to the following standard Specifications, of the latest revisions, as applicable:

1. ASTM A-312/ASME SA-312 Seamless & Welded Austenitic Stainless Steel Pipe

2. ASME SA-403 Wrought Austenitic Stainless Piping Fittings

3. ASTM A351 / A351M - 06 Standard Specification for Castings, Austenitic, for Pressure-Containing Parts

4. ASME SA-815 Wrought Ferritic, Austenitic & Martensitic Stainless Pipe Fittings

5. ANSI/ASME 36.19 **Stainless Steel Pipes - Dimensions and Weights**

6. ANSI/ASME B1.20.1 Pipe Thread

7. ASTM F593 - 02(2008) Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

1.04 Noted Restrictions – None

1.05 Quality Control

A. The CONTRACTOR shall furnish and install stainless steel pipe and all appurtenances, complete in place, all in accordance with the standard DRAWINGS and as described in these Specifications.

B. All pipe shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.

C. During the manufacture of the pipe, the OWNER or ENGINEER shall be given access to all areas where manufacturing and testing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

D. Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with requirements as applicable.

PART 2 PRODUCTS

2.01 Stainless steel Process Piping

A. The stainless steel pipe shall consist of welded or seamless steel Type 316 in accordance with ASTM A-312/ASME SA-312. The stainless steel pipe shall be as specified on the DRAWINGS. The pipe shall be Schedule 40, unless otherwise specified.

B. Where flanged pipe is required, the flanges shall be ANSI 150 lb. Flanges may be screwed on using tapered pipe threading, weld neck, or slip-on welded.

C. All flange gaskets on the piping at the treatment system shall be constructed of Kel-F or Teflon. Products containing neoprene and silicone are not recommended for TCE & PCE use.

D. Where threaded pipe is required, screwed fittings shall be Grinnell, Providence, RI, or equal. Where welded pipe is required, fittings shall be long radius type, Tube Turns Technologies, Louisville, KY, or equal.

E. Pipe sizes, joints, wall thicknesses, (or thickness schedule), shall be as indicated in the Pipe Schedule included with these Specifications.

F. Joints

1. Threaded Joints

2. Pipe screw threads to conform to ANSI/ASME B1.20.1 Pipe Thread. Ream pipe ends and remove all burrs and chips after cutting and threading. Protect pipe thread during assembly. Apply thread lubricant to male threads as follows: John Crane Co., Morton Grove, IL, "Anti-Seize" for steam and condensate, boiler feed water and blowdown; red lead graphite for vent lines and roof conductors and Teflon tape for all other services.

3. Flanged Joints

a. Stainless steel pipe flanges shall conform to ASME SA-815. Flanges shall be raised face except when bolted to flat face cast iron flange.

b. Flanged joints shall be made with steel bolts, bolt studs with nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges.

c. Bolting for all joints shall be 316 Stainless Steel per ASTM F593-95 with an 85,000 psi average tensile strength. Bolt studs and studs shall be of the same quality as machine bolts. Threads shall be coated with an anti-seizing compound before nut installation.

d. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.

e. Gaskets for flat face flanges shall be full face type. Gaskets for raised face flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Gaskets shall be 1/8 in. thick minimum and of following types: Kel-F or Teflon.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. Installation shall be performed per the manufacturer’s specifications.

B. The maximum spacing between pipe supports shall be in accordance with the following table.

Pipe Support Spacing		
SS (std. Weight or heavier), Cast Iron, Ductile Iron	**Max Spacing**	
	Steam & Liquids	**Air & Gases**
1-1/2” and under	7’-0”	7’-0”
2”, 2-1/2”, 3”	10’-0”	14’-0”
4”, 5”, 6”	14’-0”	20’-0”
8”, 10”, 20’-0”	20’-0”	20'-0"
12” and above	20’-0”	20’-0”

C. Additional supports shall be provided where the following occurs:

1. where the pipe changes direction

2. adjacent to flanged valves and strainers

3. at equipment connections and heavy fittings.

D. The CONTRACTOR shall provide at least one hanger adjacent to each joint in grooved-end stainless steel pipe with mechanical couplings.

3.03 Flushing and Testing

A. Installed piping shall be flushed and tested as per the manufacturer's specifications and the Specifications contained in Sections 40 05 13.09-11.

END OF SECTION

40 05 13.33 Brass, Bronze, and Copper Process Piping

PART 1 GENERAL

1.01 Section Includes

A. This section covers furnishing, and installing, all copper piping, fittings, accessories, and supports, etc., with the exception of any piping which is an integral part of any equipment assembly which would be furnished by the manufacturer.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All copper piping and fittings shall conform to the following standard specifications, of the latest revisions, as applicable:

1. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings

2. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

3. ASTM B32 – Standard Specification for Solder Metal

4. ASTM B88 – Standard Specification for Seamless Copper Water Tube

5. ASTM B 828 – Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

1.04 Noted Restrictions

A. Solder filler metal shall be in accordance with ASTM B32 but shall not be Alloy Sn50.

B. Approved Manufacturers

1. All materials shall be the appropriate model number of specified on the construction plans as manufactured by the companies listed herein.

a. Copper Tubing:

b. Anaconda

c. Phelps-Dodge

2. Service Saddle:

a. James Jones - J-979 or equal

3. Corporation Stop:

a. Mueller – 110 H-15013 or equal

4. Angle Meter Stop:

   a. Mueller – 110 H-142258 or equal

5. Ninety Bend Coupling:

   a. Mueller – 110 H-15526 or equal

6. Insulating Pipe Bushings, Unions, or Couplings:

   a. Pipeline Coating and Engineering Co.

   b. Smith Blair

   c. Pipe Seal and Insulator Company

1.05 Quality Assurance

A. The CONTRACTOR shall furnish and install copper pipe and all associated appurtenances, complete in place, in accordance with the standard DRAWINGS and as described in these specifications.

B. All piping shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.

C. During the manufacture of the pipe, the OWNER or ENGINEER shall be given access to all areas where manufacturing and testing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

D. All soldering processes, procedures, and solderers for copper and copper alloy pipe and tube shall be in accordance with ASTM B 828.

E. Double strap bronze service saddles shall be installed on asbestos-cement or ductile iron pipe.

1.06 Delivery, Storage, and Handling

A. Pipe and tube required by the applicable standard to be cleaned and capped shall be delivered to the job site with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipe and tube from moisture and dirt. Elevate above grade. When stored inside, do not exceed the structural capacity of the floor.

C. Protect fittings, flanges, and piping specialties from moisture and dirt.

PART 2 PRODUCTS

2.01 Materials

A. Copper

1. Copper tubing shall conform to the requirements of ASTM B 88 for seamless copper water tube. Copper tubing shall be true, smooth, and clean on both inside and outside and free from any cracks, seams or other defects. It shall be truly cylindrical, of the full specified outside and inside diameters, and of uniform thickness of metal. Piping located aboveground or suspended within vaults shall be Type L. Buried piping shall be Type K.

2. Fittings shall be copper conforming to ASTM B 75 and ANSI B16.22, with solder end joints. Fittings 3/8 inch and smaller may have flared end connections only.

3. Solder shall be silver solder conforming to ASTM B32, Grade 95TA. Do not use cored solder.

B. Brass Pipe, Nipples, and Fittings

1. Short threaded nipples, brass pipe and fittings shall conform to ASTM B 43, Schedule 40. Threads shall conform to ANSI B2.1.

C. Bronze Appurtenances

1. All items specified herein shall be manufactured of bronze conforming to ASTM B 62, "Composition Brass or Ounce Metal Castings."

2. All service saddle bodies shall be manufactured of bronze and shall be tapped for an iron pipe thread. The seal with the pipe shall be affected with either a rubber gasket or an O-ring.

a. Service saddles shall be the double strap type for all sizes of asbestos-cement or ductile iron pipe. The straps (or bails) shall be flat and shall be manufactured of Everdur or Silnic bronze.

3. Corporation stops shall be manufactured of bronze. The inlet fitting shall be a male iron pipe thread when used with saddle and the outlet connection shall be a compression type.

4. Angle meter stops shall be manufactured of bronze. The inlet connection shall be a compression type and the outlet fitting shall be a meter flange or meter coupling. The inlet and outlet shall form an angle of 90 degrees on a vertical plane through the centerline of the meter stop. A rectangular lug and lock wing shall be provided on the top of the fitting to operate the shutoff mechanism. Two-inch angle

meter stops shall be with "slotted" holes for 1-1/2-inch or 2-inch meters.

D. Flanges, Gaskets, Bolts, and Nuts

1. Connect to flanged valves and fittings with bronze flanges conforming to ANSI B16.24, Class 125 or Class 150, to match the connecting flange. Use solder end companion flanges.

2. Gaskets shall be full face, 1/8-inch thick, and shall be one of the following non-asbestos materials:

a. Cloth-inserted rubber. Products: John Crane Co. Style 777 or equal. Gaskets shall be suitable for a pressure of 200 psi at a temperature of 180°F.

b. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal. Gaskets shall be suitable for a water pressure of 500 psi at a temperature of 400°F.

3. When both aboveground adjoining flanges are bronze, use bronze bolts and nuts. Bolts shall conform to ASTM F 468, Grade C65100 or C63000. Nuts shall conform to ASTM F 467, Grade C65100 or C63000.

4. When only one of the aboveground adjoining flanges is bronze, use Type 316 stainless steel bolts and nuts conforming to ASTM A 193, Grade B8M for bolts, and ASTM A 194, Grade 8M for nuts.

5. Connect to buried ferrous flanges with flange insulation kits. Bolts used in flange insulation kits shall conform to ASTM B 193, Grade B7. Nuts shall comply with ASTM A 194, Grade 2H. If the adjoining buried flange is bronze, use bronze bolts and nuts as described above, without a flange insulation kit.

6. Provide one (1) washer for each nut. Each washer shall be of the same material as the nut.

2.02 Joining Materials

A. Solder filler metal shall be in accordance with ASTM B32 and shall be Alloy Sn95 or Alloy Sn94; where Tin (Sn) is approximately 95%, and Silver (Ag) is approximately 5%, having 0.10% maximum Lead (Pb) content.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. Copper Tubing and Fittings

1. Cut tubing square and remove burrs. Clean both the inside and outside of fitting and pipe ends with steel wool and muriatic acid before soldering. Prevent annealing of fittings and tubing when making connections. Do not miter joints for elbows or notch straight runs of pipe for tees.

2. Bends in soft copper tubing shall be long sweep. Shape bends with shaping tools. Form bends without flattening, buckling, or thinning the tubing wall at any point.

3. Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of the ASME Boiler and Pressure Vessel Code. Silver solder shall be used. Solder shall penetrate to the full depth of the cup in joints and fittings. Solderers shall comply with ANSI B31.3, paragraph 328.

4. Buried piping shall be installed with some slack to provide flexibility in the event of a load due to settlement, expansion or contraction. A MINIMUM COVER OF 36 INCHES BELOW THE FINISHED STREET GRADE SHALL BE ADHERED TO. The tubing is to be bedded and covered with sand or select material as determined by the ENGINEER.

5. All 2-inch size services shall be installed with straight lengths of soft copper water tube Type K. Solder or compression fittings are acceptable on only the corporation stop and angle meter stop. All couplings and adapters shall be silver soldered.

B. Service Saddle

1. The service saddle shall be no closer than 18 inches to a valve, coupling, joint, or fitting unless it is at the end of the main. The installation of a service saddle on any machined section of ACP will NOT be permitted.

2. The surface of the pipe shall be filed to remove all loose material and to provide a hard, clean surface before placing the service saddle.

3. The service saddle shall be tightened firmly to ensure a tight seal; however, care shall be used to prevent damage or distortion of either the corporation stop or service saddle by overtightening.

4. The tap into the pipe shall be made in accordance with the pipe manufacturer's recommendation.

C. Installing Flange Bolts and Nuts

1. Lubricate bolt threads with graphite and oil prior to installation.

2. Set flange pipe with the flange bolt holes straddling the pipe horizontal and vertical centerlines.

D. Insulating Bushings and Unions

1. Pipe or fittings made of nonferrous metals shall be isolated from ferrous metal by nylon insulating pipe bushings, union, or couplings.

3.03 Testing – None

END OF SECTION

40 05 13.53 Ductile, Malleable, and Cast Iron Alloys Process Piping

PART 1 GENERAL

1.01 Section Includes

A. This section covers furnishing, installing, and testing (where required), all ductile iron process piping and its appurtenances. Piping shall be erected true to line and grade by skilled mechanics in strict accordance with these specifications and the DRAWINGS.

1.02 Referenced Sections – None

1.03 Cited Standards

A. All pipe, fittings and accessories shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ASI B16.1 Cast Iron Pipe Flanges

2. ANSI B16.5 Pipe Flanges and Flanged Fittings Steel Nickel Alloy and Other Special Alloys

3. ASTM D 2000 Classification System for Rubber Products in Automotive Applications

4. AWWA C219 Bolted, Sleeve-Type Couplings for Plain End Pipe

5. ANSI/AWWA C104/A21.4 – Cement-mortar Lining for Ductile Iron Pipe and Fittings for Water

6. ANSI/AWWA C110/A21.10 – Ductile Iron and Gray Iron Fittings, 3-in. through 48-in. for Water and Other Liquids

7. ANSI/AWWA C111/A21.11 – Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

8. ANSI/AWWA C115/A21.15 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges

9. ANSI/AWWA C150/A21.50 – Thickness Design of Ductile Iron Pipe

10. ANSI/AWWA C151/A21.51 – Ductile Iron Pipe, Centrifugally Cast for Water

11. ANSI/AWWA C153/A21.53 – Ductile Iron Compact Fittings, 3-in. through 24-in. and 54-in. through 64-in. for Water Service

12. ANSI/AWWA C600 – Installation of Ductile Iron Water Mains and their Appurtenances

13. ANSI/AWWA C606 – Grooved and Shouldered Joints

14. ANSI/AWS D11.2 – Guide for Welding Iron Casting

1.04 Noted Restrictions – None

1.05 Quality Control

A. All ductile iron piping and its appurtenances shall include cement-mortar lining in accordance with AWWA C104, and shall satisfy NSF 60 and 61 requirements.

B. The CONTRACTOR shall furnish and install ductile iron pipe and all appurtenances, complete in place, all in accordance with the standard DRAWINGS and as described in these specifications.

C. Ductile iron pipe shall conform to AWWA C151, subject to the following supplemental requirements. The pipe shall be of the diameter and class shown, shall include cement-mortar lining, shall be furnished complete with rubber gaskets, and shall be furnished with all specials and fittings as required in the DRAWINGS or specified herein.

D. The ductile iron pipe, and its fittings shall be provided by American Ductile Iron Pipe (a division of American Cast Iron Pipe Company, Birmingham, Alabama) or an equal approved by the ENGINEER.

E. Where piping connects to equipment, particular care shall be taken to see that pipe fittings are suitable for connection to the equipment fittings.

F. Pipe-laying lengths shall be provided in 20-foot nominal lengths with allowable trim-pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the DRAWINGS.

PART 2 PRODUCTS

2.01 Piping

A. All ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and AWWA C151, respectively, for the following minimum operating conditions:

1. The minimum internal design pressure shall be 150 psi with a 100-psi surge allowance, with a safety factor of 2, for a total internal design pressure of 500 psi. No reduction of safety factor for transient pressures shall be allowed.

2. The external loads design criteria shall be a minimum of 4 feet depth of cover at 120 lbs. per cubic feet soil weight, and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.

3. The horizontal deflection of cement-mortar-lined ductile iron pipe resulting from external load conditions shall not exceed three percent of the pipe diameter.

4. All pipe size shall be in accordance with the Piping Schedule shown in section **40 06 20 Schedules for Liquids Process Piping**.

2.02 Joints

A. Joints for ductile iron pipe and fittings shall be push-on joints, restrained joints, mechanical joints, flanged, joints, and grooved joints as specified in this section.

B. Restrained Joints

1. Restrained joints shall be "Flex-Ring" or "Lok-Ring" restrained joints as manufactured by American Ductile Iron Pipe or an approved equal.

2. Field-adaptable restraint shall be provided through the use of "Fast-Grip" or "Field Flex-Ring" as manufactured by American Ductile Iron Pipe or other pre-approved and boltless, push-on restrained devices.

3. When restrained joints require factory welding, the CONTRACTOR shall qualify all welding procedures and welders used to produce the product per the requirements of a documented quality assurance system based on ANSI/AWS D11.2.

4. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR). Restrained joints and restrained joint pipe shall be rated for the pressure rating specified in the Piping Schedule or in the DRAWINGS.

5. The CONTRACTOR shall furnish test results showing that restrained joints in the sizes specified have been successfully tested to at least twice the specified pressure rating of the joint without leakage or failure. Tests shall be performed on pipe with nominal metal thickness less than or equal to that specified for the project. Torque-activated restrained joint devices that rely on threaded bolts or set-screws for joint restraint shall not be used.

C. Flanged Joints (Pipe)

1. Flanged pipe thread-fabrication shall be Special Thickness Class 53 in accordance with AWWA C115. Threaded companion flanges for ductile iron pipe shall be ductile iron in accordance with AWWA C115, not ANSI B16.1. Flange fittings shall be ductile iron in accordance with AWWA C110or AWWA C153, not ANSI B16.1.

2. Bolt circle and bolt holes match those of ANSI B16.1 class 125 and ANSE B16.5 class 150 flanges. The flanges shall be rated for at least 250 psi working pressure.

3. The threaded flanges shall be individually fitted and machine tightened on the pipe ends.

4. Bolts, gaskets, and installation shall be in accordance with AWWA C115, Appendix A requirements, and flanged gaskets shall be Toruseal gaskets as manufactured by American Ductile Iron Pipe, with a special seal design.

5. As noted in the appendices of various ANSI/AWWA standards and AWWA Manual M41, the use of flanged joints underground is generally not recommended because of the rigidity of the joint.

6. To insure accountability, all flanged pipe shall be fabricated at the factory by the pipe manufacturer.

D. Expansion Joints

1. Flexible expansion joints shall be installed in the locations indicated on the DRAWINGS and shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and ANSI/AWWA C153/A21.53. Foundry certification of material shall be readily available upon request.

2. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 350 psi (250 psi for flexible expansion joints 2 inch and 30 inches diameter and larger.) A minimum 2:1 safety factor, determined from the published pressure rating, shall apply. Factory Mutual Approval for the 3 inch through 12 inch sizes is required.

3. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of: 20º, 2” - 12”; 15º, 14” - 36”; 12º, 48” and 4-inches minimum expansion.

4. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be holiday tested with a 1500 volt spark test conforming to said specification. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.

5. Appropriately sized polyethylene sleeves, meeting ANSI/AWWA C105/A21.5, shall be included for direct buried applications.

6. Manufacturer's certification of compliance to the above standards and requirements shall be readily available upon request. The ENGINEER shall reserve the right to inspect the manufacturer's facility for compliance.

7. All flexible expansion joints shall be FLEX-TEND 8" nominal pipe size, flange connected, double ball assembly number 408F22 with minimum 12" extension as manufactured by EBAA Iron, INC., Eastland, TX.

2.03 Flexible Pipe Couplings

A. Flexible pipe couplings and flanged coupling adapters shall be installed in the locations indicated on the DRAWINGS and shall be manufactured conforming to the requirements of ASI B16.1, ANSI B16.5, ASTM D 2000 and AWWA C219, as applicable.

B. Approved Manufacturers for are as follows:

1. Flexible Couplings

a. Dresser Industries (Style 38)

b. Romac Industries (C400 Series)

c. Smith-Blair, Inc. (Style 411)

2. Flanged Coupling Adapters

a. Dresser Industries (Style 127 or 128)

b. Romac Industries (C400 Series)

c. Smith-Blair, Inc. (900 Series)

3. Grooved Type Couplings

a. Victaulic Style 77

4. Transition Couplings

a. Transition couplings for connecting different pipes having different outside diameters shall be Dresser Style 162 couplings or ENGINEER approved equivalent.

C. Construction

1. Flexible couplings shall be provided where shown, and shall be of steel with stainless steel bolts and nuts (300 Series), without pipe stop, and shall be of sized to fit the pipe and fittings shown. The middle ring shall not be less than 1/4-inch in thickness and shall be at least as thick

as that specified for the size of pipe in which the coupling is to be used. Middle ring shall be 7 inches long (minimum) for pipe sizes through 24 inches and shall be 10 inches long (minimum) for pipe sizes larger than 24 inches. The followers shall be single-piece contoured mill sections, welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressure without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket.

2. Flexible couplings shall have middle rings made of steel conforming to ASTM A36, A53 (Type E or S), or A512 having a minimum yield strength of 30,000 psi. Follower rings shall be malleable iron (ASTM A47, Grade 32510), Ductile Iron (ASTM A 536), or steel (ASTM A108, Grade 1018 or ASTM A510, Grade 1018 or 1021).

3. Flanged coupling adapters shall be provided where shown and shall be cast iron bodied meeting the requirements of ASTM A-126, Class B. Flanges shall be of the size and class shown on the plans and shall mate with a standard cast iron flange meeting the requirements of ANSI B16.1. Flanged coupling adapters shall adapt plain end A.C. pipe or ductile or cast iron to cast iron, ductile iron, and steel flanges.

4. Grooved type couplings shall be Victaulic standard couplings, Style 77. Pipe ends at couplings shall be grooved-type for steel pipe and meet the manufacturer's design tolerances. Gaskets shall be molded, Grade E. Couplings shall be installed per the manufacturers printed instructions.

D. Gaskets

1. Gaskets for flexible couplings shall be a rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. The rubber in the gasket shall meet the following specifications:

   a. Color - Jet Black

   b. Surface - Non-Blooming

   c. Durometer Hardness - 74 ± 5

   d. Tensile Strength - 1000 psi Minimum

   e. Elongation - 175 Percent Minimum

2. The gaskets shall be immune to attack by impurities normally found in water. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above.

E. Bolts and Nuts for Couplings

1. Bolts and nuts for flexible couplings, transition couplings, and flanged coupling adapters shall be 316 stainless steel.

2. Bolts and nuts for Victaulic couplings shall be 316 Stainless Steel.

F. Gaskets

1. Gaskets for flanged coupling adapters shall be as described in Section 40 05 13.

G. Painting and Coating

1. Coat flexible couplings externally and internally with a fusion bonded epoxy coating in accordance with Section 09 99 00.

2. Flexible couplings shall be coated on their interior and exterior metal surfaces excluding seating areas and bronze and stainless steel pieces. Sandblast surfaces in accordance with SSPC SP-5. Remove all protuberances which may produce pinholes in the lining. Round all sharp edges to be coated. Remove any contaminants which may prevent ponding of the lining. Coat the interior ferrous surfaces using the following method:

a. Apply powdered thermosetting epoxy (Scotchkote 134 or equal) per the manufacturer's application recommendations to a thickness of 16 mils.

3. All epoxy coatings shall be applied by the coupling manufacturer.

2.04 Fittings

A. Fittings shall be ductile iron in accordance with AWWA C110, AWWA C153, or AWWA C606, latest revisions.

B. Buried Service Fittings: Fittings, sizes 4" — 24", with push-on, restrained push-on, or mechanical joints shall be rated for 350 psi working pressure.

C. Flanged joints for 12" and smaller sizes may also be rated for 350 psi when used with AMERICAN Toruseal gaskets

2.05 lining and Exterior Coating

A. For Buried Ductile Iron Pipe: The exterior of ductile iron pipe, special, and fittings shall be coated with a 1-mil asphaltic coating in accordance with AWWA C151, Section 51-9.

B. Except as otherwise specified, all ductile iron pipe and fittings shall be cement mortar lined in accordance with ANSI A 21.4 (AWWA C 104). Special attention shall be given to the lining of fittings. Lining shall be applied to

clean bare metal. All lining shall extend to the faces of flanges, to the end of spigots, or to the shoulder of hubs, as the case may be.

C. Ductile iron pipe underground shall be protected against external corrosion by loose polyethylene sleeves in accordance with AWWA C 105.

D. Polyethylene encasement shall be in accordance with AWWA C105. Tears shall be repaired and joints made with double plastic tape wrap. Manufacturers shall be Tape for Tape Wrap: Polyken Pipeline Coatings, Polyken No. 910; The Tapecoat Company, Tapecoat CT; or equal.

2.06 Factory Testing

A. All Ductile Iron pipe shall be subject to a factory hydrostatic test of at least 500 psi for a period of not less than 10 seconds as specified by AWWA C151.

B. Suitable controls and recording devices shall be provided so that the test pressure and duration are positively controlled.

C. Any pipe that leaks or does not withstand the test pressure is rejected.

PART 3 EXECUTION

3.01 Preparation

A. The CONTRACTOR shall install the ductile iron piping in accordance with the requirements of **40 05 13 Common Work Results for Process Piping.**

B. Pipe Preparation

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

C. Backfill

1. All backfill within 24 inches of pipe couplings shall be clean, washed concrete sand.

2. Backfill is to be placed and compacted in accordance with Section 31223.

3.02 Installation

A. When installing flexible couplings or flanged coupling adapters, care shall be taken that the connecting pipe ends, couplings and gaskets are clean and free of

all dirt and foreign matter with special attention being given to the contact surfaces of the pipe, gaskets and couplings. The couplings shall be assembled and installed in conformity with the recommendation and instruction of the coupling manufacturer.

B. Wrenches used in bolting flexible couplings and flanged coupling adapters shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened so as to secure a uniform annular space between the follower rings and the body of the pipe and all bolts tightened approximately the same amount. Diametrically opposite bolts shall be tightened progressively and evenly. Final tightening shall be done with a suitable, approved and calibrated torque wrench set for the torque recommended by the coupling manufacturer. All clamping torque shall be applied to the nut only.

C. All couplings which are to be buried shall be wrapped with 8-mil polyethylene wrap per AWWA C105.

D. Blocking

1. All bends in excess of 10 degrees, plugs, caps, tees, and wye branches along pipelines shall be adequately blocked to prevent the lines from pulling apart under pressure.

2. Lugged fittings and tie rods, clamps, collars, restrained joints, and anchoring fittings may be substituted in lieu of blocking after having received the approval of the ENGINEER. Concrete used for blocking and anchoring pipelines in trenches shall consist of concrete as specified elsewhere in these specifications.

END OF SECTION

40 05 13.55 Cement-Mortar Lining for Potable Water Process Piping

PART 1 GENERAL

1.01 Section Includes

A. This section shall describe the requirements for cement-mortar lining for the ductile iron potable water process piping and its associated appurtenances.

1.02 Referenced Sections – None

1.03 Cited Standards

A. Cement-mortar lining for all ductile iron potable water process piping, fittings and accessories shall conform to the requirements of the following standard specifications, of the latest revisions, as applicable:

1. ANSI/AWWA C104/A21.4 – Cement-mortar Lining for Ductile Iron Pipe and Fittings for Water

1.04 Noted Restrictions

A. When handling cement-mortar lined pipe and fittings, bare fork lift arms or bare hooks should not be inserted into open ends.

B. Mortar for lining should not be used after it has been mixed for more than one hour.

1.05 Quality Control

A. All pipes and fittings with cement-mortar lining should be handled with rubber covered hooks to prevent damage to the cement lining. Any other method to be used shall be approved by the OWNER or ENGINEER.

B. Surface crazing and cracks of a specified nature and magnitude are allowed in accordance and as specified in AWWA C104. If AWWA C104 verifies that these small cracks will not be detrimental to the performance and effectiveness of the lining, these cracks may be permitted.

PART 2 PRODUCTS

2.01 Cement Mix

A. The following is the recommended cement mix by volume for the cement-mortar lining:

1. 3 Parts Portland Cement

2. 2 Parts Clean Sand; sand should be free of clay and screened through a No. 20 screen.

3. Necessary water for a slump of 5 to 8.

B. The thickness of cement lining shall adhere to the table shown below in accordance with AWWA C104.

Size (in.)	Nominal Pipe Length (ft.)	Standard Thickness			Double Thickness		
		Minimum Thickness (in.)	Weight Per Foot lb	Weight Per Length lb	Minimum Thickness (in.)	Weight Per Foot lb	Weight Per Length lb
4	18	1/16	0.87	17	1/8	1.71	31
6	20	1/16	1.30	26	1/8	2.57	51
8	20	1/16	1.74	35	1/8	3.45	59
10	20	1/16	2.15	43	1/8	4.28	86
12	20	1/16	2.57	51	1/8	5.12	102

*** Weights are based on the minimum lining thickness for minimum pressure classes of ductile iron pipe. Actual lengths and weights may differ from above.

The standard thickness cement lining shall be used unless double thickness is recommended by the ENGINEER.

PART 3 EXECUTION – NOT USED

END OF SECTION

40 05 13.73 Plastic Process Piping

PART 1 GENERAL

1.01 Section Includes

A. This section includes a description of Plastic Pipe.

1.02 Referenced Sections - None

1.03 Cited Standards

A. All plastic process piping shall adhere to the following standards, or latest revisions of:

1. ASTM D1784 – 08 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

2. ASTM D1785 – 06 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

3. ASTM D 3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

4. AWWA C900-07, AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

5. ANSI/AWWA C905-08, AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution

6. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

1.04 Noted Restrictions – None

1.05 Quality Control – None

1.06 Submittals

A. CONTRACTOR shall submit copies of the manufacturer's product specifications according to the requirements of Section 01 33 00 entitled, "CONTRACTOR Submittals".

1.07 Deliverables – None

PART 2 PRODUCTS

2.01 Materials

A. PVC (Polyvinyl Chloride) Pressure Pipe, 8-Inches And Smaller, Solvent Welded

1. PVC pressure pipe 8-inches and smaller shall be made from all new rigid un-plasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 40, to conform to ASTM D 1785, unless otherwise shown. Elbows and tees shall be of the same material and schedule as the pipe. Unless otherwise shown, joint design shall be for solvent-welded construction. Pressure pipe shall be as specified in this article, as specified in Section 40 06 00, or shall be as follows:

2. Pipe shall meet the requirements of AWWA C900 “Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 12-Inch with maximum DR of 18.

3. Provisions must be made for expansion and contraction at each joint with an elastomeric seal.

4. The bell shall consist of an integral thickened wall section with an elastomeric seal. The wall thickness in the bell section shall conform to the requirements of Section 6.2 of ASTM D3139, “Standard Specification for Joint for Plastic Pressure Pipes Using Flexible Elastomeric Seals.”

5. When used for potable water systems, pipe shall meet the requirements of ANSI/NSF 61 “Drinking Water System Components – Health Effects.”

6. The pipe shall be manufactured to cast iron outside diameters (CIOD) in accordance with AWWA C900.

7. The seal shall meet the requirement of ASTM F477 “Standard for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.”

B. Gravity Sewer Pipe (PVC DR25 18”-24”)

1. Material: PVC compound shall meet cell class 12454 per ASTM D 1784 and shall be certified to ANSI/NSF Standard 61 for potability.

2. Pipe shall meet AWWA C905 and shall be UL listed.

3. Elastomeric Seal: Integral bell pipe shall be provided with factory-installed gaskets, which meet the requirements of ASTM F 477.

4. Gasketed Joint Assembly shall meet the requirements of ASTM D 3139.

C. Drain Waste Vent Pipe (PVC DR ½" – 8")

1. Pipe shall be schedule 40, extruded from PVC Compound having a minimum Cell Classification 12454B as defined in ASTM D 1784. Belled end shall conform to ASTM D 2672, "Joints for PVC Pipe Using Solvent Cements", and shall conform to ASTM D 2855.

D. Gravity Sewer Pipe (PVC DR25 4"-15")

1. Gravity sewer pipe and fittings shall comply with AWWA C900 or be made from polyvinyl chloride compounds which comply with the requirements for a minimum cell classification of 12364A ad defined by ASTM D-1784.

2. All pipe joints shall be of the bell and spigot type with electrometric seals and conform to the requirements of AWWA C900 or ASTM D-3212. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Gasket material shall conform to the requirements of ASTM F-477.

3. All fittings shall be fabricated from pipe meeting the requirements of these standards. Fabricated miter joints shall be reinforced by fusion heat welding.

a. There shall be no sign of flaking or disintegration when immersed in anhydrous acetone for 20 minutes as described in ASTM D-2152.

4. PVC gravity sewer pipe and fittings shall conform to ASTM D 3034.

5. Each pipe shall be identified with the name of manufacturer, nominal size, cell classification, ASTM designation F-1803, the pipe stiffness designation "PS-46" and manufacture's date code.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. All pipe, fittings, etc. shall be carefully handled and protected against damage, impact shocks and free fall. All pipe handling equipment shall be acceptable to the ENGINEER. Pipe shall not be placed directly on rough ground, but shall be supported in a manner which will protect the pipe against injury whenever stored at the work site. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the CONTRACTOR.

B. The CONTRACTOR shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Damaged pipe shall be replaced with new undamaged sections of pipe.

C. Before placement of the pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work. 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, rocks and any other debris following completion of pipe laying prior to testing, disinfecting and placing the completed pipeline in service.

D. Pipe shall be laid directly on the imported bedding material. No blocking will be permitted and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Bell holes shall be formed at the ends of the pipe to prevent joint loading at the bells or couplings.

E. Where necessary to raise or lower the pipe grade due to unforeseen obstructions or other causes, the ENGINEER may change the alignment and/or the grades. Such change shall be made by the deflection of joints or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer.

F. No pipe shall be installed upon a foundation into which frost has penetrated or any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be laid unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.

G. Immediately before jointing bell and spigot pipe, both the bell and spigot end of the pipe shall be thoroughly cleaned and lubricated with an approved vegetable-based lubricant. The spigot end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper alignment. Tilting of the pipe to insert the spigot into the bell will not be permitted.

H. Solvent-welded and heat-fused joints shall be carefully and thoroughly cleaned immediately before joining the pipe. Particular care shall be taken in making solvent-welded joints to ensure a uniform, homogeneous and complete bond.

I. Testing – None

END OF SECTION

40 05 23 Common Work Results for Process Valves

PART 1 GENERAL

1.01 Section Includes

A. Furnish and install all valves complete and in accordance to the requirements of the Contract Documents.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service.

B. Valve Types: Provide valves of same type by same manufacturer.

C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

D. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".

2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

1.06 Submittals

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve.

B. Shop DRAWINGS: Submit manufacturer's assembly-type (exploded view) shop DRAWINGS for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts list for each type of valve. Include this data, product data, and shop DRAWINGS in maintenance manual, in accordance with requirements of Division 1.

PART 2 PRODUCTS

2.01 Air Vacuum And Relief Valves

A. All air release and vacuum valves shall be so designed as to insure the release of air from a pipeline when such air is above atmospheric pressure. They shall also assure the entrance of air into the pipeline when the pressure inside the line is below atmospheric pressure. Both of these functions shall be automatically performed by the valve in conjunction with operating conditions of the pipeline.

B. Valves shall be designed for a maximum water working pressure of 300 psi, and shall have the joining of all parts so designed to withstand any stresses developed by the working pressures.

C. All materials used in the valves shall conform to *ASTM* Standards. All surfaces subject to moving contact by other surfaces, including valves seats, shall be made of corrosion resistant material and of material as durable as possible under the conditions to which the valves will be subjected.

D. The interior of the valve body shall be epoxy coated as follows:

1. A 10 mil or thicker even coat of holiday-free, high-impact, non-shattering, high-adhesive, tasteless, odorless, non-toxic epoxy resin shall be applied on all ferrous metal surfaces of the valves according to manufacturer's instructions, after irregularities, burrs and grease have been removed and immediately after sandblasting to white metal, followed by air blowing to remove dust. The epoxy resin shall be either "*Scotchcote No. 302*", "*Keysite 740*", or other approved equivalent recognized and used by the waterworks industry.

E. Air release and vacuum valves shall be capable of exhausting entrapped air in the water line under normal operating conditions at a rate of at least 1.5 cubic feet of free air per minute. Air release and vacuum valves shall be capable of venting and exhausting air into and from the line during draining and filling of the line at a rate of 10 cubic feet of free air per minute. The above functions shall be performed without water leakage.

F. Valves shall be designed so that through flow of air or water will not interfere with the designed performance of the valving mechanism.

G. The following air release and vacuum valves are acceptable: *"APCO Combination Air Release Valves", or approved equal.*

2.02 Resilient Wedge Gate Valves

A. Gate valves shall conform to the above referenced AWWA C515 (latest edition). Gate valves shall be designed for a water working pressure of 250 psi and shall be iron-bodied, bottom-wedging, double-disc with parallel seats and

shall have 2-inch square operating nut or handwheel, as shown, opening to the left. In addition, non-rising stem gate valves shall be equipped with "O" ring seals. Unless otherwise shown, gate valves shall have non-rising stems and shall be furnished with flanged ends. Gate valve shall be new and of current manufacture and shall be as manufactured by M and H Style 7561 or approved equal.

B. All interior parts of valves manufactured of bronze or brass except valve stems shall conform to the requirements of *ASTM B62*. Gate valve stems shall be of bronze, containing aluminum and having a minimum tensile strength of 60,000 psi, a yield strength of 40,000 psi and elongation of at least 100 percent in two inches, as determined from a test coupon poured from the same ladle from which the valve stems to be furnished are poured.

C. Ferrous surfaces in the water passages of valves 4-inches in diameter and larger shall be epoxy coated in accordance with Section TS-5.19 – Epoxy Coatings of these Specifications. The coating shall not be applied to stainless steel, brass or bronze surfaces.

2.03 Butterfly Valves:

A. Butterfly valves shall conform to the "*Standard for Rubber-Seated Butterfly Valves*" (*AWWA C504-latest edition*), except that butterfly valves, 24-inch and smaller, may be of the shorter laying length and the seat may be bonded into a groove in the valve body. The valves shall be of the class indicated on the DRAWINGS. Valve bodies shall be cast iron conforming to the "Specification for Gray Cast Iron Casting for Valves, Flanges and Pipe Fittings" (*ASTM A126*), *Class B*. Valve shafts shall be of *Type 304 stainless steel*, or approved equal, sleeve-type bearings and fitted at the outer end for connection to operating gearing. Ferrous surfaces in the water passages of all valves (excluding those surfaces manufactured of non-corrosive materials) shall be coated in accordance with Section *09 99 00* of these Specifications. Butterfly valves shall be *Pratt MKII or approved equal*.

B. MANUAL OPERATORS: The type of manual operator to be provided with each butterfly valve shall be as shown. Manual operation shall be through totally-enclosed, permanently-lubricated gear reducers. Gear reducers shall have a self-locking worm or spur and rack-type gearing and shall be equipped with handwheel or with a 2-inch square operating nut on the input shaft as noted on the DRAWINGS. Open and close stops shall be provided to limit valve disc travel. Handwheel operators shall be equipped with position indicators. The operators for buried butterfly valves shall be totally-enclosed, have fully-gasketed, sealed and grease-packed operator cases suitable for and expressly designed for installation and operation in a buried location. The maximum torque rating for a buried service operator shall be 8,000 inch-pounds.

2.04 Swing Check Valves:

A. Check Valves shall be all iron body, bronze mounted, full opening swing type with lever and spring. Valve clapper shall swing completely clear of the water way when valve is full open, permitting a “full flow” thru the valve equal to the nominal pipe diameter. They shall comply with AWWA Standard C-508 latest revision. Swing check valves shall be *M&H style 259 or approved equal*.

B. Check valves shall be rated at 175 psi water working pressure, 350 psi hydrostatic test for structural soundness (2”-12”) and 150 psi water working pressure, 300 psi hydrostatic test for structural soundness (14”-30”). Seat tightness at rated working pressure shall be in accordance with values shown in AWWA Standard C-500 for gate valves and fully conform to AWWA C508.

C. All cast iron shall conform to ASTM-A-126 Class B. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed.

D. Check valve clapper shall be all bronze in sizes 2” through 4” and cast iron 6” through 30”, Seat face for all sizes shall be neoprene rubber. The neoprene rubber ring shall be securely held in position by a bronze clamp ring mechanically attached to the clapper assembly.

E. Hinge pins shall be 18-8 stainless steel rotating in bronze plugs.

F. Bolts shall be electro zinc plated steel with hex heads and hex nuts in accordance with ASTM A-307 and A-563, respectively.

G. The inside and outside of all valve together with the working parts except bronze and machined surfaced shall be coated in accordance with AWWA standards.

2.05 Solenoid Valves

A. Solenoid valves shall be of the size, type, and class shown on the plans and in any case shall be designed for not less than 150 psi water working pressure. Valves for water, air, or gas service shall have brass or bronze body with screwed ends, stainless steel trim and spring, Teflon or other resilient seals with material best suited for the temperature and fluid handled. Solenoid valves in vaults shall have stainless steel bodies. For explosion proof, corrosion, special purposes, or outdoor locations NEMA Types 4, 7, 8, 9, 9E, 9F, or 9G enclosures shall be used as applicable. Vaults shall be considered a corrosive environment.

B. Approved Manufacturers

1. Automatic Switch Company (ASCO), Model "RED HAT"

2. Magnatrol Valve Corporation

3. Skinner Valve Division of Honeywell, Model "LANCER"

2.06 Ball Valves (2-Inches and Smaller)

A. Stainless Steel Ball Valves

1. Unless specifically indicated on the plans, all ball valves 2-inches in diameter and smaller shall have stainless steel bodies with PFTE seats and seals with stainless steel ball. Valves shall have a minimum working pressure rating of 1500 psi at 150°F. All valves shall have integral lock-out devices incorporated in the design.

2. Approved Manufacturers

a. Parker Model XVP502SS-32 - 1/4" - 1/2" size.

b. Parker Model VP50SS-12 - 3/4" - 2" size.

c. ENGINEER approved equal.

B. Bronze Ball Valves

1. Where specifically called for on the plans, provide bronze ball valves. Bronze ball valves, 2-inches and smaller shall be brass bodied with PFTE seats and seals with stainless steel ball. Valves shall be rated for 150 psi WWP minimum. All valves shall have integral lock-out devices incorporated into the design.

C. Approved Manufacturers

1. Parker Model XVP500P

2. ENGINEER approved equal.

D. Check Valves (2-inches and smaller)

1. Unless specifically indicated on the plans, all check valves, 2-inches and smaller shall be stainless steel swing check valves with PTFE gasket and stainless steel trim. Small swing check valves shall be rated for 150 psi WWP minimum.

2. Acceptable Manufacturers

a. Crane Model 370

b. ENGINEER approved equal.

E. Needle Valves

1. Needle valves shall be stainless steel bodied with stainless steel trim. Valve shall be Hoke Series 2200 or ENGINEER approved equal.

F. Pressure Relief Valves

1. Pressure relief valves shall be stainless steel bodied, stainless steel fitted with Teflon seals. Pressure relief valves shall be Circular Series 5100 or APCO 140 SERIES or ARI D-040 PN16 or Engineer Approved Equal Strainers.

2. Y-Type Strainers shall be stainless steel bodied with Type 304 stainless steel strainer. Strainer shall have 1/32-inch diameter perforations. Y-Type strainers shall be Yarway, Bailey, or ENGINEER approved equal.

2.07 Well Pump System Discharge (V-108) and Waste Line Control (V-109) Valves:

A. FUNCTION. The Waste Line Control Valve is fully closed to atmosphere when the well pump is off. When the well pump is started, the waste line valve begins to open for a preset time to allow the stagnant pump column and pipe water to flush out. Following the pre-set time, the Waste Line Control Valve shall be activated to start closing. As the pressure increases in the pump discharge line to match the system pressure, the System Line Valve will slowly open. The sequence reverses on pump shut down or on a power outage. The System Line Valve is fully closed when the well pump is off. The pump system discharge valve is designed for installation in water systems to control flow and pressure in the pipeline and shall be equipped with a built-in lift type check feature to prevent reverse flow. Each valve shall be equipped with a solenoid control feature to prevent reverse flow and a position indicator switch (120 volt).

B. MAIN VALVE. The Valve shall be hydraulically operated, single diaphragm actuated, globe or angle pattern. A resilient synthetic rubber disc shall have a rectangular cross section and shall be retained on three and one-half sides to assure proper gripping under extreme hydraulic conditions. The two-piece stainless steel valve stem shall be guided by three bearings located in the cover, intermediate body, and seat.

C. The main valve shall consist of two distinct operating chambers that are detachable and completely independent of the flow through the main valve body.

D. MAIN VALVE BODY. The valve shall consist of four components: the body with seat installed the intermediate body with bearing installed, the cover with bearing installed, and the diaphragm assembly. The valve body, power unit body, and cover shall be of ductile iron material. No fabrication or welding shall be used in the manufacturing process. The diaphragm assembly shall be the only moving part and shall form a seal between the two operating chambers. Packing glands and/or stuffing boxes are not permitted. There shall be no pistons operating the main valve or pilot controls. The valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal

against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one piece design capable of withstanding line shocks due to pressure surges. No hourglass-shaped disc retainers shall be permitted and no V-type disc guides shall be used.

1. Material Specification:

Main Valve Body And Cover:	Ductile Iron
Main Valve Trim:	316 Stainless Steel
End Detail:	150 Lb.
Pressure Rating:	250 Psi
Temperature Range:	+180
Rubber Material:	Buna-N Rubber & Nylon
Coating:	12 Mil Fusion Bonded Epoxy
Additional Options:	None

E. Solenoid Control System: The valves shall be controlled by an externally mounted solenoid valve.

F. PILOT CONTROL SYSTEM. The valve operation shall be controlled by an externally mounted pilot control system.

1. Material Specification for Pilot Control:

Pressure Rating	250 psi
Trim	316 Stainless Steel
Tubing and Framing	316 SS Tubing with 304 SS Fittings
Operating Fluids	Water
Additional Options	Opening and closing speed controls standard

G. LIMIT SWITCH. An adjustable limit switch assembly shall be mounted on the main valve, connected to the main valve stem. It shall be actuated by opening or closing the valve and easily adjusted to operate at any point of the valve's travel. The limit switch will be used to indicate the valve open position. The actuating point of the limit switch shall be adjustable.

H. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

I. Additional Requirements:

1. Assemble all control features and hardware on the basic valve at the factory.

2. Use 303 stainless steel or better for all external controls.

3. Include with each control valve:

   a. Stop valves (isolation ball valves).

      1) Y Pattern Strainers.
      2) Valves for opening and closing speed control.
      3) Solenoid valves.
      4) Valve limit switches.

4. Electronic components:

   a. 120V, 1 phase

J. Control Valves: shall be as manufactured by Cla-Val. The sizes shall be as shown on the DRAWINGS. The models shall be as follows for the two types of valves only:

Waste Line Control Valve (V-109)	Model 61-02
System Discharge Control Valve (V-108)	Model 61-02

2.08 Booster Pump (V-110) and extraction well (V-101) Control Valves

A. FUNCTION. The control valves is designed for installation on the discharge of pumps to eliminate starting and stopping surges caused by the pump. The valve shall be equipped with a built-in lift type check feature to prevent reverse flow, operating independently of the solenoid control. The valve shall be equipped with a solenoid control feature to prevent reverse flow and a position indicator switch (120 volt).

The pump starts against a closed valve. When the pump is started, the solenoid control is energized and the valve begins to open slowly, gradually increasing line pressure to full pumping Head. When the pump is signaled to shut-off, the solenoid control is de-energized and the valve begins to close slowly, gradually Reducing flow while the pump continues to run. When the Valve is closed, a limit switch assembly, which serves as an electrical Interlock between the valve and the pump, releases the Pump starter and the pump stops. Should a power failure occur, a built-in, lift-type check valve closes the moment flow stops, preventing reverse flow regardless of Solenoid or diaphragm assembly position.

B. MAIN VALVE. The Valve shall be hydraulically operated, single diaphragm actuated, globe or angle pattern. A resilient synthetic rubber disc shall have a rectangular cross section and shall be retained on three and one-half sides to assure proper gripping under extreme hydraulic conditions. The two-piece stainless steel valve stem shall be guided by three bearings located in the cover, intermediate body, and seat.

C. The main valve shall consist of two distinct operating chambers that are detachable and completely independent of the flow through the main valve body.

D. MAIN VALVE BODY. The valve shall consist of four components: the body with seat installed the intermediate body with bearing installed, the cover with bearing installed, and the diaphragm assembly. The valve body, power unit body, and cover shall be of ductile iron material. No fabrication or welding shall be used in the manufacturing process. The diaphragm assembly shall be the only moving part and shall form a seal between the two operating chambers. Packing glands and/or stuffing boxes are not permitted. There shall be no pistons operating the main valve or pilot controls. The valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one piece design capable of withstanding line shocks due to pressure surges. No hourglass-shaped disc retainers shall be permitted and no V-type disc guides shall be used.

1. Material Specification:

Main Valve Body And Cover:	Ductile Iron
Main Valve Trim:	316 Stainless Steel
End Detail:	150 Lb.
Pressure Rating:	250 Psi
Temperature Range:	+180
Rubber Material:	Buna-N Rubber & Nylon
Coating:	12 Mil Fusion Bonded Epoxy
Additional Options:	None

E. PILOT CONTROL SYSTEM. The valve operation shall be controlled by an externally mounted pilot control system.

1. Material Specification for Pilot Control:

Pressure Rating	250 psi
Trim	316 Stainless Steel
Tubing and Framing	316 SS Tubing with 304 SS Fittings
Operating Fluids	Water
Additional Options	Opening and closing speed controls standard

F. LIMIT SWITCH. An adjustable limit switch assembly shall be mounted on the main valve, connected to the main valve stem. It shall be actuated by opening

or closing the valve and easily adjusted to operate at any point of the valve's travel. The limit switch will be used to indicate the valve open position. The actuating point of the limit switch shall be adjustable.

G. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

H. The valve shall be ***Cla-Val Co. Model 60-11*** as shown on the DRAWINGS or approved equal. Extraction Well Pump Control Valves shall be as manufactured by Cla-Val Company, Newport Beach, California, 92659-0325.

2.09 Electronic Control Valve

A. FUNCTION. The Electronic control valve is designed for installation in water systems to control flow and may reduce pressure in the pipeline. The valve shall be equipped with an electronic control feature to prevent reverse flow and a position indicator switch (120 volt).

B. MAIN VALVE. The Valve shall be hydraulically operated, single diaphragm actuated, globe or angle pattern. A resilient synthetic rubber disc shall have a rectangular cross section and shall be retained on three and one-half sides to assure proper gripping under extreme hydraulic conditions. The two-piece stainless steel valve stem shall be guided by three bearings located in the cover, intermediate body, and seat.

C. The main valve shall consist of two distinct operating chambers that are detachable and completely independent of the flow through the main valve body.

D. MAIN VALVE BODY. The valve shall consist of four components: the body with seat installed the intermediate body with bearing installed, the cover with bearing installed, and the diaphragm assembly. The valve body, power unit body, and cover shall be of ductile iron material. No fabrication or welding shall be used in the manufacturing process. The diaphragm assembly shall be the only moving part and shall form a seal between the two operating chambers. Packing glands and/or stuffing boxes are not permitted. There shall be no pistons operating the main valve or pilot controls. The valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one piece design capable of withstanding line shocks due to pressure surges. No hourglass-shaped disc retainers shall be permitted and no V-type disc guides shall be used.

1. Material Specification:

Main Valve Body And Cover:	Ductile Iron
Main Valve Trim:	#304 Stainless Steel
End Detail:	150 Lb.
Pressure Rating:	250 Psi
Temperature Range:	+180
Rubber Material:	Buna-N Rubber & Nylon
Coating:	12 Mil Fusion Bonded Epoxy
Additional Options:	None

E. CONTROL SYSTEM. The valve operation shall be controlled by an externally mounted electronic controller that shall operate two solenoids to modulate the valve to maintain the process variable. The process variable are flow, pressure, and valve position.

1. Material Specification for Pilot Control:

Pressure Rating	250 psi
Trim	316 Stainless Steel
Tubing and Framing	Stainless Steel
Operating Fluids	Water
Additional Options	X117E 4-20 ma valve position transmitter with micro-switches Opening and closing speed controls, X141 pressure gauge on valve inlet, CV Flow Control

F. Should a power failure occur, a parallel hydraulic operated pressure reducing pilot system shall take control of the valve limiting the maximum outlet pressure. Upon restoration of the power, the valve shall automatically reverts back to the electronic mode. The check feature shall close the valve if a pressure reversal occurs in the pipeline. The hydraulic control valve pilot system shall consist of dual solenoids which alternately apply or relieve pressure to the diaphragm chamber to position the main valve. The pilot system shall have one normally closed solenoid (energized to open) and one normally open solenoid which will bring the valve closed upon a power failure. The pilot system shall also include an adjustable hydraulic pressure sustaining feature. The main valve shall also include and a X117E valve 4 to 20 ma position indicator with micro switches for open and closed signals.

G. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

H. The valve shall be ***Cla-Val Co. Model 131-CW*** as shown on the DRAWINGS or approved equal. Electronic Control Valve with Pressure Reducing Feature, Hydraulically Operated Valves shall be as manufactured by Cla-Val Company, Newport Beach, California, 92659-0325.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. General

1. Except as otherwise indicated, comply with the following requirements:

a. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

b. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane.

2. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

3. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections.

a. Pipe Size 2" and Smaller: One of the following, at Installer's option:

1) Threaded valves.
2) Flanged valves.

b. Pipe Size 2-1/2" and Larger:

1) Flanged valves.
2) Grooved joint valves.

4. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

5. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

B. Adjusting And Cleaning:

1. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

2. Valve Identification: Tag each valve in accordance with Division-15 section "Mechanical Identification".

C. Valve Installation:

1. Locate all valves in locations which will allow easy operation and facilitates maintenance.

2. Provide chain operators for any valves located more than 8 feet above finished floor. This means double acting lever handles for quarter turn valves, or chain wheels for multi-turn valves. Arrange valves and set up chain length for proper operation.

3.01 Testing – None

END OF SECTION

40 05 29 Hangers and Supports for Process Piping Systems

PART 1 GENERAL

1.01 Section Includes

A. This section includes materials and installation of pipe hangers and supports including accessory items, such as anchor bolts and screws and neoprene isolation pads.

1.02 Referenced Sections – None

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control – None

1.06 Submittals

A. Submit shop DRAWINGS in accordance with Section 01 33 00.

B. Provide line DRAWINGS of each typical piping system to the scale shown on the DRAWINGS, locating each support or hanger. Identify each type of hanger or support by the manufacturer's catalog number or figure.

C. Provide installation DRAWINGS and manufacturer's catalog information on each type of hanger and support used.

PART 2 PRODUCTS

2.01 Materials

A. Design Criteria

1. No attempt has been made to show or detail in the DRAWINGS every pipe support or hanger required. Provide pipe supports for every piping system installed.

2. Pipe support and hanger components shall withstand the dead loads imposed by the weight of the pipes filled with water and shall have a minimum safety factor of five based on material ultimate strength.

B. Hanger and Support Systems

1. Pipe hangers and supports shall comply with MSS SP-58 for the standard types referenced on the DRAWINGS. Construct special hangers and supports as detailed on the DRAWINGS. Type numbers for standard hangers and supports shall be in accordance with MSS SP-58 as listed below:

Type/ Number	Description	Manufacturer and Model Recommended
1	Adjustable steel clevis	Grinnell Fig. 590 or 260, Kin-Line 455, or 12C
3	Steel double-bolt pipe	Kin-Line 473, Grinnell clamp Fig. 295A or 295H
5	Pipe hanger	Kin-Line 450
7	Adjustable steel band	Grinnell Fig. 269, hanger Atlanta Engineering Fig. 22
8	Extension pipe or riser	Grinnell Fig. 261, clamp Atlanta Engineering Fig. 39
9	Adjustable band hanger	Grinnell Fig. 97
10	Adjustable swivel ring	Grinnell Fig. 70 band hanger
13	Steel turnbuckle	Grinnel Fig. 230
14	Steel clevis	Grinnell Fig. 299
15	Swivel turnbuckle	Grinnell Fig. 114
18	Steel or malleable iron	Grinnell Fig. 281, concrete insert Superstrut 452
24	U-bolt	Grinnell Fig. 137, Kin-Line 437
26	Clip	Grinnell Fig. 262, Kin-Line 477
31	Light welded steel	Grinnell Fig. 194
32	Medium welded steel	Grinnell Fig. 195 bracket
33	Heavy welded steel	Grinnell Fig. 199 bracket
36	Pipe saddle support	Grinnell Fig. 258
37	Pipe stanchion saddle	Grinnell Fig. 259, Kin-Line 467
38	Adjustable pipe saddle	Grinnel Fig. 264, support Atlanta Engineering Fig. 308

2. Pipe hangers and supports shall be hot-dipped galvanized per ASTM A 153 carbon steel (ASTM A 36, A 575, or A 576). Bases, rollers, and anchors shall be steel as described above or may be cast iron (ASTM A 48). Pipe clamps shall be steel as described above or may be malleable iron (ASTM A 47).

3. Pipe hangers and supports shall be as manufactured by Grinnell, Kin-Line, Unistrut, Superstrut, or equal.

C. Offset Pipe Clamp

1. Grinnell Figure 103, or equal. Material shall be Type 316 stainless steel.

D. Anchor Bolts and Screws

1. Anchor bolts and screws for attaching pipe supports and hangers to walls, floors, ceilings, and roof beams shall be Type 316 stainless steel, ASTM A 276. Nuts shall be type 316 stainless steel, ASTM A 194, Grade 8M, or ASTM F 594, Type 316 stainless steel.

E. Neoprene Isolating Sleeves for Metal Pipe 2 Inches and Smaller

1. Unistrut P2600, Kin-Line 418 and 419, or equal.

PART 3 EXECUTION

3.01 Preparation

A. Pipe Hanger and Wall Support Spacing

1. Install pipe hangers and wall supports on horizontal and vertical runs at the spacing shown or detailed on the DRAWINGS. Provide hanger rods (for horizontal runs) and wall supports of the sizes shown or detailed on the DRAWINGS. If no spacing or rod sizes are given in the DRAWINGS or in the specifications for a particular piping system, use the following:

2. Pipe Hanger and Wall Support Spacing for Steel Pipe:

3. Pipe Hanger or Wall Support Spacing for PVC Pipe

Max. Support Pipe Size (in)	**Min. Rod or Hanger Spacing (ft)**	**Size (in)**
3/8 and smaller	4	3/8
1/2 through 1	6	3/8
1-1/4 through 2	8	3/8
2-1/2 and 3	10	1/2
3-1/2 and 4	10	5/8
6	12	3/4
8	12	7/8
10 and 12	14	7/8
14 and 16	16	1
18	15	1
20 through 24	9	1
30	6	1
Max. Support Pipe Size (in)	**Min. Rod or Hanger Spacing (ft)**	**Size (in)**
3/4	4	3/8
1	4	3/8
1 1/2	5	3/8
2	5	3/8
2 1/2	5	1/2
3 through 6	6	1/2

4. Provide sway bracing for hangers where detailed on the DRAWINGS. If no bracing is detailed, provide bracing at 10-foot-maximum center-to-center intervals.

B. Pipe Support Spacing for Supports on Top of Slabs or Grade

1. Install pipe supports on horizontal runs at the spacing shown or detailed on the DRAWINGS. Provide supports of the type shown or detailed on the DRAWINGS. If no spacing requirements are given on the DRAWINGS or in the specifications for a particular piping system, use the following:

2. Pipe Support Spacing for Steel Pipe:

Pipe Size (in)	**Maximum Support Spacing (ft)**
3/8 and smaller	4
1/2 through 1	6
1-1/4 through 2	8
2-1/2 and 3	10
3-1/2 and 4	10
6	12
8	12
10 and 12	14
14 and 16	16
18	16
20 through 24	18
30	18

3. Pipe support spacing for other pipe materials shall be the same as described above in Section A.

3.02 Installation

A. Installing Pipe Hangers and Supports

1. Provide separate hangers and supports at valves. Provide one hanger or support around each end of the valve body or on the adjacent connecting pipe within one pipe diameter of the valve end.

2. Provide separate hangers and supports at each pipe elbow, tee, or fitting. Provide separate hangers and supports on both sides of each non-rigid joint or flexible pipe coupling.

3. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, and other equipment to which the pipe is connected.

4. Use 1-5/8-inch-high channel frames unless 3-1/4-inch is needed to provide clearance from walls. Use multiple back-to-back channels if additional clearance is needed.

B. Installing Neoprene Isolating Sleeves

1. Install a sleeve around each metal pipe 2 inches and smaller at the point of bearing or contact with the pipe hanger or support.

C. Painting and Coating

1. Paint exposed nongalvanized pipe hangers and supports to match the color of the adjacent wall per Section 09 99 00. Coat galvanized pipe supports per Section 09 99 00. Color of finish coat shall match adjacent piping. If the adjacent wall is not painted, paint the hangers and supports to match color code of the largest pipe on the support.

3.03 Testing – None

END OF SECTION

40 06 00 SCHEDULES FOR PROCESS INTEGRATION - NOT USED

END OF SECTION

DIVISION: 40 PROCESS INTEGRATION
SECTION 40 90 00 – INSTRUMENTS AND CONTROLS FOR PROCESS SYSTEMS

PART 1 GENERAL

1.01 Section Includes

A. This section covers the general requirements for furnishing all instrumentation; control and monitoring (ICM) systems complete in every detail for the purposes specified. Other parts of this section shall supplement this section as necessary.

B. The intent of this section is to require that the complete Instrumentation, Control and Monitoring System, including all parts of this section, i.e., primary elements, panel mounted and miscellaneous field instruments, etc. shall be furnished by a single ICM System Supplier to assure system uniformity, subsystem compatibility and coordination of all system interfaces. Deviations shall be considered in special circumstances but must be approved by the ENGINEER.

C. The CONTRACTOR shall furnish all equipment, materials, supplies and special tools required for proper installation of the ICM system. The CONTRACTOR shall provide all supervision and coordination required by the electrical CONTRACTOR to insure conduit runs, signal and power wiring is consistent with the requirements of all equipment that is specified in this section and as shown on the DRAWINGS. The CONTRACTOR shall perform all operational testing of individual systems and the complete start-up of the system as indicated on the DRAWINGS and as specified herein.

D. The CONTRACTOR shall provide all the necessary equipment components and interconnections and the services of the manufacturers' Engineering representatives for the Engineering, implementation, start-up, operation and instruction, to ensure that the OWNER receives a completely integrated and operational ICM as herein specified.

1.02 Referenced Sections

A. Related Sections are shown below.

1. DIVISION 26 – ELECTRICAL

2. DIVISION 27 - COMMUNICATIONS

1.03 Cited Standards – none

1.04 Noted Restrictions

A. System Responsibility

1. The CONTRACTOR's attention is directed to the fact that the ICM system as specified in this section is an integrated system and therefore shall be provided by a single competent, qualified instrumentation system supplier (ICM system supplier), who shall have total responsibility for the work of this section. Entire system including calibration, validation, start-up, operation testing and training shall be performed by qualified personnel, possessing all the necessary equipment and who have had experience performing similar work. The ICM system shall be integrated using the latest, most modern proven design and shall, as far as practical, be of one manufacturer. Overall system performance shall be guaranteed by the specified ICM system supplier.

2. The CONTRACTOR shall select the system supplier to perform the work under this section. The qualified ICM system supplier shall perform said work but it shall be understood that this shall not relieve the CONTRACTOR from any responsibility under the Contract. Although many references made herein are to work requirements and responsibilities of the ICM system supplier such references shall only mean that responsibility shall pass through the ICM system supplier but in the final analysis shall rest with the CONTRACTOR.

3. The ICM system supplier shall be responsible for the correct installation for all hardware and systems specified in this Section. Certain Primary Elements, Final Control Elements, etc., although provided as a part of this Section, shall be installed in the process lines under other sections of these Specifications; however, this installation shall be under the direct supervision of the ICM CONTRACTOR.

4. The ICM system supplier shall be responsible to see that all components of the instrumentation system, including primary measuring, indicating, transmitting, receiving, recording, totalizing, controlling and alarming devices and all appurtenances, are completely compatible and shall function as outlined, and he shall furnish such additional equipment, accessories, etc. as are necessary to meet these objectives at no additional cost to the OWNER.

B. ICM System Supplier

1. Due to the critical and complex technical requirements of this section, the complete control system shall be furnished by a single supplier who shall assume responsibility for the satisfactory performance of the complete system. Only those suppliers who can demonstrate that they possess the prerequisite capabilities and experience will be considered. Any supplier wishing to qualify must apply in writing to the

ENGINEER a minimum of 21 days prior to the bid opening date. Each applicant will be thoroughly examined, investigated and then judged as to capability to execute the Scope of Work required on this project within the time frame allotted. If a perspective ICM supplier is not notified prior to the 7-day period before bid opening, he is not approved. Each applicant and planholders will be notified as to any changes in the pre-qualified list at least 7 days prior to the scheduled bid opening. No additional ICM's will be added within 7 days prior to bid opening. Each applicant will be evaluated for the following minimum criteria:

2. Demonstrate the company's ability to successfully complete projects of similar size and nature. Provide references (including contact name and telephone number) for at least three projects where the following tasks were performed by personnel directly employed by your firm as a system supplier, system Engineering and documentation including panel assembly, schematics, and wiring diagrams, software configuration and documentation; field testing, calibration and start-up, and operating instructions and maintenance training.

3. Name the individual persons who will be responsible for office Engineering and project management, software configuration, field-testing, calibration and start-up, and operator instruction and maintenance training. References called for in the previous item shall include recent projects of these individual persons.

4. Document that the company is actively in the business of furnishing integrated instrumentation, telemetry, control and electrical equipment for the water and wastewater industries.

5. Have a qualified service facility with permanent employees located within 100 miles of the job site. Facility to include all tools, spare parts and test equipment to repair, calibrate, test and start-up the equipment to be provided on this contract.

C. Certification By System Supplier

1. At the time of quoting on this contract and prior to bid opening, the prospective system supplier shall execute and submit a written certification of intent to assume full responsibility for the complete requirements of the Contract Documents. A signed copy thereof shall be supplied to each prospective CONTRACTOR for inclusion by him with his Bidding Documents. Failure by a bidding system supplier to provide this written certification shall be treated by the CONTRACTOR as NO BID and that system supplier will not be

acceptable. The CONTRACTOR shall include with his proposal the certification, required above, only for the system supplier for whom he has inserted a price in the Bidding Documents. The certification shall be on the named system supplier's letterhead, it shall be signed by his authorized responsible representative, and it shall include the following statements:

2. (Corporate name of system supplier) hereby certifies intent to assume and execute full responsibility to select, furnish, supervise installation and connection, test and calibrate, place into operation all specified instrumentation, equipment and all assemblies, components, and accessories needed to place into service complete operating instrumentation and control system all in full compliance with the requirements of the Contract Documents.

3. In addition, it is certified that DRAWINGS and data will be prepared and submitted, specified field services will be performed by qualified personnel, the OWNER'S operating and maintenance personnel will be instructed, and technical manuals will be prepared and submitted.

4. Finally, it is certified that the quotation offered provides for full and complete compliance with the requirements of the Contract Documents without exception.

D. Job Conditions

1. DRAWINGS are diagrammatic and show the intended arrangement for system operation, piping and appurtenances. Conform to DRAWINGS as closely as possible and exercise case (1) to secure neat arrangement of piping, valves, conduit and like items, and (2) to overcome structural interferences. Verify dimensions and conditions at the place of work, so that all materials and equipment can be installed in the available spaces.

E. Guarantee And Warranties

1. The CONTRACTOR shall guarantee all work of in accordance with the General Conditions and Divisions 26 and 27. With respect to instruments and equipment, guarantee shall cover (1) faulty or inadequate design; (b) improper assembly or erection; (c) defective workmanship or materials; and (d) leakage, breakage or other failure not caused by OWNER misuse. For equipment bearing a manufacturer's warranty in excess of one year, furnish a copy of the warranty to OWNER with OWNER named as beneficiary.

1.05 Quality Control

A. Qualification and Manufacturers

1. The ICM system supplier shall be a recognized supplier of primary elements, panel and field instruments, panels, etc., of the general type specified herein and shall have been regularly engaged in providing this equipment on a single system responsibility basis for municipal water and wastewater treatment processes.

2. Also, the personnel employed for system Engineering, supervision, start-up, operational testing and training shall be regularly employed and factory trained by the ICM system supplier. Actual installation may or may not be performed by the ICM system supplier employees but the ICM system supplier shall be responsible for the technical supervision of the installation to ensure that it is proper in all respects.

B. Standard of Quality

1. Furnish equipment of the types and sizes specified which has been demonstrated to operate successfully. Wherever on the DRAWINGS and in these Specifications, materials or equipment have been specified by using the name of products or manufacturers, no substitutes will be allowed. Material or equipment, so specified, has been selected as being most suitable.

2. The order of listed manufacturers shall not be construed as a preference or order of quality. Where the manufacturer's listed are followed by "or equal", the burden of proof of equivalency in quality and performance shall rest with the ICM system supplier and shall require the ENGINEER's approval. The procedure for submission of products for approval as equivalent shall be as specified under submittals below. All electrical equipment and materials, including their installation, shall conform to Division 16 unless specified otherwise in this Section.

C. Factory Inspection

1. ENGINEER may inspect fabricated equipment at the factory. Notify ENGINEER in sufficient time so that factory inspection can be arranged. Factory inspection shall be made after manufacturer has performed satisfactory checks, adjustments, tests and operations. Approval of equipment at the factory only allows the manufacturer to ship the equipment to the site, and does not constitute final acceptance by OWNER. The ENGINEER shall indicate on return of the approval submittal each item requiring factory inspection. Lack of such

indication by the ENGINEER shall constitute a waiver of factory inspection.

D. Coordination with Electrical

1. Conduits and wire for instrumentation are supplied under Division 26. Prior to installation of any instrumentation conduit, verify conduit size and conduit runs with the electrical CONTRACTOR. Notify the ENGINEER of any conflicts or deviations prior to installation.

E. DRAWINGS

1. Information on the DRAWINGS: The following information relative to the work of this Section is indicated on the DRAWINGS.

   a. Location of all primary elements, control panels and final control elements.

   b. Location of instrumentation power junction boxes for instrument electrical power connection.

   c. Location of all equipment having alarm and equipment status contacts.

   d. General control room and control panel layouts.

2. Information Not Shown on the DRAWINGS. The following information relative to the work of the division may differ from the DRAWINGS, but shall be the responsibility of the ICM system supplier to determine, furnish and coordinate with the applicable other divisions, based on the system specified.

   a. Coordinate with electrical the actual number and size of conduit runs and tubing for power between instrument power junction boxes, signal conduit stub-outs, main headers and control panels, field mounted primary elements, field instruments and final control elements.

   b. Number or sizes of conductors or tubing required for all electric, pneumatic and hydraulic signals, if required.

   c. Point of connection to any hydraulic or pneumatic supply lines.

   d. Detailed control panel layouts.

1.06 Submittals

A. Shop DRAWINGS shall be submitted in accordance with Section 01 33 00 Specifications and per the following:

1. Before proceeding with any manufacturing, submit Shop DRAWINGS for review in complete bound sets indexed by specification number. Describe the items being submitted. Manufacturer's specification or data sheets shall be clearly marked to delineate the options or styles to be furnished. Submit only complete systems, not pieces of equipment from various systems. Show dimensions, physical configurations, methods of connecting instruments together, mounting details, and wiring schematics. Schematics shall be complete with tag numbers. Submit fabrication, nameplate legends, and control panel internal wiring and piping schematic DRAWINGS clearly showing all equipment and tag numbers on all panels. Submit panel graphic DRAWINGS where applicable. Include material specifications lists where applicable.

2. Submit an "Equipment Specification Data" form for each item of equipment which shall summarize the specification features as called for in these Specifications and include such other necessary data as would provide a complete and adequate specification for reordering an exact duplicate of the original item from the manufacturer at some future date.

3. The assigned tag numbers and manufacturer's part numbers shall be included but will not be considered as a substitute for any of the required statement of specifications. More than one tag numbered item may be included on a sheet.

B. Record DRAWINGS

1. Process and Instrumentation Diagrams: Prepare and submit "Record" process and instrumentation diagrams for all work included.

2. Without limiting the generality of other requirements of these Specifications, arrange for the submittal, by the Subcontractor, of a reproducible mylar of complete schematics and wiring diagrams or DRAWINGS to include all installed field and panel conduit and piping/tubing runs and routing, tray systems, supports, mounting details, point to point diagrams with a cable, wire, tube and termination numbers. DRAWINGS shall be a record of work as actually constructed and shall be labeled as "Record."

C. Instruction Manuals

1. Furnish ten (10) sets of Instruction Manuals and Parts Lists for instrumentation equipment. Obtain data from manufacturers, and format and bind as specified. Obtain distribution method instructions from ENGINEER.

2. Schedule: Deliver copies of manuals not later than the equipment shipment date.

3. Contents: Include in manuals not less than the following information, as applicable, for each instrument, equipment, subsystem and/or control loop.

    a. General, introduction and overall description, purpose, functions, simplified theory of operations, etc.

    b. Specifications (including equipment specification data sheet as described above under Shop DRAWINGS).

    c. Installation instructions, procedures, sequences, tolerances and precautions.

    d. Operational procedures.

    e. Shut-down procedures.

    f. Maintenance, calibration and repair instructions.

    g. Parts list and spare parts recommendations.

4. Format

    a. Use DRAWINGS and pictorials to illustrate the text to the extent necessary to ensure 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. Control loop and/or subsystem operational descriptions shall identify the function of each instrument and its reaction to the other instruments in the loop.

5. Binding

a. 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.

D. Accessory and Maintenance Materials: Furnish the following items as specified herein. Deliver to ENGINEER, as directed, with itemized list in a letter of transmittal accompanying each shipment.

1. Special Tools and Accessories

a. Furnish special tools, instruments and accessories for maintaining instruments and equipment requiring periodic repair and adjustment as specified elsewhere herein, including, 1 – 4-20ma loop calibrator (Transcat #4353E), and accessories(laptop interface is #1784 PCMC) to interface laptop computer with Allen-Bradley SLC 503/504 PLC. Also, furnish special lifting and handling devices for equipment requiring such devices.

2. Maintenance Materials and Spare Parts: Deliver in manufacturer's original containers labeled to completely describe contents and equipment for which it is furnished. Spare parts shall consist of the following basic items:

a. One (1) minimum of each type of plug-in, etched or printed circuit board assembly. Provide five (5) percent spare for boards in multiple use.

b. Two (2) of each type switch used.

c. Ten (10) percent but not less than six (6) of each type light bulb and fuse used.

d. Minimum of one (1) year supply of expendable items, such as charts, ink, ribbons, etc.

3. Storage

a. When shown on the DRAWINGS, provide local lockable storage cabinet(s) of sufficient size to contain all of the required spare parts and maintenance equipment. Cabinets shall be of the size and type as shown on the DRAWINGS, or if not shown, may be incorporated as lockable section of control panels.

E. ICM System Supplier Certified Reports: The ICM system supplier shall submit written report for each control panel and associated field instruments certifying that (1) the equipment had been properly coordinated and installed under his supervision, (2) the equipment is in accurate calibration, (3) he was present when the equipment was placed in operation, (4) he has checked, inspected, calibrated and adjusted the equipment as necessary, (5) has been operated under maximum power variation conditions and operated satisfactorily, and (6) is fully covered under the terms of the guarantee.

F. Demonstration and Final Operation Test Plans and Results: Submit for approval, a written plan for demonstrating that each system of equipment meets the specified operational requirements. Submit a written plan for procedures to be used in final operation testing of entire systems including a description for each system of test methods and materials, testing all instruments, a list of the equipment involved with the functional parameters to be recorded on each item, and shop DRAWINGS of required temporary by-passes and like facilities. Submit three copies of test results and records for all final operation tests.

1.07 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, which could degrade the equipment.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repair any damage as directed and approved.

PART 2 PRODUCTS

2.01 General

A. Provide instruments, equipment and materials suitable for service conditions and meeting standard specifications such as ANI, ASTI, IA and SAGA. The intent of this specification is to secure instruments and equipment of a uniform quality and manufacture throughout the plant; i.e., all instruments in the plant,

supplied by the ICM system supplier, of the same type shall be by the same manufacturer. This allows the stocking of the minimum number of spare parts.

B. Mountings

1. Mount and install equipment as indicated. Where not shown, mount field instruments according to best standard practice on pipe mounts, pedestal mounts, or other similar means in accordance with supplier's recommendation. Where mounted in control panels, mount according to requirements of that section.

2. Equipment specified for field mounting shall be suitable for direct pipe mounting, pedestal mounting, or surface mounting and non in-line indicators and equipment with calibration adjustments or requiring periodic inspection shall be mounted not lower than three (3) feet nor higher than five (5) feet above walkways, platforms, catwalks, etc. All such equipment shall be weather and splash proof, and electrical equipment shall be in NEMA 4 cases. If mounted in a designated hazardous area, the equipment shall be explosion proof or rated intrinsically safe, whether so specified herein or not.

C. Instrument Identification

1. All major instrumentation and equipment items or systems specified in this section are identified by system and tag numbers. This same number appears in the tag number designations on the DRAWINGS and on the schedules of these Specifications. All instrumentation and equipment shall be identified by nameplates or tags. Nameplates for panels and panel mounted equipment shall be as specified in the section for Panels and Control Room Hardware. Field equipment shall be tagged with assigned instrumentation tag number. Tags shall be laminated plastic and shall be positioned and lined up to provide a neat appearance. They shall be attached to the cleaned metal surfaces with 316 stainless steel screws. For field panels or large equipment cases use stainless steel screws. For field panels or large equipment cases use stainless steel screws; however, such permanent attachment shall not be on an ordinarily replaceable part. In all cases the tag shall be plainly visible to a standing observer. In addition to tags, field mounted control stations shall have a nameplate indicating their function and the variable controlled. Nameplate shall be attached by one of the above methods.

2.02 Electronic Equipment

A. If the equipment is electronic in nature, provide solid-state equipment to the extent practicable. Select components of construction for their suitability and reliability. Employ adequate components derating to preclude failures because of transients and momentary overloads reasonably expected in normal operation. Design units or operation without forced cooling, unless such cooling is an integral part of the device.

B. All equipment shall be rated for normal operating performance with varying operating conditions over the following minimum ranges:

1. Power

a. Electrical: 120 volts AC ±10%, 60 Hz ±1 Hz except where specifically stated otherwise on the DRAWINGS or in the Specifications.

2. Field Instruments

Outdoor Areas	
Ambient Temperature:	-15°F to +120°F
Ambient Relative Humidity:	5% to 100%
Weather:	Rain, sleet, snow and ice
Provide, as necessary, enclosures, sunshields, thermostatically controlled heaters, etc., to assure normal operations under these conditions.	

Indoor Unheated Areas	
Ambient Temperature:	-15°F to 120°F
Ambient Relative Humidity:	5% to 100%
Indoor Environmentally Controlled Areas:	
Ambient Temperature:	40° to 90°F

C. Power Supplies

1. Provide two 24vdc power supplies per control panel for operation on 120 volts, 60 Hz current. This requirement is to prevent total loss of control because of the failure of a common DC power supply. The ICM system supplier shall install dual DC power supplies in each panel with automatic failure detection and annunciation and switch over without loss of control functions. These dual power supplies shall be totally independent with all solid-state rectifiers, regulators, failure sensing, and output switching. Source of operating power shall be 120

volts, 60 Hz commercial/UPS power. Units shall be din rail mounted within the control panels. All power supplies to have screw type connection. No soldering required to remove/replace. Power supplies to be Power One LWN 250 watt 24VDC or approved equal.

D. Signal Isolators, Converters and Conditioners

1. Ensure that input-output signals of all instruments and control devices are compatible. Unless otherwise specified, signals between field and panels shall be 4 to 20 ma DC unless specifically approved otherwise. Granting such approval does not relieve the ICM system supplier from the compatibility requirement above. Provide signal isolators and converters as necessary to obtain the required system performance. Mount the devices behind control panels or in the field at point of application. Provide items as manufactured by AGM Electronics, Action Instruments, or equal.

2.03 Auxiliary Contacts by Others

A. Provide instruments and equipment to connect to auxiliary contacts provided by others for alarms, status of equipment, interlocking, and other functions as indicated and as specified herein.

2.04 Painting

A. Provide factory paint for all instruments and equipment except where in pipelines. Provide paint as required for structural supports, brackets, etc.

2.05 Electrical

A. The construction work shall include all the power supply wiring, instrumentation wiring, interconnecting wiring and equipment grounding as indicated, specified and required and not specifically included under Divisions 26 and 27.

B. Wiring installations shall include cables, conductors, terminals connectors, wire markers, and all other required materials not specifically included in other Sections. For wiring materials, refer to Division 16 and details on the electrical DRAWINGS.

C. Provide the materials and complete all the required installations for equipment grounding as specified in Division 26 of these Specifications and conforming to the National Electric Code (NEC) and the manufacturer’s requirements, and as indicated on the electrical DRAWINGS.

D. Incidental items not included in the Contract Documents, that can legitimately

and reasonably be inferred to belong in the instrumentation work shall be provided by the ICM system supplier.

E. Field Wiring: Provide 18 gauge or larger stranded cable for multiple conductors for instrument signal wiring of low voltage service. Provide shielded conductors where necessary for proper performance and operation of equipment. Use insulation rated for intended service. Ring out signal wiring prior to termination. Provide wire number tags per Section 16-3.7 for each termination. Provide pre-insulated crimp-on connectors for wire terminations and splices. Use ratchet type crimping tool, which does not release until proper crimp pressure has been applied. All alarm and status signals shall be 28 volt DC maximum.

F. Programmable Controller Connections

1. Provide relays with isolated contacts at the field instruments for inputs/outputs to the programmable controller. Refer to the DRAWINGS for inputs to the programmable controller.

G. Schedules

1. Schedules, where required, are attached in the following sections. The schedules shall not be construed as a Bill of Materials. Refer to the DRAWINGS and Specifications for the scope of work.

H. Uninterruptible Power Supply (UPS)

1. The uninterruptible power system shall be supplied to provide a constant AC power source to the PLC and associated control items (see plans). Input voltage shall be 120v plus or minus 10% nominal with switch to inverter at 96 vac. The transfer to commercial (line) power will occur at 101 vac. Maximum allowable transfer time is 4 milliseconds. Units shall include current limiting for overload protection. Maximum allowable harmonic distortion is 7%. Battery supply shall be sealed lead acid type and the battery charger shall be an integral part of the UPS. The UPS shall be a double conversion type. The power rating of the UPS shall be 1500 VA/1050W minimum. The UPS shall have a set of isolated contacts for “on battery power” and “common alarm”. Provide isolated relay outputs for: UPS on bypass, UPS trouble, and UPS low battery. Units shall be Toshiba series 1000 no or equal.

2.06 Radio Communications

A. The following equipment shall be provided, installed, tested and made functionally ready by the CONTRACTOR for the OWNER’S use:

1. Radio: Data Linc Ethernet Radio Modem (with 6 to 28 Volt DC power supply) Catalog # SRM-6210E

2. Lightning suppression device: Polyphaser

3. Cable: LMR 400 coaxial cable (provide adequate length with no splices), LMR 240 (3' loop at radio with coupling to LMR 400)

4. Antenna: Data Linc 5db gain Omni-Directional Remote Mount Radio Antenna ANXFG9023

2.07 Structural Steel Fabrications

A. Design all fabrications for dynamic and vibratory loadings. Use structural steel shapes conforming to ASTI A36, A440, A500, A501, A570, A618 or equal, as applicable. Conform welding to AWS D2.0 Code. Galvanize specific items in accordance with ASTI A123 or A336 as applicable; use galvanized bolts and fasteners with galvanized assemblies. Use minimum 1/4" thickness for steel entirely or partially submerged during equipment operation. Submit design calculations showing adequate structural integrity for the intended purpose.

PART 3 EXECUTION

3.01 Preparation

A. Inspect each instrument and piece of equipment for damage, defects, completeness, and for installation of instruments and equipment.

3.02 Installation

A. Manufacturers' Installation and Supervision

1. Furnish the services of authorized factory personnel especially trained and experienced in the installation of the equipment to: (1) supervise the installation in accordance with the approved Instruction Manual; (2) be present when the instruments and equipment are first put into operation; (3) inspect, check, adjust as necessary and approve the installation; (4) calibrate the instruments, in accordance with the Specifications herein, until all trouble or defects are corrected and the installation and operation are acceptable; and (5) prepare and submit the specified Manufacturers' Certified Report. Include all costs for representative's services in the Contract Price.

B. Instrument Calibration

1. Provide the services of factory trained instrumentation technicians, tools and equipment to field calibrate each instrument to its specified accuracy in accordance with the manufacturer's specifications and instructions for calibration. Each instrument shall be calibrated at 0 percent, at 50 percent and 100 percent 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 shall have accuracies traceable to the National Bureau of Standards, as applicable. Provide a written report to the ENGINEER on each instrument certifying that it has been calibrated to its published specified accuracy. This report shall include a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerances, defects noted, correction action required, and correction made. The range of the instrument and final system settings shall be clearly highlighted in the field calibration list.

C. System Validation

1. Provide the services of factory trained and field experienced instrumentation ENGINEER(s) to validate each instrumentation system to verify that each system is operational and performing its intended function within system tolerance. System tolerance is defined as the root-mean-square sum of the system component published specified accuracies from input to output. Validate each system by simulating inputs at the first element in look (i.e., sensor) of 0 percent, 50 percent and 100 percent of span, or on/off and verifying look output devices (i.e., recorder, indicator, alarm, etc., except controllers). During system validation, make provisional settings on levels, alarms, etc. 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.

2. Cause malfunctions to sound alarms or switch to standby to check system operation. Check all systems thoroughly for correct operation. Test equipment for this function shall be as specified under "Instrument Calibration."

3. Immediately correct all defects and malfunctions disclosed by tests. Use new parts and materials as required and approved and retest. Provide a report certifying completion of validation of each instrument system. This report shall indicate calculated system tolerances,

verification that system meets these tolerances, and any provisional setting made to devices.

D. Final Operational Testing and Acceptance

1. Upon completion of instrument calibration and system validation, test all systems under process conditions. The intent of this test is to demonstrate and verify the operational inter-relationship of the instrumentation systems. This testing shall include, but not be limited to, taking process variables to their limits (simulated or process) to verify all alarms, failure interlocks, and operational interlocks between systems and/or mechanical equipment.

2. Immediately correct defects and malfunctions with approved methods and materials in each case and repeat the testing. Upon completion of final operational testing; submit certified report indicating that total ICM system meets all the functional requirements specified herein. The ENGINEER shall countersign this report and it shall constitute final acceptance of the ICM system.

3. Testing shall be observed by the ENGINEER. Notify the ENGINEER in writing a minimum of 48 hours supplier shall begin or have begun plant start-up.

E. Start-up Assistance

1. Provide the services of a factory trained and field experienced instrumentation Engineering to assist OWNER’S personnel during start-up of the plant process. Purpose of this assistance is to support in making final adjustments of settings on the instrument systems.

F. Instruction of OWNER’S Personnel

1. Provide the services of a factory trained and field experienced instrumentation ENGINEER to conduct group training of OWNER’S designated personnel in the operation of each instrument system. This training shall be for the time period of 2 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 system descriptions (Section 19-11) and operation and maintenance manuals furnished under these Specifications.

3.03 Testing

A. Verify, at the factory, wiring continuity and verify panel operation by

simulated inputs and outputs. Provide a report certifying the control panels are operable and meet the requirements of these specifications.

END OF SECTION

DIVISION 40: PROCESS INTEGRATION

SECTION 40 91 00 - PRIMARY PROCESS MEASUREMENT DEVICES

40 91 13 CHEMICAL PROPERTIES PROCESS MEASUREMENT DEVICES

40 91 13.16 Chlorine Process Measurement Devices (Residual Analyzers)

PART 1 GENERAL

1.1 Section includes

A. Chlorine Analyzer for monitoring total residual chlorine.

1.2 Submittals

Complete installation, operation and maintenance, and installation instructions shall be furnished as specified in Section 01 33 00. Installation of equipment shall not begin until specified manuals and instructions have been supplied and approved by the Owner. Shop Drawings and O&M Manuals shall be submitted in accordance with Section 01 33 00.

1.3 System Description

A. The chlorine analyzer shall employ a DPD colorimetric method of measurement using DPD indicator and a buffer solution.

B. The analyzer shall be capable of measure free or total residual chlorine by changing the indicator and buffer solutions.

C. A measurement shall be taken every 2.5 minutes and results displayed by a three digit LCD readout in the range of 0 to 5 mg/L.

D. The analyzer shall be designed for 30-days unattended operation and use only 473 mL of each reagent per month.

E. The analyzer shall operate with an LED light source with a peak wavelength of 510 nm.

F. The instrument shall measure a sample blank before each sample measurement to provide automatic zero reference to compensate for sample color and turbidity and changes in light intensity due to voltage fluctuations or light source aging.

G. The instrument shall provide a minimum detection limit of 0.03 mg/L or better, precision better than ±5% or 0.005 mg/l as Cl_2, and accuracy better than ±5% or 0.03 mg/L as Cl_2.

H. The analyzer shall be microprocessor-controlled and provide a 4-20 mA recorder output as well as 2 alarms.

I. Each alarm shall be user-selectable for sample concentration alarms (high or low), analyzer system warnings, or analyzer system shut down alarms.

J. The sample concentration alarms shall be fully adjustable through the entire range.

K. The system warning shall activate for minor variations in analyzer performance and it shall shut down the analyzer until corrective action is taken.

L. The microprocessor shall provide self-diagnostic functions accessible through an alphanumeric, menu-driven keyboard.

M. Two SPDT normally open/normally closed dry contact relays rated at 5A resistive load at 230 Vac shall be provided.

N. Recorder outputs shall be 4-20 mA.

O. Recorder span minimum and maximum values shall be operator programmable at the menu-driven keypad over the entire operating range.

P. The chlorine analyzer shall be housed in an IP-62 rated, ABS plastic enclosure designed for wall mounting.

Q. The enclosure shall have two clear polycarbonate windows for viewing the measurement readout and reagent levels.

R. Power requirements shall be 100-115/230 Vac, 50/60 Hz, switch selectable, 95 VA maximum.

S. The instrument shall be the 54400-02 Model CL17 Total Residual Chlorine Analyzer, manufactured by Hach Company or equal.

1.4 Environmental Requirements

A. Operational Criteria
   1. Sample flow rate: 200 to 500 mL/minute
   2. Sample pressure: 1 to 5 psig
      a. The supplied conditioning kit allows for up to 120 psig.
   3. Sample temperature: 3 to 40 degrees C
   4. Operating temperature: 0 to 40 degrees C
   5. Operating humidity: 90 percent at 40 degrees C maximum

1.5 Warranty

A. The product shall include a one-year warranty from the date of project completion.

PART 2 PRODUCTS

2.1 Manufacturer

A. Hach Company, Loveland, CO or Equal
   1. Model CL17 Chlorine Analyzer

2.2 Manufactured Unit

A. The Chlorine Analyzer shall consist of a sample valve, flow cell, and buffer and indicator solutions.
B. The Analyzer shall be housed in a NEMA 12 enclosure, IP62-rated with the gasketed door latched.

2.3 Components

A. Standard equipment:
   1. Analyzer
   2. three-month supply reagents
   3. Spare pump tubing
   4. Wall mount kit
   5. Sample conditioning kit
   6. Manual

B. Dimensions
   1. 13.5 inches wide (343 mm)
   2. 17.9 inches high (455 mm)
   3. 7 inches deep (178 mm)

C. Weight: 25 pounds (11.3 kg)

D. The Analyzer shall includes a standard sample conditioning element consisting of a pressure regulator, strainer, and shut-off valve.

E. Connectors:
   1. Sample inlet quick-connect 0.25-inch O.D. polyethylene tubing
   2. Sample drain 0.50-inch I.D. flexible tubing
   3. Overflow drain 0.50-inch I.D. flexible tubing
   4. Air purge quick-connect 0.25-inch O.D. polyethylene tubing (optional)

2.4 Accessories

A. Power cord
B. Maintenance kit with pre-assembled tubing
C. 1 year reagent supply
D. Pocket Colorimeter II for free & total chlorine, low and high range combination unit

PART 3 EXECUTION

A. Installation

40 91 15 Magnetic Flow Meters

PART 1 GENERAL

1.01 Description

This section describes requirements for magnetic flowmeters.

1.02 Related Work Specified Elsewhere

A. Painting and Coating: 099000.

B. Pressure Testing of Piping: 400500.

1.03 Submittals

A. Submit shop DRAWINGS in accordance with the General Provisions and Section 013300.

B. Submit manufacturer's catalog data and detail DRAWINGS showing dimensions, pressure rating, coatings, and meter parts and describe by material of construction specifications (such as AISI, ASTM, SAE, or CDA) and grade or type. Identify each meter by tag number to which the catalog data and detail sheets pertain.

C. Show meter laying lengths.

PART 2 MATERIALS

2.01 Manufacturers

A. The meter flow tube and transmitter shall be by the same manufacturer.

B. The Magnetic Flow Meter (sensor) shall be Model Sitran FM MAG 5100W and Transmitter shall be SITRAN FM MAG 6000 Manufactured by Siemens or Approved Eq.

2.02 Meter Design

A. The magnetic flowmeter shall be an obstructionless pipeline-mounted instrument to magnetically measure the flow of the process media. The output signal shall not be affected by changes in fluid viscosity or density and shall have zero point stability and auto zeroing functions. Provide the magnetic flowmeter with the following features:

1. Drip- and splash-proof sensor, capable of withstanding temporary submersion of up to 30 feet of water for 48 hours.

2. Integral terminal box with watertight cable seals.

3. Stainless steel grounding rings and grounding straps.

4. Interconnecting cables.

B. The manufacturer shall furnish application performance guarantee with submittals.

2.03 Materials of Construction--Flangeless Meters

A. The flow tube shall be flangeless wafer construction with cast aluminum enclosure. Provide bolting kit.

B. Liner and electrodes shall be as indicated in the subsection on "Service Conditions."

2.04 Materials of Construction--Flanged Meters

A. The flow tube shall be Type 304 stainless steel.

B. Liner and electrodes shall be as indicated in the subsection on "Service Conditions."

2.05 Indicator/Totalizer

A. The indicator/totalizer shall accept the process flow signal from the magnetic flowmeter and convert its electrical output signals directly proportional to the instantaneous metered flow rate. The housing shall be suitable for field mounting.

2.06 Transmitter

A. The transmitter shall be microprocessor based with flow rate indicator in Engineering units, forward, reversed, and net flow totalizer, all in user-selectable Engineering units. The display shall also be capable of indicating alarm status and velocity of fluid. The transmitter shall be mounted as indicated in the instrument list.

B. The preamplifier input impedance shall be a minimum of 10E+11 ohms.

C. Power Requirements: 117-volt a-c, ±10%, 60 hertz.

D. Totalized flow and programmed configuration shall be maintained in memory for up to 10 years.

2.07 Interconnecting Cable

A. The interconnecting cable between the sensor and the transmitter shall be furnished by the magnetic flowmeter manufacturer.

2.08 Performance

The overall system's performance shall be as follows:

1. Accuracy: 0.5% of flow rate with minimum fluid velocity of 1 fps.
2. Repeatability: ±0.1% of flow rate.
3. The accuracy of each meter shall be verified by calibration in a flow laboratory traceable to the U.S. National Institute of Standards and Technology.
4. Adjustable full-scale range.
5. Outputs: Bidirectional, isolated 4- to 20-mA d-c and either 24-volt d-c scaled pulse, or 0- to 10-KHz frequency.
6. Minimum Conductivity: 5 micromhos/centimeter.
7. Power Consumption: 20 watts maximum.
8. Temperature Limits, Ambient: -20°F to +140°F.
9. Temperature Limits, Process: Elastomers +160°F, Teflons +300°F, ceramic 350°F.
10. Field Selectable Low Flow Cutoff: 0% to 10%.
11. The flowmeter shall have a positive zero return (PZR) input controlled by an external dry contact.
12. Environmental Rating: NEMA 4X. For additional information see electrical DRAWINGS.
13. The meter shall have empty pipe detection.
14. A common alarm discrete output (a dry contact or a transistor switch) shall be provided for remote indication of fault conditions.

2.09 Meter Identification

Provide identification tag per schedule in construction DRAWINGS.

PART 3 EXECUTION

3.01 Service Conditions

MAGNETIC FLOWMETER AND INDICATOR/TOTALIZER					
1.	P&ID No.	PID-2	PID-3	PID-4	PID-5
2.	Service	RAW WATER	BAG Filter	IX SYSTEM	LGAC
3.	Tag No.	See Dwg	See DWG	See DWG	See DWG
4.	Metering Tube				
	Size Flg. (in.)	See Dwg	See DWG	See DWG	See DWG
	Rating (psi)	225	225	225	
5.	Metering Tube Material	Stainless steel	Stainless steel	Stainless steel	
6.	Liner Material	Polyurethane	Polyurethane	Polyurethane	
7.	Electrode Material	316 SST	316 SST	316 SST	
8.	Electrical Classification	NEMA 4	NEMA 4	NEMA 4	
9.	Flow Rate Ind. Scale	gpm	gpm	gpm	
10.	Flow Totalizer Multiplier	NA	NA	NA	
11.	Aux. Output Signal	NA	NA	NA	
12.	Aux. Output Signal To	PLC	PLC	PLC	
13.	Transmitter Mounting				
14.	Process Media				
15.	Spec. Gravity	1	1	1	
16.	Conductivity (mhos) (min/max)	700-2,000	700-2,000	700-2,000	
17.	Percent Solids (min/max)	0/0.1	0/1	0/1	
18.	Flow (gpm) (min/max)				
19.	Press. (psig) (min/max)	0-150	0-150	0-150	
20.	Temp. (°F) (min/max)	35-95	40-80	40-80	

3.02 Painting and Coating

A. Coat exposed carbon steel components of meter tube and sensor the same as the adjacent piping. If the adjacent piping is not coated, then coat per Section 099000, System No. 10. Apply the specified prime and intermediate coats at the place of manufacture. Apply finish coat in field. Finish coat shall match the color of the adjacent piping.

END OF SECTION

DIVISION 40 PROCESS INTEGRATION

SECTION 40 91 00 – PRIMARY PROCESS MEASUREMENT DEVICES
40 91 16 PRESSURE TRANSMITTERS

PART 1 - GENERAL

1.01 SCOPE

A. This section includes furnishing Pressure Transmitters as shown on the Plans and specified herein.

B. Related work specified elsewhere includes, but is not limited to Division 26, electrical. Also refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

A. The following material shall be submitted to the Engineer prior to installation, in accordance with Division 26, and as required elsewhere in the Contract Documents:

1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.

2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

1.04 MANUFACTURERS

A. Pressure transmitter manufacturers shall be Foxboro IGP 10 or approved equal by Bristol Babcock, or Rosemount.
B. Differential pressure transmitter shall be Ashcroft Model GC52 or Rosemont 3051 or Approved Equal.

PART 2 - PRODUCTS

2.01 PRESSURE TRANSMITTER

A. Provide pressure transmitters with 1/2 inch NPT process connection, block and bleed valve, and local indicator scaled in engineering units.

B. Transmitters shall be of a two-wire type, 24 VDC powered, producing a 4 to 20 mA output proportional to the calibrated pressure range of the instrument. Transmitters shall be capable of driving a 500 ohm loop load.

C. Instrument accuracy shall be within plus or minus 0.5 percent of span, and a 0.2 percent repeatability. Dead band shall be within 0.1 percent of span.

D. Instrument enclosure shall be NEMA 4, with 316 stainless steel wetted parts.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment and materials specified in this section shall be installed, connected, and tested in accordance with the manufacturers' recommendations, and as shown on the Plans. Contractor shall coordinate with other trades to insure proper connection to piping and other mechanical equipment.

3.02 ACCEPTANCE

A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation.

END OF SECTION

DIVISION 40 PROCESS INTEGRATION

SECTION 40 91 00 – PRIMARY PROCESS MEASUREMENT DEVICES
40 91 17 PRESSURE SWITCHES

PART 1 - GENERAL

1.01 SCOPE

A. This section covers Pressure Switches as shown on the Plans.

B. Related work specified elsewhere includes, but is not limited to Division 26, electrical. Also refer to requirements of General Conditions for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for and guarantee performance of the equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the equipment.

B. Reference standards shall be the latest edition, including addenda, supplements and revision. Applicable reference publications include the following:

1. NEC
2. NEMA

1.03 SUBMITTALS

A. Submit product information cut sheets containing manufacturer's specifications, Operations and maintenance data, instrument enclosure type, installation location, and process pressure range to be supplied. Indicate product part number in full.

B. Provide submittals in accordance with Section 01 33 00, and elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.01 PRESSURE SWITCHES

A. Pressure switches shall have snap action, single-pole, and double-throw switching elements with an electrical rating of at least 10 amperes at 120 VAC. Switches shall be enclosed in a NEMA 4X housing for outdoor use.

B. Operating pressures and set points shall be determined in the field, unless otherwise indicated on the Plans.

C. Set points shall be fully adjustable and shall be in the middle of the working range. Accuracy shall be plus or minus 1/2 of one per cent of adjustable range.

D. For pressures up to 80 PSIG pressure sensing element shall be of the diaphragm or bellows type, and shall have a proof pressure of at least twice the maximum working pressure. Diaphragms or bellows shall be of stainless steel.

E. Pressure switches shall be as manufactured by Mercoid DA series, Barksdale Controls, Union Electric Controls Company, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment and materials specified in this section shall be installed and connected as specified and shown on the drawings. Contractor shall coordinate with Mechanical and Piping to insure proper connection to piping and/or other mechanical equipment.

3.02 ACCEPTANCE

A. As a condition precedent to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

END OF SECTION

DIVISION 40 PROCESS INTEGRATION

SECTION 40 91 00 – PRIMARY PROCESS MEASUREMENT DEVICES
40 91 18 ULTRASONIC LEVEL TRANSMITTERS AND CONTROLLERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A This section covers the Ultrasonic Level Transmitters and Controllers to be provided where indicated on the Plans.

B. Related work specified elsewhere includes, but is not limited to section 16000 Electrical. Also, refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

A. The following material shall be submitted to the Engineer prior to installation, in accordance with Division 26, and as required elsewhere in the Contract Documents:

1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.

2. Prior to Final Acceptance of the work, the Contractor shall provide the Operations and Maintenance Manuals, in accordance with the Contract Documents.

PART 2 - PRODUCTS

2.01 ULTRASONIC LEVEL CONTROLLER

A. The ultrasonic level controller system shall be comprised of a transmitter in a NEMA 4X housing, an ultrasonic transducer, and cabling. The system shall be of the non-contact type for continuous measurement and control of liquid and solid levels.

B. The transmitter shall include a front panel mounted, 4 digit LCD indicator, scaleable in engineering units. The transmitter shall provide a 4-20 mA DC analog output signal which is proportional to level. The unit shall also have 5 form ’C’ SPDT relays assignable for level control, totalizing, sampling, and alarming. The LCD shall provide messages for loss of echo, and cabling trouble. The transmitter shall be designed to operate from -20 degrees C to +50 degrees C.

C. The transducer shall be encapsulated in chemical and corrosion resistant material, such as Kynar, Teflon, or TEFZEL, and be capable of operating from -40 degrees C to +73 degrees C. The unit shall be ambient temperature compensated. The transducer shall be compatible with the level range as indicated on the Plans, and shall operate with up to 1200 feet of separation from the transmitter.

D. The transducer shall be capable of measuring a span of up to 33 feet. The span and range shall be set in the field. Accuracy shall be +/-0.25 percent of range.

E. The system shall operate on 120 VAC, and shall be Milltronics HydroRanger 200 with XPS-10 transducer, or approved equal.

F. Differential level controllers, where indicated on the Plans, shall be Milltronics Hydroranger 200 with XPS-10 transducer, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment and materials specified in this section shall be installed and connected as specified, and as shown on the Plans. The Contractor shall coordinate the installation with the other trades, to insure proper installation of the transducer, transmitter, and associated conduit and cables.

B. The Contractor shall calibrate the instruments to the proper ranges, as required by the Owner and the Engineer. Where analog signals are connected to local, or remote monitoring equipment, the Contractor shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

3.02 ACCEPTANCE

A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

3.03 SPARE PARTS

A. Provide the Owner with a list of the manufacturers’ recommended spare parts.

END OF SECTION 40 91 18

40 91 23 Miscellaneous Properties Measurement Devices

40 91 23.37 General Well Control Operation

PART 1 GENERAL

1.01 Section Includes

A. This section describes the CONTRACTOR'S responsibilities for general well control operation.

1.02 Referenced Sections - none

1.03 Cited Standards – None

1.04 Noted Restrictions – None

1.05 Quality Control

A. Each well is equipped with one pump. The normal operating sequence will use on/off set points to control the pump system to match the inflow rate within a level band. The well pump will start/stop when called for by the SCADA system.

B. The facility will operate with 1) a flow meter transmitter, 2) a well level transmitter, and 3) a pressure transmitter that will monitor and signal values to the PLC. In addition all PLC I/O will be available remotely to the SCADA system.

PART 2 PRODUCTS

2.01 Input / Output Control Operation Signal / Alarms / Status

A. The summary of the I/O schedule has been provided on the electrical plans and summarized herein to clearly illustrate all the PLC, level control, and appurtenant equipment operation status locally and remotely at SCADA headquarters.

B. Each input and output signal description is identified by the location of the signal is sent to, the point of operation, status and control is required. The I/O schedule also identifies whether the I/O point is a control signal, status of operation or an alarm with a summary of the I/O status registered at local panels or SCADA headquarters.

C. A general I/O Summary Table is provided below please reference the DRAWINGS for a full listing.

I/O SUMMARY TABLE	
EW-1 WELL SITES	
DIGITAL INPUTS	**TYPE**
Well Run	STATUS
Well in Auto	STATUS
Well Call	STATUS

DIGITAL OUTPUTS	**TYPE**
Well Start/Stop	CONTROL

ANALOG INPUTS	**TYPE**
Well Level	PROCESS
Well Flow	PROCESS
Well Pressure	PROCESS

2.02 Well Operator Interface Module

A. The Well Operator Interface Module (OIM) shall be programmed with Rockwell Automation RSVIEW SE per section 40 94 33. Screen colors shall be contrasting in nature with ISA standard color scheme (i.e. red = alarm) Provide 50% mockup display for review by ENGINEER and OWNER personnel with revisions made to screens at no additional cost. Screens shall be as follows:

1. Overview Screen: Display of individual process and status points on graphic display in a PID format. Provide all status, alarm and process points per PID.

2. Alarm Screen: Display of all current station alarms with ability to acknowledge and silence alarms.

3. Status Screen: Display of all current station status points. .

4. Site Process points: Display of all process points (flow, level, pressure).

5. Set point screen: Display and control of all set points

6. Well runtime/trending screens: Display of well runtime

7. Process runtime/trending screens: Display of flow, level and pressure runtime.

8. Configuration screens: Control and Display of all setpoints.

9. Flow summary screen: Display of Current and Previous day flows with highest/lowest/average flows.

10. Provide 5 additional screens, content to be determined by ENGINEER or ENGINEER during construction.

11. Provide menu bar on each screen for navigation to all other screens.

PART 3 EXECUTION – NOT USED

END OF SECTION

PART 1 GENERAL

1.01 General Conditions

A. The General Conditions apply to all divisions and sections of this engineering specification, which shall be used to perform work as shown on the plans and as specified, and shall be properly coordinated with work as described in the related Specifications.

B. The DRAWINGS and these Specifications are complementary to each other; what is called for by one shall be as binding as if called for by both. If there is any conflict between what is shown on the DRAWINGS and what is written in the Specifications, the details described on the DRAWINGS shall take precedence and the CONTRACTOR shall communicate the conflicts to the ENGINEER in a timely manner.

C. Safety

1. The CONTRACTOR shall be familiar with, and shall at all times conform to the regulations of the *"OSHA General Industry Occupational Safety and Health Standards," "OSHA Safety and Health Regulations for Construction,"* and other applicable state and municipal standards and regulations.

1.02 Referenced Sections – Payment

1.03 Cited Standards

A. Standards listed as "Reference Standards" in the various sections of these contract documents are hereby incorporated into these Specifications by reference.

B. Referenced documents shall include all revisions, amendments, supplements, or addenda issued on or before the date of advertising for bids.

1.04 Noted Restrictions – None

1.05 Quality Control

A. Manufacturers and suppliers of equipment furnished under this Contract shall guarantee said equipment for one year following the date of acceptance of the completed Contract by the OWNER unless specifically indicated otherwise for the equipment.

1.06 Submittals

A. The CONTRACTOR shall submit shop DRAWINGS on all mechanical equipment to be furnished under this Contract. The number of copies

submitted shall be as specified in Section 01 33 00. Prior to submitting the DRAWINGS, the CONTRACTOR shall review the information for completeness. Only complete information will be reviewed by the ENGINEER, and only after the CONTRACTOR has signified his approval of the information.

B. Shop DRAWINGS shall consist of outline DRAWINGS, cut-away DRAWINGS, parts lists, material specification lists, and all information required to substantiate that the proposed equipment meets the Specifications. In some special cases reproducible transparencies of shop DRAWINGS shall be furnished in addition to the specified number of copies. Shop DRAWINGS submittals will not be considered complete if cut-away or assembly DRAWINGS with part and material specification lists are not included.

C. Shop DRAWINGS for motors shall include published dimension sheets and shall include a motor data sheet which shows all the motor characteristics, including horsepower, efficiency, power factor, voltage, code letter, design letter, service factor, enclosure, and insulation. All characteristics of the motor shall be shown on the data sheet which shall have been reviewed and found acceptable by the ENGINEER prior to delivery of the motor.

D. The CONTRACTOR shall provide calculations and details on all parts individually and severally to show that the equipment offered satisfies the performance, strength, vibration, and other requirements of these Specifications.

1.07 Deliverables - None

PART 2 PRODUCTS

2.01 Materials

A. General

1. The manufacturer, supplier and CONTRACTOR are strongly cautioned to review carefully other related sections of the Specifications. Some equipment will require modifications from the manufacturer's standard to meet the Specifications.

2. All items of equipment shall be the product of a manufacturer experienced in the design, construction, and operation of equipment for the purpose required, and who shall have established a record of successful operation for at least 5 years of such equipment manufactured or produced by them. When two or more units of equipment for the same purpose are required, they shall be products of the same manufacturer.

3. Equipment shall be made up of parts which are designed to act as a unit; and the manufacturer shall guarantee that when the component parts are assembled into the final unit, these parts will fit and operate satisfactorily. The equipment manufacturer's responsibility shall extend to the selection and mounting of gear drive units, motors or other prime movers, accessories, and auxiliaries required for proper operation.

4. If necessary, modifications shall be made in manufacturer's standard product to make it conform to the specific requirements of the Plans and Specifications and to requirements contained in regulations issued by public agencies.

5. All equipment shall include all production line improvements made to the delivery or contract date.

6. All mechanical items shall be rated heavy-duty by the manufacturer.

7. Elevation of this project above sea level is approximately 40 to 50 feet. All mechanical equipment shall conform thereto.

8. Structural steel shall conform to ASTM A 36. Iron castings shall be tough close-grained gray iron castings in accordance with ASTM A 48.

9. Parts of equipment shall be amply proportioned for all stresses which may occur during operation and for any additional stresses which may occur during fabrication, transportation, handling, and erection. Bearings, unless otherwise specified, shall be designed such that at maximum loadings the AFBMA B-10 rating is not less than 50,000 hours.

10. Chlorine room shall not have aluminum products.

11. Fasteners for aluminum shall be stainless steel. Steel, other than stainless steel, shall be isolated from aluminum with neoprene, or other approved material.

12. Bronze, which will be in contact with water or any liquid, used in the manufacture of any equipment, shall not contain more than 2 percent of aluminum nor more than 6 percent of zinc.

B. Motors

1. Motors shall be manufactured in accordance with NEMA Standards and shall be as specified herein unless otherwise specified in the individual equipment specifications. Not all motors are intended to be

standard design motors; some motors may require special features in order to meet specified requirements.

2. Motors, unless otherwise specified, shall be constant-speed, squirrel-cage, induction type with roller or ball bearings in accordance with NEMA Standards and shall be 460-volt, 3-phase, 60-Hertz for the mechanical equipment unless indicated or approved otherwise by the ENGINEER.

3. Motors shall be insulated for wet area application. The winding shall be given a minimum of three (3) dips and bakes of insulating varnish and shall receive a sealer coat of epoxy or silicone. The nameplate shall read "Special Class F Epoxy or Silicone Insulated."

4. The individual Sections will generally indicate enclosure required for each application. The following shall govern in case enclosure is not specified.

5. Electric motors which are mounted inside and protected from the weather: Horizontal motors shall be of TEFC construction with stainless steel rodent screens unless otherwise specified. Vertical motors shall be WP-1 enclosure.

6. Electric motors which are exposed to the weather or severe moisture conditions: Horizontal and vertical motors shall be totally enclosed fan cooled construction (TEFC). Totally enclosed motors shall have drain holes at the lowest point in the case for condensate drainage.

7. The service factor for motors shall be as specified in the various Sections. If not specified, it shall be at least 1.15. The maximum applied load shall not exceed the nameplate horsepower. The amperage at maximum applied load shall not exceed the full-load nameplate amperage value.

8. All motors shall be rated at 40 degrees C ambient with not more than 55 degrees C rise and shall have a minimum of Class F insulation as specified before for full horsepower motors unless otherwise specified. Fractional horsepower motors shall have Class B insulation.

9. Single-phase motors, unless otherwise specified, shall be rated 40 degrees C ambient.

10. Motors shall conform to the latest ANSI, NEMA, and IEEE Standards for motors of the specified class and rating. Unless specified otherwise for a particular piece of equipment, motor bearings shall be of the anti-friction type with an AFBMA B-10 life rating of not less than

50,000 hours. Motor bearings shall be grease or oil lubricated with convenient provisions for inspection and servicing.

11. All motors except for hoisting equipment shall be special high efficiency type. The minimum full load motor efficiency and power factor for high efficiency type motors shall be as listed hereinafter. Full load efficiency and power factor shall be shown on the nameplate.

		Full Load Rating, Percent				**Full Load Rating, Percent**	
Hp	**rpm**	**Eff.**	**PF**	**Hp**	**rpm**	**Eff.**	**PF**
1	1,800	84	79	**30**	3,600	91	91
	1,200	78.5	75		1,800	93	86
					1,200	92.4	85
1 1/2	3,600	81.5	91	**40**	3,600	91.7	90
	1,800	84	79		1,800	93	87
	1,200	82.5	75		1,200	93	85
2	3,600	84	89	**50**	3,600	91.7	91
	1,800	84	79		1,800	94.1	87
	1,200	84	68		1,200	93	86
3	3,600	82.5	89	**60**	3,600	92.4	90
	1,800	88.5	85		1,800	94.1	87
	1,200	86.5	74		1,200	93.6	86
5	3,600	86.5	86	**75**	3,600	93	92
	1,800	88.5	86		1,800	94.1	87
	1,200	87.5	85		1,200	94.1	86
7 1/2	3,600	86.5	88	**100**	3,600	93.6	90
	1,800	90.2	85		1,800	94.5	90
	1,200	88.5	85		1,200	94.1	86
10	3,600	87.5	90	**125**	3,600	93.6	90
	1,800	90.2	86		1,800	95	90
	1,200	86.5	85		1,200	94.5	90
15	3,600	89.5	88	**150**	3,600	94.1	90
	1,800	91.7	85		1,800	95	90
	1,299	90.2	85		1,200	94.5	90
20	3,600	90.2	90	**200**	3,600	94.1	93
	1,800	91.7	86		1,800	95	90
	1,200	91	85		1,200	94.5	87
25	3,600	91	90	**250**	3,600	94.1	93
	1,800	93	87		1,800	94.5	87
	1,200	92.4	85				

12. Motor sizes noted in the individual equipment specifications and the plans are estimates only, and it is the responsibility of the equipment manufacturers and of the CONTRACTOR to furnish motors, electrical circuits, and equipment of ample horsepower capacity to operate the equipment without exceeding the rated nameplate full-load current at rated nameplate voltage, or overheating at maximum load capacity under the most severe operating service of the equipment.

13. Where not shown on the DRAWINGS or in these Specifications, the manufacturer of each piece of motorized equipment shall inform the ENGINEER and the CONTRACTOR in writing as to the size and type of electrical controls required to properly operate the equipment. Location of conduit boxes of motors shall be shown on the manufacturer's DRAWINGS.

14. Motors larger than 1 horsepower shall not be aluminum construction.

C. Equipment Anchoring Design and Performance Requirements

1. Equipment shall be anchored to supports with bolts, anchor bolts, or other connections acceptable to ENGINEER.

    a. Connections shall be designed to accommodate operating forces and seismic loads.

2. Equipment manufacturer shall determine the number, size, type, and location of bolts, anchor bolts, or other connections acceptable to ENGINEER.

    a. CONTRACTOR shall obtain from equipment manufacturer anchoring material and templates or setting DRAWINGS in time for anchors to be cast-in-place when concrete is placed.

3. Anchor bolts shall be in accordance with Section 05 05 00.

    a. Bolt holes in equipment support frames shall not exceed the bolt diameter by more than 25 percent, up to a limiting maximum oversize of 1/4 inch.

    b. Minimum bolt diameter shall be 1/2 inch.

    c. Connections and related details shall be designed for seismic Zone 4 and sealed by a professional ENGINEER registered in the State of California and shall be in accordance with UBC Chapter 23, Part III, Earthquake Design.

d. For equipment with an operating weight of 400 pounds or more, CONTRACTOR shall submit calculations. Calculation shall be current, shall conform to requirements specified herein, shall be made and sealed by a professional ENGINEER registered in the State of California, and shall include the following, as a minimum:

1) Determination of the operating weight and centroid of the equipment. The operating weight shall be the weight of the unit plus the weight of fluids or solids normally contained in the unit during operation.
2) Determination of seismic forces and overturning moments. Not more than 50 percent of dead load shall be considered when used to resist overturning moments.
3) Determination of the shear and tension forces in connections at each support to resist loads calculated as required in preceding subparagraph d.
4) Design of connection details based on maximum shear and tension forces calculated as required in the preceding subparagraph d.

e. Friction shall not be used to resist seismic loads.

D. Mechanical Power Transmission Equipment

1. All mechanical power transmission equipment including V-belts, sheaves, gear reducers, open and enclosed gearing shall be rated for 24-hour-a-day service and sized with a minimum service factor of 1.5. The 1.5 service factor shall be related to the nameplated horsepower and torque of the prime source of power and not the equipment actual loading. Should the manufacturer recommend a service factor larger than 1.5 percent, the manufacturer's recommendation shall take precedence. Speed reducers shall have a thermal horsepower rating of not less than the horsepower rating of the driving motor.

E. Gear Reduction Units

1. Unless otherwise specified, all gear reduction units shall be the helical or herringbone type. No planetary gear units shall be used for any purpose, and worm gear type units may be used only where specified. Gear reduction units shall be selected for the class of service specified, and where not specified, the class of service shall be Class II or heavier as determined by the manufacturer of such units after he is informed by the CONTRACTOR as to what equipment the units are to be used for and to what type of duty the equipment will be subjected.

2. Gears of gear reduction units shall be made of highest quality alloys treated for hardness and severe service. All gear reduction units on equipment shall be selected for Class II or more severe service as classified by the American Gear Manufacturers' Association (AGMA).

3. The complete reduction unit shall be fully enclosed in a heavy cast iron housing with gears running in oil. Bearings shall be of anti-friction type.

4. The actual and rated horsepower capacity, torque, overhung capacity, and bearing capacity of each reduction unit shall be not less than the horsepower rating of the drive motor nor less than that which will be encountered under full load and under the most severe operating conditions which the equipment will be called upon to operate. The ENGINEER may reject any gear reduction unit that does not meet the above requirements. Only gear reduction units manufactured in accordance with the American Gear Manufacturer's Association (AGMA) will be accepted.

5. The CONTRACTOR of each item of equipment shall furnish to the ENGINEER, through the CONTRACTOR, complete engineering information, catalog data, design features, load capacities, and mechanical efficiency ratings for each gear reduction unit incorporated in the work. Class of service or service factor shall be stated on each gear reduction unit nameplate.

F. Electrical Work

1. Unless specified otherwise in the following parts on mechanical equipment, all electrical work, materials, and equipment shall conform to the electrical specifications. It shall be the responsibility of the CONTRACTOR to provide complete electrical systems sized to suit the equipment furnished and installed.

G. Lubrication Fittings

1. All lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housing, or guards. Fittings shall be accessible from safe, permanent walk or walk areas without ladders or scaffolds. Fittings for underwater bearings shall be brought above the water surface with stainless steel tubing and mounted on edge of structure above. Fittings shall be Lincoln "Bullneck" Hydraulic Surface Check Fittings, Lincoln engineering Company, St. Louis, Missouri, or equivalent. Lubrication fittings shall be mounted together wherever possible. They shall not be individual fittings field-mounted

together, but use shall be made of factory-mounted multiple fitting assemblies located in convenient areas. Connection from multiple fitting assemblies to point of use shall be minimum 3/16-inch stainless steel tubing, securely mounted parallel with equipment lines and protected where exposed to damage.

H. Machinery and Equipment Guards

1. Approved guards for all machinery drives, pulleys, or rotating shafting shall be detailed and furnished by the CONTRACTOR. Such guards shall be neatly and substantially constructed, adequately supported from adjacent framing, and shall be provided in all cases. While all such guards are not indicated in detail on the DRAWINGS, the CONTRACTOR is assumed to be familiar with the requirements of Cal-OSHA, and any applicable local regulations regarding machinery guards or safety devices. All guards shall be sized so that pulleys 15 percent over size may be installed. The width of the guard shall be such as to allow one additional belt to be added in the future. The frame shall be covered with expanded aluminum for heat dissipation. The CONTRACTOR shall assume the responsibility for detailing these items and submitting shop DRAWINGS to the ENGINEER for approval. Guards shall be constructed of 6061-T6 aluminum unless otherwise indicated. All guards shall be isolated so no dissimilar metals come in contact.

2.02 Equipment – none

2.03 Fabrications – none

PART 3 EXECUTION

3.01 Preparation

A. General

1. The furnishing and installation of equipment shall include testing, painting, checking levels and alignment, furnishing and placing of lubricants of whatever type, and furnishing of factory-trained service mechanics or ENGINEERs where specified. All equipment when finally installed shall be complete and ready for operation without binding or overloading of critical components or motors. The CONTRACTOR shall furnish at no extra cost to the ENGINEER all appurtenances, piping, valves, fittings, wiring, supports, hangers, and other devices as are required to place the equipment in first-class operating condition and in a neat and workmanlike manner.

3.02 Installation

A. Installation of Equipment

1. Installation of equipment shall not begin until the instructions covering that part of the equipment, as specified hereinbefore, have been supplied to the ENGINEER.

2. Equipment shall be installed complete and ready to operate. In the installation of equipment none but mechanics skilled in the various trades shall be employed.

3. Welding shall be by electric arc and shall be done by qualified welders in accordance with applicable welding codes.

4. Metal work to be embedded in concrete shall be accurately placed and held in correct position while the concrete is being placed. The surface of all metal work to be in contact with concrete shall be thoroughly cleaned immediately before concrete is placed. Anchor bolts shall be cast in place when the concrete is poured. Anchors shall be installed as recommended by the manufacturer to develop the full strength of the bolt. No use shall be made of flush shells or concrete anchors.

5. Anchor bolts for heavy equipment, unless otherwise detailed, shall be encased in metal tubing as indicated on the DRAWINGS. Pump and other similar foundations shall be left 1 inch below the grade of machine base unless otherwise noted on the DRAWINGS. After the proper setting of machine for alignment and grade, the recess below the base, together with recess between the anchor bolt and the metal tube, shall be grouted and carefully finished with nonshrink grout.

6. Moving parts of equipment and machinery shall be carefully installed, tested for operation, and adjusted so that all parts move freely and function to secure satisfactory operation.

7. Piping required for proper operation of equipment shall be furnished and installed. Piping layouts may require modification from that indicated on the DRAWINGS depending on equipment furnished. All costs for piping or piping modifications required to suit the particular equipment furnished shall be borne by the CONTRACTOR.

8. The CONTRACTOR shall provide the services of competent and experienced technical representatives of the manufacturers of all equipment and systems furnished under the contract for a minimum of three man-days (not including travel time) for assembly, installation, and testing assistance unless otherwise specified. In each case, the CONTRACTOR shall arrange to have the manufacturer’s

representative revisit the jobsite until testing and startup problems have been resolved to the satisfaction of the ENGINEER. This requirement applies to manufacturers of all equipment furnished (excluding manually operated valves smaller than 24 inches in size, and any other items of equipment specifically exempted by the ENGINEER in writing). A service record shall be maintained on each item of equipment and shall be delivered to the ENGINEER prior to acceptance of Final Test Operation.

B. Alignment of Motors and Equipment

1. In every case where a drive motor is connected to a driven piece of equipment by a flexible coupling, the coupling halves shall be disconnected and the alignment between the motor and the equipment checked and corrected after the complete unit has been leveled on its foundation, and again after grout has set and foundation bolts have been tightened.

2. In general, checking and correcting the alignment shall follow the procedures set up in the latest Standards of the Hydraulic Institute, Instructions for Installation, and Operation and Maintenance of Centrifugal Pumps. Equipment shall be properly leveled and brought into angular and parallel alignment.

3. Equipment bases shall not be grouted nor foundation bolts finally tightened until all piping connections are complete and in satisfactory alignment with no strain transmitted to the equipment.

C. Mortar and Grout

1. Special nonshrink mortar or grout shall be used in the placement of all heavy equipment and equipment bases.

2. Nonshrink mortar shall be as specified in Section 03 60 00. Machinery shall first be perfectly aligned and leveled by means of steel wedges and shims near anchor bolts. Anchor bolts shall be tightened against the shims on wedges before placing grout. Before placement of grout, equipment shall again be checked for level and alignment. Grout shall then be thoroughly packed into place, filling all voids under the base of equipment.

3. Grout around all machinery bases shall be neatly pointed. All sandblast, grease, and debris shall be removed before any grouting is done.

D. Painting

1. Equipment shall be painted in accordance with the requirements of Section 09 00 00.

E. Operation and Maintenance Manuals

1. The CONTRACTOR shall furnish copies of operation and maintenance manuals for each system or item as specified in Section 01 33 00. These manuals shall be broken down into sections and indexed. The sections shall include Mechanical Equipment, Automatic and Special Valves, Control Systems, Electrical, and others as necessary. Under each section there shall be a description of the operation and maintenance, lubrication schedules, and installation instructions of each item. All sections shall be labeled and each item shall be sublabeled. There shall be included in the front of each booklet an index laminated with plastic on both sides for rough use. Each booklet shall be bound in hard cover and the booklets shall be delivered prior to installation of any operating equipment. No acceptance of any equipment will be made until the complete manuals have been submitted, evaluated, and found acceptable. One CONTRACTOR'S copy of the complete manual shall be at the jobsite available for use by field personnel and the ENGINEER during installation, start-up, and testing of the equipment.

3.03 Testing

A. Before testing, all equipment and mechanisms shall be filled by the CONTRACTOR with the proper oil and grease as recommended by the equipment manufacturer. CONTRACTOR shall furnish all personnel, chemicals, and other necessary items as are required for the initial testing of equipment.

B. Each piece of equipment shall be operated by the CONTRACTOR for at least 8 hours after installation. This does not relieve the CONTRACTOR of responsibility in the event of failure, binding, overloading, overheating, or other malfunction of the equipment after initial testing is performed. Initial testing and final test operation shall be as specified in the Special Provisions.

3.04 Special Tools

A. All special tools that are required to assemble, disassemble, repair, and maintain any item of mechanical equipment shall be furnished with the equipment. Special tools shall include any type of tool that has been specifically made for use on an item of equipment for assembly, disassembly, repair, and maintenance. When special tools are provided, they shall be marked or tagged, and a list of such tools shall be included with the maintenance and operation instructions describing use of each marked tool.

END OF SECTION

Pump Schedule:

Pump Type	**Well Pump**	**Booster Pump**	**Dosing Pump**
Section in Specifications	**43 06 21 Extraction Well Pump**	**43 21 50 Booster Pump**	**43 32 76.13 Calcium Hypochlorite Pumps and Appurtenances**
Location	Well Site	Treatment Plant	Treatment Plant
Quantity	1	1	2
Manufacturer	Peerless	Peerless	Grundfos
Model No.	Per Manufacturer	Per Manufacturer	CR5-6
Fluid	Well Water	Reservoir Water	Calcium Hypochlorite
Operating Flow rate (gpm)	2040 gpm @560ft TDH	2040 gpm @ 410ft TDH	0.69 to 2.0 lb/h
Horsepower (hp)	450	300	2-3
Revolutions Per Minute (rpm)	1780	1780	
Operating Pressure (psi)	--	--	150 psi max backpressure
Electrical	480V 3-phase	480V 3-phase	110-220V 1 Ph

Note: See individual pump specifications below for additional requirements.

END OF SECTION

Equipment Schedule:

Equipment Name	**Dual Vessel GAC System**	**Ion Exchange Vessels**
Section in Specifications	**43 31 13.13 Activated Carbon-Gas and Liquid Purification Filters**	
Recommended Manufacturer		
Model Number		
Supplier		
Location	Concrete Pad	Concrete Pad
Quantity	4	3
Fluid	Well Water and Backwash	Well Water and Backwash
Flow Rate (gpm)	2040	2040
Material	Carbon Steel	Carbon Steel
Size		

END OF SECTION

DIVISION 43: PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT
SECTION 43 21 10 – PUMPING EQUIPMENT: GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 Summary

A. Section Includes:

1. Pumping equipment.

B. Related Sections include but are not necessarily limited to:

1. Section 09 99 00 – Painting and Protective Coatings.
2. Section 43 21 30 – Vertical Turbine Pumps.
3. Section 40 00 00 – Process Integration (General).

1.02 Quality Assurance

A. Referenced Standards:

1. Hydraulic Institute (HI):
   a. Standards for centrifugal, rotary and reciprocating pumps.
2. Fully coordinate all mechanical seal systems specified to ensure pump and seal compatibility.

1.03 Definitions

A. The abbreviations are defined as follows:

1. IPS: Iron Pipe Size.
2. NPSHR: Net Positive Suction Head Required.
3. TDH: Total Differential Head.
4. TEFC: Totally Enclosed Fan Cooled.
5. WP1: Weather Protected Type 1.

B. Pump Service Category - Pump or pumps having identical names (not tag numbers) used for specific pumping service.

1.04 Submittals

A. Shop DRAWINGS:

1. See Section 01 33 00.

a. Product technical data including:

1) Performance data and curves with flow (gpm), head (FT), horsepower, efficiency, NPSH requirements, submergence requirement.
2) Pump accessory data.
3) Bearing supports, shafting details and lubrication provisions.
4) Solids passage information.

b. Certifications:

1) Certified pump performance curves as described in Article 2.04.
2) Statement relative to installation and start-up per paragraph 3.02-A.4.

c. Test reports:

1) Factory pump performance tests.

d. Operation and Maintenance Manuals:

1) See Section 01 33 00.

PART 2 PRODUCTS

2.01 Acceptable Manufacturers

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Mechanical seals:

a. Chesterton.

b. Garlock.

B. Submit requests for substitution in accordance with Specification Section 01640.

2.02 Accessories

A. Each Unit:

1. Lifting eye bolts or lugs.

2. Plugged gage cock connection at suction and discharge nozzles.

3. Tapped and plugged openings for casing and bearing housing vents and drains.

4. Fittings for properly adding flushing lubricant.

5. Pressure relief fittings for grease lubrication.

B. Packing Seal:

1. Provide unless a mechanical seal is specified in the individual pump specification sections.

2. Minimum of five rings graphite impregnated synthetic packing.

3. Provide minimum 1/4 IN DIA supply tap and 1/2 IN DIA minimum drain tap.

4. Provide split teflon or bronze water seal ring.

5. Adjustable split follower cast iron or bronze gland.

2.03 Fabrication

A. Pump Support:

1. Design base to support weight of drive, shafting and pump.

2. Comply with HI vibration limitations.

3. Mount vertical pumps on single piece pedestal baseplate.

4. Fabricate to withstand all operating loads transmitted from the pump and drive.

2.04 Source Quality Control

A. If specifically required in the individual pump specification sections, provide factory tests:

1. All-units:

a. Hydrostatic test at 150 percent of shutoff head for a minimum of 5 minutes.

2. Adjustable speed units:

a. Head (FT) versus flow (gpm) pump curves:

1) Maximum, minimum and two equally spaced intermittent speeds.
2) Efficiencies along each curve.
3) Brake horsepower along each curve.

3. Constant speed units:

a. Head (FT) versus flow (gpm) pump curves:

1) Efficiencies along curve.
2) Brake horsepower along each curve.
3) Hydraulic thrust along each curve.

4. Results certified by a registered professional ENGINEER.

a. Statically and dynamically balance each pump per HI standards.

PART 3 EXECUTION

3.01 Installation

A. See Section 40 00 00.

B. Floor or Pad-Mounted Pump Units and Submersible Pumping Units:

1. Align vertically and horizontally level, wedge and plumb units to match piping interfaces.

2. Assure no unnecessary stresses are transmitted to equipment flanges.

3. Tighten flange bolts at uniform rate and manufacturer’s recommended torque for uniform gasket compression.

4. Support and match flange faces to uniform contact over entire face area prior to bolting pipe flange and equipment.

5. Permit piping connecting to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.

6. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.

7. Assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened. Test alignment by

loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange. Realign as necessary, install flange bolts and make equipment connection.

8. Field paint units as defined in Section 09 99 00.

9. Provide pressure gage on discharge of all pumps.

3.02 Field Quality Control

A. Provide services of equipment manufacturer's field service representatives to:

1. Inspect equipment covered by these Specifications.

2. Supervise pre-start adjustments and installation checks.

3. Conduct initial startup of equipment and perform operational checks.

4. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by OWNER'S personnel.

5. Instruct OWNER'S personnel for the specified minimum number of hours at jobsite on operation and maintenance of each of the following for each identifiably different unit of pumping equipment:

6. Vertical Turbine Pump and Motor.

a. Two sessions on pump at 4 hours minimum per session.

b. Two sessions on motor at 4 hours minimum per session.

END OF SECTION

DIVISION 43: PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT
SECTION 43 21 20 – VERTICAL TURBINE PUMP MOTORS

PART 1 GENERAL

1.01 Summary

A. Section Includes:

1. This section includes the requirements for vertical turbine pump motors for the following pumps:

   a. EW-1 Well Pump – Line Shaft Pump.

   b. BP-2 Booster Pump

2. The CONTRACTOR shall provide the deep well vertical turbine pump motors with associated wiring and appurtenances, complete and operable, in accordance with the Contract Documents.

   a. Related sections include but are not necessarily limited to:

      1) Section 43 21 10 – Pumping Equipment: General Requirement.
      2) Section 43 21 30 – Vertical Turbine Pumps
      3) Section 43 00 00 – Process Integration (General)

1.02 Quality Assurance

A. Referenced Standards

1. Unless otherwise specified herein, all applicable provisions of AWWA E-101 (Part A), latest edition, are hereby made a part of these specifications. In the case of a conflict between these specifications and AWWA E-101 (Part A), the more stringent of the two shall prevail.

B. Codes and Standards

1. All equipment shall be fabricated, assembled, and tested in accordance with the most current applicable standards, as defined by the following institutions:

   a. American National Standards Institute (ANSI)

   b. Institute of Electrical and Electronic ENGINEERs (IEEE)

   c. National Electrical Manufacturer’s Association (NEMA)

   d. Anti-Friction Bearing Manufacturers’ Association (AFBMA)

2. All materials and equipment shall be labeled or listed as being approved by the Underwriters Laboratories (U.L.) whenever applicable.

C. Quality Control

1. The motor shall be new and of current manufacture. No motor shall be purchased for use in the work prior to acceptable shop DRAWINGS submitted by the CONTRACTOR in accordance with OWNER'S requirements.

1.03 Submittals

A. Provide submittals in accordance with Section 01 33 00.

B. Before purchase of equipment, the CONTRACTOR shall submit to the OWNER for approval, six (6) copies of shop DRAWINGS and descriptive matter as are necessary to show the dimensions, construction, and performance of the electric motor proposed.

C. The CONTRACTOR shall submit to the OWNER six (6) copies of motor maintenance manuals, technical literature, and parts lists, prior to final start-up and testing.

PART 2 PRODUCTS

2.01 Vertical Hollow Shaft Motors

A. Acceptable Manufacturers

Motors shall be U.S. Motors, General Electric, Siemens, or ENGINEER approved equal.

B. General

Motor shall be type and HP indicated in Section 43 21 30. To the extent applicable, these requirements shall also apply to Submersible Vertical Turbine Pump Motors.

The motor when operating at speeds between 10 percent and 100 percent of rated speed, shall maintain sufficient self-cooling such that rated temperature rise shall not be exceeded when driving the pump at that speed and supplying all the required driving torque.

Motor insulation for units operating at 600 VAC rms or less, shall utilize an "Inverter Grade" system that has increased mechanical and dielectric capabilities. "Inverter Grade" shall be defined as a system that includes

additional features which clearly indicate an attempt to improve the dielectric capabilities of the motor winding and the mechanical rigidity of the stator winding assembly. The system used in the motor manufacturer's standard and premium efficient sinewave products represents the base levels by which the motor manufacturer shall determine if they meet the "Inverter Grade" system requirements. The motor manufacturer shall submit in writing an evaluation of how the "Inverter Grade" system meets the intent of this specification. Insulation shall conform to the requirements of NEMA MG-I, part 31.

Vertical hollow shaft electric motors shall be Design B, high thrust, squirrel cage, induction type having NEMA weather protected Type I enclosures unless specified otherwise. Motors shall be built to efficiently and effectively drive pumps specified. Motors shall operate in accordance with these specifications.

The motor shall be of the proper size to drive the pump continuously over the complete head-capacity range without the loading exceeding the rated horsepower excluding service factor.

The motor shall be especially suitable both electrically and mechanically to drive the pump as specified. The speed, horsepower, torque, base, thrust, bearing, shaft, and motor tolerances shall be coordinated closely with pump manufacturers requirements so as to provide a satisfactory, efficient drive without overloading, overheating or abnormal vibration.

The motor shall be designed to operate at rated load in a maximum ambient temperature of 40 degrees C at a maximum altitude of 1,000 meters.

C. Specific Motor Requirements

1. Power

Unless specified otherwise, motors shall be nameplate rated, 3 phase, 60 hertz, 460 volts.

2. Speed

Unless specified otherwise, motors shall be 4 pole and shall have a synchronous speed of 1800 rpm at 60 hertz.

3. Starting Characteristics

All motors shall be capable of full voltage line start, unless specified otherwise.

4. Efficiency

All motors shall be rated premium efficiency, unless specified otherwise. Rated efficiencies shall be based on NEMA Standard MG1-12.536. Guaranteed efficiencies shall be determined in accordance with IEEE #12, Test Method B or E, latest revision.

5. Service Factor

Rated service factor shall be 1.15 or greater on sine wave power only. Service factor shall be 1.0 on VFD power.

6. Insulation System

a. All motors shall be provided with Class "F" or better insulation systems except that motor lead insulation may be Class "F" or better. Impregnating materials shall be rated Class "F" (155°C) minimum. Completed windings, when tested in accordance with IEEE #57, latest revision, shall show a thermal rating of not less than 150°C for 50,000 hour's life.

b. Windings shall be held firmly in stator slots to prevent coil shift. Sharp edges and burrs shall be removed from stator slots prior to winding or inserting coils. Slot liners and coil end phase insulation, in addition to the coating, shall be provided. Stator windings shall be of high conductivity copper magnet wire.

c. Completed stator windings shall be provided with a properly cured, uniform impregnation for mechanical rigidity, moisture resistance, and protection against winding failures from accumulation of foreign conductive matter. The completed insulation system shall be capable of withstanding phase-to-ground rms voltage of 600 volts continuous and 2,300 volts instantaneous (surge or transient).

7. Mechanical

a. End shields and frame shall be of cast iron construction.

b. The critical speed of the shaft and rotor assembly shall always be above the operating speed of the motor by at least 10%.

c. The motor shall be dynamically balanced and vibration shall be measured per NEMA MGI - 12.06.

8. Rotor

Rotor shall be made from high grade steel laminations. Squirrel cage windings shall be cast aluminum or bar type with brazed or welded end rings. Rotor shall be dynamically balanced and treated with a rust

9. Temperature Rise

Rated temperature rise above 40 degrees C ambient temperature measured by resistance at service factor load of 1.15 shall not exceed 90 degrees C.

The motors, when operating at speeds between 10 percent and 100 percent of rated speed, shall maintain sufficient self-cooling such that rated temperature rise shall not be exceeded when driving the pump at that speed and supplying all the required driving torque.

10. Inrush Current

Motors shall be rated NEMA locked rotor Code H or better except where NEMA locked rotor Code H is specifically permitted.

11. Bearings

a. Motors shall be equipped with anti-friction type thrust and guide bearings. Angular contact ball thrust bearings shall be used in preference to spherical roller thrust bearings wherever possible. Angular contact ball thrust bearings shall be self-cooled wherever possible. Water cooled angular contact ball thrust bearings shall be used only when approved by OWNER. Spherical roller thrust bearings may be water cooled if required by motor manufacturer.

b. Bearings shall be of sufficient capacity to carry all static and dynamic up and down thrust load, both momentary and continuous, imposed by the pump. Bearings shall provide minimum 3-year B10 life (26,300 hours) based on continuous design operating point thrust load and 1-year B10 life (8770 hours) based on maximum pump shut-off thrust load. Bearings shall also provide for minimum momentary upthrust equal to 30% of rated downthrust.

c. The CONTRACTOR shall provide shop DRAWINGS, applications data, catalogue data, and calculations to

demonstrate that the bearings provided meet the requirements of this paragraph.

12. Bushings

Motors shall be equipped with externally mounted lower end head shaft steady bushings unless specified otherwise.

13. Lubrication System

Motor bearings including thrust bearings shall be oil lubricated; however, steady bushings may be grease lubricated. Oil lubrication systems shall provide optimum lubrication of bearings. Said systems shall have sufficient oil storage and oil cooling capacity to limit oil bath temperature rise to 45°C above 40°C ambient temperature unless temperature rise of 50°C is specifically permitted. Oil lubricated motors shall have visual level indicators and accessible fill and drain plugs. Indicators and plugs shall be located 180° from pump discharge unless specified otherwise. Grease lubrication systems shall be regreasable and shall provide for automatic flushing or purging of grease cavity during regreasing.

14. Thermal Protection

a. Motors shall be equipped with winding thermostats.

15. Space Heaters

Motors shall be equipped with 120 volt single phase belt type space heaters capable of raising motor temperature 10°C above ambient temperature to prevent condensation.

16. Non-Reverse Protection

Motors shall be equipped with non-reverse mechanisms which shall limit maximum reversal to within 10° of rotation.

17. Terminal Box

Motors shall be equipped with extra-large heavy duty split type conduit boxes. Unless shown or specified otherwise, motor terminal boxes shall be located at 180° from pump discharge.

18. Screens

Motors with WP-I and WP-II enclosures shall be equipped with suitable corrosion resistant safety and rodent screens. Said screens shall not interfere with motor cooling or motor heat dissipation.

19. Nameplates

a. Motor nameplates shall be of stainless steel and shall be securely fastened to the motor frame with pins of a like material.

b. The following information shall be contained on the motor nameplate as a minimum:

1. Rated horsepower
2. Full load speed
3. Frequency
4. NEMA KVA code and design letter (when applicable)
5. Rated voltage
6. Manufacturer's serial number
7. Manufacturer's model number
8. Temperature rise
9. Locked rotor code
10. Service factor
11. Insulation class
12. Maximum ambient
13. Full load current at nameplate voltage
14. Frame size designation
15. Number of phases
16. Full load power factor

c. Connection Data Nameplate

Motor start, motor run characteristics, and motor connection diagram.

d. Bearing Data Nameplate

Manufacturers, bearing types (thrust and guide), bearing numbers, thrust capacity, oil type, minimum operating oil viscosity, maximum operating oil bath temperature, required cooling water flow, and maximum cooling water pressure.

e. Motor Shop Testing

Motor testing procedure shall be in accordance with the American Standard Test Code for polyphase induction motors and generators, publication IEEE 112. All motors shall be given routine tests to determine that they are free from electrical or mechanical defects. The routine test shall, as a minimum, conform to NEMA Standard MG-12.51.

PART 3 EXECUTION

3.01 Pumping Unit Installation

A. The CONTRACTOR shall install the electric motor and shall conduct the initial operation of all pumping units furnished under these specifications and shall provide sufficient personal supervision over all installation and start-up procedures accordingly, unless otherwise specified. The CONTRACTOR shall also provide all test equipment necessary to determine initial operating performance.

B. Pumps and motors shall be installed in strict conformance with the printed instructions of the pump/motor manufacturer. Provide shaft stretch calculations, required lateral setting, and written measurement confirmation documents. The OWNER will furnish shop DRAWINGS for installed pumping equipment to the CONTRACTOR.

3.02 Field Testing

A. All pumps shall be field-tested after installation by the CONTRACTOR to demonstrate satisfactory operation at specified efficiencies without causing excessive noise, cavitation, vibration, and overheating of the bearings.

B. After the entire project installation is completed, and at such time as the ENGINEER may direct, the CONTRACTOR shall conduct an operating test for all equipment for approval. All mechanical and electrical operating systems and all other operations as directed by the ENGINEER shall be inspected and tested. The tests shall include, but not be limited to the following:

1. Operation of the pump to maximum capacity.

2. Operation of all valves and gages.

3. Operation of circuit breakers, switches, lights, and other operable electrical equipment.

C. The CONTRACTOR shall note that pump field tests may not be permitted until after the well has been disinfected and/or accepted by the State Department of Health Services. Additionally, the well may have to be pumped to waste for several hours prior to performing field tests. The CONTRACTOR shall schedule and coordinate field pump testing accordingly.

D. The equipment shall be demonstrated to operate in accordance with the requirements of these specifications. The tests shall be performed in the presence of the ENGINEER, and where applicable, an authorized representative of the equipment manufacturer. The CONTRACTOR shall furnish all instruments and personnel required for the tests, and the OWNER will furnish the necessary electric power and water.

E. Each pumping unit shall be operated for a period of two weeks during which time acceptance tests may be conducted. Head, capacity, overall efficiency, and input and output horsepower shall be determined for at least three different operating conditions in the operating range of the pumping unit, including the specified design point, for comparison with the certified pump curves and the factory performance test results, both as approved by the City.

F. Pumping unit (pump and motor) shall perform in the field substantially in accordance with the certified pump curves and the factory performance test results as adjusted for field conditions. If, in the opinion of OWNER, the equipment furnished under this contract does not perform in accordance with these specifications, CONTRACTOR shall promptly make all necessary repairs or corrections so that the equipment fully complies with these specifications. CONTRACTOR shall remove, restore, and replace the equipment if required. Factory and field performance tests shall be rerun if necessary. Pump manufacturer's field service ENGINEER will assist OWNER or its representative in the proper conduct of the above field acceptance tests.

3.03 Pumping Unit Vibration

Completed pump unit (pump and motor) shall receive a final field trim balance, as may be required, and vibration of unit shall not exceed 0.0025 inches, peak to peak amplitude when operating. CONTRACTOR shall field measure vibration with a suitable calibrated instrument and all measurements shall be witnessed by ENGINEER and/or EOR. Vibration shall be measured at motor thrust bearing housing and at any other locations on pumping unit as directed by OWNER. The CONTRACTOR shall furnish all necessary instruments to measure the field vibration of the pumping unit.

PART 4 NOT USED

END OF SECTION

DIVISION 43: PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT
SECTION 43 21 30 – VERTICAL TURBINE PUMP FOR WELL

PART 1 GENERAL

1.01 Summary

A. Section Includes:

1. This section includes specifications for one line shaft, vertical turbine deep well pump for Extraction Well No. 1 (EW-1). Each vertical turbine deep well pump shall be provided complete with multistage bowl, column, impeller, discharge head, motor and all required accessories.

B. Related Sections include but are not necessarily limited to:

1. Section 43 21 10 – Pumping Equipment: General Requirements.

2. Section 43 21 20 – Deep Well Vertical Turbine Pump Motors.

3. Section 43 00 00 – Process Integration (General).

1.02 Quality Assurance

A. Referenced Standards:

1. American Iron and Steel Institute (AISI):

2. American National Standard Institute (ANSI):

a. B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

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

a. A48, Gray Iron Castings (Class 35 Minimum).

b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

c. A1O8, Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.

d. A120, Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless for Ordinary Uses.

e. A276, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

f. B505, Standard Specification for Copper-Base Alloy Continuous Castings.

g. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.

h. American Water Works Association (AWWA):

i. E101, Vertical Turbine Pumps - Line Shaft and Submersible Types.

j. Hydraulic Institute Standards (HI).

k. Society of Automotive ENGINEERs (SAE).

1.03 Submittals

A. Shop DRAWINGS:

1. See Section 01 33 00.

2. Product technical data including:

a. Acknowledgment that products submitted meets requirements of standards referenced.

b. Manufacturer's installation instructions.

c. See Section 43 21 10.

d. Schematic elevation showing dimensions of pump base, column, shaft, bowl assembly, cone strainer, discharge head and motor

3. After the above equipment submittals have been approved, submit for approval complete fabrication, assembly, foundation, and installation DRAWINGS, together with detailed specifications and data covering materials of construction, weights, power drive assembly, parts, devices, wiring diagrams, and other accessories forming a part of the equipment furnished. DRAWINGS, specifications, and other submittal data shall include, but shall not be limited to, the following:

a. Anchor bolt placement and anchor bolt details including projections from concrete.

b. Materials of construction including shafts, bearings, impellers, castings, pump base, stuffing boxes, and shaft guards.

c. Electric motor data including size, make, type, designation, and mounting details.

4. After the above equipment submittals have been approved, the additional submittals shall include, but shall not be limited to, the following. Equipment shall not be shipped until these shop test submittals have been submitted and approved.

a. Certified pump performance curves for the supplied pumps as determined in the specified shop test.

b. Operation and Maintenance Manuals. See Section 01 33 00.

1.04 Performance and Design Requirements

A. General: Pumps shall be designed and constructed to satisfactorily meet the conditions and requirements specified below and for the installations as shown on the DRAWINGS. The pump shall have a head-capacity characteristic that is constantly rising to shutoff head without any sags. The pumping units shall have a non-overloading horsepower characteristic.

B. Performance Parameters for Extraction Well No. 1 Pump:

	Design Point
Flow (gpm)	2,040
TDH (feet)	550
Minimum Efficiency per Stage (%)	80
Minimum NPSHR (feet)	15.0
Maximum Shutoff Head (feet)	750
Maximum Stages (No.)	7
Maximum Speed (RPM)	1,800
Minimum Motor Horsepower (HP)	450

Pump Bowl Setting: 480 feet below ground surface.

C. Provide pumps with increasing head characteristics from design point to shutoff condition. Provide pumps with net positive suction head requirements (NPSHR) less than the net positive suction head available (NPSHA) at all operating conditions.

PART 2 PRODUCTS

2.01 Acceptable Manufacturers

A. The pump manufacturer shall be responsible for the entire pump and motor assembly. Subject to compliance with the Contract Documents, the pumping units shall be manufactured by Peerless Pumps 14MD-7 Stage or only approved equal.

2.02 General

A. Pumps and motors shall be rated for continuous duty and shall be capable of pumping the specified flow range without surging, cavitation or vibration. The pumps shall not overload the motors for any point on the speed pump performance characteristic curve within the limits of stable pump operation as recommended by the manufacturer to prevent surging, cavitation, and vibration, as well as throughout the entire pump operating range. The service factors for the motors shall not be applied when sizing the motors. To insure vibration-free operation, all rotative components of each pumping unit shall be statically and dynamically balanced. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the amplitude of vibration as measured at any point on the pumping unit shall not exceed the limits set forth in the latest edition of the Hydraulic Institute Standards. All parts of each pump shall be designed to withstand the stresses that will be imposed upon them during their handling, shipping, erection, and operation. The completed units, when assembled and operating, shall be free of cavitation, vibration, noise, and oil or water leaks over the range of operation. All units shall be so constructed that dismantling and repairing can be accomplished without difficulty.

2.03 Line Shaft Pump Components

A. General:

1. Furnish unit consisting of a vertical shaft turbine pump connected to a vertical hollow shaft motor. Design unit with non-reversing ratchets. Where applicable, these component requirements also apply to the submersible pumping unit.

2. Weight of revolving parts of pump including unbalanced hydraulic thrust of impeller is carried by thrust bearing in driver.

3. Hollow shaft motor construction shall provide for adjusting impeller clearance in relationship to bowls.

B. Column:

1. Construct discharge column pipe of Schedule 40 ASTM A53 Grade B steel with threaded ends and threaded sleeve type couplings. The column sections shall include water lubricated bearing retainers at each column joint.

2. Provide top and bottom sections of column pipes to 5-foot lengths. See requirement for bowl suction pipe under Item E, Pump Bowl.

3. Provide intermediate column sections not exceeding 10 feet in length.

4. Sand blast column piping and coat inside and out, at the factory, with a minimum 15 mils dry film thickness fusion bonded epoxy that is NSF approved for use with potable water. Field coat exposed threaded areas of pipe and couplings with field applicable liquid epoxy, potable grade, as recommended by the fusion bond epoxy manufacturer.

C. Water Level Cable:

1. Length (feet) and material of cable to be furnished for water level transducer.

2. Schedule 40 PVC perforated pipe shall be furnished for the transducer shaft.

D. Open Line Shaft:

1. The line shafting shall be turned, ground and polished AISI 416 stainless steel, of ample size (1.875-inch minimum) to operate the pump without distortion or vibration and shall be tested for straightness. Shafting shall not be smaller than the minimum permitted by ANSI B58.1 and shall be straight in accordance with ANSI B58.1. The shafts shall be furnished in interchangeable sections not over 10 feet in length that shall be field replaceable. Shaft couplings shall be extra strong threaded steel couplings, machined from solid bar steel and shall be designed to transmit the full load torque and thrust and to maintain alignment between adjacent shaft sections. Couplings shall be of AISI 316 stainless steel, or better.

2. Maximum length: 10 Feet.

3. Furnish renewable shaft sleeves constructed from 416 stainless steel at each bearing location.

4. Undercutting of shafting at sleeve locations is not permitted.

5. Line shaft bearings shall be removable self-flushing rubber type supported by retainers threaded between machined faces of discharge column.

6. Provide complete line shaft pre-lubrication system to water lubricate line shaft bearings prior to pump startup.

   a. Pump Bowl:

      1) Provide bowl constructed of close grained cast iron, free from imperfections and accurately machined and fitted.

      2) Coat pump bowl water passages with an abrasion-resistant baked enamel, phenolic or epoxy. The coating shall be NSF approved for potable water service.

      3) Design to ensure easy removal of bearings and impeller.

      4) Provide 5 feet of suction pipe of same diameter, material, and coating as pump column with heavy duty, cone-shaped, type 316 stainless steel strainer. The strainer shall have a minimum inlet open area of not less than four times the suction pipe size.

      5) Plug discharge case bypass ports.

   b. Bearings:

      1) Provide units with sleeve bearings of SAE 660 bronze in each bowl.

      2) In bowl, provide main bronze bearing immediately above impeller and a lower bronze bearing immediately below impeller.

   c. Provide for lubrication of bowl bearings continuously with water from system pressure.

   d. Pump Shaft and Impeller:

      1) Provide pump unit shaft constructed of rolled and ground 416 stainless steel.

      2) Furnish enclosed type impellers constructed of bronze and securely attached to impeller shaft.

3) Ensure impeller is accurately fitted and statically and dynamically balanced.

4) Pump shaft minimum diameter: size to handle worst case down thrust condition and maximum loads of the motor and bowl assembly.

e. Discharge Head Assemblies:

1) Discharge Head Assembly. The discharge head assembly shall be fabricated steel composed of a pump base, a discharge elbow, and a stuffing box. The coupling on the line shaft shall not interfere with the ability to service the packing container. The pump discharge head base plate shall conform to ASTM Designation A36 and shall be of sufficient thickness to support the assembled weight of the pump and motor, and to safely withstand all stress imposed thereon by vibration, shock, seismic action, and all possible direct and eccentric loads. The base shall be of adequate horizontal dimension to provide sufficient footing contact area and anchorage facilities. Lifting lugs of sufficient strength to support the weight of the complete pump unit exclusive of motor shall be provided. Provide a tapped drain in the discharge head for collection of seal leakage. The discharge flange shall be 150# ANSI flat face flange. The discharge head assembly shall be designed for 150 psi working pressure and 250 psi test pressure.

2) Construct discharge nozzle with a vertical vane to minimize turbulence.

3) Unless shown otherwise on the DRAWINGS, mount the discharge head on fabricated steel base plate that is of sufficient size to span opening in support structure. The fabricated steel base plate shall have tapped holes for bolting down pump discharge head, complete with all bolts, nuts, washers, and anchor bolts. The top of the fabricated steel base plate shall be machined to mate with the pump discharge head base plate. The dimensions and thickness of the fabricated steel base plate shall be determined by the pump manufacturer.

4) Furnish stuffing box constructed of cast iron and containing not less than five rings of graphite impregnated teflon packing (Crane C1065) or Kevlar Aramid fiber. Compress packing around shaft with adjustable gland. Furnish grease fitting to provide additional lubrication to bronze upper shaft bearing. Stuffing box must be located and accessible above pump base plates and with enough room to allow for maintenance. The entire unit, including the stuffing box, shall be designed to withstand the pump shut-off head condition. Provide connections for grease inlet and pressure relief. Provide 416 stainless steel head shaft. Provide bronze upper shaft bearing directly below stuffing box, in the head, to eliminate any shaft whip which could damage the seal. Hard pipe with 3/8 inch diameter 316 SS piping from stuffing box bleed off to floor drain near pump.

5) Provide drain connection and pre-lubricating product water connection and piping.

6) Provide tapped and plugged openings for casing and bearing housing vents and drains.

f. Data Plates:

1) Provide 316 stainless steel data plate securely attached to each pump discharge head.

2) Include manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data.

2.04 Pump Motors

A. Vertical Turbine Pump Motors shall comply with Sections 43 21 20.

B. The Extraction Well No. 1 Pump Motor shall be a vertical hollow shaft, 4-pole, squirrel cage, induction type, Weather Protected 1 (WP1) motor.

2.05 Accessories

A. See Sections 43 00 00 and 40 00 00.

2.06 Factory Test

A. Provide factory test in accordance with Section 43 21 10 and HI Standards with project motor and pump. Certified test results shall be provided to the ENGINEER.

PART 3 EXECUTION

3.01 Installation and Start-up

A. Install products in accordance with manufacturer's instructions and in full compliance with Section 43 21 20. Arrange for the pump manufacturer or supplier of the equipment furnished to provide the services of competent factory-trained personnel to supervise the installation lateral adjustment dimension and initial operation. Include this cost in the price of the equipment.

B. Field Quality Control

1. Following completion of the installation and satisfactory start-up of the equipment, the pump manufacturer's representative shall conduct field testing in compliance with Section 43 21 20. The operation, over the entire specified range, shall be free of vibration, noise, or cavitation.

2. Vibration shall be checked and recorded. Full speed vibration of pumps shall be equal to or less than the amplitude limits recommended in the Hydraulic Institute Standards.

3. Each pump performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump discharge head, water surface elevation in the well, and pump capacity. Readings shall be documented for at least five pumping conditions to define the actual pumping curve. One test shall be at shutoff head. Each power lead to the motor shall be checked for proper current balance at the motor terminals and the MCC.

4. In the event any of the pumping equipment fails to meet the above test requirements, modify and retest in accordance with this Section and with Section 43 21 20.

3.02 Instruction of OWNER'S Personnel

A. After the equipment has been installed, tested, adjusted, and placed in satisfactory operating condition, provide the services of a representative of the manufacturer to instruct the OWNER'S operating personnel in the use and

maintenance of the equipment. Schedule the dates, duration, and content of instruction in consultation with the City. Include the cost of this service in the price of the equipment. Provide well operating log, monitor flow, discharge pressure, motor horsepower, packing gland temperature operating hours.

3.03 Field Quality Control

A. See Sections 43 21 10 and 43 00 00.

3.04 Warranty

The Manufacturer/Supplier/Installer shall warranty the pump and motor assembly for a one-year period from the date of successful operation of the assembly, and not from the date of the installation. Once all facilities are made operational and the pump is successfully field-tested, the warranty period will commence.

PART 4 NOT USED

END OF SECTION

DIVISION 43: PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT
SECTION 43 21 40 – VERTICAL TURBINE PUMP FOR BOOSTER PUMP (BP-2)

PART 1 GENERAL

1.01 Summary

A. Section Includes:

1. This section includes specifications for one line shaft, vertical turbine booster pump (BP-2). Each vertical turbine booster pump shall be provided complete with multistage bowl, column, impeller, discharge head, motor and all required accessories.

B. Related Sections include but are not necessarily limited to:

1. Section 43 21 10 – Pumping Equipment: General Requirements.

2. Section 43 21 20 – Deep Well Vertical Turbine Pump Motors.

3. Section 43 00 00 – Process Integration (General).

1.02 Quality Assurance

A. Referenced Standards:

1. American Iron and Steel Institute (AISI):

2. American National Standard Institute (ANSI):

a. B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

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

a. A48, Gray Iron Castings (Class 35 Minimum).

b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

c. A1O8, Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.

d. A120, Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless for Ordinary Uses.

e. A276, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

f. B505, Standard Specification for Copper-Base Alloy Continuous Castings.

g. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.

h. American Water Works Association (AWWA):

1) E101, Vertical Turbine Pumps - Line Shaft and Submersible Types.

i. Hydraulic Institute Standards (HI).

j. Society of Automotive ENGINEERs (SAE).

1.03 Submittals

A. Shop DRAWINGS:

1. See Section 01 33 00.

2. Product technical data including:

a. Acknowledgment that products submitted meets requirements of standards referenced.

b. Manufacturer's installation instructions.

c. See Section 43 21 10.

d. Schematic elevation showing dimensions of pump base, column, shaft, bowl assembly, cone strainer, discharge head and motor

3. After the above equipment submittals have been approved, submit for approval complete fabrication, assembly, foundation, and installation DRAWINGS, together with detailed specifications and data covering materials of construction, weights, power drive assembly, parts, devices, wiring diagrams, and other accessories forming a part of the equipment furnished. DRAWINGS, specifications, and other submittal data shall include, but shall not be limited to, the following:

a. Anchor bolt placement and anchor bolt details including projections from concrete.

b. Materials of construction including shafts, bearings, impellers, castings, pump base, stuffing boxes, and shaft guards.

c. Electric motor data including size, make, type, designation, and mounting details.

4. After the above equipment submittals have been approved, the additional submittals shall include, but shall not be limited to, the following. Equipment shall not be shipped until these shop test submittals have been submitted and approved.

   a. Certified pump performance curves for the supplied pumps as determined in the specified shop test.

   b. Operation and Maintenance Manuals. See Section 01 33 00.

1.04 Performance and Design Requirements

A. General: Pumps shall be designed and constructed to satisfactorily meet the conditions and requirements specified below and for the installations as shown on the DRAWINGS. The pump shall have a head-capacity characteristic that is constantly rising to shutoff head without any sags. The pumping units shall have a non-overloading horsepower characteristic.

B. Performance Parameters for Booster Pump (BP-2):

	Design Point
Flow (gpm)	2,040
TDH (feet)	410
Minimum Efficiency per Stage (%)	80
Minimum NPSHR (feet)	15.0
Maximum Shutoff Head (feet)	700
Maximum Stages (No.)	7
Maximum Speed (RPM)	1,800
Minimum Motor Horsepower (HP)	300

C. Provide pumps with increasing head characteristics from design point to shutoff condition. Provide pumps with net positive suction head requirements (NPSHR) less than the net positive suction head available (NPSHA) at all operating conditions.

PART 2 PRODUCTS

2.01 Acceptable Manufacturers

A. The pump manufacturer shall be responsible for the entire pump and motor assembly. Subject to compliance with the Contract Documents, the pumping

units shall be manufactured by Peerless Pumps 14MD-5 Stage or Approved equal.

2.02 General

A. Pumps and motors shall be rated for continuous duty and shall be capable of pumping the specified flow range without surging, cavitation or vibration. The pumps shall not overload the motors for any point on the speed pump performance characteristic curve within the limits of stable pump operation as recommended by the manufacturer to prevent surging, cavitation, and vibration, as well as throughout the entire pump operating range. The service factors for the motors shall not be applied when sizing the motors. To insure vibration-free operation, all rotative components of each pumping unit shall be statically and dynamically balanced. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the amplitude of vibration as measured at any point on the pumping unit shall not exceed the limits set forth in the latest edition of the Hydraulic Institute Standards. All parts of each pump shall be designed to withstand the stresses that will be imposed upon them during their handling, shipping, erection, and operation. The completed units, when assembled and operating, shall be free of cavitation, vibration, noise, and oil or water leaks over the range of operation. All units shall be so constructed that dismantling and repairing can be accomplished without difficulty.

2.03 Line Shaft Pump Components

A. General:

1. Furnish unit consisting of a vertical shaft turbine pump connected to a vertical hollow shaft motor. Design unit with non-reversing ratchets. Where applicable, these component requirements also apply to the submersible pumping unit.

2. Weight of revolving parts of pump including unbalanced hydraulic thrust of impeller is carried by thrust bearing in driver.

3. Hollow shaft motor construction shall provide for adjusting impeller clearance in relationship to bowls.

4. MATERIALS. As a minimum, the pump bowl assembly shall be furnished in materials based on the Materials Table 4 in the ANSI/AWWA E101-88 Standard. All materials used and not specified herein shall be the best available for the purpose intended as dictated by the best engineering practice and shall, within this limitation, conform

to the latest Standard of the American Society for Testing Materials so far as numbers. All materials used shall be described in the bidders' proposal including references to ASTM numbers.

a. Bearings:

1) Provide units with sleeve bearings of SAE 660 bronze in each bowl.

2) In bowl, provide main bronze bearing immediately above impeller and a lower bronze bearing immediately below impeller.

3) Provide for lubrication of bowl bearings continuously with water from system pressure.

b. Pump Shaft and Impeller:

1) Provide pump unit shaft constructed of rolled and ground 416 stainless steel.

2) Furnish enclosed type impellers constructed of bronze and securely attached to impeller shaft.

3) Ensure impeller is accurately fitted and statically and dynamically balanced.

4) Pump shaft minimum diameter: size to handle worst case down thrust condition and maximum loads of the motor and bowl assembly.

c. Suction and Discharge Head Assemblies:

1) Suction and Discharge Head Assembly. The suction and discharge head assembly shall be fabricated steel composed of a pump base, a discharge tee, and a stuffing box. The coupling on the line shaft shall not interfere with the ability to service the packing container. The pump discharge head base plate shall conform to ASTM Designation A36 and shall be of sufficient thickness to support the assembled weight of the pump and motor, and to safely withstand all stress imposed thereon by vibration, shock, seismic action, and all possible direct and eccentric loads. The base shall be of adequate horizontal dimension to provide sufficient

footing contact area and anchorage facilities. Lifting lugs of sufficient strength to support the weight of the complete pump unit exclusive of motor shall be provided. Provide a tapped drain in the discharge head for collection of seal leakage. The discharge flange shall be 150# ANSI flat face flange. The discharge head assembly shall be designed for 150 psi working pressure and 250 psi test pressure.

2) Construct discharge nozzle with a vertical vane to minimize turbulence.

3) Unless shown otherwise on the DRAWINGS, mount the discharge head on fabricated steel base plate that is of sufficient size to span opening in support structure. The fabricated steel base plate shall have tapped holes for bolting down pump discharge head, complete with all bolts, nuts, washers, and anchor bolts. The top of the fabricated steel base plate shall be machined to mate with the pump discharge head base plate. The dimensions and thickness of the fabricated steel base plate shall be determined by the pump manufacturer.

4) Furnish stuffing box constructed of cast iron and containing not less than five rings of graphite impregnated teflon packing (Crane C1065) or Kevlar Aramid fiber. Compress packing around shaft with adjustable gland. Furnish grease fitting to provide additional lubrication to bronze upper shaft bearing. Stuffing box must be located and accessible above pump base plates and with enough room to allow for maintenance. The entire unit, including the stuffing box, shall be designed to withstand the pump shut-off head condition. Provide connections for grease inlet and pressure relief. Provide 416 stainless steel head shaft. Provide bronze upper shaft bearing directly below stuffing box, in the head, to eliminate any shaft whip which could damage the seal. Hard pipe with 3/8 inch diameter 316 SS piping from stuffing box bleed off to floor drain near pump.

5) Provide tapped and plugged openings for casing and bearing housing vents and drains.

d. Data Plates:

1) Provide 316 stainless steel data plate securely attached to each pump discharge head.

2) Include manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data.

2.04 Pump Motors

A. Vertical Turbine Pump Motors shall comply with Sections 43 21 20.

B. TYPE. The motor shall be of a vertical type and be of the proper rating to drive the specified pump continuously over the complete operating range of head capacity without the pump load exceeding the motor nameplate rating or operating at any time in the service factor rating. The motor shall be as manufactured by U.S. Motors.

C. DESIGN. The 300hp vertical motor shall be premium efficiency. The motor shall be a completely enclosed type, designed for operation on 460 volts, 60 hertz, 3 phase, alternating current, 1800 rpm, vertical hollow shaft, weather protected WP-1, Type RUS, self-release coupling, 1.15 service factor, 40 degree C ambient, and high thrust rated. The bearing shall have a 1-10 minimum life of three years when considering shut off thrust.

2.05 Accessories

A. See Sections 40 00 00 and 43 00 00.

2.06 Factory Test

A. Provide factory test in accordance with Section 43 21 10 and HI Standards with project motor and pump. Certified test results shall be provided to the ENGINEER.

PART 3 EXECUTION

3.01 Installation and Start-up

A. Install products in accordance with manufacturer's instructions and in full compliance with Section 43 21 20. Arrange for the pump manufacturer or supplier of the equipment furnished to provide the services of competent factory-trained personnel to supervise the installation lateral adjustment dimension and initial operation. Include this cost in the price of the equipment.

B. Field Quality Control

1. Following completion of the installation and satisfactory start-up of the equipment, the pump manufacturer's representative shall conduct field testing in compliance with Section 43 21 20. The operation, over the entire specified range, shall be free of vibration, noise, or cavitation.

2. Vibration shall be checked and recorded. Full speed vibration of pumps shall be equal to or less than the amplitude limits recommended in the Hydraulic Institute Standards.

3. Each pump performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump discharge head, water surface elevation in the well, and pump capacity. Readings shall be documented for at least five pumping conditions to define the actual pumping curve. One test shall be at shutoff head. Each power lead to the motor shall be checked for proper current balance at the motor terminals and the MCC.

4. In the event any of the pumping equipment fails to meet the above test requirements, modify and retest in accordance with this Section and with Section 43 21 20.

3.02 Instruction of OWNER'S Personnel

A. After the equipment has been installed, tested, adjusted, and placed in satisfactory operating condition, provide the services of a representative of the manufacturer to instruct the OWNER'S operating personnel in the use and maintenance of the equipment. Schedule the dates, duration, and content of instruction in consultation with the City. Include the cost of this service in the price of the equipment. Provide well operating log, monitor flow, discharge pressure, motor horsepower, packing gland temperature operating hours.

3.03 Field Quality Control

A. See Sections 43 21 10 and 43 00 00.

3.04 Warranty

The Manufacturer/Supplier/Installer shall warranty the pump and motor assembly for a one-year period from the date of successful operation of the assembly, and not from the date of the installation. Once all facilities are made operational and the pump is successfully field-tested, the warranty period will commence.

PART 4 NOT USED

END OF SECTION

DIVISION 43: PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT
SECTION 43 31 13.19 – CARTRIDGE FILTER FOR LIQUID PURIFICATION

PART 1 GENERAL

1.01 General:

A. The CONTRACTOR shall furnish all labor, materials, and equipment necessary to do all the work specified or required by these Specifications or the Plans. All materials specified by name, brand, or manufacturer, or selected for use under these Specifications, shall be delivered unopened at the jobsite in their original containers bearing the manufacturer's label. No material other than that specified or approved shall be delivered, stored, or kept at the jobsite.

1.02 Submittals

A. Submit six (6) complete sets of shop DRAWINGS and manufacturer's data including the following:

1. Installation instructions.
2. Dimensions, weight, materials, parts, devices, and all other information required to verify compliance with these Specifications.
3. Manufacturer's Literature and Technical Data: DRAWINGS and Specifications for proposed building system
4. Anchorage details of structure to foundation and signed seismic calculation

1.03 Manufacturer's Warranty

A. Manufacturer shall provide a minimum of 1 year warranty on the materials and workmanship.

PART 2 PRODUCTS

2.01 Cartridge Filter Housing

A. 4 Bag filters shall be furnished and installed as shown in construction DRAWINGS.

B. All units to be designed, fabricated, and "U" stamped in accordance with ASME, Section VIII, Division 1, Boiler and pressure vessel code, in compliance to latest addenda.

C. 42 inch diameter filter vessel: 225 PSI, RF inlet / tangential outlet, Stainless Steel, maximum operating temperature 400°F with Viton seals, seal material Buna-N, 1 inch NPT vents, flanged-end connections.

D. Inlet/Outlet flange connections per ANSI B 16.5

2.02 Filter Bags

A. 42” Diameter Filter vessel: 14 Bag with 7” x 32” Dimension, 5 microns, made from polyester materials compliant with food requirements, maximum efficiency 99.9%, maximum temperature 320 °F, conforms to US Code of Federal Regulation 21 CFR part 177 and NSF 61.

2.03 Manufacturer

A. EATON MBF HD Type Filter with DURGAF Filter bags or Approved Equal

PART 3 EXECUTION

3.01 General Installation Requirements:

A. All work under this Section and all testing, where applicable, shall be performed in accordance with manufacturer’s printed recommendations, specifications and installation instructions except where more stringent requirements are shown or specified herein.

END OF SECTION

DIVISION 43: PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT
SECTION 43 32 63 – ULTRAVIOLET DISINFECTION EQUIPMENT

PART 1 GENERAL

1.01 Work Included

A. Furnish, install, test and place into operation, an ultraviolet (UV) disinfection system complete with UV modules, UV lamps, control panel and all other appurtenances necessary to provide a complete installation for satisfactory operation.

1.02 Related Work

A. Division 26 – Electrical

1.03 System Description

A. Design Conditions

1. General

a. Average daily flow – 1,700 gpm

b. Disinfection peak hourly flow – 2,040 gpm

c. Hydraulic Peak hourly flow – 2,040 gpm

d. Total Dissolved Solids concentration – 320 mg/L

e. Ultraviolet Transmittance (%) – >65

f. Annual water temperature range – 36 degrees F to 86 degrees F

2. The UV system will be designed to deliver a minimum UV dose of 400 J/m^2, in effluent with a UV Transmission of 98% after reductions for quartz sleeve absorption, sleeve fouling, and lamp aging. The basis for evaluating the UV dose delivered by the UV system will be the manufacturer's bioassay as carried out by an independent third party. Bioassay validation methodology to follow protocols described in US EPA Design Manual

1.04 Quality Assurance

A. The CONTRACTORs shall be responsible for ensuring that all equipment installed is properly connected to other related equipment for proper functioning of the wastewater treatment facilities.

B. The manufacturer will be regularly engaged in the manufacture of UV systems with a proven track record of at least one hundred (100) installations in North America.

1.05 Submittals

A. SHOP DRAWINGS AND ENGINEERING DATA

1. Submit complete shop DRAWINGS to the ENGINEER in accordance with the requirements of Section 01 33 00, General Specifications.

2. Submit complete engineering data to the ENGINEER in accordance with the requirements of Section 01 33 00, General Specifications.

1.06 Storage and Protection

A. Store and protect the UV disinfection equipment and accessories in accordance with the Manufacturer's recommendations. A building enclosure shall be provided as per plans and specification.

1.07 GUARANTEE

A. Provide a guarantee against defective and deficient equipment and workmanship in accordance with the requirements of General Conditions.

B. The UV system manufacturer shall guarantee the operating life of the lamp for a period of one year.

1.08 Measurement and Payment

A. Payment for this work will include all equipment, materials and labor necessary to perform the work under this specification as shown on the DRAWINGS and specified herein and included in Individual Contract I – General. Payment for all work performed under this section shall be included in the lump sum price of Individual Contract.

PART 2 PRODUCTS

2.01 Manufacturers

A. The design has been based on equipment provided by the following manufacturers:

1. Siemens Industries, Model M2600 UV System for Drinking Water.

2. Or Approved equal.

2.02 System Components

A. Ultraviolet Disinfection

1. Construction: Type 304 Stainless steel.

2. Number of lamps: 4 with quartz sleeves

3. No of UV irradiance Sensors – 4 reactor mounted

4. All material in contact with effluent: stainless steel or quartz.

5. All wire exposed to UV light: stainless steel.

6. All material exposed to UV light: stainless steel, anodized aluminum, quartz 214, or Teflon.

B. Electrical

1. Power Supply – 480 V 3 phase and 60 HZ

2. Interconnecting cables: weatherproof, suitable for outdoor installation.

3. Power Consumption

Maximum power draw to UV system: 3500 watts.

C. Max Flow – 4,000 gpm

D. Control Unit

1. Housing NEMA 12

2. Material – Stainless Steel

3. Digital Input Signal : Enable contact for switching the lamps on or off in position remote

E. Analog Input Signal

1. UV Sensor – 4-20 mA

2. Flow Rate – 4-20 mA

F. Analog Output Signal

1. For UV Intensity – 4-20 mA, accuracy ± 5%

G. Digital Output Signal

1. Advance UV Alarm
2. Flow Rate Alarm
3. Failure of UV Lamp
4. Alarm water temperature
5. UV alarm
6. Cleaning Alarm

H. Interface

1. Ethernet

PART 3 EXECUTION

3.01 Installation

A. GENERAL

Install new package equipment in accordance with Manufacturer's recommendations and installation DRAWINGS.

B. START-UP AND OPERATION

1. START-UP SERVICES

a. The Manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of the UV disinfection equipment and instruct the OWNER'S personnel in the operation and maintenance of the equipment before the equipment is accepted by the OWNER. All equipment and materials necessary to perform testing shall be the responsibility of the installer. This will include, as a minimum, a portable generator (if temporary power is required) and water in the tanks.

C. SPARE PARTS

1. Provide the following spare parts or equivalent:

a. UV Disinfection

b. Four (4) UV lamps

c. One (1) face shield to protect operator from UV light.

d. One (1) gallon of cleaning solution – Lime-a-way manufactured by Ecolab.

e. And, as deemed necessary per manufacturer

2. Spare parts utilized during startup and prior to acceptance of the equipment shall be replaced by the CONTRACTOR at no additional cost to the OWNER.

END OF SECTION

DIVISION 43: PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT
SECTION 43 32 76.13 – CALCIUM HYPOCHLORITE PUMP AND APPURTENANCES

PART 1 GENERAL

1.01 Section Includes

A. The CONTRACTOR shall furnish and install one calcium hypochlorite feed pump with all necessary piping and appurtenances as shown on the DRAWINGS and described herein. The system shall be designed to feed low concentrations of calcium hypochlorite in solution continuously as required for water treatment applications. The system shall be a single pre-assembled, package unit in a welded aluminum frame consisting of chlorinator, electrical boxes, centrifugal pumps, and balance tank for ease of installation and operation. Field assembled systems shall not be acceptable. The system shall be the PowerPro® Model 3050 by PPG Industries, Inc or approved equal. Only NSF Standard 60 listed Accu-Tab® SI (scale inhibitor) calcium hypochlorite tablets by PPG Industries, Inc or approved equal shall be used.

B. The base proposal requires furnishing equipment as specified herein. The bidder is cautioned that substitutions must meet the quality and operational requirements of each feature specified in part 2 below. Batch systems with pressure mixing components producing chlorine concentrations exceeding the limits of the specifications will not be considered.

C. Any system offered shall use an NSF Standard 61 listed erosion feeder.

D. This shall include:

1. Skid-mounted calcium hypochlorite chemical feed pumps and controls
2. Discharge Pumps
3. Control Panel

1.02 Referenced Sections

A. Related work and Sections are shown below:

1. Section 01 33 00 – Submittal Procedures
2. Piping external to a unit
3. Electrical wiring
4. Pressure indicators
5. Level switches

1.03 Cited Standards – None

1.04 Noted Restrictions

A. A maximum chlorine solution level of 0.05% (500 ppm) shall be maintained to prevent calcification in system components. Systems producing chlorine concentrations higher than 0.05% shall not be acceptable.

B. Delivery shall be by erosion feed technology to control accurate and consistent concentration limits in the chlorine treatment solution. Spray and/or vortex technology systems shall not be acceptable.

C. The chlorinator shall automatically and continuously feed a limited quantity of chlorine in solution as needed; when the system is not running, no more chlorine than that amount which can be fed in one minute or less shall be left in the tank to prevent chlorine loss. Batch systems preparing excess quantities of solution for delivery over an extended period shall not be acceptable.

D. Centrifugal pumps wired to the system electrical box shall feed freshly mixed chlorine treatment solution only as required for maximum efficiency. Batch systems requiring the use of a metering pump or pumps to feed pre-prepared standing solution shall not be acceptable.

E. All piping in the chlorinator unit shall be Schedule 80 PVC for durability. Systems with flexible tubing shall not be acceptable.

F. The start/stop commands shall be issued by the PLC through local HOA switches interlocked with the well pump motor starters for permission to run (hardwired). In normal operation the HOA switch shall be in AUTO and the booster pump shall be running for the separate PLCs to start each feed pump. The SCADA shall monitor the feed pump running status, run time, motor fail, and seal leakage alarms. In the event of a pump failure, the PLC will issue a pump failure alarm. See contract drawing PID-6 for more signals.

G. When the HOA switch is in HAND mode, the pump shall be started locally without the PLC intervention but still with the booster pump running permission required.

1.05 Quality Control

A. All equipment furnished shall be new and of best quality entirely suitable for the purpose intended.

1.06 Submittals

A. Shop DRAWINGS. Submit shop DRAWINGS fabrication, assembly,

foundation, and installation DRAWINGS, together with detailed specifications and data covering materials of construction, devices, and other accessories forming a part of the equipment furnished in accordance with the requirements of **Section 01 33 00 Submittal Procedures**.

B. Submit documentation that all equipment and piping in contact with calcium hypochlorite is compatible with (e.g. UL listed 0.05% concentrations of calcium hypochlorite).

C. For calcium hypochlorite pumps, submit capacity, discharge pressure, horsepower and data on assembly, anchor bolts, and mounting. Provide data on variable speed drive which shall include catalogue cuts on all drive equipment, controls, accessories, and wiring requirements.

D. For motor driven equipment, submit motor data; including the manufacturer; locked rotor current in amps and motor speed in rpm.

E. For instrumentation, submit catalogue cuts, wiring diagrams, and equipment data.

F. Instructions. The CONTRACTOR shall provide field assembly, installation and operation and maintenance instructions in conformance with manufacturer's recommendations.

PART 2 PRODUCTS

2.01 Tablet Chlorinator

Tablets are placed on a sieve plate inside the chlorinator; as water flows across the sieve plate, the tablets erode at a rate proportional to the flow rate.

2.02 Inlet Water Supply Connection with Filter

A. The connection shall be 1 ½" and shall include pressure gauge reading 0 to 150 PSIG installed for inlet pressure.

2.03 Inlet Solenoid Valve

A. The solenoid valve opens and closes on command when the system receives a signal.

2.04 Digital Flow Meter

A. A flow sensor shall transmits a pulse signal to a digital monitor, measuring the flow of the fresh water-dissolving stream.

2.05 Flow Control Valve

A. PVC gate valve mounted in line with the flow meter allows operator to adjust flow of water-dissolving stream.

2.06 Solution Tank

A. The solution tank shall be made of high density polyethylene with minimum capacity of 28 gallons.

2.07 Primary Solution Tank Level Control.

A. The level control shall be made from Schedule 80 PVC and 316L stainless steel, and float valve meters the tablet by-pass flow. The by-pass stream balances the variation in the water-dissolving stream. The float valve opens or closes to maintain the pump rate as it is manually throttled.

2.08 Secondary High/Low Level Solution Tank Control.

A. The tank control shall prevents the solution tank from overflowing.

B. High level: when activated, a switch opens the circuit to the solenoid valve, causing the valve to close.

C. Low level: shuts pump down preventing cavitation. A restart timer prevents the pump from “chattering”.

2.09 Solution Delivery Pumps.

A. The pumps shall deliver chlorinated solution into a pressurized stream. Two Grundfos (CR 5-6) vertical multi-stage centrifugal pumps, one duty and another standby equipped with VFD integrated in same skid shall be provided. The variable frequency drive (VFD) motor on the solution delivery pump is controlled by the process controller.

B. The feed pumps shall be wired for semiautomatic control, furnished with variable speed motors. The start/stop commands shall be issued by the PLC through local HOA switches interlocked with the well pump motor starters for permission to run (hardwired). In normal operation the HOA switch shall be in AUTO and the booster pump shall be running for the separate PLCs to start each feed pump. The separate PLCs shall monitor the feed pump running status, run time, motor fail, and seal leakage alarms. In the event of a feed pump failure, the PLC will issue a pump failure alarm.

C. When the HOA switch is in HAND mode, the pump shall be started locally without the PLC intervention but still with the well pump running status required.

2.010 The local control panel shall include the following operator controls and indicators as a minimum:

A. Common failure alarm light, amber.

B. Pump running light, red.

C. Power on light, white.

D. Hand/Off/Auto selector switch

E. Electrical enclosure shall be factory installed and totally enclosed in a NEMA 4X, (IP66) wash-down enclosure. Capable of operating on any input power from 110VAC to 240VAC, 50/60 Hz single phase supply without user configuration or selection switches

2.011 Solution Injection Pump Air Bleed.

A. Used to prime the pump at start-up, or at any time, if necessary. Also functions as a recycle line for tank cleaning.

2.012 Primary Backflow Prevention.

A. A PVC Ball check valve prevents reverse flow of water into the system.

2.013 Discharge Control Valve (manual).

A. Used to balance system output water flow with system input water flow.

2.014 Other Materials

A. Fabrications. Steel fabrications for mountings and anchorages shall conform to the requirements of ASTM A-36 for fabricated steel.

B. Shop Coatings. Shop coat exposed ferrous metal surfaces in conformance with Section 09 99 00.

C. Gaskets. Use Viton gaskets with calcium hypochlorite flanged connections.

PART 3 EXECUTION

3.01 Preparation – None

3.02 Installation

A. Installation And Start-Up

1. Examine the equipment delivered to the site to determine that it is in conformance with the approved shop DRAWINGS and install. Coordinate activities with the instrumentation, monitoring and control work. Furnish the services of a competent factory-trained representative of equipment supplier or manufacturer to assist in and supervise the initial operation. Include an appropriate allowance in the price of the equipment.

B. Field Coating

1. Field coat exterior surfaces in conformance with the requirements set in **Division 09 - Finishes**. Prior to placement of any equipment finish coat any exterior surfaces which will rest on slabs or be otherwise covered up.

C. Instruction

1. After the equipment has been installed, tested, adjusted, and placed in satisfactory operating condition, provide the services of a representative of the manufacturers to instruct the operating personnel in the use and maintenance of the equipment. Schedule the duration and dates of this instruction after consultation with the ENGINEER. Include the cost of instruction in the price of the equipment.

3.03 Warranty

A. The manufacturer shall guarantee in writing that this unit, operated in accordance with written instructions given and accepted by the OWNER, will perform in complete accord with the specifications. All components shall be warranted against manufacturers' defects for twelve (12) months from its original installation date.

3.04 Testing – None

END OF SECTION