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DEPARTMENT OF THE NAVY
NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
10 INDUSTRIAL HIGHWAY MAIL STOP NO. 82
LESTER, PA 19113-2090

SPECIFICATION NO:
04-92-0056

CONTRACT NO:
N62472-92-C-0056

APPROPRIATION:
DERA

INTERIM REMEDIAL ACTION - TANKS 53 AND 56
TANK FARM 5
AT THE
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

DESIGN BY:

TRC ENVIRONMENTAL CORPORATION
5 WATERSIDE CROSSING
WINDSOR, CONNECTICUT 06095

SPECIFICATION PREPARED BY:

Architectural:	Civil:	Structural:
N/A	Ronald J Mault	N/A
Electrical	Mechanical:	Submitted by:
Robert A Hoff	Robert A Hoff	Carl M Stoppa

DATE: June 25 1993

SPECIFICATION APPROVED BY: Russell Gorlett DATE: 7-9-93

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SECTION 01010

GENERAL PARAGRAPHS

PART 1 GENERAL

1.1 REFERENCE

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

CODE OF FEDERAL REGULATIONS (CFR)

41 CFR 60.4	Construction Contractors - Affirmative Action Requirements

1.2 SUBMITTALS

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

1.2.1 SD-18, Records

a. Report of subcontracts G

b. Work performed by Contractor G

c. Certification of Contractor required insurance G

d. Schedule of prices G

e. As-built drawings G

f. As-built record of materials G

1.2.1.1 Report of Subcontracts

Provide, for contracts greater than $10,000, in accordance with paragraph entitled "Affirmative Action Compliance."

1.2.1.2 Work Performed by Contractor

Provide in accordance with the paragraph entitled, "Description of Work Performed by the Contractor."

1.3 GENERAL INTENTION

It is the declared and acknowledged intention and meaning to provide and secure an Interim Remedial Action System, complete and ready for use.

1.4 GENERAL DESCRIPTION

The work includes removal of utility lines and asphalt paving. The work also includes the provision of a metal pre-engineered, insulated one story building consisting of reinforced concrete footings, concrete slab on grade, structural steel frame, metal deck roof, interior partitions and ceiling of metal stud and gypsum wall board, steel doors and metal frames, finish hardware, field painting, toilet accessories, plumbing, lighting and fire alarm systems. Exterior work includes an asphalt concrete parking area, concrete pads, water, electrical and sanitary sewer distribution systems, grading, seeding, chain link fencing, fuel oil storage tank and piping. The work also includes extraction wells, piping, equalization, clearwell, sludge and recycle water storage tanks, flocculator, clarifier, filters, chemical feed systems, pumps, controls, pad mounted transformer and incidental related work.

1.5 LOCATION

The work shall be located at the Naval Education and Training Center, Newport, Rhode Island, approximately as shown. The exact location will be indicated by the Contracting Officer.

1.6 GOVERNMENT REPRESENTATIVES

a. The work will be under the general direction of an officer of the Civil Engineer Corps, United States Navy or another officer or representative of the Government, designated in block 26 of Standard Form 1442. Except in connection with the Disputes Clause of this contract, this designated person has complete charge of and exercise full supervision over the work so far as it affects the interests of the Government.

b. For the purposes of the Dispute Clause, the "Contracting Officer" is the Commander, Naval Facilities Engineering Command, or his representatives warranted for this purpose. Any claim submitted under the Dispute Clause shall be submitted to the Contracting Officer in care of the person designated in block 26 of Standard Form 1442 as the representative of the Contracting Officer authorized to receive the claim.

c. The provisions of this paragraph or provisions elsewhere in this contract regarding supervision, approval, or direction by the Contracting Officer or the designated person shall not relieve the Contractor of responsibility for accomplishing the work, with regard to sufficiency or time of performance, except as other wise provided.

1.7 AFFIRMATIVE ACTION COMPLIANCE

Notice of requirement for affirmative action to ensure equal employment opportunity (Apr 1984):

(Applies when the amount of the contract is in excess of $10,000.)

a. The offeror's attention is called to the Equal Opportunity clause

and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

b. The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
3.1 percent	6.9 percent

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

c. The Contractor's compliance with Executive Order 11246 as amended, and the regulations in 41 CFR 60.4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60.4. Compliance with the goals will be measured against the total work hours performed.

d. The Contractor shall provide written notification to the Director, Office of Federal Contract Compliance Programs, within 10 working days following award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the--

(1) Name, address, and telephone number of the subcontractor;

(i) Employer identification number of the subcontractor;

(2) Estimated dollar amount of the subcontract;

(3) Estimated starting and completion dates of the subcontract; and

(4) Geographical area in which the subcontract is to be performed.

e. As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is Newport County, Rhode Island. (FAR 52.222-23)

1.8 ORAL MODIFICATION

No oral statement by any person other than the Contracting Officer or his r presentative, as provided in the Contract Clause entitled "Changes," will in any manner or degree modify or otherwise affect the terms of this contract.

1.9 INSURANCE

1.9.1 Minimum Requirements

The Contractor shall procure and maintain during the entire period of performance under this contract the following minimum insurance coverage:

a. Comprehensive general liability: $500,000 per occurrence

b. Automobile liability: $200,000 per person; $500,000 per occurrence, $20,000 per occurrence for property damage

c. Workmen's compensation: As required by Federal and State workers' compensation and occupational disease laws

d. Employer's liability coverage: $100,000, except in States where workers compensation may not be written by private carriers

e. Others as required by State law.

1.9.2 Insurance--Work on a Government Installation (SEP 1989)

a. The Contractor shall, at its own expense, provide and maintain during the entire performance period of this contract at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

b. Before commencing work under this contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

c. The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that

require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request. (FAR 52.228-5)

1.10 NO WAIVER BY THE GOVERNMENT

The failure of the Government in any one or more instances to insist upon strict performance to any of the terms of this contract or to exercise any option herein conferred shall not be construed as a waiver or relinquishment to any extent of the right to assert or rely upon such terms or option on any future occasion.

1.11 SCHEDULE OF PRICES

1.11.1 Data Required

Within 5 days after award of the contract, the Contractor shall prepare and deliver to the Officer in Charge of Construction a schedule of prices (construction contract) on the forms furnished for this purpose. The schedule of prices shall consist of a detailed breakdown of the contract price, giving the quantities for each of the various kinds of work; the unit prices; and the total prices therefore. The actual schedule must be based on the actual breakdown of the bid price. The format, content, and number of copies required will be prescribed by the Officer in Charge of Construction and will be subject to his approval. The submission of the required data shall not otherwise affect the contract terms.

1.11.2 Submittal Instructions

Furnish four copies of the schedule of prices in accordance with the paragraph entitled "Data Required." Identify costs for the building, and include all work out to the 5-foot line. Work to the 5-foot line shall include all construction encompassed within a theoretical line 5 feet from the face of the exterior walls and shall include building equipment such as cooling towers and attendant construction placed beyond the 5-foot line. Identify the cost for site work, and include all work not defined as work to the 5-foot line. Payments will not be made pursuant to the Contract Clause entitled "Payments to Contractor" until the schedule of prices has been submitted to and approved by the Contracting Officer.

1.12 PAYMENTS TO THE CONTRACTOR

Payments made in accordance with the Contract Clause entitled "Payments Under Fixed-Price Construction Contract" will be made on submission of itemized requests by the Contractor and will be subject to reduction for overpayments or increase for underpayments on preceding payments to the Contractor.

1.12.1 Payment for Materials Offsite

Pursuant to the paragraph entitled "Payments to the Contractor," payments may be made to the Contractor for materials stored off construction sites. However, the following conditions must be met:

a. Th conditions described in th paragraph entitled "Payments to the Contractor."

b. The material must be within a distance of 50 miles by streets and roads the county of the construction site.

c. The materials shall be adequately insured and protected from theft and exposure.

d. The materials shall not be susceptible to deterioration or physical damage in storage or in transit to the jobsite. Items such as steel, machinery, pipe and fittings, and electrical cable are acceptable for progress payments; items such as gypsum wallboard, glass, insulation, and wall coverings are not. Payments will not be made for materials in transit to the jobsite or storage site.

1.12.2 Obligation of Government Payments

Th obligation of the Government to make any of the payments required under any of the provisions of this contract shall, in the discretion of the Officer in Charge of Construction, be subject to:

a. Reasonable deductions on account of defects in material or workmanship; and

b. Any claims which the Government may have against the Contractor under or in connection with this contract. Any overpayments to the Contractor shall, unless otherwise adjusted, be repaid to the Government upon demand.

1.13 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

Requests for payment in accordance with the terms of the contract shall consist of:

a. The Contractor's invoice on the form furnished for this purpose, which shall show, in summary form, the basis for arriving at the amount of the invoice; and

b. The contract performance statement on the form furnished for this purpose, which shall show, in detail, the estimated cost percentage of completion and value of completed performance for each of the construction categories stated in this contract. The format, content, and number of copies required will be prescribed by the Officer in Charge of Construction and will be subject to his approval. The submission of the required data will not otherwise affect the contract terms.

1.14 EQUITABLE ADJUSTMENTS - WAIVER AND RELEASE OF CLAIMS

a. Whenever the Contractor submits a claim for equitable adjustment under any clause of this contract which provides for equitable adjustment of the contract, such claim shall include all types of adjustments in the total amounts to which the clause entitles the

Contractor, including, but not limited to, adjustments arising out of delays or disruptions or both caused by such change. Except as the parties may otherwise expressly agree, the Contractor shall be deemed to have waived: (1) any adjustments to which he otherwise might be entitled under the clause where such claim fails to request such adjustments; and (2) any increase in the amount of equitable adjustments additional to those requested in his claim.

b. The Contractor agrees that, if required by the Contracting Officer, he shall execute a release, in form and substance satisfactory to the Contracting Officer, as part of the supplemental agreement setting forth the aforesaid equitable adjustment. The Contractor further agrees that such release shall discharge the Government, including its officers, agents, and employees, from any further claims, including, but not limited to, further claims arising out of delays and/or disruptions caused by the aforesaid change.

1.15 AS-BUILT RECORDS

1.15.1 As-Built Drawings

Maintain at the jobsite two sets of full-size contract drawings marked to show any deviations which have been made from the contract drawings, including buried or concealed construction and utility features revealed during the course of construction. Record the horizontal and vertical location of all buried utilities that differ from the contract drawings. These drawings shall be available for review by the Contracting Officer at all times. Upon completion of the work, deliver the marked sets of prints to the Contracting Officer. Requests for partial payments will not be approved if the marked prints are not current, and request for final payment will not be approved until the marked prints are delivered to the Contracting Officer.

1.15.2 As-Built Record of Materials

A record of the materials used shall be furnished prior to completion of the contract. Submission of this data is a condition for final payment under the contract.

Where several manufacturers' brands, types, or classes of the item listed have been used in the project, the specific areas where each item was used shall be designated. Designations shall be keyed to the areas and spaces depicted on the contract drawing. The record of materials used shall be furnished in the following format:

MATERIALS DESIGNATION	SPECIFICATION	MANUFACTURER	MATERIALS USED (MANUFACTURER'S DESIGNATION)	WHERE USED

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 STATION REGULATIONS

The Contractor and his employees and subcontractor shall become familiar with and obey all station regulations, including fire, traffic, and security regulations. All personnel employed on the station shall keep within the limits of the work (and avenues of ingress and egress) and shall not enter any restricted areas unless required to do so and are cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

3.1.1 Working Hours

Regular working hours shall consist of an 8 1/2-hour period established by the Contracting Officer between 7 a.m. and 5 p.m., Monday through Friday, excluding Government holidays. The Contractor shall make application for work outside regular working hours 15 calendar days prior to such work in accordance with the paragraph entitled "Work Outside Regular Hours."

3.1.2 Work Outside Regular Hours

If the Contractor desires to carry on work outside regular hours, including Saturdays, Sundays, and Government holidays, an application shall be delivered to the Officer in Charge of Construction. The Contractor shall allow ample time to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Officer in Charge of Construction. All utility cutovers shall be made after normal working hours or on Saturdays, Sundays, and Government holidays. Anticipated costs shall be included in the bid.

3.2 ORDER OF WORK

The Contractor shall schedule his work so as to cause the least amount of interference with station operations. Work schedules shall be subject to the approval of the Officer in Charge of Construction. Permission to interrupt any station roads, railroads, and/or utility service shall be requested in

writing a minimum of 15 calendar days prior to the desired date of interruption.

3.3 WORK BY THE CONTRACTOR

3.3.1 Performance of Work by the Contractor (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty (20) percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government. (FAR 52.236-1)

3.3.2 Description of Work Performed by Contractor

In addition to the requirements of the paragraph entitled "Performance of Work by the Contractor (APR 1984)" and prior to the commencement of work at the site, furnish to the Contracting Officer a description of the work to be performed with the Contractor's own organization and the percentage of the total amount of work to be performed under the contract which this represents. Consider the value of materials as part of the work performed by the Contractor only if the materials are to be installed on the site by the Contractor's own organization.

3.4 EXISTING WORK

a. The removal or altering in any way of existing work shall be carried on in such a manner as to prevent injury or damage to any portion(s) of the existing work which remain(s).

b. All portions of existing work which have been altered in any way during construction operations shall be repaired or replaced in kind and in a manner to match existing or adjoining work, as approved by the Contracting Officer. All work of this nature shall be performed by the Contractor at the Contractor's expense and shall be performed as directed by the Officer in Charge of Construction. At the completion of all operations, existing work shall be in a condition equal to or better than that which existed before the new work started.

3.5 SANITATION

Adequate sanitary conveniences of a type approved for the use of persons employed on the work shall be constructed, properly secluded from public observation, and maintained by the Contractor in such a manner as required or approved by the Officer in Charge of Construction. These conveniences shall be maintained at all times without nuisance. Upon completion of the work, the conveniences shall be removed by the Contractor from the premises, leaving the premises clean and free from nuisance.

3.6 SPECIFICATIONS AND STANDARDS

The specifications and standards referenced in this project specification, including addenda, amendments, and errata listed, will govern in all cases

where references thereto are made. In case of differ nces between thes specifications or standards and this project specification or its accompanying drawings, this project specification and its accompanying drawings will govern to the extent of such differences. Otherwise, the referenced specifications and standards will apply. The requirement fot packaging, packing, marking, and preparation for shipment or delivery included in the referenced specifications will apply only to materials and equipment that are furnished directly to the Government and not to materials and equipment that are to be furnished and installed by the Contractor.

3.7 OPTIONAL REQUIREMENTS

Where a choice of materials or methods, or both, is permitted in this contract, the Contractor will be given the right to exercise the option unless otherwise required by the specification.

3.8 GENERAL PROVISIONS

Any reference within this project specification to a General Provision shall be understood to be a reference to the Contract Clause(s) or the General Paragraph(s) addressing the subject matter of the particular reference.

-- End of Section --

SECTION 01011

ADDITIONAL GENERAL PARAGRAPHS

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.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.59	Hazard Communication

CORPS OF ENGINEERS (COE)

COE 1-1-11	1985 Network Analysis Systems, October 15
COE EM-385-1-1	1992 Safety and Health Requirements Manual

MILITARY SPECIFICATIONS (MIL)

MIL-S-16165	(Rev. E) Shielding Harnesses, Shielding Items and Shielding Enclosures for Use in the Reduction of Interference from Engine Electrical Systems

MILITARY STANDARDS (MIL-STD)

MIL-STD-461	(Rev. C) (Notice 2) Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-462	(Notice 6) Electromagnetic Interference Characteristics

1.2 PROJECT INFORMATION

1.2.1 Contract Drawings, Maps, and Specifications (SEP 1987)

a. 5 sets of large-scale contract drawings and specifications will be furnished to the Contractor without charge except applicable publications incorporated into the technical sections by reference. Additional sets will be furnished on request at the cost of reproduction. One set of reproducibles will be furnished the Contractor. The work shall conform to the specifications and the following contract drawings identified on the following index of drawings.

b. Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.

c. The Contractor shall check all drawings furnished him immediately upon their receipt and shall promptly notify the Contracting Officer of any discrepancies. Figures marked on drawings shall in general be followed in preference to scale measurements. Large scale drawings shall in general govern small scale drawings. The Contractor shall compare all drawings and verify the figures befor laying out the work and will be responsible for any errors which might have been avoided thereby.

(DFARS 252.236-7002)

1.2.2 Drawing Numbers

NAVFAC DRAWING NO.	TITLE
2162107	Title Sheet
2162108	Legend
2162109	Existing Site Plan and Demolition Plan
2162110	General Site Plan
2162111	Enlarged Building Area Site Plan
2162112	Ground Water Extraction Details
2162113	General Site Details
2162114	Pipings Profiles
2162115	Soil Boring Logs
2162116	Treatment Building Elevations
2162117	Building Floor Plan
2162118	Treatment Building Details
2162119	Treatment Building Foundation Plan
2162120	Structural Loading Plan
2162121	Treatment System Layout
2162122	Treatment Equipment Details
2162123	Treatment System Details
2162124	Process and Instrument Diagram
2162125	Process and Instrument Diagram
2162126	Equipment and Piping Schedule
2162127	Heating and Ventilating Floor Plan
2162128	Mechanical Details
2162129	Plumbing Floor Plan
2162130	Plumbing For Floor Drain System
2162131	Electrical Site Plan
2162132	Electrical Floor Plans
2162133	Distribution Riser Diagram & Details
2162134	Pump Riser Diagrams & Symbols
2162135	Pump Station Power Wiring Diagrams
2162136	Pump Station Control Wiring Diagram

NAVFAC DRAWING NO.	TITLE
2162137	Process Control Panel Wiring Diagram
2162138	Process Control Panel Wiring Diagram
2162139	Electrical Details, Notes & Schedule
2162140	Electrical Details

1.2.3 Boring Logs

NAVFAC Drawing No. 2162115, "Soil Boring Logs" indicate the information obtained by Government investigation. The Government does not guarantee that borings indicate actual conditions, except for the exact locations and the time that they were made. Subsurface data, not specified or indicated, have been obtained by the Government at this station. The data are available for examination by prospective bidders in the office of the Contracting Officer at the station.

1.3 SUBMITTALS

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

1.3.1 SD-18, Records

a. Construction schedule G

b. Equipment delivery schedule G

c. Monthly update to construction schedule and equipment delivery schedules G

d. Accident Prevention Plan G

1.3.1.1 Construction Schedule

Within 15 days after award of the contract, prepare and submit to the Contracting Officer for approval a feasible construction schedule in accordance with the clause of the Contract Clauses entitled "Schedules for Construction Contract," except as modified in this contract.

1.3.1.2 Equipment Delivery Schedule

Within 35 days after award of the contract, submit to the Contracting Officer for approval, a schedule showing the procurement plans for materials, plant, and equipment. Submit in the format prescribed by the Contracting Officer, and include as a minimum the following information:

a. Description

b. Date of the purchase order

c. Promised shipping date

d. Name of the manufacturer or supplier

e. Date delivery is expected

f. Date the material or equipment is required, according to the current progress schedule or network.

1.3.1.3 Network Analysis System

As an alternative to the preceding construction and equipment delivery schedules, the Contractor may use the critical path method (CPM) or, subject to the approval of the Contracting Officer, some other system affording similar and equal information and control to that provided by the CPM. An example of one of the numerous acceptable types of network analysis systems is shown in Appendix A of COE 1-1-11. The use of one of these methods shall be subject to the terms of the clause of the Contract Clauses entitled "Schedules for Construction Contracts." Should the Contractor exercise the option to use a network analysis system, the Contractor also has the option of providing a schedule of prices in accordance with the paragraph of Section 01010, "General Paragraphs" entitled "Schedule of Prices" or providing a network analysis system, including costs.

1.3.1.4 Monthly Update to Schedules

Update the construction schedule and equipment delivery schedule at monthly intervals or as directed. Reflect any changes occurring since the last update. Submit copies of the purchase orders and confirmation of the delivery dates as directed. Update the construction schedules and equipment schedules with each invoice for progress payment in accordance with the clause of the Contract Clauses entitled "Schedules for Construction Contract."

1.4 ADDITIONAL INFORMATION REQUIRED OF THE CONTRACTOR

1.4.1 Subcontractors and Personnel

Reference is made to the clause of the Contract Clauses entitled "Subcontract (Labor Standards)." In addition to the data required by that clause, provide a list of the key personnel of the Contractor and subcontractors (including addresses and telephone numbers) for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.5 PROJECT SCHEDULE AND TIME CONSTRAINTS

1.5.1 Commencement, Prosecution, and Completion of Work (APR 84)

The Contractor shall be required to (a) commence work under this contract within 15 calendar days after award of the contract, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 360 calendar days after the required commencement of work. The time stated for completion shall include final cleanup of the premises.

(FAR 52.212-3)

1.5.1.1 Definitions

a. The date the Contracting Officer signs the SF 1442 is the date of the award of the contract.

b. A period of 15 days, after which contract time commences, is to allow for the mailing of the SF 1442 and the Contractor's submission and approval of the required bonds, Certificates of Insurance and Certification as to the percentage of work to be performed by the Contractor.

c. The contract time for the purpose of fixing the completion date shall begin to run 15 days from the date of award on the SF 1442, regardless of when the performance and payment bonds are executed.

1.5.2 Liquidated Damages - Construction (APR 84)

(FAR 52.212-5(a))

1.5.2.1 Failure to Complete Work

If the Contractor fails to complete the work within the time specified in the contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of $700.00 for each day of delay.

(FAR 52.212-5(a))

1.5.2.2 Contractor Liability with Government Termination

If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

(FAR 52.212-5(b))

1.5.2.3 Contractor Liability Without Government Termination

If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

(FAR 52.212-5(c))

1.6 DIVISION OF WORK

1.6.1 Government-Furnished Material and Equipment

a. Desks and Cabinets

1.6.2 Government-Installed Work

a. Desks and Cabinets

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 FACILITIES AND SERVICES

3.1.1 Availability of Utilities Services

Pursuant to the clause of the Contract Clauses entitled "Availability and Use of Utility Services," reasonable amounts of the following utilities will be made available to the Contractor without charge.

Electricity
Potable Water

The point at which the Government will deliver such utilities or services and the quantity available is as indicated. The Contractor shall pay all costs incurred in connecting, converting, and transferring the utilities to the work. The Contractor shall make connections, including providing backflow-preventing devices on connections to domestic water lines; providing meters; and providing transformers; and make disconnections.

3.1.2 Contractor's Storage Area

The clause of the Contract Clauses entitled "Operations and Storage Areas" and the following apply:

3.1.2.1 Storage in Existing Buildings

The Contractor shall be working around existing buildings; the storage of material will not be allowed in the buildings.

3.1.2.2 Storage Size and Location

The open site available for storage shall be as indicated. The storage area will be approximately 8,000 square feet.

3.1.3 Temporary Buildings

Locate these where directed and within the indicated operations area.

3.1.3.1 Maintenance of Temporary Facilities

Suitably paint and maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

3.2 RESTRICTIONS ON EQUIPMENT

3.2.1 Electromagnetic Interference Suppression

a. Electric Motors: Motors shall comply with MIL-STD-461 relative to radiated and conducted electromagnetic interference. A test for electromagnetic interference will not be required for motors

that are identical physically and lectrically to those that have previously met the requirements of MIL-STD-461. An electromagnetic interference suppression test will not be required for electric motors without commutation or sliprings having no more than one starting contact and operated at 3,600 revolutions per minute or less.

b. Contractor's Construction Equipment: Equipment used by the Contractor shall comply with MIL-S-16165 for internal combustion engines and MIL-STD-461 for other devices capable of producing radiated or conducted interference.

c. Tests for Electromagnetic Interference Suppression: Conduct tests on electric motors and the Contractor's construction equipment in accordance with MIL-STD-461 and MIL-STD-462. The test location shall be reasonably free from radiated and conducted interference. Furnish the testing equipment, instruments, and personnel for making the tests; a test location; and other necessary facilities.

3.2.2 Radio Transmitter Restrictions

Conform to the restrictions and procedures for the use of radio transmitting equipment, as directed. Do not use transmitters without prior approval.

3.3 RESTRICTIONS ON OPERATIONS

3.3.1 Restrictions Upon Interrupting Utility Services

The clause of the Contract Clauses entitled "Schedules for Construction Contract"; the paragraph of Section 01010, "General Paragraphs," entitled "Order of Work"; and the following apply:

a. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

b. Interruption to Water, Sanitary Sewer, Storm Sewer, Telephone Service, Electric Service, Air Conditioning, Heating, Fire Alarm, and Compressed Air: These shall be considered utility cutovers pursuant to the paragraph of Section 01010, "General Paragraphs," entitled "Work Outside Regular Hours." This limit includes time for deactivation and reactivation.

3.3.2 Restrictions Upon Interrupting Station Operations

Reference is made to the paragraph of Section 01010, "General Paragraphs," entitled "Order of Work." The work under this contract requires special attention to the scheduling and conduct of the work in connection with existing operating systems. Identify on the project schedule each factor which constitutes a potential interruption to operations. The following conditions apply:

a. The main fuel line through the Tank Farm as shown on the drawings is active and must not be disturbed.

b. The Contractor shall not block access to the Fire Fighting Training Facility at any time.

3.3.3 Coordination With Other Work

The clause of the Contract Clauses entitled "Other Contracts"; the paragraph of Section 01010, General Paragraphs entitled "Order of Work"; and the following apply:

3.3.4 Security Requirements

No employee or representative of the Contractor will be admitted to the work site without satisfactory proof of United States citizenship or is specifically authorized admittance to the work site by the Officer in Charge of Construction.

3.3.5 Accident Prevention Plan

Submit in writing an Accident Prevention Plan in accordance with Contract Clause titled "Accident Prevention" and the current edition of the U.S. Army Corps of Engineers "Safety and Health Requirements Manual" COE EM 385-1-1 in effect on the date of the solicitation. Prepare the Accident Prevention Plan following the guidelines found in Table 1-1, page 3 of COE EM 385-1-1. The Accident Prevention Plan shall also include a hazard communication program complying with the requirements of 29 CFR 1926.59 and COE EM 385-1-1. For each major phase of the work, prepare an activity hazard analysis as required by COE EM 385-1-1. The Contractor shall meet in conference with the Contracting Officer to discuss and develop mutual understandings relative to the overall safety program. Work at the construction site will not be permitted until the Accident Prevention Plan is approved by the Contracting Officer.

3.4 ACTIONS REQUIRED OF THE CONTRACTOR

3.4.1 Location of Underground Facilities

Verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified to be removed but indicated in locations to be traversed by piping, ducts, and other work to be installed. Verify the elevations before the new work is laid closer than the nearest manhole or other structure at which an adjustment in grade could be made. For additional work required by reason of conflict between new and existing work, an adjustment in contract price will be made in accordance with the clause of the Contract Clauses entitled "Differing Site Conditions."

3.4.2 Station Permits

Obtain these pursuant to the paragraph of Section 01010, "General Paragraphs," entitled "Station Regulations." Permits are required for, but are not necessarily limited to, welding, digging, and burning. Allow 7 calendar days for processing of the application.

3.4.3 Storm Protection

If a warning of gale force winds is issued, take precautions to minimize any danger to persons, and protect the work and any nearby Government property. Precautions shall include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work if storms of lesser intensity pose a threat to the work or any nearby Government property.

3.4.4 Unforeseen Hazardous Material

If material, not otherwise identified as hazardous, is encountered which may be dangerous to human health if disturbed during construction operations, the Contractor shall stop that portion of the work and avoid coming in contact with the material. The Contractor shall immediately notify the Contracting Officer concerning the possible existence of hazardous material. The intent is to identify materials such as friable and non friable asbestos, polychlorinated biphenyls (PCBs) and paint containing lead. Within 14 calendar days, the Government will perform testing to determine if the material is hazardous. If the material is not hazardous or poses no danger, the Contracting Officer will direct the Contractor to proceed without change. If the material is hazardous and must be disturbed or handled to accomplish work, the Contracting Officer will direct a change pursuant to the Contract Clauses titled "Changes" and "Differing Site Conditions".

-- End of Section --

SECTION 01090

REFERENCES

PART 1 GENERAL

1.1 REFERENCES

Reference publications are cited in other sections of the specifications along with identification of their sponsoring organizations. The addresses of the sponsoring organizations are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

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707 North Calvert Street
Baltimore, MD 21202
Ph: 301-333-1541 Fax: 301-333-4999

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

1230 Keith Building
Cleveland, OH 44115
Ph: 216-241-7333 Fax: 216-241-0105

METAL LATH/STEEL FRAMING ASSOCIATION (ML/SFA)
600 South Federal Street, Suite 400
Chicago, IL 60605
Ph: 312-922-6222 Fax: 312-922-2734

MILITARY HANDBOOKS (MIL-HDBK)
Defense Printing Service (DPS)
ATTN: Cataloging
Building 4D NPN-DODSSP
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: Commercial: 215-697-2179/-2664
Autovon: 442-2658/-2664 Fax: 215-697-2978

MILITARY SPECIFICATION SHEET (MS)
Defense Printing Service (DPS)
ATTN: Cataloging
Building 4D NPN-DODSSP
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: Commercial: 215-697-2179/-2664
Autovon: 442-2658/-2664 Fax: 215-697-2978

MILITARY SPECIFICATIONS (MIL)
Defense Printing Service (DPS)
ATTN: Cataloging
Building 4D NPN-DODSSP
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: Commercial: 215-697-2179/-2664
Autovon: 442-2658/-2664 Fax: 215-697-2978

MILITARY STANDARDS (MIL-STD)
Defense Printing Service (DPS)
ATTN: Cataloging
Building 4D NPN-DODSSP
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: Commercial: 215-697-2179/-2664
Autovon: 442-2658/-2664 Fax: 215-697-2978

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)
600 South Federal Street, Suite 400
Chicago, IL 60605
Ph: 312-922-6222 Fax: 312-922-2734

NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)
1440 South Creek Drive
P. O. Box 218340
Houston, TX 77084
Ph: 713-492-0535 Fax: 713-492-8254

NATIONAL ASSOCIATION OF GARAGE DOOR MANUFACTURERS (NAGDM)
1300 Sumner Avenue
Cleveland, OH 44115
Ph: 216-241-7333 Fax: 216-241-0105

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)
P. O. Box 6808
Falls Church, VA 22046
Ph: 703-237-8100 Fax: 703-237-7442

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBPVI)
1055 Crupper Avenue
Columbus, OH 43229
Ph: 614-888-8320 Fax: 614-847-1828

NATIONAL CABLE TELEVISION ASSOCIATION (NCTA)
1724 Massachusetts Avenue, N.W.
Washington, DC 20036-1969
Ph: 202-775-3550 Fax: 202-775-3698

NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS (NCRP)
7910 Woodmont Avenue, Suite 800
Bethesda, MD 20814
Ph: 301-657-2652 Fax: 301-907-8768

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
2101 "L" Street, N.W., Suite 300
Washington, DC 20037
Ph: 202-457-8474 Fax: 202-457-8468

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)
1385 Piccord Drive
Rockville, MD 20850
Ph: 301-977-3698 Fax: 301-977-9589

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
One Batterymarch Park
P. O. Box 9146

Quincy, MA 02269
Ph: 800-344-3555 Fax: 617-984-7057

NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)
1250 Connecticut Avenue, N.W., Suite 200
Washington, DC 20036
Ph: 202-463-2764/-2766 Fax: 202-463-2791

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)
P. O. Box 34518
Memphis, TN 38134
Ph: 901-377-1818 Fax: 901-382-6419

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)
Publications Department
4676 Columbia Parkway
Cincinnati, OH 45226
Ph: 513-533-8287 Fax: 513-533-8287

or

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Ph: 800-336-4700 Fax: 703-321-8547
703-487-4650

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)
Route 270 and Quince Orchard Road
Gaithersburg, MD 20899
Ph: 301-975-2000 Fax: 301-975-2128

NATIONAL LIME ASSOCIATION (NLA)
3601 North Fairfax Drive
Arlington, VA 22201
Ph: 703-243-5463 Fax: 703-243-5489

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)
O'Hare International Center
10255 West Higgins Road, Suite 600
Rosemont, IL 60018-5607
Ph: 708-299-9070 Fax: 708-299-1183

NATIONAL SANITATION FOUNDATION (NSF)
3475 Plymouth Road
P. O. Box 1468
Ann Arbor, MI 48106
Ph: 313-769-8010 Fax: 313-769-0109

NATIONAL TERRAZZO & MOSAIC ASSOCIATION (NTMA)
3166 Des Plaines Avenue, Suite 132
Des Plaines, IL 60018
Ph: 800-323-9736 Fax: 708-635-9127

NATIONAL WEATHER SERVICE (NWS)
4400 Stamp Road, Room 404
Temple Hills, MD 20748
Ph: 301-899-3784 Fax: 301-762-4109

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)
1400 East Touhy Avenue, Suite G-54
Des Plaines, IL 60018
Ph: 708-299-5200 Fax: 708-299-1286

NAVAL CIVIL ENGINEERING LABORATORY (NCEL)
Technical Library, Code L06C
Port Hueneme, CA 93043
Ph: 805-982-1078 Fax: 805-982-1409
805-982-4980 805-982-1418

NAVAL ENERGY & ENVIRONMENTAL SUPPORT ACTIVITY (NEESA)
Officer in Charge
Port Hueneme, CA 93043-5014
Ph: 805-982-5751
Autovon: 551-5388 Fax: 805-982-5388

NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)
200 Stovall Street
Code 1652
Alexandria, VA 22332
Ph: 202-325-0362 Fax: 202-325-6904

NAVY DIRECTIVES (ND)
200 Stovall Street
Code DSO2B
Alexandria, VA 22332
Ph: 703-325-0450 Fax: 703-325-1916

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)
#1 South Wilmington
P. O. Box 25201
Raleigh, NC 27611
Ph: 919-733-2520 Fax: 919-733-9150

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

P. O. Box 87A
Cumberland Center, ME 04021
Ph: 207-829-6901 Fax: 207-829-6901

NORTHERN VIRGINIA DIVISION, STATE AIR POLLUTION
CONTROL BOARD (NVDSAPCB)
6225 Brandon Avenue, #310
Springfield, VA 22150
Ph: 703-644-0311 Fax: 703-644-0296

PLASTICS PIPE INSTITUTE (PPI)
Wayne Interchange Plaza II
155 Route 46 West
Wayne, NJ 07470
Ph: 201-812-9076 Fax: 201-890-7029

PLUMBING AND DRAINAGE INSTITUTE (PDI)
1106 West 77th, South Drive
Indianapolis, IN 46260-3318
Ph: 317-251-6970 Fax: None

PLUMBING AND PIPING INDUSTRY COUNCIL (PPIC)
501 Shatto Place, Suite 402
Los Angeles, CA 90020
Ph: 213-487-3790 Fax: 213-487-3880

PORCELAIN ENAMEL INSTITUTE (PEI)
1101 Connecticut Avenue, N.W., Suite 700
Washington, DC 20036
Ph: 708-857-1134 Fax: 708-223-4579

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)
175 West Jackson Boulevard
Chicago, IL 60604
Ph: 312-786-0300 Fax: 312-786-0353

PUBLIC UTILITIES COMMISSION (PUC)
State of California
ATTN: Documents Section
505 Van Ness Avenue
San Francisco, CA 94102
Ph: 415-557-1812 Fax: None

REDWOOD INSPECTION SERVICE (RIS)
California Redwood Association
405 Enfrente Drive, Suite 200
Novato, CA 94949
Ph: 415-382-0662 Fax: 415-382-8531

RURAL ELECTRIFICATION ADMINISTRATION (REA)
USDA-REA-ASD
Administrative Services Division
Publications and Directives Management Branch
South Agriculture Building
ATTN: Publications, Room 0180
14th and Independence Avenue, SW
Washington, DC 20250
Ph: 202-382-8674 Fax: 202-382-1915

SCREEN MANUFACTURERS ASSOCIATION (SMA)
655 Irving Park at Lake Shore Drive, Suite 201
Chicago, IL 60613-3198
Ph: 312-525-2644 Fax: 312-248-9659

SEALED INSULATING GLASS MANUFACTURERS ASSOCIATION (SIGMA)
401 North Michigan Avenue
Chicago, IL 60611
Ph: 312-644-6610 Fax: 312-321-6869

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)
P. O. Box 70
Merrifield, VA 22216
Ph: 703-790-9890 Fax: 703-803-3732

SINGLE-PLY ROOFING INSTITUTE (SPRI)
20 Walnut Street, Suite 208
Wellesley Hills, MA 02181
Ph: 617-237-7879 Fax: 617-237-1064

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)
400 Commonwealth Drive
Warrendale, PA 15096-0001
Ph: 412-776-4841/-5760 Fax: 412-776-5760

SOCIETY OF THE PLASTICS INDUSTRY, INC. (SPI)
1275 "K" Street, N.W., Suite 400
Washington, DC 20005
Ph: 202-371-5200 Fax: 202-371-1022

SOLAR RATING AND CERTIFICATION CORPORATION (SRCC)
Interstate Solar Coordination Council
900 America Center Building
St. Paul, MN 55101
Ph: 612-296-4737 Fax: 612-296-1290

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENT CONTROL (SCDHEC)
334 Calhalin Street
Charleston, SC 29401
Ph: 803-724-5800 Fax: None

SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL (SBCCI)
900 Montclair Road
Birmingham, AL 35213
Ph: 205-591-1853 Fax: 205-592-7001

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)
2831 Airways Boulevard
Memphis, TN 38132
Ph: 901-346-2222 Fax: 901-346-2233

SOUTHERN PINE INSPECTION BUREAU (SPIB)
4709 Scenic Highway
Pensacola, FL 32504
Ph: 904-434-2611 Fax: 904-433-5594

STEEL DECK INSTITUTE (SDEI)
P. O. Box 9506
Canton, OH 44711
Ph: 216-493-7886 Fax: 216-493-7886

STEEL DOOR INSTITUTE (SDI)
30200 Detroit Avenue
Cleveland, OH 44145-1967
Ph: 216-899-0010 Fax: 216-892-1404

STEEL JOIST INSTITUTE (SJI)
1205 Forty-Eight Avenue, Suite A
North Myrtle Beach, SC 29577
Ph: 803-449-0487 Fax: None

STEEL STRUCTURES PAINTING COUNCIL (SSPC)
4400 Fifth Avenue
Pittsburg, PA 15213-2683
Ph: 412-268-3327 Fax: 412-431-5428

STEEL TANK INSTITUTE (STI)
728 Anthony Trail
Northbrook, IL 60062
Ph: 708-498-1980 Fax: 708-498-3178

STEEL WINDOW INSTITUTE (SWI)
1230 Keith Building
Cleveland, OH 44115
Ph: 216-241-7333 Fax: 216-241-0105

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)
If using UPS:
15 Technology Parkway South
Norcross, GA 30092
Ph: 800-332-8686; 404-446-1400 Fax: 404-446-6947

or

If ordering by mail:
Service Department
P. O. Box 105113
Atlanta, GA 30348-5113

THE ALUMINUM ASSOCIATION, INCORPORATED (AA)
P. O. Box 753
Waldorf, MD 20601
Ph: 301-645-0756 Fax: 301-843-0159

TRUSS PLATE INSTITUTE (TPI)
583 D'Onofrio Drive, Suite 200
Madison, WI 53719
Ph: 608-833-5900 Fax: 608-833-4360

TUBULAR EXCHANGER MANUFACTURERS ASSOCIATION (TEMA)
25 North Broadway
Tarrytown, NY 10591
Ph: 914-332-0040 Fax: 914-332-1541

UNDERWRITERS LABORATORIES INC. (UL)
333 Pfingsten Road
Northbrook, IL 60062
Ph: 708-272-8800 Fax: 708-272-8129

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)
2655 Villa Creek Drive, Suite 155
Dallas, TX 75234
Ph: 214-243-3902 Fax: 214-243-3907

UNIVERSITY OF CALIFORNIA DIVISION OF AGRICULTURE AND
NATURAL RESOURCES (UCDANR)
Agricultural Publication

6701 San Pablo Avenue
Oakland, CA 94608-1239
Ph: 415-642-2431 Fax: 415-643-5470

U.S. DEPARTMENT OF COMMERCE PRODUCT STANDARDS (PS)
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
Ph: 202-377-5494 Fax: 202-275-2529

VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION (VDHT)
1401 East Broad Street
Richmond, VA 23219
Ph: 804-786-2801 Fax: 804-786-6250

VIRGINIA DEPARTMENT OF POLLUTION CONTROL (VDPC)
Department of Labor and Industry
205 North Fourth Street
P. O. Box 12064
Richmond, VA 23241
Ph: 804-786-2376 Fax: 804-371-6524

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)
1401 East Broad Street
Richmond, VA 23219
Ph: 804-786-2801 Fax: 804-786-6250

VIRGINIA DIVISION OF SOIL AND WATER CONSERVATION COMMISSION (VSWCC)
203 Governor Street, Suite 206
Richmond, VA 23219
Ph: 804-371-7489

WATER QUALITY ASSOCIATION (WQA)
4151 Naperville Road
Lisle, IL 60532
Ph: 708-505-0160 Fax: 708-505-9637

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)
P. O. Box 23415
Portland, OR 97223
Ph: 503-639-0651 Fax: 503-684-8928

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)
Yeon Building
522 S.W. 5th Avenue
Portland, OR 97204-2122
Ph: 503-224-3930 Fax: 503-224-3934

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

Not used.

1.2 DEFINITIONS

1.2.1 Submittal

Shop drawings, product data, samples, and administrative and closeout submittals presented for review and approval. Contract Clauses "Material and Workmanship," paragraph (b) and "Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.2.2 Types of Submittals

The following four groupings of submittals into which all submittal descriptions are classified, as designated in the paragraph entitled "Schedule of Submittal Descriptions."

a. Shop Drawings: As used in this Section, drawings, schedules, diagrams, and other data prepared specifically for this Contract, by the Contractor or through the Contractor by way of a subcontractor, manufacturer, supplier, distributor, or other lower tier contractor, to illustrate a portion of the work.

b. Product Data: Preprinted material such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate a portion of the work, but not prepared exclusively for this Contract.

c. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to a portion of the work, illustrating a portion of the work or establishing standards for evaluating the appearance of the finished work or both.

d. Administrative Submittals: Data presented for reviews and approval to ensure that the administrative requirements of the project are adequately met but not to ensure directly that the work is in accordance with the design concept and in compliance with the Contract documents.

1.2.3 Approving Authority

The person authorized to approve a submittal.

1.2.4 Work

As used in this Section, on- and off-site construction required by the Contract documents, including labor necessary to produce the construction and materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Submit the following in accordance with the requirements of this section.

1.3.1 SD-18, Records

a. Submittal register G

1.3.1.1 Submittal Register

State for each submittal the Contractor's planned submittal date. Submit within 30 days after award of the contract. Submit on copies of the "Submittal Register." Obtain the original from the following source:

a. From the register with the submittal items filled in, attached.

1.4 PROCEDURES FOR SUBMITTALS

1.4.1 Reviewing, Certifying, Approving Authority

The QC organization shall be responsible for reviewing and certifying that submittals are in compliance with contract requirements. The approving authority on submittals is the QC Manager unless otherwise specified for the specific submittal. At each "Submittal" paragraph in the individual specification Sections, a notation "G," following a submittal item, indicates the Contracting Officer is the approving authority for that submittal item.

1.4.2 Constraints

a. Submittals listed or specified in this Contract shall conform to the provisions of this Section, unless explicitly stated otherwise.

b. Submittals shall be complete for each definable feature of work; components of the definable feature interrelated as a system shall be submitted at the same time.

c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, the submittal will be returned without review.

d. Approval of a separate material, product, or component does not imply approval of assembly in which the item functions.

1.4.3 Scheduling

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of the work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.

b. Except as specified otherwise, allow a review period, beginning with receipt by the approving authority, that includes at least 15 working days for submittals for QC Manager approval and 20 working days for submittals for Contracting Officer approval. The period of review for submittals with Contracting Officer approval begins when the Government receives the submittal from the QC organization. The period of review for each résubmittal is the same as for the initial submittal.

c. For submittals requiring review by the Fire Protection Engineer, allow a review period, beginning when the Government receives the submittal from the QC organization, of 30 working days for return of the submittal to the Contractor. The period of review for each resubmittal is the same as for the initial submittal.

1.4.4 Variations

Variations from contract requirements require Government approval pursuant to Contract Clause entitled "Specifications and Drawings for Construction" and will be considered where advantageous to the Government. When proposing a variation, submit a written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to the Government. If lower cost is a benefit, also include an estimate of the cost saving. Identify the proposed variation separately and include the documentation for the proposed variation along with the required submittal for the item. When submitting a variation for approval, the Contractor warrants the following:

1.4.4.1 Variation Is Compatible

The Contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of the work.

1.4.4.2 Contractor Is Responsible

The Contractor shall take actions and bear the additional costs, including review costs by the Government, necessary due to the proposed variation.

1.4.4.3 Review Schedule Is Modified

In addition to the normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.4.5 Contractor's Responsibilities

a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and

coordinate each submittal with requirements of the work and Contract documents.

b. Transmit submittals to the QC organization in orderly sequence, in accordance with the Submittal Register, and to prevent delays in the work, delays to the Government, or delays to separate contractors.

c. Advise the Contracting Officer of variation, as required by the paragraph entitled "Variations."

d. Correct and resubmit submittal as directed by the approving authority. Direct specific attention, in writing or on resubmitt d submittal, to revisions not requested by the approving authority on previous submissions.

e. Furnish additional copies of submittals when requested by the Contracting Officer, to a limit of 20 submittals.

f. Complete work which must be accomplished as a basis of a submittal in time to allow the submittal to occur as scheduled.

g. Ensure no work has begun until submittals for that work have been returned as "approved," or "approved as noted", except to the extent that a portion of the work must be accomplished as a basis of the submittal.

1.4.6 QC Organization Responsibilities

a. Note the date on which the submittal was received from the contractor on each submittal for which the QC Manager is the approving authority.

b. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and Contract documents.

c. Review submittals for conformance with project design concepts and compliance with the Contract documents.

d. Act on submittals, determining the appropriate action based on the QC organization's review of the submittal.

(1) When the QC Manager is the approving authority, take the appropriate action on the submittal from the possible actions defined in the paragraph entitled, "Actions Possible."

(2) When the Contracting Officer is the approving authority or when a variation has been proposed, forward the submittal to the Government with the certifying statement or return the submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of the submittal determines the appropriate action.

e. Ensure that material is cl arly legible.

f. Stamp each sheet of each submittal with the QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When the approving authority is the Contracting Officer, the QC organization will certify submittals forwarded to the Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with Contract Number N62472-92-C-0056, is in compliance with the Contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval. Government approval of proposed variation, if any, is recommended.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Certified by QC Manager _____, Date _____"
(Signature)

(2) When the approving authority is the QC Manager, the QC manager will use the following approval statement when returning submittals to the Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with Contract Number N62472-92-C-0056, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use, approved for use subject to Government approval of proposed variation.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Approved by QC Manager _____, Date _____"
(Signature)

g. Sign the certifying statement or approval statement. The person signing the certifying statements shall be the QC organization member designated in the approved QC plan. The signatures shall be in original ink. Stamped signatures are not acceptable.

h. Update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by the Contracting Officer.

i. Retain a copy of approved submittals at the project site, including the Contractor's copy of approved samples.

j. When the approving authority is the QC Manager, forward two copies

of each approved submittal, except "Samples," where one set is required, to the Contracting Officer.

1.4.7 Government's Responsibilities

When the approving authority is the Contracting Officer, the Government will:

a. Note the date on which the submittal was received from the QC Manager, on each submittal for which the Contracting Officer is the approving authority.

b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with the Contract documents.

c. Identify returned submittals with one of the actions defined in the paragraph entitled "Actions Possible" and with markings appropriate for the action indicated.

d. Retain three copies of each submittal, except "Samples," where one copy will be retained.

1.4.8 Actions Possible

Submittals will be returned with one of the following notations:

a. Submittals marked "not reviewed" will indicate the submittal has been previously reviewed and approved, is not required as a submittal, does not have evidence of being reviewed and approved by the Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Returned submittals deemed to lack review by the Contractor or to be incomplete shall be resubmitted with appropriate action, coordination, or change.

b. Submittals marked "approved" "approved as submitted" authorize the Contractor to proceed with the work covered.

c. Submittals marked "approved as noted" authorize the Contractor to proceed with the work as noted provided the Contractor takes no exception to the notations.

d. Submittals marked "revise and resubmit" or "disapproved" indicate the submittal is incomplete or does not comply with the design concept or the requirements of the Contract documents and shall be resubmitted with appropriate changes.

1.5 FORMAT OF SUBMITTALS

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to the office of the approving authority. Transmit submittals with a

transmittal form prescribed by the Contracting Officer and standard for the project. The transmittal form shall identify th Contractor, indicat the date of the submittal, and include information prescribed by the transmittal form and required in the paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.5.2 Identifying Submittals

Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on the transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location.

b. Construction Contract number.

c. The Section number of the specification Section by which the submittal is required.

d. The submittal description (SD) number of each component of the submittal.

e. When a resubmission, an alphabetic suffix on the submittal description, for example, SD-10A, to indicate the resubmission.

f. The name, address, and telephone number of the subcontractor, supplier, manufacturer and any other second tier contractor associated with the submittal.

g. Product identification and location in project.

1.5.3 Format for Product Data

a. Present product data submittals for each Section as a complete, bound volume. Include a table of contents listing page and catalog item numbers for product data.

b. Indicate, by prominent notation, each product which is being submitted; indicate the specification Section number and paragraph number to which it pertains.

c. Supplement product data with material prepared for the project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for the project.

1.5.4 Format for Shop Drawings

a. Shop drawings shall not be less than 8 1/2 by 11 inches nor more than 30 x 42 inches.

b. Present 8 1/2 x 11-sized shop drawings as a part of the bound volume for the submittals required by the Section. Present larger

drawings in sets.

c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to the information required in the paragraph entitled "Identifying Submittals."

d. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Identify materials and products for work shown.

1.5.5 Format of Samples

a. Furnish samples in the sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

(1) Sample of Equipment or Device: Full size.

(2) Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

(3) Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

(4) Sample of Linear Devices or Materials: 10-inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

(5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

(6) Color Selection Samples: 2 inches by 4 inches.

(7) Sample Panel: 4 feet by 4 feet.

(8) Sample Installation: 100 square feet.

b. Samples Showing Range of Variation: Where variations are unavoidable due to the nature of the materials, submit sets of samples of not less than three units showing the extremes and middle of the range.

c. Reusable Samples: Incorporate returned samples into the work only if so specified or indicated. Incorporated samples shall be in undamaged condition at the time of use.

d. Recording of Sample Installation: Note and preserve the notation of the area constituting the sample installation but remove the notation at the final clean up of the project.

1.5.6 Format of Administrative Submittals

a. When the submittal includes a document which is to be used in the project or become a part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document, but to a separate sheet accompanying the document.

b. Operation and Maintenance Manual Data: Submit in accordance with Section 01730, "Operation and Maintenance Data." Include components required in that Section and the various technical sections.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies of Product Data

a. Submit six copies of submittals of product data requiring review and approval only by the QC organization and seven copies of product data requiring review and approval by the Contracting Officer.

1.6.2 Number of Copies of Shop Drawings

a. For shop drawings presented on sheets larger than 8 1/2-inches by 14 inches, submit one reproducible and three prints of each shop drawing prepared for this project.

(1) Transmit reproducibles rolled in mailing tubes.

(2) After review, the approving authority will retain the prints and return only the reproducible with notation resulting from the review.

b. For shop drawings presented on sheets 8 1/2-inches by 14 inches or less, conform to the quantity requirements for product data.

1.6.3 Number of Samples

a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

b. Submit one sample panel. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of non-solid materials.

1.6.4 Number of copies of Administrative and Closeout Submittals

a. Unless otherwise specified, submit administrative and closeout submittals which are 8 1/2 inches by 14 inches or smaller in size in the quantity required for product data.

b. Unless otherwise specified, submit administrative and closeout submittals larger than 8 1/2 inches by 14 inches in size in the quantities required for shop drawings.

c. Submit adminstrative submittals required under "SD-19, Operation and Maintenance Manuals" to conform to Section 01730, "Operation and Maintenance Data."

1.7 SCHEDULE OF SUBMITTAL DESCRIPTIONS (SD)

SD-01, Data

Submittals which provide calculations, descriptions, or other documentation regarding the work.

SD-02, Manufacturer's Catalog Data

Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. A type of product data.

SD-03, Manufacturer's Standard Color Charts

Preprinted illustrations displaying choices of color and finish for a material or product. A type of product data.

SD-04, Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, detail of fabrications, layout of particular elements, connections, and other relational aspects of the work. A type of shop drawing.

SD-05, Design Data

Design calculations, mix designs, analyses, or other data, written in nature and pertaining to a part of the work. A type of shop drawing.

SD-06, Instructions

Preprinted material describing installation of a product, system, or material, including special notices and Material Safety Data Sheets, if any, concerning impedances, hazards, and safety precautions. A type of product data.

SD-07, Schedules

A tabular list of data or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work. A type of shop drawing.

SD-08, Statements

A document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other lower tier contractor, the purpose of which is to further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verification of quality. A type of shop drawing.

SD-09, Reports

Reports of inspection and laboratory test, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-10, Test Reports

A report signed by an authorized official of a testing laboratory that a material, product, or system identical to the material, product or system to be provided has been tested in accordance with requirements specified by naming the test method and material. The test report must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. Testing must have been within three years of the date of award of this Contract. A type of product data.

SD-11, Factory Test Reports

A written report which includes the findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for this project before it is shipped to the job site. The report must be signed by an authorized official of a testing laboratory and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. A type of shop drawing.

SD-12, Field Test Reports

A written report which includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. The report must be signed by an authorized official of a testing laboratory or agency and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. A type of shop drawing.

SD-13, Certificates

Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material meet specified requirements. The statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address. A type of shop drawing.

SD-14, Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work. A type of sample.

SD-15, Color Selection Samples

Samples of the available choice of colors, textures, and finishes of a product or material, presented over substrates identical in texture to that proposed for the work. A type of sample.

SD-16, Sample Panels

An assembly constructed at the project site in a location acceptable to the Contracting Officer and using materials and methods to be employed in th work; completely finished; maintained during construction; and removed at the conclusion of the work or when authorized by the Contracting Officer. A type of sample.

SD-17, Sample Installations

A portion of an assembly or material constructed where directed and, if approved, retained as a part of the work. A type of sample.

SD-18, Records

Documentation to ensure compliance with an administrative requirement or to establish an administrative mechanism. A type of administrative submittal.

SD-19, Operation and Maintenance Manuals

Data intended to be incorporated in an Operations and Maintenance Manual. A type of administrative submittal.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SUBMITTAL REGISTER
INSTRUCTIONS

1. Use submittal register form for the project's Submittal Register and to track progress of submittals as they are processed. Users may arrange Parts "A" and "B" side-by-side in a 3-ring notebook.

2. The Government will supply submittal register forms, with columns (a) through (e) completed to the extent that will be required by the Government. Consider these forms as being for convenience only. Correct variations from requirements shown in specification sections; ensure Submittal Register conforms to specification sections.

a. Column (a): Lists each specification section in which a submittal is required.

b. Column (b): Lists each submittal description (SD No. and type, e.g. SD-04, Drawings) required in each specification section. Follow each submittal description with the list of material or products to be addressed in each submittal description.

c. Column (c): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate submittal reviews. Do not consider entries in column (c) as limiting project requirements; do not consider that a blank must be filled in by Contractor or the Government.

d. Column (d): Indicates approving authority for each submittal. A "G" indicates approval by Contracting Officer; a blank indicates approval by QC Manager.

e. Column (e): Indicates, for submittals to be approved by Contracting Officer, specific reviewers other than QC organization. This column may or may not be filled out on the copy supplied by the Government.

3. Column (f) through column (i) will be used by Contractor, QC organization and the Government on their own copies to record data established by the Contractor.

a. Column (f): As submittals are processed, list a consecutive number assigned by Contractor for each group of submittals. Place this same number in the appropriate block of "Submittal Transmittal Form". For a resubmission, repeat transmittal control number of the original submittal with a suffix; e.g. No. "100B" is second resubmission of material originally transmitted under No. "100."

b. Column (g): List dates scheduled for approving authority to receive submittals. These dates are the scheduled beginnings of submittal review period. The Contractor proposes these dates and the Contracting Officer approves them to establish the approved Submittal Register.

c. Columns (h) and (i): Use to record Contractor's review when

forwarding submittals to the QC organization.

4. Column (j) through column (o) will be used by Contractor, QC organization, and the Government on their own copies, in the following manner:

Contractor

a. Column (j): Enter date submittal is delivered to QC organization if QC Manager is approving authority or to the Government via QC organization if Contracting Officer is approving authority.

b. Columns (k) and (l): No entries are required on Contractor's copy.

c. Columns (m) and (n): Enter action and date of action by approving authority as shown on returned submittal.

d. Column (o): Enter date Contractor receives an acted-on submittal.

QC organization

a. Column (j): Enter date QC organization receives submittal from Contractor.

b. Columns (k) and (l): If approving authority is Contracting Officer, enter date QC organization forwards certified submittal to Contracting Officer.

c. Columns (m) and (n): If approving authority is Contracting Officer, enter the Government action and date of action as shown on returned submittal. If approving authority is QC Manager, enter QC action and date of action.

d. Column (o): Enter date QC organization returns submittal to Contractor, regardless of who is approving authority. If QC Manager is approving authority, it is also the date the information copy is forwarded to the Government.

Government

a. Column (j): When Contracting Officer is approving authority, enter date submittal is received from QC organization.

b. Columns (k) and (l): When Contracting Officer is approving authority, enter date submittal is routed or received from specialized reviewer, such as fire protection engineer, architect-engineer, etc.

c. Columns (m) and (n): When approving authority is Contracting Officer, enter the Government action and date of action. When approving authority is QC organization, enter QC Manager action and date of action, as indicated on information copy forwarded by QC organization.

d. Column (o): When Contracting Officer is approving authority, enter

date submittal is returned to Contractor via QC organization.

Contract Number: 04-92-0056 | Project Title: INTERIM REMEDIAL ACTION - TANK FARM 5 NETC

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 01010	SD-18, Records	1.2.1				
2)	Report of subcontracts	1.2.1.1	G	ROICC		
3)	Work performed by Contractor	3.3.2	G	ROICC		
4)	required insurance	1.9.2	G	ROICC		
5)	Schedule of prices	1.11	G	ROICC		
6)	As-built drawings	1.15.1	G	ROICC		
7)	As-built record of materials	1.15.2	G	ROICC		
8)	Omitted					
9) 01011	SD-18, Records	1.3.1				
10)	Construction schedule	1.3.1.1	G	ROICC		
11)	Equipment delivery schedule	1.3.1.2	G	ROICC		
12)	Monthly update	1.3.1.4	G	ROICC		
13)	Accident Prevention Plan	3.3.5	G	ROICC		
14) 01300	SD-18, Records	1.3.1				
15)	Submittal register	1.3.1.1	G	ROICC		
16) 01400	SD-18, Records	1.2.1				
17)	Quality Control (QC) plan	1.6	G	ROICC		
18) 01560	SD-18, Records	1.3.1				
19)	Solid waste disposal permit	1.3.1.1	G	ROICC		
20)	Disposal permit for hazardous	1.3.1.2	G	ROICC		

* Navy Notes:
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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	waste					
2) 01680	SD-12, Field Test Reports	1.3.1				
3)	Extraction System Performance	1.3.1.1	G	ROICC		
4)	Monitoring					
5)	Ground Water Quality Monitoring	1.3.1.2	G	ROICC		
6)	Treatment Facility Operation	1.3.1.3	G	ROICC		
7)	Quality Assurance/Quality	1.3.1.4	G	ROICC		
8)	Control Plan					
9) 01680	SD-18, Records	1.3.2				
10)	Preliminary Operation and	3.3.1	G	ROICC		
11)	Maintenance Plan:					
12)	Operation and Maintenance Log	3.4.6	G	ROICC		
13)	Facility Operator Qualifications	1.4.1	G	ROICC		
14)	System Performance Monitoring	3.1	G	ROICC		
15)	Reports					
16)	Field notebooks	3.4.5	G	ROICC		
17)	Correspondence	3.5.2	G	ROICC		
18)	System start-up and prove-out	3.5.3	G	ROICC		
19)	report					
20)	Monthly progress reports	3.5.3	G	ROICC		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Quarterly program reports	3.5.3	G	ROICC		
2)	Annual progress reports	3.5.3	G	ROICC		
3)	Hazardous waste manifests	3.5.3	G	ROICC		
4) 01680	SD-19, Operation and Maintenance M	1.3.3				
5)	Operation and Maintenance	3.5.3	G	ROICC		
6)	Manuals					
7) 02050	SD-08, Statements	1.3.1				
8)	Demolition plan	1.3.1.1	G	A/E		
9) 02060	SD-08, Statements	1.3.1				
10)	Site safety and health plan	1.3.1.1	G	A/E		
11)	Excavation and material	1.3.1.2	G	A/E		
12)	handling plan					
13)	Field sampling and laboratory	1.3.1.3	G	A/E		
14)	testing plan					
15)	Piping removal and disposal plan	1.3.1.4	G	A/E		
16)	Qualification	1.3.1.5	G	A/E		
17) 02060	SD-18, Records	1.3.2				
18)	Contaminated soil disposal	3.14	G	A/E		
19)	paperwork					
20)	Contaminated water handling	3.14	G	A/E		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	paperwork					
2) 02102	SD-14, Samples	1.2.1				
3)	Tree wound paint	2.1				
4) 02221	SD-08, Statement	1.3.1				
5)	Shoring and sheeting plan	1.3.1.1	G	A/E		
6)	Dewatering system	1.3.1.2	G	A/E		
7) 02221	SD-12, Field Test Reports	1.3.2				
8)	Capillary water barrier	2.1.1.1	G	A/E		
9)	Omitted					
10)	Controlled fill and Controlled	2.1.2.1	G	A/E		
11)	backfill					
12)						
13) 02225	SD-08, Statements	1.3.1				
14)	Shoring and sheeting plan	1.3.1.1	G	A/E		
15)	Dewatering plan	1.3.1.2	G	A/E		
16) 02225	SD-11, Factory Test Reports	1.3.2				
17)						
18)	backfill	2.1.1	G	A/E		
19)	Pipe bedding	2.1.6	G	A/E		
20) 02225	SD-12, Field Test Reports	1.3.3				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Test for moisture-density	1.3.3.1				
2)	relation					
3)	Density and moisture tests	1.3.3.2				
4) 02511	SD-02, Manufacturer's Catalog Data	1.4.1				
5)	Precast car stops	2.1.4				
6) 02511	SD-08, Statements	1.4.2				
7)	Record	1.4.2.1	G	A/E		
8) 02511	SD-10, Test Reports	1.4.3				
9)	Trial batch	3.2.2.1				
10)	Mix design	1.4.3.1	G	A/E		
11) 02511	SD-12, Field Test Reports	1.4.4				
12)	materials	2.1				
13)	Pavement	3.2.2.3				
14) 02511	SD-13, Certificates	1.4.5				
15)	materials	2.1				
16) 02511	SD-14, Samples	1.4.6				
17)	sample	3.2				
18)	cores	3.2				
19) 02661	SD-02, Manufacturer's Catalog Data	1.3.1				
20)	Water service line	2.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Corporation stops	2.1.2.1				
2)	Curb stop	2.1.2.3				
3) 02661	SD-06, Instructions	1.3.2				
4)	Installation	3.1.1				
5) 02661	SD-13, Certificates	1.3.3				
6)	Water service line	2.1				
7) 02671	SD-04, Drawings	1.2.1				
8)	Rotary-drilled wells	1.2.1.1	G	A/E		
9) 02671	SD-08, Statements	1.2.2				
10)	Water disposal methods	3.8	G	A/E		
11)	Cuttings disposal methods	3.8	G	A/E		
12)	Filter sand placement equipment	3.4				
13)	Filter sand placement methods	3.4				
14) 02671	SD-12, Field Test Reports	1.2.3				
15)	Well hole	1.2.3.1	G	A/E		
16)	Pump test	3.9.1	G	A/E		
17) 02671	SD-13, Certificates	1.2.4				
18)	Casings	2.1.1	G	A/E		
19)	Cement	2.1.4	G	A/E		
20)	Bentonite Pellets	2.1.4.2	G	A/E		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Riser	2.1.1	G	A/E		
2)	Screens	2.1.2	G	A/E		
3)	Filter Sand	2.1.3	G	A/E		
4) 02671	SD-16, Sample Panels	1.2.5				
5)	Well hole	1.2.3.1	G	A/E		
6) 02730	SD-02, Manufacturer's Catalog Data	1.4.1				
7)	Pipeline materials	2.1				
8) 02730	SD-04, Drawings	1.4.2				
9)	Precast concrete manhole	2.2.1.1				
10) 02730	SD-13, Certificates	1.4.3				
11)	Pipeline materials	2.1				
12)	Precast concrete manhole	2.2.1.1				
13) 02740	SD-02, Manufacturer's Catalog Data	1.4.1				
14)	Collector main	2.1	G	A/E		
15)	Service line	2.1	G	A/E		
16)	Precast Concrete Manhole	2.4				
17)	Pressure Gauges	2.2	G	A/E		
18)	Gate Valves	2.1.2.5	G	A/E		
19)	Globe Valve	2.1.2.7	G	A/E		
20)	Water Meters	2.3	G	A/E		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Check Valve		G	A/E		
2)	Manhole Frame and Cover	2.4.1.1				
3) 02740	SD-06, Instructions	1.4.2				
4)	Installation	3.1				
5) 02740	SD-13, Certificates	1.4.3				
6)	Collector main	2.1	G	A/E		
7)	Service line	2.1	G	A/E		
8)	Pressure Gauges	2.2	G	A/E		
9)	Water Meter	2.3	G	A/E		
10)	Precast Concrete Manhole	2.4				
11)	Manhole Frame and Cover	2.4				
12) 02831	SD-02, Manufacturer's Catalog Data	1.2.1				
13)	Chain-link fencing	2.1				
14)	Accessories	2.1.4				
15) 02831	SD-04, Drawings	1.2.2				
16)	Gates	2.1.2				
17)						
18)	Post spacing	3.2.1				
19)	Location of gate, corner, end,	3.2.1				
20)	and pull posts					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 02831	SD-06, Instructions	1.2.3				
2)	Fence	3.2				
3)						
4) 02831	SD-10, Test Reports	1.2.4				
5)	Weight in ounces for zinc	1.2.4.1				
6)	coating					
7)	Thickness of PVC coating	1.2.4.1				
8)	Chemical composition and	1.2.4.1				
9)	thickness of aluminum alloy coating					
10) 02831	SD-13, Certificates	1.2.5				
11)	Fabric	2.1.1				
12)	Posts	2.1.3				
13)	Braces	2.1.3				
14)	Framing	2.1.2				
15)	Rails	2.1.3				
16)	Tension wires	3.2.4				
17)	Gates	2.1.2				
18) 02930	SD-02, Manufacturer's Catalog Data	1.3.1				
19)	Erosion control materials	2.10				
20)	Pesticides	2.9				

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SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Wood cellulose fiber mulch	2.6.4				
2) 02930	SD-10, Test Reports	1.3.2				
3)	Topsoil composition tests	2.2.4				
4) 03300	SD-02, Manufacturer's Catalog Data	1.3.1				
5)	Waterstops	2.2.9				
6)	Materials for curing concrete	2.2.10				
7)	Joint sealants	2.2.13				
8)	Joint filler	2.2.12				
9)	Vapor barrier	2.2.8				
10)	Epoxy bonding compound	2.2.14				
11)						
12) 03300	SD-04, Drawings	1.3.2				
13)	Reinforcing steel	1.3.2.1				
14)	Formwork	1.3.2.2				
15) 03300	SD-05, Design Data	1.3.3				
16)	mix design	2.1.1				
17) 03300	SD-08, Statements	1.3.4				
18)	Curing concrete elements	1.3.4.1				
19)	Form removal schedule	1.3.4.2				
20)	Pumping concrete	1.3.4.3				

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1)						
2)						
3) 03300	SD-10, Test Reports	1.3.5				
4)	Concrete mix design	1.3.5.1				
5)	Fly ash	1.3.5.2				
6)	Pozzolan	1.3.5.2				
7)	Ground iron blast-furnace slag	1.3.5.3				
8)	Aggregates	2.2.3				
9)						
10) 05500	SD-02, Manufacturer's Catalog Data	1.2.1				
11)	Manhole frames and covers	2.6	G	A/E		
12)	Cover plates and frames	2.5				
13)						
14) 05500	SD-04, Drawings	1.2.2				
15)	Manhole frames and covers	2.6	G	A/E		
16)						
17)	Cover plates and frames	2.5	G	A/E		
18)	angles and plates	2.8				
19) 05500	SD-13, Certificates	1.2.3				
20)	certificate	1.2.3.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 05500	SD-14, Samples	1.2.4				
2)	Aluminum surfaces	2.2.6				
3) 06101	SD-04, Drawings	1.2.1				
4)	Fabrications	2.4				
5) 06101	SD-13, Certificates	1.2.2				
6)	Lumber	2.1.1				
7)	Softwood plywood	2.1.3				
8)						
9)	Particleboard	2.1.4				
10) 07160	SD-02, Manufacturer's Catalog Data	1.2.1				
11)	Asphalt	2.1				
12)	Asphalt primer	2.2				
13)	Coal-tar pitch	2.4				
14)	Creosote primer	2.3				
15)	Fibrous asphalt	2.5				
16) 07230	SD-02, Manufacturer's Catalog Data	1.2.1				
17)	Insulation	2.1				
18)	Adhesive	2.2				
19)	Mechanical fasteners	2.2				
20)	Protection board or coating	2.3				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 08110	SD-02, Manufacturer's Catalog Data	1.2.1				
2)	Doors	2.1	G	A/E		
3)	Frames	2.5				
4)	Accessories	2.3	G	A/E		
5)	Weatherstripping	2.6				
6) 08110	SD-03, Manufacturer's Standard Col	1.2.2				
7)	Factory-applied enamel finish	2.8.3				
8) 08110	SD-04, Drawings	1.2.3				
9)	Doors	2.1	G	A/E		
10)	Frames	2.5				
11)	Accessories	2.3	G	A/E		
12)	Weatherstripping	2.6				
13) 08110	SD-07, Schedules	1.2.4				
14)	Doors	2.1				
15)	Frames	2.5				
16) 08360	SD-02, Manufacturer's Catalog Data	1.2.1				
17)	Doors	2.2	G	A/E		
18) 08360	SD-04, Drawings	1.2.2				
19)	Doors	2.2	G	A/E		
20) 08360	SD-06, Instructions	1.2.3				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Doors	2.2				
2) 08360	SD-19, Operation and Maintenance M	1.2.4				
3)	Doors	2.2				
4) 08710	SD-02, Manufacturer's Catalog Data	1.2.1				
5)	Hardware items	2.2	G	A/E		
6) 08710	SD-06, Instructions	1.2.2				
7)	Installation	3.1				
8) 08710	SD-07, Schedules	1.2.3				
9)	Hardware schedule	1.2.3.1				
10)						
11) 08710	SD-18, Records	1.2.4				
12)	Key bitting	1.2.4.1	G	A/E		
13) 08710	SD-19, Operation and Maintenance M	1.2.5				
14)	Hardware Schedule	1.2.3.1				
15) 08800	SD-06, Instructions	1.2.1				
16)	Setting and sealing materials	2.2				
17)	Glass setting	3.2				
18) 09100	SD-04, Drawings	1.2.1				
19)	Metal support systems	2.1				
20) 09250	SD-02, Manufacturer's Catalog Data	1.2.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Gypsum board	2.1.1				
2)	Fasteners	2.1.3				
3)	Joint treatment materials	2.1.2				
4)	Accessories	2.1.4				
5) 09900	SD-06, Instructions	1.2.1				
6)						
7)	Manufacturer's material safety	1.6.2				
8)	data sheets					
9) 09900	SD-07, Schedules	1.2.2				
10)	Piping and conduit	3.7				
11)	identification					
12) 09900	SD-08, Statements	1.2.3				
13)	Applicator's qualifications	1.2.3.1				
14)	Evidence of acceptable variation	1.2.3.2				
15) 09900	SD-13, Certificates	1.2.4				
16)	Coating	1.2.4.1				
17)	Sealant	1.2.4.1				
18) 10522	SD-02, Manufacturer's Catalog Data	1.3.1				
19)	Fire extinguishers	2.1	G	A/E		
20) 10800	SD-02, Manufacturer's Catalog Data	1.2.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Manufactured units	2.3				
2) 10800	SD-13, Certificates	1.2.2				
3)	Manufactured units	2.3				
4) 10800	SD-14, Samples	1.2.3				
5)	Manufactured units	2.3				
6) 11308	SD-02 Manufacturer's Catalog Data	1.3.1				
7)	Chemical Feed System	2.2	G	A/E		
8) 11308	SD-04 Drawings	1.3.2				
9)	Chemical Feed System	2.2	G	A/E		
10) 11308	SD-06 Instructions	1.3.3				
11)	Chemical Feed System	2.2	G	A/E		
12) 11308	SD-07 Schedules	1.3.4				
13)	Chemical Feed System	2.2	G	A/E		
14) 11308	SD-09 Test Reports	1.3.5				
15)	Testing	3.3	G	A/E		
16) 11308	SD-13 Certificates	1.3.6				
17)	Chemicals	2.1	G	A/E		
18) 11308	SD-19 Operation and Maintenance Ma	1.3.7				
19)	Chemical Feed System	2.2	G	A/E		
20) 11309	SD-02, Manufacturer's Catalog Data	1.4.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Pumps	2	G	A/E		
2)	Materials	2	G	A/E		
3)	Motors	2	G	A/E		
4)	Finishes	2	G	A/E		
5)	Pump Controllers	2	G	A/E		
6) 11309	SD-05, Design Data	1.4.2				
7)	Pump Curves	2	G	A/E		
8) 11309	SD-19, Operations and Maintenance	1.4.3				
9)	Pumps	2	G	A/E		
10)	Pump Contollers	2	G	A/E		
11)	Safety Precautions	2	G	A/E		
12)	Temperature Restriction	2				
13)	Manufacturer's Installation	3.1				
14)	Procedure					
15) 11339	SD-04, Drawings	1.3.1				
16)	Package Flocculator/Clarifier	1.2.1	G	A/E		
17)	System					
18) 11339	SD-05, Design Data	1.3.2				
19)	Package Flocculator/Clarifier	1.2.1	G	A/E		
20)	System					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 11339	SD-06, Instruction	1.3.3				
2)	Flocculator/clarifier	1.2.1	G	A/E		
3) 11339	SD-12, Field Test Reports	1.3.4				
4)	Inspection	3.1	G	A/E		
5)	Preoperational test	3.3.1	G	A/E		
6)	In-service test	3.3.2	G	A/E		
7) 11339	SD-13, Certificates	1.3.5				
8)	Flocculator/clarifier corrosion	2.2.1	G	A/E		
9)	protection					
10) 11339	SD-19, Operation and Maintenance M	1.3.6				
11)	Package flocculator/clarifier	1.2.1	G	A/E		
12) 11366	SD-02, Manufacturer's Catalog Data	1.4.1				
13)	Tank Valving and Piping	2.4	G	A/E		
14)	Controls	1.5	G	A/E		
15)	Filter Media	2.3	G	A/E		
16)	Underdrain System	2.2	G	A/E		
17)	Pressure Tank	2.1	G	A/E		
18) 11366	SD-19, Operation and Maintenance M	1.4.2				
19)	Pressure Filter System	1.5	G	A/E		
20) 11367	SD-02, Manufacturer's Catalog Data	1.3.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Filter Press System	2.2	G	A/E		
2) 11367	SD-05, Design Data	1.3.2				
3)	Filter Press System	2.2	G	A/E		
4) 11367	SD-18, Records	1.3.3				
5)	Posted operating instructions	1.5	G	A/E		
6) 11367	SD-19, Operations and Maintenance	1.3.4				
7)	Filter Press, Data Package 3	2.2	G	A/E		
8) 11368	SD-02, Manufacturers Catalog Data UV Oxidation Treatment System	1.41 3.1	G	A/E		
9) 11368	SD-04, Drawings UV Oxidation Treatment System	1.4.2 3.1	G	A/E		
10) 11368	SD-05, Design Data UV Oxidation Treatment System	1.4.3 3.1	G	A/E		
11) 11368	SD-12, Field Test Reports VOC Removal Treatment Tests	1.4.4 3.1	G	A/E		
12)	Omitted					
13) 11368	SD-19, Operation and Maintenance M	1.4.5				
14)	UV Oxidation Treatment System		G	A/E		
15) 11369	SD-02, Manufacturer's Catalog Data	1.4.1				
16)	Tank	2.1	G	A/E		
17)	Carbon	2.2	G	A/E		
18)	Pipe Connection and Fittings	2.1	G	A/E		
19)	Pressure Gauge	2.1	G	A/E		
20)	Air Release Valve	2.1	G	A/E		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 11369	SD-04, Drawings	1.4.2				
2)	Carbon Adsorber	2.1	G	A/E		
3)	Appurtenant Equipment	2.1	G	A/E		
4) 11369	SD-18, Records	1.4.3				
5)	Manufacturer's Installation	3.1	G	A/E		
6)	Procedure					
7) 11369	SD-19, Operation and Maintenance M	1.4.4				
8)	Carbon Adsorber	2.1	G	A/E		
9) 13121	SD-02, Manufacturer's Catalog Data	1.5.1				
10)	materials	2.1	G	A/E		
11) 13121	SD-03, Manufacturer's Standard Col	1.5.2				
12)	Factory color finish	2.9.2	G	A/E		
13) 13121	SD-04, Drawings	1.5.3				
14)	Preengineered building	1.5.3.1	G	A/E		
15)	anchor bolts	1.5.4.1	G	A/E		
16) 13121	SD-05, Design Data	1.5.4				
17)	Building	1.5.4.1	G	A/E		
18)	Foundation loads	1.2.3	G	A/E		
19)	Anchor bolts	1.5.4.1	G	A/E		
20)						

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Omitted					
2) 13121	SD-11, Factory Tests	1.5.5				
3)	Factory Color Finish	2.9.2				
4)	Insulation	2.7				
5) 13121	SD-13, Certificates	1.5.6				
6)	materials	2.1	G	A/E		
7) 13121	SD-19, Operation and Maintenance M	1.5.7				
8)	Preengineered Building	1.5.3.1	G	A/E		
9) 15275	SD-02, Manufacturer's Catalog Data	1.3.1				
10)	Shop drawings	2				
11)	Materials	2				
12)	Tank Mixer	2				
13) 15275	SD-06, Instructions Manufacturers Installation Instruction	1.3.2 3.1				
14) 15400	SD-02, Manufacturer's Catalog Data	1.3.1				
15)	Pipe and fittings	2.1				
16)	Valves	2.2.2				
17)	Plumbing fixtures	2.4				
18)	Water heaters	2.5				
19)	Pipe hangers and supports	2.3.4				
20)	Omitted					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Omitted					
2)	Water meters	2.2.3	G	A/E		
3)	Omitted					
4)	Drains	2.1.4				
5)	Omitted					
6)	Backflow preventers	2.2.4	G	A/E		
7)	Omitted					
8) 15400	SD-19, Operation and Maintenance M	1.3.2				
9)	Water heaters	2.5				
10)	Omitted					
11) 15405	SD-02, Manufacturer's Catalog Data	1.3.1				
12)	Pipe and fittings	2.1	G	A/E		
13)	Valves	2.1.3	G	A/E		
14)	Pipe hangers and supports	2.2.3	G	A/E		
15)	Omitted					
16) 15483	SD-02, Manufacturer's Catalog Data	1.4.1				
17)	Pipe and fittings	2.1	G	A/E		
18)	Valves	2.1.3				
19)	Flexible hose	2.1.4.1				
20)	Dielectric unions	2.1.4.2				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Strainers	2.1.4.4				
2)	Instruments	2.1.5	G	A/E		
3)	Storage tanks	2.2	G	A/E		
4)	Copper tube extracted joint	3.1.4.1				
5) 15483	SD-06, Instructions	1.4.2				
6)	Copper tube extracted joint	3.1.4.1				
7) 15483	SD-13, Certificates	1.4.3				
8)	Flexible hose	2.1.4.1				
9)	Dielectric unions	2.1.4.2				
10)	Tank surface preparation	2.1.6				
11)	Coating materials	2.1.6				
12)	Coating application procedure	2.1.6				
13)	Omitted					
14) 15488	SD-02, Manufacturer's Catalog Data	1.3.1				
15)	Air compressor	2.1	G	A/E		
16)	Omitted					
17)	Air receiver	2.2	G	A/E		
18)	Desiccant air dryers	2.3	G	A/E		
19)	Desiccant	2.3				
20)	Pipe	2.4.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Fittings	2.4.1				
2)	Valves	2.4.2				
3)	Pressure gages	2.4.3				
4)	Hangers and supports	2.4.4				
5)	Quick disconnect couplings	2.4.5				
6)	Filters	2.4.6				
7)	Strainers	2.4.7				
8)	Traps	2.4.8				
9)	Lubricators	2.4.9				
10)	Flexible connections	2.4.10				
11)	Dielectric unions	2.4.11				
12)	Omitted					
13)	Omitted					
14)	Identification labels for piping	2.5				
15)	Omitted					
16) 15488	SD-06, Instruction	1.3.2				
17)	Air receiver	2.2				
18) 15488	SD-08, Statements	1.3.3				
19)	Welding and brazing procedures	3.1.3				
20)	Welding procedure qualifications	1.4.1				

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Contract Number: 04-92-0056 | Project Title: INTERIM REMEDIAL ACTION - TANK FARM 5 NETC

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Brazing procedure qualifications	1.4.2				
2)	Welder and brazer qualifications	1.4.3				
3)	Cleaning and flushing procedures	3.1.1.3				
4) 15488	SD-10, Test Reports	1.3.4				
5)	Air compressor	2.1	G	A/E		
6)	Air receiver	2.2	G	A/E		
7)	Hydrostatic tests	3.2.2.2	G	A/E		
8)	Leak tightness tests	3.2.2.2	G	A/E		
9) 15488	SD-18, Records	1.3.5				
10)	air compressor	2.1	G	A/E		
11)	Omitted					
12) 15488	SD-19, Operation and Maintenance M	1.3.6				
13)	Air compressor	2.1	G	A/E		
14)	Omitted					
15) 15621	SD-02, Manufacturer's Catalog Data	1.3.1				
16)	Central furnaces	2.1.1	G	A/E		
17)	Air filters	2.2.1	G	A/E		
18) 15621	SD-12, Field Test Reports	1.3.2				
19)	Operating tests	3.3.2	G	A/E		
20)	Firing tests	3.3.3	G	A/E		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 15621	SD-13, Certificates	1.3.3				
2)	Central furnaces	2.1.1	G	A/E		
3) 15621	SD-18, Records	1.3.4				
4)	Posted operating instructions	1.4	G	A/E		
5) 15621	SD-19, Operations and Maintenance	1.3.5				
6)	Central furnaces	2.1.1	G	A/E		
7) 15850	SD-02, Manufacturer's Catalog Data	1.3.1				
8)	Fans	2.1	G	A/E		
9) 15850	SD-12, Field Test Reports	1.3.2				
10)	Preliminary tests	3.3.2				
11)	Air handling and distribution	3.3.3				
12)	equipment tests					
13)	Omitted					
14) 15850	SD-13, Certificates	1.3.3				
15)	Fans	2.1				
16) 15850	SD-19, Operation and Maintenance M	1.3.4				
17)	Fans	2.1				
18) 15895	SD-02, Manufacturer's Catalog Data	1.4.1				
19)	Dampers	2.7				
20)	Omitted					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Louvers	2.7				
2)	Omitted					
3)	Diffusers, registers, and	2.4				
4)	grilles					
5)	Metal ducts	2.1				
6)	Omitted					
7) 15895	SD-04, Drawings	1.4.2				
8)	Omitted					
9)	Duct hangers and supports	3.1.2				
10) 15895	SD-05, Design Data	1.4.3				
11)	Duct span versus reinforcement	1.4.3.1				
12)	schedule					
13) 15895	SD-06, Instructions	1.4.4				
14)	Ductwork and ductwork	1.4.4.1				
15)	accessories					
16) 15895	SD-07, Schedules	1.4.5				
17)	Diffusers, registers, and	2.4				
18)	grilles					
19)	Duct hangers and supports	3.1.2				
20)	Omitted					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Omitted					
2) 15895	SD-10, Test Reports	1.4.6				
3)	Omitted					
4)	Sound pressure level rating	1.4.6.1				
5)	Louvers	2.7				
6) 15895	SD-11, Factory Test Reports	1.4.7				
7)	Omitted					
8)	Omitted					
9)	Plenum or casing acoustical	1.4.7.1				
10)	tests					
11) 15895	SD-12, Field Test Reports	1.4.8				
12)	Air duct leakage tests	3.2.1				
13)	Omitted					
14)	Omitted					
15)	Omitted					
16)	Omitted					
17)	Omitted					
18)	Omitted					
19) 15996	SD-08, Statements	1.4.1				
20)	Independent TAB agency	1.4.1.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	personnel qualifications					
2)	Design review report	1.4.1.2				
3)	Pre-field DALT preliminary	1.4.1.3				
4)	notification					
5)	Pre-field TAB engineering report	1.4.1.4				
6)	Advanced notice for DALT field	1.4.1.5				
7)	work					
8)	Advanced notice for Season 1	1.4.1.5				
9)	TAB field work					
10)	Check out list for Season 1	1.4.1.6				
11)	Advanced notice for Season 2	1.4.1.5				
12)	TAB field work					
13)	Check out list for Season 2	1.4.1.6				
14)	Pre-final DALT report	3.1.2				
15)	certified DALT report	1.4.2.1				
16) 15996	SD-12, Field Test Reports	1.4.2				
17)	Certified DALT report	1.4.2.1				
18)	Certified TAB report for Season	1.4.2.2				
19)	1					
20)	Certified TAB report for Season	1.4.2.2				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	2					
2) 16375	SD-02, Manufacturer's Catalog Data	1.4.1				
3)	Conduit	2.1.1				
4)	Insulating tape	2.1.3				
5)	Medium voltage cable	2.1.7	G	A/E		
6)	Medium voltage cable joints	3.1.6.2	G	A/E		
7)	Medium voltage cable terminators	2.1.8	G	A/E		
8)	Kilowat Hour/Demand Submeter	2.1.14				
9)	Precast concrete structures	2.1.12.1	G	A/E		
10)	Frames and covers	2.1.12.2				
11)	Cable lubricants	3.1.5.1				
12)	Sealing material	2.1.12.1				
13)	Telephone cable and splices	2.1.9				
14)	Omitted					
15)	Ground rod	3.1.8.5				
16) 16375	SD-04, Drawings	1.4.2				
17)	Conduit	2.1.1				
18)	Insulating tape	2.1.3				
19)	Medium voltage cable	2.1.7	G	A/E		
20)	Medium voltage cable joints	3.1.6.2	G	A/E		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Medium voltage cable terminators	2.1.8	G	A/E		
2)	Precast concrete structures	2.1.12.1	G	A/E		
3)	frames and covers	2.1.12.2				
4)	Telephone cable and splices	2.1.9				
5)	Precast manholes	2.1.12.1				
6)	Omitted					
7)	Omitted					
8) 16375	SD-06, Instructions	1.4.3				
9)	Ground megger	1.4.3.1				
10)	Terminator	2.1.8.2				
11)	Termination kit	3.1.6				
12)	Omitted					
13) 16375	SD-08, Statements	1.4.4				
14)	Cable splicer/terminator	3.1.6.3				
15) 16375	SD-10, Test Reports	1.4.5				
16)	heat shrinkable joint kit	1.4.5.1				
17) 16375	SD-11, Factory Test Reports	1.4.6				
18)	Medium voltage cable	2.1.7				
19) 16375	SD-12, Field Test Reports	1.4.7				
20)	Insulation resistance test	3.2.3				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Continuity test	3.2.2.1				
2)	High potential (hi-pot) test	3.2.3.2				
3)	600 volt cable tests	3.2.1				
4)	Medium voltage cable tests	3.2.2				
5)	Grounding systems	3.1.8				
6)	Medium voltage cable	2.1.7				
7) 16375	SD-13, Certificates	1.4.8				
8)	Precast concrete structures	2.1.12.1				
9)	frames and covers	2.1.12.2				
10)	Medium voltage cable	2.1.7				
11)	Medium voltage cable terminators	2.1.8				
12)	Medium voltage cable joints	3.1.6.2				
13) 16402	SD-02, Manufacturer's Catalog Data	1.3.1				
14)	Receptacles	2.9				
15)	Circuit breakers	2.10.2				
16)	Switches	2.8				
17)	Conduit and fittings	2.2				
18)	Device plates	2.7				
19)	Wires and cables	2.5				
20)	Outlet boxes and covers	2.3				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Omitted					
2) 16402	SD-04, Drawings	1.3.2				
3)	Panelboards	2.10	G	A/E		
4)	Omitted					
5)	Motor control centers	2.14	G	A/E		
6) 16402	SD-08, Statements	1.3.3				
7)	Fuses	2.11				
8) 16402	SD-11, Factory Test Reports	1.3.4				
9)	Transformer tests	1.3.4.1				
10) 16402	SD-12, Field Test Reports	1.3.5				
11)	600-volt wiring test	3.2.2				
12)	Grounding system test	3.2.3				
13)	Omitted					
14)	Omitted					
15) 16462	SD-02, Manufacturer's Catalog Data	1.3.1				
16)	Pad-mounted transformers,	2.2	G	A/E		
17)	dead-front					
18)	Insulated high-voltage	2.2.1.1	G	A/E		
19)	load-break connectors					
20)	Omitted					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Surge arresters	2.2.1.1	G	A/E		
2)	Omitted					
3)	Omitted					
4)	Bushing well inserts	2.2.1.1	G	A/E		
5)	Insulated standoff bushings	2.2.1.1	G	A/E		
6)	Insulated protective caps	2.2.1.1	G	A/E		
7) 16462	SD-04, Drawings	1.3.2				
8)	Pad-mounted transformers,	2.2	G	A/E		
9)	dead-front					
10) 16462	SD-09, Reports	1.3.3				
11)	routine and other tests	1.3.3.1	G	A/E		
12)	design tests	1.3.3.2	G	A/E		
13) 16462	SD-12, Field Test Reports	1.3.4				
14)	Acceptance checks and tests	3.5.1	G	A/E		
15)	Ground resistance test reports	1.3.4.1	G	A/E		
16) 16462	SD-18 Records	1.3.5				
17)	Transformer Test Schedule	1.3.5.1	G	A/E		
18) 16462	SD-19, Operation and Maintenance M	1.3.6				
19)	Pad-mounted transformers,	2.2	G	A/E		
20)	dead-front					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 16510	SD-02, Manufacturer's Catalog Data	1.4.1				
2)	Fluorescent lighting fixtures	2.1	G	A/E		
3)	Fluorescent lamps	2.1.1				
4)	Fluorescent core and coil	2.1.2				
5)	ballasts					
6)	Emergency lighting equipment	2.3	G	A/E		
7) 16530	SD-02, Manufacturer's Catalog Data	1.5.1				
8)	Luminaires	2.2	G	A/E		
9)	Lamps	2.2.1				
10)	Ballasts	2.2.2				
11) 16530	SD-04, Drawings	1.5.2				
12)	Luminaires	2.2	G	A/E		
13) 16530	SD-12, Field Test Reports	1.5.3				
14)	Operating test	3.2				
15) 16722	SD-02, Manufacturer's Catalog Data	1.4.1				
16)	Control panel	2.1	G	ND408		
17)	Storage batteries	2.2.1	G	ND408		
18)	Battery charger	2.2.2	G	ND408		
19)	Steel cabinet	2.1	G	ND408		
20)	Manual pull station	2.3	G	ND408		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Heat detectors	2.4	G	ND408		
2)	Alarm horns	2.5	G	ND408		
3)	Visual alarms	2.6	G	ND408		
4)	Main annunciator	2.1.1	G	ND408		
5)	Auxiliary transmitter	2.7	G	ND408		
6)	Wiring	2.12	G	ND408		
7)	Ground rods	2.8.1	G	ND408		
8)	Conduit	2.9	G	ND408		
9)	Outlet boxes	2.10	G	ND408		
10)	Fittings for conduit and outlet	2.11	G	ND408		
11)	boxes					
12) 16722	SD-04, Drawings	1.4.2		ND408		
13)	Fire alarm system	1.5.1	G			
14) 16722	SD-05, Design Data	1.4.3		ND408		
15)	Standby power calculations	1.4.3.1	G	ND408		
16) 16722	SD-08, Statements	1.4.4				
17)	Qualifications of installer	1.2	G	ND408		
18) 16722	SD-12, Field Test Reports	1.4.5				
19)	Preliminary testing	3.2.1	G	ND408		
20)	Final acceptance testing	3.2.2	G	ND408		

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 16722	SD-18, Records	1.4.6				
2)	System as-built drawings	1.4.6.1	G	ND408		
3) 16722	SD-19, Operation and Maintenance M	1.4.7				
4)	Fire alarm system	1.5.1	G	ND408		
5) 16741	SD-02, Manufacturer's Catalog Data	1.3.1				
6)	Wire and cable	2.3	G	A/E		
7)	Cable splices, and connectors	2.2	G	A/E		
8) 16901	SD-02, Manufacturer's Catalog Data	1.3.1				
9)	Starters		G	A/E		
10)	Alarm		G	A/E		
11)	Wiring and Cabling	2.1.2	G	A/E		
12)	Instrumentation Drawings		G	A/E		
13) 16901	SD-04, Drawings	1.3.2				
14)	Process Power MCC					
15)	Pump Control MCC A&B					

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(PART B) SUBMITTAL REGISTER

Location: | Contractor:

CONTRACTOR ACTION			APPROVING AUTHORITY ACTION				CONTR	
ACT. CODE	DATE OF ACTION	DATE FWD TO APPR AUTH / DATE RECD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RECD FROM OTH REVIEWER	ACT. CODE	DATE OF ACTION	MAILED TO CONTR / RECD FROM APPR AUTH	REMARKS
(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
								1)
								2)
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								17)
								20)

ACTION CODES: NR: Not Reviewed AN: Approved as Noted
A: Approved RR: Disapproved; Revise and Resubmit
(Others may be prescribed by the Transmittal Form)

SECTION 01400

QUALITY CONTROL (QC)

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 A 880	1989 Criteria for use in Evaluation of Testing Laboratories and Organizations for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
ASTM C 1077	1991 (Rev. A) Laboratories Testing Concrete and Concrete Aggregates for Use In Construction and Criteria for Laboratory Evaluation
ASTM D 3666	1991 (Rev. A) Evaluating and Qualifying 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 Use in the Evaluation of Testing and Inspection Agencies as Used in Construction
ASTM E 543	1989 (Rev. A) Determining the Qualification of Nondestructive Testing Agencies

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 15 calendar days after award of the contract.

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 AM the next working day after each day that work is performed;

b. Testing Plan and Log, 1 copy, at the end of each month;

c. Monthly Summary Report of Field Tests: Original and 1 copy attached to the Contractor Quality Control Report at the end of each month;

d. QC Meeting Minutes: 1 copy, within 2 calendar days of the meeting;

e. Rework Items List: 1 copy, by the last working day of the month and;

f. QC Certifications: As required by the paragraph entitled "QC Certifications."

1.4 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Manager, a QC Plan, a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review, submittal approval except for submittals designated for Contracting Officer approval, testing, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this contract. The QC program shall cover construction operations on-site and off-site and shall be keyed to the proposed construction sequence.

1.5 QC MANAGER

1.5.1 Duties

Provide a QC Manager at the work site to manage and implement the QC program. The only duties and responsibility the QC Manager shall have on this Contract is managing and implementing the QC program. The QC Manager is required to attend the QC Plan meeting, 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 the work site. The QC Manager shall report directly to an officer of the firm and shall not be the same individual as, nor be subordinate to, the project superintendent or the project manager.

1.5.2 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 which included the major trades that are part of this Contract.

1.5.3 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager shall be the same as for the QC manager.

1.6 QUALITY CONTROL (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. Name and qualifications, in resume format, for the QC Manager.

b. A letter signed by an officer of the firm appointing the QC Manager and stating that he/she is responsible for 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 non-conforming work.

c. Procedures for reviewing, approving and managing submittals. Provide the names of the persons authorized to review and certify submittals prior to approval.

d. Testing laboratory information required by the paragraphs entitled "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. Documentation procedures, including proposed report formats.

h. A listing of outside organizations such as testing laboratories, architects, and consulting engineers that will be employed by the Contractor and a description of the services these firms will provide.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and requires separate control requirements. As a minimum, if approved by the Contracting Officer, consider each division of the specifications as a definable feature of work. However, at times, there may be more than one definable feature of work in each division of the specifications.

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 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 the QC Manager 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, a minimum of seven calendar days prior to a proposed change. Proposed

changes must be approved by the Contracting Officer.

1.7 COORDINATION AND MUTUAL UNDERSTANDING MEETING

Prior to submission of the QC Plan and 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 the 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 the QC Manager 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.

1.8 QC MEETINGS

After the start of construction, the QC Manager shall conduct QC meetings once every two weeks at the work site with the project superintendent and the foreman responsible for the upcoming work. 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 any of 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;

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. Schedule the three phases of control and testing:
   - 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; and

f. Address items that may require revising the QC plan:
   - Changes in procedures.

1.9 THREE PHASES OF CONTROL

The QC Manager shall perform the three phases of control 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.

1.9.1 Preparatory Phase

Notify the Contracting Officer at least 2 working days in advance of each preparatory phase. Conduct the preparatory phase with the superintendent, and the foreman responsible for the definable feature of work. Document the results of the 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 each paragraph of the applicable specification sections;

b. Review the contract drawings;

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.

1.9.2 Initial Phase

Notify the Contracting Officer at least 2 working 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 foreman responsible for that definable feature of work. 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 requir d;

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.

1.9.3 Follow-Up Phase

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

a. Ensure the work is in compliance with Contract requirements;

b. Maintain the quality of workmanship required;

c. Ensure that testing is performed; and

d. Ensure that rework items are being corrected.

1.9.4 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least two weeks prior to the start of the preparatory and initial phases.

1.10 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01300, "Submittals."

1.11 TESTING

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

1.11.1 Testing Laboratory Requirements

Provide an independent testing 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 entitled "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 (P.E) 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.

1.11.2 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.

1.11.3 Inspection of Testing Laboratories

Prior to approval of non-accredited 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.

1.11.4 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.

1.11.5 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 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.

1.12 QC CERTIFICATIONS

1.12.1 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."

1.12.2 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.

1.12.3 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."

1.13 DOCUMENTATION

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

1.13.1 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 throughout the life of the Contract. 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 on the following:
- 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 description of incident and proposed action.)

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 which 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.

1.13.2 Contractor Quality Control Report

Reports are required for each day that work is performed and for every seven 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 the 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 the 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 and include a list of who performed the tests.

d. Results of the Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report

for this definable featur of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed and includ a list of who performed the tests.

e. Results of the three phases of control for off-site work, if applicable, including actions taken.

f. List the rework items identified, but not corrected by close of business.

g. List the rework items corrected from the rework items list along with the corrective action taken.

h. Include a "remarks" section in this report which will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, construction deficiencies encountered, QC meetings held, acknowledgement that as-built drawings have been updated, corrective direction given by the QC Manager and corrective action taken by the Contractor.

i. Contractor Quality Control Report certification.

1.13.3 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, any 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.

1.13.4 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.

1.13.5 As-Built Drawings

The QC Manager is required to review the as-built drawings required by Section 01010, "General Paragraphs," to ensure that as-built drawings are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. The QC Manager shall initial each deviation or revision. Upon completion of work, the QC Manager shall submit a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.13.6 Report Forms

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

a. Combined Contractor Production Report and Contractor Quality Control Report (1 sheet), with separate continuation sheet.

b. Testing Plan and Log.

c. Rework Items List.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

CONTRACTOR PRODUCTION REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE		
CONTRACT NO	TITLE AND LOCATION	REPORT NO
CONTRACTOR	SUPERINTENDENT	
AM WEATHER / PM WEATHER	MAX TEMP °F	MIN TEMP °F

WORK PERFORMED TODAY

WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

JOB SAFETY

WAS A JOB SAFETY MEETING HELD THIS DATE? ☐ YES ☐ NO
(If YES attach copy of the meeting minutes)

WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? ☐ YES ☐ NO
(If YES attach copy of completed OSHA report)

WAS TRENCHING/SCAFFOLD/HV ELECTRICAL/HIGH WORK DONE? ☐ YES ☐ NO
(If YES attach statement or checklist showing inspection performed)

WAS HAZARDOUS MATERIAL/WASTE RELEASED INTO THE ENVIRONMENT? ☐ YES ☐ NO
(If YES attach description of incident and proposed action)

TOTAL WORK HOURS ON JOB SITE THIS DATE	
CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT	
TOTAL WORK HOURS FROM START OF CONSTRUCTION	

LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED

SAFETY REQUIREMENTS HAVE BEEN MET

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY INCLUDE NUMBER OF HOURS USED TODAY

REMARKS

CONTRACTOR/SUPERINTENDENT

DATE

FORM 01400-1 6/91

Sheet of

C NTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

PHASE	Y - YES; N - NO, SEE REMARKS; BLANK - NOT APPLICABLE	IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND *LIST PERSONNEL PRESENT*
PREPARATORY	THE PLANS AND SPECS HAVE BEEN REVIEWED.	
	THE SUBMITTALS HAVE BEEN APPROVED.	
	MATERIALS COMPLY WITH APPROVED SUBMITTALS.	
	MATERIALS ARE STORED PROPERLY.	
	PRELIMINARY WORK WAS DONE CORRECTLY.	
	TESTING PLAN HAS BEEN REVIEWED.	
	WORK METHOD AND SCHEDULE DISCUSSED	
INITIAL	PRELIMINARY WORK WAS DONE CORRECTLY.	TESTING PERFORMED & WHO PERFORMED TEST
	SAMPLE HAS BEEN PREPARED/APPROVED.	
	WORKMANSHIP IS SATISFACTORY.	
	TEST RESULTS ARE ACCEPTABLE.	
	WORK IS IN COMPLIANCE WITH THE CONTRACT.	
FOLLOW-UP	WORK COMPLIES WITH CONTRACT AS APPROVED IN INITIAL PHASE.	TESTING PERFORMED & WHO PERFORMED TEST

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)

REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

REMARKS

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.

AUTHORIZED QC MANAGER AT SITE

DATE

GOVERNMENT QUALITY ASSURANCE REPORT

DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

GOVERNMENT QUALITY CONTROL MANAGER

DATE

FORM 01400-1 6/91

(Back)

Sheet of

CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE	
CONTRACT NO.	REPORT NO

PHASE	Y - YES, N - NO, SEE REMARKS; BLANK - NOT APPLICABLE		IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND *LIST PERSONNEL PRESENT*
PREPARATORY	THE PLANS AND SPECS HAVE BEEN REVIEWED.		
	THE SUBMITTALS HAVE BEEN APPROVED.		
	MATERIALS COMPLY WITH APPROVED SUBMITTALS.		
	MATERIALS ARE STORED PROPERLY.		
	PRELIMINARY WORK WAS DONE CORRECTLY.		
	TESTING PLAN HAS BEEN REVIEWED		
	WORK METHOD AND SCHEDULE DISCUSSED		

PHASE	Y - YES, N - NO, SEE REMARKS, BLANK - NOT APPLICABLE		IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND *LIST PERSONNEL PRESENT*	TESTING PERFORMED & WHO PERFORMED TEST
INITIAL	PRELIMINARY WORK WAS DONE CORRECTLY.			
	SAMPLE HAS BEEN PREPARED/APPROVED.			
	WORKMANSHIP IS SATISFACTORY.			
	TEST RESULTS ARE ACCEPTABLE.			
	WORK IS IN COMPLIANCE WITH THE CONTRACT.			

FORM 01400-2 6/91

CONTRACTOR QUALITY C NTR L REPORT CONTINUATION SHEET

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

CONTRACT NO.	DATE
	REPORT NO

PHASE	Y - YES, N - NO, SEE REMARKS; BLANK - NOT APPLICABLE	IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND *LIST PERSONNEL PRESENT*	TESTING PERFORMED & WHO PERFORMED TEST
FOLLOW-UP	WORK COMPLIES WITH CONTRACT AS APPROVED IN INITIAL PHASE.		

REWORK ITEMS LIST

Contract No. and Title:_____

Contractor:_____

NUMBER	DATE IDENTIFIED	DESCRIPTION	CONTRACT REQUIREMENT (Spec. Section and Par. No., Drawing No. and Detail No., etc.)	ACTION TAKEN BY QC MANAGER	RESOLUTION	DATE COMPLETED

TESTING PLAN AND LOG

CONTRACT NUMBER	PROJECT TITLE AND LOCATION	CONTRACTOR

SPECIFICATION SECTION AND PARAGRAPH NUMBER	ITEM OF WORK	TEST REQUIRED	ACCREDITED/ APPROVED LAB		SAMPLED BY	TESTED BY	LOCATION OF TEST		FREQUENCY	DATE COMPLETE	DATE FORWARDED TO CONTR. OFF.	REMARKS
			YES	NO			ON SITE	OFF SITE				

Page _____ of _____

SECTION 01560

ENVIRONMENTAL PROTECTION

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 th basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

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
49 CFR 178	Shipping Container Specification

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 paragraph entitled "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

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 Wast s

This includes salts, acids, alkalies, herbicides, pesticides, organic chemicals, and spent products which serve no purpose.

1.2.6 Sanitary Wastes

1.2.6.1 Sewage

Wastes characterized as domestic sanitary sewage.

1.2.6.2 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.

1.3 SUBMITTALS

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

1.3.1 SD-18, Records

a. Solid waste disposal permit G

b. Disposal permit for hazardous waste G

1.3.1.1 Solid Waste Disposal Permit

Submit one copy of a state and local permit or license showing such agency's agencies' approval of the disposal plan.

1.3.1.2 Disposal Permit for Hazardous Waste

Submit a copy of the applicable EPA and state permits or licenses for transportation, treatment, storage, and disposal of hazardous waste by permitted facilities.

1.4 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 nvironment, including but not limited to water, air, and noise pollution.

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 Land Resources

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officers permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attach ropes, cables, or guys is authorized, the Contractor shall be responsible for any resultant damage.

3.1.1.1 Protection

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove tre s with 30 percent or more of their root systems destroyed.

3.1.1.2 Replacement

Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before replacement.

3.1.1.3 Temporary Construction

Remove traces of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction. Grade temporary roads, parking areas, and similar temporarily used areas to conform with surrounding contours.

3.1.2 Water Resources

3.1.2.1 Stream Crossings

The Contracting Officer's approval is required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Remove temporary culverts or bridges upon completion of work, and repair the area to its original

condition or as indicated.

3.1.2.2 Oily Wastes

Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Surround all temporary fuel oil or petroleum storage tanks with a temporary earth berm of sufficient size and strength to contain the contents of the tanks in the event of leakage or spillage.

3.1.3 Fish and Wildlife Resources

Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work.

3.2.1 Designated Areas

The Government will monitor work in the areas indicated on the drawings. Submit a work schedule for approval for these areas and notify the Contracting Officer 30 calendar days prior to starting work in these areas. Changes to the approved work schedule must be approved by the Contracting Officer 48 hours prior to commencing on that portion of work.

3.3 EROSION AND SEDIMENT CONTROL MEASURES

3.3.1 Burnoff

Burnoff of the ground cover is not permitted.

3.3.2 Borrow Pit Areas

Manage and control borrow pit areas to prevent sediment from entering nearby streams or lakes. Restore areas, including those outside the borrow pit, disturbed by borrow and haul operations. Restoration includes grading, replacement of topsoil, and establishment of a permanent vegetative cover. Uniformly grade side slopes of borrow pit to note more than a slope of 1 part vertical to 2 parts horizontal. Uniformly grade the bottom of the borrow pits to provide a flat bottom and drain by outfall ditches or other suitable means. Stockpile topsoil remove during the borrow pit operation, and use as part of restoring the borrow pit area.\

3.3.3 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the

duration of exposure of unprotected soils.

3.3.4 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

3.3.4.1 Mechanical Retardation and Control of Runoff

Mechanically retard and control the rate of runoff from the construction site. This includes construction of sedimentation and erosion control fence, diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

3.3.4.2 Sediment Basins

Trap sediment in temporary sediment basins. Select a basin size to accommodate the runoff of a local 10-year storm. Pump dry and remove the accumulated sediment, after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs.

3.3.4.3 Borrow

Permit only in areas where suitable environmental controls are not possible.

3.3.4.4 Vegetation and Mulch

Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

a. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish a suitable stand of grass. The seeding operation shall be as specified in Section 02930, "Turf."

3.4 CONTROL AND DISPOSAL OF SOLID AND SANITARY WASTES

Pick up solid wastes, and place in containers which are regularly emptied. Do not prepare, cook, or dispose of food on the project site. Prevent contamination of the site of other areas when handling and disposing of wastes. On completion, leave the areas clean. Control and dispose of waste.

3.4.1 Disposal of Garbage, Rubbish and Debris

Dispose of garbage, rubbish and debris in accordance with the requirements specified.

3.4.1.1 Removal From Government Property

Remov and dispose garbag , rubbish and debris from Government property.

3.4.2 Sewage, Odor, and Pest Control

Dispose of sewage through connection to a station sanitary sewage system. Where such system is not available, use chemical toilets or comparably effective units, and periodically empty wastes into a station sanitary sewage system, or construct and maintain an approved type of adequate sanitary convenience for the use of persons employed on the work in accordance with the General Paragraphs titled, "SANITATION." Include provisions for pest control and elimination of odors.

3.5 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

3.5.1 Hazardous Type Waste

Store hazardous waste in approved containers (49 CFR 178) properly labeled to identify the type of waste and the date the container was filled. Remove the containers from the project site, and store and dispose of hazardous waste in accordance with 40 CFR 263 and 40 CFR 264. For oil and hazardous material spills, notify the Contracting Officer immediately.

3.5.2 Petroleum Products

Conduct the fueling and lubricating of equipment and motor vehicles to protect against spills and evaporation. Dispose of lubricants to be discarded and all excess oil.

3.5.3 Lead-Acid Battery Electrolyte

Dispose of electrolyte solution from lead-acid batteries. Do not dump electrolyte onto the ground or into storm drains or sanitary sewers

a. An industrial waste treatment plant, if available and approved by the Contracting Officer for neutralizing and disposing of battery acid electrolyte.

b. Transport the electrolyte to a state-approved hazardous waste disposal site. The method of transportation and equipment shall comply with applicable Federal and state regulations.

3.5.4 Equipment (Hazardous Material)

Make available to the Contracting Officer or the Contracting Officer's Representative, two complete sets of the proper personal protective equipment as required herein for entry into the inspection of the hazardous

control area. Provide equivalent training to th Contracting Officer or a designated representative in the use of the required personal protective equipment as that provided to Contractor employees. Provide manufacturer's certificate of compliance for all equipment required.

3.5.4.1 Protective Clothing

Provide personnel exposed to the hazardous area with proper protective whole body clothing, head coverings, gloves, and foot coverings.

3.6 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars except as otherwise specified. Only wet cutting will be permitted for cutting bituminous concrete.

3.7 NOISE

Make the maximum use of low-noise emission equipment. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during the designated times.

3.8 HAZARDOUS WASTE GENERATION

Handle generated hazardous waste in accordance with 40 CFR 262.

3.9 HAZARDOUS WASTE DISPOSAL

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

-- End of Section --

SECTION 01680

TREATMENT SYSTEM AND FACILITY OPERATION

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.

CODE OF FEDERAL REGULATIONS

40 CFR 261	Identification and Listing of Hazardous Wastes

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846	1986 Test Methods for Evaluating Solid Waste, Third Edition
EPA 600	1976 Methods for Contaminant Monitoring
EPA CLP TAL	1991 Contract Laboratory Program Statement of Work for Organic Analysis
EPA CLP TCL	1991 Contract Laboratory Program Statement fo Work for Inorganic Analysis

STATE OF RHODE ISLAND

RIDEM	1992 State of Rhode Island Department of Environmental Management, rules and Regulations for Hazardous Waste Management

1.2 DESCRIPTION OF WORK:

1.2.1 Work included:

a. Start-up, operate and maintain the ground water extraction and treatment plant facility as shown and described in these specifications, in accordance with the system performance requirements. Start-up shall be accomplished within 30 calendar days after receiving written notice to proceed with start-up from the Contracting Officer. Continue system operation and maintenance for 12 months after the 30 day start-up period.

1.2.2 Description of Operation:

a. Extraction System Operation: Extraction system operation includes a series of 13 extraction wells where contaminated ground water will be pumped using electric submersible well pumps and routed to the treatment facility. A series of seven adjacent, monitoring wells will be used to measure ground water levels and water quality.

b. Treatment Facility Operation: The following information describes the

influent characteristics and treatment objective.

1. Flowrate: Up to 50 gallons per minut (gpm)

2. Inorganics:

CONTAMINANT	ESTIMATED INFLUENT CONCENTRATION (mg/l)	TREATMENT OBJECTIVE (mg/l)
Aluminum	25	2
Iron	90	1
Magnesium	20	2
Manganese	5	2
Total Suspended Solids	300	5

3. Organic Compounds:

CONTAMINANT	ESTIMATED INFLUENT CONCENTRATION (ug/l)	TREATMENT OBJECTIVE (ug/l)
Vinyl Chloride	1	<1
Methylene Chloride	18	<10
Acetone	15	<10
1,1-Dichloroethane	17	<10
1,2-Dichloroethene	60	<5
Chloroform	1	<1
1,1,1-Trichloroethane	107	<50
Trichloroethene	75	<5
Tetrachloroethene	28	<5
Benzene	12	<5
Toluene	11	<1
Ethylbenzene	29	<2
Xylenes	147	<10
Naphthalene	16	<1
2-methylnaphthalene	58	<1
D-n-Butylphthalate	8	<5
Butylbenzylphthalate	2	<1
Bis(2-Ethylhexyl)Phthalate	53	<5

4. pH: 6-7 6

Treatment includes inorganic metals removal by precipitation, settling and filtration. Treatment chemicals for pH adjustment, flocculation, coagulation and oxidation will be blended with the influent.

The treated water will flow to a flash mix tank and flocculator located on the clarifier where polymers will be added to promote floc growth. The settled floc or sludge will be pumped to the Sludge Thickener Tank and the clarified liquid will flow to the pressure filter. At this point the treated water's pH will be adjusted with sulfuric acid. Acid addition will be controlled by pH monitoring.

Turbidity monitoring will alert the operator that metals pretreatment is

not operating properly. The filters will strain out large particles and remove additional inorganics. The pressur filter effluent will flow to the Ultraviolet Light-Oxidation (UV-Ox) and Activated Carbon Adsorption (GAC) treatment systems for organic treatment.

Subprocesses: The pressure filter backwash process will be operator initiated. When head loss through the filter reaches a predetermined point, the operator will start the backwash sequence. The operator will start the backwash pump thereby reversing flow through the filter for a predetermined time period. At the end of the cycle, the backwash pump is manually de-energized. The backwash drains to the sludge thickener tank which decants to the recycle tank. Pumps recycle the water to the Equalization Tank at a 20 gpm rate. Solids are generated when treating ground water and when backwashing the filters. As solids settle in the clarifier, these are periodically pumped to the sludge thickener tank. This tank contains decant ports used to return clear supernate to the Recycle Tank. Sludge is thickened in the cone shaped bottom. Sludge dewatering is operator initiated by manually energizing the sludge pump and filter press. The filter press and sludge pump are activated and water is separated from the solids in a press cycle. The liquid filtrate is routed to the recycle tank and the filter cake is deposited into 55-gallon drums, sampled and managed as potential hazardous waste and stored for off-site disposal.

1.2.3 System Performance Requirements:

a. Extraction System
   1. Combined Design Flow: 2-50 gpm

b. Treatment Facility
   1. Design Flow: Up to 50 gpm
   2. Flocculator/Clarifer:

CONTAMINANT	ESTIMATED INFLUENT CONCENTRATION (mg/l)	TREATMENT OBJECTIVE (mg/l)
Aluminum	25	3
Iron	90	5
Magnesium	20	3
Manganese	5	3
Total Suspended Solids	300	10

   3. Pressure Filter:

CONTAMINANT	ESTIMATED INFLUENT CONCENTRATION (mg/l)	TREATMENT OBJECTIVE (mg/l)
Aluminum	3	2
Iron	5	1
Magnesium	3	2
Manganese	3	2
Total Suspened Solids	10	5

4. UV/Oxidation Treatment:

CONTAMINANT	ESTIMATED INFLUENT CONCENTRATION (ug/l)	TREATMENT OBJECTIVE (ug/l)
Vinyl Chloride	1	1
Methylene Chloride	18	14
Acetone	15	10
1,1-Dichloroethane	17	10
1,2-Dichloroethene	60	5
Chloroform	1	1
1,1,1-Trichloroethane	107	75
Trichloroethene	75	5
Tetrachloroethene	28	5
Benzene	12	5
Toluene	11	1
Ethylbenzene	29	2
Xylenes	147	10
Naphthalene	16	1
2-Methylnaphthalene	58	1
D-n-Butylphthalate	8	5
Butylbenzylphthalate	2	1
Bis(2-Ethylhexyl)Phthalate	53	5

5. GAC Adsorption

CONTAMINANT	ESTIMATED INFLUENT CONCENTRATION (ug/l)	TREATMENT OBJECTIVE (ug/l)
Vinyl Chloride	1	<1
Methylene Chloride	14	<10
Acetone	10	<10
1,1-Dichloroethane	10	<10
1,2-Dichloroethene	5	<5
Chloroform	1	<1
1,1,1-Trichloroethane	75	<50
Trichloroethene	5	<5
Tetrachloroethene	5	<5
Benzene	5	<5
Toluene	1	<1
Ethylbenzene	2	<2
Xylenes	10	<10
Naphthalene	1	<1
2-Methylnaphthalene	1	<1
D-n-Butylphthalate	5	<5
Butylbenzylphthalate	1	<1
Bis(2-Ethylhexyl)Phthalate	5	<5

1.3 SUBMITTALS

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

1.3.1 SD-12, Field Test Reports

a. Extraction System Performance Monitoring G
b. Ground Water Quality Monitoring G
c. Treatment Facility Operation G
d. Quality Assurance/Quality Control Plan G

1.3.1.1 Extraction System Performance Monitoring

Provide all necessary personnel, equipment, and materials required to measure waer levels in monitoring and extraction wells shown, to establish water table elevations prior to pumping, evaluate drawdown effects associated with extraction system pumping, and regulate extraction well pumping rates to effectively capture the contaminated ground water plume. All monitoring and extraction wells shall be surveyed for elevation (±0.01 feet) Mean Sea Level using the National Geodetic Verical Datum.

1.3.1.2 Ground Water Quality Monitoring

Provide sampling and analysis of ground water in the area of the contaminated plume as specified herein.

1.3.1.3 Treatment Facility Operation and Monitoring

Provide operation and monitoring of the Treatment Facility as specified herein.

1.3.1.4 Quality Assurance/Quality Control Plan

Provide a Quality Assurance/Quality Control (QA/QC) Plan which provides the documentation, methodology, and scheduling details for the Treatment System and Facility Operation monitoring program. The QA/QC plan shall also require that extraction system performance monitoring be conducted by a certified hydrogeologist with experience in operating ground water extraction systems and conducting ground water extraction tests. The QA/QC Plan shall also include sampling protocol; methodologies, and procedures associated with the Ground Water Quality and Treatment Facility Operation.

1.3.2 SD-18, Records G

Submit the following to the Contracting Officer:

a. Extraction System Performance Monitoring
b. Ground Water Quality Monitoring
c. Treatment Facility Operation

1. Preliminary Operation and Maintenance Plan: G
   Submit 90 days before scheduled start-up.
2. The Operation and Maintenance Log G
   will be submitted to the Contracting Officer at project close out in accordance with paragraph entitled "Records" in this section.
3. Facility Operator Qualifications, G
   in accordance with the Article entitled Quality Assurance in this Section.

4. System Performance Monitoring Reports G
   as required under paragraph ntitled "System Performance Monitoring" in this section.
5. Field notebooks G
   as required under paragraph entitled "Sampling Requirements" in this section.
6. Correspondence G
   as required under paragraph entitled "Correspondence" in this section.
7. System start-up and prove-out report G
8. Monthly progress reports G
9. Quarterly program reports G
10. Annual progress reports G
11. Hazardous waste manifests G

1.3.3 SD-19, Operation and Maintenance Manuals G

Operation and Maintenance Manuals in with paragraph entitled "Operation and Maintenance Manual" in this section. G

1.4 QUALITY ASSURANCE

1.4.1 Minimum Qualifications:

Extraction System Performance Monitoring shall be conducted under the supervision of a professional hydrogeologist. Ground Water Quality Monitoring shall be conducted by a certified laboratory. Treatement Facility Operator shall be certified as a Grade II Wastewater Treatment Plant Operator by the State of Rhode Island Department of Environmental Management (RIDEM).

1.5 SEQUENCE

1.5.1 Extraction System Performance Monitoring shall commence 7 days prior to start-up and during the 13 month treatment facility start-up and prove-out operation period.

1.5.2 Ground Water Quality Monitoring shall commence three months after system start-up and conclude twelve months after system start-up.

1.5.3 Treatment Facility Operation shall commence at the beginning of the 30 day start-up and conclude 13 months later.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.1 EXTRACTION SYSTEM PERFORMANCE MONITORING

On a monthly basis, the Contractor shall provide the materials, equipment, tools and labor required to measure the water level to the nearest hundredth of a foot using an electronic water level indicator in the thirteen (13) extraction wells, and seven (7) monitoring wells as shown

on the Contract Drawings and as directed by the Contracting Officer, produce water level elevations referenced to NGVD 1929 datum in a table format, produce a water table contour and ground water flow direction map at a scale of 1 inch to 100 feet illustrating water table contours at 1 foot intervals and extraction well capture zones. The reports will be due 14 days after the monitoring has been performed.

The Contractor shall adjust extraction well pumping rates as necessary to optimize the capture zone of the contaminated ground water plume in response to the above analysis and as approved by the Contacting Officer.

3.2 GROUND WATER QUALITY MONITORING

3.2.1 Description of Work

Provide a sampling and analysis program which will collect data at the seven monitoring wells as selected by the Contracting Officer on a quarterly basis for one (1) year commencing three months after system start-up.

a. Contractor will select a government approved analytical laboratory which is certified to conduct Contract Laboratory Program (CLP) analysis for the required analysis.
b. Record water level measurements using a handheld water level meter and well headspace prior to sampling.
c. Contractor will schedule all required analysis with the selected laboratory.
d. All monitoring wells will be developed and sampled in accordance with EPA approved methods. At a minimum, the removal of 3 well volumes is required prior to sampling and all sampling equipment shall be decontaminated.
e. A minimum of one trip blank, Matrix Spike Duplicate (MSD), MSD blank, and sampling equipment blank shall be collected during each of the four quarterly sampling events. A minimum of two duplicate samples shall also be collected for analysis.

3.2.2 Analytical Methods

All ground water samples will be analyzed for the entire TAL (except that the pesticides/PCB fraction can be eliminated) according to EPA CLP TAL and TCL inorganics according to EPA CLP TCL, the following physical water quality parameters shall also be analyzed and recorded:

pH
Total Suspended Solids
Conductivity
Turbidity

3.3 TREATMENT FACILITY OPERATION

3.3.1 Preliminary Operation and Maintenance Plan

The Contractor shall prepare a Preliminary Operation and Maintenance Plan which shall be used as a guide for plant start-up, sampling, routine monitoring and laboratory testing during the 30 day start-up.

3.3.2 Plan Contents: The Preliminary Operation and Maintenance Plan shall contain the following information:

a. Description of Normal Operation and Maintenance
   1. Description of Prescribed Treatment or Operating Conditions
   2. Description of Tasks for Operation
   3. Description of Tasks for Maintenance
   4. Frequency of each Operation and Maintenance Task
b. Description of Potential Operating Problems
   1. Description and Analysis of Potential Operating Problems
   2. Sources of Information Regarding the Problem
   3. Common Remedies
c. Description of Routine Monitoring and Laboratory Testing
   1. Description of Monitoring Tasks
   2. Description of Required Laboratory Tests and Their Implementation
   3. Required Quality Assurance/Quality Control (QA/QC)
   4. Scheduled Monitoring and Testing Frequency
   5. Additional Monitoring and Testing Requirements
d. Description of Alternative Operation and Maintenance
   1. Alternative Procedures to Prevent Undue Hazard
   2. Analysis of Vulnerability and Additional Resource
   3. Requirements Should a Failure Occur
e. Safety Plan
   1. Description of General Precautions and Equipment for Site Personnel
   2. Safety Plans Required in Emergencies
f. Equipment Maintenance
   1. General Maintenance Requirements and Frequency
   2. Equipment Record System
   3. Site and Equipment Maintenance
g. Annual Operation and Maintenance Budget

3.3.3 Respond to Government Comments in writing and revise operation and maintenance plan to meet Government requirements.

3.4 SYSTEM START-UP AND PROVE-OUT

Perform system start-up and prove-out to insure that all system components are functioning according to specifications within prescribed operating parameters. System start-up and prove-out shall be documented in a written report and approved by a registered Professional Engineer.

3.4.1 System Start-up: Perform start-up to insure the following:

a. Well pumps are functioning correctly.
b. All tanks and mixers are sound and functional.
c. The treatment associated equipment and associated apparatus function correctly.
d. All piping is sound and leakproof.
e. Chemical feed pumps operate correctly.
f. The plant's pumps function properly.
g. Proper functioning of plant utilities, e.g., water, heating, ventilation, lighting, etc.

System start-up shall include verification of Treatment System Performance by sampling water daily for routine monitoring at the following locations:

1. Influent from wells
2. Clarifier Effluent
3. Pressure Filter Effluent

Routine monitoring equipment shall be a spectrophtometer installed at the site capable of detecting TAL metals and total suspended solids at target clean-up level concentrations in the effluent water. For proposal purposes, the Contractor shall base cost of routine monitoring to be every 8 hours for the first day, and every 24 hours for the second through the thirtieth day. Analytical equipment shall be capable of providing positive analysis for all constituents of interest to at least the effluent limits prescribed.

One week after system start-up, water shall be sampled and submitted to a certified laboratory Treatment Facility Performance verification. Lab analysis shall consist of volatile organic compounds according to EPA 600 Methods 8240/8270 and TCL inorganics according to EPA CLP TCL. Samples will be taken from the following locations:

1. Influent from wells
2. Pressure filter effluent
3. UV/Oxidation effluent
4. GAC effluent

This procedure shall be repeated three weeks later to determine whether system start-up has been successful.

Provide necessary tools, maintenance equipment, safety equipment, janitorial equipment or service, and chemicals.

3.4.2 System Prove-out: System prove-out shall begin when system start-up has been successfully accomplished (all units and subsystems operational as complete system). The system prove-out period shall continue for a minimum of 52 weeks after start-up is complete, and shall consist of system operation, monitoring and influent/effluent sampling and field analysis. System prove-out shall be complete when the Contractor successfully demonstrates that the system can operate according to design specifications and within the limits of water quality requirements. The Contractor shall provide personnel to prove-out the system during the 52 week period. Activities include but are not limited to, the following:

a. Servicing of all equipment per manufacturer's recommendations.
b. Verification of proper equipment functioning.
c. Replacement of expendable or defective items to maintain a full inventory.
d. Replacement of defective parts under warranty.
e. Sampling and analysis of treatment system influents/effluents, extraction wells, and monitoring wells.
f. Treatment system routine monitoring as outlined above shall be performed daily. Lab analysis as outlined above shall be performed monthly. Sludge waste management and disposal per

RIDEM and EPA Region 1 requirements. The Contractor will determine if the sludge is regulated as a hazardous waste or not and dispose accordingly.

g. Building and grounds maintenance including cleaning, touch up painting, etc.
h. The Government will supply trash containers and pick up trash.
i. The Contractor will clear snow and maintain the grounds at the plant.
j. Provide all chemicals for ground water treatmentas specified in Section 11308, "Chemical Feed Systems."
k. Provide all necessary tools, safety equipment, labor and materials to operate the ground water treatment plant during the prove-out period.

The Contractor shall maintain a daily log of activities, to include documentation of daily and other periodic inspections, equipment problems, actions taken, and notifications made to responsible NAVY personnel and RIDEM/EPA regulatory authorities.

3.4.3 Operating and Maintenance Manual: The Contractor shall develop and implement an operating and maintenance manual for the extraction system treatment facility, including the well pumps, water meters, flooculator/clarifier unit, pressure filters UV-oxidation unit, GAC adsorption unit, sludge filter, press pumps, motors and bearings. The manual shall include a periodic maintenance schedule and maintenance procedure. The manual shall be based on manufacturer's recommendations, permit requirements and the Contractor's experience through the first 90 days of the system prove-out. The manual must be delivered to the Contracting Officer 150 days after the start of the prove-out period.

3.4.4 System Performance Monitoring: The Contractor shall begin system performance monitoring at the end of the system start-up period and continue for 52 weeks. System performance monitoring shall consist of the following:

a. Sampling and analysis of Treatment Facility water quality for performance as described in this section.
b. Monitoring ground water extraction and monitor well flow, level and water quality as described in this section.
c. Sampling of the sludge filter cake to determine its Toxicity Characteristic Leaching Procedure (TCLP) and inorganic constituents after two weeks of operation and then once more at a time as directed by the Contracting Officer.

Results of system performance will be furnished to the Contracting Officer monthly in the form of a written report. The monthly reports will be used as the basis for quarterly and annual written monitoring reports prepared by the Contractor. Monthly report shall be provided by the 10th day of th following month and will include data for the previous month's sampling.

3.4.5 Sampling Requirements;

a. Sampling and analytical procedures will be in accordance with Naval Energy and Environmental Support Activity document NEESA 20.0-047B, "Sampling and Chemical Analysis Quality Assurance

Requirements for th Navy Installation Restoration program, Jun 1988."

b. Decontaminate sampling equipment prior to collecting each ground water sample.

c. Samples collected during plant start-up shall be analyzed at Level C Data Quality using Contract Laboratory Program (CLP) methods. Data validation will not be required; however, deliverables shall be available if validation is requested at a later time.

d. Sampling Documentation

1. Maintain a permanently bound filed notebook on-site indicating the time, date, pump flow rates, and location of sample collection (including written description), description of the sample preservation, sample container identification number and results of all field testing.
2. Record all information using indelible ink. Each page of the notebook shall be dated and signed by the recorder.
3. All field notebooks and all laboratory analytical reports shall be made available for inspection upon request from the Contracting Officer.
4. The sampling notebook and all laboratory analytical reports shall be submitted to the Contracting Officer as part of the project records.

3.4.6 Records:

a. Maintain a bound operation and maintenance log which shall include at a minimum:

1. Average weekly flow rate of each pumping well.
2. Total daily flow and average daily flow rate through each treatment unit.
3. Analytical results for influent and effluent samples.
4. Daily maintenance and repairs made to equipment.
5. Daily recording of differential pressure across each pressure filter.
6. All observations noted as unusual during facility inspections.
7. Weekly quantity of sludge processed and dry sludge produced.
8. Weekly quantity of treatment chemicals used.

3.4.7 Operator Instruction:

a. Prior to the end of the 13-month start-up and prove-out operating period, Contractor shall have his hydrogeologist and treatment facility operator spend 40 hours training personnel to fully operate and maintain the facility. Instructions shall include but not be limited to:

1. Equipment operation, maintenance and service

requirements including a r view of operation and maintenance manuals.

2. Testing requirements.
3. Provide NAVY with VHS video tape of all manufacturer's demonstrations and instructions of all installed equipment. Review these videos with NAVY personnel and update if required.

3.5 SUBMITTALS AND PRESENTATIONS

3.5.1 Format and Content:

All reports and plans shall be prepared utilizing a four-level paragraph system. Reports shall consist of 8 1/2"x11" pages with oversize drawings folded. Drawings and sketches shall be of engineering quality, and submitted in a way that does not detract from their utility (e.g., tubes, oversize envelopes).

3.5.2 Correspondence:

The Contractor shall keep a record of each substantive phone conversation and written correspondence related to the performance of this contract. A summary of the phone conversations and written correspondence shall be submitted to the Contracting Officer monthly and is due no later than the 10th of the following month. For this contract, "substantive" is defined as:

a. All calls to or from Navy personnel that require action by either the Navy or the Contractor.
b. All calls to or from Navy personnel that directly or indirectly affect contracts terms and conditions.
c. All calls to or from federal, state or local regulatory agency personnel.
d. All calls to Contractor personnel that require calling party to be referred to the NAVY Public Affairs Office.

Calls involved in the routine performance of project work that do not fit the above definition of substantive need not be recorded and provided to the Contracting Officer.

3.5.3 Technical Standards:

The Contractor shall furnish seven copies of all required technical submittals. Following each submission, comments generated as a result of the Government's review shall be fully addressed by the Contractor. The Contracting Officer will be the final authority on incorporation of comments. Required technical submittals include the following reports:

a. Operating and Maintenance Manuals
b. System Start-up and Prove-out Report
c. Monthly Progress Reports
d. Quarterly Progress Reports
e. Annual Progress Reports
f. Hazardous Waste Manifests

The Government will submit plans to regulatory agencies for review and approval. Comments generated as a result of the regulatory agencies' review shall be fully addressed by the Contractor.

-- End of Section --

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 REFERENCES

The publication listed below forms a part of this specification to the extent referenced. The publication is referred to in the text by the basic designation only.

DEFENSE LOGISTICS AGENCY (DLA)

DLA H4/H8	Federal Cataloging Handbook Commercial and Government Entity (CHEE), Sections A and B, United States and Canada, Sections C and D, NATO, Supply Code for Manufacturers

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit operation and maintenance (O&M) data which is specifically applicable to this contract and a complete and concise depiction of the provided equipment or product. Data containing extraneous information to be sorted through to find applicable instructions will not be accepted. Present information in sufficient detail to clearly explain user O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with Section 01300, "Submittals."

1.2.1 Quantity

Submit five copies of the manufacturers' information specified herein for the components, assemblies, subassemblies, attachments, and accessories. The items for which O&M data is required are listed in the technical sections which specify that particular item.

1.2.2 Package Content

For each product, system, or piece of equipment requiring submission of O&M data, submit the package required in the individual technical section. Package content shall be as required in the paragraph entitled "Schedule of Operations and Maintenance Data Packages."

1.2.3 Delivery

Submit O&M data to the Contracting Officer for review and acceptance; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

1.2.4 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M data. Changes, additions, or revisions

required by the Contracting Officer for final acc ptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.3.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

1.3.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.3.1.2 Operator Prestart

Include requirements to set up and prepare each system for use.

1.3.1.3 Startup, Shutdown, and Postshutdown Procedures

Include a control sequence for each of these operations.

1.3.1.4 Normal Operations

Include control diagrams with data to explain operation and control of systems and specific equipment.

1.3.1.5 Emergency Operations

Include emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.

1.3.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.

1.3.1.7 Environmental Conditions

Include a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

1.3.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.3.2.1 Lubrication Data

Include lubrication data, other than instructions for lubrication in accordance with paragraph entitled "Operator Service Requirements":

a. A table showing recommended lubricants for specific temperature ranges and applications;

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and

c. A lubrication schedule showing service interval frequency.

1.3.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

1.3.3 Corrective Maintenance

Include manufacturer's recommendations on procedures and instructions for correcting problems and making repairs.

1.3.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.3.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation numbering.

1.3.3.3 Maintenance and Repair Procedures

Include instructions and list tools required to restore product or equipment to proper condition or operating standards.

1.3.3.4 Removal and Replacement Instructions

Include step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances,

dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.3.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.

1.3.3.6 Corrective Maintenance Man-Hours

Include manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

1.3.4 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.3.4.1 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

a. Manufacturer's standard commercial practice: The parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice.

b. Other than manufacturer's standard commercial practice: End item manufacturer may add a cross-reference to implement components' assemblies and parts requirements when implementation in manual form varies significantly from the style, format, and method of manufacturer's standard commercial practice. Use the format in the following example:

End Item Manufacturer's Alphanumeric Sequence	Actual Manufacturer's Name and FSCM	Actual Manufacturer Part No.
100001	John Doe & Co. 00000	2000002

List FSCM in accordance with DLA H4/H8.

1.3.4.2 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

1.3.4.3 Personnel Training Requirements

Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

1.3.4.4 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3.4.5 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each subcontractor installing the product or equipment. Include local representatives and service organizations most convenient to the project site. Provide the name, address, and telephone number of the product or equipment manufacturers.

1.4 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.4.1 Data Package 1

a. Safety precautions

b. Maintenance and repair procedures

c. Warranty information

d. Contractor information

1.4.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan and schedule

f. Maintenance and repair procedures

g. Removal and replacement instructions

h. Spare parts and supply list

i. Parts identification

j. Warranty information

k. Contractor information

1.4.3 Data Package 3

a. Safety precautions

b. Normal operations

c. Emergency operations

d. Environmental conditions

e. Lubrication data

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring diagrams and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Parts identification

m. Warranty information

n. Testing equipment and special tool information

o. Contractor information

1.4.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and postshutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Corrective maintenance man-hours

p. Parts identification

q. Warranty information

r. Personnel training requirements

s. Testing equipment and special tool information

t. Contractor information

1.4.5 Data Package 5

a. Safety precautions

b. Environmental conditions

c. Preventive maintenance plan and schedule

d. Troubleshooting guides and diagnostic techniques

e. Wiring and control diagrams

f. Maintenance and repair procedures

g. Spare parts and supply list

h. Warranty information

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 02050

DEMOLITION AND REMOVAL

PART 1 GENERAL

1.1 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6	1983 Demolition Operations-Safety Requirements

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 61-SUBPART M	National Emission Standard for Asbestos

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations. Store materials that cannot be removed daily in areas specified by the Contracting Officer. Demolish and remove materials containing asbestos in accordance with Section 01560, "Environmental Protection."

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.

1.3.1.1 Required Data

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, "Demolition Operations - Safety Requirements."

1.4.1 Notifications

Furnish timely notification of demolition projects to Federal, state, regional, and local authorities in accordance with 40 CFR 61-SUBPART M.

Notify the state's environmental protection agency and the Contracting Officer in writing 10 days prior to the commencement of work in accordanc with 40 CFR 61-SUBPART M.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

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 which is to remain in place, be reused, or remain the property of the Government. Repair items which are to remain which are to be salvaged and which are damaged during performance of the work to their original condition, or replace with new. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.6.3 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services r connections for electrical and mechanical utilities.

1.7 BURNING

Burning will not be permitted.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Underground Storage Tank #53 Shunt Piping

3.1.1.1 Pipeline Cleaning

Clean the pipelines by removing valves or other flanged appurtenances in the concrete vaults. Provide means to catch and contain any free draining material. Provide pipeline pigging by pulling or pushing a pipe cleaning assembly to remove remaining solids or liquids. Catch and contain all solids or liquids removed from the pipeline. Dispose of waste in accordance with Section 01560, "Environmental Protection" and Section 02060, "Hazardous Materials Management."

3.1.1.2 Pipeline Removal

Provide gasketed blind flanges in the concrete vaults to isolate the tank shunt piping from the loop piping. Remove the pipes from the vault and seal all openings watertight with concrete. Excavate and remove all piping between the concrete vaults. Dispose of piping as scrap metal or waste in accordance with Section 01560, "Environmental Protection".

3.1.2 Utilities and Related Equipment

Remove or cap existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. Remove transformer, power panel and related electrical equipment and deliver to a location on the station in accordance with instructions of the Contracting Officer. If utility lines are encountered that are not shown on drawings, contact the Contracting Officer for further instructions.

3.1.3 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregat base as indicated to a depth of 11 inches below new finish grade. Provide neat sawcuts at limits of pavement removal as indicated.

3.2 FILLING

Fill holes and other hazardous openings in accordance with Section 02221, "Earthwork for Structures and Pavements".

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 r moval proc dures, 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 by prospective purchasers or sold on the site.

3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.3.3 Salvaged Materials and Equipment

Remove materials and equipment that are indicated to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as directed within 3 miles of the work site.

3.4 CLEANUP

3.4.1 Debris and Rubbish

Remove and transport debris and rubbish in a manner that will prevent spillage on streets or adjacent areas. Limit to 3/8-cubic yard capacity buggies or other conveyances used on roofs and within the building to transport removed debris. Clean up spillage from pavements, streets and adjacent areas. Conform to other applicable requirements under Section 01560, "Environmental Protection."

-- End of Section --

SECTION 02060
HAZARDOUS MATERIALS MANAGEMENT

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 4397	1984 (R 1989) Polyethylene Sheeting For Construction, Industrial and Architectural

CODE OF FEDERAL REGULATIONS

29 CFR 1910	Occupational Safety and Health Standards; General Industry
29 CFR 1926	Occupational Safety and Health Standards; Construction Standards
40 CFR 261	Identification and Listing of Hazardous Wastes

ARMY CORPS OF ENGINEERS (COE)

COE EM-385-1-1	1992 Corps of Engineers Safety and Health Requirments Manual

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846	1986 Test Methods for Evaluating Solid Waste, Third Edition
EPA 600	1976 Methods for Contaminant Monitoring

STATE OF RHODE ISLAND

RIDEM	1992 State of Rhode Island Department of Environmental Management, Rules and Regulations for Hazardous Waste Management

1.2 DESCRIPTION OF WORK

The work includes preparation of and conformance with a Site Safety and Health Plan, Excavation and Material Handling Plan, Field Sampling and Laboratory Testing Plan, Piping Removal and Disposal Plan and Hazardous Material Management Standards.

1.3 SUBMITTALS

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

1.3.1 SD-08, Statements

a. Site safety and health plan G

b. Excavation and material handling plan G

c. Field sampling and laboratory testing plan G

d. Piping removal and disposal plan G

e. Qualification G

1.3.1.1 Site Safety and Health Plan

Describe site safety and health plan and procedues as related to excavation and drilling in possibly contaminated soils and water. Furnish the nam and qualifications based on education, training, and work experience of the proposed Site Safety and Health Officer.

1.3.1.2 Excavation and Material Handling Plan

Describe methods, means, equipment, sequence of operations and schedule to be employed in excavation, drilling, handling, stockpiling, transport and disposal of soil that exhibits possible contamination.

1.3.1.3 Field Sampling and Laboratory Testing Plan

Describe field sampling methods and quality control procedures. Identify laboratory and laboratory methods to be used for contamination testing and waste characterization. Sample reports shall show sample identification for location, date, time, sample method, contamination level(s), name of individual sampler, identification of laboratory, and quality control procedures.

1.3.1.4 Piping Removal and Disposal Plan

Describe methods, means, sequence of operations, and schedule to be employed in the testing, pumping, cleaning, de-vaporizing, inspecting, removal, and disposal or salvage of underground piping.

1.3.1.5 Qualification

Prior to start of work, submit documentation of recent experience and resumes of all personnel working on the project that may contact hazardous materials.

1.3.2 SD-18, Records

a. Contaminated soil disposal paperwork G

b. Contaminated water handling paperwork G

1.4 AREAS OF CONTAMINATION

Drill cuttings and water encountered during the well installation may be contaminated and shall be handled as specified herein. Additionally contaminated sludge and soils may be encountered during removal of tank shunt piping and in other excavations on the site.

1.5 QUALIFICATIONS (CONTRACTOR EXPERIENCE)

Prior to start of work, submit data for approval showing that the personnel employed on the project that may come in contact with Hazardous Materials have been trained for Health and Safety, and are familiar with the following:

a. Applicable safety rules and regulations

b. Handling and disposal of the types of wastes encountered in drilling and excavating in contaminated media.

c. Drilling, excavation, testing, and disposal of contaminated soils, liquids and sludge.

PART 2 PRODUCTS

2.1 PLASTIC SHEETING

ASTM D 4397, 40 mil polyethylene.

2.2 DRUMS

Steel, 55 gallon, DOT approved for hazardous waste transport.

PART 3 EXECUTION

3.1 SAMPLING, TESTING, AND DISPOSAL OF CONTAMINATED SOIL AND WATER

Furnish labor, materials, and equipment to sample and test soil to determine if contaminated and to dispose of contaminated soil (including drill cuttings) as specified herein.

3.2 SITE SAFETY AND HEALTH PLAN (SSHP)

Furnish safety, health, and accident prevention provisions and develop a Site Safety and Health Plan (SSHP). The SSHP shall incorporate the requirements of 29 CFR 1910, 29 CFR 1926, and COE EM-385-1-1. Site work shall not start until the SSHP is approved by the Contracting Officer.

3.3 SITE SAFETY AND HEALTH OFFICER (SSHO)

Identify an individual to serve as the Site Safety and Health Officer (SSHO). The SSHO shall report problems and concerns regarding health and safety to the Contracting Officer. The SSHO shall have a working knowledge of State and Federal occupational safety and health and hazardous waste regulations, and shall provide training to Contractor employees in air

monitoring practices and techniques.

3.4 SPILL AND DISCHARGE CONTROL PLAN

Develop, implement, and maintain a comprehensive spill and discharge control plan. The plan shall provide contingency measures for potential spills and discharges from handling and transportation of contaminated soils and water and be coordinated with the Station spill and discharge control plan.

3.5 TRAINING

Provide health and safety training to all on-site personnel that may come in contact with hazardous materials in accordance with 29 CFR 1910 prior to starting work. Furnish copies of current training certification statements for personnel prior to initial entry into the work site.

3.5.1 On-site Training

Prior to starting on-site work, a site-specific health and safety training briefing shall be held by the SSHO to discuss the implementation of the SSHP. Notify the Contracting Officer 24 hours prior to begining the safety briefing.

3.6 PERSONNEL PROTECTION

Furnish appropriate personal safety equipment and protective clothing to personnel and ensure that safety equipment and protective clothing is kept clean and well maintained.

3.7 RESPIRATORY PROTECTION PROGRAM

Develop a respiratory protection program, addressing respirator usage and training, in accordance with 29 CFR 1910 and COE EM-385-1-1.

3.8 DECONTAMINATION

Decontaminate all construction equipment that comes in contact with contamination and decontaminate or properly dispose of personal protective equipment and clothing worn in contaminated areas at the end of the work day. The SSHO shall be responsible for ensuring personal protective equipment is decontaminated before being reissued. Construct the decontamination pad as shown and collect and discharge the decontamination water to underground storage tank #52.

3.9 FIRST AID AND EMERGENCY RESPONSE EQUIPMENT AND PROCEDURES

Provide appropriate emergency first aid equipment for treatment of exposure to site physical and chemical hazards. Provide and post a list of emergency phone numbers and points of contact for fire, hospital, police, ambulance, and other necessary contacts. Provide and post a route map detailing the directions to the nearest medical facility.

3.10 MATERIALS HANDLING

3.10.1 Drill Cuttings

As drill cuttings are brought to the surface, test with an Organic Vapor Analyzer/Flame Ionization Device (OVC/FID). Load cuttings into durms completely full and segregate those cuttings that exceed a reading of 10 parts per million (ppm) using the OVA/FID or are visually contaminated into separate drums and label accordingly. Stockpile and inventory all drums in the Contractor's staging and storage area.

3.10.2 Well Installation Water

Route all water from well installation (development and pumping test) to Underground Storage Tank #52 in a means approved by the Contracting Officer to avoid spilling or splashing.

3.10.3 Pipeline Cleaning Wastes

Contain all waste generated by the tank shunt piping cleaning operation in drums for disposal.

3.10.4 Excavation Soils

During excavation, test soil with an OVA/FID every 25 feet. Segregate and stockpile those soils that exceed 10 ppm using the OVA/FID or are visually contaminated into 50 cubic yard piles. The stockpiles shall be constructed in the Contractor's staging and storage area using plastic sheeting under and over the soil per RIDEM regulations.

3.11 MATERIALS TESTING

3.11.1 Drill Cuttings

Take one composite sample for every ten drums or portion therof according to EPA protocol. Submit the samples to a certified laboratory for testing of Total Petroleum Hydrocarbons (TPH) in accordance with EPA 600, Volatile Organic Compounds Method 8240 in accordance with EPA SW-846 and Toxicity Characteristic Leaching Procedure (TCLP) in accordance with 40 CFR 261.

3.11.2 Excavation Soils

Take one composite sample for every 50 cubic yards of stockpiled soil or portion thereof. Test the samples in accordance with the testing outlined for Drill Cuttings in Section 3.11.1, above.

3.12 MATERIALS DISPOSAL

3.12.1 Drill Cuttings and Excavation Soils

Dispose of drill cutting and excavation soils that are classified as regulated waste according to the test results in accordance with EPA and RIDEM regulations.

Dispose of drill cuttings and excavation soils that are unregulated by spreading over the project area in a location and manner approved by th Contracting Offic r.

3.12.2 Pipeline Cleaning Wastes

Dispose of oily wastes from pipeline cleaning in accordance with EPA and RIDEM regulations.

3.12.3 Well Installation Water

Dispose of well installation water in Underground Storge Tank #52 with the Project Area.

3.13 RECORDS

Furnish field testing and laboratory results to the Contracting Officer within 24 hours after the results are obtained.

3.14 DOCUMENTATION

Provide Contracting Officer a copy of the chain of custody and a copy of all documentation (e.g. manifests, bill of lading, certificate of destruction) required by Federal, State, and local authority for the treatment, transportation, and disposal of any contaminated soil and water. Provide contaminated soil and water disposal paperwork.

-- End of Section --

SECTION 02102

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 REFERENCES

Not used.

1.2 SUBMITTALS

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

1.2.1 SD-14, Samples

a. Tree wound paint

Submit samples in cans with manufacturer's label.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 TREE WOUND PAINT

Bituminous based paint of standard manufacture specially formulated for tree wounds.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Protection shall be in accordance with Section 01560, "Environmental Protection."

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting

Officer in ample time to minimize interruption of the service. Refer to Section 01011, "Additional General Paragraphs," and S ction 01560, "Environmental Protection," for additional utility protection.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Protection shall be in accordance with Section 01560, "Environmental Protection."

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01011, "Additional General Paragraphs," and Section 01560, "Environmental Protection," for additional utility protection.

3.2 CLEARING

Shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas to be cleared, except for trees and vegetation indicated or directed to be left standing.

3.3 TREE REMOVAL

Where indicated, remove designated trees and stumps and grub roots.

3.4 PRUNING

Trim trees designated to be left standing within the cleared areas of dead branches 1 1/2-inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1 1/4-inches in diameter with an approved tree wound paint.

3.5 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

3.5.1 Nonsaleable Materials

Remove from the project site and dispose of off station, timber, scrub, vegetation, and debris considered as nonsaleable. Burning will not be permitted.

-- End of Section --

SECTION 02221

EARTHWORK FOR STRUCTURES AND PAVEMENTS

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 C 33	1990 Concrete Aggregates
ASTM C 136	1984 (Rev. A) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	1978 (R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1140	1954 (R 1990) Amount of Material in Soils Finer than the No. 200 (75-Micrometer) Sieve
ASTM D 1557	1978 (R 1990) Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 1586	1984 Penetration Test and Split-Barrel Sampling of Soils
ASTM D 2434	1968 (R 1974) Permeability of Granular Soils (Constant Head)
ASTM D 2487	1990 Classification of Soils for Engineering Purposes
ASTM D 2922	1981 (R 1990) 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)
ASTM D 3786	1987 Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method
ASTM D 4253	1983 Maximum Index Density of Soils Using a Vibratory Table

ASTM D 4254	1983 Minimum Index Density of Soils and Calculation of Relative Density
ASTM D 4318	1984 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4355	1984 Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	1989 Water Permeability of Geotextiles by Permittivity
ASTM D 4533	1985 (R 1990) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	1986 (R 1990) Breaking Load and Elongation of Geotextiles (Grab Method)
ASTM D 4751	1987 Determining the Apparent Opening Size of a Geotextile
ASTM D 4759	1988 Determining the Specification Conformance of Geosynthetics
ASTM D 4833	1988 Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

CORPS OF ENGINEERS (COE)

COE EM-385-1-1	1992 Safety and Health Requirements Manual

1.2 DEFINITIONS

1.2.1 Backfill

A specified material used in refilling a cut, trench, or other excavation, placed at a specified degree of compaction.

1.2.2 Capillary Water Barrier

A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high porosity which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below a slab.

1.2.3 Cohesive Materials

Cohesive materials include materials classified by ASTM D 2487 as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

1.2.4 Cohesionless Materials

Cohesionless materials include materials classified by ASTM D 2487 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.

1.2.5 Compaction

The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 698 or ASTM D 1557 for general soil types or ASTM D 4253 and ASTM D 4254 (Relative Density) for isolated cohesionless materials, abbreviated in this specification as " _____ percent ASTM D _____ maximum density".

1.2.6 Controlled Fill and Controlled Backfill

A specified soil mix or gradation of materials constructed to attain maximum bearing strength and minimize consolidation or differential settlement under a load. Controlled fill is sometimes called "structural fill".

1.2.7 Embankment

A "fill" having a top that is higher than adjoining ground.

1.2.8 Excavation

The removal of soil, rock, or hard material to obtain a specified depth or elevation.

1.2.9 Fill

Specified material placed at a specified degree of compaction to obtain an indicated grade or elevation.

1.2.10 Hard Material

Weathered rock, dense consolidated deposits or conglomerate materials, (excluding manmade materials such as concrete) which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment with ripper teeth or the use of jack hammers for removal. Material indicated in the soil boring logs as having a standard penetration resistance as determined by ASTM D 1586 between 60 and 600 blows per foot is arbitrarily defined herein as "Hard Material."

1.2.11 In Situ Soil

Existing in place soil.

1.2.12 Lift

A layer (or course) of soil placed on top of a previously prepared or placed soil.

1.2.13 Rock

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 cubic yard in volume. Material indicated in the soil boring logs as having a standard penetration resistance as determined by ASTM D 1586 greater than 600 blows per foot is arbitrarily defined herein as "Rock." Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.14 Soil

The surface material of the earth's crust resulting from the chemical and mechanical weathering of rock and organic material.

1.2.15 Subgrade

The material in excavation (cuts) and fills (embankments) immediately below any subbase, base, pavement, or other improvement. Also, as a secondary definition, the level below which work above is referenced.

1.2.16 Topsoil

In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Topsoil may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. Gradation and material requirements specified herein apply to all topsoil references in this contract. The material shall be representative of productive soils in the vicinity.

1.2.17 Unsatisfactory Material

Existing, in situ soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in fill or embankment without excessive consolidation or loss of stability. Materials classified as PT, OH, or OL by ASTM D 2487 are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse, frozen material, uncompacted backfills from previous construction, unsound rock or soil lenses, or other deleterious or objectionable material.

1.2.18 Working Platform

A layer of compacted crushed rock or natural stone that replaces the in situ soil to provide a stable, uniform bearing foundation for construction equipment to facilitate further site construction.

1.3 SUBMITTALS

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

1.3.1 SD-08, Statement

a. Shoring and sheeting plan G

b. Dewatering system G

1.3.1.1 Shoring and Sheeting Plan

Describe materials or shoring system to be used. Indicate whether or not any components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a registered professional engineer. Indicate sequence and method for installation and removal.

1.3.1.2 Dewatering System

Describe methods to be employed in removing water from exposed surfaces and diverting surface water from other areas or structures. Describe the basic components of the dewatering system proposed and its planned method of operation.

1.3.2 SD-12, Field Test Reports

a. Capillary water barrier granular fill tests G

b. Controlled fill and Controlled backfill material tests G

1.4 REGULATORY REQUIREMENTS

Materials and workmanship specified herein with reference to DOT State Standard 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."

1.5 DELIVERY AND STORAGE

Deliver and store materials in a manner to prevent contamination or segregation. Store synthetic fiber filter cloth to prevent exposure to direct sunlight in accordance with the manufacturer's recommendations.

1.6 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations as indicated.

b. No pipes or other man-made obstructions, exc pt those indicat d, will be encountered.

c. The character of the material to be excavated or used for subgrade is as indicated. Hard material identified as shale on the borings shall not be considered as rock and removal of such material shall not give cause for a claim for additional compensation regardless of hardness or difficulty in removing. Rock as defined in the paragraph entitled, "Definitions," will not be encountered.

d. Ground water elevations indicated are those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

e. Borrow material suitable backfill and fill material in the quantities required is not available at the project site.

f. Blasting will not be permitted.

1.7 SITE CONDITIONS

1.7.1 Dewatering Plan

Base on site surface and subsurface conditions and available soils and hydrological data.

1.7.2 Utilities

Contact the Contracting Officer 72 hours prior to construction for the location of all existing underground utilities. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to privately owned utilities in accordance with procedures outlined by the utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work as affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Granular Fill

2.1.1.1 Capillary Water Barrier

Provide a capillary water barrier under concrete floor slabs consisting of clean crushed stone, crushed gravel, or uncrushed gravel conforming to ASTM C 33 coarse aggregate grading size 57, 67, or 7. Underlay the

capillary water barrier by a 2-inch thick course of granular filter material consisting of clean concrete sand conforming to grading size no. 6 in accordance with ASTM C 33.

2.1.2 Soil Materials

Provide materials free from debris, roots, wood, scrap materials, vegetable matter, refuse or frozen material. Maximum particle size permitted is 3 inches. Use excavated material from the site for the work indicated when material falls within the requirements specified herein.

2.1.2.1 Controlled Fill and Controlled Backfill

Provide materials classified as GW, GP, SW, SP, by ASTM D 2487 where indicated. The liquid limit of such material shall not exceed 35 percent when tested in accordance with ASTM D 4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D 4318, and not more than 20 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D 1140. Coefficient of permeability shall be a minimum of 0.002 feet per minute when tested in accordance with ASTM D 2434.

2.1.2.2 General Backfill Beside Structures

Soft, spongy, highly plastic, or otherwise unstable material is prohibited. Material shall be unclassified but shall contain sufficient fines to ensure proper compaction. Material shall be classified as GP, GM, GC, SP, SM by ASTM D 2487. If more material is required than is available from on-site excavation, then provide that material from approved sources.

2.1.2.3 General Site Fill, Backfill and Embankment Material

Provide a soil material from the borrow that can be readily compacted to the specified densities. Materials shall be classified as GP, GM, GC, SP, SM, SC by ASTM D 2487.

2.1.2.4 Working Platform

Material and thicknesses of working platform for support of construction equipment shall be at the discretion of the construction contractor. The gradation and placement of such material shall not create large void spaces upon which overlying work is indicated to be placed.

2.1.2.5 Borrow

Provide materials meeting requirements for general site fill, controlled fill and controlled backfill, general backfill, granular fill. Obtain borrow materials in excess of those furnished from excavations described herein from sources off Government property.

2.2 FILTER FABRIC FOR WEED BARRIER

Provide a pervious sheet of polyester, nylon, glass or polypropylene, ultraviolet resistant filaments woven, spun bonded, fused, or otherwise manufactured into a nonraveling fabric with uniform thickness and strength.

The fabric shall hav the following manufacturer c rtified minimum average roll properties as determined by ASTM D 4759:

		Class A	Class B
a.	Grab tensile strength (ASTM D 4632) machine and transversed direction	min. 180	80 lbs.
b.	Grab elongation (ASTM D 4632) machine and transverse direction	min. 15	15 percent
c.	Puncture resistance (ASTM D 4833)	min. 80	25 lbs.
d.	Mullen burst strength (ASTM D 3786)	min. 290	130 psi.
e.	Trapezoidal tear strength (ASTM D 4533)	min. 50	25 lbs.
f.	Apparent opening size (ASTM D 4751)	See Criteria Below	

1. Soil with 50% or less particles by weight passing US No. 200 Sieve, AOS less than 0.6mm (greater than #30 US Std. Sieve)

2. Soil with more than 50% particles by weight passing US No. 200 Sieve, AOS less that 0.297mm (greater than #50 US Std. Sieve)

g.	Permeability (ASTM D 4491)	k fabric > k soil
h.	Ultraviolet Degradation (ASTM D 4355) at 150 hours	70% Strength Retained

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheeting

Provide shoring where required. In addition to Section XXIII A and B of COE EM-385-1-1, and other requirements of this contract meet the following:

a. Prevent undermining of pavements, foundations and slabs.

b. Slope banks where space permits.

c. Where shoring and sheeting materials remain in place in completed work to prevent settlements or damage to adjacent structures or as directed, backfill the excavation to 3 feet below the finished grade and remove the remaining exposed portion of the shoring before completing the backfill.

3.1.2 Dewatering

Dispose of surface water which may accumulate in open excavations, unfinished fills, or other low areas. Remove water by trenching where approved, pumping, or other methods to prevent softening of exposed

surfaces. Surface dewatering plan shall include rerouting of any storm water runoff or natural drainage if necessary and shall comply with requirements specified in Section 01560, "Environmental Protection."

3.1.3 Water Removal

Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation. Before excavating below ground water level, place the dewatering system into operation. Lower the water levels at least one foot below the bottom and side slopes of the excavation. Relieve the hydrostatic pressure in pervious zones below the subgrade elevation in layered soils in order to prevent uplift. Use screens and gravel packs as necessary on the dewatering devices to prevent the removal of fines from the soil.

3.1.4 Operation and Performance

Operate the dewatering system until construction work below existing water levels is complete. Measure and record the performance of the dewatering system at the same time each day by use of observation wells and piezometers installed in conjunction with the dewatering system. After placement of initial slabs and backfill, the water level may be allowed to rise but at no time allow it to rise higher than one foot below the prevailing level of excavation or backfill. Have a back-up pump and system available for immediate use. See specification section 01560 "Environmental Protection" for additional requirements.

3.1.5 Protection and Restoration of Surfaces

Protect newly graded areas from traffic, erosion, and settlements. Repair and reestablish damaged or eroded slopes, elevations or grades and restore surface construction prior to acceptance. Protect existing streams, ditches and storm drain inlets from water-borne soil by means of straw bale dikes filter fabric dams. Conduct work in accordance with requirements specified in Section 01560, "Environmental Protection."

3.1.5.1 Disposal of Excavated Material

Dispose of excavated material in such a manner that it will not obstruct the flow of runoff, streams, endanger a partly finished structure, impair the efficiency or appearance of facilities, or be detrimental to the completed work.

3.2 SURFACE PREPARATION

3.2.1 Clearing and Grubbing

Perform as specified in Section 02102, "Clearing and Grubbing".

3.2.2 Stockpiling Topsoil

Strip approved topsoil to a depth of 6 inches from the site where excavation or grading is indicated and stockpile separately from other excavated material. Locate topsoil so that the material can be used

readily for the finished grading. Protect and store in s gregated piles until needed.

3.3 EXCAVATION

Excavate to contours and dimensions indicated. Keep excavations free from water while construction is in progress. Notify the Contracting Officer immediately in writing in the event that it becomes necessary to remove rock, hard material, or other material defined as unsatisfactory to a depth greater than indicated and an adjustment in contract price will be considered in accordance with the Contract clause entitled "Differing Site Conditions." Refill excavations cut below the depths indicated with controlled fill and compact as specified herein. Excavate soil disturbed or weakened by construction operations or soils softened from exposure to weather. Refill with controlled fill and compact as specified herein.

3.3.1 Excavations for Structures and Spread Footings

Excavate to depth indicated. If excavation is deeper than indicated, then fill with controlled fill material prior to placement of footings.

3.3.2 Shoring and Sheeting

Shore and sheet excavations as described in the submitted plan, with various members sized and arranged to prevent injury to persons and damage to structures. Also arrange shoring and sheeting to preclude injurious caving during removal.

3.4 BORROW MATERIALS

Select borrow materials to meet requirements and conditions of the particular fill or backfill materials to be used. Obtain borrow materials from sources off of Government property.

3.5 FILLING AND BACKFILLING

3.5.1 Subgrade Preparation

Scarify the underlying subgrade surface to a depth of 12 inches before the fill is started. Step, bench, or break up sloped surfaces steeper than one vertical to 4 horizontal so that the fill material will bond with or be securely keyed to the existing material. Scarify existing surface to a minimum depth of 12 inches if subgrade density is less than the degree of compaction specified and recompact. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and recompact as specified for the adjacent or overlying fill. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.5.2 Fill and Backfill Beside Structures

Place required backfill material adjacent to structures and compact in a manner that prevents wedging action or eccentric loading upon or against the structures. Step or serrate slopes bounding or within areas to be backfilled to prevent sliding of the fill. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Do not place material on surfaces that are muddy, frozen, or contain frost. Do not use equipment for backfilling operations or for the formation of embankments against structures that will overload the structure. Backfilling against concrete will be done only after the concrete has attained its 28-day compressive strength.

3.5.3 Controlled Fill and Controlled Backfill

Place controlled fill and controlled backfill under spread footing, concrete slabs not pile supported, and pavements in loose lifts of 6 inches. Do not place material on surfaces that are muddy, frozen, or contain frost. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each lift as specified herein before placing the overlaying lift. Compaction shall be accomplished continuously over the entire area. Sufficient passes shall be made to ensure that specified density is obtained.

3.5.4 General Fill, and General Backfill

Construct fill, backfill and embankment at the locations and to lines and grades indicated. Use only approved materials in constructing fill on the prepared subgrade. Place satisfactory material in horizontal lifts not exceeding 8 inches in loose depth. Do not place material on surfaces that are muddy, frozen, or contain frost. Compact with equipment well suit d to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each lift as specified before placing the overlaying lift.

3.5.5 Final Backfill for Utilities

Construct backfill (final backfill) for storm drains, manholes, utility lines, and other utility appurtenances using the material and compaction requirements specified herein for the adjacent or overlying work. Bedding and initial backfill requirements are specified in Section 02225, "Excavation, Backfilling, and Compacting for Utilities." Backfilling against concrete will be done only after the concrete has attained its 28-day compressive strength.

3.5.6 Fill for Capillary Water Barrier

Place granular fill on a 2-inch layer of filter material over compacted subgrade. Compact granular fill in lifts of 4 inches with a minimum of two passes of a hand-operated plate type vibratory compactor per lift.

3.5.7 Weather Limitations

Fill and backfill shall not be constructed when w ather conditions detrimentally affect the quality of the finished course. Place fill and backfill only if the atmospheric temperature is above freezing in the shade and is rising. Do not construct fill and backfill in the rain or on saturated subgrades. If weather conditions are windy, hot or arid, with high rate of evaporation, schedule the placement in cooler portions of the day and furnish equipment to add moisture to the fill or backfill during and after placement.

3.6 COMPACTION

Compact each layer or lift of material specified so that the in-place density tested is not less than the percentage of maximum density specified in Table III.

TABLE III

	Percent ASTM D 698 Maximum Density	
	Cohesive Material	Cohesionless Material
Fill, Embankment and Backfill		
General Fill and General Backfill under steps and parking lots	90	95
General Fill and General Backfill under sidewalks and grassed areas	85	90
General Backfill and General Fill beside structures	90	95
Controlled fill and Controlled backfill under footings, pavements and structures	95	100
Refill undercut materials	N/A	100
Under building slabs, steps and parking lots, top 12 inches	93	98
Under footings, top 12 inches	95	100
Under sidewalks, and grass areas, top 6 inches	85	90

3.7 FINISH OPERATIONS

3.7.1 Site Grading

Grade to finished grades indicated within 0.10 foot. Grade areas to drain water away from structures and to provide suitable surfaces for mowing machines. Existing grades which are to remain but are disturbed by the Contractor's operations shall be restored as specified herein.

3.7.2 Finishing Subgrades Under Structures and Pavements

Finish surface of top lift of fill or top of subgrade to the elevation and cross section indicated. Finished surface shall be smooth and of uniform texture. Lightly scarify or blade the finished surface to bring the finished surface to within 0.05 foot of the indicated grade and to eliminate imprints made by compaction and shaping equipment. Surface shall show no deviations in excess of 3/8 inch when tested with a 10-foot straightedge.

3.7.3 Disposition of Surplus Material

Surplus or other soil material not required or suitable for filling, backfilling, or embankment shall be removed from Government property. Comply with the requirements of Section 01560, "Environmental Protection."

3.7.4 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur and as required in the Section 01560, "Environmental Protection" and as specified in the paragraph entitled "Protection and Restoration of Surfaces." Repair or reestablish damaged grades, elevations, or slopes prior to acceptance of work.

3.8 FIELD QUALITY CONTROL

3.8.1 Sampling

Furnish one 50-pound composite sample taken at random times daily of subgrade being compacted and fill material being placed. Submit samples, in the number directed, whenever the source or character of the fill, backfill, or embankment material changes. Contain each sample in a clean container and fasten to prevent loss of material. Tag each sample for identification. Tag shall contain the following information:

Contract No. _____
Sample No. _____
Date of Sample _____
Sampler _____
Source _____
Intended Use _____

3.8.2 Tests

Test fill, backfill, and granular fill using ASTM C 136 for conformance to ASTM C 33, and ASTM D 2487 gradation limits. Test fill for material finer than the No. 200 sieve using ASTM D 1140. Test

fill backfill for liquid limit and plasticity index using ASTM D 4318. Test fill backfill and subgrade in cut materials for moisture density relations using ASTM D 698 or ASTM D 4253 and ASTM D 4254. Test fill backfill for permeability in accordance with ASTM D 2434. Perform one of each of the required tests for each material used when directed. Provide additional tests as specified above for each source change. Perform density tests in randomly selected locations using ASTM D 2922 and ASTM D 3017 as follows: one test per 2000 square feet in each layer of lift. Determine moisture content of soil material in place at every location where in-place density is tested.

3.8.3 Controlled Fill

Method of in-place density tests shall be in accordance with paragraph "Tests." Acceptance of the compacted material shall be determined in each location by the results of a minimum of two consecutive tests. The average of two tests shall equal or exceed the specified density. The location of the tests for each compacted layer will be randomly selected by the Contracting Officer.

-- End of Section --

SECTION 02225

EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES

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 D 698	1978 (R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1557	1978 (R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2487	1990 Classification of Soils for Engineering Purposes
ASTM D 2922	1981 (R 1990) 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)
ASTM D 4253	1983 Maximum Index Density of Soils Using a Vibratory Table
ASTM D 4254	1983 Minimum Index Density of Soils and Calculation of Relative Density

CORPS OF ENGINEERS (COE)

COE EM-385-1-1	1992 Safety and Health Requirements Manual

1.2 DEFINITIONS

1.2.1 Backfill

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

1.2.2 Cohesive Materials

Soils classified by ASTM D 2487 as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when fines have a plasticity index greater than zero.

1.2.3 Cohesionless Materials

Soils classified by ASTM D 2487 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.

1.2.4 Compaction

The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 698 or ASTM D 1557 for general soil types or ASTM D 4253 or ASTM D 4254 (Relative Density) for isolated cohesionless materials, abbreviated in this specification as "_____ percent ASTM D _____ maximum density."

1.2.5 Granular Pipe Bedding

A dense, well-graded aggregate mixture of sand, gravel, or crushed stone (mixed individually, in combination with each other, or with suitable binder soil) placed on a subgrade to provide a suitable foundation for pipe. Granular bedding material may also consist of poorly graded sands or gravels where fast draining soil characteristics are desired.

1.2.6 Hard Material

Weathered rock, dense consolidated deposits, or conglomerate materials (excluding man made materials such as concrete) which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.7 In-Situ Soil

Existing in place soil.

1.2.8 Lift

A layer (or course) of soil placed on top of subgrade or a previously prepared or placed soil in a fill or backfill.

1.2.9 Porous Fill

A granular soil material having a large void ratio when placed and compacted, allowing a free flow of fluid to or from the surrounding soil, with no more than 5% of the material passing the No. 100 Sieve.

1.2.10 Refill

Material placed in excavation to correct overcut in depth.

1.2.11 Rock

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 cubic yard in volume. Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increas production.

1.2.12 Topsoil

In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Topsoil may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material.

1.2.13 Unyielding Material

Rock rib, ridge, rock protrusion, or soil with cobbles in the trench bottom requiring a covering of finer grain material or special bedding to avoid bridging in the pipe or conduit.

1.2.14 Unsatisfactory Material

In-Situ soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in the trench without excessive consolidation or loss of stability. Also backfill material which contains refuse, frozen material, large rocks, debris, soluble particles, and other material which could damage the pipe or cause the backfill not to compact. Materials classified as PT, OH, or OL by ASTM D 2487 are unsatisfactory.

1.2.15 Unstable Material

Material in the trench bottom which lacks firmness to maintain alignment and prevent joints from separating in the pipe, conduit, or appurtenance structure during backfilling. This may be material otherwise identified as satisfactory which has been disturbed or saturated.

1.3 SUBMITTALS

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

1.3.1 SD-08, Statements

a. Shoring and sheeting plan G

b. Dewatering plan G

1.3.1.1 Shoring and Sheeting Plan

Describe materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional engineer registered in any jurisdiction. Indicate sequence and method of installation and removal.

1.3.1.2 Dewatering Plan

Describe methods for removing collected water from open trenches and diverting surface water or piped flow away from work area. Describe equipment and procedures for installing and operating the dewatering system indicated. Describe the basic components of the dewatering system proposed for use and its planned method of operation. Record performance and effectiveness of method or system in use and submit weekly.

1.3.2 SD-11, Factory Test Reports

a. Trench backfill material tests G

b. Pipe bedding material tests G

1.3.3 SD-12, Field Test Reports

a. Test for moisture-density relation

b. Density and moisture tests

Submit field test data not listed above sufficiently in advance of construction so as not to delay work.

1.3.3.1 Test for Moisture-Density Relation

Submit 7 days prior to commencing utility excavation.

1.3.3.2 Density and Moisture Tests

Submit within 14 days of test date.

1.4 REGULATORY REQUIREMENTS

Materials and workmanship specified herein with reference to DOT State Standard 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."

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver and store materials in a manner to prevent contamination, segregation, freezing, and other damage. Store synthetic fiber filter fabric to prevent exposure to direct sunlight.

1.6 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. No pipes or other man-made obstructions, except those indicated, will be encountered.

c. The character of the material to be excavated or found in the trench is as indicated. Hard material identified as shale on the borings shall not be considered as rock and removal of such material shall not give cause for a claim for additional compensation regardless of hardness or difficulty in removing. Rock as defined in paragraph entitled "Definitions," will not be encountered.

d. Ground water elevations indicated are those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

e. Borrow material Suitable backfill and bedding material in the quantities required is not available at the project site.

f. Blasting will not be permitted.

1.7 PROTECTION

1.7.1 Dewatering Plan

Base on site surface and subsurface conditions, available soil and hydrological data.

1.7.2 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Provide soil materials as specified below free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, ice, or other deleterious and objectionable materials.

2.1.1 Backfill

Bring trenches to grade indicated on the drawings using material classified as GM, SM or SC by ASTM D 2487 with a maximum particle size of 3 inches.

2.1.2 Special Backfill for Structures and Pavements

Backfill trenches under roads, structures, and paved areas as specified in Section 02221, "Earthwork For Structures and Pavements."

2.1.3 Sand

Clean, coarse-grained sand classified as SW or SP by ASTM D 2487 for bedding and backfill as indicated.

2.1.4 Gravel

Clean, coarsely graded natural gravel, crushed stone or a combination thereof having a classification of GW GP in accordance with ASTM D 2487 for bedding and backfill as indicated. Maximum particle size shall not exceed 1-1/2 inches.

2.1.5 Borrow

Provide materials meeting requirement for porous fill, pipe bedding, general site fill, fill, special backfill, sand, gravel, backfill, granular fill. Obtain borrow materials in excess of those furnished from excavations specified herein from sources off Government property.

2.1.6 Pipe Bedding

Provide material for pipe bedding as indicated consisting of sand as classified in accordance with ASTM D 2487.

2.2 CONCRETE PIPE CRADLES OR ARCHES

Concrete pipe cradles and arches where indicated conforming to lines and dimensions indicated. Construct cradles and arches in accordance with Section 03300, "Concrete."

2.3 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch-minimum width, color coded as specified below

for the intended utility with warning and identification imprinted in bold black letters continuously ov r the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Yellow:	Electric
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems

2.3.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.3.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheeting

Provide shoring. In addition to Section XXIII A and B of COE EM-385-1-1 and other requirements set forth in this contract, include provisions in the shoring and sheeting plan that will accomplish the following:

a. Prevent undermining of pavements, foundations and slabs.

b. Prevent slippage or movement in banks or slopes adjacent to the excavation.

3.1.2 Dewatering

Plan for and provide the structures, equipment, and construction for the collection and disposal of surface and subsurface water encountered in the course of construction.

3.1.3 Water Removal

Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation, prevent hydrostatic uplift, and provide a stable trench condition for installation of the utility. Use screens and gravel packs or other filtering systems on the dewatering devices to prevent the removal of fines from the soil..

3.1.4 Operation and Performance

Operate the dewatering system until construction work below existing water levels is complete. Measure and record the performance of the dewatering system. After placement of the pipe or conduit and the initial backfill, the water level may be allowed to rise but at no time allow it to rise higher than one foot below the prevailing level of excavation or backfill. Have a back-up pump and system available for immediate use.

3.1.5 Structures and Surfaces

Protect newly backfilled areas and adjacent structures, slopes, or grades from traffic, erosion settlement, or any other damage. Repair and reestablish damaged or eroded grades and slopes and restore surface construction prior to acceptance. Protect existing streams, ditches, and storm drain inlets from water-borne soil by means of straw bale dike filter fabric dams or as indicated on the contract drawings. Perform work in accordance with requirements specified in Section 01560 "Environmental Protection."

3.1.6 Channels and Swales

Construct erosion control jute netting protection in areas indicated to th lines and thicknesses indicated to dissipate stream energy and prevent erosion.

3.2 SURFACE PREPARATION

3.2.1 Stockpiling Topsoil

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be wasted. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.2 Cutting Pavement, Curbs, and Gutters

Make cuts with neat, parallel, straight lines one foot wider than trench width on each side of trenches and one foot beyond each edge of pits.

3.3 GENERAL EXCAVATION AND TRENCHING

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 to a depth greater than indicated. Make trench sides as nearly vertical as practicable except where sloping of sides is allowed. Sides of trenches shall not be sloped from the bottom of the trench up to the elevation of the top of the pipe conduit duct. Excavate boulders, and other unyielding material to an overdepth at least 6 inches below the bottom of the pipe conduit duct and appurtenances unless otherwise indicated or specified. Blasting will not be permitted. Overexcavate soft, weak, or wet excavations as indicated. Use bedding gravel placed in 6-inch-maximum layers to refill overdepths to the proper grade. At the Contractor's option, the excavations may be cut to an overdepth of not less than 4 inches and refilled to required grade as specified. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe conduit duct structure on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded. Dimension of bell holes shall be as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. Trench dimensions shall be as indicated.

3.3.1 Shoring and Sheeting

Shore and sheet excavations as described in the plan submitted with various member sizes arranged to prevent injury to persons and damage to structures. Arrange shoring and sheeting to preclude injurious caving during removal. Obtain approval from the Contracting Officer prior to removing shoring, sheeting, or bracing in excavations adjacent to on-grade slabs, foundations, or other structural elements.

3.4 BEDDING

Of materials and depths as indicated for utility lines and utility line structures. Place bedding in 6-inch-maximum loose lifts. Provide uniform and continuous support for each section of structure except at bell holes or depressions necessary for making proper joints.

3.4.1 Concrete Cradles

Specified in lieu of other types of bedding for a particular type of pipe material, shall be as indicated or specified.

3.5 BURIED WARNING AND IDENTIFICATION TAPE

Install tape in accordance with manufacturer's recommendations except as modified herein. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.6 BACKFILLING

Construct backfill in two operations (initial and final) as indicated and specified in this section. Place initial backfill in 6-inch-maximum loose lifts to one foot above pipe, conduit, duct unless otherwise specified. Ensure that initially placed material is tamped firmly under pipe haunches. Bring up evenly on each side and along the full length of the pipe, conduit, or duct structure. Ensure that no damage is done to the utility or its protective coating. Place the remainder of the backfill (final backfill) in 9-inch-maximum loose lifts unless otherwise specified. Compact each loose lift as specified in the paragraph entitled "General Compaction" before placing the next lift. Do not backfill in freezing weather or where the material in the trench is already frozen or is muddy, except as authorized. Provide a minimum cover from final grade of 50 inches for water piping and for sewer mains. Where settlements greater than the tolerance allowed herein for grading occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities. Testing for the following shall be complete befor final backfilling: water distribution, sanitary sewer systems. Provide buried warning and identification tape installed in accordance with the manufacturer's recommendation.

3.7 COMPACTION

Use hand-operated, plate-type, vibratory, or other suitable hand tampers in areas not accessible to larger rollers or compactors. Avoid damaging pipes and protective pipe coatings. Compact material in accordance with the following unless otherwise specified. If necessary, alter, change, or modify selected equipment or compaction methods to meet specified compaction requirements.

3.7.1 Compaction of Material in Subcuts or Overexcavations

In soft, weak, or wet soils, tamp refill material to consolidate to density of adjacent material in trench wall. In stable soils, compact to 90 percent of ASTM D 4254 relative density.

3.7.2 Compaction of Pipe and Conduit Bedding

In soil, compact to 90 percent of ASTM D 4254 relative density.

3.7.3 Compaction of Backfill

Compact initial backfill material surrounding pipes, cables, conduits, or ducts, to 90 percent of ASTM D 698 or ASTM D 4254 maximum density except where bedding and backfill are the same material. Where bedding and backfill are the same material, compact initial backfill to the density of the bedding. Under areas to be seeded or sodded, compact succeeding layers of final backfill to 85 percent of ASTM D 698 or ASTM D 4254 maximum density. For utilities under structures and pavements compact succeeding layers of final backfill as specified under section 02221 Earthwork for Structures and Pavements."

3.8 SPECIAL EARTHWORK INSTALLATION REQUIREMENTS

3.8.1 Manholes and Other Appurtenances

Provide at least 12 inches clear from outer surfaces to the embankment or shoring. Remove rock as specified herein. Remove unstable soil that is incapable of supporting the structure to an overdepth of one foot and refill with gravel or sand to the proper elevation. Stabilize soft, weak, or wet excavations as indicated. Refill overdepths with gravel to the required grade and compact to 90 percent of ASTM D 698 maximum density.

3.8.2 Compaction for Structures and Pavements

Compaction requirements for materials in pavement sections above the subgrade level shall be as specified in Section 02221, "Earthwork for Structures and Pavements."

3.9 FINISH OPERATIONS

3.9.1 Grading

Finish to grades indicated within one-tenth of a foot. Provide sod or topsoil in areas to be seeded or sodded in accordance with requirements specified in Section 02930, "Turf." Grade areas to drain water away from structures and to provide suitable surfaces for mowing machines. Grade existing grades that are to remain but have been disturbed by the Contractor's operations.

3.9.2 Spreading Topsoil

Comply with the requirements of Section 02930, "Turf."

3.9.3 Disposition of Surplus Material

Surplus or other soil material not required or suitable for filling, backfilling, or grading shall be removed from Government poperty. Comply with requirements of Section 01560, "Environmental Protection."

3.9.4 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur and as required in Section 01560, "Environmental Protection." Repair or reestablish damaged grades, elevations, or slopes.

3.9.5 Pavement Repair

Repair pavement, curbs, and gutters as specified in Section 02511, "Asphalt Concrete Paving and Incidental Construction." Do not repair pavement until trench or pit has been backfilled and compacted as specified herein. Provide a temporary road surface of gravel over backfilled portion until permanent pavement is repaired. Remove and dispose of temporary road surface material when permanent pavement is placed. As a minimum, maintain one-way traffic on roads and streets crossed by trenches. Fully open roads

and streets to traffic within 3 days.

3.10 FIELD QUALITY CONTROL

Test sand, gravel, bedding and backfill for conformance to specified requirements. Test backfill to be used under roads and paved areas for conformance to special requirements. Test bedding and backfill for moisture-density relations in accordance with ASTM D 698 and ASTM D 4253 as specified herein. Perform at least one of each of the required tests for each material provided. Perform sufficiently in advance of construction so as not to delay work. Provide additional tests as specified above for each change of source. Perform density and moisture tests in randomly selected locations and in accordance with ASTM D 2922 and ASTM D 3017 as follows:

a. Bedding and Backfill in Trenches: One test per 50 linear feet in each lift.

b. Appurtenance Structures: One test per 100 square feet or fraction thereof in each lift.

-- End of Section --

SECTION 02511

ASPHALT CONCRETE PAVING AND INCIDENTAL 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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T30	1990 Mechanical Analysis of Extracted of Aggregate
AASHTO T230	1990 Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1559	1989 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2172	1988 Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2950	1991 Density of Bituminous Concrete in Place by Nuclear Method

STATE HIGHWAY SPECIFICATION (SHS)

SHS RIDOT	State of Rhode Island and Providence Plantations Department of Transportation, Standard Specifications for Road and Bridge Construction, Dated 1971, (RIDOT) Amended 1992. Division of Public Works.

1.2 DESCRIPTION

This section includes the provision of all plant, labor, and materials necessary for the preparation of the subgrade and the construction thereon of a subbase course, a base course, a prime coat, a surface course, paint striping and incidental construction. Provide all work and materials in accordance with the applicable requirements of the SHS RIDOT. Sections mentioned herein refer to those specifications. Paragraphs in SHS RIDOT titled "Method of Measurement and Payment" and "Prosecution and Progress" shall not apply. Where the term "Engineer" is used in SHS RIDOT it shall be construed to mean the Contracting Officer.

1.3 RELATED REQUIREMENTS

Excavation and filling to establish elevation of subgrade is specified in Section 02221, "Earthwork for Structures and Pavements."

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Precast car stops

1.4.2 SD-08, Statements

a. Asphalt Mix Delivery Record

1.4.2.1 Required Record Data

Record and submit the following information pertaining to the delivery of mix to the job site:

(1) Truck No:

(2) Time In:

(3) Time Out:

(4) Tonnage and Discharge Temperature:

(5) Mix Type: G

(6) Location:

(7) Stations Placed:

Record the above information for each load and submit daily on Government furnished forms. Placement will not be permitted unless the Contractor has a working asphalt thermometer on site.

1.4.3 SD-10, Test Reports

a. Trial batch reports

b. Mix design G

1.4.3.1 Mix Design

Submit results of all laboratory tests performed on each mix design. Testing shall have been accomplished not more than one year prior to the date of material placement.

1.4.4 SD-12, Field Test Reports

a. Paving materials

b. Pavement

Submit reports for testing specified under paragraph titled "Field Quality Control."

1.4.5 SD-13, Certificates

a. Paving materials

Submit certificates, signed by the producer, that all paving materials and incidental construction items conform to specification requirements.

1.4.6 SD-14, Samples

a. Uncompacted sample of each mix type

b. Pavement cores

Submit 2 pavement cores if the in-place nuclear density method is used.

PART 2 PRODUCTS

2.1 MATERIALS

Provide materials in accordance with the applicable requirements of the SHS RIDOT, except where specified otherwise. Recycled asphalt pavement material may be used as permitted by SHS RIDOT.

2.1.1 Subbase

Materials for construction of the subbase shall be in accordance with Section 300, Gradation II.

2.1.2 Base Course

Materials for construction of the base course shall be in accordance with Section 300, Gradation I.

2.1.3 Surface Course

Materials for construction of the surface course shall be in accordance with Section 402 Type II.

2.1.4 Precast Car Stops

Provide car stops to the profile and size indicated. Manufacture with air entrained concrete having a minimum compressive strength of 3,000 psi at 28

days, with two No. 4 reinforcing rods located at mid-point of its cross section and with two galvanized sle ves for anchoring.

2.2 COMPOSITION OF MIXTURE REQUIREMENTS

2.2.1 Mixture Properties

Gradation of mineral aggregate shall be as specified. The percentage of bituminous material provided in the bituminous mixtures shall be within the limits specified. Mixtures shall have the following physical properties:

Test Property	Values
Stability (50-Blows)	Not less than 500 pounds
Flow (0.01 inch)	Not more than 20 nor less than 8
Percent Air Voids	Not less than 4 nor more than 6 for binder course; not less than 3 nor more than 5 wearing course
Percent Voids in Mineral Aggregates	See Table I

TABLE I

MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE (VMA)

U.S.A Standard Sieve Designation	Nominal Maximum Particle Size, In.	Minimum VMA Percent
No. 4	0.187	18
3/8 inch	0.375	16
1/2 inch	0.500	15
3/4 inch	0.750	14
1 inch	1.000	13

2.2.2 Quantity of Bituminous Material

Mix asphalt cement with aggregates of corresponding mixes in the following proportions:

ASPHALT CEMENT PERCENT BY WEIGHT OF TOTAL MIX

Binder Course	Surface Course
4-8	5-9

PART 3 EXECUTION

3.1 CONSTRUCTION

Provide construction in accordance with the applicable requirements of the SHS RIDOT, except where indicated or specified otherwise.

3.1.1 Subgrade

Preparation of subgrade shall be in accordance with Section 02221 "Earthwork For Structures And Pavement".

3.1.2 Subbase

Methods of construction of the subbase shall be in accordance with Section 300.

3.1.3 Base Course

Methods of construction of the base course shall be in accordance with Section 300.

3.1.4 Surface Course

Methods of construction of the surface course shall be in accordance with Section 402. Provide prime coat on the base course before construction of the modified binder course. Provide tack coat on the binder course before construction of the surface course.

3.1.5 Precast Car Stops

Provide car stops where indicated. Install with an anchor rod driven through each sleeve.

3.2 FIELD QUALITY CONTROL

Sample shall be taken by the Contractor as specified herein at the expense of the Contractor. Testing shall be conducted by an independent testing laboratory selected by the Contractor and approved by the Contracting Officer. The independent testing laboratory shall be manned by qualified technicians supervised by a registered professional soils engineer, not employees of the Contractor and shall be otherwise equipped to perform all tests in accordance with the standards specified herein. All tests shall be performed at the Contractor's expense. All materials and material sources will be approved by the Contracting Officer 2 days prior to the use of such material in the work. The Contractor shall replace the pavement where sample cores have been removed.

3.2.1 Sample and Core Identification

Place each sample and core in a container and securely seal to prevent loss of material. Tag each sample for identification. The tag shall contain the following information:

a. Contract No.

b. Sample No.

c. Quantity

d. Date of Sample

e. Sample Description

f. Source/Location/Stations Placed

g. Intended Use

3.2.2 Testing

3.2.2.1 Trial Batch

Submit current bituminous design reports for all mix types proposed for use on the project.

3.2.2.2 Bituminous Mix Testing

Take two samples per day per mix type at the plant or from the truck. Test the uncompacted mix for extraction in accordance with ASTM D 2172 and sieve analysis in accordance with AASHTO T30. Test the samples for stability and flow in accordance with ASTM D 1559. If two consecutive tests fail to meet requirements of the specifications, placement operations shall cease and a new trial batch shall be submitted for approval prior to resumption of placement operations.

3.2.2.3 Testing of Pavement Course

a. Density: Determine density of the pavement by testing cores obtained from the binder and surface course in accordance with AASHTO T230. Take three cores at locations designated by the Contracting Officer for each 200 tons, or fraction thereof, of asphalt placed. Deliver cores undisturbed and undamaged to the laboratory and provide test results within 48 hours of each days placement of paving materials.

b. Thickness: Determine thickness of the binder and surface course from cores taken for the density test.

c. Straightedge Test: Test the compacted surface of the binder course and surface course with a straightedge as the work progresses. Apply the straightedge parallel with and at right angles to the center line after final rolling. Uneveness of the base course shall not vary more than plus or minus 1/4 inch in ten feet; variations in the surface course shall not vary more than plus or minus 1/4 inch in ten feet. Any portion of the pavement showing irregularities greater than that specified shall be corrected as directed by the Contracting Officer.

3.2.2.4 Alternate Testing Method for Pavement Courses

At the Contractor's option the following in-place testing method may be used to determine density and thickness in lieu of the testing specified above. Frequency of testing shall be the same. If the in-place nuclear method to determine density is used, take two pavement cores at locations designated by the Contracting Officer and turn over to the Government to verify pavement thickness.

a. Density: Determine density of the pavement by in-place testing using Nuclear Method in accordance with ASTM D 2950.

b. Thickness: Determine thickness of the finished pavement by use of the following equation:

$$t = \frac{W}{0.75d}$$

Where t = pavement thickness, in inches.
W = average weight per square yard of mixture actually used in the work.
d = compacted density as measured by nuclear density device.

-- End of Section --

SECTION 02661

EXTERIOR WATER DISTRIBUTION SYSTEM (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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.18	1984 Cast Copper Alloy Solder Joint Pressure Fittings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ANSI/ASME B16.22	1989 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME/ANSI B16.26	1988 Cast Copper Alloy Fittings for Flared Copper Tubes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 32	1989 Solder Metal
ASTM B 61	1990 Steam or Valve Bronze Castings
ASTM B 62	1990 Composition Bronze or Ounce Metal Castings
ASTM B 88	1989 Seamless Copper Water Tube

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	1987 Installation of Ductile-Iron Water Mains and Their Appurtenances

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical 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. Water service line piping, fittings, joints, valves and couplings

b. Corporation stops

c. Curb stop

d. Curb box

Submit manufacturer's standard drawings or catalog cuts for the listed items, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

1.3.2 SD-06, Instructions

a. Installation procedures for water piping

1.3.3 SD-13, Certificates

a. Water service line piping, fittings, joints, valves and couplings

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry, do not drag pipe to the trench. Store rubber gaskets and plastic piping and jointing materials that are not to be installed immediately, under cover out of direct sunlight.

PART 2 PRODUCTS

2.1 WATER SERVICE LINE MATERIALS

2.1.1 Piping Materials

2.1.1.1 Copper Tubing and Associated Fittings

Tubing shall conform to ASTM B 88, Type K. Fittings for solder-type joint shall conform to ANSI B16.18 or ANSI/ASME B16.22;

fittings for compression-type joint shall conform to ASME/ANSI B16.26, flared tube type.

2.1.1.2 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.1.2 Water Service Line Appurtenances

2.1.2.1 Corporation Stops

Ground key type; made of bronze conforming to ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ASME/ANSI B16.26.

2.1.2.2 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.

2.1.2.3 Curb Stops

Ground key, round way, inverted key type; shall be made of bronze conforming to ASTM B 61 or ASTM B 62; and rated at 150 psi. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb stop indicating direction of flow.

2.1.2.4 Curb Boxes

Provide for each curb stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Location of Water Lines

The work covered by this section shall terminate at a point approximately 5 feet from the building. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer

horizontally than 10 feet from any sanitary sewer line. Do not lay water lines in the same trench with electric wiring.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02225, "Excavation, Backfilling, and Compacting for Utilities."

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with bell end pointing in the direction of laying. Grade pipeline in straight lines; avoid formation of dips and low points. Support pipe at proper elevation and grade, and secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevents installation.

3.1.1.4 Connections to Existing Lines

After approval is obtained, make connections to existing water lines with a minimum interruption of service on the existing line. Use tapping or drilling machine valve and mechanical joint type stainless steel sleeve for connections to be made under pressure. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the branch. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Contracting Officer in writing at least 15 days prior to the date the connections are required; receive approval before any service is interrupted. Furnish all materials required to make connections into the existing water supply systems and perform all excavation, backfilling, and other incidental labor as required.

3.1.2 Installation of Water Service Piping

3.1.2.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; such water service lines shall be closed with plugs or caps.

3.1.2.2 Service Line Connections to Water Mains

Connect service lines to the main by a corporation stop and gooseneck and install a service stop below the frostline as indicated. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.

3.1.2.3 Special Requirements for Installation of Metallic Piping

a. Metallic Piping Installation, General: Install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" and with applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.

b. Jointing:

(1) Threaded Joints: Make threaded joints up tight with a stiff mixture of graphite and oil, inert filler and oil, or an approved graphite compound; apply to male threads only. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling joint.

(2) Joints for Copper Tubing: Cut copper tubing with square ends; remove fins and burrs. Handle tubing carefully; replace dented, gouged, or otherwise damaged tubing with undamaged tubing. Make solder joints using ASTM B 32, 95-5 tin-antimony or Grade Sn96 solder. Solder and flux shall not contain lead. Before making joint, clean ends of tubing and inside of fitting or coupling with wire brush or abrasive. Apply a rosin flux to tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and flare tubing with a flaring tool.

3.1.3 Disinfection

Flush and disinfect new potable water lines and affected portions of existing potable water lines in accordance with Section 15400, "Plumbing".

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed properly in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test water s rvice lines in accordanc with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at copper tubing joints (soldered, compression type, brazed and threaded joints).

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

-- End of Section --

SECTION 02671

ROTARY-DRILLED EXTRACTION AND MONITORING WELLS

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 C 150	1989 Portland Cement
ASTM C 494	1990 Chemical Admixtures for Concrete

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 570/9-75-001	Water Well Construction Practices

1.2 SUBMITTALS

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

1.2.1 SD-04, Drawings

a. Rotary-drilled wells G

1.2.1.1 Required Drawings G

Submit drawings or catalog cuts showing rotary-drilled methods and well components and details of well casings, well screens, filter sand, grout, air lines, and gages. Detail drawings or catalog cuts shall be accompanied by a cross section showing the relative size, location, and spacing of the well components such as the hole size, casing, well screen, filter sand, air line and gage, and grout.

1.2.2 SD-08, Statements

a. Water disposal methods G

b. Cuttings disposal methods G

c. Filter sand placement equipment list

d. Filter sand placement methods

1.2.3 SD-12, Field Test Reports

a. Well hole G

b. Pump test G

1.2.3.1 Well Hole Reports

Provide data for ground water extraction and monitoring wells and submit data obtained at each well site, in triplicate. Include the appropriate depth, details of construction, length and location of screens, screen openings, filter sand size, yield test data and bentonite clay seal. Submit a drillers log drawn to scale with coarseness and fineness modulus of each strata, time penetration log (time to drill through each formation), and sieve analysis.

1.2.4 SD-13, Certificates

a. Casings G

b. Cement G

c. Bentonite Pellets G

d. Riser G

e. Screens G

f. Filter Sand G

1.2.5 SD-16, Sample Panels

a. Well hole G

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact. Replace defective or damaged materials with new materials.

1.4 GENERAL REQUIREMENTS

Provide each system complete and ready for operation. The work includes providing rotary drilled ground water extraction wells, and groundwater monitoring wells for purposes of installing groundwater extraction pumps and to provide a means of procuring representative ground water samples at the indicated locations shown on the Contract Drawings. Each system, including equipment, materials, installation, and workmanship shall be in accordance with EPA 570/9-75-001, except as modified herein. In the manual referred to herein, the advisory provisions shall be considered mandatory, as though the word "shall" has been substituted for the word "should" wherever it appears. Reference to the "Project Representative" and the "Owner" shall be interpreted to mean the Contracting Officer. Other applicable requirements are included under Section 01560, "Environmental Protection", and Section 02060, "Hazardous Material Management."

PART 2 PRODUCTS

2.1 MATERIALS

Shall conform to the respective specifications and other requirements as specified herein.

2.1.1 Riser

Provide riser with flush screwed joints. Ground water well casing to be 304 stainless steel. Monitoring wells shall be schedule 40 PVC.

2.1.2 Well Screens

Type 304 stainless steel, 4" inside diameter, slotted wire-wound type, for extraction wells; 2" inside diameter slotted schedule 40 PVC (ASTM D-2665, D-1784) for monitoring wells. Provide screens with adequate strength to resist external forces, both during and after installation. Length shall be as indicated. Water velocity through openings shall not exceed 0.1 foot per second. Determine the well screen openings from an analysis of the sand in the water-bearing strata. Provide joints of the same material as the screen. Bottom section of well screens shall be capped.

2.1.3 Filter Sand

Provide clean, round, uniform 20/30 "Ottawa" sand.

2.1.4 Grout

Provide neat cement grout, Type I or II portland cement conforming to ASTM C 150, and water. The mixed grout shall contain no more than 7 gallons of water per bag (1.0 cubic foot or 94 pounds) of cement.

2.1.4.1 Admixtures

ASTM C 494.

2.1.4.2 Bentonite Clay

Provide 5/8" (1.5 mm) solid bentonite clay pellets.

2.1.5 Auxiliary Equipment

Provide discharge piping and equipment to dispose of pumped water to Underground Storage Tank #52 as detailed in Section 02060, "Hazardous Materials Management" during developing and testing of well.

PART 3 EXECUTION

3.1 GENERAL

The contractor shall be required to provide "Rotary-Drilled Ground Water Extraction and Monitoring Wells" at the locations shown and to the details and depths as indicated on the contract drawings. All work shall be done

in accordance with Section 02060, "Hazardous Materials Management."

3.2 DRILLING

3.2.1 Groundwater Extraction Well

Drill a hole to the diameter and depth as indicated using the dual-rotary drilling method to remove cuttings and minimize the creation of mudcake on the borehole walls. A temporary casing shall be installed in the unconfined and weathered rock layer to an approximate depth of 50 feet, and then pulled when installing the sand envelope. The contractor shall take soil samples every five (5) feet in the saturated zone of each well hole and perform grain size analysis on each sample. The grain-size data shall be used to select the proper well screen slot size for each well. Handle drill cutting in accordance with Section 02060, "Hazardous Materials Management."

3.2.2 Groundwater Monitoring Well

Drill a hole to the diameter and depth as indicated using the air-rotary drilling method. Handle drill cuttings in accordance with Section 02060, "Hazardous Materials Management."

3.3 RISER AND WELL SCREEN

Provide threaded joints in accordance with ANSI B2.1. Provide the riser and well screens concentrically in the drill hole. Seal the bottom of the screen with a threaded or welded plug, consisting of the same material and thickness as the screen body, or a welded plate, consisting of the same material and thickness as the screen body or riser.

3.4 FILTER SAND ENVELOPE

Following completion of the underream, fill the entire annular space between the screen and outside wall of the underreamed hole with filter sand. The filter sand envelope shall extend from a point equal in distance to 2.5 times the largest diameter of the underreamed hole below the lowest screen and the same distance above the highest screen. Control speed of sand placement to prevent bridging and to allow for settlement of the sand. Equipment and methods required to place the sand shall be approved by the Contracting Officer prior to commencement of work.

3.5 BENTONITE PELLET SEAL FOR MONITORING WELLS

The bentonite pellets shall be poured down the annular space between the riser and borehole slowly, evenly and in a manner to prevent bridging. Following installation of the pellets, they shall be tampered with a flat ended rod to ensure the pellets are tightly pressed against the sand pack.

3.6 GROUTING

Following installation of the pellets and hydration for a minimum of one hour, cement/bentonite grout shall be provided. The grout shall be installed by extending the fill pipe to the top of the bentonite pellets and grouting slowly by filling the annular space with grout and retracting

the grout pipe at the rate the grout fills the space.

3.7 WELL COMPLETION

Provide the casing for monitoring wells and prepare the extraction wells for the valve pit as shown.

3.7.1 Well Development

Set the casing or valve pit and allow the neat cement grout to harden a minimum of 72 hours prior to well development. Provide well development in accordance with Article 52 of EPA Manual 570/9-75-001, except explosives will not be permitted. Provide pumps, compressors, plungers, bailers, and other equipment required to fully limit sand intrusion during the life of the well. Pump the well free of sand, mud, drillings, and other foreign matter. During development record the well yield and submit this information with the well data.

The Contractor shall collect all development water in an approved hazardous waste tanker trailer. The tanker shall have a capacity of at least 5,000 gallons and shall be free of any liquid, sludge or solids prior to being used to store development water. The Contracting Officer shall have the authority to reject any tanker trailer containing residuals, not inspected in the last year, not having DOT certification or which has damage or defects. Alternatively, the development water can be pumped directly to Underground Storage Tank #52 in a manner approved by the Contracting Officer. Minimum pipe size shall be 1 inch diameter.

The Contractor shall dispose of the development water by injecting the contents of the tanker into existing Underground Storage Tank #52 adjacent to the work in a manner approved by the Contacting Officer.

3.7.2 Sanitary Seal

Provide a sanitary seal for the well to prevent contamination until the pump foundation and pump are installed on the well.

3.8 WASTE DISPOSAL

Dispose of waste materials and soil removed from the drilled holes as indicated in Section 02060, "Hazardous Materials Management."

3.9 FIELD SAMPLING AND TESTING

3.9.1 Pump Test

Provide a 72-hour multiple-well pumping test on the thirteen (13) newly installed extraction wells which will be located as shown. The purpose of this test is to determine, record and evaluate the following:

* Long-term sustainable yield of each extraction well

* Capture zones of the wells individually and collectively

* Pumping interference effects on each well from the simultaneous pumping of each well

This information will be used to evalute the effectiveness of the extraction wells in capturing the ground water contamination plume and determining each extraction well's long-term sustainable yield. Provide the pumping test according to the specific details of each part of the test as outlined below.

72-Hour Pumping Test

Before the actual pumping of each well starts, a 48-hour period of "background" non-pumping water level measurements shall be taken from each extraction well and all nearby monitoring and observation wells.

The wells to be monitored include: Extraction Wells EW-1 through EW-13, all existing and new monitoring wells as shown.

Measurements shall be made by the Contractor with a multi-channel data logger attached to pressure transducers within the wells and/or by manual measurements of water levels with an electronic water level indicator. Measurements shall be recorded to the nearest 0.01 feet. Measurements shall be made be made at a frequency of no greater than 1 hour.

The purpose of the "background" water level measurements is to determine if periodic fluctuations in the water table occurring prior to the iniation of the 72-hour pumping test. Upward or downward trends in the water table elevation prior to the commencement of the pumping test shall be noted by the Contractor.

After "background" measurements are completed, the pumping of the thirteen extraction wells shall proceed. Initially, each well shall be pumped simultaneously at a pre-determined rate.

The pumping rate of each extraction well shall be determined by the Contractor during development of each extraction well.

During the initial six hours of the pumping test, the Contractor shall "adjust" the pumping rate of each extraction well to produce at least 8 feet drawdown in each extraction well's pre-pumping water level. The Contractor shall monitor the drawdown by collecting and recording water level measurements in each extraction well every 15 minutes. In addition, the Contractor shall adjust the pumping rate of each extraction well to prevent the well's submersible pump from cycling off and on more than six times per hour.

After the initial six hours of the pumping test, the Contractor shall continue to adjust the pumping rate of each extraction well, as needed, to maintain at least 8 feet of drawdown in each extraction well and to prevent the pumps from cycling more than six times per hour. Water level measurement frequency in the extraction wells can be increased to every hour.

Flow from the electric submersible pumps shall be adjusted with the globe valves attached to the discharge line in the well valve pits. Flow rates

shall be measured and r corded in tabular form with the in-line flow meter.

Water level measurements shall be made with a multi-channel data logger attached to pressure transducers within the wells and/or manual measurements using an electric water level indicator. Measurements shall be made at the frequencies specified above.

The extraction well pumps shall be shut off after 72 hours (4320 minutes). Recovery of the water levels will be recorded during a 36-hour recovery period. The water level recovery measurements shall be recorded every hour during the recovery period.

Special provisions should be provided for in the event that adverse weather conditions or a power or pump failure occurs during the test. It is critical that each well's pumping rate be adjusted according to the criteria discussed above and the adjusted flow rate and time of adjustment noted.

In the event of pump, equipment or power failure or any other shutdown of the system during the 72-hour test, the Contractor shall repeat the test until an uninterrupted 72-hour set of data is furnished.

In order to obtain accurate and neat data points, all manual water level measurements an extraction well pumping rates should be recorded on a pumping test data sheet.

The Contractor shall provide to the Contracting Officer copies of neat and legible data sheets from each monitored well. Plotted graphs of drawdown vs. time shall also be provided for each well. Pre-pumping or "background" measurement and recovery measurement data sheets and plotted graphs should also be provided to the Contracting Officer.

-- End of Section --

SECTION 02730

EXTERIOR SANITARY SEWER SYSTEM

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 th basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3	1984 Ladders - Fixed - Safety Requirements

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 62	1991 (Rev. B) Building Brick (Solid Masonry Units made from Clay or Shale)
ASTM C 144	1991 Aggregate for Masonry Mortar Units
ASTM C 478	1990 (Rev. B) Precast Reinforced Concrete Manhole Sections
ASTM C 923	1989 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 969	1989 (Rev. 1990) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM D 3034	1989 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 4101	1982 (Rev. 1988) Polypropylene Plastic Injection and Extraction Materials

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-5	1989 Installation of Polyvinyl Chloride (PVC) Sewer Pipe
UBPPA UNI-B-6	1990 Low-Pressure Air Testing of Installed Sewer Pipe

1.2 RELATED REQUIREMENTS

Section 15011,"Mechanical General Requirements," applies to this section with additions and modifications as specified herein.

1.3 SYSTEM DESCRIPTION

1.3.1 Sanitary Sewer Gravity Pipeline

Provide 8-inch lines of polyvinyl chloride (PVC) plastic pipe. Provide building connections 8-inch lines of polyvinyl chloride (PVC) plastic pipe.

Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Pipeline materials including joints, fittings, and couplings

Submit manufacturer's standard drawings or catalog cuts.

1.4.2 SD-04, Drawings

a. Precast concrete manhole

1.4.3 SD-13, Certificates

a. Pipeline materials, joints and fittings, including factory-applied linings

b. Precast concrete manhole sections

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise. Production control tests shall have been performed at the intervals or frequency specified in the referenced publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03300, "Cast-In-Place Concrete."

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

2.1.1 PVC Plastic Gravity Sewer Piping

2.1.1.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, with ends suitable for elastomeric gasket joints.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Precast Concrete and Associated Materials

2.2.1.1 Precast Concrete Manhole Sections

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478. Base and first riser shall be monolithic.

2.2.1.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923.

2.2.2 Metal Items

2.2.2.1 Frames and Covers for Manholes

See Section 05500, "Metal Fabrications".

2.2.2.2 Manhole Steps

Zinc-coated steel conforming to ANSI A14.3. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps will not be permitted. Steps are not

required in manholes less than 4 feet deep.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

Apply except where specific exception is made in the following paragraphs entitled, "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

1. A vertical separation of at least 18 inches between the bottom of the sanitary piping and the top of the water line.

2. Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.

3. That the length (minimum 18 feet) of the sanitary piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the water line.

c. Sanitary Sewer Manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02225, "Excavation, Backfilling and Compacting for Utilities."

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for

the same purpose.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line. Core drill existing manhole and install flexible connection to effect a watertight seal. Adjust the manhole as shown.

3.1.2 Special Requirements

3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" of this section and with the requirements of UBPPA UNI-B-5 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of UBPPA UNI-B-5 for assembly of joints. Make joints to other pipe materials in accordanc with the recommendations of the plastic pipe manufacturer.

3.1.3 Concrete Work

Cast-in-place concrete as specifiec in Section 03300, "Cast-In-Place Concrete."

3.1.4 Manhole Construction

Use precast concrete base sections. Make inverts in precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled, "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes. Adjust frame to grade with brick and mortar, conforming to ASTM C 62, Grade SW and ASTM C 144.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 Metal Work

a. Workmanship and Finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing as detailed below. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Infiltration Tests and Exfiltration Tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969.

b. Low-pressure Air Tests: Perform tests as follows:

(5) PVC Plastic Pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

-- End of Section --

SECTION 02740

EXTERIOR GROUND WATER COLLECTION SYSTEM

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 OF MECHANICAL ENGINEERS (ASME)

ANSI/ASME B16.3	1985 Malleable Iron Threaded Fittings Classes 150 and 300
ANSI/ASME B16.4	1985 Cast Iron Threaded Fittings Classes 125 and 250
ASME/ANSI B16.26	1988 Cast Copper Alloy Fittings for Flared Copper Tubes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM B 32	1989 Solder Metal
ASTM B 61	1990 Steam or Valve Bronze Castings
ASTM B 62	1990 Composition Bronze or Ounce Metal Castings
ASTM D 2774	1972 (R 1983) Underground Installation of Thermoplastic Pressure Piping

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	1987 Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C800	1989 Underground Service Line Valves and Fittings

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	1988 Installation of Polyvinyl Chloride (PVC) Pressure Pipe

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements," applies to this section with additions and modifications specified herein.

1.3 DESIGN REQUIREMENTS

1.3.1 Ground Water Extraction Collector Mains

Provide collector mains indicated as 2-inch lines of polyethylene pipe and fittings.

1.3.2 Ground Water Extraction Well Service Lines

Provide service lines indicated as 1-inch lines from collector main to the well valve pit. Service lines shall be polyethylene. Provide a valve pit over each well to house piping, valves, water meter and controls as shown.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Collector main piping, fittings, joints, valves and couplings G

b. Service line piping, fittings, joints, valves and couplings G

c. Precast Concrete Manhole

d. Pressure Gauges G

e. Gate Valves G

f. Globe Valve G

g. Water Meters G

h. Check Valve G

i. Manhole Frame and Cover

Submit manufacturer's standard drawings or catalog cuts for the listed items.

1.4.2 SD-06, Instructions

a. Installation procedures for piping, valves and water meters

1.4.3 SD-13, Certificates

a. Collector main piping, fittings, joints, valves and couplings G

b. Service line piping, fittings, joints, valves and couplings G

c. Pressure Gauges G

d. Water Meter G

e. Precast Concrete Manhole

f. Manhole Frame and Cover

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping and jointing materials, and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry, do not drag pipe to the trench. Store rubber gaskets and plastic piping and jointing materials that are not to be installed immediately, under cover out of direct sunlight.

PART 2 PRODUCTS

2.1 COLLECTOR MAIN AND SERVICE LINE MATERIALS

2.1.1 Piping Materials

2.1.1.1 Polyethylene Piping

Polyethylene piping material and fittings shall be Type III C5 P34 as tabulated in ASTM D-1248, and have recommended designation values of 3-3-5-4-3-3-C as referenced in ASTM D 3350.

The polyethylene pipe shall have a minimum rating of 120 psi and minimum thickness equivalent to SDR-21. Joints shall be of the compression gasket type for underground installation.

The pipe shall be homogenous throughout and free from visible cracks,

holes, foreign materials, blisters, wrinkles and d nts.

The pipe shall be marked with an easily legible and permanent surfacce mark specifically identifying the manufacturer by name or trademark and the size, schedule, and type of pipe.

2.1.1.2 Steel Pipe and Associated Fittings

Pipe shall conform to ASTM A 53, Standard Weight, zinc-coated. Fittings shall conform to ANSI/ASME B16.4, Class 125, zinc-coated; or to ANSI/ASME B16.3, Class 150, zinc coated, threaded.

2.1.1.3 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.1.2 Collector Main and Service Line Appurtenances

Shall conform to the requirements of Section 15400, "Plumbing".

2.1.2.1 Corporation Stops

Ground key type; made of bronze conforming to ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ASME/ANSI B16.26.

2.1.2.2 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.

2.1.2.3 Curb Stops

Ground key, round way, inverted key type; shall be made of bronze conforming to ASTM B 61 or ASTM B 62; and rated at 150 psi. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb stop indicating direction of flow.

2.1.2.4 Curb Boxes

Provide for each curb stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Each box shall have a heavy coat of bituminous paint.

2.1.2.5 Gate Valves

FS WW-V-54 and FS WW-V-58 valves shall be double disc, with a water

pressure rating of 200 psig. Valves shall be of outside-screw-and-yoke configuration. Valves shall have flanged or threaded end connections, with a union on at least one side of the valve.

2.1.2.6 Check Valves

FS WW-V-51 or MIL-V-18435. Valves shall have threaded end connection. FS WW-V-51 valves shall be swing check, with a water pressure rating of 200 psig. MIL-V-18436 valves shall be swing check, cast iron or steel bodies with bronze trim, and designed for hydraulic working pressure of 175 psig. True union ball check valves shall be PVC with threaded or socket connections and shall have a pressure rating not less than that of the pipe.

2.1.2.7 Globe Valves

FS WW-V-51. Valves shall have steel body, threaded end connection, Class 125, rising stem, bolted bonnet type with handle.

2.2 PRESSURE GAGES

All pressure gages shall have a minimum 2 inch diameter, 270 degree scale 2% accuracy, white face, black numerals and pointer. All gages shall be bronze bourdon tube, enclosed in an aluminum alloy case, with a 1/4-inch NPT connection at bottom. Gages shall have a range of up to 100 psi. Locations shall be as shown on the Contract Drawings.

2.3 WATER METERS

Water meters for measuring flow from the extraction wells shall be 5/8 inch minimum size, iron body, positive displacement and resistant to volatile organic contaminants in the flow. The meter shall have a hermetically sealed direct reading non-resettable 6-digit totalizer (in gallons) and a minimum 3-inch diameter dial with increments of 0.1 gallons capable of registering flow from 2 to 20 gallons per minute at an accuracy of 98% and a low flow range of 0.75 gallons per minute at an accuracy of 95%.

2.4 MANHOLES

2.4.1 Precast Concrete Manhole and Associated Materials

2.4.1.1 Precast Concrete Manhole Sections

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478. Base and first riser shall be monolithic.

2.4.1.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923.

2.4.2 Metal Items

2.4.2.1 Frames and Covers for Manholes

See Section 05500, "Metal Fabrications".

2.4.2.2 Manhole Steps

Zinc-coated steel as indicated conforming to ANSI A14.3. As an option, plastic or rubber coating pressure-molded to the steel may be used.

Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to pipeline installation except where specific exception is made in the "Special Requirements" paragraphs.

3.1.2 Earthwork

Perform earthwork operations in accordance with Section 02225, "Excavation, Backfilling and Compacting for Utilities."

3.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with bell end pointing in the direction of laying. Grade pipeline in straight lines; avoid formation of dips and low points. Support pipe at proper elevation and grade, and secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevents installation. Depth of cover over top of pipe shall not be less than 4 feet, 2 inches.

3.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.1.5 Installation of Extraction Well Piping

3.1.5.1 Special Requirements for Installation of Metallic Piping

a. Metallic Piping Installation, General: Install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" and with applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.

b. Jointing:

(1) Threaded Joints: Make threaded joints up tight with a stiff mixture of graphite and oil, inert filler and oil, or an approved graphite compound; apply to male threads only. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling joint.

(2) Joints for Copper Tubing: Cut copper tubing with square ends; remove fins and burrs. Handle tubing carefully; replace dented, gouged, or otherwise damaged tubing with undamaged tubing. Make solder joints using ASTM B 32, 95-5 tin-antimony or Grade Sn96 solder. Solder and flux shall not contain lead. Before making joint, clean ends of tubing and inside of fitting or coupling with wire brush or abrasive. Apply a rosin flux to tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and flare tubing with a flaring tool.

3.1.5.2 Special Requirements for Installation of Polyethylene Piping

a. Polyethylene Piping Installation, General: Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774.

All pipes shall be marked in accordance with the latest acceptable standards for the "Marking of Pipe" such as specified by ANSI. Mark number and weight and/or pipe schedule shall be conspicuously painted on each piece.

Any pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

Polyethylene pipe shall be purchased in minimum 100 foot coil sections and jointed above ground into continous lengths using compression fittings suitable for this pressure service and shall

be performed in strict conformance with the pipe manufacturer's recommendations.

3.1.6 Manhole Construction

Use precast concrete riser section with slab top over a crushed stone base and set level. Install the opening for the frame over the well. Route piping through the manhole wall in an opening cut cleanly 2 inches larger than the pipe and seal watertight with a non-shrink grout. Set frame over opening in a mortar bed to the proper grade.

3.1.7 Valve Pit Piping and Appurtenances

Install the valves, water meter and other appurtenances as indicated and as specified in Section 15400, "Plumbing".

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed properly in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test collector mains and service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test plastic water mains in accordance with UBPPA UNI-B-3 for pressure and leakage tests. The amount of leakage on pipelines made of plastic water main pipe shall not exceed the amounts given in UBPPA UNI-B-3, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed. No leakage will be allowed at plastic pipe joints, flanged joints and threaded joints.

-- End of Section --

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 referred to in the text by the basic designation only.

FEDERAL SPECIFICATIONS (FS)

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

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Chain-link fencing components

b. Accessories

1.2.2 SD-04, Drawings

a. Gates

b. Post spacing

c. Location of gate, corner, end, and pull posts

1.2.3 SD-06, Instructions

a. Fence

1.2.4 SD-10, Test Reports

a. Weight in ounces for zinc coating

b. Thickness of PVC coating

c. Chemical composition and thickness of aluminum alloy coating

1.2.4.1 Required Report Data

Submit reports of listing of chain-link fencing and accessories regarding weight in ounces for zinc coating, thickness of PVC coating, and chemical composition and thickness of aluminum alloy coating.

1.2.5 SD-13, Certificates

a. Fabric

b. Posts

c. Braces

d. Framing

e. Rails

f. Tension wires

g. Gates

1.3 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

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 II, aluminum-coated steel, 9-gauge. Mesh size, 2 inches. Provide selvage knuckled at both selvages. Height of fabric, as indicated.

2.1.2 Gates

FS RR-F-191/2; Type II, double swing. Shape and size of gate frame, as indicated. Framing and bracing members, round of steel alloy. Steel member finish, or aluminum-coated steel. 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 od, 0.120 inches minimum wall thickness and aluminum pipe frames and intermediate braces shall be 1.869 inches od, 0.940 lb/ft of length. Gate fabric, as specified for fencing fabric. Barbed wire top on gate, as specified herein. Coating for steel latches, stops, hinges, keepers, and accessories, galvanized minimum thickness of 0.010 inch. Gate latches plunger bar type. Gate leaves more than 8 feet wide shall have intermediate members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. 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 B. End, corner, and pull posts; Class 1, steel pipe, Grade B . Braces and rails; Class 1, steel pipe, Grade B, in minimum sizes listed in FS RR-F-191/3 for each class and grade.

2.1.4 Fencing Accessories

FS RR-F-191/4. Provide wire ties constructed of the same material as the fencing fabric.

2.1.5 Concrete

Provide as specified in Section 03300, "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 amount of water to produce a workable mix.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation. Compact fill used to establish fence line.

3.1.2 Excavation

Excavate to dimensions indicated for concrete-embedded items, except in bedrock. If bedrock is encountered, continue excavation to depth indicated

or 18 inches into bedrock, whichever is less, with a diameter in bedrock a minimum of 2 inches larger than outside diameter of post. Clear post holes of loose material. Dispose of waste material outside limits of station.

3.2 FENCE INSTALLATION

Install fence on prepared surfaces to line and grade indicated. Secure fastening and hinge hardware in place to fence framework by peening or welding. Allow for proper operation of components. Coat peened or welded areas with a repair coating matching original coating. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.2.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10-feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade. Provide drawings showing location of gate, corner, end, and pull posts.

3.2.2 Post Setting

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

3.2.2.1 Earth and Bedrock

Provide concrete bases of dimensions indicated. Compact concrete to eliminate voids, and finish to a dome shape. In bedrock, set posts with a minimum of 1-inch of grout around each post. Work grout into hole to eliminate voids, and finish to a dome shape.

3.2.3 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and a diagonal truss rod and truss tightener used as a tension member.

3.2.4 Top and Bottom Tension Wires

Install top and bottom tension wires before installing chain-link fabric, and pull wires taut. Place top and bottom tension wires within 8 inches of respective fabric line.

3.2.5 Fabric

Pull fabric taut and secure fabric to top wire and bottom wire, close to both sides of each post and at maximum intervals of 24 inches on center. 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. Install fence fabric to provide approximately 2-inch deflection at center of fabric span between two posts, when a force of approximately 30 pounds is applied perpendicular to fabric. Fabric should return to its original position when force is removed.

3.3 ACCESSORIES INSTALLATION

3.3.1 Supporting Arms

Design supporting arms to accommodate top rail. Install supporting arms as recommended by manufacturer. In addition to manufacturer's standard connections, permanently secure supporting arms to posts. Studs driven by low-velocity powder-actuated tools may be used with steel, wrought iron, ductile iron, or malleable iron. Do not use studs driven by powder-actuated tools with gray iron or other material that will fracture.

3.3.2 Barbed Wire

Install barbed wire on supporting arms above fence posts. Extend each end member of gate frames sufficiently above top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Pull each strand taut and securely fasten each strand to each supporting arm or extended member. Secure wires in accordance with fence manufacturer's recommendations.

3.3.3 Gates

Install swing gates to swing through 180 degrees from closed to open.

3.3.4 Padlock

Provide padlock for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlock keyed alike, and provide two keys for padlock according to Section 08710, "Finish Hardware".

3.4 SECURITY

Install new security fencing, remove existing security fencing, and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer and cognizant Security Officer.

3.5 CLEANUP

Remove waste fencing materials and other debris from the station.

-- End of Section --

SECTION 02930

TURF

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 Z88.2	1980 Respiratory Protection

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 977	1991 Emulsified Asphalt

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000-SUBPART Z	Toxic and Hazardous Substances

DEPARTMENT OF AGRICULTURE (DOA)

DOA FSA	January 1985 Federal Seed Act Rules and Regulations of the Secretary of Agriculture
DOA SSIR	April 1984 Soil Survey Investigation Report No. 1, Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples, Soil Conservation Service

FEDERAL SPECIFICATIONS (FS)

FS Q-P-166	(Rev. E) Peat, Moss; Peat Humus; and Reed-Sedge

1.2 DEFINITIONS

1.2.1 Pesticide

Soil fumigants, herbicides, insecticides and fungicides.

1.2.2 Stand of Turf

95 percent ground cover of the established species.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data

a. Erosion control materials

b. Pesticides

c. Wood cellulose fiber mulch

Include physical characteristics, and recommendations.

1.3.2 SD-10, Test Reports

a. Topsoil composition tests

Submit reports for test specified in DOA SSIR.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

1.4.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.4.1.2 Fertilizer and Lime Delivery

Deliver to the site in original, unopened containers bearing manufactur r's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer and lime may be furnished in bulk with certificate indicating the above information.

1.4.1.3 Pesticide Delivery

Deliver to the site in the original unopened containers with legible label indicating Environmental Protection Agency (EPA) registration number and manufacturer's registered uses.

1.4.2 Storage

1.4.2.1 Seed, Lime, and Fertilizer Storage

Store in cool, dry locations away from contaminants.

1.4.2.2 Pesticide Storage

Do not store with other landscape materials.

1.4.2.3 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Treat when foliage is 6 to 10 inches high and approximately 4 to 6 weeks prior to stockpiling.

1.4.3 Handling

Do not drop or dump materials from vehicles.

1.5 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.5.1 Planting Dates

1.5.1.1 Seed

Sow seed from March 15 to June 15 for spring planting and from August 15 to October 15 for fall planting.

1.5.2 Restrictions

Do not plant when the ground is frozen, snow covered, or muddy.

1.6 EXTENT OF WORK

Provide seedbed preparation, topsoiling, fertilizing, seeding, and mulching of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

State-approved of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with DOA FSA and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer.

2.1.2 Composition

Name of Grass or Legume Botanical and Common

Seed	Min. Percent Pure Seed	Min. Percent Germination and Hard Seed	Max. Percent Weed Seed
Kentucky Bluegrass (50%±20%) (Poa pratensis)	85	75	5

Name of Grass or L gume Botanical and Common

Seed	Min. Percent Pure Seed	Min. Perc nt Germination and Hard Seed	Max. Percent Weed Seed
Perenial Ryegrass (50%±20%) (Lolium perenne)	98	90	1

2.2 TOPSOIL

2.2.1 Existing Soil

Modify existing soil to conform to the requirements specified in paragraph entitled "Composition."

2.2.2 On-Site Topsoil

Reusable surface soil stripped and stockpiled on site if requirements specified for topsoil in paragraph entitled "Composition" are met.

2.2.3 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.4 Composition

Containing from 5 to 20 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4-inch screen. Other components shall be within the following percentages:

Silt	25-50
Clay	10-30
Sand	20-35
pH	5 to 7.6
Soluble Salts	600 ppm maximum

2.3 pH ADJUSTERS

2.3.1 Lime

Commercial grade hydrated limestone containing not less than 50 percent of total oxides, 80 percent calcium and 14 percent magnesium oxide, gradation, as follows: Minimum 75 percent passing 100-mesh sieve and 100 percent passing 20-mesh sieve.

2.3.2 Aluminum Sulfate

Commercial grade.

2.4 SOIL CONDITIONERS

Provide singly or in combination as required to meet specified requirements for topsoil. Soil conditioners shall be nontoxic to plants.

2.4.1 Peat

Peat moss derived from a freshwater site and conforming to FS Q-P-166 as modified herein. Shred and granulate peat to pass 1/2-inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.4.2 Sand

Clean and free of materials harmful to plants.

2.4.3 Perlite

Horticultural grade.

2.4.4 Vermiculite

Horticultural grade.

2.4.5 Composted Wood Derivatives

Ground bark, sawdust, or other wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.4.5.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.4.5.2 Nitrogen Content

Minimum percent based on dry weight:

Redwood Sawdust	0.5
Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.4.6 Calcined Clay

Granular particles produced from montmorillonite clay calcined to minimum temperature of 1200 degrees to the following gradation: minimum 90 percent passing 8-mesh screen, 99 percent retained on 60-mesh screen and, maximum 2 percent passing 100-mesh screen. Bulk density: 40 pounds maximum per cubic foot.

2.5 FERTILIZER

2.5.1 Commercial Grade Fertilizer

Grandular fertilizer shall be a slow.r lease type with 20 percent nitrogrn, 10 percent phosphorus, and 10 percent potash. A minimum of 50 percent of the nitrogen shall be water insoluble.

2.5.2 Controlled Release Fertilizer with Hydroseeding

Nitrogen-phosphorus-potassium ratio of 16-7-12 plus 2 percent iron, composed of pills coated with plastic resin to provide continuous release of fertilizer for at least 6 months.

2.6 MULCHES

Free from, noxious weeds, mold, and other deleterious materials.

2.6.1 Wood Chips

Ground redwood or fir tree bark, 3/16-inch maximum particle size.

2.6.2 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment.

2.6.3 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Provide only marsh hay for lawn areas.

2.6.4 Wood Cellulose Fiber Mulch

Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 3.5 to 5.0. Use with hydraulic application of grass seed and fertilizer.

2.7 ASPHALT ADHESIVE

Emulsified asphalt conforming to ASTM D 977, Grade RS-1. Use with straw or hay mulch.

2.8 WATER

Suitable quality for irrigation.

2.9 PESTICIDES

Herbicide Insecticide and Fungicide: EPA registered and approved. Furnish for preemergence and postemergence application for crabgrass control and broadleaf weed control.

2.10 EROSION CONTROL MATERIALS

2.10.1 Net

Heavy, twisted jute mesh, plastic net, biodegradable paper fabric with knitted yarns, or standard weave burlap.

2.10.2 Blanket

Excelsior.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Subgrade

After areas required to be turfed have been brought to the required subgrade, thoroughly till to minimum depth of 6 inches by scarifying, disking, harrowing, or other approved methods. Remove debris and stones larger than one inch in any dimension remaining on surface after tillage.

3.1.2 Topsoiling

Immediately prior to placing topsoil, scarify subgrade to a 2-inch depth for bonding of topsoil with subsoil. Spread topsoil evenly to a minimum depth of 4 inches. Do not spread topsoil when frozen or excessively wet or dry. Correct irregularities in finished surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.3 Fertilizer, pH Adjusters, and Soil Conditioners

3.1.3.1 Application Rates and Analysis

Apply fertilizer pH adjuster and soil conditioner at rates and analysis as determined by laboratory soil tests of the topsoil supplied. Apply at rates of 23 pounds per 1000 square feet.

3.1.3.2 Depth

Incorporate fertilizer, pH adjusters, soil conditioners into soil to minimum depth of 6 inches. This may be done as part of the subgrade tillage operation specified herein.

3.1.3.3 Drill Seeding, Broadcast Seeding, and Drop Seeding

Incorporate fertilizer and lime into soil to a minimum depth of 6 inches. Application may be performed as part of the subgrade tillage operations.

3.1.3.4 Hydroseeding

Apply liquid fertilizer in amounts sufficient to promote the specified stand of turf. Apply lime manually during subgrade preparation.

3.1.4 Application of P sticides

3.1.4.1 Liquid Application

Hydraulic equipment for liquid application of chemicals shall have leakproof tanks and positive agitation method, plus gauges and valves capable of maintaining constant application pressures. Calibrate and meter equipment so that application of chemicals in specified amounts can be determined.

3.1.4.2 Application and Reporting Procedure

Apply herbicides and other chemicals in accordance with EPA label restrictions and recommendations and federal and state laws. Make daily reports to the Contracting Officer stating areas treated with each chemical, the quantity applied and spray mixture or formulation used. Application at each site shall be under the supervision of a certified applicator.

3.1.4.3 Application Precautions

Apply in well ventilated areas. Avoid inhalation, injection, or spilling on clothing or skin. Wear protective clothing in accordance with manufacturer's material safety data sheet recommendations. Personnel shall not be exposed to pesticides exceeding the exposure levels recommended in the most stringent of the following: 29 CFR 1910.1000-SUBPART Z, or the manufacturer's material safety data sheet. If excessive exposures are unavoidable, use respirators approved by the National Institute for Occupational Safety and Health for protection from pesticides, fumigants, herbicides and fungicides. Conform to the selection and usage guidance in ANSI Z88.2.

3.1.4.4 Personnel Injury and Property Damage Prevention

Apply in a manner to prevent injury to personnel, and damage to property, from either direct spray, or drifting of chemicals both on and off Government property.

3.1.4.5 Disposal of Excess Chemicals and Containers

Perform in accordance with the Section 01560, "Environmental Protection."

3.2 SEEDING

3.2.1 Seed Application

Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed to average depth of 1/2 inch by means of spike-tooth harrow, cultipacker, or other approved device.

3.2.2 Hydroseeding

Mix seed, fertilizer, and wood cellulose fiber in required amount of water to produce a homogeneous slurry. Add wood cellulose fiber after seed, water, and fertilizer have been thoroughly mixed and apply at the rate of 200 pounds per acre dry weight. When hydraulically sprayed on the ground, material shall form a blotterlike cover impregnated uniformly with grass seed. Immediately following the application of the slurry mix, make separate application of wood cellulose mulch at the rate of 1,000 pounds, dry weight, per acre. Cover shall allow rainfall or applied water to percolate to underlying soil.

3.2.3 Mulch

Spread evenly at the rate of 1/2 tons per acre. Anchor by crimping mulch with serrated disc, or by spraying asphalt emulsion on mulched surface at 0.02 gallon per square yard. Take precautionary measures to prevent asphalt materials from marking or defacing structures, pavements, utilities, or plantings.

3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width. If seeding is performed with cultipacker-type seeder or by hydroseeding, rolling may be eliminated.

3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turfing operations. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

3.5 TURF ESTABLISHMENT PERIOD

3.5.1 Period Parameters

Turf establishment period will be in effect until turf has been mowed three times.

3.5.2 Maintenance During Turf Establishment Period

3.5.2.1 Mowing

Mow turfed area to an average height of 2-1/2 inches when average height of grass becomes 4 inches for spring planting and to an average height of

2 inches whenever the average height of grass reaches 3 inches for fall planting.

3.5.2.2 Promotion of Turf Growth

Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, and perform other operations necessary to promote turf growth.

3.5.2.3 Post-Fertilizing

Post-fertilize the turfed areas with commercial grade controlled release fertilizer approximately 28 days after planting and at intervals of 6 weeks thereafter until accepted. Apply fertilizer uniformly at the rate of 23 pounds per 1000 square feet.

3.6 FIELD QUALITY CONTROL

3.6.1 Final Inspection and Acceptance

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final acceptance will be based upon a satisfactory stand of turf. Prior to final acceptance, apply 23 pounds per 1,000 square feet of controlled release fertilizer.

3.6.2 Replanting

Replant within specified planting dates areas which do not have a satisfactory stand of turf.

-- End of Section --

SECTION 03300

CAST-IN-PLACE CONCRETE

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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M182	1960 (R 1989) Burlap Cloth Made for Jute or Kenaf

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.2	1991 Selecting Proportions for Structural Lightweight Concrete
ACI 213R	1987 Structural Lightweight Aggregate Concrete
ACI 301	1989 Structural Concrete for Buildings
ACI 302.1R	1989 Concrete Floor and Slab Construction
ACI 304R	1989 Measuring, Mixing, Transporting and Placing Concrete
ACI 304.2R	1991 Placing Concrete by Pumping Methods
ACI 305R	1991 Hot Weather Concreting
ACI 306.1	1990 Cold Weather Concreting
ACI 315	1992 Details and Detailing of Concrete Reinforcement
ACI 318	1992 Building Code Requirements for Reinforced Concrete
ACI 347R	1988 Formwork for Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82	1990 (Rev. A) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 185	1990 (Rev. A) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 496	1990 (Rev. A) Steel Wire, Deformed, for

	Concrete Reinforcement
ASTM A 497	1990 (Rev. B) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615	1990 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 616/A 616M	1990 Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617/A 617M	1990 Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 706/A 706M	1990 Low-Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM C 31	1990 (Rev. A) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	1990 Concrete Aggregates
ASTM C 39	1986 Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	1990 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 94	1991 Ready-Mixed Concrete
ASTM C 143	1990 (Rev. A) Slump of Hydraulic Cement Concrete
ASTM C 150	1992 Portland Cement
ASTM C 171	1969 (R 1986) Sheet Materials for Curing Concrete
ASTM C 172	1990 Sampling Freshly Mixed Concrete
ASTM C 173	1978 Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	1991 Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	1986 Air-Entraining Admixtures for Concrete
ASTM C 309	1989 Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	1990 Chemical Admixtures for Concrete
ASTM C 595	1989 Blended Hydraulic Cements

ASTM C 618	1991 Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 881	1990 Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 920	1987 Elastomeric Joint Sealants
ASTM C 989	1989 Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1107	1991 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D 1190	1974 (R 1980) Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 1751	1983 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	1984 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1850	1974 (R 1979) Concrete Joint Sealer, Cold-Application Type
ASTM D 4397	1984 (R 1989) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

CORPS OF ENGINEER (COE)

COE CRD-C-572	1974 Polyvinylchloride Waterstop

U.S. DEPARTMENT OF COMMERCE PRODUCT STANDARDS (PS)

PS 1	1983 Construction and Industrial Plywood

1.2 DEFINITIONS

a. "Cementitious material" as used herein shall include all portland cement, pozzolan, fly ash, ground iron blast-furnace slag, and silica fume.

b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data

a. Waterstops

b. Materials for curing concrete

c. Joint sealants

d. Joint filler

e. Vapor barrier

f. Epoxy bonding compound

1.3.2 SD-04, Drawings

a. Reinforcing steel

b. Formwork

Reproductions of contract drawings are unacceptable.

1.3.2.1 Reinforcing Steel

ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars.

1.3.2.2 Formwork

ACI 347R. Include design calculations indicating arrangement of forms, sizes and grades of supports (lumber), panels, and related components. Indicate placement schedule, construction, and location and method of forming control joints. Include locations of inserts, pipework, conduit, sleeves, and other embedded items. Furnish drawings and descriptions of shoring and reshoring methods proposed for floor and roof slabs, spandrel beams, and other horizontal concrete members.

1.3.3 SD-05, Design Data

a. Concrete mix design

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, silica fume, ground slag, polypropylene fibers, and admixtures; and applicable reference specifications. Submit additional data regarding concrete aggregates if the source of aggregate changes. Submittal shall

clearly indicate wh re each mix design will be used when more than one mix design is submitted. An identical concrete mix design previously approved within the past 12 months by the Northern Division, Naval Facilities Engineering Command, may be used without further approval, if copies of the previous approval and fly ash, silica fume, and pozzolan test results are submitted. The approval of fly ash, silica fume, and pozzolan, and polypropylene fibers tests results shall have been within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

1.3.4 SD-08, Statements

a. Curing concrete elements

b. Form removal schedule

c. Pumping concrete

1.3.4.1 Curing Concrete Elements

Submit proposed materials and methods for curing concrete elements.

1.3.4.2 Form Removal Schedule

Submit schedule for form removal indicating element and minimum length of time for form removal.

1.3.4.3 Pumping Concrete

Submit proposed materials and methods for pumping concrete. Submittal shall include mix designs, pumping equipment including type of pump and size and material for pipe, and maximum length and height concrete will be pumped.

1.3.5 SD-10, Test Reports

a. Concrete mix design

b. Fly ash

c. Pozzolan

d. Ground iron blast-furnace slag

e. Aggregates

1.3.5.1 Concrete Mix Design

Submit copies of test reports showing that the mix has been successfully tested to produce concrete with the properties specified and that mix will be suitable for the job conditions. Test reports shall be submitted along

with the concrete mix design. Obtain approval before concrete placement.

1.3.5.2 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C 618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.3.5.3 Ground Iron Blast-Furnace Slag

Submit test results in accordance with ASTM C 989 for ground iron blast-furnace slag. Submit test results performed within 6 months of submittal date.

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. 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.

1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. ACI 301 for job site storage of materials. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials can be accurately identified after bundles are broken and tags removed.

PART 2 PRODUCTS

2.1 CONCRETE

2.1.1 Contractor-Furnished Mix Design

ACI 301, and ACI 318 and ACI 211.2 ACI 304.2R and ACI 213R except as otherwise specified. The specified compressive strength of the concrete f'c for each portion of the structure shall be as indicated. For portions whose strength is not indicated, concrete shall be as specified below.

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Range of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)
Concrete exposed to weather; slabs; pads; thrust blocks; reinforced foundation walls and footings	4000	67	1-3	0.50	4-8

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Range of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)

Maximum slump shown above may be increased one inch for methods of consolidation other than vibration. Slump may be increased to 7 inches when superplasticizers are used. The water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days shall not exceed 0.30.

2.1.1.1 Required Average Strength Of Mix Design

The selected mixture shall produce an average compressive strength exceeding the specified strength by the amount indicated in ACI 301. When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation shall be calculated and the required average compressive strength shall be determined in accordance with ACI 301. When a concrete production facility does not have a suitable record of tests to establish a standard deviation, the required average strength shall be as follows:

a. For f'c less than 3000 psi, 1000 psi plus f'c.

b. For f'c between 3000 and 5000 psi, 1200 psi plus f'c.

c. For f'c over 5000 psi, 1400 psi plus f'c.

2.2 MATERIALS

2.2.1 Cement

ASTM C 150, Type I or II or ASTM C 595, Type IP(MS) or IS(MS) blended cement except as modified herein. The blended cement shall consist of a mixture of ASTM C 150 cement and one of the following materials: ASTM C 618 pozzolan or fly ash, ASTM C 989 ground iron blast-furnace slag, or silica fume. The pozzolan or fly ash content shall not exceed 25 percent by weight of the total cementitious material. The ground iron blast-furnace slag shall not exceed 50 percent by weight of total cementitious material. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

2.2.1.1 Fly Ash and Pozzolan

ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Types N and F. Add with cement.

2.2.1.2 Ground Iron Blast-Furnace Slag

ASTM C 989, Grade 120.

2.2.2 Water

Wat r shall be fresh, clean, and potable.

2.2.3 Aggregates

ASTM C 33, except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalies in the cement.

2.2.4 Nonshrink Grout

ASTM C 1107.

2.2.5 Admixtures

Calcium chloride shall not be used as an admixture.

2.2.5.1 Air-Entraining

ASTM C 260.

2.2.5.2 Accelerating

ASTM C 494, Type C.

2.2.5.3 Retarding

ASTM C 494, Type B, D, or G.

2.2.5.4 Water Reducing

ASTM C 494, Type A, E, or F.

2.2.6 Materials for Forms

Provide wood, plywood, or steel. Use plywood or steel forms where a smooth form finish is required. Lumber shall be square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Plywood: PS 1, B-B concrete form panels or better. Steel form surfaces shall not contain irregularities, dents, or sags.

2.2.6.1 Form Ties and Accessories

The use of wire alone is prohibited. Form ties and accessories shall not reduce the effective cover of the reinforcement.

2.2.7 Reinforcement

2.2.7.1 Reinforcing Bars

ACI 301 unless otherwise specified. ASTM A 615 and ASTM A 617/A 617M with the bars marked A, Grade 60; or ASTM A 616/A 616M with the bars marked R, Grade 60. ASTM A 706/A 706M.

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Range of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)

2.2.7.2 Mechanical Reinforcing Bar Connectors

ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar.

2.2.7.3 Welded Wire Fabric

ASTM A 185 or ASTM A 497. Provide flat sheets of welded wire fabric for slabs and toppings.

2.2.7.4 Wire

ASTM A 82 or ASTM A 496.

2.2.8 Vapor Barrier

ASTM D 4397 polyethylene sheeting, minimum 6 mil thickness.

2.2.9 Polyvinylchloride Waterstops

COE CRD-C-572.

2.2.10 Materials for Curing Concrete

2.2.10.1 Impervious Sheeting

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

2.2.10.2 Pervious Sheeting

AASHTO M182.

2.2.10.3 Liquid Membrane-Forming Compound

ASTM C 309, white-pigmented, Type 2, Class B.

2.2.11 Liquid Chemical Sealer-Hardener Compound

Compound shall be magnesium fluosilicate which when mixed with water seals and hardens the surface of the concrete. Do not use on exterior slabs exposed to freezing conditions. Compound shall not reduce the adhesion of resilient flooring, tile, paint, roofing, waterproofing, or other material applied to concrete.

2.2.12 Expansion/Contraction Joint Fill r

ASTM D 1751 or ASTM D 1752, 1/2 inch thick, unless otherwise indicated.

2.2.13 Joint Sealants

2.2.13.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D 1190 or ASTM C 920, Type M, Class 25, Use T, except that ASTM D 1850 may be used inside buildings.

2.2.13.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C 920, Type M, Grade NS, Class 25, Use T.

2.2.14 Epoxy Bonding Compound

ASTM C 881. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces. Provide Class A if placement temperature is below 40 degrees F; Class B if placement temperature is between 40 and 60 degrees F; or Class C if placement temperature is above 60 degrees F.

2.2.15 Epoxy Coating Compound

Provide epoxy coating resistant to corrosive chemicals on all interior concrete surfaces of chemical feed and storage areas.

PART 3 EXECUTION

3.1 FORMS

ACI 301. Provide forms, shoring, and scaffolding for concrete placement unless indicated or specified otherwise. 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 indicated. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Provide formwork with clean-out openings to permit inspection and removal of debris. Forms submerged in water shall be watertight.

3.1.1 Coating

Before concrete placement, coat the contact surfaces of forms with a nonstaining mineral oil, nonstaining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms for surfaces to which adhesive, paint, or other finish material is to be applied.

3.1.2 Removal of Forms and Supports

After placing concrete, forms shall remain in place for the time periods specified in ACI 347R. Prevent concrete damage during form removal.

3.1.2.1 Special Requirements for Reduced Time Period

Forms may be removed earlier than specified if ASTM C 39 test results of field-cured samples from a representative portion of the structure indicate that the concrete has reached a minimum of 85 percent of the design strength.

3.1.3 Reshoring

Reshore concrete elements where forms are removed prior to the specified time period. Do not permit elements to deflect or accept loads during form stripping or reshoring. Forms on columns, walls, or other load-bearing members may be stripped after 2 days if loads are not applied to the members. After forms are removed, slabs and beams over 10 feet in span and cantilevers over 4 feet shall be reshored for the remainder of the specified time period in accordance with paragraph entitled "Removal of Forms." Perform reshoring operations to prevent subjecting concrete members to overloads, eccentric loading, or reverse bending. Reshoring elements shall have the same load-carrying capabilities as original shoring and shall be spaced similar to original shoring. Firmly secure and brace reshoring elements to provide solid bearing and support.

3.2 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI 301. Provide bars, wire fabric, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement shall not contain rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per foot of th reinforcement has been reduced to less than that specified in paragraph entitled "Reinforcing Bars." Remove loose rust prior to placing steel. Tack welding is prohibited.

3.2.1 Vapor Barrier

Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches. Remove torn, punctured, or damaged vapor barrier material and provide with new vapor barrier prior to placing concrete. Concrete placement shall not damage vapor barrier material.

3.2.2 Tolerances

Place reinforcement and secure with galvanized or noncorrodible chairs, spacers, or metal hangers. Use concrete or other noncorrodible material for supporting reinforcement on the ground.

3.2.3 Splicing

As indicated. For splices not indicated ACI 301. Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus 2 inches.

3.2.4 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Bolt threads shall match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.2.5 Cover

ACI 301 for minimum coverage, unless otherwise indicated.

3.2.6 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.

3.2.7 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.

3.2.8 Expansion Joints and Contraction Joints

Provide expansion joint at edges of interior floor slabs on grade abutting vertical surfaces, and as indicated. Make expansion joints 1/2 inch wide unless indicated otherwise. Fill expansion joints not exposed to weather with preformed joint filler material. Completely fill joints exposed to weather with joint filler material and joint sealant. Do not extend reinforcement or other embedded metal items bonded to the concrete through any expansion joint unless an expansion sleeve is used. Provide contraction joints, either formed or saw cut or cut with a jointing tool, to the indicated depth after the surface has been finished. Sawed joints shall be completed within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.2.9 Waterstop Splices

Fusion weld in the field.

3.3 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

ASTM C 94, ACI 301, ACI 302.1R, and ACI 304R, except as modified herein. Batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Rang of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)

3.3.1 Measuring

Make measurements at intervals as specified in paragraphs entitled "Sampling" and "Testing."

3.3.2 Mixing

ASTM C 94 and ACI 301. Machine 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 and place concrete within 60 minutes if the air temperature is greater than 85 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.

3.3.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.4 PLACING CONCRETE

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. 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, water, snow, and ice from within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from one end of the structure towards the other. Position grade stakes on 10-foot centers maximum in each direction when pouring interior slabs and on 20-foot centers maximum for exterior slabs.

3.4.1 Vibration

ACI 301. Furnish a spare vibrator on the job site whenever concrete is placed. Consolidate concret slabs gr ater than 4 inches in depth with

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Rang of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)

high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straightedge. Operate vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Do not use vibrators to transport the concrete in the forms. Insert and withdraw vibrators approximately 18 inches apart. Penetrate the previously placed lift with the vibrator when more than on lift is required. Place concrete in 18-inch maximum vertical lifts. External vibrators shall be used on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete.

3.4.2 Application of Epoxy Bonding Compound

Apply a thin coat of compound to dry, clean surfaces. Scrub compound into the surface with a stiff-bristle brush. Place concrete while compound is stringy. Do not permit compound to harden prior to concrete placement. Follow manufacturer's instructions regarding safety and health precautions when working with epoxy resins.

3.4.3 Cold Weather

ACI 306.1. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 5 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

3.4.4 Hot Weather

ACI 305R. Maintain required concrete temperature using Figure 2.1.5 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Range of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)

3.5 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

3.5.1 *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 347R. Exposed surfaces shall be uniform in appearance and finished to a smooth form finish unless otherwise specified.

3.5.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified shall be finished with wood floats to even surfaces. Finish shall match adjacent finishes.

3.5.3 *Formed Surfaces*

3.5.3.1 As-Cast Rough Form for Surfaces Not Exposed to Public View

Remove fins and other projections exceeding 0.25 inch in height; level abrupt irregularities.

3.5.3.2 As-Cast Smooth Form for Surfaces Exposed to Public View

Form facing material shall produce a smooth, hard, uniform texture on the concrete. Remove fins and other projections.

3.6 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Depress the concrete base slab where indicated. Where straightedge measurements are specified, Contractor shall provide straightedge.

3.6.1 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.

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Range of Slump (inches)	Wat r-Cement Ratio (by weight)	Air Entr. (percent)

3.6.1.1 Scratched

Use for surfaces intended to receive bonded applied cementitious applications. After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance as defined below, the surface shall be roughened with stiff brushes of rakes before final set.

3.6.1.2 Floated

Use for exterior slabs where not otherwise specified. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further, until ready for floating. Whether floating with a wood, magnesium, or composite hand float, with a bladed power trowel equipped with float shoes, or with a powered disc, float shall begin when the surface has stiffened sufficiently to permit the operation. During or after the first floating, surface shall be checked with a 10-foot straightedge applied at no less than two different angles, one of which is perpendicular to the direction of strike off. High spots shall be cut down and low spots filled during this procedure to produce a surface level within 1/4 inch in 10 feet.

3.6.1.3 Steel Troweled

Use for floors intended as walking surfaces. First, provide a floated finish. The finish shall next be power troweled three times, and finally hand troweled. The first troweling after floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks and uniform in texture and appearance. The finished surface shall produce a surface level to within 1/4 inch in 10 feet.

3.6.1.4 Nonslip Finish

Use on surfaces of exterior platforms, steps, and landings; and on exterior and interior pedestrian ramps. Apply dry shake aggregate of ceramically bonded aluminum oxide to the surface at a minimum rate of 25 pounds per 100 square feet. Blend approximately two-thirds of the aggregate with portland cement as recommended by the manufacturer and apply to the surface evenly and without segregation. After blended material has been embedded by floating, apply the remainder of the blended material to the surface at right angles to the previous application. Apply blended material heavi r in any areas not sufficiently covered by the first application. Perform a second floating immediately following the first. After the selected material has been embedded by the two floatings, complete the operation with a broomed finish.

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Range of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)

3.6.1.5 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Perform a floated finish, then draw a broom or burlap belt across the surface to produce a coarse scored texture. 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.

3.6.1.6 Concrete Toppings Placement

The following requirements apply to the placement of toppings of concrete on base slabs that are either freshly placed and still plastic, or on hardened base slabs.

a. Placing on a Fresh Base: Screed and bull float the base slab. As soon as the water sheen has disappeared, lightly rake the surface of the base slab with a stiff bristle broom to produce a bonding surface for the topping. Immediately spread the topping mixture evenly over the roughened base before final set takes place. Give the topping the finish specified herein.

b. Bonding to a Hardened Base: When the topping is to be bonded to a floated or troweled hardened base, roughen the base by scarifying, grit-blasting, scabbling, planing, flame cleaning, or acid-etching to lightly expose aggregate and provide a bonding surface. R mov dirt, laitance, and loose aggregate by means of a stiff wire broom. Keep the clean base wet for a period of 12 hours preceding the application of the topping. Remove excess water and apply a 1:1:1/2 cement-sand-water grout, and brush into the surface of the base slab. Do not allow the cement grout to dry, and spread it only short distances ahead of the topping placement. Do not allow the temperature differential between the completed base and the topping mixture to exceed 10 degrees F at the time of placing. Place the topping and finish as specified herein.

3.6.2 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

3.6.3 Curbs

Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. Cut contraction joints 3/4 inch deep with a jointing tool after the surface has been finished. Provide expansion joints 1/2 inch thick and spaced every 100 feet maximum unless otherwise indicated. Perform pavement finish.

3.6.4 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, and shall be 24 inches long, 12 inches wide, and 4 inches thick with smooth-finished countersunk dishes sloped to drain away from the building.

3.7 CURING AND PROTECTION

ACI 301 unless otherwise specified. Begin curing immediately following form removal. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer-hardener or epoxy coating.

3.7.1 Moist Curing

Remove water without erosion or damage to the structure.

3.7.1.1 Ponding or Immersion

Continually immerse the concrete throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

3.7.1.2 Fog Spraying or Sprinkling

Apply water uniformly and continuously throughout the curing period. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

3.7.1.3 Pervious Sheeting

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

3.7.1.4 Impervious Sheeting

Wet the entire exposed surface of the concrete 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

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Range of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)

joints. Repair torn or damaged sheeting or provide new sheeting. Cov r or wrap columns, walls, and other vertical structural elements from the top down with impervious sheeting; overlap and continuously tape sheeting joints; and introduce sufficient water to soak the entire surface prior to completely enclosing.

3.7.2 Liquid Membrane-Forming Curing Compound

Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Apply in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. Provide and maintain compound on the concrete surface throughout the curing period. Do not use this method of curing where the use of Figure 2.1.5 in ACI 305R indicates that hot weather conditions will cause an evaporation rate exceeding 0.2 pound of water per square foot per hour.

3.7.2.1 Application

Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance, and before joints are sawed. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Respray concrete surfaces subjected to rainfall within 3 hours after the curing compound application.

3.7.2.2 Protection of Treated Surfaces

Prohibit pedestrian and vehicular traffic and other sources of abrasion at least 72 hours after compound application. Maintain continuity of th coating for the entire curing period and immediately repair any damage.

3.7.3 Liquid Chemical Sealer-Hardener

Apply sealer-hardener to interior floors. Apply the sealer-hardener in accordance with manufacturer's recommendations. Seal or cover joints and openings in which joint sealant is to be applied as required by the joint sealant manufacturer. The sealer-hardener shall not be applied until the concrete has been moist cured and has aged for a minimum of 30 days. Apply a minimum of two coats of sealer-hardener.

3.7.4 Epoxy Coating for Chemical Resistance

Apply epoxy coating resistant to corrosive chemicals on all interior concrete surfaces of chemical feed and storage areas. Apply the coating in two coats in accordance with manufacturer's recommendations after the concrete has cured.

3.7.5 Curing Periods

ACI 301 except 10 days for retaining walls, pavement or chimneys, 21 days for concrete that will be in full-time or intermittent contact with seawater, salt spray, alkali soil or waters. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval by the Contracting Officer.

3.7.6 Requirements for Type III, High-Early-Strength Portland Cement

The curing periods shall be not less than one-fourth of those specified for portland cement, but in no case less than 72 hours.

3.8 FIELD QUALITY CONTROL

3.8.1 Sampling

ASTM C 172. Collect samples of fresh concrete to perform tests specified. ASTM C 31 for making test specimens.

3.8.2 Testing

3.8.2.1 Slump Tests

ASTM C 143. Take concrete 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, when test cylinders are made, and for each batch (minimum) or every 10 cubic yards (maximum) of concrete.

3.8.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 10 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.8.2.3 Compressive Strength Tests

ASTM C 39. Make five test cylinders for each set of tests in accordance with ASTM C 31. Precautions shall be taken to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Samples

Location	f'c (Min. 28-Day Comp. Strength) (psi)	ASTM C 33 Aggregate (Size No.)	Range of Slump (inches)	Water-Cement Ratio (by weight)	Air Entr. (percent)

for strength tests of each mix design of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result shall be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than f'c or if any strength test result falls below f'c by more than 500 psi, take a minimum of three ASTM C 42 core samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core test shall be considered structurally adequate if the average of three cores is equal to at least 85 percent of f'c and if no single core is less than 75 percent of f'c. Locations represented by erratic core strengths shall be retested. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.8.2.4 Air Content

ASTM C 173 or ASTM C 231 for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

-- End of Section --

SECTION 05500

METAL FABRICATIONS

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.

THE ALUMINUM ASSOCIATION, INCORPORATED (AA)

AA 45	1980 Aluminum Finishes
AA 46	1978 Anodized Architectural Aluminum

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S302	1987 Steel Buildings and Bridges

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.3	1985 Powder-Actuated Fastening Systems - Safety Requirements
ANSI B18.2.1	1981 Square and Hex Bolts and Screws Inch Series
ANSI B18.6.2	1972 (R 1983) 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	1990 Lock Washers
ANSI B18.22.1	1965 (R 1990) Plain Washers

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME/ANSI B18.2.2	1987 Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	1991 Structural Steel
ASTM A 47	1990 Ferritic Malleable Iron Castings
ASTM A 48	1983 (R 1990) Gray Iron Castings
ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A 123	1989 (Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	1982 (R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	1991 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 307	1991 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 500	1990 (Rev. A) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 525	1991 (Rev. A) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 780	1990 Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 786/A 786M	1989 Rolled Steel Floor Plates
ASTM B 26/B 26M	1991 Aluminum-Alloy Sand Castings
ASTM B 108	1991 Aluminum-Alloy Permanent Mold Castings
ASTM B 209	1990 Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	1991 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1	1992 Structural Welding Code Steel

FEDERAL SPECIFICATIONS (FS)

FS FF-S-325	(Int Am. 3) Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS FF-P-395	(Rev. C) Pin, Drive Guided and Pin Drive, Powder Actuated (Fasteners for Power Actuated and Hand Actuated Fastening Tools)
FS TT-P-664	(Rev. D) Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant
FS GGG-D-777	(Rev. B) Driver, Projectile Unit, Powder

	Actuated (High Velocity) (Abov Water Only); Pin, Drive, Powder Actuated; and Cartridge, Powder Actuated Tool
FS RR-G-1602	(Rev. C) Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)

MILITARY STANDARDS (MIL-STD)

MIL-STD-889	(Rev. B) Dissimilar Metals

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM BG	1988 Metal Bar Grating Manual

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 3	1989 Power Tool Cleaning
SSPC SP`6	1989 Commercial Blast Cleaning

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Manhole frames and covers G

b. Cover plates and frames

1.2.2 SD-04, Drawings

a. Manhole frames and covers, installation drawings G

b. Cover plates and frames, installation drawings G

c. Cover plates and frames, installation drawings G

. Embedded angles and plates, installation drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC S302.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1.2.3 SD-13, Certificates

a. Primer certificate

1.2.3.1 Certificate

Submit a certificate from the manufacturer stating that the primer conforms to requirements of FS TT-P-664. Certify that the product has been tested and approved for inclusion in the Qualified Products List (QPL).

1.2.4 SD-14, Samples

a. Aluminum surfaces

Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 QUALIFICATION OF WELDERS

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

1.4 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 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A 36/A 36M.

2.1.2 Structural Tubing

ASTM A 500.

2.1.3 Steel Pipe

ASTM A 53, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A 47.

2.1.5 Gratings

a. Gray cast iron ASTM A 48, Class 40.

b. Metal plank type grating FS RR-G-1602

c. Metal bar type grating NAAMM BG

2.1.6 Floor Plates, Patterned

Floor plate ASTM A 786/A 786M. Steel plate shall not be less than 14 gage..

2.1.7 Anchors and Fasteners

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

2.1.7.1 Expansion Shields

FS FF-S-325, of group, type, class, and style best suited for the purpose. Provide shields recessed not less than 2 1/2 inches into concrete or masonry. Devices of Groups IV, V, VI, and VII shall not be used in sizes greater than 3/8 inch unless so indicated.

2.1.7.2 Lag Screws and Bolts

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

2.1.7.3 Toggle Bolts

ANSI B18.2.1.

2.1.7.4 Bolts, Nuts, Studs and Rivets

ASME/ANSI B18.2.2 or ASTM A 307.

2.1.7.5 Powder Driven Fasteners

FS FF-P-395 or FS GGG-D-777. Use when permitted by ANSI A10.3. Follow safety provisions of ANSI A10.3.

2.1.7.6 Screws

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

2.1.7.7 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.

2.1.8 Aluminum Alloy Products

Conform to ASTM B 209 for sheet plate, ASTM B 221 for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings, as applicable. Provide aluminum extrusions at least 1/8-inch thick and aluminum plate or sheet at least 0.050-inch thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A 123, ASTM A 153 or ASTM A 525 G-90, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780 or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved by the Contracting Officer. Clean areas to be repaired and remove the slag from the welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread the molten material uniformly over surfaces to be coated and wipe the excess material off.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within friction-type joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil. Tint additional prime coat with a small amount of tinting pigment. On manhole covers and frames and steps apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Unexposed Sheet, Plate, and Extrusions

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA 45, or AA 46.

2.3 ACCESS DOORS AND PANELS

Provide flush type access doors and panels. Fabricate frames for access doors of steel not lighter than 14-gage with welded joints and anchorage for securing into construction. Provide access doors with a minimum of 14-by 20-inches and of not lighter than 14-gage steel, with stiffened edges and welded attachments. Provide access doors hinged to frame and with a flush-face, turn-screw-operated latch. Provide exposed metal surface with a baked enamel finish.

2.4 CORNER GUARDS AND SHIELDS

Jambs and sills of openings and edges of platforms shall be steel shapes and plates anchored in masonry or concrete with welded steel straps or end-weld stud anchors. Form corner guards for use with finish on walls, of 0.0625-inch thick stainless steel conforming to ASTM A 167 with polished finish. Extend corner guards 5 feet above top of cove base or to top of the wainscot, whichever is less, and anchor with adjustable anchors of 16-gage expanded metal.

2.5 COVER PLATES AND FRAMES

Fabricate cover plates of 1/4-inch thick rolled steel weighing not more than 100 pounds per plate with a selected raised pattern nonslip top surface. Plate shall be galvanized. Reinforce to sustain a live load of 200 pounds per square foot. Frames shall be structural steel shapes and plates, with bent steel bars or headed anchors welded to frame for anchoring to concrete. Miter and weld all corners. Butt joint straight runs. Allow for expansion on straight runs over 15 feet. Provide flush drop handles for removal formed from 1/4-inch round stock where indicated. Provide holes and openings with 1/2-inch clearance for pipes and equipment. Remove sharp edges and burrs from cover plates and exposed edges of frames. Weld all connections and grind top surface smooth. Weld bar stops every six inches. Provide 1/8-inch clearance at edges and between cover plates.

2.6 GAS-TIGHT MANHOLE COVER AND FRAME

Provide a heavy duty type made of ductile cast-iron with bolted lid, machined bearing surfaces and gasket grooves, continuous neoprene gasket, counter sunk bronze hex head cap screws, and concealed watertight

pickholes. Provide frame with a minimum 24-inch diameter clear opening. Maximum weight of frame and cover together to be 530 pounds.

2.7 GUARD POSTS

Provide heavy weight steel pipe as specified in ASTM A 53. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 2500 psi.

2.8 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 8 inches bearing on masonry at each end.

Provide angles and plates, ASTM A 36/A 36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A 123.

PART 3 EXECUTION

3.9 INSTALLATION

Install items at locations indicated, according to manufacturer's instructions. Items listed below require additional procedures.

3.10 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, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.11 BUILT-IN-WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.12 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.13 FINISHES

3.13.1 Dissimilar Materials

Where dissimilar metals as defined by MIL-STD-889 are in contact, or where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Alkyd is not to be used on metal in contact with concrete or masonry.

3.13.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.13.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.14 ACCESS PANELS

Install a removable access panel not less than 12-by 12-inches directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.15 COVER PLATES AND FRAMES

Install the tops of cover plates and frames flush with floor.

3.16 MANHOLE FRAMES AND COVERS

Install as shown.

-- End of Section --

SECTION 06101

CARPENTRY

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/BHMA A156.9	1988 Cabinet Hardware (BHMA 201)
ANSI A208.1	1979 (R 1986) Mat-Formed Wood Particleboard
ANSI B18.2.1	1981 Square and Hex Bolts and Screws Inch Series
ANSI B18.5.2.1M	1981 Metric Round Head Short Square Neck Bolts
ANSI B18.5.2.2M	1982 Metric Round Head Square Neck Bolts (ANSI/ASME B18.5.2.2M)
ANSI B18.6.1	1981 Wood Screws (Inch Series)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.2	1987 Square and Hex Nuts (Inch Series) (ASME/ANSI B18.2.2)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 687	1989 High-Strength Nonheaded Steel Bolts and Studs

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C1	1990 All Timber Products - Pressure Treatment
AWPA C2	1990 Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
AWPA C9	1990 Plywood, Pressure Treatment
AWPA M2	1990 Inspection of Treated Timber Products
AWPA M6	1988 Brands Used on Forest Products

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI QS	1988 Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

AMERICAN WOOD PRESERVERS BUREAU (AWPB)

AWPB LP22	1988 Softwood Lumber, Timber and Plywood Pressure Treated with Waterborne Preservative for Ground Contact Use

FEDERAL SPECIFICATIONS (FS)

FS FF-N-105	(Rev. B) (Valid Notice 1) Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FS FF-S-325	(Int Am. 3) Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS FF-B-588	(Rev. D) Bolt, Toggle and Expansion Sleeve, Screw

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	1985 High-Pressure Decorative Laminates

NATIONAL FOREST PRODUCTS ASSOCIATION (NFP)

NFP NDS	1986 (Supp. 1988) National Design Specification for Wood Construction and Supplement 1986 Design Values for Wood Construction

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

NWWDA I.S.4	1981 Water-Repellent Preservative Treatment for Millwork

U.S. DEPARTMENT OF COMMERCE PRODUCT STANDARDS (PS)

PS-1	1983 Construction and Industrial Plywood
PS-20	1970 (R 1986) American Softwood Lumber Standard

1.2 SUBMITTALS

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

1.2.1 SD-04, Drawings

a. Fabrications

Submit details and erection data associated with the work of other trades, materials, species, arrangements, profiles of moldings, thicknesses, sizes of parts, construction, fastenings, and clearances.

1.2.2 SD-13, Certificates

a. Lumber

b. Softwood plywood

c. Particleboard

Submit certificates from the grading agency on graded but unmarked materials attesting that materials meet the grade requirements specified herein.

1.3 QUALITY ASSURANCE

1.3.1 Grade and Quality Marking

1.3.1.1 Lumber Marking

Each piece or each bundle of lumber, millwork, and trim shall be identified by the grade mark of a recognized association or independent inspection agency that is certified by the Board of Review, American Lumber Standards Committee, to grade the species.

1.3.1.2 Plywood Marking

Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, and shall show exposure durability classification, grade, and compliance with PS-1.

1.3.1.3 Pressure Treatment Marking

Each treated piece shall be inspected in accordance with AWPA M2 and permanently marked or branded by the producer in accordance with AWPA M6, except that lumber which is smaller than 2 by 4 inches or shorter than 36 inches and bundled may be marked on outer faces only.

1.3.2 Sizes and Patterns of Wood Products

Yard and board lumber sizes shall conform to PS-20. Provide shaped lumber and millwork in the patterns indicated and standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes. Actual sizes shall be within manufacturing tolerances allowed by the applicable standard.

1.3.3 Moisture Content of Wood Products

Air-dry or kiln-dry lumb r. Kiln-dry treated lumber after treatment. The maximum moisture content of wood products at time of delivery to the job site shall be as follows:

a. Interior Paneling: 12 percent.

b. Interior Finish Lumber, Trim, and Millwork: For 1 1/4 inches or less in nominal thickness, 12 percent on 85 percent of the pieces and to 15 percent on remainder.

c. Exterior Treated or Untreated Finish Lumber and Trim: For 4 inches or less in nominal thickness, 15 percent.

d. Other Materials: 19 percent.

1.3.4 Preservative Treatment of Wood Products

1.3.4.1 Nonpressure Treatment

Treat woodwork and millwork, such as exterior trim, door trim, and window trim, in accordance with NWWDA I.S.4, with either 2 percent copper napthenate, 3 percent zinc napthenate, or 1.8 percent copper-8-quinolinolate. Provide a liberal brush-coat of preservative treatment to field cuts and holes.

1.3.4.2 Pressure Treatment

Lumber treated in accordance with AWPA C1 and AWPA C2, and plywood in accordance with AWPA C1 and AWPA C9 shall be used on the exterior of buildings and for wood members in contact with masonry or concrete. Treatment shall be verified by an approved inspection agency report, or the AWPB LP22 on each piece.

1.3.5 Quality Standards (QS)

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in AWI QS. Items not specified to be of a specific grade shall be Custom grade.

1.4 DELIVERY, STORAGE AND HANDLING

Deliver lumber, plywood, trim, and millwork to the job site in an undamaged condition. Stack materials to ensure ventilation and drainage. Protect against dampness before and after delivery. Store materials under cover in a well-ventilated enclosure and protect against extreme changes in temperature and humidity. Do not store products in the building until wet trade materials are dry.

PART 2 PRODUCTS

2.1 WOOD

2.1.1 Lumber

Except where a specific grade is indicated or specified, any of the species and grades listed in NFP NDS that have allowable unit stresses not less than 575 psi unit stress in bending (Fb) with 1,400,000 psi modulus of elasticity (E).

2.1.2 Trim, Finish, and Frames

Southern Pine, Ponderosa Pine, White Pine, or Douglas Fir, first grade of the species for natural finish and second grade of the species for paint finish. Run trim, except window stools and aprons, with hollow backs. Exposed edges of boards shall be eased. Trim to receive opaque finish may be finger jointed.

2.1.3 Softwood Plywood

PS-1, thicknesses as indicated.

2.1.3.1 Plywood for Countertops

Exterior Type, A-C Grade.

2.1.3.2 Plywood for Shelving

Interior type, A-B Grade, any species group.

2.1.4 Particleboard

ANSI A208.1, Grade 1-M-2 or 2-M-2 or better.

2.2 LAMINATED PLASTIC

NEMA LD 3.

2.2.1 Countertop Finish

Grade GP 50 or PF 42, satin finish. Color and pattern as indicated.

2.2.2 Countertop Backing Sheet

Grade BK 20.

2.3 HARDWARE

Provide sizes, types, and spacings of manufactured building materials recommended by the product manufacturer except as otherwise indicated or specified. Provide hot-dipped galvanized steel or aluminum nails and fastenings where used on the exterior or exposed to the weather.

2.3.1 Expansion Shields

FS FF-S-325. Except as shown otherwise, maximum size of devices in Groups IV, V, VI, and VIII shall be 3/8 inch.

2.3.2 Toggle Bolts

FS FF-B-588.

2.3.3 Wood Screws

ANSI B18.6.1.

2.3.4 Wire Nails and Staples

FS FF-N-105.

2.3.5 Bolts, Nuts, Lag Screws, and Studs

ANSI B18.2.1, ANSI B18.5.2.1M, ANSI B18.5.2.2M, ASME B18.2.2, and ASTM A 687.

2.4 FABRICATIONS

2.4.1 Countertops

Fabricate with lumber and a core of exterior plywood or particleboard, glued and screwed to form an integral unit. Bond laminated plastic under pressure to exposed surfaces, using type of glue recommended by the plastic manufacturer, and bond a backing sheet under pressure to the underside of the countertop. The countertop unit shall be post-formed type with no-drip nose, cove moulding, Style A backsplash, and covered with NEMA LD 3, Grade PF 42 plastic. Backsplash shall be not less than 3 1/2 inches nor more than 4 1/2 inches high.

2.4.2 Cabinets

Wall and base cabinets and vanity cabinets shall be of the same construction and appearances. Fabricate with solid ends and frame fronts, or with frames all around. Frames shall be solid hardwood not less than 3/4 by 1 1/2 inches. Ends, bottom, back, partitions, and doors shall be hardwood plywood. Mortise and tenon, dovetail, or dowel and glue joints to produce a rigid unit. Cover exposed edges of plywood with hardwood strips. Doors, frames, and solid exposed ends shall be 3/4 inch thick; bottom, partitions, and framed ends 1/2 inch minimum; shelves 5/8 inch minimum; back 1/4 inch minimum.

2.4.2.1 Cabinet Hardware

ANSI/BHMA A156.9. Provide hardware for each door, including two self-closing hinges. Provide two side-mounted metal drawer slides for each drawer. Hardware exposed to view shall be bright chromium plated.

2.4.2.2 Finish

Provide a natural factory finish on wood surfaces after fabrication. Th finish shall be the fabricator's standard natural finish, except that it shall be equivalent to one coat of sealer and one coat of spar varnish on surfaces, and equivalent to a second coat of spar varnish on surfaces exposed to view. Sand lightly and wipe clean between coats.

2.4.3 Casework With Transparent Finish (CTF)

2.4.3.1 AWI Quality Grade (CTF)

Premium grade.

2.4.3.2 Construction (CTF)

Details shall conform to flush overlay design.

2.4.3.3 Semi-Exposed Parts

As specified in the Quality Standards for the grade selected.

2.4.4 Casework With High Pressure Laminate Finish (CHPL)

2.4.4.1 AWI Quality Grade (CHPL)

Premium grade.

2.4.4.2 Construction (CHPL)

Details shall conform to flush overlay design.

2.4.4.3 Exposed Surfaces

High pressure laminate.

2.4.4.4 Semi-Exposed Surfaces

As specified in the Quality Standards for the grade selected.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Rough Carpentry

Fit tightly, set to the required lines and levels, and secure rigidly in place. Spike, nail, and bolt in an approved manner; using the proper siz fasteners, and take care not to split the members. Drill members for bolting; provide washers under heads and nuts; and draw nuts and bolts up tight.

3.1.2 General Finish Work

Provid sizes, materials, and designs as indicated and specified. Where practicable, shop assemble and finish items of built-up millwork. Joints shall be tight and constructed in a manner that will conceal shrinkage. Miter trim and moldings at exterior angles and at returns. Material shall show no warp after installation. Install millwork and trim in the maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

3.1.3 Doors and Frames

Set plumb and square. Provide solid blocking not more than 16 inches o.c. for each jamb. Position blocking so as to occur behind hinges and lock strikes. Double wedge frames and fasten with finishing nails. Set nails for putty stopping. Provide 1/16 inch minimum, 1/8 inch maximum clearance at heads and jambs and 3/8 inch minimum, 7/16 inch maximum between floor finish and bottom of door. Install hardware in accordance with manufacturer's instructions.

3.1.4 Counters

Construct as indicated. Conceal fastenings where practicable, fit the counter level, install in a rigid manner, and scribe to adjoining surfac s. Provide counter sections in the longest lengths practicable; keep joints in tops to a minimum; and where joints are necessary, provide tight hairline joints drawn up with concealed-type heavy pull-up bolts. Glue joints with water-resistant glue and, make rigid with screws, bolts, or other approved fastenings.

3.1.5 Cabinets

Install level, plumb, and tight against adjacent walls. Secure cabinets to walls with concealed toggle bolts, and secure top to cabinet with concealed screws. Make cut-outs for fixtures to templates supplied by fixture manufacturer. Locate cut-outs for pipes so that edges of holes will be covered by escutcheons.

-- End of Section --

SECTION 07160

BITUMINOUS DAMPPROOFING

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 D 41	1985 Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 43	1973 (R 1988) Creosote Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 449	1989 Asphalt Used in Dampproofing and Waterproofing
ASTM D 450	1978 (R 1984) Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing
ASTM D 2823	1990 Asphalt Roof Coatings
ASTM D 4263	1983 (R 1988) Indicating Moisture in Concrete by the Plastic Sheet Method

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926	Safety and Health Regulation for Construction

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Asphalt

b. Asphalt primer

c. Coal-tar pitch

d. Creosote primer

e. Fibrous asphalt

1.3 DELIVERY AND STORAGE

Deliver materials in sealed containers bearing the manufacturer's original labels. Labels shall include the date of manufacture and the recommended shelf life.

1.4 SAFETY AND HEALTH REQUIREMENTS

If coal-tar pitch materials are used, the Contractor shall conform to all OSHA 29 CFR 1926 and General Industry Health Standards as well as state and local standards.

PART 2 PRODUCTS

2.1 ASPHALT

ASTM D 449, Type I or Type II.

2.2 ASPHALT PRIMER

ASTM D 41.

2.3 CREOSOTE PRIMER

ASTM D 43.

2.4 COAL-TAR PITCH

ASTM D 450, Type II or Type III.

2.5 FIBROUS ASPHALT

ASTM D 2823, except that mineral stabilizer shall contain no asbestos.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Remove or cut form ties and repair all surface defects as required in Section 03300, "Cast-in-place Concrete." Clean concrete and masonry surfaces to receive dampproofing of foreign matter and loose particles. Apply dampproofing to clean dry surfaces. Moisture test in accordance with ASTM D 4263. If test indicates moisture, allow a minimum of 7 additional days after test completion for curing. If moisture still exists, redo the test until substrate is dry.

3.2 APPLICATION

Use either the hot-application method or cold-application method, or cold-application method. The cold-application method shall be used in confined spaces where the use of hot bitumen would be hazardous. Apply dampproofing after the priming coat is dry, but prior to any deterioration of the primed surface, and when the ambient temperature is above 40 degrees F.

3.2.1 Surface Priming

Prime surfaces to receive coal-tar pitch dampproofing with a coat of creosote primer. Prime surfaces to receive asphalt or fibrous asphalt dampproofing with a coat of asphalt primer. Apply priming when the ambient temperature is above 40 degrees F and at the rate of approximately one gallon per 100 square feet, fully covering the entire surface to be dampproofed.

3.2.2 Hot-Application Method

Apply two mop coats of hot coal-tar pitch or two mop coats of hot asphalt to surfaces. Apply mop coats uniformly using not less than 25 pounds of coal-tar pitch or 20 pounds of asphalt per 100 square feet for each coat. Do not heat asphalt above 450 degrees F and do not heat coal tar pitch above 400 degrees F. Have kettlemen in attendance at all times during the heating to ensure that the maximum temperature specified is not exceeded. Apply hot asphalt bitumen or coal tar pitch and fully bond to the primed surface. Provide a finished surface that is smooth, lustrous, and impervious to moisture. Recoat dull or porous spots.

3.2.3 Cold-Application Method

Apply two coats of fibrous asphalt to surfaces to be dampproofed. Apply each coat uniformly using not less than one gallon of fibrous asphalt per 50 square feet. Apply the first coat by brush or spray to provide full bond with the primed surface, and brush or spray the second coat over a thoroughly dry first coat. Provide a finished surface that is of uniform thickness and impervious to moisture. Recoat porous areas.

3.3 PROTECTIVE COVERING

Protect dampproofed surfaces against which backfill will be placed with one layer of 15-pound saturated felt conforming to the requirements specified herein. Use asphalt-saturated felt where the dampproofing material is asphalt and use coal-tar-saturated felt where the dampproofing material is coal-tar pitch. Embed felts in the second coating of bitumen and lap edges and ends not less than one inch.

-- End of Section --

SECTION 07230

PERIMETER AND UNDER-SLAB INSULATION

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 C 578	1987 (Rev. A) Preformed, Cellular Polystyrene Thermal Insulation
ASTM C 591	1985 Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation

FEDERAL SPECIFICATIONS (FS)

FS HH-I-1972/1	Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced With Aluminum Foil on Both Sides of the Foam
FS HH-I-1972/2	(Am. 1) Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Asphalt/Organic Felt, Polymer/Organic Mat, Asphalt/Glass Mat, or Polymer/Glass Mat on Both Sides of the Foam

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Insulation

b. Adhesive

c. Mechanical fasteners

d. Protection board or coating

Include descriptive literature with material characteristics and instructions on installation methods and procedures.

1.3 DELIVERY AND STORAGE

Deliver materials to the site in original, sealed packages bearing manufacturer's name and designation, specification number, type, and class. Protect material from damage during construction.

PART 2 PRODUCTS

2.1 INSULATION

Provide only thermal insulating materials recommended by manufacturer for type of application indicated.

2.1.1 Material Properties

Provide thermal insulating materials with the following properties:

a. Thermal Resistance: Provide thermal resistance (R-value) of not less than 11 degrees F per square foot per hour per Btu.

b. Compressive Resistance at Yield: Not less than 25 pounds per square inch (psi).

c. Water Absorption: Not more than 0.1 percent by volume.

2.1.2 Insulating Materials

a. Polystyrene Board: ASTM C 578, Type IV Type VI Type X.

b. Polyurethane or Polyisocyanurate Unfaced Board: ASTM C 591.

c. Polyurethane or Polyisocyanurate Faced Board: FS HH-I-1972/1 and FS HH-I-1972/2.

2.2 ADHESIVE, AND MECHANICAL FASTENERS:

As recommended by the insulation manufacturer and as approved.

2.3 PROTECTION BOARD OR COATING:

As recommended by the insulation manufacturer and as approved.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Application of Thermal Insulation

Provide perimeter insulation as shown.

3.1.2 Manufacturer's Instructions

Perform installation, attachment, taping of edges, provision of vapor retarder, and other requirements such as protection against vermin, insects, damage during construction, and foundation drainage in accordance with manufacturer's instructions and recommendations.

3.1.3 Insulation on Vertical Surfaces

Install thermal insulation as indicated. Install cellular glass block or board at edge of slab. Fasten insulation to concrete with adhesive or

mechanical fasteners.

3.1.4 Insulation Under Slab

Provide insulation horizontally under entire slab on grade. Install insulation on top of vapor retarder provided over fill and turn vapor retarder up over the outside edge of insulation to top of slab. Below vapor retarder, provide flat, smooth, dry, and well tamped fill.

3.1.5 Protection of Insulation

Protect insulation on vertical surfaces from damage during construction and backfilling by application of protection board or coating. Do not leave installed vertical insulation unprotected overnight. Where exterior applied insulation extends above grade, install protection over the insulation above grade and extending 6 inches below grade.

-- End of Section --

SECTION 08110

STEEL DOORS AND FRAMES

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 A 526/A 526M	1990 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM C 578	1987 (Rev. A) Preformed, Cellular Polystyrene Thermal Insulation
ASTM C 591	1985 Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
ASTM D 2863	1987 Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

DOOR AND HARDWARE INSTITUTE (DHI)

DHI A115.1	1988 Preparation for Mortise Locks for 1 3/8 Inch and 1 3/4 Inch Doors (ANSI/DHI A115.W1)
DHI A115.2	1988 Preparation for Bored Locks for 1 3/4 Inch and 1 3/8 Inch Doors (ANSI/DHI A115.W2)
DHI A115.4	1988 Preparation for Lever Extension Flush Bolts

MILITARY SPECIFICATIONS (MIL)

DOD-P-21035	(Rev. A) Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

STEEL DOOR INSTITUTE (SDI)

SDI 100	1985 Standard Steel Doors and Frames
SDI 105	1987 Recommended Erection Instructions for Steel Frames
SDI 107	1984 Hardware on Steel Doors (Reinforcement - Application)

SDI A151.1	1987 Test Procedure and Acceptance Criteria for Physical Endurance for Ste l Doors and Hardware Reinforcings (ANSI/SDI A151.1)
SDI 111F	Recommended Completed Opening Anchors for Standard Steel Doors and Frames

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Doors G

b. Frames

c. Accessories G

d. Weatherstripping

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction.

1.2.2 SD-03, Manufacturer's Standard Color Charts

a. Factory-applied enamel finish

Where colors are not indicated, submit manufacturer's standard colors and patterns to the Contracting Officer for selection.

1.2.3 SD-04, Drawings

a. Doors G

b. Frames

c. Accessories G

d. Weatherstripping

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

1.2.4 SD-07, Schedules

a. Doors

b. Frames

Submit door and frame locations.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4-inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI 100, except as specified otherwise. Doors shall be either hollow steel construction or composite construction. Prepare doors to receive hardware specified in Section 08710, "Finish Hardware." Undercut doors where indicated. Exterior doors shall have top edge closed flush. Doors shall be 1 3/4 inches thick, unless otherwise indicated.

2.1.1 Door Grades

2.1.1.1 Heavy Duty Doors

SDI 100, Grade II, Model 3, or 4, of size(s) and design(s) indicated. Provide where shown. Fill hollow steel exterior doors with insulation.

2.1.1.2 Extra Heavy Duty Doors

SDI 100, Grade III, Model 3, 4, or 5, of size(s) and design(s) indicated. Provide where shown. Fill hollow steel exterior doors with insulation.

2.2 INSULATED STEEL DOOR SYSTEMS

At the option of the Contractor, insulated steel doors and frames may be provided in lieu of Grade I standard steel doors and frames. Door size(s), design, and material shall be as specified for standard steel doors. Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with SDI A151.1 and shall have met the requirements for Level C. Prepare doors to receive hardware specified in Section 08710, "Finish Hardware." Doors shall be 1 3/4 inches thick. Provide insulated steel doors and frames at entrances to dwelling units.

2.3 ACCESSORIES

2.3.1 Louv rs

Louvers for exterior doors shall be inv rted Y type. W ld or tenon louver blades to frame and fasten the entire louver assembly to the door with moldings. Moldings on the room or nonsecurity side of the door shall be detachable; moldings on the security side of the door shall be an integral part of the louver. Form louvers of 16-gage hot-dip galvanized steel for xterior doors and panels. Provide aluminum wire cloth, 18 by 18 or 18 by 16 mesh, for insect screens. Louvers for exterior door(s) shall have a minimum of 30 percent net-free opening.

2.3.2 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08710, "Finish Hardware," provide overlapping steel astragals with the doors.

2.3.3 Moldings

Provide moldings around glass and louvers. Provide nonremovable moldings on the outside of exterior doors and on the corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to the stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.4 PLASTIC FOAM CORES

a. Rigid Polyurethane Foam: ASTM C 591, Type 1 or 2, foamed-in-place or in board form, with an oxygen index of not less than 22 percent when tested in accordance with ASTM D 2863; or

b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II.

2.5 STANDARD STEEL FRAMES

SDI 100, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

2.5.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

2.5.3 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and shall member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

2.5.4 Stops and Beads

Form stops and beads from 20-gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inches on centers. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.5.5 Terminated Stops

Where indicated, terminate interior door frame stops 6 inches above floor.

2.5.6 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.5.7 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.5.7.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16-inch diameter steel wire, adjustable or T-shaped;

b. Stud Partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;

c. Completed Openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI 111F; and

d. Solid Plaster Partitions: Secure anchors solidly to back of frames and tie into the lath. Provide adjustable top strut anchors on each side of frame for fastening to structural members or ceiling construction above. Size and type of strut anchors shall be as recommended by the frame manufacturer.

2.5.7.2 Floor Anchors

Provide floor anchors drilled for 3/8-inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips r sting on and anchored to the structural slabs.

2.6 WEATHERSTRIPPING

As specified in Section 08710, "Finish Hardware."

2.7 HARDWARE PREPARATION

Reinforce, drill, and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable r quirements of SDI 107 and DHI A115.1, DHI A115.2, DHI A115.4. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI 100, as applicable. Punch door frames, with the exception of frames that will have weatherstripping to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.8 FINISHES

2.8.1 Factory-Primed Finish

Unless specified otherwise, phosphate treat and factory prime metal doors and frames as specified in SDI 100.

2.8.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate doors, frames and louvers from galvanized steel, ASTM A 526/A 526M, Coating Designation G60 or A60 (galvannealed). Repair damaged zinc-coated surfaces by the application of zinc dust paint conforming to DOD-P-21035. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI 100. Provide for exterior doors.

2.8.3 Factory-Applied Enamel Finish

After factory priming, apply one coat of medium-enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements shall be in accordance with the coating manufacturer's recommendations. Color(s) of finish coat shall match approved color sample(s).

2.9 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed w lded and soldered joints smooth. Design door frame sections for use with

the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable.

2.9.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI 100. After erection and glazing, clean and adjust hardware.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

SECTION 08360

SECTIONAL OVERHEAD DOORS

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 A 36/A 36M	1991 Structural Steel
ASTM A 123	1989 (Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 227/A 227M	1991 Steel Wire, Cold-Drawn for Mechanical Springs
ASTM A 229/A 229M	1991 Steel Wire, Oil-Tempered for Mechanical Springs
ASTM A 525	1991 (Rev. A) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM C 236	1989 Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM E 330	1990 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

MILITARY SPECIFICATIONS (MIL)

MIL-P-21035	(Rev. B) Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

NATIONAL ASSOCIATION OF GARAGE DOOR MANUFACTURERS (NAGDM)

ANSI/NAGDM 102	1988 Sectional Overhead Type Doors

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Docrs G

1.2.2 SD-04, Drawings

a. Doors G

Show types, sizes, locations, metal gages including minimum metal decimal thickness, hardware provisions, installation details, and other details of construction.

1.2.3 SD-06, Instructions

a. Doors

1.2.4 SD-19, Operation and Maintenance Manuals

a. Doors

Submit Data Package 2 in accordance with Section 01730, "Operation and Maintenance Data."

1.3 DELIVERY, STORAGE, AND HANDLING

Protect doors and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name. Store doors in dry locations with adequate ventilation, free from dust and water. Storage shall permit easy access for inspection and handling. Remove damaged items and provide new.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Hard-Drawn Springwire

ASTM A 227/A 227M.

2.1.2 Oil-Tempered Springwire

ASTM A 229/A 229M.

2.1.3 Steel Sheet

ASTM A 525.

2.1.4 Steel Shapes

ASTM A 36/A 36M.

2.2 DOORS

ANSI/NAGDM 102. Industrial doors. Metal doors shall be horizontal sections hinged together which operate in a system of tracks to completely close the door opening in the closed position and make the full width and height of the door opening available for use in the open position. Provide a permanent label on the door indicating the name and address of the manufacturer. Doors shall be of the standard lift type designed to slide

up and back into a horizontal overhead position and requiring a maximum of 16 inches of headroom for 2-inch tracks and 21 inches of headroom for 3-inch tracks. Doors shall be operated by hand crank with gear or sprocket reduction.

2.3 DESIGN REQUIREMENTS

ANSI/NAGDM 102 as indicated for the building. Doors shall remain operable and undamaged after conclusion of tests conducted in accordance with ASTM E 330 using the design wind load.

2.4 FABRICATION

2.4.1 Steel Overhead Doors

Form door sections of hot-dipped galvanized steel not lighter than 20 gage with longitudinal integral reinforcing ribs. Sections shall be not less than two inches in thickness. Meeting rails shall have interlocking joints to ensure a weathertight closure and alignment for full width of the door. Sections shall be of the height indicated or the manufacturer's standard, except the height of an intermediate section shall not exceed 24 inches. Bottom sections may be varied to suit door height, but shall not exceed 30 inches in height. Provide glass panels as indicated. Install panels using rubber gaskets as standard with the door manufacturer.

2.4.1.1 Insulated Sections

Insulate door sections with fibrous glass or plastic foam to provide a "U" factor of 0.14 or less when tested in accordance with ASTM C 236. Cover interior of door sections with steel sheets of not lighter than 24 gage to completely enclose the insulating material.

2.4.2 Tracks

Provide galvanized steel tracks not lighter than 14 gage for 2-inch tracks and not lighter than 12 gage for 3-inch tracks. Provide vertical tracks with continuous steel angle not lighter than 13 gage for installation to walls. Incline vertical track through use of adjustable brackets to obtain a weathertight closure at jambs. Reinforce horizontal track with galvanized steel angle; support from track ceiling construction with galvanized steel angle and cross bracing to provide a rigid installation.

2.4.3 Hardware

Provide hinges, brackets, rollers, locking devices, and other hardware required for complete installation. Roller brackets and hinges shall be 14-gage galvanized steel. Rollers shall have ball bearings and case-hardened races. Provide reinforcing on doors where roller hinges are connected. Provide a positive locking device and cylinder lock with two keys on manually operated doors.

2.4.4 Counterbalancing

Counterbalance doors with an oil-tempered, helical-wound torsional spring mounted on a steel shaft. Spring tension shall be adjustable; connect

spring to doors with cable through cable drums. Cable safety factor shall be at least 7 to 1.

2.5 MANUAL OPERATORS

2.5.1 Chain Hoist Operators

Provide a galvanized, endless chain operating over a sprocket. Extend chain to within 4 feet of the floor and mount on inside of building. Obtain reduction by use of roller chain and sprocket drive or gearing. Provide chain cleat and pin for securing operator chain. Hoist shall allow for future installation of power operators. The force required to operate the door shall not exceed 35 pounds. Provide lifting handles on both sides of door.

2.6 WEATHER SEALS

Provide exterior doors with weatherproof joints between sections by means of tongue-and-groove joints, rabbetted joints, shiplap joints, or wool pile, vinyl or rubber weatherstripping; a rubber, wool pile, or vinyl, adjustable weatherstrip at the top and jambs; and a compressible neoprene, rubber, wool pile, or vinyl weather seal attached to the bottom of the door.

2.7 FINISHES

Concealed ferrous metal surfaces and tracks shall be hot-dip galvanized. Other ferrous metal surfaces, except rollers and lock components, shall be hot-dip galvanized and shop primed.

2.7.1 Galvanized and Shop Primed

Surfaces specified shall have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coat shall conform to ASTM A 525, coating designation G60, for steel sheets, and ASTM A 123 for assembled steel products. The weight of coatings for assembled products shall be as designated in Table I of ASTM A 123 for the class of material to be coated. The prime coat shall be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces with galvanizing repair paint conforming to MIL-P-21035 and spot prime. At the Contractor's option, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel topcoat may be applied in lieu of prime coat specified.

PART 3 EXECUTION

3.1 INSTALLATION

Install doors in accordance with approved shop drawings and manufacturer's instructions. Upon completion, doors shall be weathertight and free from warp, twist, or distortion. Lubricate and adjust doors to operate freely.

3.2 TESTING

After installation is complete, operate doors to demonstrate installation and function of operators, safety features, and controls. Correct deficiencies.

-- End of Section --

SECTION 08710

FINISH HARDWARE

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/BHMA A156.1	1988 Butts and Hinges (BHMA 101)
ANSI/BHMA A156.2	1989 Bored and Preassembled Locks and Latches (BHMA 601)
ANSI/BHMA A156.4	1986 Door Controls - Closers (BHMA 301)
ANSI/BHMA A156.5	1984 Auxiliary Locks and Associated Products (BHMA A501)
ANSI/BHMA A156.6	1986 Architectural Door Trim (BHMA 1001)
ANSI/BHMA A156.7	1988 Template Hinge Dimensions (BHMA 111)
ANSI/BHMA A156.13	1987 Mortise Locks and Latches (BHMA 621)
ANSI/BHMA A156.16	1989 Auxiliary Hardware (BHMA 1201)
ANSI/BHMA A156.18	1987 Materials and Finishes (BHMA 1301)
ANSI/BHMA A156.21	1989 Thresholds

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 883	1990 Padlocks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	1990 Fire Doors and Windows
NFPA 101	1991 Code for Safety to Life from Fire in Buildings and Structures

STEEL DOOR INSTITUTE (SDI)

SDI 100	1985 Standard Steel Doors and Frames

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Hardware items G

Submit for each different item.

1.2.2 SD-06, Instructions

a. Installation

Include instructions for installing and adjusting hardware.

1.2.3 SD-07, Schedules

a. Hardware schedule

1.2.3.1 Hardware Schedule

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (If fire rated and listed)	ANSI/BHMA Finish Designation

1.2.4 SD-18, Records

a. Key bitting G

1.2.4.1 Chart Requirements

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

a. Complete listing of all keys (AA1, AA2, etc.).

b. Complete listing of all key cuts (AA1-123456, AA2-123458).

c. Tabulation showing which key fits which door.

d. Copy of floor plan on 8 1/2- by 11-inch sheets showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.2.5 SD-19, Operation and Maintenance Manuals

a. Hardware Schedule items, Data Package 1

Submit data package in accordance with Section 01730, "Operation and

Maintenance Data."

1.3 QUALITY ASSURANCE

1.3.1 Hardware Manufacturers and Modifications

Provide, as far as practicable, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.3.2 Hardware Designations

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with manufacturer's name and catalog number as shown in hardwar schedule. Deliver permanent keys to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware to be applied to metal or to prefinished doors shall be made to template. Promptly furnish template information or templates to door and frame manufacturers. Template hinges shall conform to ANSI/BHMA A156.7. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE ITEMS

Conform to the respective standards listed and to requirements specified herein. Hinges, locks, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover. Provide hardware items as specified below and as listed under paragraph entitled "Hardware Schedule."

2.2.1 Hinges

ANSI/BHMA A156.1, 4 1/2 by 4 1/2 inches. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

2.2.2 Mortise Locks and Latches

ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2 1/4 inches with a bushing at least 1/4 inch long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Knobs and roses of mortise locks shall have screwless shanks and no exposed screws.

2.2.3 Bored Locks and Latches

ANSI/BHMA A156.2, Series 4000, Grade 1.

2.2.4 Cylinders and Cores

Provide cylinders and cores for new locks. Cylinders and cores shall have seven pin tumblers. Cylinders shall be products of one manufacturer, and cores shall be the products of one manufacturer.

2.2.5 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.2.5.1 Knobs and Roses

In addition to meeting test requirements of ANSI/BHMA A156.2 and ANSI/BHMA A156.13, knobs, roses, and escutcheons shall be 0.050 inch thick if unreinforced. If reinforced, outer shell shall be 0.035 inch thick and combined thickness shall be 0.070 inch, except knob shanks shall be 0.060 inch thick.

2.2.6 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master keying system. Furnish a quantity of key blanks equal to 20 percent of the total number of file keys. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate."

2.2.7 Closers

ANSI/BHMA A156.4, Series C02000, Grade 1, with optional feature (o.f.) PT 4C, unless otherwise specified. Provide closers complete with brackets, arms, mounting devices, fasteners, cement cases, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule.

2.2.7.1 Identification Marking

In addition to the manufacturer's name or trademark, each closer shall bear the manufacturer's size designation where it will be visible after installation.

2.2.8 Door Protection Plates

ANSI/BHMA A156.6.

2.2.8.1 Sizes of Kick Plates

Width for single doors shall be 2 inches less than door width; width for pairs of doors shall be one inch less than door width. Height of kick plates shall be 8 inches for flush doors and one inch less than height of bottom rail for pan 1 doors.

2.2.9 Door Bumpers

ANSI/BHMA A156.16.

2.2.10 Padlock for Fence Gate

ASTM F 883.

2.2.11 Thresholds

ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.2.12 Weather Stripping

A set shall include head and jamb seals. Weather stripping shall be one of the following:

2.2.12.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts.

2.2.12.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

2.2.12.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

2.2.13 Rain Drips

Extruded aluminum, not less than 0.08 inch thick. Set drips in sealant conforming to Section 07920, "Sealants," and fasten with stainless steel screws.

2.2.13.1 Door Rain Drips

Approximately 1 1/2 inches high by 5/8 inch projection. Align bottom with bottom edge of door.

2.2.13.2 Overhead Rain Drips

Approximately 1 1/2 inches high by 2 1/2 inches projection, with length equal to overall width of door frame. Align bottom with door frame rabbet.

2.2.14 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.3 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel.

2.4 FINISHES

ANSI/BHMA A156.18. Hardware shall have BHMA 630 finish unless specified otherwise. Hinges for exterior doors shall be stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Exit devices may be provided in BHMA 626 finish in lieu of BHMA 630 finish. Exposed parts of concealed closers shall have finish to match lock and door trim. Hardware for aluminum doors shall be finished to match the doors.

2.5 KEY CABINET AND CONTROL SYSTEM

ANSI/BHMA A156.5

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware with full-threaded screws. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weather Stripping Installation

Handle and install weather stripping so as to prevent damage. Provide full contact, weather-tight seals. Doors shall operate without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 9 inches o.c. after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weather Stripping

Provide interlocking, self-adjusting type on heads and jambs and flexible hook type at sills. Nail weather stripping to door one inch o.c. and to heads and jambs at 4 inches o.c.

3.1.1.3 Spring Tension Type Weather Stripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze, stainless steel nails with stainless steel. Space nails not more than 1 1/2 inches o.c.

3.1.2 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with

cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 FIRE DOORS AND EXIT DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors.

3.3 HARDWARE LOCATIONS

SDI 100, unless indicated or specified otherwise.

a. Kick Plates: Push side of single-acting doors.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where directed. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Furnish complete instructions for setup and use of key control system.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

HW-1 Door No. 1
All hardware by door manufacturer

HW-2 Door No. 2

1 1/2 Pair Hinges	2112
1 Lockset	F08
1 Closer	C02021
1 Kickplate (inside only)	J102

HW-3 Door No. 3

1 1/2 Pair Hinges	A2111
1 Lockset	F76 Grade 1
1 Closer	C02021
1 Kick Plate (inside only)	J102

-- End of Section --

SECTION 08800

GLAZING

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 C 669	1975 (R 1989) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
ASTM C 1036	1990 Flat Glass

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

FLAT GLASS MARKETING ASSOCIATION (FGMA)

FGMA GM	1990 Glazing Manual
FGMA SM	1990 Sealant Manual

SEALED INSULATING GLASS MANUFACTURERS ASSOCIATION (SIGMA)

SIGMA TB-3001	1990 Sloped Glazing of Organically Sealed Insulating Glass Units
SIGMA TM-3000	1990 Vertical and Basic Field Glazing of Organically Sealed Insulating Glass Units

1.2 SUBMITTALS

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

1.2.1 SD-06, Instructions

a. Setting and sealing materials

b. Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in

safe, dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

PART 2 PRODUCTS

2.1 GLASS

ASTM C 1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.1.1 Clear Glass

Type I, Class 1 (clear), Quality q4 (A). Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or 1/8-inch float glass for openings up to and including 15 square feet, 3/16 inch for glazing openings over 15 square feet but not over 30 square feet, and 1/4 inch for glazing openings over 30 square feet but not over 45 square feet.

2.2 SETTING AND SEALING MATERIALS

Provide as specified in the FGMA GM, SIGMA TM-3000, SIGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted shall be gray or neutral color.

2.2.1 Glazing Compound

ASTM C 669. Use for face glazing metal sash.

2.2.2 Elastomeric Sealant

See Section 13121, "Pre-Engineered Metal Buildings".

2.2.3 Preformed Channels

Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the particular condition.

2.2.4 Sealing Tapes

Preformed, semisolid, polymeric-based material of proper size and compressibility for the particular condition. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant

manufacturer. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

2.2.5 Setting Blocks and Edge Blocks

Lead or neoprene of 70 to 90 Shore "A" durometer hardness, chemically compatible with sealants used, and of sizes recommended by the glass manufacturer.

2.2.6 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

PART 3 EXECUTION

3.1 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the FGMA GM, FGMA SM, SIGMA TB-3001, SIGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the FGMA GM, FGMA SM, SIGMA TB-3001, SIGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place.

3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted.

-- End of Section --

SECTION 09100

METAL SUPPORT 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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463	1988 Steel Sheet, Cold-Rolled, Aluminum-Coated Type I and Type II
ASTM A 525	1990 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM C 645	1988 Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
ASTM C 754	1988 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board
ASTM C 841	1987 Installation of Interior Lathing and Furring

UNDERWRITERS LABORATORIES INC. (UL)

UL FRD	1990 Fire Resistance Directory

1.2 SUBMITTALS

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

1.2.1 SD-04, Drawings

a. Metal support systems

Submit for the erection of metal framing, furring. Indicate materials, sizes, thicknesses, and fastenings.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A 525, G-60; aluminum coating ASTM A 463, T1-25; or a 55-percent aluminum-zinc coating.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841.

2.1.2 Materials for Attachment of Gypsum Wallboard

2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 645.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C 645, but not lighter than 25 gage.

2.1.2.3 Furring Structural Steel Columns

ASTM C 645. Steel (furring) clips and support angles listed in UL FRD may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

2.1.2.4 Z-Furring Channels with Wall Insulation

Not lighter than 26-gage galvanized steel, Z-shaped, with 1 1/4-inch and 3/4-inch flanges and 1 1/2-inch furring depth.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Gypsum Wallboard

3.1.1.1 Suspended and Furred Ceiling Systems

ASTM C 754, except that framing members shall be 16 inches o.c. unless indicated otherwise.

3.1.1.2 Nonload-Bearing Wall Framing and Furring

ASTM C 754, except as indicated otherwise.

3.1.1.3 Furring Structural Steel Columns

Install studs or galvanized steel clips and support angles for erection of gypsum wallboard around structural steel columns in accordance with the UL FRD, d sign number(s) indicated.

3.1.1.4 Z-Furring Channels with Wall Insulation

Install Z-furring channels vertically spaced not more than 24 inches o.c. Locate Z-furring channels at interior and exterior corners in accordance with manufacturer's printed erection instructions. Fasten furring channels to concrete walls with powder-driven fasteners or hardened concrete steel nails through narrow flange of channel. Space fasteners not more than 24 inches o.c.

3.2 ERECTION TOLERANCES

Framing members which will be covered by finished such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/4 inch in 8 feet from a straight line;

c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/8 inch in 8 feet from a straight line;

c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

SECTION 09250

GYPSUM BOARD

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 C 36	1991 Gypsum Wallboard
ASTM C 475	1989 Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 840	1988 Application and Finishing Gypsum Board
ASTM C 954	1986 Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 1047	1985 (R 1990) Accessories for Gypsum Wallboard and Gypsum Veneer Base

GYPSUM ASSOCIATION (GA)

GA 216	1989 Application and Finishing of Gypsum Board

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Gypsum board

b. Fasteners

c. Joint treatment materials

d. Accessories

Submit for each type of gypsum board.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.3.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation.

1.3.3 Handling

Neatly stack gypsum board flat to prevent sagging or damage to the edges, ends, and surfaces.

1.4 ENVIRONMENTAL CONDITIONS

1.4.1 Temperature

Maintain a uniform temperature of not less than 50 degrees F in the structure for at least 48 hours prior to, during, and following the application of gypsum board, cementitious backer units, and joint treatment materials, or the bonding of adhesives.

1.4.2 Exposure to Weather

Protect gypsum board products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

PART 2 PRODUCTS

2.1 MATERIALS

Shall conform to the respective specifications and standards and to the requirements specified herein. Provide gypsum board manufactured from asbestos-free materials.

2.1.1 Gypsum Board

ASTM C 36.

2.1.1.1 Regular

48 inches wide, 1/2-inch thick, tapered edges.

2.1.2 Joint Treatment Materials

ASTM C 475.

2.1.2.1 Embedding Compound

Specifically formulated and manufactured for us in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.2.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.2.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.2.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.2.5 Joint Tape

Cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.3 Fasteners

2.1.3.1 Screws

ASTM C 954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick.

2.1.4 Accessories

ASTM C 1047. Fabricate from corrosion protected steel or plastic designed for its intended use. Flanges shall be free of dirt, grease, and other materials that may adversely affect the bond of joint treatment. Provide prefinished or job decorated materials.

2.1.5 Water

Clean, fresh, and potable.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grabbars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Gypsum Board and Framing

Verify that surfaces of gypsum board and framing to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C 840 or GA 216 and the requirements specified herein. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length. Cut out gypsum board as required to make neat close joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Surfaces of gypsum board and substrate members may be bonded together with an adhesiv , except where prohibited by fire rating(s). Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C 840, System VIII or GA 216.

3.2.2 Arches and Bending Radii

Apply gypsum board in accordance with ASTM C 840, System IX or GA 216.

3.2.3 Floating Interior Angles

Locate the attachment fasteners adjacent to ceiling and wall intersections in accordance with ASTM C 840, System XII or GA 216, for single-ply applications of gypsum board to wood framing.

3.2.4 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C 840, System XIII or GA 216, unless indicated otherwise.

3.3 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C 840 or GA 216. Provide joint, fastener depression, and corner treatment. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer.

3.4 CAULKING

Caulk openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 13121, "Pre-Engineered Metal Buildings." Apply calking material with exposed surface flush with gypsum board.

3.5 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finish as specified. Remove predecorated gypsum board which cannot be restored to like-new condition. Provide new predecorated gypsum board.

-- End of Section --

SECTION 09900

PAINTING

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.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000	1988 Air Contaminants
29 CFR 1910.1025	1988 Lead

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1500	(Rev. A) Sealer, Surface (Latex Block Filler)
CID A-A-1558	Paint, Stencil

FEDERAL SPECIFICATIONS (FS)

FS TT-P-19	(Rev. D) Paint, Latex (Acrylic Emulsion, Exterior Wood and Masonry)
FS TT-P-29	(Rev. J) (Int Am. 2) Paint, Latex Base, Interior, Flat, White and Tints
FS TT-E-489	(Rev. H) Enamel, Alkyd, Gloss, Low VOC Content
FS TT-E-505	(Rev. B) Enamel (Odorless, Alkyd, Interior, High Gloss)
FS TT-E-509	(Rev. C) Enamel, Odorless, Alkyd, Interior, Semigloss, White and Tints
FS TT-E-545	(Rev. C) Primer, (Enamel-Undercoat, Alkyd, Odorless, Interior, Flat, Tints and White)
FS TT-P-645	(Rev. B) Primer, Paint, Zinc-Molybdate, Alkyd Type
FS TT-P-1511	(Rev. B) Paint, Latex (Gloss and Semigloss, Tints and White) (for Interior Use)

FEDERAL STANDARDS (FED-STD)

FED-STD-313	(Rev. C) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

MILITARY SPECIFICATIONS (MIL)

DOD-P-15328	(Rev. D) (Am. 1) Primer (Wash), Pretreatment (Formula No. 117 for Metals) (Metric)
MIL-P-24441	(Rev. A) (Supp. 1) Paint, Epoxy-Polyamide
MIL-P-28577	(Rev. B) Primer, Water-Borne, Acrylic or Modified Acrylic, for Metal Surfaces

MILITARY STANDARDS (MIL-STD)

MIL-STD-101	(Rev. B) Color Code for Pipelines and for Compressed Gas Cylinders

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC PA 1	1982 Shop, Field, and Maintenance Painting
SSPC PA 3	1982 A Guide to Safety in Paint Application
SSPC SP 1	1982 Solvent Cleaning
SSPC SP 2	1989 Hand Tool Cleaning
SSPC SP 3	1989 Power Tool Cleaning
SSPC SP 6	1989 Commercial Blast Cleaning
SSPC SP 7	1989 Brush-Off Blast Cleaning
SSPC SP 10	1989 Near-White Blast Cleaning
SSPC VIS 1	1989 Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)

1.2 SUBMITTALS

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

1.2.1 SD-06, Instructions

a. Manufacturer's material safety data sheets

Submit Manufacturer's material safety data sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

1.2.2 SD-07, Schedules

a. Piping and conduit identification

Submit color stencil codes.

1.2.3 SD-08, Statements

a. Applicator's qualifications

b. Evidence of acceptable variation

1.2.3.1 Applicator's Qualifications

Submit evidence that the Contractor or his subcontractor has satisfactorily applied paint by airless spray at a minimum of two sites. Indicate the names and locations of the sites, and type and design of the equipment used, including safety devices.

1.2.3.2 Evidence of Acceptable Variation

If a product proposed for use does not conform to requirements of the referenced specification, submit for approval to the Contracting Officer, evidence that the proposed product is either equal to or better than the product specified. The submittal shall include the following:

a. Identification of the proposed substitute;

b. Reason why the substitution is necessary;

c. A comparative analysis of the specified product and the proposed substitute, including tabulations of the composition of pigment and vehicle;

d. The differences between the specified product and the proposed substitute; and

e. Other information necessary for an accurate comparison of the proposed substitute and the specified product.

1.2.4 SD-13, Certificates

a. Coating

b. Sealant

1.2.4.1 Requirements

For each type of coating, sealant, or other product furnished:

a. Submit a certificate from the manufacturer stating that the product conforms to requirements of the referenced specification.

b. If the referenced specification has a Qualified Products List (QPL), certify that the product has been tested and approved for inclusion in the QPL.

1.3 QUALITY ASSURANCE

1.3.1 Qualifications of Airless Spray Applicators

Satisfactory application of paint by airless spray at a minimum of two sites.

1.3.2 Field Samples and Tests

The Government will take one-pint samples of paint at random from the products delivered to the job site and test them to verify that the products either conform to the referenced specifications or the approved substitution. Products which do not conform shall be removed from the job site and replaced with new products that conform to the referenced specification or the approved substitution.

1.4 REGULATORY REQUIREMENTS

1.4.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, the Contractor shall provide coating materials that conform to the restrictions of the regional jurisdiction. Notify the Contracting Officer of any paint specified herein which fails to conform to the Air Quality Management District Rules (cited in Appendix A) for the location of the project. In localities where the specified coating or paint is prohibited, the Contracting Officer may direct the substitution of the acceptable coating systems.

1.4.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.4.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.4.4 Asbestos Content

Materials shall not contain asbestos.

1.4.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5 DELIVERY AND STORAGE

Deliver materials in sealed, labeled containers bearing the manufacturer's name, brand designation, specification number, batch number, color, and date of manufacture. Restrict storage and mixing of materials to locations designated by the Contracting Officer.

1.6 SAFETY METHODS

Apply coating materials using safety methods and equipment in accordance with the following:

1.6.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA 3.

1.6.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to th most stringent guidance of:

a. The chemical manufacturer when using mineral spirits, or other chemicals. Use impermeable gloves, chemical goggles or faceshield, and other recommended protective clothing and equipment to avoid exposure of skin, eyes, and respiratory system. Conduct work in a manner to minimize exposure of building occupants and the general public.

b. The appropriate OSHA standard in 29 CFR 1910.1025 for surface preparation on painted surfaces containing lead, zinc-chromate, strontium-chromate, asbestos, or other toxic ingredients.

c. 29 CFR 1910.1000.

d. Threshold Limit Values (R) of the American Conference of Governmental Industrial Hygienists.

e. Manufacturer's Material Safety Data Sheets (MSDS).

1.7 ENVIRONMENTAL CONDITIONS

1.7.1 Exterior Coatings

Do not apply coating to surfaces during foggy or rainy weather, or under the following surface temperature conditions:

a. Less than 5 degrees F above the dew point;

b. Below 40 degrees F (for oil-based paints), 50 degrees F (for latex paints) or over 95 degrees F, unless approved by the Contracting Officer.

1.7.2 Interior Coatings

Apply coatings when surfaces to be painted are dry and the following surface temperatures can be maintained:

a. Between 65 and 95 degrees F during the application of enamels.

b. Between 50 and 95 degrees F during the application of other coatings.

1.8 COLOR SELECTION

Where colors not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

1.9 LOCATION AND SURFACE TYPE TO BE PAINTED

1.9.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

c. Existing coated surfaces that are damaged during performance of the work.

1.9.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceiling, and furred spaces.

c. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

1.9.3 Exterior Painting

Includes new surfaces of the metal doors and frames as indicated. Also included are existing coated surfaces made bare by cleaning operations.

1.9.4 Interior Painting

Includes new surfaces of the building and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.9.5 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

b. Do not paint the following, unless indicated otherwise:

(1) New zinc-coated, aluminum, and copper surfaces under insulation;

(2) New aluminum jacket on piping; and

(3) New interior ferrous piping under insulation.

1.9.6 Exterior Painting of Site Work Items

Field coat the following items:

New Surfaces

a. Doors and Frames

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the specifications and standards referenced in PART 3. For materials specified by reference to a specification which has a Qualified Products List (QPL), the material provided shall have been tested and approved for inclusion in the QPL.

2.1.1 Latex Block Filler

CID A-A-1500.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other substances deleterious to coating performance as specified for each substrate.

3.3 PREPARATION OF METAL SURFACES

3.3.1 Existing and New Ferrous Surfaces

a. Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2. Brush-off blast remaining surface in accordance with SSPC SP 7; Water blast between 2000 and 3000 psi, may be used to remove loose coating and other loose materials. Use inhibitor as recommended by coating manufacturer to prevent premature rusting.

b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6.

3.3.2 Final Ferrous Surface Condition:

Cleaned surface shall be similar to photographs in SSPC VIS 1 as follows:

Degree of Cleaning	Adherent Mill Scale	Rusting Mill Scale	Rusted	Pitted and Rusted
Hand Tool Cleaning SSPC SP 2	(1)	B St 2	C St 2	D St 2
Power Tool Cleaning SSPC SP 3	(1)	B St 3	C St 3	D St 3
Commercial Blast Cleaning SSPC SP 6	(1)	(1)	C Sa 2	D Sa 2
Brush-Off Blast Cleaning SSPC SP 7	(1)	B Sa 1	C Sa 1	D Sa 1

Near White Blast Cleaning SSPC SP 10	A Sa 2-1/2	B Sa 2-1/2	C Sa 2-1/2	D Sa 2-1/2

Note: (1) No photograph is available or recommended for comparisón.

3.3.3 Galvanized Surfaces

a. New Galvanized: Solvent clean in accordance with SSPC SP 1. If the galvanized metal has been "passivated" or "stabilized," the coating shall be completely removed by brush-off abrasive blast or other treatment, or the surface shall be primed with a primer which is specifically recommended by the paint manufacturer for use on passivated or stabilized galvanized steel.

3.3.4 Aluminum, Other Non-Galvanized, and Non-Ferrous Surfaces

a. Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with a mild detergent to remove dirt and water soluble contaminates.

b. Pretreatment: Apply DOD-P-15328 as a pretreatment (.3-.5 mil DFT).

3.4 PREPARATION OF GYPSUM BOARD

3.4.1 Gypsum Board

a. Surface Cleaning: Gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material.

b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with spackling compound and sand smooth.

3.5 APPLICATION

3.5.1 Coating Application

Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein. Thoroughly work coating materials into joints, crevices, and open spaces. Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying. Provide each coat in specified condition to receive the next coat.

b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by the manufacturer, before applying subsequent coats.

Follow manufacturer's recommendations for surface pr paration if primers or intermediate coats are allowed to dry longer than recommended by manufactur rs of subsequ nt coatings. Each coat shall cover the surface of the preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.

c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

3.5.2 Equipment

Apply coatings with approved brushes, approved rollers, or approved spray equipment, unless specified otherwise. Spray areas made inaccessible to brushing by items such as ducts and other equipment.

3.5.3 Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

3.5.4 Coating Systems

a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

I Exterior Metal Surfaces
II Interior Metal Surfaces
III Building Systems Surfaces: Interior and Exterior

b. Minimum Dry Film Thickness (DFT): Apply paints, primers, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.

c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.

d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

(1) One coat of primer.

(2) One coat of undercoat or intermediate coat.

(3) One top coat to match adjacent surfaces.

e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein,

except that pretreatments, s alers and fillers ne d not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.6 COATING SYSTEMS FOR METAL

a. Primer: Apply specified ferrous metal primer on the same day that surface is cleaned. If flash rusting occurs, re-clean the surface prior to application of primer.

(1) Inaccessible Surfaces: Prior to erection, use two coats of the specified primer on metal surfaces that will be inaccessible after erection.

(2) Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

(3) Surface Previously Coated with Epoxy or Urethane: Apply MIL-P-24441/1, Formula 150, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.

(4) Pipes and Tubing; The semitransparent film applied to pipes and tubing at the mill is not to be considered a shop coat. Apply specified ferrous metal primer prior to application of subsequent coats.

(5) Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer, MIL-P-28577.

b. Apply coatings of Tables I, II and III. "DFT" means dry film thickness in mils.

3.7 PIPING AND CONDUIT IDENTIFICATION

Piping And Conduit Identification, Including Surfaces In Concealed Spaces: Provide in accordance with MIL-STD-101. Place stenciling in clearly visible locations. On piping and conduits not covered by MIL-STD-101, stencil approved names or code letters, in letters a minimum of 1/2-inch high for piping and a minimum of 2-inches high elsewhere. Stencil arrow-shaped markings on the piping and conduit to indicate the direction of flow. Use black stencil paint, CID A-A-1558.

3.8 INSPECTION AND ACCEPTANCE

In addition to meeting the previously specified requirements, demonstrate the mobility of moving components, including but not limited to swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of the coatings have elapsed and prior to invoicing for final payment.

TABLE - I

EXTERIOR METAL SURFACES

	SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
		******* FERROUS SURFACES *******					
A.	New Steel That Has Been Blast-cleaned (Up to SSPC SP 6)	MIL-P-24441	1.5	MIL-P-24441	2.0	MIL-P-24441	2.0
B.	New Steel That Has Been Blasted to SSPC SP 10	MIL-P-24441/1 Form. 150	3.0	MIL-P-24441/1 Form. 150	3.0	MIL-P-24441	2.0
		******* GALVANIZED SURFACES *******					
C.	New Galva-nized Surfaces	MIL-P-28577	1.5	N.A.		MIL-P-24441	1.5
D.	Galva-nized Surfaces With Slight Coating Deterior-ation; Little or No Rusting	Spot pre-treatment, DOD-P-15328, on exposed metal	1.5	N.A.		FS TT-P-19 MIL-P-24441	1.5 1.5
		Spot Prime MIL-P-28577	3.0	N.A.		MIL-P-24441	1.5

TABLE - II

INTERIOR METAL SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
A. Metal Except Floors, Not Specified Otherwise	FS TT-P-645 on non-shop-primed surfaces	2.0	FS TT-E-545	1.5	FS TT-E-509	1.5
B. Metal in Toilets, and Other Interior High-Humidity Areas	FS TT-P-645, 1 coat on shop-primed surfaces and 2 coats on non-shop-primed surfaces	2.0	FS TT-E-545	1.5	FS TT-E-509 FS TT-E-505	1.5

TABLE - III

BUILDING SYSTEMS SURFACES: INTERIOR AND EXTERIOR

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
1. Mechanical, Electrical, and Miscellaneous Metal Items, Except Hot Metal Surfaces and New Prefinished Equipment: Prefinishing of new mechanical and electrical equipment is specified in the section covering the particular item.						
A. Surfaces Not Adjacent to Painted Surfaces	FS TT-E-489	1.5	FS TT-E-1593	1.5		
B. Surfaces Adjacent to Painted Surfaces	Coating systems as specified. Color of topcoat to match adjacent surfaces. 1.5 mils dry film thickness for each coat.					
C. New Exposed	FS TT-P-645 MIL-P-24441/1	1.5 3.0	FS TT-E-489	1.5	FS TT-E-489 MIL-P-24441/3	1.5 3.0

TABLE - III

BUILDING SYSTEMS SURFACES: INTERIOR AND EXTERIOR

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
Exterior (2 coats) Piping						
D. Wallboard	FS TT-P-19	1.5	N.A.		FS TT-P-29,	
	FS TT-P-19	1.5	N.A.		FS TT-E-509, "Eggshell"	1.5
	FS TT-P-19	1.5	N.A.		FS TT-P-1511, Semi Gloss	1.5

-- End of Section --

SECTION 10522

FIRE EXTINGUISHERS

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.

FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)

FM P7825	1991 Approval Guide

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	1990 Portable Fire Extinguishers

UNDERWRITERS LABORATORIES INC. (UL)

UL FPED	1991 Fire Protection Equipment Directory
UL 8	1990 (R 1991) Foam Fire Extinguishers
UL 299	1990 (R 1991) Dry Chemical Fire Extinguishers
UL 711	1990 Fire Extinguishers

1.2 SYSTEM DESCRIPTION

Provide fire extinguishers in accordance with the required and advisory provisions of NFPA 10, and as specified herein. Fire extinguishers shall be UL FPED listed or FM P7825 approved. In the publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Northern Division, Naval Facilities Engineering Command, Fire Protection Engineer.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals." The fire protection engineer, Northern Division, Naval Facilities Engineering Command will review any approve all submittals in this section requiring Government approval.

1.3.1 SD-02, Manufacturer's Catalog Data

a. Fire extinguishers G

Submit for each type of fire extinguisher.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original sealed containers or packages, bearing the manufacturer's name and brand designation. Handle and store materials to protect them from damage during the entire construction period. Replace all damaged items with new items.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

Fire Extinguishers shall be steel cylinder type with metal valve assembly, rechargeable, wall mounted, and shall conform to the requirements specified herein. Provide mounting devices in accordance with the UL standards referenced herein. Fire test rating requirements are those established by UL 711.

2.1.1 Dry Chemical Fire Extinguishers

UL 299. Provided stored pressure multi-purpose dry chemical fire extinguishers, equipped with integral pressure indicating gage, 20 pound nominal charge weight having a minimum fire test rating of 4A:30B:C.

2.1.2 Pressurized Aqueous Film Forming Foam (AFFF) Fire Extinguishers

UL 8. Provide 2 1/2 gallon pressurized AFFF liquid charge type fire extinguishers equipped with integral pressure indicating gage and having a minimum fire test rating of 3A:40B.

PART 3 EXECUTION

3.1 INSTALLATION

Install mounting devices on walls and vertical surfaces for exposed wall mounted fire extinguishers. The top of installed extinguishers shall not be more than 5 feet above the finished floor. Provide fire extinguishers fully charged and ready for use.

-- End of Section --

SECTION 10800

TOILET AND BATH ACCESSORIES

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.

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380	Dispenser, Paper Towel
CID A-A-2668	Dispenser, Toilet Paper, Cabinet
CID A-A-2703	Dispenser, Soap

FEDERAL SPECIFICATIONS (FS)

FS DD-M-00411	(Rev. C) Mirrors, Glass
FS WW-P-541/8	(Rev. B) (Am. 1) Plumbing Fixture (Accessories, Land Use) (Detail Specification)

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Manufactured units

Submit for each type of accessory specified. Include descriptions of materials, finishes, fastening and anchoring devices, and appurtenances.

1.2.2 SD-13, Certificates

a. Manufactured units

Submit for each type of accessory specified, attesting that materials meet the specified requirements.

1.2.3 SD-14, Samples

a. Manufactured units

Submit one of each type of accessory complete with appurtenances and finished as specified. Approved samples may be installed in the work

provided each sample is labeled for identification and location recorded.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in unopened containers, labeled with the manufacturer's names and brands, ready for installation. Store accessories in safe, dry locations until needed for installation.

PART 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

Fabricate accessories in accordance with commercial practice, with welds ground smooth. Bend, flange, draw, form, and perform similar operations in a manner to ensure no defects. Doors shall be warp free. Key manufacturer's standard locks alike, for groups of accessories; two keys furnished for each group.

2.2 FINISHES

Finishes on metals not specified otherwise shall be provided as follows:

Metal	Finish
Corrosion-resisting Steel (Stainless Steel)	General-purpose Polished

2.3 MANUFACTURED UNITS

2.3.1 Toilet Tissue Dispensers (Surface Mounted)

2.3.1.1 Type II, Two Rolls of Tissue, Vertical Mount

CID A-A-2668 combination of carbon or stainless steel or plastic.

2.3.2 Paper Towel Dispenser (Surface Mounted)

CID A-A-2380, stainless steel.

2.3.2.1 Type I (Single-fold Towels)

Minimum thickness of uncoated metal 0.029-inch. Color of dispenser shall be white.

2.3.3 Waste Receptacles

FS WW-P-541/8, Type II. Provide reuseable liner of the type standard with the receptacle manufacturer.

2.3.3.1 Mounting S, Surface Mounting

Capacity shall be not less than 3 cubic feet.

2.3.4 Soap Dispensers

CID A-A-2703 Type II, waterless paste, circular reservoir with inside diameter of 5 7/8 plus or minus 1/16-inches and a depth of 1 1/4-inches, stainless steel capable of holding a 1-gallon can of such diameter.

2.3.5 Mirrors

Class 2, Style E, Grade 2, electrocopper plated, conforming to FS DD-M-00411, mirror shall be equipped with an integral shelf for the full width of the mirror and a back of the type standard with the manufacturer. Shelf shall be the mirror manufacturer's standard type that forms the coved bottom member of the mirror frame as a single unit. Shelf shall be not less than 0.050 inch thick and 5 inches deep, with rounded ends; material and finish as specified for mirror frame.

PART 3 EXECUTION

3.1 INSTALLATION

Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Exposed screw heads shall be oval. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details and locations with other trades and Anerican Institute of Architects guidelines as their work progresses. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Accessories without backplates shall have concealed fasteners. Unless indicated or specified otherwise, install accessories with sheet metal screws or wood screws in lead-lined braided jute, teflon or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board without solid backing into the metal studs, or to metal backplates secured to metal studs.

-- End of Section --

SECTION 11308

CHEMICAL FEED 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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1785	(1991) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM F 441	(1989) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC-01	(1990; Supple 1991) National Standard Plumbing Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 50	(1988; Rev thru Mar 1991) Cabinets and Boxes

1.2 GENERAL REQUIREMENTS

1.2.1 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 5 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.

1.2.2 Nameplates

Pumps and motors 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.

1.2.3 Verification of Dimensions

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

1.3 SUBMITTALS

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

1.3.1 SD-02 Manufacturer's Catalog Data

a. Chemical Feed System G

Manufacturer's descriptive and technical literature, catalog cuts, performance charts, and pump curves.

1.3.2 SD-04 Drawings

a. Chemical Feed System G

Detail drawings containing complete piping, wiring, schematic, flow diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for installation, maintenance and operation.

1.3.3 SD-06 Instructions

a. Chemical Feed System G

Material safety data sheets, installation instructions, and framed instructions.

1.3.4 SD-07 Schedules

a. Chemical Feed System G

List of materials, list of equipment, including a complete list of parts and supplies with current unit prices and source of supply. List of parts recommended by the manufacturer to be replaced after 1 year service. List of special tools for each type of equipment furnished including special tools necessary for adjustment, operation, maintenance, and disassembly.

1.3.5 SD-09 Test Reports

a. Testing G

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

a. Chemicals G

Certification of chemicals supplied.

1.3.7 SD-19 Operation and Maintenance Manuals

a. Chemical Feed System G

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, number, service manual, parts list, and brief description of all equipment and their basic operating features. Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and trouble-shooting guides. 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.

1.4 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.1 CHEMICALS

A 30 day supply at the maximum pumping rate for each feeder or pair of duplexed feeders shall be provided. Two copies of the material safety data sheet shall be furnished for each chemical. Two copies of certification that the chemical supplied meets the requirements shall be furnished. Chemicals shall conform to the following:

2.1.1 Acids

Sulfuric acid (93.2% concentration-liquid).

2.1.2 Caustic

Sodium hydroxide (50% concentration-liquid).

2.1.3 Coagulant

Cationic polyelectrolyte - polyquaternary amine (liquid).

2.1.4 Flocculant

Anionic polyacrylamide (emulsion).

2.1.5 Oxidants

Hydrogen peroxide (50% concentration-liquid).

2.2 CHEMICAL FEED SYSTEM

The system shall consist of a storage tank from which the chemical solution shall, by means of pumps or mechanical devices, be delivered through piping to the point of application. Each chemical feeding system shall include gauges, back pressure regulators, strainers, pressure relief valves, sight glasses and flow metering devices, check valves, and hand valves. Construction shall be as simple as practicable to provide equipment isolation, bypass and reliable service and to be readily accessible for inspection, cleaning, adjustment, repairs, and replacements. System data and drawings shall be submitted for approval prior to delivery.

2.2.1 Capacity

Each chemical metering machine shall be capable of delivering chemical solution at any rate from the minimum flow rate to the maximum flow rate and shall be capable of continuous operation at rated capacity. Accuracy shall be plus or minus 2 percent over a 20 to 1 range from the required maximum capacity to the minimum pumping rate.

2.2.1.1 Acid Feed System

Acid feed system shall conform to the following:

b. Sulfuric acid solution delivery.
Number of pumps: 1.
Controls: Automatic rate adjustment.
Concentration: Minimum 90 percent; maximum 95 percent.
Pressure: 35 psig backpressure at point of injection.
Feed/flow rate: Minimum 0.1 gph; maximum 2.5 gph.

2.2.1.2 Caustic Feed System

Caustic feed system shall conform to the following:

a. Sodium hydroxide (caustic soda) solution delivery.
Number of pumps: 1.
Controls: Automatic rate adjustment.
Concentration: Minimum 45 percent; maximum 55 percent.
Pressure: 35 psig backpressure at point of injection.
Feed/flow rate: Minimum 0.1 gph; maximum 2.5 gph.

2.2.1.3 Coagulant Feed System

Coagulant feed system shall conform to the following:

a. Cationic Polyelectrolyte solution delivery.
Number of pumps: 1.
Controls: Automatic rate adjustment.
Concentration: Minimum 0.5 percent; maximum 2 percent.
Pressure: 20 psig backpressure at point of injection.

Feed/flow rate: Minimum 0.1 gph; maximum 2.5 gph.

2.2.1.4 Flocculant Agent Feed Systems

Flocculant agent feed system shall conform to the following:

a. Anionic polyacrylamide solution delivery.
Number of pumps: 1.
Controls: Automatic rate adjustment.
Concentration: Minimum 0.5 percent; maximum 2 percent.
Pressure: 20 psig backpressure at point of injection.
Feed/flow rate Minimum 0.1 gph; maximum 2.5 gph.

2.2.1.5 Oxidant Feed System

Oxidant feed system shall comply with the following:

a. Hydrogen peroxide solution delivery:
Number of pumps: 2.
Controls: Automatic rate adjustment.
Concentration: Minimum 45 percent; maximum 55 percent.
Pressure: 20 psig backpressure at point of injection.
Feed/flow rate: Minimum 0.1 gph; maximum 2.5 gph.

2.2.2 Controls

The chemical metering machines shall be provided with the appurtenances and accessories, as required, for feed rate control. Manual range adjustment shall be provided on all systems. The controls shall be compatible with the programmable logic controller as specified in Section 16901 to achieve the desired process functions.

2.2.2.1 Automatic Control

Automatic control shall have the capability to vary feed rate based on signals from a flow meter or pH controller.

2.2.2.2 Semiautomatic Control

Semiautomatic control shall have the capability to automatically start and stop the feeding machines in response to the operating or non-operating status of the receiving plant process. The pump start and stop shall respond to flow switch or pump operation or timer status.

2.2.2.3 Nonautomatic Control

Nonautomatic control shall have the capability for starting or stopping the feeding machines and adjustment of the solution feed rate by the operator.

2.2.3 Metering Pumps or Mechanical Devices

All metering pumps or mechanical devices shall be of the positive displacement, double diaphragm type, hydraulically activated and with diaphragms balanced during operation. Pump output shall be adjustable by controlling stroke length and frequency. All pump wetted parts shall be

compatible with fluid pumped.

2.2.4 Drives for Metering Pumps

The metering pumps shall be supplied with and driven by alternating current electric motor drives.

2.2.4.1 Electric Motor Drive

Electric motor shall be of sufficient capacity to operate the feeding machines under all operating conditions without exceeding their rated nameplate current or power, or their specified temperature limits. The motors shall have starting characteristics and ruggedness necessary under the actual conditions of operations or clean-up procedures used in the areas where they will be located.

a. Alternating current motors with power rating of 1/3 hp or less are suitable for 115 volts, one-phase, 60-Hz service; motors with power rating in excess of 1/3 hp are suitable for 460 volts, three-phase, 60-Hz service.

2.2.5 Valves

2.2.5.1 Metering Pump Valves

The metering pump shall be equipped with adjustable internal vacuum and pressure relief valve, hydraulic oil refill valve, and automatic air bleed valve. The relief valve shall be adjustable over the full pressure range of the pump and shall be preset at the factory.

2.2.5.2 Suction and Discharge Valves

Suction and discharge valve cartridge shall be fitted with ball checks.

2.2.5.3 Back Pressure Valve

Back pressure regulating valve shall be provided as required. The regulators shall be of polyvinyl chloride construction with fluorocarbon resin or chlorosulphonated polyethylene diaphragms. Diaphragms shall be spring opposed with loading pressures adjustable by means of a screw in the top works.

2.2.6 Solution Tanks

Solution tanks shall be manufactured of translucent polyethylene graduated in 5 gallon increments. Tanks shall be fully resistant to the effects of the solution concentrations listed in paragraph Capacity. Tank fittings shall be pressure rated for 1.5 times the weight of solution at full capacity. Each tank shall have the capacity listed and shall be equipped with a fill nozzle, vent, discharge, level instrument, drain, and two spare connections. Tanks shall be reinforced to withstand all forces when full of solution. Tanks shall be completely shop fabricated with no field assembly permitted. Drain connection shall provide complete drainage of the tank. All gaskets shall be fluorocarbon elastomer; nuts and bolts shall be Type 316 stainless steel; and steel supports shall be either

stainless or epoxy coated. Each tank shall be furnished with a calibrated side wall strip to indicate volume. A permanent plastic sign indicating the tank contents shall be attached to the front of each tank. Tanks smaller than 36 inches in diameter shall be fitted with removable lids.

2.2.6.1 Acid Tank

Acid tanks shall conform to the following:

b. Sulfuric acid solution resistant.
Number of tanks: 1.
Minimum tank capacity: 55 gal.
Sign shall read: "DANGER - SULFURIC ACID SOLUTION."

2.2.6.2 Caustic Tank

Caustic tanks shall conform to the following:

a. Sodium hydroxide (caustic soda) solution resistant.
Number of tanks: 1.
Minimum tank capacity: 55 gal.
Sign shall read: "DANGER - ALKALI (SODIUM HYDROXIDE) SOLUTION."

2.2.6.3 Coagulant Tank

Coagulant tanks shall conform to the following:

a. Polyelectrolyte solution resistant.
Number of tanks: 1.
Minimum tank capacity: 55 gal.
Sign shall read: "CAUTION - POLYELECTROLYTE SOLUTION."

2.2.6.4 Flocculant Agent Tank

Flocculant agent tanks shall conform to the following:

a. Anionic polyacrylamide solution resistant.
Number of tanks: 1.
Minimum tank capacity: 55 gal.
Sign shall read: "Caution-Polyacrylamide Solution."

2.2.6.5 Oxidant Tank

Oxidant tank as specified in Section 15275, "Storage Tanks."

2.2.7 Solution Gauges

Solution gauges shall be diaphragm type with Bourdon tube and diaphragm compartments filled completely with oil, and shall be made of materials suitable for the application.

2.2.8 Injectors

Injectors for chemical solution shall be introduced into the water mains by means of a stainless steel or plastic injection quill inserted into the

main through a corporation cock. The device for introducing the solution into a pressure main shall be constructed in such a way that accidental breakage of discharge hose or tubing will not cause water to escape from the water-service line, and will allow disassembling of the unit without leakage from the main.

2.2.9 Tank mixers

Tank mixers shall be provided for initial mixing and for maintaining suspensions in the flocculant and coagulant basins.

2.3 PIPING

2.3.1 Backflow Preventer

Backflow prevention devices shall be provided integral with the injection quills in accordance with NAPHCC-01.

2.3.2 Plumbing

Water piping, drain, waste and vent piping shall be in accordance with Section 15400,"Plumbing."

2.3.3 Chemical Solution Piping

Chemical solution piping smaller than 1-1/2 inch diameter shall be PVC pipe conforming to ASTM D 1785, CPVC pipe conforming to ASTM F 441, stainless steel or tubing resistant to the chemical solution. Fittings for plastic pipe shall be of plastic with flanged or threaded joints. Joints for tubing shall be made using a clamp-type mechanical coupling.

2.4 ELECTRICAL WORK

Electric motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Electrical equipment and wiring shall be in accordance with Section 16402, "Interior Wiring Systems" and shall conform to NFPA 70. Electrical ratings shall be as indicated.

2.4.1 Motor Starters

Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified.

2.4.2 Control and Protective Devices

Manual or automatic control and protective or signal devices required for the operation and any control wiring required for controls and devices shall be provided. Equipment shall be prewired to the maximum practicable extent. Control cabinets shall conform to UL 50.

2.5 EQUIPMENT APPURTENANCES

Bolts, nuts, anchors, washers and all other types of supports necessary for the installation of the equipment shall be galvanized steel, cadmium plated or Type 316 stainless steel.

2.6 AUXILIARY EQUIPMENT AND SPARE PARTS

2.6.1 Auxiliary Equipment

2.6.1.1 pH Probe and controller.

A pH probe and controller for automatic operation shall be provided. The pH probe and controller shall be capable of sensing pH and controlling the chemical feed rate based on the pH level.

2.6.1.2 Flow Meter

A flow meter for automatic operation shall be provided.

2.7 FACTORY PAINTING

Factory painting shall conform to manufacturer's standard factory finish, provided it does not discolor in the presence of hydrogen sulfide fumes, high water vapor atmosphere, alkaline water vapor, and concentrated oxidizing conditions. Coating shall be not less than 1.75 mils thick.

2.8 FRAMED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Chemical Feeding Equipment

The chemical metering machines and all equipment appurtenances shall provide a complete and integrated system in accordance with the instruction of the manufacturer and under the direct supervision of the manufacturer's representative.

3.1.2 Pump Support

Pump stands and platforms shall be adequate to support the pumping system.

3.1.3 Pipe, Tubing, Hangers and Supports

The installation of pipes and tubes shall be in accordance with Section 15400, "Plumbing."

3.2 PAINTING

Factory painted items requiring touching up in th field shall be thoroughly cleaned of all foreign material and shall be primed and top-coated with the manufacturer's standard factory finish provided it does not discolor in the presence of hydrogen sulfide fumes, high water vapor atmosphere, alkaline water vapor, and concentrated oxidizing conditions. Equipment which did not receive a factory finish shall be painted as specified in Section 09900, "Painting." Coating shall be not less than 1.75 mils thick.

3.3 TESTING

After installation of the chemical metering machine is complete, operating tests shall be carried out to assure that the chemical metering installation operates properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted. Reports of all tests shall be submitted prior to final acceptance of the installation.

3.3.1 Tanks

Tanks shall be cleaned of loose debris and dried prior to testing. Tanks shall be field tested for leaks or damage in shipment. Tanks shall be tested with each solution for a period of 24 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 tanks shall be repaired or tanks shall be replaced. Damaged ceramic tanks shall be replaced.

3.3.2 Metering Pumps

Chemical solution pumps shall be tested to demonstrate that the pumps are capable of operating without vibration or leakage. Testing shall be performed at the maximum design flow rate and at half the design flow rate. Testing shall be demonstrated while controlled and operated in all feasible modes with the pumps operated singly and in unison. The response of each pump shall be plotted on curves for the various operating pressures encountered and the results shall be compared to the curves shown on the manufacturer's published pump data. If control characteristic curves are not available at the time of testing, the pump manufacturer's service engineer shall generate such curves for each pump. Pump curves shall graphically depict the pump displacement at 25, 50, 75, and 100 percent of motor speed for SCR equipped pumps, and at 25, 50, 75, and 100 percent of maximum stroke position for all pumps. Curves shall be generated only for the specified back pressure.

3.3.3 Time, Volume and Pumping Pressure

Pumps shall be tested by filling a portable calibrated standpipe with chemical and measuring the outage, with all other equipment valved off. The time, volume and pumping pressures shall be recorded. The portable standpipe shall be furnished by the Contractor.

3.3.4 Test Pressure

Tests shall be carried out at 5 and 35 psig. Back pressure valves shall be manually controlled for this testing, and shall be reset as necessary after testing. The time to deliver a given quantity of chemical at a given stroke and speed setting shall be the same at all pressures.

3.3.5 Flow

Pumps shall be tested to demonstrate zero gpm flow at a zero stroke or speed setting. Failure to meet this test shall be cause for rejection

3.3.6 Synchronization

The pumps shall be operated for a period of 4 hours to demonstrate that the double diaphragm systems do not lose their synchronization. Loss of synchronization shall also be cause for rejection and the pump shall be repaired or replaced as necessary. Repaired or replaced equipment shall be fully retested.

3.3.7 Chemical Waste

Chemicals wasted during testing procedures shall be neutralized to achieve a pH value between 6.5 and 9.5 and a chlorine concentration of not more than 1 percent (10,000 mg/L). All chemicals wasted during testing procedures shall be routed through the treatment process at a rate that the process can assimilate without upset.

3.4 POSTING FRAMED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Framed instructions shall be posted prior to acceptance testing of the systems.

3.5 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

--End of Section--

SECTION 11309

PROCESS PUMPS

PART 1 GENERAL

1.6 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 A48 1992 Grey Iron Castings

1.7 DESCRIPTION

Provide all pumps and pumping equipment as shown of the type indicated in the "Pump Schedule".

This section includes all pumps except where integral with a manufactured piece of equipment.

Provide the pumps as shown.

1.8 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements", and Section 15405, "Treatment System Piping" apply.

1.9 SUBMITTALS

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

1.9.1 SD-02, Manufacturer's Catalog Data

a. Pumps G
b. Materials G
c. Motors G
d. Finishes G
e. Pump Controllers G

1.9.2 SD-05, Design Data

a. Pump Curves G

Submit dimensional data, materials of construction, installation, operation and utility requirements.

1.9.3 SD-19, Operations and Maintenance Manuals

a. Process Pumps G
b. Pump Contollers G
c. Safety Precautions G
d. Temperature Restriction

e. Manufacturer's Installation Procedure

PART 2 PRODUCTS

2.1 EXTRACTION WELL PUMPS

2.1.1 Pump service and duty as indicated on pump schedule.

a. Type: Completely submersible.

b. Casing: 304 Stainless Steel

c. Impeller: 304 Stainless Steel on 431 Stainless Steel Shaft.

d. Check Valve: NBR, 316 Stainless Steel

e. Intermediate Bearings: 304 Stainless Steel, Zincless Bronze.

f. Electric Motor: 1/3 horsepower, 3450 RPM, 208 volts, single phase, 60 Hz.

g. Accessories: Oil resistant power cord 120 feet long, ABS well seal to accomodate cord.

2.2 TRANSFER, BACKWASH AND RECYCLE PUMPS

2.2.1 Pump Service and duty as indicated on Pump Schedule.

a. Type: Single Stage, horizontal mounted, end suction, close coupled centrifugal.

b. Casing: Cast Iron ASTM A48

c. Impeller: Enclosed, Cast Iron ASTM A48

d. Shaft: Stainless Steel 416

e. Power Frame: Cast Iron ASTM A48

f. Wearing Ring: Bronze

g. Mechanical Steel: "Buna-N" bellows and cup with 316 stainless steel metal parts.

h. Lubrication Fittings: Conveniently located for quick accessibillity and provide positive bearing lubrication.

i. Motors: NEMA rated, drip proof.

j. All exposed metal surfaces, other than stainless steel, shall be shop coated with an epoxy coated paint.

2.3 SUMP PUMP

2.3.1 Pump Service and duty as indicated on Pump Schedule.

a. Type: The pump shall be a vertical extended shaft single stage centrifugal sump type. The suction end of the pump shall have a minimum of 1 1/2" diameter and the discharge end shall have a minimum 1 1/4" diameter. The pump shall be driven by a drip proof 208 volt, three phase, 60 Hertz, 1750 rpm vertical electrical motor enabling the pump to have a minimum efficiency of 55% at operating condition.

The pump shall be provided with a steel baseplate allowing the pump to be bolted to the top of the sump. The bolts shall be easily accessible allowing for convenient removal of the pump if necessary.

2.4 SLUDGE PUMPS

2.4.1 Pump service and duty as indicated on the Pump Schedule.

a. Provide compressed air-operated double diaphragm pumps with wetted parts, resistant to the flow duty. The pump shall consist of a pump body with cover and base tee, diaphragm with compression spring assist on suction fill cycle, inlet and outlet check valves, and extra heavy-duty air discharge muffler/silencer, air pressure regulator, air-lubricating filter, solenoid valve, and plugged gauge cocks. Pump shall be capable of at least 20 strokes per minute without subsequent damage to the pump or associated equipment, and shall be capable of running dry without damage.

b. Pump Bodies: Pump bodies, including covers, base tees, and spools, shall be cast iron, lined with an abrasive-resistant elastomer having a minimum thickness of 1/4-inch on all castings in contact with the pumped material. The entire assemblies shall be capable of sustaining the loads imposed by the operating conditions.

c. Diaphragms and Spring Assemblies: Abrasive-resistant diaphragms shall be provided between the body of the pumps and the covers, and shall serve as a gasket between the bodies and covers. Steel compression spring assemblies, with operating rods clamped to diapraghms, shall be provided. Rods and springs shall be contained in housings attached to pump covers, with housings designed to permit easy access to and adjustment of compression springs.

d. Packing: Pumps shall be designed so that no packing, rotary seal, or water seal is required.

e. Check Valves: Ball type check valves shall be provided, mounted at the suction and discharge sides. The balls shall be lead impregnated rubber, having a specific gravity not less than 2.25, with replaceable ball valve seats.

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor shall position anchors, secure and connect all pump system components in strict accordance with the pump manufacturer's instructions and recommendations. The contractor shall supply all necessary anchor bolts, temporary lifting equipment, labor and all equipment shall be installed by competent and skilled workmen, and shall be carefully aligned, connected and anchored as required.

-- End of Section --

SECTION 11339

PACKAGE FLOCCULATOR/CLARIFIER SYSTEM

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 PUBLIC HEALTH ASSOCIATION (APHA)

APHA SMEWW	Examination of Water and Wastewater

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5	1988 (Errata 1988) Pipe Flanges and Flanged Fittings (ASME/ANSI B16.5)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	1990 Structural Steel

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA MCAWW	Methods for Chemical Analysis of Water and Wastes

MILITARY SPECIFICATIONS (MIL)

MIL-P-24441	(Rev. A) (Supp. 1) Paint, Epoxy-Polyamide

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 10	1989 Near-White Blast Cleaning

1.2 SYSTEM DESCRIPTION

1.2.1 Applications

The package flocculator/clarifier system shall be of the inclined parallel plate type with separate mixing and flocculating chambers, upflow clarifier and sludge hopper, all assembled as an intergral unit to treat contaminated ground water. The system shall be provided with mixing and flocculating basins with mechanical agitators where metal precipitates shall be formed as a result of pH adjustment using sodium hydroxide and coagulant/flocculant chemical application. The metal hydroxides and other suspended solids shall be settled in the clarifier hopper for removal and clarified water shall flow by gravity out of the system. All piping, valves, controls, wiring and control panel necessary shall be provided with the unit as a complete working integrated system ready for installation.

1.2.2 Influent Characteristics

Provide flocculator/clarifier designed for a maximum flow of 50 gallons per minute (gpm). Operating temperatures of the influent will range from 45 to 60 degrees F and ambient air temperatures will range from 50 to 95 degrees F. The total solids loading (suspended solids and precipitates) will range from 100 to 300 milligrams per liter (mg/L). The influent is further characterized as follows:

Ground Water Influent	Minimum		Maximum
Total suspended solids	100	to	300 mg/L
Total volatile organics	0.2	to	2 mg/L
Total iron, Fe	2	to	50 mg/L
pH (before adjustment)	5.5	to	7.5 ppm
pH (after adjustment)	8.0	to	9.0

1.2.3 Performance Requirements

The total suspended solids concentration in the effluent from the flocculator/clarifier shall not exceed the following limitations based on maximum influent characteristics as listed above:

Contaminants	Maximum
Total suspended solids	10 mg/L

At a minimum, the flocculator/clarifier shall provide 90% removal efficiency for total suspended solids or a concentration not exceeding 10 mg/l, whichever is lower.

1.3 SUBMITTALS

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

1.3.1 SD-04, Drawings

a. Package Flocculator/Clarifier System G

Submit shop drawings for package flocculator/clarifer system and accessory equipment including principal dimensions, location of fittings and unit foundation.

1.3.2 SD-05, Design Data

a. Package Flocculator/Clarifier System G

Submit analysis, including detention time, surface loading rate, and other data necessary for design. Calculations shall take into account the rate of flow, influent concentrations, particle characteristics, fluid temperature, and pH.

1.3.3 SD-06, Instruction

a. Flocculator/clarifier G

1.3.4 SD-12, Field Test Reports

a. Inspection G

b. Preoperational test G

c. In-service test G

1.3.5 SD-13, Certificates

a. Flocculator/clarifier corrosion protection G

Submit written verification on the fabricator's letterhead that surface preparation and coating application were performed in accordance with the manufacturer's printed recommendations for the coating system.

1.3.6 SD-19, Operation and Maintenance Manuals

a. Package flocculator/clarifier, Data Package 3 G

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data".

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, such as subfreezing temperatures, precipitation, and high winds. Store materials susceptible to deterioration by direct sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on ground. If special precautions are required, prominently and legibly stencil instructions for such precautions on outside of equipment or its crating.

1.4.2 Handling

Handle equipment in such a manner as to ensure delivery to final location in sound, undamaged condition. Take special care not to damage interior and exterior surfaces, plates and associated supports and pipe coatings or linings. Make satisfactory repairs to damaged materials at no cost to Government. Carry and do not drag materials.

PART 2 PRODUCTS

2.1 DESIGN STANDARDS

The flocculator/clarifier equipment manufacturer shall not have less than five (5) years experience in the design, construction and operation of equipment of the type specified, and have had equipment of similar size and construction in successful operation for at least five (5) years and at five plants under similar service.

The package flocculator/clarifier system shall be designed and constructed to meet the following standards:

Design flow	50 gpm
Maximum surface loading rate	0.65 gpm/sq. ft.
Inclined plate angle (from horizontal)	55 to 60 degrees
Maximum height of unit	11 feet *
Mixing Basin Detention Time	Min. 30 seconds
Flocculating Basin Detention Time	Min. 3 minutes

* Note: the maximum height of unit shall be such that the plates can be removed for service within the building height of 15 feet.

2.2 MATERIALS

Use 3/16-inch minimum thick carbon steel conforming to ASTM A 36/A 36M or material having equivalent structural properties and corrosion resistance for tank, hoppers, stationary and adjustable weirs, nozzles, flow distributor and energy dissipator device, bolts, seals, stiffeners, washers and nuts. Clean and finish carbon steel surfaces as described in paragraph entitled "Flocculator/Clarifier Corrosion Protection". Provide all electrical equipment according to NEMA standards.

2.2.1 Flocculator/Clarifier Corrosion Protection

2.2.1.1 Steel

Provide a two-coat coal tar epoxy coating system to the interior surfaces of the flocculator/clarifier. Provide a MIL-P-24441 coating system to the exterior surfaces of the Flocculator/Clarifier. Prior to shop painting, abrasive blast clean the surfaces in accordance with SSPC SP 10 to a surface profile of 1 to 2 1/2 mils.

2.2.1.2 Internal Surfaces

Plate and other material shall be corrosion and chemically resistant to the water mixture as specified in paragraph entitled, "SYSTEM DESCRIPTION ".

2.2.1.3 Hardware

Bolts, stiffeners, washers, nuts, screws, pins, and fittings as required shall be corrosion resistant. Provide materials that are inherently corrosion resistant and not merely treated with a corrosion-resistant coating, such as provided by the galvanizing process.

2.2.2 Accessibility and Support

Provide a ladder meeting OSHA standards bolted to the unit. Parts subject to wear or requiring adjustment, inspection, cleaning or repair shall be accessible and capable of convenient removal when required. The flocculator/clarifier shall be supported on structural steel legs to support the design loading and in accordance with the Uniform Building Code for Seismic Zone 2, and to provide a minimum of 12 inches of clearance below the sludge discharge nozzle.

2.2.3 Flanges

Use only flat face flanges and drill 150-pound ANSI Standard bolt circle and remove burrs. Use flanged piping connections that conform to ASME B16.5, welding neck type.

2.2.4 Weirs or Orifices

Provide stationary weirs or orifices for overflow from the parallel plates and adjustable supports to tank side walls to meet flow requirements. Use carbon steel or other approved material. Use nondeteriorating sealant or gaskets for mounting.

2.2.5 Parallel Plates

Plates shall be individually removable while the unit is in operation. Plate spacing shall be nominally 2 inches.

2.2.6 Sludge Hopper

Provide a sludge hopper below the clarifier as an integral unit shaped as an inverted pyramid or cone sloping to a common 3-inch outlet.

2.2.7 Mixers

Provide a fixed speed mixer in the mixing basin and a variable speed mixer in the flocculating basin. Mixers shall be stainless steel with 115 VAC, 0.25 horsepower, totally enclosed motors sized and designed for the influent characteristics.

2.2.8 Low Point Drains

Provide means at low points for dewatering unit.

2.2.9 Identification Plates

Provide anodized aluminum identification and instruction plates and stamp necessary data. Securely affix plates, in prominent location, to tank with nonferrous screws or bolts of not less than 1/8-inch in diameter.

2.2.10 Instruction Plates

Instruction plates shall describe special or required procedures to operate and service equipment, and shall include warnings of hazardous procedures and notice of safety and health requirements. Plates shall be durable and

legible throughout equipment life.

2.3 FABRICATION

Provide shop fabricated, skid mounted package flocculator/clarifier system which is comprised of separate mixing and flocculating chambers, upflow clarifier with parallel plates and a sludge hopper, all as an integral unit.

PART 3 EXECUTION

3.1 INSPECTION

Inspect each component of the flocculator/clarifier for compliance with requirements specified. This element of inspection shall encompass visual examinations and dimensional measurements. Noncompliance with specified requirements, or presence of one or more defects preventing or lessening maximum efficiency of separator operation, shall constitute cause for rejection.

3.2 INSTALLATION

Lift tank as required without parallel plates in place onto level foundation. Level unit and bolt to floor to ensure unit stability. Insert plates into tank and place on supports. Avoid abrupt contact between the plate packs and the tank walls and pack supports to avoid damage. Flocculator/clarifier system installation shall be conducted in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

3.3.1 Preoperational Test

The manufacturer's service representative shall inspect, operate, and test unit before in-service testing by the Contractor.

3.3.1.1 Tests

Tests shall include but not be limited to the following:

a. Soundness (without cracked or otherwise damaged parts).

b. Completeness in all details, as specified.

c. Correctness of setting, alignment, and relative arrangement of each component.

d. Verification of proper operation for all system components.

3.3.1.2 Preoperational Investigation and Test Report

Submit manufacturer's service representative's preoperational test report. Document inspections, operations, adjustments, and tests performed and indicate whether they were acceptable or not. For unacceptable items, describe correctiv action taken or recommended. Include detailed

descriptions of points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. Include the manufacturer's certificate that equipment conforms to specified requirements and is ready for permanent operation and that nothing in installation will render manufacturer's warranty null and void.

3.3.2 In-Service Tests

After preoperational test has been successfully completed and unit has been properly connected to influent and effluent piping, allow influent water previously described in paragraph entitled, "SYSTEM DESCRIPTION" to flow into flocculator/clarifier filled with water. Obtain a sample and perform a jar test of the water to predict optomized treatment chemical feed rates and other operating criteria. Submit report to the Contracting Officer for approval. Adjust and level overflow weirs. Optimize operation of unit within 5 working days using the results of the jar test to adjust feed rates . Operate unit for a minimum of 6 hours prior to testing for removal of contaminants and document testing results.

3.3.2.1 Analytical Methods

Test and sample preservation methods for test contaminants shall be in accordance with the latest revisions of APHA SMEWW, APHA Standard Methods for the Examination of Water and Wastewater, EPA MCAWW, EPA Methods for Chemical Analysis of Water and Wastes, or those substitute methods approved by the governing regulatory agencies having jurisdiction.

3.3.2.2 Test for Contaminants

Verify the flocculator/clarifier efficiency by testing influent and effluent for contaminants described in paragraph entitled "Performance Requirements". Tests shall be performed by an independent certified testing laboratory.

3.3.2.3 Sampling Procedures

Within an 8 hour period and at regular intervals collect a minimum of 4 influent and effluent samples from sampling ports provided as part of the flocculator/clarifier. Purge each sampling port to remove built-up solids or other material prior to collecting sample. Collect wastewater samples isokinetically in clean glass containers with polytetrafluoroethylene lined caps. Collect duplicate wastewater samples in separate glass containers. Do not attempt to split sample. Use containers for other contaminants as recommended in references listed in paragraph entitled "Analytical Methods".

3.3.2.4 Acceptance Criteria

75 percent of the effluent samples taken shall not exceed the specified daily maximum limit for total suspended solids. If the flocculator/clarifier does not meet requirements of this specification, due to poor workmanship and wrong fabrication dimensions, the unit may be rejected. If the unit is not operating at design efficiency 5 days after

installation, Government may reject system. In th vent Government rejects unit, Contractor shall remove flocculator/clarifier or defective components and replace with acceptable unit or components and test as specified above.

-- End of Section --

SECTION 11366

PRESSURE FILTERS

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 test by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B31.1 1992 Power Piping

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements", and Section 15405, "Treatment System Piping", apply.

1.3 GENERAL REQUIREMENTS

Design, fabrication, and installation of pressure filters shall conform to ANSI B31.1 and the ASME Boiler and Pressure Vessel Code, except as specified otherwise. In ANSI B31.1 and the ASME Boiler and Pressure Vessel Code, the advisory provisions shall be considered mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" and "owner" shall be interpreted to mean the contracting officer. Section 15011, "Mechanical General Requirements", applies to this section except as specified otherwise.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Tank Valving and Piping G
b. Controls G
c. Filter Media G
d. Underdrain System G
e. Pressure Tank G

1.4.2 SD-19, Operation and Maintenance Manuals

a. Pressure Filter System G

1.5 SYSTEM DESCRIPTION

Provide two (2) vertical pressure type filters as shown to facilitate the removal of iron and other suspended particles from the water to be treated.

Each filter shall have a diameter of 42 inches. The filtering system will be complete with a multi-port type valve system to facilitate semi-automatic operation between normal flow and backwashing by turning one valve manually and be equipped with all other components necessary for proper operation of the filtering equipment.

PART 2 PRODUCTS

2.1 PRESSURE TANK

The filter tank will be designed for 100 psig ASME Code requirement and will be carbon steel of welded construction with dished heads. Each tank will have an 11" x 15" manhole in the top head, a cleanout connection in the side shell, and structural steel legs. Each tank will bear the ASME stampand be factory coated with primer and epoxy in accordance with Section 09900, "Painting."

2.2 UNDERDRAIN SYSTEM

The underdrain system shall utilize gravel or screens to support the media above and collect/disperse flow during backwash. Corrosion resistant galvanized steel strainers will be fastened to retain the filter media.

2.3 FILTER MEDIA

Above the underdrain, provide a 6-inch thick layer of coarse sand with an effective grain size of 0.8 to 1.0 mm. Above the coarse sand, provide a 16-inch layer of silica sand with an effective grain size of 0.4 to 0.5 mm. Provide a top layer consisting of 16-inches of anthracite media with an effective grain size of 0.8 to 1.0 mm.

2.4 MAIN OPERATING VALVE AND PIPING

All internal and external valves and piping, and set cocks shall be furnished fully assembled. All external piping shall be galvanized steel. The main operating valve shall allow for semi-automatic operation enabling the system operator to select normal or backwash flow by manually turning one valve. Piping shall be arranged to facilitate normal flow filtering by routing inlet water into the top of the tank and collecting filtered effluent through the underdrain and out the bottom of the tank. Backwash water shall enter the bottom of the tank and be collected above the media layer for discharge.

2.5 PRESSURE GAUGES

Pressure gauges shall be furnished and installed on the filter influent and effluent pipes. Gauges shall have a 2 1/2" dial and a pressure range from 0-100 psi.

2.6 QUALITY ASSURANCE

2.6.1 Warranty

The pressure filter system shall be warranted against defects in materials or workmanship under normal use and service for a period of one year after

date of original operation but not more than 18 months from date of shipment from the company's factory when installed and used in accordance with good standard practice.

PART 3 EXECUTION

3.1 INSTALLATION

Install materials and equipment as indicated and in accordance with manufacturer's recommendations. The contractor shall supply all necessary anchor bolts, temporary lifting equipment, labor and all other items needed for satisfactory installation.

-- End of Section --

SECTION 11367

FILTER PRESS SYSTEM

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 within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M 1991 Structural Steel

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements," and Section 15405, "Treatment System Piping", apply.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data

a. Filter Press System G

1.3.2 SD-05, Design Data

a. Filter Press System G

Submit dimensional data, materials of construction, installation, operation and utility requirements.

1.3.3 SD-18, Records

a. Posted operating instructions for filterpress equipment G

Submit text of posted operating instructions.

1.3.4 SD-19, Operations and Maintenance Manuals

a. Filter Press, Data Package 3 G

1.4 DELIVERY, STORAGE, AND HANDLING

Equipment and parts shall be packaged for shipment to prevent breakage and damage to components. Deliver materials to the site, inspect for damage, unload and store with a minimum of handling. Store materials off the ground and under a weathertight covering.

1.5 POSTED OPERATING INSTRUCTIONS

Provide in accordance with Section 15011, "Mechanical General Requirements."

1.6 SPARE PARTS

Furnish spare parts, identical and interchangeable with the original parts, in clearly marked containers in accordance with the following schedule. Where percentage of spare part units results in a fractional number, the number furnished shall be the next highest unit.

a. One set of filter cloths and gaskets.
b. One back-up plate.

1.7 TOOLS

Furnish special tools necessary for proper maintenance and operation of the equipment.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

ASTM A 36/A 36M.

2.2 FILTER PRESS SYSTEM

A 4 cubic foot plate and frame filter press shall be provided to efficiently dewater hydroxide sludges from the ground water treatment system to a dry cake. The system shall include all components necessary for a complete operating unit including a control panel, an automatic sludge pump control system, automatic plate shifter opening and closing system, automatic blow down assembly, and cake discharge hopper elevated to facilitate direct disposal to drums.

2.2.1 Design

a. Performance Criteria: The filter press shall be able to dewater a ferric hydroxide sludge to produce a filter cake with a minimum 30 percent solids by weight.

b. Liquid Characteristics: The sludge from the clarifer blowdown will contain 0.5 to 2 percent solids. The temperature of the sludge will range from 45 to 65° and the pH will be 8 to 9.

c. The general design parameters for the filter press are:

- The filter press shall have a volume of 4 cubic feet and minimum filtration area of 80 square feet.
- The filter press will be supplied with 100-psig air from elsewhere in the facility.
- An automatic plate shifter opening and closing system shall be provided.

- The filter press shall be configured with a core blowdown system to remove remaining filtrate from the press after the dewatering cycle is complete.
- An automatic sludge pump control system shall be furnished to control the flow rate and pressure from the sludge pump.
- The filter plates shall be configured so they can be pressurized and the filter cake blown off the fabric without manual scrapping.

d. Plates: Plates shall be center-feed, four-corner discharge, lightweight, polyproplylene recessed chamber plates, and shall be EPDM gasketed to ensure leak-free operation and complete with polypropylene filter cloths.

e. Hydraulic Pump: A pneumatically actuated hydraulic pump shall clamp the press by pressurizing the hydraulic system after the plate stack is closed. The hydraulic pump shall automatically compensate for varying temperatures and pressures. The hydraulic pump and pneumatic components shall be fully enclosed in a fabricated steel cabinet for protection from damage, and shall be easily accessible for maintenance. All components shall be modular for ease of maintenance.

f. Frame: The filter press frame shall be constructed of carbon steel with full-width 304 stainless steel caps on the side bars. After installation in the press, the hydraulic clamping system shall be factory tested at full pressure for at least 24 hours. The feed and discharge piping installed on the press shall be factory tested for leakage at 100 psi.

g. Control Panel: The control panel shall consist of a close/open selector; an air supply switch, a hydraulic pump switch; gauges for line air pressure, pump air pressure, and hydraulic pressure. The control panel also shall house the complete automatic sludge pump control system. Included with the control panel shall be an additional pressure gauge, showing air pressure going to the sludge pump as wellas a resettable running time meter which will track the press cycle time (time during which air diaphragm pump is energized). A "Cycle Over" light shall be mounted on the control panel.

h. Blowdown Manifold: The blowdown manifold shall be factory piped, and shall consist of the necessary piping and valves to joint the four filtrate discharge ports into a common discharge pipe. Closing the valves and introducing the air into the upper filtrate port shall force air through the filter cake in each chamber of the press and out the inlet pipe. A 0- to 60-psi air regulator and air pressure gauge to control and monitor air blowdown shall be supplied.

i. Sludge Pump Control System: The sludge pump control system shall b designed to sequence the startup and pressure ramping of the feed pump in discreet adjustable 5 minute and 25 psi increments until the ultimate (100 psig) pressure is attained. The control system shall maintain the ultimate pressure for a preselected time before shutting down the feed pump and providing a signal that the press is ready to open by lighting a "Cycle Over" light. Also included shall be a low hydraulic pressure safety shutdown circuit which shall shut down the sludge pump in the event of low hydraulic closing pressure.

j. Plate Shifter: Provide one fully mechanized plate shifter to move each filter plate individually across the full opening space of the plate stack with the hydraulic cylinder on the filter press fully retracted. The shifter shall move one plate at a time to provide access on both sides of the plate for media inspeciton and filter cake removal. The unit shall be pneumatically powered and shall have two carriages to move both handles of the filter plate stack by pressing against both the unshifted and shifted plate stacks. It shall operate in a reciprocating motion as directed by the operator, picking up an individual plate, moving it across the open area, and depositing the discharged plate at the follower end of the filter. Provide a lanyard control to stop the plate shifter or hydraulic open/close at any intermediate point if desired for safety, inspection or maintenance. Resetting of the plate shifter or hydraulic open/close after inspection shall be initiated by resetting the interlock poppet on the press air supply valve. Provide adjustable operating speed with a control valve in the pneumatic system. Plate shifters which do not either hold back the filter plates or align the plate stack at each end of the stroke shall not be provided. The unit shall be pneumatically powered.

k. Blank Plate: A blank plate shall be provided which can be inserted at any point in the stack with the tail plate to run a partial filter press load. The blank plate isolates all filter plates between it and the follower.

l. Filter Cloth: The cloths shall be polypropylene monofilament cloths of the double sided type with interconnecting "barrel neck" sewn integrally and manufactured from the same material. The cloth shall be retained on the plate with plastic lips fitted in heat seal holes on the side of the cloth. The cloth supplied shall be a polypropylene felt cloth calendared on the cake side. The cloth shall have a nominal porosity of 40 to 50 scfm at 1/4-inch water pressure. The cloth shall have a minimum weight of 12 ounces per square yard.

m. Cake Discharge: The filter press shall be equipped with a hopper to funnel all cake into a 55-gallon drum for storage. The filter press shall be elevated as shown on the Contract Drawings to facilitate drum disposal of the cake below the press and to route filtrate to the recycle tank.

2.3 PIPING

Inlet, Effluent, and Drain Piping.

2.3.1 Pipe and Fittings

Pipe and fittings except as otherwise specified shall be Schedule 40 PVC of sizes as indicated.

2.4 FINISH

Prepare the metallic surfaces to SSPC-10 near white metal blast cleaned surface. Provide a primer and top epoxy coat in accordance with Section 09900, "Painting."

PART 3 EXECUTION

3.1 MATERIALS PROTECTION

3.2 INSTALLATION

3.2.1 Filter Press System

Install the filter press system in accordance with the recommendations of the manufacturer of the equipment, as approved. Take special care to correctly align equipment components.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests and Inspection, General

The Contractor shall perform field tests and provide labor, equipment, and incidentals required for the tests. The Contractor shall give the Contracting Officer two weeks notice of the dates and times scheduled for tests.

3.3.2 Tests

The completed filter press shall be tested to demonstrate that the sytem meets the specified requirements. The test shall be documented in a written report that includes:

a. Personnel
b. Date of tests
c. Pressures used for the sludge pump
d. Sludge flows
e. Run time for the cycles
f. Filter cake percent solids
g. Feed solids analysis

-- End of Section --

SECTION 11368
ULTRAVIOLET LIGHT OXIDATION TREATMENT SYSTEM

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 A 36/A 36M	1990 Structural Steel
ASTM A 316	1990 Stainless Steel

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements", and Section 15405, "Treatment System Piping."

1.3 DESIGN AND PERFORMANCE REQUIREMENTS

A package ultraviolet (UV) light oxidation treatment system utilizing hydrogen peroxide as the oxidant shall be designed and provided to reduce organic compound concentrations in the 50 gallons per minute waste stream as detailed in Section 01680, "Treatment System and Facility Operation." The system shall include all materials, equipment, hydrogen peroxide feed system for the UV Oxidation System and controls necessary to achieve the required treatment. The system supplier shall perform bench scale testing of a composite sample from seven monitoring wells as identified by the Contracting Officer to perform final design before fabricating equipment to determine equipment size, oxidant feed rate and other parameters necessary.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. UV Oxidation Treatment System G

1.4.2 SD-04, Drawings

a. UV Oxidation Treatment System G

1.4.3 SD-05, Design Data

a. UV Oxidation Treatment System G

1.4.4 SD-12, Fi ld Test Reports

a. VOC Removal Treatment t sts G

1.4.5 SD-19, Operation and Maintenance Manuals

a. UV Oxidation Treatment System G

1.5 SPARE PARTS

Provide a replacement UV lamp with the system.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General

All materials and parts shall be designed to be chemical resistant to the process and waste stream. The enclosure shall be constructed of ASTM A 36/A 36M structural steel with an epoxy top coat. Electrical and control enclosures shall be UL listed, NEMA 4X.

PART 3 EXECUTION

3.1 PACKAGE SYSTEM

The UV Oxidation Treatment System shall be provided, delivered and installed to provide the required treatment as a package system including all materials, equipment, piping, controls, wiring, oxidant feed system and other articles necessary for a complete working system.

At a minimum the system shall provide an oxidation chamber where VOC's are converted to inert by-products using hydrogen peroxide and ultraviolet light, an automatic tube cleaning device, an oxidant feed system, wiring and controls conforming to the National Electrical Code and that shall be integrated into the master programmable logic controller to provide system power, control and emergency interlocks and alarms to provide shut down because of:

Accidental Entry
High temperature or pressure
Low presure
Others as shown

The UV Oxidation System shall be equipped to de-energize UV lamps incrementally if not all energy is required.

3.2 MANUFACTURER'S FIELD SERVICES

3.2.1 Installation and Start-up Supervision

Furnish the services of the system manufacturer's technical representative to directly supervise installation and testing in accordance with

recommendations. During system start-up, the technical representative shall test equipment and controls and make adjustments as necessary to optomize the treatment process.

3.3 GUARANTEE

The UV Oxidation Treatment System shall be guaranteed to provide the required treatment removals as detailed in this specification as measured by a sample test conducted after system start-up.

-- End of Section --

SECTION 11369

GRANULAR ACTIVITED CARBON TREATMENT SYSTEM

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 within the text by the basic designation only.

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements" and Section 15405, "Treatment System Piping", apply.

1.3 GENERAL REQUIREMENTS

Provide one (1) skid mounted granular activated carbon (GAC) adsorber unit at the location and as shown. Unit must have the capacity for a flow rate of 50 GPM, diameter of five feet, pressure rated for 15 psi and contain a minimum of 2000 lbs of dry granular activated carbon.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Tank G
b. Carbon G
c. Pipe Connection and Fittings G
d. Pressure Gauge G
e. Air Release Valve G

1.4.2 SD-04, Drawings

a. Carbon Adsorber G
b. Appurtenant Equipment G

Submit shop drawings for carbon adsorber and all appurtenant equipment.

1.4.3 SD-18, Records

a. Manufacturer's Installation Procedure G

1.4.4 SD-19, Operation and Maintenance Manuals

a. Carbon Adsorber G

PART 2 PRODUCTS

2.1 CARBON ADSORBER UNITS

a. Type: Tank to be 304 stainless steel capable of holding 2000 pounds of dry granular carbon. Unit must be capable of operating at a flow rate of 50 gpm.

b. Each Carbon Adsorber must be DOT rated and mounted on a carbon steel skid for easy 4 way handling by a fork lift.

c. Connections: 2 1/2" FPT inlet, 2 1/2" FPT outlet with quick disconnect end connections.

d. Operating pressure: Up to 15 psi.

e. Drain Valve: 1" FPT

f. Optional Equipment: Air bleed valve and pressure gauge installed on inlet.

2.2 GRANULAR ACTIVATED CARBON

Provide nonpolar granular activated carbon with an activity level between 700 and 1000 meters squared per gram and an apparent density between 25 and 30 pounds per cubic foot.

PART 3 EXECUTION

3.1 INSTALLATION

Provide materials and equipment as indicated on the contract drawings and in accordance with manufacturer's recommendations. The contractor shall supply all necessary lifting equipment, labor and all other items needed for satisfactory installation.

-- End of Section --

SECTION 13121

PREENGINEERED METAL BUILDINGS

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	1986 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

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	1988 Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	1991 Structural Steel
ASTM A 572/A 572M	1991 High-Strength Low- Alloy Columbium-Vanadium Steels of Structural Quality
ASTM A 588/A 588M	1991 (Rev. A) High-Strength Low- Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM B 117	1990 Salt Spray (Fog) Testing
ASTM C 236	1989 Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM C 920	1987 Elastomeric Joint Sealants
ASTM D 522	1988 Mandrel Bend Test of Attached Organic Coatings
ASTM D 828	1987 Tensile Breaking Strength of Paper and Paperboard

ASTM D 2244	1989 Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	1987 Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	1990 Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	1990 Measuring Adhesion by Tape Test
ASTM D 4214	1989 Evaluating Degree of Chalking of Exterior Paint Films
ASTM E 84	1989 (Rev. A) Surface Burning Characteristics of Building Materials
ASTM E 96	1990 Water Vapor Transmission of Materials
ASTM G 23	1989 Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	1992 Structural Welding Code Steel

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA LRMBSM	1986 Low Rise Metal Building Systems Manual

STEEL DECK INSTITUTE (SDEI)

SDEI DDM	1990 Steel Deck Institute Diaphragm Design Manual

UNDERWRITERS LABORATORIES INC. (UL)

UL 580	1988 (R 1989) Uplift Resistance of Roof Assemblies

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 and sidewall

sheets. The clear height between finished floor and bottom of roof steel shall be as indicated.

1.2.2 Framing

Provide building with vertical walls and gable roof. Building shall be single-span structures with the following framing system: column with rigid frame, similar to AISC S335, Type I construction. End walls shall be of rigid frame. Roof slope shall be a minimum of 1/2 inch per foot to a maximum of 4 inches per foot. Design framed openings structurally.

1.2.3 Foundation Requirements

Design foundations for allowable soil bearing pressure and a minimum bottom of footing depth as indicated. Use a factor of safety of 1.5 for overturning, sliding and uplift, and a concrete compressive strength as specified in Section 03300, "Cast-in-Place Concrete". The foundation loads are supplied by the building manufacturer.

1.3 EXPERIENCE

1.3.1 Manufacturer

Provide the metal building that is the product of a recognized metal building systems manufacturer who has been in the practice of manufacturing metal buildings for a period of no less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and fabricating metal building systems. 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.

1.4 DESIGN REQUIREMENTS

MBMA LRMBSM, for loading combinations and definitions with the exceptions of wind load and special collateral loads. Design for each material shall be as specified by the Design Authority as listed in MBMA LRMBSM.

1.4.1 Roof Dead, Live, and Snow Loads

Roof dead load	By Building Manufacturer
Roof live load	20 pounds per square foot
Roof snow load	25 pounds per square foot
Floor load	750 pounds per square foot

1.4.2 Wind Loads

Wind pressures shall be computed and applied in accordance with ASCE 7. Basic wind speed and importance factors are as indicated.

Wind design velocity	114 miles per hour

1.4.3 Collateral Loads

Collateral Loads	5 pounds per square foot

1.4.4 Deflection

1.4.4.1 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.

1.4.4.2 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 in Seismic Zones 2 through 4.

1.4.4.3 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.

1.4.4.4 Openings

Limit deflections of steel framing above and along the side of rolling door openings to a maximum of 1/2 the allowable movement in the telescoping top roller of the doors to ensure proper operation. Frame all equipment openings over 12 inches by 12 inches.

1.5 SUBMITTALS

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

1.5.1 SD-02, Manufacturer's Catalog Data

a. Preengineered metal building materials G

Submit sufficient data indicating conformance to specified requirements on materials provided under this section.

1.5.2 SD-03, Manufacturer's Standard Color Charts

a. Factory color finish G

Submit one sample of each color indicated for verification that the color matches the colors indicated. Where colors are not indicated, submit not

less than four different samples of manufacturer's standard colors for selection by the Contracting Officer.

1.5.3 SD-04, Drawings

a. Preengineered building G

b. Template for anchor bolts G

Submit as necessary to erect the building and install components.

1.5.3.1 Preengineered Building

Submit complete design drawings for the preengineered building. Submit drawings for the foundations and anchorage.

1.5.4 SD-05, Design Data

a. Building G

b. Foundation loads G

c. Anchor bolts G

1.5.4.1 Building

Submit design calculations for the entire preengineered building and foundations, prepared and stamped by a professional engineer. Also submit for components requested, and stamp with the seal of a professional engineer. Include sizes and location of anchor bolts.

1.5.5 SD-11, Factory Tests

a. Factory Color Finish

b. Insulation

1.5.6 SD-13, Certificates

a. Preengineered metal building materials G

Submit certificates attesting that materials comply with this specification.

1.5.7 SD-19, Operation and Maintenance Manuals

a. Preengineered Building, data package 1 G

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handl 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 20 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 LRMBSM 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:

Items	Minimum Thickness (Uncoated)
Steel Structural Members Other Than Roof and Wall Panels	18 Manufacturer's Standard (MFG STD) gage, .0478 inch
Roof and Wall Panels	
Steel	24 MFG STD gage, .0239 inch
Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings, and Liner Panels	
Steel	26 MFG STD gage, .0179 inch
Eave Gutters and Downspouts	
Steel	26 MFG STD gage, .0179 inch
Roof Ventilators	
Steel	26 MFG STD gage, .0179 inch
Louvers	
Steel	18 MFG STD gage, .0478 inch

2.1.2 Panels

a. Fabricated of zinc-coated steel.

b. Preformed.

d. If designed as diaphragm, roof decks shall be designed in accordance with SDEI DDM.

Depth of the panels shall be as indicated. Panels over 30 fe t in length shall be designed for thermal expansion and contraction.

2.1.2.1 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 Miscellaneous Metal Work
See Section 05500, "Metal Fabrications".

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.

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 retrain water.

2.3.3 Sealant

Provide elastomeric type sealant conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, use NT, color white containing no oil or asphalt. Exposed sealant shall cure to a rubberlike consistency. Concealed sealant may be the nonhardening type.

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, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. 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.

2.4 GUTTERS

Provide 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 40 feet for steel. Provide water tight seal at all other joints. Provide gutters below the slope line of the roof, to allow snow and ice to slide clear. 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 not less than the size of gutter indicated 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. Provide gutter outlets with stainless

steel wire ball strainers of a standard type. 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.

2.6 LOUVERS

Provide louvers and frames of the sizes, design, and color indicated. Provide the same finish specified in paragraph entitled "Finish". Fold or bead blades at the edges, set at an angle to exclude driving rains, and secure to the frames by riveting or welding as standard with manufacturer. Provide mullions for louvers over 4 feet in width; provide not less than one mullion for each 4-foot width. Provide flanges on the interior face of frames where air intakes or exhaust louvers are indicated to be connected with mechanically operated dampers or metal ductwork. Provide woven wire bird screening, not less than 3- by 3-mesh per square inch in rewirable frames, on the exterior of louvers; install screen frames by means of clips to allow easy removal for cleaning and rewiring. The screens and frames shall be of the same type metal as the louvers; screen wire shall be not less than 0.0475 inch in diameter.

2.7 FIELD INSTALLED INSULATION

Blanket type 0.6-pound fiber-glass as standard with the metal building manufacturer having a factory-applied facing on one side and a permeance rating of 0.05 or less when tested in accordance with ASTM E 96.

a. Facing on insulation shall be vinyl-scrim foil, except that behind liner panels facing may be 0.002-inch thick aluminum foil. Vinyl-scrim foil shall have a tensile strength of not less than 40 pounds machine direction and 30 pounds cross machine direction when tested in accordance with ASTM D 828.

b. The insulation, including facings, shall have a flame spread rating of 75 or less and a smoke development factor of 100 or less when tested in accordance with ASTM E 84.

c. Wall insulation shall have guarded hot box values for "R" of 19 or more as measured in accordance with ASTM C 236 test method. Roof insulation shall have guarded hot box values for "R" of 30 or more as measured in accordance with ASTM C 236.

d. Provide insulation containing 20 percent or greater recovered material which has been diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, provide the one containing the higher recovered material content.

2.8 DOORS

Doors are specified in Section 08110 and Section 08360. Provide framing members and flashings as necessary for installation of the doors.

2.9 FINISH

2.9.1 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.

2.9.2 Factory Color Finish

Provide exterior and interior exposed surfaces of metal roof and wall panels, roof ventilators, louvers, 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 of 1.0 mil for exterior coating exclusive of primer. Provide exterior primer thickness 0.8 mil. Interior color finish shall consist of a backer coat with dry film thickness of 0.5 mil. 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 1/16 inch.

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 #8 rating by ASTM D 4214.

c. Flexibility: ASTM D 522, Method A, 1/8 inch diameter, 180 degree bend, no evidence of fracturing to the naked eye.

d. Adhesion: ASTM D 3359, Method B, 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 D 2247, 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 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. Provide an approved nonabsorptive gasket.

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 in the longest obtainable lengths. 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 base, at the top, around windows, door frames, framed louvers, and other similar openings. 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. Install liner panels to 2 feet above finished floor.

3.2.4 Roof Construction

Apply the roofing panels in full lengths from ridge or ridge panel to eaves with no transverse joints except at the junction of ventilators,

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 1 1/2 corrugations for standard corrugated sheets.

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.

3.2.6 Installation of Insulation

3.2.6.1 Roof Insulation

Install over purlins before roof coverings are applied. Hold insulation rigid until secured in place. Insulation facing shall be exposed on the interior side of the building. Fold and staple facing tabs of insulation on 6-inch centers to completely seal joints. If folding and stapling is accomplished from the inside, push the tabs neatly up between the edges of adjoining blankets.

3.2.6.2 Wall Insulation

Install over girts before wall coverings are applied. Hold insulation rigid until secured in place. Expose facing toward the interior side of the building. Fold and staple facing tabs of insulation on 6-inch cent rs to completely seal joints. If folding and stapling is accomplished from the inside, push the tabs neatly up between the edges of adjoining blankets. Cover side laps of insulation with metal strips formed for this purpose and paint to match the facing material. Install the strips spanning from girt to girt and in accordance with the metal building manufacturer's recommendations.

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. See Section 09900, "Painting", for painting of shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows.

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 --

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"; Division 11, "Equipment"; 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 two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

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.

1.3.4 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.

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 accordance with requirements of DIVISION 16 "Electrical."

1.6 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under Section 16402, "Interior Wiring Systems.". 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 contactors 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. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 16402, "Interior Wiring System."

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.

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 blist ring, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark. The film 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 F, 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, pretreat, prime and paint metal surfaces; except aluminum surfac s 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 120 degrees Fahrenheit (F) shall b 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.

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

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

-- End of Section --

SECTION 15275

STORAGE TANKS

PART 1 GENERAL

1.1 REFERENCE

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 MATERISLS (ASTM)

ASTM A36	1991 Specification for Structural Steel.

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC-SP 10	1989 Near White Blast Cleaning

1.2 GENERAL REQUIREMENTS

Provide all treatment system storage tanks and appurtenant equipment as listed on the "Tank Schedule" contained within the contract drawings at the locations shown.

1.3 SUBMITTALS

1.3.1 SD-02, Manufacturer's Catalog Data G

a. Shop drawings for all steel and aluminum tanks.

b. Materials of construction, thickness, dimensions

c. Tank Mixer

1.3.2 SD-06, Instructions G

a. Manufacturer's Installation Instructions

PART 2 PRODUCTS

2.1 STEEL TANKS

Tanks shall be fabricated from ASTM A36 carbon steel to the dimensions and sizes as shown. Tank walls and ceiling shall be minimum 1/4 - inch thick. Tank ceiling shall be reinforced as necessary to support equipment and maintenance loading.

Two lifting eyes shall be welded to the tank to facilitate placement in the building.

Tank fabricator shall also provide the necessary manways, pipe inlets and tank stands, as shown.

Tank interior to be sand blasted to SSPC-SP 10 standards and then lined with a two coat coal-tar epoxy.

Tank exterior of the tank shall be shop coated with red primer paint and two coat high gloss epoxy enamel paint as specified in Section 09900.

2.2 Tank Mixer

Provide where indicated on the contract drawings vertical shaft collapsible propeller-type mixer. Mount mixer through a flange in the top of the tank to extend to the tank mid-point.

2.3 ALUMINUM TANKS

Aluminum chemical storage tanks shall be fabricated from 1/4 - inch thick 6061 - 5000 series, aluminum suitably braced and reinforced for the span of tank as required for the service intended.

The aluminum tank shall also be provided with the following accessories:

a. Tank level gauge calibrated in gallons to read full depth of storage tank.

b. Manway, minimum 24 inches ID.

c. Floating relief manhole cover.

d. Flanged tank fittings, size as indicated.

e. 6-inch I.D. tank vent with check valve and dust filter contained in flanged aluminum housing.

f. 4-inch I.D. automatic air vent valve.

g. Sight glass - 1-inch O.D. Non-Automatic glass sight gage complete with shutoff valves, guarded gage glass to read full depth of tank.

2.4 Tank Mixer

Provide where indicated, vertical shaft, collapsible propeller-type mixer with fixed or variable speed controls as shown on the mixer schedule. Mount mixer through a flange in the top of the tank to extend to the tank mid-point.

PART 3 3 EXECUTION

3.1 INSTALLATION

3.1.1 Provide tanks and tank equipment as indicated and in accordance with manufacturer's recommendations. The contractor shall supply all necessary anchor bolts, temporary lifting equipment, labor and all other items needed for installation. All equipment shall be carefully placed, connected and placed into service.

3.1.2 Flush and clean fuel tank prior to delivery to site and keep sealed during construction.

3.1.3 Anchor tanks in accordance with manufacturer's instructions.

3.1.4 Tank treatment equipment shall be as indicated.

-- End of Section --

SECTION 15400

PLUMBING 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 A112.19.5	1979 (R 1990) Trim for Water-Closet Bowls, Tanks, and Urinals
ANSI A112.36.2M	1983 (Errata 1984) Cleanouts
ANSI B16.18	1985 Cast Copper Alloy Solder Joint Pressure Fittings
ANSI B16.24	1979 Bronze Pipe Flanges and Flanged Fittings Class 150 and 300
ANSI Z21.22	1986 (Addenda 1990) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
ANSI Z358.1	1990 Emergency Eyewash and Shower Equipment

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.6.1M	1979 Supports for the Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.18.1M	1989 Plumbing Fixture Fittings
ASME/ANSI A112.19.1M	1987 Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	1990 Vitreous China Plumbing Fixtures
ASME A112.21.1M	1991 Floor Drains
ASME/ANSI B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings
ASME/ANSI B16.22	1989 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME/ANSI B16.26	1988 Cast Copper Alloy Fittings for Flared Copper Tubes

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1019	1978 Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Types

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM B 32	1989 Solder Metal
ASTM B 42	1991 Seamless Copper Pipe, Standard Sizes
ASTM B 88	1989 Seamless Copper Water Tube
ASTM D 2665	1991 (Rev. A) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C651	1986 (Addendum 1990) Disinfecting Water Mains
AWWA C700	1988 Cold-Water Meters - Displacement Type, for Customer Service

BUILDING OFFICIALS & CODE ADMINISTRATORS INTERNATIONAL, INC. (BOCA)

BOCA NPC	1990 (Am. 1991) National Plumbing Code

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-USC	1992 List of Approved Backflow Prevention Assemblies

MILITARY SPECIFICATIONS (MIL)

MIL-G-1086	(Rev. E) Gasket Material, Synthetic Rubber (For Bolted Steel Tanks)

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1988 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application
MSS SP-80	1987 Bronze Gate, Globe, Angle and Check Valves

UNDERWRITERS LABORATORIES INC. (UL)

UL 174 1989 (R 1991) Household Electric Storage Tank Water Heaters

1.2 SYSTEM DESCRIPTION

Provide new plumbing systems, complete and ready for operation. Plumbing systems including manufacturer's products shall be in accordance with the required and advisory provisions of the Plumbing Code (BOCA NPC). Plumbing systems include piping less than 5 feet outside of building walls and piping beyond 5 feet outside of building walls including connections to existing exterior distribution systems.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data

a. Pipe and fittings

b. Valves

c. Plumbing fixtures

d. Water heaters

e. Pipe hangers and supports

f. Water meters G

g. Drains

h. Backflow preventers G

For pumps, include certified pump test curves.

1.3.2 SD-19, Operation and Maintenance Manuals

a. Water heaters, Data Package 2

b. Pumps, Data Package 2 G

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

Plumbing systems including fixtures, equipment, materials, installation, and workmanship shall be in accordance with the BOCA NPC Plumbing Code except as modified herein. In the Plumbing Code referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for the word "should" wherever it appears; reference to the "authority having jurisdiction," the Administrative Authority, the Plumbing Official, and the Design Engineer shall be interpreted to mean the Contracting Officer. Capacity of equipment shall be not less than that indicated.

PART 2 PRODUCTS

2.1 DRAIN, WASTE, AND VENT (DWV) PIPE AND FITTINGS

Fittings shall be long radius fittings, except fittings in vent piping may be short radius fittings. Minimum size piping shall be 2 inches for buried piping and 1.5 inches for aboveground piping.

2.1.1 Buried Piping

Provide piping up to but not more than 6 inches aboveground or floor slab on grade.

2.1.1.1 Plastic Pipe, Fittings, and Solvent Cement

a. Polyvinyl Chloride (PVC) System: ASTM D 2665.

2.1.2 Aboveground Piping

2.1.2.1 Plastic Pipe, Fittings, and Solvent Cement

a. Polyvinyl Chloride (PVC) System: ASTM D 2665.

2.1.3 Cleanouts

ANSI A112.36.2M; provide threaded bronze or thermoplastic or PVC plastic cleanout plugs.

2.1.3.1 Floor Cleanouts

Provide cast-iron or ductile-iron floor cleanout with anchor flange, adjustable height polished bronze, nickel bronze, stainless steel, or chromium-plated copper alloy rim and scoriated floor plate with "CO" cast in the plate, and countersunk screws for installing floor plate flush with finished floor.

2.1.3.2 Wall Cleanouts

Provide polished stainless steel or chromium-plated copper alloy cover plate and secure to cleanout plug with countersunk stainless steel screw.

2.1.4 Drains

ASME A112.21.1M; provide cast-iron or ductile-iron drains and clamping rings for use with membrane waterproofing. Provide P-traps for each floor drain.

2.1.4.1 Flush Strainer Floor Drains

Provide with double drainage flange, perforated or slotted cast bronze or nickel bronze, polished stainless steel, or chromium-plated copper alloy strainer, and adjustable collar. Drains of sizes 2, 3, and 4 inches shall have strainers with minimum free drainage area of 5, 11, and 18 square inches, respectively.

2.1.4.2 Shower Floor Drains

Provide as specified for flush strainer floor drains, except that finish shall be polished stainless steel or chromium-plated copper alloy and PVC drains may be provided for fiberglass shower stalls where fire separation requirements are not violated.

2.1.4.3 Extended Rim Floor Drains

Provide as specified for flush strainer floor drains, except strainer body shall have one-inch extended rim installed flush with finished floor.

2.2 DOMESTIC WATER PIPING

2.2.1 Buried Piping and Aboveground Piping

2.2.1.1 Copper Tubing

ASTM B 88, Type L for aboveground piping, Type K for buried piping, with ANSI B16.18 or ASME/ANSI B16.22 solder joint fittings; or with ASME/ANSI B16.26 flared joint fittings. Provide ASTM B 42 copper pipe nipples with threaded end connections. Provide ASTM B 32, 95-5 tin-antimony solder, or provide Plumbing Code approved lead-free solder. Provide copper tubing for pipe sizes 4 inches or smaller.

2.2.2 Water Valves

Provide valves suitable for minimum of 125 psig and minimum of 180 degrees F hot water. Valves shall have threaded end connections with a union on all but one side of the valve, or solder end connections for connections between bronze valves and copper tubing. Provide blue finish and red finish on valves in cold domestic water piping and hot domestic water piping, respectively.

2.2.2.1 Globe and Angle Valves

MSS SP-80, Class 125

2.2.2.2 Check Valves

MSS SP-80, Class 125, swing check

2.2.2.3 Ball Valves

Full port design, copper alloy. Valves shall have two-position lever handles.

2.2.2.4 Hose Bibbs

Provide angle type copper alloy hose bibb with lockshield and removable handwheel. Inlet shall have internal threads. Outlet shall have vacuum breaker with 0.75-inch external hose threads.

2.2.2.5 Nonfreeze Wall Hydrant

ASSE 1019, cast bronze, with lockshield and removable handwheel, one-inch external thread inlet, 0.75-inch external hose thread outlet with automatic draining vacuum breaker. Hydrant shall be of sufficient length to extend through walls and place the valve seat inside the building or in the crawl space. Bonnet and valve stem shall be removable from outside of the building.

2.2.2.6 Pressure Relief Valves

ANSI Z21.22 copper alloy body, automatic reseating with test lever.

2.2.2.7 Water Temperature Mixing Valves

Provide copper alloy body valve of the pressure equalizing type. Valve shall be of the adjustable thermostatic type and shall mix the hot water and cold water to deliver hot water at set temperature.

2.2.3 Water Meters

AWWA C700 displacement type, with register reading in U.S. gallons.

2.2.4 Backflow Preventers

Reduced pressure principle type. Furnish proof that each make, model/design, and size of backflow preventer being furnished for the project is approved by and has a current "Certificate of Approval" from the FCCCHR-USC. Listing of the particular make, model/design, and size in the current FCCCHR-USC will be acceptable as the required proof.

2.3 MISCELLANEOUS PIPING MATERIALS

2.3.1 Flanges

ASME/ANSI B16.1, Class 125, for use in ferrous piping; ASME/ANSI B16.22 or ANSI B16.24 for use in copper tubing; with MIL-G-1086 full face flat type synthetic rubber gaskets.

2.3.2 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal in unfinished spaces.

2.3.3 Pipe Sleeves

2.3.3.1 Sleeves in Masonry and Concrete Walls, Floors, Roofs

ASTM A 53, Schedule 40 or Standard Weight, hot-dip galvanized steel, ductile-iron or cast-iron pipe sleeves.

2.3.3.2 Sleeves in Non-Masonry or -Concrete Walls, Floors, and Roofs

Provide 26 gage hot-dip galvanized steel sheet.

2.3.4 Pipe Hangers and Supports

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joints with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.3.5 Access Doors

Provide 12- by 12-inch factory prefabricated and primed flush face steel access doors including steel door frame with continuous hinges and turn-screw-operated latch. Door frame shall be for installation in plaster and masonry walls. Furnish doors under this section to provide proper access to concealed valves; install doors under the appropriate section of this specification.

2.4 FIXTURES, FITTINGS, ACCESSORIES, AND SUPPLIES

Provide control-stop valves in each supply to each fixture. The finish of fittings, accessories, and supplies exposed to view shall be chromium-plated per ASME A112.18.1M. Centerset faucets shall be top-mounted with inlets on not greater than 4-inch centers.

2.4.1 Tank Type Water Closets (WC-1)

ASME A112.19.2M, close-coupled, white vitreous china, water conservation type, floor-mounted, floor or wall outlet as indicated, siphon jet or reverse trap, elongated bowl, black solid plastic elongated open-front seat with cover, and ANSI A112.19.5 trim. Nonfloat swing type flush valves are not acceptable. Water flushing volume shall not exceed 3.5 gallons per flush.

2.4.2 Laboratory Sink (LS-1)

Type 304 stainless steel, single compartment stainless steel mounting rim, one-hole with stainless steel strainer and tailpiece, undercoated, minimum dimensions of 20 inches wide by 24 inches front to rear. Provide copper alloy chromium plated swivel gooseneck faucet with vacuum barrier, indexed for hot and cold water.

2.4.3 Lavatories (LV-1)

ASME/ANSI A112.19.1M, white enameled cast-iron, or ASME A112.19.2M white vitreous china with ASME A112.6.1M concealed arm carrier support, shelf back type, minimum dimensions of 20 inches wide by 18 inches front to rear. Provide ASME A112.18.1M copper alloy combination faucets with body mounted from behind the vertical surface of shelf back lavatory with gooseneck spout with aerator 5 inches above rim, pop-up drain fittings and 1.25-inch adjustable P-traps. Provide ASME A112.6.1M concealed. Wall hangers with thru-bolts and back plates for mounting.

2.4.4 Combination Emergency Shower and Eyewash (EW-1)

ANSI Z358.1, column mounted on a floor flange. Design combination unit so components can be operated individually from a common fixture supply line. Provide a 10-inch diameter stainless steel deluge shower head with elbow, stay-open ball valve operated by pull rod and triangular handle, and eyewash with stainless steel receptor and two spray outlets. Provide eyewash with stay-open ball valve operated by foot treadle and push handle.

2.4.5 Outdoor Emergency Shower (ES-1)

ANSI Z358.1, wall-mounted, frost-proof, hand-operated behind wall valve installation (stay-open ball valve). Provide 10" diameter stainless steel deluge shower head with elbow 1" interconnecting pipe and fittings.

2.5 WATER HEATERS ELECTRIC (WH)

UL 174, instantaneous type, wall-mounted, cast aluminum construction with stainless steel trim, 208/1/60 electrical connection, complete with flow restrictor (for remote pipe-mounting). See drawings for locations, capacities, and piping details.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of plumbing systems including fixtures, equipment, materials, and workmanship shall be in accordance with the BOCA NPC Plumbing Code, except as modified herein. When fixtures require both hot water and cold water supplies, provide the hot water supply to the left of the cold water supply. Plastic piping shall not penetrate fire walls or fire floors and shall be used on one side of fire walls and fire floors not closer than 6 inches to the penetration.

3.1.1 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread paste, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil.

3.1.2 Solder End Valves

Remove stems and washers and other item subject to damage by heat during installation. Reassemble valve after soldering is completed. Valves without heat sensitive parts do not require disassembly but shall be opened at least two turns during soldering.

3.1.3 Pipe Supports (Hangers)

Provide additional supports at the concentrated loads in piping between supports, such as for inline water pumps and flanged valves.

3.1.3.1 Maximum Spacing Between Supports

a. Vertical Piping: Support metal piping at each floor, but at not more than 10-foot intervals, with pipe riser clamps or offset pipe clamps. Support plastic and glass piping at each floor and at midpoint between floors, but at not more than 5-foot intervals.

b. Horizontal Piping: Support cast-iron piping at 5-foot intervals, except for pipe exceeding 5-foot length, provide supports at intervals equal to the pipe length but not exceeding 10 feet. Support plastic and glass piping at 4-foot intervals and support plastic piping at each change of direction. Support steel piping and copper tubing as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One and under	1.25	1.5	2	2.5	3	3.5	4	5	6
Steel Pipe	7	8	9	10	11	12	13	14	16	17
Copper Tube	6	7	8	8	9	10	11	12	13	14

3.1.4 Ductile Iron Pipe Aboveground

Provide flanged joints.

3.1.5 Installation of Pipe Sleeves

Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than one inch space between exterior of piping or pipe insulation and interior

of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal at both ends of th sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. Seal both ends of penetrations through fire walls and fire floors to maintain fire resistive integrity with UL listed fill, void, or cavity material. Extend sleeves in floor slabs 3 inches above the finished floor, except sleeves are not required where DWV piping passes through concrete floor slabs located on grade.

3.1.6 Copper Tube Extracted Joint

An extracted mechanical tee joint may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to ensure a free flow joint. Braze extracted joints using a copper phosphorus classification brazing filler metal. Soldered joints shall not be permitted.

3.2 NAMEPLATES

Provide laminated plastic nameplates for equipment, gages, thermometers, and valves; stop valves in supplies to fixtures will not require nameplates. Laminated plastic shall be 0.125-inch thick melamine plastic, black with white center core. Surface shall be a matte finish. Corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule. Each inscription shall identify its function. Equipment nameplates shall show the following information:

a. Manufacturer, type, and model number

b. Contract number and accepted date

c. Capacity or size

d. System in which installed

e. System which it controls

3.3 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

Notify the Contracting Officer in writing at least 15 days prior to the date the connections are required; receive approval before any service is interrupted. Provide materials required to make connections into the existing water supply systems and perform excavating, backfilling, and other incidental labor as required. Furnish the labor and the tapping or drilling machine for making the actual connections to the existing systems.

3.4 FIELD QUALITY CONTROL

3.4.1 Inspections

Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer's submittals.

3.4.2 Field Testing

Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the BOCA NPC Plumbing Code, except as modified herein. Correct defects in the work provided by the Contractor, and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

3.4.2.1 Domestic Water Piping

Before applying insulation, hydrostatically test each piping system at not less than system working pressure with no leakage or reduction in gage pressure for 2 hours.

3.4.2.2 DWV Piping

Before the installation of fixtures, cap ends of each system, fill piping with water to the roof, and allow to stand until a thorough inspection has been made. If the system is tested in sections, each opening shall be plugged and each section tested with not less than a 10-foot head or water. After plumbing fixtures have been set and their traps filled with water, subject the entire sanitary system to a final air pressure test of not more than 1.0 inch of water column and a smoke or peppermint test. Perform the air and smoke test with an approved smoke testing machine which shall show a clear passage of smoke and air throughout the entire system. The entire system shall be proven absolutely tight under such test.

3.5 DISINFECTION

Disinfect new water piping in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with clean water until maximum residual chlorine content is not greater than 0.2 parts per million or residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit results prior to new water piping being placed into service.

-- End of Section --

SECTION 15405

TREATMENT SYSTEM PIPING

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 B16.23	1984 Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ANSI B16.24	1979 Bronze Pipe Flanges and Flanged Fittings Class 150 and 300
ANSI Z21.22	1986 (Addenda 1990) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME/ANSI B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings
ASME/ANSI B16.22	1989 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ANSI/ASME B16.29	1986 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ANSI/ASME B16.32	1984 Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	1981 Water Pressure Reducing Valves for Domestic Water Supply Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM B 32	1989 Solder Metal
ASTM B 306	1988 Copper Drainage Tube (DWV)
ASTM D 1784	1991 Rigid Poly (Vinyl Chloride) (PVC) Compounds

ASTM D 1785	1991 Poly (Vinyl Chloride) (PVC) Plastic Pipe
ASTM D 2466	1990 (Rev A) Poly (Vinyl Chloride) PVC Plastic Pipe Fittings, Schedule 40
ASTM D 2665	1991 (Rev. A) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	1981 Water Pressure Reducing Valves for Domestic Water Supply Systems

BUILDING OFFICIALS & CODE ADMINISTRATORS INTERNATIONAL, INC. (BOCA)

BOCA NPC	1990 (Am. 1991) National Plumbing Code

MILITARY SPECIFICATIONS (MIL)

MIL-G-1086	(Rev. E) Gasket Material, Synthetic Rubber (For Bolted Steel Tanks)

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1988 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application
MSS SP-70	1990 Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	1990 Cast Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	1987 Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	1985 Cast Iron Globe & Angle Valves Flanged and Threaded Ends

1.2 SYSTEM DESCRIPTION

Provide new treatment system piping, complete and ready for operation as shown on the Contract Drawings. Treatment system piping including manufacturer's products shall be in accordance with the required and advisory provisions of the Plumbing Code (BOCA NPC). Treatment system piping includes piping less than 5 feet outside of building walls including connections to existing exterior distribution systems.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data

a. Pipe and fittings G

b. Valves G

c. Pipe hangers and supports G

1.4 QUALITY ASSURANCE

Treatment system piping including equipment, materials, installation, and workmanship shall be in accordance with the Plumbing Code except as modified herein. In the Plumbing Code referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for the word "should" wherever it appears; reference to the "authority having jurisdiction," the Administrative Authority, the Plumbing Official, and the Design Engineer shall be interpreted to mean the Contracting Officer. Capacity of equipment shall be not less than that indicated.

PART 2 PRODUCTS

2.1 DRAIN, WASTE, AND VENT (DWV) PIPE AND FITTINGS

Fittings shall be long radius fittings, except fittings in vent piping may be short radius fittings. Minimum size piping shall be 2 inches for buried piping and 1.5 inches for aboveground piping.

2.1.1 Buried Piping

Provide piping up to but not more than 6 inches aboveground or floor slab on grade.

2.1.1.1 Plastic Pipe, Fittings, and Solvent Cement

a. Polyvinyl Chloride (PVC) System: ASTM D 2665.

2.1.2 Aboveground Piping

2.1.2.1 Plastic Pipe, Fittings, and Solvent Cement

a. Polyvinyl Chloride (PVC) System: ASTM D 1785.

2.1.2.2 Copper Tubing

ASTM B 306, with ANSI B16.23, ANSI/ASME B16.29, or ANSI/ASME B16.32 solder joint fittings using ASTM B 32, 95-5 tin-antimony or Grade Sn96 tin-silver solder, and flux containing not more than 0.2 percent lead.

2.1.2.3 Steel Pipe and Fittings

a. Galvanized Steel: ASTM A 53.

2.1.3 Valves

Provide valves suitable for minimum of 125 psig. Valves shall have flanged end connections except sizes smaller than 2.5 inches may have threaded end connections with a union on all but one side of the valve, or solder end connections for connections between bronze valves and copper tubing.

2.1.3.1 PVC Gate Valves

ASTM D 1785, with PTFE seats and seals, rated for 150 psi with end connections conforming to ASTM D 2466.

2.1.3.2 Steel Gate Valves

MSS SP-80, Class 125 except sizes 2.5 inches and larger shall conform to MSS SP-70, Class 125.

2.1.3.3 PVC Globe Valves

ASTM D 1784, with PTFE seats and seals, rate for 150 psi with end connections conforming to ASTM D 2466.

2.1.3.4 Steel Globe Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-85, Class 125.

2.1.3.5 PVC Check Valves

ASTM D 1784, with PTFE seats and seals, rate for 150 psi with end connections conforming to ASTM D 2466.

2.1.3.6 Steel Check Valves

MSS SP-80, Class 125, swing check, except sizes 2.5 inches and larger shall conform to MSS SP-71, Class 125, swing check, cast-iron or bronze body.

2.1.3.7 PVC Ball Valves

ASTM D 1784, with PTFE seats and seals, rate for 150 psi with end connections conforming to ASTM D 2466.

2.1.3.8 Steel Ball Valves

Full port design, copper alloy, except sizes 2.5 inches and larger shall be ductile-iron body or cast-iron body. Valves shall have two-position lever handles.

2.1.3.9 Pressure Relief Valves

ANSI Z21.22 copper alloy body, automatic reseating with test lever.

2.1.3.10 Pressure Reducing Valves

ASSE 1003.

2.1.4 Strainers

Strainers shall have blow off outlet with pipe nipple and gate valve and discharge pipe nipple. Copper alloy or cast-iron body. Provide stainless steel strainer element with perforations of 0.047 inch.

2.1.5 Pressure Gauges

Provide single style pressure gauge for water with 4.5-inch dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range suitable for the intended service.

2.2 MISCELLANEOUS PIPING MATERIALS

2.2.1 Flanges

ASME/ANSI B16.1, Class 125, for use in ferrous piping; ASME/ANSI B16.22 or ANSI B16.24 for use in copper tubing; with MIL-G-1086 full face flat type synthetic rubber gaskets. ANSI B16.25 for PVC piping.

2.2.2 Pipe Sleeves

Provide in the section as specified in Section 15400, "Plumbing."

2.2.3 Pipe Hangers and Supports

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joints with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide protection shield for plastic piping.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of treatment system piping including equipment, materials, and workmanship shall be in accordance with the BOCA NPC, except as modified herein.

3.1.1 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread paste, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil.

3.1.2 Solder End Valves

Remove stems and washers and other item subject to damage by heat during installation. Reassemble valve after soldering is completed. Valves without heat sensitive parts do not require disassembly but shall be opened at least two turns during soldering.

3.1.3 Unions and Flanges

Provide unions and flanges where necessary to permit easy disconnection of piping and apparatus. Each connnection having a threaded end valve shall have a union.

3.1.4 Valves

Install valves in positions accessible for operation and repair.

3.1.5 Pipe Supports (Hangers)

Provide additional supports at the concentrated loads in piping between supports, such as for inline pumps and flanged valves.

3.1.5.1 Maximum Spacing Between Supports

a. Vertical Piping: Support metal piping at each floor, but at not more than 10-foot intervals, with pipe riser clamps or offset pipe clamps. Support plastic piping, but at not more than 5-foot intervals.

b. Horizontal Piping: Support cast-iron piping at 5-foot intervals, except for pipe exceeding 5-foot length, provide supports at intervals equal to the pipe length but not exceeding 10 feet. Support plastic piping at 4-foot intervals and support plastic piping at each change of direction. Support steel piping and copper tubing as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One and under	1.25	1.5	2	2.5	3	3.5	4	5	6
Steel Pipe	7	8	9	10	11	12	13	14	16	17
Copper Tube	6	7	8	8	9	10	11	12	13	14

3.2 PIPE IDENTIFICATION AND NAMEPLATES

Identify piping service in accordance with MIL-STD-101 and Section 09900 with markings not further than 20 feet. Provide one copy of the piping identification code framed under glass. Provide laminated plastic nameplates for equipment, gages, thermometers, piping and valves; stop valves in supplies to equipment will not require nameplates. Laminated plastic shall be 0.125-inch thick melamine plastic, black with white center core. Surface shall be a matte finish. Corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule. Each inscription shall identify its function. Equipment nameplates shall show the following information:

a. Manufacturer, type, and model number

b. Contract number and accepted date

c. Capacity or size

d. System in which installed

e. System which it controls

3.3 FIELD QUALITY CONTROL

3.3.1 Inspections

Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer's submittals.

3.3.2 Field Testing

Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the Plumbing Code, except as modified herein. Correct defects in the work provided by the Contractor, and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

3.3.2.1 Treatment System Piping

Hydrostatically test each piping system at not less than system working pressure with no leakage or reduction in gage pressure for 2 hours.

3.3.2.2 DWV Piping

Before the installation of fixtures, cap ends of each system, fill piping with water to the roof, and allow to stand until a thorough inspection has been made. If the system is tested in sections, each opening shall be plugged and each section tested with not less than a 10-foot head or water. After plumbing fixtures have been set and their traps filled with water, subject the entire sanitary system to a final air pressure test of not more than 1.0 inch of water column and a smoke or peppermint test. Perform the air and smoke test with an approved smoke testing machine which shall show a clear passage of smoke and air throughout the entire system. The entire system shall be proven absolutely tight under such test.

-- End of Section --

SECTION 15483

FUEL OIL HANDLING SYSTEM

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 A13.1	1981 (R 1985) Scheme for the Identification of Piping Systems
ANSI B16.24	1979 Bronze Pipe Flanges and Flanged Fittings Class 150 and 300
ANSI B18.2.1	1981 Square and Hex Bolts and Screws Inch Series

AMERICAN PETROLEUM INSTITUTE (API)

API STD 599	1988 Steel and Ductile Iron Plug Valves
API RP 1615	1987 (Cautionary Statement 1989) Installation of Underground Petroleum Storage Systems

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	1989 Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI/ASME B16.3	1985 Malleable Iron Threaded Fittings Classes 150 and 300
ASME B16.21	1978 Nonmetallic Flat Gaskets for Pipe Flanges
ASME/ANSI B16.39	1986 Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME/ANSI B18.2.2	1987 Square and Hex Nuts (Inch Series)
ASME B31.1	1992 Power Piping
ASME B31.3	1990 Chemical Plant and Petroleum Refinery Piping
ANSI/ASME B40.1	1985 Gauges - Pressure Indicating Dial Type - Elastic Element

ASME BPVC SEC IX	1989 Boiler and Pr ssure Vessel Code: Section IX Qualifications Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	1991 Structural Steel
ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 194/A 194M	1990 (Rev. A) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 307	1990 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM B 88	1989 (Rev. A) Seamless Copper Water Tube

FEDERAL SPECIFICATIONS (FS)

FS WW-V-35	(Rev. C) Valve, Ball
FS WW-U-531	(Rev. F) Unions, Pipe, Steel or Malleabl Iron: Threaded Connection, 150 LB, 250 LB and 300 LB WSP
FS WW-S-2739	Strainers, Sediment: Pipeline, Water, Air, Gas, Oil, or Steam

MILITARY SPECIFICATIONS (MIL)

MIL-A-907	(Rev. E) Antiseize Thread Compound, High Temperature
MIL-C-19902	(Rev. C) Caps, Vents, Fuel Storage Tank
MIL-G-17713	(Rev. D) Gages, Liquid Level Measuring, Tank
MIL-V-18436	(Rev. F) Valves, Check: Bronze, Cast-Iron, and Steel Body
MIL-C-19902	(Rev. C) Caps, Vent, Fuel Storage Tank
MIL-T-22361	(Am. 1) Thread Compound; Antiseize, Zinc Dust-Petrolatum
MIL-P-24441	(Rev. B) Paint, Epoxy-Polyamide
MIL-T-27730	(Rev. A) Tape, Antiseize, Polytetrafluoroethylene, with Dispenser

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1988 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application
MSS SP-80	1987 Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	1990 Flammable and Combustible Liquids Code
NFPA 78	1989 Lightning Protection Code

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 10	1989 Near-White Blast Cleaning
SSPC Paint 20	1982 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")

UNDERWRITERS LABORATORIES INC. (UL)

UL 142	1987 (R 1987) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 842	1980 (R 1987) Valves for Flammable Fluids

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements" applies to this section with additions and modifications specified herein.

1.3 DEFINITIONS

1.3.1 Carrier Piping

Piping which contains fuel oil, exclusively.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Pipe and fittings G

b. Valves

c. Flexible hose

d. Dielectric unions

e. Strainers

f. Instruments G

g. Storage tanks G

h. Copper tube extracted joint

1.4.2 SD-06, Instructions

a. Copper tube extracted joint

1.4.3 SD-13, Certificates

a. Flexible hose

b. Dielectric unions

c. Tank surface preparation

d. Coating materials

e. Coating application procedure

1.5 REGISTRATION

Contractor shall obtain required tank registration or permit/approval application forms from governing regulatory agencies. Furnish completed forms to the Contracting Officer and the installation environmental office within 10 days after contract award for their submission to the regulatory agency.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Copper Piping

2.1.1.1 Pipe and Tubing

ASTM B 88, Type K annealed.

2.1.1.2 Flanges and Flanged Fittings

ANSI B16.24, Class 150 pound.

2.1.2 Vent Piping

ASTM A 53 standard weight, zinc-coated steel with zinc-coated malleable iron fittings ANSI/ASME B16.3.

2.1.3 Valves

2.1.3.1 Bronze Gate Valves

MSS SP-80 Class 125, 2 inches and smaller, wedge disk, nonrising stem.

2.1.3.2 Ball Valves

FS WW-V-35, Type III, Class BZ, PTFE seat, UL listed.

2.1.3.3 Relief Valves

UL 842, steel or bronze bodies, corrosion-resistant valve seats, and positive closing to prevent leakage.

2.1.3.4 Check Valves

MIL-V-18436, Group A, Type I, Trim 3, Class 150.

2.1.3.5 Plug Valves

Bronze API STD 599, PTFE seat, non-lubricated full port, square head, UL listed.

2.1.4 Piping Accessories

2.1.4.1 Flexible Hose

Flexible metal hose, corrugated type with braided wire sheath covering, close-pitch annular corrugations, rated for a working pressure of at least 125 psig, 8-inch minimum live length, screwed end connections, UL listed for flammable liquid service. Metal for hose and braided wire sheath shall be stainless steel, any type of ASTM 300-series.

2.1.4.2 Unions

ASME/ANSI B16.39, Class 150 pound.

a. Dielectric Unions: Union comprised of steel female pipe thread end and copper solder-joint end conforming to dimensional, strength, and pressure requirements of FS WW-U-531, Class 1. Steel parts shall be galvanized or plated. Union shall have a water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, it shall be able to withstand a 600-volt breakdown test.

2.1.4.3 Hangers, Supports, and Shields

Design, selection, fabrication, installation, and spacing shall conform to MSS SP-58 and MSS SP-69. Hangers, supports, rods, anchors, nuts, bolts, and washers shall be hot-dip galvanized. Hangers and supports shall be of the adjustable type.

2.1.4.4 Strainers

FS WW-S-2739 duplex basket type, with inlet and outlet on the same center line. Cast steel or fabricated steel body, 40 by 40 mesh ASTM 300-series stainless steel baskets. Open area of one basket shall be 2 1/2-times inlet or outlet piping area. Furnish one spare basket.

2.1.4.5 Gaskets

Provide one piece, factory cut, 1/16 inch thick, gaskets resistant to the effects of fuel oil and manufactured of fire-resistant materials. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints. Dimensions for gaskets shall be in accordance with ASME B16.21.

2.1.4.6 Bolting

Material for bolts and studs ASTM A 307, Grade-B and for nuts ASTM A 194/A 194M, Grade-2. Dimensions of bolts, studs and nuts ANSI B18.2.1 and ASME/ANSI B18.2.2 with threads conforming to ASME B1.1 coarse type, with Class 2A fit for bolts and studs, and Class 2B for nuts.

2.1.4.7 Sleeves in Masonry and Concrete Walls, Floors, Roofs

Provide in this Section as specified in Section 15400.

2.1.4.8 Identification for Piping Aboveground

Labels for pipes 3/4-inch diameter and larger shall bear printed legends to identify contents of pipes and arrows to show direction of flow. Labels shall have color coded background to signify levels of hazard in accordance with ANSI A13.1. Legends and type and size of characters shall also conform to ANSI A13.1. For pipes smaller than 3/4-inch diameter, provide brass identification tags 1 1/2 inches in diameter with legends in depressed black filled characters. Identification markings shall be in accordance with Section 09900.

2.1.4.9 Miscellaneous Metal

ASTM A 36/A 36M, standard mill finished structural shapes, hot-dip galvanized after fabrication.

2.1.5 Instruments

2.1.5.1 Tank Gages

MIL-G-17713, buoyant force type with direct r ading dial.

2.1.5.2 Thermometers

Thermometers shall be bi-metal dial type with stainless steel case, stem, and fixed thread connection; 5-inch diameter dial with glass face gasketed within the case; accuracy within one percent of scale range. Provide scale range suitable for the intended service.

2.1.5.3 Pressure Gages

ANSI/ASME B40.1, single style with 4 1/2-inch diameter dial for fuel, brass or aluminum case, bronze tube; accuracy within 2 percent of scale range. Provide scale range suitable for the intended service.

2.1.6 Protective Coating Materials for Aboveground Tanks

Coatings shall be the products of one manufacturer and coating application procedure shall be in accordance with manufacturer's instruction. Tank surface preparation shall be abrasive blast clean steel surfaces in accordance with SSPC SP 10 to a surface profile of 1/2 to 2 mils.

2.1.6.1 External Coatings

Protect aboveground steel tanks against atmospheric corrosion with a coat of organic, lead and chromate free, zinc-rich primer conforming to SSPC Paint 20, Type II applied to a minimum dry film thickness of 4 mils and finish with two coats of epoxy-polyamide topcoat conforming to MIL-P-24441. Apply a gray first topcoat conforming to MIL-P-24441/2, Formula 151 applied to a minimum dry film thickness of 3 mils and finish with a white second topcoat conforming to MIL-P-24441/3, Formula 152 applied to a minimum dry film thickness of 3 mils resulting in a total system minimum dry film thickness of 11 mils.

2.2 FUEL OIL STORAGE TANKS AND ACCESSORIES

2.2.1 Fuel Oil Storage Tanks

Construct fuel oil tanks of steel to comply with NFPA 30, and UL 142. Provide openings for fill, vent, pump suction, oil return, oil level gauge. Size vent pipes according to NFPA 30 and UL 142 but not less than 1 1/4-inch nominal inside diameter. Vent pipe shall connect to tapping at high end of tank and shall not extend more than one inch into tank.

2.2.2 Design, Construction, and Testing of Fuel Oil Tanks

Aboveground steel fuel oil tanks, UL 142, welded construction, UL listed, complete with containment dike as shown on drawings.

2.2.3 Connections to Fuel Oil Tanks

Provide th following connections:

a. Goose-neck vent caps or caps conforming to MIL-C-19902.

b. Fill lines with removable single strainer and locking fill boxes.

c. A sounding connection, to permit entry of the gaging rod, with a locking cap. Provide graduated gaging rod and calibration chart.

d. Pump suction lines with internal vertical pipes and foot valve extending to within 4 inches of tank bottom.

e. Fuel oil supply, return, fill and vent piping utilizing swing joint elbows to allow for ample tank movement and pipe expansion. Drain piping into tank when pump is shut-off.

f. Flexible hose connections for vibration isolation of oil burning equipment.

g. On steel tanks weld a 12- by 12- by 1/4-inch steel striker plate under gage and fill lines.

h. Nylon dielectric bushings on pipe connections to steel tanks.

i. Ball float valves on vent lines to restrict flow into tank when the tank reaches 90 percent full.

j. Automatic high level alarm with setting of approximately 95 percent and 98 percent of tank capacity. Audible alarm shall sound locally at tank, and alarm signal shall be transmitted to remote locations as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Contractor shall provide installation of fuel oil piping system in accordance with applicable Federal, State, regional or local regulations.

3.1.1 Fuel Oil Piping System

Install piping in out-of-the-way locations, in a manner that will minimize cutting of beams, girders, columns, or load-bearing members. Installation of oil piping and equipment in buildings shall conform to NFPA 30 except as indicated or specified herein. Underground piping shall also conform to API RP 1615.

3.1.1.1 Underground Piping

a. Arrange piping to minimize piping across tanks.

b. Piping shall be free from traps and shall drain toward tank.

c. Provide swing joints at points where underground piping connects to the tank.

d. Install underground fuel lines in a single trench with a bed of well-compacted non-corrosive material such as cleaned, washed sand at least 6 inches deep.

e. Trenches shall be wide enough to permit at least 6 inches of backfill between underground fuel lines and the sides and floor of the trench. Provide cover of at least 6 inches.

3.1.2 Steel Piping

Steel piping 2 inches and smaller shall be threaded or socket-welded. Steel piping 2 1/2 inches and larger shall be buttwelded. Flanges may be used for valves and equipment installation. Piping joints shall conform to ASME B31.3. Direct buried piping connections shall be welded.

3.1.3 Threaded Joints in Piping

Provide lubricant or polytetrafluoroethylene tape conforming to MIL-T-27730 on male threads of screwed joints. Red or white lead and zinc compound conforming to MIL-T-22361 may be used. Lubricate threaded pipe joints, as well as bolts and studs used on high temperature pipe joints up to 1050 degrees F, with anti-seize compound in accordance with MIL-A-907. Piping shall be free from fins and burrs. Ream or file out pipe ends to size of bore and remove chips. Attach screwed flanges by screwing the pipe through the flange, and reface pipe and flange accurately.

3.1.4 Copper Tubing

Cut with square ends and remove burrs and fins. Replace tubing cut, dented, or otherwise damaged with new tubing. Clean outside surface of tubing ends and inside recess of fittings to bright metal with wire brush or abrasive, then apply flux to outside surface of tubing ends and on the recess inside of fittings. Insert tubing to the full depth of fitting, then braze. Remove stems and washers of solder-joint type valves before brazing. Brazing procedure qualification and preparation and procedures for joints shall be in accordance with ASME B31.3.

3.1.4.1 Copper Tube Extracted Joint

Extracted mechanical tee joint may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to assure a free flow joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints are not permitted. Joints shall meet all system design and test requirements specified herein, be approved by the manufacturer for the specific service and be installed in strict accordance with the manufacturers written procedures and instructions.

3.1.5 W lding

3.1.5.1 Welding of Piping

Welding of joints in piping, butt welds, fillet welds, bends, loops, offsets, and cleaning of pipe shall be in accordance with ASME B31.1. Welds shall be visually examined and meet acceptance standards specified in Chapter VI of ASME B31.1.

3.1.5.2 Quality of Welds

Quality of welds, correction of defects, stress relieving, and preheating shall be in accordance with ASME B31.1.

3.1.5.3 Arc Welding and Gas Welding

In accordance with ASME BPVC SEC IX.

3.1.6 Unions and Flanges

Place unions and flanges where necessary to permit easy disconnection of piping and apparatus. Each connection having a threaded end valve shall have a union.

3.1.7 Valves

Install valves in positions accessible for operation and repair.

3.1.8 Thermometers

Provide thermometers and thermal sensing elements of control valves with separable sockets. Install separable sockets in pipe lines in such a manner to sense the temperature of flowing fluid and minimize obstruction to flow.

3.1.9 Fuel Oil Storage Tanks

Install storage tanks, vents and other connections in accordance with NFPA 30, recommendations and published instructions of the manufacturer, and as indicated. Provide grounding of tanks directly through ground rods or through bonding to grounded network in accordance with NFPA 78. Fasten aboveground fuel oil tanks on a firm reinforced concrete foundation. Provide fireproofed steel supports between tank and foundation. Materials for concrete shall meet requirements specified in Section 03300, "Cast-in-Place Concrete".

3.2 FIELD QUALITY CONTROL

Prior to application of test pressure, remove or valve off piping components which may be damaged by test and install a calibrated test gauge in the system. Maintain test pressure for at least one hour. In the event of leakage, locate and repair leak by rewelding and repeat test. Materials and equipment shall be subject to inspection at the installation site by the Contracting Officer.

3.2.1 Piping Test

Before backfilling of pipe trenches, perform hydrostatic test of fuel oil piping at 1 1/2 times system pressure or 100 psig whichever is greater.

3.2.2 Protective Coating Systems

Inspect protective coating systems, with a holiday tester just prior to placement in ground. Holidays revealed shall be promptly repaired. Steel piping coating system shall be given a holiday test with a voltage of 100 to 200 times the mil thickness of the coating.

3.2.3 Steel Fuel Oil Storage Tanks

Test tanks for leaks by applying internal air pressure and using soapsuds, linseed oil or equivalent material on external welds. For horizontal tanks, test pressure shall be not less than 5 nor more than 7 psig. For vertical tanks, test pressure shall be not less than 1 1/2 psig nor more than that pressure which first causes visible deformation of the tank. During testing, tank shall be provided with a suitable pressure relief device.

3.2.4 Cathodic Protection

Test to prove continuity of electrical connections prior to backfill.

-- End of Section --

SECTION 15488

LOW PRESSURE COMPRESSED AIR SYSTEMS (NON-BREATHING AIR TYPE)

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 B16.11	1980 Forged Steel Fittings, Socket-Welding and Threaded

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ANSI/ASME B1.20.1	1983 Pipe Threads, General Purpose (Inch)
ANSI/ASME B16.3	1985 Malleable Iron Threaded Fittings Classes 150 and 300
ASME/ANSI B16.5	1988 (Errata 1988) Pipe Flanges and Flanged Fittings
ASME/ANSI B16.9	1986 Factory-Made Wrought Steel Buttwelding Fittings
ASME/ANSI B16.34	1988 Valves - Flanged, Threaded and Welding End
ASME B31.1	1989 (Addenda 1989) Power Piping
ANSI/ASME B40.1	1985 Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC VIII D1	1989 (Addenda 1989) Boiler and Pressure Vessel Code: Section VIII Pressure Vessels, Division 1
ASME BPVC SEC IX	1989 Boiler and Pressure Vessel Code: Section IX Qualifications Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 193/A 193M	1990 (Rev. A) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature

	Service
ASTM A 194/A 194M	1990 (Rev. A) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1	1990 Structural Welding Code Steel
ANSI/AWS Z49.1	1988 Safety in Welding and Cutting

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.219	Mechanical Power Transmission Apparatus

FEDERAL SPECIFICATIONS (FS)

FS PPP-T-66	(Rev. E Reinst) Tape, Packaging, Vinyl Plastic Film
FS WW-U-531	(Rev. F) Unions, Pipe, Steel or Malleable Iron: Threaded Connection, 150 LB, 250 LB and 300 LB WSP
FS WW-T-696	(Rev. E) (Valid Notice 1) Traps, Steam and Air
FS WW-S-2739	Strainers, Sediment: Pipeline, Water, Air, Gas, Oil or Steam

MILITARY SPECIFICATIONS (MIL)

MIL-G-1149	(Rev. C) Gasket Materials, Synthetic Rubber, 50 and 65 Durometer Hardness
MIL-V-24384	(Rev. B) Valves, Pressure Regulating, for Low Pressure Air or Nitrogen Systems
MIL-T-27730	(Rev. A) Tape, Antiseize, Polytetrafluoroethylene, with Dispenser

MILITARY STANDARDS (MIL-STD)

MIL-STD-101	(Rev. B) Color Code for Pipelines and for Compressed Gas Cylinders

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1988 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application

MSS SP-80	1987 Bronze Gate, Globe, Angle and Check Valves
MSS SP-84	1990 Valves - Socket Welding and Threaded Ends
MSS SP-89	1985 Pipe Hangers and Supports - Fabrication and Installation Practices

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	1988 Industrial Control Devices, Controllers and Assemblies
NEMA ICS 6	1988 (Rev. 1) Enclosures for Industrial Controls and Systems
NEMA MG 1	1987 (Rev. 1) Motors and Generators

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 10	1989 Near-White Blast Cleaning

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements", applies to this section, with the 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. Air compressor G

b. Air receiver G

c. Desiccant air dryers G

d. Desiccant

e. Pipe

f. Fittings

g. Valves

h. Pressure gages

i. Hangers and supports

j. Quick disconnect couplings

k. Filters

l. Strainers

m. Traps

n. Lubricators

o. Flexible connections

p. Dielectric unions

q. Identification labels for piping

For receivers, include Manufacturer's Data Report Form U-1 or U-1A

1.3.2 SD-06, Instruction

a. Air receiver

Include manufacturer's recommended certification test procedure and recommended procedure for cleaning, external painting, and delivery preparation.

1.3.3 SD-08, Statements

a. Welding and brazing procedures

b. Welding procedure qualifications

c. Brazing procedure qualifications

d. Welder and brazer qualifications

e. Cleaning and flushing procedures

1.3.4 SD-10, Test Reports

a. Air compressor G

b. Air receiver G

c. Hydrostatic tests G

d. Leak tightness tests G

1.3.5 SD-18, Records

a. Posted operating instructions for air compressor G

1.3.6 SD-19, Operation and Maintenance Manuals

a. Air compressor, Data Package 4 G

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

1.3.6.1 Equipment Data

Submit the following data for equipment listed for "Operation and Maintenance Instructions, Parts and Testing".

a. Name and address of authorized branch or service department.

b. Characteristic curves.

c. Following applicable data completely filled in:

Manufacturer and Model No. _____

Operating Speed _____

Capacity _____ (SCFM)

Type of Bearings in Unit _____

Type of Lubrication _____

Type and Adjustment of Drive _____

Capacity of Tank _____

Electric Motor: Manufacturer, Frame and Type _____

Motor Speed _____ RPM

Current Characteristics and HP of Motor _____

_____ Thermal Cut-out Switch: Manufacturer, Type and Model _____

Starter: Manufacturer: Type and Model _____

1.4 QUALITY ASSURANCE

Design, fabrication, installation, and testing of compressed air systems shall conform to ASME B31.1, ASME BPVC SEC VIII D1, and ASME BPVC SEC IX, except as specified otherwise. In ASME B31.1, ASME BPVC SEC VIII D1, and ASME BPVC SEC IX, the advisory provisions shall be considered mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having

jurisdiction" and "owner" shall be interpreted to mean the Contracting Officer.

1.4.1 Welding Procedure Qualifications

Qualifications for each welding procedure shall conform to the requirements of ASME B31.1 and the following.

1.4.1.1 Butt Welded Joints

Butt welded joints shall be full penetration joints.

1.4.2 Brazing Procedure Qualifications

Qualification of the brazing procedures is required for each group of materials to be brazed as indicated in ASME BPVC SEC IX. Record in detail and qualify the "Brazing Procedure Specifications" for every brazing procedure proposed. Include provisions for repairs. Qualification for each brazing procedure shall conform to the requirements of ASME B31.1 and to this specification. The brazing procedures shall specify end preparation for brazed joints, including cleaning, alignments, and fit-up clearances. Submit copies of the brazing procedure specifications for each type of brazing required in accordance with the paragraph "Submittals." Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable brazes. This information shall be submitted on the forms printed in ASME BPVC SEC IX, or their equivalent. Brazing procedure qualifications shall be identified individually and shall be referenced on the shop drawings or suitably keyed to the contract drawings.

1.4.3 Brazing Operator and Welder and Brazer Qualifications

Qualify each brazer and brazing operator assigned to work covered by this specification by performance tests using equipment, positions, procedures, base metals, and filler metal from the same specification, classification, or group number that will be encountered on his assignment. Brazers or brazing operators who make acceptable procedure qualification tests will be considered performance-qualified for the brazing procedure used. Determine performance qualification in accordance with ASME B31.1 and as specified.

1.4.3.1 Certification

Before assigning brazers or brazing operators to the work, provide the Contracting Officer with their names, together with certification that each individual is performance-qualified as specified. No brazing work shall start prior to procedure qualification. The certification shall state the type of brazing and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests. When requested by the Contracting Officer, provide copies of qualification records and laboratory test reports.

1.4.3.2 Renewal of Qualification

Requalification of a brazer or brazing operator shall b required under any of the following conditions:

a. When a brazer or brazing operator has not used the specific brazing process for a period of 6 months.

b. There is specific reason to question his ability to make brazes that will meet the requirements of the specifications.

1.4.4 Qualification of Pressure Vessel (receiver) Inspectors

State Certification of Competency and active commission from the National Board of Boiler and Pressure Vessel Inspectors (NBBI), Columbus, Ohio.

1.5 SAFETY PRECAUTIONS

1.5.1 Temperature Restriction

Compressors or other equipment shall not discharge compressed air to the piping systems above 100 degrees F unless approved by the Contracting Officer. Aftercoolers or other devices shall be provided to comply with the temperature restriction.

1.5.2 Rotating Equipment

Fully guard couplings, motor shafts, gears and other exposed 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.

1.5.3 Welding and Brazing

Safety in welding, cutting, and brazing of pipe shall conform to ANSI/AWS Z49.1.

PART 2 PRODUCTS

2.1 LOW PRESSURE AIR COMPRESSOR UNIT, 10 HP AND LESS, UP TO 125 PSIG

2.1.1 Compressor and Receiver Capacity

Capacity - 35 SCFM. Discharge Working Pressure - 100 psig. Receiver Volume - Horizontal 120 gal. Oil-free air delivered at indicated pressure.

2.1.2 Mounting

Common sub-base for receiver and compressor. Compressor and motor to be mounted on receiver.

2.1.3 Compressor Type

Reciprocating, two stage.

2.1.4 Nameplate

Metal, securely fastened to equipment or base, listing:

Manufacturer's name and address
Model and serial numbers
Compressor operating data and rating.

2.1.5 Receiver

ASME BPVC SEC VIII D1 and ASME BPVC SEC IX stamp. Provide service valve, pressure gage, and ASME BPVC SEC VIII D1 and ASME BPVC SEC IX code safety valve.

2.1.6 Receiver Condensate Drain

Automatic float-type trap per FS WW-T-696.

2.1.7 Compressor Accessories

Air inlet filter and silencer. Air-cooled intercooler and aftercooler which reduce air discharge temperature to 100 degrees F.

2.1.8 Control

Unloaded start with enclosed diaphragm-type pressure switch automatically controlling start-and-stop.

2.1.9 Motor

Squirrel-cage induction motor with drip-proof enclosure and conforming with NEMA MG 1, suitable for operation on the indicated power supply. Rated horsepower of motor shall equal or exceed power required for continuous operation of compressor at full load.

2.1.10 Starter

Capacity and electrical characteristics shall be compatible with motor. Starter shall conform with NEMA ICS 2 with NEMA ICS 6 enclosure. Include thermal overload protection of all phases.

2.1.11 Noise

75 dBA maximum sound level one meter from compressor unit.

2.2 LOW PRESSURE AIR RECEIVER

ASME BPVC SEC VIII D1, labeled and rated for 125 psig, equipped with required valves and trimmings, including gage and automatic drain valve and ASME BPVC SEC VIII D1 and ASME BPVC SEC IX pressure safety relief valve. Pressure as indicated. Sandblast exterior and interior to SSPC SP 10, near-white. Lining shall be a factory applied 8 mil minimum white epoxy coating. Exterior finish shall be standard factory finish.

2.3 DESICCANT AIR DRYERS

Chamber of welded steel, 125 psig working pressure, ASME labeled conforming to ASME BPVC SEC VIII D1, with flanged or threaded fittings, and automatic drain valve. Manufacturer's recommended desiccant in tablet form which will not nest or cake. Contractor shall provide a supply of desiccant for initial operations in unbroken shipping containers equal to not less than four charges of desiccant for the dryer.

2.4 LOW PRESSURE COMPRESSED AIR PIPING AND ACCESSORIES

Low Pressure Compressed Air Piping and Accessories (125 psig at 150 degrees F): Conform to the following:

2.4.1 Steel Piping

a. Pipe: ASTM A 53, seamless carbon steel, Schedule 40, black.

b. Fittings, Size 2 Inches and Larger: ASME/ANSI B16.9, carbon steel, butt welding, schedule 40, or ASME/ANSI B16.5, carbon steel welding neck flanges, Class 150, ASME/ANSI B16.5, flanged fittings, carbon steel, Class 150, gaskets 1/16-inch oil resistant synthetic rubber MIL-G-1149, bolts ASTM A 193/A 193M, Grade B7, and nuts, ASTM A 194/A 194M, Grade 7. Butt welded joints shall be full penetration consumable insert or backing ring type.

c. Fittings, Size 1 1/2 Inches and Smaller: ANSI/ASME B16.3, threaded malleable iron, Class 150, or ANSI B16.11, forged carbon steel 3000-pound socket welding or 2000-pound threaded. Joints may also be butt welded or flanged, as specified for sizes 2 inches and larger.

d. Flat-faced Steel Flanges: Where connections are made to 125-pound cast iron flanges with steel flanges, use only flat-faced Class 150 steel flanges.

e. Unions: FS WW-U-531, Class 1 (300 psig WOG).

2.4.2 Valves

2.4.2.1 Gate Valves

a. Bronze Gate Valves: MSS SP-80, Class 150, 2 inches and smaller, wedge disc, rising stem, inside screw type, with brazed joints ends when used with copper tubing.

b. Steel Gate Valves: MSS SP-84, 2 inches and smaller, ASME/ANSI B16.34, over 2 inches, flanged ends, outside screw and yoke type with solid wedge or flexible wedge disc, Class 150.

2.4.2.2 Globe and Angle Valves

a. Bronze Globe and Angle Valves: MSS SP-80, Class 150, 2 inches and smaller, 200-lb. class, except that 150 lb. class valves with brazed ends may be used for copper tubing. Valves shall have renewable seats and discs except brazed-end valves which shall have integral seats.

b. Steel Globe and Angle Valves: MSS SP-84, 2 inches and smaller, ASME/ANSI B16.34, over 2 inches, flanged ends, Class 150.

2.4.2.3 Pressure Reducing Valves

MIL-V-24384, Type I - Pressure Reducing, spring or dome loaded type, with nominal pressure rating of not less than inlet system pressure indicated. Provide pressure reducing valves capable of being adjusted to specified flow and pressure, and suitable for intended service. Provide pilot valve for dome loaded type if required for proper operation.

2.4.2.4 Safety Valves

ASME BPVC SEC VIII D1 and ASME BPVC SEC IX Code stamped safety valve), 125-psig, for unfired pressure vessels, bronze, with threaded or flanged connections; factory set and sealed.

2.4.2.5 Check Valves

MSS SP-80, Bronze body with brazed joint or threaded ends or steel body with flanged end, ASME/ANSI B16.34, or threaded ends, MSS SP-84. The check valve shall have a perforated piston with closed downstream end, in line with the pipe and held closed by a steel poppet return spring.

2.4.2.6 Pressure Regulators

Diaphragm type, air loaded, tight closing single seat, brass body with integral filter and bowl.

2.4.2.7 Needle Valves

One-piece bodies with integral or screwed bonnet, stems of hardened stainless steel with fine thread for metering and ease of adjusting, teflon packing; and shall be of the pressure balanced type. Needle valves shall be of the slow opening type.

2.4.3 Pressure Gages

ANSI/ASME B40.1, Accuracy Grade A, for air, with steel or brass case, and nonshatterable safety glass, and a pressure blowout back to prevent glass from flying out in case of an explosion. Gages shall have a 3 1/2-inch minimum diameter dial and a dial range of approximately twice working pressure.

2.4.4 Hangers and Supports

Provide pipe hangers and supports conforming to MSS SP-58, MSS SP-69, and ASME B31.1, except as specified or indicated otherwise. Furnish zinc plated pipe hangers and supports except for copper plated inserts for copper piping. Provide tubing supports of U-shaped steel bolts and nuts firmly secured to adequately support structures such as walls, columns, floors, or brackets. Clips shall fit closely around piping but shall have sufficient clearance to permit longitudinal movement of piping during normal expansion and contraction. Provide supports at valves, fittings, branch lines, outlets, changes in direction, equipment, and accessories.

2.4.5 Quick Disconnect Couplings

All brass and suitable for a working pressure of not less than 125 psig. Female side of coupling (fixed end) shall have male thread connection with automatic shutoff. Provide male side of coupling with hose stem and ball check to bleed pressure from hose and prevent hose whipping.

2.4.6 Single Cartridge Type Filters

125 psig operating pressure and filter housing of brass or bronze. Provide cellulose cartridge filters of graded density construction capable of removing liquids and solids of 5 microns and larger. Filter capacity shall be compatible with rated flow of equipment or pressure reducing valves provided.

2.4.7 Strainers

FS WW-S-2739. Bronze or malleable iron body, Class 125, Style Y, Type II, simplex type, with 20-mesh Monel or stainless steel screen.

2.4.8 Traps

FS WW-T-696 to drain water and other liquids from system. Type of traps, as indicated, and rated working pressure not less than system operating pressure.

2.4.9 Lubricators

Brass body, 125 psig minimum rating, with clear plastic bowl and metal guard.

2.4.10 Flexible Connections

Vibration isolation, wire braid reinforced corrugated metal hose type, line-sized, with bronze end connections, suitable for pressure indicated. Length as recommended by manufacturer but not less than 18 inches.

2.4.11 Dielectric Unions

Steel female pipe thread end and copper solder-joint ends, conforming to dimensional, strength and pressure requirements of FS WW-U-531, Class 1. Steel parts shall be galvanized or plated. Union shall have a

water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, it shall also be able to withstand a 600-volt breakdown test.

2.4.12 Tetrafluoroethylene Tape

MIL-T-27730 for screw-jointed pipe.

2.5 IDENTIFICATION LABELS FOR PIPING

Labels for pipes 3/4 inch O.D. and larger shall bear printed legends to identify contents of pipes and arrows to show direction of flow. Except that of pipes smaller than 3/4 inch O.D., labels shall have color coded backgrounds to signify levels of hazard in accordance with MIL-STD-101. Legends and type and size or characters shall also conform to MIL-STD-101. Labels shall be made of plastic sheet in conformance with FS PPP-T-66 with pressure-sensitive adhesive suitable for the intended applications or they may be premolded of plastic to fit over specific pipe outside diameters 3/4 inch and larger. For pipes smaller than 3/4 inch O.D., furnish brass identification tags 1 1/2 inches in diameter with legends in depressed black-filled characters.

2.6 FRESH WATER

Fresh water for cleaning, flushing, and testing shall be clean and potable.

2.7 SOURCE QUALITY CONTROL

Test air compressors and compressed air dryers at the factory to assure proper operation. Certify satisfactory accomplishment of tests.

PART 3 EXECUTION

3.1 INSTALLATION

Install materials and equipment as indicated and in accordance with the manufacturer's recommendations.

3.1.1 Piping

Unless specifically stated to the contrary, fabrication, assembly, welding, and brazing shall conform to ASME B31.1 for all piping of the air system. Piping shall follow the general arrangement shown. Cut piping accurately to measurements established for the work. Work piping into place without springing or forcing, except where cold-springing is specified. Piping and equipment within buildings shall be entirely out of the way of lighting fixtures and doors, windows, and other openings. Locate overhead piping in buildings in the most inconspicuous positions. Do not bury or conceal piping until it has been inspected, tested, and approved. Where pipe passes through building structure, pipe joints shall not be concealed, but shall be located where they may be readily inspected and building structure shall not be weakened. Avoid interference with other piping, conduit, or equipment. Except where specifically shown otherwise, vertical piping shall run plumb and straight and parallel to

walls. Piping connected to equipment shall be installed to provide flexibility for vibration. Ad quately support and anchor piping so that strain from weight of piping is not imposed on the equipment.

3.1.1.1 Fittings

Use long radius ells where appropriate to reduce pressure drops. Pipe bends in lieu of fittings may be used for low pressure piping where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and must be free from any appreciable flattening, wrinkling, or thinning of the pipe. Mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction shall not be used. Make branch connections with welding tees, except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.1 may be used.

3.1.1.2 Clearances for Welding

Provide clearances from walls, ceilings, and floors to permit the installation of joints. The clearances shall be at least 6 inches for pipe sizes 4 inches and less, 10 inches for pipe sizes over 4 inches, and sufficient in corners. However, the specified clearances shall not waive requirements for welders to be qualified for the positions to be welded.

3.1.1.3 Cleaning and Flushing Procedures

Before jointing and erection of piping or tubing, thoroughly clean interiors of pipe sections, tube, and components. In steel pipe, loosen scale and other foreign matter by rapping sharply and expel by wire brush and swab. Blow out both steel pipe and copper tube and components with compressed air at 100 psig or more. Maintain cleanliness by closure of pipe/tube openings with caps or plugs. Before making final terminal connections, blow out complete system with compressed air at 100 psig or more.

3.1.1.4 Changes in Pipe Size

Use reducing fittings for changes in pipe size. The use of bushings will not be permitted. In horizontal lines, 2 1/2 inches and larger, reducing fittings shall be of the eccentric type to maintain the bottom of the lines in the same plane.

3.1.1.5 Drainage and Flexibility

Compressed air piping shall be free of unnecessary pockets and pitched approximately 3 inches per 100 feet in the direction of flow to low points. Where pipes must be sloped so that condensate flows in opposite direction to air flow, slope 6 inches per 100 feet or greater. Provide flexibility by use of fittings, loops, and offsets in piping. Install branches at top of a main to prevent carryover of condensate and foreign matter.

3.1.2 Threaded Joints

Where possible use pipe with factory cut threads, otherwise cut pipe ends square, remove fins and burrs, and cut taper pipe threads in accordance

with ANSI/ASME B1.20.1. Threads shall be smooth, clean, and full cut. Apply thread tape to male threads only. Work piping into place without springing or forcing. Backing off to permit alignment of threaded joints will not be permitted. Engage threads so that not more than three threads remain exposed.

3.1.3 Welding and Brazing Procedures

Perform welding and brazing in accordance with qualified procedures using qualified welders and welding operators and brazers. Do not perform welding and brazing when the quality of the completed weld or braze could be impaired by the prevailing working or weather conditions. The Contracting Officer will determine when weather or working conditions are unsuitable for welding. Welding of hangers, supports, and plates to structural members shall be in accordance with AWS D1.1.

3.1.3.1 Cleaning for Welding and Brazing

Surfaces to be welded or brazed shall be free from loose scale, slag, rust, paint, oil, and other foreign material. Joint surfaces shall be smooth and free from defects which might affect proper welding. Clean each layer of weld metal thoroughly by wire brushing, grinding, or chipping prior to inspection or deposition of additional weld metal.

3.1.3.2 Stress Cracking During Brazing

For material susceptible to stress corrosion cracking from molten brazing filler metal, avoid applying stress during brazing.

3.1.3.3 Welding or Brazing of Valves

Welding or Brazing of Valves: Disassemble valves subject to damage from heat during welding or brazing and reassemble after installation. Open valves two or three turns off the seat when not subject to heat damage during welding or brazing; do not backseat valve.

3.1.4 Flare Fittings

Provide flare fittings only where necessary to connect copper tubing to equipment. Use short sections of annealed tubing soldered or brazed to hard drawn tubing using couplings on expanded ends on the annealed tubing made with special tools designed for that purpose. Make flares with the appropriate flaring tools. Cut annealed tubing only with cutting wheel tool. Do not ream out inside burr or lip left by the cutting wheel but fold back lip with flare tool to form seal/gasket inside flare. When new, the flare should cover not more than 75 percent of the flare seating surface of either the male or female flare fittings. Put the flare nut on the tube before making the flare.

3.1.5 Valves

ASME B31.1. Install valves at the locations indicated and elsewhere as required for the proper functioning of the system.

3.1.5.1 Gate Valves

Provid gate valves unless otherwise directed. Install valves in positions accessible for operation and repair. Install valve with stem horizontal or above.

3.1.5.2 Globe Valves

Install globe valves so that the pressure will be below the disk. Install globe valves with the stems vertical.

3.1.5.3 Pressure-Reducing Valves

Provide compressed air entering each pressure-reducing valve with a strainer. Provide each pressure-reducing valve unit with two block valves and with a globe or angle bypass valve and bypass pipe. Provide a bypass around a reducing valve of reduced size to restrict its capacity to approximately that of the reducing valve. Provide each pressure reducing valve unit with an indicating gage to show the reduced pressure, and a safety valve on the low pressure side. These requirements do not apply to small pressure regulating valves used to adjust pressure for pneumatic equipment.

3.1.6 Hangers and Supports

Selection, fabrication and installation of piping hangers and supports shall conform to MSS SP-58, MSS SP-69, and MSS SP-89 except that spacing of the hangers and supports shall be as per Table I.

TABLE I. MAXIMUM SPAN FOR PIPE

DIAMETER INCHES	STD. WT. STEEL PIPE SCHEDULE 40
1/2	5'-0"
3/4	5'-9"
1	6'-6"
1 1/2	7'-6"
2	8'-6"
2 1/2	9'-3"

3.1.7 Pressure Gages

Provide pressure gages with a shut-off valve or petcock installed between the gage and the line.

3.1.8 Strainers

Provide strainers with meshes suitable for the services where indicated, or where dirt might interfere with the proper operation of valve parts, orifices, or moving parts of equipment.

3.1.9 Equipment Foundations

Provide equipment foundations of sufficient size and weight and of proper design to preclude shifting of equipment under operating conditions or under any abnormal conditions which could be imposed upon the equipment. Provide foundations which meet the requirements of the equipment manufacturer, and when required by the Contracting Officer, obtain from the equipment manufacturer approval of the foundation design and construction for the equipment involved. Equipment vibration shall be maintained within acceptable limits, and shall be suitably dampened and isolated.

3.1.10 Equipment Installation

Install equipment strictly in accordance with these specifications, and the manufacturers' installation instructions. Grout equipment mounted on concrete foundations before piping is installed. Install piping in a manner that does not place a strain on any of the equipment. Do not bolt flanged joints tight unless they match properly. Extend expansion bends adequately before installation. Grade, anchor, guide and support piping without low pockets.

3.1.11 Cleaning of System

Clean the various system components before final closing as the installations are completed. Remove foreign matter from equipment and surrounding areas. Preliminary or final tests will not be permitted until the cleaning is approved by the Contracting Officer.

3.1.12 Unions and Flanges

Provide unions and flanges where necessary to permit easy disconnection of piping and apparatus, and as indicated. Provide a union for each connection having a screwed-end valve. Provide unions or flanges not farther apart than 100 feet. Provide unions on piping under 2 inches in diameter, and provide flanges on piping 2 inches and over in diameter. Install dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous to non-ferrous connections.

3.1.13 Painting of Piping and Equipment

Paint piping and equipment in accordance with Section 09900, "Painting."

3.1.14 Identification of Piping

Identify piping in accordance with MIL-STD-101. Use commercially manufactured piping identification labels. Space identification marking on runs not farther apart than 50 feet. Provide two copies of the piping identification code framed under glass and install where directed.

3.2 FIELD QUALITY CONTROL

3.2.1 Examinations

3.2.1.1 Welding Examinations

In accordance with Section 15116, "Welding Pressure Piping," and the following: The Contractor shall perform visual examinations to detect surface and internal discontinuities in completed welds. Visually examine all welds. When examination indicates defects in a weld joint, the weld shall be repaired by a qualified welder. Remove and replace defects as specified in ASME B31.1, unless otherwise specified. Repair defects discovered between weld passes before additional weld material is deposited. Whenever a defect is removed, and repair by welding is not required, blend the affected area into the surrounding surface, eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, examine the area by the same methods which first revealed the defect to ensure that the defect has been eliminated. After rewelding, reexamine the repaired area by the same test methods originally used for that area. Any indication of a defect shall be regarded as a defect unless reevaluation by surface conditioning and reexamination shows that no unacceptable defects are present. The use of any foreign material to mask, fill in, seal, or disguise welding defects will not be permitted.

3.2.1.2 Brazing Examinations

The Contractor shall perform brazing examinations. Visually examine all compressed air systems as follows:

a. Check brazed joint fit-up. Diametrical clearances shall conform to brazing procedure requirements.

b. Check base material of pipe and fitting for conformance to the applicable drawing or specification.

c. Check grade of brazing alloy for conformance to the brazing procedure before fit-up or brazing.

d. Check completed brazed joint for a complete ring of brazing alloy between the outside surface of the pipe and the face of the fitting, and for a visible fillet.

e. Check stainless steel and other susceptible material for evidence of stress cracks. Check inside of joint if possible with borescope or other aids.

Defective joints may be repaired. However, no more than two attempts to repair by reheating and additional face feeding of brazing filler metal will be permitted, after which the defective joint shall be unsweated, reprepared as a new joint, examined for defects on pipe and fittings, and rebrazed.

3.2.2 Testing

3.2.2.1 General Requirements, Testing

Perform testing after cleaning. Contractor shall provide everything required for tests. Tests shall be subject to the approval of the Contracting Officer. Calibrate the test pressure gages with a dead weight tester within 15 days before use and certify by initial and date on a sticker applied to dial face. Pressurize each piping system individually and check to assure that there are no cross-connections between different systems prior to hydrostatic and operational tests.

3.2.2.2 Hydrostatic Tests and Leak Tightness Tests

a. Preliminary Preparation

Remove or isolate from the system the compressor, air dryer, filters, instruments, and equipment which would be damaged by water during hydrostatic tests and reinstall after successful completion of tests.

b. Performance of Hydrostatic Tests

Hydrostatically test piping systems in accordance with ASME B31.1. Vent or flush air from the piping system. Pressurize system for 10 minutes with water at one and one-half times design working pressure, then reduce to design working pressure and check for leaks and weeps.

c. Compressed Air Leak Test

After satisfactory completion of hydrostatic pressure test, blow systems dry with clean, oil-free compressed air, and test with clean, dry air at design working pressure. Brush joints with soapy water solution to check for leaks. Install a calibrated test pressure gage in piping system to observe any loss in pressure. Maintain required test pressure for a sufficient length of time to enable an inspection of joints and connections.

3.2.2.3 Operational Tests

Test equipment as in service to determine compliance with contract requirements and warranty. During the tests, test equipment under every condition of operation. Test safety controls to demonstrate performance of their required function. Completely test system for compliance with specifications.

-- End of Section --

SECTION 15621

WARM AIR HEATING 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 S1.4 (ASA 47)	1983 Sound Level Meters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 396	1990 (Rev. A) Fuel Oils
ASTM F 1040	1987 Filter Units, Air Conditioning: Viscous-Impingement and Dry Types, Replaceable

FEDERAL SPECIFICATIONS (FS)

FS WW-F-2743	Furnaces, Warm Air and Heaters, Unit, Forced Air Circulation, Oil- and Gas - Fired

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA DC 3	1989 Residential Controls - Electrical Wall-Mounted Room Thermostats

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	1987 Installation of Oil Burning Equipment
NFPA 54	1988 National Fuel Gas Code
NFPA 90A	1989 Installation of Air Conditioning and Ventilating Systems
NFPA 90B	1989 Installation of Warm Air Heating and Air Conditioning Systems
NFPA 211	1988 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, (SMACNA)

SMACNA HVACALTM	1985 HVAC Air Duct Leakage Test Manual

SMACNA HVACTAB	1983 HVAC Systems - Testing, Adjusting, and Balancing

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical 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. Central furnaces G

b. Air filters G

Include types and ratings of utilities required, efficiency of item under installed conditions, and size and mounting requirements.

1.3.2 SD-12, Field Test Reports

a. Operating tests G

b. Firing tests G

Submit field test reports in accordance with the paragraph entitled "Field Quality Control."

1.3.3 SD-13, Certificates

a. Central furnaces G

1.3.4 SD-18, Records

a. Posted operating instructions G

1.3.5 SD-19, Operations and Maintenance Manuals

a. Central furnaces, Data Package 3 G

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

1.4 POSTED OPERATING INSTRUCTIONS

Provide instructions for start-up, normal operating, shutdown, and emergency shutdown procedures.

PART 2 PRODUCTS

2.1 HEATING EQUIPMENT

Provide self-contained, indirect, oil-fired, forced-air, furnaces conforming to FS WW-F-2743. Heating equipment shall consist of a heat exchanger; burner; centrifugal blower; a sheet metal cabinet-type casing with provisions for duct, discharge-nozzle, and all required operating, limit, and safety controls. Equipment shall be suitable for burning light oil (Grade 2). Provide a 24-volt control transformers, high limit, and fan time delay relay. Minimum annual fuel utilization efficiency (AFUE) shall be 78 percent for 22,000 to 225,000 Btu/hr input capacities oil-fired units. The steady state efficiencies for 225,001 to 400,000 Btu/hr and over 400,000 Btu/hr input capacities gas-fired units shall not be less than 80 percent at maximum rated capacity and not less than 78 percent at minimum rated capacity that is provided and allowed by the controls. The steady state efficiencies for the same input capacities oil-fired units shall not be less than 81 percent at minimum rated capacity that is provided and allowed by the controls.

2.1.1 Central Furnaces

FS WW-F-2743 Type I of the upflow, high-boy style designed to supply heated air through a duct system.

2.1.2 Burners

Do not provide manually ignited type burners. Burners shall always return to low fire for ignition. Provide control system for high-low-off operation.

2.1.2.1 Oil Burners

The oil burner shall include motor, ignition equipment, safety devices, and accessories necessary for a fully automatic system that conforms to FS WW-F-2743. Furnish low oil-pressure switches in the fuel supply piping for oil-fired units equipped with programming controls. Provide a delayed opening oil shutoff valve, as specified in FS WW-F-2743, for oil-fired units not equipped with programming controls. Use fuel oil conforming to ASTM D 396 of grade specified. Burners shall be factory installed, wired, and fire tested.

2.2 ACCESSORY EQUIPMENT

2.2.1 Air Filters

2.2.1.1 Replaceable Units

a. Provide ASTM F 1040 Type 1, throw-away frames and media, Grade A and 1" thick. Form frames to provide positive support for the media pad and sufficient structural rigidity for normal handling and installation.

2.2.2 Thermostat

Provide wall mounted, low voltage type conforming to NEMA DC 3 with an operating range from 55 degrees F to 90 degrees F. Housing shall have concealed setpoint dials, covers with allen head screws with visible thermometers. The mounting plate or base shall be made of thermal insulating material or shall support the thermal element not less than 1/4 inch from the wall. The control unit of the thermostat shall consist of a temperature sensing element, control switch, and anticipating heater. The control switch shall be a hermetically-sealed switch. Thermostat shall have provisions for calibrating the unit to the accuracy specified in NEMA DC 3. The design shall preclude calibration adjustment with ordinary tools, such as screwdriver or pliers. When mercury switches ar used in the control unit, a leveling surface which is an integral part of the thermostat, shall be provided for use in leveling the thermostat during installation. Unless otherwise specified, a system selector switch having "heat" and "off" positions, and a fan selector switch having "auto" and "on" positions shall be provided integral to or mounted on a subbase of the thermostat.

2.3 FLUE CONNECTIONS

Flue connections shall be furnished as specified in FS WW-F-2743. Provide a draft regulator of the barometric-type for oil-fired draft control. Flue connections, including pipe and fittings, shall conform to NFPA 211 and shall be galvanized sheet steel having a nominal thickness not less than that required by NFPA 211. The weight of zinc-coating in ounces per square foot shall be not less than 1.25 commercial. If the standard flue connection on the furnace is other than the size specified for the furnace pipe, provide a suitable adapter. Provide suitable cleanouts to permit cleaning of the entire flue connection without dismantling.

2.3.1 Metal Chimneys

Design and construct to safely convey flue gases to the outside atmosphere. Provide parts and accessories designed for firm attachment to ensure strength, rigidity, and durability. Fire stops, thimbles, and support assemblies shall conform to the NFPA 211.

2.3.1.1 Metal Chimneys

Design for low and medium-heat appliances conforming to NFPA 211. Design and construct stacks to withstand a wind pressure of 30 pounds per square foot of surface based on 67 percent of the projected area. Provide cleanout opening with a tight-fitting, hinged, cast iron door and frame at the base of each stack.

a. Prefabricated Lined Stacks: Sectional type conforming to the applicable requirements of UL, for materials, heat tolerances, dimensions, and linings. The listing of chimneys in the UL, Gas and Oil Equipment Directory will be acceptable evidence that the stacks meet the requirements. In lieu of such listing, the Contractor may submit a written certificate from any nationally recognized testing agency that the stacks have been tested in

accordance with methods of testing of the UL, and conform to NFPA 211. Provide sections to be joined with acid-resisting high-temperature cement and steel draw bands. Provide roof housing, rain cap, downdraft diverter, and other accessories required.

b. Cleanout Doors: Provide galvanized cast iron, complete with frames, and unless otherwise indicated, sized to match flues. Provide the frames with a continuous flange and anchors for securing into masonry. Provide doors hinged as standard with the manufacturer and fastening devices to hold the door in the closed position.

2.4 WARM AIR CONNECTIONS

For central furnaces, provide discharge and return air ductwork, including air terminal devices, as specified in Section 15895, "Ductwork and Ductwork Accessories."

2.5 FUEL-OIL SYSTEM

Provide as specified in Section 15483 "Fuel Oil Handling System."

2.6 ELECTRICAL EQUIPMENT

Provide complete with motors, motor starters, thermal overload protection, and controls. Equipment and wiring shall be in accordance with Section 16402, "Interior Wiring Systems."

2.7 ASBESTOS PROHIBITION

Asbestos and asbestos containing products are prohibited.

PART 3 EXECUTION

3.1 PREPARATION

Provide storage for equipment and material at the project site. All parts shall be readily accessible for inspection, repair, and renewal. Protect materials and equipment from the weather.

3.2 INSTALLATION

Warm air heating system installation shall conform to the requirements contained in NFPA 90A or NFPA 90B, as applicable. Combustion air supply and ventilation shall be in accordance with NFPA 31 or NFPA 54, as applicable.

3.2.1 Furnace

Provide foundations, settings, or suspensions for mounting equipment and accessories, including but not limited to supports, vibration isolators, stands, guides, anchors, clamps, and brackets. Foundations and suspension for equipment shall conform to the recommendations of the manufacturer, unless otherwise indicated. Set anchor bolts and sleeves accurately using

templates. Provide anchor bolts and lag screws with welded-on plates on the head end and guard against damage until equipment is installed. Level bases using jacks or steel wedges, and when resting on concrete, neatly grout-in with a non-shrinking grout. Locate equipment as indicated and in such a manner that working space is available for all servicing, such as shaft removal, replacing or adjusting drives, motors or shaft seals, air filters, access to automatic controls and lubrication. Provide electrical isolation between dissimilar metals to minimize galvanic corrosion. Clean the interior of cabinets or casings before completion of installation. Prime all uncoated ferrous-metal work and apply a finish coat of paint as specified in Section 09900, "Painting."

3.2.2 Flue Connections

Connect furnace to the stack with the specified flue connections, draft regulators, draft hoods, as applicable, in accordance with NFPA 211.

3.2.3 Ductwork

Install as specified in Section 15895, "Ductwork and Ductwork Accessories."

3.2.4 Air Filters

Provide air filters where indicated. Do not operate fans or blowers until filters are installed. After completion of tests and before the building is accepted by the Government, provide a new set of throwaway filters, where utilized, or clean the permanent type filters.

3.3 FIELD QUALITY CONTROL

Inspect equipment when it is delivered to the job site. The right is reserved to inspect any equipment at the plant of the manufacturer, during or after manufacture. Inspect and repair all refractory after installation and prior to startup. Continually inspect equipment during installation, after installation, and during the tests. Upon completion and prior to acceptance, perform tests and furnish all necessary equipment and materials required for the tests as specified herein to demonstrate that warm air heating system is in compliance with contract requirements. Make all tests under the direction of the Contracting Officer. Read all indicating instruments at half-hour intervals.

3.3.1 Start-Up

Prior to start up, clean all equipment, adjust belts to proper tension, lubricate motors and pulley bearings, and install air filters. Adjust safety and operating controls as necessary to place them in proper operation and sequence.

3.3.2 Operating Tests

Perform the following operating tests to demonstrate satisfactory furnace operation. Check burner safety controls by simulating flame failure in accordance with the manufacturer's instructions. Operate furnace for a period sufficient to make the following observations and r cord the

following data but in no case less than on hour. These tests may be run concurrent with fire tests sp cified b low to the xtent practical. Demonstrate satisfactory operation of all heat-regulating controls and safety controls. Record temperature rise across the heat exchanger under all firing rates after equilibrium conditions have been reached at each firing rate. Record ammeter and voltmeter readings for the furnace motor and circulating blower motor.

3.3.3 Firing Tests

Test combustion controls and equipment with specified fuel at 100 percent rated load. Demonstrate satisfactory smoke-count numbers and combustion efficiency. Maintain firing for at least 4 hours, and where high-low-off combustion controls are provided, operate the furnace for one hour at low fire and 3 hours at high fire. During tests, verify proper operation of controls. Adjust burners for maximum efficiency using Orsat or similar apparatus. Record temperature rises across heat exchangers. Minimum requirements for satisfactory combustion efficiency shall be 10.0 percent carbon dioxide for oil burners. Minimum temperatures of flue gas at the stack shall be 100 degrees F above the flue-gas dew points. The observed smoke at all firing rates during the prescribed tests shall not exceed that indicated by a number 2 spot for the burners firing a distillate fuel or gas and a number 4 spot for burners firing a residual type fuel on the Shell-Bacharach scale.

3.3.4 Air Duct Leakage Test

Comply with SMACNA HVACALTM. Test ducts, plenums, and casings for air leakage. Prior to application of insulation, subject new ductwork to static pressure equivalent to that indicated. Before installing supply outlets, apply temporary caps where outlets will be connected. Connect a test blower temporarily to inlet end of duct and, by throttling its intake, adjust static pressure in duct to required value. Read voltage and current to blower motor and total static pressure across blower wheel. Apply data to AMCA certified performance table for the test blower to derive volumetric flow rate (cfm) of air injected into duct. Remove temporary caps and test blower. Verify the maximum allowable air leakage of the total air that duct is required to deliver. Perform the measurement of leakage using a calibrated orifice tube with its individual calibration curve.

3.4 TESTING, ADJUSTING, AND BALANCING

Perform in accordance with SMACNA HVACTAB, Chapter VII, "Air System TAB Procedures," to achieve and confirm compliance with drawings and specifications; prepare complete report of final test results.

3.4.1 Markings of Settings

Following final acceptance of the balancing report, the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked so that adjustment can be restored if disturbed at anytime.

3.4.2 Sound Level Tests

Upon completion of testing and balancing of air systems, conduct sound level tests of conditioned spaces. Use sound level meter required by ANSI S1.4 (ASA 47), Type 2, calibrated in accordance with NBS standards and guidelines, and accompanied by a certificate of calibration. Record sound levels in dBA with air systems off, with heating system only operating. Record the following data for each room and system:

a. Background sound level (systems off);

b. Total sound level corrected for background; and

c. Sound power rating by manufacturer of the respective outlet.

Test Locations: Take sound level reading at location 6 feet from face of each outlet on a line at 45 degrees with face of outlet. Remedial Action: If sound level at any observation point exceeds 45 dBA, take remedial action as directed.

-- End of Section --

SECTION 15850

AIR HANDLING EQUIPMENT

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.

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 210	1985 Fans for Rating
AMCA 300	1985 (R 1987) Certified Sound Rating Program for Air Moving Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code

UNDERWRITERS LABORATORIES INC. (UL)

UL 705	1984 (R 1990) Power Ventilators

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements," applies to this section with the 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. Fans G

Include sound rating data and sound power level for all octave-band center frequencies or loudness level.

1.3.2 SD-12, Field Test Reports

a. Preliminary tests

b. Air handling and distribution equipment tests

Include certification by the equipment manufacturer's representative.

1.3.3 SD-13, Certificates

a. Fans

1.3.4 SD-19, Operation and Maintenance Manuals

a. Fans, Data Package 3

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

PART 2 PRODUCTS

2.1 FANS

Sound rating in accordance with AMCA 300; statically and dynamically balanced, with air capacities, brake horsepowers, fan types, fan arrangement, sound power levels or loudness level, and static pressure. Fan bearing life shall have a minimum average life of 200,000 hours at design operating conditions. Provide nominal 2-mesh 0.063-inch wire diameter, aluminum bird screens for outdoor outlets. Equip with automatic (backdraft) dampers where indicated. Have thermal overload protection in the operating disconnect switches within the building. Construct housings and impellers of aluminum, except as specified otherwise. Provide non-sparking construction where indicated. For wiring terminations, provide terminal lugs to match branch circuit conductor quantities, sizes, and materials. Enclose terminal lugs in terminal box sized to NFPA 70.

2.1.1 Power Roof Ventilators

UL 705 with UL label and AMCA 210 with AMCA seal, centrifugal V-belt fans in spun aluminum housings high-impact plastic with glass fiber reinforcement. Equip motors with unfused safety disconnect switches mounted under fan housings and resilient mounts. Mount motors out of air stream. Provide gravity actuated, aluminum multiple blade construction backdraft damper and cast iron or steel sheaves, dynamically balanced and bored to fit shafts and keyed.

PART 3 EXECUTION

3.1 PREPARATION

Provide storage for equipment and materials at the project site. Parts shall be readily accessible for inspection, repair, and renewal. Protect materials and equipment from weather.

3.2 INSTALLATION

Install air distribution equipment as indicated and in accordance with the manufacturer's instructions. Provide clearance for inspection, repair, replacement, and service. Electrical work shall conform with NFPA 70

and Section 16402. Provide overload protection in the operating disconnect switches and magnetic starters. Locate air intake of air handling equipment at a minimum of 25 feet from industrial stacks, bathroom vents, and sanitary risers. Prevailing wind direction shall not be used as justification for placing air intake closer than 25 feet of exhaust stacks. Locate annunciator panel in maintenance office or foreman's office.

3.2.1 Power Ventilators

Secure roof exhausters with cadmium plated steel lag screws to roof curb. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

3.3 FIELD QUALITY CONTROL

Schedule and administer specified tests. Provide personnel, instruments, and equipment for such tests. Correct defects and repeat the respective inspection and tests. Give the Contracting Officer ample notice of the dates and times scheduled for tests and trial operations. Conduct inspection and testing in the presence of the Contracting Officer.

3.3.1 Inspection

Prior to initial operation, inspect equipment installation for conformance with drawings and specifications.

3.3.2 Preliminary Tests

For each item of air handling and distribution equipment and its components, perform an operational test for a minimum period of 4 hours.

3.3.3 Testing and Balancing

After preliminary tests, perform air handling and distribution equipment tests, adjustment, and balancing in accordance with Section 15996, "Testing/ Adjusting/Balancing: Heating/Ventilating/Cooling Systems".

-- End of Section --

SECTION 15895

DUCTWORK AND DUCTWORK ACCESSORIES

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.

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 500	1991 Louvers, Dampers and Shutters
AMCA 501	1985 Application Manual for Air Louvers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 527/A 527M	1990 Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock-Forming Quality
ASTM C 423	1990 (Rev. A) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 90	1990 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	1989 Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA DCS	1985 HVAC Duct Construction Standards - Metal and Flexible
SMACNA SRM	1991 Seismic Restraints Manual: Guidelines for Mechanical Systems
SMACNA HVACADLTM	1988 HVAC Air Duct Leakage Test Manual

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements," applies to this section with the additions and modifications specified herein.

1.3 PRESSURE CLASSIFICATION

SMACNA DCS, Section 1, and as indicated.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Dampers

b. Louvers

c. Diffusers, registers, and grilles

d. Metal ducts

1.4.2 SD-04, Drawings

a. Duct hangers and supports details

1.4.3 SD-05, Design Data

a. Duct span versus reinforcement schedule

1.4.3.1 Duct Span Versus Reinforcement Schedule

Submit maximum duct dimension, board stiffness rating, board thickness, type and spacing of reinforcement, and maximum duct static pressure.

1.4.4 SD-06, Instructions

a. Ductwork and ductwork accessories

1.4.4.1 Ductwork and Ductwork Accessories

Including job inspection checklist, methods of on-site storage and handling, and recommended repair methods.

1.4.5 SD-07, Schedules

a. Diffusers, registers, and grilles

b. Duct hangers and supports

Submit a schedule of inlets and outlets indicating location, catalog model

number, manufacturer, dim nsional information, sound pressure level rating, nominal rated volumetric flow rate (cfm), neck or face velocity at specified cfm, pressure drop at specified cfm, throw and drop for outlets, range for diffusers, and maximum and minimum cfm modulation.

1. 4.6 SD-10, Test Reports

a. Sound pressure level rating

b. Louvers

1.4.6.1 Sound Pressure Level Rating

Submit for inlets and outlets including diffusers, registers and grilles.

1.4.7 SD-11, Factory Test Reports

a. Plenum or casing acoustical tests

1.4.7.1 Plenum or Casing Acoustical Tests

Submit as required in paragraph entitled "Casings and Plenums."

1.4.8 SD-12, Field Test Reports

a. Air duct leakage tests

1.5 QUALITY ASSURANCE

1.5.1 Modification of References

SMACNA Duct Construction Manuals: The SMACNA recommendations shall be considered as mandatory requirements. Substitute the word "shall" for the word "should" in these manuals.

PART 2 PRODUCTS

2.1 METAL DUCTS

2.1.1 Steel Ducts

ASTM A 527/A 527M galvanized steel sheet, lock-forming quality; coating designation G90.

2.2 DUCTS OF PRESSURE CLASSES 3-INCH OR LESS WATER GAGE

Construction, metal gage, hangers and supports, and reinforcements shall conform with SMACNA DCS, except that ducts with pressure classifications below 2 inch water gage that are located outside of the conditioned space shall have a seal class C. Ductwork shall be airtight and shall not vibrate or pulsate when system is in operation. Pressure sensitive tape shall not be used as a primary sealant on ductwork with pressure classifications above one inch water gage. Air leakage shall be less than 5 percent of the system capacity. Construct ductwork of galvanized steel.

2.2.1 Curved Elbows

Make a centerline radius not less than 1 1/2 times the width or diameter of the duct.

2.2.2 Laps

Make laps at joints in the direction of air flow. Space button-punch or bolt-connection in standing seams at fixed centers not greater than 6 inches. Longitudinal locks or seams, known as "button-punch snap-lock," may be used in lieu of Pittsburg Lock.

2.2.3 Fittings

Elbows, vaned elbows, take-offs, branch connections, transitions, splitters, volume dampers, fire dampers, flexible connections, and access doors shall conform with SMACNA DCS, Section 2. Provide factory fabricated airtight, and noncorrosive test holes with screw cap and gasket.

2.3 CASINGS AND PLENUMS

Factory fabricated components with field installation. Furnish certified testing data from plenum or casing manufacturer obtainable directly from an independent acoustical laboratory, listing sound absorption and transmission loss characteristics of panel assembly. Sound absorption coefficients and sound transmission loss, determined by an independent laboratory, shall be in accordance with ASTM C 423 and ASTM E 90 respectively.

2.4 DIFFUSERS, REGISTERS, AND GRILLES

2.4.1 Material and Finishes

Provide factory-furnished diffusers, registers, and grilles constructed of steel. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Steel parts shall be factory zinc phosphate treated prior to priming and painting or have a baked-on enamel finish. Colors shall be selected or approved by Contracting Officer.

2.4.2 Sound Pressure Level

Manufacturer certified sound pressure level rating of inlets and outlets. Conform with the following permissible room sound pressure levels:

NC Range, dB	Typical Application
55	Heating and Ventilating

2.4.3 Throw

The distance from the diffuser, register, or grille to the point which the air velocity falls below 100 feet per minute shall not exceed 1.5 times the outlet mounting height.

2.4.4 Drop

Maximum drop of air stream shall not be within 6 feet of the floor at the end of the throw.

2.4.5 Registers

Double-deflection supply registers. Provide manufacturer-furnished volume dampers. Volume dampers shall be of the group-operated, opposed-blade type and key adjustable by inserting key through face of register. Operating mechanism shall not project through any part of the register face. Automatic volume control devices will be acceptable. Provide exhaust and return registers as specified for supply registers, except that exhaust and return registers shall have a single set of nondirectional face bars or vanes having the same appearance as the supply registers.

2.4.6 Grilles

Construct and finish as specified above for registers, except that volume dampers shall be omitted.

2.5 DUCT SLEEVES, PREPARED OPENINGS, AND CLOSURE COLLARS

2.5.1 Duct Sleeves

Fabricate from minimum 20-gage galvanized steel. Where sleeves are installed in bearing walls, provide structural steel sleeves as indicated. Size sleeves to provide one-inch clearance between duct and sleeve or between insulation and sleeve for insulated ducts.

2.5.2 Prepar d Openings

Provide one-inch clearance between the duct and the sleeve, or one-inch clearance between insulation and sleeve for insulated ducts except at grilles, registers, and diffusers.

2.5.3 Closure Collars

Four inches wide minimum, fabricated from minimum 20-gage galvanized steel.

2.6 DEFLECTORS

Factory-fabricated and factory- or field-assembled units consisting of curved turning vanes or scoop type extractors for uniform air distribution and change of direction with minimum turbulence and pressure loss. Provide curved vanes for square elbows. For round ducts taking off from rectangular ducts, provide factory fabricated, galvanized sheet metal, spin-in fittings. These fittings shall have scoop extractors, butterfly dampers, and locking quadrant operators.

2.7 DAMPERS AND LOUVERS

Construct dampers and louvers with galvanized sheet metal two gages heavier than ducts in which installed. Except as modified herein, the construction shall be of aluminum or galvanized steel with interlocking edges and maximum 10-inch blade width. Conform with SMACNA DCS. Dampers shall be opposed-blade type where indicated.

2.7.1 Backdraft Dampers (Gravity Dampers or Shutters)

Factory-fabricated, with statically balanced blades that open automatically when the fan starts and close by gravity when the fan stops. Provide th edges of blades with felt or rubber strips to prevent rattling.

2.7.2 Splitter Manual Volume Dampers

Balancing, factory-fabricated type. Equip dampers with accessible mechanism such as quadrant operators or 3/16-inch rods brought through the side of ducts with locking setscrew and bushing. Where quadrant operators are furnished, provide chrome plated or enamel painted type with exposed edges rounded.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to NFPA 90A, SMACNA DCS and SMACNA FGDCS. Provide mounting and supporting of ductwork and accessories including, but not limited to, structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors, and dampers. Provide electrical isolation between dissimilar metals. Electrical isolation may be fluorinated elastomers or sponge-rubber gaskets. Install ductwork accessories as indicated and as recommended by manufacturer's printed instruction. Allow clearance for inspection, repair, replacement, and

service. Louvers in accordance with AMCA 501.

3.1.1 Ductwork

Air distribution systems shall operate with no chatter or vibration.

3.1.1.1 Field Changes to Ductwork

Those required to suit the sizes of factory-fabricated equipment actually furnished, shall be designed to minimize expansion and contraction. Use gradual transitions in field changes as well as modifications to connecting ducts.

3.1.1.2 Dampers

When installed on ducts to be thermally insulated, equip each damper operator with stand-off mounting brackets, bases, or adapters to provide clearance between the duct and operator not less than the thickness of insulation. Stand-off mounting items shall be integral with the operator or standard accessory of damper manufacturer.

3.1.1.3 Deflectors

Provide in square elbows, duct-mounted supply outlets, take-off or extension collars to supply outlets, and tap-in branch-off connections. Adjust supply outlets to provide air volume and distribution as indicated or specified.

3.1.1.4 Access Doors

Provide for automatic dampers, volume dampers, fire dampers, coils, thermostats, temperature controllers, valves, filters, humidifiers and other concealed apparatus requiring service and inspection in the duct systems, as specified in Section 05500.

3.1.1.5 Duct Sleeves, Prepared Openings, and Closure Collars

Provide for ductwork penetrations in floors, walls, and partitions through which metallic ductwork passes.

a. Duct Sleeves: Fill space between duct and sleeve or between insulation and sleeve for insulated ducts with mineral fiber, except at grilles, registers, and diffusers.

b. Prepared Openings: Fill space between duct and opening or between insulation and opening for insulated ducts with mineral fiber, except at grilles, registers, and diffusers.

c. Closure Collars: Fit collars snugly around ducts or insulation. Grind edges of collar smooth to preclude tearing or puncturing insulation covering or vapor barrier. Provide nails with maximum 6-inch centers on collars.

3.1.1.6 Packing

Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber.

3.1.2 Duct Hangers and Supports

SMACNA DCS, Section 4. Provide seismic restraint complying with SMACNA SRM. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable intermediate metal framing. Provide retainer clips where C clamps are used.

3.1.2.1 Flexible Connectors

Provide flexible connectors between fans and ducts or casings and where ducts are of dissimilar metals as indicated. For round ducts, securely fasten flexible connectors by zinc-coated steel clinch-type draw-bands. For rectangular ducts, lock flexible connectors to metal collars.

3.1.3 Inspection Plates and Test Holes

Provide, where required, in ductwork or casings for all balance measurements. If possible, test holes should be located at least 7.5 times diameters downstream from a disturbance. Extend cap through insulation.

3.1.4 Flashing

Provide waterproof flashing where ducts pass through exterior walls and roofs.

3.1.5 Cleaning of Ducts

Remove all debris and dirt from ducts and wipe clean. Before installing air outlets, force air through entire system at maximum attainable velocity to remove accumulated dust. Provide temporary air filters to protect ductwork which may be harmed by excessive dirt. For large systems, clean duct with high power vacuum machines.

3.2 FIELD QUALITY CONTROL

Administer and direct tests. Furnish instruments, equipment, connecting devices, and personnel for the tests. Notify Contracting Officer 3 days before inspection or testing is scheduled. Correct defects in work. Repeat tests until work is in compliance.

3.2.1 Air Duct Leakage Tests

Comply with SMACNA HVACADLTM. Test ducts, plenums, and casings for air leakage. Prior to application of insulation, subject new ductwork to static pressure equivalent to that indicated. Before installing supply outlets, apply temporary caps where outlets will be connected. Connect a test blower temporarily to inlet end of duct and, by throttling

its intake, adjust static pressure in duct to required value. Read voltage and current to blower motor, total static pressure across blower wheel, and fan rpm. Apply data to AMCA certified performance table for the test blower to derive volumetric flow rate (cfm) of air injected into duct. Remove temporary caps and test blower. Verify the maximum allowable air leakage of the total air that duct is required to deliver. Perform the measurement of leakage using a calibrated orifice tube with its individual calibration curve.

-- End of Section --

SECTION 15996

TESTING/ADJUSTING/BALANCING: HEATING/VENTILATING/COOLING 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.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	1989 National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning System

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.4 (ASA 47)	1983 Sound Level Meters
ANSI S1.11 (ASA 65)	1986 Octave- Band and Fractional-Octave-Band Analog and Digital Filters

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE HSA	1987 (Errata 1988 and 1989) (Correction 1990) Handbook, HVAC Systems and Applications

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB PSTABES	1983 Testing, Adjusting, Balancing of Environmental Systems
NEBB PSMSV	1977 Measuring Sound and Vibration

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA HVACADLTM	1988 HVAC Air Duct Leakage Test Manual
SMACNA HVACTAB	1983 HVAC Systems - Testing, Adjusting and Balancing

1.2 DESCRIPTION OF WORK

The work includes testing, adjusting, and balancing (TAB) of heating, ventilating, air distribution systems including equipment, ducts, and piping which are located within, on, under, between, and adjacent to buildings.

1.2.1 Air Distribution Systems

Systems shall be tested, adjusted, and balanced (TAB'd) in compliance with this section.

1.3 DEFINITIONS

a. DALT: Duct air leakage testing

b. DALT'd: Duct air leakage tested

c. Sound measurements terminology: Defined in AABC MN-1 or NEBB PSMSV.

d. TAB team supervisor: TAB team engineer.

e. TAB team technician: TAB team assistant.

f. Field check group: One or more systems of the same basic type; the subgroup of a "field check group" is a "system."

g. Out-of-tolerance data: Pertains only to field checking of certified DALT or TAB report. The term is defined as a measurement taken during field checking which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the certified DALT or TAB report for a specific parameter.

h. Season of maximum heating load: Time of year when outdoor ambient temperature at equipment installation site remains within following range throughout the period of data recording for TAB work. Indicated winter outdoor design dry bulb temperature plus 30 to minus 30 degrees Fahrenheit.

1.4 SUBMITTALS

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

1.4.1 SD-08, Statements

a. Independent TAB agency personnel qualifications

b. Design review report

c. Pre-field DALT preliminary notification

d. Pre-field TAB engineering report

e. Advanced notice for DALT field work

f. Advanced notice for Season 1 TAB field work

g. Check out list for Season 1

h. Advanced notice for Season 2 TAB field work

i. Check out list for Season 2

j. Pre-final DALT report

k. Final certified DALT report

1.4.1.1 Independent TAB Agency Personnel Qualifications

For either type of agency proposed for approval, submit information certifying that: The TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract; the work to be perform by the TAB agency shall be limited to testing, adjusting, and balancing of HVAC air and water systems to satisfy the requirements of this specification section.

Submit following for one of the two types of agencies to Contracting Officer for approval in compliance with Appendix B, "TAB Personnel Qualification Requirements."

a. Independent AABC or NEBB certified TAB agency:

(1) TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification.

(2) TAB team supervisor: Name and copy of AABC or NEBB TAB supervisor certificate and expiration date of current certification.

(3) TAB team field leader: Name and documented evidence that the team field leader meets the qualification requirements.

(4) TAB team field technicians: Names and documented evidence that each field technician meets the qualification requirements.

(5) Current certificates: Registrations and certifications shall be current, and valid for the duration of this contract. Certifications which expire prior to completion of the TAB work, shall be renewed in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification shall not perform TAB work on this contract.

b. Independent experienced TAB agency:

(1) Duration of agency experience: Documented evidence verifying that the agency meets the qualification requirements.

(2) Type of agency experience: Documented evidence of acceptable completion of TAB work which meet the qualification requirements. Submitted evidence shall include:

(a) Reports: The complete TAB reports accepted by the owner or owner's representative for each system offered as

experience. Project TAB report forms with formats other than AABC or NEBB forms may be acceptable if on review by the Contracting Officer, the reports are found to include reporting of HVAC system parameters to the extent required by AABC or NEBB TAB report forms.

(b) Locations: Name and address of building in which each system is located. Name and telephone number of the present maintenance manager of each system. This information will be used to evaluate the actual results in the field of the TAB work offered as experience, and will be considered by the Contracting Officer in approving or disapproving the subject submittal.

(3) P.E. Endorsements: Letters of endorsement from three registered Professional Engineers (P.E.) versed in the field of HVAC design and construction and who are legally independent of the TAB agency. These endorsements shall hav been written no more than 3 years prior to this contract's bid opening date. The letters shall endorse the TAB agency. Letters of endorsement of an individual, who is currently a full-time employee of the TAB agency, will not be acceptable as the agency endorsements. Additionally, each endorsement shall include the endorser's typed name, his signature, the typed date of his signature, and the imprint of his registered P.E. seal.

(4) Instruments List: A list of instruments owned by the agency, with the following information detailed for each instrument: manufacturer's name and model number, serial number, and last calibration date.

(5) TAB team supervisor: Name and documented evidence that supervisor meets the qualification requirements.

(6) TAB Team field leader: Name and documented evidence that leader meets the qualification requirements.

(7) TAB team field technicians: Names and documented evidence that each technician meets the qualification requirements.

c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.4.1.2 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.4.1.3 Pre-Field DALT Preliminary Notification

a. Notification: On completion of the duct installation for each system, the Contractor shall notify the Contracting Officer in writing within 5 days after completion.

b. Duct testing: The Contracting Officer shall randomly select sections of the completed duct system for testing by the Contractor. The sections selected shall not exceed more that 20 percent of the total measured linear footage of supply, return, exhaust or plenum duct length. Sections of main ducts, branch main ducts, branch ducts and plenums are subject to testing. From time of receipt of the Contractor's notification of system completion, the Contracting Officer shall provide the Contractor within 7 working days selected locations of duct sections which are to be tested.

c. DALT testing: All DALT testing shall be in accordance with SMACNA HVACADLTM.

1.4.1.4 Pre-Field TAB Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

(1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.

(2) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit AABC or NEBB or SMACNA HVACTAB data report forms with the following pre-field information filled in:

(1) Design data obtained from system drawings, specifications, and approved submittals.

(2) Notations detailing additional data to be obtained from the contract site by the TAB field team.

(3) Locations of planned Pitot traverses of duct mains and branches, calculated velocities, and duct Pitot traverse test report forms already set up.

(4) Designate the actual data to be measured in the TAB field work.

(5) Provide a list of the types of instruments, and the measuring range of each, which ar anticipated to be used for measuring

in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each it m of TAB data. If th selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. The instrument key number shall be placed in the blank space where the measured data would be entered.

c. Prerequisite HVAC work checkout list: A list of inspections and work items which are to be completed by the Contractor, and submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site. At a minimum, a list of the applicable inspections and work items listed in the NEBB PSTABES, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection." Also, list as prerequisite work items, the deficiencies pointed out by the TAB engineer in his design review report.

1.4.1.5 Advanced Notices

a. Submit "Advanced Notice for DALT Field Work" in writing.

b. Submit "Advanced Notice for Season 1 TAB Field Work" in writing.

c. Submit "Advanced Notice for Season 2 TAB Field Work" in writing.

d. Pre-field DALT preliminary notification.

1.4.1.6 Completed Check Out Lists

a. Check out list for Season 1

b. Check out list for Season 2

Submit "Prerequisite HVAC Work Checkout List" and certify in writing that each item has been checked and is operating as designed.

1.4.2 SD-12, Field Test Reports

a. Certified DALT report

b. Certified TAB report for Season 1

c. Certified TAB report for Season 2

Submit certified reports in the specified format including the above data.

1.4.2.1 Certified DALT Report

a. Report format: Submit report data on Air Duct Leakage Test Summary Report Forms as shown on Page 6-2 of SMACNA HVACADLTM. In addition, submit in the report, a marked duct shop drawing which

identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section. The report shall be reviewed and certified by the TAB supervisor.

b. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

c. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

1.4.2.2 Certified TAB Reports

Submit Certified TAB Report for Season 1 and Certified TAB Report for Season 2 in the following manner:

a. Report format: Submit the completed pre-field data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed and certified by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.

b. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded.

c. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

d. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

1.5 QUALITY ASSURANCE

1.5.1 Modifications of References

Accomplish work in accordance with referenced publications of AABC or NEBB except as modified by this section. In the references referred to herein, 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 "authority having jurisdiction," the "Administrative Authority," the "Owner," or the "Design Engineer" to mean the "Contracting Officer."

1.5.2 Responsibilities

The Contractor shall be responsible for ensuring compliance with the requirements of this section. The following delineation of specific work responsibilities is specified to facilitate execution of the various work efforts by personnel from separate organizations. This breakdown of specific duties is specified to facilitate adherence to the schedule listed in Appendix A.

1.5.2.1 Contractor

a. TAB personnel: Ensure that the DALT work and the TAB work is accomplished by either of the following groups provided they meet the applicable requirements specified in Appendix B.

   (1) Independent AABC or NEBB certified TAB agency

   (2) Independent experienced TAB agency

b. Pre-DALT/TAB meeting: Attend the meeting with the TAB supervisor.

c. HVAC documentation: Furnish one complete set of the following HVAC-related documentation to the TAB Agency:

   (1) Contract drawings and specifications

   (2) Approved submittal data for equipment

   (3) Construction work schedule

   (4) Up-to-date revisions and change orders for the previously listed items

d. Submittal and work schedules: Ensure that the schedule for submittals and work required by this section and specified in Appendix A, is met.

e. Coordination of supporting personnel: Provide the technical personnel, such as factory representatives or HVAC controls installer required by the TAB field team to support the DALT and TAB field measurement work. Provide equipment mechanics to operate HVAC equipment to enable TAB field team to accomplish the DALT and TAB field measurement work. Ensure these support personnel are present at the times required by the TAB team, and cause no delay in the DALT and TAB field work. Conversely, ensure that the HVAC controls installer has required support from the TAB team field leader to complete the controls check out.

f. Deficiencies: Ensure that equipment defects, installation deficiencies, and design deficiencies reported by the TAB team field leader are brought to the attention of the Contracting Officer. Ensure that design deficiencies reported by the TAB field leader, or the TAB team supervisor, are transmitted to the Contracting Officer within 4 calendar days from date of receipt from the TAB agency.

g. Prerequisite HVAC work: Complete ch ck out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report. List as prerequisite work items, the deficiencies, pointed out by the TAB team supervisor in the design review report. Ensure that the TAB Agency gets a copy of the prerequisite HVAC work checklist specified in the paragraph entitled, "Submittals." Do not allow the TAB team to commence TAB field work until all of the following are completed.

(1) HVAC system installations are fully complete.

(2) HVAC prerequisite checkout work lists have been completed, submitted, and approved.

(3) DALT field checks for all systems are completed.

h. Advance notice: Furnish to the Contracting Officer with advance written notice for each event, the commencement of the DALT field work and for the commencement of the TAB field work.

1.5.2.2 TAB Agency

Provide the services of a TAB team which complies with the requirements of Appendix B.

1.5.2.3 TAB Team Supervisor

a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.

b. Pre-DALT/TAB meeting: Attend meeting with Contractor.

c. Design review report: Review project specifications and accompanying drawings to verify that the air systems and water systems are designed in such a way that the TAB engineer can accomplish the work in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.

d. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the

pre-field engineering report, the pre-field DALT plan or during the DALT or TAB field work.

e. Pre-field DALT preliminary notification: Monitor the completion of the duct installation of each system and provide the necessary written notification to the Contracting Officer.

f. Pre-field engineering report: Utilizing the following HVAC-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.

g. Prerequisite HVAC work checklist: Ensure the Contractor gets a copy of this checklist at the same time as the pre-field engineering report is submitted.

h. Technical assistance for DALT work

(1) Technical assistance: Provide immediate technical assistance to TAB field team.

(2) DALT field visit: Near the end of the DALT field work effort, visit the contract site to inspect the HVAC installation and the progress of the DALT field work. Conduct a site visit to the extent necessary to verify correct procedures are being implemented and to confirm the accuracy of the pre-final DALT Report data which has been reported. Also, sufficient evaluation shall be made to allow the TAB supervisor to issue certification of the final report.

i. Certified DALT report: Certify the DALT report. This certification includes the following work:

(1) Review: Review the DALT Pre-final report data. From these field reports, prepare the certified DALT report.

(2) Verification: Verify adherence, by the TAB field team, to the procedures specified in this section.

j. Technical Assistance for TAB Work: Provide immediate technical assistance to the TAB field team for the TAB work.

(1) TAB field visit: At the midpoint of the Season 1 and Season 2 TAB field work effort, visit the contract site to inspect the HVAC installation and the progress of the TAB field work. Conduct site visit full-time for a minimum of one 8-hour workday duration.

k. Certified TAB report: Certify the TAB report. This certification includes the following work:

(1) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.

(2) Verification: Verify adherence, by the TAB field team, to the

TAB plan prescribed by the pr -field engineering report and verify adherence to the procedures specified in this section.

l. Design deficiencies: Submit in writing as soon as possible, to the Contractor and the Contracting Officer, each design deficiency reported by the TAB field team. Provide, in this submittal, a complete explanation including supporting documentation detailing the deficiency.

m. TAB Field Check: The TAB team supervisor shall attend and supervise Season 1 TAB field check.

1.7.2.4 TAB Team Field Leader

a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution".

b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.

c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC Checklist, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

1.8 PRE-DALT/TAB MEETING

Meet with the Contracting Officer's TAB representative to develop a mutual understanding relative to the details of the DALT work and TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 DALT PROCEDURES

3.1.1 DALT Field Work

Leak test the HVAC air ducts and sections of each system as selected by th Contracting Officer. Accomplish leak tests in accordance with SMACNA HVACADLTM, except as modified by this section. Use the duct class, seal class, leakage class and the leak test pressure data indicated on the drawings, to comply with the procedures specified in SMACNA HVACADLTM. Provide instruments and consumables required to accomplish the DALT field work. Follow the same basic, procedure specified below in paragraph "TAB Field Work," which include maintenance of and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship and treatment of deficiencies.

3.1.2 Data From DALT Field Work

After completion of the DALT work, prepare a pre-final DALT report using the reporting forms specified. Data required by those data report forms shall be furnished by the TAB team. Prepare the report neatly and legibly; the pre-final DALT report shall be the final DALT report minus the TAB supervisor's review and certification. Verbally notify the Contracting Officer's TAB representative that the field check of the pre-final DALT report data can commence; give this verbal notice 48 hours in advance of when the field checking shall commence.

3.1.3 Quality Assurance for DALT Field Work

a. Field Check

(1) Pre-final DALT report data: Field check for accuracy, in the presence of the Contracting Officer's TAB representative, the pre-final DALT report data for each system. The TAB team field leader shall be present full-time when the field check of 50 percent of the duct sections for each duct system reported shall be conducted. Pre-final report field checks may be conducted separately for each system to allow phas d testing.

(2) Additional system field check: If any data on the DALT report form for a given duct section is out-of-tolerance, then data for one more duct section will be checked. The additional duct section to be checked shall be in addition to the original 50 percent of duct sections to be checked.

(3) Out-of-tolerance: If more than 15 percent of the duct sections checked for a given system are determined to be out-of-tolerance, testing shall be terminated and the pre-final DALT report data for the given system shall be disapproved.

b. Additional field checks: If during the random field checks of the pre-final DALT report data is determined to be out-of-tolerance, the Contractor shall make the necessary corrections and prepare a revised pre-final DALTS report. A field check of the revised report data shall then be rescheduled with the Contracting Officer's TAB representative.

c. Final certified DALT report: On successful completion of all field checks of the pre-final DALT report data for all systems, the TABS Supervisor shall assemble, review, certify and submit the final certified DALT Report.

d. Prerequisite to TAB Field Work: Upon completion of DALT work, field check and correction of outstanding items, including additional field checks, submit the final certified DALT report for Contracting Officer approval. No TAB field work shall commence prior to the completion and approval, for all systems, of the pre-final DALT report field check.

3.2 TAB PROCEDURES

3.2.1 TAB Field Work

Test, adjust, and balance the listed HVAC systems to the state of operation indicated on and specified in the contract design documents. Air systems and water systems shall be proportionately balanced and reported in the Season 1 certified TAB report. Only water and airflow report data which would be affected in terms of accuracy due to outside ambient conditions shall be deferred and reported in the Season 2 certified TAB report. Provide instruments and consumables required to accomplish the TAB work. Conduct TAB work, including sound measurement work, on the listed HVAC systems in conformance with the AABC MN-1, or NEBB PSTABES, and NEBB PSMSV, except as modified by this section:

a. Maintenance and calibration of instruments.

b. Accuracy of measurements.

c. Preliminary procedures: Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. Plan TAB field procedures, including selecting locations for TAB test ports and accesses, and record preliminary field data.

d. Air distribution systems TAB work:

(1) Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, terminal units, and air distribution devices for supply air, return air, outside air, mixed air relief air, and makeup air.

(2) Heating and ventilating unit systems including fans, coils, ducts, plenums, roof vents, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

(3) Exhaust fan system including fans, ducts, plenums, grilles, and hoods for exhaust air.

e. Sound measurement work:

(1) Areas to be sound measured: Measure and record the A-weighted sound level (dBA) in each room.

(2) Procedure: At the time the sound level is measured, each room shall be unoccupied, except for TAB team, and all HVAC systems that would cause noise in the room shall be operating in their noisiest mode. When a dBA measurement is above the recommended indoor design goal of ASHRAE HSA, then measure and record the sound level (dB) in each octave. Attempt to mitigate the sound level and bring the level to within the specified ASHRAE goals, if such mitigation is within the TAB team's control. If sound level cannot be

brought into compliance, provide written notice of the deficiency to the Contractor for resolution or correction.

(3) Timing: Sound levels shall be measured at times prescribed by AABC or NEBB.

(4) Meters: Measure sound levels with a sound meter complying with ANSI S1.4 (ASA 47), Type 1 or 2, and an octave band filter set complying with ANSI S1.11 (ASA 65). Measurement methods for overall sound levels and for octave band sound levels shall be as prescribed by NEBB.

(5) Calibration: Sound levels shall be calibrated as prescribed by AABC or NEBB except that calibrators emitting a sound pressure level tone of 94 dB at 1000 hertz (Hz) are also acceptable.

(6) Background noise correction: Determine background noise component of room sound (noise) levels for each (of eight) octave bands as prescribed by AABC or NEBB.

f. TAB work on performance tests:

(1) Performance tests: In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the heating systems.

(2) Ambient temperatures: On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. That is, record these temperatures at beginning and at the end of data taking.

(3) Cooling tower: Perform a cooling tower performance test in accordance with the acceptance test code for Water Cooling Towers, CTI ATC-105 utilizing report forms and documentation as described in AABC MN-1, Chapter 22.

g. TAB work within seasonal limitations:

(1) Performance tests: Accomplish proportionate balancing TAB work on the air distribution systems and water distribution systems, in other words, accomplish adjusting and balancing of the air flows and water flows, any time during the duration of this contract, subject to the limitations specified elsewhere in this section. However, accomplish, within the following seasonal limitations, TAB work on HVAC systems which directly transfer thermal energy.

(2) Season of maximum load: Visit the contract site for at least one TAB work sessions for TAB field measurements.

(3) Sound measurements within seasonal limitations: Comply with paragraph titled, "Sound Measurement Work," specifically, the requirement that a room must be operating in its noisiest mode at the time of sound measurements in the room. The maximum noise level measurements could depend on seasonally related heat or cooling transfer equipment.

(4) Ambient temperatures: On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. That is, record these temperatures at beginning and at the end of data taking.

h. Workmanship: Conduct TAB work on specified HVAC systems until measured parameters are within plus or minus 10 percent of the design values, that is, the values specified or indicated on the contract documents.

i. Deficiencies: Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled, "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction. Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.2.2 Data From TAB Field Work

After completion of the TAB work, prepare a pre-final TAB report using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph titled, "Workmanship" of this section. Prepare the report neatly and legibly; the pre-final TAB report shall be the final TAB report minus the TAB supervisor's review and certification. Obtain, at the contract site, the TAB supervisor's review and certification of the TAB report. Verbally notify the Contracting Officer's TAB representative that the field check of the certified TAB report data can commence; give this verbal notice 48 hours in advance of when the field checking shall commence. Do not schedule field check of the certified TAB report until the specified workmanship requirements have been met or written approval of the deviations from the requirements have been received from the Contracting Officer.

3.2.3 Quality Assurance For TAB Field Work

a. Field check: Test shall be made to demonstrate that capacities and general performance of air and water systems comply with the contract requirements.

(1) Recheck: During field check, the Contractor shall recheck, in the presence of the Contracting Officer, random selections of data (water, air quantities, air motion, sound level readings) recorded in the certified report.

(2) Areas of recheck: Points and areas of recheck shall be selected by the Contracting Officer.

(3) Procedures: Measurement and test procedures shall be the same as approved for work for forming basis of the certified report.

(4) Recheck selections: Selections for recheck will not exceed 25 percent of the total number of reported data entries tabulated in the report.

b. Retests: If random tests reveals a measured quantity which is out-of-tolerance, the report is subject to disapproval at the Contracting Officers discretion. In the event the report is disapproved, all systems shall be readjusted and tested, new data recorded, new certified reports submitted, and a new field check conducted at no additional cost to the Government.

c. Approval prerequisite: Compliance with the field checking requirements of this section is a prerequisite to the final approval of the certified TAB report submitted.

3.3 MARKING OF SETTINGS

Permanently mark the settings of HVAC adjustment devices including splitters, and dampers so that adjustment can be restored if disturbed at any time. The permanent markings shall indicate the settings on the adjustment devices which result in the data reported on the submitted certified TAB report.

3.4 MARKING OF TEST PORTS

The TAB team shall permanently and legibly mark and identify the location points of the duct test ports.

-- End of Section --

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 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.

1.4.1 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.

1.4.2 Drawings

Submit drawings a minimum of 14 inches by 20 inches in size using a minimum scale of 1/8 inch per foot. 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.

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

1.4.4 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 b 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.

1.4.4.1 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.

1.4.4.2 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.

1.4.5 Operation and Maintenance Manuals

Comply with the requirements of Section 01730 and the technical sections.

1.4.5.1 Operating Instructions

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

1.5 QUALITY ASSURANCE

1.5.1 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 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.

1.5.2 Regulatory Requirements

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

1.5.3 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.

1.5.4 Service Support

The equipment items shall be supported by service organizations which ar 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. 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.

1.5.5 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.

1.5.6 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.

1.6 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.

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.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. 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.

1.7 NAMEPLATES

FS L-P-387. Provide laminated plastic nameplates for each panelboard, equipment enclosure, relay, switch, and device. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 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 1 by 2.5 inches. Lettering shall be a minimum of 0.25-inch high normal block style.

1.8 WARNING SIGNS

Provide warning signs for the enclosures of electrical, transformers, having a nominal rating exceeding 600 volts. Provide metal signs having nominal dimensions of 14 inches by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 3-inch high white letters on a red and black field.

1.9 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each cable or wire located in manholes, handholes, and vaults. Tag only new wire and cable provided by this contract. The tags shall be polyethylene. Do not provide handwritten letters. As an example, a tag could have the following designation: "11.5 NAS 1-80A500," denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, Phas A, sized at 500 MCM.

1.9 .1 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 4500 pounds per square inch; and that are 0.035-inch thick, non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 300 degrees F. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 175 pounds. The cable tags shall have block letters, numbers, and symbols one-inch high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

1.10 ELECTRICAL REQUIREMENTS

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

1.10.1 Motors and Equipment

Provide electrical components of mechanical equipment, such as motors, motor starters, control or push-button stations, float or pressure switches, solenoid valves, and other devices functioning to control mechanical equipment, including control wiring and conduit for circuits rated 100 volts or less, to conform with the requirements of the section covering the mechanical equipment. Extended voltage range motors will not be permitted. The interconnecting power wiring and conduit, control wiring rated 120 volts (nominal) and conduit.

Provide motors, controllers, integral disconnects, and contactors with their respective pieces of equipment, except controllers indicated as part of the motor control centers shall be provided under Section 16402, "Interior Wiring Systems". Extended voltage range motors shall not be permitted. 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. As an exception to these requirements, provide disconnect switches, contactors, and controllers for existing motor-operated equipment under Section 16402, "Interior Wiring Systems."

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, and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to equipment under Section 16402, "Interior Wiring Systems." Power wiring and conduit shall conform to Section 16402, "Interior Wiring Systems." Control wiring and conduit shall be provided under, and conform to the requirements of the section specifying the associated equipment.

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. 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 equipment or system. When significant changes or modifications in the

equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

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.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PAINTING OF EQUIPMENT

3.1.1 Factory Applied

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.

3.1.2 Field Applied

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.

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 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 --

SECTION 16375

UNDERGROUND ELECTRICAL WORK

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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M198	1975 (R 1986) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS1	1990 Impregnated Paper Insulated, Lead Covered Cable, Solid Type
AEIC CS6	1987 (R 1989) Ethylene Propylene Rubber Insulated Shielded Power Cable Rated 5 Through 69 kV

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2	1993 National Electrical Safety Code
ANSI C119.1	1986 Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts

FEDERAL SPECIFICATIONS (FS)

FS RR-F-621	(Rev. E) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

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

IEEE 48	1990 High-Voltage Alternating-Current Cable Terminations
IEEE 400	1991 Making High- Direct-Voltage Tests on Power Cable Systems in the Field
IEEE 404	1986 Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 46,000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500,000 V

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA RN 1	1986 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	1983 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 6	1990 PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA WC 8	1988 Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code

RURAL ELECTRIFICATION ADMINISTRATION (REA)

REA 345-6	1978 Splicing Plastic-Insulated Cables (PC-2)
REA 345-67	1987 Filled Telephone Cables (PE-39)

UNDERWRITERS LABORATORIES INC. (UL)

UL 83	1991 (R 1991) Thermoplastic-Insulated Wires and Cables
UL 467	1984 (R 1986) Grounding and Bonding Equipment
UL 486A	1991 (R 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 510	1986 (R 1986) Insulating Tape
UL 854	1991 Service-Entrance Cables

1.2 RELATED REQUIREMENTS

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

1.3 DEFINITIONS

In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Conduit

b. Insulating tape

c. Medium voltage cable G

d. Medium voltage cable joints G

e. Medium voltage cable terminators G

f. Kilowat Hour/Demand Submeter

g. Precast concrete structures G

h. Manhole Frames and covers

i. Cable lubricants

j. Sealing material for precast manhole and handhole joints

k. Telephone cable and splices

l. Ground rod

1.4.2 SD-04, Drawings

a. Conduit

b. Insulating tape

c. Medium voltage cable G

d. Medium voltage cable joints G

e. Medium voltage cable terminators G

f. Precast concrete structures G

g. Manhole frames and covers

h. Telephone cable and splices

i. Precast manholes

1.4.3 SD-06, Instructions

a. Ground megger

b. Terminator

c. Termination kit

1.4.3.1 Test Instrument and Procedure

Submit for use of ground megger with proposed method indicated.

1.4.4 SD-08, Statements

a. Cable splicer/terminator

Thirty days before making splices or terminations, submit names of the cable splicers to be employed, together with proof that splicer has at least 3 years experience in splicing the type and rating of cables specified. Submit certification for each splicer by the cable joint kit manufacturer in the use of manufacturer's kits.

1.4.5 SD-10, Test Reports

a. Factory engineered heat shrinkable joint kit

1.4.5.1 Manufacturer's Test

Submit the manufacturer's test report indicating that performance of the heat shrinkable joint kit is equivalent to the cable rating, in accordance with the applicable sections of IEEE 48, IEEE 404, and AEIC CS1.

1.4.6 SD-11, Factory Test Reports

a. Medium voltage cable of X-Y corona discharge plot

Submit for approval 7 days before the materials are used.

1.4.7 SD-12, Field Test Reports

a. Insulation resistance test

b. Continuity test

c. High potential (hi-pot) test

d. 600 volt cable tests

e. Medium voltage cable tests

f. Grounding systems test

g. Medium voltage cable, plot of calculated resistance versus step voltage.

Identify each cable for 600-volt, and medium voltage cable tests. When testing grounding electrodes and systems, identify each electrode and system for each test.

1.4.8 SD-13, Certificates

a. Precast concrete structures

b. Manhole frames and covers

c. Medium voltage cable

d. Medium voltage cable terminators

e. Medium voltage cable joints

1.5 QUALITY ASSURANCE

Each cable splicer may be required to make an approved dummy splice in the presence of the Contracting Officer in accordance with cable manufacturer's instructions. The Contractor shall furnish the material for dummy splices.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Conduit

2.1.1.1 Plastic Conduit and Tubing

NEMA TC 2, Type EPC-40 PVC.

2.1.1.2 Plastic Utilities Duct for Concrete Encasement

NEMA TC 6, Type EPC-40 PVC.

2.1.2 Fittings

2.1.2.1 PVC Fittings

NEMA TC 3.

2.1.3 Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.1.4 Power Wire and Cable

2.1.4.1 Wire and Cable Conductor Sizes

Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Wires and cables manufactured more than 12 months prior to date of delivery to the site shall not be used.

a. Conductors: Conductors shall be copper.

b. Equipment Manufacturer Requirements: Where Contractor provides equipment whose manufacturer requires copper conductors at the terminations, or requires that only copper conductors be provided between components of equipment, the Contractor shall provide copper conductors, or necessary splices, splice boxes, and other work required to satisfy manufacturer's requirements.

2.1.5 600 Volt Wires and Cables

UL 83 THWN XHHW. Only use wires with "W" type designation in wet or damp locations. Use No. 12 minimum sized conductors, unless otherwise noted. Use Type "USE" conforming to UL 854 for direct burial cable.

2.1.6 600 Volt Wire Connector and Terminals

a. For use with Copper Conductors: UL 486A.

2.1.7 Medium Voltage Cable

Rated as indicated, with both conductor and insulation shielding, and a PVC or polyethylene jacket. Cable shall meet NEMA WC 8 and AEIC CS6 for ethylene-propylene-rubber insulation. The year of manufacture shall be durably marked on the outer surface of each cable at regular intervals throughout cable length.

2.1.8 Medium Voltage Cable Terminators

IEEE 48 Class 1 2. Components shall be from one manufacturer. Furnish installation instructions including stress relief cones devices.

2.1.8.1 Medium Voltage Cable Terminators

IEEE 48, Class 1. Provide terminators for termination of single and multiconductor cables. Terminator installations shall include stress relief cones for shielded cables. Do not use aluminum and copper bearing parts in contact with each other.

2.1.8.2 Terminator, Heat Shrinkable Type

a. Provide as specified for terminating single conductor, or the single conductor of multiconductor, extruded dielectric, nonmetallic jacketed type cables for service voltage up to 35 KV. The indoor and outdoor terminator shall be the product of one manufacturer who shall furnish components in the form of a kit, including complete instructions which shall be followed for assembly and installation, suitable for the type and materials of the cable terminated. The terminator shall consist of a uniform

cross section heat shrinkable polymeric construction stress relief tubing and environmentally sealed outer covering that is nontracking, resists heavy atmospheric contaminants, ultra violet rays and oxidative decomposition.

b. Provide heat shrinkable sheds or skirts of the same material for outdoor application as well as ground braid and clamp.

2.1.8.3 Terminator, Cold-Shrink Rubber Type

IEEE 48, Class 1. Provide termination as specified herein for terminating single conductor, or the single conductors of multiconductor, solid insulated, nonmetallic jacketed type cables for service voltage up to 35 kV outdoor and 35 kV indoor. Termination shall be rated for continuous operation at 90 degree C, with an emergency overload temperature rating of 130 degree C. Terminator shall be a one-piece design, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber, munsel gray in color. Termination shall not require heat or flame for installation. Termination kit shall contain all necessary materials (except for the lugs) required to make three terminations. Termination shall be designed for installation in low or highly contaminated indoor and outdoor locations.

2.1.9 Telephone Cable and Splices

REA 345-67. Indicate the number of pairs. Splices shall conform to REA 345-6.

2.1.10 Pull Wire

No. 14 hot-dip galvanized steel or plastic rope having a minimum tensile strength of 200 pounds in each empty duct. Leave a minimum of 24 inches of slack at each end of the pull wires.

2.1.11 Grounding and Bonding Equipment

UL 467.

2.1.12 Underground Structures

2.1.12.1 Precast Concrete Construction

Provide precast concrete manhole and handhole structures, subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes and handholes.

a. General: Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have an

ultimat 28-day compressive strength of not 1 ss than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, pr cast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

b. Construction Structure top, bottom, and wall shall be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed of future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as directed, and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. The minimum concrete cover for reinforcing steel shall be 2 inches. Provide drain sumps for precast structures a minimum of 12 inches in diameter and 4 inches deep.

c. Joints: Provide tongue-and-groove or shiplap joints on mating edges of precast components. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M198, Type B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.1.12.2 Metal Frames and Covers

Shall be made of cast iron. Cast-iron frames and covers shall be 32-inch diameter and meet FS RR-F-621. Covers shall be rated AASHTO H20.

2.1.12.3 Pulling-In Irons

Shall be steel bars bent in the form indicated and cast in the walls and floors. In the floor they shall be centered under the cover and in the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the manhole. Pulling-in irons shall project into the manhole approximately 4 inches. Iron shall be hot-dipped galvanized after fabrication.

2.1.12.4 Cabl Racks

Including rack arms and insulators, shall be suffici nt to accommodate th cables. Racks in power manholes shall be spaced not more than 3 feet apart, and each manhole wall shall be provided with a minimum of two racks. Racks in signal manholes shall be spaced no more than 16 1/2 inches apart with the end rack being no further than 12 inches from the adjacent wall. The wall bracket shall be channel steel. Slots for mounting cable rack arms shall be spaced at 8-inch intervals. The cable rack arms shall be of steel or malleable iron and shall be of the removable type. Insulators shall be dry-process glazed porcelain. The metal portion of racks shall be hot-dip galvanized after fabrication.

2.1.12.5 Grounding in Manholes Handholes

Provide No. 6 AWG bare copper grounding pigtails on walls of each manhole handhole. The pigtails shall be exothermically welded to the reinforcing bars and shall extend at least 8 inches into manhole handhole. Two pigtails shall be provided in each manhole handhole.

2.1.12.6 Precast Manholes Handholes Installation

Commercial precast assembly shall be set on 6 inches of level, 90 percent compacted granular fill, 3/4-inch to 1-inch size, extending 12 inches beyond the manhole handhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.

2.1.12.7 Field Painting

Cast-iron frames and covers not buried in masonry shall be cleaned of mortar, rust, grease, dirt and other deleterious materials, and given a coat of bituminous paint.

2.1.13 Drainage Pipe and Fittings

Cast-iron, extra strength. Drains shall be cast-iron, coated or uncoated, plain pattern, bottom outlet with perforated or slotted hinged cover.

2.1.14 Kilowatt Hour/Demand Submeter

Provide a 400A, 120/208, 3 Phase solid state electronic kilowatt hour/demand submeter. Provide (3) u-shaped current sensors for service line conductors and (1) 20A, 3P circuit breaker to connect to the meter's voltage sensing wires. Submeter shall be equipped with the following features:

a. Solid State Electronic Digital Display
b. Memory Retention Through Power Outages
c. Lockable Steel Housing

Killowatt hour/demand submeter shall be located adjacent to the main power panel.

PART 3 EXECUTION

3.1 INSTALLATION

NFPA 70 and ANSI C2.

3.1.1 Concrete

Concrete work for electrical requirements shall conform to the requirements of Section 03300, "Cast-In-Place Concrete."

3.1.1.1 Cutting Cable

Use heat shrink adhesive coated caps on cable ends or tape cable ends immediately after cutting to prevent moisture from entering the cable. Varnish the tape when cable is not expected to be connected for at least 72 hours.

3.1.1.2 Restoration

Replace sod which has been removed, as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, pad construction, and other work to original condition and maintain until final acceptance. Provide necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging or mulching.

3.1.1.3 Crossing Cables

Separate cables crossing other cables or metal piping from each other by not less than 12 inches of well tamped earth.

3.1.1.4 Connections

Provide cables in one piece without splices between connections except where the distance exceeds the lengths in which cables are manufactur d.

3.1.1.5 Bends

Bends in cables shall have an inner radius not less than 12 times the cable diameter.

3.1.1.6 Horizontal Slack

Leave a horizontal slack of approximately 3 feet in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought aboveground, leave additional slack to make necessary connections.

3.1.1.7 Identification Slabs Markers

Provide a slab at each change of direction of cable, over the ends of ducts or conduits which are installed under paved areas and roadways, and over each splice. Identification slabs shall be of concrete approximately 20 inches square by 6 inches thick and shall be set flat in the ground so that top surface projects not less than 3/4 inch, nor more than 1 1/4 inches

aboveground. The concrete shall have a compressive strength of not less than 3000 psi and have a smooth troweled finish on exposed surface. Inscribe an identifying legend such as "electric cable," "telephon cable," "splice," or other applicable designation on the top surface before concrete hardens. Inscribe circuit identification symbols on slabs as directed. Letters or figures shall be approximately 2 inches high and grooves shall be approximately 1/4 inch in width and depth. Install slabs so that the side nearest the inscription on top shall include an arrow indicating the side nearest the cable.

3.1.1.8 Cable End Seal

Ends of cable shall be taped immediately after cutting to prevent moisture from entering the cable. Where the cable is not expected to be connected for at least 72 hours, the tape shall also be varnished.

3.1.2 Underground Conduit/Duct Without Concrete Encasement

3.1.2.1 Conduit

The type of conduit shall be EPC-40 PVC. The top of the conduit shall b not less than 24 inches below grade, and shall have a minimum slope of 3 inches in each 100 feet away from buildings and toward manholes and other necessary drainage points. Run conduit in straight lines except where a change of direction is necessary. As each conduit run is completed, draw a nonflexible testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. Provide not less than 3 inches clearance from the conduit to each side of the trench. A minimum clearance of 2 1\2 inches shall be provided between adjacent conduits. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4-inch sieve. Provide color, type and depth of warning tape as specified in paragraphs "BURIED WARNING AND IDENTIFICATION TAPE" in Section 02225.

3.1.3 Underground Duct with Concrete Encasement

Construct underground duct lines of individual conduits encased in concrete. Except where rigid galvanized steel conduit is indicated or specified, the conduit shall be PVC Type DB. Do not mix different kinds of conduit in any one duct bank. Ducts shall not be smaller than 5 inches in diameter unless otherwise indicated. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 1\2 inches, except separate light and power conduits from control, signal, and telephone conduits by a minimum concrete thickness of 3 inches.

a. Under paved areas and as shown, encase ducts in concrete. Extend the concrete encasement at least 5 feet beyond the edges of paved areas. Where conduit runs under existing roads, cut and patch the pavement as indicated.

b. The top of the concrete encasement shall not be less than 18 inches below grade except that under roads and pavement it shall be not less than 24 inches below grade.

3.1.3.1 Duct and Conduit Placement

Duct lines shall have a continuous slope downward toward manholes and away from buildings with a pitch of not less than 3 inches in 100 feet. Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be mad up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger.

3.1.3.2 Termination and Cleaning of Conduit

Terminate conduits in end-bells where duct lines enter manholes handholes. Separators shall be of precast concrete, high impact polystyrene, steel, or a combination of these. Stagger conduit joints by rows and layers to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand, and dirt with suitable conduit plugs. As each section of a duct line is completed from manhole handhole to manhole handhole, draw a stiff bristle brush having the same diameter of the duct through the duct, until duct is clear of particles of earth, sand, and gravel; then immediately install end plugs.

3.1.3.3 Connections to New Manholes Handholes

Construct concrete-encased duct lines connecting to underground structures to have a flared section adjacent to the manhole to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the encasement and the wall of the structure.

3.1.3.4 Connections to Existing Manholes Handholes

For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and extend into the duct line encasement. Chip out the structure wall to form a key for the duct line encasement.

3.1.4 Conduit Protection at Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations shall be protected by a PVC sheath at the penetration; PVC sheath be 40-mils thick conforming to NEMA RN 1, and shall extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.1.5 Cable Pulling

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Accumulate cable slack at each manhole or junction box where space permits by training cable around the interior to form one complete loop. Maintain minimum allowable bending radii in forming such loops.

3.1.5.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables. Cable lubricants shall be soapstone, graphite, or talc for rubber or plastic jacketed cables. Lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.

3.1.5.2 Cable Pulling Tensions

Tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.

3.1.5.3 Secondary Cable Runs in Nonmetallic Duct Conduit

Although not indicated, include an insulated copper equipment grounding conductor sized as required by the rating of the overcurrent device supplying the phase conductors, in nonmetallic duct conduit, for secondary cable runs, 600 volts and less.

3.1.5.4 Installation of Cables in Manholes, Handholes and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators at a maximum of 18 inches. In existing manholes, handholes and vaults where new ducts are to be terminated or where new cables are to be installed, locate the existing installation of cables, cable supports and grounding as required for a uniform installation with cables carefully arranged and supported. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space opening or future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure. Provide 2 cable racks in each underground structure through which cable is run.

3.1.5.5 Cable Markers (or Tags) in Manholes

Provide as specified in Section 16011, "Electrical General Requirements."

3.1.5.6 Conductors Installed in Parallel

Conductors shall be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.1.6 Cable Terminating

Protect terminations of insulated power and lighting cables from accidental contact, deterioration of coverings and moisture by providing terminating devices and materials. Install terminations of insulated power and lighting cables cable joints and medium voltage terminations in accordance with the manufacturer's requirements. Make terminations with materials and methods as indicated or specified herein or as designated by the written instructions of the cable manufacturer and termination kit manufacturer.

3.1.6.1 Splices for 600 Volt Class Cables

Splice in underground systems only in accessible locations such as manholes and handholes, with a compression connector on the conductor and by insulating and waterproofing by one of the following methods suitable for continuous submersion in water and pass ANSI C119.1.

a. Provide cast-type splice insulation by means of molded casting process employing a thermosetting epoxy resin insulating material applied by a gravity poured method or by a pressure injected method. Provide component materials of the resin insulation in a packaged form ready for convenient mixing without removing from the package. Do not allow the cables to be moved until after the splicing material has completely set.

b. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which includes a mold suitable for the cables to be spliced. When the mold is in place around the joined conductors, prepare the resin mix and pour into the mold. Do not allow cables to be moved until after the splicing materials have completely set.

c. Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which should be applied by a clean burning propane gas torch. Cables may be moved when joint is cool to the touch.

3.1.6.2 Medium Voltage Cable Joints

Provide power cable joints suitable for direct burial or continuous immersion in water and made only in accessible locations in manholes or handholes.

a. Make medium-voltage joints by using a kit of one manufacturer and with written approval of the manufacturer of the cable which is to be spliced. Provide the Contracting Officer with a copy of the manufacturer's instructions before jointing is started. Upon request, supply manufacturer's design qualification test report in

accordance with IEEE 404. Joint design shall have been proof tested in accordanc with IEEE 404. Connectors for joint shall be tin-plated electrolytic copper, having ends tapered and having center stops to equalize cable insertion.

(1) Epoxy Cast-Type Joint Methods: Provide cast-type joint insulation by means of a molded casting process employing a thermosetting epoxy resin insulating material which shall be applied by a gravity poured method or by a pressure injected method. Provide component materials of the resin insulation in a packaged form ready for convenient mixing without removing from the package. Do not allow cables to be moved until after the jointing material has completely set.

(2) EPR Cast-Type Joint: Provide insulation by means of a molded casting process employing an ethylene propylene-rubber (EPR) jointing compound which results in an inseparable bond between the jointing material and cable insulation. The molding process shall include injection of molding material into the mold to ensure void-free joints.

(3) Watertight Taped-Type Joint: Consists of an approved connector, self-fusing tape (splicing compound), self-bonding semiconducting tape, tinned copper shielding tape or braid, and plastic tape.

(4) Tape Overcast-Type Joint: Watertight taped-type, overcast with an epoxy resin construction for the cast-type, pressure method. Provide joint suitable for the rated voltage of the cable, to a limit of 15 KV.

(5) Vulcanized-Type Joint: Heat-pressure process of an approved type and employing materials and equipment suitable for the type and voltage of cables for which it is used. Materials used in the jointing process shall be fully and permanently compatible with materials in the cables. Provide joint suitable for the rated voltage of the cable, to a limit of 5 KV.

(6) Heat-Shrinkable Joint: A uniform cross-section heat-shrinkable polymeric construction consisting of a linear stress relief system, a high dielectric strength insulating material, and an integrally bonded outer conductor layer for shielding. Replace original cable jacket with a heavy-wall heat-shrinkable sleeve with hot-melt adhesive coating. Provide joint suitable for the rated voltage of the cable.

b. Joints in Shielded Cables: Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a No. 6 AWG bare copper ground connection brought out in a watertight manner and grounded to a 3/4-inch by 10-foot ground rod as part of the joint installation. Wire shall be trained to the sides of the enclosure in a manner to avoid interference with the working area.

3.1.6.3 Certificate of Competency for Cable Splicer/Terminator

Certification of the qualification of the cable splicer/terminator shall be submitted, for approval, 30 days before splices or terminations are to be made in medium voltage (5 kV to 35 kV) cables. The certification shall include the training, and experience of the individual on the specific type and classification of cable to be provided under this contract. The certification shall indicate that the individual has had three or more years recent experience splicing and terminating medium voltage cables. The certification shall also list a minimum of three splices/terminations that have been in operation for more than one year. In addition, the individual may be required to perform a dummy or practice splice/termination in the presence of the Contracting Officer, before being approved as a qualified cable splicer. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice/termination kit, and detailed manufacturer's instructions for the cable to be spliced. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for certification of an alternate cable splicer.

3.1.7 Fireproofing of Cables in Manholes, Handholes and Vaults

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in manholes, handholes, and vaults.

3.1.7.1 Tape-Wrap

Tape-wrap lead-sheathed or other metallic-sheathed or metallic armored cables without a nonmetallic protective covering over the sheath or armor prior to application of fireproofing. Wrap shall be in the form of two tightly applied half-lapped layers of a pressure-sensitive 10 mil thick plastic tape, and shall extend not less than one inch into the duct. Even out irregularities of the cable, such as at splices, with insulation putty before applying tape.

3.1.8 Grounding Systems

Shall be as indicated, and as required by NFPA 70 and ANSI C2.

3.1.8.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed when indicated to provide an earth ground of the value before stated for the particular equipment being grounded.

3.1.8.2 Grounding Connections by Exothermite Type Process

Make grounding connections which are buried or otherwise normally inaccessible, excepting specifically those connections for which access for periodic testing is required, by exothermite type process. Make thermit welds strictly in accordance with the weld manufacturer's written recommendations. Welds which have "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at thermit weldments.

3.1.8.3 Compression Ground Grid Connector

For accessible connections in lieu of a thermit type process, a compression ground grid connector of a type which uses a hydraulic compression tool to provide the correct circumferential pressure may be used. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.8.4 Grounding Conductors

Bare soft-drawn copper wire No. 4 AWG minimum unless otherwise indicated or specified.

3.1.8.5 Ground Rod Connections

Connect copper-clad steel ground rods only to insulated TW, or RHW copper ground conductor and weld the connection. Insulate entire area of the rod in the vicinity of the weld and the connecting wire and seal against moisture penetration.

3.1.8.6 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground does not exceed 5 ohms. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

3.1.8.7 Conduit

Provide empty conduits with a No. 14 AWG zinc coated steel wire or a plastic rope having a breaking strength of at least 200 lbs. Leave 24 inches of spare at each end of the pull.

3.1.9 Earthwork For Utilities

Section 02225, "Excavation, Backfilling, and Compacting for Utilities."

3.1.9.1 Backfilling

Section 02225, "Excavation, Backfilling, and Compacting for Utilities."

3.1.10 Reconditioning of Surfaces

3.1.10.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve and replace sod or topsoil after backfilling is completed. Replace sod that is damaged by seeding equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of

seed as that used in the original s eding.

3.1.10.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.2 FIELD QUALITY CONTROL

As an exception to requirements that may be stated elsewhere in the contract, notify the Contracting Officer 5 working days prior to each test.

3.2.1 Distribution Conductors 600 Volt Class

Perform 600 volt cable tests to verify that no short circuits or accidental grounds exist. Make tests using an instrument which applies a voltage of approximately 500 volts to provide a direct reading in resistance; minimum resistance shall be 250,000 ohms.

3.2.2 Medium Voltage Cables

After installation, and before placing in service, perform a dc High Potential Test on cables rated above 600 volts. Perform medium voltage cable tests after installation in accordance with IEEE 400. Calculate the effective insulation resistance and submit a plot of the calculated resistance versus the step voltage. Adhere to precautions and limits as specified in the applicable standards. Current sensing circuits in test equipment shall measure only the leakage current associated with the cable under test, and shall not include internal leakage current of the test equipment. Perform the following test procedures and record the results for each cable test as outlined on the D.C. High Voltage Cable Test Report attached at the end of this section. Submit this report with a cover letter and with data typed in.

a. Record temperature and relative humidity. Do not perform tests unless weather is clear and relative humidity is below 70 percent.

b. Test each conductor individually with other conductors grounded. Shields shall be grounded.

c. Terminations shall be properly corona suppressed by guard ring, field reduction sphere, or other suitable methods.

d. Perform insulation resistance and continuity test prior to hi-pot test.

e. Apply a dc hi-pot in at least five equal increments until maximum test voltage is reached. Record a dc leakage current at each step after a constant stabilization time consistent with system charging current decay. One hundred percent voltage shall be reached in a maximum of 60 seconds.

f. Separabl insulated connectors shall be plugged into insulated bushings.

g. Raise the test conductor to a maximum test voltage and hold for a total of 15 minutes except 5 minutes for 5kV PILC cables. Readings of leakage current shall be recorded each minute.

h. Reduce the conductor test potential to zero and apply the grounds for at least 10 minutes.

i. The dc test voltage shall be 55 KV.

j. Furnish the Contracting Officer with three copies of test results.

3.2.2.1 Splicing New Cables Into Existing Cables

When new cables are spliced into existing cables, perform the hi-pot test on the new cable prior to splicing. After test results are approved for new cable and splice is made, perform an insulation resistance test, continuity test and a dc hi-pot test at 55 KV on the length of cable including the splice; and test the existing cable to the nearest disconnection point.

3.2.3 Medium Voltage Cables

Perform insulation resistance test and hi-pot test on medium voltage cables. Conduct the tests in three phases: for the existing conductors, for the new conductors after installation, and for the combined new and existing conductors after splicing. Prior to conducting these tests, disconnect the conductors from the equipment.

3.2.3.1 Insulation Resistance Between Conductor and Insulation Shield

Measure between each conductor and insulation shield, that is shielded cables. Use a 1 KV or 2.3 KV megger for this test. Insulation resistance values less than one megohm for each 1 KV of operating voltage are not acceptable. Bring to the attention of the Contracting Officer unsatisfactory test results. Record insulation resistance readings.

3.2.3.2 High Potential (Hi-Pot) Test

Make a hi-pot test by applying a direct current (dc) voltage between each conductor of the system as one terminal, and the ground and the sheaths or shields of the wires and cables connected together as the other terminal. Perform the dc hi-pot test using an instrument designed for this purpose. Slowly raise the voltage in (for 15 KV cables) increments and hold for a period of one minute at each level. Record the value of the measured leakage current for each voltage step and plot a curve of the leakage current versus voltage. When the final voltage step is reached, maintain that voltage for 5 minutes and at the end of that interval, record the leakage current reading. Test new cables in increments up to 15 KV cables). The Government will furnish the test voltages for existing cables and new cables spliced to existing cables. Notify the Contracting Officer 7 days prior to hi-pot tests. Submit recorded test recordings and voltage versus current curves for approval.

-- End of S ction --

SECTION 16402

INTERIOR 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	1990 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

FEDERAL SPECIFICATIONS (FS)

FS W-C-375	(Rev. B) Circuit Breaker, Molded Case; Branch Circuit and Service
FS W-S-896	(Rev. E) Switches, Toggle (Toggle and Lock), Flush Mounted

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FU 1	1986 Low Voltage Cartridge Fuses
NEMA ICS 1	1988 (Rev. 1-2) Industrial Control and Systems
NEMA ICS 2	1988 Industrial Control Devices, Controllers and Assemblies
NEMA ICS 4	1983 (R 1988) (Rev. 1) Terminal Blocks for Industrial Use
NEMA ICS 6	1988 (Rev. 1) Enclosures for Industrial Control and Systems
NEMA KS 1	1990 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA ST 20	1986 Dry-Type Transformers for General Applications
NEMA WD 1	1983 (R 1989) Wiring Devices

NEMA WD 6	1988 Wiring D vices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code

UNDERWRITERS LABORATORIES INC. (UL)

UL 6	1981 (R 1991) Rigid Metal Conduit
UL 50	1988 (R 1990) Cabinets and Boxes
UL 67	1988 (R 1991) Panelboards
UL 83	1991 (R 1992) Thermoplastic-Insulated Wires and Cables
UL 198C	1986 (R 1990) (Bul. 1992) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198E	1988 (R 1988) (Bul. 1992) Class R Fuses
UL 198H	1988 (R 1990) (Bul. 1992) Class T Fuses
UL 360	1986 (R 1990) (Bul. 1991) Liquid-Tight Flexible Steel Conduit
UL 467	1984 (R 1986) Grounding and Bonding Equipment
UL 486A	1991 (R 1991) (Errata 1992) Wire Connector and Soldering Lugs for Use with Copper Conductors
UL 486C	1991 (R 1991) Splicing Wire Connectors
UL 489	1991 (R 1991) (Bul. 1992) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 498	1991 (R 1992) Attachment Plugs and Receptacles
UL 508	1989 (R 1991) (Bul. 1992) Industrial Control Equipment
UL 510	1986 (R 1986) Insulating Tape
UL 514A	1991 Metallic Outlet Boxes
UL 514B	1989 (R 1990) (Errata 1991) (Bul. 1992) Fittings for Conduit and Outlet Boxes

UL 514C	1988 (R 1989) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 845	1988 (R 1989) Motor Control Centers
UL 869	1989 (R 1991) Service Equipment
UL 943	1985 (R 1990) (Bul. 1991) Ground-Fault Circuit Interrupters
UL 1569	1983 (R 1991) (Bul. 1992) Metal-Clad Cables

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. Conduit and fittings (each type)

e. Device plates

f. Wires and cables

g. Outlet boxes and covers

1.3.2 SD-04, Drawings

a. Panelboards G

b. Motor control centers G

Motor control centers G

1.3.3 SD-08, Statements

a. Fuses

Submit coordination data as specified in articl ntitl d, "FUSES" of this

section.

1.3.4 SD-11, Factory Test Reports

a. Transformer tests

1.3.4.1 Transformer Tests

Submittal shall include routine NEMA ST 20 transformer test results on each transformer and also contain the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

1.3.5 SD-12, Field Test Reports

a. 600-volt wiring test

b. Grounding system test

1.3.5.1 Format

Submit test results for approval in report form.

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.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall be rigid steel (zinc-coated) conduit conforming to the following:

2.2.1 Rigid Steel Conduit (Zinc-Coated)

ANSI C80.1, UL 6.

2.2.1.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.2 Fittings for Metal Conduit, and Liquid-Tight Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.2.1 Fittings for Rigid Metal Conduit

Compression-type. Split couplings unacceptable.

2.3 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

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 and signal circuits, classes 1, 2, and 3, may be stranded. Conductor sizes and ampacities shown 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

2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN conforming to UL 83 or Type XHHW, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

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.

2.5.5 Metal-Clad Cable

UL 1569; NFPA 70, Type MC cable.

2.6 SPLICES AND TERMINATION COMPONENTS

UL 486A, as applicable, for wire connectors and UL 510 for insulating tapes. Connectors for wires 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. For metal outlets, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

2.8 SWITCHES

2.8.1 Toggle Switches

FS W-S-896, totally enclosed with bodies of thermosetting plastic and mounting strap. Handles shall be brown. Wiring terminals shall be screw-type, side-wired. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.8.2 Pilot Lights

Provide yoke-mounted, candelabra-base sockets rated 125 volts and fitted with glass or plastic jewels. Provide clear, 6-watt lamp in each pilot switch. Jewels for use with switches controlling motors shall be green, jewels for other purposes shall be red.

2.8.3 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 4X, enclosure per NEMA ICS 6.

2.8.4 Breakers Used as Switches

For 120- and 277-Volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

2.9 RECEPTACLES

UL 498 and NEMA WD 1, general grade, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap.

2.9.1 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Provide UL listed receptacle in "wet locations."

2.9.2 Ground-Fault Circuit Interrupter (GFCI) 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 GFCI devices.

2.10 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.

2.10.1 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main bus s and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

2.10.2 Circuit Breakers

FS W-C-375, UL 489, thermal magnetic-type with interrupting capacity of 10,000 minimum amperes rms symmetrical. Breaker terminals shall be UL listed as suitable for the type of conductor provided. Plug-in circuit breakers unacceptable.

2.11 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch control center. Time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

2.11.1 Cartridge Fuses, Current Limiting Type (Class R)

UL 198E, Class RK-1 time delay-type. Associated fuseholders shall be Class R only.

2.11.2 Cartridge Fuses, Current Limiting Type (Classes J, L, and CC)

UL 198C, Class J for zero to 600 amps, Class L for 601 to 6,000 amps, and Class CC for zero to 30 amps.

2.11.3 Cartridge Fuses, Current Limiting Type (Class T)

UL 198H, Class T for zero to 1,200 amps, 300 volts; and zero to 800 amps, 600 volts.

2.12 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase. 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 pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. 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. Selector switch shall have means for locking in any position. 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 or, alternatively, manually operated nonfused switch which disconnects motor from source of supply shall be placed within sight of motor location. 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. Minimum short circuit withstand rating of combination motor controller shall be 20,000 rms symmetrical amperes.

2.12.1 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from a separate control source. Provide terminals and terminal boards. Provide separate control disconnect switch within controller. One secondary lead shall be fused; other shall be grounded.

2.12.2 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

2.12.3 Pilot and Indicating Lights

Provide transformer, resistor, or diode type.

2.12.4 Terminal Blocks

NEMA ICS 4.

2.13 MANUAL MOTOR STARTERS

Three pole designed for surface mounting with overload protection and pilot lights.

2.14 MOTOR CONTROL CENTERS

UL 845, NEMA ICS 2. Wiring shall be Class I, Type B, in NEMA Type 4X enclosure. Provide control centers suitable for operation on 208/120-volt, 3-phase, 4-wire, 60 Hz system and shall have minimum short-circuit withstand and interrupting rating of 25,000 amperes rms symmetrical. Incoming power feeder shall be cable entering at the bottom of enclosure and terminating on main protective device. Main protective device shall be molded case circuit breaker rated 20,000 amperes rms symmetrical interrupting capacity. Interconnecting wires shall be copper. Terminal blocks shall be plug-in-type so that controllers may be removed without disconnecting individual control wiring.

2.14.1 Bus Systems

Provide the following bus systems. Power bus shall be braced to withstand fault current of 25,000 amperes rms symmetrical. Wiring troughs shall b isolated from horizontal and vertical bus bars.

2.14.1.1 Horizontal and Main Buses

Horizontal bus shall have continuous current rating of as indicated. Main bus shall be copper, silver-plated enclosed in isolated compartment at top of each vertical section. Main bus shall be isolated from wire troughs, starters, and other areas.

2.14.1.2 Vertical Bus

Vertical bus shall have continuous current rating as indicated, and shall be copper, silver-plated.

2.14.1.3 Ground Bus

Copper ground bus shall be provided full width of motor control center and shall be equipped with necessary lugs.

2.14.1.4 Neutral Bus

Insulated neutral bus shall be provided continuous through the motor control center; neutral shall be full rated. Lugs of appropriate capacity shall be provided, as required.

2.15 GROUNDING AND BONDING EQUIPMENT

UL 467.

2.16 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 conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, or enclosures shall be labeled or identified as such.

3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

3.1.3 Wiring Methods

Provide insulated conductors installed in conduit, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Provide bare or insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide bare or insulated, green conductor for grounding conductors installed in conduit or raceways. Minimum conduit size shall be 3/4 inch in diameter for low voltage lighting and power circuits.

3.1.3.1 Service Entrance Conduit, Underground

Galvanized rigid steel. Underground portion shall be encased in minimum of 3 inches of concrete and shall be installed minimum 18 inches below slab or grade.

3.1.3.2 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel.

3.1.3.3 Conduit in Floor Slabs

Rigid steel.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.4.1 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finish slab.

3.1.4.2 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws.

3.1.4.3 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.4 Pull Wire

Install pull wires in empty conduits in which wire is to be installed by others. Pull wire shall be plastic having minimum 200-pound tensile strength. Leave minimum 12 inches of slack at each end of pull wire.

3.1.4.5 Telephone and Signal System Conduits

Install in accordance with specified requirements for conduit and with additional requirement that no length of run shall exceed 150 feet for trade sizes 2 inches and smaller and shall not contain more than two 90-degree bends or equivalent. Provide pull or junction boxes where necessary to comply with these requirements. Inside radii of bends in conduits one-inch trade size and larger shall be minimum five times nominal diameter. Terminate conduit at bottom edge of backboard with plastic bushing.

3.1.4.6 Conduit Installed in Concrete Floor Slabs

Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab. Increase slab thickness as ecessary to provide minimum one-inch cover over conduit. Where embedded conduits cross expansion joints, provide suitable watertight expansion fittings and bonding jumpers. Conduit larger than one-inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab.

3.1.4.7 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.8 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.9 Flexible Connections

Provide liquid-tight flexible connections of short length, 6-foot maximum, for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow slack. Provide liquid-tight flexible conduit in wet locations. Provide separate ground conductor across flexible connections.

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring or 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, when installed exposed up to 7 feet above interior floors and walkways. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. Threaded studs driven in by powder charge and provided with lockwashers and nuts or nail-type nylon anchors may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.5.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except that 4-by-2-inch boxes may be used where only one raceway enters outlet.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Furnish boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.5.3 Extension Rings

Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.

3.1.6 Mounting Heights

Mount panelboards, circuit breakers, and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor, receptacles 18 inches above finished floor, and other devices as indicated. Measure mounting heights of wiring devices and outlets to center of device or outlet.

3.1.7 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. Identify control circuit terminations in accordance with Section 15951, "Space Temperature Control Systems."

3.1.8 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.

3.1.9 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.10 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 raceways, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.10.1 Grounding Conductor

Provide bare or insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide bare or insulated, green conductor for grounding conductors installed in conduit or raceways.

3.1.10.2 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

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 each test.

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

Test 600-volt wiring to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter 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 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground does not exceed 5 ohms. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test

for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours aft r rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

SECTION 16462

PAD-MOUNTED TRANSFORMERS

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
ANSI C37.47	1981 (Supp. 1983) (Correction 1984) (R 1988) Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses
ANSI C57.12.26	1987 (Correction 1990) Transformers - Pad-Mounted Compartmental-Type, Self-Cool d, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34,500 Grd Y/19,920 Volts and Below; 2500 kVA and Smaller
ANSI C57.12.28	1988 (Correction 1988) Switchgear and Transformers - Pad-Mounted Equipment - Enclosure Integrity

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	1991 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM D 1535	1989 Specifying Color by the Munsell System

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

IEEE 386	1985 Separable Insulated Connector Systems for Power Distribution Systems Above 600 V
ANSI/IEEE C57.12.00	1987 Liquid-Immersed Distribution, Power, and Regulating Transformers
ANSI/IEEE C57.12.80	1978 (R 1986) Power and Distribution Transformers
IEEE C57.12.90	1987 Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for

	Short-Circuit Testing of Distribution and Power Transformers
ANSI/IEEE C62.11	1987 Metal-Oxide Surge Arresters for AC Power Circuits

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	1991 Electrical Power Distribution Equipment and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code
NFPA 70B	1990 Electrical Equipment Maintenance

UNDERWRITERS LABORATORIES INC. (UL)

UL 467	1984 (R 1986) Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

Section 16011, "Electrical General Requirements," applies to this section, with the 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. Pad-mounted transformers, dead-front G

b. Insulated high-voltage load-break connectors G

c. Surge arresters G

d. Bushing well inserts G

e. Insulated standoff bushings G

f. Insulated protective caps G

1.3.2 SD-04, Drawings

a. Pad-mounted transformers, dead-front G

1.3.2.1 Contents

Drawings shall indicate, but not be limited to the following:

a. Overall dimensions, front view, and sectional views.

b. Ratings and sizes of lugs, impedance, and taps.

c. One-line diagram.

d. Time current curves:

(1) Manufacturer's published time-current curves (on full size logarithmic paper) of the transformer high side fuse and secondary circuit breakers.

(2) Composite of time-current curves (on full size logarithmic paper) with fuse and breaker characteristics overlayed to ensure that protection and coordination are achieved.

1.3.3 SD-09, Reports

a. Pad-mounted transformer routine and other tests G

b. Pad-mounted transformer design tests G

Submit certified copies of the following ANSI/IEEE C57.12.00 and IEEE C57.12.90 transformer tests.

1.3.3.1 Routine and Other Tests

Routine and other tests shall be performed by the manufacturer on the actual transformer prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number, for the following tests and receive approval before delivery of equipment to the project site.

a. Resistance measurements

b. Ratio

c. Polarity and phase relation

d. No-load losses (NLL) and excitation current

e. Impedance voltage and load loss (LL)

f. Low frequency dielectric

g. Leak

h. Pressure

i. Lightning impulse test

(1) State test voltage levels

(2) Submit photo copies of output wave shapes.

1.3.3.2 Design Tests

ANSI/IEEE C57.12.80, Section 5.1.2 states that "design tests are made only on representative apparatus of basically the same design." Submit design test reports with catalog data and drawings for each of the specified transformers. Design tests must have been conducted within five years of the date of award of this contract.

a. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (strip, layer, or disk), the same kVA, the same cooling type (OA), the same temperature rise, and the same insulating liquid as the transformer specified.

b. Lightning impulse dielectric: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (strip, layer, or disk), a tap changer, if specified, the same temperature rise, and the same insulating liquid as the transformer specified.

(1) State test voltage levels.

(2) Submit photo copies of output wave shapes.

c. Audible sound level: "Basically the same design" for the audible sound level test means a pad-mounted transformer with the same BIL and the same kVA as the transformer specified.

d. Lifting and moving devices: "Basically the same design" for the lifting and moving devices test means a pad-mounted transformer in the same weight range as the transformer specified.

e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with the same kVA and the same insulating liquid as the transformer specified.

1.3.4 SD-12, Field Test Reports

a. Submit report of results of Acceptance checks and tests specified by paragraph entitled "Field Quality Control." G

b. Ground resistance test reports G

1.3.4.1 Ground Resistance Test Reports

Upon completion and before final acceptance of the work, submit the measured ground resistance of each ground rod and grounding system, and soil condition at the same time the measurements were taken.

1.3.5 SD-18 Records

a. Transformer Test Schedule G

1.3.5.1 Source Quality Control

The Government reserves the right to witness tests. Provide Transformer Test Schedule for tests to be performed at the manufacturers test facility. Submit required reports and notify the Government 30 days before scheduling test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled dates and locations for testing.

1.3.6 SD-19, Operation and Maintenance Manuals

b. Pad-mounted transformers, dead-front, Data Package 5 G

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 16375, "Underground Electrical Work," and Section 16402, "Interior Wiring Systems".

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS, DEAD-FRONT

ANSI C57.12.26 and ANSI C57.12.28 with separate high- and low-voltage compartments, primary switching and fuses, secondary circuit breakers, metering, and accessories.

2.2.1 Compartments

Divide high- and low-voltage compartments into sections with steel isolating barriers extending the full height and depth of the compartment. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

2.2.1.1 High Voltage

High-voltage compartment shall contain the incoming line, insulated high-voltage load-break connectors, six high-voltage bushing wells with inserts configured for loop feed application, connector parking stands with insulated standoff bushings, protective caps, dead-front surge arresters, tap changer, and ground pad.

a. Insulated high-voltage load-break connectors: IEEE 386,

rated 95 kV BIL, kV for operation on a 15 kV system. Current rating: 200 amperes rms continuous. Short tim rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connectors and inserts shall be the product of a single manufacturer. Connector shall have a steel reinforced hook-stick eye, grounding eye, test point and arc-quenching contact material. Provide stainless steel holddown bail assembly.

b. Loop feed sectionalizer switch, oil-immersed type rated at 15kV, 95kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high voltage compartment. Provide four-position switch as follows:

(1) Position one: Transformer connected to line A only.

(2) Position two: Transformer open and loop closed.
Transformer open and loop open.

(3) Position three: Transformer connected to line B only.

(4) Position four: Line A connected to line B and both lines connected to transformer.

c. Current-limiting fuses dry-well mount: ANSI C37.47. Provide fuses in air-insulated, oil-sealed, dead-front, non-load-break dry-well fuse canisters and on the load side of the load-break switch. Interlock fuse canisters with the load-break switch so that the fuses may be removed only when the switch is in the "Off" position. The fuses shall remove the transformer from service in case of an internal fault. Size fuses to approximately 150 percent of the transformer rating and adequately coordinate with the low voltage breaker in the Main Distribution Panel PP so that the low-voltage breaker clears any downstream low-voltage fault or overload before the high-voltage fuses begin to melt. The fuses shall have an interrupting rating of 50,000 rms amperes symmetrical at the system voltage specified. Asymmetrical multiplying factor is 1.5. Furnish a spare fuse for each fuse provided.

d. Surge arresters: ANSI/IEEE C62.11, rated 15 kV, fully shielded, dead-front, elbow type suitable for plugging into inserts. Provide three arresters for radial feed circuits.

e. Bushing Well Inserts: IEEE 386, 200 Amp., 15 kV Class. Provide an insert for each bushing well.

f. Protective Caps: IEEE 386, 200 Amp., 15 kV Class. Provide insulated protective caps (not shipping caps) for insulating and sealing out moisture from unused bushing inserts and insulated standoff bushings.

g. Parking stands: Provide a parking stand near each bushing well. Provide insulated standoff bushings for parking of energized loadbreak connectors on parking stands.

2.2.1.2 Low Voltag

Low-voltage compartment shall contain gages, valves, thermometers, drains, cable lugs, low-voltage bushings, pressure relief valve, filling provisions, stainless steel transformer nameplate, and ground pad.

2.2.2 Transformer

Oil insulated two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type. Transformer shall be rated 300 kVA, 95 kV BIL, high voltage of 13.8 kV delta primary, with four 2 1/2 percent full capacity taps, two above and two below rated primary voltage. Secondary voltage shall be 208Y/120. Minimum tested impedance shall not be less than 5 percent. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Accessories shall include drain and sampler valve, filler connection, liquid level gage, grounding pads, top filter press connection, lifting lugs, provisions for jacking under base, diagrammatic nameplate, pressure relief valve, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator. The transformer base construction shall be of the fabricated type and suitable for using rollers or skidding in any direction. Provide transformer top with an access handhole. Transformer shall have its kVA rating conspicuously displayed on its enclosure. The transformer shall have an insulated low-voltage neutral bushing with lugs for ground cable, and with removable ground strap.

2.2.3 Corrosion Protection

Bases and cabinets of transformers shall be corrosion resistant and shall be fabricated of stainless steel conforming to ASTM A 167, Type 302 or 304. Form cabinets of stainless steel sheets no less than No. 13 U.S. gage. Paint bases, cabinets and tanks Munsell 7GY3.29/1.5 green. The Munsell color notation is specified in ASTM D 1535.

2.2.4 Insulating Liquid

a. Mineral oil: ASTM D 3487, Type II, tested in accordance with ASTM D 117. Provide identification of transformer as "non-PCB" on the nameplate.

2.3 NAMEPLATES

Provide as specified in Section 16011, "Electrical General Requirements."

2.4 WARNING SIGNS

Provide as specified in Section 16011, "Electrical General Requirements."

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to ANSI C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and ANSI C2, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 16375, "Underground Electrical Work". Connect ground conductors to the upper end of the ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors. Ground rod shall be 3/4-inch, 10 feet long copper.

3.2.2 Pad-Mounted Transformer Grounding

Provide copper grounding conductors and connect them to the ground loop as indicated. Provide a ground conductor from the transformer secondary neutral to ground loop sized as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Connections

Make joints in grounding conductors and mats by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified in Section 16375, "Underground Electrical Work," paragraph entitled "Grounding."

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

Provide a 1/0 bare copper-ground girdle around transformer. Girdle shall be buried 1 foot deep and placed 3 feet laterally from the transformer enclosure. Connect girdle to enclosure and 3/4-inch, 10 feet long copper clad steel ground rods at two opposite places using 1/0 copper. Exothermically weld joints.

3.2.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground does not exceed 5 ohms. Test each ground rod for resistance to grond before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.4 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on concrete slab. Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 x 6 - W2.9 x W2.9 mesh placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 12-inch-thick, well-compacted gravel base. The top of the concrete slab shall be approximately 4 inches above the finished grade. Edges above grade shall have 1/2-inch chamfer. The slab shall be of adequate size to project at least 8 inches beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Cut off and bush conduits 3 inches above slab surface. Concrete work shall be as specified in Section 03300, "Cast-in-Place Concrete".

3.5 FIELD QUALITY CONTROL

3.5.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, NFPA 70B, NETA ATS, and referenced ANSI standards. Perform visual and mechanical inspections and electrical tests specific to liquid-filled transformers, and grounding system in accordance with NETA ATS. Remove wedges, ties, and blocks installed by the manufacturer to prevent damage during shipment.

3.5.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

SECTION 16510

INTERIOR LIGHTING

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 C82.1	1985 (Supp. 1990) Ballasts for Fluorescent Lamps

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IES)

IES LHBK	Lighting Handbook, Reference (1984) and Application (1987) Volumes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code
NFPA 101	1991 Code for Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES INC. (UL)

UL 924	1990 (R 1991) Emergency Lighting and Power Equipment, Seventh Edition
UL 935	1984 (R 1990) (Bul. 1990) Fluorescent-Lamp Ballasts, Seventh Edition
UL 1570	1988 (R 1990) Fluorescent Lighting Fixtures, Third Edition

1.2 RELATED REQUIREMENTS

Section 16011, "Electrical General Requirements," applies to this section, with the additions and modifications specified herein. Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 16402, "Interior Wiring Systems."

1.3 DEFINITIONS

1.3.1 Average Life

Time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

1.4 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals." Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IES LHBK, as applicable, for the lighting system specified.

1.4.1 SD-02, Manufacturer's Catalog Data

a. Fluorescent lighting fixtures G

b. Fluorescent lamps

c. Fluorescent core and coil ballasts

d. Emergency lighting equipment G

PART 2 PRODUCTS

2.1 FLUORESCENT LIGHTING FIXTURES

UL 1570.

2.1.1 Fluorescent Lamps

Provide the number, type, and wattage indicated. Energy-saving, rapid-start lamps shall be rated 32 watts, 2900 approximate initial lumens, 20,000 hours average rated life. Average rated life is based on 3 hours operating per start.

2.1.2 Fluorescent Core and Coil Ballasts

UL 935, ANSI C82.1, and shall be labeled Certified Ballast Manufacturers (CBM) certified by Electrical Testing Laboratories (ETL). Ballasts shall be high power factor type unless indicated otherwise and shall be designed to operate on the voltage system to which they are connected. Ballasts shall be electronic Class P and shall have sound rating "A" unless otherwise noted. Fixtures and ballasts shall be designed and constructed to limit the ballast case temperature to 90 degrees Celsius (C) when installed in an ambient temperature of 40 degrees C. Provide three lamp fixtures with two ballasts per fixture.

2.1.2.1 Energy-Saving Ballasts

Provide electronic T8 energy-saving fluorescent ballasts of the CBM certified full light output type. Ballasts shall have an average input wattage of 65 or less when operating two F032T8 lamps 50 or less when operating one F032T8 lamp. Ballast shall be compatible for use with T8 Tri-phosphorous energy-saving lamps.

2.2 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered type.

2.2.1 Self-Powered Exit Signs (Battery Type)

Provide with automatic power failure device, test switch, pilot light, and fully automatic high/low trickle charger in a self-contained power pack in a NEMA 4X housing. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years.

2.3 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated.

2.3.1 Emergency Lighting Unit

Provide as indicated in a NEMA 4X housing. Emergency lighting units shall be rated for 12 volts, except units having no remote-mounted lamps and having no more than two unit-mounted lamps may be rated 6 volts.

2.3.2 Fluorescent Emergency System

Each system shall consist of an automatic power failure device, cover-mounted test switch and pilot light, and fully automatic solid-state charger in a self-contained power pack. Charger shall be either trickle, float, constant current or constant potential type, or a combination of these. Battery shall be sealed electrolyte type with capacity as required to supply power to the number of lamps shown for each system. Battery shall operate unattended and require no maintenance, including no additional water, for a period of not less than 5 years.

PART 3 EXECUTION

3.1 INSTALLATION

Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of NFPA 70. Mounting heights specified or indicated shall be to bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.

3.1.1 Exit and Emergency Lights

3.1.1.1 Exit Lights

Wire exit lights on same circuit as ambient lighting. Wire fixtures to circuit ahead of any light switches to insure operation of exit lights upon loss of power to ambient lights.

3.1.1.2 Emerg ncy Lights

Wire emergency lights ahead of the switch to the normal lighting circuit located in the same room or area.

3.2 *FIELD QUALITY CONTROL*

Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this Section.

-- End of Section --

SECTION 16530

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

1.2 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 C78.1354	1990 Electric Lamps - 100-Watt, 55-Volt, S54 Single-Ended High-Pressure Sodium Lamps
ANSI C82.4	1985 (Supp. 1988) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

ILLUMINATING ENGINEERING SOCIETY (IES)

IES LHBK	Lighting Handbook, Reference (1984) and Application (1987) Volumes

UNDERWRITERS LABORATORIES INC. (UL)

UL 1029	1986 (R 1990) (Bul. 1990) High-Intensity-Discharge Lamp Ballasts, Fourth Edition
UL 1572	1984 (Errata 1990) (Bul. 1991) (R 1991) High Intensity Discharge Lighting Fixtures, Second Edition

1.3 RELATED REQUIREMENTS

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

1.4 DEFINITIONS

1.4.1 Average Life

Time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

1.4.2 Groundline Section

That portion between one foot above and 2 feet below the groundline.

1.5 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals." Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IES LHBK, as applicable, for the lighting system specified.

1.5.1 SD-02, Manufacturer's Catalog Data

a. Luminaires G

b. Lamps

c. Ballasts

1.5.2 SD-04, Drawings

a. Luminaires G

1.5.2.1 Luminaires

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and computerized candlepower distribution data shall accompany shop drawings.

1.5.3 SD-12, Field Test Reports

a. Operating test

Submit test results as stated in paragraph entitled "Field Quality Control."

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 16402, "Interior Wiring Systems".

2.2 LUMINAIRES

UL 1572. Provide luminaires as indicated. Provide luminaires complete with lamps of number, type, and wattage indicated. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs and equipment, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

2.2.1 Lamps

2.2.1.1 High-Pressure Sodium (HPS) Lamps

100-watt conforming to ANSI C78.1354.

2.2.2 Ballasts for High-Intensity-Discharge (HID) Luminaires

UL 1029 and ANSI C82.4, and shall be constant wattage autotransformer (CWA) or regulator, high power-factor type. Provide single-lamp ballasts which shall have a minimum starting temperature of minus 30 degrees C. Ballasts shall be:

a. Designed to operate on voltage system to which they are connected.

b. Constructed so that open circuit operation will not reduce the average life.

PART 3 EXECUTION

3.1 GROUNDING

Ground noncurrent-carrying parts of equipment including luminaires, as specified in Section 16375, "Underground Electrical Work." Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, conduct an operating test to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

SECTION 16722

FIRE ALARM AND FIRE DETECTING SYSTEM (LOCAL AND AUXILIARY)

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

FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)

FM P7825	1991 Approval Guide

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code
NFPA 72	1990 Installation, Maintenance, and Use of Protective Signaling Systems
NFPA 72E	1990 Automatic Fire Detectors
NFPA 90A	1989 Installation of Air Conditioning and Ventilating Systems
NFPA 1221	1991 Installation, Maintenance, and Use of Public Fire Service Communications Systems

UNDERWRITERS LABORATORIES INC. (UL)

UL FPED	1991 Fire Protection Equipment Directory
UL 6	1981 (R 1991) Rigid Metal Conduit
UL 467	1984 (R 1986) Grounding and Bonding Equipment
UL 514A	1991 Metallic Outlet Boxes
UL 514B	1989 (R 1990) (Errata 1991) (Bul. 1992) Fittings for Conduit and Outlet Boxes

1.2 QUALIFICATIONS OF INSTALLER

Prior to commencing work, submit data showing that the Contractor has successfully installed fire alarm systems of the same type and design as specified herein, or that he has a firm contractual agreement with a subcontractor having the required experience. Include the names and

locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that the system has performed satisfactorily for a period of at least 18 months.

1.2.1 Manufacturer's Representative

Provide the services of a representative or technician from the manufacturer of the system, experienced in the installation and operation of the type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of the system and to provide instruction to Government personnel.

1.3 GENERAL REQUIREMENTS

Section 16011, "General Requirements, Electrical" applies to this section with additions and modifications specified herein. The work includes material, tools, and equipment necessary for and incidental to the provision of a complete and usable standard system conforming to the applicable requirements of NFPA 70, NFPA 72, NFPA 72E, NFPA 90A, and NFPA 1221 and this specification. In referenced NFPA publications, the advisory provisions shall be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Northern Division, Naval Facilities Engineering Command, Fire Protection Engineer. Equipment and devices shall be compatible and operable in all respects with, and shall in no way impair reliability or operational functions of, the existing base fire alarm system. Materials and equipment to be furnished under this contract shall be essentially the current design products of manufacturers regularly engaged in production of such equipment and shall be listed by the Underwriters' Laboratories, Inc. in the UL FPED, or approved by Factory Mutual System and listed in FM P7825.

1.4 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals." The Northern Division, Naval Facilities Engineering Command, Fire Protection Engineer will review for approval all submittals required by this section.

1.4.1 SD-02, Manufacturer's Catalog Data

a. Control panel and modules G

b. Storage batteries G

c. Battery charger G

d. Steel cabinet G

e. Manual pull station G

f. Heat detectors G

g. Alarm horns G

h. Visual alarms G

i. Main annunciator G

j. Auxiliary transmitter G

k. Wiring G

l. Ground rods G

m. Conduit G

n. Outlet boxes G

o. Fittings for conduit and outlet boxes G

Data which describe more than one type of item shall be clearly marked to indicate which type the Contractor intends to provide. Submit only originals. Photocopies will not be accepted. Partial submittals will not be accepted.

1.4.2 SD-04, Drawings

a. Fire alarm system G

Submit shop drawings to include floor plans showing initiating and indicating appliances and end-of-line supervisory devices. Drawings shall also include wiring diagrams showing points of connection and terminals used for all electrical field connections in the system.

1.4.3 SD-05, Design Data

a. Standby power calculations G

1.4.3.1 Standby Power Calculations

Submit design calculations to substantiate that the battery capacity exceeds supervisory and alarm power requirements.

1.4.4 SD-08, Statements

a. Qualifications of installer G

1.4.5 SD-12, Field Test Reports

a. Preliminary testing G

b. Final acceptance testing G

Submit for all inspections and tests specified under paragraph entitled "Field Quality Control."

1.4.6 SD-18, Records

a. System as-built drawings G

1.4.6.1 System As-Built Drawings

Upon completion, and before final acceptance of the work, furnish to the Contracting Officer a complete set of as-built drawings, including complete as-built circuit diagrams, of the system. The as-built drawings shall be 34 inches by 22 inches reproducible drawings on mylar film drawn to the same scale as the contract drawings and with title block similar to contract drawings. The as-built drawings shall be furnished in addition to the record drawings required by Division 1.

1.4.7 SD-19, Operation and Maintenance Manuals

a. Fire alarm system, Data Package 5 G

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data." Furnish one complete manual prior to the time that final acceptance tests are performed, and furnish the remaining manuals before the contract is completed. Inscribe the following identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the location of the building, the name of the Contractor, system manufacturer and the contract number. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: circuit drawings; wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shutdown instructions; installation instructions; maintenance instructions; safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list.

1.5 SYSTEM DESIGN

1.5.1 Operation

System shall be a complete, electrically supervised, manual and automatic, zoned, annunciated, fire alarm system as described herein, and as shown on the drawings. Provide separate circuits from the control panel to each zone of initiating devices as specified herein. Transmission of signals from more than one zone over a common circuit to the control panel is prohibited. Operation shall be such that actuation of any:

a. Manual station

b. Heat detector

c. A coded signal to be transmitted over the station fire alarm system.

Shall cause all of the following actions:

a. All building evacuation alarm devices indicating appliances to operate continuously;

b. The integral annunciator to properly register;

All operations shall remain in the alarm mode except alarm indicating appliances if manually silenced until th system is manually restored to normal. All system circuits shall be electrically supervised including the following:

a. Initiating circuits.

b. Evacuation alarm sounding indicating appliance circuits including flashing light circuits.

c. Battery power supply low and no voltage across the standby battery terminals and open battery circuit.

A single open or ground fault condition in any detection (initiating) or indicating appliance circuit shall not result in any loss of system function, but shall cause the operation of system trouble signals. A ground fault condition or single break in any other circuit shall cause operation of the system trouble signals. Loss of AC power, abnormal AC voltage, a break in the standby battery power circuit, or low battery voltage shall also cause operation of system trouble signals. The abnormal position of any switch in the control panel shall also cause operation of the system trouble signals. Audible and visual equipment for supervision of the AC power supply shall be energized from the auxiliary DC power supply and vice versa. Trouble signals shall sound continuously until manually silenced or the system has been restored to normal.

1.5.2 Power Source

Primary power source shall be 120 volts AC service, transformed through a two winding isolation type transformer and rectified to 24 volts DC for operation of all signal initiating, signal sounding, trouble signal and tripping circuits. Provide secondary DC power supply for operation of system in the event of failure of the AC source. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and shall not cause transmission of a false alarm. Loss of AC power shall not prevent transmission of a signal to station fire alarm headquarters upon operation of any signal initiating circuit. Obtain AC operating power from a single connection into the line side of incoming building power source ahead of all building services. Provide an independent properly fused safety switch, with provisions for locking the cover and operating handle in the "POWER ON" position for this connection located adjacent to main distribution panel. Paint the switch box red and identify it by a lettered designation.

1.6 SPARE PARTS

Furnish the following spare parts:

a. 2 of each type of heat detector installed

b. 5 complete sets of system keys

c. 1 of each type of audible and visual alarm device installed

d. 2 of each type of fuse required by the system

PART 2 PRODUCTS

2.1 CONTROL PANEL

Modular type panel installed in a surface mounted NEMA 4X steel cabinet with hinged door and cylinder lock. Switches and other controls shall not be accessible without the use of a key. The control panel shall be a neat, compact, factory-wired assembly containing all parts and equipment required to provide specified operating and supervisory functions of the system. Panel cabinet shall be finished on the inside and outside with factory-applied enamel finish. Provide separate alarm and trouble lamps located on the exterior of the cabinet door or visible through the cabinet door for each zone initiating circuit. Provide audible trouble signal. Provide permanent engraved rigid plastic or metal identification plates, or silk-screened labels attached to the rear face of the panel viewing window, for all lamps and switches. Provide one set of Form C dry alarm contacts per zone, and a common system trouble contact. System power shall be 120 volts AC service, transformed through a two winding isolation transformer and rectified to 24 volts DC for operation of all system initiating, actuating, signal sounding (indicating appliance), trouble signal and fire alarm tripping circuits. Provide remote bell with a rigid plastic or metal identification sign which reads "Fire Alarm System Trouble." Lettering on identification sign shall be a minimum of one inch high. Permanently label all switches. Panel shall be provided with the following switches:

a. Trouble silencing switch which transfers audible trouble signals to an indicating lamp. For non-self-resetting type switch, upon correction of the trouble condition, audible signals will again sound until the switch is returned to its normal position. For silencing switch of the momentary action, self-resetting type, the trouble signal circuit shall be automatically restored to normal upon correction of the trouble condition.

b. Evacuation alarm silencing switch which when activated will silence all alarm indicating appliances without resetting the panel, and cause operation of system trouble signals. Subsequent alarm(s) from additional zone(s) not originally in alarm shall cause activation of the evacuation alarms even with the alarm silencing switch in the "silenced" position.

c. Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of the system and zone trouble signals.

d. Reset switch which when activated will restore the system to normal standby status after the cause of the alarm has been corrected, and all activated initiating devices reset. Operation of reset switch shall restore activated smoke detectors to normal standby status.

e. Lamp test switch.

2.1.1 Main Annunciator

Provide integral with the main control panel. Provide separate alarm and trouble lamps for each zone alarm initiating circuit as indicated below and 2 spares, located on the exterior of the cabinet door or visible through the cabinet door. Lamps shall be Light Emitting Diode (LED) type. Zone modules for spare zones shall be provided in the control panel. Supervision will not be required provided a fault in the annunciator circuits results only in loss of annunciation and will not affect the normal functional operation of the remainder of the system. Each lamp shall provide specific identification of the zone by means of a permanent label. In no case shall zone identification consist of the words "Zone 1," "Zone 2," etc., but shall consist of the description of the zone.

2.1.2 Initiating Zones

Shall be arranged as follows:

a. Zone 1: Treatment Building Heat Detection
b. Zone 2: Treatment Building Manual Pull Stations
c. Zone 3: Spare
d. Zone 4: Spare

2.2 AUXILIARY POWER SUPPLY

2.2.1 Storage Batteries

Provide sealed lead calcium batteries and charger. Drycell batteries are not acceptable. House batteries in the control panel or in a well constructed vented steel cabinet with cylinder lock, non-corrosive base, and louvered vents. Provide batteries of adequate ampere-hour rating to operate the system and tripping circuits under supervisory conditions for 60 hours, at the end of which time batteries shall be capable of operating the entire system in a full alarm condition for not less than 30 minutes. Provide calculations substantiating the battery capacity. Provide reliable separation between cells to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts. Provide batteries with post-and-nut, "L"-blade, or similar terminals. Slip-on tab type terminals are not acceptable. When a separate battery cabinet is used, provide a fuse block for battery leads within the cabinet. Finish the cabinet on the inside and outside with enamel paint. Locate the top of the battery cabinet not more than 4 feet above floor level.

2.2.2 Battery Charger

Provide completely automatic high/low charging rate type capable of recovery of the batteries from full discharge to full charge in 24 hours or less. Provide an ammeter for recording rate of charge and a voltmeter to indicate the state of battery charge under load. Meters shall be factory installed, or factory-supplied plug-in modules. Field installation of meters other than the panel manufacturer's plug-in modules is prohibited. Provide a trouble light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high-rate switch is provided. House charger in the control panel or battery cabinet.

2.3 MANUAL PULL STATION

Noncoded double action type with mechanical reset features. Stations shall be surface mounted and interior type as indicated. Equip each station with a terminal strip with contacts of proper number and type to perform functions required. Stations shall be a type not subject to operation by jarring or vibration. Break-glass-front stations are not permitted; however, a pull-lever break-glass-rod type is acceptable. Station color shall be red. Station shall provide visible indication of operation. Restoration shall require use of a key or special tool.

2.4 HEAT DETECTORS

Designed for detection of fire by rate compensating principle. Locate detectors in accordance with their listing by UL or FM and the requirements of NFPA 72E, except provide at least two detectors in all rooms of 600 square feet or larger in area. Temperature rating of detectors shall be in accordance with NFPA 72E. No detector shall be located closer than 12 inches to any part of any lighting fixture nor closer than 24 inches to any part of an air supply or return diffuser. Detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, shall be types approved for such locations. Provide with terminal screw type connections. Removal of detector head from its base shall cause activation of system trouble signal.

2.4.1 Rate Compensating Detector

Designed for surface outlet box mounting and supported independently of conduit, tuping or wiring connections. Detectors shall be hermetically sealed and automatically resetting type which will operate when ambient air temperature reaches detector setting regardless of rate of temperature rise. Detector operation shall not be subject to thermal time lag.

2.5 ALARM HORNS

Surface-mounted, single projector, vibrating type suitable for use in an electrically supervised circuit and shall have a sound output rating of at least 90 decibels at 10 feet. Horns specifically listed for outdoor use shall be provided in exposed locations. Horn devices shall be field selectable multitone type. Finish horns in red enamel.

2.6 VISUAL ALARMS

Surface-mounted lamp assembly suitable for use in an electrically supervised circuit. Lamp shall be the flashing stroboscopic type and powered from the alarm circuit. Lamps shall provide a minimum of 75 candle power. Flash rate shall be between 60 and 120 flashes per minute. Lamps shall be protected by a thermoplastic lens, and labelled "FIRE" in letters at least 1/2 inch high. Provide visual alarms within 12 inches of each audible alarm. Visual alarms may be part of an audio-visual alarm assembly.

2.7 AUXILIARY TRANSMITTER

Auxiliary transmitters shall be of the coded, electronic positive non-interfering type. Transmitters shall be solid state electronic type utlizing form "A" or form "C" dry contracts which, when activated by the fire alarm control panel, will transmit four rounds of code. Driving springs if required shall have the capability to transmit not less than 8 complete four-round groups of code before being rewound. [Electronic transmitters shall have a standby battery with the capacity to power the transmitter in a standby status for 60 hours and then transmit not less thatn 8 complete four-round groups of code.] Transmitters shall be designed for operation at 100 milliamperes and shall be capable of full operation between 70 and 120 milliamperes DC line current. Transmitters shall have the ability to transmit signals through ground to overcome an open circuit. Transmitters shall have a device to disconnect the transmitter for maintenance purposes. Code wheel if required shall be metallic. Transmitter code shall be as directed by the Contracting Officer. The transmitter shall be capable of transmitting signals at varying rates of speed ranging from electrical impulses as 3 1/4 second intervals to 1/4 second intervals and shall be field adjustable to any speed within this range. Mechanism shall be housed in a wall mounted locked metal cabinet. Cabinet shall be finished in gloss red enamel. Provide engraved metallic bronze or nickel-alloy or rigid plastic code number plate mounted on face of transmitter housing.

2.8 GROUNDING

Ground transmitter by connection from the grounding terminal connection of the box to either a driven ground rod or a buried, metallic water pipe. Resistance to ground shall not exceed 10 ohms.

2.8.1 Ground Rods

UL 467. Rods shall be the sectional type, copper-encased steel, with a minimum diameter of 3/4-inch and a total length of 10 feet. The rods shall have a hard, clean, smooth, continuous copper surface throughout the length of the rod. The copper shall have a minimum wall thickness of 0.013 inch at any point on the rod. Ground rods shall not protrude more than 3 inches above grade.

2.9 CONDUIT

2.9.1 Rigid Steel Conduit (Zinc-Coated)

ANSI C80.1 or UL 6.

2.10 OUTLET BOXES

UL 514A, cast metal.

2.11 FITTINGS FOR CONDUIT AND OUTLET BOXES

UL 514B, compression type.

2.12 WIRING

NFPA 70, NFPA 72, NFPA 72E, and NFPA 1221. Wire for 120V circuits shall be No. 12 AWG minimum solid conductor. Wire for low voltage DC circuits shall be No. 14 AWG minimum solid conductor. Insulation shall be 75 degree C minimum with nylon jacket. Cable from control panel to auxiliary transmitter shall be as required. Color code all wiring.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the requirements of NFPA 70, NFPA 72, NFPA 72E, NFPA 90A, and NFPA 1221. Each conductor used for the same specific function shall be distinctively color coded. Each function color code shall remain consistent throughout the system. Use colors as directed by the Contracting Officer to match existing base color coding scheme. All wiring shall be in galvanized rigid steel conduit or electrical metallic tubing. All circuit conductors shall be identified within each enclosure where a tap, splice or termination is made. Conductor identification shall be by plastic coated self sticking printed markers or by heat-shrink type sleeves. The markers shall be attached in a manner that will not permit accidental detachment. Control circuit terminations shall be properly identified. Wiring for DC circuits shall not be permitted in the same conduit or tubing as wiring for AC circuits. Paint all junction box covers red or provide them with permanent labels reading "Fire Alarm Circuit."

3.2 FIELD QUALITY CONTROL

3.2.1 Preliminary Testing

Contractor shall conduct the following tests during installation of wiring and system components. Any deficiency pertaining to these requirements shall be corrected by the Contractor prior to final acceptance testing of the system. Record results of testing. All test results shall be given to the Contracting Officer.

a. Ground Resistance: The resistance of each connection to ground shall be measured and shall not exceed 10 ohms. Record readings.

b. Operation of Entire System. Operate all initiating and indicating devices.

c. Operation of Supervisory System: Operate all portions to demonstrate correctness of installation.

3.2.2 Final Acceptance Testing

The Contractor shall notify the Contracting Officer when the system is ready for final acceptance testing. Request scheduling for final acceptance testing only after all necessary preliminary tests have been made and all deficiencies found have been corrected to the satisfaction of the equipment manufacturer's technical representative and the Contracting

Officer, and written certification to this effect has been received by the Division Fire Prot ction Engineer. The system shall be in service at least 15 days prior to final acceptance testing. The Contractor shall allow at least 15 days between the date final testing is requested and the date the final acceptance testing takes place. The Contractor shall furnish all appliances, equipment, instruments, devices and personnel for this test. The system shall be tested for approval in the presence of representatives of the manufacturer, the Contracting Officer, and the Northern Division Fire Protection Engineer. All necessary tests shall be made including the following, and any deficiency found shall be corrected and the system retested.

3.2.2.1 Entire System

The entire system shall be tested by operating all fire alarm initiating, notification, and signaling devices. Perform tests with the system operating on primary power and repeat the test with the system operating on battery power only. Necessary equipment to test smoke detectors and heat detectors shall be provided.

3.2.2.2 Supervisory Systems

All aspects of the supervisory functions of the systems shall be operated.

3.2.3 Additional Tests

When deficiencies, defects or malfunctions develop during the tests required, all further testing of the system shall be suspended until proper adjustments, corrections or revisions have been made to assure proper performance of the system. If these revisions require more than a nominal delay, the Contracting Officer shall be notified when the additional work has been completed, to arrange a new inspection and test of the fire alarm system. All tests required shall be repeated prior to final acceptance, unless directed otherwise.

-- End of Section --

SECTION 16741

TELEPHONE DISTRIBUTION SYSTEMS, OUTSIDE PLANT

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	1990 National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1990 National Electrical Code

RURAL ELECTRIFICATION ADMINISTRATION (REA)

REA 344-2	1987 List of Materials Acceptable for Use on Telephone Systems of REA Borrowers
REA 345-6	1978 Splicing Plastic-Insulated Cables (PC-2)
REA 345-67	1987 Filled Telephone Cables

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. Wire and cable G

b. Cable splices, and connectors G

1.4 DELIVERY, STORAGE, AND HANDLING

Ship cable on reels in 500 foot length with a minimum overage of 10 percent. Radius of the reel drum shall not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable shall be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to

prevent moisture from entering the cable. Reels with cable shall be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacturer of such products and shall be the manufacturer's latest standard design.

2.2 CABLE SPLICES, AND CONNECTORS

2.2.1 Copper Cable Splices

Splices shall consist of a moisture resistant, two-wire connector held rigidly in place to assure maximum continuity. Provide correct connector size to accommodate the cable gage of the supplied cable. Connector shall be listed in REA 344-2.

2.3 WIRE AND CABLE

2.3.1 Copper Conductor Cable

Solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core shall be separated into compartments. Cable shall be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Contractor shall verify distances between splice points prior to ordering cable in specific cut lengths. Gage of conductor shall determine the range of numbers of pairs specified; 19 gage (6 to 400 pairs), 22 gage (6 to 1200 pairs), 24 gage (6 to 2100 pairs), and 26 gage (6 to 3000 pairs). Copper conductor shall conform to the following:

2.3.1.1 Underground

Provide filled cable meeting the requirements of REA 345-67.

PART 3 EXECUTION

3.1 INSTALLATION

Install all system components and appurtenances in accordance with manufacturer's instructions and as shown. Provide all necessary interconnections, services, and adjustments required for a complete and operable telephone system. Installation shall be done in accordance with the safety requirements of ANSI C2, and NFPA 70.

3.1.1 Contractor Damage

Promptly r pair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a nonindicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.2 Underground Duct

Underground duct shall be constructed as specified in Section 16375, "Underground Electrical Work." Ducts under roads, paved areas, and railroad tracks shall be concrete encased.

3.1.2.1 Connections to Existing Manholes Handholes

For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut the steel and extend it into the duct line envelope.

3.1.2.2 Connections to Concrete Pads

For duct line connections to concrete pads, break an opening in the pad out to the dimensions required and preserve the steel in the pad. Cut the steel and extend it out to tie into the reinforcing of the duct line envelope. Chip out the opening in the pad to form a key for the duct line envelope.

3.1.2.3 Connections to Existing Ducts

Where connections to existing duct lines are indicated, excavate the lines to the maximum depth required. Cut off lines and remove loose concrete from the conduits before new concrete encased ducts are installed. Provide reinforced concrete collar, poured monolithically with the new duct line to take the shear at the joint of the duct lines.

3.1.3 Reconditioning of Surfaces

3.1.3.1 Unpaved Surface Treatment

Restore unpaved surfaces disturbed during the installation of duct or direct burial cable to their original elevation and condition. Carefully preserve existing sod and topsoil and replace after the backfilling is completed. Replace damaged sod with seed of quality equal to that removed. Where the surface is disturbed in a newly seeded area, reseed the restored surface with the same quantity and formula of seed as that used in the original seeding.

3.1.4 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling

apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts oth r than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects. When def cts are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Cable pulling shall also be stopped when reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer.

3.1.4.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension shall not be exceeded.

3.1.4.2 Pulling Eyes

Equip cables 1.25 inches in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 1.25 inches with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel of 3/4-inch links between pulling-in eyes or grips and pulling strand.

3.1.4.3 Installation of Cables in Manholes, Handholes, and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 4 feet. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with cables arranged and supported as specified for new cables. Identify each cable with corrosion-resistant embossed metal tags.

3.1.5 Cable Splicing

3.1.5.1 Copper Conductor Splices

Perform splicing in accordance with requirements of REA 345-6 except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply for pairs assigned for carrier application.

3.1.6 Grounding

Ground exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

3.2 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.2.1 Acceptance Tests

3.2.1.1 Copper Conductor Cable

All or part of the following tests may be required by the Contracting Officer: Shield continuity, conductor continuity, conductor insulation resistance, DC-loop resistance, resistance unbalance, insertion loss, frequency response, line noise measurement, subscriber loop measurements, structural return loss (one or two man), cable carrier insertion loss, and cable carrier frequency response.

-- End of Section --

SECTION 16901

CONTROL PANELS AND INSTUMENTATION

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.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code

UNDERWRITERS LABORATORY (UL)

UL 854	1991 (R. 1992) Service Entrance Cables

1.2 GENERAL REQUIREMENTS

Section 16011, "Electrical General Requirements" and Section 16402, "Interior Wiring Systems" and NFPA 70 apply to this section with additions and modifications specified herein.

Provide a complete control system in accordance with this specification, the treatment system process and instrument diagram, electrical ladder diagrams, and the treatment process and controls description.

1.2.1 Electrical Characteristics

Electrical characteristics for this project shall be 208/120 volts secondary, three phase, 4 wire. Final connections to the control system shall be as detailed on drawings.

1.2.2 Qualifications of Installer

Prior to commencing work, submit data showing that the Contractor has successfully installed control systems of the same type and design as specified herein, or that he has a firm contractural agreement with a subcontractor having the required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that the system has performed satisfactorily for a period of at least 18 months.

1.2.3 Manufacturer's Representative

Provide the services of a representative or technician from the manufacturer of the system, experienced in the installation and operation of the type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of the system and to

provide instruction to Government personnel.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data (M)

a. Starters G
b. Alarm G
c. Wiring and Cabling G
d. Instrumentation Drawings G

1.3.2 SD-04, Drawings

a. Process Power MCC
b. Pump Control MCC A&B

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment in accordance with Section 16011, "Electrical General Requirements" and Section 16402, "Interior Wiring Systems".

2.1.1 Conduit

Provide materials for this section as specified in accordance with Section 16402, "Interior Wiring Systems".

2.1.2 Wire and Cable

2.1.2.1 Wire and cable conductor sizes are designated by American Wire Gauge (AWG). Conductor and conduit sizes indicated are for copper conductors. Insulated conductors shall bear the date of manufacture imprinted on the wire insulation with other identification. Wire and cable manufactured more than 24 months before delivery to the job site shall not be used.

2.1.2.2 Conductors rated 600 volts and less, including service entrances, shall conform to UL 854, Type THW, THHW, THHN. Conductor size and number of conductors in each cable shall be as indicated. Cable shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable tiles and plates, or heat shrink type sleeves. Control circuit terminations shall be properly identified. Conductors shall be solid copper.

2.1.3 Enclosures

2.1.3.1 Fabricate panels and enclosures of 16-gage furniture-grade steel or 6063-T5 extruded aluminum alloy, totally enclosed on all sides, with hinged door and keyed lock with manufacturer's standard shop-painted finish.

2.1.3.2 Provide UL listed panels for use with line voltage devices.

Panel Mounted Equipment: include all equipment that is not door mounted. See 2.1.3.3.

2.1.3.3 Door Mounted Equipment: include all run pilot lights, acknowledge switch and hand-off-automatic selector switches.

2.1.3.4 Provide nylon based double screw type terminal blocks with spare terminal for extra wiring.

2.1.4 Programmable Logic Controller (PLC)

2.1.4.1 Provide 3 programmable logic controllers (PLC), capable of performing sequential logic functions and closed loop processor functions, to monitor control and integrate all automated well and process system functions as defined by the process diagrams, ladder diagrams, and treatment process and control description as detailed in paragraph 3.6 of this specification.

2.1.4.2 The primary PLC shall be capable of handling up to 300 I/O functions in any mix ratio, the primary PLC, located in the process control panel in the process building, shall control all automated functions in the process building. The primary PLC shall also be required to interface on a limited basis with two remote PLCs located at each of the groups of wells designated as "A" and "B" on the drawings. This communication consists of transmitting a well shutdown signal in the event of a malfunction in the process building. The primary PLC will not be required to monitor operation at the remote PLCs.

2.1.4.3 There shall be 2 secondary PLCs 1 located in each pump motor control center (MCC) "A" and "B" near each of the well groups. Each of these PLCs shall be capable of handling 50 I/O functions in any mix ratio to control the well pumps ON/OFF sequence. The communication between these remote PLCs and the primary PLC will be to receive the shutdown signal from the primary PLC.

2.1.4.4 A single portable programmable terminal shall be provided for the three PLC's. This unit will be equipped with all necessary hardware and software to allow for on line PLC reprogramming and diagnostic evaluation with the PLC's built in diagnostic instructions.

2.1.5 PH Element and Transmitter Controller

2.1.5.1 Provide a PH element to electrochemically measure, indicate, transmit and control the PH of a process fluid. The method of measurement shall be by the differential electrode technique. Include the element, transmitter, interconnections, cable and junction box. PH element shall be submersion mounted in a liquid storage tank.

2.1.5.2 The PH sensor shall be accurate to within $\pm$ 0.05 PH units with a system resolution within 0.01 PH units. The sensor shall include an integral pre-amplifier/signal conditioner and be capable of operaing in a fluid temperature renage of 50-100°F. Materials of construction shall be compatible with contact fluid.

2.1.5.3 The transmitter shall include 4-20 mA isolated outputs, LCD or LED digital display suitable for control pan l mounting. Menu driven microprocessor based with keypad for control settings. Manual control output activation for system testing.

2.1.6 Flow Element and Transmitter

2.1.6.1 Provide a flow element to measure indicate and transmit the flow of a process fluid in a full pipe. The method of measurement shall be the mechanical paddle wheel style.

2.1.6.2 The flow element shall be accurate to within ± 1% on the full scale. Flow range is 0-60 gallons per minute at 25 psig. An integral signal conditioner shall be incorporated to provide a 4-20 mA linear output signal proportional to flow.

2.1.7 Flow Switch

2.1.7.1 Provide a flow switch to indicate flow and transmit the presence of a process fluid in a full pipe. The method shall be the float type system.

2.1.7.2 The flow switch shall be constructed of materials suitable for the fluids being measured and capable of operation from 0-50 psi at 50-100°F. The switch shall be a standard N/O SPDT max. 30 VA.

2.1.8 Level Controller and Transmitter

2.1.8.1 Provide a liquid level transmitter to indicate and transmit liquid tank level. The transmitter shall use a variable capacitance transducer technology to continuously monitor liquid level.

2.1.8.2 The transmitter will have a range of 0" to 25" w.c. to 0 to 250" w.c. with a turndown ratio of 10 to 1. Provide with ANSI 150 LB flange mount design.

2.1.8.3 The transmitter shall include 4-20 mA output signal and have an accuracy of ± 0.25% and be capable of operating in fluid temperatures of 50-100 °F.

PART 3 EXECUTION

3.1 INSPECTION

3.1.1 Examine areas and conditions under which electric control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 INSTALLATION OF ELECTRIC CONTROL SYSTEM

3.2.1 Provide systems and materials in accordance with manufacturer's instruction and provide electrical components and use electrical products complying with requirements of Section 16402. Mount controllers at convenient locations and heights.

3.3 ENCLOSURE

3.3.1 Both the interior process power and process control panel MCC enclosures shall be industrial gasketed, classified NEMA 12 to provide a mositure barrier. They shall be for wall mounting and be painted with a special paint highly resistant to moisture, light gray to limit heat gain. Both of the outside pump control MCC enclosures shall be classified NEMA 4X water tight with a drip lip over the door. They shall be for stantion mounting and be painted with moisture resistant paint, light gray to limit heat gain.

3.3.2 The motor starters in each enclosure shall have the appropriate NEMA rating to match the motor horsepower. Each starter shall have three motor overload devices, one for each phase. Each starter shall have an individual breaker disconnect.

3.4 COMPONENTS

Inside the process control panel enclosure shall be an alarm transmission panel for transmitting a remote alarm signal by dedicated telephone line. All devices on the door of this enclosure shall be rated NEMA 4X. All manual/off/automatic selector switches shall be key operated.

3.5 WIRING

3.5.1 Wiring in each enclosure shall conform to process control panel wiring codes with wire numbers on each terminating point of a wire and wire colors conforming to standard process control codes. Wire colors shall be as follows: black - power, white - neutral, red - control, yellow - remote powered, blue - dc power. All interconnecting wires shall be brought to terminal boards.

3.5.2 The control devices and instruments shall be grouped by function on the panel and placed in a neat, orderly, and pleasing arrangement to facilitate an understanding of the control and its operation. All components shall be marked with engraved plastic plates (black on white background) on or near them.

3.5.3 The term "control wiring" is defined to include providing wire, conduit, and miscellaneous materials as required for mounting and connecting electric control devices.

3.5.4 Install complete control wiring system for electric control systems. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

3.5.5 Number-code or color-code conductors, appropriately for future identification and servicing of control system.

3.5.6 Furnish labels appropriate for the use. Install labels onto equipment and/or onto panel door to properly identify the function of the device.

3.5.7 All wiring shall be kept trained into wireways or gutters.

3.5.8 All terminals shall be clearly and permanently labeled.

3.5.9 Contractor shall make all wiring terminations and ensure that control panel is fully operational and functional prior to the completion of the project.

3.6 TREATMENT PROCESS AND CONTROLS DESCRIPTION

3.6.1 General

3.6.1.1 Due to the variability in the ground water extraction well yield as influent to the treatment system, the main process line pump system has been designed for duplex service. With this flexibility, if the total well yield is less than the treatment system design capacity of 50 gpm, one pump may be taken out of service and a lower but steady flow maintained through the process. This is the preferred alternative to cycling the treatment system by batching 50 gpm when the equalization tank fills. In all cases, level controls can automatically activate the second pump to duty based on rising water levels in any of the tanks. The entire system will be integrated with a programmable logic controller (PLC) to sense and operate individual unit processes as well as interlock all units if a failure condition is detected to shutdown all systems.

3.6.2 Main Line Process

3.6.2.1 Ground Water Extraction: Ground water will be pumped from wells designed to provide complete capture of the plume. A low level sensor (LSEW 14-26) in the wells will turn off the submersible pumps if excessive drawdown occurs to protect against motor burnout. A high level sensor (LSEW 1-13) will restart the pump upon recovery. A minimum drawdown in the wells will be established with the high level sensors so that a gradient exists towards the wells even when the pumps are off to ensure capture.

Extracted ground water will enter the treatment system in an equalization tank (Tank #1) acting to dampen flow surges and prime the transfer pump (P-01A & B) system. A mixer in the equalization tank will be operated continuously. At the higher pH the solubility of the metal ions is decreased and precipitates will start to form.

3.6.2.2 Flocculator/Clarifier: As the water level in the equalization tank rises, a pressure transducer will activate a level switch in the PLC which will activate one of the transfer pumps (P-01A or B) to initiate flow to the flocculator/clarifier (F/C). In the pump discharge line a flow meter (FM) will sense and measure flow to pace the coagulant, flocculant and oxidant chemical feed pumps for injection into this line. If the water level keeps rising in the equalization tank, the transducer will activate a second level switch which will activate the second transfer pump (P-01B or A). If the water level rises further to an unsafe level, the transducer/PLC will shutdown all upstream feed sources (in this case the extraction wells) and activate an alarm in the building and to the Naval

Base Fire/Emergency Station. This control logic is repeated in all tank/pump units in the system.

Flow will enter the rapid mixing and flocculation basins of the F/C where mechanical mixers (M-5, M-6) activated by the flow switch (FS04) provide turbulent and laminar agitation, repectively. The catonic coagulent enhances the formation of the precipitates into particles and the anionic flocculent promotes agglomeration of particles into a larger, settleable mass. The feed rates of all chemicals will be optimized during system start-up based on jar and on-line tests. In the claifier, flow is directed up through the inclined settling plates to overflow weirs. Solids settle to the hopper bottom for extraction on a timed basis (T01) by sludge pump (SP-01) discharging to the sludge tank (Tank #5). Clarified water will overflow to a clearwell (Tanks #2). A 90% removal efficiency of Total Suspended Solids can be expected in the F/C to a level of 10 mg/l.

3.6.2.3 Pressure Filtration: When the water level rises in the clearwell, a transducer will activate a level switch which in time will activate the transfer pump system (P-02A/B) to charge the water to 25 psi± necessary for the pressure filters. Flow is forced through the dual media (antracite/sand) filters where further solids removal occurs by retaining particles in the pre spaces of the media. Under clean conditions the headloss through the units will be ±4 psi. as solids clog the media, the headloss will increase. The plant operator will manually initiate the backwashing on one filter unit at a time when the headloss approaches ±12 psi as indicated on the local gauges. It is expected that with proper operation of the clarifier, the filters will not clog rapidly thus enabling the operator to backwash one unit per day as a good housekeeping practice before they reach the 12 psi headloss while keeping the other unit on-line. If the headloss builds unchecked to the point that the pressure loss exceeds 12 psi (adjustable), a pressure switch will activate the shutdown/alarm control. Process effluent from the pressure filters should have a Total Suspended Solids concentration below 2 mg/l.

From the pressure filter process flow will enter a clearwell (Tank #3) which in addition to priming the next set of transfer pumps will also be used to store water for filter backwashing. Under normal system operation only the top 500 gallons in the tank will be used for the downstream transfer pumps (P-03A/B) as controlled by the tank level. For backwash water 1500 gallons will remain in the tank for prime on the backwash pump (P-04). In this tank a probe will measure pH and adjust the acid feed rat to produce a pH of ±5.7 using similar controls as discussed earlier for the caustic feed system. This lower pH is required for the UV/oxidation treatment because of possible fouling problems from the carbonate hardness at the higher pH. The tank will be equipped with a mixer operated by an adjustable timer.

3.6.3 Off-Line Processes

3.6.3.1 Pressure Filter Backwash: The operator will manually operate the valves and pump required to initiate backwashing. The backwash pump (P-04) will force water at a high flow rate upwards through the selected filter to remove solids. The backwash water will enter the Sludge Thickener Tank (Tank #5) to remove solids from the system. Water will be continuously decanted off the top of the tank to the Recycle Tank (Tank #6) while sludge

settles to the cone-shaped bottom. High level in this tank as sensed by a float will shutdown any tank feed sources and activate the alarm condition.

3.6.3.2 Flocculator/Clarifier Sludge Removal: Sludge accumumlated in the bottom of the clarifier will be intermittently withdrawn by the use of a sludge pump (SP-01) controlled with an adjustable timer. The sludge will enter the Sludge Storage Tank (tank #5) at a solids concentration of 1-2%. Water will be continuously decanted from the tank as discussed above. When the Recycle Tank fills, level controls will activate the pump to return this water to the head of the treatment plant (Tank #1).

3.6.3.3 Filter Press Operation: As the sludge level builds in the storage tank (Tank #5), the plant operator will have to maually initiate the filter press operation. Sludge will be withdrawn from Tank #5 using an air diaphragm sludge pump (SP-02) at a solids concentration of 30%± for disposal. In the plate and frame type filter press, the system is energized gradually to 100 psi and liquid filtrate is removed from th sludge. The filtrate will flow by gravity to the Recycle Tank (Tank #6) for return to the system. The filter press will be elevated to facilitate this arrangement. The recycle tank will be maintained normally empty (a maximum of 200 gallons to prime the recycle pump (P-05) for this purpose and to ready the process for storage of the 1500 gallon± slug of water resulting from filter backwash. The elevated filter press will also allow the cake to be dropped from the press into drums for storage.

3.6.3.4 Plant Floor Drain System: The building floor slab will be sloped to floor drains which will be piped to a closed sump and pump system. Under normal operation, the floor drains will collect plant washdown water and the pump can discharge these flows to the head of the system (Tank #1). To protect against a chemical spill upsetting this operation, the sump pump (VP-01) will only be activated by the operator manually turning the pump on. A float control set at a sump volume of 200 gallons will trip a control panel alarm telling the operator the sump is filling. The operator can then decide to turn the pump on to discharge the water to Tank #1 or initiate spill containment measures in the sump. If the liquid level continues to rise further, a level control will trip a second alarm to the Naval Base Fire/Emergency Station and shutdown all systems.

3.6.3.5 Treatment System Maintenance Features: Each treatment unit will be equipped with bypass piping to take that system out of service while possibly maintaining plant flow to the remaining operating systems. This operation should only be allowed in an emergency and if the effluent will still meet discharge requirements. The piping system will be installed with line drains/sample taps (L.D.) that will enable equipment and tanks to be drained if necessary. These line drains will be equipped with quick-connect end fittings to allow connection of a portable hose that could be routed to the floor drain or some other removal option.

--End of Section --