

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

**DEPARTMENT OF THE NAVY  
WESTERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
SAN BRUNO, CALIFORNIA**

**SPECIFICATION NO:  
CONTRACT NO: N62474-94-D-7609  
APPROPRIATION: BRAC**

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
CONSTRUCTION SPECIFICATIONS**

at

**MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

**DRAWINGS AND SPECIFICATIONS PREPARED BY:**

**PRC ENVIRONMENTAL MANAGEMENT, INC.**

135 Main Street, Suite 1800  
San Francisco, California 94105  
(415) 543-4880

**PRELIMINARY**

**FEB 24 1997**

**NOT FOR CONSTRUCTION**

February 24, 1997

PRC Environmental Management, Inc.  
1099 18th Street  
Suite 1960  
Denver, CO 80202  
303-295-1101  
Fax 303-295-2818



February 24, 1997

Mr. Su Don Tu  
Department of the Navy  
Engineering Field Activity West  
Naval Facilities Engineering Command  
900 Commodore Way, Buildign 210  
San Bruno, California 94066-5006

CLEAN Contract Number N62474-94-D-7609  
Contract Task Order 003

**Subject: East-side Aquifer Treatment System (EATS) Preliminary Design Report, Preliminary Design Drawings, and Preliminary Construction Contractor Specifications, Moffett Federal Airfield, Moffett Field, California**

Dear Mr. Tu:

Enclosed are six copies each of the EATS Preliminary Design Report, the EATS Preliminary Design Drawings, and the Preliminary EATS Construction Contractor Specifications. Copies of the report and drawings are being forwarded to the regulatory agencies and project personnel.

If you have any questions or comments, please call me at (303) 312-8850.

Sincerely,

A handwritten signature in black ink that reads "Steve Tsadwa". The signature is written in a cursive style with a long horizontal line extending to the right.

Steve Tsadwa  
Project Engineer

ST:cmg

Enclosures

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
PRELIMINARY DESIGN PACKAGE  
MOFFETT FEDERAL AIRFIELD**

**DISTRIBUTION LIST**

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PRELIMINARY DESIGN REPORT  
EAST-SIDE AQUIFER TREATMENT SYSTEM

DATED 24 FEBRUARY 1997

IS FILED AS ADMINISTRATIVE RECORD NO.  
**N00296.002969**

PRELIMINARY DESIGN DRAWINGS  
EAST-SIDE AQUIFER TREATMENT SYSTEM

DATED 24 FEBRUARY 1997

IS FILED AS ADMINISTRATIVE RECORD NO.  
**N00296.002971**

EAST-SIDE AQUIFER TREATMENT SYSTEM  
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MOFFETT FIELD, CALIFORNIA

SPECIFICATIONS SUMMARY

Spec. No.	Specification Title
00501	List of Drawings
01010	Summary of Work
01300	Submittals
01400	Quality Control
01560	Temporary Controls
02076	Demolition and Removal
02220	General Excavation, Filling, and Backfilling
02510	Surface Restoration
02670	Rotary-Drilled Water Wells
02675	Auger-Drilled Monitoring Wells
02831	Fence, Chain Link
03302	Cast-In-Place Concrete
05500	Metal Fabrication
11241	Chemical Addition System
11395	Air Stripper
13121	Canopy
15011	Mechanical General Requirements
15080	Piping, Valves, and Appurtenances
15160	Pumps
16011	Electrical General Requirements
16403	Wiring Systems
<del>16900</del> <del>16940</del>	Instrumentation and Controls

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SECTION 00501  
LIST OF DRAWINGS

PART 1 GENERAL

1.1 SUMMARY

This section lists the drawings for the project pursuant to contract clause DFARS 252.236-7001, "Contract Drawings, Maps and Specifications."

1.2 CONTRACT DRAWINGS

Contract drawings are as follows with each drawing bearing the general title "East-Side Aquifer Treatment System."

Drawing No.	Revision No.	NAVFAC Drawing No.	Title
T1		0	Title Sheet
T2		0	Symbols Legend
C1		0	Site Plan
C2		0	Equipment Plan
C3		0	Wells and Miscellaneous Civil Details
C4		0	Equipment Cross-Sections and Miscellaneous Details
S1		0	Treatment System Pad
S2		0	Treatment System Pads Structural Details
I1		0	Process Flow Diagram
I2		0	Piping and Instrumentation Diagram
I3		0	Piping and Instrumentation Diagram
E1		0	Electrical Site Plan
E2		0	Electrical One-Line Diagram and Panel Schedules
E3		0	Electrical Power Plan
E4		0	Cable Schedule
E5		0	Motor Starter Panel
E6		0	Motor Control Schematics

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1.3 SUPPLEMENTARY DRAWINGS

Supplementary drawings are not a part of the contract but are for information only.

1.3.1 Utility Drawings

Contractor is responsible for field verifying the locations of all existing utilities in the vicinity of construction. Utility drawings are the property of the Government and shall not be used for any purpose other than that intended by the contract. Utility drawings shall not be relied on for exact locations of utilities, mains, services or laterals. Contractor shall obtain and examine copies of all pertinent utility drawings prior to field verifying utility locations.

1.3.2 Subsurface Data

Subsurface data have been obtained by the Government as part of various environmental investigations at Moffett Federal Airfield. The data are available for examination at Moffett Federal Airfield.

END OF SECTION

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**SECTION 01010  
SUMMARY OF WORK**

**PART 1 GENERAL**

**1.1 WORK COVERED BY CONTRACT DOCUMENTS**

**1.1.1 Project Description**

The work includes the furnishing of all labor, materials, and equipment to construct the East-Side Aquifers Treatment System, including earthwork, asphalt paving, well installation, piping, treatment system installation, and incidental related work.

**1.1.2 Location**

The work is located at Moffett Federal Airfield, approximately as shown on the Drawings. The exact location will be indicated by the Contracting Officer.

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-18, Records**

- a. List of contact personnel (G), their addresses and phone numbers.

**1.3 SPECIAL SCHEDULING REQUIREMENTS**

- a. The entire Airfield will remain in operation during the entire construction period. Conduct operations so as to cause the least possible interference with normal operations.
- b. Construction activities will be conducted on or near Macon Road, Marriage Road, golf course, and other portions of the base. Construction activities shall be conducted in a manner that minimizes disruption of base traffic and activities.

**1.4 CONTRACTOR PERSONNEL REQUIREMENTS**

**1.4.1 Subcontractors and Personnel**

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and 24-hour telephone numbers for use in an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists. Furnish updated lists when changes occur and additional information becomes available.

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**1.4.2 Identification Badges**

Identification badges, if required, will be obtained by the Navy without charge. Application for and use of badges will be as directed. Immediately report instances of lost or stolen badges to the Contracting Officer.

**1.5 CONTRACTOR ACCESS AND USE OF PREMISES**

**1.5.1 Station Regulations**

The Contractor shall be responsible for coordination with a qualified representative of NASA the Moffett Federal Airfield regulations including areal limits of work and restricted areas. Ensure that Contractor personnel employed at Moffett Federal Airfield become familiar with and obey Airfield regulations. Keep within the limits of the work and avenues of ingress and egress. Do not enter restricted areas unless required to do so and until cleared for such entry. Permission to interrupt station roads, railroads, or utility services shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption from a qualified representative of NASA. The Contractor's equipment shall be conspicuously marked for identification.

**1.5.2 Working Hours**

Regular working hours shall consist of a period established by the Contracting Officer between 7 a.m. and 5 p.m., Monday through Friday, excluding Government holidays.

**1.5.3 Work Outside Regular Hours**

Work outside regular working hours requires Contracting Officer approval. Provide written request 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress. During periods of darkness, the various work areas shall be lighted in a manner approved by the Contracting Officer.

**1.5.4 Occupied Buildings**

The Contractor shall be working around existing buildings that are occupied. Do not enter the buildings without prior approval of the Contracting Officer. Coordinate necessary access to all buildings with Contracting Officer.

**1.6 EXISTING WORK**

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work that have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

**1.7 LOCATION OF UNDERGROUND FACILITIES**

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Obtain and examine copies of all pertinent station drawings prior to construction. Mark the surface of the ground where existing underground utilities are indicated on maps or discovered. Verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified to be removed, in locations to be traversed by piping or other work to be installed.

**1.8 PRECONSTRUCTION CONFERENCE**

After award of the contract, but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding of the following: administration of the value engineering and safety program, preparation and submission of the schedule of prices, shop drawings and other submittals, scheduling, programming and prosecution of work. Major subcontractors who will be engaged in the work shall also attend.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

Not used.

**END OF SECTION**

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**SECTION 01300  
SUBMITTALS**

**PART 1 GENERAL**

The specifications for the submittals for this delivery order are found in PART 7.0 SUBMITTALS in the specifications for the base contract beginning on Page C-43 with the following changes.

1. Change subparagraph 7.4.7.j to read "forward six copies" instead of two.
2. Change subparagraph 7.4.6.d to read "retain five copies" instead of three.
3. Insert the Sample Forms Submittal Register (PART A and PART B) after page C-45.
4. Insert the Submittal Register (PART A), with columns (a) through (e) filled in, behind the blank sample forms at the end of Section 7.0.

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

Not Used

**END OF SECTION**

SAMPLE FORM SUBMITTAL REGISTER (PART A)

CONTRACT NO:

PROJECT TITLE:

SPEC SECTION NO. (a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT (b)	SPEC PARA. NO. (c)	CLASSIF/ APPR BY CO (d)	GOVT OR A/E REVR (e)	TRANS CONTL NO. (f)	PLANNED SUBMITTAL DATE (g)
01010	SD-18 RECORDS List of Contact Personnel	1.2.1	G			
01400	SD-18 RECORDS Quality Control Plan	1.2.1	G			
01560	SD-08 STATEMENTS					
	a. Preconstruction Survey Report	1.3.1				
	b. MSDSs	1.3.1				
	c. Site Health & Safety Plan	1.3.1				
	d. Environmental Protection Plan	1.3.1	G			
01560	SD-18 RECORDS					
	a. Solid Waste Disposal Permit/ Manifests	1.3.2				
	b. Hazardous Waste Permits/ Manifests	1.3.2	G			
02076	SD-08 STATEMENTS Demolition Plan	1.3.1	G			
02220	SD-12 FIELD TEST REPORTS					
	a. Fill and Backfill Material	1.3.1				
	b. Bedding Material	1.3.1				
	c. In-Place Density	1.3.1				
02510	SD-05 DESIGN DATA Asphalt Mix Formula	1.2.1				
02510	SD-08 STATEMENTS Asphalt Concrete	1.2.2				
02510	SD-12 FIELD TEST REPORTS Asphalt Concrete	1.2.3				
02510	SD-13 CERTIFICATES					
	a. Aggregates	1.2.4				
	b. Asphalt Cement	1.2.4				
	c. Asphaltic Emulsion	1.2.4				

SAMPLE FORM SUBMITTAL REGISTER (PART A)

CONTRACT NO:

PROJECT TITLE:

SPEC SECTION NO. (a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT (b)	SPEC PARA. NO. (c)	CLASSIF/ APPR BY CO (d)	GOVT OR A/E REVR (e)	TRANS CONTL NO. (f)	PLANNED SUBMITTAL DATE (g)
02670	SD-01 DATA					
	a. Northing, easting of each extraction well	1.2.1				
	b. Elevation of each piezometer top of casing	1.2.1				
	c. Ground surface elevation adjacent to each extraction well	1.2.1				
02670	SD-08 STATEMENTS					
	a. Water Disposal Methods	1.2.2				
	b. Sand Placement Equipment List	1.2.2				
	c. Sand Placement Methods	1.2.2				
02670	SD-13 CERTIFICATES					
	a. Casings	1.2.3				
	b. Cement	1.2.3				
	c. Screens	1.2.3				
	d. Sand	1.2.3				
02675	SD-01 DATA					
	a. Northing, easting of extraction well	1.2.1				
	b. Elevation of each monitoring well top of casing	1.2.1				
	c. Ground surface elevation adjacent to each monitoring well	1.2.1				
02675	SD-08 STATEMENTS					
	a. Water Disposal Methods	1.2.2				
	b. Sand Placement Equipment List	1.2.2				
	c. Sand Placement Methods	1.2.2				
02675	SD-13 CERTIFICATES					
	a. Casings	1.2.3				
	b. Cement	1.2.3				
	c. Screens	1.2.3				
	d. Sand	1.2.3				
02831	SD-02 MANUFACTURER'S CATALOGUE DATA					
	a. Fencing Components	1.3.1				
	b. Accessories	1.3.1				

**SAMPLE FORM SUBMITTAL REGISTER (PART A)**

**CONTRACT NO:**

**PROJECT TITLE:**

<b>SPEC SECTION NO. (a)</b>	<b>SD NO &amp; TYPE OF SUBMITTAL-MATL OR PRODUCT (b)</b>	<b>SPEC PARA. NO. (c)</b>	<b>CLASSIF/ APPR BY CO (d)</b>	<b>GOVT OR A/E REVR (e)</b>	<b>TRANS CONTL NO. (f)</b>	<b>PLANNED SUBMITTAL DATE (g)</b>
03302	SD-10 TEST REPORTS Compressive Strength	1.2.1				
03302	SD-13 CERTIFICATES a. Cement b. Aggregate c. Admixtures d. Reinforcement e. Expansion-joint filler	1.2.2				
05500	SD-08 STATEMENTS a. Qualifications of welders	1.2.1				
11241	SD-02 MANUFACTURER'S CATALOG DATA a. Antiscalant tank	1.4.1				
11241	SD-05 DESIGN DATA Seismic tiedowns	1.4.2				
11241	SD-07 SCHEDULES a. Chemical addition system b. Auxiliary equipment and spare parts	1.4.3				
11241	SD-09 REPORTS Field test reports	1.4.4				
11241	SD-13 CERTIFICATES Supplied chemical certificates	1.4.5				
11241	SD-19 OPERATION AND MAINTENANCE MANUALS a. Chemical addition system	1.4.6				
11395	SD-01 DATA Design data and supporting calculations	1.3.1		G		
11395	SD-02 MANUFACTURERS CATALOG DATA a. Stripper b. Blower c. Blower inlet filter d. Instruments	1.3.2				

**SAMPLE FORM SUBMITTAL REGISTER (PART A)**

**CONTRACT NO:**

**PROJECT TITLE:**

<b>SPEC SECTION NO. (a)</b>	<b>SD NO &amp; TYPE OF SUBMITTAL-MATL OR PRODUCT (b)</b>	<b>SPEC PARA. NO. (c)</b>	<b>CLASSIF/ APPR BY CO (d)</b>	<b>GOVT OR A/E REVR (e)</b>	<b>TRANS CONTL NO. (f)</b>	<b>PLANNED SUBMITTAL DATE (g)</b>
11395	<b>SD-04 DRAWINGS</b>					
	a. Air stripper plan view and profile	1.3.3				
	b. Blower plan view	1.3.3				
11395	<b>SD-05 DESIGN DATA</b>					
	Seismic tiedowns	1.3.4	G			
11395	<b>SD-07 SCHEDULES</b>					
	a. Air stripping system	1.3.5				
	b. Auxiliary equipment and spare parts	1.3.5				
	c. Testing	1.3.5				
11395	<b>SD-13 CERTIFICATES</b>					
	Certificate of Compliance for each manufacturer	1.3.6				
11395	<b>SD-19 OPERATION AND MAINTENANCE MANUAL</b>					
	a. Stripper	1.3.7				
	b. Blower	1.3.7				
13121	<b>SD-04 DRAWINGS</b>					
	a. Pre-engineered building	1.5.1	G			
	b. Template for anchor bolts	1.5.1				
13121	<b>SD-05 DESIGN DATA</b>					
	a. Building	1.5.2	G			
	b. Foundation loads	1.5.2	G			
	c. Anchor bolts	1.5.2	G			
	d. Purlins and girts	1.5.2	G			
	e. Bracing	1.5.2	G			
	f. Foundation	1.5.2	G			
13121	<b>SD-13 CERTIFICATES</b>					
	a. Pre-engineered metal building materials	1.5.3				
13121	<b>SD-19 OPERATION AND MAINTENANCE MANUAL</b>					
	Manufacturer provided maintenance data	1.5.4				

SAMPLE FORM SUBMITTAL REGISTER (PART A)

CONTRACT NO:

PROJECT TITLE:

SPEC SECTION NO. (a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT (b)	SPEC PARA. NO. (c)	CLASSIF/ APPR BY CO (d)	GOVT OR A/E REVR (e)	TRANS CONTL NO. (f)	PLANNED SUBMITTAL DATE (g)
15080	SD-02 MANUFACTURER'S CATALOG DATA					
	a. Pipe and fittings	1.2				
	b. Valves	1.2				
	c. Tubing and fittings	1.2				
	d. Pipe supports	1.2				
	e. Valve boxes	1.2				
	f. Filters	1.2				
15160	SD-02 MANUFACTURER'S CATALOG DATA					
	Each pump	1.2.1				
15160	SD-06 INSTRUCTIONS					
	Pump Installation	1.2.2				
15160	SD-13 CERTIFICATES					
	Each pump	1.2.3				
15160	SD-19 OPERATION AND MAINTENANCE MANUALS					
	a. Pump Operation and Maintenance	1.2.4				
	b. Parts List	1.2.4				
16011	SD-02 MANUFACTURERS CATALOG DATA					
	Each manufactured item	1.5.1				
16011	SD-04 DRAWINGS					
	Wiring diagrams and instrumentation details	1.5.2				
16011	SD-06 INSTRUCTIONS					
	Manufacturers Instructions	1.5.3				
16011	SD-13 CERTIFICATES					
	Products, materials, finishes, and equipment	1.5.4				
16011	SD-19 OPERATION AND MAINTENANCE MANUAL					
	All equipment	1.5.5				

**SAMPLE FORM SUBMITTAL REGISTER (PART A)**

**CONTRACT NO:**

**PROJECT TITLE:**

<b>SPEC SECTION NO. (a)</b>	<b>SD NO &amp; TYPE OF SUBMITTAL-MATL OR PRODUCT (b)</b>	<b>SPEC PARA. NO. (c)</b>	<b>CLASSIF/ APPR BY CO (d)</b>	<b>GOVT OR A/E REVR (e)</b>	<b>TRANS CONTL NO. (f)</b>	<b>PLANNED SUBMITTAL DATE (g)</b>
16403	<b>SD-02 MANUFACTURERS CATALOG DATA</b>					
	a. Receptacles	1.3.1				
	b. Circuit breakers	1.3.1				
	c. Switches	1.3.1				
	d. Transformers	1.3.1				
	e. Enclosed circuit breakers	1.3.1				
	f. Motor controllers	1.3.1				
16043	<b>SD-04 DRAWINGS</b>					
	a. Panelboards	1.3.2				
	b. Transformers	1.3.2				
16403	<b>SD-19 OPERATION AND MAINTENANCE MANUALS</b>					
	Electrical systems	1.3.3				
16900	<b>SD-02 MANUFACTURERS CATALOG DATA</b>					
	a. PLC control panel	1.4.1				
	b. Programmable controllers	1.4.1				
	c. Programmable controller programming software	1.4.1				
	d. Operator interface panel	1.4.1				
	e. Personal computer	1.4.1				
	f. Data acquisition and supervisory control software	1.4.1				
	g. Instruments	1.4.1				
16900	<b>SD-04 DRAWINGS</b>					
	a. Catalog information	1.4.2				
	b. Specification data sheets	1.4.2				
	c. Fabrication drawings	1.4.2				
	d. Elementary wiring diagrams	1.4.2				
	e. Interconnecting wiring diagrams	1.4.2				
16900	<b>SD-19 OPERATIONS AND MAINTENANCE MANUALS</b>					
	a. PLC control panel	1.4.3				
	b. Operator interface panel	1.4.3				
	c. Instruments	1.4.3				

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**SECTION 01400  
QUALITY CONTROL**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM A 880	(1989) Criteria for Use in Evaluation of Testing Laboratories and Organization for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
ASTM C 1077	(1992) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 3666	(1992) (Rev. A) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 3740	(1988) Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(1990) Evaluation of Testing and Inspection Agencies as Used in Construction
ASTM E 543	(1992 Rev. C) Evaluating Agencies that Perform Nondestructive Testing

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-18, Records**

- a. Quality Control (QC) plan (G)  
Submit a QC plan within 30 calendar days after receipt of Notice of Award.

**1.3 INFORMATION FOR THE CONTRACTING OFFICER**

Deliver the following to the Contracting Officer:

- a. Combined Contractor Production Report/Contractor Quality Control Report (1 sheet): Original and 1 copy, by 10:00 a.m. the next working day after each day that work is performed;

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- b. **Monthly Summary Report of Field Tests:** Original and 1 copy attached to Combined Contractor Production Report/Contractor Quality Control Report at the end of each month;
- c. **QC Meeting Minutes:** 1 copy within 2 calendar days of the meeting;
- d. **Rework Items List:** 1 copy by the last working day of the month and;
- e. **Testing Plan and Log:** 1 copy at the end of each month.
- f. **QC Certifications:** As required by the paragraph titled "QC Certifications."

**1.4 QC PROGRAM REQUIREMENTS**

QC program requirements are specified in Remedial Action Contract (RAC) No. N62474-93-D-2151 with International Technology (IT) Corporation.

**1.5 QC ORGANIZATION**

**1.5.1 QC Manager**

**1.5.1.1 Duties**

Provide a QC Manager at the work site to manage and implement the QC program. The QC Manager is required to attend QC meetings with Navy, attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review and approval except those designated for Contracting Officer approval, ensure testing is performed, and prepare QC certifications and documentation required in this Contract. No work or testing may be performed unless the QC Manager is on site. In addition to managing and implementing the QC program, the QC Manager may perform other duties.

**1.5.1.2 Qualifications**

An individual with a minimum of 5 years experience as a foreman, superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts.

**1.5.2 Submittal Reviewers Duties and Approving Authority**

Each submittal shall be reviewed for compliance with contract requirements by a Registered Engineer qualified in the discipline being reviewed prior to certification or approved by the QC Manager. Unless specifically indicated otherwise, the approving authority for submittals shall be the QC Manager. If a technical section designates the Contracting Officer, or other authority to approve a particular submittal, then the Contracting Officer shall be the approving authority.

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**1.6 QC PLAN**

**1.6.1 Requirements**

Provide for approval by the Contracting Officer a QC plan that covers both on-site and off-site work and includes the following:

- a. Duties, responsibilities, and authorities of each person in the QC organization.
- b. A listing of outside organizations such as architectural and consulting engineering firms or laboratories that will be employed by the Contractor and a description of the services these firms will provide.
- c. A letter signed by an officer of the firm appointing the QC Manager and stating that he/she is responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of nonconforming work.
- d. Testing laboratory information required by the paragraphs titled "Accredited Laboratories" or "Testing Laboratory Requirements," as applicable.
- e. A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.
- f. Procedures to identify, record, track, and complete rework items.
- g. A chart showing the QC organizational structure and its relationship to the production side of the organization.
- h. Names and qualifications, in resume format, for each person in the QC organization.
- i. Procedures for reviewing, approving, and managing submittals. Provide the names of the persons in the QC organization authorized to review and certify submittals prior to approval.
- j. Documentation procedures, including proposed report formats.
- k. A list of the definable features of work. A definable feature of work is a task that is separate and distinct from other tasks and requires separate control requirements. As a minimum, if approved by the Contracting Officer, consider each section of the specifications as a definable feature of work. However, at times, there may be more than one definable feature of work in each section of the specifications.

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**1.6.2 Preliminary Work Authorized Prior to Approval**

The only work that is authorized to proceed prior to the approval of the QC plan is mobilization of storage and office trailers, temporary utilities, and surveying.

**1.6.3 Approval**

Approval of the QC plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC plan and operations as necessary to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify his/her submitted qualifications.

**1.6.4 Notification of Changes**

Notify the Contracting Officer, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of 7 calendar days prior to a proposed change. Proposed changes must be approved by the Contracting Officer.

**1.7 QC PLAN MEETING**

Meet with the Contracting Officer to discuss the QC plan requirements of this Contract prior to submission of the QC plan. The purpose of this meeting is to develop a mutual understanding of QC plan requirements prior to plan development and submission.

**1.8 COORDINATION AND MUTUAL UNDERSTANDING MEETING**

After submission of the QC plan, but prior to the start of construction, meet with the Contracting Officer to discuss the QC program required by this Contract. The purpose of this meeting is to develop a mutual understanding of QC details, including forms to be used for documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production, and QC personnel with the Contracting Officer. As a minimum, the Contractor's personnel required to attend shall include the project manager, project superintendent, and QC Manager. Minutes of the meeting shall be prepared by the QC Manager and signed by both the Contractor and the Contracting Officer.

**1.9 QC MEETINGS**

After the start of construction, the QC Manager shall conduct QC meetings once every 2 weeks at the work site with the project superintendent. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. The QC Manager shall notify the Contracting Officer at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

- a. Review the minutes of the previous meeting,

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- b. Review the schedule and the status of work:
  - Work or testing accomplished since last meeting;
  - Rework items identified since last meeting;
  - Rework items completed since last meeting.
- c. Review the status of submittals:
  - Submittals reviewed and approved since last meeting;
  - Submittals required in the near future.
- d. Review the work to be accomplished in the next 2 weeks and documentation required:
  - Establish completion dates for rework items;
  - Preparatory phases required;
  - Initial phases required;
  - Follow-up phases required;
  - Testing required;
  - Status of off-site work or testing;
  - Documentation required.
- e. Resolve QC and production problems
- f. Address items that may require revising the QC plan:
  - Changes in QC organization personnel;
  - Changes in procedures.

1.10 THREE PHASES OF CONTROL

The QC Manager shall perform the three phases of control (preparatory, initial, and follow-up) to ensure that work complies with Contract requirements. The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each definable feature of work: A definable feature of work is a task which is separate and distinct from other tasks and requires separate control requirements.

1.10.1 Preparatory Phase

Notify the Contracting Officer at least 2 work days in advance of each preparatory phase. Conduct the preparatory phase with the foreman responsible for the definable feature. Document the results of preparatory phase actions in the daily Contractor Quality Control Report. Perform the following prior to beginning work on each definable feature of work:

- a. Review the applicable specification;
- b. Review the Contract drawings;

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- c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;
- d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;
- e. Examine the work area to ensure that the required preliminary work has been completed;
- f. Examine the required materials, equipment, and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;
- g. Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and
- h. Discuss construction methods.

**1.10.2 Initial Phase**

Notify the Contracting Officer at least 2 work days in advance of each initial phase. When construction crews are ready to start work on a definable feature of work, conduct the initial phase with the superintendent. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

- a. Establish the quality of workmanship required;
- b. Resolve conflicts;
- c. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and
- d. Ensure that testing is performed by the approved laboratory.

**1.10.3 Follow-Up Phase**

Document in the daily Contractor Quality Control Report, the following for on-going work daily, or more frequently as necessary until the completion of each definable feature of work:

- a. Work is in compliance with Contract requirements;
- b. Quality of workmanship is maintained;
- c. Testing is performed by the approved laboratory; and

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d. Rework items are being corrected.

**1.11 SUBMITTAL REVIEW AND APPROVAL**

Procedures for submission, review and approval of submittals are described in the Remedial Action Contract (RAC).

**1.12 TESTING**

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

**1.12.1 Testing Laboratory Requirements**

Provide an independent testing laboratory or procure a laboratory qualified to perform sampling and tests required by this Contract. When the proposed testing laboratory is not accredited by an acceptable accreditation program as described by the paragraph titled "Accredited Laboratories," submit to the Contracting Officer for approval certified statements signed by an official of the testing laboratory attesting that the proposed laboratory meets or conforms to the following requirements:

- a. Sampling and testing shall be under the technical direction of a Registered Professional Engineer (PE) with at least 5 years of experience in construction material testing.
- b. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C 1077.
- c. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D 3666.
- d. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.
- e. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A 880. Laboratories shall meet the requirements of ASTM E 329.
- f. Laboratories engaged in nondestructive testing (NDT) shall meet the requirements of ASTM E 543.
- g. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of Occupational Safety and Health Administration (OSHA) and United States Environmental Protection Agency (EPA).

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**1.12.2 Accredited Laboratories**

Acceptable accreditation programs are the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO) program, and the American Association for Laboratory Accreditation (A2LA) program. Furnish to the Contracting Officer a copy of the Certificate of Accreditation, Scope of Accreditation, and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract.

**1.12.3 Inspection of Testing Laboratories**

Prior to approval of nonaccredited laboratories, the proposed testing laboratory facilities and records may be subject to inspection by the Contracting Officer. Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and the internal QC procedures.

**1.12.4 Capability Check**

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing for compliance with the standards set forth in this Contract.

**1.12.5 Test Results**

Cite applicable Contract requirements, tests, or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms to or fails to conform to specified requirements. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

**1.13 QC CERTIFICATIONS**

**1.13.1 Contractor Quality Control Report Certification**

Each Contractor Quality Control Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the Contract drawings and specifications to the best of my knowledge, except as noted in this report."

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**1.13.2 Invoice Certification**

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

**1.13.3 Completion Certification**

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested, and is in compliance with the Contract."

**1.14 DOCUMENTATION**

Maintain current and complete records of on-site and off-site QC program operations and activities.

**1.14.1 Contractor Production Report**

Reports are required for each day that work is performed and shall be attached to the Contractor Quality Control Report prepared for the same day. Account for each calendar day that construction or testing activities are conducted. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Production Reports are to be prepared, signed, and dated by the Project Superintendent and shall contain the following information:

- a. Date of report, report number, name of contractor, Contract number, title and location of Contract, and superintendent present.
- b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.
- c. A list of Contractor and subcontractor personnel on the work site, their trades, employer, work location, description of work performed, and hours worked.
- d. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results of the following survey:
  - Was a job safety meeting held? (If YES attach a copy of the meeting minutes)
  - Were there any lost time accidents? (If YES attach a copy of the completed OSHA report)
  - Was trenching/scaffold/high voltage electrical/high work done? (If YES attach a statement or checklist showing inspection performed)
  - Was hazardous material/waste released into the environment? (If YES, attach a description of meetings held and accidents that happened)

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- e. A list of equipment/material received each day that is incorporated into the job.
- f. A list of construction and plant equipment on the work site including the number of hours used, idle, and down for repair.
- g. Include a "remarks" section in this report that will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered, and a record of visitors to the work site.

**1.14.2 Contractor Quality Control Report**

Reports are required for each day that work is performed, for every 7 consecutive calendar days of no-work, and on the last day of a no-work period. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Quality Control Reports are to be prepared, signed, and dated by the QC Manager and shall contain the following information:

- a. Identify the control phase and the definable feature of work.
- b. Results of Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the drawings and specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.
- c. Results of Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed; include a list of who performed the tests.
- d. Results of Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed; include a list of who performed the tests.
- e. List the rework items identified but not corrected by close of business.
- f. List the rework items corrected from the rework items list along with the corrective action taken.
- g. Include a "remarks" section in this report that will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, construction deficiencies encountered, QC meetings held, acknowledgement that

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as-built drawings have been updated, corrective direction given by the QC Organization, and corrective action taken by the Contractor.

h. Contractor Quality Control Report certification.

**1.14.3 Testing Plan and Log**

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the Contracting Officer, remarks, and acknowledgement that an accredited or Contracting Officer-approved testing laboratory was used. Attach a copy of the updated "Testing Plan and Log" to the last daily Contractor Quality Control Report of each month.

**1.14.4 Rework Items List**

The QC Manager shall maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Contractor Rework Items List" to the last daily Contractor Quality Control Report of each month. The Contractor shall be responsible for including on this list items needing rework including those identified by the Contracting Officer.

**1.14.5 As-Built Drawings**

The QC Manager is required to review the as-built drawings, to ensure that as-built drawings are kept current by the Contractor on a daily basis, and marked to show deviations from the Contract Drawings. The QC Manager shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

**1.14.6 Report Forms**

The following forms, which are attached at the end of this section, are acceptable for providing the information required by the paragraph titled "Documentation." Although use of these specific formats is not required, any other format used shall contain the same information:

- a. Combined Contractor Production Report/Contractor Quality Control Report (1 sheet), with separate continuation sheet
- b. Testing Plan and Log
- c. Rework Items List

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PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

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SECTION 01560  
TEMPORARY CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

49 CFR 178	Shipping Container Specification
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standard for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan

1.2 DEFINITIONS

1.2.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.2 Solid Waste

Rubbish, debris, garbage, and other discarded solid materials, except hazardous waste as defined in the paragraph titled "Hazardous Waste," resulting from industrial, commercial, and agricultural operations and from community activities.

1.2.3 Rubbish

Combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

1.2.4 Debris

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Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.

1.2.5 Chemical Wastes

Wastes containing salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

1.2.6 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.7 Hazardous Waste

Hazardous substances as defined in 40 CFR 261 or as defined by applicable state and local regulations.

1.2.8 Oily Waste

Petroleum products and bituminous materials.

1.2.9 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of the Clean Air Act and includes the following compounds:

chlorofluorocarbon-11 (CFC-11)	chlorofluorocarbon-213 (CFC-213)
chlorofluorocarbon-12 (CFC-12)	chlorofluorocarbon-214 (CFC-214)
chlorofluorocarbon-13 (CFC-13)	chlorofluorocarbon-215 (CFC-215)
chlorofluorocarbon-111 (CFC-111)	chlorofluorocarbon-216 (CFC-216)
chlorofluorocarbon-112 (CFC-212)	chlorofluorocarbon-217 (CFC-217)
chlorofluorocarbon-113 (CFC-113)	halon-1211
chlorofluorocarbon-114 (CFC-114)	halon-1301
chlorofluorocarbon-115 (CFC-115)	halon-2402
chlorofluorocarbon-211 (CFC-211)	carbon tetrachloride
chlorofluorocarbon-212 (CFC-212)	methyl chloroform

1.2.10 Industrial Hygienist

An Industrial Hygienist must be certified by the American Board of Industrial Hygiene.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals."

1.3.1 SD-08, Statements

A. Preconstruction survey report

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- B. Material Safety Data Sheets (MSDSs) for products to be used in constructing the project.
- C. Site health and safety plan. Submit in accordance with the requirements contained in Section C, Part 3 of the RAC Contract.
- D. Environmental protection plan (G)

**1.3.2 SD-18, Records**

- A. Solid waste disposal permit/manifests
- B. Disposal permit/manifests for hazardous waste (G)

**1.3.2.1 Solid Waste Disposal Permit**

Submit one copy of a state and local permit or license showing approval for waste disposal.

**1.4 CLASS I ODS PROHIBITION**

Class I ODS as defined and identified in this document shall not be used in the performance of this contract nor be provided as part of the equipment. This prohibition shall be considered to prevail over any other provision, specification, drawing, or referenced documents.

**1.5 ENVIRONMENTAL PROTECTION REQUIREMENTS**

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with federal, state, and local regulations pertaining to the environment, including but not limited to water, air, and noise pollution.

**1.5.1 Preconstruction Survey**

Perform a preconstruction survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. The photographs shall be turned over to the Contracting Officer.

**1.6 SAFETY PROGRAM**

**1.6.1 Unforeseen Hazardous Material**

If material is encountered that may be dangerous to human health upon disturbance during construction operations, stop that portion of work and notify the Contracting Officer immediately. The intent is to identify materials such as polychlorinated biphenyls (PCBs),

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lead paint, and friable and nonfriable asbestos. If the material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If the material is hazardous, the Government will direct the Contractor how next to proceed.

**1.6.2 Hazardous Noise**

Provide hazardous noise signs, as directed, wherever equipment and work procedures produce sound levels greater than 84 dBA or 140 dB peak sound level measured at a distance of 3 feet.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

**3.1 PROTECTION OF NATURAL RESOURCES**

Preserve the natural resources within the project boundaries and outside the limits of permanent work, restore to an equivalent or improved condition upon completion of work, confine construction activities to within the limits of the work indicated or specified.

**3.1.1 Oily Wastes**

Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water.

**3.2 EROSION AND SEDIMENT CONTROL MEASURES**

**3.2.1 Mechanical Retardation and Control of Runoff**

The Contractor shall maintain compliance with the National Pollutant Discharge Elimination System (NPDES) General Industrial Stormwater Permit.

**3.3 TEMPORARY STORMWATER CONTROL**

The contractor shall provide means to transfer stormwater runoff that passes through any removed section of stormwater drain line. The transfer system shall not impede or restrict flow from upgradient lines.

**3.4 CONTROL AND DISPOSAL OF HAZARDOUS WASTE**

**3.4.1 Hazardous Waste Disposal**

Dispose of hazardous waste in accordance with 40 CFR 263, 40 CFR 264, and 40 CFR 265.

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**3.4.2 Hazardous Waste Storage**

Store hazardous waste in containers in accordance with 49 CFR 178. Hazardous waste shall be identified in accordance with 40 CFR 261 and 40 CFR 262.

**3.4.3 Spills of Oil and Hazardous Materials**

Take precautions to prevent spills of oil and hazardous materials. In the event of a spill, immediately notify the Contracting Officer. Spill response shall be in accordance with 40 CFR 300 and applicable state regulations.

**3.5 PROTECTION OF EXPOSED EXCAVATION**

Appropriate barriers shall be used to prevent access to exposed excavations. Appropriate traffic barriers shall be used where the excavation is adjacent to a roadway.

**END OF SECTION**

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SECTION 02076  
DEMOLITION AND REMOVAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6 (1990) Demolition Operations - Safety Requirements

SANTA CLARA VALLEY WATER DISTRICT (SCVWD)

SCVWD-IM890 (1989) Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. Disconnect designated utilities, salvage identified items and materials, and remove rubbish and debris from the project site; do not allow accumulations on the fueling station pavements. Store materials that cannot be removed daily in areas specified by the Contracting Officer.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals."

1.3.1 SD-08, Statements

a. Demolition plan (G)

Submit proposed salvage, demolition, and removal procedures to the Contracting Officer for approval before work is started. Demolition plan shall include procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform with ANSI A10.6.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris to facility pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or

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objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris.

**1.6 PROTECTION**

**1.6.1 Traffic Control Signs**

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

**1.6.2 Existing Work**

Protect existing work that is to remain in place, be reused, or remain the property of the Government. Repair pavements which are to remain that are damaged during performance of the work to their original condition, or replace with new.

**1.6.3 Facilities**

Protect electrical and mechanical services and utilities.

**1.7 BURNING**

Burning will not be permitted.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

**3.1 PREPARATION**

Notify Contracting Officer of work that may affect adjacent structures or that may cause potential noise, utility outage, or disruption. Coordinate with the Contracting Officer.

**3.2 EXISTING FACILITIES TO BE REMOVED**

**3.2.1 Paving and Slabs**

Sawcut asphaltic concrete paving and slabs as indicated for system trenching and/or pad construction. Provide neat sawcuts at limits of pavement removal as indicated. The asphaltic concrete paving shall be removed and disposed off-site.

**3.2.2 Patching**

Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched

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areas shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish.

**3.2.3 Building 6, Building 12, and Building 45 Treatment Systems Removal**

The Building 6, Building 12, and Building 45 treatment systems are to be removed and disposed or relocated and reused as follows:

**3.2.3.1 Fencing, Building 6 and Building 12 Treatment Systems**

All fencing associated with these systems is to remain intact. Fencing or gates damaged during demolition and removal is to be repaired with equivalent materials and workmanship.

**3.2.3.2 Fencing, Building 45 Treatment System**

All fencing associated with the Building 45 Treatment System shall be demolished and removed by the Contractor. Contractor shall dispose or salvage fencing material off site in accordance with Paragraph 3.3 of this Section.

**3.2.3.3 Concrete and Asphalt Pads, Building 6, Building 12, and Building 45 Treatment Systems**

All concrete and asphalt pads associated with these systems are to remain intact to the extent practical during demolition and removal. Any damage to the pads due to demolition or removal of equipment shall be repaired with suitable concrete or asphalt patches to match the surrounding surfaces.

**3.2.3.4 Double-walled HDPE Piping, Building 6, Building 12, and Building 45 Treatment Systems**

The carrier pipe of the secondarily contained HDPE piping from the extraction wells to the treatment system shall be triple-rinsed. Rinsewater shall be collected, stored, and treated by the Contractor using the west-side aquifers treatment system (WATS) when it becomes fully operational. If possible, the carrier pipe shall be removed by pulling out of the containment pipe and properly disposed off site following all applicable regulations and in accordance with Paragraph 3.3 of this Section. If the carrier pipe cannot be removed without excavation, the Contractor shall drain it and permanently cap it in place using an appropriately-sized, watertight cap of equivalent material.

**3.2.3.5 Underground Discharge Piping, Building 6, Building 12, and Building 45 Treatment Systems**

The underground discharge piping that carried treatment system effluent to the associated storm drain catch basins is to be capped in place using appropriately-sized, watertight caps of equivalent material.

**3.2.3.6 Underground Electrical and Instrumentation Wiring, Building 6, Building 12, and Building 45 Treatment Systems**

All underground electrical and instrumentation wiring shall be taken out of service in accordance with Section 16011 and removed from its associated conduit. Removed wiring

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shall be salvaged or disposed off site by the Contractor in accordance with Paragraph 3.3 of this Section.

**3.2.3.7 Underground Electrical and Instrumentation Conduit, Building 6, Building 12, and Building 45 Treatment Systems**

All underground electrical and instrumentation conduit shall be capped in place using appropriately-sized, water-tight caps of equivalent material.

**3.2.3.8 Aboveground Piping and Conduit, Building 6, Building 12, and Building 45 Treatment Systems**

All aboveground piping and conduit shall be removed and salvaged or disposed of off site by the Contractor in accordance with Paragraph 3.3 of this Section.

Conduit associated with portions of the Building 45 Treatment System that are to be relocated and reused shall left intact by the Contractor.

**3.2.3.9 Aboveground Electrical and Instrumentation Wiring, Building 6, Building 12, and Building 45 Treatment Systems**

All aboveground electrical and instrumentation wiring shall be taken out of service complying with the requirements of Section 16011. Wiring shall be salvaged or disposed of off site by the Contractor in accordance with Paragraph 3.3 of this Section.

Electrical and Instrumentation Wiring associated with portions of the Building 45 Treatment System that are to be relocated and reused shall left intact by the Contractor.

**3.2.3.10 Pipe Support Channels, Building 6, Building 12, and Building 45 Treatment Systems**

Pipe support channels shall be salvaged to the extent practical and reused in the EATS and WATS systems. Unused pipe support channels shall be salvaged or disposed of off site by the Contractor in accordance with Paragraph 3.3 of this Section.

**3.2.3.11 Granulated Activated Carbon (GAC) Vessels, Building 6, Building 12, and Building 45 Treatment Systems**

GAC vessels shall be taken out of service and moved to a location designated by the Contracting Officer for future on-site reuse. The GAC vessel surfaces shall be sanded in a manner to remove all visible rust on the interior and exterior of the vessel. Existing paint shall be lightly sanded to provide a suitable bonding surface for paint application. After sanding, the surfaces shall be cleaned to remove any visible grease or oil. The interior of the vessels shall be painted with two coats of metal primer and two coats of rust-resistant epoxy paint suitable for potable water service. The exterior of the vessels shall be painted with two coats of metal primer and two coats of white or gray, rust-resistant enamel paint. After reconditioning, two of the GAC vessels shall be relocated and reused in the EATS as indicated on the Drawings.

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3.2.3.12 Pumps, Bag Filter Housings, Instrumentation, Electrical Panels, Tanks, and Valves, Building 6 and Building 12 Treatment Systems

Equipment that is designated by the Drawings or the Specifications to be relocated and reused as part of the EATS shall be carefully disassembled, relocated, reassembled in the configurations shown on the Drawings. Other equipment that is determined to be in good condition and salvage value to the Government will be designated by the Contracting Officer and shall be transported by the Contractor to a location designated by the Contracting Officer. All other equipment shall be salvaged or disposed of off site by the Contractor in accordance with Paragraph 3.3 of this Section.

3.2.3.13 Pumps, Bag Filter Housings, Instrumentation, Electrical Panels, and Valves, Building 45 Treatment System.

Building 45 Treatment System Equipment that is designated to be relocated and reused as part of the Westside-Aquifers Treatment System shall be carefully disassembled and relocated as specified by the Contracting Officer. Equipment that will not be reused shall be salvaged or disposed of off site by the Contractor in accordance with Paragraph 3.3 of this Section.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after notice to proceed. Materials and equipment shall not be viewed on site by prospective purchasers or sold on the site.

3.4 CLEANUP

3.4.1 Debris and Rubbish

Remove and transport debris and rubbish in a manner that will prevent spillage on pavements, streets, or adjacent areas. Clean up spillage from pavements, streets, and adjacent areas.

END OF SECTION

**SECTION 02220**  
**GENERAL EXCAVATION, FILLING, AND BACKFILLING**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 136	(1992) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1140	(1992) Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))
ASTM D 2487	(1992) Classification of Soils for Engineering Purposes
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

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**1.2 DEFINITIONS**

**1.2.1 Hard Materials**

Weathered rock, dense consolidated deposits, or conglomerate materials that are not included in the definition of "rock" but that usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

**1.2.2 Rock**

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Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling, and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume.

**1.2.3 Backfill**

Material used in refilling a cut, trench, or other excavation.

**1.2.4 Fill**

Material used to fill a previously void area.

**1.2.5 Cohesionless Materials**

Materials ASTM D 2487 classified as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

**1.3 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.3.1 SD-12, Field Test Reports**

- a. Fill and backfill material tests
- b. Bedding material test
- c. In-place density tests

**1.4 DELIVERY, STORAGE, AND HANDLING**

Perform in a manner to prevent contamination or segregation of materials.

**PART 2 PRODUCTS**

**2.1 GRAVEL BACKFILL**

Gravel backfill for the concrete pad shall consist of materials conforming to Class 2 aggregate base, 3/4-inch maximum, as specified in Section 26-1.02A of SS-1.

**2.2 BASE COURSE**

Base course material shall conform with Section 02510.

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**2.3 BEDDING MATERIAL**

ASTM D 2487, classification SW or SP, maximum particle size 3/8 inch.

**2.4 COMMON BACKFILL MATERIAL**

Material from trench excavations that shall be reused to the extent possible as select trench backfill, provided that it is not contaminated and is free of debris, roots, wood, scrap material, vegetation, refuse, and other deleterious or objectionable materials. The maximum particle diameter shall be 3 inches.

**PART 3 EXECUTION**

**3.1 SURFACE PREPARATION**

**3.1.1 Cutting Asphalt and Concrete**

Saw cut with neat, parallel, straight lines to a minimum of 6 inches beyond the edges of the excavation.

**3.1.2 Removal of Asphalt and Concrete**

Asphalt and concrete that is cut shall be removed and disposed off-site by the Contractor.

**3.1.3 Stockpile Common Backfill**

Materials removed from trenches and intended to be reused as backfill shall be stockpiled at an on-site location designated by the Contracting Officer.

**3.2 PROTECTION**

**3.2.1 Dewatering**

Groundwater infiltration into the shallow trenches is not expected to be a concern during construction activities. Groundwater is expected to be deeper than all required trench bottom elevations.

**3.2.2 Underground Utilities**

Locations of known existing utilities shown on the Drawings are approximate and are based upon existing utility maps, the NASA geographical information system database, and utility surveys conducted for this project. Physically verify the location and elevation of all existing utilities prior to starting construction. Mark the surface of the ground where existing underground utilities are discovered.

**3.3 EXCAVATION**

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Excavate to depths and dimensions indicated. Because trenching will not be conducted to depths of known contamination, it is anticipated that soils will not be contaminated. Soil disturbed or weakened by Contractor's operations and soils softened or made unsuitable for subsequent construction due to exposure to weather shall be removed and replaced.

Excavated soil shall be stockpiled in the immediate area or at an on-site location as directed by the Contracting Officer. Keep excavations free from water while construction is in progress. Notify the Contracting Officer immediately in writing if it becomes necessary to remove rock or hard, unstable, or otherwise unsatisfactory material. Blasting will not be permitted. Use bedding material placed in 6-inch-maximum thickness layers to refill overdepths to the proper grade. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe on bedding material as indicated or specified at every point along its entire length. Trench dimensions shall be as indicated on the Drawings.

Remove hard material and rock to elevations necessary for placement of granular bedding.

**3.4 FILLING AND BACKFILLING**

Fill and backfill in lifts of 6 inches maximum thickness to elevations, and dimensions indicated on the Drawings. Compact each lift before placing overlaying lift.

**3.4.1 Excavation Backfilling**

Backfill as rapidly as construction, testing, and acceptance of work permits. Backfill shall be placed and compacted in 6-inch lifts to top of trench.

**3.5 COMPACTION**

Expressed as a percentage of maximum density.

**3.5.1 Paved Areas**

Compact to 95 percent of ASTM D 1557.

**3.5.2 Bedding Material**

Compact with at least two passes of a vibratory plate or vibratory roller after the placement of each lift. Compact in a manner to avoid damage to emplaced pipe, electrical conduit, and fittings.

**3.6 FINISH OPERATIONS**

**3.6.1 Grading**

Finish grades as indicated within one-tenth of 1 foot. Grade areas to drain water away from structures.

**3.6.3 Protection of Surfaces**

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Protect newly graded areas from traffic, erosion, and settlement that may occur. Repair or re-establish damaged grades, elevations, or slopes.

3.7 DISPOSAL OF SURPLUS MATERIAL

Surplus excavated soils shall be stockpiled at an on-site borrow location as directed by the Contracting Officer. The staged soil shall be placed in covered roll-off boxes or on an impervious plastic sheet and covered with an impervious plastic sheet in a manner to minimize any migration of soils by wind or rain. The soil pile shall also be surrounded by hay bales or similar controls to prevent migration of the soil.

All deleterious material such as brush, refuse, stumps, roots, and timber shall be removed from Government property and properly disposed of by the Contractor.

3.8 FIELD QUALITY CONTROL

3.8.1 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

3.8.1.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 1557 for moisture density relations, as applicable.

3.8.1.2 Density Tests

Test density in accordance with ASTM D 1556 or ASTM D 2922 and ASTM D 3017. When ASTM D 2922 and ASTM D 3017 density tests are used, verify density test results by performing ASTM D 1556 density tests at a locations already tested by ASTM D 2922 or ASTM D 3017. Perform an ASTM D 1556 density test at the start of the job, and for every 10 ASTM D 2922 and ASTM D 3017 density tests thereafter. Test each lift at randomly selected locations every 2,000 square feet.

END OF SECTION

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**SECTION 02510**  
**SURFACE RESTORATION FOR ASPHALTIC CONCRETE PAVED AREAS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 136	(1992) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D 2172	(1988) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

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**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals." 1.2.1

**1.2.1 SD-05, Design Data**

**Required Data**

Submit a job-mix formula for bituminous mixture 14 days before asphalt concrete is placed. Ensure formula is within the specified design range.

- a. Job-mix formula for asphalt concrete

**1.2.2 SD-08, Statements**

- a. Asphalt concrete

Submit copies of weighmaster's certificates or certified delivery tickets for each truck load of material.

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1.2.3 SD-12, Field Test Reports

a. Asphalt concrete

Submit as required in paragraph titled "Field Quality Control."

1.2.4 SD-13, Certificates

a. Aggregates for base course and asphalt concrete

b. Asphalt cement

c. Asphaltic emulsion

1.3 QUALITY ASSURANCE

Materials and workmanship specified herein with the referenced State Standard (SS) specifications shall be in accordance with the referenced articles, sections, and paragraphs of the standard except that contractual and payment provisions do not apply. Where the term "Engineer" is used, it shall mean the Contracting Officer. Where the term "state" is used, it shall mean "Federal Government."

1.4 EQUIPMENT

1.4.1 Mixing Plant and Construction Equipment

Section 39 of SS-1.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

2.1.1.1 Base Course

Section 26 of SS-1, Class 2, 3/4-inch maximum size gradation.

2.1.1.2 Asphalt Concrete

Section 39 of SS-1, Type B, conforming to 1/2-inch maximum, medium gradation.

2.1.2 Asphalt Materials

2.1.2.1 Asphalt Cement

Section 92 of SS-1, Grade AR-4000

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**2.1.2.2 Asphaltic Emulsion for Tack Coat**

Section 94 of SS-1, Grade SS-1h.

**PART 3 EXECUTION**

**3.1 PREPARATION**

**3.1.1 Subgrade**

Prior to construction of base course, clean previously constructed subgrade of foreign substances.

**3.1.2 Base Course**

Base course shall be placed and compacted on prepared subgrade.

**3.1.3 Asphalt Concrete Preparation**

Uniformly mix mineral aggregate with bituminous material in a central plant in accordance with Section 39 of SS-1. The percentage of asphalt cement binder shall be between 5 and 7 percent.

**3.2 INSTALLATION**

**3.2.1 Base Course Installation**

Place aggregate base in accordance with requirements of Section 26 of SS-1 and to the thickness shown. Grade and compact in 6-inch layers to at least 95 percent of maximum density according to ASTM D 1557 Method D. Maintain base course in proper condition until asphaltic concrete is in place, including drainage, rolling, shaping, and watering. Maintain sufficient moisture at the surface to prevent a dusty condition by light sprinkling with water. Recondition, reshape, and recompact areas of completed base course damaged prior to paving operations.

**3.2.2 Tack Coat**

Apply asphaltic emulsion to existing pavement surfaces and to the surface of the base course in accordance with Section 39 of SS-1.

**3.2.3 Asphalt Concrete Installation**

**3.2.3.1 Placing**

Deliver bituminous mixtures to the roadbed at temperatures specified in Section 39 of SS-1. Spread in accordance with Section 39 of SS-1.

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**3.2.3.2 Compaction**

Initial or breakdown rolling and final rolling of the uppermost layer of asphalt concrete shall be in accordance with Section 39 of SS-1. Compaction by vehicular traffic shall not be permitted.

**3.2.3.3 Joining Pavement**

Carefully make joints between old and new pavements and of successive days work in such manner as to ensure a continuous bond between old and new sections. Expose and clean edges of existing pavement. Cut edge to straight, vertical surfaces. Paint joints with a uniform tack coat before the fresh mixture is placed.

**3.3 FIELD QUALITY CONTROL**

**3.3.1 Base Course Finish Surface**

Surface tolerance shall conform to Section 26 of SS-1. When base course is constructed in more than one layer, specified smoothness requirements apply only to top surface.

**3.3.2 Pavement Smoothness**

Test wearing course shall be in accordance with Section 39 of SS-1. Perform one test for each 400 square yards of pavement.

**3.3.3 Gradation**

**3.3.3.1 Base Course Gradation**

Perform the base course gradation test in accordance with ASTM C 136. Perform one test for each 500 tons of material.

**3.3.3.2 Asphalt Concrete Gradation**

Perform the asphalt concrete gradation test in accordance with ASTM C 136. Perform one test for each 100 tons of material.

**3.3.4 Base Course Density**

Perform one moisture-density relationship test (ASTM D1557, Method D) on a sample of the base course material to be used.

Perform in-place density tests in accordance with ASTM D 1556. Perform two tests for each 2,000 square yards of surface area.

**3.3.5 Asphalt Content of Asphalt Concrete**

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Determine percent asphalt content by extraction in accordance with ASTM D 2172, Method A. Perform one test for each 100 tons of material.

3.4 PROTECTION OF PAVEMENT

After final rolling, do not permit vehicular traffic on the pavement until pavement has cooled and hardened and in no case before 6 hours after rolling.

END OF SECTION

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SECTION 02670  
ROTARY-DRILLED EXTRACTION WELL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form part of this specification to the extent referenced. The publications are referenced in text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A312 (1994) Seamless and Welded Austenitic Stainless Steel Pipe

ASTM C136 (1995) Sieve Analysis of Fine and Coarse Aggregates

ASTM C150 (1995) Portland Cement

ASTM D1784

ASTM D5521 (1994) Development of Ground-Water Monitoring Wells in Granular Aquifers.

ASTM F480

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-89/034 (1991) Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells

SANTA CLARA VALLEYS WATER DISTRICT (SCVWD)

SCVWD IM890 (1989) Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County

1.2 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01300, "Submittals."

1.2.1 SD-01, Data

- a. Northing, easting of each extraction well
- b. Elevation of each piezometer top of casing

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- c. Ground surface elevation adjacent to each extraction well

**1.2.2 SD-08, Statements**

- a. Water disposal methods
- b. Sand placement equipment list
- c. Sand placement methods

**1.2.3 SD-13, Certificates**

- a. Casings
- b. Cement
- c. Screens
- d. Sand

**1.3 DELIVERY, STORAGE, AND HANDLING**

The Contractor shall deliver materials in an undamaged condition. Store materials off the ground to provide protection against oxidation and possible contamination caused by ground contact. The Contractor shall replace defective or damaged materials with new materials.

**1.4 GENERAL REQUIREMENTS**

The Contractor shall provide each system complete and ready for operation. Each system, including equipment, materials, installation, and workmanship shall be in accordance with EPA 600/4-89/034, except as modified herein. The Contractor shall obtain well construction permits from SCVWD Well Division and notify the SCVWD Well Division at least 24 hours prior to the placement of grout.

**PART 2: PRODUCTS**

**2.1 MATERIALS**

All materials shall conform to the respective specifications and other requirements as specified herein.

**2.1.1 Casings**

All extraction well casings shall consist of Type 304 stainless steel with the Schedule

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5 mid-body wall thickness and Schedule 40 flush threaded ends. Six-inch nominal casings shall be provided for the extraction wells. Casings for piezometers and drop tubes shall consist of 1-inch nominal, flush-threaded polyvinyl chloride (PVC) pipe. Casings shall be provided in 5-foot, 10-foot, and 20-foot lengths. All stainless-steel casings shall conform to ASTM A312. All PVC casings shall conform to ASTM D1784 and ASTM F480.

**2.1.2 Well Screens**

All extraction well screens will consist of Type 304 stainless steel with the Schedule 5 mid-body wall thickness and Schedule 40 flush threaded ends. Six-inch nominal screens shall be provided for the extraction wells. All piezometer and drop tube screens will consist of 1-inch nominal, flush-threaded Schedule 40 PVC and be machine-slotted with a 0.010-inch slot width. Piezometer and drop tube screened intervals shall match the extraction well screened interval. Screens shall be provided in 5-foot, 10-foot, and 20-foot lengths. All stainless-steel screens shall conform to ASTM A312. All PVC casings shall conform to ASTM D1784 and ASTM F480.

Extraction well screens shall be wire-wrapped, with the outer wire welded to a internal structure. Outer wire shall be V-shaped in cross-section, so that slots between the wire widen inwardly to minimize clogging. The outside width of the slots shall be 0.010 inch.

**2.1.3 Filter Pack Sand**

Sand shall be clean, rounded, water-worn sand consisting of not less than 80 percent by weight silicon dioxide (quartz). The sand shall be free of organic material. The sand shall pass through the No. 2 sieve and be retained by the No. 16 sieve, when tested by ASTM C 136.

**2.1.4 Bentonite Seal**

The bentonite seal shall consist of dried, 0.375- or 0.5-inch diameter bentonite pellets. Both coated (with a natural resin) and uncoated pellets shall be provided by the Contractor. Coated pellets shall be used when bentonite must be tremmied through a column of water, uncoated pellets may be used when bentonite is placed in a dry portion of the borehole. The levels of hazardous constituents in the bentonite pellets shall be below Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) limits.

**2.1.5 Grout**

The upper annual seal shall consist of cement grout (Type I or II Portland cement conforming to ASTM C 150, Wyoming bentonite, and water). The cement to bentonite ratio shall be 9 to 1 by weight. The mixed grout shall contain no more

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than 7 gallons of water per bag (94 pounds) of cement.

**2.1.6 Silt Trap**

The silt trap shall consist of blank casing as specified in Section 2.1.1, capped by a threaded stainless-steel cap.

**2.1.7 Centralizers**

Two stainless-steel well centralizers with a 6-inch inside diameter (ID) and a 11.75-inch outside diameter (OD) shall be used. One centralizer shall be located below the well screen, at the silt trap. The second centralizer shall be located immediately above the top of the well screen.

**2.1.8 Well Cover**

The well cover shall be a 12-inch ID cast iron or steel well box, fabricated as shown on the Drawings.

**2.1.9 Auxiliary Equipment**

The Contractor shall provide equipment to collect and dispose of water and cuttings produced during well construction and pumped water during development and testing of the well.

**PART 3: EXECUTION**

**3.1 DRILLING AND WELL CONSTRUCTION**

The depth of the permanent wells shall be as shown on the Drawings. The borehole shall be drilled using the air rotary casing hammer (ARCH) drilling method with a 11.75-inch OD drive casing. Three casing/screen assemblies will be installed in the borehole: a 6-inch nominal extraction well, a 1-inch nominal piezometer, and a 1-inch nominal drop tube.

**3.1.1 Drilling**

Work shall be performed with an ARCH drilling rig capable of handling a 11.75-inch OD drive casing. The casing hammer must be securely mounted in the mast of the rig. Rigs which require a man to climb the mast and attach a cable to the hammer will not be permitted due to safety concerns. Rig shall include a casing puller capable of applying at least 200,000 pounds of pull. Backhammering the casing and other unsafe methods of pulling the casing will not be acceptable. Temporary drive casing shall be smooth wall threaded casing with water tight connections. Casing strength shall be rated at a minimum of 100,000 pounds per

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square inch. No cutting or welding of drive casing during installation or extraction will be permitted.

3.1.2 Well Construction

The 6-inch extraction well casing will be centered in the borehole. The two 1-inch casings will be strapped to the 6-inch casing.

Annular materials shall be installed to depths shown on the Drawings. All annular materials installed through a water column shall be placed with a tremmie pipe. The top of the sand pack and bentonite seal shall be sounded to determine actual depths. The sand pack shall be surged periodically during sand emplacement. The bentonite pellets shall be allowed to hydrate for a minimum of 12 hours before placing cement grout above the seal. Wells will be grouted according to SCVWD specifications and with a SCVWD inspector present.

The well shall terminate inside a 12-inch ID well box, as shown on the Drawings. The well box shall be installed to a height of 6 inches above grade.

3.1.3 Well Development

The Contractor shall develop the extraction wells in accordance with ASTM D5521. The Contractor shall furnish pumps, compressors, bailers, surge blocks, meters, and other equipment required to fully develop the well for maximum yield of water and to limit silt intrusion during the life of the well. Wells shall stand a minimum of 24 hours after completion of construction before development occurs.

Wells shall be mechanically surged with a close-fitting surge block prior to development with a pump. The depth to the top of sediment in the well shall be measured, and then sand shall be removed with a pump or bailer, periodically throughout the surging process. Surging shall continue until little or no sediment is measured in the well. Well development will continue by pumping and backwashing with a pump and ancillary equipment capable of producing 12 gallons per minute. Development with the pump will begin at the top of the screen and move progressively toward the bottom of the screen. The pump shall initially be set at a rate equal to 30 percent of the maximum design flow rate for the well (as specified in Table 4 of the design basis report) and gradually increased to 110 percent of the maximum design flow rate. Field parameters (temperature, specific conductance, turbidity, pH) shall be periodically measured and recorded along with pumping rate and visual observations of discharge water. Development shall continue until parameters readings are consistent and there is no change in appearance of discharge water, before and after the well is backflushed.

3.2 WASTE DISPOSAL

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All water produced during drilling, well construction, and well development and all equipment decontamination water shall be containerized by the Contractor, and transferred by the Contractor to a Baker tank located near Building 45, or the investigation water storage tank (T-401) of the west-side aquifers treatment system(WATS) as directed by the Contracting Officer. Contractor shall treat the water by pumping it into the WATS when it is fully operational. Treatment of water by the WATS shall be conducted by the Contractor in a manner consistent with the WATS Operation and Maintenance Manual.

All soil cuttings shall be transferred by the Contractor to the soil bio-pad, located south of Hangars 2 and 3. All other waste materials generated by the Contractor, such as personal protective equipment, plastic sheeting, and boxes shall be containerized and removed from Government property and properly disposed of off-site by the Contractor.

3.3 CONSTRUCTION OVERSIGHT

The Contractor shall provide at least 72 hours notice to the Navy before drilling and well construction activities commence. During the drilling and construction of the well, the supervising field geologist or engineer provided by the Navy shall have the authority to make minor modifications to the construction as necessary. The need for any major modifications shall be negotiated with the Navy and the Contractor.

3.4 SURVEYING

The Contractor shall provide a California-licensed surveyor to survey the location (northing, easting) of each extraction well and the elevations of each piezometer top of casing (TOC) and the ground surface adjacent to each extraction well. The piezometer TOC elevation shall be reported to within 0.01-foot accuracy and 0.1-foot precision. All other measurements shall be reported to within 0.1-foot accuracy and 0.5-foot precision. The piezometer TOC elevation will be measured by placing the surveying rod directly on top of the north side of the well casing. The surveyor shall cut a notch into the top of the well casing to indicate the measuring point.

All elevation measurements shall be referenced to a single datum, the mean sea level (msl) elevation. All easting and northing coordinates shall be reported in the California state plane zone 3 projection, North American Datum (NAD) 1927. Surveyed locations shall be referenced to benchmarks H-111, located at the southern end of Hangar 1, and G-111, located south of the housing area on the western side of Moffett Field, just north of US 101. The reference locations and elevations for H-111 and G-111 are:

Benchmark H-111

North Coordinate: 335,641.64'

East Coordinate: 1,549,212.51'

EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA

Elevation: 17.61'

Benchmark G-111

North Coordinate: 334,044.86'

East Coordinate: 1,546,623.47'

Elevation:

END OF SECTION

EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA

SECTION 02675  
AUGER-DRILLED MONITORING WELL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form part of this specification to the extent referenced. The publications are referenced in text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |            |  |
|------------|--|
| ASTM D1784 | (1994) Rigid Polyvinyl Chloride (PVC) Compounds  |
| ASTM F480  | (1994) Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios, SCH 40 and SCH 80 |
| ASTM C136  | (1995) Sieve Analysis of Fine and Coarse Aggregates  |
| ASTM C150  | (1995) Portland Cement   |
| ASTM D5521 | (1994) Development of Ground-Water Monitoring Wells in Granular Aquifers                                 |

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

- |                  |  |
|------------------|--|
| EPA 600/4-89/034 | (1991) Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells |
|------------------|--|

SANTA CLARA VALLEY WATER DISTRICT (SCVWD)

- |             |   |
|-------------|---|
| SCVWD IM890 | (1989) Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County |
|-------------|---|

1.2 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01300, "Submittals."

1.2.1 SD-01, Data

- a. Northing, easting of each monitoring well
- b. Elevation of each monitoring well top of casing
- c. Ground surface elevation

1.2.2 SD-08, Statements

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

- a. Water disposal methods
- b. Sand placement equipment list
- c. Sand placement methods

**1.2.3 SD-13, Certificates**

- a. Casings
- b. Cement
- c. Screens
- d. Sand

**1.3 DELIVERY, STORAGE, AND HANDLING**

The Contractor shall deliver materials in an undamaged condition. Store materials off the ground to provide protection against oxidation and possible contamination caused by ground contact. The Contractor shall replace defective or damaged materials with new materials.

**1.4 GENERAL REQUIREMENTS**

The Contractor shall provide each system complete and ready for operation. Each system, including equipment, materials, installation, and workmanship shall be in accordance with EPA 600/4-89/034, except as modified herein. The Contractor shall obtain well construction permits from SCVWD Well Division and notify the SCVWD Well Division at least 24 hours prior to the placement of grout.

**PART 2: PRODUCTS**

**2.1 MATERIALS**

All materials shall conform to the respective specifications and other requirements as specified herein.

**2.1.1 Casings**

All casings shall consist of two-inch nominal, flush-threaded, Schedule 40 polyvinyl chloride (PVC). Casings shall be provided in 5-foot, 10-foot, and 20-foot lengths. All PVC casings shall conform to ASTM D1784 and ASTM F480.

**2.1.2 Well Screens**

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

All well screens will consist of two-inch nominal, flush-threaded, Schedule 40 PVC. The screens shall be machine slotted; the width of the slots shall be 0.010 inch. All PVC screens shall conform to ASTM D1784 and ASTM F480.

**2.1.3 Filter Pack Sand**

Sand shall be clean, rounded, water-worn sand consisting of not less than 80 percent by weight silicon dioxide (quartz). The sand shall be free of organic material. The sand shall pass through the No. 2 sieve and be retained by the No. 16 sieve, when tested by ASTM C 136.

**2.1.4 Bentonite Seal**

The bentonite seal shall consist of dried, 0.375- or 0.5-inch diameter bentonite pellets. Both coated (with a natural resin) and uncoated pellets shall be provided by the Contractor. Coated pellets shall be used when bentonite must be tremmied through a column of water, uncoated pellets may be used when bentonite is placed in a dry portion of the borehole. The levels of hazardous constituents in the bentonite pellets shall be below Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) limits.

**2.1.5 Grout**

The upper annual seal shall consist of cement grout (Type I or II Portland cement conforming to ASTM C 150, Wyoming bentonite, and water). The cement to bentonite ratio shall be 9 to 1 by weight. The mixed grout shall contain no more than 7 gallons of water per bag (94 pounds) of cement.

**2.1.6 Well Cover**

The well cover shall be a 8-inch ID cast iron or steel well box, with a leak-resistant cover.

**2.1.7 Auxiliary Equipment**

The Contractor shall provide equipment to collect and dispose of water and cuttings produced during well construction and pumped water during development and testing of the well.

**PART 3: EXECUTION**

**3.1 DRILLING AND WELL CONSTRUCTION**

The borehole shall be drilled using the hollow stem auger (HSA) drilling method with 8-inch outside diameter OD auger flights. One 2-inch nominal casing/screen assembly will be installed in each borehole.

**3.1.1 Drilling**

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

Drilling equipment should accommodate the collection of continuous soil samples with a split-barrel sampler. The PRC geologist/engineer will determine which borings will be continuously sampled and the sample intervals at borings that are not continuously sampled.

**3.1.2 Well Construction**

Annular materials shall be installed to depths shown on the Drawings. The top of the sand pack and bentonite seal shall be sounded to determine actual depths. The sand pack shall be surged periodically during sand emplacement. The bentonite pellets shall be allowed to hydrate for a minimum of 12 hours before placing cement grout above the seal. Wells will be grouted according to SCVWD specifications and with a SCVWD inspector present.

The well shall terminate inside a 8-inch ID well box, as shown on the Drawings. The well box shall be installed to a height of 3 inches above grade. The PVC casing shall be cut flush with a casing cutter, allowing enough space between the locking well cap and well box cover so that the well box cover seals properly.

**3.1.3 Well Development**

The Contractor shall develop the extraction wells in accordance with ASTM D5521. The Contractor shall furnish pumps, compressors, bailers, surge blocks, meters, and other equipment required to fully develop the well for maximum yield of water and to limit silt intrusion during the life of the well.

Wells shall stand a minimum of 24 hours after construction before development may begin. Wells shall be mechanically surged with a close-fitting surge block prior to development with a pump. The depth to the top of sediment in the well shall be measured, and then sand shall be removed with a pump or bailer, periodically throughout the surging process. Surging shall continue until little or no sediment is measured in the well. Well development will continue by pumping and backwashing with a pump, which will initially be set at the top of the screen and lowered progressively toward the bottom of the screen. Field parameters (temperature, specific conductance, turbidity, pH) shall be periodically measured and recorded along with pumping rate and visual observations of discharge water. Development shall continue until parameters readings are consistent and there is no change in appearance of discharge water, before and after the well is backflushed.

**3.2 WASTE DISPOSAL**

All water produced during drilling, well construction, and well development and all equipment decontamination water shall be containerized by the Contractor, and transferred by the Contractor to a Baker tank located near Building 45, or the investigation water storage tank (T-401) of the west-side aquifers treatment system (WATS) as directed by the Contracting Officer. Contractor shall treat the water by pumping it into the WATS when it is fully operational. Treatment of water by the WATS shall be conducted by the Contractor in a manner consistent with the WATS Operation and Maintenance Manual.

EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA

All soil cuttings shall be transferred by the Contractor to the soil biopad, located south of Hangars 2 and 3. All other waste materials generated by the Contractor, such as personal protective equipment, plastic sheeting, and boxes shall be containerized and removed from Government property and properly disposed of off-site by the Contractor.

3.3 CONSTRUCTION OVERSIGHT

The Contractor shall provide at least 72 hours notice to the Navy before drilling and well construction activities commence. During the drilling and construction of the well, the supervising field geologist or engineer provided by the Navy shall have the authority to make minor modifications to the construction as necessary. The need for any major modifications shall be negotiated with the Navy and the Contractor.

3.4 SURVEYING

The Contractor shall provide a California-licensed surveyor to survey the location (northing, easting) of each monitoring well and the elevations of each monitoring well top of casing (TOC) and the ground surface adjacent to each monitoring well. The piezometer TOC elevation shall be reported to within 0.01-foot accuracy and 0.1-foot precision. All other measurements shall be reported to within 0.1-foot accuracy and 0.5-foot precision. The piezometer TOC elevation will be measured by placing the surveying rod directly on top of the north side of the well casing. The surveyor shall cut a notch into the top of the well casing to indicate the measuring point.

All elevation measurements shall be referenced to a single datum, the mean sea level (msl) elevation. All easting and northing coordinates shall be reported in the California state plane zone 3 projection, North American Datum (NAD) 1927. Surveyed locations shall be referenced to benchmarks H-111, located at the southern end of Hangar 1, and G-111, located south of the housing area on the western side of Moffett Field, just north of US 101. The reference locations and elevations for H-111 and G-111 are:

Benchmark H-111

North Coordinate: 335,641.64'  
East Coordinate: 1,549,212.51'  
Elevation: 17.61'

Benchmark G-111

North Coordinate: 334,044.86'  
East Coordinate: 1,546,623.47'  
Elevation:

END OF SECTION

EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA

SECTION 02831  
FENCE, CHAIN LINK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS RR-F-191	(Rev. J) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories) (General Specification)
FS RR-F-191/1	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric) (Detail Specification)
FS RR-F-191/2	(Rev. C) Fencing, Wire and Post, metal (Chain-Link Fence Gates) (Detail Specification)
FS RR-F-191/3	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)
FS RR-F-191/4	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) (Detail Specification)

1.2 SYSTEM DESCRIPTION

This section covers the requirements for the chain-link fencing to be placed around the treatment system. Further details on the placement of the fencing and the construction details are shown on the Drawings.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300, "Submittals."

1.3.1 SD-02, Manufacturer's Catalog Data

- a. Fencing components
- b. Accessories

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA

2.1 CHAIN-LINK FENCING AND ACCESSORIES

FS RR-F-191 and detailed specifications as referenced and other requirements as specified.

2.1.1 Fabric

FS RR-F-191/1; Type I, zinc-coated steel, 9-gauge. Mesh size, 2 inches. Provide selvage knuckled at one selvage and twisted and barbed at the other. Height of fabric as indicated on Drawings. All fabric in the fence and gates shall contain redwood privacy slats to limit visibility through the fence.

2.1.2 Gates

FS RR-F-191/2; Type I, single swing. Shape and size of gate frame, as indicated. Framing and bracing members, round or square of steel alloy. Steel member finish, zinc coated. Gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade except that steel pipe frames shall be 1.90 inches outside diameter, 0.120 inches minimum wall thickness and aluminum pipe frames and intermediate braces shall be 1.869 inches outside diameter, 0.940 lb/ft of length. Gate fabric, as specified for fencing fabric, also with wood slats. Coating for steel latches, stops, hinges, keepers, and accessories, galvanized. Gate latches, fork type. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding will not be permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

2.1.3 Posts and Braces

FS RR-f-191/3 line posts; Class 1, steel pipe, Grade A or B. End, corner, and pull posts; Class 1, steel pipe, Grade A or B. Braces and rails; Class 1, steel pipe, Grade A or B, in minimum sizes listed in FS RR-F-191/3 for each class and grade.

2.1.4 Fencing Accessories

Shall conform to the requirements of FS RR-F-191/4.

2.1.5 Concrete

Shall conform to the requirements of Section 03302, "Cast-in-Place Concrete."

2.1.6 Grout

Provide grout of proportions one part portland cement to three parts clean, well-graded sand and a minimum of water to produce a workable mix.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Excavation

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

Excavate to dimensions indicated for concrete-embedded items. Clear post holes of loose material. Dispose of waste material off Moffett Federal Airfield such as with general construction debris.

**3.2 FENCE INSTALLATION**

Install fence to line and grade indicated. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

**3.2.1 Post Spacing**

Provide posts at each corner and along sides at manufacturer's recommended distances. Provide gate posts spaced as necessary for size of gate openings.

**3.2.2 Post Setting**

Set post plumb. Allow concrete to cure a minimum of 72 hours before performing other work on posts.

Provide concrete bases of dimensions indicated. Compact concrete to eliminate voids and finish to a dome shape.

**3.2.3 Bracing**

Brace gate with a diagonal truss rod and truss tightener used as a tension member.

**3.2.4 Fabric**

Pull fabric taut and secure fabric to tension wire and posts. Secure fabric to posts using stretcher bars, ties or clips spaced 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post.

Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is 2 inches above ground level.

**3.3 ACCESSORIES INSTALLATION**

**3.3.1 Post Caps**

Install Post caps as recommended by the manufacturer.

**3.3.2 Gates**

Install swing gate to swing through 190 degrees from closed to open.

**3.4 CLEANUP**

Remove waste fencing materials and other debris from the site.

EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA

END OF SECTION

EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA

**SECTION 03302**  
**CAST-IN-PLACE CONCRETE (MINOR CONSTRUCTION)**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN CONCRETE INSTITUTE (ACI)**

- ACI 301 (1994) Structural Concrete for Buildings
- ACI 304R (1989) Measuring, Mixing, Transporting, and Placing Concrete
- ACI 305R (1991) Hot Weather Concreting
- ACI 306.1 (1990) Cold Weather Concreting

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

- ASTM A 615/A 615M (1993) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- ASTM C 33 (1993) Concrete Aggregates
- ASTM C 94 (1994) Ready-Mixed Concrete
- ASTM C 143 (1990, Rev. A) Slump of Hydraulic Cement Concrete
- ASTM C 150 (1994) Portland Cement
- ASTM C 171 (1992) Sheet Materials for Curing Concrete
- ASTM C 172 (1990) Sampling Freshly Mixed Concrete

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-10 Test Reports**

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

**Compressive Strength**

**1.2.2 SD-13, Certificates**

- a. Cement
- b. Aggregate
- c. Admixtures
- d. Reinforcement
- e. Expansion-joint filler

**1.3 MODIFICATION OF REFERENCES**

Accomplish work in accordance with ACI publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

**1.4 DELIVERY, STORAGE, AND HANDLING**

Do not deliver concrete until ready for concrete placement. Store concrete aggregates to prevent contamination or segregation. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Provide for accurate identification after bundles are broken and tags removed.

**PART 2 PRODUCTS**

**2.1 CONCRETE**

**2.1.1 Contractor Mix Design**

ACI 301, except as modified herein. Unless indicated otherwise, concrete shall have a 28-day compressive strength of 3000 psi. Slump shall be between 2 and 4 inches in accordance with ASTM C 143. Provide ASTM C 33 aggregate Size No. 57 or 67.

**2.1.2 Ready-Mixed Concrete**

ASTM C 94, except as modified herein. Ready-mixed concrete is defined in this specification as concrete produced regularly by a commercial establishment and delivered to the purchaser in the plastic state.

EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA

2.2 MATERIALS

2.2.1 Cement

ASTM C 150

2.2.2 Water

Water shall be potable.

2.2.3 Aggregates

ASTM C 33. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalis in the cement.

2.2.4 Reinforcement

Reinforcing Bars shall be ASTM A 615 Grade, coated steel.

2.2.5 Materials for Curing Concrete

Impervious Sheeting shall meet ASTM C 171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

PART 3 EXECUTION

3.1 FORMS

ACI 301. Set forms true to line and grade and make mortar-tight. Chamfer above grade exposed joints, edges, and external corners of concrete 3/4 inch, unless otherwise indicated. Before concrete placement, coat the contact surfaces of forms with a nonstaining form coating compound. Do not use mineral oil on formed surfaces to be painted. Prevent concrete damage during form removal. Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width shall be a minimum of 4 inches greater than finished dimensions indicated.

3.2 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI 301. Provide bars, wire fabric, and other reinforcing materials, including wire ties, supports, and other devices necessary to install and secure the reinforcement.

3.2.1 Cover and Splicing

ACI 301, unless otherwise indicated.

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

**3.2.2 Setting Miscellaneous Material**

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

**3.2.3 Construction Joints**

ACI 301. Continue reinforcement across joints, unless otherwise indicated.

**3.3 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE**

ACI 304R, except as modified herein. ASTM C 94; machine mix concrete and provide mandatory batch ticket information for each load of ready mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time to 60 minutes if the air temperature is greater than 85 degrees F. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. Do not place concrete when weather conditions prevent proper placement and consolidation. in uncovered areas during periods of precipitation, or in standing water.

Prior to placing concrete, remove dirt, construction debris, and water, from within the forms. Consolidate concrete slabs greater than 4 inches depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping.

**3.3.1 Cold Weather**

ACI 306.1. Provide and maintain 50 degrees Fahrenheit (EF) minimum concrete temperature. Do not place concrete when the ambient temperature is below 40 EF. Cover concrete and provide with a source of heat sufficient to maintain 50 EF minimum while curing.

**3.3.2 Hot Weather**

ACI 305R. Concrete temperature from initial mixing through final cure shall not exceed 90 EF. Cool ingredients before mixing, or substitute chip ice for part of required mixing water or use other suitable means to control concrete temperature to prevent rapid drying of newly placed concrete. Shade the fresh concrete and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit curing without damage.

**3.4 SURFACE FINISHES**

ACI 301 for repair and finish, unless otherwise specified. Floors shall be sloped according

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

to the Drawings and in all cases to avoid standing water except upgradient of air stripper mounting pad.

**3.4.1 Defects**

Repair formed surfaces by removing minor honeycombs, pits greater than 1 square inch surface area or 0.25 inch maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with nonshrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb (including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate, or other defects) which affect the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain approval of corrective action prior to repair. The surface of the concrete shall not vary more than the allowable tolerances of ACI 301. Exposed surfaces shall be uniform in appearance and finished to a smooth form finish, unless otherwise specified.

**3.4.2 Floated Finish**

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater. Surface shall be level to within 1/4 inch in 10 feet where floor drains are not provided.

**3.4.3 Broomed Finish**

Provide for ramps. Provide a floated finish, then finish with a flexible bristle broom. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.

**3.5 CURING AND PROTECTION**

ASTM C 171. Cure using one of the following methods. Protect concrete from injurious action by sun, rain, wind, flowing water, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the curing period. Forms may be removed 48 hours after concrete placement.

**3.5.1 Moist Curing**

Provide for the removal of water without erosion or damage to the structure.

**3.5.1.1 Fog Spraying or Sprinkling**

Provide uniform and continuous application of water throughout the curing period. For mean daily temperatures between 40 and 50 EF, increase the curing period by 50 percent.

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

**3.5.1.2 Pervious Sheeting**

Cover the entire surface of the concrete with two thicknesses of wet sheeting. Mats shall be at least as long as the width of the surface to be cured. During application, do not drag the mats over the finished concrete nor over mats already placed. Completely cover surface and edges of the concrete, with a 6 inch overlap over adjacent mats. Wet mats thoroughly and keep continuously wet throughout the curing period.

**3.5.2 Impervious-Sheeting Curing**

Wet the entire exposed surface thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12 inches minimum. Provide sheeting not less than 18 inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting.

**3.5.3 Curing Periods**

Allow 7 days.

**3.6 SAMPLING AND TESTING**

**3.6.1 Sampling**

ASTM C 172. Collect samples of fresh concrete to perform tests specified.

**3.6.2 Slump Tests**

ASTM C 143. Take samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement and for each batch (minimum) or every 10 cubic yards (maximum) of concrete.

**END OF SECTION**

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

**SECTION 05500  
METAL FABRICATION**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

- |               |   |
|---------------|---|
| ANSI A10.3    | (1991) Powder-Actuated Fastening Systems  |
| ANSI B18.2.1  | (1981; R 1992) Square and Hex Bolts and Screws Inch Series                                      |
| ANSI B18.2.2  | (1987; R 1993) Square and Hex Nuts (Inch Series)  |
| ANSI B18.6.2  | (1972; R 1993) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws |
| ANSI B18.6.3  | (1972; R 1991) Machine Screws and Machine Screw Nuts  |
| ANSI B18.21.1 | (1994) Lock Washers (Inch Series)   |
| ANSI B18.22.1 | (1965; R 1990) Plain Washers  |

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

- |            |  |
|------------|--|
| ASTM A 307 | (1994) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength |
| ASTM A 687 | (1993) High-Strength Nonheaded Steel Bolts and Studs             |
| ASTM E 488 | (1990) Strength of Anchors in Concrete and Masonry Elements      |

**AMERICAN WELDING SOCIETY, INC. (AWS)**

- |          |                                      |
|----------|--------------------------------------|
| AWS D1.1 | (1994) Structural Welding Code Steel |
|----------|--------------------------------------|

**COMMERCIAL ITEM DESCRIPTIONS (CID)**

- |              |   |
|--------------|---|
| CID A-A-1924 | Shield, Expansion (Self Drilling Tubular Expansion Shell) |
|--------------|---|

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-08, Statements**

**a. QUALIFICATION OF WELDERS**

Qualify welders in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.

**1.3 DELIVERY, STORAGE, AND PROTECTION**

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

**PART 2 PRODUCTS**

**2.1 ANCHOR BOLTS**

ASTM A 307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

**2.2 THREADED INSERTS (EXPANSION ANCHORS)**

Provide inserts recessed not less than 9 inches into concrete or masonry. Pullout of 650 lb in concrete  $f'c = 3,000$  psi, as tested, ASTM E 488. (CID A-A-1924, of Group II, Type 4, Class 1. Provide embedment required by manufacturer.)

**2.3 LAG SCREWS AND BOLTS**

ANSI B18.2.1, type and grade best suited for the purpose.

**2.4 TOGGLE BOLTS**

ANSI B18.2.1.

**2.5 BOLTS, NUTS, STUDS AND RIVETS**

ANSI B18.2.2 and ASTM A 687 or ASTM A 307.

**2.6 POWDER DRIVEN FASTENERS**

Follow safety provisions of ANSI A10.3.

EAST-SIDE AQUIFER TREATMENT SYSTEM  
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2.7 SCREWS

ANSI B18.2.1, ANSI B18.6.2, and ANSI B18.6.3.

2.8 WASHERS

Provide plain washers to conform to ANSI B18.22.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ANSI B18.21.1.

PART 3 EXECUTION

3.1 EXPANSION ANCHOR INSTALLATION

Install items at location indicated, according to manufacturer's instructions.

3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied.

END OF SECTION

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

**SECTION 11241  
CHEMICAL ADDITION SYSTEM**

**PART 1 GENERAL**

**1.1 REFERENCES**

Not used.

**1.2 SYSTEM DESCRIPTION**

The chemical addition system shall consist of a chemical supply storage tank from which chemical additive shall be pumped through tubing to the point of application. The chemical addition system shall include a tank, metering pump (existing), static mixer (existing), valving, and associated instrumentation, as shown on the Drawings.

**1.3 GENERAL REQUIREMENTS**

Sections 15011, "Mechanical General Requirements," and 15080, "Piping, Valves, and Appurtenances" apply to this section except as specified herein. Sections 16011, "Electrical General Requirements," 16403, "Wiring Systems," and 16900, "Instrumentation and Controls" also apply to this section.

**1.4 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.4.1 SD-02, Manufacturer's Catalog Data**

**a. Antiscalant tank (T-105)**

Manufacturer's descriptive and technical literature, catalog cuts, performance charts, and pump curves sufficient to verify compliance with requirements of this section.

**1.4.2 SD-05, Design Data (G)**

Provide calculations and detailed drawings demonstrating the ability of the tiedowns to restrain the antiscalant tank (T-105) during a seismic event. The calculations and drawings shall be prepared and sealed by a California-licensed Civil or Structural Engineer.

**1.4.3 SD-07, Schedules**

**a. Chemical Addition System**

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

List materials and equipment, including a complete list of parts and supplies with current unit prices and source of supply. List special tools for each type of equipment furnished including special tools necessary for adjustment, operation, maintenance, and disassembly.

**b. Auxiliary Equipment and Spare Parts**

List parts recommended by the manufacturer expected to be replaced during or after the first 1 and 3 years of service.

**1.4.4 SD-09, Reports**

**a. Field Test Reports**

Provide test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

**1.4.6 SD-13, Certificates**

**a. Supplied Chemical Certificates**

Submit two copies of certification stating that the chemical supplied meets the specified requirements.

**1.4.7 SD-19, Operation and Maintenance Manuals**

**a. Chemical Addition System**

Submit six complete copies of operating instructions outlining the step-by-step procedures are required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. The instructions shall include as-built drawings of the piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed. Flow diagrams shall be included in the instructions.

Submit six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and trouble-shooting guides.

**1.5 EQUIPMENT**

Equipment specified under this section requiring special tools or assembly, adjustment, setting, or maintenance thereof shall be furnished as standard accessories.

**1.6 DELIVERY AND STORAGE**

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
MOFFETT FIELD, CALIFORNIA**

All equipment delivered and placed in storage shall be protected from weather conditions, including rain, humidity, and temperature variations, as well as dirt and dust, and other contaminants.

**1.7 AUXILIARY EQUIPMENT AND SPARE PARTS**

Concurrent with delivery and installation of the specified equipment, auxiliary equipment and spare parts shall be furnished as follows:

- a. Spare parts for each different item of material and equipment specified including all of the parts recommended by the manufacturer which are expected to be replaced during or after the first 1 and 3 years of service.
- b. One extra of each part used that is made from glass, hard rubber, or clear plastic.

**1.8 FIELD MEASUREMENTS**

The Contractor shall become familiar with details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

**PART 2 PRODUCTS**

**2.1 MATERIALS AND EQUIPMENT**

Materials and equipment complete with accessories shall be selected by the Contractor for performance compatibility. Capacity and design of the chemical addition system shall be suitable for 24-hour full load service in ambient, nonfreezing conditions.

**2.1.1 Standard Products**

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

**2.1.2 Nameplates**

The chemical tank shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. The metering pump shall retain any existing nameplate. Additional information, similar to that required for the chemical tank, shall be provided on a separate plate.

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
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**2.2 METERING PUMP (P-106)**

Reuse the electronically controlled antiscalant pump currently in use by the Building 45 air stripping system.

**2.3 TANK (T-105)**

Provide one 300-gallon minimum capacity vertical tank for storage of the additive selected based on requirements of Section 2.4 of this section. Tank diameter shall not exceed that shown on the Drawings. Tank materials of construction shall be fully compatible with the selected additive.

The tank shall be equipped with a fill nozzle, vent, discharge level instrument, drain, and two spare connections. The drain connection shall provide complete drainage of the tank.

A permanent plastic sign indicating tank contents shall be attached to the front of the tank.

**2.4 CHEMICAL ADDITIVE**

A chemical additive shall be selected to prevent precipitation and deposition of calcium and other hardness compounds and metal salt/oxides in the East-Side Aquifer Treatment System. Typical characteristics of the east-side aquifer water are presented in Table 1 at the end of this section.

The additive shall not lower treatment system effluent pH below 6.5 or raise the pH above 8.5. Nor shall it increase treatment system effluent toxicity. The additive shall be available for delivery in semi-bulk quantities. Guarantee shall be provided by the product manufacturer that, in the event of unsatisfactory performance of the additive, remaining product will be fully refunded.

Suggested additive:     BT-543  
                                  Protection Engineering Inc.  
                                  116 Washington Avenue, Suite C  
                                  Richmond, CA 94801

Demonstrated equal.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

Installation procedures for each piece of equipment shall be as recommended by the equipment manufacturer and as specified herein. Materials and equipment shall be prepared for service as recommended by the manufacturer.

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
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The Contractor is responsible for providing all necessary accessories and appurtenances to form complete and functional air stripping system and to properly operate the equipment specified in this section.

**3.2 STARTUP**

Startup of the chemical addition system equipment shall be in accordance with the equipment manufacturer's recommendations.

**3.3 FIELD EQUIPMENT TESTING**

After installation of the equipment, the Contractor shall conduct operating tests to demonstrate that the equipment will operate in accordance with all specified requirements. Deficiencies related to all system components with the exception of the antiscalant pump (P-106) shall be corrected by the Contractor at no additional cost to the Government.

Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; will perform in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of all associated instrumentation and control equipment, proper alignment, excessive noise levels, and power consumption.

All process piping shall be tested in accordance with Section 15080, "Piping and Appurtenances."

**3.3.1 Antiscalant Tank (T-105)**

The antiscalant tank shall be field tested for leaks or damage in shipment. The tank shall be hydrostatically tested to 1.5 times the system operating pressure for a period of 8 hours at which time no visible leakage shall be evident. All pipes, hoses, pumps, water, power, and other equipment required to convey the test liquids and to carry out the tests shall be supplied by the Contractor. Damage or leaks in the tank shall be repaired or the tank shall be replaced.

**3.3.2 Metering Pump (P-106)**

The metering pump shall be tested to demonstrate that the pump is capable of operating without vibration or leakage. Testing shall be performed at the maximum design flow rate and at half the design flow rate.

**END OF SECTION**

EAST-SIDE AQUIFER TREATMENT SYSTEM  
 MOFFETT FEDERAL AIRFIELD  
 MOFFETT FIELD, CALIFORNIA

**TABLE 1**  
**ESTIMATED AIR STRIPPER INFLUENT WATER QUALITY PARAMETERS**

CONSTITUENT	ESTIMATED DISSOLVED CONCENTRATION
<b>METALS (<math>\mu\text{g/L}</math>)</b>	
Aluminum	6058
Antimony	<0.5
Arsenic	2.6
Barium	202
Beryllium	<0.5
Chromium	17.4
Cobalt	5.7
Copper	16.0
Iron	6,870
Lead	4.3
Manganese	632
Mercury	<0.5
Nickel	26.0
Potassium	2,023
Selenium	<0.5
Thallium	<0.5
Vanadium	25.2
Zinc	23.6
<b>ANIONS (<math>\mu\text{g/L}</math>)</b>	
Sulfate	143,000
Bicarbonate	520,000
Chloride	36,000
<b>CATIONS (<math>\mu\text{g/L}</math>)</b>	
Calcium	126,000
Magnesium	87,000

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CONSTITUENT	ESTIMATED DISSOLVED CONCENTRATION
METALS ( $\mu\text{g/L}$ )	
Sodium	72,000
OTHER PARAMETERS	
pH	7.3
Temperature (EF)	65 - 75
Total Dissolved Solids (mg/L)	1,000
Total Suspended Solids (mg/L)	<5

$\mu\text{g/L}$  = micrograms per liter  
 $\text{mg/L}$  = milligrams per liter

EAST-SIDE AQUIFER TREATMENT SYSTEM  
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**SECTION 11395  
AIR STRIPPER**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this section to the extent referenced. The publications are referred to in the text by the basic designation only.

**OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)**

29 CFR 1910.219 Environmental Health & Safety for Hazardous Waste Site Operations.

**1.2 GENERAL REQUIREMENTS**

Section 15011, "Mechanical General Requirements," applies to this section except as specified herein. Sections 16011, "Electrical General Requirements," 16403, "Wiring Systems," and 16900, "Instrumentation and Controls" also apply to this section.

**1.3 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals," prior to procurement and installation unless otherwise noted.

**1.3.1 SD-01, Data (G)**

Calculations and data supporting the sizing, general design, and selection of air stripper.

**1.3.2 SD-02, Manufacturer's Catalog Data**

- a. Stripper
- b. Blower
- c. Blower inlet air filter
- d. Instruments

**1.3.3 SD-04, Drawings**

- a. Air stripper plan view and profile
- b. Blower plan view

**1.3.4 SD-05, Design Data (G)**

- a. Seismic Tiedown(s)

Provide calculations and detailed drawings demonstrating the ability of the tiedowns to restrain the air stripper during a seismic event. The calculations and drawings shall be prepared and sealed by a California-licensed Civil or Structural Engineer.

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
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**1.3.5 SD-07, Schedules**

**a. Air Stripping System**

List of materials, list of equipment, including a complete list of parts and supplies with current unit prices and source of supply. List of special tools for each type of equipment furnished including special tools necessary for adjustment, operation, maintenance, and disassembly.

**b. Auxiliary Equipment and Spare Parts**

List of parts recommended by the manufacturer to be replaced after 1 and 3 years of service.

**c. Testing**

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

**1.3.6 SD-13, Certificates of Compliance**

Written statements submitted and signed by an authorized official of each manufacturer attesting that the supplied equipment conforms to the requirements of the Contract Documents and will perform as intended.

**1.3.7 SD-19, Operation and Maintenance Manuals**

Provide manufacturer's operation and maintenance manuals for:

- a. Stripper
- b. Blower

**1.4 WARRANTIES**

The Contractor shall provide an air stripper and associated equipment provided as part of this package will meet all performance criteria described in Paragraph 2.2.2 of this section.

**1.5 EQUIPMENT**

Equipment specified under this section requiring special tools or assembly, adjustment, setting, or maintenance thereof shall be furnished as standard accessories.

**1.6 DELIVERY AND STORAGE**

Material and equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation, dirt, dust, or other contaminants.

**1.7 AUXILIARY EQUIPMENT AND SPARE PARTS**

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
MOFFETT FEDERAL AIRFIELD  
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Concurrent with delivery and installation of the specified equipment, auxiliary equipment and spare parts shall be furnished as follows:

- a. Spare parts for each different item of material and equipment specified including all of the parts recommended by the manufacturer to be replaced after 1 and 3 years service.
- b. One extra of each part used that is made from glass, hard rubber, or clear plastic.

**1.8 FIELD MEASUREMENTS**

Verify all dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

**1.9 SAFETY PRECAUTIONS**

Fully guard couplings, motor shafts, gears, and other exposed or rotating or rapidly moving parts in accordance with OSHA 29 CFR 1910.219. Provide rigid and suitably secured guard parts readily removable without disassembling guarded unit.

**PART 2 PRODUCTS**

**2.1 MATERIALS AND EQUIPMENT**

Materials and equipment complete with accessories shall be selected by the Contractor for performance compatibility.

**2.1.1 Standard Products**

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

**2.1.2 Nameplates**

The air stripper and blower shall have the manufacturer's name, address, type or style, model and serial number, and any pertinent operating information on a plate secured to the item of equipment. Nameplates shall be located so as to be readily accessible and visible by system operators.

**2.2 AIR STRIPPER (R-101)**

Provide one skid mounted, low profile, plate (tray) type air stripper with blower.

The air stripper shall be a fully engineered and transportable unit fabricated of stainless steel, anodized aluminum, high density polyethylene, or demonstrated equal (as approved by the Contracting Officer). The base of the air stripper shall act as a process water retention sump with a minimum capacity of 40 gallons. The sump shall be configured for gravity discharge with a minimum discharge invert height as shown on the Drawings. The sump discharge

**EAST-SIDE AQUIFER TREATMENT SYSTEM  
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shall be also be configured to enable modification by installation of a discharge water pump. The air stripper design shall incorporate a demister or other mechanical device to prevent entrainment of water out of the stripper.

The air stripper and associated equipment shall, to the extent practical, be fabricated, assembled, and tested in the factory to minimize installation and setup time in the field. Floor dimensions of the skid mounted unit shall not exceed those shown on the Drawings.

All parts of the air stripper and mounting structure shall be designed to withstand all stresses that may occur during fabrication, transportation, installation, and intermittent or continuous operation and as a result of adverse environmental conditions (assume maximum wind speed 69 mph; seismic zone 4). All parts of the air stripper and associated equipment shall be weather resistant.

The air stripper vessel and components shall be designed and built to allow for disassembly and manual or mechanical cleaning as part of routine maintenance. Use of chemical agents for removal of scaling shall not be a requirement.

**2.2.1 Operating Conditions**

Maximum influent water flow rate:	39.5 gpm
Minimum influent water flow rate:	21.0 gpm
Influent water temperature:	60EF
Influent water quality:	See Table 1
Influent water contaminant concentrations:	See Table 2

**2.2.2 Performance Requirements**

Effluent from the air stripper shall meet the treatment goals presented in Table 3. Capacity and design of the air stripper and associated equipment shall be suitable for 24-hour full load service in ambient, nonfreezing conditions.

Air stripper performance will be verified by the Contracting Officer by sampling and analysis of air stripper effluent as described in Table 4 of this section.

**2.3 BLOWER**

Provide one blower capable of providing the air flow rate required to attain the air stripper performance standards addressed in paragraph 2.2.2. Total air flow from the blower and through the air stripper shall not exceed 300 standard cubic feet per minute under normal operating conditions. Also provide an inlet filter to prevent dust in ambient air from entering the blower.

The blower shall be equipped with a damper or other means of manually regulating air flow from 40 to 100 percent of full blower capacity.

The blower shall be either direct or belt drive, radial blade, or centrifugal type. Belt drive blowers shall be provided with grease lubricated ball or roller bearings. The blower shall be designed such that noise at 3 feet from the blower is less than 85 dBA. Motor electrical requirements shall be indicated on the nameplate.

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**2.4 VENT PIPE**

Provide a vent pipe (stack) constructed of chemically compatible materials for discharge of vapors from the air stripper. The top of the vent pipe shall be fitted with an insect screen and shall protrude no less than 3 feet above the pre-engineered metal structure over the east-side aquifers treatment system. The vent pipe shall be designed and mounted such that the air stripper and vent pipe will withstand stresses from wind, equipment installation, and normal system operation.

A 1-inch NPT plugged port shall be installed a distance of 10 stack diameters from the stack entrance (top of air stripper) to be used for stack sampling. A 1-inch NPT plugged port shall also be provided at a 90 degree angle from the sample port and 2 stack diameters below the sample port.

**2.5 INSTRUMENTATION AND CONTROLS**

The following instruments shall be installed in the skid mounted air stripper system:

high-low level switch (LSHL 101) on the stripper sump  
high-high level switch (LSHH 101) on the stripper sump  
level glass (LG 101) on the stripper sump  
low pressure switch (PSL 103) on the blower discharge  
hand/off/auto (HOA) switch (HS 103) on the blower motor

Required instrumentation locations are shown on the Drawings. All instruments must conform to the requirements of Section 16900, "Instrumentation and Controls."

**2.6 PIPING AND APPURTENANCES**

Process piping and valves shall be provided and installed in accordance with Section 15080, "Piping, Valves, and Appurtenances." Piping and valves external to the air stripper shall be provided as shown on the Drawings.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

The air stripper shall be leveled, plumbed, and aligned into position by the Contractor. Installation procedures for each piece of equipment shall be as recommended by the equipment manufacturer and as specified herein. Materials and equipment shall be prepared for service as recommended by the manufacturer.

The Contractor is responsible for providing all necessary accessories and appurtenances to form complete and functional air stripping system and to properly operate the equipment specified in this section. Special tools necessary for proper operation and maintenance of the equipment specified in this section shall be furnished by the Contractor.

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MOFFETT FEDERAL AIRFIELD  
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**3.2 SUPERVISION**

Obtain the services of a qualified engineer or technician from the air stripper manufacturer to supervise installation, start-up, and testing of the unit. After satisfactory installation of the equipment, the engineer or technician shall provide a signed certification that the equipment is installed in accordance with the manufacturer's recommendations.

**3.3 STARTUP**

Startup of the air stripper and associated equipment shall be in accordance with the equipment manufacturer's recommendations.

**3.4 FIELD EQUIPMENT TESTING**

After installation of the equipment, the Contractor shall conduct operating tests to demonstrate that the equipment will operate in accordance with all specified requirements.

Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; will perform in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of all associated instrumentation and control equipment, proper alignment, excessive noise levels, and power consumption.

**3.4.1 Leak Testing**

The air stripper sump shall be hydrostatically tested with potable water prior to any operational tests.

The air stripper sump shall be filled to the high water level control switch set point level for a period of 24 hours and inspected for leaks. Any leaks shall be repaired by the Contractor at no cost to the Government.

All process piping shall be tested in accordance with Section 15080, "Piping, Valves, and Appurtenances."

**3.4.2 Performance Testing**

After successful completion of the leak tests conducted by the Contractor to demonstrate operation of the equipment in accordance with the specified requirements, a field performance test shall be conducted demonstrating performance of the equipment.

The field performance test shall consist of 24 hours of continuous operation of the air stripper. Field performance of the air stripper and associated equipment shall be coordinated with the field performance testing of the piping system specified in Section 15080 and the mechanical equipment specified in Section 15160. The performance test period will begin once the flow rate from each well has been set. Successful completion of the field performance test and acceptance of the results by the Contracting Officer is required prior to final acceptance of the treatment system. The Contractor shall give the Contracting Officer a minimum of 2 weeks notice prior to conducting field performance test on the air stripper and associated equipment.

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Field performance testing of the air stripper shall be performed at the maximum sustainable flow rate for the extraction system based on extraction well production rates.

**3.4.3 Sampling and Sample Handling**

Sampling will follow the schedule presented in Table 4 to verify compliance with the performance requirement outlined in Paragraph 3.4.2 of this section. All samples shall be collected and analyzed by the Navy or its representatives.

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**TABLE 1**  
**ESTIMATED AIR STRIPPER INFLUENT WATER QUALITY PARAMETERS**

CONSTITUENT	ESTIMATED DISSOLVED CONCENTRATION
<b>METALS (<math>\mu\text{g/L}</math>)</b>	
Aluminum	6058
Antimony	<0.5
Arsenic	2.6
Barium	202
Beryllium	<0.5
Chromium	17.4
Cobalt	5.7
Copper	16
Iron	6,870
Lead	4.3
Manganese	632
Mercury	<0.5
Nickel	26
Potassium	2,023
Selenium	<0.5
Thallium	<0.5
Vanadium	25.2
Zinc	23.6
<b>ANIONS (<math>\mu\text{g/L}</math>)</b>	
Sulfate	143,000
Bicarbonate	520,000
Chloride	36,000
<b>CATIONS (<math>\mu\text{g/L}</math>)</b>	
Calcium	126,000
Magnesium	87,000

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CONSTITUENT	ESTIMATED DISSOLVED CONCENTRATION
METALS ( $\mu\text{g/L}$ )	
Sodium	72,000
OTHER PARAMETERS	
pH	7.3
Temperature (EF)	65 - 75
Total Dissolved Solids (mg/L)	1,000
Total Suspended Solids (mg/L)	<5

$\mu\text{g/L}$  = micrograms per liter  
mg/L = milligrams per liter

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**TABLE 2**  
**ANTICIPATED AIR STRIPPER INFLUENT CONTAMINANT CONCENTRATIONS**

CONTAMINANT	CONCENTRATION ( $\mu\text{g/L}$ )
Trichloroethane	17.2
Tetrachloroethene	9.4
Vinyl Chloride	9.0
1,2-Dichloroethene	29.3
1,1-Dichloroethane	1.7
Total Petroleum Hydrocarbon (purgeable)	41.2
Total Petroleum Hydrocarbon (extractable)	419.8

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**TABLE 3**  
**AIR STRIPPER EFFLUENT TREATMENT REQUIREMENTS**

CONTAMINANT	TREATMENT GOAL ( $\mu\text{g/L}$ )
Trichloroethene	0.5
Tetrachloroethene	0.5
Vinyl Chloride	0.5
1,2-Dichloroethene	0.5
1,1-Dichloroethane	0.5
Total VOCs (EPA Method 8010)	0.5 daily average 5.0 instantaneous maximum

VOCs = volatile organic compounds

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**TABLE 4**  
**PERFORMANCE TEST SAMPLING SCHEDULE**

<b>SAMPLING LOCATION</b>	<b>PARAMETER</b>	<b>ANALYTICAL METHOD</b>	<b>SAMPLING FREQUENCY</b>
Air Stripper Effluent	VOCs TPH Extractable TPH Purgeable Metals Biotoxicity	EPA Method 8010 EPA Method 8015 Mod. EPA Method 8015 EPA Method 8020 96 Hour Fish Toxicity	After 1, 8, 16, and 24 hours of operation

END OF SECTION

EAST-SIDE AQUIFER TREATMENT SYSTEM  
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SECTION 13121  
CANOPY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- |           |  |
|-----------|--|
| AISC FCD  | (1990) Quality Certification Program Description   |
| AISC S329 | (1985) Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts |
| AISC S335 | (1989) Structural Steel Buildings Allowable Stress Design and Plastic Design                       |

Manual of Steel Construction, 9th ed.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                   |  |
|-------------------|--|
| ASTM A 36/A 36M   | (1994) Carbon Structural Steel   |
| ASTM A 463/A 463M | (1995) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process  |
| ASTM A 500        | (1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes   |
| ASTM A 529/A 529M | (1994) High-Strength Carbon-Manganese Steel of Structural Quality  |
| ASTM A 572/A 572M | (1994; Rev. C) High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality   |
| ASTM A 588/A 588M | (1994) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick                            |
| ASTM A 653/A 653M | (1995) Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process                                 |
| ASTM A 755/A 755M | (1995) Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products |

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ASTM A 792/A 792M	(1995) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM B 209/A 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221/A 221M	(1995; Rev. A) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM C 308	(1985; R 1990) Working, Setting, and Service Strength Setting Times of Chemical-Resistant Resin Mortars
ASTM D 522	(1993; Rev. A) Mandrel Bend Test of Attached Organic Coatings
ASTM D 2244	(1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1994) Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1995) Measuring Adhesion by Tape Test
ASTM D 3841	(1992) Glass-Fiber-Reinforced Polyester Plastic Panels
ASTM D 4214	(1989) Evaluating Degree of Chalking of Exterior Paint Films
ASTM G 23	(1995) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

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METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA LRMBSM (1986; Supp. 1990) Low Rise Metal Building Systems Manual

STEEL DECK INSTITUTE (SDEI)

SDEI DDM (1990) Diaphragm Design Manual

UNDERWRITERS LABORATORIES INC. (UL)

UL 580 (1994; Bul. 1994, R 1995) Uplift Resistance of Roof Assemblies

UNIFORM BUILDING CODE

Uniform Building Code 1994 Edition

1.2 DESCRIPTION OF BUILDING

1.2.1 Dimensions

Building dimensions shall be as standard with manufacturer, not less than those indicated, but exceeding the indicated dimensions only by the amount of the closest standard size thereto. Eave height shall be measured from the top of finished floor to intersection of insides of roof.

The clear height between finished floor and bottom of roof steel shall be as indicated on the Drawings. All supports shall be placed within the dimension of the pad curb; no supports or bracing shall be placed in the interior of the curb of the 30-foot by 18-foot treatment system pad. No bracing or posts shall block the any of the gated areas as shown on Drawings C2, and S1.

1.2.2 Framing

Provide building with vertical struts and single-slope roof. Building shall be a single-span or multiple-span structure with one of the following framing systems: self-framing, column with single-span or continuous trusses, continuous beam frames, column with rigid frame, or rigid frame type, similar to AISC S335, Type I construction. Roof slope shall be a minimum of 1 to 12.

1.2.3 Foundation Requirements

Design foundations for allowable soil bearing pressure and a minimum bottom of footing depth as indicated. Contractor shall determine allowable soil bearing pressure. Use a factor of safety of 1.5 for overturning, sliding and uplift, and a concrete compressive strength as specified in Section 03302, "Cast-In-Place Concrete." The foundation loads are supplied by the building manufacturer.

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1.3 EXPERIENCE

1.3.1 Manufacturer

The manufacturer shall have AISC FCD, category MB certification.

1.3.2 Installer

Erector shall have specialized experience in the erection of metal building systems for a period of at least 3 years unless a waiver has been obtained by the Contractor from the Contracting Officer.

1.4 DESIGN REQUIREMENTS

1994 UBC; AISC 9th Edition, and MBMA LRMBSM for loading combinations and definitions with the exceptions of wind load and special collateral loads.

1.4.1 Roof Dead and Live Loads

Use,

Dead Load = per Code

Live Load = 20 psi per Table 16-C

1.4.2 Wind Loads

Use,

Wind = 70 mph

Exposure = C

Importance Factor = 1.15

1.4.3 Seismic Loads

Use,

Seismic Zone = 4

Importance Factor = 1.25

1.4.5 Deflection

1.4.5.1 Structural Members

The maximum deflection of main framing members shall not exceed 1/240th of their respective spans. The maximum deflection due to live load in roof panels and purlins shall not exceed 1/180th of their respective spans.

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**1.4.5.2 Roof Panels**

UL 580, Class 90. The design analysis shall establish that the roof, when deflected under dead plus live or snow loads, will not result in a negative gradient. Maximum deflections shall be based on sheets continuous across two or more supports with sheets unfastened and fully free to deflect. In addition, the roof decking shall be designed for a 200-pound concentrated load at midspan on a 12-inch wide section of deck. Panels thinner than 0.03 inches are not permitted for diaphragms used to resist seismic loads.

**1.4.5.3 Wall panels**

The maximum deflection due to wind on wall panels and girts shall be limited to 1/120th of their respective spans except that when interior finishes are used the maximum allowable deflection shall be limited to 1/180th of their respective spans.

**1.5 SUBMITTALS**

Submit the following in accordance with section entitled "Submittal Procedures."

**1.5.1 SD-04, Drawings**

- a. Pre-engineered building (G)
- b. Template for anchor bolts

Submit as necessary to erect the building and install components.

**1.5.1.1 Pre-engineered Building**

Submit complete design drawings for the pre-engineered building. Submit drawings for the foundations and anchorage.

**1.5.2 SD-05, Design Data**

- a. Building (G)
- b. Foundation loads (G)
- c. Anchor bolts (G)
- d. Purlins and girts (G)
- e. Bracing (G)
- f. Foundation (G)

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1.5.2.1 Building

Submit design calculations for the entire pre-engineered building and foundations, prepared and stamped by a California professional Civil or structural engineer. Include sizes and location of anchor bolts.

1.5.3 SD-13, Certificates

a. Pre-engineered metal building materials

Submit certificates attesting that materials comply with this specification.

1.5.4 SD-19, Operation and Maintenance Manuals

Submit manufacturer provided maintenance data.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle manufactured items so that materials remain dry and undamaged. Do not store in contact with materials that might cause staining.

1.7 WARRANTY

Provide warranty against water leaks arising out of or caused by ordinary wear and tear by the elements for a period of 10 years. Such warranty shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.

PART 2 PRODUCTS

2.1 WALL AND ROOF MATERIALS

MBMA LRMBM and ASTM D 3841, except as specified otherwise herein. Design roof and wall panels, accessories, and flashings to be completely weathertight and free of abrasions, loose fasteners, and deformations.

2.1.1 Minimum Thickness

As required to conform to design requirements but not less than the following:

<u>Items</u>	<u>Minimum Thickness (Uncoated)</u>
Girders and Columns	3/16 inch
Purlins and Girts	14 Manufacturer's Standard gage (MFG STD)
Roof Panels	
Steel	22 MFG STD gage
Aluminum	0.04 inch

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**Wall Panels**

Steel	24 MFG STD gage
Aluminum	0.032 inch

**Bracing** 3/16 inch thick steel members

**Column Base Plates** 5/8 inch thick

**Column Anchor Bolts** 5/8 inch diameter

**Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings, and Liner Panels**

Steel	24 MFG STD gage
Aluminum	0.032 inch
Plastic	0.045 inch

**Eave Gutters and Downspouts**

Steel	24 MFG STD gage
Aluminum	0.032 inch

**2.1.2 Panels**

- a. Fabricated of zinc-coated steel, aluminum-coated steel, aluminum/zinc-coated steel, or aluminum, except translucent wall panels indicated.
- b. Preformed.
- c. Factory-insulated to provide weathertight joint upon installation, with:
  - (1) Inner and outer sheets formed and joined at edges into a tongue-and-groove joining system with vinyl seals, closed cell foam tape, or factory-applied nonskinning butyl sealant; or
  - (2) Outer sheet designed to overlap adjacent panel a minimum of one configuration.
- d. If designed as diaphragm, roof decks shall be designed in accordance with SDEI DDM.

**2.1.2.1 Zinc-Coated Steel Sheet**

ASTM A 755/A 755M, Coating Class G-90 or ASTM A 653/A 653M, SQ, Grade 33, Coating Class G-90.

**2.1.2.2 Aluminum-Coated Steel Sheet**

ASTM A 463/A 463M, Type 1 or Type 2.

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**2.1.2.3 Aluminum/Zinc-Coated Steel Sheet**

ASTM A 792/A 792M, AZ 55

**2.1.2.4 Aluminum Sheet**

Alloy 3004 Alclad conforming to ASTM B 209.

**2.1.2.5 Liner Panels**

Formed of same type material as used for wall panels to closely approximate configuration of panels indicated.

**2.2 FRAMING AND STRUCTURAL MEMBERS**

**2.2.1 Steel**

ASTM A 36/A 36M, ASTM A 529/A 529M, ASTM A 572/A 572M, or ASTM A 588/A 588M.

**2.2.2 Aluminum**

ASTM B 221 or ASTM C 308.

**2.2.3 Structural Tube**

ASTM A 500 or ASTM B 221.

**2.3 MISCELLANEOUS ITEMS**

**2.3.1 Caps, Strips, and Plates**

Form ridge caps, eave and edge strips, fascia strips, miscellaneous flashings, and miscellaneous sheet metal accessories from the same material and gage as the roof panels. Wall plates, base angles or base channels, and other miscellaneous framing members may be standard structural steel shapes, or may be formed from steel not lighter than 18 gage thick.

**2.3.2 Closure Strips**

Provide closure strips of closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering. Closure strips shall not absorb or retain water.

**2.3.3 Sealant**

Provide elastomeric type sealant containing no oil or asphalt. Exposed sealant shall cure to a rubberlike consistency. Concealed sealant may be the nonhardening type.

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**2.3.4 Gaskets and Insulating Compounds**

Provide nonabsorptive gaskets and insulating compounds suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

**2.3.5 Fasteners**

Provide fasteners for steel wall and roof panels of zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum wall and roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear strength of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick. When wall covering is factory color finished, exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering. Nonpenetrating fastener system using concealed clips shall be manufacturer's standard for the system provided.

**2.3.5.1 Screws**

Provide self-tapping screws not less than No. 14 diameter and not less than No. 12 diameter if self-drilling/self-tapping type.

**2.3.5.2 End-Welded Studs**

Provide automatic shouldered type studs with a shank diameter of not less than 3/16 inch and cap or nut for holding covering against the shoulder.

**2.3.5.3 Explosive Actuated Fasteners**

Fasteners for use with explosive actuated tools shall have a shank diameter of not less than 0.145 inch with a shank length of not less than 1/2 inch for fastening panels to steel and not less than 1 inch for fastening panels to concrete.

**2.3.5.4 Blind Rivets**

Provide aluminum rivets with 3/16 inch nominal diameter shank or stainless steel rivets with 1/8 inch nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Provide hollow stem rivets with closed ends.

**2.3.5.5 Bolts**

Provide bolts not less than 1/4 inch diameter, shouldered or plain shank as required, with nuts.

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2.4 GUTTERS

Provide gutters complete with mitered corners, end pieces, and special pieces that may be required. Expansion-type slip joints shall be provided at the center of the runs and at intervals of not more than 32 feet for aluminum and not more than 40 feet for steel. Provide water tight seal at all other joints. Provide hangers and fastenings from a metal compatible with the gutters. Space hangers not more than 36 inches apart.

2.5 DOWNSPOUTS

Provide cross sectional area adequate to carry all precipitation collected in gutters and complete including elbows and offsets. Provide downspouts in approximately 10-foot lengths; end joints shall telescope not less than 1/2 inch and longitudinal joints shall be locked. Position downspouts not less than 1/2 inch away from walls and fasten to the walls at top, bottom, and at not to exceed 5 foot centers intermediately between with manufacturer's standard type leader straps, or concealed type fasteners. Form straps and fasteners from a metal compatible with the downspouts. All downspouts shall be positioned to drain water outside of the curbed treatment system pad.

2.6 FINISH

2.6.1 Shop Painting

Ferrous metal work, except factory-finished work, zinc-coated work, aluminum-coated work, and work specified to be painted herein, shall be (1) cleaned of dirt, rust, scale, loose particles, grease, oil, and other deleterious substances; (2) phosphate treated; and (3) then be given one coat of an approved rust-inhibiting primer paint of the type standard with the metal building manufacturer.

2.6.2 Factory Color Finish

Provide exterior and interior exposed surfaces of metal roof and wall panels, gutters, downspouts, and metal accessories with a thermal-cured factory finish. Color shall be selected from manufacturer's standard colors. Provide an exterior finish top coat of 70 percent resin fluoropolymer. Provide standard dry film thickness standard with building manufacturer. Interior color finish shall consist of the same coating and dry film thickness as the exterior. Provide interior and exterior color finish meeting the test requirements specified below. Tests shall have been performed on the same factory finish and thickness provided.

- a. Salt Spray Test: ASTM B 117, minimum 1000 hours. Undercutting of the paint film from the score line shall not exceed 16 inches.
- b. Accelerated Weathering Test: ASTM G 23, Method 2, Type D apparatus minimum 2000 hours or Type EH apparatus minimum 500 hours, no checking, blistering or loss of adhesion; color change less than 5 NBS units by ASTM D 2244 and chalking less than No. 8 rating by ASTM D 4214.
- c. Flexibility: ASTM D 522, Method A, 8 inch diameter, 180 degree bend, no evidence of fracturing to the naked eye.

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- d. Adhesion: ASTM D 3359, Method B, for laboratory test and film thickness less than 5 mil and Method A for site tests. There shall be no film removed by tape applied to 11 parallel cuts spaced 1/8 inch apart plus 11 similar cuts at right angles.
- e. Impact: ASTM D 2794, no loss of adhesion after direct and reverse impact equal to 1.5 times metal thickness in mils, expressed in inch-pounds.
- f. Humidity Resistance: ASTM D2247, 1500 hours, no signs of blistering, cracking, creepage, or corrosion on score panel.

PART 3 EXECUTION

3.1 INSPECTION

Check concrete dimensions, anchor bolt size and placement, and slab elevation with the metal building manufacturer's templates and drawings before setting any steel.

3.2 ERECTION

Erect in accordance with the manufacturer's approved erection instructions and diagrams. Correct defects and errors in the fabrication of building components in a manner approved by the Contracting Officer. If defects or errors in fabrication of components cannot be corrected, remove and provide nondefective components. When installing wall and roof systems, install closure strips, flashing, sealing material, and other accessories in accordance with building manufacturer's instructions to provide a weathertight system, free of abrasions, loose fasteners, and deformations. After erection is complete, repair and coat abraded and damaged, primed or factory-finished surfaces to match adjacent surfaces.

3.2.1 Dissimilar Materials

Prevent direct contact between aluminum surfaces, and ferrous or other incompatible metals, by one of the following methods:

- a. Paint the incompatible metal with a coating of manufacturer's standard heavy-bodied paint.
- b. Paint the incompatible metal with a prime coat of corrosion inhibitive primer followed by one or two coats of aluminum metal-and-masonry paint, or other suitable protective coating, excluding products containing lead and chromium pigmentation.
- c. Provide an approved nonabsorptive gasket.
- d. Apply an approved caulking between the aluminum and the incompatible metal.

If drainage from incompatible metal passes over aluminum, paint the incompatible metal by method (a) or (b). Paint aluminum surfaces in contact with concrete or masonry materials by method (a). Paint green or wet wood, or wood treated with incompatible wood preservatives, by method (a) or use two coats of aluminum paint.

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**3.2.2 Rigid Frames, Bases, and Sill Members**

Brace frames as necessary to ensure safety. Set accurately, using a nonshrink grout to obtain uniform bearing on the concrete and to maintain a level base line elevation. Clean surfaces to receive the mortar and thoroughly moisten immediately before placement of mortar. Water cure exposed surfaces of mortar with wet burlap for 7 days.

**3.2.2.1 Field Welding**

Steel, AWS D1.1. Aluminum, AA 30.

**3.2.2.2 Field Bolting**

AISC S329

**3.2.3 Wall Construction**

Apply panels wall heights as indicated with no horizontal joints. Lay side laps away from the prevailing winds. Seal side and end laps with the joint sealing material recommended by the manufacturer. Flash or seal walls at the top. Flashing will not be required where approved "self-flashing" panels are used. Minimum end laps for all types of panels shall be 2 1/2 inches. Minimum side laps for all types of panels shall be one corrugation, one configuration, or an interlocking joint.

**3.2.4 Roof Construction**

Apply the roofing panels in top eave to bottom eave on shed roofs with no transverse joints except at the junction of light transmitting roof panels, chimneys, and similar openings. Lay side laps away from the prevailing wind, and seal side and end laps with joint sealing material. Flash and seal the roof at the ridge, at eaves and rakes, at projections through the roof, and elsewhere as necessary. Minimum side lap shall be one corrugation, configuration, or interlocking rib except 1 1/2 corrugations for standard corrugated sheets. End laps shall not be less than 6 inches and shall occur only over purlins.

**3.2.5 Minimum Fastener Spacing**

Space fasteners according to manufacturer's instructions, but not to exceed:

- a. 8 inches o.c. at end laps of covering,
- b. 12 inches o.c. at connection of covering to intermediate supports,
- c. 12 inches o.c. side laps of roof coverings, 18 inches o.c. at side laps of wall.

**3.3 FIELD PAINTING**

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same color and material used for the shop coat.

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3.4 FIELD QUALITY CONTROL

At the discretion of the Contracting Officer, sample panels may be taken at random from each delivery or from stockpiles on the site at any time during the construction period, and tests may be made to check the conformance of the materials to the requirements specified in paragraph entitled "Factory Color Finish." Failure of the sample sheets to pass the required tests shall be cause for rejection of all sheets represented by the samples and replacement of the entire shipment.

END OF SECTION

EAST-SIDE AQUIFER TREATMENT SYSTEM  
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SECTION 15011  
MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117 (1990) Salt Spray (Fog) Testing

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)

1.2 RELATED REQUIREMENTS

This section applies to Division 2, "Site Work," and all sections of Division 15, "Mechanical," of this project specification unless specified otherwise in the individual section.

1.3 QUALITY ASSURANCE

1.3.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design, and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

1.3.2 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

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**1.3.3 Service Support**

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment, which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

**1.3.2 Manufacturer's Nameplate**

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

**1.3.5 Modification of References**

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

**1.4 DELIVERY, STORAGE, AND HANDLING**

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

**1.5 SAFETY REQUIREMENTS**

**1.5.1 Equipment Safety**

Provide positive means of locking out equipment so that equipment cannot be accidentally started during maintenance procedures. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of the type specified. Provide catwalks, maintenance platforms, and guardrails where required for safe operation and maintenance of equipment. Provide ladders or stairways to reach catwalks and maintenance platforms. Ensure that access openings leading to equipment are large enough to carry through routine maintenance items such as filters and tools.

**1.5.2 Warning Sign**

Provide a permanent placard or sign at the entrance to confined spaces contained in the equipment. The sign shall warn personnel not to enter the space until the atmosphere inside has been tested and systems have been de-energized.

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1.5.3 Lockout of Energy Sources

Provide appropriate lockout devices for energy isolating valves and for machines or other equipment to prevent unexpected start-up or release of stored electrical, mechanical, hydraulic, pneumatic, thermal, chemical, or other energy in accordance with 29 CFR 1910.147. Lockout devices for valves shall provide a means of attachment to which, or through which, a lock can be affixed or shall have a locking mechanism built into it so that the valve cannot be moved from the lockout position until the lock is removed. Electrical isolation of machines or other equipment shall be in accordance with requirements of DIVISION 16, "Electrical."

1.6 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects, and contractors with their respective pieces of equipment. Motors, controllers, disconnects, and contractors shall conform to requirements of Section 16011, "Electrical General Requirements." Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contractors shall have a maximum of 120-volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment.

1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

PART 2 PRODUCTS

Not used.

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PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

Equipment painting, factory applied or shop applied, shall be as specified herein, and provided under each individual section.

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.1225 inch on either side of the scratch mark. The fill thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees Fahrenheit (EF), submit certifications that the manufacturer's standard factory painting system conforms to the heat resistance requirement in addition to other certifications.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, protect, prime, and paint metal surfaces; aluminum surfaces need not be painted. Apply coatings to clean, dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil, and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120EF shall be cleaned to bare metal. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

Temperatures Less Than 120EF: Immediately after cleaning, the metal surfaces subject to temperatures less than 120EF shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to minimum dry film thickness of 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.

END OF SECTION

EAST-SIDE AQUIFER TREATMENT SYSTEM  
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SECTION 15080  
PIPING, VALVES, AND APPURTENANCES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.5 (1973) Steel Pipe Flanges, Flange Valves and Fittings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 182 (1995; Rev. b) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service

ASTM A 312 (1994; Rev. b) Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe

ASTM C 1173 (1995) Flexible Transition Couplings for Underground Piping Systems

ASTM D 1248 (1984; editorial changes 1989) Polyethylene Plastics Molding and Extrusion Materials

ASTM D 1784 (1992) Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds

ASTM D 1785 (1994) Standard Specification for Polyvinyl Chloride (PVC), Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2239 (1994) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

ASTM D 2464 (1994) Standard Specification for Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2467 (1994) Standard Specification for Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2564 (1993) Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings

ASTM D 2855 (1993) Standard Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings

ASTM D 3261 (1993) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic, Pipe and Tubing

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**ASTM F 714 (1994) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter**

**FEDERAL SPECIFICATIONS**

**WW-V-35C (1985) Valves, Ball**

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals," in sufficient detail to show full compliance with the specification:

**SD-02 Manufacturer's Catalog Data**

- a. Pipe and fittings
- b. Valves
- c. Tubing and fittings
- d. Pipe supports
- e. Valve boxes
- f. Filters

**PART 2 PRODUCTS**

**2.1 STAINLESS STEEL PIPE FOR EXTRACTION WELL SERVICE**

**2.1.1 Pipe**

Schedule 40, welded or seamless 304 series stainless steel, ASTM A 312.

**2.1.2 Fittings**

Fittings in well shall be threaded. Fittings shall be compatible with Schedule 40 pipe in Section 2.3.1. Fittings shall be constructed from 304 stainless steel conforming to ASTM A 182.

**2.1.3 Valves**

**2.1.3.1 Ball**

Double union end 304 or 316 stainless steel ball valve, WW-V-35C, Type II. Seats and seals shall be tetrafluoroethylene.

**2.2 POLYVINYLCHLORIDE (PVC) PIPE FOR TREATMENT PAD AND DISCHARGE SERVICE**

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**2.2.1 Pipe**

ASTM D 1785, Schedule 80. PVC Class 12454B, ASTM D1784.

**2.2.2 Fittings**

Socket-type: ASTM D2467, Schedule 80. PVC Class 12454B, ASTM D1784, ASTM C1173.

Threaded: ASTM D 2464. PVC Class 12454B, ASTM D1784.

Flanged: ANSI B16.5 Class 150 lb. dimensions, Van Stone style, with viton, or tetrafluoroethylene-bonded EPDM gaskets.

**2.2.3 Cement and Lubricant**

Solvent cement: ASTM D2564.

Thread lubricant: in accordance with the pipe manufacturer's recommendations.

**2.2.4 Valves**

**2.2.4.1 Ball**

**Bronze:**

Valve shall be rated for not less than 125 psi service. Valve bodies shall be threaded connection type constructed of Class A copper alloy. Balls and stems shall be manufacturer's standard with hard chrome plating finish. Valves shall be suitable for flow from either direction and shall seal equally tight in either direction.

Valves with ball seals held in place by spring washers are not acceptable. Seats and seals shall be tetrafluoroethylene. Packing shall be made of non-asbestos type materials.

**Plastic:**

Valve bodies shall have solvent weld socket or threaded ends and shall be rated for not less than 125 psig. Seats and seals shall be tetrafluoroethylene.

**2.2.4.2 Check**

**Bronze:**

Standard horizontal swing check type rated for not less than 125 psig. Body end connections shall be threaded in pipe sizes 2 inches and under.

**Plastic:**

Valve bodies shall have solvent weld socket or threaded ends and shall be rated for not less than 125 psig.

**2.2.4.3 Three-Way T-Port**

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Valve body construction shall be bronze or PVC with solvent weld socket or threaded connections. Maximum working pressure shall not be less than 125 psi at 68EF. Seats shall be self-lubricating tetrafluoroethylene. O-ring seals shall be viton. Possible valve positions shall include complete shut-off, 90E left, 90E right, and straight-through flow.

**2.2.5 Field Applied Protective Coating**

All exposed PVC pipe, fittings, and appurtenances shall receive paint or wrapping material to protect PVC from ultraviolet radiation according to manufacturer's recommendations. Protection shall be applied after completion of treatment facility but prior to operation. At no time shall PVC pipe, fittings, or appurtenances be unprotected from ultraviolet radiation for a cumulative period of 1 year for schedule 40 pipe and 2 years for schedule 80 pipe.

**2.3 POLYETHYLENE (PE) PIPE FOR WATER TRANSMISSION**

**2.3.1 Pipe**

ASTM F 714. Pipe material shall be PE 3406 as designated by ASTM D 1248. Standard inside dimension ratio-pressure rated (SDR-PR) pipe in accordance with ASTM D2239. SDR shall be 11. Pressure rating shall not be less than 150 psi. Pipe shall be ultraviolet (UV) light-stabilized with 2 percent carbon black.

**2.3.2 Fittings**

ASTM D 3261. Butt fusion: PE 3406 as designated by ASTM D 1248, with a pressure rating greater than or equal to adjacent pipe. UV-stabilized with 2-percent carbon black.

Flanged: ANSI B16.5 Class 150 lb. dimensions, Van Stone style, with viton, or tetrafluoroethylene-bonded EPDM gaskets.

**2.4 POLYETHYLENE (PE) TUBING FOR ANTISCALANT AND SAMPLE PORT SERVICE**

**2.4.1 Tubing**

Cross-linked, high-density polyethylene. Inside diameter as specified on Drawings. Pressure rating to exceed maximum anticipated conditions of service.

**2.4.2 Fittings**

Fittings shall be brass, or 304 or 316 series stainless steel. All fittings for PE tubing shall be of the same type and from the same manufacturer.

To reduce headloss, wye fittings shall be installed instead of tee fittings at all junctions.

**2.5 PIPE SUPPORTS**

Pipe supports shall be placed as shown on the Drawings. Pipe supports shall be sized and installed to support pipe and appurtenances when filled with water. Baseplates will be a minimum of 4 inches wide and 4 inches long and 1/8 inches thick. Anchor bolts will be

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1/4"-20UNC-2A bolts at least 4 1/2 inches in length. Pipe supports, baseplates, and saddles shall be galvanized or enameled carbon steel and, if fabricated by the Contractor, conforming to Specification 05500.

Pipe supports from the Building 6, Building 12, and Building 45 treatment systems shall be relocated and reused to the extent possible.

**2.6 AIR RELEASE VALVES**

The air release valves shall operate under pressure to allow entrapped air to escape from pipelines through an orifice sized for a working pressure of 250 psi. Air release valves shall have a minimum venting capacity of 2.5 cfm at 50 psi. Air release valves shall close when liquid enters the valves. If more air accumulates, the opening cycle shall repeat automatically.

Valve materials shall be cast iron, stainless steel, tetrafluoroethylene, and viton.

A ball valve conforming to Paragraph 2.2.3.1 of this section shall be installed on the inlet of each air release valve. The ball valve size shall match the size of the air release valve inlet.

**2.7 SAMPLE PORT VALVES**

Sample port valves shall be of the needle type. Valve body shall be brass in a straight-run or angle pattern as shown on Drawings. Pressure rating shall not be less than 150 psi. Packing shall be tetrafluoroethylene. Valve shall require no less than 5 turns to fully open. All sample port valve discharges shall be fitted with a brass barbed hose connector for 1/4-inch, inside diameter tubing. All sample port valves shall be pointed downward.

**2.8 AIR RELEASE/VACUUM VALVES (AVV)**

AVVs shall be constructed of cast iron with stainless steel trim. AVVs shall be designed and installed to exhaust air from the GAC vessels and the GAC vessel discharge standpipe during filling of the units. AVVs shall also be designed and installed allow air into the pipeline under vacuum conditions to break the vacuum and prevent siphonage and/or collapsing of the GAC vessels. Maximum working pressure for water service shall not be less than 125 psi.

**2.9 DUPLEX BAG FILTERS, EXISTING (F-107 A/B, F-107 C/D)**

Duplex bag filters shall be relocated from the existing Building 6 and 12 Treatment Systems. The entire filter assembly, including influent and effluent ball valves, differential pressure gauges, and filter stand shall be relocated intact.

**2.10 IDENTIFICATION OF VALVES**

Each shut-off or control valve, except those on equipment, shall be provided with a 1-inch minimum diameter heavy brass tag. Tags shall bear a nameplate permanently fastened to the valve identifying number of the valve and, when shown, one or more identifying letter symbol of the service line.

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Numbers and letters shall be block type with 0.25 inch high numbers and letters stamped on the tags and filled with black enamel. Where necessary to operate more than one valve to control a section of piping, the numbers of the other valves shall be stamped on the tag in 0.125 inch high block numbers and letters filled with black enamel.

Attach tags to the valves by split-key rings soldered so that the ring and tag cannot be removed.

**PART 3 EXECUTION**

**3.1 PIPE HANDLING**

Handle pipe and accessories in a manner to ensure delivery to the installation location in an undamaged condition. Hand carry pipe into position. Before installation, inspect the pipe for defects. Promptly remove defective material from the site. Replace defective material with sound material without additional cost to the Government.

**3.2 INSTALLATION**

Plastic piping shall be installed in accordance with the manufacturer's installation instructions.

**3.2.1 Vertical Piping**

Piping shall be secured at sufficiently close intervals to keep pipe in alignment and to support weight of pipe and contents.

Piping shall be secured in position by approved stakes or braces when piping is to stand free, or when no structural element is available for providing stability during construction.

**3.2.2 Horizontal Piping, Suspended**

All piping shall be supported at intervals in accordance with the manufacturer's instructions.

**3.2.3 Horizontal Piping, Underground**

The full length of each section of PVC or length of PE coiled pipe shall rest solidly upon the pipe bed, with recess excavated to accommodate couplings or joints. Relay pipe that had its grade or joint disturbed during installation. Do not lay pipe in water or when conditions are unsuitable for the work. Securely close open ends of the pipe, fittings, and valves when work is not in progress to prevent foreign material from entering the pipes and fittings. Piping laid on grade shall be firmly braced prior to embedment in concrete.

**3.2.4 Cutting**

Cuts shall be made square with pipe and burrs shall be removed by smoothing edges. Cut pipe in a manner that will not cause damage to the pipe. Pipe cutting should be in accordance with the manufacturer's recommendations and consistent with the type of joint to be used.

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**3.2.5 Joints, PVC**

Threaded joints shall be used only where necessary. Threaded joints shall be tightened by strap wrench to not more than one full turn beyond hand tight. All other joints shall be solvent cemented in accordance with ASTM D 2855.

**3.2.6 Joints, PE**

PE pipe and fittings shall be joined by thermal butt fusion in accordance with ASTM D 3261 and the recommendations of the manufacturer of the pipe and fittings. Junction with other materials shall be the type of adapter and technique as recommended by the pipe manufacturer.

**3.2.7 UV Protection, PVC Pipe**

All aboveground PVC pipe, fittings, valves shall be treated according to the manufacturer's recommendations to minimize degradation caused by UV light. Such treatment shall not interfere with the normal operation of valves or fittings.

**3.2.8 PE Piping**

To prevent the accumulation of air in high points in the PE conveyance pipe, piping shall be installed in a manner to allow air to flow toward air release valve locations. Placement of additional air release valves at locations in addition to those shown on the Drawings may be necessary in the case of utility crossings. Placement and installation of additional air release valves shall be the responsibility of the Contractor.

**3.2.9 Piping Connections to Threaded or Socket-Welded Valves, Flowmeters, and Rotameters.**

All threaded or socket-welded valves, flowmeters, and rotameters installed in pipelines (tubing not included) that may have to be removed for repair, maintenance, or replacement shall be installed with adjacent union connections to allow easy removal of the appurtenance for repair, maintenance, or replacement. If two or more valves, flowmeters, and/or rotameters are installed adjacent to each other on a pipeline, one set of union connections on either upstream and downstream of all appurtenances shall be sufficient if appurtenance can be easily removed for repair, maintenance, or replacement.

The requirements of the above Paragraph shall not apply to the emergency shower and eyewash station.

**3.3 TESTING**

**3.3.1 Hydrostatic Tests**

Subject newly laid piping, fittings, valves, and appurtenances to a hydrostatic pressure test of 100 psi for 2 hours. Test pressure shall not vary by more than 5 psi for the duration of the test. Conduct test after the pipe is laid, the joints completed, and the trench backfilled. Remove and replace pipe, fittings, or valves discovered to be cracked or defective as a consequence of the test, with sound material. Repeat the test until test results are approved.

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END OF SECTION

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**SECTION 15160  
PUMPS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM A492           Stainless and Heat-Resisting Steel Rope Wire

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION  
(NEMA) STANDARD**

MG-1               (1993) Motors and Generators

**1.2 SUBMITTALS**

Submittals are due prior to the installation of the pumps. The Contractor shall submit the following in accordance with the RAC contract:

**1.2.1 SD-02 Manufacturers Catalog Data**

Data providing information on materials of construction, motors, performance curves, and dimensional drawings for each pump model.

**1.2.2 SD-06 Manufacturer's Instructions**

Material describing the installation of the pumps, including special notices.

**1.2.3 SD-13 Certificate of Compliance**

A written statement, signed by an authorized official of the manufacturer of the pumps, attesting that the pumps conform to the requirements of the contract documents and will perform as intended as an integral part of the project work.

**1.2.4 SD-19 Operations and Maintenance Manuals**

Materials from the manufacturer describing the operation and maintenance aspects for:

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a. Pump Operations and Maintenance

Detailed procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication, and cleaning necessary to minimize corrective maintenance and repair for pumps and motors.

b. Parts List

Operation and maintenance manuals shall include anticipated list of parts that may need replacement within the first six months after the completion of the project.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory waterworks operation at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the jobsite. Pumps of the same type shall be the product of one manufacturer.

PART 2 PRODUCTS

2.1 SUBMERSIBLE WELL PUMPS (P1, P2, P3, P4, and P5)

Shall pump water from 6-inch extraction wells in the extraction trench to an on-site wastewater treatment facility. All five pumps shall be submersible pumps designed for continuous, submerged operation. The pumps shall be capable of discharging the following quantities, at the specified discharge head, from the extraction wells indicated on the following table.

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Pump	Extraction Well	Design Flow Rate Gallons per Minute (gpm) <sup>1</sup>	Total Dynamic Head at Design Flow Rate (feet)	Recommended Horsepower <sup>2</sup>
P1	EXW-1	3.5-7.0	49-83	1/3
P2	EXW-2	6.0-10.5	56-81	1/3
P3	EXW-3	3.0-7.5	49-68	1/3
P4	EXW-4	6.0-10.5	57-89	1/3
P5	EXW-5	2.5-4.0	45-81	1/3

1. Design flow rate is that flow rate most likely expected for long-term yield after well installation and development. Design flow rate is neither less than minimum projected flow rate nor greater than maximum projected flow rate. Pump sizes should be chosen so that published operating range of flow includes the design flow rate at the approximate middle of that range.
2. Horsepower requirement based on mean of total dynamic head at design flow rate range shown. Horsepower may vary according to pump manufacturer.

Each pump shall have a maximum pressure shut-off below rated pressure of pump and downstream piping. Pumps shall be controlled to shut off below manufacturer's recommended flow range or when, during operation, air is introduced into the pump. The pump intake shall have a minimum submergence of 2 feet. The bottom of pump housing shall rest at least 6 inches but not over 2 feet above bottom of casing. The construction of each pump shall be as follows:

**Pump:** Driven by motor attached below the pump section. The maximum nominal casing width shall not exceed 4 inches. Pump shall be supplied with motor, inlet screen, check valve, driver, flow inducer sleeve/shroud, thermal overload device, hanging hook, and associated wires/cables.

**Power cord:** Designed for quick disconnection/connection with the power supply.

**Check Valve:** American Iron and Steel Institute (AISI) 304 or 316 stainless steel. The check valve seat shall be a combination of AISI 316 stainless steel and viton.

**Diffuser Chamber:** AISI 304 or 316 stainless steel.

**Bearings:** Top and intermediate bearings shall be a combination of AISI 316 stainless steel and viton.

**Impellers:** Constructed of AISI 304 or 316 stainless steel and statically and dynamically balanced. All bolts and nuts shall be of stainless steel.

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Impellers shall be securely fastened to the drive shaft in such a manner as to make it readily removable.

Impeller Seal Rings: AISI 316 stainless steel and viton.

Flow Sleeve: Pumps shall be installed with flow sleeves that force water intake to the pump from below pump motor. Flow sleeves shall aid in adequate cooling of pump motor when low flow rates are encountered. Flow sleeves shall be constructed of stainless steel with an inside diameter between 4.4 and 5.0 inches for 4-inch nominal diameter motor and 6-inch nominal diameter well casing or screen.

### **2.1.2 SUBMERSIBLE MOTORS**

Each submersible pump shall be driven by a continuous-duty motor designed for underwater operation. Motors shall have normal starting torque, low-starting-current characteristics, and shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. Motor bearings shall provide smooth operations under the conditions encountered for the life of the motor. Adequate thrust bearings shall be provided in the motor to carry the weight of all rotating parts plus the hydraulic thrust and shall be capable of withstanding upthrust imposed during pump starting. The motor shall be acceptable for use with 230-volt  $\pm 10\%$ , single phase, three-wire, 60 Hz service. The rating shall be stamped on the nameplate. Motors shall conform to NEMA MG-1. Provide control box for single-phase motor. Manufacturer shall review schematic and provide additional contacts and relays for operation.

### **2.1.2 POWER CABLE**

The pump manufacturer shall supply enough power cable from each pump to reach the local control panel.

### **2.1.3 PIPING CONNECTIONS**

All pipe connections will be threaded connections of suitable size and suitably arranged for piping shown in the Drawings. Piping shall be installed to preclude the formation of air pockets.

### **2.1.4 PUMP - LIFTING CABLE**

A stainless steel cable shall be connected to a hook at the top of each submersible pump and attached to the top of the well casing. The cable shall be able to support the weight of the pump, down pipe, and water in the down pipe and conform to ASTM A492. The final cable length shall be at a length that does not allow the pump to touch the bottom of the well if the down pipe breaks or is disassembled. The cable is intended to be used to retrieve the pump should the down pipe break or is disassembled.

### **2.1.5 SUPPORT**

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Each submersible pump, down pipe, and water in the down pipe shall be supported with a pipe support at the outlet of each well head.

**2.1.6 SPARE PARTS FOR SUBMERSIBLE WELL PUMPS**

The Contractor shall furnish the following spare parts for each pump model:

- a. One complete set of pump bearings.
- b. One complete set of gaskets and seals.
- c. One complete set of bowl and impeller wearing rings for each stage.
- d. One complete set of motor bearings.

All spare parts furnished shall be interchangeable with and of the same materials and workmanship as the corresponding original parts of the pumps and motors. Each part shall be clearly marked or tagged for identification as to size and type of pumping unit for which it is intended.

**2.2 TRANSFER PUMP (P-104)**

Transfer of flow from air stripper effluent to bag filters shall be accomplished by a self-priming centrifugal pump. This pump should be provided by air stripper manufacturer as an integral part of air stripper. Pump casing shall be enameled cast iron or AISI 304 or 316 stainless steel, with carbon/ceramic seals and viton elastomers. Casing shall be constructed with bolted plate to permit inspection and removal of the impeller.

Pump motor shall be totally-enclosed, fan cooled (TEFC) for 230-volt, 60-Hz, single phase service, with a recommended size of 1 hp. Expected total dynamic head range for transfer pump is 23 to 79 feet. However, motor shall provide necessary motor hp to achieve desired pump performance. Motor shall have built-in overload protection, with automatic reset.

Pump design shall prevent pump from running dry or pump shall be able to run dry for 30 minutes with no damage.

**2.2.1 Spare Parts**

The Contractor shall furnish the following spare parts each for the transfer pump (P-104):

- a. One complete set of pump bearings.
- b. One complete set of gaskets and seals.
- c. One complete set of bowl and impeller wearing rings.
- d. One complete set of motor bearings.
- e. One complete set of motor brushes.

All spare parts furnished shall be interchangeable with and of the same materials and workmanship as the corresponding original parts of the pumps and motors. Each part shall be clearly marked or tagged for identification as to size and type of pumping unit for which it is intended.

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**2.3 SUBMERSIBLE SECONDARY CONTAINMENT SUMP PUMP (P-110)**

Contractor shall furnish and install a centrifugal submersible sump pump and motor in the sump of the treatment pad. Pump shall be constructed of corrosion resistant plastics, stainless steel, or appropriately coated cast iron and manufactured for prolonged submersed service.

Pump casing shall be cast iron or AISI 304 or 316 stainless steel. Casing shall be constructed with bolted plate to permit inspection and removal of the impeller. Impeller shall be semi-open type, capable of passing 1/4-inch diameter solids. Intake shall be protected with a slotted intake strainer with an effective free area sufficient to prevent cavitation and degradation of efficiency. Strainer shall not allow particles larger than 1/4 inches in diameter to enter the pump. The strainer shall be located so it can be cleaned without removing the pump for the sump.

Pump shaft shall be constructed of ground and polished AISI Type 304 or 316 stainless steel. Mechanical properties and diameter of shaft shall ensure that whip, deflection, or vibration will not be of sufficient magnitude to impose greater than designed loads on the shaft bearings under normal operating conditions.

Pump shall be capable of pumping a minimum of 15 gpm against a total dynamic head of 50 feet based on pumping clear, fresh water at 68 degrees Fahrenheit.

Recommended motor size is 1/2 horsepower with 115-volt, single-phase, 60-Hertz (Hz) service. Motor shall be permanently sealed, oil-filled, and watertight. Power cord shall be of sufficient length for the appropriate electrical connections, waterproof, internally grounded, oil-resistant, with three-prong plug.

An integral float switch enclosed in a NEMA 250 type 4 enclosure shall start the pump when water depth in the sump is greater than 20 inches and shut the pump off before the water level in the sump is below the pump inlet. Pump motor starter shall also have a manual override switch.

**2.3.1 Spare Parts**

The Contractor shall furnish the following spare parts each for the submersible sump pump (P-110):

- a. One complete set of pump bearings.
- b. One complete set of gaskets and seals.
- c. One complete set of bowl and impeller wearing rings.
- d. One complete set of motor bearings.
- e. One complete set of motor brushes.

All spare parts furnished shall be interchangeable with and of the same materials and workmanship as the corresponding original parts of the pumps and motors. Each part shall be clearly marked or tagged for identification as to size and type of pumping unit for which it is intended.

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**2.4 PIPING CONNECTIONS**

All pipe connections to pumps will be threaded of suitable size and suitably arranged for piping shown on the Drawings. Piping shall be installed to prevent the formation of air pockets.

**2.5 TOOLS AND ACCESSORIES**

The Contractor shall furnish with each model of pumping unit one set of all special tools required for complete assembly and disassembly of the pump and motor and all other appurtenances and accessories that may be required to make the unit complete and ready for operation.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

The pumps will be installed by the Contractor in accordance with the written instructions of the manufacturer.

**3.2 FIELD EQUIPMENT TEST**

An insulation resistance test of the cable and the motor shall be conducted prior to installation of the pump, during installation of the pump, and after installation is complete. The resistance readings shall not be less than 10 mega-ohms.

After installation of each pump and all associated appurtenances is complete, an operating test shall be conducted by the Contractor to ensure that each system operates properly. Each pump shall be given a running field test in the presence of the Contracting Officer for a minimum of 6 hours. This test may be done concurrently with other system testing. The pump shall be operated at the design flow rate specified. The Contractor shall verify that the pump supplies the design flowrate and the design pressure. The test shall assure that the pump and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual controls function properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected by the Contractor and the tests shall be repeated.

**END OF SECTION**

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**SECTION 16011**  
**ELECTRICAL GENERAL REQUIREMENTS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

ANSI C2 (1993) National Electrical Safety Code

**CODE OF FEDERAL REGULATIONS (CFR)**

29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)

**INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)**

IEEE 100 (1992) Dictionary of Electrical and Electronics Terms

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)**

NEMA ICS 6 (1993) Enclosures for Industrial Control and Systems

NEMA MG 1 (1993) Motors and Generators

NEMA MG 10 (1983; R 1988) Energy Management Guide for Selection and Use of Polyphase Motors

NEMA MG 11 (1977; R 1992) Energy Management Guide of Selection and Use of Single-Phase Motors

**NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

NFPA 70 (1993) National Electrical Code

**1.2 RELATED REQUIREMENTS**

This section applies to certain sections of Division 2, "Site Work," Division 11, "Equipment," Division 15, and "Mechanical Systems". This section applies to all sections of Division 16, "Electrical," of this project specification unless specified otherwise in the individual sections.

**1.3 DEFINITIONS**

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

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- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

**1.4 ELECTRICAL CHARACTERISTICS**

Electrical characteristics for this project shall be 208/120 volts secondary, three-phase, four wire. Final connections to the power distribution system at the existing buildings shall be made by the Contractor as indicated on the drawings and as directed by the Contracting Officer.

**1.5 SUBMITTALS**

Submittals required in the sections which refer to this section shall conform to the requirements of Section 01300, "Submittals" and to the following additional requirements. Submittals shall include the manufacturer's name, trade name, place of manufacture, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and technical paragraph reference. Submittals shall also include applicable federal, military, industry, and technical society publication references, and years of satisfactory service, and other information necessary to establish contract compliance of each item to be provided. Photographs of existing installations are unacceptable and will be returned without approval.

**1.5.1 SD-02, Manufacturer's Catalog Data**

Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts. Handwritten and typed modifications and other notations not part of the manufacturer's preprinted data will result in the rejection of the submittal. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified for certificates of compliance.

**1.5.2 SD-04, Drawings**

Submit drawings a minimum of 355 by 510 mm (14 inches by 20 inches) in size using a minimum scale of 3 mm per 300 mm (1/8 inch per foot), except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

**1.5.3 SD-06, Instructions**

Where installation procedures or part of the installation procedures are required to be in accordance with manufacturer's instructions, submit printed copies of those instructions prior to installation. Installation of the item shall not proceed until manufacturer's instructions are

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received. Failure to submit manufacturer's instructions shall be cause for rejection of the equipment or material.

**1.5.4 SD-13, Certificates**

Submit manufacturer's certifications as required for products, materials, finishes, and equipment as specified in the technical sections. Certificates from material suppliers are not acceptable. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance.

**1.5.4.1 Reference Standard Compliance**

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), Underwriters Laboratories Inc. (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

**1.5.4.2 Independent Testing Organization Certificate**

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

**1.5.5 SD-19, Operation and Maintenance Manuals**

Submit complete operation and maintenance manuals including detailed descriptions of procedures for startup, operation, and regular maintenance of operating equipment.

**1.5.5.1 Operating Instructions**

Submit text of posted operating instructions for each system and principal item of equipment as specified in the technical sections.

**1.6 QUALITY ASSURANCE**

**1.6.1 Material and Equipment Qualifications**

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The

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2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

**1.6.2 Regulatory Requirements**

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70.

**1.6.3 Alternative Qualifications**

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

**1.6.4 Service Support**

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

**1.6.5 Manufacturer's Nameplate**

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

**1.6.6 Modification of References**

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

**1.7 POSTED OPERATING INSTRUCTIONS**

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.

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- d. The procedure in the event of equipment failure.
- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Install operating instructions in a pocket on the door of the main control panel. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

**1.8 NAMEPLATES**

Provide laminated plastic nameplates for each panelboard, equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 3 mm (0.125 inch) thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm (one by 2.5 inches). Lettering shall be a minimum of 6.35 mm (0.25 inch) high normal block style.

**1.9 WARNING SIGNS**

Provide warning signs for the enclosures of electrical equipment including substations, transformers, generators, and switchgear having a nominal rating exceeding 600 volts. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 355 by 255 mm (14 inches by 10 inches) with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 75-mm (3-inch) high white letters on a red and black field.

**1.10 ELECTRICAL REQUIREMENTS**

Electrical installations shall conform to ANSI C2, NFPA 70, and requirements specified herein.

**1.10.1 Motors and Equipment**

Provide motors, controllers, and contactors with their respective pieces of equipment. Motors, controllers, integral disconnects, and contactors shall conform to Section 16402, "Interior Wiring Systems". Control voltage for controllers and contactors shall not exceed 120 volts nominal. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

**1.10.2 Wiring and Conduit**

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment under Section 16402, "Interior Wiring Systems." Power wiring and conduit shall conform to Section 16402, "Interior

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**Wiring Systems." Control wiring and conduit shall be provided under, and conform to, the requirements of the section specifying the associated equipment.**

**1.10.3 High Efficiency Motors**

**1.10.3.1 High Efficiency Single-Phase Motors**

Unless otherwise specified, single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11.

**1.10.3.2 High Efficiency Polyphase Motors**

Unless otherwise specified, polyphase motors shall be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.

**1.11 INSTRUCTION TO GOVERNMENT PERSONNEL**

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

**1.12 LOCKOUT REQUIREMENTS**

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 15, "Mechanical."

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

**3.1 PAINTING OF EQUIPMENT**

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical sections.

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**3.2 NAMEPLATE MOUNTING**

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

**3.3 WARNING SIGN MOUNTING**

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 9 meters (30 feet) apart.

**3.4 CABLE TAG INSTALLATION**

Install cable tags in each manhole, handhole, and vault as specified, including each splice. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

**END OF SECTION**

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**SECTION 16403**  
**WIRING SYSTEMS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

ANSI C80.1 (1990) Rigid Steel Conduit - Zinc Coated

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM B 1 (1990) Hard-Drawn Copper Wire

ASTM B 8 (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)**

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ICS 2 (1993) Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC

NEMA ICS 6 (1993) Industrial Control and Systems Enclosures

NEMA MG 1 (1993, Rev. 1) Motors and Generators

NEMA MG 10 (1983; R 1988) Energy Management Guide for Selection and Use of Polyphase Motors

NEMA MG 11 (1977; R 1992) Energy Management Guide of Selection and Use of Single-Phase Motors

NEMA ST 20 (1992) Dry-Type Transformers for General Applications

NEMA TC 2 (1990) Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)

NEMA TC 3 (1990) PVC Fittings for Use with Rigid PVC Conduit and Tubing

NEMA TC 14 (1984; R 1986) Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings

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- NEMA WD 1 (1983; R 1989) Wiring Devices
- NEMA WD 6 (1988) Wiring Devices - Dimensional Requirements
- NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
- NFPA 70 (1993) National Electrical Code
- UNDERWRITERS LABORATORIES INC. (UL)
- UL 6 (1993; Bul. 1993) Rigid Metal Conduit
- UL 50 (1992; R 1994, Bul. 1993 and 1994) Safety Enclosures for Electrical Equipment
- UL 67 (1993; R 1994) Panelboards
- UL 83 (1991; Bul. 1993, 1994, and 1995, R 1994) Thermoplastic-Insulated Wires and Cables
- UL 360 (1986; Bul. 1991, R 1994) Liquid-Tight Flexible Steel Conduit
- UL 467 (1993; Bul. 1994) Grounding and Bonding Equipment
- UL 486A (1991; Errata 1991 and 1992, R 1992, Bul. 1993 and 1994) Wire Connectors and Soldering Lugs for Use With Copper Conductors
- UL 486C (1991; R 1992, Bul. 1994) Splicing Wire Connectors
- UL 489 (1991; Bul. 1992, 1993, 1994, and 1995, R 1994) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
- UL 498 (1991; Bul. 1993, 1994, and 1995, R 1994) Attachment Plugs and Receptacles
- UL 506 (1994; R 1994, Bul. 1994) Specialty Transformers
- UL 508 (1993; Bul. 1993 and 1994, R 1994) Industrial Control Equipment
- UL 510 (1994; R 1994) Chloride, Polyethylene, and Rubber Insulating Tape
- UL 514A (1991; R 1993, Bul. 1993 and 1994) Metallic Outlet Boxes
- UL 514B (1989; Errata 1991, R 1993, Bul. 1993 and 1994) Fittings for Conduit and Outlet Boxes
- UL 514C (1988; R 1989, Bul. 1993 and 1994) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
- UL 869 (1989; R 1991, Bul. 1992, 1993, and 1995) Service Equipment

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UL 943 (1993; Bul. 1993, 1994, and 1995, R 1995) Ground-Fault Circuit Interrupters

UL 984 (1991) Hermetic Refrigerant Motor-Compressors

1.2 RELATED REQUIREMENTS

Section 16011, "Electrical General Requirements," applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals".

1.3.1 SD-02, Manufacturer's Catalog Data

- a. Receptacles
- b. Circuit breakers
- c. Switches
- d. Transformers
- e. Enclosed circuit breakers
- f. Motor controllers

1.3.2 SD-04, Drawings

- a. Panelboards
- b. Transformers

1.3.3 SD-19, Operation and Maintenance Manuals

- a. Electrical Systems

Provide basic data relating to the design, operation, and maintenance of the electrical distribution system. This shall include:

- I Single line diagram of the "as-built" electrical system. Indicate point of attachment to existing building electrical system.
- ii. Schematic diagram of electrical control system. Reference Section 16900, Controls and Instrumentation.
- iii. Manufacturers' operating and maintenance manuals on active electrical equipment.

1.4 QUALITY ASSURANCE

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or words of similar meaning, to mean Contracting Officer.

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**PART 2 PRODUCTS**

**2.1 MATERIALS AND EQUIPMENT**

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

**2.2 CONDUIT AND FITTINGS**

Rigid steel (zinc-coated) conduit, rigid nonmetallic conduit, and liquid-tight flexible conduit, conforming to the following:

**2.2.1 Rigid Steel Conduit (Zinc-Coated)**

ANSI C80.1, UL 6.

**2.2.2 Rigid Nonmetallic Conduit**

PVC Type EPC-40, in accordance with NEMA TC 2, or fiberglass conduit, in accordance with NEMA TC 14.

**2.2.3 Liquid-Tight Flexible Metal Conduit, Steel**

UL 360.

**2.2.4 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit**

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

**2.2.4.1 Fittings for Rigid Metal Conduit and IMC**

Threaded-type. Split couplings unacceptable.

**2.2.5 Fittings for Rigid Nonmetallic Conduit**

NEMA TC 3.

**2.3 OUTLET BOXES AND COVERS**

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic. Provide outlet box with plastic cover and UL listed as raintight while in use.

**2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES**

Volume greater than 1640 mL (100 cubic inches), UL 50, hot-dip, zinc-coated, if sheet steel.

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2.5 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.5.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.5.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

2.5.1.2 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2.5.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

- a. 208/120 volt, 3-phase
  - (1) Phase A - black
  - (2) Phase B - red
  - (3) Phase C - blue
- b. 120/240 volt, single phase: Black and red

2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83.

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**2.5.4 Bonding Conductors**

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

**2.6 SPLICES AND TERMINATION COMPONENTS**

UL 486A for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

**2.7 DEVICE PLATES**

Provide UL listed, one-piece device plates for outlets to suit the devices installed. Plates installed in wet locations shall be gasketed and UL listed as raintight while in use.

**2.8 RECEPTACLES**

UL 498 and NEMA WD 1, general grade, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of ivory thermosetting plastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. Duplex receptacles shall be 15 amperes, 125 volts, No. 5242.

**2.8.1 Weatherproof Receptacles**

Receptacle shall be UL listed for use in "wet locations with plug in use."

**2.8.2 Ground-Fault Circuit Interrupter (GFI) Receptacles**

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFI devices.

**2.9 PANELBOARDS**

UL 67 and UL 50. Panelboards for use as service disconnecting means shall additionally conform to UL 869. Panelboards shall be circuit breaker-equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for future installation of breaker sized as indicated. Panelboard locks shall be keyed same. Directories shall indicate load served by each circuit of panelboard. Directories shall also indicate source of service (upstream panel, switchboard, motor control center, etc.) to panelboard. Type directories and mount in holder behind transparent protective covering.

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**2.9.1 Circuit Breakers**

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

**2.10 TRANSFORMERS**

NEMA ST 20, general purpose, dry-type, self-cooled, ventilated. Provide transformers in NEMA 3R enclosure according to NEMA ICS 6. Transformer shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 150 degrees C under full-rated load in maximum ambient of 40 degrees C. Transformer of 150 degrees C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

**2.11 MOTORS**

NEMA MG 1 hermetic-type sealed motor compressors shall also comply with UL 984. Provide the size in terms of kW (HP), or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.

**2.11.1 High Efficiency Single-Phase Motors**

Single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11.

**2.11.2 High Efficiency Polyphase Motors**

Polyphase motors shall be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.

**2.11.3 Motor Sizes**

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided.

## 2.12 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with automatic-type maintained-contact PLC control, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that automatic regulatory control devices are bypassed when switch is in "hand" position. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

### 2.12.1 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide fuses in each ungrounded primary feeder. One secondary lead shall be fused; other shall be grounded.

### 2.12.2 Enclosures for Motor Controllers

Provide a motor starter enclosure consisting of a single door NEMA 4 enclosure according to NEMA ICS 6 with all motor starting equipment and control components.

#### 2.12.2.1 The enclosure shall be constructed from 14 gauge steel having continuously welded seams with body and door stiffeners from proper rigidity. The enclosure shall meet NEMA 4 requirements according to NEMA ICS 6.

- a. Provide 12 gauge steel interior back panel for mounting all electrical equipment.
- b. Provide a cylinder-type lock with a t-type door handle.
- c. Following fabrication, the panel section shall be decreased, bonderized, finished smooth with epoxy filler, sanded and sprayed with a rust inhibiting alkyd primer.

#### 2.12.3 Arrange components in the panel in a neat manner corresponding with status devices located on the enclosure door. Arrange components on the enclosure door as indicated on the drawings.

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- a. All electrical wiring within the panels shall be suitable identified, bundled and bound with plastic slip lock straps terminated on numbered terminal strips.
- b. Use #16 AWG stranded control wires with 1/64 inch type MW thermoplastic insulation. All wires to be identified at both ends with Brady adhesive wraparound markers.
- c. Identify the terminal ends of control wires by number which shall conform to the wiring connections shown on the Shop Drawings. Terminate connections within the panel at the bottom of the panel on terminal blocks with all external connections properly identified for field connections.

**2.13 TELEPHONE SYSTEM**

Provide system of telephone wire-supporting structures, including: conduits with pull wires and other accessories for telephone service to the main control panel.

**2.14 GROUNDING AND BONDING EQUIPMENT**

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 19 mm (3/4 inch) and minimum length of 10 feet.

**2.15 NAMEPLATES**

Provide as specified in Section 16011, "Electrical General Requirements."

**PART 3 EXECUTION**

**3.1 INSTALLATION**

Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

**3.1.1 Underground Service**

Underground service feeder conductors and associated conduit to the treatment system main panelboard shall be continuous from the existing service entrance equipment located in the designated building.

**3.1.2 Service Entrance Identification**

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

**3.1.3 Wiring Methods**

Provide insulated conductors installed in rigid steel conduit for all exposed wiring and PVC, rigid nonmetallic conduit for wiring below grade, except where specifically indicated or specified

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otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 16 mm (1/2 inch) in diameter for low voltage lighting and power circuits.

**3.1.4 Conduit Installation**

Run conduits as indicated on the plans. Minimum burial depth of 18".

Exposed conduits in the treatment area shall be trapeze hung from roof joist and supported as required. Unistrut type framework shall be required for conduits running down to equipment.

**3.1.5 Boxes, Outlets, and Supports**

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces.

**3.1.6 Conductor Identification**

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves.

**3.1.7 Splices**

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

**3.1.8 Electrical Penetrations**

Seal openings around electrical penetrations through walls using a firestopping material.

**3.1.9 Grounding and Bonding**

In accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, and neutral conductor of wiring systems.

**3.1.10 Equipment Connections**

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring,

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control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

**3.2 FIELD QUALITY CONTROL**

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to system testing.

**3.2.1 Devices Subject to Manual Operation**

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

**3.2.2 600-Volt Wiring Test**

When, and if directed by the Contracting Officer, perform insulation resistance tests to wiring rated 600 volts and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

**3.2.3 GFI Receptacle Test**

Test GFI receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

**END OF SECTION**

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SECTION 16900  
INSTRUMENTATION AND CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to in the test by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C700 (1990; C700a) Cold-Water Meters - Displacement Type, Bronze Main Case

AWWA C701 (1988) Cold-Water Meters - Turbine Type, for Customer Service

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6 (1993) Industrial Control and Systems Enclosures

1.2 DESCRIPTION

This section covers the design, fabrication, assembly, testing, installation and placement into operation of the complete control and instrument system.

The control and instrumentation system shall be comprised of the individual sub-systems and components necessary to meet the functional requirements of the treatment process as specified in the operational plan. The control and instrument system unit processes are as follows:

- a. Extraction well system.
- b. Air stripper and anti-scalant system.
- c. Back-up air stripper system.
- d. Miscellaneous Systems.

The piping and instrumentation diagrams (P&IDs) indicate the functional requirements of the overall control system and the basic configuration of instruments. Process connections for field instruments and wiring not indicated on the diagrams or itemized herein are to be provided as required for complete operation of all control and instrument systems.

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- a. Provide all accessories not itemized but required to meet the operational plan of the control and instrumentation system.

### 1.3 QUALITY ASSURANCE

Equipment specified in this section shall be provided as a complete control and instrument system by one control supplier.

#### 1.3.1 Control Supplier Responsibilities

The control supplier shall be familiar with all related electrical systems and shall assume complete responsibility for engineering and furnishing the system, advising the contractor on technical matters and certifying the correctness of the installation. The supplier shall also be responsible for calibrating instruments, performing loop checks, testing, documenting and starting up the complete control and instrument system.

The control supplier shall be responsible for providing the programmable controller with all programming required to meet the operational plan. This responsibility shall also include the following:

- a. Simulated factory testing of the program.
- b. Field testing of the program.
- c. Program documentation including a printed version and electronic file.
- d. Training of the Owner in the use of the programmable controller.

The control supplier shall also be responsible for configuration of the operator interface software to display real time data on the computer screen with graphics representing various treatment processes. Control options of process equipment shall also be integrated into the graphical representations of the process. This responsibility shall also include the following:

- a. Loading the application onto the computer to be used on site and establishing communications with the host programmable logic controller (PLC) at the treatment site.
- b. Field testing the program and documenting the operation of all field devices and accuracy of the acquired data at the process computer.
- c. Training of the Owner in the use of the operator interface software as configured.

#### 1.3.2 Contractor Responsibilities

The Contractor shall be ultimately responsible for a complete and coordinated control and instrument system which shall perform the specified functions. The Contractor shall coordinate work on this system with the control supplier such that the following are provided:

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- a. All components provided under this section are properly installed according to the manufacturer's recommendations.
- b. The proper type, size and number of control wires with their conduits are provided and installed.
- c. Proper electric power circuits are provided for all components and systems.

**1.4 SUBMITTALS**

**1.4.1 SD-02, Manufacturer's Catalog Data**

- a. PLC control panel
- b. Programmable controllers
- c. Programmable controller programming software
- d. Operator interface panel
- e. Personal computer
- f. Data acquisition and supervisory control software
- g. Instruments

Before any components are fabricated or integrated into panels to be wired or shipped to the site, furnish to the Engineer and receive his review of five copies of Shop Drawings including full details, catalog cut sheets and any such other descriptive matter as may be required to fully describe the equipment and to demonstrate its conformity to these Specifications.

**1.4.2 SD-04, Drawings**

Shop Drawings as specified in this Section shall include the following information to fully describe the systems.

- a. Catalog information with descriptive application literature on all major constituents of the control and instrument system as defined in this Specification.
- b. Specification data sheets on all components of the control and instrument system. Cite specific features for each component and assign it with a name tag designation.
- c. Fabrication drawings and catalog information for all control panels and enclosures.
- d. Elementary wiring diagrams of prewired panels and consoles indicating wiring to all instruments and electrical devices.
- e. Interconnecting wiring diagrams indicating all component and panel terminal board numbers. These diagrams are to be coordinated with the motor starter panel wiring diagrams for proper interface wiring.

Present Shop Drawings in a clear and thorough manner clearly marking each copy to identify pertinent products and models. Individually annotate catalog cut sheets to identify applicable items.

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1.4.3 SD-19, Operation and Maintenance Manuals.

Submit complete operation and maintenance manuals for the following items:

- a. PLC control panel
- b. Operator interface panel
- c. Instruments

PART 2 PRODUCTS

2.1 PRIMARY PLC CONTROL PANEL

Provide the primary system PLC control panel consisting of a single-door enclosure complete with all instrument and control components.

The PLC enclosure shall be constructed from 14 gauge steel having continuously welded seams with body and door stiffeners from proper rigidity. The enclosure shall meet NEMA 4 requirements.

- a. Provide 12 gauge steel interior back panel for mounting all electrical equipment.
- b. Provide a cylinder-type lock with a t-type door handle.
- c. Following fabrication, the panel section shall be decreased, bonderized, finished smooth with epoxy filler, sanded and sprayed with a rust inhibiting alkyd primer.

Arrange components in the panel in a neat manner corresponding with status devices located on the enclosure door. Arrange components on the enclosure door as indicated on the drawings.

- a. All electrical wiring within the panels shall be suitable identified, bundled and bound with plastic slip lock straps terminated on numbered terminal strips.
- b. Use #16 AWG stranded control wires with 1/64 inch type MW thermoplastic insulation. All wires to be identified at both ends with Brady adhesive wraparound markers.
- c. Identify the terminal ends of control wires by number which shall conform to the wiring connections shown on the Shop Drawings. Terminate connections within the panel at the bottom of the panel on terminal blocks with all external connections properly identified for field connections.

2.2 PROGRAMMABLE CONTROLLERS

Provide programmable controller systems complete with power supply, processor, input/output interface, all mounting racks, cables, connectors and miscellaneous devices needed for complete functional assemblies.

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All components shall be from a family of modular equipment exhibiting the following environmental characteristics.

- a. Operational temperature: 0-60EC.
- b. Operational humidity: 5-95% non-condensing.
- c. EMI immunity per IEEE 472-1974.
- d. Shock and vibration resistant.

**2.2.2 Power Supplies**

Provide the PLC and I/O racks with power supplies exhibiting the following characteristics:

- a. Primary power - 98-132 VAC, 47-63 Hz (nominal 120 VAC @ 60 Hz).
- b. Internal constant voltage source capable of withstanding high voltage spikes and brownouts without external protection.
- c. Provides all voltages required by controller and/or local rack mounted auxiliary devices and I/O.
- d. Distribute power on local rack backplane bus.
- e. Front mounted on/off switch, line fuse, and power on/status indicators.
- f. Clearly identified and protected power terminals.

**2.2.3 Input/Output Modules**

Provide the PLC with sufficient number of input/output modules to accommodate design requirements. Provide modules for system with the following characteristic:

- a. Suitable for harsh environment, meet IEEE 472 surge standards.
- b. Utilize high density modules wherever possible.
- c. Front mounted point status indicators for each I/O point.
- d. Locking tab or screw to prevent unintentional movement of module.
- e. Removable screw terminal wiring connectors to ease in wiring modules.
- f. Output models shall be provided with self contained fuses for overload and short circuit protection of the module. Modules shall have an indicator that shows fuse status.

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- g. Isolation shall be used between all internal and external power circuits. This isolation shall meet the minimum specification of 1500 VRMS.
- h. I/O addressing shall be flexible and configured via software setup.

**2.2.4 Mounting Rack**

Provide the PLC with a mounting rack exhibiting the following characteristics:

- a. Mounting slots for the PLC, power supply and all I/O.
- b. Provide 10 percent spare slots per rack with a minimum of two slots.
- c. Capable of each slot being keyed, so as to allow only a single type of module to be inserted in any given slot.
- d. Compatible with all controllers, power supplies, I/O and auxiliary rack mounted devices.
- e. In multiple rack system, all racks are to be identical.

**2.2.5 Programmable Controller**

The programmable controller shall exhibit the following characteristics:

- a. 8K CMOS RAM memory, EEPROM backed completely.
- b. 16 bit word structure.
- c. Built-in real time clock calendar, 5 year lithium battery backed.
- d. Memory protect keyswitch.
- e. Two front mounted programming and interfacing ports.
- f. Front mounted LED's to indicate processor, remote I/O and battery status.
- g. Self-diagnostics and error checking.
- h. Address a minimum of 960 I/O.
- I. Ability to connect to a data communication network via a leased line telephone modem.
  - I. Hosted network, minimum 19.2k baud.
  - ii. Computer and/or graphics interface communications.
  - iii. Front mounted, easily accessible connections.

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- iv. Utilizing low cost reliable cabling.
- v. Minimum network length 1500 feet.
- j. Ability to connect to a local operator interface panel with front mounted connections.
- k. Programming and execution.
  - I. User programmed in ladder logic, and predefined functions including:
    - 1) Relay logic.
    - 2) Timers.
    - 3) Counters.
    - 4) One shots.
    - 5) Latches.
    - 6) Math with minimum of addition, subtraction, multiplication, division and square root.
    - 7) Data conversion.
    - 8) Comparison: =, <, >.
    - 9) Data transfer.
    - 10) Sequencer functions.
    - 11) Subroutines.
    - 12) MCR functions.
    - 13) Word, table, and file instructions.
    - 14) PID control with up to 8 loops.
    - 15) Floating point math and word storage.
  - ii. Scan rate, typical 1 ms per K of user program.
  - iii. Programmable from either the PLC communication port or over dial-up telephone lines.

**2.2.6 I/O Requirements**

Size system I/O requirements as necessary for system requirement. Refer to wiring diagrams. Use this only as a reference for minimum I/O requirements.

**2.2.7 Accessories**

**2.2.7.1 Constant voltage source for clean power to PLC I/O rack and I/O.**

Provide a constant voltage source transformer, single-phase, sized to allow minimum 250 VA over nominal load for the PLC system.

Recommended manufacturer: Sola.

**2.2.7.2 Modems**

Provide a telephone modem which shall reside in the PLC control cabinet, two matching modems for use at the base maintenance office and a fourth modem for use by the Engineer. They shall all exhibit the following characteristics:

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- a. Fully Hayes compatible
- b. Meets CCITT V.32 and Bell 212A & 203 standards.
- c. MNP Class 5 Data compression.
- d. Automatic Error detection, speed detection and fallback.
- e. Ability to communicate over dial-up and leased lines.
- f. Serial cable for connection to the PLC.

2.2.8 Documentation

- a. Provide four complete sets of assembly and installation manuals for all equipment.
- b. Provide four complete sets of programming manuals for processor and intelligent I/O modules.

2.2.9 Spare parts

Provide a recommended spare parts list for complete system.

2.3 PROGRAMMABLE CONTROLLER PROGRAMMING SOFTWARE

2.3.1 Software Characteristics

Provide a software package used to program the PLC exhibiting the following characteristics:

- a. Develop and edit program off-line and on-line using an IBM-AT compatible personal computer.
- b. Complete ladder annotation.
  - I. Minimum of 24 characters in 3 rows for description of each instruction.
  - ii. Rung description.
  - iii. Long detailed description.
  - iv. Page titles.
  - v. Coil-rung cross references.
- c. Complete cross reference report.
  - I. Bit cross reference.
  - ii. Timer cross reference.
  - iii. Counter cross reference.

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- iv. Word cross reference.
  - d. Rack I/O location report.
  - e. Data table utilization report.
  - f. Undescribed instruction report.
  - g. Unused instruction report.
  - h. Ability to monitor and program over dial-up telephone line, using modems.
- 2.3.2 Hardware
- Provide all hardware, cards, cables, keys, manuals, etc. required to program, edit and monitor logic both on-line and off-line.
- 2.3.3 Documentation
- a. Provide one complete set of manuals and software to engineer within one week of shop drawing acceptance.
  - b. Provide complete and extensive operating and troubleshooting instructions pertaining to software use.
  - c. Provide three complete sets of manuals pertaining to the use of the programming and documentation software.
- 2.4 LOCAL OPERATOR INTERFACE PANEL
- 2.4.1 Terminal
- Provide an industrial terminal with a CRT, integral key sealed membrane keypad, integral ten function key keypad that is directly compatible with the programmable controller.
- The terminal shall be NEMA 4X in accordance with NEMA ICS 6, panel mounted with sealed membrane data entry keypads and impact resistant Lexan CRT shield.
- 2.4.1.1 Screen format
- a. 25 rows x 80 characters.
  - b. 5x7 characters in 8x10 cells.
- 2.4.1.2 Character set
- a. Full ASCII character set.
  - b. Thin line and block graphics.
  - c. Large and small process graphic symbols.
- 2.4.1.3 Serial interface

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- a. Standard a synchronous RS-232C.
- b. Baud rates: 300-19.2 k.

2.4.1.4 Miscellaneous Requirements

- a. Tamper proof password security.
- b. Built-in self diagnostics.

2.4.2 Hardware

Provide all hardware, cards, cables, keys, manuals, etc. required to program, edit and monitor system.

2.5 GAGE PRESSURE TRANSMITTERS

Provide sealed gage pressure transmitters for gage pressure measurement of liquids. Transmitter measurement capsule shall consist of a thin-film metallic resistance sensing element and a diaphragm seal.

Gage pressure transmitters shall meet the following functional specifications.

- a. Power supply: 120 volt
- b. Output: 4-20 mA d-c.
- c. Lightning suppression: 500 watts for 1 ms; 8.5 amp peak surge current at 1 ms; 36 volt minimum clamping voltage
- d. Approvals: FM approval Class 1, Division 1, groups B, C, and D. NEMA 4 housing.
- e. Span and Zero: continuously adjustable
- f. Operating temperature: -40E to 180EF
- g. Turndown ratio: 3:1
- h. Accuracy:  $\pm 0.25\%$  of calculated span including the combined effects of linearity, hysteresis, and repeatability
- I. Range: reference instrument wiring diagrams

Gage pressure transmitters shall meet the following physical specifications:

- a. Construction materials: Electronic housing shall be 304 stainless steel. Process diaphragm shall be Hastelloy C-22. Process flange shall be stainless steel.
- b. Process connection:  $\frac{1}{2}$ " NPT with reducing bushing  $\frac{1}{2}$ " to  $\frac{1}{4}$ " NPT
- c. Electrical connection:  $\frac{1}{2}$ " conduit
- d. Tagging: stainless steel tag engraved to match PID designation

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2.6 PRESSURE SWITCH

Provide adjustable set point pressure switches with adjustable deadband with two (2) SPDT switches, 15 amp, 120 volt.

2.7 PRESSURE GAUGES

Analog type with face diameter of 2½ inches minimum. Accuracy shall be +/- 3 percent of span. Each gauge shall have a 1/4 inch NPT brass fitting. Dial scale shall be in units of psig.

2.8 LEVEL TRANSMITTERS

Level transmitters shall consist of a flexible cable sensor and integrally mounted electronic transmitter element. The sensing element shall be wetted parts shall be constructed of 316 stainless steel and PFA. The transmitter shall be powered by 120 Vac, and shall provide a 4-20 mA dc output signal. An integral meter shall also be provided.

The transmitter unit shall be rated for not less than 20 psi at 140 degrees F, and shall have an accuracy of +/- 0.1 percent of full scale. Transmitter housing shall meet NEMA 4X.

Recommended manufacturer: Drexelbrook Engineering Company

Level transmitters will measure individual extraction well levels. Conditions of service and suggested model numbers are contained in the instrument list (attached).

2.9 LEVEL SWITCHES

2.9.1 Capacitance

Capacitance level switches for tank service shall be the multipoint type with 3 independent and noninteracting setpoints along a single sensing element. The sensing element shall be 316 stainless steel covered with a material to reject coating. The sensor shall be intrinsically safe for all groups Div. 1 and 2.

The level unit shall have three DPDT relays, one with 1-120 seconds adjustable time delay, one with adjustable differential, and one plain on/off. The unit shall have an accuracy of 2 percent on all ranges. Supply voltage shall be 120 Vac, 60 hz.

Recommended manufacturer: Drexelbrook Engineering Company.

A multipoint level controller will control operation of investigation water pump P-402 based on level in tank T-401. Conditions of service and suggested model number are contained in the instrument list (attached).

2.9.2 Float

Float level switches shall be side-mounted single-station horizontal switches with wetted parts constructed of PVC or other material if necessary to meet compatibility requirements of measured fluid. Threaded connections shall be NPT. Switch contacts shall be a minimum 15 amps at 120 Vac resistive.

2.10 LEVEL GAUGES

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Direct reading volumetric type assemblies with guarded gauge glass and calibrated in gallons to read full depth of tank or vessel. Gauges shall be isolated from tank or vessel by block valves. Wetted part materials of construction shall be compatible with the fluid measured at tank conditions of service.

2.11 FLOWMETERS

2.11.1 Positive Displacement

Positive displacement type flowmeters shall be bronze body, magnetic drive meters conforming to AWWA C700. Meter construction shall enable removal of the measuring chamber assembly for repair or replacement without removing the main case from the service line.

The registers shall be powered by 120 Vac input and shall have LCD rate and totalizer displays. The registers shall provide 4-20 mAdc analog output signals.

Suggested Manufacturer: Kent Meters, Inc.

Positive displacement flowmeters will measure individual extraction well flowrates and potable water flow to the utility connection and safety shower/eyewash station. Conditions of service and suggested model numbers are contained in the instrument lists (attached).

2.11.2 Turbine

Turbine flow meters shall be bronze body, magnetic drive meters conforming to performance and material requirements of AWWA C701, Class II in-line (high-velocity) type. Connections shall be flanged and shall conform to ANSI B16.1 Class 125. Meter construction shall enable removal of the measuring element for repair or replacement without removing the main case from the service line.

Meter register shall be powered by 8.5 to 30 Vdc input and shall have LCD rate and totalizer displays. The registers shall provide 4-20 mAdc analog output signals.

Suggested Manufacturer: Kent Meters, Inc.

Turbine flow meters will measure the WATS influent flow rate and the storm drain action flow rate. Conditions of service and suggested model numbers are contained in the instrument list (attached).

2.12 FLOW INDICATORS

2.12.1 Rotameters

Direct reading. All wetted materials shall be constructed of materials compatible with fluid being measured at conditions of service. Accuracy +/- 5 percent of reading or +/- 2 millimeters on scale. Meter shall be mounted on adjacent pipe channel as indicated on the Drawings.

2.13 CONTROL VALVES

2.13.1 Valves

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Valves shall provide linear flow response to valve stem position changes. Valve body material and rating shall conform to the piping specifications as a minimum. Connections shall be double union ends. Valves shall be sized for the conditions of service specified in the instrument list (attached).

**2.13.2 Actuators**

Modulating electronic positioners accepting a 4-20 mA input.

**2.14 THREE-WAY VALVES**

**2.14.1 Valves**

Valve bodies shall be PVC with EPDM trim. Connections shall be threaded or compatible with tubing for valves smaller than 1 inch, and shall be flanged or threaded for valves larger than 1 inch. Connections shall comply with requirements of Section 15080, "Piping, Valves, and Appurtenances."

**2.14.2 Actuators**

The three-way valve for diversion of antiscalant flow shall have a solenoid-driven actuator. The valve for diversion of storm drain action water flow shall have a solenoid or motor-driven actuator accepting a 120 Vac control signal.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

Coordinate all equipment and services provided under this section with electrical equipment furnished under other sections of this Specification.

Install all components as listed in this Specification making all electrical connections in accordance with the Drawings and/or with accepted manufacturer's Shop Drawings, if they differ, at no extra cost.

**3.2 TESTS**

The control instrument supplier shall check the control instrument system components to verify proper installation and determine whether the systems are ready to operate as specified.

All setpoint settings shall be checked and tabulated and their operation demonstrated prior to a complete system check (e.g., contact closures, alarms, interlock functions).

A functional acceptance test shall be performed on a unit process basis by the control instrument supplier, and each function shall be demonstrated to the satisfaction of the Engineer.

- a. The control instrument supplier shall notify the Engineer at least two weeks prior to the functional acceptance test.
- b. The control instrument supplier shall prepare sheets for each unit process itemizing each component and check off each component's proper operation, installation, calibration setting, etc.

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**3.3 SYSTEM ACCEPTANCE**

System acceptance shall be defined as follows:

- a. All submittals accepted and full documentation on all systems reviewed.
- b. Successful completion of all testing.
- c. Training program complete.

**END OF SECTION**