03.15- 3/24/95 - 00189

March 24, 1995
Submittal of 100% Design Specifications for Bid
Table of Contents

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Table of Contents

SECTION 01010

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.

CORPS OF ENGINEERS (COE)

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

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) Measurement of Electromagnetic Interference Characteristics

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 1989 Safeguarding Construction, Alteration, and Demolition Operations

1.2 PRECONSTRUCTION SUBMITTALS

Submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.2.1 SD-04, Drawings

a. Shop Drawings G

Within 120 days of issuance of the delivery order, submit shop drawings that detail and describe all components of the project not currently indicated on the contract drawings such as that the shop drawings and the contract drawings, when taken together, provide a complete representation of the project requirements. Shop drawings shall include, but not be limited to the items listed in the submittal register provided at the end of this section.

1.2.2 SD-09, Reports

a. Construction Plans G

b. Work Plan G

1.2.2.1 Construction Plans

Within 45 days of issuance of the delivery order, submit Construction Plans consisting of the following items:

(1) Civil/structural drawings providing details of building and building foundations;

(2) Treatment system equipment general arrangements showing appropriate elevation sections of the items depicted in the drawings;

(3) Mechanical drawings defining all equipment sizes, capacities and installation details; pipe routing, sizes, anchors and supports including pressure reducing station and condensate cooling well details; mechanical control system details; building plumbing system details.

(4) Instrument and control drawings defining control loops, motor connections (using point to point wiring diagrams), control panel details, all necessary ladder logic for control schemes, conduit routing cable/conduit schedules, and instrument installation/location details.

(5) Electrical drawings defining building and site pump locations; power and lighting circuiting requirements of all equipment (i.e., wiring, devices, telephone devices, lighting fixtures, motors, motor starters, PLC/control equipment, etc.); single line diagrams; panelboard schedule details; and motor control wiring schematics.

1.2.2.2 Work Plan

Within 90 days of issuance of the delivery order, submit a work plan consisting of the following elements.

a. Narrative

Provide a brief description of the project objectives, scheduling, sampling and analysis requirements, decontamination procedures, site work and excavation procedures, construction requirements, and storage, transportation, and removal requirements.

b. An Erosion Control Plan in accordance with State and local regulations, consisting of site plans indicating locations of erosion control features during the various states of construction, details of erosion control features, and applicable notes;

c. Environmental Protection Plan
Within 15 days of issue of delivery order, meet with the Navy's Technical Representative (NTR) to discuss environmental protection requirements for the project. After meeting with the NTR, prepare, and submit an Environmental Protection Plan in accordance with Section C, Part 4.0, of the Basic Contract. In addition to items specified in Section C, Part 4.0 of the Basic Contract, the Environmental Protection Plan shall address:

(1) Safety Program G
(2) Notice of Intent G

The contractor shall prepare a completed Notice of Intent (NOI) form in accordance with the requirements of the State's general permit for stormwater discharges from construction sites. Submit NOI, and the appropriate permit fee to the NTR a minimum of 14 days prior to start of construction.

The contractor shall keep a copy of the approved permit on site at the contractor's trailer at all times.

(3) Erosion and Sediment Inspection Reports G

Submit to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inches of rain.

d. Site Health and Safety Plan

Provide a site specific Site Health and Safety Plan in accordance with Section C, Part 3.0, of the Basic Contract.

e. Construction Quality Control Plan

Provide a QC Plan in accordance with Section C, Part 6.0, of the Basic Contract.

(1) Submittal Register

As part of the QC Plan, submit a completed Submittal Register to document quality control for materials, inspection, and testing in accordance with Section C, Part 7.0 of the Basic Contract. A copy of the Submittal Register is provided in Attachment 01010-A.

(2) Testing Laboratory Qualifications

As part of the QC Plan, submit qualifications for each laboratory which will be used in accordance with Section C, Part 6.0, of the Basic Contract.

f. Sampling and Analysis Plan (Quality Assurance Project Plan)

Provide a Sampling and Analysis Plan describing all sampling and analyses requirements and procedures for the delivery order. The Plan shall contain a field sampling plan and a quality assurance plan.

g. Air Monitoring Plan

h. Transportation and Disposal Plan

i. Aquifer Test Work Plan

Provide a work plan describing the scope of work to be performed for the aquifer test, including, but not limited to, length of test, test procedures, and reporting requirements. The test work plan shall consist of the following elements:

The test well shall be pumped to determine well efficiency and acceptance and to estimate aquifer transmissivity, storage coefficient and specific capacity. To obtain this information, at least one and preferably two observation wells shall be drilled at suitable distances from the pumped well. The well shall be test pumped at a constant rate for 24 hours if the aquifer is confined or 72 hours if the aquifer is unconfined.

The discharge of the test pump will be measured by a circular orifice meter, totalizing meter, flume, or other suitable device, and the water level measured electronically or by air line or tape to the nearest 0.5 in (13 mm). Measurements of the yield and water level will be made every 30 to 60 seconds for the first 10 minutes of the test, every minute for the next 5 minutes, every 5 minutes from 15 to 60 minutes, every 30 minutes from 60 to 300 minutes, every hour from 300 to 1,440 minutes, and every 8 hours from 1,440 minutes until the end of the test. A water sample (approximately 1 qt.) shall be obtained within 20 minutes after starting the pump and then about 5 minutes before shutting the pump down.

After the pump is shut down, recovery measurements of the water level shall be made for a period equal to at least three-fourths of the pumping period or until the water level has reached the original static level. The recovery measurements shall be made at the same time intervals that measurements were made during the pumping portion of the test.

1.2.3 Forwarding Preconstruction Submittals

Within 60 days of issuance of the delivery order, and before procurement, fabrication, or mobilization, submit to the Architect-Engineer: Baker Environmental, Inc., Airport Office Park, Building 3, 420 Rouser Road, Corapolis, PA 15108, and to distribution as directed, the preconstruction submittals required in this specification. The Architect-Engineer for this project will review the Work Plan for the NTR to determine compliance of the

Contractor's Work Plan with the requirements of the contract documents for this delivery order.

1.2.4 Review Comments

The Contractor's Work Plan will be reviewed. The NTR will compile and coordinate all Government review comments, and forward consolidated review comments to the Contractor. Review comments on the Work Plan shall be resolved, and submittals modified as required. After the correction of the submittals, submit one corrected final copy of the Work Plan to the NTR for final review. The Work Plan shall be approved prior to commencement of any other work associated with this delivery order.

1.3 SUBMITTALS

Submit the following in accordance with Section C of the Basic Contract.

1.3.1 SD-18, Records

a. As-Built Records G

b. Environmental Condition Report

c. Status Reports

d. QC Meeting Minutes

e. Test Plan and Log

f. Contractor Production Report

g. QC Report

h. Rework Items List

i. Permits

j. Contractor's Closeout Report

1.3.1.1 As Built Records

Maintain two sets of full size contract drawings and two sets of full size approved shop drawings marked to show any deviations which have occurred, including buried or concealed construction and utility features revealed during the course of construction. Record horizontal and vertical locations of buried utilities that differ from the contract drawings. Show the size, manufacturer's name, model number, capacity, and electrical power characteristics of the equipment installed. These drawings shall be available for review by the NTR at any time. At the completion of the work, deliver marked

sets of the contract drawings to the NTR. Contractor shall incorporate all shop drawing deviations, and deliver one complete set of reproducible sepias of the shop drawings to the NTR.

1.3.1.2 Environmental Condition Report

Prior to starting work, perform a preconstruction survey with the NTR. Take photographs showing existing environmental conditions on and adjacent to the site. Prior to starting work, submit the results of the survey in an Environmental Condition Report to the NTR.

1.3.1.3 Contract Management System (CMS)

The CMS shall be a system able to provide, as a minimum, the activities in sorts or groups as specified in the Basic Contract and any subsequent Delivery Orders.

a. Status Report

All Status Reports shall comply with the Basic Contract and any subsequent Deliver Orders. Submit a Technical Progress Report, Cost Performance Report, Modification Log, Time-Scaled Logic Diagram, Government Materials Tracking Report, Variance Analysis Report, and Waste Materials Report. Submit the first delivery order Status Report approximately 30 days after approval of the Contractor's Work Plan. Thereafter, submit Status Reports every 30 days. Status report periods shall be consistent with the invoice reporting periods.

1.3.1.4 QC Meeting Minutes

The QC Representative shall document all QC meetings by delivering copies of the minutes to the NTR within 3 calendar days after each QC meeting. The submittals shall comply with Section C, Part 6.0 of the Basic Contract.

1.3.1.5 Test Plan and Log

A summary report of all field tests containing both "required" and "actual" results plus "passed" or "failed" for conforming, nonconforming and repeated test results shall be submitted to the NTR at the end of each month in accordance with Section C, Part 6.0 of the Basic Contract.

1.3.1.6 Contractor Production Report (CPR)

The CPR shall be prepared and submitted daily to the QC Representative in accordance with Section C, Part 6.0, of the Basic Contract.

1.3.1.7 QC Report

The QC Report shall be submitted by the QC Representative to the NTR every day

work is performed, material is delivered, direction is pending, or a labor force is present in accordance with Section C, Part 6.0, of the Basic Contract.

1.3.1.8 Rework Items List

The QC Representative shall deliver a copy of the rework items list to the NTR on a monthly basis in accordance with Section C, Part 6.0, of the Basic Contract.

1.3.1.9 Permits

Fifteen days prior to beginning on-site work, submit draft copies of the following permits required for onsite activities:

a. Excavation Permit; from the Public Works Officer, Utilities Division

b. Welding and Burning Permit; from the Base Fire Marshall

1.3.1.10 Contractor's Closeout Report

Submit upon completion of the project. This report shall include: Introduction, Summary of Action, Final Health and Safety Report, Summary of Record Documents, Field Changes and Contract Modifications, Final Documents, summary of Chemical and Geotechnical Testing, Offsite Disposition of Materials, Groundwater Recovery Report, Summary of Final Testing Results, and QC Summary report.

1.3.2 SD-19, Operation and Maintenance Manuals

Provide Operation and Maintenance Manuals as specified in Section 01730, "Operation and Maintenance Data," individual sections of these specifications, and the Basic Contract.

1.3.3 Forwarding Submittals

As soon as practicable after award of the contract, and before procurement or fabrication, submit, except as specified otherwise, to the NTR, the submittals required in this specification. The Architect-Engineer for this project will review and provide surveillance for the NTR to determine if Contractor-approved submittals comply with the contract requirements, and will review and approve for the NTR those submittals not permitted to be Contractor approved to determine if submittals comply with the contract requirements. At each "Submittal" paragraph in the individual specification sections, a notation "G", following a submittal item, indicates the NTR is the approving authority for that submittal item. One copy of the transmittal form for submittals shall be forwarded to the NTR.

1.4 GENERAL INTENTION

It is the declared and acknowledged intention and meaning to provide and secure a groundwater extraction and treatment system, an in situ vacuum extraction system and a soil and debris removal action at Operable Unit No. 2, Marine Corps Base, Camp Lejeune, North Carolina.

1.5 GENERAL DESCRIPTION

a. The work includes installation of a groundwater treatment system and building, groundwater extraction wells, and incidental related work at Site 82, approximately as shown.

b. The work includes installation of an in situ vacuum extraction systems and building, vacuum extraction wells, and incidental related work at Area of Concern (AOC) 1, approximately as shown.

c. The work includes removal and disposal of contaminated soil and debris from five (5) soil AOCs, and incidental related work, approximately as shown.

1.6 DESCRIPTION OF CONTAMINANTS PRESENT

Site investigation performed to date have identified the presence of volatile organic compounds (VOCs) in the shallow aquifer (less than 30 feet) and the Castle Hayne Aquifer (greater than 100 feet). The VOCs detected include chlorobenzene, chloromethane, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethane, total-1,2-dichloroethene, methylene chloride, tetrachloroethane, 1,1,2-trichloroethane, trichloroethene (TCE), vinyl chloride, benzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, ethylbenzene, toluene and total xylenes. Many of the VOCs detected exceed Federal Maximum Contaminant Levels (MCLs) for drinking water. Metals detected include aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, vanadium, and zinc. In general, semi-volatile organic compounds are not considered contaminants of concern.

Site investigations performed to date have identified the presence of surface and subsurface contamination at five (5) soil AOCs. These areas, and maximum concentrations detected are:

a. Soils in the ravine area (AOC 2) are contaminated with polynuclear aromatic hydrocarbons (PAHs), PCBs, and metals. In addition, AOC 2 contains various debris, including, but not limited to, empty and partially filled 55-gallon drums, 1 and 5 gallon pails, battery packs, and shell casings. The site also contains construction debris including, but not limited to, scrap metal, porcelain bathroom fixtures, metal lockers and furniture.

b. AOC 3 contains PCB contaminated soil (35 µg/kg dieldrin).

c. AOC 4 contains PCB contaminated soil (42,000 µg/kg PCB-1260).

d. AOC 5 contains pesticide contaminated soil (180,000 µg/kg 4,4-DDD).

e. AOC 6 contains PCB contaminated soil (26,000 µg/kg PCB-1260).

Additional sampling information and soil boring logs for these areas are provided at the end of this section.

1.7 LOCATION

The work shall be located at Operable Unit No. 2, Marine Corps Base, Camp Lejeune, approximately as shown. The exact location will be indicated by the NTR.

1.8 PROJECT INFORMATION

1.8.1 Drawings, Maps and Specifications

Four sets of contract drawings, maps and specifications will be furnished to the Contractor without charge, except applicable publications incorporated into the technical provisions by reference. Additional sets will be furnished on request at no charge. The work shall conform to the following contract drawings and maps, all of which form a part of these specifications and are available in the office of the NTR.

Sheet No.	Drawing No.	Drawing Title
1	G-1	Cover Sheet
2	G-2	Vicinity and Location Map and General Notes
3	C-1	Overall Site Plan
4	C-2	Site Piping Plan
5	C-3	Offsite Water, Sewer, and Electrical Plan
6	C-4	Offsite Effluent Outfall - Plan and Profile 1
7	C-5	Offsite Effluent Outfall - Plan and Profile 2 and Details
8	C-6	Soil AOC-1
9	C-7	Soil AOC 2 and AOC 3
10	C-8	Soil AOC 4 and AOC 5
11	C-9	Soil AOC 6
12	C-10	Groundwater Treatment Plant - Site Plan
13	C-11	Site Staking and Geometry Plan

Sheet No.	Drawing No.	Drawing Title
14	C-12	Groundwater Treatment Plant - Grading and Paving Plan
15	C-13	Erosion and Sedimentation Plan 1
16	C-14	Erosion and Sedimentation Plan 2
17	C-15	Erosion and Sedimentation Plan 3
18	C-16	Recovery Well Details
19	C-17	Civil Details
20	P-1	Process Flow Diagram
21	P-2	Piping and Instrumentation Diagrams - Symbols and Legends
22	P-3	Piping and Instrumentation Diagrams - Pretreatment System Drawing 1
23	P-4	Piping and Instrumentation Diagrams - Pretreatment System Drawing 2
24	P-5	Piping and Instrumentation Diagrams - VOC Removal System
25	P-6	Piping and Instrumentation Diagrams - Plant Service Systems
26	A-1	Architectural - Schedules and Details
27	A-2	Architectural - Floor Plan
28	A-3	Architectural - Elevations
29	A-4	Architectural - Details 1
30	S-1	Groundwater Recovery Bldg - Structural General Notes and Typ. Details
31	S-2	Groundwater Recovery Bldg - Floor and Foundation Plan
32	S-3	Groundwater Recovery Bldg - Foundation Plan - Containment Area
33	S-4	Groundwater Recovery Bldg - Sections and Details 1
34	S-5	Groundwater Recovery Bldg - Partial Plans and Sections
35	M-1	Mechanical and Equipment Layout Plan
36	M-2	Mechanical Piping Plan 1
37	M-3	Mechanical Piping Plan 2
38	M-4	Mechanical - Sections 1
39	M-5	Mechanical - Sections 2
40	M-6	Mechanical - Section 3
41	M-7	Mechanical - Sections 4
42	M-8	Mechanical - Sections 5
43	M-9	Mechanical - Sections 6
44	M-10	Mechanical - Details 1
45	M-11	Mechanical - Details 2
46	M-12	Mechanical - Details 3
47	M-13	Mechanical - Plumbing Plan and Details
48	H-1	Groundwater Recovery Bldg - HVAC Plan and Schedules
49	H-2	Groundwater Recovery Bldg - HVAC Details 1
50	E-1	Symbols List, Legend and Details
51	E-2	Main Distribution and Details

Sheet No.	Drawing No.	Drawing Title
52	E-3	Treatment Plant Single Line - Panelboard #1
53	E-4	Treatment Plant Single Line - Panelboard #2
54	E-5	Treatment Plant Single Line - Panelboard #3
55	E-6	Treatment Plant Single Line - Panelboard #4
56	E-7	Treatment Plant Single Line - Panelboard #A
57	E-8	Panelboard Schedules
58	E-9	Power Plan 1
59	E-10	Power Plan 2
60	E-11	Conduit and Cable Schedule - Power
61	E-12	Conduit and Cable Schedule - Control
62	E-13	Site Plan
63	E-14	Lighting Plan
64	E-15	Lighting Fixture Details
65	E-16	Grounding Plan
66	E-17	PLC Control Panel Drawing
67	E-18	Treatment Bldg - Instrumentation Riser Diagram
68	E-19	Treatment Bldg - Instrument Location Plan
69	E-20	Electrical Control Loop Drawing 1
70	E-21	Electrical Control Loop Drawing 2
71	E-22	Electrical Control Loop Drawing 3
72	E-23	Electrical Control Loop Drawing 4
	I-1	Instrumentation Installation Details 1
	I-2	Instrumentation Installation Details 2

1.8.2 Reference Report

The following reference reports are available for examination in the office of the NTR and are intended only to show the existing conditions. The reports and drawings are the property of the Government and shall not be used for any purpose other than that intended by the specification.

Reports

Baker Environmental, Inc., 1993. Remedial Investigation Report for Operable Unit No. 2 (Sites 6,9, and 82) Final. August 1993.

Baker Environmental, Inc., 1993. Feasibility Study for Operable Unit No. 2 (Sites 6, 9, and 82) Final. August 1993.

Baker Environmental, Inc., 1994. Project Plans, Contaminated Soil and Groundwater Remedial Design, Operable Unit No. 2, Final. February 1994.

1.9 PROJECT SCHEDULE AND TIME CONSTRAINTS

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 360 calendar days after the required notice to

proceed. The time stated for completion shall include final cleanup of the premises. The time stated for completion does not include the maintenance period for the seeding of disturbed areas. The time stated for completion does not include the 90-day operational period.

1.10 SAFETY PROGRAM

In addition to safety requirements in the Basic Contract, the Contractor shall implement a safety program conforming to the requirements of Federal, state, and local laws, rules and regulations as specifically related to contaminated soil removal and treatment operations. The program shall include, but is not limited to, the following:

a. Occupational Safety and Health Standards

b. COE EM-385-1-1

c. NFPA 241

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 FACILITIES AND SERVICES

3.1.1 Availability of Utilities Services

a. The Government shall supply potable and non-potable water required to perform work to the Contractor. The water source location is an 8-inch water main to be installed along Piney Green Road to a point approximately 1300 feet south of Building 651. Work shall be coordinated with the Base Utilities Branch (Mr. Carl Baker, 910-451-5024). The Contractor shall provide all piping, hoses, pumps, and connections to transport water to the desired locations on site. The Contractor shall also provide a backflow-prevention device and metered connections to the water source. The Contractor shall be responsible for payment arrangements with base.

b. The Government shall supply reasonable amounts of temporary power to the Contractor. The Contractor shall provide all equipment and labor to the work. The Contractor shall make connections, including providing meters, and make disconnections.

c. The Contractor shall not operate nor disturb the setting of control devices in the base utilities system, including water, sewer, electrical and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify

the NTR giving 2 days advance notice when such operation is required.

d. The Contractor shall contact Base Telephone Services in writing to obtain telephone connection and payment information. Cost for telephone connection will be paid by the Contractor. The Contractor shall provide all equipment and labor necessary to connect the telephone service to the site. The Contractor shall make arrangements for connections and disconnections and payments.

3.1.2 Storage in Existing Buildings

Storage in existing buildings will not be allowed.

3.1.3 Open Site Storage Size and Location

The open site available for storage shall be confined to the areas indicated on the contract drawings.

3.1.4 Trailers, Storage, and Temporary Buildings

Locate these where directed. Trailers or storage buildings will be permitted, where space is available subject to the approval of the NTR. The trailers or buildings shall be in good condition, free from visible damage, rust and deterioration, and meet all applicable safety requirements. Trailers shall comply with all appropriate state and local vehicle requirements. Failure of the Contractor to maintain the trailers or storage buildings in good condition will be considered sufficient reason to require their removal. A sign not smaller than 24 inches by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state or local standards for anchoring mobile trailers.

3.1.3.1 Storage and Office Trailers

Provide a trailer of sufficient size for an office trailer work area and floor area for the exclusive use of the Contractor's Quality Control Representative. Also provide room in the same trailer for the Quality Control Records. Provide the Quality Control representative with a 4-foot by 8-foot plan table, a standard size office desk and chair, and telephone service. Quality control records shall be filed in the office and available at all times to the Government.

a. Trailers must meet state station requirements and must be in good condition.

b. Trailers shall be lockable and shall be locked when not in use.

c. Trailers shall have a sign in the lower left hand corner of left door of trailer with the following information: company name, address,

registration number of trailer or vehicle identification number, location on base, duration of contract or stay on-base, contract number, local on-base phone number, off base phone number of main office, and emergency recall person and phone number.

3.2 RESTRICTIONS ON OPERATIONS

3.2.1 Scheduling

3.2.1.1 General Scheduling Requirements

The work areas will remain in operation during the entire construction period. The Contractor shall schedule the work as to cause the least amount of interference with Base operations. Work schedules shall be subject to the approval of the NTR. Permission to interrupt Base roads shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

3.2.1.2 Regular Work Hours

The regular work hours for the Marine Corps Base, Camp Lejeune, North Carolina, are 0730 to 1530, Monday through Friday.

3.2.1.3 Work Outside Regular Hours

If the Contractor desires to carry on work outside regular hours or on Saturdays, Sundays or holidays, the Contractor shall submit an application to the NTR. The Contractor shall allow ample time to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. At night, the Contractor shall light the different parts of the work in an approved manner.

3.2.2 Security Requirements

Contractor shall comply with general security requirements in accordance with Section C of the Basic Contract. 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 NTR.

3.2.2.1 Extraordinary Security Requirements

The clause of the Contract Clauses entitled "Identification of Employees" and the following apply:

a. Contractor Registration: Register with the Pass Office located at the main gate.

b. Equipment Markings: Equipment owned or rented by the company will have the company name painted or stenciled on the equipment in a conspicuous location. Rented equipment is to be conspicuously marked with a tag showing who rented it. Register the equipment with the truck investigation team.

c. Procedure Information: For additional information regarding registration procedures, contact the Officer in Charge of Contractors at 910-451-2326.

3.3 ACTIONS REQUIRED OF THE CONTRACTOR

The Contractor shall comply with all requirements stated in Section C, Part 2.0, of the Basic Contract.

3.3.1 Base Permits

Permits are required for, but not necessarily limited to, welding, digging, and burning. Allow 7 calendar days for processing of the application. One copy of all applicable permits shall be posted at the job site.

3.4 PUBLIC RELEASE OF INFORMATION

The Contractor shall comply with all requirements stipulated in Section C, Part 2.0, of the Basic Contract.

3.5 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows.

3.5.1 Disposal of Rubbish and Debris

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows:

3.5.1.1 Removal from Government Property

a. Provide 24-hour advance written notice to the NTR of contractor's intention to dispose of off-base.

b. Disposal at sites or landfills not holding a valid State of North Carolina permit is specifically prohibited. The prohibition also applies to sites where a permit may have been applied for but not yet obtained.

c. Off-base disposal of construction debris outside the parameters of this

paragraph at sites without state permits and/or not in accordance with all regulatory requirements shall require the contractor at his own expense to remove, transport, and relocate the debris to a state approved site. The contractor shall also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris.

3.5.1.2 Removal to a Base Sanitary Landfill

a. Haul rubbish and debris to the Government Landfill site indicated or specified. Conform to Regulations of Base Sanitary Landfill.

Each category of construction debris shall be separated at the construction site and delivered separately to the landfill.

Each category of construction debris shall be placed in the landfill at a location designated by the landfill operator.

Each and every vehicle delivering debris must be weighed upon entrance and weighed upon exiting. All debris must be covered.

b. Metals will not be accepted at the Base Sanitary Landfill. Materials which may be deposited in the landfill include:

(1) Mixed Debris
The following materials shall be placed in e landfill in a location designated by the landfill operator. These items may be mixed together.

Sheetrock - plaster - glass (broken).

Non-asbestos insulation - (fiberglass and mineral wool shall be bagged).

Packaging paper, styrofoam, and pasteboard boxes.

Non-asbestos roofing materials such as shingles, built-up and single ply roofing.

Painted wood such as doors, windows, siding and trim.

Plastic/fiberglass such as pipe, electrical boxes, cover plates, etc.

Ceramic and vinyl flooring or tile - ceiling tile.

(2) Masonry and Concrete

Concrete, block, brick, mortar shall be delivered to the landfill

separately from any other items and placed in a location designated by the landfill operator. All reinforcement wire and rebar must be removed flush with exposed surfaces.

(3) Nonrecycleable Cardboard

Corrugated cardboard boxes shall be delivered to the base recycling center located at Building 913. If base personnel rejects the cardboard, they shall be taken to the landfill.

(4) Nonrecycleable Wood Pallets

All useable pallets shall be delivered to the base recycling center located at building 913. If base personnel rejects the pallets, they shall be taken to the landfill.

(5) Treated Wood

Treated wood such as piling, power poles, etc., shall be delivered to the landfill, separated from any other items and placed in locations as designated by the landfill operator.

(6) Untreated/Unpainted Wood

Such as lumber, trees, stumps, limbs, tops, etc., shall be delivered to the landfill separated from any other items and placed in a location designated by the landfill operator.

(7) Organic Matter

Such as leaves, pine straw, grass clippings, and shrub clippings shall be delivered to the landfill separated from any other items and placed in a location designated by the landfill operator. No bags or containers are allowed.

(8) Fiberglass Tanks (550-gallon or less)

Tanks must be cleaned before delivery to landfill.

(9) Asphalt Pavement

Remove from Government Property and delivery to an asphalt recycling establishment. The contractor shall provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling establishment receiving the removed asphalt.

(10) Asbestos

Dispose as directed by the NTR.

(11) Lead Based Paint Materials

Dispose as directed by the NTR.

(12) Metals

Metals will not be accepted at the landfill. Metals shall be removed from each and every category before delivery to the landfill.

(Example: Removal all hardware from doors and windows.)

Metal construction debris disposal shall be disposed of at DRMO Bldg. TC-861 - Camp Geiger.

Aluminum
Brass
Copper
Lead
Other Metal
Electrical Wiring
Cable (Cut in 3-foot or less sections)

3.5.2 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.

3.5.3 Fire Protection

COE EM-385-1-1, NFPA 241, and activity for regulations. Obtain approval from the activity Fire Chief prior to commencement of hot work operations.

3.5.3.1 Notification of Fire

Post the activity fire poster in conspicuous locations and at telephone in construction shacks.

3.5.4 Quarantine for Imported Fire Ant (4/82)

Onslow, Jones and Cartaret Counties and portions of Dublin and Craven Counties have been declared a generally infested area by the United States Department of Agriculture (USDA) for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth in USDA Quarantine No. 81 dated 9 October 1970, and USDA Publication 101.81-2A of 23

July 1976, is required for operations hereunder. Pertinent requirements of the quarantine for materials originating on the Camp Lejeune reservation, the Marine Corps Air Station (Helicopter), New River and the Marine Corps Air Station, Cherry Point, which are to be transported outside Onslow "County or adjacent suppression areas, include the following:

a. Certification is required for the following articles and they shall not be moved from the reservation to any point outside Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an Officer of the Plant Protection and Quarantine Program of the U. S. Department of Agriculture.

   (1) Bulk soil.

   (2) Used mechanized soil-moving equipment. (Used mechanized soil-moving equipment is exempt if cleaned of loose noncompacted soil.)

   (3) Other products, articles, or means of conveyance,if it is determined by an inspector that they present a hazard of transporting spread of the imported fir ant and the person in possession thereof has been so notified.

b. Authorization for movement of equipment outside the imported fire and regulated area shall be obtained from USDA, APHIS, PPQ, Box 83, Goldsboro, North Carolina, 27530, Attn: Mr. Haywood Cox, telephone (919) 735-1941. Requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Soil on or attached to equipment, supplies, and materials shall be removed by washing with water or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as necessary and as directed.

3.6 REQUIRED INSURANCE

Insurance requirements from Section H of the Basic Contract are enforced in their entirety.

-- End of Section --

SECTION 01430

WASTE SAMPLING 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 within the text by the basic designation only.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA)

EPA/540/P-91/008	Compendium of ERT Waste Sampling Procedures, 1991
EPA SW-846	Test Methods for Evaluating Solid Wastes (Nov. 1986)

NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY (NEESA)

NEESA 20.2-047B	Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program (June 1988)

1.2 SUBMITTALS

Submit the following in accordance with Section C, Part 7.0, of the Basic Contract, and revised Submittal Register.

1.2.1 SD-08, Statements

a. Sample Log

1.2.2 SD-12, Field Test Reports

a. Confirmatory Sample Analysis Results

b. Waste Characterization Sample Analysis Results

1.3 DEFINITIONS

1.3.1 Confirmation Sampling

Confirmation sampling shall include all sampling conducted in the open excavations during the post-removal stage to confirm the removal of all contaminated soil.

1.3.2 Waste Characterization Sampling

Waste characterization sampling shall include all sampling of the excavated soils to characterize the soils for disposal.

1.4 DESCRIPTION OF WORK

Collect and analyze environmental samples from the excavated area after waste has been removed to confirm the removal of all contaminated soil.

1.5 QUALITY ASSURANCE

1.5.1 Waste Sampling

Adhere to all sample acquisition, handling, custody documentation, decontamination, and quality assurance/quality control (QA/QC) requirements and procedures as required by federal, state and local regulations.

1.5.2 Analytical Laboratory

The Contractor shall be solely responsible for the execution and accuracy of the waste stream analyses. The Contractor shall use a NEESA-certified laboratory for all soil and waste analyses. All analytical standard methods shall meet, at a minimum, NEESA 20.2-047B QA/QC Level C requirements for confirmation sampling and Level C requirements for waste characterization sampling and shall also be in accordance with federal, local and state regulations.

1.5.3 Data Validation

An independent firm shall be subcontracted for data validation. Samples collected shall be evaluated using Level C quality control. Data review procedures specified by NEESA 20.2-047B and the Functional Guidelines established by EPA Region IV shall be followed to ensure that raw data are not altered and that an audit trail is developed for those data which require reduction. Specific Quality Assurance/Quality Control (QA/QC) procedures shall be included in the Sampling and Analysis Plan indicated in Section 01010. Data validation results shall be provided in the Contractor's Closeout Report indicated in Section 01010.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

Supply all personnel, equipment, and facilities to collect and analyze the environmental samples required to characterize the wastes.

3.1.1 Sample Acquisition

Sampling procedures shall be consistent with NEESA 20.2-047B Guidelines.

After the excavation has been completed:

a. Visually inspect the area for stained or discolored soil.

b. Field screen the area using an organic vapor analyzer.

c. If no stained or discolored soil is visible, and the organic vapors are below 50 ppm, collect one confirmation sample for every 500 square feet of excavation, and one sample for every 50 linear feet of each sidewall of the excavation.

d. Place the sample in an appropriate sample container for shipment for off-site confirmation analyses.

e. If stained soils are visible, or if organic vapor levels are greater than 50 ppm, or if contamination is suspected, notify the Navy's Technical Representative (NTR).

3.1.1.1 Confirmation Samples

Confirmation samples shall be collected from the walls and the bottom of the open excavations. One sample for every 500 square feet along the bottom of the excavation and one sample for every 50 linear feet of soil along each wall of the excavation shall be collected.

Confirmation samples from AOCs 3, 4, 5, and 6 shall be analyzed for Pesticides/PCBs (SW-846 Method 8080). The confirmation samples from AOC 2 shall be analyzed for Volatiles, Pesticides/PCBs, Arsenic, Cadmium, and Manganese (SW-846 Methods 8240, 8080, 7060, 7131, and 6010 respectively).

If the compounds listed in Table 3.1 exceed the Remediation Action Objectives (RAO) concentrations in the confirmation samples, notify the NTR. If they fall below the RAO concentrations in the confirmation samples, no further excavation is required.

Table 3.1
Remedial Action Objectives

Media	Contaminant of Concern	Remediation Goal	Unit
Soil	PCBs	10,000	ug/kg
	4,4'-DDT	60,000	ug/kg
	Benzene	5.4	ug/kg
	Trichloroethene	32.2	ug/kg
	Tetrachloroethene	10.5	ug/kg
	Arsenic	23,000	ug/kg
	Cadmium	39,000	ug/kg
	Manganese	390,000	ug/kg

3.1.1.2 Waste Characterization Samples

Waste characterization samples shall be collected for the purpose of determining handling, transportation, and disposal requirements and for determining personal and environmental protection and monitoring requirements.

Characterization samples shall be collected from the soils from each AOC (2,3,4,5, and 6). One thoroughly mixed composite sample shall be collected for every 250 cubic yards or a minimum of 1 sample for each AOC.

The composite sample shall consist of six (6) grab samples representative of the material being sampled. The grab samples shall be thoroughly mixed to obtain a relatively homogenous mixture.

The characterization samples shall be analyzed for the following parameters:

a. TCL Volatiles, Semi-Volatiles, Pesticides/PCBs (SW-846 Methods 8240, 8270, and 8080 respectively)

b. TAL Metals (SW-846 Methods 6010, 7060, 7471, 7740)

c. TRPH- GRO/DRO (SW-846 Method 8015 modified); for AOC 2 only

d. Oil and Grease (SW-846 Method 9071); for AOC 2 only

Additionally, one composite sample from each of AOC (2,3,4,5, and 6) shall be analyzed for the following parameters:

a. TCLP Volatiles, Semi-Volatiles, Pesticides, and Herbicides (SW-846 Methods 1311, 8240, 8270, 8080, and 8150)

b. RCRA Characteristics (SW-846 Methods 9010, 9030, 9045, and 1010)

c. Moisture Content (ASTM Method D-2216)

d. Paint Filter Test (SW-846 Method 9095)

3.1.2 Sample Handling

Sampling, sample handling, and sampling containers must be consistent with the chemicals expected, the matrix of the sample, and planned analytical procedures. Precleaned glass sample containers with teflon lids are required.

The Contractor shall describe in the Sampling and Analysis Plan (Quality Assurance Project Plan) strict chain-of-custody procedures to be used during collection, transport, and analysis of all samples.

3.1.3 Sampling Documentation

Maintain a sample log containing, at a minimum, the following information:

a. Date and Time of Sampling

b. Sample Locations

c. Sample Matrix

d. Sample Identification Number

e. QA/QC Sample Identification

f. Analyses to be Performed

g. Type and Number of Sample Containers

h. Signatures of Individuals Performing Sampling

-- End of Section --

SECTION 01561

EROSION AND SEDIMENT CONTROL
07/92

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.

FEDERAL SPECIFICATIONS (FS)

FS O-F-241	(Rev. D) Fertilizers; Mixed, Commercial

U.S. ARMY CORPS OF ENGINEERS (CW) PUBLICATIONS

CW 02215	1977 Plastic Filter Fabric

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M182	1960 (Rev. 1982) Burlap Cloth Made From Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A185	1985 Steel Welded Wire, Fabric, for Concrete Reinforcement
ASTM C33	1990 Concrete Aggregate
ASTM D98	1987 Calcium Chloride
ASTM D1682	1964 (Rev. 1985) Breaking Load and Elongation of Textile Fabrics
ASTM D3786	1987 Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT	1990 Standard Specifications for Roads and Structures

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES (NCDEHNR)

NCDEHNR 1990 North Carolina Soil Erosion Control Planning and Design Manual

1.2 DESCRIPTION OF WORK

The work includes the provision of temporary erosion control measures to prevent the pollution of air, water, and land within the project limits and in areas outside the project limits where work is accomplished in conjunction with the project. Installation of temporary erosion control features shall be coordinated with the construction of permanent erosion control features to assure effective and continuous control of erosion and pollution. Provide and maintain erosion control measures in accordance with NCDEHNR requirements.

1.3 SUBMITTALS

Vendor to submit, for approval, four copies of information which includes catalog data, shop drawings, and installation instructions. Seven copies of any Operation and Maintenance Manuals will be required. All submittals will be received a minimum of 14 days prior to start of construction and shall be in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Silt Fence

1.3.2 SD-04, Drawings

a. Erosion Control Plan G

1.3.2.1 Erosion Control Plan

Submit, for approval, four copies of a Contractor furnished erosion and sediment control plan to the Resident Officer in Charge of Construction, a minimum of 14 days prior to start of construction. The plans shall not be a reproduction of the contract documents. The erosion and sediment control shown on the drawings shall indicate the minimum erosion control requirements and shall be site adapted and modified to suit the sequence of construction operations. As a minimum, the Contractor furnished erosion and sediment control plan shall indicate the following:

a. Clearing limits

b. New construction and existing construction affected by new construction

c. Grading sequence shown with installation sequence of temporary and permanent erosion control features

d. Type, size, and location of temporary erosion control features

1.3.2.2 General Guidance

Design to accommodate the runoff of a local 10 year storm. The following publications shall be used as a guide for developing the Contractor furnished plan:

a. Guide for sediment control on construction sites - USDA Soil Conservation Service

b. Processes, Procedures, and Methods to Control Pollution Resulting From All Construction Activity - EPA

c. Guidelines for erosion and sediment control planning and implementation - EPA

d. NCDEHNR North Carolina Soil Erosion Control Planning and Design Manual.

PART 2 PRODUCTS

2.1 SILT FENCE

2.1.1 Standard Catalog Product

A manufacturer's standard catalog product for a preassembled silt fence may be provided in lieu of the indicated silt fence except that the filter fabric shall be as specified, and the height of the structure shall be as indicated.

2.1.2 Posts

Ensure that posts for sediment fences are either 4-inch diameter pine, 2-inch diameter oak, or 1.33 lb/linear ft steel with a minimum length of 4 feet. Make sure that steel posts have projections to facilitate fastening the fabric.

2.1.3 Filter Fabric

A woven or nonwoven polypropylene, nylon or polyester containing stabilizers and/or inhibitors to make the fabric resistant to deterioration from ultraviolet, and with the following properties:

a. Minimum grab tensile strength (ASTM D1682)	100 pounds
b. Minimum grab elongation (ASTM D1682)	25 percent
c. Minimum mullen burst strength (ASTM D3786)	210 psi
d. E.O.S. (CW 02215)	20 - 100

2.1.4 Standard Catalog Product

A manufacturer's standard catalog product for a preassembled silt fence may be provided in lieu of the indicated silt fence except that the filter fabric shall be as specified, and the height of the structure shall be as indicated.

2.2 TEMPORARY SEEDING

2.2.1 Seed

State certified seed of the latest season's crop. Provide seed as specified in Part 3 - Execution.

2.2.2 Fertilizer

FS O-F-241, Type I, Class 2, with 10 percent nitrogen, 20 percent available phosphoric acid, and 10 percent potash.

2.2.3 Mulch

Hay or straw. Provide in an air dried condition for placement with commercial mulch blowing equipment.

2.3 DUST SUPPRESSORS

ASTM D 98 calcium chloride, magnesium chloride, or other standard manufacturer's products designed for dust suppression.

2.4 WATER FOR DUST SUPPRESSION

Water used for dust suppression shall be free from oil, acids, alkalis, salts, or any other substance that is toxic or otherwise harmful to surrounding vegetation.

2.5 CHECK DAM

a. Place stone to the lines and dimensions as shown in the Soil and Erosion drawing on a filter fabric foundation.

b. Keep the center stone section at least 9 inches below natural ground level where the dam abuts the channel banks.

c. Extend stone at least 1.5 ft beyond the ditch banks to keep overflow water from undercutting the dam as it re-enters the channel.

d. Set spacing between dams to ensure that the elevation at the top of the lower dam is the same as the toe elevation of the upper dam.

e. Protect the channel downstream from the lowest check dam, considering that water will flow over and around the dam.

f. Make sure that the channel reach above the most upstream dam is stable.

g. Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones.

PART 3 EXECUTION

3.1 SILT FENCE

3.1.1 Construction

a. Construct the silt fence of standard strength or extra strength synthetic filter fabrics.

b. Ensure that the height of the silt fence does not exceed 18 inches above the ground surface.

c. Construct the filter fabric from a continuous roll cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the filter cloth only at a support post with overlap to the next post.

d. Support standard strength filter fabric by wire mesh fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long, or tie wires. Extend the wire mesh support to the bottom of the trench.

e. When a wire mesh support fence is used, space posts a maximum of 8 feet apart. Support posts should be driven securely into the ground to a minimum of 18 inches.

f. Extra strength filter fabric with 6 feet post spacing does not require wire mesh support fence. Staple or wire the filter fabric directly to posts.

g. Excavate a trench approximately 4 inches wide and 8 inches deep along the proposed line of posts and upslope from the barrier for imbedment of silt fence fabric.

h. Backfill the trench with compacted soil or gravel placed over the filter fabric.

i. Do not attach filter fabric to existing trees.

3.2 TEMPORARY SEEDING

Within 48 hours after attaining the grading increment specified herein, provide seed, fertilizer, and mulch on graded areas when any of the following conditions occur:

a. Grading operations stop for an anticipated duration of 30 days or more.

b. Provide on the slopes of cuts and fill slopes for every 5 foot increment of vertical height of the cut or fill.

c. When it is impossible or impractical to bring an area to finish so that permanent seeding operations can be performed without serious disturbance from additional grading.

d. When an immediate cover is required to minimize erosion, or when erosion has occurred.

e. Provide on erosion control devices constructed using soil materials.

3.2.1 General

Loosen subgrade to a minimum depth of 4 inches. Uniformly apply the seed, fertilizer, and mulch at the specified application rates. Roll the seeded area after applying seed and fertilizer. Do not seed or fertilize when the Navy's Technical Representative (NTR) determines conditions are unfavorable. Provide water to promote turf growth.

3.2.2 Seed

Provide seed type and quantity (pounds per acre) as follows:

SEED TYPE	Nov 16 - Jan 31	Feb 01 - Apr 15 Oct 16 - Nov 15	Apr 16 - Oct 15
Hybrid Fescue	200	200	
Red Top	6	6	6
Bermuda	45(unhulled)	45(unhulled)	100(hulled)

3.2.3 Fertilizer

Apply at the rate of 1000 pounds per acre.

3.2.4 Mulch

Spread mulch at the rate of 1.5 tons per acre and anchor by crimping mulch with a disc.

3.3 DUST SUPPRESSORS

Immediately dampen the surface before calcium chloride application. Apply dust suppressors on unsurfaced base, subbase and other unsurfaced travel ways at a rate between 1.0 and 1.25 pounds per square yard of surface for pellets for the initial application. For subsequent application of dust suppressors, application rates may be approximately 75 percent of the initial application rates. Do not apply when raining or the moisture conditions exceed that required for proper application. Apply other dust suppressors in accordance with manufacturer's instructions. Protect treated surfaces from traffic for a minimum of 2 hours after treatment. Repeat application of dust suppressors as required to control dust emissions.

3.4 GENERAL MAINTENANCE AND INSPECTION

Inspect erosion control devices after each rainfall and daily during prolonged rainfall. Remove sediment deposits after each rainfall or when sediment reaches approximately one-half the barrier height. Immediately repair damaged erosion control devices and damaged areas around and underneath the devices. Maintain erosion control devices to assure continued performance of their intended function. Modify the Contractor furnished erosion control plan as required to control problem areas noticed after each inspection.

3.4.1 Maintenance

a. Should the fabric of a silt fence collapse, tear, decompose or become ineffective, replace it promptly. Replace burlap every 60 days.

b. Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.

c. Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized.

d. Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam. Correct all damage immediately. If significant erosion occurs between dams, install a protective riprap liner in that portion of the channel.

e. Remove sediment accumulated behind the dams as needed to prevent damage to channel vegetation, allow the channel to drain through the stone check dam, and prevent large flows from carrying sediment over the dam. Add stones to dams as needed to maintain design height and cross section.

3.5 CLEAN UP

At the completion of the job, or when directed or approved by the NTR, erosion control devices shall be removed. Erosion control devices and areas immediately adjacent to the device shall be filled (where applicable), shaped to drain and to blend into the surrounding contours, and finished. Erosion control devices may remain in place when approved by the NTR.

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

The manufacturer or bidder shall submit operation and maintenance (O&M) data/manuals which are specifically applicable to this contract and a complete and concise depiction of the provided equipment or product. Extraneous information which must be sorted through to find applicable instructions will not be accepted. Present information in sufficient detail to clearly explain user O&M requirements of the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section C, Part 7, of the Basic Contract.

1.2.1 Quantity

The manufacturer or bidder shall submit seven (7) copies of the manufacturers' O&M information specified herein for the components, assemblies, subassemblies, attachments, and accessories. The item for which an O&M data/manual is required is listed in the technical section which specifies that particular item.

1.2.2 Package Content

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

a. In the event the manufacturer or bidder fails to deliver O&M Data/Manuals within the time limits set forth above, the Navy's Technical Representative (NTR) may withhold from progress payments 50 percent of the price of the item with which such data/manuals are associated.

1.2.3 Delivery

The General Contractor shall submit O&M data after review from the vendor package to the NTR for review and acceptance; data specified for a given item shall be submitted to the NTR within the timeframe identified in the submittal register.

1.2.4 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Bidder if a component of an item is so affected subsequent to acceptance of the O&M data. Changes, additions, or revisions required by the NTR for final acceptance of submitted data, shall be submitted within 30 calendar days of the notification of this change requirement.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The O&M Data Packages shall consist of the following:

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

The General Contractor shall submit O&M data to the NTR for review and acceptance within the timeframe identified in the submittal register.

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 Labor-Hours

Include manufacturer's projection of corrective maintenance labor-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 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

The manufacturer or bidder shall furnish the O&M data packages specified in each individual technical specification section. 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 02010

GENERAL SITE WORK

SECTION I - PROJECT REQUIREMENTS

PART 1 GENERAL

1.1 LOCATION

All aspects of this project are located at Operable Unit No. 2, Marine Corps Base, Camp Lejeune, North Carolina.

1.2 PROJECT DESCRIPTION

The project is a soil and groundwater remediation task. Various areas of concern (AOC) have been established which demonstrates abnormally high levels of chemical contamination.

Several shallow and deep wells will be drilled to access the contaminated groundwater. The water will be pumped to a groundwater treatment building where it will be processed to the extent required to make it fit for human consumption.

The fully processed water will be released back to the ground via a nearby creek. For a more detailed description refer to the Process Description and Control Philosophy Report in Attachment B and project drawings in Attachment C.

1.3 SCOPE

By solicitation of competitive bids and subsequent evaluation thereof, OHM Remediation Services Corp. intends to, via this Bid Specification, secure the services of a subcontractor of the General Site Work Activities and to define the extent of their responsibilities.

1.3.1 Work Included

Without limiting or restricting the volume of work and solely for the convenience of the Subcontractor, the extent of the Subcontractor's responsibilities for the work defined in the scope section is as follows:

a. Provide labor, tools, equipment and supervision to perform following activities.

- General excavation, filling and backfilling
- Provide a stone base, a bituminous base, and a bituminous concrete surface pavements.
- Provide and install exterior water distribution system

- Provide and install exterior sanitary sewer system
- Provide and install chain-link fence and gates.
- Coordinate all installation efforts with structural, mechanical, electrical, I&C and HVAC subcontractors.

1.3.2 Work Not Included

The extent of the Subcontractor's responsibility does not include activities clearly defined and specified as a responsibilities of the structural, electrical, I&C or HVAC subcontractor.

1.4 LEVEL OF PERFORMANCE

The bidder shall be completely responsible that equipment, materials, and services furnished under this specification are of appropriate industry standard in every respect including adherence to all applicable codes and standards, with first-class workmanship throughout. Therefore, if any requirement of this specification is deemed by the Subcontractor to be incorrect, unsuitable, contradictory, or such that conformance therewith would diminish or adversely affect in any way the Subcontractor's responsibility, the Bidder shall specifically delineate his objections and the reasons therefor in his proposal, so that they may be resolved before the purchase order is placed. In all other respects, the Subcontractor, by accepting the purchase order, shall be deemed to have agreed that conformance with the specification's requirements will not prejudice in any way the Purchaser's rights under warranty.

1.5 DEFINITIONS

Bidder - A company submitting a proposal to fulfill the requirements of this specification.

Mechanical Subcontractor - The company accepting the purchase order for fulfilling the requirements of this specification and provide all mechanical services involved with this project.

Structural Subcontractor - The company which provides all structural, construction services involved with this project.

Electrical Subcontractor - The company which provides all electrical services involved with this project.

I&C Subcontractor - The company which provides all instrumentation and control services involved with this project.

HVAC Subcontractor - The company which provides HVAC services involved with this project.

General Site Work Subcontractor - The company which provides services in accordance with scope of this specification.

General Contractor - OHM Remediation Services Corp., 5335 Triangle Parkway, Suite 450, Norcross, GA 30092.

Purchaser - Department of the Navy, Naval Facilities Engineering Command, Atlantic Division (LANTDIV)

Engineer - Baker Environmental, Inc. Corapolis, PA 15108

Approved - This word, when applied by the General Contractor to the Subcontractor's drawings or documents, means that the drawings or documents are satisfactory from the standpoint of interfacing with all non-subcontractor furnished components of the installation, and/or that the General Contractor have not observed any statement or feature that appears to deviate from the specification's requirements. Except for the interfacing with all non-subcontractor furnished components, the Subcontractor shall retain the entire responsibility for complete conformance with all specification requirements and performance guarantees.

Approved as Revised - These words, when applied by the General Contractor to the Subcontractor's drawings or documents, mean that the drawings or documents are approved as defined above except that the changes shown are required for the proper interfacing with non-subcontractor furnished components of the installation or are necessary to be in conformance with the specification requirements. On the basis that the Subcontractor shall retain the entire responsibility for compliance shall retain the entire responsibility for compliance with all specification requirements (except those affected by interfacing with non-Subcontractor furnished components), the Subcontractor shall either:

1. Incorporate the changes into his drawing or document and resubmit to the Engineers, or

2. Inform the General Contractor that the changes cannot be made without prejudice to the Subcontractor's responsibility under warranty, and resubmit with explanation of the reasons therefor.

Not Approved - These words, when applied by the General Contractor to the Subcontractor's drawings or documents, mean that the drawings or documents are being returned to the Subcontractor for his remediation. After remediation, the drawings shall be resubmitted to the General Contractor.

Shall - Indicates a mandatory requirement.

1.6 REFERENCES

The publications referencing applicable standards are listed under each

specific section listed in Section II, Part 2 of this Specification and their attachments.

1.7 QUALITY ASSURANCE

1.7.1 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.

1.7.2 Alternative Qualifications

Products having less than a 2-year field service record shall be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.7.3 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 Navy's Technical Representative (NTR).

1.8 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.

1.9 SAFETY REQUIREMENTS

1.9.1 Equipment Safety

Provide positive means of locking out equipment so that equipment cannot be accidentally started during installation procedures. High-temperature, acid and caustic 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, construction platforms, and guardrails where required for safe construction of the equipment. Provide ladders, scaffold or stairways to reach catwalks and construction platforms. Ensure that access

openings leading to equipment are large enough to carry through routine maintenance items such as filters and tools.

1.9.2 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 the electrical specification.

1.10 POSTED OPERATING INSTRUCTIONS

Attach operating instructions provided by manufacturers of 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.

1.11 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 inches high normal block style.

1.12 INSTRUCTIONS 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.

PART 2 PRODUCTS

2.1 SUBMITTAL

Submit copies of the documentation specified in each specific section plus the following in accordance with Section C, Part 7, of the Basic Contract.

a. Proposed excavation schedule

b. Proposed surface pavement installation schedule

c. Proposed schedule of fabrication of the necessary water distribution and sanitary sewer piping

d. List and qualifications of the proposed personnel (management, pipe fitters, welders, etc.)

2.2 PROPOSAL PRICING

Bidder shall submit project total price and itemized pricing which will include: cost of the materials, parts, pipes, armature, supports, delivery, installation, testing, etc. Pricing proposal should include cost of the supervision, maintenance and operator's training, terms of payment, price oscillations.

PART 3 EXECUTION

3.1 SCHEDULE REQUIREMENTS

The engineers have prepared a preliminary schedule for the project which identified the major milestones that must be met. These milestones are presented in Attachment C to this specification. The Bidder shall prepare and submit (with the Bid Proposal) a summary level schedule that incorporates the milestones and that represents the Bidder's plan to execute the scope of work.

It shall be the Subcontractor's responsibility to prepare and submit to the engineers a detailed Critical Path Method (CPM) schedule which incorporates the actual sequence of work to be performed and deliveries of all material and equipment needed.

Within twenty-one (21) calendar days after award of contract, the Subcontractor shall submit the detailed CPM schedule to the Engineers. This time scaled schedule shall include all Subcontractors' scope of work activities, including procurement, shop detailing/fabrication/testing and shipment activities as well as field checkout, testing and full system commissioning activities.

The Subcontractor shall also submit to the Engineers unpriced copies of all purchase orders issued for the procurement of permanent components: pipes, fittings, valves, couplings, flanges, supports, etc., to verify that commitments have been made.

3.2 COMMUNICATIONS/CORRESPONDENCE

All correspondence from the bidder shall consist of an original plus three (3) copies and shall contain the following subject heading:

Specification No. 02010
Title: General Site Work
Project: Soil and Groundwater Remediation, Operable Unit No. 2, MCB Camp Lejeune, NC

All correspondence/communications shall be addressed to the General Contractor, specifically:

OHM Remediation Services Corp., 5335 Triangle Parkway, Suite 450, Norcross, GA 30092

3.3 REJECTED WORK AND MATERIALS

The Subcontractor, upon written notice from the Purchaser, shall remove from the premises all work and materials rejected as defective, unsound, improper, or in any way failing to conform to the requirements of the contract documents. The Subcontractor shall at his sole expense make good all work

damaged by such removal and shall promptly replace materials damaged or improperly worked by him and re-execute replacing the work of any other Subcontractor that is in any way affected by the removal of the defective work.

Failure of the Subcontractor to comply with this requirement within 10 days of notification from the Purchaser, will authorize the Purchaser to take appropriate action to implement such repair or removal. The Subcontractor will be back charged for all such expenses incurred to implement such repair or removal, including the Purchaser's supervision costs.

3.4 FACILITIES AND SERVICES

3.1.1 Availability of Utilities Services

a. The Government shall supply potable and non-potable water required to perform work to the Subcontractor. The water source location is an 8-inch water main to be installed along Piney Green Road to a point approximately 1300 feet south of Building 651. Work shall be coordinated with the Base Utilities Branch (Mr. Carl Baker, 910-451-5024). The Subcontractor shall provide all piping, hoses, pumps, and connections to transport water to the desired locations on site. The Subcontractor shall also provide a backflow-prevention device and metered connections to the water source. The Subcontractor shall be responsible for payment arrangements with base.

b. The Government shall supply reasonable amounts of temporary power to the Subcontractor. The Subcontractor shall provide all equipment and labor to the work. The Subcontractor shall make connections, including providing meters, and make disconnections.

c. The Subcontractor shall not operate nor disturb the setting of control devices in the base utilities system, including water, sewer, electrical and steam services. The Government will operate the control devices as required for normal conduct of the work. The Subcontractor shall notify the NTR giving 2 days advance notice when such operation is required.

d. The Subcontractor shall contact Base Telephone Services in writing to obtain telephone connection and payment information. Cost for telephone connection will be paid by the Subcontractor. The Subcontractor shall provide all equipment and labor necessary to connect the telephone service to the site. The Subcontractor shall make arrangements for connections and disconnections and payments.

3.4.2 Storage in Existing Buildings

Storage in existing buildings will not be allowed.

3.4.3 Open Site Storage Size and Location

The open site available for storage shall be confined to the areas indicated on the contract drawings.

3.4.4 Trailers, Storage, and Temporary Buildings

Locate these where directed. Trailers or storage buildings will be permitted, where space is available subject to the approval of the Navy's Technical Representative (NTR). The trailers or buildings shall be in good condition, free from visible damage, rust and deterioration, and meet all applicable safety requirements. Trailers shall comply with all appropriate state and local vehicle requirements. Failure of the Subcontractor to maintain the trailers or storage buildings in good condition will be considered sufficient reason to require their removal. A sign not smaller than 24 inches by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state or local standards for anchoring mobile trailers.

3.4.4.1 Storage and Office Trailers

Provide a trailer of sufficient size for an office trailer work area and floor area for the exclusive use of the Subcontractor's Quality Control Representative. Also provide room in the same trailer for the Quality Control Records. Provide the Quality Control representative with a 4-foot by 8-foot plan table, a standard size office desk and chair, and telephone service. Quality control records shall be filed in the office and available at all times to the Government.

a. Trailers must meet state station requirements and must be in good condition.

b. Trailers shall be lockable and shall be locked when not in use.

c. Trailers shall have a sign in the lower left hand corner of left door of trailer with the following information: company name, address, registration number of trailer or vehicle identification number, location on base, duration of contract or stay on-base, contract number, local on-base phone number, off base phone number of main office, and emergency recall person and phone number.

3.5 RESTRICTIONS ON OPERATIONS

3.5.1 Scheduling

3.5.1.1 General Scheduling Requirements

The work areas will remain in operation during the entire construction period.

The Subcontractor shall schedule the work as to cause the least amount of interference with Base operations. Work schedules shall be subject to the approval of the NTR. Permission to interrupt Base roads shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

3.5.1.2 Regular Work Hours

The regular work hours for the Marine Corps Base, Camp Lejeune, North Carolina, are 0730 to 1530, Monday through Friday.

3.5.1.3 Work Outside Regular Hours

If the Subcontractor desires to carry on work outside regular hours or on Saturdays, Sundays or holidays, the Subcontractor shall submit an application to the NTR. The Subcontractor shall allow ample time to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. At night, the Subcontractor shall light the different parts of the work in an approved manner.

3.5.2 Security Requirements

Subcontractor shall comply with general security requirements in accordance with Section C of the Basic Contract. No employee or representative of the Subcontractor 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 NTR.

3.5.2.1 Extraordinary Security Requirements

The clause of the Contract Clauses entitled "Identification of Employees" and the following apply:

a. Subcontractor Registration: Register with the Pass Office located at the main gate.

b. Equipment Markings: Equipment owned or rented by the company will have the company name painted or stenciled on the equipment in a conspicuous location. Rented equipment is to be conspicuously marked with a tag showing who rented it. Register the equipment with the truck investigation team.

c. Procedure Information: For additional information regarding registration procedures, contact the Officer in Charge of Subcontractors at 910-451-2326.

3.6 ACTIONS REQUIRED OF THE SUBCONTRACTOR

The Subcontractor shall comply with all requirements stated in Section C, Part 2.0, of the Basic Contract.

3.6.1 Base Permits

Permits are required for, but not necessarily limited to, welding, digging, and burning. Allow 7 calendar days for processing of the application. One copy of all applicable permits shall be posted at the job site.

3.7 PUBLIC RELEASE OF INFORMATION

The Subcontractor shall comply with all requirements stipulated in Section C, Part 2.0, of the Basic Contract.

3.8 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows.

3.8.1 Disposal of Rubbish and Debris

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows:

3.8.1.1 Removal from Government Property

a. Provide 24-hour advance written notice to the NTR of Subcontractor's intention to dispose of off-base.

b. Disposal at sites or landfills not holding a valid State of North Carolina permit is specifically prohibited. The prohibition also applies to sites where a permit may have been applied for but not yet obtained.

c. Off-base disposal of construction debris outside the parameters of this paragraph at sites without state permits and/or not in accordance with all regulatory requirements shall require the Subcontractor at his own expense to remove, transport, and relocate the debris to a state approved site. The Subcontractor shall also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris.

3.8.1.2 Removal to a Base Sanitary Landfill

a. Haul rubbish and debris to the Government Landfill site indicated or specified. Conform to Regulations of Base Sanitary Landfill.

Each category of construction debris shall be separated at the construction site and delivered separately to the landfill.

Each category of construction debris shall be placed in the landfill at a location designated by the landfill operator.

Each and every vehicle delivering debris must be weighed upon entrance and weighed upon exiting. All debris must be covered.

b. Metals will not be accepted at the Base Sanitary Landfill. Materials which may be deposited in the landfill include:

(1) Mixed Debris
The following materials shall be placed in e landfill in a location designated by the landfill operator. These items may be mixed together.

Sheetrock - plaster - glass (broken).

Non-asbestos insulation - (fiberglass and mineral wool shall be bagged).

Packaging paper, styrofoam, and pasteboard boxes.

Non-asbestos roofing materials such as shingles, built-up and single ply roofing.

Painted wood such as doors, windows, siding and trim.

Plastic/fiberglass such as pipe, electrical boxes, cover plates, etc.

Ceramic and vinyl flooring or tile - ceiling tile.

(2) Masonry and Concrete

Concrete, block, brick, mortar shall be delivered to the landfill separately from any other items and placed in a location designated by the landfill operator. All reinforcement wire and rebar must be removed flush with exposed surfaces.

(3) Nonrecycleable Cardboard

Corrugated cardboard boxes shall be delivered to the base recycling center located at Building 913. If base personnel rejects the cardboard, they shall be taken to the landfill.

(4) Nonrecycleable Wood Pallets

All useable pallets shall be delivered to the base recycling center located at building 913. If base personnel rejects the pallets, they shall be taken to the landfill.

(5) Treated Wood

Treated wood such as piling, power poles, etc., shall be delivered to the landfill, separated from any other items and placed in locations as designated by the landfill operator.

(6) Untreated/Unpainted Wood

Such as lumber, trees, stumps, limbs, tops, etc., shall be delivered to the landfill separated from any other items and placed in a location designated by the landfill operator.

(7) Organic Matter

Such as leaves, pine straw, grass clippings, and shrub clippings shall be delivered to the landfill separated from any other items and placed in a location designated by the landfill operator. No bags or containers are allowed.

(8) Fiberglass Tanks (550-gallon or less)

Tanks must be cleaned before delivery to landfill.

(9) Asphalt Pavement

Remove from Government Property and delivery to an asphalt recycling establishment. The Subcontractor shall provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling establishment receiving the removed asphalt.

(10) Asbestos

Dispose as directed by the NTR.

(11) Lead Based Paint Materials

Dispose as directed by the NTR.

(12) Metals

Metals will not be accepted at the landfill. Metals shall be removed from each and every category before delivery to the landfill.

(Example: Removal all hardware from doors and windows.)

Metal construction debris disposal shall be disposed of at DRMO Bldg. TC-861 - Camp Geiger.

Aluminum
Brass
Copper
Lead
Other Metal
Electrical Wiring
Cable (Cut in 3-foot or less sections)

3.8.2 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.

3.8.3 Fire Protection

COE EM-385-1-1, NFPA 241, and activity for regulations. Obtain approval from the activity Fire Chief prior to commencement of hot work operations.

3.8.3.1 Notification of Fire

Post the activity fire poster in conspicuous locations and at telephone in construction shacks.

3.8.4 Quarantine for Imported Fire Ant (4/82)

Onslow, Jones and Cartaret Counties and portions of Dublin and Craven Counties have been declared a generally infested area by the United States Department of Agriculture (USDA) for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth in USDA Quarantine No. 81 dated 9 October 1970, and USDA Publication 101.81-2A of 23 July 1976, is required for operations hereunder. Pertinent requirements of the quarantine for materials originating on the Camp Lejeune reservation, the Marine Corps Air Station (Helicopter), New River and the Marine Corps Air

Station, Cherry Point, which are to be transported outside Onslow "County or adjacent suppression areas, include the following:

a. Certification is required for the following articles and they shall not be moved from the reservation to any point outside Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an Officer of the Plant Protection and Quarantine Program of the U. S. Department of Agriculture.

(1) Bulk soil.

(2) Used mechanized soil-moving equipment. (Used mechanized soil-moving equipment is exempt if cleaned of loose noncompacted soil.)

(3) Other products, articles, or means of conveyance,if it is determined by an inspector that they present a hazard of transporting spread of the imported fir ant and the person in possession thereof has been so notified.

b. Authorization for movement of equipment outside the imported fire and regulated area shall be obtained from USDA, APHIS, PPQ, Box 83, Goldsboro, North Carolina, 27530, Attn: Mr. Haywood Cox, telephone (919) 735-1941. Requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Soil on or attached to equipment, supplies, and materials shall be removed by washing with water or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as necessary and as directed.

3.9 REQUIRED INSURANCE

(a) Within fifteen (15) days after award of this contract, the Subcontractor shall furnish the Contracting Officer a Certificate of Insurance as Evidence of the existence of the following insurance coverage in amounts not less than the amount specified below in accordance with the FAR 52.228-05, "Insurance - Work on a Government Installation (Sep 1989)" clause, Section I. This insurance must be maintained during the entire performance period.

Coverage

Comprehensive General Liability: $500,000

Automobile Liability: $200,000 per person; $500,000 per occurrence for bodily injury; $20,000 per occurrence for property damage.

Workmens' Compensation: As required by Federal and State Workers' compensation and occupational disease statutes.

Employer's Liability Coverage: $100,000 except in states where workers' compensation may not be written by private carriers.

Other as required by state law.

(b) Above insurance coverages are to extend to Subcontractor personnel operating Government owned equipment and vehicles.

(c) The Certificate of Insurance shall provide for thirty (30) days written notice to me Contracting Officer by the insurance company prior to cancellation or material change in policy coverage. Other requirements and information are contained in the aforementioned "Insurance" clause.

SECTION II - GENERAL SITE WORK SUBCONTRACTOR

PART 1 GENERAL

Refer to Section I, Part 1 of this specification.

PART 2 PRODUCTS (SERVICES)

The P&ID, civil, mechanical, electrical, etc., drawings necessary to perform required works defined in the scope of this specification are provided in Attachment B to this specification.

2.1 GENERAL EXCAVATION, FILLING AND BACKFILLING

The scope of activities, references, execution and limits involved with excavation, filling and backfilling are described in Specification Section 02220 Attachment D to this Specification.

2.2 BITUMINOUS CONCRETE PAVEMENT

The scope of activities, references, installation, application and field quality control involved with stone base, bituminous base, and a bituminous concrete surface course are described in Specification Section 02510 Attachment E to this Specification.

2.3 EXTERIOR WATER DISTRIBUTION SYSTEM

The scope of activities, references, materials, execution and field quality control involved with the construction of the exterior water distribution system are described in Specification Section 02661 Attachment F to this Specification.

2.4 EXTERIOR SANITARY SEWER SYSTEM

The scope of activities, references, materials, execution and field quality

control involved with the construction of the Exterior Sanitary Sewer System are described in Specification Section 02730 Attachment G to this Specification.

2.5 FENCE, CHAIN LINK

The scope of activities, references, materials execution and cleanup involved with the construction of the chain link and accessories are described in Specification Section 02831 Attachment J to this Specification.

2.6 PAINTING

All painting where applicable shall be applied in accordance with Specification Section 09900 Attachment H to this Specification.

2.7 INSULATION

All exterior piping which requires heat trace and insulation shall be applied in accordance with Specification Section 02696 Attachment I to this Specification.

PART 3 EXECUTION

See Section I, Part 3 of this Specification.

SECTION 02060

DRUM AND CONTAINER REMOVAL

PART 1 GENERAL

1.1 DEFINITIONS

The following definitions shall apply to all removal requirements.

1.1.1 Spill

A spill shall denote both an intentional and unintentional uncontrolled discharge or release resulting in any quantity of a possibly hazardous constituent running off or about to run off the external surface of equipment or other source, as well as contamination resulting from those releases.

1.1.2 Leak

Leak or leaking shall denote an instance in which any article, container, or equipment has a liquid or semi-liquid on any portion of its external surface.

1.1.3 Container

A container shall be any portable device with a capacity less than or equal to 5 gallons in which a material can be stored, handled,transported, treated or disposed of.

1.1.4 Drum

A drum shall be any portable device with a capacity greater than 5 gallons in which a material can be stored, handled, transported treated or disposed of.

1.1.5 Open

A container or drum shall be considered open if there are any visible holes on the surface of the container or drum, or if the container or drum appear to be leaking.

PART 2 PRODUCTS

2.1 OVERPACK DRUMS

Overpack drums shall meet all federal, state, and local regulations regarding waste containment and transportation. Overpack drums other than 55 or 95-gallon capacity may be used, but must meet the corrosion and reactivity requirements specified in the following sections. The Contractor shall notify the NTR for approval prior to utilizing any overpack drums not specified below.

2.1.1 Steel Overpack Drums

Steel overpack drums shall have 55-gallon capacity and have an open-head with a corrosion resistant epoxy liner, bolt ring, bolt nut, and rubber sponge gasket.

2.1.2 Polyethylene Overpack Drums

Polyethylene overpack drums shall have a 95-gallon capacity and shall be ultra violet light inhibiting with a closed cell polyethylene gasket.

2.2 RINSATE SOLUTIONS AND SOLVENTS

Rinsate solutions shall be required to triple-rinse and remove any residual solids, liquids, or vapors from the drums and containers.

PART 3 EXECUTION

3.1 REMOVAL OF DRUMS AND CONTAINERS

Initially identify the size, color, condition, type and identifying markings on each of the drums and containers. Remove all drums and containers from the ground surface as indicated. All leaking or open drums and containers holding liquids, sludges, or solids, as well as deteriorated drums that may rupture during handling shall be placed into overpack drums compatible with the drum's contents.

If the potential exists for spilling the liquid contents of the drums and containers during the excavation or moving process, the liquid shall be transferred to an overpack drum using a portable pump capable of transferring the liquid to an appropriate container prior to moving the existing container.

If a rupture occurs during the excavation or moving process, the spilled drum contents and affected soil shall be contained, collected, and overpacked. Remove all visually contaminated soil include a 2 foot width of soil around and beneath the perimeter of any spill area. The soil shall be placed in the overpack drum containing the spilled drum contents. All excavations shall remain open until the excavated areas are sampled, tested, certified to be clean and approved by the NTR.

Empty and deteriorated drums shall be transferred to the designated debris staging area.

Transfer all overpack drums, drums and containers holding liquids, solids, or sludges to a lined containment area for compatibility testing and hazard categorization.

3.2 PROCESSING OF DRUMS, CONTAINERS AND THEIR ASSOCIATED CONTENTS

The Contractor in conjunction with the NTR shall determine the applicable hazard categorization and waste compatibility testing in accordance with all federal, state and local regulations. The contractor shall be responsible for providing the disposal facilities with all necessary waste analysis and profiles that may be required for waste disposal acceptance.

SECTION 02220

GENERAL EXCAVATION, FILLING, AND BACKFILLING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	1992 Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	1991 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))
ASTM D 1140	1992 Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve
ASTM D 1557	1991 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))
ASTM D 2487	1992 Classification of Soils for Engineering Purposes
ASTM D 4318	1984 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909	Fertilizer

1.2 DEFINITIONS

1.2.1 Cohesive Materials

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

1.2.2 Cohesionless Materials

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

1.3 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7 of the Basic Contract.

1.3.1 SD-12, Field Test Reports (4 copies 2 weeks after test)

a. Fill and backfill test

b. Density tests

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent cross contamination with segregated materials.

1.5 CONTAMINATED MATERIALS

Transportation and disposal of contaminated soils shall be in accordance with Section 02223, "Transportation and Disposal of Contaminated Material". Assume for the purposes of on site handling and stockpiling that all soils in AOC-2 through AOC-6 indicated for removal are contaminated.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.1 Common Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location. Moisture content shall be adjusted as necessary to accommodate compaction requirements.

2.1.2 Backfill and Fill Material

ASTM D 2487, classification GW, GP, GM, SW, SP, SM, with a maximum ASTM D 4318 liquid limit of 35 maximum ASTM D 4318 plasticity index of 12 and a maximum of 25 percent by weight passing ASTM D 1140, No. 200 sieve.

2.1.3 Topsoil

Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

2.2 BORROW

Obtain borrow materials conforming to common fill and backfill material from the Government borrow pit as directed by the NTR. The Government borrow pit is located as indicated within a haul distance of 5 miles from the work site. If the Government borrow pit is used, the Contractor shall perform clearing, grubbing, and stripping required for providing access to suitable borrow material. Dispose of materials from clearing and grubbing operations off Government property. Strip top 12 inches of soil material from borrow area and stockpile. After removal of borrow material, regrade borrow pit using stockpiled soil material to contours which shall blend in with adjacent topography. Maximum side slopes shall be two horizontal to one vertical. Excavation and backfilling of borrow pit shall ensure proper drainage.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, and brush within the clearing limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

3.1.2 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

3.2 PROTECTION

3.2.1 Site Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.2.1.1 Surface Drainage

So that construction operations progress successfully, completely drain

construction site during periods of construction to keep soil materials sufficiently dry. Provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.

3.2.1.2 Subsurface Drainage

Dewatering shall not be required or permitted.

3.2.2 Underground Utilities

The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

3.2.3 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.3 GENERAL EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Refill with backfill and fill material and compact to 95 percent of ASTM D 698 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with backfill and fill material and compact to 95 percent of ASTM D 698 maximum density.

3.4 EXCAVATION OF CONTAMINATED MATERIALS

3.4.1 Materials and Equipment

3.4.1.1 General

a. Provide all labor, materials, and equipment necessary to accomplish the work specified in these paragraphs.

b. The Contractor shall notify the Contractor Officer at least 48 hours prior to the start of excavation of contaminated soils. The Contractor shall stage his/her operations to minimize the time the contaminated soil is exposed to the weather. Provide protection

measures around the area of contaminated soils to divert runoff of water within the excavation boundaries.

c. Contaminated soil which is discovered during excavation for utility installation will be handled at the discretion of the NTR. The NTR will be notified whenever contaminated soil is suspected which may require handling in accordance with Section 02223.

3.4.1.2 Unclassified Excavation

Excavation is unclassified. All excavation shall be completed regardless of the type, nature, or condition of the materials encountered.

3.4.2 Limits of Excavation - AOCs 3, 4, 5, and 6

a. Excavations shall be to the depths shown on the construction drawings Remedial Action work plan, or until groundwater is encountered. Excavation will proceed in AOCs 3, 4, 5, and 6 until confirming soil concentrations are below the Remedial Action objectives for PCBs,pesticides, metals, and VOCs as specified in Section 01430. A 48 hour analytical turnaround time shall be required to prevent the excavations from remaining open for extended periods of time. All soils removed shall be placed in roll off containers.

b. Once the Contractor has excavated to the specified limits of the excavation, an on-site analysis consisting of a visual inspection shall be performed on the surrounding soil. If the visual inspection reveals evidence of visibly contaminated soil, the Contractor shall consult with the Navy's Technical Representative (NTR) to determine the extent of additional excavation. When the exposed excavation surfaces do not contain visual evidence of contaminated soil, confirmation samples shall be collected and sent to an analytical laboratory for analysis in accordance with Section 01430 "Waste Sampling Requirements".

c. Final Excavation areas shall be governed by field conditions and determined by the Navy's Technical Representative.

d. Construct a small berm around the top perimeter of the excavation areas to prevent surface waters from entering the pits. Remove and contain any ponded water collected in the excavations.

e. Place excavated contaminated soil to be disposed of in roll off boxes. Cover the boxes and secure them within the limits of Storage Lot 203 for processing, testing, and disposal.

f. Contaminated soil and debris to be disposed must not contain free liquids. The Contractor may be required to dewater the soil by

applying a drying agent such as kiln dust to the excavated material,

g. Contaminated materials shall be loaded into covered containers or vehicles designed to transport such materials without spillage. Care shall be taken during loading operations to minimize the potential for spillage, tracking, or other means of deposition of contaminated materials outside the work area. Contaminated materials which become spilled on roads, street, or other areas outside the limits of excavation during the loading operation shall be immediately cleaned up to the satisfaction of the Navy's Technical Representative.

h. Backfilling of excavated areas shall begin only after receipt of the confirmation sampling results and approval of the Navy's Technical Representative.

i. The Contractor and the Navy's Technical Representative shall work together closely to coordinate excavation, sampling, and analyses to minimize downtime. The Contractor shall schedule work to minimize downtime.

j. Backfill will be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D 698.

3.4.3 Limits of Excavation - AOC 2

a. The Contractor shall excavate all drums, containers, porcelain, rubble, batteries, and other various debris as directed by the NTR. The Contractor shall use appropriate surface geophysical equipment, such as magnetometers, to locate surface debris covered by vegetation.

b. Debris and other waste material removed during excavation activities shall be transported and disposed of as described in Sections 01430, "Waste Sampling Requirements" and 02223, "Transportation and Disposal of Contaminated Material."

c. Upon removal of contaminated soil and surface debris, the Contractor shall restore the ground surface to approximate the surrounding grade and restore disturbed vegetation.

d. Ground surface restoration shall begin only after the receipt of confirmation sampling results as described in Section 01430 and approval of the NTR.

e. Backfill will be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D 698.

f. The Contractor and the NTR shall work together to coordinate excavation, transportation, and ground surface restoration to minimize downtime. The Contractor shall schedule work to minimize downtime.

3.4.4 Method of Measurement

a. The solid waste shall be separated according to their final disposal requirements. The quantity of work done under this paragraph shall be measured in tons, which shall be the actual weight of the solid waste removed. Quantity shall be verified by the certified delivery tickets provided by the treatment/disposal facility.

b. No separate measurements shall be made for control of water, protection of obstructions, or other work associated with the excavation and loading of materials at the site. These tasks are considered to be incidental to and part of the work specified.

3.5 FILLING AND BACKFILLING

Fill and backfill to original contours, elevations, and dimensions. Compact each lift before placing overlaying lift.

3.5.1 Common Fill Placement

Provide for general site. Place in 12-inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

3.5.2 Backfill and Fill Material Placement

Provide for contaminated soil removal area. Place in 12-inch lifts.

3.5.3 Method of Measurement

a. The quantity of work done under this paragraphs shall be measured in cubic yards of backfill compacted in place as specified herein. Quantities of backfill /fill shall be computed from the cross sections taken before and during the work of the excavation prior to and after backfilling. Field measurements, in cubic yards, and quantity computations shall be performed by a state licensed surveyor and submitted to the NTR for approval. Measurement shall not include yardage excavated without authorization, or yardage of materials used for purposes other than those specified.

b. No separate measurement shall be made for grading or finishing the site. These tasks are considered to be incidental to and part of

the work specified for "Replacement of Soil and Site Restoration".

3.6 COMPACTION

Expressed as a percentage of maximum density. Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade shall be required. Density requirements specified herein are for cohesionless materials. When cohesive materials are encountered or used, density requirements may be reduced by 5 percent.

3.6.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5-foot line of the structure to 85 percent of ASTM D 698.

3.6.2 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D 698.

3.6.3 Paved Areas

Compact top 12 inches of subgrades to 95 percent of ASTM D 698.
Compact fill and backfill materials to 95 percent of ASTM D 698.

3.7 FINISH OPERATIONS

3.7.1 Grading

Finish grades to match existing and as indicated within one-tenth of one foot. Grade areas to drain water away from structures. For existing grades that shall remain but which were disturbed by Contractor's operations, grade as directed.

3.7.2 Seed

Scarify existing subgrade. Provide 4 inches of topsoil for newly graded finish earth surfaces and areas disturbed by the Contractor.
If there is insufficient on-site topsoil meeting specified requirements for topsoil, provide topsoil required in excess of that available. Seed shall match existing vegetation. Provide seed at 5 pounds per 1000 square feet. Provide CID A-A-1909, Type I, Class 2, 10-10-10 analysis fertilizer at 25 pounds per 1000 square feet. Provide commercial agricultural limestone of 94-80-14 analysis at 70 pounds per 1000 square feet. Provide mulch and water to establish an acceptable stand of grass.

3.7.3 Protection of Surfaces

Provide an erosion control matting to keep soils in place while allowing turf to be established. Protect newly graded areas from traffic, erosion,

and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.8 DISPOSITION OF SURPLUS MATERIAL

Remove from Government property surplus or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber.

3.9 FIELD QUALITY CONTROL

3.9.1 Sampling

Take the number and size of samples required to perform the following tests.

3.9.2 Testing

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

3.9.2.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 4318 for liquid limit and for plastic limit; ASTM D 698 or ASTM D 1557 for moisture density relations, as applicable.

-- End of Section --

SECTION 02223

TRANSPORTATION AND DISPOSAL OF CONTAMINATED MATERIAL

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.

CODE OF FEDERAL REGULATIONS

CFR Part 148	Hazardous Waste Injection Restrictions
CFR Parts 260 to 280	Standards Applicable to Generators of Hazardous Waste
CFR Parts 100 to 199	Transportation

1.2 SUBMITTALS

1.2.1 Statements

a. Treatment Facility Permit

b. Transportation and Disposal Plan

1.2.1.1 Treatment Facility Permit

a. Written verification that the proposed disposal site is permitted to accept the contaminated materials specified, prior to the start of excavation. All treatment and disposal facilities shall be identified. Permitting and licensing information shall be provided for each facility along with a contact person, address, and a telephone number.

1.2.1.2 Transportation and Disposal Plan

A transportation and disposal plan shall be prepared by the Contractor in advance of excavation activities that describe the following:

a. The specific waste types and applicable waste codes to be treated and/or disposed

b. Anticipated quantities to be managed

c. Facility information, address, permit information, contact

d. Profiles of the materials destined for treatment and disposal

d. Transporter name, address, contact, phone number

e. Applicable transporter license/hauler permits

f. Schedule for implementing transportation and disposal activities

g. Other pertinent information as requested by the Navy Technical Representative

1.2.2 SD-18, Records

a. Shipment manifests

b. Delivery and disposal documentation

c. Work Site Decontamination documentation

1.2.2.1 Shipment Manifests

Generate copies of manifests or shipping papers as applicable for shipments of waste materials within 24 hours after removal of waste from the site.

1.2.2.2 Delivery and Disposal Documentation

Verification that the wastes were actually delivered and disposed of at the disposal site, within 7 days of disposal.

1.2.2.3 Work Site Decontamination Certificate

Verification that all vehicles and containers were decontaminated prior to leaving the site, were properly operating, and were covered, within 24 hours after off-site transportation of the material.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Materials and Equipment

Furnish all labor, materials, and equipment necessary to transport and dispose of contaminated soils in accordance with applicable Federal, State, and local

requirements.

3.1.2 Waste Disposal

3.1.2.1 Processing Sampling Wastes

Wastes generated during hazard characterization and compatibility testing, which shall include but not be limited to, all surplus samples, glass jars, sampling devices, and chemical materials, shall be packed in overpack drums and labeled for off-site disposal.

3.1.2.2 Processing Rinsate Solutions

Temporarily store in compatible containers the rinsate solutions generated during equipment and personnel decontamination. Sampling and analysis may be required prior to final disposition. The rinsate solution will be temporarily stored in the final staging area prior to final disposition as determined by the Navy Technical Representative.

3.1.3 Transportation and Disposal Records

Provide and prepare all waste shipment records/manifests for hazardous and nonhazardous wastes, required by the Resource Conservation and Recovery Act (RCRA) and the U.S. Department of Transportation (DOT). The Contractor shall complete all labels, profile sheets, and disposal restriction forms as necessary, including all DOT, USEPA, and state classifications. The Contractor shall provide a 48 hour notification to MCB Environmental Management Division for required signatures on waste manifests. Following completion of all paperwork, the Contractor shall submit this material and supporting documentation to the Navy's Technical Representative.

3.1.4 Transportation

The Contractor shall be solely responsible for complying with all federal, state, and local requirements for transporting hazardous materials through the applicable jurisdictions and shall bear all responsibility and cost for any noncompliance. In addition to those requirements, the Contractor shall do the following:

a. The Contractor shall weigh all vehicles containers for disposal prior to leaving MCB Camp Lejeune. The Contractor may use MCB landfill scales if the scales operator is provided with a 24 hour notification. The existing scales in Storage Lot 203 may be used. The Contractor can utilize the Base scales at Lot 203 which have been calibrated to North Carolina standards to ±10 percent.

b. Inspect and document all vehicles and containers for proper operation and covering.

c. Inspect all vehicles and containers for proper markings, manifest documents, and other requirements for waste shipment.

d. Perform and document decontamination procedures prior to leaving the worksite and again before leaving the disposal site.

3.1.5 Disposal

All contaminated materials classified as hazardous under RCRA (40 CFR Part 261) that are removed from the site shall be disposed of in a RCRA hazardous waste treatment/disposal facility permitted to accept such materials.

All decontaminated metal material acceptable per DRMO standards shall be taken to an on-base metal recycling facility.

3.2 Treatment Facilities

The proposed treatment for contaminated soils determined to be RCRA hazardous waste is incineration. The Contractor will recommend an appropriate permitted facility for the treatment and disposal of the contaminated soil contingent upon Navy approval, characterization of the material, and regulatory status.

SECTION 02510

BITUMINOUS CONCRETE PAVEMENT

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 M140	1990 Emulsified Asphalt
AASHTO M208	1990 Cationic Emulsified Asphalt
AASHTO M226	1990 Viscosity Graded Asphalt Cement

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 698	1991 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))
ASTM D 1188	1989 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
ASTM D 1556	1990 Density of Soil in Place by the Sand-Cone Method
ASTM D 2726	1990 Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
ASTM D 2922	1991 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	1988 Moisture Content of Soil and Rock in Place by Nuclear Methods

(Shallow Depth)

FEDERAL SPECIFICATIONS (FS)

FS TT-P-1952	(Rev. B) Paint, Traffic and Airfield Marking, Water Emulsion Base

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT RS	1990 Roads and Structures

1.2 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-05, Design Data (4 copies 4 weeks after order)

a. Job-mix formula

1.2.1.1 Job-Mix Formula

Submit the mix design, including mixing temperature, for approval. The mix design shall include a certified laboratory analysis of mix composition with marshall stability value, void content, and flow. After mix design approval, job mixes shall conform to the range of tolerances specified in NCDOT RS. An identical mix design previously approved within the past 12 months by the Atlantic Division, Naval Facilities Engineering Command, may be used without further approval, provided that copies of the previous approval are submitted. Obtain acknowledgement of receipt prior to bituminous concrete placement. Submit additional data regarding materials if the source of the materials changes.

1.3 QUALITY ASSURANCE

1.3.1 Modification to References

Except as specified herein or as indicated, work and materials shall be in accordance with the NCDOT RS. The provisions therein for method of measurement and payment do not apply, and references to "Engineer" shall be interpreted to mean the Navy's Technical Representative (NTR).

1.4 ENVIRONMENTAL REQUIREMENTS

Do not produce or place bituminous concrete when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the

ambient temperature is less than 40 degrees F in the shade away from artificial heat.

1.5 BARRICADES AND SIGNALS

Provide and maintain temporary signs, signals, lighting devices, markings, barricades, and channelizing and hand signaling devices to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the NTR.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Bituminous Concrete Mix

NCDOT RS, Section 645, Type I-1 for material and mix. Provide crushed stone aggregates for the bituminous mix.

2.1.2 Stone Base Course

NCDOT RS, Sections 1005 and 1010 for aggregate base course, standard Size No. ABC.

2.2 MIX PLANT

NCDOT RS, Sections 610-5.

PART 3 EXECUTION

3.1 INSTALLATION AND APPLICATION

Provide a stone base, a bituminous base, and a bituminous concrete surface course. Provide a tack coat and a stone base course, and a bituminous concrete surface course. Subgrade preparation shall be as specified in Section 02220, "General Excavation, Filling, and Backfilling."

3.1.1 Stone Base Course Placement

Begin spreading base material at the point nearest the source of supply. Permit traffic and hauling over the base. Fill ruts formed by traffic and reroll. After base course placement, continue machining and rolling until surface is smooth, compacted, well bonded, and true to the designed cross section. Compact to 100 percent ASTM D 698 maximum dry density. Maintain the base smooth and true to grade and cross section until bituminous concrete placement.

3.1.2 Bituminous Concrete Application

3.1.2.1 Placing Temperature

Minimum temperature of bituminous concrete during placement into mechanical spreader shall be 225 degrees F. Mixtures which have a lower temperature shall be rejected.

3.1.2.2 Joints

Where new pavement abuts existing bituminous pavement, cut existing surface course along straight lines approximately 6 inches from edge. Cuts shall be vertical and extend full depth of surface course. Prior to bituminous concrete placement, apply asphalt cement to exposed edges of cold joints.

3.1.2.3 Spreading and Finishing Equipment

Spread the bituminous concrete to a uniform density and produce a smooth finish, true to cross section and free from irregularities. Provide adjustable screeds to shape the surface to true cross section.

3.1.2.4 Bituminous Concrete Placement

As continuous as possible. Place in maximum 2-inch lifts. Avoid passing rollers over unprotected edges of bituminous concrete prior to bituminous concrete cooling. If rollers pass over unprotected edges of bituminous concrete prior to cooling, cut bituminous concrete back to expose full depth of bituminous concrete. Immediately prior to resumption of bituminous concrete placement, coat exposed edges of bituminous concrete with asphalt cement. When bituminous concrete placement resumes, rake the hot bituminous concrete against asphalt cement and compact.

3.1.2.5 Featheredges

Accomplish featheredging by raking out the larger aggregate as necessary and sloping the pavement uniformly throughout the featheredge to create a smooth transition. Unless indicated otherwise, featheredge transition shall be 10 feet.

3.1.2.6 Compaction

NCDOT RS for equipment and compaction procedures, modified to compact bituminous concrete to 96 percent of maximum laboratory density as determined by ASTM D 698. Finished surface shall be uniform in texture and appearance and free of cracks and creases.

3.1.2.7 Protection

No vehicular traffic shall be allowed on pavement for a minimum of 6 hours after final rolling, or until bituminous concrete has cured, whichever is longer.

3.3 FIELD QUALITY CONTROL

3.3.1 Sampling

Provide new materials where samples are taken. Take the number and size of samples required to perform the following tests.

3.3.1.1 Bituminous Concrete Sampling

a. Job Mix: Take one initial sample and one sample for every 400 tons or fraction thereof.

b. Thickness: Take one sample for every 500 square yards or fraction thereof.

c. Density: One field test for every 1000 square yards or fraction thereof, and one laboratory test for the project. Provide minimum 4-inch diameter cores if nuclear testing is not used.

3.3.1.2 Stone Base Course Sampling

a. Thickness: Take one sample for every 500 square yards or fraction thereof.

b. Density: One field test for every 1000 square yards or fraction thereof, and one laboratory test for the project.

3.3.2 Testing

Provide for each sample.

3.3.2.1 Bituminous Concrete Testing

a. Job Mix: Determine gradation and bitumen content.

b. Thickness: Maximum allowable deficiency shall be 1/4 inch less than the indicated thickness. Average thickness shall be as indicated.

c. Density, In Place: ASTM D 2922 and ASTM D 3017; cored sample ASTM D 1188 or ASTM D 2726.

3.3.2.2 Stone Base Course Testing

a. Thickness: Maximum allowable deficiency shall be 1/2 inch less than the indicated thickness. Average thickness shall be as indicated.

b. Density: ASTM D 698 or ASTM D 2922 and ASTM D 3017.

-- 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
ANSI B18.5.2.1M	1981 Metric Round Head Short Square Neck Bolts

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA MRE	1991 Manual for Railway Engineering (Fixed Properties)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME/ANSI B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings
ANSI/ASME B16.3	1992 Malleable Iron Threaded Fittings
ANSI/ASME B16.4	1992 Cast Iron Threaded 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
ASME/ANSI B18.2.2	1987 Square and Hex Nuts (Inch Series)
ANSI/ASME B18.5.2.2M	1982 Metric Round Head Square Neck Bolts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	1990 Ferritic Malleable Iron Castings
ASTM A 48	1992 Gray Iron Castings

ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 139	1990 Electrical-Fusion (ARC)- Welded Steel Pipe (NPS 4 and Over)
ASTM A 252	1990 Welded and Seamless Steel Pipe Piles
ASTM A 307	1992 (Rev. A) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 536	1984 Ductile Iron Castings
ASTM A 563	1992 (Rev. A) Carbon and Alloy Steel Nuts
ASTM A 746	1986 (R 1991) Ductile Iron Gravity Sewer Pipe
ASTM B 32	1992 Solder Metal
ASTM B 61	1990 Steam or Valve Bronze Castings
ASTM B 62	1990 Composition Bronze or Ounce Metal Castings
ASTM B 88	1992 Seamless Copper Water Tube
ASTM C 94	1992 Ready-Mixed Concrete
ASTM D 1527	1989 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
ASTM D 1785	1991 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2235	1988 Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2241	1989 Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2282	1989 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe
ASTM D 2466	1990 (Rev. A) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D 2468	1990 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	1991 (Rev. A) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2774	1972 (R 1983) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	1990 Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	1989 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F 402	1988 Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	1990 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	1990 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/A21.5	1988 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C110/A21.10	1987 Ductile-Iron and Gray-Iron Fittings, 3in. Through 48in., for Water and Other Liquids
AWWA C111/A21.11	1990 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	1988 Flanged Ductile-Iron Pipe with Threaded Flanges
ANSI/AWWA C151/A21.51	1991 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153/A21.53	1988 Ductile-Iron Compact Fittings, 3 in. Through 16 in., for Water and Other Liquids

AWWA C203	1991 Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied
AWWA C500	1986 Gate Valves for Water and Sewerage Systems
AWWA C502	1985 (Errata 1985) Dry-Barrel Fire Hydrants
AWWA C503	1988 Wet-Barrel Fire Hydrants
AWWA C508	1982 Swing-Check Valves for Waterworks Service, 2 in. Through 24 in. NPS
AWWA C509	1987 Resilient-Seated Gate Valves for Water and Sewerage Systems
AWWA C511	1992 Reduced-Pressure Principle Backflow-Prevention Assembly
AWWA C600	1987 Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	1987 Grooved and Shouldered Joints
AWWA C651	1992 Disinfecting Water Mains
AWWA C700	1990 (Addendum 1991) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C701	1988 Cold-Water Meters - Turbine Type, for Customer Service
AWWA C702	1986 Cold-Water Meters - Compound Type
AWWA C703	1986 Cold-Water Meters - Fire Service Type
AWWA C704	1992 Propeller-Type Meters for Waterworks Applications
AWWA C800	1989 Underground Service Line Valves and Fittings
AWWA C900	1989 (Addendum 1992) Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution

AWWA M23	1980 PVC Pipe - Design and Installation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-80	1987 Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	1992 Installation of Private Fire Service Mains and Their Appurtenances

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	1988 Installation of Polyvinyl Chloride (PVC) Pressure Pipe
UBPPA UNI-B-8	1986 Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe

UNDERWRITERS LABORATORIES INC. (UL)

UL 246	1979 (R 1987) Hydrants for Fire-Protection Service
UL 262	1988 (R 1991) Gate Valves for Fire-Protection Service
UL 312	1988 (R 1991) Check Valves for Fire-Protection Service
UL 789	1987 (R 1990) Indicator Posts for Fire-Protection Service

1.2 RELATED REQUIREMENTS

Section 15010, "General Mechanical Requirements," applies to this section with additions and modifications specified herein.

1.3 DESIGN REQUIREMENTS

1.3.1 Water Service Lines

Provide water service lines indicated as 4-inch diameter and larger of polyvinyl chloride (PVC) plastic water main pipe. Provide valves and water main accessories where indicated. Submit design calculations for water piping.

Provide water service lines indicated as less than 4-inch diameter, from water distribution main to building service at a the point indicated. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances where specified. Submit design calculations for water piping.

1.4 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7 of the Basic Contract.

1.4.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a. Water distribution main piping, fittings, joints, valves and couplings

b. Water service line piping, fittings, joints, valves and couplings

c. Hydrants

d. Corporation stops

e. Valve boxes

f. Indicator posts

g. Water meters

h. Backflow preventer

i. Antifreeze device

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.

1.4.2 SD-06, Instructions (4 copies 4 weeks after order)

a. Installation procedures for water piping

1.4.3 SD-13, Certificates (4 copies 4 weeks after order)

a. Water distribution main piping, fittings, joints, valves and couplings

b. Water service line piping, fittings, joints, valves and couplings

c. Fire hydrants

d. Backflow preventer

e. Antifreeze device

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 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 PVC Plastic Water Main Pipe and Associated Fittings

a. Pipe and Fittings: Pipe shall conform to AWWA C900 and shall be plain end or gasket bell end, Pressure Class 50 (DR 18) with cast-iron pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53, and shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the

same requirements as fittings with mechanical-joint ends, except that bell design shall be modified for push-on joint for use with specified PVC plastic pipe.

b. Joints and Jointing Material: Joints for pipe and fittings shall be push-on joints as specified in ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints as specified in ASTM D 3139, or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D 3139 and AWWA C111/A21.11. Provide each joint connection with a elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories shall be as specified in AWWA C111/A21.11 for push-on joints and mechanical joints. Mechanically coupled joints using a sleeve type mechanical coupling, as specified in paragraph entitled "Sleeve-Type Mechanical Couplings," may be used as an optional jointing method in lieu of push-on joints on plain-end PVC plastic pipe, subject to limitations specified for mechanically coupled joints using a sleeve-type mechanical coupling and to the use of internal stiffeners as specified for compression-type joints in ASTM D 3139.

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe. Unless specified otherwise, valves conforming to AWWA C509 shall be nonrising stem type with mechanical-joint ends. Unless otherwise specified, valves conforming to UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have 0-ring stem seals and shall be bolted and constructed so as to permit easy removal of parts for repair. In lieu of mechanical-joint ends and push-on joint ends, valves may have special ends for connection to sleeve-type mechanical coupling. Valve ends and gaskets for connection to sleeve-type mechanical coupling shall conform to the applicable requirements specified for the joint or coupling. Valves shall be of one manufacturer.

2.1.2.2 Gate Valves in Valve Pits

AWWA C500, to AWWA C509, or to UL 262. Valves conforming to AWWA C500 shall be outside-screw-and-yoke rising-stem type with double disc gates and flanged ends. Valves conforming to AWWA C509 shall be outside-screw-and-yoke rising-stem type with flanged ends. Valves conforming to UL 262 shall be outside-screw-and-yoke type, have double-disc or split-wedge type gate and flanged ends, and be designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Provide valves with handwheels that open by counterclockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. In lieu of flanged ends, valves may have grooved ends suitable for grooved type joints, as specified in paragraph entitled "Ductile-Iron Piping." Valves shall be of one manufacturer.

2.1.2.3 Check Valves

Swing-check type conforming to AWWA C508 or UL 312. Valves conforming to AWWA C508 shall have iron or steel body and cover and flanged ends. Valves conforming to UL 312 shall have cast iron or steel body and cover, shall have flanged ends, and be designed for a working pressure of 175 psi. Materials for UL 312 valves shall conform to reference standards specified in AWWA C508. Valves shall have clear port opening. In lieu of flanged ends, valves may have grooved ends suitable for grooved type joints, as specified in paragraph entitled "Ductile Iron Piping." Valves shall be of one manufacturer.

2.1.2.4 Fire Hydrants

Dry-barrel type. Dry-barrel type hydrants shall conform to AWWA C502 or to UL 246, "Base Valve" design, and shall have 6-inch inlet, 5 1/4-inch valve opening, one 4 1/2 -inch pumper connection, and two 2 1/2-inch hose connections. Pumper connection and hose connections shall be individually valved with independent nozzle gate valves. Inlet shall have mechanical-joint or push-on joint end, and shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap nuts, and threads on hose and pumper connections shall be as [specified in AWWA C502 or AWWA C503 or UL 246.

2.1.2.5 Valve Boxes

Provide a valve box for each gate valve. Valve boxes shall be of cast iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Each cast-iron box shall have a heavy coat of bituminous paint.

2.1.2.6 Sleeve-Type Mechanical Couplings

Design to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. Coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. Middle ring shall be of cast iron [or steel] and the follower rings shall be of malleable iron or ductile iron. Cast iron shall conform to ASTM A 48 and shall be not less than Class 25. Malleable iron shall conform to ASTM A 47. Ductile iron shall conform to ASTM A 536. [Steel shall have a strength not less than that of the pipe.] Gaskets shall be designed for resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Bolts shall be track-head type; bolts and nuts shall be either of the following: bolts conforming to tensile requirements of ASTM A 307, Grade A, with nuts conforming to tensile requirements of ASTM A 563, Grade A; or round-head square-neck type bolts conforming to ANSI B18.5.2.1M and ANSI/ASME B18.5.2.2M with hex nuts conforming to ASME/ANSI B18.2.2. Bolts shall be 5/8 inch in diameter; minimum number of bolts for each coupling shall be 3 for 3-inch pipe, 4 for 4-inch pipe, and 5 for 6-inch pipe. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint.

2.1.2.7 Tracer Wire for Nonmetallic Piping

Tracer wire shall be bare copper or aluminum wire not less than 0.10 inch in diameter, provided in sufficient length to be continuous over each separate run of nonmetallic pipe.

2.1.2.8 Indicator Posts

UL 789. Provide one coat of primer and two coats of red enamel paint.

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Plastic Piping

Plastic pipe and fittings shall bear the seal of approval of the National Sanitation Foundation for potable water service. Plastic pipe and fittings shall be supplied from the same source.

a. Polyvinyl Chloride (PVC) Plastic Piping: ASTM D 1785, Schedule 40; or ASTM D 2241, with SDR as required to provide 150 psi minimum pressure rating. Fittings shall conform to ASTM D 2466. Pipe and fittings shall be of the same PVC plastic material and shall be one of the following pipe/fitting combinations, as marked on pipe and fitting, respectively: PVC 1120/PVC I; PVC 1220/PVC 12;] PVC 2120/PVC II; PVC 2116/PVC II. Solvent cement for jointing shall conform to ASTM D 2564.

2.2.2 Water Service Line Appurtenances

2.2.2.1 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.

2.2.2.2 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.

2.2.2.3 Curb or Service 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 or service stop indicating direction of flow.

2.2.2.4 Gate Valves 3-Inch Size and Smaller [on Buried Piping]

MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged end connections, or threaded end connections with a union on one side of the valve. Provide handwheel operators.

2.2.2.5 Gate Valves Smaller Than 3-inch Size in Valve Pits

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Valves shall have flanged end connections, or threaded end connections with a union on one side of the valve and a handwheel operator.

2.2.2.6 Curb Boxes

Provide for each curb or service 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.

2.2.2.7 Valve Boxes

Provide for each gate valve [on buried piping]. Valve boxes shall be of iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Each cast-iron box shall have a heavy coat of bituminous paint.

2.3 WATER METERS

AWWA C700 AWWA C701 AWWA C702 AWWA C703 AWWA C704. Meter shall register in U.S. gallons. Displacement type water shall be of freeze-proof split-case type.

2.4 BACKFLOW PREVENTER

AWWA C511 reduced pressure principle type, as modified herein. Backflow preventers shall have threaded connections and all bronze construction for sizes of 2 inches and smaller, and shall have flanged connections and galvanized cast-iron or epoxy coated cast-iron construction for sizes larger than 2 inches. The backflow preventer shall include two check valves located between two shut-off valves with an area of reduced pressure between the check valves and a relief device arranged to discharge to the atmosphere. Fluctuation in piping pressure shall not cause cycling. The backflow preventer shall automatically maintain a low pressure zone to positively prevent the backflow of water into the water supply system. The backflow preventer shall automatically indicate failure of any part vital to the prevention of backflow by the continuous discharge of the relief device. The backflow preventer shall be suitable for a cold water working pressure of [150] [175] psig. The backflow preventer shall be designed so that any moving part may be replaced without removing the backflow preventer.

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. Do not lay water lines in the same trench with gas lines fuel lines or electric wiring.

a. Water Piping Installation Parallel With Sanitary Sewer Piping

(1) Normal Conditions. Water Piping shall be laid at least 10 feet horizontally from a sewer or sewer manhole whenever possible. Distance shall be measured edge to edge.

(2) Unusual Conditions. When local conditions prevent a horizontal separation of 10 feet, water piping may be laid closer to a sewer or sewer manhole provided:

(a) Bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.

(b) Where this vertical separation cannot be obtained, sewer piping shall be constructed of AWWA-approved water pipe, pressure tested in place without leakage prior to backfilling.

(c) Sewer manhole shall be of watertight construction and tested in place.

b. Installation of Water Piping Crossing Sanitary Sewer Piping

(1) Normal Conditions. Water piping crossing above sewer piping shall be laid to provide a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping.

(2) Unusual Conditions. When local conditions prevent a vertical separation described above, the following construction shall be used:

(a) Sewer piping passing over or under water piping shall be constructed of AWWA-approved water piping, pressure tested in place without leakage prior to backfilling.

(b) Water piping passing under sewer piping shall, in addition, be protected by providing the following. A vertical separation of at least 18 inches between bottom of sewer piping and top of water piping; adequate structural support for sewer piping to prevent excessive deflection of joints and settling on and breaking of water piping; and that the length (minimum 18 feet) of

water piping be centered at the point of crossing so that joints shall be equidistant and as far as possible from sewer piping.

c. Sanitary Sewer Piping or Sanitary Sewer Manholes. No water piping shall pass through or come in contact with any part of a sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02220, "General Excavation, Filling, and Backfilling."

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. Depth of cover over top of pipe shall not be less than 2 1/2 feet.

3.1.1.4 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.

3.1.1.5 Connections to Existing Water 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 sleeves 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. Minimize interruption time.

3.1.2 Installation of Water Mains

3.1.2.1 Special Requirements for Ductile-Iron Piping

a. Installation, General: Unless otherwise specified in the following subparagraphs, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

b. Jointing:Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assembly push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UBPPA UNI-B_3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint; assembly in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical joint connections and to not re-bevel. Assembly joints made with sleeve-type mechanical couplings manufacturer using internal stiffeners as specified for compression-type joints.

c. Pipe Anchorage: Provide concrete thrust blocks, reaction backing, for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and

positioning of thrust blocks shall be as indicated. Use concrete conforming to ASTM C 94 having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength

3.1.2.2 Installation of Valves and Hydrants

a. Installation of Valves: Install gate valves conforming to AWWA C500 and UL 262 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves conforming to AWWA C509 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Install gate valves on PVC water mains in addition in accordance with the recommendations of AWWA M23 for appurtenance installation in AWWA M23, Chapter 7,"Installation." Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated. Make and assemble joints to gate valves [and check valves] as specified for making and assembling the same type joints between pipe and fittings.

b. Installation of Hydrants: Install hydrants in accordance with the requirements of AWWA C600 for hydrant installation as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings.

3.1.2.4 Installation Beneath Railroad Right-of-Way

Where pipeline passes under the right-of-way of a commercial railroad, install piping in accordance with the specifications for pipelines conveying nonflammable substances in AREA MRE. For PVC plastic water main pipe, install in addition in accordance with the recommendations of AWWA M23 for installation of casings.

3.1.3 Installation of Water Service Piping

3.1.3.1 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 a point directed by the Contracting Officer; such water service lines shall be closed with plugs or caps.

3.1.3.2 Service Line Connections to Water Main

Connect service lines to the main by a corporation stop and gooseneck and install a service stop below the frostline. Connect service lines to PVC plastic water mains in accordance with UBPPA UNI-B-8 and the recommendations of AWWA M23, Chapter 9, "Service Connections."

3.1.3.3 Special Requirements for Installation of Plastic Piping

a. Plastic 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 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

b. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

c. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.1.4 Disinfection

Flush and disinfect new potable water lines and affected portions of existing potable water lines in accordance with AWWA C651. Apply chlorine by the continuous feed method. Flush the 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. Disinfection of systems supplying nonpotable water is not required.

3.1.5 Backflow Preventer

Backflow preventer shall be installed in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The NTR will conduct field inspections and witness field tests specified in this section. The General Site Work Subcontractor shall perform field tests,

and provide labor, equipment, and incidentals required for testing. The General Site Work Subcontractor 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 mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test PVC plastic water mains in accordance with UBPPA UNI-B-3 for pressure and leakage tests. The amount of leakage on pipelines made of PVC 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. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at plastic pipe joints, flanged joints, 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 02696

EXTERIOR PIPING INSULATION AND HEAT TRACING

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 209	1990 Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 533	1985 (R 1990) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 547	1977 Mineral Fiber Preformed Pipe Insulation
ASTM C 552	1991 Cellular Glass Thermal Insulation
ASTM D 226	1989 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

1.2 SYSTEM DESCRIPTION

Provide field-applied insulation for exterior steam piping and existing insulated piping affected by Contractor's operation.

1.3 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Insulation

b. Jacket

c. Piping Heat Tracing

1.3.2 SD-06, Instructions (4 copies with quote)

a. Installation manual for field-applied insulation

b. Installation instructions for piping heat tracing

PART 2 PRODUCTS

2.1 PIPING INSULATION

Products containing asbestos will not be permitted. Insulation shall be fibrous glass, calcium silicate or cellular glass, as recommended by the manufacturer for the particular application.

2.1.1 Fibrous Glass Pipe Insulation

ASTM C 547.

2.1.2 Calcium Silicate Pipe Insulation

ASTM C 533.

2.1.3 Cellular Glass Pipe Insulation

ASTM C 552.

2.2 MINIMUM THICKNESS OF INSULATION FOR STEAM PIPING

2.2.1 Fibrous Glass Pipe Insulation

Nominal Pipe Sizes (Inches)	Aboveground Piping Insulation Thickness (Inches) Groundwater
less than 3	1.0
3 thru 4	1.0
5 thru 6	1.5
8 and larger	2.0

2.2.2 Calcium Silicate Pipe Insulation

Nominal Pipe Sizes (Inches)	Piping on Piers (Not in Trenches) Insulation Thickness (Inches) Groundwater
less than 3	1.5
3 thru 4	1.5
5 thru 6	2.0
8 and larger	2.0

2.2.4 Cellular Glass Pipe Insulation

Cellular glass pipe insulation having an insulating efficiency not less than that of the specified thickness of calcium silicate pipe insulation may be provided in lieu of calcium silicate pipe insulation.

2.3 ALUMINUM JACKET

ASTM B 209, Temper H14, minimum thickness of 0.016 inch, with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated aluminum covers for insulation on fittings, valves, and flanges.

2.4 ASPHALT-SATURATED FELT

ASTM D 226, without perforations, minimum weight of 10 pounds per 100 square feet.

2.5 PIPING HEAT TRACING

Self-regulating type piping heat tracing with a conductive polymer core, tinned cooper shield, and insulating jacket that is resistant to chemical environments. Heat tracing shall be suitable for use in the application exposure environment.

Heat tracing shall regulate output based on temperature to maintain pipe temperature of 50 degrees F.

2.5.1 Thermal Output Rating of Heat Tracing

Nominal Pipe Sizes (Inches)	Heat Tracing Thermal Output Rating (W/FT)
1 2/3 and less	3.0
2 thru 3	5.0
4 thru 8	8.0

PART 3 EXECUTION

3.1 INSTALLATION

Obtain NTR's written approval of piping systems prior to the application of insulation. Insulation shall be clean, dry, and installed prior to the

application of insulation jacket. Do not use short pieces of insulation and jacket materials where a full length section will fit. Provide insulation materials and jackets with smooth and even surfaces, with jackets drawn tight, and secured on longitudinal and end laps. Insulate fittings and piping accessories with premolded, precut, or field-fabricated pipe insulation of the same pipe insulation material and thickness as the adjoining pipe insulation. Provide unions, flanges, valves, and piping accessories with removable (snap-on) sections of insulation. Provide insulation continuous through pipe hangers and pipe supports. Do not step on or walk on insulation or jacket.

3.2 PIPING INSULATION

3.2.1 Fibrous Glass Pipe Insulation

Install in accordance with the manufacturer's recommendations.

3.2.2 Calcium Silicate Pipe Insulation

Install in accordance with the manufacturer's recommendations, except as modified herein. Secure with not less than 0.375-inch width fibrous glass reinforced waterproof tape or stainless steel bands spaced not more than 8 inches on centers. Provide one layer of asphalt-saturated felt over the insulation prior to installing aluminum jacket. Factory-applied polyethylene and kraft paper moisture barrier will not be permitted as a substitute for the asphalt-saturated felt.

3.2.3 Cellular Glass Pipe Insulation

Install as specified for calcium silicate pipe insulation.

3.3 INSULATION JACKET

Provide new piping insulation and existing piping insulation affected by Contractor's operations with aluminum jacket. Machine cut the jacket to produce a straight, smooth edge. Lap longitudinal and circumferential seams not less than 2 inches. Install jackets on horizontal piping with the longitudinal seam approximately midway between horizontal centerline and the bottom side of pipe. Install with the top edge of jacket overlapping the bottom edge of jacket and with the seam of each jacket offset from the seam of the adjacent jacket. Install jackets on vertical piping and on piping pitched from the horizontal from low point to high point so that the lower circumferential edge of each jacket overlaps the jacket below it. Provide factory prefabricated covers for insulation on fittings, valves, and flanges. Finish jackets neatly at pipe hangers and pipe supports. Terminate jackets neatly at the ends of unions, valves, traps, and strainers. Secure jacket with stainless steel bands spaced not more than 8 inches on center.

3.4 ASPHALT-SATURATED FELT

Apply felt with longitudinal and circumferential seams lapped not less than 6 inches. Secure with not less than 0.5-inch width stainless steel bands spaced not more than 8 inches on center.

3.5 PIPING HEAT TRACING

Install piping heat tracing in accordance with manufacturer's written instructions. Provide additional lengths of heat tracing for valves, fittings, etc., as suggested by manufacturer. Heat tracing shall be wired in accordance with Section 16402, "Interior Wiring System." Heat tracing shall be installed in accordance with the National Electric Code and IEEE Standard 515-1983.

-- 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 the basic designation only.

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 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 D 2321	1989 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	1992 Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 2680	1990 Acrylonitrile-Butadiene-Styrene(ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 3034	1989 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3139	1989 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	1992 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 402	1988 Safe Handling of Solvent Cements Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

ASTM F 477	1990 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 794	1991 Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 949	1992 Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C111/21.11	1990 (Erratum 1991) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C900	1989 (Addendum 1992) Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution
AWWA M23	1980 PVC Pipe - Design and Installation

FEDERAL SPECIFICATIONS (FS)

FS RR-F-621	(Rev. E) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	1988 Installation of Polyvinyl Chloride (PVC) Pressure Pipe
UBPPA UNI-B-6	1990 Low-Pressure Air Testing of Installed Sewer Pipe

1.2 RELATED REQUIREMENTS

Section 15010, "General Mechanical," applies to this section with additions and modifications as specified herein.

1.3 SYSTEM DESCRIPTION

1.3.1 Sanitary Sewer Gravity Pipeline

Provide mains and laterals as shown on the drawings of polyvinyl chloride (PVC) plastic pipe.

1.3.2 Sanitary Sewer Pressure Lines

Provide pressure lines of polyvinyl chloride (PVC) plastic pressure pipe.

1.3.3 Packaged Sewage Pumping System

Provide and install a packaged sewage system complete with concrete manhole with cover, pump, pump lifting and support system, internal piping, level controls, and remote control panel.

1.4 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.4.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Pipeline materials including joints, fittings, and couplings

b. Packaged sewage pumping system

Submit manufacturer's standard drawings or catalog cuts.

1.4.2 SD-04, Drawings (4 copies 4 weeks after order)

a. Precast concrete manhole

b. Packaged sewage pumping system

1.4.3 SD-13, Certificates (4 copies 4 weeks after order)

a. Pipeline materials, joints and fittings, including factory-applied linings

b. Cast iron frames, covers, and gratings

c. 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.

1.5.2 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, or ASTM F 949 with ends suitable for elastomeric gasket joints.

2.1.1.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

2.1.2.1 PVC Plastic Pressure Pipe and Fittings

Pipe shall conform to AWWA C900 and shall be plain end or gasket bell end, Pressure Class 150 (DR 18), with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell

design shall be modified, as approved, for push-on joint suitable for use with the PVC plastic pressure pipe specified in this paragraph.

2.1.2.2 PVC Plastic Pressure Joints and Jointing Material

Joints for pipe shall be push-on joints as specified in ASTM D 3139. Joints between pipe and fittings shall be push-on joints as specified in ASTM D 3139 or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D 3139 and AWWA C111/A21.11. Each joint connection shall be provided with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical-joints for joint connections between pipe and fittings shall be as specified in AWWA C111/A21.11, respectively, for push-on joints and mechanical-joints.

2.2 CONCRETE MATERIALS

Concrete materials shall be as specified in Section 03300, "Cast in Place Concrete."

2.3 PACKAGED LOW PRESSURE SEWAGE PUMPING SYSTEM

The Subcontractor shall furnish all labor, materials, equipment, and incidentals required to provide simplex pumping system as specified herein.

The system shall consist of sewage grinder pump, level control switches, discharge plumbing with hydraulically sealed discharge flange, pump mounting plates with bottom rail supports, upper rail supports, lifting chain, pedestal mount and cord sealing plate for panel or NEMA 4 junction box; to be installed in a precast concrete manhole as specified. A NEMA 4X weatherproof control box shall be supplied for mounting remote from the basin.

GENERAL
Grinder pump shall be a heavy duty pump modified to be used as a grinder. Each grinder pump shall contain special cutters to reduce sewage to a fine slurry. The stationary cutter shall consist of hardened 316 "L" stainless steel and the rotary cutter shall consist of chrome alloyed cast iron. The cutter materials shall provide maximum corrosion and abrasion resistance. The remaining portion of the grinder pumps, with the exception of seal materials and wet end, shall be similar to the heavy duty pumps used in larger pump stations for daily operation.

PUMP DESIGN
The Grinder pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight

contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

CABLE ENTRY SEAL

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

MOTOR

The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155° C (311° F). The stator shall be dipped and baked three times in class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40° C (104° F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125° C (260° F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and pump shall be designed and manufactured by the same source.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40° C (104° F) ambient and with a temperature rise not to exceed 80° C. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

BEARINGS
The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Sleeve or single row lower bearings are not acceptable.

MECHANICAL SEAL
Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an oil reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the oil chamber, shall contain one stationary and one positively driven rotating ceramic ring. The upper, secondary seal unit, located between the oil chamber and the motor housing, shall contain one stationary carbon seal ring and one positively driven rotating ceramic seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to provide oil expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

2.3.1 OPERATING CONDITIONS

Pump shall have a capacity of 30 gpm against a total head of 10 feet. Pump motor shall be 3 hp, 3 phase, 460 volts, 3450 rpm, 60 Hz cycle.

2.3.2 SUMP LEVEL CONTROLS

Float switches shall be supplied to control sump level. The switches shall be sealed in a solid polypropylene float for corrosion and shock resistance. The support wire shall have a heavy Neoprene jacket. A weight shall be attached to cord above the float to hold switch in place in sump and efficiently prevent sharp bends in the cord when the float operates. A quantity of three

(3) floats shall be provided to control level.

2.3.3 OPERATION OF SYSTEM

On sump level rise lower switch shall first be energized, then upper level switch shall next energize and start pump. With pump operating, sump level shall lower to low switch turn-off setting and pump shall stop. If level continues to rise when pump is operating, alarm switch shall energize and signal the alarm, where used. All level switches shall be adjustable for level setting, from the surface.

2.3.4 CHECK VALVE AND PIPING

The discharge piping shall include a ball check valve with hydraulically sealed discharge flange and a gate valve. Discharge from station shall be fitted to the NPT connections on the pump. All piping external to the station shall be furnished and installed by the mechanical subcontractor.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Precast Concrete 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

FS RR-F-621, cast iron.

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

a. Sanitary Piping Installation Parallel With Water Line:

(1) Normal Conditions: Sanitary piping or manholes shall be laid at least 10 feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.

(2) Unusual Conditions: When local conditions prevent a horizontal separation of 10 feet, the sanitary piping or manhole may be laid closer to a water line provided that:

(a) The top (crown) of the sanitary piping shall be at least 18 inches below the bottom (invert) of the water main.

(b) Where this vertical separation cannot be obtained, the sanitary piping shall be constructed of AWWA-approved water pressure tested in place without leakage prior to backfilling.

(c) The sewer manhole shall be of watertight construction and tested in place.

b. Installation of Sanitary Piping Crossing a Water Line:

(1) Normal Conditions: Lay sanitary piping crossing water lines to provide a separation of at least 18 inches between the top of the sanitary piping and the bottom of the water line whenever possible.

(2) Unusual Conditions: When local conditions prevent a vertical separation described above, use the following construction:

(a) Sanitary piping passing over or under water lines shall be constructed of AWWA-approved water pipe, pressure tested in place without leakage prior to backfilling.

(b) Sanitary piping passing over water lines shall, in addition, be protected by providing:

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 02220 "General Excavation, Filling and Backfilling."

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 or groove ends in the upgrade direction. Adjust spigots in bells and tongues in grooves to give a uniform space all around. Blocking or wedging between bells and spigots or tongues and grooves shall 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 NTR before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

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 ASTM D 2321 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 ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.2.2 Installation of PVC Plastic Pressure Pipe and Fittings

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" of this section; with the requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Joints: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to fittings, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint and assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint mechanical-joint connections and do not re-bevel.

b. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C 94 having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03300 "Cast in Place Concrete".

3.1.4 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and 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 sparging shall 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. Sparging shall 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.

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 shall 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.

b. Field Painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The NTR shall 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. 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:

(1) 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.

3.2.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. 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. Test PVC plastic pressure lines in accordance with the requirements of UBPPA UNI-B-3 for pressure and leakage tests, using the allowable leakage given therein.

-- 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 94	1990 Ready-Mixed Concrete

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-191/3	(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

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Chain-link fencing components

b. Accessories

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 I, zinc-coated steel, 12-gage. Mesh size, 2 inches. Provide selvage knuckled at one selvage and twisted and barbed at the other. 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 or steel alloy. 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, fork type. Gate leaves more than 8 feet wide shall have intermediate members as necessary to provide rigid construction, free from sag or twist. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding shall not be permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangements.

2.1.3 Posts, Top Rails, and Braces

FS RR-F-191/3 line posts; Class 1, steel pipe, Grade A. End, corner, and pull posts; Class 1, steel pipe, Grade A. Braces and rails; Class 1, steel pipe, Grade A 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

ASTM C 94, using 3/4-inch maximum-size aggregate, and having minimum compressive strength of 3000 psi at 28 days.

PART 3 EXECUTION

3.1 SITE PREPARATION

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 in area defined by the Purchaser.

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 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 corner and pull posts.

3.2.2 Post Setting

Set posts plumb. Allow concrete 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.

3.2.3 Top Rails

Install top rails before installing chain-link fabric. Pass top rail through intermediate post caps. Provide expansion coupling spaced as indicated.

3.2.4 Fabric

Pull fabric taut and secure fabric to top rail, 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 embedded as indicated. 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 Post Caps

Install post caps as recommended by the manufacturer.

3.3.2 Supporting Arms

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 power-actuated tools may be used with steel, wrought iron, ductile iron, or malleable iron. Do not use studs driven by power-actuated tools with gray iron or other material that shall fracture.

3.3.3 Barbed Wire

Install barbed wire on supporting arms above fence posts. Extend each end member of gate frames sufficiently above top member to carry five 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.

3.6 CLEANUP

Remove waste fencing materials and other debris from the station.

-- End of Section --

SECTION 02900

GROUNDWATER RECOVERY 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) PUBLICATIONS

D 2488	1984 Visual Classification of Soils (Unified Soil Classification System)
A 312	1989 (Rev. A) Stainless and Welded Austenitic Stainless Steel Pipe
D 422	1963 Particle Size Distribution
C 478	1989 Precast Concrete Manhole Sections
D 1586	1967 Penetration Test and Split Tube Sampling of Soils
C 494	1986 Chemical Admixtures for Concrete
D 2113	1970 Diamond Core Drilling for Rock Sampling
C 150	1989 Type I or II Portland Cement
D 2122	1990 Method for Determining Dimensions of Thermoplastic Pipe and Fittings
D 2321	1989 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
D 3350	1984 Polyethylene Plastic Pipe and Fittings Materials
D 3139	1989 Standard Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals
F 477	1976 (Rev. 85) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

U.S. ENVIRONMENTAL PROTECTION AGENCY PUBLICATIONS

ECBSOPQAM 1991 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV

530/R-93-001 1992 RCRA Ground-Water Monitoring Draft Technical Guidance

540/P-87/001 1987 A compendium of Superfund Field Operations Methods

U. S. GEOLOGICAL SURVEY (USGS) PUBLICATIONS

WSP 1536E 1962 Theory of Aquifer Tests. U. S. Geological Survey Water Supply Paper 1536E, by J. G. Ferris and others.

WSP 2220 1983 Basic Ground-Water Hydrology U. S. Geological Survey Water Supply Paper 2220, by R. C. Heath

OTHER PERTINENT RESOURCES

ISBN0-9616456-0-1 1986, Groundwater and Wells, Johnson Division, Union Oil Products, by F. G. Driscoll

NORTH CAROLINA ADMINISTRATIVE CODE

Title 15A Subchapter 2L, Sections .0100 - .0200 1993 Classifications and Water Quality Standards Applicable to the Groundwater of North Carolina

Title 15A Subchapter 2C, Section .0100 - .0119 1992 Well Construction Standards

NATIONAL ELECTRICAL CODE

NFPA 70 1993 National Electrical Code

MANUFACTURERS STANDARDIZATION SOCIETY OF VALVE AND FITTINGS INDUSTRY (MSS) PUBLICATION

SP-58-83 Pipe Hangers and Supports - Materials, Design and Construction

1.2 PROFESSIONAL ENGINEER

A Professional Engineer licensed to practice in the State of North Carolina will be provided to prepare designs, plans and reports supporting the recovery system construction as described herein.

1.3 PROFESSIONAL GEOLOGIST

A Professional Geologist licensed to practice in the State of North Carolina shall be furnished to start up, balance and provide to the government a report for groundwater recovery operations, as specified herein.

1.4 SUBMITTALS

The Subcontractor will submit the following in accordance with Section C, Part 7.0 of the Basic Contract.

1.4.1 Permits and Licenses (4 copies 4 weeks after order)

The Subcontractor will obtain and submit copies of all required permits to the NTR. Copies of individual employee licenses shall also be furnished to the NTR before field operations may commence.

1.4.2 SD-02, Manufacturer's Data (4 copies with quote)

a. Well Casing
b. Well Screen
c. Filter Pack
d. Groundwater Recovery Equipment, Complete
e. Well Centralizers
f. Subcasing for Type III Well
g. Pump Controllers
h. Valves
i. Groundwater Piping

1.4.3 SD-12, Field Test Reports (4 copies 4 weeks after test)

Submit a report, signed and sealed by a Professional Geologist, that presents data on the performance of each recovery well installed. Report certification shall be in compliance with NCAC T15A: 02L Rules .0103, .0106, .0110, or .0202, as appropriate. Topics to be addressed in the report include: well installation logs, well development report, results of two 72-hour aquifer tests, including zones of hydraulic influence and groundwater capture, peak pumping rates, aquifer drawdown data, aquifer hydraulic transmissivity, and storativity.

1.4.4 SD-13, Certificates (4 copies 4 weeks after order)

a. Professional Engineer's Statements, Designs, Plans and Reports for civil, mechanical and electrical construction and installation of the groundwater recovery system, in accordance with Section 01010, "General Paragraphs." The Professional Engineer's certification shall conform to the standards set forth in NCAC Title 15A Sub. 2L.

b. Professional Geologist's Plans and Reports shall be certified in conformance with the standards set forth in NCAC Title 15A Sub. 2L.

c. Well drillers shall be licensed to perform such work in the State of North Carolina. Drilling logs and records will be signed by the personnel performing the work.

1.4.5 SD-19, Operation and Maintenance Manuals (7 copies 4 weeks after order)

Furnish the data, for the items listed, to the Navy Technical Representative (NTR) for review and acceptance; O&M data shall comply with requirements specified in Section 01010, "General Paragraph," and the Submittal Register.

a. Groundwater Recovery Equipment, as delineated in paragraph 2.4 of this section (Data package 4).

1.5 EARTHWORK

Provide in accordance with Section 02220, "General Excavation, Filling, and Backfilling" and other sections as applicable.

1.6 ENVIRONMENTAL PROTECTION

Provide in accordance with Section 01010, "General Paragraphs," and in accordance with the Basic Contract.

1.7 GENERAL REQUIREMENTS

Provide in accordance with Sections 15011, "Mechanical General Requirements" and 16011, "Electrical General Requirements."

1.8 RELATED WORK

Section 02901, "Groundwater Treatment System."

1.9 DESCRIPTION OF WORK

The work includes the installation of groundwater recovery system as shown on the contract drawings, and as specified herein. The groundwater recovery system shall include: shallow aquifer and Castle Hayne (deep) aquifer recovery wells, pumps, piping, electric power and control wiring, conduit,and

controls, recovery well buildings and appurtenances. The shallow aquifer pumps shall be pneumatically operated and the deep aquifer pumps shall be submersible electric motor driven. The recovery well pumps and controls for each well shall be provided complete by one manufacturer, regularly involved in the production of well pumps and controls.

Installation of the recovery well system shall be completed in two phases, as described in Part 3. The intent of this phased approach is to install one (1) shallow aquifer and one (1) Castle Hayne aquifer recovery well as Phase I. The two recovery wells shall be used to conduct independent aquifer tests. Following construction and field performance testing of these two wells, the Contractor shall recommend to the NTR, the placement of the remaining four (two shallow wells and two deep wells) recovery wells in Phase II. Placement of the remaining recovery wells shall be based on the data generated from the field performance tests. After approval by the NTR, the Contractor shall install the remaining recovery wells as Phase II.

This contract requires a total of three (3) shallow recovery wells and three (3) Castle Hayne recovery wells. If test data indicate, additional shallow and deep recovery wells may be recommended to the NTR.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the respective specifications and other requirements as specified herein. Where a trade name or manufacturer's name is used or specified, such use or specification is for reference or guidance only; an equal tool, part or component, in all respects may be provided upon demonstration of equivalency.

2.2 RECOVERY WELLS

2.2.1 Recovery Well Casing

New decontaminated (per EPA 530/R-93-001) type 304, Schedule 5, midbody Schedule 40 ends, stainless steel (ASTM A 530), threaded for joining to well screen. Casing sections threaded together will be sealed with Teflon® O-rings. Casings shall have a 6-inch nominal inside diameter. Casings shall be plumb and centered in the annulus. Plumbness shall be sufficient to set and operate pump and appurtenances without damage.

2.2.2 Recovery Well Screens

New decontaminated (per EPA 530/R-93-001) wire wound, continuous slot, Type 304, Schedule 5, midbody Schedule 40 ends, stainless steel (ASTM A-530) well screens with a 6-inch nominal inside diameter with stainless steel end cap. Screens threaded together will be sealed with Teflon® O-rings. Provide screens with adequate strength to resist external forces, both during and

after installation. Length of well screen shall be as indicated. The well screen opening size shall be 0.010 inch for Type II wells and 0.020 inch for Type III wells. Screens shall be plumb and centered in the annular space. Plumbness shall be sufficient to set and operate a pump and appurtenances without damage.

2.2.3 Centralizers

Stainless steel bow-type locking clamp centralizers will be utilized as shown on sheet number C-10.

2.2.4 Filter Pack

The subcontractor will provide sufficient quantities of clean, inert, quartz sand having a uniformity coefficient (C_u) of 2.5 or less as described in Driscoll (1986). The grading of the filter pack will be based on the grain size of the finest layer to be screened in order to provide a continuous stream of turbidity-free discharge water. The subcontractor will sample the formation at intervals (described in following subsections). A representative formation sample to be screened will be subjected to grain-size analysis (ASTM D 422) by the Subcontractor; the final filter pack design procedure will conform to that identified in Driscoll (1986) and ECBSOPQAM (1991), Appendix E.

2.2.5 Bentonite Pellet Seal

The subcontractor will provide an expansive bentonite pellet seal to protect the well sand pack from grout intrusion. The bentonite pellets will consist of 1/4 to 1/2 inch diameter chips of pure Wyoming grade bentonite applied by the tremie method.

2.2.6 Grout

Grout, or well annular space sealant, shall consist of the following mixture:

a. 94-pound Portland Type I cement (ASTM C-150)

b. 3-5 pounds powdered pure Wyoming bentonite, without polymers or other additives

c. 6-7 gallons clear potable water

The grout will be formulated by mixing the bentonite and water first, then adding the cement to the clay/water suspension. The final mix proportions will be decided at the work site by the NTR or designated representative. Grout will be applied by the tremie method.

2.2.7 Drilling Fluids

The shallow aquifer wells will be installed by the hollow-stem auger method, therefore, the use of drilling fluids for these wells is not anticipated. If, in the NTR's opinion, well drilling or construction will be facilitated by the use of fluids for shallow well construction, potable water utilization will be allowed.

The deep wells will be installed using the rotary drilling methods, incorporating a natural slurry of native formation materials (borehole advancement cuttings) and potable water. If, in the opinion of the NTR or designated representative, work can be facilitated by using the mud rotary drilling method, pure Wyoming bentonite powder may be added to the drilling fluid. The permitted amount of bentonite shall be the smallest quantity possible, consistent with good drilling practice.

2.2.8 Surface Casing

The deep aquifer extraction well will be recased through the contaminated surface layer using a 12-inch inside diameter Schedule 80 PVC surface casing. The casing will be flush threaded.

2.3 RECOVERY WELLHEAD BUILDINGS

Refer to Specifications Section 13135 for building requirements.

2.4 GROUNDWATER RECOVERY EQUIPMENT

The groundwater recovery system shall be provided complete with the following:

2.4.1 Electrical Control Panel

An electrical control panel shall be provided for each extraction system. Each panel shall contain, at a minimum:

a. Status indicators (on/off) for each station (extraction well)

b. Emergency power switches for each station

c. A readout of total flow from the system.

2.4.2 Groundwater Extraction Pump

Each shallow aquifer recovery pump shall be a commercially available controllerless pneumatically driven single stage oil-less device powered by a reciprocating tank-mounted air compressor rated at 15 cubic feet per minute and 100 pounds per square inch (for each pump installed).

Each deep aquifer groundwater recovery pump shall be a commercially available submersible pump with an integrated electric motor and impeller stack. Each pump shall be suitably sized for the specified discharge and total dynamic head (TDH) as indicated in the equipment list provided in Section 02901, "Groundwater Treatment System." Shallow recovery well pumps shall be capable of a minimum sustained pumpage of 3 gallons per minute. Deep recovery well pumps will be capable of a sustained yield of 200 gallons per minute. Materials shall be resistant to corrosion and compatible with site contaminants and conditions. All openings shall be through fittings securely welded to the pump casing and properly water-tight, where desirable. Discharge shall be through the top of the impeller stack with an opening diameter as indicated. There shall be a minimum of two non-return check valves at the connection between the impeller stack and the discharge piping.

2.4.3 Pump Controllers and Well-Head Installations

Deep well pump motors shall be suitable for the discharge and TDH requirements. Each pump motor shall be fitted with a limit switch in each installation. The limit switch shall turn the motor off (low-level switch) within a range of water levels in the particular well from 0.5 feet above the intake to the pump to 5 feet or less above the intake of the pump. An on/off indicator shall be provided at the PLC panel. A totalizing, mechanical flow meter shall be provided at each well head. A power switch and circuit breaker (if appropriate) shall be provided at each well-head. A means of measuring the water level in the well shall be provided as part of the pump installation. Each discharge pipe shall have, at the well-head, a ball-type drain valve and a pressure indicator with associated shut-off and drain valves as indicated. The well-head shall be adequately constructed via valving, disconnects, flanges, or access panels to allow maintenance or replacement of the piping, pump, wiring, and so forth, at each station without shutting down of the entire extraction system or permanent modification of the individual well-head.

2.4.4 Valves

Valves shall be ball-type, fitted with an indicating handle (open, shut or mid-range) and appropriate for the pipe connection. Valves shall be protected from freezing to zero degrees Fahrenheit. Valves shall be suitable for use with site contaminants and conditions. Packing and seals shall be hydrocarbon resistant. Valves shall be resistant to a pH range of 4 to 8, and have a pressure rating of 150 PSIG.

2.4.5 Groundwater Piping

Groundwater piping shall be HDPE, Schedule 40, conforming to ASTM C-3350 and sized as indicated. Piping joints shall be butt fusion welded.

2.4.6 Other

Provide fittings, adapters, air relief valves, and other appurtenances as required to ensure a complete and operable system.

PART 3 EXECUTION

3.1 GENERAL

Groundwater extraction well installation operations shall be supervised, directed, and monitored by a Professional Geologist with experience in hydrogeology and groundwater recovery. Groundwater recovery plans and reports shall be prepared, signed and sealed including certification number and date, by the Professional Geologist in accordance with NCAC T15A:02L. Prior to beginning work, the Professional Geologist shall meet with the NTR to discuss the groundwater recovery plan including work procedures and safety precautions. Any part of the work requirements, preparation, or review needing the approval of an engineer shall be signed and sealed by a Professional Engineer, in conformance with NCAC T15A:02L.

Installation of the recovery well system shall be completed in two phases. In Phase I, the subcontractor shall install one (1) shallow (Type II) and one (1) Castle Hayne (Type III) recovery well as indicated and specified. Following construction and field performance testing of these two recovery wells, the subcontractor shall recommend, in a written report to the NTR, the locations for the remaining recovery wells. Placement of the remaining recovery wells shall be based on data generated from the field performance tests. After approved from the NTR, the subcontractor shall install the remaining recovery wells as Phase II.

For preliminary design purposes, a total of three (3) shallow recovery wells and three (3) Castle Hayne recovery wells are indicated.

Well installation operations shall conform to the minimum requirements set forth in NCAC TI5A:02C, "Well Construction Standards."

3.2 RECOVERY WELLS

3.2.1 General

The two initial recovery wells shall be installed at the locations indicated, and shall be of two types:

Type II - Shallow Aquifer

Type III - Castle Hayne Aquifer

3.2.2 Type II Soil Boring and Shallow Recovery Well Installation

The Type II construction is a single cased well screened over a specific depth interval in the site's surficial aquifer. The Phase I well will be installed at the location shown in the project drawings.

The subcontractor will utilize the hollow-stem auger method to advance a pilot hole at the designated extraction well location. The shallow water bearing unit's formation materials will be sampled on a 5-foot depth interval beginning at a depth of 5 feet below land surface until the drilling termination depth using the Standard Penetration Test and Split Spoon procedure (ASTM D 1586). Soil boring samples will be visually identified in the field by the Unified Soil Classification System (ASTM D 2488) and recorded on a Soil Boring Log as work progresses. A representative aquifer formation sample will be selected with the NTR's approval and subjected to a grain size analysis (ASTM D 422) in order to properly finalize well screen sand pack design. The subcontractor will perform this design task in conformance with the procedure described by Driscoll (1986) and required by NCAC T15A:02C Rule .0107. The subcontractor's sand pack design recommendation will be furnished to the NTR for review and approval.

The borehole will be reamed with a large diameter auger (nominal 12-inch inside diameter) to permit the well assembly insertion. The shallow aquifer extraction wells will be constructed of stainless steel casings and screens, as described previously. The casings and screens will be decontaminated prior to use and threaded together and sealed using Teflon ® O-rings. A stainless steel end cap will be threaded to the well screen bottom. Stainless steel bow-type locking clamp centralizers will be attached to the assembly, just above the well screen and at its lowest section. The well assembly will be inserted into the auger and continuously suspended immediately above the borehole bottom during the placement of annular well construction materials. The subcontractor will exercise extreme care to ensure that the well assembly is both plumb and properly centered within the augers. The acceptable tolerance is less than 1 degree per 50 feet of well depth as determined using the methods outlined by Driscoll (1986). Failure to perform this part of the work adequately shall be sufficient cause to require the subcontractor to reconstruct the well immediately upon demand at no additional cost to the Government. The wells shall have a project-specific designed sand pack set securely and uniformly around the well screen, from the borehole bottom to a point not less than two feet above the well screen. The sand pack shall be emplaced by the tremie method and will be tamped, washed, rodded or vibrated by tapping the casing in order to preclude bridging. The subcontractor will perform frequent checks for volumetric and dimensional quality control so that the length and completeness of the sand pack is ensured. The augers will be gradually withdrawn from the borehole in one foot increments as well construction proceeds.

Following sand pack emplacement, a 2-foot thick expansive bentonite pellet seal will be placed immediately above the sand pack in order to prevent the

intrusion of grout annular space sealant. The bentonite pellet seal will be placed uniformly and will be measured to verify its proper insertion.

After a period of at least four hours has been allowed for hydration of the bentonite pellet seal, the cement-bentonite grout annular space sealant will be emplaced by the tremie method. The cement-bentonite grout will be emplaced as a slurry by positive pressure application from the pellet seal above the well screen to a point approximately 3 feet below ground surface in a single monolithic (continuous) effort. Additional grout sealant will be added as the initial grout sealant consolidates within the annular space. The subcontractor will carefully monitor and record the volumes of materials used and the time required to complete each task. This information will be entered into the subcontractor's well construction completion diagram.

3.2.3 Type III Soil Boring/Deep Recovery Well Installation

The Type III deep aquifer recovery well is a dual-cased well screened within the upper portion of the Castle Hayne Aquifer underlying the study area. The Type III Phase I well will be installed at the location designated by the project drawings.

The subcontractor will utilize either the hollow-stem auger method or the rotary method (using a natural soil and potable water slurry) to advance a pilot hole from ground surface to the bottom of the surficial aquifer. Soil samples will be collected at 5-foot depth intervals beginning at a depth of 5 feet below grade to the surficial aquifer's lower extent by the Standard Penetration Test and split spoon procedure (ASTM D 1586). Soil samples will be visually classified in the field by the Unified Soil Classification System (ASTM D 2488); the soil identification information and other pertinent subsurface data will be recorded on the driller's soil boring log, as work progresses.

A 12-inch inside diameter (nominal size) Schedule 80 PVC pipe surface casing (subcasing) will be installed into the reamed borehole and suspended immediately above the borehole bottom as it is grouted into placed using the cement-bentonite grout mixture described in Section 2.2.6 of these Specifications. The surface casing will be secured so that it is plumb within one degree per 50 feet of casing length. The grout will be applied by the tremie method under positive pressure in a single continuous effort from borehole bottom to a point three feet below ground surface. The grout will be permitted to consolidate approximately four hours; additional grout will be added as necessary. Well completion work will not resume until the surface casing installation has been allowed to set up for at least 24 hours.

The rotary drilling method will be used, employing a recirculated potable water and drilling cuttings slurry to advance a 10-1/2 inch diameter (nominal) borehole to the target depth. Formation samples will be obtained on 5-foot centers using the Standard Penetration Test and split spoon method (ASTM D 1586) for soils or double-tubed NQ core barrel (ASTM D 2113) for rock. Soil

samples will be visually classified and logged in the field as described in this Specification Section, above, and rock materials will be visually identified and logged at the site according to the procedures presented in EPA/540/P-87/001, chapter 8.3.5.2.4, Rock Methods. The subcontractor will obtain a representative aquifer formation sample, perform a grain size analysis and design a project specific sand pack in the manner described in Section 3.2.2, above.

If borehole drilling becomes difficult due to the presence of hydrostatic pressures or borehole collapse, the subcontractor may be permitted to enhance the drilling fluid slurry with the addition of a powdered pure Wyoming grade bentonite. The decision to allow this change will be made in the field, based upon the actual conditions encountered and is subject to review and approval by the NTR. The addition of bentonite to the drilling slurry will be limited to the smallest quantity possible, consistent with good drilling practice.

The deep aquifer recovery wells will be constructed of stainless steel casings and screens, as described previously. The casings and screens will be decontaminated prior to use, and threaded together and sealed using Teflon® O-rings. Stainless steel bow-type locking clamp centralizer will be attached to the assembly, just above the well screen and at its lowest section. The well assembly will be inserted into the borehole and continuously suspended immediately above the borehole bottom during the placement of annular well construction materials. The subcontractor will exercise extreme care to ensure that the well assembly is both plumb and properly centered within the borehole. The acceptable tolerance is less than one degree per 50 feet of well depth as determined by the procedures described by Driscoll (1986). Failure to perform this part of the work adequately shall be sufficient cause to require the subcontractor to reconstruct the well immediately upon demand at no additional cost to the Government. The wells shall have a project-specific designed sand pack set securely and uniformly around the well screen, from the borehole bottom to a point not less than 2 feet above the well screen. The sand pack shall be emplaced by the tremie method and will be washed, tamped, rodded or vibrated by tapping the casing in order to preclude bridging. The subcontractor will perform frequent checks for volumetric and dimensional quality control so that the length and completeness of the sand pack is ensured.

Following sand pack emplacement, a 2-foot thick expansive bentonite pellet seal will be placed immediately above the sand pack in order to prevent the intrusion of grout annular space sealant. The bentonite pellet seal will be placed uniformly and will be measured to verify its proper insertion.

After a period of at least four hours has been allowed for hydration of the bentonite pellet seal, the cement-bentonite grout annular space sealant will be emplaced by the tremie method. The cement-bentonite grout will be emplaced as a slurry by positive pressure application from the pellet seal above the well screen to a point approximately 3 feet below ground surface in a single monolithic (continuous) effort. Additional grout sealant will be added as the

initial grout sealant consolidates within the annular space. The subcontractor will carefully monitor and record the volumes of materials used and the time required to complete each task. This information will be entered into the subcontractor's well construction completion diagram.

3.2.4 Initial Development

The initial development of each well shall be made no sooner than 48 hours after completion of the well. Development shall proceed by over pumping using a submersible or surface pump until the discharge is visibly free of sediment, or until the physical parameters of pH and specific conductance have stabilized within 10 percent. Development fluids shall be contained and consolidated for disposal through either the treatment plant or to the on-base sanitary sewer system, as directed by the NTR.

3.2.5 Aquifer Test

On aquifer test each will be conducted by the subcontractor using the Phase I shallow recovery well and the Phase I deep recovery well. The two test wells shall be pumped to determine well efficiency and acceptance, estimate aquifer transmissivity, storage coefficient and specific capacity. To obtain this information, at least one and preferably two observation wells shall be drilled at suitable distances from the pumped well. The well shall be test pumped at a constant rate for 24 hours if the aquifer is confined or 72 hours if the aquifer is unconfined.

The discharge of the test pump will be measured by a circular orifice meter, totalizing meter, flume, or other suitable device, and the water level measured electronically or by air line or tape to the nearest 0.5 in (13 mm). Measurements of the yield and water level will be made every 30 to 60 seconds for the first 10 minutes of the test, every minute for the next 5 minutes, every 5 minutes from 15 to 60 minutes, every 30 minutes from 60 to 400 minutes, every hour from 300 to 1,440 minutes and every 8 hours from 1,440 minutes until the end of the test. A water sample (approximately 1 liter) shall be obtained within 20 minutes after starting the pump and then about 5 minutes before shutting the pump down.

After the pump is shut down, recovery measurements of the water level shall be made for a period equal to at least 3/4 of the pumping period or until the water level has reached the original static level. The recovery measurements shall be made at the same time intervals that measurements were made during the pumping portion of the test.

In general, aquifer testing should conform to the theory, methods and analytical procedures described by Ferris and others (1962) in WSP-1536E.

3.3 GROUNDWATER RECOVERY

The groundwater recovery system shall be installed, operated and maintained for 90 days by the contractor. The Professional Geologist shall monitor and direct the initial groundwater recovery operations and shall provide a report of progress in the subcontractor's closeout report in accordance with Section 01010, "General Paragraphs." The progress report shall include the quantity of extracted groundwater, static water levels, drawdown levels and hydrogeologic conditions. After three months operation of the system by the subcontractor, the Government shall assume operation of the system. The subcontractor is to provide training for the government personnel to properly operate and maintain the system. This training shall be given by the Professional Geologist for five 8-hour working days. The training shall include a section on well maintenance and repair, in accordance with NCAC T15A:02C Rule .0112.

3.3.1 Discharge of Groundwater

The groundwater shall be discharged to the groundwater treatment system (Section 02901, "Groundwater Treatment System").

3.3.2 Project Derived Waste Materials

Project derived waste materials include disposable personal protective equipment (PPE), recirculated drilling fluids, drilling cutting, paper or plastic well construction materials bags, etc. Excess or spoiled bentonite pellets, well screen sand pack and other unused generally inert substances may also become project derived wastes.

Materials or substances likely to come into contact with subsurface contaminants shall be segregated from those materials not probably contaminated. Excess or spoiled well construction materials and PPE will be placed into separate DOT-17H 55-gallon drums and so labeled.

Recirculated drilling fluids and borehole cuttings will be staged at the well site and bulked into roll-off boxes for hazardous waste characteristics testing and appropriate disposition. The large anticipated volume of such wastes will necessitate the use of a front-end loader and pumping equipment to transfer the fluids and cuttings from the staging location to the roll-off boxes. Once waste characterization testing is complete, the subcontractor will furnish the NTR with analytical documentation and expeditiously arrange for the removal and disposal of the wastes, in strict conformance with applicable federal and North Carolina environmental regulations. The waste removal and disposal will be performed promptly upon receipt of a notice to proceed order from the NTR.

3.4 SPARE PARTS

Subcontractor shall provide a list of recommended spare critical parts for the

system together with a cost estimate and source of the recommended spare parts. This list shall be provided to the NTR within (2) weeks after submittals are approved.

3.5 FINAL CLEANUP AND SITE RESTORATION

Subcontractor shall remove vehicles, equipment, waste material and other debris from the site. Restore the work area to make it reasonably safe and accessible to personnel and equipment engaged in succeeding tasks. If necessary, this may require regrading.

3.6 NAMEPLATES

3.6.1 Equipment Identification

Provide laminated plastic nameplates for equipment, gauges, thermometers, and stop valves. Laminated plastic shall be 0.125 inch thick Melamine plastic, 0.125-inch thick, white with black center core. Surface shall be matte finish. All corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1 by 2.5 inches. Lettering shall be a minimum of 0.25 inches high normal block style. Key the 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

3.6.2 Well Identification

Wells will be identified by attaching a permanent nameplate, as described above in Section 3.6.1 and will show the following information, in conformance with NCAC T15A:02C Rule .0108:

a. Well installation subcontractor and registration number
b. Well number
c. Date of well completion
d. Total depth of well and screened interval
e. A warning that the water is contaminated and not for consumptive use under any circumstances

3.7 INSTRUMENTATION AND CONTROLS

Install all system components and appurtenances in accordance with the manufacturer's recommendations and as shown. Provide all necessary

interconnections, services, and adjustments required for a complete operable system. All electrical work shall be in accordance with NFPA 70 and as specified.

3.8 TESTS

3.8.1 General Requirements

Upon completion and before final acceptance of the work, each system shall be tested as in service to determine compliance with the contract requirements and applicable warranties. Each new piping system and any pressure vessels shall be hydrostatically tested with clean water at not less than 125 psig and shall show no leakage or reduction in gauge pressure after 4 hours. All equipment shall be tested in operation for a continuous period of not less than 90 days. During the tests, all equipment shall be tested under every condition of normal expected operation. All controls shall be tested to demonstrate performance of their required function. All piping shall be thoroughly flushed and cleaned before being placed in operation. The contractor shall furnish instruments, connecting devices and personnel for the test. Each system shall be completely tested for compliance with specification and all conditions thereof, and all adjusting and balancing shall be completed to the satisfaction of the NTR. Adjustment of controls and balancing of systems shall extend for 90 days after the completed systems are put in operation.

3.8.2 Well Plumbness

Well plumbness is a major acceptance test and will be determined in the field using the methods described in Driscoll (1986). The wells shall be installed to a maximum tolerance of less than one degree for each 50 feet of well depth. The maximum allowable deflection for a 50-foot deep well is 0.4 feet and the maximum allowable deflection for a 100-foot depth well is 0.9 feet. Wells installed at deviations greater than those stated shall be deemed to be unusable and shall be replaced immediately upon demand, at no additional cost to the Government.

3.8.3 Aquifer Tests and Acceptance Criteria

One shallow aquifer recovery well and one deep aquifer recovery well will be utilized during Phase I of this effort to obtain aquifer hydraulic characterization information and to test the Phase I wells for general acceptability. The acceptance criteria and test procedure are described by Heath (1983) in WSP 2220, pages 58-59.

The Phase II shallow aquifer and deep aquifer recovery wells will also be tested for acceptance using the procedure and criteria presented by Heath (1983). The subcontractor will demonstrate to the NTR's satisfaction that recovery wells operate with the following minimum characteristics:

Well Type	Production Rate	Minimum Efficiency
Shallow Aquifer	3 gpm	50%
Deep Aquifer	200 gpm	70%

These acceptance standards are considered to be minimum and may be modified only with the approval of the NTR.

3.9 WELL ABANDONMENT

Improperly installed wells must be replaced. Well replacement means that the improperly installed well must be abandoned in strict conformance with NCAC T15A:02C Rule .0113.

--End of Section --

SECTION 02901

GROUNDWATER TREATMENT SYSTEM

PART 1 GENERAL

1.1 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 136	Guidelines Establishing Test Procedures for the Analysis of Pollutants

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electric Code

1.2 SUBMITTALS

Manufacturer to submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data

The manufacturer shall submit four (4) manufacturer catalog data for all items with the quote.

1.2.2 SD-04, Drawings

The manufacturer shall submit four (4) copies dimensioned general arrangement drawings for each major process equipment item or subsystem 4 weeks after receiving order.

The bidder shall submit, as appropriate, the following drawings:

a. Power Plan
b. Control Panel Layout
c. Cable Conduit Schedule
d. Power Distribution Schematics
e. Process Flow Diagram
f. Piping and Instrumentation Diagrams
g. Equipment Data Sheets (as applicable)
h. Site Layout
i. Piping Layout
j. Piping Elevation Details

k. Instrument Installation Details

1.2.3 SD-09, Reports

a. Installation Instructions - The manufacturer shall submit four (4) copies of the installation instructions of all process and mechanical items 6 weeks after order. Failure to submit installation instructions may be cause for rejection.

b. Tests - Submit a report of all test procedures and results, if appropriate, 30 days after final test completion.

1.2.4 SD-19, Operations and Maintenance Data (7 copies, 8 weeks after order)

a. Groundwater Treatment System (Data Package 3). (Provide O&M package for water treatment system as a complete and operable unit. Provide individual component data packages as specified in section 01730.)

1.2.5 SD-18, As-Built Records

Manufacturer to provide four (4) copies of final as-built records 4 weeks after successful equipment startup.

1.3 EQUIPMENT

The manufacturer shall provide the equipment in accordance with the following Sections, as appropriate, of these specifications:

11300 Groundwater Feed Tank and Appurtenances
11307 Air Stripper and Holding Tank
11308 Cartridge Filters
11309 Carbon Adsorbers
11314 Dewatering Press
11315 Centrifugal Pumps
11399 Packaged Iron Removal System
15487 Compressed Air System

Other Sections as applicable

1.4 TREATMENT BUILDING

The General Contractor will design, furnish and install a pre-engineered structure to house the equipment in accordance with applicable State and local codes and with the following Sections of these specifications:

03300 Cast in Place Concrete (Minor Construction)

Other sections as applicable

1.5 GENERAL REQUIREMENTS

Provide in accordance with Sections 15010, "General Mechanical Requirements" and 16011, "Electrical General Requirements."

1.6 ENVIRONMENTAL PROTECTION

Provide in accordance with Section 01010, "General Paragraphs," and the Basic Contract.

1.7 DESCRIPTION OF WORK

The work includes the design, procurement and installation of a groundwater treatment system as indicated on the drawings, and specified herein. The system shall include iron removal/sludge handling; groundwater feed storage and equalization; pH adjustment; air stripping; cartridge filtration; granular activated carbon (GAC) adsorption; treated effluent storage and discharge, and all associated pumps, piping and controls.

1.8 DEFINITIONS

Manufacturer- A company submitting a proposal to fulfill the requirements of this specifications.

Building Subcontractor - The company which provides all structural, construction services involved with this project.

Electrical Subcontractor - The company which provides all electrical services involved with this project.

I&C Subcontractor - The company which provides all instrumentation and control services involved with this project.

HVAC Subcontractor - The company which provides HVAC services involved with this project.

General Contractor - OHM Remediation Services Corp., 5335 Triangle Parkway, Suite 450, Norcross, GA 30092.

Purchaser - Department of the Navy, Naval Facilities Engineering Command, Atlantic Division (LANTDIV)

Shall - Indicates a mandatory requirement.

PART 2 PRODUCTS

2.1 PIPING AND VALVES

The General Contractor will furnish all interconnecting piping and valves in accordance with the following sections of these specifications:

15400 Plumbing
15401 Contaminated Groundwater
15402 Caustic Service
15403 Acid Service
15404 Sludge Service
15405 Air Service

2.2 GROUNDWATER TREATMENT CONTROL SYSTEM

The General Contractor will design, and install an overall master groundwater treatment control system with analog and digital inputs and outputs (I/O) as indicated on the drawings and in accordance with the following sections of these specifications.

PART 3 EXECUTION

3.1 GENERAL

Design, provide and install the following in accordance with the applicable codes and requirements as required for a complete and operable system:

Reinforced concrete floor, exterior tank foundations, and pre-engineered metal building with masonry curtain walls. Groundwater treatment system piping.

Groundwater treatment system control system. All electrical work shall be in accordance with NFPA 70 and as specified in Division 16.

Install the following in accordance with the applicable sections of these specifications:

Iron Removal System
Dewatering Press
Equalization Tank with agitator and pH adjustment controls
Packed Tower Air Stripper
Cartridge Filtration System
Two Granular Activated Carbon (GAC) Adsorbers
Treated Groundwater Storage Tank
Backwash Holding Tank
Air Compressor
Pumps

Groundwater shall be treated to the effluent requirements specified and discharged to the surface as indicated.

3.2 EFFLUENT REQUIREMENTS

Volatile organic contaminants have been detected at the following maximum concentrations, in micrograms per liter (µg/l) or parts per billion (ppb), and shall be removed to below the following limits, in µg/l or ppb.

	Influent	Effluent
Vinyl Chloride	800.0	1.4
Trichloroethene	58,000.0	2.8
1,2-Dichloroethene	30,000.0	70.0
1,2-Dichloroethane	30.0	0.38
Tetrachloroethene	920.0	0.7
Ethylbenzene	52.0	29.0

Inorganics shall be removed as necessary to provide proper treatment system performance.

3.3 PIPING, VALVES AND INSTRUMENTS

The General Contractor and manufacturer shall design and install all piping in accordance with the applicable sections of these specifications as required for a complete and operable system.

3.4 INSTRUMENTATION AND CONTROL SYSTEM

The General Contractor and manufacturer shall design, furnish, and install the instrumentation and control system for the groundwater treatment system to provide for a system that continuously processes contaminated groundwater with a minimal amount of operator input, 1 man hour per day maximum desired. The basis of the system shall be a set of programmable logic controller (PLC) modules with a central, dedicated operator interface module. This PLC system shall be located in the treatment system building office, as indicated.

3.4.1 System Inputs and Outputs

Based on the Piping and Instrument Diagrams (P&IDs) there are ~~116~~ 85 Input/Outputs (I/Os) in the PLC system. To allow for system expansion, provide a system with at least 170 I/Os. I/Os to be provided for the control system are as follows:

Digital Inputs (DI)	45
Digital Outputs (DO)	21
Analog Inputs (AI)	16
Analog Outputs (AO)	3

The PLC system logic and controls shall be designed to adjust to step changes that may be introduced to the system. The logic for the control of the treatment system is as indicated.

The PLC system shall receive inputs from and send outputs to the extraction well system and the groundwater treatment system. The inputs shall include items such as, but not limited to, levels, alarms, flow rates, pressures, on/off indicators, and start/stop signals. Outputs shall include items such as, but not limited to, control set points, start/stop signals, and speed controller signals. The treatment system PLC system shall also interface with equipment vendor (manufacturer) PLC systems via a data highway interface.

Piping, Power, Controls, Accessories, and Appurtenances shall be installed in accordance with the manufacturer's recommendation and as shown. Provide all necessary interconnections, services, and adjustments as required for a complete and operable system. All electrical work shall be in accordance with NFPA 70 and as specified in Section 16011.

3.5 NAMEPLATES

Provide laminated plastic nameplates for equipment, gauges, thermometers, and stop valves. Laminated plastic shall be 0.125 inch thick Melamine plastic, black with white center core. Surface shall be a matte finish. All corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be one inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering. Key the 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. Identification number indicated on drawings
b Manufacturer, type, and model number
c. Capacity or size
d. System in which installed

3.6 SEQUENCE OF OPERATION

3.6.1 Deep Groundwater Influent Flow

Groundwater shall be pumped from the deep aquifer wells to the Groundwater Feed Storage Tank for equalization and pH adjustment. Groundwater will then be pumped to the Air Stripper.

3.6.2 Iron Removal System

Groundwater from the shallow wells shall be pumped to an iron removal system. The pH of the groundwater shall be raised in the air agitated Initial pH Adjustment Reactor in order to precipitate out dissolved iron and other

precipitable inorganics. The groundwater shall then flow by gravity to a stilling reactor to allow the air to separate. Groundwater shall then be mixed in a separate reactor with a polymer solution to form flocculate. Groundwater and flocculate shall flow by gravity to an inclined plate clarifier. Clear water from the clarifier shall flow by gravity to a Head Tank. Partially treated groundwater will then be pumped to the Groundwater Feed Storage Tank.

Sludge collected at the clarifier bottom shall be continuously recycled to the flocculation chamber to optimize solids loading. Sludge shall be blown down intermittently to a Sludge Thickening Tank and thickened by gravity separation. Solids from the Sludge Thickening Tank shall be pumped intermittently to a Dewatering Filter Press for dewatering. Sludge shall be placed in an environmental bulk container and shipped to an appropriate off-site disposal facility.

3.6.3 Air Stripping

Process water from the Groundwater Feed Storage Tank shall be pumped to a Packed Tower Air Stripper. The process water shall enter the top of the tower and flow by gravity, counter current to the stripping air, to an Air Stripper Effluent Holding Tank. Air shall be discharged to the atmosphere without additional treatment.

3.6.4 Cartridge Filtration and Granular Activated Carbon (GAC) Adsorption

Process water shall be pumped from the Air Stripper Effluent Holding Tank through a Cartridge Filtration System and thence through Granular Activated Carbon Adsorbers to a Treated Effluent Storage Tank. GAC Adsorbers shall be backwashed manually based on differential pressure. Backwash water shall flow to the Backwash Holding Tank. Cartridge filter elements shall be changed manually.

3.6.5 Treated Effluent Storage and Discharge

Treated effluent shall be stored in sufficient capacity to provide backwash water demands and treated effluent shall be discharged by gravity to the outfall designated in the drawings.

3.7 STARTUP AND INITIAL TESTING

Both the General Contractor and the manufacturer shall provide all startup and testing services in accordance with the applicable Sections of these specifications and make all required adjustments.

Water generated during system startup and testing shall be discharged per the direction of the NTR. Unless otherwise noted, clean water shall be used for testing.

Provide valves and fittings as required to obtain water samples for testing. Samples shall be obtained via fittings from the effluent piping of the equipment being tested. Samples shall not be obtained from temporary drain hoses or pipes.

Maintain an accurate log of all test procedures and results. Submit a report of procedures and results to the NTR for approval.

Upon completion of startup and testing, treated groundwater shall be discharged to surface as indicated only after the approval of the NTR.

3.8 OPERATIONS

The groundwater treatment system shall be operated and maintained by the General Contractor for a period of 90 days. The 90 day operational period will start only after all components of the system have been through the startup and initial testing, the aquifer testing specified in Section 02900, "Groundwater Recovery System" have been completed, all recovery wells have been installed, and the NTR has accepted the system in its entirety. A state registered professional geologist or engineer shall monitor the groundwater treatment system's operation, and provide an initial and a final report containing hours of operation, volume of water treated, and weekly water quality laboratory analysis. The report shall include specific performance data for the major components of the system, including, but not limited to, the solids removal system, air stripping system, granular activated carbon adsorption system, and the dewatering press system. After three months operation by the General Contractor, the Government shall assume operation of the equipment. The General Contractor shall provide training (five 8 hour days) for Government personnel in how to properly operate and maintain the system. This training shall be in addition to the training required by Section 02900, "Groundwater Recovery System."

3.8.1 Water Quality Analyses

Water quality analysis of the groundwater treatment system influent and effluent shall be for volatile organic compounds and metals as required to evaluate treatment system performance. The General Contractor shall submit a Sampling and Analysis Plan outlining all sampling and analysis methods, procedures and frequencies.

3.9 FINAL TESTING

All piping shall be thoroughly flushed and cleaned before being placed in operation. Upon completion and before final acceptance of the work, each system shall be tested as in service to determine compliance with the contract requirements and warranty. Each new piping system and all pressure vessels shall be hydrostatically tested at normal working pressure and shall show no leakage or reduction in gauge pressure after 4 hours. All equipment shall be tested in operation for a continuous period of not less than 3 months. During

the tests, all equipment shall be tested under every condition of operation. All controls shall be tested to demonstrate performance of their required function. The General Contractor shall furnish instruments, connecting devices and personnel for the test. All defects in the manufactured equipment provided by the manufacturer shall be corrected by him. Each system shall be completely tested for compliance with specification and all conditions thereof, and all adjusting and balancing shall be completed to the satisfaction of the NTR. Adjustment of controls and balancing of systems shall extend for one year after the completed systems are put in operation. The manufacturer shall furnish all materials and labor to make all repairs required one year after the systems are accepted by the NTR.

-- End of Section --

SECTION 02902

VACUUM EXTRACTION SYSTEM

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR CIVIL ENGINEERS

ASCE 7	1988 Minimum Design Loads for Buildings and other Structures.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS

C 150	1989 Type I or II Portland Cement
D 1785	1989 Poly (Vinyl Chloride) (PVC) Plastic Pipe
D 2466	1988 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings
D 2564	1988 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 136	40 CFR 136 Guidelines Establishing Test Procedures for the Analysis of Pollutants

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electric Code

1.2 SUBMITTALS

Submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data:

a. Piping and Fittings

b. PVC Solvent Cement
c. Valves
d. Treatment System Control Panel

1.2.2 SD-12, Field Test Reports:

a. Vacuum Extraction System Test

b. Carbon Contactors

1.2.3 SD-19, Operations and Maintenance Data:

a. Vacuum Extraction System (Provide O&M package for system as a complete and operable unit.

1.3 DESCRIPTION OF SYSTEM

Provide vacuum extraction systems in accordance with this Section of these specifications to meet the performance requirements specified.

The primary objective of the work is to achieve source (i.e., soil) remediation. The work includes the design and installation of a soil vacuum extraction system (SVE) to remediate the soil to the cleanup goals specified. Existing contaminant conditions are as identified to the Contractor by separate document.

An on-site pilot test was performed to provide preliminary site-specific data for the design of the SVE system. The results of this test are included in the Basis of Design Report, provided to the Contractor as a separate document.

1.4 EQUIPMENT BUILDING

Provide in accordance with this section and the following Sections of these specifications:

03302 Cast in Place Concrete (Minor Construction)

Other sections as applicable

1.5 GENERAL REQUIREMENTS

Provide in accordance with Sections 15011 "Mechanical General Requirements" and 16011, "Electrical General Requirements."

1.6 ENVIRONMENTAL PROTECTION

Provide in accordance with Section 01560 "Temporary Controls."

PART 2 - PRODUCTS

2.1 PIPING AND VALVES

All piping valves and fittings shall be rated to resist external and operating forces. All materials shall be resistant to corrosion by the contaminants and conditions at the site.

PVC Piping and fittings shall conform to ASTM 1785 and ASTM 2466.

2.2 VACUUM EXTRACTION WELLS

2.2.1 Well Casings and Screens

Provide casing and screens with adequate strength to resist external and operating forces. Length of well screen and screen opening size shall be designed by the Contractor.

PVC casing and screens shall conform to ASTM 1785.

2.2.2 Filter Pack

Provide clean, round, hard water-worn quartz with less than 5 percent feldspar, no fossils, carbonate or organics. The filter pack shall have gradation specifications designed by the Contractor to facilitate the flow of gas and liquid from the surrounding soil.

2.2.3 Cement Grout

Provide neat cement grout, Type I or II portland cement conforming to ASTM C150.

2.3 EQUIPMENT

2.3.1 Foundation Requirements

Design spread foundations for an allowable soil bearing pressure of 2000 pounds per square foot. Use a concrete compressive strength as specified in Section 03300 "Cast-in-Place Concrete, (Minor Construction)." Actual foundation loads shall be provided by the Contractor, for verification by the Government.

2.3.2 Soil Vapor Extraction System

The extraction system shall be designed for continuous operation and equipped with instrumentation for process evaluation including pressures, vacuum and temperature indicators, a recovered groundwater totalizer, and

flow meter for vapor flow determination.

2.3.3 Vapor/Liquid Separator

Vapor/Liquid separator vessel shall be epoxy coated for corrosion protection.

PART 3 EXECUTION

3.1 GENERAL

Confirm that the technology is appropriate for the soil and shallow aquifer remediation at the sites.

Provide the data necessary to design and install a full-scale remediation system at the site.

Design and install a full-scale vacuum extraction system to remediate the soil within the full area of the site as indicated to the cleanup goals specified. Separated liquid shall be pumped to the groundwater treatment building. Gases removed shall be vented to the atmosphere if contaminant levels are within acceptable environmental limits, or passed through a granular activated carbon filter if necessary to meet air discharge requirements.

3.2 SAMPLING AND ANALYSIS PLAN

Submit in accordance with Section \=01010=\, "General Paragraphs."

3.3 AREA OF COVERAGE

The full scale vacuum extraction system shall remediate the soil and shallow aquifer within AOC 1 as indicated on the drawings.

3.4 EFFLUENT REQUIREMENTS

Separated liquid shall be discharged to the on-site groundwater treatment system without further treatment.

Volatile contaminants vented to the atmosphere shall not exceed the emission rates for volatile organic compounds and toxics as specified in the State of North Carolina.

3.5 CLEANUP GOALS

The soil cleanup goals, in parts per billion, for the contaminants of concern in AOC 1 are as follows:

Trichloroethene	32.2
Tetrachloroethene	10.5
Benzene	5.4

3.6 INSTALLATION

Install equipment, piping, power, controls, accessories and appurtenances in accordance with the manufacturer's recommendation. Provide all necessary interconnections, services, and adjustments as required for a complete and operable system. All electrical work shall be in accordance with NFPA 70 and as specified in Section 16011.

3.6.1 Piping

All extraction piping shall be installed 18" underground from vent wells to the equipment building. Separated water piping shall be installed 18" underground from the equipment building to the groundwater extraction header as indicated and installed with a backflow preventer.

3.6.2 Sampling Ports

The system shall be provided with sampling ports for acquisition of influent and effluent vapors and liquids for analysis.

3.6.3 Soil Disposal

Material excavated for the installation of piping and the equipment building shall be sampled and disposed of in accordance with state and Federal regulations and in accordance with Section \=01560=\.

3.6.4 Nameplates

Provide laminated plastic nameplates for equipment, gauges, thermometers, and stop valves. Laminated plastic shall 0.125 inch thick Melamine plastic, black with white center core. Surface shall be a matte finish. All corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be one inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering. Equipment nameplates shall show the following information:

a. Manufacturer, type, and model number
b. Contract number and accepted date
c. Capacity or size

3.7 SEQUENCE OF OPERATION

3.7.1 Extraction

Soil vapor shall be extracted from vent wells in the areas indicated to a depth designed by the Contractor based on initial testing. The number and arrangement of the vent wells shall be determined by the Contractor and approved by the NTR.

3.7.2 Separation

Extracted soil vapor shall be delivered to an inlet separator to separate vapor from liquid. The separated liquid shall be pumped to the groundwater treatment building as indicated. Separated vapor shall be discharged to atmosphere or, if necessary to meet state emission requirements, delivered to the vapor treatment equipment.

3.7.3 Vapor Treatment

Separated vapor shall be treated by granular activated carbon, if necessary to meet the effluent requirements of this specification, and exhausted to the atmosphere. Exhaust height shall be in accordance with local and state requirements.

3.8 STARTUP AND INITIAL TESTING

3.8.1 General

The Contractor shall provide all startup and testing services, and make all required adjustments.

Groundwater generated during system startup and testing shall be discharged per the direction of the NTR.

Maintain an accurate log of all test procedures and results. Submit a report of procedures and results to the NTR for approval.

Upon completion of startup and testing, treated groundwater shall be discharged to the groundwater treatment building only after the approval of the NTR.

3.9 OPERATIONS

The vacuum extraction system shall be operated and maintained by the Contractor for a period of three months. Three month operational period will start only after all components of the system have been through the startup and initial testing and the NTR has accepted the system in its entirety. A certified professional geologist shall monitor the vacuum

extraction system's operation, and provide an initial and a final report containing hours of operation, volume of water recovered, and weekly air quality laboratory analysis. After three months operation by the Contractor, the Government shall assume operation of the equipment. The Contractor shall provide training (four 8 hour days) for Government personnel in how to properly operate and maintain the system.

3.9.1 Air Quality Analyses

Air quality analysis of extraction system influent and effluent shall be for volatile organic compounds as required to evaluate system performance. Contractor shall submit a Sampling and Analysis outlining all sampling and analytical methods, procedures and frequencies.

3.10 FINAL TESTING

Upon completion and before final acceptance of the work, the systems shall be tested as in service to determine compliance with the contract requirements and warranty. Each new piping system and all pressure vessels shall be pneumatically tested at not less than 125 psig and shall show no leakage or reduction in gauge pressure after 4 hours. All equipment shall be tested in operation for a continuous period of not less than 3 months. During the tests, all equipment shall be tested under every condition of operation. All controls shall be tested to demonstrate performance of their required function. All piping shall be thoroughly flushed and cleaned before being placed in operation. The Contractor shall furnish instruments, connecting devices and personnel for the test. Each system shall be completely tested for compliance with specification and all conditions thereof, and all adjusting and balancing shall be completed to the satisfaction of the NTR. Adjustment of controls and balancing of systems shall extend for one year after the completed systems are put in operation.

-- End of Section --

SECTION 03010

STRUCTURAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 PROJECT DESCRIPTION

The project involves construction of a groundwater treatment system. All aspects of this project are located at Operable Unit No. 2, Marine Corps Base, Camp Lejeune, North Carolina.

1.2 SCOPE

The intent of this specification is to outline and describe the structural portion of the material supply and work that will be required for this project. OHM Remediation Services Corp., via this Bid Specification, intends to solicit competitive bids and perform bid evaluation to secure the services of a building subcontractor (subcontractor hereafter).

1.3 EQUIPMENT, MATERIAL, AND SERVICES FURNISHED BY SUBCONTRACTOR

1.3.1 The subcontractor shall design, prepare construction drawings, procure, furnish all supervision, labor and equipment to install and inspect the following items:

a. Structural roof system - double pitch bar joists and base plates, metal roof, doors, windows, louvers, accessories and hardware.

b. Exterior load-bearing masonry walls, interior walls, wall reinforcement, anchors, ties and accessories, concrete walls, column anchor bolts, piers and foundations.

c. Reinforced concrete floor slabs, equipment pads and anchorage, embedded items for mechanical and electrical utilities, concrete apron slabs at doors, miscellaneous concrete pads at wellheads and foundation for wetwells and metering station.

d. Containment area concrete slabs walls, stairs, equipment pads and anchorage, foundation and sump.

e. Miscellaneous items such as steel grating, structural steel or precast lintels and angles, floor drains, hollow-core precast pre-stressed concrete planks.

f. Floorings and ceilings.

g. Toilet compartments, partitions, toilet accessories and lockers.

h. Gutters and downspouts.

i. Painting

j. Coordination of activities and requirements of other trades.

1.3.2 The Subcontractor shall furnish all temporary sanitary facilities, lighting, enclosures, cribbing, temporary supports, pumps, and air compressors required to complete the work. It shall be the Subcontractor's responsibility to provide sump pumps and temporary weather enclosures, if necessary, to maintain a dry working environment.

1.3.3 The Subcontractor shall supply all required personal safety equipment including fire protection.

1.3.4 The Subcontractor shall be responsible for submitting equipment manufacturer's data for installation, operation, and maintenance to owner technical representative prior to installation as delineated in the specifications (Attachment A).

1.3.5 The Subcontractor shall be responsible for all receiving, unloading, sorting, storing, loading, and hauling from the point of delivery to the storage area and/or to the erection location. All equipment shall be handled, stored, and protected in such a manner as to ensure its proper alignment, finish, and manufactured strength. All required temporary blocking, stiffening, covering, weather protection, etc., shall be furnished by the Subcontractor. The Subcontractor also shall provide all necessary labor and supervision for the removal and replacement of temporary protection of stored and erected equipment for periodic inspection by the Owner or his authorized representative.

1.3.6 The Subcontractor shall be responsible to obtain Owner's approval of all color selections of furnishing materials prior to installation.

1.4 LEVELS OF PERFORMANCE

The Subcontractor shall accomplish this work in a first-class workmanlike manner while fulfilling all conditions and requirements of this specification (Attachment A), project drawings (Attachment B), and contract documents. The work of this contract shall include all that is necessary for complete in-place, tested and approved installation ready for occupancy and operation by the owner. The Subcontractor shall have total responsibility for the execution of the work covered by this specification, project drawings, and contract documents, including all applicable codes, regulations, and standards. If any requirements of this specification is deemed by the Subcontractor to be incorrect, unsuitable, contradictory, or such that conformance therewith would diminish or adversely affect in any way the Subcontractor's responsibility, the Bidder shall specifically delineate his

objections and the reasons therefor in his proposal, so that they may be resolved before the purchase order is placed. In all other respects, the Subcontractor, by accepting the purchase order, shall be deemed to have agreed that conformance with the specification's requirements will not prejudice in any way, the Purchaser's rights under warranty.

1.5 DRAWINGS USE AND INTERPRETATION

All drawings are listed in Attachment A.

1.5.1 Drawings A-1 through A-4 and S-1 through S-7 are design drawings. They establish the overall building dimensions and clearances, basic architectural features and indicate sizes and configurations of structural components. The Subcontractor shall prepare construction drawings and backup design calculations addressing all technical requirements of this RFQ and PE stamp/seal all documents.

1.5.2 Civil drawings C-1, C-10, C-12, C-16 and C-17 are provided for overall site plan, location of concrete apron slabs, miscellaneous slabs for wellhead buildings and foundation for wetwells and metering stations and foundation for LPG tank. All the above items are within the Subcontractor's scope of supply to design and furnish.

1.5.3 Mechanical drawings M-1 through M-13 and electrical drawings E-9, E-10 and E-16 are provided for identifying and coordinating other trade requirements such as embedded items, core-drilling structural components.

1.6 DEFINITIONS

Bidder - A company submitting a proposal to fulfill the requirements of this specification.

Subcontractor - The company accepting the purchase order for fulfilling the requirements of this specification.

General Contractor - OHM Remediation Services Corp., 5335 Triangle Parkway, Suite 450, Norcross, GA 30092.

Purchaser - Department of the Navy, Naval Facilities Engineering Command, Atlantic Division (LANTDIV)

Approved - This word, when applied by the General Contractor to the Subcontractor's drawings or documents, means that the drawings or documents are satisfactory from the standpoints of interfacing with all non-subcontractor furnished components of the installation, and/or that the General Contractor has not observed any statement or feature that appears to deviate from the specification's requirements. Except for the interfacing with all non-subcontractor furnished components, the Subcontractor shall

retain the entire responsibility for complete conformance with all specification requirements and performance guarantees.

Approved as Revised - These words, when applied by the General Contractor to the Subcontractor's drawings or documents, mean that the drawings or documents are approved as defined above except that the changes shown are required for the proper interfacing with non-subcontractor furnished components of the installation or are necessary to be in conformance with the specification requirements. On the basis that the Subcontractor shall retain the entire responsibility for compliance with all specification requirements (except those affected by interfacing with non-Subcontractor furnished components), the Subcontractor shall either:

1. Incorporate the changes into his drawing or document and resubmit to the Engineers, or

2. Inform the General Contractor that the changes cannot be made without prejudice to the Subcontractor's responsibility under warranty, and resubmit with explanation of the reasons therefor.

Not Approved - These words, when applied by the General Contractor to the Subcontractor's drawings or documents, mean that the drawings or documents are being returned to the Subcontractor for the remediation. After remediation the drawings shall be resubmitted to the General Contractor.

Shall - Indicates a mandatory requirement.

1.7 CODES AND STANDARDS

1.7.1 Design, materials, equipment and workmanship provided by the Subcontractor shall comply with the requirements and recommended practices of all applicable federal, state and local codes, laws, ordinances, rules and regulations governing this type of work including, but not limited to, those referenced in specifications of Attachment A.

1.7.2 The latest revision, supplement, or addenda shall be used for all applicable regulations, codes, standards, and material specification.

1.7.3 Where specification requirements exceed minimum-grade levels indicated by the law, regulations, codes, standards or ordinances, specification requirements shall prevail.

1.8 QUALITY ASSURANCE

The bidder must have a minimum of 5 years experience in similar projects of comparable size, involving load-bearing masonry walls and cast-in-place concrete slabs and foundations. The bidder shall submit evidence of completion and references for at least 10 similar projects.

PART 2 PRODUCTS

2.1 SUBMITTAL

Submit the following in accordance with Section C, Part 7, of the Basic Contract.

2.1.1 Submit copies of documents such as catalog cuts, installation instructions, design calculations, drawings and O&M manuals as identified in the specification sections of Attachment A.

2.1.2 Design calculations, construction drawings and shop drawings shall be prepared by and stamped by a Professional Engineer, registered in the State of North Carolina.

2.2 PROPOSAL PRICING

Bidder shall submit an itemized proposal that specifically breaks out the cost of:

a. Structural systems including roof joists, roofing, doors, windows, louvers.

b. Masonry walls, ties, anchors and accessories.

c. Reinforced concrete slabs, equipment pads and anchorage and foundation in the Groundwater Treatment Plan building and the Containment building.

d. Miscellaneous concrete pads and foundations.

e. Painting.

f. Project total.

2.3 NAMES OF SUBCONTRACTORS (IF APPLICABLE)

Bidder shall submit names of subcontractors with a breakdown of responsibilities, such as pre-engineered building, masonry, concrete, etc. General Contractor reserves the right to approve/reject any subcontractor(s).

3.1 EXECUTION

3.1 SCHEDULE REQUIREMENTS

The General Contractor has prepared a preliminary schedule for the project which identifies the major milestones that must be met. These milestones are presented in Attachment C to this specification. The bidder shall prepare and submit (with the bid proposal) a summary level schedule that incorporates the

milestones and that represents the bidder's plan to execute the scope of work.

3.2 COMMUNICATIONS/CORRESPONDENCE

All correspondence from the Subcontractor shall consist of an original plus three (3) copies and shall contain the following subject heading:

Specification No. 03010
Title: General Specification - Structural
Soil and Groundwater Remediation - OU2, MCB Camp Lejeune, NC

All correspondence/communications shall be addressed to the General Contractor, specifically:

OHM Remediation Services Corp.
5335 Triangle Parkway, Suite 450,
Norcross, GA 30092
Attention: James A. Dunn, Jr., P.E., Project Manager

3.3 REJECTED WORK AND MATERIALS

The Subcontractor, upon written notice from the Purchaser, shall remove from the premises all work and materials rejected as defective, unsound, improper, or in any way failing to conform to the requirements of the contract documents. The Subcontractor shall at his sole expense make good all work damaged by such removal and shall promptly replace materials damaged or improperly worked by him and re-execute replacing the work of any other Subcontractor that is in any way affected by the removal of the defective work.

Failure of the Subcontractor to comply with this requirement within 10 days of notification from the Purchaser, will authorize the Purchaser to take appropriate action to implement such repair or removal. The Subcontractor will be back charged for all such expenses incurred to implement such repair or removal, including the Purchaser's supervision costs.

3.4 FACILITIES AND SERVICES

3.1.1 Availability of Utilities Services

a. The Government shall supply potable and non-potable water required to perform work to the Subcontractor. The water source location is an 8-inch water main to be installed along Piney Green Road to a point approximately 1300 feet south of Building 651. Work shall be coordinated with the Base Utilities Branch (Mr. Carl Baker, 910-451-5024). The Subcontractor shall provide all piping, hoses, pumps, and connections to transport water to the desired locations on site. The Subcontractor shall also provide a backflow-prevention device and metered connections to the water source. The Subcontractor

shall be responsible for payment arrangements with base.

b. The Government shall supply reasonable amounts of temporary power to the Subcontractor. The Subcontractor shall provide all equipment and labor to the work. The Subcontractor shall make connections, including providing meters, and make disconnections.

c. The Subcontractor shall not operate nor disturb the setting of control devices in the base utilities system, including water, sewer, electrical and steam services. The Government will operate the control devices as required for normal conduct of the work. The Subcontractor shall notify the NTR giving 2 days advance notice when such operation is required.

d. The Subcontractor shall contact Base Telephone Services in writing to obtain telephone connection and payment information. Cost for telephone connection will be paid by the Subcontractor. The Subcontractor shall provide all equipment and labor necessary to connect the telephone service to the site. The Subcontractor shall make arrangements for connections and disconnections and payments.

3.4.2 Storage in Existing Buildings

Storage in existing buildings will not be allowed.

3.4.3 Open Site Storage Size and Location

The open site available for storage shall be confined to the areas indicated on the contract drawings.

3.4.4 Trailers, Storage, and Temporary Buildings

Locate these where directed. Trailers or storage buildings will be permitted, where space is available subject to the approval of the Navy's Technical Representative (NTR). The trailers or buildings shall be in good condition, free from visible damage, rust and deterioration, and meet all applicable safety requirements. Trailers shall comply with all appropriate state and local vehicle requirements. Failure of the Subcontractor to maintain the trailers or storage buildings in good condition will be considered sufficient reason to require their removal. A sign not smaller than 24 inches by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state or local standards for anchoring mobile trailers.

3.4.4.1 Storage and Office Trailers

Provide a trailer of sufficient size for an office trailer work area and floor area for the exclusive use of the Subcontractor's Quality Control

Representative. Also provide room in the same trailer for the Quality Control Records. Provide the Quality Control representative with a 4-foot by 8-foot plan table, a standard size office desk and chair, and telephone service. Quality control records shall be filed in the office and available at all times to the Government.

a. Trailers must meet state station requirements and must be in good condition.

b. Trailers shall be lockable and shall be locked when not in use.

c. Trailers shall have a sign in the lower left hand corner of left door of trailer with the following information: company name, address, registration number of trailer or vehicle identification number, location on base, duration of contract or stay on-base, contract number, local on-base phone number, off base phone number of main office, and emergency recall person and phone number.

3.5 RESTRICTIONS ON OPERATIONS

3.5.1 Scheduling

3.5.1.1 General Scheduling Requirements

The work areas will remain in operation during the entire construction period. The Subcontractor shall schedule the work as to cause the least amount of interference with Base operations. Work schedules shall be subject to the approval of the NTR. Permission to interrupt Base roads shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

3.5.1.2 Regular Work Hours

The regular work hours for the Marine Corps Base, Camp Lejeune, North Carolina, are 0730 to 1530, Monday through Friday.

3.5.1.3 Work Outside Regular Hours

If the Subcontractor desires to carry on work outside regular hours or on Saturdays, Sundays or holidays, the Subcontractor shall submit an application to the NTR. The Subcontractor shall allow ample time to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. At night, the Subcontractor shall light the different parts of the work in an approved manner.

3.5.2 Security Requirements

Subcontractor shall comply with general security requirements in accordance with Section C of the Basic Contract. No employee or representative of the

Subcontractor 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 NTR.3.5.2.1 Extraordinary Security Requirements

The clause of the Contract Clauses entitled "Identification of Employees" and the following apply:

a. Subcontractor Registration: Register with the Pass Office located at the main gate.

b. Equipment Markings: Equipment owned or rented by the company will have the company name painted or stenciled on the equipment in a conspicuous location. Rented equipment is to be conspicuously marked with a tag showing who rented it. Register the equipment with the truck investigation team.

c. Procedure Information: For additional information regarding registration procedures, contact the Officer in Charge of Subcontractors at 910-451-2326.

3.6 ACTIONS REQUIRED OF THE SUBCONTRACTOR

The Subcontractor shall comply with all requirements stated in Section C, Part 2.0, of the Basic Contract.

3.6.1 Base Permits

Permits are required for, but not necessarily limited to, welding, digging, and burning. Allow 7 calendar days for processing of the application. One copy of all applicable permits shall be posted at the job site.

3.7 PUBLIC RELEASE OF INFORMATION

The Subcontractor shall comply with all requirements stipulated in Section C, Part 2.0, of the Basic Contract.

3.8 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows.

3.8.1 Disposal of Rubbish and Debris

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows:

3.8.1.1 Removal from Government Property

a. Provide 24-hour advance written notice to the NTR of Subcontractor's intention to dispose of off-base.

b. Disposal at sites or landfills not holding a valid State of North Carolina permit is specifically prohibited. The prohibition also applies to sites where a permit may have been applied for but not yet obtained.

c. Off-base disposal of construction debris outside the parameters of this paragraph at sites without state permits and/or not in accordance with all regulatory requirements shall require the Subcontractor at his own expense to remove, transport, and relocate the debris to a state approved site. The Subcontractor shall also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris.

3.8.1.2 Removal to a Base Sanitary Landfill

a. Haul rubbish and debris to the Government Landfill site indicated or specified. Conform to Regulations of Base Sanitary Landfill.

Each category of construction debris shall be separated at the construction site and delivered separately to the landfill.

Each category of construction debris shall be placed in the landfill at a location designated by the landfill operator.

Each and every vehicle delivering debris must be weighed upon entrance and weighed upon exiting. All debris must be covered.

b. Metals will not be accepted at the Base Sanitary Landfill. Materials which may be deposited in the landfill include:

(1) Mixed Debris
The following materials shall be placed in e landfill in a location designated by the landfill operator. These items may be mixed together.

Sheetrock - plaster - glass (broken).

Non-asbestos insulation - (fiberglass and mineral wool shall be bagged).

Packaging paper, styrofoam, and pasteboard boxes.

Non-asbestos roofing materials such as shingles, built-up and single ply roofing.

Painted wood such as doors, windows, siding and trim.

Plastic/fiberglass such as pipe, electrical boxes, cover plates, etc.

Ceramic and vinyl flooring or tile - ceiling tile.

(2) Masonry and Concrete

Concrete, block, brick, mortar shall be delivered to the landfill separately from any other items and placed in a location designated by the landfill operator. All reinforcement wire and rebar must be removed flush with exposed surfaces.

(3) Nonrecycleable Cardboard

Corrugated cardboard boxes shall be delivered to the base recycling center located at Building 913. If base personnel rejects the cardboard, they shall be taken to the landfill.

(4) Nonrecycleable Wood Pallets

All useable pallets shall be delivered to the base recycling center located at building 913. If base personnel rejects the pallets, they shall be taken to the landfill.

(5) Treated Wood

Treated wood such as piling, power poles, etc., shall be delivered to the landfill, separated from any other items and placed in locations as designated by the landfill operator.

(6) Untreated/Unpainted Wood

Such as lumber, trees, stumps, limbs, tops, etc., shall be delivered to the landfill separated from any other items and placed in a location designated by the landfill operator.

(7) Organic Matter

Such as leaves, pine straw, grass clippings, and shrub clippings shall be delivered to the landfill separated from any other items and placed in a location designated by the landfill operator. No bags or containers are allowed.

(8) Fiberglass Tanks (550-gallon or less)

Tanks must be cleaned before delivery to landfill.

(9) Asphalt Pavement

Remove from Government Property and delivery to an asphalt recycling establishment. The Subcontractor shall provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling establishment receiving the removed asphalt.

(10) Asbestos

Dispose as directed by the NTR.

(11) Lead Based Paint Materials

Dispose as directed by the NTR.

(12) Metals

Metals will not be accepted at the landfill. Metals shall be removed from each and every category before delivery to the landfill.

(Example: Removal all hardware from doors and windows.)

Metal construction debris disposal shall be disposed of at DRMO Bldg. TC-861 - Camp Geiger.

Aluminum
Brass
Copper
Lead
Other Metal
Electrical Wiring
Cable (Cut in 3-foot or less sections)

3.8.2 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.

3.8.3 Fire Protection

COE EM-385-1-1, NFPA 241, and activity for regulations. Obtain approval from the activity Fire Chief prior to commencement of hot work operations.

3.8.3.1 Notification of Fire

Post the activity fire poster in conspicuous locations and at telephone in construction shacks.

3.8.4 Quarantine for Imported Fire Ant (4/82)

Onslow, Jones and Cartaret Counties and portions of Dublin and Craven Counties have been declared a generally infested area by the United States Department of Agriculture (USDA) for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth in USDA Quarantine No. 81 dated 9 October 1970, and USDA Publication 101.81-2A of 23 July 1976, is required for operations hereunder. Pertinent requirements of the quarantine for materials originating on the Camp Lejeune reservation, the Marine Corps Air Station (Helicopter), New River and the Marine Corps Air Station, Cherry Point, which are to be transported outside Onslow "County or adjacent suppression areas, include the following:

a. Certification is required for the following articles and they shall not be moved from the reservation to any point outside Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an Officer of the Plant Protection and Quarantine Program of the U. S. Department of Agriculture.

   (1) Bulk soil.

   (2) Used mechanized soil-moving equipment. (Used mechanized soil-moving equipment is exempt if cleaned of loose noncompacted soil.)

   (3) Other products, articles, or means of conveyance,if it is determined by an inspector that they present a hazard of transporting spread of the imported fir ant and the person in possession thereof has been so notified.

b. Authorization for movement of equipment outside the imported fire and regulated area shall be obtained from USDA, APHIS, PPQ, Box 83, Goldsboro, North Carolina, 27530, Attn: Mr. Haywood Cox, telephone (919) 735-1941. Requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Soil on or attached to equipment, supplies, and materials shall be removed by washing with water or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as necessary and as directed.

3.9 REQUIRED INSURANCE

(a) Within fifteen (15) days after award of this contract, the Subcontractor shall furnish the Contracting Officer a Certificate of Insurance as

Evidence of the existence of the following insurance coverage in amounts not less than the amount specified below in accordance with the FAR 52.228-05, "Insurance - Work on a Government Installation (Sep 1989)" clause, Section I. This insurance must be maintained during the entire performance period.

Coverage

Comprehensive General Liability: $500,000

Automobile Liability: $200,000 per person; $500,000 per occurrence for bodily injury; $20,000 per occurrence for property damage.

Workmens' Compensation: As required by Federal and State Workers' compensation and occupational disease statutes.

Employer's Liability Coverage: $100,000 except in states where workers' compensation may not be written by private carriers.

Other as required by state law.

(b) Above insurance coverages are to extend to Subcontractor personnel operating Government owned equipment and vehicles.

(c) The Certificate of Insurance shall provide for thirty (30) days written notice to me Contracting Officer by the insurance company prior to cancellation or material change in policy coverage. Other requirements and information are contained in the aforementioned "Insurance" clause.

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 CONCRETE INSTITUTE (ACI)

ACI 211.1	1989 Recommended Practice for Selecting Proportions for Normal and Heavyweight 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	1980 (R 1986) Details and Detailing of Concrete Reinforcement
ACI 318	1989 (R 1992) Building Code Requirements for Reinforced Concrete
ACI 347R	1989 Formwork for Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82	1990 (Rev. A) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 123	1989 (Rev. A) Zinc (HotDip Galvanized) Coatings on Iron and Steel Products
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/A 615M	1992 (Rev. A) Deformed and Plain Billet Steel Bars for Concrete Reinforcement
ASTM C 31	1991 Making and Curing Concrete Test Specimens in the Field
ASTM C 33	1992 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	1992 Ready Mixed Concrete
ASTM C 143	1990 (Rev. A) Slump of Hydraulic Cement Concrete
ASTM C 150	1992 Portland Cement
ASTM C 171	1992 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 (Rev. B) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	1986 Air Entraining Admixtures for ConcretE
ASTM C 309	1991 Liquid Membrane Forming Compounds for Curing Concrete
ASTM C 311	1992 Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete

ASTM C 494	1992 Chemical Admixtures for Concrete
ASTM C 567	1991 Unit Weight of Structural Concrete
ASTM C 618	1987 Specifications for Flyash and Raw or Calcined Natural Pozzolan
ASTM C 881	1990 Epoxy Resin Base Bonding Systems for Concrete
ASTM C 920	1987 Elastomeric Joint Sealants
ASTM C 989	1988 Specification for Ground Iron Blast-Furnace Slag
ASTM D 1752	1984 (R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 4397	1991 Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.4	1992 Structural Welding Code Reinforcing Steel

CORPS OF ENGINEERS (COE)

COE CRDC572	1974 Polyvinylchloride Waterstop

FEDERAL SPECIFICATIONS (FS)

FS SSS200	(Rev. E) (Am. 1) Sealants, Joint, Two Component, Jet Blast Resistant, Cold Applied, For Portland Cement Concrete Pavement

U.S. DEPARTMENT OF COMMERCE PRODUCT STANDARDS (PS)

PS1	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

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 SD02, Manufacturer's Catalog Data (4 copies each with quote)

a. Waterstops

b. Materials for curing concrete

c. Joint sealants

d. Joint filler

e. Vapor barrier

1.3.2 SD04, Drawings (4 copies each 3 weeks after order)

a. Reinforcing steel

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.

1.3.3 SD05, Design Data (4 copies each)

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 where 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 Atlantic Division, Naval Facilities

Engineering Command, may be used without further approval, if copies the previous approval and fly ash, silica fume, and pozzolan test results are submitted. The approval of fly ash, silica fume, and pozzolan (polypropylene fibers) tests results shall have been within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

1.3.4 SD010, Test Reports (4 copies each 3 weeks after order)

- Concrete mix design

1.3.4.1 Concrete Mix Design

Submit copies of test report 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.

1.4 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 211.1, ACI 301, and ACI 318 [and ACI 211.2] [ACI 304.2R] [and] [ACI 213R] except as otherwise specified. The compressive strength (f'c) of the concrete for each portion of the structure(s) shall be as indicated 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	4000	57	1-4	0.50	6%
All other					

areas	4000	57	1-3	0.35	6%

Maximum slump shown above may be increased one inch for methods of consolidation other than vibration. Provide air entrainment using air entraining admixture.

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 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.

2.2.2 Water

Water 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

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.

2.2.5.5 High Range Water Reducer (HRWR) (Superplasticizers)

ASTM C 494, Type F and ASTM C 1017.

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: PS1, BB 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/A with the bars marked A, Grade 60.

2.2.7.2 Welded Wire Fabric

ASTM A 185. Provide flat sheets of welded wire fabric for slabs and toppings where called for on drawings.

2.2.7.3 Wire

ASTM A 82 or ASTM A 496.

2.2.8 Vapor Barrier

ASTM D 4397 polyethylene sheeting, minimum 6 mil thickness.

2.2.8.1 Waterproof Paper

Kraft paper, glass reinforming fibers and layers of polyethylene laminated under heat and pressure to form a single layer meeting the requirements of FS UUB790, Type I, Grade A, Style 4; or waterproof paper, regular, conforming to ASTM C 171, consisting of two sheets of kraft paper cemented together with bituminous material in which are embedded cords or strands of fiber running in both directions not more than 1 1/4 inch apart.

2.2.8.2 Polyethylene Sheeting

ASTM D 4397, minimum 6 mil thickness.

2.2.9 Polyvinylchloride Waterstops

COE CRDC-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 Filler

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 C 920, Type M, Class 25

2.2.13.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C 920, Type M, Grade NS, Class 25

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 Dovetail Anchor Slot

Preformed metal slot approximately one inch by one inch of not less than 22 gauge galvanized steel cast in concrete. Coordinate actual size and throat opening with dovetail anchors and provide with removable filler material.

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 NTR 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 cleanout 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 the 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 ongrade concrete floor slab. Use the greatest widths

and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches [and tape or cement joints]. 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. Place a 2 inch layer of clean concrete sand on vapor barrier before placing concrete.

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 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.

3.2.7 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.

3.2.8 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.

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 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 concrete slabs greater than 4 inches in depth with 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 one 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.

3.4.5 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.

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. Minimum thickness of slabs,high point and low point elevations and floor drains are shown on drawings. Depress the concrete base slab where quarry tile, ceramic tile,are 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 bleed-water appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleed-water 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 bleed-water.

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 10foot 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 and for reception of floor coverings. First, provide a floated finish. The finish shall next be power troweled two 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 heavier 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.

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 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained. a burlap drag. Drag a strip of clean, wet burlap from 3 to 10 feet wide and 2 feet longer than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks. Round edges and joints with an edger having a radius of 1/8 inch.

3.6.2 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/4 inch per foot. Limit variation in cross section to 1/4 inch in 5 feet.

3.6.3 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

3.6.4 Curbs and Gutters

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.

3.6.5 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, unless otherwise indicated, 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 joints. Repair torn or damaged sheeting or provide new sheeting. Cover 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 the coating for the entire curing period and immediately repair any damage.

3.7.3 Liquid Chemical Sealer Hardener

Apply sealer hardener to interior floors not receiving floor covering and floors located under access flooring. 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 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 NTR.

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 for strength tests of each 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 inplace 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.

SECTION 03410

PRECAST CONCRETE (NON-PRESTRESSED)

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 304	R1989 Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	1991 Hot Weather Concreting
ACI 306.1	1990 Cold Weather Concreting
ACI 309R	1987 Consolidation of Concrete
ACI 318	1989 (R 1992) Building Code Requirements for Reinforced Concrete

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 185	1990 (Rev. A) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 307	1992 (Rev. A) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 615/A 615M	1992 (Rev. B) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 33	1992 Concrete Aggregates
ASTM C 94	1992 (Rev. A) Ready-Mixed Concrete
ASTM C 150	1992 Portland Cement

ASTM C 260 1986 Air-Entraining Admixtures for Concrete

ASTM C 494 1992 Chemical Admixtures for Concrete

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.4 1992 Structural Welding Code Reinforcing Steel

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-116 1985 Quality Control for Plants and Production of Precast and Prestressed Concrete Products

PCI MNL-120 1985 Design Handbook - Precast and Prestressed Concrete

PCI MNL-124 1989 Fire Resistance of Precast Prestressed Concrete

UNDERWRITERS LABORATORIES INC. (UL)

UL FRD 1992 Fire Resistance Directory

1.2 PRECAST MEMBERS

The work includes the provision of precast non-prestressed concrete herein referred to as precast members [except that precast concrete wall panels shall be provided as specified in Section 03411, titled "Precast Concrete Wall Panels"]. Precast members shall be the product of a manufacturer specializing in the production of precast concrete members. In the ACI publications, the advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears; reference to the "Building Official," the "Structural Engineer" and the "Architect/ Engineer" shall be interpreted to mean the Navy's Technical Representative (NTR).

1.3 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7 of the Basic Contract.

1.3.1 Manufacturer's Catalog Data (4 copies each with quote)

a. Anchorage and lifting inserts and devices

b. Bearing pads

1.3.2 SD-04, Drawings (4 copies, 3 weeks after order)

a. Drawings of precast members

1.3.2.1 Drawing Information

Submit drawings indicating complete information for the fabrication, handling, and erection of the precast member. Drawings shall not be reproductions of contract drawings. Design calculations and drawings of precast members (including connections) shall be prepared and sealed by a registered professional engineer, and submitted for approval prior to fabrication. The drawings shall indicate, as a minimum, the following information:

a. Marking of members for erection

b. Connections for work of other trades

c. Connections between members, and connections between members and other construction

d. Location and size of openings

e. Headers for openings

f. Joints between members, and joints between members and other construction

g. Reinforcing details

h. Material properties of steel and concrete used

i. Lifting and erection inserts

j. Dimensions and surface finishes of each member

k. Erection sequence and handling requirements

l. All loads used in design (such as live, dead, handling, and erection)

1.3.3 SD-05, Design Data (4 copies each, 3 weeks after order)

a. Precast concrete members design calculations

b. Concrete mix design

1.3.3.1 Precast Concrete Members Design Calculations

Submit calculations reflecting design conforming to requirements of paragraph entitled "Precast Concrete Member Design." Design calculations and drawings of precast members (including connections) shall be prepared and sealed by a registered professional engineer, and submitted for approval prior to fabrication.

1.3.3.2 Concrete Mix Design

Prior to concrete placement, submit a mix design for each strength and type of concrete. Include a complete list of materials including type; brand; source and amount of cement, pozzolan, and admixtures; and applicable reference specifications.

1.3.4 SD-08, Statements (4 copies, 3 weeks after order)

a. Fabrication

Submit quality control procedures established in accordance with PCI MNL-116 by the precast manufacturer.

1.3.5 SD-11, Factory Test Reports (4 copies)

a. Contractor-furnished mix design

Submit copies of test reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Obtain approval before concrete placement.

1.3.6 SD-18, Records (4 copies)

a. Concrete batch ticket information

1.3.6.1 Record Requirement

ASTM C 94. Submit mandatory batch ticket information for each load of ready-mixed concrete.

1.4 QUALITY ASSURANCE

1.4.1 Precast Concrete Member Design

ACI 318 and the PCI MNL-120. Design precast members (including connections) for the design load conditions and spans indicated, and for additional loads imposed by openings and supports of the work of other trades. Design precast members for a 50 psf live load. Design precast members for handling without cracking in accordance with the PCI MNL-120. Precast members shall have a fire rating of 1-hour in accordance with UL FRD, or as designed in accordance with PCI-MNL 124.

1.4.2 Factory Fabrication, Sampling, and Testing

PCI MNL-116. At the precast manufacturer's option, in lieu of core samples, ACI 318, full scale load tests may be performed. Perform on randomly selected members, as directed by the Contracting Officer.

1.5 DELIVERY AND STORAGE

Lift and support precast members at the lifting and supporting points indicated on the shop drawings. Store precast members off the ground. Separate stacked precast members by battens across the full width of each bearing point. Protect from weather, marring, damage, and overload.

1.6 FACTORY INSPECTION

At the option of the NTR Contracting Officer, precast units may be inspected by the NTR prior to being transported to the job site. The Contractor shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Government's right to enforce contractual provisions after units are transported or erected.

PART 2 PRODUCTS

2.1 CONTRACTOR-FURNISHED MIX DESIGN

ACI 318. The minimum compressive strength of concrete at 28 days shall be 5000 psi, unless otherwise indicated. Add air-entraining admixtures at the mixer to produce between 4 and 6 percent air by volume.

2.2 MATERIALS

2.2.1 Cement

ASTM C 150 Type I blended cement, except as modified herein.

2.2.2 Water

Water shall be fresh, clean, and potable.

2.2.3 Aggregates

2.2.3.1 Aggregates Selection

ASTM C 33, Size 57, 67, 7, except as modified herein. Obtain 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 Grout

2.2.4.1 Nonshrink Grout

ASTM C 1107

2.2.4.2 Cementitious Grout

Shall be a mixture of portland cement, sand, and water. Proportion one part cement to approximately 2.5 parts sand, with the amount of water based on placement method. Provide air entrainment for grout exposed to the weather.

2.2.5 Admixtures

2.2.5.1 Air-Entraining

ASTM C 260

2.2.5.2 Accelerating

ASTM C 494, Type C or E

2.2.5.3 Water Reducing

ASTM C 494, Type A, E, or F

2.2.6 Reinforcement

2.2.6.1 Reinforcing Bars

ASTM A 615/A 615M Grade 40, 60.

2.2.6.2 Welded Wire Fabric

ASTM A 185.

2.2.7 Metal Accessories

Provide ASTM A 123 or ASTM A 153 galvanized.

2.2.7.1 Inserts

ASTM A 47, Grade 32510 or Grade 35018, or ASTM A 27/A 27M Grade U-60-30

2.2.7.2 Structural Steel

ASTM A 36/A 36M

2.2.7.3 Bolts

ASTM A 307.

2.2.8 Bearing Pads

2.2.8.1 Hardboard (Interior Only)

PS-58 class as specified by the precast manufacturer.

2.3 FABRICATION

PCI MNL-116 unless specified otherwise.

2.3.1 Forms

Brace forms to prevent deformation. Forms shall produce a smooth, dense surface. Chamfer exposed edges of columns and beams 3/4 inch, unless otherwise indicated. Provide threaded or snap-off type form ties.

2.3.2 Reinforcement Placement

ACI 318 for placement and splicing. Reinforcement may be preassembled before placement in forms. Provide exposed connecting bars, or other approved connection methods, between precast and cast-in-place construction. Remove any excess mortar that adheres to the exposed connections.

2.3.3 Concrete

2.3.3.1 Concrete Mixing

ASTM C 94 Mixing operations shall produce batch-to-batch uniformity of strength, consistency, and appearance.

2.3.3.2 Concrete Placing

ACI 304R, ACI 305R for hot weather concreting, ACI 306.1 for cold weather concreting, and ACI 309R, unless otherwise specified.

2.3.3.3 Concrete Curing

Commence curing immediately following the initial set and completion of surface finishing. Provide curing procedures to keep the temperature of the concrete between 50 and 190 degrees F. When accelerated curing is used, apply heat at controlled rate and uniformly along the casting beds. Monitor temperatures at various points in a product line in different casts.

2.3.4 Surface Finish

Repairs located in a bearing area shall be approved by the Contracting Officer prior to repairs. Precast members containing hairline cracks which are visible and are less than 0.02 inches in width, may be accepted, except that cracks larger than 0.005 inches in width for surfaces exposed to the weather

shall be repaired. Precast members which contain cracks greater than 0.02 inch in width shall be approved by the NTR, prior to being repaired. Any precast member that is structurally impaired or contains honeycombed section deep enough to expose reinforcing shall be rejected.

2.3.4.1 Unformed Surfaces

Provide a floated steel troweled finish.

2.3.4.2 Formed Surfaces

PCI MNL-116 (Appendix A - Commentary), Chapter 3, for grades of surface finishes.

a. Exposed Surfaces: Provide a finish Grade B surface finish. The combined area of acceptable defective areas shall not exceed 0.2 percent of the exposed to view surface area, and the patches shall be indistinguishable from the surrounding surfaces when dry.

PART 3 EXECUTION

3.1 SURFACE REPAIR

Prior to erection, and again after installation, precast members shall be checked for damage, such as cracking, spalling, and honeycombing. As directed by the NTR, precast members that do not meet the surface finish requirements specified in Part 2 in paragraph titled, "Surface Finish" shall be repaired, or removed and replaced with new precast members.

3.2 ERECTION

Precast members shall be erected after the concrete has attained the specified compressive strength, unless otherwise approved by the precast manufacturer. Erect in accordance with the approved shop drawings. PCI MNL-116 and PCI MNL-120 (Chapter 8), for tolerances. Brace precast members, unless design calculations submitted with the shop drawings indicate bracing is not required. Follow the manufacturer's recommendations for maximum construction loads. Place precast members level, plumb, square, and true within tolerances. Align member ends.

3.3 BEARING SURFACES

Shall be flat, free of irregularities, and properly sized. Size bearing surfaces to provide for the indicated clearances between the precast member and adjacent precast members or adjoining field placed surfaces. Correct bearing surface irregularities with nonshrink grout. Provide bearing pads where indicated or required. Do not use hardboard bearing pads in exterior locations. Place precast members at right angles to the bearing surface,

unless indicated otherwise, and draw-up tight without forcing or distortion, with sides plumb.

3.4 ANCHORAGE

Provide anchorage for fastening work in place. Conceal fasteners where practicable. Make threaded connections up tight and nick threads to prevent loosening.

3.5 WELDING

AWS D1.4 for welding connections and reinforcing splices. Protect the concrete and other reinforcing from heat during welding. Weld continuously along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Grind smooth visible welds in the finished installation.

3.6 OPENINGS

Holes or cuts requiring reinforcing to be cut, which are not indicated on the approved shop drawing, shall only be made with the approval of the NTR and the precast manufacturer. Drill holes less than 12 inches in diameter with a diamond tipped core drill.

3.7 GROUTING

Clean and fill keyways between precast members, and other indicated areas, solidly with nonshrink grout or cementitious grout. Provide reinforcing where indicated. Remove excess grout before hardening.

3.8 SEALANTS

Provide as indicated and as specified in Section 07920, titled "Sealants."

--End of Section--

SECTION 04230

REINFORCED MASONRY

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 315	1980 (R 1986) Details and Detailing Of Concrete Reinforcement
ACI 318	1989 (R 1992) Building Code Requirements for Reinforced Concrete
ACI 530.1	1992 Masonry Structures (ASCE 6-92)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	1992 Structural Steel
ASTM A 82	1990 (Rev. A) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153	1982 (R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	1992 (Rev. B) Stainless and Heat-Resisting Chromium-Nickel Steel Plate,Sheet, and Strip
ASTM A 185	1990 (Rev. A) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 366/A 366M	1991 Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 497	1990 (Rev. B) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 525	1991 (Rev. B) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 615/A 615M	1992 (Rev. B) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 616/A 616M	1992 Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617/A 617M	1992 Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 641	1992 Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A 706/A 706M	1992 (Rev. B) Low-Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM B 370	1992 Copper Sheet and Strip for Building Construction
ASTM C 55	1993 Concrete Building Brick
ASTM C 62	1992 (Rev. C) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 90	1993 Load-Bearing Concrete Masonry Units
ASTM C 94	1992 (Rev. A) Ready-Mixed Concrete
ASTM C 216	1992 (Rev. D) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	1992 (Rev. A) Mortar for Unit Masonry
ASTM C 476	1991 Grout for Masonry
ASTM C 652	1992 (Rev. D) Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C 744	1992 Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	1991 Preconstruction and Construction Evaluations of Mortar for Plain and Reinforced Unit Masonry
ASTM C 901	1985 (R 1990) Prefabricated Masonry Panels
ASTM C 920	1987 Elastomeric Joint Sealants
ASTM C 1019	1989 (Rev. A) Sampling and Testing Grout
ASTM C 1072	1986 Masonry Flexural Bond Strength

ASTM D 994	1971 (R 1982) Preformed Expansion Joint Filler for Concrete (Bituminous Type)
ASTM D 1056	1991 Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 2000	1990 Rubber Products in Automotive Applications
ASTM D 2287	1992 Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 447	1992 (Rev. B) Compressive Strength of Masonry Prisms
ASTM E 514	1990 Water Penetration and Leakage Through Masonry

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO UBC	1991 Uniform Building Code

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-116	1985 Quality Control for Plants and Production of Precast Prestressed Concrete Products

1.2 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a. Anchors, ties

b. Wire reinforcement

c. Movement joints

1.2.2 SD-04, Drawings (4 copies each, 3 weeks after order)

a. Details of steel reinforcement

b. Lintels

1.2.2.1 Details of Steel Reinforcement

Provide drawings showing all fabrication dimensions and locations for placing of the reinforcing steel and accessories.

1.2.3 SD-10, Test Reports (4 copies each, 3 weeks after order)

a.Unit strength method

b.Prism test

c.Mortar properties

d.Grout

1.2.3.1 Unit Strength Method

Compute compressive strength of masonry system "Unit Strength Method", ACI 530.1. Submit calculations and certifications of unit and mortar strength.

1.2.3.2 Prism Test

Submit test reports on three prisms in accordance with ASTM E 447,Method B modified as specified in ACI 530.1.

1.2.4 SD-11, Factory Test Reports (4 copies each, 3 weeks after order)

a. Concrete masonry units

b. Clay or shale bricks

c. Mortar and grout admixtures

1.2.4.1 Mortar and Grout Admixtures

Submit test reports indicating that mortar and grout properties are as specified when the admixtures are used.

1.2.5 SD-12, Field Test Reports (4 copies each)

a. Grout strength

b. Mortar strength and properties

1.2.6 SD-13, Certificates (4 copies each)

a. Concrete masonry units

b. Clay or shale bricks

c. Movement joints

d. Masonry inspector

1.3 QUALITY ASSURANCE

1.3.1 Inspection

Inspection is required for structural masonry. Coordinate details the Navy's Technical Representative (NTR).

1.3.1.1 Masonry Inspection

Employ a qualified masonry inspector approved by the NTR in addition to the Quality Control Representative to perform continuous inspection of the masonry work. Acceptance by a State or municipality having a program of examining and certifying masonry inspectors will be considered adequate qualification. The masonry inspector shall be at the site continuously during masonry construction.

1.3.2 Appearance

After work has started, do not change source of materials if appearance of finished work would be affected.

1.3.3 Testing

ACI 530.1, "Quality Assurance" except that the cost of the testing shall be paid by the General Site Work Subcontractor.

1.4 DELIVERY, STORAGE, AND HANDLING

a. Handle masonry units to avoid chipping and breaking. Deliver cement and lime in unbroken bags, barrels, or other sealed containers. Plainly mark and label containers with manufacturer's name and brand.

b. Protect masonry units from contact with the soil. Protect moisture-controlled units from rain or ground water. Keep anchors, ties, and reinforcement free of loose rust and scale. Keep cementitious materials dry. Store and handle cement to prevent inclusion of foreign materials. Store aggregates in a manner to avoid contamination or segregation.

1.5 BRACING AND SCAFFOLDING

Provide all bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

2.1.1 Hollow Load and Non-Load Bearing Units

ASTM C 90, Type I, normal weight. Nominal size as required by design.

2.2 CLAY OR SHALE BRICKS

2.2.1 Facing Brick

ASTM C 216, Type FBS, FBX, FBA. Nominal size 4 inches.

2.3 MORTAR

2.3.1 Mortar Properties

ASTM C 270, Type S. Strength (f'm) as indicated. Test in accordance with ASTM C 780. Use Type I Portland cement.

2.3.2 Admixtures

Do not use admixtures containing chlorides.

2.3.2.1 Air Entrainment

When structural reinforcement is incorporated, maximum air-content 12 percent in cement-lime mortar and 18 percent in masonry cement mortar.

2.3.2.2 Water-Repellant Admixture

Polymeric type formulated to reduce porosity and water transmission. When tested in accordance with ASTM C 1072, panel shall have flexural strength not less than that specified or indicated. When tested in accordance with ASTM E 514, panel shall exhibit no water visible on back and through the panel after 24 hours. Not more than 25 percent of wall area shall be damp after 72 hours.

2.3.2.3 Lime Alternates

Lime alternates which have a current ICBO, ICBO UBC, Evaluation Report number whose findings state it may be used as an alternate to lime for Type M, S, N, and O mortars will be deemed acceptance provided the user follows the manufacturer's proportions and mixing instructions as set forth in report.

2.3.2.4 Colored Mortar

Where colored mortar is indicated, add pure mineral oxide pigment materials in proportions recommended by manufacturer and as approved, for mortar color

indicated.

a. Quantity of pigment to cementitious content of the masonry cement shall not exceed 5 percent by weight. Carbon black shall not exceed 1 percent by weight.

b. Quantity of pigment to cementitious content of cement-lime mix shall not exceed 10 percent by weight, carbon black no more than 2 percent by weight.

2.3.4 Water

Water for mixing shall be potable.

2.4 GROUT

ASTM C 476, fine. Slump between 8 and 11 inches. Provide minimum grout strength of 2000 psi in 28 days, as tested by ASTM C 1019.

2.4.1 Admixtures

Do not use air-entrainment, antifreeze or chloride admixtures.

2.4.2 Ready Mixed Grout

ASTM C 94.

2.5 ANCHORS, TIES

Stainless steel, ASTM A 167 Type 304 for wire not totally embedded. Optionally, for completely embedded wire, ASTM A 641, Class 1 or 3. Provide cavity wall ties with integral drip located in cavity. Do not use corrugated wall ties.

a. Plate, headed and bent bar anchors, ASTM A 36/A 36M.

b. Sheet metal anchors and ties, ASTM A 366/A 366M, ASTM A 525.

c. Wire mesh ties, ASTM A 185.

d. Wire ties and anchors, ASTM A 82.

2.5.1 Wire Reinforcement

2.5.1.1 Horizontal Joint Reinforcement

Fabricate from cold drawn steel wire, ASTM A 82. Hot-dip galvanize after fabrication, ASTM A 153, B-2. Provide ACI 530.1 truss type reinforcement with two or more longitudinal wires welded to continuous diagonal cross wire, or

ladder type with perpendicular cross wires not more than 16 inches o.c. Provide reinforcement for cavity walls with integral drip located in the cavity.

2.5.1.2 Wire Fabric

ASTM A 185 smooth, ASTM A 497 deformed.

2.5.2 Adjustable Anchors

Provide adjustable anchors 3/16-inch diameter steel wire, triangular-shaped. Anchors attached to steel shall be 5/16 inch diameter steel bars placed to provide 1/16-inch play between flexible anchors and structural steel members.

2.6 REINFORCING BARS

2.6.1 Deformed Bars

ASTM A 615/A 615M, ASTM A 616/A 616M, ASTM A 617/A 617M, or ASTM A 706/A 706M.

2.6.2 Fabrication

ACI 530.1.

2.6.3 Bar Positioners

Provide positioners that prevent displacement of reinforcing during construction.

2.6.4 Design

ACI 318 for flexural and shear strength. Concrete shall have a minimum 28-day compressive strength as required by design using 1/2 inch to No. 4 nominal-size coarse aggregate. Reinforcement ASTM A 615/A 615M, Grade 60. Limit lintel deflection due to dead plus live load to L/600 or 0.3 inches. Provide top and bottom bars for lintels over 36 inches in length. Provide 1 1/2 inch minimum cover, top and bottom.

2.6.5 Exposed Surfaces

Provide standard grade surface finish.

2.6.6 Lintels

Maintain minimum clearance of 3/4 inch between reinforcement and interior faces of units. Reinforce for full length and sufficient length beyond end of item to allow splicing or tying to building reinforcement. Provide splices per ACI 315. Lintel for the roll-up door is designed to adequately support and suit the selected door and the associated mechanism.

2.7 THROUGH-WALL FLASHING

2.7.1 Stainless Steel

ASTM A 167, Type 304, 0.010 inch minimum thickness. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions. Deformations shall consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations. Lap seams 3 to 4 inches. Use lead-free solder.

2.8 MOVEMENT JOINTS

2.8.1 Contraction Joint Material

2.8.1.1 Rubber Shear Key

ASTM D 2000, 2AA-805. Minimum durometer hardness of 80.

2.8.1.2 Elastomeric Joint Sealant

ASTM C 920.

2.8.1.3 Joint Detail

Size and shape as required by design.

2.8.2 Expansion Joint Material

ASTM D 994, ASTM D 1056 Class RE 41, ASTM C 920. Resistant to oils and solvents.

2.8.2.1 Joint Detail

Size and shape as required by design. Coordinate with specified pre-engineered building manufacturer requirements.

2.9 INSERTS FOR WEEP HOLES

Prefabricated aluminum, plastic or wood blocking sized to form the proper size opening in head joints. Provide aluminum and plastic inserts with grill or screen-type openings designed to allow the passage of moisture from cavities and to prevent the entrance of water or insects.

PART 3 EXECUTION

3.1 INSPECTION

Prior to start of work, masonry inspector shall verify the foundation conditions listed in ACI 530.1.

3.2 SPECIAL PREPARATION

3.2.1 Cold Weather Installation

When either of the following conditions exist:

a. Ambient temperature falls below 40 degrees F, or

b. Temperature of masonry units is below 40 degrees F,

Implement cold weather procedures of ACI 530.1.

3.2.2 Hot Weather Installation

When either of the following conditions exist:

a. Ambient air temperature exceeds 100 degrees F, or

b. Ambient air temperature exceeds 90 degrees F and wind velocity is more than 8 m.p.h.,

Implement hot weather procedures of ACI 530.1.

3.3 ERECTION OF MASONRY UNITS

3.3.1 Mortar

Mix all cementitious materials and aggregates between 3 and 5 minutes in mechanical batch mixer with sufficient amount of water to produce workable consistency. Do not hand mix without approval of Masonry Inspector. Do not retemper after 2 1/2 hours. Do not retemper colored mortar.

3.3.2 Bond

Construct masonry in running bond pattern.

3.3.3 Solid Units

ACI 530.1, place with fully mortared bed and head joints.

3.3.4 Hollow Units

ACI 530.1.

3.3.5 All Units

a. Place clean units while mortar is soft and plastic. Any unit disturbed to the extent that initial bond is broken shall be removed and relaid in

fresh mortar.

b. Cut exposed edges or faces of masonry units smooth or position so that all exposed faces or edges are unaltered manufactured surfaces.

c. At end of each day, cover new work. Step back masonry; do not tooth.

3.3.6 Tolerances

ACI 530.1.

3.3.7 Embedded Items and Accessories

a. Construct chases as masonry units are laid.

b. Coordinate installation of pipes and conduits passing through walls, piers, or beams as indicated. Use steel sleeves where indicated.

c. Install and secure anchors, flashing, weep holes, nailing blocks, and other accessories as indicated.

3.3.8 Bed and Head Joints

Joints shall be 3/8 inch thick, except that bed joint of starting course placed over foundations may be 1/4 inch to 3/4 inch thick.

3.3.9 Finishing Joints

a. In exposed and below grade masonry, fill holes created by line pins with mortar.

b. Tool joints with round or vee jointer when mortar is thumbprint hard. After joints are tooled, trim off mortar burrs with trowel. Tool the exterior joints of the interior width of cavity walls.

c. Remove masonry protrusions extending 1/2 inch or more into cells or cavities to be grouted.

3.3.10 Collar Joints

Solidly fill collar joints less than 3/4 inch wide with mortar as job progresses.

3.3.11 Through-Wall Flashing

Provide as indicated. Extend flashing from a point 1/4-inch outside of exterior face of walls. Bend down exterior edge to form a drip. Flashing shall be extended beyond interior face of wall and turned up not less than 2 inches. Secure flashing as required. Provide flashing in lengths as long as

practicable. Lap ends not less than 1 1/2-inches for interlocking type and 4 inches for other types. Seal laps as necessary to ensure watertight construction. Provide dams at ends of flashing where masonry abuts concrete and where flashing ends within the masonry. When both widths are not brought up together, protect flashing from damage until they are fully enclosed in the wall.

3.3.12 Weep Holes

Wherever through-wall flashing occurs, provide weep holes spaced 24 inches o.c. for brick faced wall construction.

3.4 REINFORCEMENT

3.4.1 Preparation

At time mortar or grout is placed, all reinforcement shall be free of mud, oil or other materials that might reduce bond.

3.4.2 Placing Tolerances

a. Place steel in walls and flexural elements within 1/2 inch when the distance (d) from centerline of steel to opposite face of masonry is equal to 8 inches or less, within 1 inch for d between 8 and 24 inches.

b. Place vertical bars in wall within 2 inches of indicated location along length of wall.

c. Bars may be moved as necessary to avoid interference with other reinforcing, conduits, or embedded items. If bars are moved more than specified tolerance, notify NTR for approval for resulting arrangement.

3.4.3 Securing Reinforcement

Support and fasten reinforcement to prevent displacement by construction loads or placement of grout or mortar. Lap or hook corner bars.

3.4.4 Details of Reinforcement

a. Clear distance between reinforcing bars and any face of masonry unit or formed surface, shall be as indicated but not less than 1/2 inch.

b. Get approval from NTR for all splices not indicated.

c. Do not bend embedded reinforcement.

d. Place joint reinforcement so that longitudinal wires are embedded in mortar with minimum cover of 1/2 inch when not exposed to weather or earth and 5/8 inch when exposed to weather or earth.

3.4.5 Wall Ties

Embed ends of wall ties in mortar joints.

3.4.5.1 Hollow Units

Wall tie ends shall engage outer face shells by at least 1/2 inch.

3.4.5.2 Solid Units

Embed wire wall ties at least 1-1/2 inch into mortar bed.

3.4.5.3 Minimum Number of Ties

Bond widths with No. 9 gauge ties , one tie per 2.67 square feet. Bond widths with 3/16 inch diameter ties, one tie per 4.50 square feet. Maximum spacing between ties, 36 inches horizontally and 24 inches vertically. The spacing for ties with an integral drip shall be one-half the spacing given.

3.4.5.4 Adjustable Ties

a. Use one tie for each 1.77 square feet of wall area.

b. Do no exceed 16 inch spacing horizontally or vertically.

c. 1-1/4 inch maximum misalignment of bed joints from one width to the other.

d. 1/16 inch maximum clearance between connecting parts of ties.

e. Ties shall have at least two 3/16 inch diameter pintle legs.

3.4.6 Adjustable Anchors

Weld spacers to roads and columns. Provide shapes standard with the flexible-anchor manufacturer when approved. Clean welds and give one coat of zinc-rich touch up paint.

3.5 GROUTING

3.5.1 Preparation

Ensure that spaces to be grouted are free of mortar droppings, debris, loose aggregates and any material deleterious to masonry grout. Reinforcement and ties shall be in place before grouting.

3.5.2 Cleanouts

a. When grout pour exceeds 5 feet in height, provide cleanouts in bottom course of masonry in each grout pour.

b. Provide 3 inch minimum cleanout openings.

c. After cleaning, close cleanout openings and brace to resist grout pressure.

3.5.3 Placing Time

Place grout within 1-1/2 hours of introducing water to mixture. Sample and test grout, ASTM C 1019, for each 5,000 square feet of wall.

3.5.4 Pour Height

ACI 530.1.

3.5.5 Lift Height

Place grout in lifts not exceeding 5 feet. For 8 inch block wall, maximum lift is 2 feet.

3.5.6 Consolidation

Consolidate grout at time of placement.

a. Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling.

b. Consolidate pours exceeding 12 inches in height by mechanical vibration. Reconsolidate by mechanical vibration after initial water loss and settlement have occurred.

3.6 FIELD QUALITY CONTROL

3.6.1 Mortar Strength and Properties

ASTM C 780, for the first 3 consecutive days, and each third day thereafter.

3.6.2 Grout Strength

ASTM C 1019, for the first 3 consecutive days, and each third day thereafter, or each batch of ready mixed grout.

3.6.3 Prism Test

Make at least one prism test sample for each 5,000 square feet of wall, but not less than three such samples for any building.

3.7 CLEANING

a. Keep exposed surfaces clean during construction. Avoid smearing mortar on face of units.

b. Clean masonry with potable water. Detergents may be used.

c. Do not use acid, caustic solutions, or sandblasting.

d. Masonry shall be free of stains, efflorescence, mortar or grout droppings, and debris.

--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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M180 1990 Corrugated Sheet Steel Beams for Highway Guardrail

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S302 1987 Steel Buildings and Bridges

AISC S328L 1986 Structural Steel Buildings Load & Resistance Factor Design

AISC S335 1989 Structural Steel Buildings Allowable Stress Design and Plastic Design

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	1990 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 569/A 569M	1991 Rev. A) Steel, Carbon (0.15 Maximum. Percent), Hot-Rolled Sheet and Strip Commercial Quality
ASTM A 687	1989 High-Strength Nonheaded Steel Bolts and Studs
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
ASTM B 429	1990 (Rev. A) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 1187	1982 Asphalt-Base Emulsions for Use as Protective Coatings for Metal

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1	1990 Structural Welding Code Steel

CODE OF REFERRAL REGULATIONS (CFR)

29 CFR 1910.27	Fixed Ladders

FEDERAL SPECIFICATIONS (FS)

FS FF-S-325	(Int Am. 3) Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS TT-P-664	(Rev. D) Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant
FS RR-G-1602	(Rev. C) Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM BG	1988 Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	1991 Code for Safety to Life from Fire in Buildings and Structures

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 3	1989 Power Tool Cleaning
SSPC SP 6	1989 Commercial Blast Cleaning

1.2 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a. Handrails

b. Ladders

c. Structural steel door frames

d. Wheel guards

1.2.2 SD-04, Drawings (4 copies each 4 weeks after order)

a. Handrails, installation drawings

b. Ladders, installation drawings

c. Embedded angles and plates, installation drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC S303.

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 (4 copies 4 weeks after order)

a. Primer Certificate

1.2.3.1 Certificates

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 (4 copies)

a. Safety nosings

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 Anchors Bolts

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

2.1.5.1 Expansion Anchors

FS FF-S-325, of group II, type 4, class 1. Provide embeddment required by manufacturer.

2.1.5.2 Lag Screws and Bolts

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

2.1.5.3 Toggle Bolts

ANSI B18.2.1.

2.1.5.4 Bolts, Nuts, Studs and Rivets

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

2.1.5.5 Power Driven Fasteners

Follow safety provisions of ANSI A10.3.

2.1.5.6 Screws

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

2.1.5.7 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.

2.2 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 Navy's Technical Representative (NTR). 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 shall 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.

2.2.4.3 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 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.

2.4 GUARD POSTS (BOLLARDS)

Provide 6-inch prime coated standard 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.

2.5 HANDRAILS

Design handrails to resist a concentrated load of 250 lbs in any direction at any point of the top of the rail or 20 lbs per foot applied horizontally to top of the rail, whichever is more severe.

2.5.1 Stainless Steel Handrails, Including Stainless Steel Inserts

Provide stainless steel handrails, including inserts in concrete, stainless steel pipe or structural tubing, Schedule 40, conforming to ASTM A 554. Provide stainless steel railings of 1 1/2-inch maximum outside diameter.

a. Fabrication: Joint posts, rail, and corners by one of the following methods:

(1) Flush-type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8-inch hexagonal-recessed-head setscrews.

(2) Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Butt railing splices

and reinforce them by a tight fitting interior sleeve not less than 6 inches long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

b. Provide removable sections as indicated.

2.6 LADDERS

Fabricate vertical ladders conforming to Section 7 of CFR 1910.27. Use 2 1/2-inch by 3/8-inch steel flats for stringers and 3/4-inch diameter steel rods for rungs. Rungs to be not less than 16 inches wide, spaced one foot apart, plug welded or shouldered and headed into stringers. Install ladders so that the distance from the rungs to the finished wall surface shall not be less than 7 inches. Provide heavy clip angles riveted or bolted to the stringer and drilled for not less than two 1/2-inch diameter expansion bolts as indicated. Provide intermediate clip angles not over 48 inches on centers.

2.6.1 Ladder Cages

Conform to 29 CFR 1910.27. Fabricate 2 by 1/4-inch horizontal bands and 1 1/2-inch by 3/16-inch vertical bars. Provide attachments for fastening bands to the side rails of ladders or directly to the structure. Provide and fasten vertical bars on the inside of the horizontal bands. Extend cages not less than 27 inches or more than 28 inches from the centerline of the rungs, excluding the flare at the bottom of the cage, and not less than 27 inches in width. Clear the inside of the cage of projections.

2.7 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, support framing for ceiling-mounted toilet partitions, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections, fasteners, or welds. 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.

2.8 SAFETY NOSINGS FOR CONCRETE TREADS

Provide safety nosings of cast iron with cross-hatched abrasive-surfaces. Nosing to be at least 4 inches wide and 1/4-inch thick and terminating at not more than 6 inches from the ends of treads for stairs and as indicated for platforms and landings. Provide safety nosings with anchors embedded in the

concrete and with tops flush with the top of the traffic surface.

2.9 STRUCTURAL STEEL DOOR FRAMES

a. Provide frames as indicated. If not otherwise shown, construct frames of structural shapes, or shape and plate composite, to form a full depth channel shape with at least 1 1/2-inch outstanding legs.

b. Where track, guides, hoods, hangers, operators, and other such accessories are required, provide support as indicated.

c. Provide jamb anchors near top, bottom, and at not more than 24-inch intervals. Provide the bottom of each jamb member with a clip angle welded in place with two 1/2-inch diameter floor bolts for adjustment.

d. Provide spreaders between bottoms of floor jamb members. When floor construction permits, they may be left in place, concealed in the floor.

2.10 WHEEL GUARDS

Provide wheel guards of hollow, heavy-duty type cast iron conforming to ASTM A 48, with shaped, rounded top, at least 18 inches high, and designed to provide a minimum of 6 inches of protection.

PART 3 EXECUTION

3.1 INSTALLATION

Install items at locations indicated, according to manufacturer's instructions. Items listed below require additional procedures.

3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

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

3.3 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.

3.4 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.

3.5 FINISHES

3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D 1187, asphalt-base emulsion.

3.5.2 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.

3.5.3 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 NTR.

3.6 HANDRAILS

3.6.1 Stainless Steel Handrail

Install in pipe sleeves embedded in concrete and filled with non-shrink grout or quick setting anchoring cement with anchorage covered with standard pipe collar pinned to post or masonry with expansion shields and bolts or toggle bolts. Secure rail ends by steel pipe flanges anchored by expansion shields and bolts.

3.7 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to masonry or concrete with not less than two 1/2-inch diameter expansion bolts. Install intermediate clip angles not over 48 inches on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. In no case shall ends of ladders rest upon floor.

3.8 WHEEL GUARDS

Anchor guards to concrete or masonry in accordance with manufacturer's instructions. Fill hollow cores solid with concrete with minimum compressive strength of 2500 psi.

SECTION 07214

BOARD AND BLOCK THERMAL 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 165	1992 Measuring Compressive Properties of Thermal Insulations
ASTM C 203	1992 Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C 272	1991 Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C 552	1991 Cellular Glass Thermal Insulation
ASTM C 553	1992 Mineral fiber Blanket and Felt Insulation (Industrial Type)
ASTM C 578	1992 Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	1985 Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
ASTM C 612	1983 Mineral Fiber Block and Board Thermal Insulation
ASTM C 930	1992 Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 828	1987 Tensile Breaking Strength of Paper and Paperboard
ASTM D 1621	1873 (R 1979) Compressive Properties of Rigid Cellular Plastics
ASTM D 3833	1988 Water Vapor Transmission of Pressure-Sensitive Tapes

ASTM D 4397	1991 Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 84	1991 (Rev. A) Surface Burning Characteristics of Building Materials
ASTM E 96	1992 Water Vapor Transmission of Materials
ASTM E 136	1992 (Rev. A) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 154	1988 Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1920.134	Respiratory Protection

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	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
FS HH-I-1972/3	Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Perlite Insulation Board on One side and Asphalt/Organic Felt of Asphalt/Glass Fiber Felt on Other Side of the Foam
FS HH-I-1972/4	Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Gypsum Board on One Side and Aluminum Foil or Asphalt/Organic Felt on the Other Side of the Foam
FS HH-I-1972/5	Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Perlite Board to Both Sides of the Foam

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	1992 Installation of Oil Burning Equipment
NFPA 54	1992 National Fuel Gas Code
NFPA 70	1993 National Electrical Code
NFPA 211	1992 Chimneys, Fireplaces, Vents, and solid Fuel Burning appliances

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM	1988 Puncture Test for Container board

1.2 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a. block or board insulation

b. Pressure sensitive tape

c. Vapor retarder

d. Accessories

1.2.2 SD-06, Instructions (4 copies each 4 weeks after order)

a. Block and Board Insulation

b. Adhesive

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials to the site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect form damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.3.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.4 SAFETY PRECAUTIONS

1.4.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration)(MSHA) in accordance with 29 CFR 1910.134.

1.4.2 Other Safety considerations

Consider safety concerns and measures as outlined in ASTM C 930.

PART 2 PRODUCTS

2.1 BLOCK OR BOARD INSULATION

Provide only thermal insulating materials recommended by manufacturer for type of application indicated. Provide board or block thermal insulation conforming to the following standards and the physical properties listed below:

a. Extruded Preformed Cellular Polystyrene: ASTM C 578

2.1.1 Thermal Resistance

As indicated.

2.1.2 Fire Protection Requirement

a. Flame spread index of 5 or less when tested in accordance with ASTM E 84.

b. Smoke developed index of 165 or less when tested in accordance with ASTM E 84.

2.1.3 Other Material Properties

Provide thermal insulating materials with the following properties:

a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than 25 pounds per square inch (psi) when measured according to ASTM D 1621.

b. Flexural strength: Not less than 50 pounds per square inch (psi) when measured according to ASTM C 203.

c. Water Vapor Permeance: Not more than 1.0 Perms or less when measured according to ASTM E 96, desiccant method, in the thickness required to provide the specified thermal resistance, including facings, if any.

d. Water Absorption: Not more than 1 percent by total immersion, by volume, when measured according to ASTM C 272.

2.1.4 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section.

2.1.5 Prohibited materials

Do not provide materials containing more than one percent of asbestos.

2.2 VAPOR RETARDER AND DAMPPROOFING

2.2.1 Vapor Retarder under floor Slab

a. Water vapor permeance: 0.2 Perm or less when tested in accordance with ASTM E 96.

b. Puncture resistance: Maximum load no less than 40 pounds when tested according to ASTM E 154.

2.3 PRESSURE SENSITIVE TAPE

As recommended by manufacturer of vapor retarder and having a water vapor permeance rating of one perm or less when tested in accordance with ASTM D 3833.

2.4 ACCESSORIES

2.4.1 Adhesive

As recommended by insulation manufacturer.

2.4.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that all areas that shall be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If installing perimeter or under slab insulation, check that the fill is flat, smooth, dry, and well tamped. If moisture or other conditions are found that do not allow the proper installation of the insulation, do not proceed but notify the Navy's Technical Representative (NTR) of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Production Devices

Unless using insulation board that passes ASTM E 136 in addition to the requirements in Part 2, install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.

b. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: minimum clearances as required by NFPA 2111.

c. Gas Fired Appliances: Clearances as required in NFPA 54.

d. Oil Fired appliances: Clearances as required in NFPA 31.

Blocking is not required if chimneys or flues are certified by the Manufacturer of ruse in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation Board

Install and handle insulation in accordance with the manufacturer's Installation Instructions. Keep material dry and free of extraneous materials. Observe safe work practices.

3.3.2 Electrical Wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.3 Cold Climate Requirement

Place insulation to the outside of pipes.

3.3.4 Continuity of Insulation

Butt tightly against adjoining boards and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating any thermal bridges or voids.

3.3.4 INSTALLATION ON WALLS

3.4.1 Installation on Masonry Walls

Apply board directly to masonry with adhesive or fasteners as recommended by the insulation manufacturer. Fit between obstructions without impaling board on ties or anchors. Apply in parallel courses with joints breaking midway over course below. Put ends in moderate contact with adjoining insulation without forcing. Cut and shape as required to fit around wall penetrations, projections, or openings to accommodate conduit or other services. Seal around cut-outs with sealant. Install board in wall cavities so that it leaves at least a nominal one inch free air space outside of the insulation to allow for cavity drainage.

Insert premolded or board insulation into masonry unit hollow cores as recommended by the insulation manufacturer.

3.4.2 Adhesive Attachment to Concrete and Masonry Walls

Apply adhesive to wall and completely cover wall with insulation.

a. As recommended by the insulation manufacturer.

b. Use only full back method for pieces of one square foot or less.

c. Butt all edges of insulation and seal edges with tape.

3.4.3 Mechanical Attachment on Concrete and Masonry Walls

Cut insulation to cover walls. Apply adhesive to wall and set clip or other mechanical fastener in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners, bend split prongs flush with insulation. Butt all edges of insulation and seal with tape.

3.5 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to exterior walls or slab edges in slab-on-grade or floating-slab construction.

3.5.1 Manufacturer's Instructions

Install, attach, tape edges, provide vapor retarder and other requirements such as protection against vermin, insects, damage during construction as recommended in manufacturer's instructions.

3.5.2 Insulation on Vertical Surfaces

Install thermal insulation as indicated on exterior of foundation walls on grade beams partially below grade and on edges of slabs on grade. Fasten insulation with adhesive or mechanical fasteners.

3.5.3 Insulation Under Slab

Provide insulation horizontally under entire slab on grade for a distance as indicated. Turn insulation up at slab edge, and extend full height of slab. Install insulation on top of vapor retarder and turn retarder up over the outside edge of insulation to top of slab.

3.5.4 Protection of Insulation

Protect insulation on vertical surfaces from damage during construction and back filling by application of protection board or coating. Do not leave installed vertical insulation unprotected overnight. Install protection over entire exposed exterior insulation board.

3.6 VAPOR RETARDER

Apply a continuous vapor retarder as indicated. Overlap all joints at least 6 inches and seal with pressure sensitive tape. Seal at sill, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

-- End of Section --

SECTION 07920

SEALANTS

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 834	1991 Latex Sealants
ASTM C 920	1987 Elastomeric Joint Sealants

1.2 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Sealants

b. Primers

c. Bond breakers

d. Backstops

Data for the sealants shall include shelf life, recommended cleaning solvents, and color.

1.3 ENVIRONMENTAL CONDITIONS

The ambient temperature shall be within the limits of 40 and 100 degrees F when sealant is applied.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon. Elastomeric sealant containers shall be labeled to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 F degrees or less than 40 degrees F.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it shall be applied.

2.1.1 Interior Sealant

ASTM C 920, Type S or M, Grade NS, Class 12.5, Use NT. Location(s) and color(s) of sealant shall be as follows:

LOCATION	COLOR
a. Small voids between walls or partitions and door frames, built-in or surface-mounted equipment and fixtures, and similar items.	As selected
b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	As selected
c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	As selected
e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	As selected

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T. Location(s) and color(s) of sealant shall be as follows:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b. Masonry joints where shelf angles occur.	As selected

c. Expansion and control joints.	As selected
d. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.	As selected
e. Voids where items pass through exterior walls.	As selected
f. Metal-to-metal joints where sealant is indicated or specified.	As selected

2.1.3 Floor Joint Sealant

ASTM C 920, Type S or M, Grade P, Class 25, Use T. Location(s) and color(s) of sealant shall be as follows:

LOCATION	COLOR
a. Seats of metal thresholds for exterior doors.	As selected
b. Control and expansion joints in floors, slabs, and walkways.	As selected

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer for the particular application.

2.4 BACKSTOPS

Provide glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Backstop material shall be compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that shall be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces shall be clean, dry to the touch, and free from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. When resealing an existing joint, remove existing calk or sealant prior to applying new sealant.

3.3.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that shall be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

APPLICATION

Joint Width-To-Depth Ratios

a. Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For metal, glass or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry, or stone:		
1/4 inch (minimum)	1/4 inch	1/4 inch
Over 1/4 inch to 1/2 inch	1/4 inch	Equal to width

Over 1/2 inch to 2 inches	1/2 inch	5/8 inch
Over 2 inches	(As recommended by sealant manufacturer)	

b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding shall not be required on metal surfaces.

3.3.2 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

a. Where indicated.

b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios."

3.3.3 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.4 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

3.3.5 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified.

3.4 PROTECTION AND CLEANING

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hours then remove by wire brushing or sanding.

b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

-- 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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/DHI A115	1991 Steel Door Preparation Standards
ANSI A151.1	1987 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings

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 A 591/A 591M	1989 Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications
ASTM C 578	1992 Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	1985 Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
ASTM D 2863	1991 Measuring the Minimum Oxygen concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM E 283	1991 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

MILITARY SPECIFICATIONS (MIL)

MIL-P-21035	(Rev. B) Paint, High Zinc dust content, Galvanizing Repair (Metric)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	1992 Fire doors and Fire windows
NFPA 252	1990 Fire Tests of door Assemblies

STEEL DOOR INSTITUTE (SDI)

ANSI/SDI 100	1991 Standard Steel Doors and Frames
SDI 105	1991 Recommended Erection Instructions for Steel Frames
SDI 107	1984 Hardware on Steel Doors (Reinforcement - Application)
SDI 111B	Recommended Standard Details for Dutch Doors
SDI 111F	Recommended Completed Opening Anchors for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES INC. (UL)

UL 10B	1986 (R 1990) (Bul. 1992) Fire Tests of door assemblies

1.2 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a. Doors

b. Frames

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 (4 copies with quote)

a. Factory-applied enamel finish

Where colors are not indicated, submit manufacturer's standard colors and patterns to the Navy's Technical Representative (NTR) for selection.

1.2.3 SD-04, Drawings (4 copies each 4 weeks after order)

a. Doors

b. Frames

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

1.2.4 SD-07, Schedules (4 copies each 4 weeks after order)

a. Doors

b. Frames

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. 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

ANSI/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

ANSI/SDI 100, Grade II, Model 1, of size(s) and design(s) indicated. Provide where shown. Fill hollow steel doors with insulation.

2.1.1.2 Extra Heavy Duty Doors

ANSI/SDI 100, Grade III, Model 1, of size(s) and design(s) indicated. Provide where shown. Fill hollow steel exterior doors with insulation.

2.2 ACCESSORIES

2.2.1 Louvers

Louvers for interior doors or metal frames shall be stationary sightproof type. Weld 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 doors and panels. Louvers for exterior doors shall have steel-framed insect screens rigidly secured to louvers to permit ready removal. Provide aluminum wire cloth, 18 by 18 or 18 by 16 mesh, for insect screens. Louvers, before screening, except louvers for exterior door(s), shall have a minimum of 35 percent net-free opening. Louvers for lightroof doors shall have a minimum of 20 percent net-free opening. Louvers for exterior door(s) shall have a minimum of 30 percent net-free opening.

2.2.2 Astragals

For pairs of exterior steel doors which shall not have aluminum astragals or removable mullions, as specified in Section 08710, "Finish Hardware," provide overlapping steel astragals with the doors.

2.2.3 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. Moldings shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.3 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.

2.4 STANDARD STEEL FRAMES

ANSI/SDI 100, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, mullions, unless otherwise indicated.

2.4.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

2.4.2 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.

2.4.3 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.

2.4.3.1 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.

2.4.3.2 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 resting on and anchored to the structural slabs.

2.5 FIRE DOORS AND FRAMES

NFPA 80 and this specification. The requirements of NFPA 80 shall take precedence over details indicated or specified.

2.5.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories, Inc. (UL), Factory Mutual Engineering Corporation (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10B. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

2.5.2 Steel Astragal on Fire Doors

Astragal on pairs of labeled fire doors shall conform to NFPA 80 and UL requirements.

2.6 WEATHERSTRIPPING

As specified in Section 08710, "Finish Hardware."

2.6.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08710, "Finish Hardware." Insert gasket in groove after frame is finish painted. Air leakage of weatherstripped doors shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accord with ASTM E 283.

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 requirements of SDI 107 and ANSI/DHI A115. 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 ANSI/SDI 100, as applicable. Punch door frames, with the exception of frames that shall have weatherstripping or lightproof or soundproof gasketing, 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 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 MIL-P-21035. Phosphate treat and factory prime zinc-coated surfaces as specified in ANSI/SDI 100. Provide for all doors.

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 welded 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. Frames for use in solid plaster partitions shall be welded construction. On wraparound frames for masonry partitions, provide a throat opening 1/8 inch larger than the actual masonry thickness. Design other frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive caulking compound.

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

Set frames in accordance with ANSI/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. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.1 Frames

Set frames in accordance with ANSI/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 requiring ceiling struts of overhead bracing, anchor frames to the struts or bracing. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that steps are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in ANSI/SDI 100. After erection and glazing, clean and adjust hardware.

3.1.3 Fire Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80.

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 08331

ROLLING SERVICE 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 123	1989 (Rev A) Zinc (Hot-Dip Galvanized Coatings on Iron and Steel Products
ASTM A 525	1991 (Rev. B) 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

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA IC 1	1988 (Rev. 1-2) Industrial control and systems
NEMA IC 2	1988 Industrial control Devices, Controllers and Assemblies
NEMA IC 6	1988 (Rev. 1) Enclosures for Industrial Controls and systems
NEMA MG 1	1987 (Rev. 1-2_ Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code
NFPA 80	1992 Fire doors and fire windows

UNDERWRITERS LABORATORIES INC. (UL)

UL 506	1989 Specialty Transformers

1.2 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7 of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a. Rolling service doors

b. Motors

c. Controls

For electrically operated system, submit wiring diagrams for motor and controls.

1.2.2 SD-04, Drawings (4 copies 4 weeks after order)

a. Rolling service doors

Submit drawings for doors showing types, sizes, locations, metal gages, hardware provisions, installation details, and other details of construction. For motor-operated doors include supporting brackets for motors, location, type, and ratings of motors, and safety devices.

1.2.3 SD-06, Instructions (4 copies 4 weeks after order)

a. Rolling service doors

Submit manufacturer's currently recommended installation procedures for doors with the shop drawings.

1.2.4 SD-19, Operation and Maintenance Manuals (7 copies 4 weeks after order)

a. Rolling service doors

Submit Data Package 2, with wiring diagrams in accordance with the Basic Contract.

1.3 DELIVERY AND STORAGE

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, and in such a manner as to permit access for inspection and handling. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

PART 2 PRODUCTS

2.1 ROLLING SERVICE DOORS

Shall be spring counterbalanced, rolling type, and shall be designed for use on exterior openings, as indicated. Doors shall be operated by electric-power with auxiliary hand chain operation. Doors shall be complete with guides, hardware, fastenings, operating mechanisms, and accessories. Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position. Doors, hardware, and anchors shall be designed to withstand a basic wind speed of 90 miles per hour (MPH) without damage. This speed shall be used in computing the wind load. Wind pressure shall be computed and applied in accordance with ASCE 7. Exterior doors shall be mounted on interior side of walls.

2.2 FABRICATION

2.2.1 Curtains

Shall be formed of interlocking galvanized steel slats of shapes standard with the manufacturer, except that slats for exterior doors shall be flat type. Curtain shall roll up on a barrel supported at head of opening on brackets and be balanced by a torsional spring system in the barrel. Slats shall be of the gauge required for the width indicated and the wind pressure specified above. Vision panels shall be provided in doors where indicated. Slats for exterior doors shall be insulated with not less than 1/2 inch thick polyurethane or polyisocyanurate foam insulation. Interior side of insulation shall be covered with interlocking galvanized steel slats not lighter than 24 gauge.

2.2.2 Endlocks and Windlocks

The ends of each slat or each alternate slat shall have malleable iron or galvanized steel endlocks of manufacturer's stock design. In addition to endlocks, exterior doors which are more than 16 feet wide or which have a design wind load of more than 20 pounds per square foot, shall have windlocks or integral slat lugs of manufacturer's standard design at ends of at least every sixth slat. Windlocks or lugs shall prevent curtain from leaving guide because of deflection from wind pressure or other forces.

2.2.3 Bottom Bar

The curtain shall have a steel bottom bar consisting of two angles of equal weight, one on each side, or an equivalent extruded aluminum section, fastened to bottom of curtain. Do not use aluminum on doors more than 16 feet wide. In addition, exterior doors shall have a compressible and replaceable rubber, neoprene, or vinyl weather seal attached to bottom bar. Attach a combination compressible seal and fail-safe safety device for stopping and

reversing the travel of the door to the bottom bar of doors that are electric-power operated.

2.2.4 Guides

Steel structural shapes or formed steel shapes fastened to wall with steel shapes not less than 3/16-inch thick. Guides shall be of sufficient depth or shall incorporate a steel locking bar to retain the curtain in place under the wind pressure specified. Provide continuous vinyl or neoprene weather seals on guides at exterior doors. Securely attach guides to adjoining construction with not less than 3/8-inch diameter bolts, spaced near each end and not over 30 inches apart.

2.2.5 Barrel

Steel pipe or commercial welded steel tubing of proper diameter and thickness for the size of curtain. Deflection shall not exceed 0.03 inch per foot of span. Close ends of barrel with cast-iron plugs, machined to fit the pipe and either pinned or attached with screws in the spring barrel, except that drive end plug may be steel welded in place. Welding shall not be used on the tension end. Install within the barrel an oil-tempered, stress relieved, helical, counterbalancing steel spring, capable of producing sufficient torque to assure easy operation of the door curtain from any position. At least 80 percent of the door weight shall be counterbalanced at any position. Spring-tension shall be adjustable without removing the hood.

2.2.6 Brackets

Fabricate of steel plate or heavy cast iron to support the barrel, curtain, and operator and to form a supporting ring and end closure for the hood. Provide prelubricated, self-aligning ball bearings, shielded or sealed.

2.2.7 Hoods

Steel, not lighter than 24 gage formed to fit contour of end brackets and reinforced with steel rods, or rolled beads at top and bottom edges. Hoods for openings more than 12 feet in width shall have intermediate supporting brackets. Provide a weather baffle at the lintel or inside the hood of each exterior door.

2.2.8 Locking Device

For each manually operated exterior rolling door provide manufacturer's standard chain- or bar-type locking device on the inside. The locking device shall be of type to receive a padlock with a 5/16-inch diameter shackle.

2.3 MANUAL OPERATION

2.3.1 Manual Hand-Chain Operation

Provide galvanized, endless chain operating over a sprocket and extending to within 3 feet of floor. Obtain reduction by use of roller chain and sprocket drive or suitable gearing. Gears shall be high-grade gray iron, cast from machine-cut patterns. The pull required to operate the door shall not exceed 35 pounds.

2.4 ELECTRIC OPERATION

2.4.1 Operator Features

Provide operators complete with electric motor, machine-cut reduction gears, steel chain and sprockets, magnetic brake, overload protection, brackets, pushbutton controls, limit switches, magnetic reversing contactor, and other accessories necessary for proper operation. The operator shall be so designed that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency auxiliary operators. Make provision for immediate emergency manual operation of door by chain-gear mechanism in case of electrical failure. The emergency manual operating mechanism shall be so arranged that it may be put into and out of operation from the floor, and its use shall not affect the timing of the limit switches. Provide an electrical or mechanical device which shall disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged.

2.4.2 Motors

Shall conform to NEMA MG 1, high-starting torque, reversible type of sufficient horsepower and torque output to move the door in either direction from any position, and produce a door travel speed of not less than two-thirds foot or more than one foot per second, without exceeding the rated capacity. Motors shall be suitable for operation on current of the characteristics indicated and shall operate at not more than 3600 rpm. Single-phase motors shall not have commutation or more than one starting contact. Motor enclosures shall be the drip-proof type or NEMA TENV type. Install motors in approved locations.

2.4.3 Controls

Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, thermal-overload protection, solenoid-operated brake, limit switches, and remote control switches at locations indicated. Remote control switches shall be at least 5 feet above the floor line, and all switches shall be located so that the operator shall have complete visibility of the door at all times. The control equipment shall conform to NEMA ICS 1 and NEMA ICS 2. Control enclosures shall be NEMA ICS 6, Type 12 or Type 4, for interior locations and Type 4 for exterior locations, except that contactor

enclosures may be Type 1. Locate control switches inside the building unless otherwise indicated. Each switch control station shall be of the three-button type, with the buttons marked "OPEN,n "CLOSE," and "STOP." The "OPEN" and "STOP" buttons shall be of the type requiring only momentary pressure to operate. The "CLOSE" button shall be of the type requiring constant pressure to maintain the closing motion of the door. When the door is in motion, and the "STOP" button is pressed or the "CLOSE" button released, the door shall stop instantly and remain in the stop position; from the stop position, the door may then be operated in either direction by the "OPEN" or "CLOSE" buttons. Pushbuttons shall be full-guarded to prevent accidental operation. Provide limit switches to automatically stop the doors at their fully open and closed positions. Positions of the limit switches shall be readily adjustable.

2.2.4 Safety Device

The bottom bar of power-operated doors shall have a safety device that shall immediately stop and reverse the door in its closing travel upon contact with an obstruction in the door opening or upon failure of the device or any component of the control system and cause the door to return to its full open position. The door-closing circuit shall be automatically locked out and the door shall be operable manually until the failure or damage has been corrected. Do not use safety device as a limit switch.

2.4.5 Control Transformer

Shall be provided in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less (preferably 24 volts). The transformer shall conform to UL 506.

2.4.6 Electrical Work

Electrical components and installation shall conform to NFPA 70. The door manufacturer shall furnish manual or automatic control and safety devices, including extra flexible type SO cable and spring-loaded automatic takeup reel or equivalent device, as required for proper operation of the door. Conduit, wiring, and mounting of controls is specified in section titled "Interior Wiring Systems."

2.4.7 Hazardous Locations

Electrical materials, equipment, and devices for installation in hazardous locations, as defined by NFPA 70, shall be specifically approved by Underwriters Laboratories or an independent testing agency using equivalent standards, for the particular chemical group and the class and division of hazardous location involved.

2.5 FINISHES

Slats, steel bottom bars, and hoods shall be hot-dip galvanized and shop primed. Shop prime other parts of coiling doors, except faying surfaces.

2.5.1 Primed Finish

Clean surfaces thoroughly, treat to assure maximum paint adherence, and provide a factory dip or spray coat of rust-inhibitive metallic oxide or synthetic resin primer on exposed surfaces.

2.5.2 Galvanized and Shop-Primed Finish

Surfaces specified shall have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating shall conform to ASTM A 525, coating designation G90, for steel sheets, except that hoods located on interior of the building may be G60, and ASTM A 123 for iron and steel products. The weight of coatings for products shall be as designated in Table I of ASTM A 123 for the thickness of base metal 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 by the materials and methods conforming to ASTM A 780 and spot prime. At the option of the Contractor, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel top coat may be applied to slats before forming, in lieu of prime coat specified.

PART 3 EXECUTION

3.1 INSTALLATION

Install doors in accordance with approved detail drawings and manufacturer's directions. Locate anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories accurately. Upon completion, doors shall be weathertight and shall be free from warp, twist, or distortion.

3.2 FINAL ADJUSTMENT

Doors shall be lubricated and properly adjusted to operate freely.

-- 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.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION, INC. (BHMA)

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 A156.3	1989 Exit Devices (BHMA 701)
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
ANSI/BHMA A156.8	1988 Door Controls - Overhead Holders (BHMA 311)
ANSI/BHMA A156.12	1986 Interconnected Locks & Latches (BHMA 611)
ANSI/BHMA A156.13	1987 Mortise Locks & Latches (BHMA 621)
ANSI/BHMA A156.15	1986 Closer Holder Release Devices (BHMA 321)
ANSI/BHMA A156.16	1989 Auxiliary Hardware (BHMA 1201)
ANSI/BHMA A156.17	1987 Self Closing Hinges & Pivots
ANSI/BHMA A156.18	1987 Materials and Finishes (BHMA 1301)
ANSI/BHMA A156.21	1989 Thresholds

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	1991 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	1992 Fire Doors and fire Windows
NFPA 101	1991 Code for Safety to Life from Fire in Buildings and Structures

STEEL DOOR INSTITUTE (SDI)

ANSI/SDI 100	1991 Standard Steel Door and Frames

UNDERWRITERS LABORATORIES INC. (UL)

UL BMD	1992 Building Materials Directory
UL 14C	1979 (R 1984) Swinging Hardware for Standard Tin-Clad Fire Doors Mounted SIngly and in Pairs

1.2 SUBMITTALS

Bidders to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Hardware items

1.2.2 SD-06, Instructions (4 copies with quote)

a. Installation

1.2.3 SD-07, Schedules (4 copies with quote)

a. Hardware Schedule

b. Keying system

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

Submit key bitting charts to the Navy's Technical Representative (NTR) 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.

1.3 QUALITY ASSURANCE

1.3.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

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 item number as shown in hardware schedule. Deliver permanent keys and removable cores to the NTR, 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 FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements specified, even if such hardware is not specifically mentioned under paragraph entitled, "Hardware Schedule." Swinging hardware for tin-clad fire doors shall conform to UL 14C. Such hardware shall bear the label of Underwriters Laboratories, Inc., and be listed in UL BMD or labeled and listed by another testing laboratory acceptable to the NTR.

2.3 HARDWARE ITEMS

Hinges, locks, latches, exit devices, bolts, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it shall be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

ANSI/BHMA A1S6.1, 4 1/2 by 4 1/2 inches unless otherwise specified. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins shall be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

ANSI/BHMA A156.17.

2.3.2 Mortise Locks and Latches

ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide factory-installed lead lining in locks for lead-shielded doors. 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.

2.3.3 Auxiliary Locks

ANSI/BHMA~ A156.5, Grade 1.

2.3.4 Exit Devices

ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Touch bars may be provided in lieu of conventional crossbars and arms. Provide escutcheons, not less than 7 by 2 1/4 inches.

2.3.5 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Cylinders and cores shall have six or seven pin tumblers. Cylinders shall be products of one manufacturer, and cores shall be the products of one manufacturer. Rim cylinders, mortise cylinders, and knobs of bored locksets shall have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core. Verify with using agency.

2.3.6 Keying System

Provide an extension of the existing keying system. Existing locks were manufactured by * and have * interchangeable cores. Provide construction interchangeable cores. * Provide key cabinet as specified.

Sub-master keying system shall be provided for the building, and shall be keyed to the existing * removable-core master and grand master keying systems. Equipment spaces and mechanical rooms shall be keyed separately from the building systems, and shall be keyed alike to the existing Best master and grand master systems for these doors. * Verify with using agency.

2.3.7 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.3.7.1 Knobs and Roses

In addition to meeting test requirements of ANSI/BHMA~ A156.2 and ANSI/BE~ 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.

2.3.7.2 Lever Handles

Provide lever handles in lieu of knobs for doors which shall be accessible to handicapped persons. Lever handles for exit devices shall meet the test requirements of ANSI/BHMA. A156.13 for mortise locks. Lever handle locks shall have a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when a force in excess of that specified in ANSI/BHMA~ A156.13 is applied to the lever handle. Lever handles shall return to within 1/2 inch of the door face.

2.3.7.3 Texture

Provide knurled or abrasive coated knobs or lever handles for doors which are accessible to blind persons and which lead to dangerous areas.

2.3.8 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group. Furnish * great grand master keys, * construction master keys, and * control keys for removable cores. 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." Do not place room number on keys. * Verify with using agency.

2.3.9 Door Bolts

ANSI/BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: ANSI/BHMA A156.3, Type 25.

2.3.10 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, full size covers, except at 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.

2.3.10.1 Identification MA~king

In addition to the manufacturer's name or trademark, each closer shall bear the manufacturer's size designation where it shall be visible after installation.

2.3.11 Overhead Holders

ANSI/BHMA A156.8.

2.3.12 Closer Holder-Release Devices

ANSI/BHMA A156.15.

2.3.13 Door Protection Plates

ANSI/BHMA A156.6.

2.3.13.1 Sizes of Armor and Kick Plates

Width for single doors 8hall 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 10 inches for flush doors. Height of armor plates shall be not less

than 36 inches for flush doors, except that armor plates on fire doors shall be 16 inches high.

2.3.14 Edge Guards

ANSI/BHMA A156.6, stainless steel, of same height as armor plates. Apply to hinge stile lock stile.

2.3.15 Door Stops and Silencers

ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.16 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.

2.3.17 Weather Stripping

A set shall include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weather stripped doors shall not exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Weather stripping shall be one of the following:

2.3.17.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Aluminum shall be clear (natural) anodized.

2.3.18 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized. Set drips in sealant conforming to Section 07920, "Sealants," and fasten with stainless steel screws.

2.3.18.1 Door Rain Drips

Approximately 1 1/2 inches high by 5/8 inch projection. Align bottom with bottom edge of door.

2.3.18.2 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.

2.3.19 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.4 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. Provide fasteners of type necessary to accomplish a permanent installation.

2.5 FINISHES

ANSI/BHMA A156.18. Hardware shall have BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except surface door closers which shall have aluminum paint finish, and except steel hinges which shall have BHMA 652 finish (satin chromium plated). 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 except where BHMA 630 is specified under paragraph entitled "Hardware Sets." Exposed parts of concealed closers shall have finish to match lock and door trim.

ANSI/BHMA A156.18. Hardware shall have BHMA 612 finish (satin bronze), unless specified otherwise. Surface door closers shall have bronze paint prime coat finish. Steel hinges shall have BHMA 639 finish (satin bronze plated) BHMA 600 finish (primed for painting). 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. Hardware showing on interior of toilet rooms shall have BHMA 629 finish (bright stainless steel) or BHMA 625 finish (bright chromium plated).

2.6 KEY CABINET AND CONTROL SYSTEM

ANSI/BHMA A156.5, Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks. Verify requirement with using agency.

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. 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.

3.1.2 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 , and UL 14C for swinging tin-clad fire doors.

3.3 HARDWARE LOCATIONS

ANSI/SDI 100, unless indicated or specified otherwise.

a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.

b. Mop Plates: Bottom flush with bottom of door.

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. On tags and envelopes, indicate door and room numbers or master or grand master key.

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, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks,

and give keys to the NTR. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

Verify requirements with using agency and governing codes.

-- End of Section --

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below from 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 920	1987 Elastomeric Joint Sealants

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1025	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-28	(Rev. G) Paint, aluminum, heat Resisting (1200 DEG. F)
FS TT-P-29	(Rev. J) (Int Am. 2) Paint, Latex Base, Interior, Flat, White and Tints
FS TT-P-38	(Rev. E) Paint, Aluminum (Ready-Mixed)
FS TT-V-81	(Rev. G) Varnish: Mixing, for Aluminum Paint

FS TT-P-95	(Rev. C) (Am. 1) Paint, Rubber: For swimming Pools and Other concrete and Masonry Surfaces
FS TT-P-102	(Rev. E.) (Int Am. 1) Paint, Oil (Alkyd Modified, Exterior, White and Tints)
FS TT-V-119	(Rev. D) (Am. 2) Varnish, Spar, Phenolic-Resin
FS TT-S-176	(Rev. E) (Am. 1) Sealer, Surface, Varnish Type, Floor, wood and Cork
FS TT-T-291	(Rev F) (Int Am. 1) Thinner, Paint, Mineral spirits, Regular and Odorless
FS TT-P-320	(Rev. D) Pigment, Aluminum: Powder and Paste for Paint
FS TT-E-487	(Rev. E) (Am. 1) Enamel: Floor and Deck
FS TT-E-489	(Rev. H) Enamel, Alkyd, gloss, Low VOC Content
FS TT-E-490	(Rev. E) (Am. 3) Enamel, silicone Alkyd Copolymer, Semigloss (For Exterior and Interior Non-Residential Use)
FS TT-E-496	(Rev. B) (Am. 3) Enamel, heat-Resisting (400 DEG. F, Black)
FS TT-C-498	(Rev. C) Coating Compound, Bituminous, Fillers, solvent Type, aluminum Pigmented
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-C-542	(Rev. E) Coating, Polyurethane, Oil-Free, Moisture Curing
FS TT-E-545	(Rev. C) Primer, (Enamel-Undercoat, Alkyd, Odorless, Interior, Flat, Tints and White)
FS TT-C-555	(Rev. B) (Am. 1) coating, Textured (for Interior and Exterior Masonry Surfaces)

FS TT-P-645	(Rev. B) Primer, Paint, Zinc-Molybdate, Alkyd Type
FS TT-P-664	(Rev. D) Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant
FS TT-S-708	(Rev. A) (Am. 2) Stain, Oil: Semi-Transparent, Wood, Exterior
FS TT-S-711	(Rev. C) Stain; Oil Type, Wood, Interior
FS TT-P-00791	(Rev. B) (Am. 2) Putty: Linseed Oil Type, (For Wood-Sash-Glazing)
FS TT-P-1511	(Rev. B) Paint, Latex (Gloss and Semigloss, Tints and White) (for Interior Use)
FS TT-E-1593	(Rev. B) (Valid Notice 1) Enamel, Silicone Alkyd Copolymer, Gloss (For Exterior and Interior Use)
FS TT-P-1728	(Rev. A) (Am. 1) Paint, Latex Base, Interior, Flat, Deep-Tone
FS TT-P-001984	(Primer Coating, Latex Base, Exterior (Undercoat for wood), White and Tints
FS TT-P-001992	Stain, Latex, Exterior for wood Surfaces
FS TT-P-002119	Paint, Latex-Base, High-Traffic Area, flat and Eggshell finish (Low Lustre), (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-E-700	(Rev. A) (Am. 1) Enamel, Deck, Interior, Gray (Formula No. 20L) (Metric)
MIL-S-12935	(Rev. D) Sealer, Surface; for Knots

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
DOD-C-24667	(Am. 1) Coating System, Nonskid, for Roll or Spray Application (Metric)
MIL-P-28577	(Rev. B) Primer, Water-Borne, Acrylic or Modified Acrylic, Semigloss, for Metal Surfaces
MIL-P-28578	(Rev. B) Paint, Water-Borne, Acrylic or Modified Acrylic, Semigloss, for Metal Surfaces
MIL-P-28582	(Valid Notice 1) Primer Coating, Exterior, Lead Pigment-Free (Undercoat for Wood, Ready-Mixed, White and Tints)
MIL-C-83286	(Rev. B) (Valid Notice 1) Coating Urethane, Aliphatic Isocyanate, for Aerospace Applications

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 Paint 20	1982 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")
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

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-06, Instructions (4 copies each 1 week after order)

a. Application instructions

b. 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 (4 copies)

a. Piping and conduit identification

Submit color stencil codes.

1.2.3 SD-08, Statements (4 copies each 1 week after order)

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. Indicated 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 Navy's Technical Representative (NTR), 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 (4 copies 4 weeks after order)

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 shall 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 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.4.2 Chromate content

do not use coatings containing zinc-chromate or strontium-chromate.

1.4.3 Asbestos Content

Materials shall not contain asbestos.

1.4.4 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5 DELIVERY AND STORAGE

Deliver materials i leased, 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 NTR.

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 the 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. Removal of coatings which contain lead is specified in Section 02090, "Removal and Disposal of Lead-Containing Paint."

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 and varnishes;

b. Between 50 and 95 degrees F during the application of other coatings.

1.8 COLOR SELECTION

Colors of finish coats shall be as indicted or specified. Where 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 Paint 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 ceilings, furred spaces, attic spaces, crawl spaces, and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

1.9.3 Exterior Painting

Includes new surfaces of the building and appurtenances 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, joints, 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 of 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;

(3) New interior ferrous piping under insulation.

1.9.6 Exterior Painting of Site Work Items

Field coat the following items:

(1) Doors;

(2) Roll-up doors;

(3) New metal surfaces that have been damaged during installation.

1.9.7 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

a. Field coat the following items:

(1) Exposed mechanical and electrical 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;

(3) New interior ferrous piping under insulation;

(4) Equipment with a manufacturer's shop applied final coating.

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 AA-A-1500.

2.1.2 Deep Tone colors

Where deep tone colors are indicated or specified and a latex coating is specified, use FS TT-P-1728, in lieu of FS TT-P-29.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware accessories, machined surfaces, radiator covers, 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 w, SSPC SP 3, SSPC SP 6, or SSPC SP 10. 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 or SSPC SP 10.

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 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 comparison.

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.

b. Pretreatment: Apply DOD-P-15328 as a pretreatment on galvanized surfaces (.3 to .5 mil DFT).

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).

3.3.5 Terne-Coated Metal Surfaces

solvent clean surfaces with mineral spirits, FS TT-T-291. Wipe dry with clean, dry cloths.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Concrete and Masonry

a. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil: Wash new and existing uncoated surfaces with a solution composed of 1.2 cup trisodium phosphate, 1.4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. Wash existing coated surfaces with a suitable detergent and rinse thoroughly. For large areas, water blasting may be used.

(2) Fungus and Mold: Wash new and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

(3) Glaze and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5- to 10-percent by weight aqueous solution of hydrochloric (muriatic) acid. do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. do not acid clean more than 4 square feet of surface, per workman, at one time.

(5) Removal of Existing Coatings: For surfaces to receive textured coating FS TT-C-555, remove existing coatings including soundly adhered coatings if recommended by textured coating manufacturer.

b. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

3.5 PREPARATION OF WOOD AND PLYWOOD SURFACE (as applicable)

3.5.1 New Surfaces

New Plywood and Wood Surfaces, Except Floors, to Receive Natural Finish:

a. Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the NTR prior to receiving paint or other finish. do not use water to clean uncoated wood. Scrape to remove loose coatings. Lightly sand to roughen the entire area of previously enamel-coated wood surfaces.

b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution composed of 3 ounces (2/3 cup) trisodium phosphate, 1 ounce (1/3 cup) household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

c. Cosmetic Repair of Minor Defects:

(1) Knots and Resinous wood and Fire, Smoke, Water, and color Marker Stained Existing Coated Surface: Prior to application or paint, treat with an application of MIL-S-12935 commercially available knot sealer.

(2) Open Joints and Other Openings: fill with whiting putty, FS TT-P-00791. Sand Smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

d. Prime coat for New Exterior surfaces: Prime coat trim before wood becomes dirty, warped, or weathered.

e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.

3.6 APPLICATION

3.6.1 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 preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover the surface of the preceding coat or surface completely, ad 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.

3.6.2 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.

3.6.3 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 NTR to use thinners. The written permission shall include quantities and types of thinners to use.

3.6.4 Coating Systems

a. Systems by Substrates: apply coatings that conform to the respective specifications listed in the following Tables:

Tables

I	Exterior Metal Surfaces
II	Interior Metal Surfaces
III	Building systems Surfaces: Interior and Exterior
IV	Exterior Concrete, Concrete Masonry, Stucco, and Asbestos-Cement Surfaces
V	Interior Concrete, Concrete Masonry, Plaster and Wallboard Surfaces
VI	Exterior Wood and Plywood Surfaces

b. Minimum Dry film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise i 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, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.7 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 shall 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.

3.8 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables IV and V.

3.9 COATING SYSTEMS FOR WOOD AND PLYWOOD (as applicable)

a. apply coatings of Tables VI and VII.

b. Prior to erection, apply two coats of the specified primer to treat and prime wood and plywood surfaces which shall be inaccessible after erection.

c. Apply stains in accordance with the manufacturer's printed instructions.

3.10 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.

3.11 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 NTR. 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
A. New Steel That Has Been Blast-Cleaned (Up to SSPC SP 6)	MIL-P-28577 or MIL-P-2441/1 or*	1.5	MIL-P-28578 or MIL-P-24441/1 or*	2.0	MIL-P-28578 or MIL-P-83286 or*	2.0

*Verify requirement with using agency.

B. Existing Steel That Has Been Spot-blasted (Up to) (SSPC SP 6)	Spot Prime MIL-P-28577 1.5 on bare surface previously coated with alkyd or latex			N.A.		FS TT-E-490 or FS TT-P-19 or MIL-P-28578	1.5 1.5 1.5
	Spot Prime MIL-P-24441/1 Form. 150, on surfaces previously coated with epoxy	3.0		N.A.		MIL-P-28578 or MIL-C-83286	1.5 1.5

TABLE I

EXTERIOR METAL SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
C. New and Existing Steel That Has Been Blaster to SSPC SP 10	MIL-P-24441/1 Form. 150	3.0	MIL-P-24441/1 Form. 150	3.0	FS TT-P-19 or MIL-P-28578 or MIL-C-83286	2.0 2.0 2.0
********** GALVANIZED SURFACES **********						
D. NEW Galva-nized Surfaces	FS TT-P-19	1.5	N.A.		FS TT-P-19 or	1.5
	FS TT-P-664	1.5	FS TT-E-489	1.5	FS TT-E-489 or	1.5
	MIL-P-28577	1.5	N.A.		MIL-P-28578	1.5

*Verify requirement with using agency.

E. Galvanized Surfaces With Slight Coating Deterioration; Little or No Rusting	Spot pre-treatment, DOD-P-15328, on exposed metal	1.5	N.A.	FS TT-P-19 MIL-P-18578	1.5 1.5
				or	
	Spot Prime MIL-P-28577	3.0	N.A.	MIL-P-28578	1.5
				or	
	Spot Prime MIL-P-24441/1 Form. 150 on bare metal	3.0	N.A.	MIL-P-28578 MIL-C-83286	1.5 1.5

*Verify requirement with using agency.

TABLE I

EXTERIOR METAL SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
	********** SURFACES NOT SPECIFIED OTHERWISE **********					
H. Terne-coated and Other Metal, Except Roof Surfaces Not Specified Otherwise	FS TT-P-645 MIL-P-28577 1 coat on shop-primed surfaces and 2 coats on Non-shop primed surfaces	2.0 2.0	FS TT-E-489 FS TT-E-489 N.A.	1.5 1.5	FS TT-E-489 FS TT-E-1593 MIL-P-28578 (2 coats)	1.5 or 1.5

*Verify requirement with using agency.

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	or
	FS TT-P-645 MIL-P-28577 on non-shop-primed surfaces	1.0 2.0	FS TT-P-1511, SemiGloss	1.5	FS TT-P-1511 SemiGloss	1.5	or
	MIL-P-28577	1.5	MIL-P-28578	1.5	MIL-P-28578	1.5	

*Verify requirement with using agency

TABLE II

INTERIOR METAL SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT	
C. 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	or
	FS TT-P-645 MIL-P-28577	1.5 1.5	FS TT-P-1511 SemiGloss	1.5	FS TT-P-1511 SemiGloss	1.5	or

*Verify requirement with agency.

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. Paint copper pipe exposed in interior spaces.						
A. Surfaces Not	FS TT-P-645	2.0	FS TT-E-489 FS TT-E-1593	1.5 1.5	FS TT-E-489 FS TT-E-1593	1.5 or 1.5 or
Adjacent to Painted Surfaces			2 coats of same coating as used for coating metal in same space			
	MIL-P-28577	1.5	MIL-P-28578	1.5	MIL-P-28578	1.5
*Verify requirement with using agency.						
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					

TABLE III

BUILDING SYSTEMS SURFACES: INTERIOR AND EXTERIOR

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
C. New Exposed Exterior Piping	FS TT-P-645 1.5 MIL-P-24441/1 (2 coats)		FS TT-E-489 1.5 3.0		FS TT-E-489 1.5 MIL-P-24441/3	or 3.0
*Verify requirements with using agency.						

2. Hot Metal Surfaces, including Smokestacks

A. Surface Subject to Temperatures of 120 to 400 Degrees F	N.A.	FS TT-E-496, Type II	1.5	FS TT-E-496 Type II	1.5
		SSPC Paint 20, Type I	1.5	SSPC Paint 20, Type I	1.5
B. New Surfaces and Existing Surfaces Made Bare by Cleaning Operations Subject to Temperatures Over 400 Degrees F	N.A.	FS TT-P-28	1.5	FS TT-P-28	1.5
		SSPC Paint 20, Type I	1.5	SSPC Paint 20, Type I	1.5

3. Insulation and Surfaces of Insulation Coverings:

A. Plastic Foam Insulation	N.A.	FS TT-P-19	1.5	FS TT-P-19	1.5
B. Cloth and Paper Covering on Insulation	Glue size and primer recommended by material manufacturer, 1 coat each	N.A.		Coating to match adjacent surfaces	

TABLE IV

EXTERIOR CONCRETE, CONCRETE MASONRY, STUCCO, AND ASBESTOS-CEMENT SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
A. New Concrete Excluding Tops of Slabs and Including Soffits	CID A-A-1500, concrete					
	As recommended by FS TT-C-555 Manufacturer		FS TT-C-555, Type III (see note)		FS TT-C-555 Type II (see note)	
Note: Sufficient coats to provide not less than 20 mils of finished coating system. Texture: Sand						
B. New Concrete Masonry On Uncoated Surface	CID A-A-1500,					
	As recommended By FS TT-C-555 Manufacturer		FS TT-C-555, Type II (see note)		FS TT-C-555, Type II (see note)	
Note: Sufficient coats to provide not less than 20 mils of finished coating system. Texture: Sand						

TABLE V

INTERIOR CONCRETE, CONCRETE MASONRY, PLASTER AND WALLBOARD SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
A. Concrete not Specified Otherwise, Except Floors and Ceilings	FS TT-P-19	1.5	N.A.		FS TT-P-19	1.5
C. Concrete Except Floors, in Toilets and Other Interior High-Humidity Areas _____,	FS TT-P-19	1.5	FS TT-P-1511 SemiGloss	1.5	FS TT-P-1511 SemiGloss	1.5
D. Concrete Masonry	CID A-A-1500 *		FS TT-P-002119, Class 2		FS TT-P-002119 Class 2 "Eggshell"	
E. Concrete, Masonry in Toilets and High Humidity Areas _____, _____,	FS TT-P-19	1.5	FS TT-P-1511 SemiGloss	1.5	FS TT-P-1511 SemiGloss	1.5

*Varies. Fill all holes in surface of masonry.
*Verify requirements with using agency.

*Verify requirements with using agency.

TABLE VI

INTERIOR WOOD AND PLYWOOD SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
A. Wood and Plywood Not Specified Otherwise	FS TT-S-176 on softwood Plywood	1.5	FS TT-E-545	1.5	FS TT-E-509	1.5
	FS TT-P-001984	or 1.5	FS TT-P-1511, SemiGloss	1,5	FS TT-P-1511, SemiGloss	1.5

*Verify requirement with using agency.

-- 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-2524	Holder, Toilet Paper (Single Roll)
CID A-A-2668	Dispenser, Toilet Paper, Cabinet

FEDERAL SPECIFICATIONS (FS)

FS W-H-50	(Rev. B) Hand Drier, Blower, Electric
FS DD-M-411	(Rev. C) Mirrors, Glass
FS WW-P-541/8	(Rev. B) (Am. 1) Plumbing Fixture(Accessories, Land Use) (Detail Specification)
FS RR-A-1255	(Rev. D) Ash Receiver, Tobacco (Wall Mounted, Paraboloidal Shape, 2-Quart Capacity)

1.2 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.2.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a. Toilet Tissue Dispensers

b. Paper Towel dispensers

c. Waste Receptacles

d. Grab Bars

e. Robe Hooks

f. Soap Dispensers

g. Mirrors

h. Seat Cover dispensers

i. Ash Receiver

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. Flanges of recessed accessories to return to walls to pride a continuous, tight-against-the wall installation. 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
Aluminum	Satin Anodic, Clear
Carbon Steel	Bright chromium Plate
Copper alloy (Brass)	Bright Chromium Plate
Zinc Allow	Bright chromium Plate

2.3 MANUFACTURED UNITS

2.3.1 Toilet Tissue Dispensers (Surface Mounted)

*Note: Designer to check with using agency for type toilet tissue dispensers preferred.

2.3.1.1 Type II, Roller Mounted on single Continuous Bracket

CID A-A-2524, chromium plated steel. Holder shall consist of wall plate with

one stationary or integral post and one hinged post. Fix a roller or bar to the stationary post. The holder shall be antipilfering type.

2.3.2 Paper Towel Dispenser (Surface Mounted)

CID A-A-2380, stainless steel.

Verify type with using agency.

2.3.2.1 Type I (Single-fold Towels)

Minimum thickness of uncoated metal 0.029-inch. Satin finish stainless steel.

2.3.3 Waste Receptacles

FS WW-P-541/8, Type II. Provide reusable liner of the type standard with the receptacle manufacturer.

2.3.3.1 Mounting S, Surface Mounting

Capacity shall be not less than * cubic feet. *Verify with using agency.

2.3.4 Grab Bars

FS WW-P-541/8, Type IV, Class 2, surface mounted, stainless steel, 1 1/4 inches in diameter, with a nominal wall thickness of not less than 0.50 inch (18 gage), of the length and shape indicated, and with a nonslip finish. Grab bars and mounting devices shall be capable of withstanding a static load of 250 pounds at any point on the bar.

2.3.5 Robe Hooks

Provide two hooks integral with the wall flange. Projection shall be not less than 1 5/8 inches form the back of the wall flange to the end of the hooks. Hooks shall be stainless steel, copper alloy, or aluminum alloy.

2.3.6 Soap Dispensers

Waterless paste, circular reservoir capable of holding a 1-gallon can of such diameter integral refillable container with 40 fluid ounce capacity. Lather dispersed by spring action "push-in" valve, capacity of 10 fluid ounces powder dispersed with a soap feed mechanism and an agitator designed to break up powdered soap, capacity of 38 cubic inches of stainless steel chromium plated brass or chromium plated carbon steel chromium plated zinc die casting or plastic. Verify type preferred with using agency.

2.3.7 Mirrors

Class 2, Type E, Grade 2, electrocopper plated, conforming to FS DD-M-411, except that mirror shall be capable of being tilted forward or returned to upright position size as indicated and 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 covered 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. Verify with using agency.

2.3.8 Seat Cover Dispenser

FS WW-P-541/8, Type I, Class 2-seat cover only S, surface mounted and shall have a capacity of 200 seat covers.

2.3.9 Ash Receiver

Type I or II, Class 1 or 2, conforming to FS RR-A-1255.

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 with other trades as their work progresses. Brackets, plates, anchoring devices and similar items used for mounting accessories in showers shall be bedded in a silicone or polysulphide sealant as specified in Section 07920, "Sealants," as they are set to pride a watertight installation. 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 and plaster walls without solid

backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

-- End of Section --

SECTION 11272

JET AERATION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

Reference	Title
	NATIONAL BUREAU OF STANDARDS
PS 15-69	Custom Contact Molded Reinforced Polyester Chemical-Resistant Process Equipment
	THE SOCIETY OF THE PLASTICS INDUSTRY, INC.
	Recommended Practice for Shipping and Installation of Reinforced Plastic Pipe, Duct, and Tanks
	AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)
ASTM D3299-71	Specification for Filament-Wound Glass-Fiber Reinforced Thermoset Resin Chemical-Resistant Tanks
ASTM D4097-82	Specification for Contact Molded Glass-Fiber Reinforced Thermoset Chemical-Resistant Tanks
ASTM D-2310-80	Standard Specification Machine Mode - Reinforced Thermosetting Resin Pipe
ASTM D-2966-93 Type I Grade 2, Class F	Standard Specification for Filament Wound Reinforced Thermosetting Resin Pipe

1.2 DESCRIPTION OF WORK

Provide a complete and ready-for-operation Jet Aeration System and appurtenances to yield a complete and functional system.

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization reasonably convenient to the job site.

The Jet Aeration System shall be of the NYBRID type and shall be provided with independent mixing capacity. The system shall include a pressurized water header fed by a jet motive pump.

1.3 SUBMITTALS

All submittals shall conform to the requirements of Section C, Part 7 of the Basic Contract.

Detailed drawings and data shall be provided for the following equipment:

a. FRP Water Header with Mono Mixi-Jets and Primary Jets

b. Dry pit pump

c. Pump motor

d. Wall penetration sleeve

e. Valves

f. Interconnecting piping and fittings

g. S.S. aeration header supports with S.S. saddles

h. Electrical wires, switches, controls, etc.

i. Pressure and temperature gauges

j. System overview P&ID diagram, showing major equipment, connecting piping, valves, drains, vents, etc., and their instrumentation, electrical schematic diagram showing signal and power interconnecting wiring.

k. Scaled equipment and components, drawings, fully dimensioned with itemized bill of materials (BOM).

l. Electrical schematic and connection (point-to-point wiring) diagram.

m. Recommended Spare Parts List.

n. Installation instructions for all equipment.

o. Operations and Maintenance (O&M) manual for the complete system.

1.4 GENERAL REQUIREMENTS

Provide in accordance with Section 15010, General Mechanical and Section16011, Electrical General Requirements.

1.4.1 Service Support

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

1.4.2 Manufacturer's Nameplate

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

PART 2 PRODUCTS

2.1 GENERAL

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. Products having less than a 2-year field service record shall be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

2.1.1 Safety

2.1.1.1 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.

2.1.1.2 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."

2.1.2 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.

2.1.3 Nameplates

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.

2.1.4 Motors and Equipment

Provide motors, controllers, integral disconnects, and contactors with their respective pieces of equipment, except controllers indicated as part of the motor control centers.

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.

2.1.4.1 High Efficiency Motors

2.1.4.1.1 High Efficiency Single-Phase Motors

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

2.1.4.1.2 High Efficiency Polyphase Motors

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

2.1.5 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.

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

2.2 SPECIFICS

Components of the Jet Aeration System shall include:

a. Motive jet pumps
b. Jet aeration headers
c. S.S. aeration header supports c/w S.S. saddles

The contractor shall be responsible for the supply of all S.S. anchorages (5/8" dia. minimum) and for the complete installation of the system including all interconnecting pipes and valves.

2.2.1 Operating Conditions

The contractor shall supply Mixi-Jet header and associated equipment.

A sufficient number of jets (bi-directional) shall be supplied and preassembled on the headers to satisfy the sufficient agitation.

Mixi-Jet header will be installed in steel tank 14 feet diameter and 20 feet high.

2.2.2 Jet Header Construction

The mixing requirements must be met by a well designed/fabricated jet aeration system. The jet aeration system shall be designed to satisfy the highest quality standards of material, workmanship and assembly.

The specified type of fabrication shall permit inspection of each jet assembly and, particularly, the internal interface connections of the primary jets. The jet headers shall be fabricated in FRP. The jet assembly shall be molded in polyurethane.

To ensure maximum reliability, mixing performance, and the maintenance, this specification clearly calls for a state-of-the-art construction method which will eliminate some major potential for clogging.

Construction shall be of completely pre-molded, non-altered components. Each jet shall be pre-assembled as a unit using such components prior to being assembled with non-altered 50 psi fiberglass pipe. To achieve such modularity, all pieces must be completely molded and simply assembled to each other by socket connections. As part of a "jet module," short header sections shall also be molded using hand lay-up fabrication so that every component meets the ASTM-D-2310-80 standards. A complete structural report produced by a recognized test facility or university must be provided to the engineer by the aeration manufacturer. This report shall indicate the following items:

- Evaluation of flotation forces c/w typical calculations
- Evaluation of header deflection
- Calculation of equivalent inertia and admissible deflexion of the headers
- Calculations for maximum possible pressure

Note: These design values must be established for FRP pipe used for the headers and also for complete jet headers as a final product. This report must be signed by an independent engineer specializing in plastic material.

To comply with this specification, no component shall be subjected to any structural modification by drilling or cutting once it has been molded.

A 3-inch minimum turning radius shall be used to direct the water from the header toward each primary jet. This radius is to be measured on the water pipe diameter axis. Each primary jet shall form a smooth transition extending over a minimum length of 6 inches.

In order to provide a superior resistance to abrasion, the whole final jet assembly must be pre-molded the same way using polyurethane. FRP shall not be accepted for these parts.

After inspection, the complete jet aeration header shall be coated with a "hot coat" solution for ultra-violet protection. This solution shall be made of green paint pigment and isophtalic resin. All FRP products must use the same resin suitable for permanent immersion in water.

2.2.2.1 FRP Header

Construction shall only make use of complete pre-molded, non-altered components except the main FRP pipe headers (air and water).

Construction shall use FRP 50 psi coded pipes manufactured in accordance with ASTM-D-2310-80 standards. The water headers shall be machined with large orifices (typically 8-inch diameter) to permit special molded adapters (pre-jet) to be fitted to the header. These pieces shall be formed with a 3-inch diameter radius having a minimum opening of 4 inches to finish the internal surfaces by hand. Such large orifices shall also allow inspection of all critical sections of the water header during the assembly work. The 3-inch radius pre-jet adaptor is to be measured on the water pipe diameter axis.

After inspection, the complete jet aeration header shall be coated with a "hot coat" solution for ultra-violet protection. This solution shall be made of green paint pigment and isophtalic resin. All FRP products must use the same resin suitable for permanent immersion in water.

2.3.2.2 Jet Construction

The jet assemblies shall be made of polyurethane material for the best resistance to abrasion. FRP material shall not be accepted for these parts. They shall be premolded with special socket connections to ensure perfect geometric assembly. No drilling or cutting shall be permitted to these pieces.

2.3 SUPPORT SYSTEM FOR JET HEADERS

The jet header shall be supported at 7'0" minimum centers by 304 SS supports. These supports shall be adjustable in elevation over 8 inches (minimum). Once the jet outlet axes are adjusted to the desired level, all supports will be welded in place by the contractor who will also supply and install all anchors. These anchors shall be of the Wes-Jet type, 5/8" diameter in 304 SS material.

Each support shall be provided with dual vertical legs 30 inches (minimum) apart for maximum stability. These supports shall be designed to physically retain the water pipes and the air pipes separately. Single support around one of the header (air or water) is not acceptable.

2.4 INSTALLATION AND HANDLING OF AERATION HEADERS

The subcontractor shall be responsible for checking installation of all aeration headers (by others). All necessary precautions shall be taken to ensure that headers are uniformly supported horizontally at all times. The subcontractor shall check the anchoring, stability, and leveling of all concrete bases.

All FRP headers and pipes must be handled with care and be well supported during transport, unloading, storage and installation. Supports must be used at every 7'0" centers at all times.

When required, field connections of FRP headers will be provided by the contractor to join all piping together. These joints must be made by a recognized subcontractor specialized in FRP. Special attention must be provided to ensure that all joints are sealed and structurally compatible with the supplied FRP pipework. Leaks of any description will not be accepted.

2.5 JET MOTIVE PUMPS

Supply of the jet motive pumps shall be the responsibility of the manufacturer. The sizing and efficiency of these pumps shall meet the needs of the aeration system for:

a. Optimized energy efficiencies
   Required hydraulic conditions for optimal operation. The base-pump utilized shall not exceed 10 HP and all equipment shall operate on an electric A.C. supply source of:

   460 volts 3 phases 60 cycles

PART 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Shipment of the system will not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

3.2.1 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.

3.2.2 Installation Sequence

The equipment shall be assembled and installed by the mechanical contractor (others) in accordance with the manufacturer's drawings and instruction manuals to conform to the particular application involved with the details shown. Electrical connection will be made (by others) after the mechanical contractor completed equipment installation.

The General Contractor shall test each piece of the equipment and shall furnish written certification that it has been installed in accordance with the manufacturer's requirements, and is calibrated and ready to begin the operation.

3.3 FIELD INSPECTIONS AND TESTS

3.3.1 Inspections

Prior to initial testing, inspect jet aeration system for compliance with drawings, specifications, and manufacturer's submittals.

3.3.2 Operational Tests

Test equipment as in service to determine compliance with contract requirements and warranty. Test equipment under every condition of operation. Test safety controls to demonstrate performance of their required function. Completely test system for compliance with specifications. Test shall be witnessed by the Base's Pressure Vessel Certifier.

3.4 INSTRUCTION TO GOVERNMENT PERSONNEL

Furnish the services of competent instructors to give full instructions 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.

SECTION 11300

GROUNDWATER FEED TANK AND APPURTENANCES

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A-167-97	Specifications for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM C581-83	Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures, Intended for Liquid Service
ASTM D570-81	Test Method for Water Absorption of Plastics
ASTM D790-84a	Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating
ASTM D883-85	Definitions of Terms Relating to Plastics
ASTM D4097-82	Specification for Contact Molded Glass-Fiber Reinforced Thermoset Chemical-Resistant Tanks
ASTM D2583-81	Test Method for Indentation Hardness of Rigid Plastic by Means of a Barcol Impresser
ASTM D3299-81	Specification for Filament-Wound Glass-Fiber Reinforced Thermoset Resin Chemical-Resistant Tanks
ASTM E84-84	Test Method for Surface Burning Characteristics of Building Materials

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Section X	Boiler and Pressure Vessel Code

NATIONAL BUREAU OF STANDARDS (NBS)

PS 15-L9	Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment

SOCIETY OF THE PLASTICS INDUSTRY (SPI)

Recommended Practice for Shipping and Installation of Reinforced Plastic Pipe, Duct, and Tanks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

30-87 Flammable and Combustible Liquids Code

1.2 DESCRIPTION OF WORK

Provide a complete and ready for operation Groundwater Storage Tank (T-110) and appurtenances to yield a complete and functional system.

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is reasonably convenient to the job site. Equipment of the same types shall be the product of one manufacturer.

1.3 SUBMITTALS

The Groundwater Feed Tank manufacturer shall provide information in accordance with the Vendor Data Requirements form.

The manufacturer shall provide manufacturer's catalogs, installation instructions and general arrangement drawings in accordance with Section 02901 Groundwater Feed Tank and related equipment including:

a. Tank
b. Vent
c. External connections
d. Liquid level controls mounting brackets
e. Anchor bolt sizing and placement details
f. Tank finish
g. Tank grounding
h. Tank foundation/support requirements

Drawings of tank foundation and support requirements shall include quantity, size, material, and locations of all flanges, nozzles, manways, instruments, vents and other appurtenances.

1.3.1 Equipment Delivery, Storage, Handling

During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment. The manufacturer shall coordinate shipping and delivery with the General Contractor to minimize delivery vehicle demurrage and ensure that proper unloading equipment and a field installation crew are at the job site upon arrival.

1.4 GENERAL REQUIREMENTS

Provide in accordance with Section 15010, "General Mechanical", and Section 16011, "Electrical General Requirements."

PART 2 PRODUCTS

2.1 GENERAL TANK REQUIREMENTS

The Groundwater Feed Tank shall be constructed of cross-linked polyethylene materials capable of resisting site contaminants at the following concentrations in µg/L:

Vinyl Chloride	800
Trichloroethene	58,000
1,2-Dichloroethene	30,000
1,2-Dichloroethane	30
Tetrachloroethene	920
Ethylbenzene	52

2.2 GROUNDWATER FEED TANK

2.2.1 Dimensions

The Groundwater Feed Tank (T-110) shall be the manufacturer's standard design not to exceed 17 ft. with a nominal capacity of approximately 20,000 gallons with 24 inches of freeboard remaining. The tank shall be mounted on a flat concrete foundation provided by the General Contractor. The floor shall be grouted by the General Contractor after installation to provide a minimum 1 degree slope from one side to a 3 inch diameter siphon drain.

2.2.2 Side Wall Flange Connections

Three (3) 4" diameter, three (3) 1-1/2" diameter, three (3) 3" diameter, one (1) 10" diameter and three (3) 8" diameter flat faced flanged pipe connections shall be provided with the tank as shown on the data sheets. Two (2) 24" manways also shall be provided. All flange connections shall protrude from the outside tank sidewall a minimum of 6 inches.

2.2.3 Internals

The General Contractor shall install the jet mixing pump piping and supports inside the Groundwater Storage Tank after grouting.

Bolt heads shall be internal and sealed with polyethylene.

2.3 CONTROL SYSTEMS

Two (2) ball type, side-mount level switches (high and high high) shall be provided for the tank by the General Contractor. One (1) level indicator/ transmitter also shall be provided with a high and low level alarm in the treatment control system by the General Contractor. One temperature indicator shall be provided with the tank by the General Contractor. All controls shall be configured as depicted on the drawings or data sheets.

PART 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Shipment of the item will not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

The tank manufacturer shall provide all labor, tools that are normally supplied by the tank manufacturer, and materials to install the tank and all loose appurtenances. Following installation, neat cement grout shall be added by the General Contractor to the interior to provide a 1 degree slope to the drain nozzle.

Precision gauges and levels shall be used in setting the tank. The tank shall be properly anchored to the tank pad in accordance with the manufacturer's recommendations.

Tanks and supports shall be grounded to the grounding grid.

Electrical and instrumentation equipment shall be grounded in accordance with local electrical standards and instrument manufacturer recommendations.

-- End of Section --

VENDOR DATA REQUIREMENTS GROUNDWATER STORAGE TANK	PROJECT: CAMP LEJEUNE	PREPARED BY: D. RUBIN
	PROJECT NO.: 16032	DATE: 9/28/94
	PURCHASE ORDER:	REVISION: B
M NO: T-110	RFQ NUMBER: 91580	CHECKED BY:

DATA AND DRAWINGS REQUIRED	WITH BID		ARO			ARAD			PTS		
	Q	T	Q	T	S	Q	T	S	Q	T	S
1. DIMENSIONED OUTLINE DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
2. CROSS SECTIONAL DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
3. COMPLETED DATA SHEETS	4	X									
4. PERFORMANCE CURVES											
5. CATALOG INFORMATION, CUTS, ETC.	4	X									
6. FOUNDATION DIAGRAMS AND LOADING	2	X									
7. SCHEMATIC PIPING DRAWINGS											
8. SCHEMATIC WIRING DIAGRAMS											
9. ASSEMBLY/ARRANGEMENT DRAWINGS			2	P	2W						
10. COMPONENT/SHOP DRAWINGS											
11. DETAILED PARTS LIST											
12. RECOMMENDED SPARE PARTS											
OPERATION AND MAINTENANCE MANUALS									7	X	4W
INSTALLATION INSTRUCTIONS									4	X	4W
15. MILL TEST CERTIFICATES WITH HEAT NO.											
16. ENGINEERING, FABRICATION SCHEDULE			2	C	5D						
17. WELDING PROCEDURES											
18. SHIPPING SCHEDULE											
19. WEIGHT LIST OF FABRICATED PARTS FOR ERECTION									2	X	
20. UNIT SHIPPING WEIGHT, ERECTED WEIGHT									2	X	
21. DRAWING LIST											
22. INSTRUMENT LIST/INDEX											
23. ASME CODE CALCULATIONS											
24. SERIAL NUMBER-TAG NUMBER CROSS REFERENCE											
25. ON SITE PREPARATION REQUIREMENTS	2	X									
26. ERECTION EQUIPMENT REQUIRED AT SITE	2	X									

ALL SUBMITTAL TO BE DELIVERED TO:
M REMEDIATION SERVICES CORP.
5 TRIANGLE PARKWAY
NORCORSS, GEORGIA 30092

LEGEND: Q-QUANTITY S-SCHEDULE = W-WEEKS D-DAYS
T-TYPE = P-PRINT C-CERTIFIED REPRODUCIBLE X-PHOTOCOPY
R-REPRODUCIBLE F-DXF CAD FILE
ARO - AFTER RECEIPT OF ORDER PTS-PRIOR TO SHIPMENT
ARAD - AFTER RECEIPT OF APPROVED DRAWINGS

SECTION 11302
INITIAL/FINAL pH ADJUST STORAGE TANKS AND CHEMICAL FEED SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A-167-97	Specifications for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM C581-83	Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures, Intended for Liquid Service
ASTM D570-81	Test Method for Water Absorption of Plastics
ASTM D790-84a	Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating
ASTM D883-85	Definitions of Terms Relating to Plastics
ASTM D4097-82	Specification for Contact Molded Glass-Fiber Reinforced Thermoset Chemical-Resistant Tanks
ASTM D2583-81	Test Method for Indentation Hardness of Rigid Plastic by Means of a Barcol Impresser
ASTM D3299-81	Specification for Filament-Wound Glass-Fiber Reinforced Thermoset Resin Chemical-Resistant Tanks
ASTM E84-84	Test Method for Surface Burning Characteristics of Building Materials

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Section X	Boiler and Pressure Vessel Code

NATIONAL BUREAU OF STANDARDS (NBS)

PS 15-L9	Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment

SOCIETY OF THE PLASTICS INDUSTRY (SPI)

Recommended Practice for Shipping and Installation of Reinforced Plastic Pipe, Duct, and Tanks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

30-87 Flammable and Combustible Liquids Code

1.2 DESCRIPTION OF WORK

Provide complete and ready for operation sodium hydroxide and sulfuric acid feed systems storage tanks, and appurtenances to provide complete and functional systems.

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is reasonably convenient to the job site. Equipment of the same type shall each be the product of one manufacturer.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.3.1 Manufacturer's Catalog Data

Provide manufacturer's data on the Initial and Final Adjust Tanks, Chemical Feed Systems and related control equipment.

1.3.2 Drawings

Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings of the Initial and Final pH Adjust Tanks and Chemical Feed equipment including:

a. Tank
b. Vent
c. External connections
d. Liquid level controls mounting brackets
e. Anchor bolt sizing and placement
f. Tank finish
g. Tank grounding
h. Tank foundation/support requirements

Shop drawings shall include quantity, size, material, and locations of all equipment. Shop drawings shall include wiring diagrams of control equipment.

1.3.3 Instructions

Two printed copies of the installation procedures shall be furnished prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 Operation and Maintenance Manuals

Provide O&M manuals for the caustic and acid feed systems.

1.3.5 Equipment Delivery, Storage, Handling

The Contractor shall be responsible for proper packaging and protection of all materials to prevent damage during shipping, handling, and storage. As material arrives on-site, it shall be inspected for compliance with "Recommended Practices for Shipping and Installation of Reinforced Plastic Pipe, Duct and Tanks," The Society of the Plastics Industry, Inc. The equipment shall be protected during shipment and storage.

During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment.

1.4 GENERAL REQUIREMENTS

Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "General Electrical Requirements."

PART 2 PRODUCTS

2.1 GENERAL TANK REQUIREMENTS

The Initial (T-130) and Final (T-200) pH Adjust Storage Tanks shall be constructed of cross-linked polyethylene materials.

2.2 INITIAL AND FINAL pH ADJUSTMENT STORAGE TANKS

2.2.1 Dimensions

The Initial (T-130) pH Adjust Storage Tank shall be 5'-4" overall diameter by 6'-5" overall height with a nominal capacity of approximately 1,000 gallons. The final (T-200) pH Adjust Storage Tank shall be 8'-0" overall diameter by 5'-9 1/2" overall height with a nominal capacity of 2,000 gallons. Both tanks shall be flat-bottomed with dished cover.

2.2.2 Lift Lugs

Two (2) lift lugs shall be furnished with each tank to facilitate on-site handling.

2.2.3 Control Systems

Contractor shall provide one (1) level indicator/transmitter control system as indicated on the drawings. Level sensors should operate on a capacitance basis.

2.3 NaOH FEED SYSTEM

2.3.1 Dilution Water Connection

Contractor shall provide and install a block valve for on-off control of dilution water as shown on the drawings.

2.3.2 Pumps

The NaOH pump shall be an integral part of the NaOH Feed System, shall have teflon internals, and shall have variable speed remote 4-20 mA control.

2.3.3 Reaction Tank (X-130)

The Reaction tank shall provide for intimate mixing of the concentrated NaOH with water. The tank shall be constructed of a material resistant to caustic solutions. A mechanical mixing devise shall be provided which is adequately sized based on tank dimensions.

2.3.4 Controls

Control of chemical feed pumps shall be as indicated.

2.4 SULFURIC ACID FEED SYSTEMS

2.4.1 Dilution Water Connection

Contractor shall provide and install a valve for on-off control of dilution water as indicated.

2.4.2 Pump (P-211)

The sulfuric acid feed pump shall be an integral part of the sulfuric acid feed system, shall have teflon internals, and shall have variable speed remote 4-20 mA control.

2.4.3 Controls

Control of chemical feed pumps shall be as indicated.

PART 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the equipment being installed. Installation of the item shall not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

Tanks shall be installed true and level. Precision gauges and levels shall be used in setting the tanks. Tanks shall be properly anchored to the building floor in accordance with the manufacturer's recommendations.

Tanks and supports shall be grounded to the grounding grid.

Electrical and instrumentation equipment shall be grounded in accordance with local electrical standards and instrument manufacturer's recommendations.

-- End of Section --

SECTION 11303

POLYMER FEED SYSTEM

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167-91 Specifications for stainless and heat-resisting chromium-nickel steel plate, sheet, and strip.

1.2 DESCRIPTION OF WORK

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is, in the opinion of the NTR, reasonably convenient to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.2.1 System Composition

Provide, complete, and ready for operation, a compact polymer feed system (X 132)to automatically meter, blend, mix and emulsify polymer with dilution water. One (1) metering drum pump capable of providing 0.5 to 1.0 gpm of concentrated polymer shall be provided.

1.2.2 System Requirements

The unit shall operate on 120V/60Hz/1 phase power. The entire system shall be tested to 125 psig and able to withstand sustained pressure of 50 psig. The polymer feed system shall be capable of mixing and diluting liquid polymers.

1.2.3 Polymer Feed System Requirements

Polymer Feed System shall be an integrated equipment package to automatically meter, dilute, activate, and feed liquid polymer and water. Units that employ thin-film mixing combined with in-line mixing and followed by a detention/aging chamber, providing an environment that prevents degradation of the long-chain polymer molecules are acceptable. Units that rely on the shearing action of a centrifugal mixing pump or a high-speed, high-shear impeller turbine to mechanically mix polymer shall not be allowed.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 Manufacturer's Catalog Data

Provide manufacturer's data on the polymer feed system.

1.3.2 Drawings

The Contractor shall submit for approval shop drawings of the polymer feed system equipment. These drawings shall be submitted prior to the ordering of any polymer feed system equipment.

1.3.3 Instructions

Six printed copies of the installation procedures shall be furnished prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 Operation and Maintenance Manuals

Provide Operation and Maintenance data for the polymer feed system.

1.4 EQUIPMENT DELIVERY, STORAGE, HANDLING

During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment.

1.5 GENERAL REQUIREMENTS

Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "Electrical General Requirements."

PART 2 PRODUCTS

2.1 DILUTION WATER CONNECTION

Each unit shall incorporate a block valve for on-off control of dilution water.

2.3 POLYMER DRUM PUMP

The polymer drum pump shall be supplied by the polymer feed system manufacturer as an integral part of the system and shall be 316 stainless steel gear type with variable speed remote 4-20 mA control. The pump shall be

capable of pumping highly viscous concentrated polymers without causing excessive shear.

2.5 CONTROLS

Control of polymer feed pumps shall be as required by the Contractor to complete a fully functional, automatic polymer feed system.

2.7 ACCESSORIES

2.7.3 Calibration Column

Provide a clear plastic or polypropylene calibration column for periodic calibration of the metering pumps. The column shall be 1,000 ml and also include an inlet tee with charging valve.

2.7.4 Drumpipe-Standpipes

Provide one (1) rigid standpipe with adapter fitting for insertion into the bung of a standard 55-gallon drum. The 2-inch fitting on the end of the standpipe shall have a barbed connector to accept 5/8 inch I.D. tubing.

2.7.5 55 Gallon Drum Dolly

Provide one drum dolly to store and move 55 gallon drums while in the vertical position. Dolly shall be 304 stainless steel with four (4) casters consisting of 304 stainless steel rim with a solid rubber tire, unless otherwise approved.

2.7.6 55 Gallon Drum Cart

Provide one (1) combination drum cart and cradle. The cart shall have wheels for moving of drums and a cradle to tilt and hold the drum in the horizontal position for complete draining.

PART 3 EXECUTION

3.1 INSTALLATION

Check-out of final installation, start-up, calibration and instruction of operating personnel shall be performed in accordance with recommendations.

-- End of Section --

SECTION 11304

INCLINED PLATE CLARIFIER AND APPURTENANCES

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 506	Specifications for Regular Quality Hot Rolled or Cold rolled Alloy Steel Sheet and Strip

1.2 DESCRIPTION OF WORK

The Inclined Plate Clarifier and appurtenances shall be furnished and assembled to provide a complete and functional system. Equipment details are provided in Section 2 below and on construction drawings.

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is, in the opinion of the NTR, reasonably convenient to the jobsite. Equipment of the same types shall each be the product of one manufacturer.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 Manufacturer's Catalog Data

a. Tank mixers

b. Inclined plate clarifier

1.3.2 Drawings

Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings of the inclined plate clarifier and related equipment including:

a. Mixing chamber
b. Flocculation chamber
c. Bolt down cover
d. Plate packs
e. Vents

f. External connections
g. Anchor bolt sizing and placement
h. Tank finish
i. Tank grounding
j. Tank mixers
k. Tank foundation/support requirements

Shop drawings shall include quantity, size, material, and locations of all equipment.

1.3.3 Instructions

Two printed copies of the installation procedures shall be furnished to the NTR prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 Operation and Maintenance Manuals

Provide O&M manuals for the inclined plate clarifier mixers and control equipment. Data Package 3.

1.4 EQUIPMENT DELIVERY, STORAGE, HANDLING

During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment.

1.5 GENERAL REQUIREMENTS

Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "Electrical General Requirements."

PART 2 - PRODUCTS

2.1 GENERAL

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. Products having less than a 2-year field service record shall be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

2.2 INCLINED PLATE CLARIFIER

2.2.1 Dimensions

The inclined plate clarifier (X-131) and associated mixing and flocculation (X-130) chambers shall not exceed the dimensions shown on the design Drawings, unless approved by the NTR. The tanks shall be constructed of carbon steel. The inclined plate clarifier shall be sized at a flow rate no greater than 1.0 gpm per square foot of settling area.

2.2.2 Filter Plate

Inclined plates shall consist of smooth surfaced polypropylene plates, stainless steel rods, and PVC spacers, assembled into packs. Plate packs shall be cleanable in place and shall be removable, if necessary. Plate packs shall be equipped with lifting eyes. Plates shall be sloped to a 55 degree angle from the horizontal.

2.2.3 Cover

The tank shall be equipped with a plexiglass bolt-down cover.

2.2.4 Flange Connections

Conically gussetted flange connections shall be furnished on the outside tank sidewall for connection of the mixing chamber, flocculation chamber and clarifier piping as needed.

2.2.5 Hold Down Legs

The inclined plate clarifier shall be furnished with four (4) equally spaced light duty hold down legs. Legs shall be type 304 stainless steel and shall be welded the tank.

2.3 FLOCCULATION MIXER

The flocculation chamber shall be equipped with a slow variable speed flocculation mixer appropriately sized for the dimensions of the tank. Motor shall be driven, capable of maintaining homogeneous solutions of polyelectrolytes at viscosities up to 500 CP. Mixer shall be suitable for 24 hr/day operation.

2.3.1 AGITATOR

The mixing chamber shall be furnished with an agitator, appropriately sized for the dimensions of the tank.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Installation of the item will not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

Precision gauges and levels shall be used in setting the units. The unit shall be properly anchored to the building floor in accordance with the manufacturer's recommendation. Tanks and supports shall be grounded to the grounding grid.

Electrical and instrumentation equipment shall be grounded in accordance with local electrical standards.

-- End of Section --

SECTION 11307

AIR STRIPPER AND HOLDING TANK

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 506	Specifications for Regular Quality Hot Rolled or Cold Rolled Alloy Steel Sheet and Strip
ASTM D 2103	Specification for Polyethylene Film and Sheeting
ASTM D 3299	Specification for Filament Wound Reinforced Thermoset Resin Chemical Resistant Tanks
ASTM D 4097	Specification for Contact Molded Glass Fiber Reinforced Thermoset Resin Chemical Resistant Tanks

1.2 DESCRIPTION OF WORK

The manufacturer shall provide complete and ready for operation, one packed bed air stripper (C-200) system, complete with effluent holding tank (T-220) cover with mist eliminator, high efficiency packing material, blower (K-200), holding tank level controls, pressure gauges, pressure switches, and all other appurtenances as specified herein required to yield a properly functioning air stripping system.

Material and equipment shall be new and shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is reasonably convenient to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.3 SUBMITTALS

The air stripper manufacturer shall submit the data required in accordance with the Vendor Data Requirement form.

The manufacturer shall submit general arrangement drawings showing plan and elevation of all equipment, instruments and appurtenances, installation instructions, O&M manuals in accordance with Section 02901.

1.4 DELIVERY, STORAGE, AND HANDLING MATERIALS

1.4.1 Delivery

During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment. If internal bracing requires removal prior to operation, the items containing such bracing shall have orange warning placards with 4-inch block lettering taped to the sides. Bracing to be removed shall be tagged with bright orange tags or spray paint. If special shipping and handling precautions are required, prominently and legibly stencil such precautions on the outside of the equipment or its crating. Instruments, controls, and other loose appurtenances shall be tagged and crated to prevent damage during shipment and loss on arrival. Any such crates shall be securely fastened to the delivery vehicle.

The air stripper manufacturer shall be responsible for coordinating delivery with the General Contractor in order to minimize demurrage of on-site lifting equipment and delivery vehicles. The air stripper manufacturer's factory representative provided for installation supervision shall be present to inspect the equipment upon arrival.

1.4.2 Storage and Handling

Material shall be inspected upon delivery to the site for damage, unloaded and stored (if required) with minimum handling. Materials shall be stored on-site in enclosures or under protective coverings. Materials not suitable for indoor storage shall be protected to prevent damage during periods of inclement weather, including, but not limited to, subfreezing temperatures, precipitation, and high winds. Materials susceptible to damage by sunlight shall be stored under cover to avoid damage due to high temperatures. Materials shall not be stored directly on the ground.

PART 2 PRODUCTS

2.1 AIR STRIPPER AND HOLDING TANK

2.1.1 Performance Requirements

The air stripper shall meet all of the following performance criteria rates (concentrations in µg/L or parts per billion):

Contaminant	Air Stripper Influent	Air Stripper Effluent
1,2-Dichloroethane	30	0.38
1,2-Dichloroethylene (T)	30,000	70.0
Ethylbenzene	52	29.0
Tetrachloroethene	920	0.7
Trichloroethylene	58,000	2.8
Vinyl Chloride	800	1.4

Temperature: 55 Degrees F
Influent Design Flow Rate: 500 gpm
Influent Operating Flow Rate: 465 gpm
Wind Loading: 100 mph

If any effluent limit is not met at any time during a period of 90 days after start of operations, the air stripper manufacturer shall be responsible for all costs involved with retrofitting or replacing the noncomplying unit, as required to meet the effluent discharge requirements specified above. If any component fails structurally within five years of the date of erection, the air stripper manufacturer shall be responsible for all costs involved with repairing, retrofitting or replacing the failed component.

2.1.2 Components

The Air Stripper system consists of the packed tower (C-200), effluent holding tank (T-220), cover with mist eliminator, blower (K-200), and pump controls. The blower shall be protected by a removable shroud. The holding tank, air stripper shell, feed pipe, packing supports, cover and blower shroud shall be constructed of fiberglass reinforced polyester (FRP).

All components, controls and appurtenances shall be designed for outdoor installation, with a minimum temperature of 15 degrees F and a maximum temperature of 110 degrees F.

2.1.3 Blower

The air stripper manufacturer shall supply the blower. The blower shall be powered by a 230 VAC, 3-phase TEFC motor and shall be capable of providing the required air flow rate to the column such that the stripper effluent water meets the limits set in Section 2.1.1 of this specification. The air stripper manufacturer shall determine final air flow, horsepower, and discharge pressure requirements of the blower subject to the restriction that the maximum air to water ratio is 70:1. The air stripper manufacturer shall be responsible for fan sizing and selection. The air blower shall be equipped with a 50 micron, disposable inlet filter to remove airborne particulates. The air blower shall be belt-driven, mounted on a support pad provided by the General Contractor and shall be provided with horizontal position discharge. The air stripper blower will be mounted within twenty feet of the air

stripper. The air blower shall be surrounded by a corrosion resistant enclosure and be suitable for outdoor installation. The blower shall be New York Blower, Cincinnati Fan, or Robinson. The air blower shall be steel housing/aluminum wheel or FRP. The contractor shall supply the duct work necessary to connect the air blower to the air stripper. The air blower bearings shall have a minimum BIO life of 50,000 hours.

2.1.4 Level

The system shall be equipped by the General Contractor with HI-LO/HI-OVERRIDE sump level sensors that control the air stripper influent and effluent pumps. The top sensor shall actuate the HI-OVERRIDE. If the sump should become full, the rising water level will stop the air stripper feed pump. The other level sensors shall control operation of the effluent pump by actuating HI and LO switches. The effluent pump shall start when receiving a signal from the HI switch and continue to run until the water level drops to the LO switch.

2.1.5 Air Stripper Effluent Holding Tank (T-220)

The air stripper manufacturer shall supply the effluent holding tank. The holding tank (sump) shall be a flat bottomed, closed top tank serving to collect treated water. It shall have a minimum volume of 1,000 gallons with a 24 inch freeboard above the operating level and approximate dimensions of 8 feet diameter by 5 feet high. This tank shall be attached to the bottom of the air stripping column and shall have fittings as indicated in the drawings. Final locations, sizes, and dimensions for connections shall be as shown on the data sheets.

2.1.6 Packing Material

The air stripper manufacturer shall supply the packing material. Packing material shall be of minimum nominal 2-inch, random type, and constructed of polyethylene (conforming to ASTM D-2103). Packing shall be randomly placed within the column prior to shipment. Water shall be redistributed over the cross sectional area of the tower at least once to minimize the effects of channelling on removal efficiency.

2.1.7 Cover

The air stripper manufacturer shall supply a flanged and bolted cover to inhibit entrance of large airborne particulates and insects. Cut-outs shall be covered by 1/16-inch screen.

2.1.8 Gauges

The air stripper manufacturer shall provide a Dwyer magnehelic pressure gauge mounted locally to monitor pressure in inches of water column and a locally mounted indicating flowmeter to monitor air flow rate in SCFM.

2.1.9 Pressure Switches

Low and High Pressure switches shall be provided by the General Contractor to monitor the pressure generated by the blower. In the event of a blower failure, the Low Pressure switch shall shut off the air stripper feed pump. The High Pressure switch shall activate a visual and audible alarm.

2.1.10 System Controls

The air stripper system controls shall be supplied and installed by the General Contractor as indicated.

2.1.11 Other Appurtenances

The air stripper manufacturer shall supply other appurtenances as follows: The air stripper shall be supplied with an 8 inch diameter inlet pipe that is securely anchored to the side wall of the shell. The inlet line shall be provided with a Class 150 pound flange and shall terminate with an elbow as shown on the data sheet.

Access ladders and platforms shall be provided in accordance with OSHA standards to provide access to the packing and top fixtures.

The air stripper shall be provided with two (2) equally spaced 8-inch diameter nozzles with clear lexan (or equal) covers to serve as sight glasses to observe the condition of the packing.

The air stripper manufacturer shall furnish two sets of BUNA-N gaskets for each flange including field connection points. The air stripper shall be equipped with a mesh type mist eliminator that shall remove a minimum of 95% of all 250 micron and larger entrained water droplets.

The holding tank shall be equipped with a clear, side-mounted pipe to serve as a sight glass. A 6-inch siphon drain shall also be provided in the holding tank.

2.1.12 Packing Supports

Packing supports shall be specified and supplied by the air stripper manufacturer and designed for minimum pressure drop and adequate gas flow distribution. The dead load structural strength of the free span shall be a minimum of 1.2 times the weight of the packing plus 30% liquid hold up.

2.1.13 Liquid Distributor

The air stripper manufacturer shall provide the liquid distributor. Even liquid distribution shall be provided by a multiple spray nozzle arrangement or V-Notch cascade trough arrangement. The liquid distributor shall be supported at multiple points such that the liquid distributor imposes no mechanical loads on the supply pipe.

2.1.14 Materials of Construction

The air stripper, holding tank, supply pipe, liquid distributor, and packing supports shall be constructed from fiberglass reinforced polyester resins Ashland Hetron, Dow Derekane, or Atlas Atlac, of the appropriate type to provide a minimum 10 year life and protection against the contaminants listed in Section 2.1.1. Liquid contact surfaces shall be provided with a minimum 10 mil reinforced surface veil and 100 mil vinyl ester corrosion barrier supported by high strength reinforced isophthalic structural support. External FRP surfaces shall be finished in a beige gel coat with UV inhibitors.

2.2 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B-117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 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.

2.2.1 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces, except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint. 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. Immediately after cleaning, metal surfaces 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.

PART 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Installation of the air stripper and holding tank will not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

Precision gauges and levels shall be used in setting all equipment.

3.3 MANUFACTURER'S REPRESENTATIVE

The air stripper manufacturer shall furnish the services of a qualified and experienced representative for two, eight-hour working days to inspect the equipment on arrival and supervise erection. A second two-day service visit to inspect, test, and start-up the installation and to instruct operating personnel in the operation and maintenance of component equipment shall be scheduled after systems installation is complete.

3.4 FIELD TESTING AND INSPECTION

All work shall be in accordance with the drawings and specifications. All defects disclosed by the tests shall be corrected by the Manufacturer. The air stripper shall be subjected to an operational test to demonstrate compliance with specification requirements. The NTR shall be notified in writing 14 days prior to field testing. Tests shall be conducted under design conditions to ensure proper operation of all equipment. All appliances, materials, and equipment for testing shall be provided by the General Contractor and all travel expenses in connection with the testing shall be borne by the General Contractor. Testing shall be conducted after all equipment is properly installed and electrical services are installed. All defects discovered with the manufacturer's equipment shall be corrected to the satisfaction of the NTR, and all tests repeated at the expense of the manufacturer, until the equipment is in proper working order.

VENDOR DATA REQUIREMENTS AIR STRIPPER	PROJECT: CAMP LEJEUNE	PREPARED BY: D. RUBIN
	PROJECT NO.: 16032	DATE: 9/28/94
	PURCHASE ORDER:	REVISION: B
EM NO: C-200, T-220, K-200	RFQ NUMBER: 91581	CHECKED BY:

DATA AND DRAWINGS REQUIRED	WITH BID		ARO			ARAD			PTS		
	Q	T	Q	T	S	Q	T	S	Q	T	S
1. DIMENSIONED OUTLINE DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
2. CROSS SECTIONAL DRAWINGS											
3. COMPLETED DATA SHEETS	4	X									
4. PERFORMANCE CURVES (FAN ONLY)	4	X									
5. CATALOG INFORMATION, CUTS, ETC.	4	X									
6. FOUNDATION DIAGRAMS AND LOADING	2	X									
7. SCHEMATIC PIPING DRAWINGS											
8. SCHEMATIC WIRING DIAGRAMS											
9. ASSEMBLY/ARRANGEMENT DRAWINGS (IN 13)											
10. COMPONENT/SHOP DRAWINGS (IN 13)											
11. DETAILED PARTS LIST (IN 13)											
12. RECOMMENDED SPARE PARTS (IN 13)											
OPERATION AND MAINTENANCE MANUALS									7	X	
14. INSTALLATION INSTRUCTIONS									4	X	4W
15. MILL TEST CERTIFICATES WITH HEAT NO.											
16. ENGINEERING, FABRICATION SCHEDULE			2	C	5D						
17. WELDING PROCEDURES											
18. SHIPPING SCHEDULE											
19. WEIGHT LIST OF FABRICATED PARTS FOR ERECTION									2	X	4W
20. UNIT SHIPPING WEIGHT, ERECTED WEIGHT									2	X	4W
21. DRAWING LIST											
22. INSTRUMENT LIST/INDEX											
23. ASME CODE CALCULATIONS											
24. SERIAL NUMBER-TAG NUMBER CROSS REFERENCE											
25. PROCESS CALCULATIONS	4	X									
26. STRUCTURAL CALCULATIONS			2	C	2W						

ALL SUBMITTAL TO BE DELIVERED TO:
M REMEDIATION SERVICES CORP.
5335 TRIANGLE PARKWAY
NORCORSS, GEORGIA 30092

LEGEND: Q-QUANTITY S-SCHEDULE = W-WEEKS D-DAYS
T-TYPE = P-PRINT C-CERTIFIED REPRODUCIBLE X-PHOTOCOPY
R-REPRODUCIBLE F-DXF CAD FILE
ARO - AFTER RECEIPT OF ORDER PTS-PRIOR TO SHIPMENT
ARAD - AFTER RECEIPT OF APPROVED DRAWINGS

OHM Remediation Services Corp.
Norcross, Georgia
A Subsidiary of OHM Corporation

PROJECT MANAGER APPROVAL / DATE

EQUIPMENT NAME (this will appear on drawing—32 characters maximum): AIR STRIPPING COLUMN & TANK

EQUIPMENT NO. C-200 T-200

PRELIMINARY DESIGN

EQUIPMENT

LOCATION (structure, area, other): GROUNDWATER TREATMENT

CAPACITY (note: rated, max and min): 500 GPM

SIZE: * DIAMETER *OAH

PROCESS TYPE AND SERVICE: AIR STRIPPING OF VOCs FROM GROUNDWATER

WEIGHT DRY: OP:

NO. UNITS (initial/ult.): 1

ACCESSORIES: PSH/L, PI, TI, FE

ENVIRONMENT

LOCATION: Vessel ☐ Demo area ☐ Subject to direct sun ☒ Outdoor ☒ Subject to ☒ Other ☐

CORROSIVE AREA ? YES ☐ NO ☒

DUSTY AREA ? YES ☐ NO ☒

EXPLOSIVE AREA ? YES ☐ NO ☒

SUBJECT TO FLOODING ? YES ☐ NO ☒

N/S COORD	E/W COORD	ELEVATION

PROCESS CONDITIONS

VESSEL FLUID:	CONTAMINATED GROUNDWATER
SPECIFIC GRAVITY G :	1.0
NORMAL PRESS. PSIG:	ATM
NORMAL TEMP. °F	55°F

CONSTRUCTION DETAILS

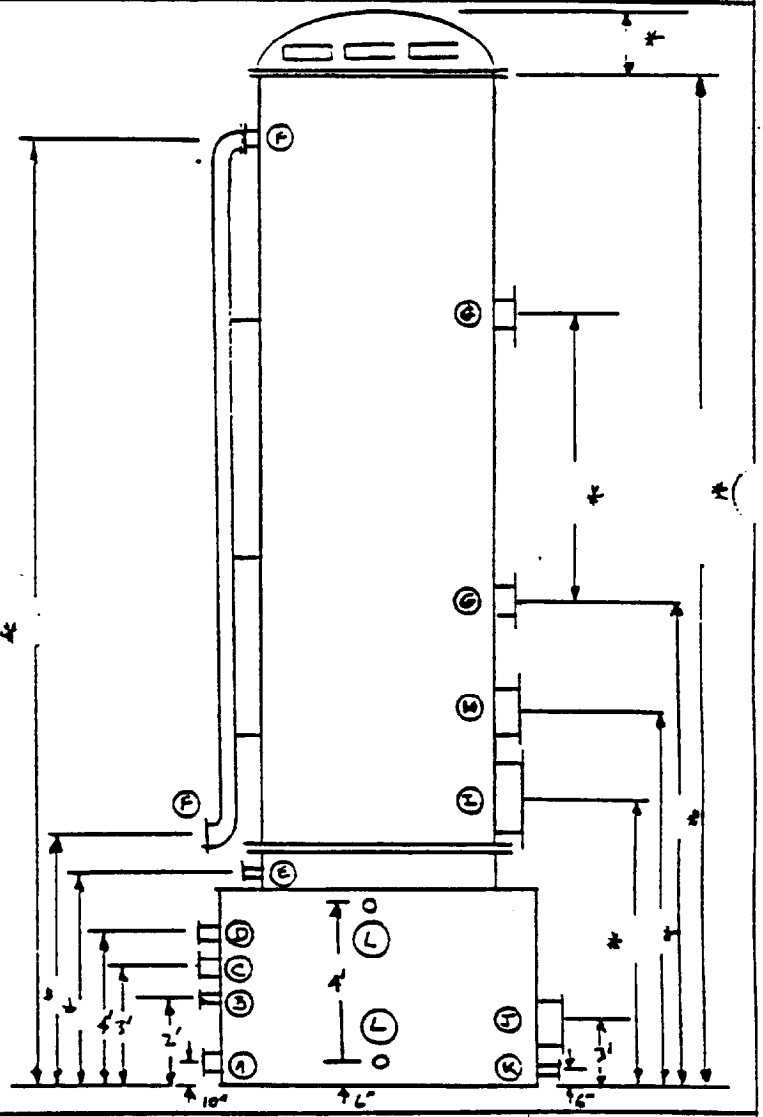
DESIGN PRESS. PSIG	MIN: -2" W.C. MAX: 1 PSI
TEMP °F	MIN: 20 MAX: 110
MATERIAL:	VINYL ESTER FRP
VOLUME USG:	N/A
INSULATION:	NONE
VERTICAL OR HIRIZONTAL:	VERTICAL
ELEVATION ABOVE GRADE FT. :	TANK @ 0

CONNECTIONS

MARK	SIZE	ORIN.	SERVICE
A	8"		PUMP SUCTION
B	2"		SPARE
C	4"		LIT
D	3"		RECYCLE
E	3"		OVER FLOW
F	4"		INLET
G	3"		SIGHT GLASS
H	[illegible]		MANWAY / CLEANOUT
J	[illegible]		MIST INLET
K	2"		MANWAY
L	4"		DRAIN
M	2"		SIGHT GLASS

REMARKS

1. ORIENTATION CLOCKWISE 0° IS NORTH
2. ALL NOZZLE PROJECTIONS MIN. 6"



ADDITIONAL DATA

SHEET TITLE:	YES	NO	NO. OF SHEETS
CONTROL REQUEST			
PROC. MEAS. REQUEST			
CONTROL VALVE DATA			
LOGIC DIAGRAM			
P & ID			
OHM INFORMATION			

VENDOR TO PROVIDE THE FOLLOWING:
1. FAN MAKE: ACFM @ "WC
2. RESIN PROPOSED
3. ALL DIMENSIONS *
4. PACKED DEPTH:
5. PACKING : TYPE SIZE
6. FAN: RPM- HP-

NOTE all revisions with number and symbol

REV.	DATE	BY
5		
4		
3		
2		
1		

JOB NO.	BY	PROJECT - PROCESS LOCATION	DATE	SHEET NO.
16032	DRAWN	LANTDIV - CAMP LEJEUNE OU-2	9/28/94	

SECTION 11308

CARTRIDGE FILTERS

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167-91	Specifications for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strips

1.2 DESCRIPTION OF WORK

Provide complete and ready for operation, three cartridge filter units (F-220 A/B/C)as specified herein.

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is reasonably convenient to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.3 SUBMITTALS

The filter manufacturer shall submit the information in accordance with the vendor data requirements form.

The manufacturer shall provide manufacturer's data, installation instructions, O&M manual, general arrangement drawings showing plan and elevation of all connections for the cartridge filter units in accordance with Section 02901.

PART 2 PRODUCTS

2.1 CARTRIDGE FILTER UNITS

Three (3) cartridge filters, each capable of handling a design flow rate of 250 gpm at a 20 psi differential pressure and a maximum operating pressure of 150 psi shall be provided. The vessel, filter support, standpipe, and piping of the filter housing units shall be constructed of 304 stainless steel. The filter housing units shall be equipped with an air relief vent. The filter housings shall be mounted on a single steel skid frame for unitized shipment. The system shall have a common inlet and a common outlet of 8" Schedule 80 304 Stainless Steel. Isolation valves shall be in accordance with Section 15401, Contaminated Groundwater Piping. Inlet and outlet connections shall be

150 pound class flanged. The units shall be arranged to allow any two units to be in operation while the third is being cleaned.

Each filter housing shall be equipped with a deviated, quick opening head. Each housing shall be equipped with a 0 - 150 psi pressure gauge.

The filter manufacturer shall supply one set of red rubber gaskets for the influent and effluent field connections. The filter manufacturer shall also provide a set of spare gaskets for all components requiring gaskets. The filter manufacturer shall supply two dozen spare filters used with the cartridge filter units; filter cartridges shall be rated at 10 micron nominal.

PART 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Installation of the item will not be allowed to proceed until the recommendations are received.

-- End of Section --

VENDOR DATA REQUIREMENTS CARTRIDGE FILTERS	PROJECT: CAMP LEJEUNE	PREPARED BY: D. RUBIN
	PROJECT NO.: 16032	DATE: 9/28/94
	PURCHASE ORDER:	REVISION: A
M NO: F-220 A/B/C	RFQ NUMBER: 91584	CHECKED BY:

DATA AND DRAWINGS REQUIRED	WITH BID		ARO			ARAD			PTS		
	Q	T	Q	T	S	Q	T	S	Q	T	S
1. DIMENSIONED OUTLINE DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
2. CROSS SECTIONAL DRAWINGS											
3. COMPLETED DATA SHEETS	4	X									
4. PERFORMANCE CURVES											
5. CATALOG INFORMATION, CUTS, ETC.	4	X									
6. FOUNDATION DIAGRAMS AND LOADING	2	X									
7. SCHEMATIC PIPING DRAWINGS											
8. SCHEMATIC WIRING DIAGRAMS											
9. ASSEMBLY/ARRANGEMENT DRAWINGS			2	P	2W	2/1	C/F	2W			
10. COMPONENT/SHOP DRAWINGS											
11. DETAILED PARTS LIST (WITH 13)									7	X	4W
12. RECOMMENDED SPARE PARTS											
OPERATION AND MAINTENANCE MANUALS									7	X	4W
.. INSTALLATION INSTRUCTIONS									4	X	4W
15. MILL TEST CERTIFICATES WITH HEAT NO.											
16. ENGINEERING, FABRICATION SCHEDULE			2	C	5D						
17. WELDING PROCEDURES											
18. SHIPPING SCHEDULE									2	X	4W
19. WEIGHT LIST OF FABRICATED PARTS FOR ERECTION									2	X	4W
20. UNIT SHIPPING WEIGHT, ERECTED WEIGHT									2	X	4W
21. DRAWING LIST											
22. INSTRUMENT LIST/INDEX											
23. ASME CODE CALCULATIONS											
24. SERIAL NUMBER-TAG NUMBER CROSS REFERENCE											

ALL SUBMITTAL TO BE DELIVERED TO:
M REMEDIATION SERVICES CORP.
5 TRIANGLE PARKWAY
NORCORSS, GEORGIA 30092

LEGEND: Q-QUANTITY S-SCHEDULE = W-WEEKS D-DAYS
T-TYPE = P-PRINT C-CERTIFIED REPRODUCIBLE X-PHOTOCOPY
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ARAD - AFTER RECEIPT OF APPROVED DRAWINGS

SECTION 11309

CARBON ADSORBERS

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53-90b	Specifications for Pipe, Steel, Black, and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A 197-87	Specifications for Cupola Malleable Iron
ASTM A 181	Specification for Forgings, Carbon Steel for General Purpose Piping

1.2 DESCRIPTION OF WORK

Provide a complete and ready for operation liquid phase granular activated carbon (GAC) adsorption system (X-220A/B) as described herein and as shown on the construction drawings.

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is reasonably convenient to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.3 SUBMITTALS

The GAC system manufacturer shall submit the information required in accordance with the vendor data requirements form. Final invoice will not be processed unless and until all required vendor data are received. Failure to meet the submittal schedule will result in back charges commensurate with the cost of the delay.

The manufacturer shall provide manufacturer's data, installation instructions, operation and maintenance (O&M) manuals and dimensioned general arrangement drawings showing plan and elevation of all connections on the following: GAC vessels (including principal dimensions, materials of construction, connection sizes and types, nozzle orientations and details, interconnecting piping, and other specified appurtenances) in accordance with Section 02901;

1.4 Operation and Maintenance Manuals

The GAC system manufacturer shall provide original quality (type set or laser print) O&M manuals for the Liquid-Phase Carbon Adsorption system. Dot matrix or photo copied manuals are not acceptable. Operation and maintenance manuals shall include detailed descriptions of the valve operation for backwash and all other modes of operation. Subvendor catalogs and O&M manuals shall be included as appendices.

PART 2 PRODUCTS

2.1 CONTACTOR VESSELS

2.1.1 Performance Requirements

Each vessel shall be capable of handling up to 250 gpm at a differential pressure of 5 psi greater than clean pressure drop at 250 gpm.

2.1.2 Carbon Adsorption Equipment Description

The adsorption equipment provided shall consist of two adsorber vessels (X-220A/B), pre-piped with all process, carbon transfer, backwash and utility piping to comprise a complete adsorption system. Piping and valving shall be furnished and arranged to allow both adsorber vessels to operate simultaneously in parallel or in series. The backwash piping shall be designed and arranged to allow one adsorber to process normally while the other is being backwashed or to allow either adsorber to use the process flow from the other for backwash. A second, external common backwash connection shall be furnished. Backwash and process piping shall have a common inlet and a common outlet. Each of these connections shall be a 150 pound raised face flanged connection.

2.1.2.1 Adsorber Vessel

The adsorbers shall be vertical, cylindrical pressure vessels with flanged and dished ASME Code top heads and 2:1 elliptical bottom heads sized for a maximum hydraulic flow rate of 5 gallons per minute per square foot of cross-sectional area and a minimum of 10 minutes empty bed contact time. The contactor vessels shall be sized to allow a minimum of 20 percent vertical bed expansion during backwash operations. The vessels shall be designed, constructed, and stamped in accordance with the ASME Code, Section VIII for a minimum design pressure rating of 75 psig at 150 degrees F.

Each adsorber unit shall be equipped with a side-mounted manway for maintenance access. The adsorber also shall be provided with handholes, with a quick opening cover, located on the top shell for ease of dry media fill. The top nozzles shall be flanged with Class 150 lap joint flanges, and side and bottom nozzles shall be Class 150 flanged. The type of flange used shall be recommended by the GAC manufacturer.

Adsorber units shall be constructed of carbon steel and shall have all welds and any other sharp edges ground smooth. All imperfections such as skip welds, delaminations, scabs, slivers, and slag shall be corrected prior to abrasive blasting. All surfaces shall be degreased prior to abrasive blasting. The adsorber internal surface shall be blasted to a white metal surface to provide an anchor pattern in the metal corresponding to approximately 4 mil. The exterior of the adsorber shall be sandblasted to a commercial blast cleaning (SSPC-SP6).

The interior surface shall be lined with light gray (Plasite 4110 Abrasion-Resistant or equivalent) Protective Coating in two multi-pass spray coatings per manufacturer's instructions to produce a 35 to 40 mil dry film thickness. The exterior of vessels, carbon steel piping, skid and appurtenances shall be coated with a single coat of grey primer followed by two coats of battle ship grey epoxy coating to a minimum combined 10 mil dry film thickness.

2.1.2.2 Underdrain Distribution System

The underdrain distribution system shall be constructed of Schedule 80 solid PVC pipe with all joints to be solvent cemented. The water shall be collected by polypropylene slotted nozzles located in the underdrain piping. These nozzles shall retain the granular activated carbon, allow water flow with a minimum of pressure drop, and shall be installed in a threaded pipe tap for ease of replacement. The underdrain system shall be designed to allow for a maximum backwash flow rate of 12 gallons per minute per square foot of cross sectional area.

2.1.2.3 Process and Utility Piping

The process and utility piping on the adsorption system shall include influent water to the system and treated water adsorber vent lines and granular activated carbon supply and discharge piping. Backwash connections are provided at flange connections to vent line (backwash outlet) and underdrain (backwash inlet).

With the exception of piping for the underdrain system, all piping shall be carbon steel, constructed of ASTM A53 carbon steel rated for 150 psig at 220 degrees F for water service. Pipe shall be Schedule 80 Carbon Steel pipe. Fittings and unions are 150 pound ASTM A197 malleable iron, with unions having integral iron seat and threaded ends. Flanges shall be 150 pound ANSI B16.5, ASTM A181, Grade I, forged carbon steel. Gaskets, as required, shall be provided as red rubber.

GAC discharge piping to the shut-off valve shall be polypropylene lined steel pipe, rated for 150 psig service at 75 degrees F.

Isolation valves shall be Dezurik, Dragger or Craine, quarter turn lever actuated butterfly fyre with Buna n seats, jeats, ductile, iron discs, and 304

ss shafts manufactured in accordance with AWWA C50A. All isolation valves shall be individually numbered with 3" high black epoxy stenciled numbers coordinated with the Operation and Maintenance instructions that describes the individual valve position during each mode of operation.

Valves for the GAC adsorber system shall be as specified in Section 15401, "Contaminated Groundwater Piping and Valving." Appropriate pressure safety valves shall be provided for each GAC vessel and shall be designed to relieve pressure at 75 psig +0/-5 percent. Each pressure relief valve shall be piped to within 12" of the skid base with SCH 40 carbon steel pipe. The granular activated carbon discharge piping shall be provided with a TFE lined plug valve.

The granular activated carbon fill and discharge piping shall be equipped with 4" nylon male "Kamlok" style hose connectors for hose transfer operations. Flush connections, consisting of 3/4" hose connectors and 3/4" ball valves shall be provided between the plug valves and hose connectors.

No valve that requires routine operation shall be located more than 5 feet above the skid floor.

2.1.2.4 Steel Skid Installation

One set of two adsorbers and all associated piping shall be preassembled on steel skid(s) for unitized shipment and installation. The steel skid(s) shall be constructed of a 6 x 13 channel iron with holes provided in the corner gussets for installation on a flat surface (or piers) as required. The combined outside dimensions of the skid(s) shall not exceed 9 feet by 18 feet. The system shall be anchored by anchor bolts, clamps, or bolts added after the system is set. Connections to the skid piping network shall be the only additional field installation required.

2.2 GRANULATED ACTIVATED CARBON

The contactor vessels shall be factory filled with granulated activated carbon meeting the following specifications:

a.	Iodine Number (min.)	900
b.	Abrasion Number (min.)	75
c.	Moisture (max.)	2.0%
d.	Effective Size (mm)	0.8-1.0
e.	Water Soluble Ash (max.)	0.5%
f.	U.S. Standard Series Sieve Size:	
	Larger than No. 8 (max.)	15%
	Smaller than No. 30 (max.)	4%

PART 3 EXECUTION

3.1 INSTALLATION

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Installation of the item will not be allowed to proceed until the recommendations are received.

3.2 MANUFACTURER'S REPRESENTATIVE

The carbon adsorption equipment manufacturer shall provide the services of a factory trained representative for two full working days to inspect, test, and start-up the installation and to instruct operating personnel on the operation and maintenance of the equipment.

3.3 TESTING AND INSPECTION

The entire assembly shall be subjected to hydrostatic testing required by the ASME Code which shall be witnessed by a representative from the General Contractor. The GAC system manufacturer shall notify the General Contractor of the planned date and location for the hydrostatic test at least 14 days in advance. The assembled adsorber system shall be inspected prior to shipment in accordance with the inspection plan.

Should disassembly be required for shipping purposes, the carbon adsorption system manufacturer shall provide all labor and tools required for re-assembly at the job site.

All work shall be in accordance with the drawings and specifications. All defects disclosed by the tests shall be corrected by the manufacturer. Equipment shall be subjected to a hydraulic operational test to demonstrate compliance with specification requirements. The NTR shall be notified in writing 14 days prior to field testing. Tests shall be conducted under normal operating conditions to ensure proper operation of all equipment. All appliances, materials, and equipment for testing shall be provided by the General Contractor, and all travel expenses in connection with the testing shall be borne by him. Testing shall be conducted after all equipment is properly installed. All defects discovered within the boundary limits of the carbon adsorption equipment shall be corrected to the satisfaction of the NTR and all tests repeated, at the expense of the carbon adsorption equipment manufacturer, until the NTR is satisfied that the equipment is in proper working order.

-- End of Section --

VENDOR DATA REQUIREMENTS GRANNULAR ACTIVATED CARBON ADSORPTION SYSTEM	PROJECT: CAMP LEJEUNE	PREPARED BY: D. RUBIN
	PROJECT NO.: 16032	DATE: 9/28/94
	PURCHASE ORDER:	REVISION: A
ITEM NO: X-220 A/B	RFQ NUMBER: 91583	CHECKED BY:

DATA AND DRAWINGS REQUIRED	WITH BID		ARO			ARAD			PTS		
	Q	T	Q	T	S	Q	T	S	Q	T	S
1. DIMENSIONED OUTLINE DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
2. CROSS SECTIONAL DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
3. COMPLETED DATA SHEETS	4	X									
4. PERFORMANCE CURVES											
5. CATALOG INFORMATION, CUTS, ETC.	4	X									
6. FOUNDATION DIAGRAMS AND LOADING	2	X									
7. SCHEMATIC PIPING DRAWINGS											
8. SCHEMATIC WIRING DIAGRAMS											
9. ASSEMBLY/ARRANGEMENT DRAWINGS			2	P	2W	2/1	C/F	2W			
10. COMPONENT/SHOP DRAWINGS											
11. DETAILED PARTS LIST (WITH 13)									7	X	4W
12. RECOMMENDED SPARE PARTS											
13. OPERATION AND MAINTENANCE MANUALS									7	X	
14. INSTALLATION INSTRUCTIONS									4	X	4W
15. MILL TEST CERTIFICATES WITH HEAT NO.											
16. ENGINEERING, FABRICATION SCHEDULE			2	C	5D						
17. WELDING PROCEDURES											
18. SHIPPING SCHEDULE									2	X	4W
19. WEIGHT LIST OF FABRICATED PARTS FOR ERECTION									2	X	4W
20. UNIT SHIPPING WEIGHT, ERECTED WEIGHT									2	X	4W
21. DRAWING LIST											
22. INSTRUMENT LIST/INDEX											
23. ASME CODE CALCULATIONS			1	C	2W						
24. SERIAL NUMBER-TAG NUMBER CROSS REFERENCE											

ALL SUBMITTAL TO BE DELIVERED TO:
OHM REMEDIATION SERVICES CORP.
5335 TRIANGLE PARKWAY
NORCORSS, GEORGIA 30092

LEGEND: Q-QUANTITY S-SCHEDULE = W-WEEKS D-DAYS
T-TYPE = P-PRINT C-CERTIFIED REPRODUCIBLE X-PHOTOCOPY
R-REPRODUCIBLE F-DXF CAD FILE
ARO - AFTER RECEIPT OF ORDER PTS-PRIOR TO SHIPMENT
ARAD - AFTER RECEIPT OF APPROVED DRAWINGS

SECTION 11310

SPENT BACKWASH AND TREATED EFFLUENT HOLDING TANKS AND APPURTENANCES

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1998-93 Standard Specification for Upright Polyethylene Storage Tanks

1.2 DESCRIPTION OF WORK

Provide, furnish and install complete and ready for operation one (1)spent backwash holding tank (T-205) and appurtenances and one (1) Treated Effluent Holding tank (T-240) and appurtenances.

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is, , reasonably convenient to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.3 SUBMITTALS

The tank manufacturer shall submit the information in accordance with the Vendor Data Requirements form. The final invoice will not be processed unless and until all required data has been received.

1.4 EQUIPMENT DELIVERY, STORAGE, HANDLING

During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment.

PART 2 - PRODUCTS

2.1 GENERAL TANK REQUIREMENTS

The Spent Backwash Holding tank and Treated Effluent holding tank shall be constructed of cross linked High Density Polyethylene (XLHDPE).

2.1.1 Dimensions

The spent backwash holding tank (T-205) and Treated Effluent Holding tank (T-240) shall each have a nominal capacity of 10,000 gallons with 24" freeboard remaining. The tank shall be a vertical cylindrical vessel with a flat bottom and integral dome top.

2.1.2 Physical Properties

Tanks shall exhibit the following minimum physical properties:

Density	59 lb/ft^3
Ultimate Tensile Strength 2" min	2,600 psi
Flexural Modulus	100,000 psi
Elongation at break, min 2"	400%
Vicat Softening Temperature	240 ^{o}F

2.1.3 Connections

Top connections shall be of the Universal Dome type. Side connections (except manways) shall be of the Two Flange type with PVC outside flanges, Type 316 stainless steel bolts and Buna N gaskets. Connections shall be as shown on the data sheets. Top and side manways shall be integrally molded.

2.1.4 Controls and Instruments

The General Contractor shall install the controls and instruments as shown on the construction drawings.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Installation of the item will not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

The tanks shall be installed true and level.

Electrical and instrumentation equipment shall be grounded in accordance with the manufacturer's recommendations and local electrical requirements.

VENDOR DATA REQUIREMENTS SPENT BACKWASH AND TREATED EFFLUENT HOLDING TANK	PROJECT: CAMP LEJEUNE	PREPARED BY: D. RUBIN
	PROJECT NO.: 16032	DATE: 9/28/94
	PURCHASE ORDER:	REVISION: A
EM NO: T-205, T-240	RFQ NUMBER: 15032	CHECKED BY:

DATA AND DRAWINGS REQUIRED	WITH BID		ARO			ARAD			PTS		
	Q	T	Q	T	S	Q	T	S	Q	T	S
1. DIMENSIONED OUTLINE DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
2. CROSS SECTIONAL DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
3. COMPLETED DATA SHEETS	4	X									
4. PERFORMANCE CURVES											
5. CATALOG INFORMATION, CUTS, ETC.	4	X									
6. FOUNDATION DIAGRAMS AND LOADING	2	X									
7. SCHEMATIC PIPING DRAWINGS											
8. SCHEMATIC WIRING DIAGRAMS											
9. ASSEMBLY/ARRANGEMENT DRAWINGS											
10. COMPONENT/SHOP DRAWINGS											
11. DETAILED PARTS LIST											
12. RECOMMENDED SPARE PARTS											
OPERATION AND MAINTENANCE MANUALS									7	X	4W
. INSTALLATION INSTRUCTIONS									4	X	4W
15. MILL TEST CERTIFICATES WITH HEAT NO.											
16. ENGINEERING, FABRICATION SCHEDULE			2	C	5D						
17. WELDING PROCEDURES											
18. SHIPPING SCHEDULE											
19. WEIGHT LIST OF FABRICATED PARTS FOR ERECTION											
20. UNIT SHIPPING WEIGHT, ERECTED WEIGHT									2	X	
21. DRAWING LIST											
22. INSTRUMENT LIST/INDEX											
23. ASME CODE CALCULATIONS											
24. SERIAL NUMBER-TAG NUMBER CROSS REFERENCE											

ALL SUBMITTAL TO BE DELIVERED TO:
IM REMEDIATION SERVICES CORP.
35 TRIANGLE PARKWAY
NORCORSS, GEORGIA 30092

LEGEND: Q-QUANTITY S-SCHEDULE = W-WEEKS D-DAYS
T-TYPE = P-PRINT C-CERTIFIED REPRODUCIBLE X-PHOTOCOPY
R-REPRODUCIBLE F-DXF CAD FILE
ARO - AFTER RECEIPT OF ORDER PTS-PRIOR TO SHIPMENT
ARAD - AFTER RECEIPT OF APPROVED DRAWINGS

PROCESS DATA SHEET FOR TANKS, DRUMS & TOWERS

OHM Remediation Services Corp.
A Subsidiary of OHM Corporation

PROJECT MANAGER APPROVAL
DATE

EQUIPMENT NAME (this will appear on drawing—32 characters maximum)
BACKWASH WATER HOLDING TANK

EQUIPMENT NO. T-205

PRELIMINARY DESIGN

EQUIPMENT

LOCATION (structure, area, other): GROUND WATER TREATMENT BLDG

CAPACITY (note: rated, max and min): 10,000 GAL. WITH 24" FREEBOARD

SIZE: * DIAMETER STAIGHT SIDE

PROCESS TYPE AND SERVICE: HOLDING SPENT BACK WASH PRIOR TO TRANSFER

WEIGHT: Empty-* Full-*

NO. UNITS (initial/ult.): 1

ACCESSORIES: SIGHT GLASS

ENVIRONMENT

LOCATION: Inside ☑ Open Area ☐ Subject to direct sun ☐ Outside ☐ Subject to Washing ☐ Other ☐

N/S COORD | E/W COORD | ELEVATION

CORROSIVE AREA ? YES ☐ NO ☒ What is corrosive?

DUSTY AREA ? YES ☐ NO ☒ Type of dust

EXPLOSIVE AREA ? YES ☐ NO ☒ class, division, group

SUBJECT TO FLOODING YES ☐ NO ☒ To what elev. ?

PROCESS CONDITIONS

VESSEL FLUID:	WATER
SPECIFIC GRAVITY G :	1.0
NORMAL PRESS. PSIG:	ATM
NORMAL TEMP. °F	70°F

CONSTRUCTION DETAILS

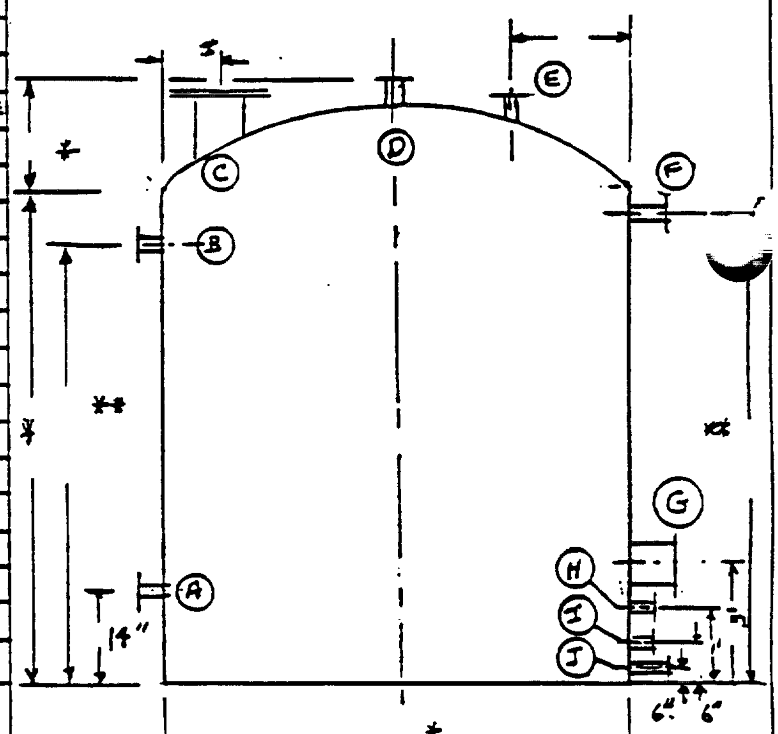
DESIGN PRESS. PSIG	MIN: -2" WC MAX:
TEMP °F	MIN: 50 MAX: 110
MATERIAL:	C2055 LINKED HIGH DENSITY POLYETHYLENE
VOLUME USG:	
INSULATION:	NONE
VERTICAL OR HORIZONTAL:	VERTICAL
ELEVATION ABOVE GRADE FT. :	0

CONNECTIONS

MARK	SIZE	ORIN.	SERVICE
A, B	4"		LEVEL SWITCH
C	24"		MANWAY
D	4"		VENT
E	4"		FILL
F, H	2"		SIGHT GLASS
G	24"		MANWAY
I	2"		PUMP SUCTION
J	3"		DRAIN

REMARKS

1. ORIENTATION CLOCKWISE 0° IS NORTH
2. MINIMUM NOZZLE PROJECTION IS 6"
3. * VENDOR TO SUPPLY
4. ** LEVELS AT 10,000 gal.



ADDITIONAL DATA

SHEET TITLE:	YES	NO	NO. OF SHEETS
CONTROL REQUEST			
PROC. MEAS. REQUEST			
CONTROL VALVE DATA			
LOGIC DIAGRAM			
P & ID			
O&M INFORMATION			

NOTE all revisions with number and symbol

REV.	DATE	BY
5		
4		
3		
2		
1		

JOB NO.	BY	PROJECT - PROCESS LOCATION	DATE	SHEET NO.
16052	D. RUBIN / Y. [illegible]	LANTDIV-CAMP LEJEUNE OU2	1/28/94	

OHM Remediation Services Corp.
A Subsidiary of OHM Corporation

PROCESS DATA SHEET FOR TANKS, DRUMS & TOWERS

PROJECT MANAGER APPROVAL:

DATE:

EQUIPMENT NAME (this will appear on drawing—32 characters maximum): TREATED EFFLUENT HOLDING TANK

EQUIPMENT NO.: T-240

PRELIMINARY DESIGN

EQUIPMENT

LOCATION (structure, area, other): GROUNDWATER TREATMENT BLDG

PROCESS TYPE AND SERVICE: BACKWASH SUPPLY

WEIGHT: Full * / Empty *

NO. UNITS (initial/ult.): 1

CAPACITY (note: rated, max and min): 10,000 GAL WITH 24" FREE BOARD

ACCESSORIES:

SIZE: * DIAMETER * STRAIGHT SIDES

ENVIRONMENT

LOCATION: Inside [X] / Same area ☐ / Subject to direct sun ☐ / Outside ☐ / Subject to freezing ☐ / Other ☐

N/S COORD | E/W COORD | ELEVATION

CORROSIVE AREA ? YES ☐ NO [X]

DUSTY AREA ? YES ☐ NO [X]

EXPLOSIVE AREA ? YES ☐ NO [X]

SUBJECT TO FLOODING: YES ☐ NO [X]

PROCESS CONDITIONS

VESSEL FLUID: WATER

SPECIFIC GRAVITY G : 1.0

NORMAL PRESS. PSIG: ATM

NORMAL TEMP. °F: 70°F

CONSTRUCTION DETAILS

DESIGN PRESS. PSIG MIN: -2" WC MAX:

TEMP °F MIN: 50°F MAX: 110°F

MATERIAL: CROSS LINKED HIGH DENSITY POLYETHYLENE

VOLUME USG: *

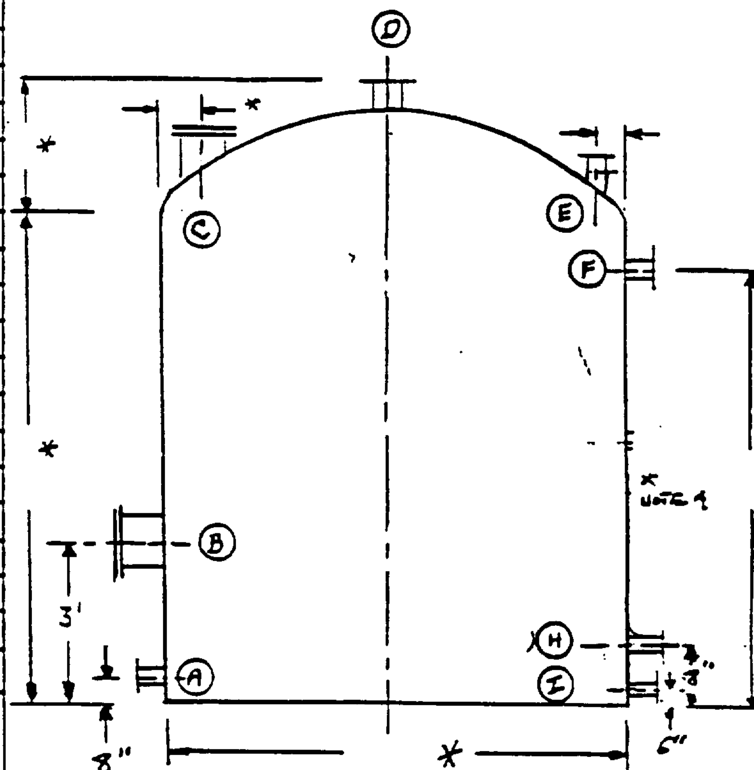
INSULATION: NONE

VERTICAL OR HORIZONTAL: VERTICAL

ELEVATION ABOVE GRADE FT. : 0

CONNECTIONS

MARK	SIZE	ORIN.	SERVICE
A	3"		SIPHON DRAIN
B,C	24"		MANWAY
D	8"		FILL
E	4"		VENT
F	8"		OUTLET
G	6"		BACKWASH PUMP
H	2"		REUSE PUMP SUCTION
I	1"		



REMARKS

1. ORIENTATION CLOCKWISE ↑ IS NORTH
2. MINIMUM NOZZLE PROJECTION IS 6"
3. * VENDOR TO SUPPLY
4. INVERT OF NOZZLE (F) @ 10,000 gal

ADDITIONAL DATA

SHEET TITLE:	YES	NO	NO. OF SHEETS
CONTROL REQUEST			
PROC. MEAS. REQUEST			
CONTROL VALVE DATA			
LOGIC DIAGRAM			
P & ID			
OHM INFORMATION			

NOTE all revisions with number and symbol

REV.	DATE	BY
5		
4		
3		
2		
1		

JOB NO.: 16032 | BY: D.R.S.D.U. | PROJECT - PROCESS LOCATION: LANTDIV - CAMP LEJEUNE OU#2 | DATE: | SHEET NO.:

SECTION 11313

SLUDGE THICKENING TANK AND APPURTENANCES

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167-91	Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA D-103	Factory-Coated Bolted Steel Tanks for Water Storage

1.2 DESCRIPTION OF WORK

The sludge thickening tank and appurtenances shall be furnished and installed to provide a complete and functional system.

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is, in the opinion of the NTR, reasonably convenient to the jobsite. Equipment of the same types shall each be the product of one manufacturer.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 Manufacturer's Catalog Data

Provide manufacturer's data on the sludge thickening tank, level control equipment and floating skimmer assemblies.

1.3.2 Drawings

Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings of all sludge thickening tank related equipment including:

a. Tank

b. Vent
c. External connections
d. Liquid level controls mounting bracket
e. Anchor bolt sizing and placement
f. Tank finish
g. Tank grounding
h. Structural support stand

Shop drawings shall include quantity, size, material, and locations of all equipment. Shop drawings shall include wiring diagrams of level control equipment.

1.3.3 Instructions

Two printed copies of the installation procedures shall be furnished to the NTR prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 Operation and Maintenance Manuals

Provide O&M manual for the sludge thickening tank, control equipment and floating skimmer assemblies. Data Package 3.

1.4 EQUIPMENT DELIVERY, STORAGE, HANDLING

During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment.

1.5 GENERAL REQUIREMENTS

Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "General Electrical Requirements."

PART 2 - PRODUCTS

2.1 GENERAL TANK REQUIREMENTS

The sludge thickening tank (T-140) shall be constructed of cross-linked polyethylene to resist site contaminants (volatile organics) at dilute concentrations. Tank shall meet the requirements of AWWA D-103.

2.2 SLUDGE THICKENING TANK

2.2.1 Dimensions

The sludge thickening tank shall be approximately 4'-0" diameter by 9'-6" overall height with a nominal capacity of 2,000 gallons. The sludge thickening tank shall be a 30 degree cone bottom, flat top tank, furnished with a hinged bolt-down cover. The tank shall be constructed of cross-linked polyethylene.

2.3 FLOATING SKIMMER ASSEMBLY

The sludge thickening tank shall be equipped with a floating skimmer assembly that will function as a supernatant overflow. The floating skimmer assembly shall be designed to collect supernatant as the level of sludge and supernatant vary within the tank.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Installation of the item will not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

Precision gauges and levels shall be used in setting the tank. Tank shall be anchored to the building floor in accordance with the manufacturer's recommendation. Tanks and supports shall be grounded to the grounding grid.

Electrical and instrumentation equipment shall be grounded in accordance with local electrical codes.

-- End of Section --

SECTION 11314

DEWATERING PRESS

PART 1 GENERAL

1.0 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167-91	Specifications for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM A 53-90b	Specifications for Pipe, Steel, Black, and Hot-Dipped, Zinc Coated Welded and Seamless.
ASTM A 197-87	Specifications for Cupola Malleable Iron
ASTM A 181	Specification for Forgings, Carbon Steel for General Purpose Piping

1.2 DESCRIPTION OF WORK

The dewatering press (X-140) and appurtenances shall be furnished and installed to provide a complete and functional system.

Material and equipment shall be new and shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is reasonably convenient to the jobsite. Equipment of the same types shall each be the product of one manufacturer.

1.3 SUBMITTALS

The Dewatering Press manufacturer shall submit the information in accordance with the vendor data requirements form.

The manufacturer shall provide manufacturer's data, operation and maintenance manuals, general arrangement drawings, and installation instructions for the dewatering press and related control equipment, safety features, and appurtenances in accordance with Section 02901.

1.3.1 Operation and Maintenance Manuals

The Dewatering Press manufacturer shall provide original quality (type set or laser print) O&M manuals for the Dewatering Press and control systems.

Photocopied or dot matrix printed manuals are not acceptable. O & M Manual shall contain complete normal and preventative maintenance instructions of all repairable components and subvendor (e.g. pumps, valves, gauges, etc.) O & M manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment. If special shipping and handling precautions are required, prominently and legibly stencil such precautions on outside of equipment or its crating.

The General Contractor shall inspect materials delivered to site for damage, and shall unload and store with minimum handling. Materials shall be stored on-site in enclosures or under protective coverings. Materials not suitable for outdoor storage shall be protected to prevent damage during periods of inclement weather, including subfreezing temperatures, precipitation, and high winds. Materials susceptible to sunlight shall be stored under cover and avoid damage due to high temperatures. Materials shall not be stored directly on the ground.

PART 2 PRODUCTS

2.1 DEWATERING PRESS

2.1.1 Dewatering Press Description

The dewatering press (X-140) shall be a fully mechanized, pneumatically/ hydraulically opened and closed, side bar plate supported, recessed plate, floor standing filter press designed to efficiently dewater metal hydroxide slurry for handling as a dry cake and shall include all components necessary for a complete operating unit as specified herein. All components shall be new, free of defects or mechanical damage and in operating condition.

The dewatering press shall be manufactured to meet the following design parameters:

Design Operating Pressure	100 psi
Total Volume	6 ft^3 (expandable to 8 ft^3)
Plate Size	24" x 24" (630 x 630 mm)
Cake Thickness	1.25 inches (32 mm)
Total Filtration Area	133 ft^2 (expandable to 178 ft^2)
Number of Chambers	21 (expandable to 28)

2.1.2 Dewatering Press Components

The dewatering press shall be supplied complete in all respects and shall be supplied with the following components, features, appurtenances, and accessories.

a. Glass filled polypropylene, recessed chamber plates
b. Fabricated steel skeleton
c. Pneumatic hydraulic opening and closing system
d. Sidebar plate suspension system
e. Air blow feed and discharge line pipes with manifold.
f. Filter cloth installed

2.1.2.1 Dewatering Press Skeleton

The dewatering press skeleton and related sub-components shall be designed to maintain the filter pack in a closed position against an internal operating pressure of 100 psi plus a minimum clamping factor of 25% greater than the maximum internal operating pressure multiplied by the filter area of the tail filter plate. Minimum closure force shall be 28 tons.

The dewatering press frame shall be fabricated of ASTM A 36 carbon steel plate. Weldments shall be totally enclosed box construction for maximum strength and ease of maintenance. All weldments shall be designed to evenly distribute the operational forces developed during filtration over the entire component. All components shall be continuously welded with a fillet weld for maximum strength. Intermittent welding of joints shall not be acceptable. Enclosed compartments within the head end weldment shall have drain holes. All components shall be designed with a minimum safety factor of 1.5 times the maximum closure force. Critical assembly points such as sidebar/end weldment shall be machined to close tolerances to ensure uniform load distribution at all stress bearing areas.

All edges and welds shall be deburred and ground smooth. All weld splatter, weld slag, and mill scale shall be removed before painting.

The head end weldment and the cylinder bracket shall be connected at two points each. Two side bars of hot rolled steel shall connect the head and cylinder bracket at the horizontal centerline of the plate pack so as not to interfere with cake discharge. Each connection point shall be designed with a minimum safety factor of 1.5 times the maximum closure force.

Each connection point shall have the intersecting components machined to tolerances that shall ensure proper fit.

The side bars shall be of sufficient size and weight to support the full operational weight of the filter plate pack including the follower head, plate pack, future plate shifter, and filter cake with a maximum deflection of 1/900 of the length of the filter press assembly.

To prevent corrosion of the sidebars due to surface finish erosion, the side bars shall come complete with 304 SS wear strips on the contact surface with plate suspension handles and follower head rollers.

The follower head subassembly shall be suspended from the side bars. The follower shall ride on rollers with stainless steel axles. Grease nipples shall be provided on the axles for periodic interspacial flushing of the roller/axle assembly.

All non-stainless steel metallic surfaces shall be finished with the manufacturer's standard finish that will withstand the 125 hr. salt spray test.

2.1.2.2 Filter Plates

Filter plates shall be of the center feed, alternating corner discharge design for operation at 100 psig pressure at ambient temperature. Plates shall be of the recessed design. Plates shall come complete with filter cloths installed.

Recessed plates shall be molded from virgin gray polypropylene and shall be filled with a minimum 10 per cent glass fiber reinforcement. Plates shall have a drainage surface design that shall provide adequate support for filter cloths and shall have integrally molded stayboss supports equally spaced on the drain field. Plate sealing surfaces shall be machined to a maximum parallel plane tolerance of 0.3 mm. Chamber recess depth dimension shall have a tolerance not to exceed 0.5 mm.

2.1.2.3 Filter Cloths

Two sets of filter cloths shall be provided for the dewatering press. Filter cloths shall be made of polypropylene fabric. Cloths shall be held in place on the filter plates by a woven, high density polypropylene cord sewn into the perimeter of the cloth. Edges shall be suitably treated to minimize wicking of water during operation.

2.1.2.4 Core Blow Connections

The dewatering press shall be provided with a flexible air hose and manual air shut-off valve and check valve to blow the center core back to the process. The air shall be introduced into the follower and shall have all piping rigidly mounted and easily accessible on the frame of the filter press.

2.1.2.5 Air Blow Down Manifold

Discharge piping containing a valve manifold shall be supplied. The manifold shall be designed to allow air to be blown through the press to remove any

residual moisture at the end of the filtration cycle. Valves shall be of the type most commonly supplied by the press manufacturer.

2.1.2.6 Pneumatic/Hydraulic Closure System

The pneumatic/hydraulic opening and closing system shall include one double acting hydraulic cylinder and one hydraulic power pack. The system shall be designed to automatically compensate for any thermal expansion or contraction of the plate stack as well as maintain the proper clamping force throughout the process cycle.

The hydraulic cylinder shall be capable of producing a minimum of 28 tons of clamping pressure at a hydraulic input pressure of 100 psi. The cylinder shall have a 4-inch diameter bore and a 18-inch stroke to provide a minimum cleanout space of 16 inches between plates. The cylinder shall be of the tie rod design for ease of servicing hydraulic seals. The piston rod shall be covered by a flexible neoprene bellow to protect the rod from contamination. The piston rod shall be connected to the follower head by means of a rod eye and clevis arrangement that allows follower head movement only in a vertical plane perpendicular to the length of the press. The rod eye and clevis shall be equipped with grease fittings. The cylinder, rod eye and clevis shall be designed with a minimum safety factor of 3.0 times the maximum cylinder capacity. The cylinder shall meet all JIC requirements.

The pneumatic/hydraulic power pack shall contain an air driven hydraulic pumping module that shall clamp the press by pressurizing the hydraulic system after the plate pack is fully closed. The hydraulic pumping module shall be designed to operate only after the hydraulic cylinder has been fully extended through the use of a pressurized oil reservoir. To minimize the use of the hydraulic pumping module, the press shall be opened by means of pressurizing the retraction stroke of the cylinder with compressed air. All hydraulic tubing, subject to system pressure, within the power pack and to and from the cylinder shall be of 304 SS and shall have minimum burst pressure rating of 3.5 times the maximum operating pressure of the power pack. The power pack shall be fully enclosed in a fabricated steel cabinet for protection from damage and shall be easily accessible for maintenance from a full width hinged cabinet door. All components shall be modular for ease of maintenance.

2.1.2.7 Controls

The Dewatering press control panel shall be mounted to the hydraulic cylinder bracket end in a NEMA 4 enclosure. The following functions shall be controlled from the panel:

a. Air supply, on/off
b. Filter press, open/close
c. Feed pump system, on/off

Core blow and air blowdown functions shall be manual. Operating instructions for these operations shall be permanently mounted on the side of the control panel behind clean, impact resistant plastic.

2.1.2.8 Plate Shifter

The dewatering press shall be supplied with the appropriate fittings and appurtenances to allow the retro-fit of a semiautomatic plate shifter system designed to assure each plate is straightened and is perpendicular to the side bars prior to shifting.

2.1.2.9 Feed and Discharge Piping

The General Contractor shall provide feed piping to the filter press feed pump and discharge line piping from the filter press filtrate discharge manifold. The filter press manufacturer shall provide the connections through the head from the center feed slurry port and the corner filtrate discharge ports in the filter pack through the stationary head. All threads shall be NPT standard.

The feed and discharge manifolding shall be designed for center core blow and at the end of the air blowing cycle.

2.1.2.10 Feed Pump

The filter press manufacturer shall supply an appropriate air operated double diaphragm pump, Sandpiper, Wilden, or ARO, no equal. A pressure regulator and interconnecting piping shall also be provided.

2.1.2.11 Future Expandability

A distance piece shall provide for the future expansion of the filter press capacity to 8 cubic feet. The distance piece shall be made of ASTM A 36 carbon steel and mount between the hydraulic cylinder piston rod and the piston rod end. The distance piece shall be supported by a roller assembly from the sidebars to prevent undue stress on the piston rod. Filter press capacity expansion shall be accomplished by removal of the distance piece and installing additional filter plates in its place.

2.1.3 Dewatering Press Accessories

2.1.3.1 Cake Cart

The dewatering press manufacturer shall provide one self-dumping cake cart capable of a minimum 8 cubic foot capacity. The cart shall be of sufficient size that the entire plate pack of the 8 cubic foot capacity can be discharged without moving the cart. The cart shall be designed to be moved and emptied by forklift.

PART 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

Installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Installation of the item will not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

Precision gauges and levels shall be used in setting all equipment.

The dewatering press manufacturer shall furnish the services of a qualified and experienced representative for two, 8-hour working days to inspect, test, and start-up the installation and to instruct operating personnel in the operation and maintenance of component equipment.

-- End of Section --

VENDOR DATA REQUIREMENTS DEWATERING PRESS AND FEED PUMP	PROJECT: CAMP LEJEUNE					PREPARED BY: D. RUBIN					
	PROJECT NO.: 16032					DATE: 9/28/94					
	PURCHASE ORDER:					REVISION: A					
ITEM NO: X-140, P-141	RFQ NUMBER: 91585					CHECKED BY:					
DATA AND DRAWINGS REQUIRED	WITH BID		ARO			ARAD			PTS		
	Q	T	Q	T	S	Q	T	S	Q	T	S
1. DIMENSIONED OUTLINE DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
2. CROSS SECTIONAL DRAWINGS											
3. COMPLETED DATA SHEETS											
4. PERFORMANCE CURVES											
5. CATALOG INFORMATION, CUTS, ETC.	4	X									
6. FOUNDATION DIAGRAMS AND LOADING	2	X									
7. SCHEMATIC PIPING DRAWINGS											
8. SCHEMATIC WIRING DIAGRAMS											
9. ASSEMBLY/ARRANGEMENT DRAWINGS			2	P	2W	2/1	C/F	2W			
10. COMPONENT/SHOP DRAWINGS											
11. DETAILED PARTS LIST (WITH 13)									7	X	4W
12. RECOMMENDED SPARE PARTS (WITH 13)									7	P	4W
13. OPERATION AND MAINTENANCE MANUALS									7	X	
14. INSTALLATION INSTRUCTIONS									4	X	4W
15. MILL TEST CERTIFICATES WITH HEAT NO.											
16. ENGINEERING, FABRICATION SCHEDULE			2	C	5D						
17. WELDING PROCEDURES											
18. SHIPPING SCHEDULE									2	X	4W
19. WEIGHT LIST OF FABRICATED PARTS FOR ERECTION									2	X	4W
20. UNIT SHIPPING WEIGHT, ERECTED WEIGHT									2	X	4W
21. DRAWING LIST											
22. INSTRUMENT LIST/INDEX											
23. ASME CODE CALCULATIONS											
24. SERIAL NUMBER-TAG NUMBER CROSS REFERENCE											

ALL SUBMITTAL TO BE DELIVERED TO:
OHM REMEDIATION SERVICES CORP.
5335 TRIANGLE PARKWAY
NORCORSS, GEORGIA 30092

LEGEND: Q-QUANTITY S-SCHEDULE = W-WEEKS D-DAYS
T-TYPE = P-PRINT C-CERTIFIED REPRODUCIBLE X-PHOTOCOPY
R-REPRODUCIBLE F-DXF CAD FILE
ARO - AFTER RECEIPT OF ORDER PTS-PRIOR TO SHIPMENT
ARAD - AFTER RECEIPT OF APPROVED DRAWINGS

SECTION 11315

PUMPS: WATER, CENTRIFUGAL

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 A 123	(1989a) 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 283	(1988) Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 307	(1990) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	(1989; B1.1a-1984) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.5	(1988; Errata Oct 1988) Pipe Flanges and Flanged Fittings
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C203	(1986) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

FEDERAL SPECIFICATION (FS)

FS TT-E-489 (Rev H) Enamel, Alkyd, Gloss, Low VOC Content

FEDERAL STANDARD (FED-STD)

FED-STD 95 (Rev B) Colors

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B73.1 Standards for Centrifugal Process Pumps

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1987; Rev 1) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (1990) Flammable and Combustible Liquids

NFPA 70 (1990) National Electrical Code

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC-Paint 16 (1982) Coal-Tar Epoxy-Polyamide Black (or Dark Red) Paint

SSPC-SP 6 (1989) Commercial Blast Cleaning

SSPC-SP 8 (1982) Pickling

SSPC-SP 10 (1989) Near-White Blast Cleaning

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is reasonably convenient to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.2.2 Description

The pumps shall be horizontal, end suction, back pull-out, centrifugal water pumps of the types indicated and specified herein. The single driving units for the pumps shall be electric motors as indicated and specified.

1.2.3 Safety Requirements

Gears, couplings, projecting set-screws, keys, and other rotating parts shall be fully enclosed or properly guarded in accordance with current OSHA regulations.

1.2.4 Nameplates

Pumps and motors shall have a standard nameplate securely affixed in a conspicuous place showing the manufacturer's name, address, type or style, model, serial number, and catalog number. In addition, the nameplate for each pump shall show the capacity in gpm at rated speed in rpm and head in feet of water. Nameplate for each electric motor shall show at least the minimum information required by 10.38 NEMA MG 1. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

1.2.5 Electrical Work

Electrical motor driven equipment specified herein shall be provided complete with motors, motor starters, and controls. Electric equipment and wiring shall be in accordance with Section 16402, "INTERIOR WIRING SYSTEMS". Electrical characteristics shall be as indicated. Motor starters shall be provided by the General Contractor complete with properly sized thermal overload protection in each phase and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage and frequency. Manual or automatic control and protective or signal devices required for the operation herein specified and any control wiring required for controls and devices but not shown on electrical plans shall be provided by the General Contractor under this section of the specifications.

1.2.7 Selection Criteria

Pumps shall be designed using hydraulic criteria based upon actual model developmental test data. Pumps shall be selected at a point within the maximum efficiency for a given impeller casing combination. Deviations within 3 percent of maximum efficiency are permissible, provided the lesser efficiency is not less than the scheduled efficiency. The impeller diameter shall be less than 90 percent of the published maximum diameter of the casing and 15 percent larger than the published minimum diameter.

1.2.8 Factory Tests

Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards. Where two or more

identical pumps are specified, only one representative pump shall be tested. Certified test results shall be submitted to the NTR.

1.3 SUBMITTALS

The pump manufacturer shall submit the information in accordance with the Vendor Data Requirements form.

The manufacturer shall submit manufacturers' catalogs, drawings, pump test results, pump curves, installation instructions and operation and maintenance manuals in accordance with Section 02901.

1.4 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified below and as shown, and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

2.2 CENTRIFUGAL WATER PUMPS

The pumps shall be the centrifugal, horizontal single-stage type, designed for process service in the configurations and capacities listed below.

2.2.1 Pump Characteristics

Air Stripper Feed Pumps (P-110 A/B): Each shall draw water Groundwater Feed Storage Tank (T-110) at a maximum rate of 540 GPM at 90 feet total dynamic head (TDH).

Air Stripper Effluent Pumps (P-220 A/B): Each shall draw water from the air stripper effluent holding tank (T-220) at a maximum rate of 540 GPM at 90 feet total dynamic head (TDH).

Backwash Water Pump (P-241): Shall draw water from the Effluent Tank (T-240) at a rate of 200 GPM at 50 feet TDH.

Pumps shall operate at optimum efficiencies to produce the most economical pumping system under the conditions encountered. Pumps shall furnish not less than 150 percent of rated capacity at a total discharge head of not less than

65 percent of total rated head. The shutoff total head shall be not greater than 120 percent of total rated head.

2.2.2 Pump Drives

The pumps shall have the following driving units and shall be connected to the driving units through flexible couplings:

Air Stripper Feed Pump Motors (2)

Rated speed: 1,760 rpm
Rated voltage: 460 VAC
Phase: 3

Air Stripper Effluent Pump Motors (2)

Rated speed: 1,760 rpm
Rated voltage: 460 VAC
Phase: 3

Backwash Water Pump Motor (1)

Rated speed: 1,760 rpm
Rated voltage: 460 VAC
Phase: 3

2.2.3 Pump Construction

Centrifugal water pumps shall be constructed in accordance with ANSI B73.1.

2.2.3.1 Pump Casings

Pump casings shall be ductile iron, horizontal shaft, and vertical split casing, of the following design:

The casings shall be designed to permit replacement of wearing parts. Pump casings shall be of uniform quality and free from blowholes, porosity, hard spots, shrinkage defects, cracks and other injurious defects. Defects in casings shall not be repaired except when such work is approved and is done by or under the supervision of the pump manufacturer, and then only when the defects are small and do not adversely affect the strength or use of the casing. Casings shall be single with flanged piping connections conforming to ANSI B16.1, Class 125. The direction of shaft rotation shall be conspicuously indicated. The casing shall have tapped openings for draining, and suction and discharge gauges. Drain openings in the volute, intake, or other passages capable of retaining trapped water shall be located in the low point of such passages.

2.2.3.2 Impellers

Impellers shall be of open design and shall be constructed of type 316 stainless steel, carefully finished with smooth water passageways, and shall be statically and dynamically balanced. Impellers shall be securely keyed to the pump shaft and shall be additionally secured with a self-locking nut.

2.2.3.3 Shaft

Shaft shall be of high grade steel, accurately machined, and shall be of sufficient size and strength to perform the work required. Stainless steel, renewable shaft sleeves shall be provided for protection of the shaft in contact with water, and in the stuffing boxes. Shaft sleeves shall be keyed to the pump shaft.

2.2.3.4 Seals

2.2.3.4.1 Gland

Gland shall be split-bronze type with AISI 18-8 stainless steel eyebolts and pins or studs. Hex-nuts shall be bronze or nongalling stainless steel.

2.2.3.4.2 Stuffing boxes

Stuffing boxes exposed to below atmospheric pressure at any operating condition, including starting, shall be provided with a water seal. Water seal shall consist of nonferrous lantern ring or a seal cage and required connections to the pump case.

2.2.3.5 Mechanical Seals

Pumps shall be equipped with double, balanced, mechanical seals, as necessary to conform to specified service requirements. Mechanical seals shall be constructed in a manner and of materials particularly suitable for the temperature service range and quality of water being pumped. Seal pressure rating shall be suitable for maximum system hydraulic conditions. Materials of construction shall include AISI 300 series stainless steel, solid tungsten-carbide rotating-seal face, and Buna-N, vinylidene-fluoride-hexafluoro-propylene, EPT, or tetrafluoroethylene seals. Bypass flushing water supply shall be free of iron rust products and other abrasive materials and shall be directed onto face of seal without dead ending. All piping and accessories shall be provided. Throttling bushing shall have clearances to minimize leakage in case of complete seal failure without restriction of flushing water. Mechanical seals shall not be subjected to hydrostatic test pressures in excess of the seal manufacturer's recommendations. Inboard mechanical seals shall be Durametallic RO, Crane 8-1 or Chesterton 241. Outboard seal shall be of the same manufacturer and suitable for containing the seal water.

2.2.3.6 Couplings

Couplings shall be of the heavy duty flexible type, keyed and locked to the shaft. The outside surface of the couplings for horizontal pumps shall be machined parallel to the axis of the shaft. The faces of the couplings shall be machined perpendicular to the axis of the shaft. Disconnecting the couplings shall be accomplished without removing the driver half or the pump half of the couplings from the shaft. Flexible couplings shall not be used to compensate for misalignment of pump.

2.2.3.7 Balance

All rotating parts of the equipment shall operate throughout the required range without excessive end thrust, vibration, or noise. Defects of this type that cannot be eliminated by installation adjustments shall be sufficient cause for rejection of the equipment. Pump impeller assemblies shall be statically and dynamically balanced to within 1/2 percent of $W \times R^2$, where W equals weight and R equals impeller radius. Shaft construction shall be substantial to prevent seal or bearing failure due to vibration. Total shaft peak-to-peak dynamic deflection measured by vibrometer at pump-seal face shall not exceed 2.0 mils under shutoff-head operating conditions. Flow from 1/4-inch iron pipe size (ips) pipe shall be provided during testing.

2.2.3.8 Bearings

Bearings shall be ball or roller type, and the main bearings shall take all radial and end thrust. Pumps that depend only on hydraulic balance to overcome end thrust will not be acceptable. Bearings shall have a minimum B_{10} life of 100,000 hours.

2.2.3.9 Lubrication

Bearings on horizontal-shaft pumps shall be the oil-bath type. Each oil reservoir shall be liberal in size and provided with a Trico or equal constant level oil cup and a drain at the lowest point. Bearing Brackets shall be equipped with Inpro or equal labyrinth type seals to prevent dust infiltration and oil leakage.

2.2.3.10 Base Plates

Horizontal-shaft centrifugal pumps shall be provided with a common base for mounting each pump and driving unit of the pump on the same base. Each base shall be constructed of high strength vinylester polymer concrete or approved equal.

2.2.3.11 Cocks, Plugs, and Accessories

The pumps shall be equipped with air cocks and drain plugs. The General Contractor shall install single gauges indicating discharge pressures for all pumps.

2.2.3.12 Piping Connections

The pump suction and discharge shall be provided with flanged connections of suitable size and suitably arranged for piping shown. Pipe flanges shall conform to ASME B16.1 and ASME B16.5. Piping shall be installed to preclude the formation of air pockets. Provide eccentric reducers as necessary to make pump connections compatible with piping arrangement shown.

2.2.3.13 Finish

Pumps shall be painted as is standard for the manufacturer subject to meeting ASTM B-117 125-hour salt spray test.

2.3 ELECTRICAL EQUIPMENT

Electrical equipment shall conform to Section 16011, "General Requirements - Electrical," and 16402, "INTERIOR WIRING SYSTEMS".

2.4 EQUIPMENT APPURTENANCES

2.4.1 Attachments

All necessary bolts, nuts, washers, bolt sleeves, and other types of attachments for the installation of the equipment shall be furnished with the equipment. Bolts shall conform to the requirements of ASTM A 307 and nuts shall be hexagonal of the same quality as the bolts used. Threads shall be clean-cut and shall conform to ASME B1.1. Bolts, nuts, and washers specified to be galvanized or not otherwise indicated or specified, shall be zinc coated after being threaded, by the hot-dip process conforming to ASTM A 153 as appropriate. Bolts, nuts, and washers specified or indicated to be stainless steel shall be Type 316.

2.4.2 Equipment Guards

Equipment driven by open shafts, belts, chains, or gears shall be provided with all-metal guards enclosing the drive mechanism. Guard shall be constructed of sheet steel. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

2.4.3 Tools

A complete set of all special tools which may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment. Special tools shall be high-grade, smooth, forged, alloy, tool steel. One pressure grease gun for each type of grease required for motors also shall be furnished. All tools shall be delivered at the same time as the equipment to which they pertain. The manufacturer shall properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the NTR.

2.4.4 Shop Painting

All motors, pump casings, and similar parts of equipment customarily finished in the shop shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the pump manufacturer. Ferrous surfaces not to be painted shall be given a shop coat of grease or other suitable rust resistant coating. Paint shall pass 125-hour salt spray test in accordance with ASTM B-117.

PART 3 EXECUTION

3.1 INSTALLATION

Each pump shall be installed in accordance with the written instructions of the manufacturer and under the direct supervision of the manufacturer's representative.

3.2 FIELD TESTS AND INSPECTION

After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. The General Contractor shall make arrangements to have the manufacturer's representatives present when field equipment tests are made. Each pumping unit shall be given a running field test in the presence of the NTR for a minimum of 2 hours. Each pumping unit shall be operated at its rated capacity or such other point on its head capacity curve selected by the NTR. The General Contractor shall provide an accurate and acceptable method of measuring the discharge flow. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly. If any deficiencies are revealed with the manufacturer's equipment during any tests, such deficiencies shall be corrected by the manufacturer and the tests shall be reconducted.

3.2.3 Field Painting

Stainless steel, galvanized steel, and nonferrous surfaces shall not be painted.

3.2.3.1 Touch-Up Painting

Factory painted items requiring touching up in the field shall be thoroughly cleaned of all foreign material and shall be primed and topcoated with the manufacturer's standard factory finish.

3.2.3.2 Exposed Ferrous Surfaces

Exposed ferrous surfaces shall be painted with two coats of enamel paint conforming to FS TT-E-489, Class A. Factory primed surfaces shall be solvent cleaned before painting. Surfaces that have not been factory primed shall be prepared and primed in accordance with the enamel paint manufacturer's recommendations.

3.3 MANUFACTURER'S FIELD SERVICES

The General Contractor shall obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment. Up to 3 days service shall be provided at no expense to the Government.

3.3.1 Demonstration

Upon completion of the work and at a time designated by the NTR, the services of one or more competent engineers shall be provided by the manufacturer for a period of not less than 4 hours to instruct a representative of the Government in the operation and maintenance of equipment furnished under this section of the specifications. These field instructions shall cover all the items contained in the bound instructions.

-- End of Section --

VENDOR DATA REQUIREMENTS CENTRIFUGAL PUMPS	PROJECT: CAMP LEJEUNE	PREPARED BY: D. RUBIN
	PROJECT NO.: 16032	DATE: 9/28/94
	PURCHASE ORDER:	REVISION: A
EM NO: P-110 A/B, P-220 A/B, P-241	RFQ NUMBER: 91585	CHECKED BY:

DATA AND DRAWINGS REQUIRED	WITH BID		ARO			ARAD			PTS		
	Q	T	Q	T	S	Q	T	S	Q	T	S
1. DIMENSIONED OUTLINE DRAWINGS	4	P	4	R	2W	4/1	C/F	2W			
2. CROSS SECTIONAL DRAWINGS											
3. COMPLETED DATA SHEETS	2	X									
4. PERFORMANCE CURVES (CERTIFIEDS WITH 13)	2	X							7	C	4W
5. CATALOG INFORMATION, CUTS, ETC.	4	X									
6. FOUNDATION DIAGRAMS AND LOADING	2	X									
7. SCHEMATIC PIPING DRAWINGS											
8. SCHEMATIC WIRING DIAGRAMS											
9. ASSEMBLY/ARRANGEMENT DRAWINGS											
10. COMPONENT/SHOP DRAWINGS											
11. DETAILED PARTS LIST (WITH 13)									7	P	4W
12. RECOMMENDED SPARE PARTS (WITH 13)									7	P	4W
OPERATION AND MAINTENANCE MANUALS									7	X	4W
14. INSTALLATION INSTRUCTIONS									4	X	4W
15. MILL TEST CERTIFICATES WITH HEAT NO.											
16. ENGINEERING, FABRICATION SCHEDULE			2	C	5D						
17. WELDING PROCEDURES											
18. SHIPPING SCHEDULE									2	X	4W
19. WEIGHT LIST OF FABRICATED PARTS FOR ERECTION									2	X	4W
20. UNIT SHIPPING WEIGHT, ERECTED WEIGHT									2	X	4W
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23. ASME CODE CALCULATIONS											
24. SERIAL NUMBER-TAG NUMBER CROSS REFERENCE									2	X	4W

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IM REMEDIATION SERVICES CORP.
5335 TRIANGLE PARKWAY
NORCORSS, GEORGIA 30092

LEGEND: Q-QUANTITY S-SCHEDULE = W-WEEKS D-DAYS
T-TYPE = P-PRINT C-CERTIFIED REPRODUCIBLE X-PHOTOCOPY
R-REPRODUCIBLE F-DXF CAD FILE
ARO - AFTER RECEIPT OF ORDER PTS-PRIOR TO SHIPMENT
ARAD - AFTER RECEIPT OF APPROVED DRAWINGS

SECTION 11316

AIR OPERATED PUMPS

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 A 123 (1989a) 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 283 (1988) Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A 307 (1990) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM D 975 (1990) Diesel Fuel Oils

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1 (1989; B1.1a-1984) Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

ASME B16.5 (1988; Errata Oct 1988)&\ Pipe Flanges and Flanged Fittings

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

FEDERAL SPECIFICATION (FS)

FS TT-E-489 (Rev H) Enamel, Alkyd, Gloss, Low Vol Content

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC-Paint 16	(1982) Coal-Tar Epoxy-Polyamide Black (or Dark Red) Paint
SSPC-SP 6	(1989) Commercial Blast Cleaning
SSPC-SP 8	(1982) Pickling
SSPC-SP 10	(1989) Near-White Blast Cleaning

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is, in the opinion of the NTR, reasonably convenient to the jobsite. Equipment of the same types shall each be the product of one manufacturer.

1.2.2 Description

The pumps shall be air driven positive displacement double-diaphragm pumps as specified.

1.2.4 Nameplates

Pumps shall have a standard nameplate securely affixed in a conspicuous place showing the manufacturer's name, address, type or style, model, serial number, and catalog number. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

1.2.7 Factory Tests

Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards. Where two or more identical pumps are specified, only one representative pump shall be tested. Certified test results shall be submitted to the NTR.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 Manufacturer's Catalog Data

Materials and Equipment

Manufacturer's descriptive data and technical literature, performance charts and curves for all pump sizes for a given casing, catalog cuts, and installation instructions. Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies, with current unit prices and source of supply.

1.3. Drawings

Positive Displacement Pump System
A complete listing of equipment and materials. Drawings containing complete schematic 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 maintenance and operation.

1.3.3 Operation and Maintenance Manuals

Provide O&M manual for air operated double-diaphragm pump Data package 3.

1.4 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified below, and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

2.2 AIR OPERATED DOUBLE-DIAPHRAGM PUMPS

Pumps shall be provided complete and ready for operation from a manufacturer regularly involved in the manufacture of this product.

The Contractor shall provide two (2) air operated double-diaphragm pumps (P-143, and P-141) with suction and discharge flange connections. Each pump shall be self-priming, capable of operating safely unattended.

Each unit shall be provided with quick opening ball check valves, neoprene diaphragms, air inlet, air cylinder, air pressure regulator, and control package.

2.2.1 Design Data

2.2.1.1 Sludge Transfer Pump (P-143)

Maximum pumping capacity (water) - gpm 10

Maximum discharge head - ft. 50

Maximum sphere size passing (lined) - inch 1/8

Inlet size 1" male NPT

Outlet size 3\4" male NPT

Maximum air requirement 4 SCFM

Required air supply pressure 30 psig

2.2.1.2 Filter Press Feed Pump (P-141)

Maximum pumping capacity (water) - gpm 50

Maximum discharge head - ft. 220

Maximum sphere size passing (lined) - inch 1/8

Inlet size 3" male NPT

Outlet size 3" male NPT

Maximum air requirement 63 SCFM

Required air supply pressure 100 psig

2.2.2 Pump Casing and Wetted Parts

The pump casing and other wetted parts shall be constructed of 316 stainless steel.

2.2.3 Air Valve

Air valve shall be provided and shall be of brass construction. An air valve cap of nylon construction shall be included.

2.2.4 Other Non-Wetted Parts

Center block, inner piston, and air chamber shall be of aluminum construction.

2.2.5 Pump Diaphragms

The pump diaphragms shall be constructed of neoprene, resistant to metal hydroxide sludges.

2.2.5 Suction and Discharge Check Valves

Suction and discharge check valves shall be ball check type of teflon construction. Valve seats (O-rings) also shall be teflon. Quick opening yoke shall be used for easy access to the valve internals. Valves shall be considered an integral part of the pump.

2.2.8 Logic Controller

A programmable logic controller (to be provided by dewatering press manufacturer) shall be used to adjust the air pressure to meet the discharge pressure requirement. As the discharge pressure changes, the controller increases or decreases the pump inlet pressure to meet demand.
The maximum desired pressure is 100 PSIG and also is adjustable throughout its range. When the press cycle is complete the controller will accept a signal to relieve system pressure and reset the pump for the next cycle.

2.2.9 Finish

Pump assembly shall have a rust-inhibiting paint or enamel finish as is standard with the manufacturer

2.2.10 Tools

A complete set of all special tools which may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment. All tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the NTR.

PART 3 EXECUTION

3.1 INSTALLATION

Each pump shall be installed in accordance with the written instructions of the manufacturer and under the direct supervision of the manufacturer's representative. Set, shim, and grout pump in strict accordance with the

manufacturers published instructions.

3.1.1 Concrete Foundations

Concrete for equipment foundations shall be as specified in Section 03302, "CAST-IN-PLACE CONCRETE (MINOR CONSTRUCTION)". Concrete foundations shall be integral with and of the same class as that of the building floor unless otherwise indicated. Concrete having a compressive strength of at least 3,000 psi shall be used in foundations that are entirely separated from the surrounding floor. An expansion joint shall be installed between the foundation and floor slab. Foundation bolts, as required, shall be furnished for proper positioning during the placement of the concrete.

3.1.2 Finishing

Set, shim, and grout pump in strict accordance with the manufacturers published instructions.

3.2 TESTS

3.2.1 Field Equipment Test

After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. The Contractor shall make arrangements to have the manufacturer's representatives present when field equipment tests are made. Each pumping unit shall be given a running field test in the presence of the NTR for a minimum of 1 hour. Each pumping unit shall be operated at its rated capacity or such other point on its head-capacity curve selected by the NTR. The Contractor shall provide an accurate and acceptable method of measuring the discharge flow. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

3.3 FIELD PAINTING

Stainless steel, galvanized steel, and nonferrous surfaces shall not be painted.

3.3.1 Touch-Up Painting

Factory painted items requiring touching up in the field shall be thoroughly cleaned of all foreign material and shall be primed and topcoated with the manufacturer's standard factory finish.

3.3.2 Exposed Ferrous Surfaces

Exposed ferrous surfaces shall be painted with two coats of enamel paint conforming to FS TT-E-489, Class A. Factory primed surfaces shall be solvent-cleaned before painting. Surfaces that have not been factory primed shall be prepared and primed in accordance with the enamel paint manufacturer's recommendations.

3.4 MANUFACTURER'S FIELD SERVICES

The Contractor shall obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment. Up to one (1) day of service shall be provided at no expense to the Government.

3.5 DEMONSTRATION

Upon completion of the work and at a time designated by the NTR, the services of one or more competent engineers shall be provided by the Contractor for a period of not less than 4 hours to instruct a representative of the Government in the operation and maintenance of equipment furnished under this section of the specifications. These field instructions shall cover all the items contained in the bound instructions.

-- End of Section --

SECTION 13121

MASONRY BUILDING

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 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 446/A 446M 1991 Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

ASTM A 463 1988 Steel Sheet, Cold-Rolled, Aluminum-Coated Type 1 and Type 2

ASTM A 755/A 755M 1989 Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating for Exterior Exposed Building Products

ASTM A 792M 1985 (Rev. A) Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot Dip Process (Metric)

ASTM B 117 1990 Salt Spray (Fog) Testing

ASTM B 209 1990 Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 1992 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM E 84 1991 (Rev. A) Surface Burning Characteristics of Building Materials

ASTM E 96 1992 Water Vapor Transmission of Materials

ASTM G 23 1990 Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

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

SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL (SBC)

SBC Standard Building Code (Latest edition)

1.2 DESCRIPTION OF BUILDING

1.2.1 Dimensions

Building dimensions shall be as standard with manufacturer, not less than those indicated, but exceeding the indicated dimensions only by the amount of the closest standard size thereto. Eave height shall be measured from the top of the eave strut at the sidewall steel line to the finished floor. 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 load bearing masonry construction with roof supported by steel joists. End walls shall be of rigid frame. Roof slope shall be a minimum of 1 inch per foot

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, Minor Construction." The foundation loads are supplied by the building manufacturer.

1.3 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.

1.3.1 Roof Dead and Live Loads

Design loads shall include dead loads and live loads. The minimum roof design live load shall be 30 pounds per square foot (psf) applied on the horizontal projection of the roof.

Structural roof members shall be designed to withstand loads imposed by the chosen HVAC equipment.

1.3.2 Wind Loads

Wind pressures shall be computed and applied in accordance with ASCE 7. Basic wind speed of 100 miles per hour (mph) shall be used in computing the wind load, unless local building code requires a greater wind speed.

1.3.3 Seismic Loads

As required for Seismic Zone 1.

1.3.4 Deflection

1.3.4.1 Structural Members

The building shall be designed to accommodate thermal expansion without excessive deflection or deformation of primary or secondary structural members, roof panels, flashing, or masonry walls.

The building shall be designed to limit horizontal drift such that the horizontal drift shall not exceed 0.5-inch total deflection from eave height to ground floor.

1.3.4.2 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.

1.3.4.3 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.

1.3.4.4 Clearance Requirements and Building Dimensions

The total inside required dimensions are as measured vertically from finished floor to the inside of column/beam haunch of the rigid frame and horizontally between the inside of the rigid frame at those points, in N-S and E-W directions.

The required clear dimensions are as follows:

Vertical dimension	18' - 0"
Horizontal dimension	N-S 96' - 0" E-W 60' - 9"

1.5 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.5.1 Drawings

a. Roof framing

b. Structural connections

c. Roofing connections

d. Roof penetrations and flashings

e. Accessories, masonry ties, gutter, downspouts

f. Foundation plans

Submit as necessary to erect the building and install components.

1.5.2 Design Data

a. Building

b. Foundation loads

c. Anchor bolts

d. Bracing

1.5.2.1 Building

Submit design calculations for the entire building, masonry walls 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.

1.5.3 Certificates

Submit certificates attesting that materials comply with this specification.

1.5.4 Operation and Maintenance Manuals

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 WARRANTY

Provide warranty against water leaks arising out of or caused by ordinary wear and tear by the elements for a period of 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 ROOF MATERIALS

MBMA LRMBSM except as specified otherwise herein. Design roof 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 Panels	16 Manufacturer's Standard (MFG STD) gage, .0478 inch
Roof Panels	
Steel	26 MFG STD gage, .0179 inch
Aluminum	0.032 inch
Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings	
Steel	26 MFG STD gage, .0179 inch
Aluminum	0.032 inch
Eave Gutters and Downspouts	
Steel	26 MFG STD gage, .0179 inch
Aluminum	0.032 inch

Roof Ventilators	
Steel	26 MFG STD gage, .0179 inch
Aluminum	0.032 inch
Louvers	
Steel	18 MFG STD gage, .0478 inch
Aluminum	0.064 inch

2.1.2 Panels

a. Fabricated of zinc-coated steel, aluminum-coated steel or aluminum/zinc-coated steel.

b. Preformed, depth shall be manufacturer's standard for selected profile.

2.1.2.1 Zinc-Coated Steel Sheet

ASTM A 755/A 755M, Coating Class G-90 or ASTM A 446 Grade B/A 446M, Grade A.

2.1.2.2 Aluminum-Coated Steel Sheet

ASTM A 463, Type 1 or Type 2.

2.1.2.3 Aluminum/Zinc-Coated Steel Sheet

ASTM A 792M, AZ 55.

2.1.2.4 Aluminum Sheet

Alloy 3004 Alclad conforming to ASTM B 209.

2.2 FRAMING AND STRUCTURAL MEMBERS

2.2.1 Steel

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

2.2.2 Aluminum

ASTM B 221 or ASTM C 308.

2.2.3 Structural Tube

ASTM A 500 or ASTM B 221.

2.3 MISCELLANEOUS ITEMS

2.3.1 Caps, Strips, and Plates

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

2.3.2 Closure Strips

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

2.3.3 Sealant

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

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 roof panels of zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear strength of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8-inch thick. 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 32 feet for aluminum and 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 ROOF CURBS

Provide roof curbs fabricated of zinc-coated steel of manufacturers standard factory finish, color as indicated complete with braces for supporting scheduled equipment. Height of curb shall be a minimum of 12 inches. Provide a sponge rubber mounting pad for a weather seal connection to equipment.

2.7 LOUVERS

Provide louvers and frames of the sizes and color indicated. Provide manufacturer's standard factory finish. Fold or bead blades at the edges, fixed at an angle to exclude driving rains, and secure to the frames by riveting or welding as standard with manufacturer. 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 and frames shall be of the same type metal as the louvers; screen wire shall be not less than 0.0475 inch in diameter. Free area of louver shall be a minimum of 49 percent. Static pressure drop across louver shall be not more than .07 inches water gauge.

2.8 INSULATION

Blanket type 0.6-pound fiberglass 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. 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 150 or less when tested in accordance with ASTM E 84.

c. Roof insulation shall have an "R" value as required to comply with governing energy and building codes.

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.

2.9 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.

2.9.2 Factory Color Finish

Provide exterior and interior exposed surfaces of metal roof and 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 the building manufacturer's standard paint. Provide standard dry film thickness of 0.8 mil for exterior coating exclusive of primer. Provide exterior primer thickness standard with building manufacturer. Interior color finish shall consist of the same coating and dry film thickness as the exterior. Provide interior and exterior color finish meeting the test requirements specified below. Tests shall have been performed on the same factory finish and thickness provided.

a. Salt Spray Test: ASTM B 117, minimum 500 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, for laboratory test and film thickness less than 5 mil and Method A for site tests. There shall be no film removed by tape applied to 11 parallel cuts spaced 1 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, 1000 hours, no signs of blistering, cracking, creepage or corrosion on score panel.

g. Specular Gloss: ASTM D 523, finished surfaces exposed to the building exterior shall have a specular gloss of 10 measured at an angle of 85 degrees.

h. Abrasion: ASTM D 968, Method A, falling sand shall not expose substrate when tested in quantities 30-40 liters of sand per mil of thickness.

PART 3 EXECUTION

3.1 INSPECTION

Check concrete dimensions, anchor bolt size and placement, and slab elevation with 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 Navy's Technical Representative (NTR). If defects or errors in fabrication of components cannot be corrected, remove and provide nondefective components. When installing wall and roof systems, install closure strips, flashing, sealing material, and other accessories in accordance with building manufacturer's instructions to provide a weathertight system, free of abrasions, loose fasteners, and deformations. After erection is complete, repair and coat abraded and damaged, primed or factory-finished surfaces to match adjacent surfaces.

3.2.1 Dissimilar Materials

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

a. Paint the incompatible metal with a coating of manufacturer's standard heavy-bodied paint.

b. Paint the incompatible metal with a prime coat of corrosion inhibitive primer followed by one or two coats of aluminum metal-and-masonry paint, or other suitable protective coating, excluding products containing lead and chromium pigmentation.

c. Provide an approved nonabsorptive gasket.

d. Apply an approved caulking between the aluminum and the incompatible metal.

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

wood treated with incompatible wood preservatives, by method (a) or use two coats of aluminum paint.

3.2.2 Bases and Sill Members

Brace members 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 Roof Construction

Apply the roofing panels in full lengths from ridge to eaves with no transverse joints except at the junction of ventilators, curbs, chimneys, and similar openings. Lay side laps away from the prevailing wind, and seal side and end laps with joint sealing material. Flash and seal the roof at the ridge, at eaves and rakes, at projections through the roof, and elsewhere as necessary. Minimum side lap shall be one corrugation, configuration, or interlocking rib.

3.2.4 Minimum Fastener Spacing

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

a. 8 inches o.c. at end laps of covering,

b. 12 inches o.c. at connection of covering to intermediate supports,

c. 12 inches o.c. side laps of roof coverings, 18 inches o.c. at side laps of wall.

3.3 FIELD PAINTING

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

SECTION 13135

PREFABRICATED REINFORCED THERMOSET PLASTIC (RTP) BUILDING

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope

This section specifies the prefabricated reinforced thermostat plastic (RTP) building, consisting of the building with lockable door, interior lighting, electric resistance heater, exhaust fans and all appurtenances required for a complete and operational unit.

B. Equipment List

Equipment numbers are as follows:

Well Housing DRW-1, DRW-2 and DRW-3

Well Housing SRW-1, SRW-2 and SRW-3

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications and Unit Responsibility

The General Contractor shall cause all of the equipment specified hereunder to be selected, designed and furnished by a single manufacturer who shall assume complete responsibility for adequacy of the equipment. The manufacturer shall have been regularly engaged for a minimum of 5 years in the design and manufacture of this type of equipment. Nothing in these provisions shall be construed as relieving the Manufacturer of his overall responsibility for this portion of the work.

B. Performance and Design Requirements

The building shall be designed in accordance with SEC (latest edition), the present configuration shown on the drawings and in accordance with the following criteria:

Wall height, feet-inches, minimum	7-8
Total height, feet-inches, minimum	8-0
Length, feet-inches	10-0
Width, feet-inches	8-0
Minimum physical standards	
Tensile strength, (psi)	15,000
Flexural strength, (psi)	25,000
Flexural modulus	1.0 x 106 psi

Water absorption, percent 24 hr.	.1 percent
Insulation, (R value) capabilities	19

1.3 SCOPE

The building will be installed in a weather exposed location subject to conditions including rain, snow, ice, wind, sunlight condensation and dust. Ambient air temperatures are expected to range between 20 degrees F and 100 degrees F.

1.4 SUBMITTALS

Submittals shall be provided in accordance with Section C, Part 7, of the Basic Contract and with Section 15010, and shall include the following:

1. Catalog data (4 copies with quote).
2. Manufacturer and method of fabrication (4 copies 4 weeks after order).
3. Materials of construction and coating details (4 copies 4 weeks after order).
4. Manufacturer's shop drawings on building including anchor bolt locations and all appurtenances and installation plans showing the arrangement of the equipment, pipe penetration details, heater and electrical installation details (4 copies 4 weeks after order).
5. Wiring diagrams for light, outlets, fans and heat (4 copies 4 weeks after order).
6. Manufacturer's shipping, handling and installation procedures (4 copies 4 weeks after order).

PART 2 PRODUCTS

2.1 BUILDING

A. General

Building shall have dimensions as specified with sloping roofs, peaked at the center. Building shall be one piece molded construction. Door and penetrations shall be located as shown. Building shall be manufactured by Warminster Fiberglass, Dyer Fiberglass Inc., or Plasti-fab, Inc.

B. Construction

The building shall be constructed of chemical-resistant double skin RTP with 1-inch thick minimum closed cell self-extinguishing foam. The RTP door shall be a double 36 inches by 78 inches minimum and shall be mounted on a stainless steel, continuous piano hinge. The doors shall be insulated and fitted with a 2-point stainless steel latch with lock, stop chain, full gasket and safety window. The gable roof shall have a 3-inch overhang on all sides. Two cadmium plated lifting eyes shall be provided for lifting the building for installation. The RTP shall have a smooth white exterior gelcoat and shall contain ultraviolet light absorbers. Resins used shall have a flame spread rating of less than 25. All fasteners throughout the building shall be stainless steel.

The building shall be designed to withstand wind loads of 125 mph and a roof snow load of 30 pounds per square foot. All penetrations shall be field coordinated with the installed equipment, and as shown on the drawings. All exposed wall sections shall be sealed in accordance with manufacturer's recommendations prior to pipe installation. Penetrations shall be sealed with a removable weathertight seal to prevent water from entering.

The unit shall be constructed with a 4-inch wide internal flange, pre-drilled for mounting with a gasket to the concrete pad shown. Gasket shall be of sufficient length for installation between the building anchor flange and the concrete foundation. Gaskets for the floor mounting flange and door shall be of neoprene.

2.2 APPURTENANCES

A. General

Appurtenances to be furnished with the building include adjustable air vents, electric resistance heater with thermostat, lighting and duplex receptacles.

B. Adjustable Air Vents

Two 8-inch diameter adjustable vents with screening shall be provided for air circulation. Vent shall be constructed of RTP.

C. Exhaust Fans

Two exhaust fans located within the building (one mounted in a location off the floor and the other mounted in the roof at opposite locations). Fans shall be controlled by an automatic door switch which activates said fans upon opening of doors. Fans shall be 900 cfm each, 120 VAC.

D. Electric Resistance Heater

A thermostatically controlled electric heater shall be mounted in a location

off the floor and shall not impede movement in the building. Heat shall be 120 VAC, 1,300 to 1,500 watt.

E. Lighting and Duplex Receptacle

Two round Circline-type fluorescent lights shall be provided. An on/off switch for the light shall be located next to the door. Four (4) 120 VAC duplex receptacles shall be provided. All electrical devices shall be wired in accordance with Division 16 of this project manual.

PART 3 EXECUTION

3.1 INSTALLATION

The prefabricated RTP buildings shall be installed on the concrete equipment foundations as shown, and in accordance with the manufacturer's printed instructions. The RTP building provided in this section shall be factory assembled and checked for fit prior to shipment to ensure trouble-free field assembly.

- END OF SECTION -

SECTION 15010

GENERAL MECHANICAL

PART 1 GENERAL

1.1 LOCATION

All aspects of this project are located at Operable Unit No. 2, Marine Corps Base, Camp Lejeune, North Carolina.

1.2 PROJECT DESCRIPTION

The project is a soil and groundwater remediation task. Various areas of concern (AOC) have been established which demonstrate abnormally high levels of chemical contamination.

Several shallow and deep wells will be drilled to access the contaminated groundwater. The water will be pumped to a groundwater treatment building where it will be processed to the extent required to make it fit for human consumption.

The fully processed water will be released back to the ground via a nearby creek. For a more detailed description refer to the Process Description and Control Philosophy Report in Attachment B and Project Drawings in Attachment C.

1.3 SCOPE

By solicitation of competitive bids and subsequent evaluation thereof, OHM Remediation Services Corp. (OHM) intends to, via this Bid Specification secure the services of a subcontractor of the General Mechanical Activities and to define the extent of their responsibilities.

1.3.1 Work Included

Without limiting or restricting the volume of work and solely for the convenience of the Subcontractor, the extent of the Subcontractor's responsibility for the work defined in the scope section is as follows:

a. Provide labor, tools, equipment and supervision to unload, transport, assembly, set-up, align, anchor, paint and insulate per manufacturer's requirements of all project equipment specified in Mechanical Equipment List - Attachment A.

b. Furnish (procure), fabricate, install, paint, and as required heat trace and insulate of all equipment connecting pipes, fittings, flanges, couplings, valves, supports, etc.

If prefabricated section of piping is provided by the specific equipment manufacturer than thorough inspection and fitting of all connections shall be made prior to installation.

c. Furnish (procure), fabricate and install interior plumbing systems including sanitary and cold water distribution systems; toilet room fixtures including lavatory, water closed, etc.; in-line instantaneous electric hot water heater for the lavatory; emergency shower and eyewash system, fire protection system including utility station and hose rack; and all required connections to the process and HVAC systems.

d. Furnish and install acid resistent floor drainage system including sump pump.

e. Furnish and install Wet Well 6 ft. sections of reinforced concrete pipe in Building Drainage and Wastewater Piping Stations.

f. Furnish, install, support and attach to the piping, drainage and wastewater pumps.

g. Install prefabricated fiberglass enclosure for wellheads and fiberglass metering manholes.

h. Set up polymer drums.

i. Set up H_2SO4 and N_aOH polyethylene containers.

j. Perform hydrostatic test to check the leakage on all installed pipe systems.

k. Coordinate all installation efforts with structural, electrical, I&C and HVAC Subcontractors.

If requested by project coordinator, install equipment, piping or components provided by other groups. For example, Mechanical Subcontractor may be requested to install transformer provided by Electrical Subcontractor, or install space air heater provided by HVAC Subcontractor or to install flow transmitter provided by I&C Subcontractor.

1.3.2 Work Not Included

The extent of the Subcontractor's responsibility does not include activities clearly defined and specified as a responsibilities of the structural, electrical, I&C or HVAC Subcontractor.

1.4 LEVEL OF PERFORMANCE

The bidder shall be completely responsible that equipment, materials, and services furnished under this specification are of appropriate industry standard in every respect including adherence to all applicable codes and standards, with first-class workmanship throughout. Therefore, if any requirement of this specification is deemed by the Subcontractor to be incorrect, unsuitable, contradictory, or such that conformance therewith would diminish or adversely affect in any way the Subcontractor's responsibility, the Bidder shall specifically delineate his objections and the reasons therefor in his proposal, so that they may be resolved before the purchase order is placed. In all other respects, the Subcontractor, by accepting the purchase order, shall be deemed to have agreed that conformance with the specification's requirements will not prejudice in any way the Purchaser's rights under warranty.

1.5 DEFINITIONS

Bidder - A company submitting a proposal to fulfill the requirements of this specifications.

Mechanical Subcontractor - The company accepting the purchase order for fulfilling the requirements of this specification and provide all mechanical services involved with this project.

Structural Subcontractor - The company which provides all structural, construction services involved with this project.

Electrical Subcontractor - The company which provides all electrical services involved with this project.

I&C Subcontractor - The company which provides all instrumentation and control services involved with this project.

HVAC Subcontractor - The company which provides HVAC services involved with this project.

General Site Work Subcontractor - The company which provides general site work like excavation, road pavements, fencing, etc.

General Contractor - OHM Remediation Services Corp., 5335 Triangle Parkway, Suite 450, Norcross, GA 30092.

Purchaser - Department of the Navy, Naval Facilities Engineering Command, Atlantic Division (LANTDIV)

Engineer - Baker Environmental, Inc. Corapolis, PA 15108

Approved - This word, when applied by the General Contractor to the Subcontractor's drawings or documents, means that the drawings or documents are satisfactory from the standpoint of interfacing with all non-Subcontractor furnished components of the installation, and/or that the General Contractor have not observed any statement or feature that appears to deviate from the specification's requirements. Except for the interfacing with all non-Subcontractor furnished components, the Subcontractor shall retain the entire responsibility for complete conformance with all specification requirements and performance guarantees.

Approved as Revised - These words, when applied by the General Contractor to the Subcontractor's drawings or documents, mean that the drawings or documents are approved as defined above except that the changes shown are required for the proper interfacing with non-Subcontractor furnished components of the installation or are necessary to be in conformance with the specification requirements. On the basis that the Subcontractor shall retain the entire responsibility for compliance with all specification requirements (except those affected by interfacing with non-Subcontractor furnished components), the Subcontractor shall either:

1. Incorporate the changes into his drawing or document and resubmit to the General Contractor, or

2. Inform the General Contractor that the changes cannot be made without prejudice to the Subcontractor's responsibility under warranty, and resubmit with explanation of the reasons therefor.

Not Approved - These words, when applied by the General Contractor to the Subcontractor's drawings or documents, mean that the drawings or documents are being returned to the Subcontractor for his remediation. After remediation, the drawings shall be resubmitted to the General Contractor.

Shall - Indicates a mandatory requirement.

1.6 REFERENCES

The publications referencing applicable standards are listed under each specific section listed in Section II, Part 2 of this Specification and their attachments.

1.7 QUALITY ASSURANCE

1.7.1 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.

1.7.2 Alternative Qualifications

Products having less than a 2-year field service record shall be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.7.3 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 Navy's Technical Representative (NTR).

1.8 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.

1.9 SAFETY REQUIREMENTS

1.9.1 Equipment Safety

Provide positive means of locking out equipment so that equipment cannot be accidentally started during installation procedures. High-temperature, acid and caustic 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, construction platforms, and guardrails where required for safe construction of the equipment. Provide ladders, scaffold or stairways to reach catwalks and construction platforms. Ensure that access openings leading to equipment are large enough to carry through routine maintenance items such as filters and tools.

1.9.2 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 the electrical specification.

1.10 POSTED OPERATING INSTRUCTIONS

Attach operating instructions provided by manufacturers of 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.

1.11 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 inches high normal block style.

1.12 INSTRUCTIONS 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.

PART 2 PRODUCTS

2.1 SUBMITTAL

Submit copies of the documentation specified in each specific section plus the following:

a. Proposed equipment installation schedule.

b. Proposed schedule of fabrication of the necessary piping.

c. List and qualifications of the proposed personnel (management, pipe fitters, welders, etc.)

2.2 PROPOSAL PRICING

Bidder shall submit project total price and itemized pricing which will include: cost of the parts, pipes, armature, supports, delivery, installation, testing etc. Pricing proposal should include cost of the supervision, maintenance and operators training, forms of payment, price oscillation, etc.

PART 3 EXECUTION

3.1 SCHEDULE REQUIREMENTS

The General Contractor have prepared a preliminary schedule for the project which identified the major milestones that must be met. These milestones are presented in Attachment D to this specification. The Bidder shall prepare and submit (with the Bid Proposal) a summary level schedule that incorporates the milestones and that represents the Bidder's plan to execute the scope of work.

It shall be the Subcontractor's responsibility to prepare and submit to the General Contractor a detailed Critical Path Method (CPM) schedule which incorporates the actual sequence of work to be performed and deliveries of all material and equipment needed.

Within twenty-one (21) calendar days after award of contract, the Subcontractor shall submit the detailed CPM schedule to the General

Contractor. This time scaled schedule shall include all Subcontractors' scope of work activities, including procurement, shop detailing/fabrication/testing and shipment activities as well as field checkout, testing and full system commissioning activities.

The Subcontractor shall also submit to the General Contractor unpriced copies of all purchase orders issued for the procurement of permanent components: pipes, fittings, valves, couplings, flanges, supports, etc., to verify that commitments have been made.

3.2 COMMUNICATIONS/CORRESPONDENCE

All correspondence from the bidder shall consist of an original plus three (3) copies and shall contain the following subject heading:

SPECIFICATION NO. 15010
TITLE: GENERAL MECHANICAL
PROJECT: Soil and Groundwater Remediation, Operable Unit No. 2, MCB Camp Lejeune, NC

All correspondence/communications shall be addressed to the General Contractor specifically:

OHM Remediation Services Corp., 5335 Triangle Parkway, Suite 450, Norcross, GA 30092

3.3 REJECTED WORK AND MATERIALS

The Subcontractor, upon written notice from the Purchaser, shall remove from the premises all work and materials rejected as defective, unsound, improper, or in any way failing to conform to the requirements of the contract documents. The Subcontractor shall at his sole expense make good all work damaged by such removal and shall promptly replace materials damaged or improperly worked by him and re-execute replacing the work of any other Subcontractor that is in any way affected by the removal of the defective work.

Failure of the Subcontractor to comply with this requirement within 10 days of notification from the Purchaser, will authorize the Purchaser to take appropriate action to implement such repair or removal. The Subcontractor will be back charged for all such expenses incurred to implement such repair or removal, including the Purchaser's supervision costs.

3.4 FACILITIES AND SERVICES

3.1.1 Availability of Utilities Services

a. The Government shall supply potable and non-potable water required to perform work to the Subcontractor. The Exterior Water

Distribution System is a responsibility of the General Site Work Subcontractor.

b. The Government shall supply reasonable amounts of temporary power to the Subcontractor. The Subcontractor shall provide all equipment and labor to the work. The Subcontractor shall make connections, including providing meters, and make disconnections.

c. The Subcontractor shall not operate nor disturb the setting of control devices in the base utilities system, including water, sewer, electrical and steam services. The Government will operate the control devices as required for normal conduct of the work. The Subcontractor shall notify the NTR giving 2 days advance notice when such operation is required.

d. The Subcontractor shall contact Base Telephone Services in writing to obtain telephone connection and payment information. Cost for telephone connection will be paid by the Subcontractor. The Subcontractor shall provide all equipment and labor necessary to connect the telephone service to the site. The Subcontractor shall make arrangements for connections and disconnections and payments.

3.4.2 Storage in Existing Buildings

Storage in existing buildings will not be allowed.

3.4.3 Open Site Storage Size and Location

The open site available for storage shall be confined to the areas indicated on the contract drawings.

3.4.4 Trailers, Storage, and Temporary Buildings

Locate these where directed. Trailers or storage buildings will be permitted, where space is available subject to the approval of the Navy's Technical Representative (NTR). The trailers or buildings shall be in good condition, free from visible damage, rust and deterioration, and meet all applicable safety requirements. Trailers shall comply with all appropriate state and local vehicle requirements. Failure of the Subcontractor to maintain the trailers or storage buildings in good condition will be considered sufficient reason to require their removal. A sign not smaller than 24 inches by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state or local standards for anchoring mobile trailers.

3.4.4.1 Storage and Office Trailers

Provide a trailer of sufficient size for an office trailer work area and floor area for the exclusive use of the Subcontractor's Quality Control Representative. Also provide room in the same trailer for the Quality Control Records. Provide the Quality Control representative with a 4-foot by 8-foot plan table, a standard size office desk and chair, and telephone service. Quality control records shall be filed in the office and available at all times to the Government.

a. Trailers must meet state station requirements and must be in good condition.

b. Trailers shall be lockable and shall be locked when not in use.

c. Trailers shall have a sign in the lower left hand corner of left door of trailer with the following information: company name, address, registration number of trailer or vehicle identification number, location on base, duration of contract or stay on-base, contract number, local on-base phone number, off base phone number of main office, and emergency recall person and phone number.

3.5 RESTRICTIONS ON OPERATIONS

3.5.1 Scheduling

3.5.1.1 General Scheduling Requirements

The work areas will remain in operation during the entire construction period. The Subcontractor shall schedule the work as to cause the least amount of interference with Base operations. Work schedules shall be subject to the approval of the NTR. Permission to interrupt Base roads shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

3.5.1.2 Regular Work Hours

The regular work hours for the Marine Corps Base, Camp Lejeune, North Carolina, are 0730 to 1530, Monday through Friday.

3.5.1.3 Work Outside Regular Hours

If the Subcontractor desires to carry on work outside regular hours or on Saturdays, Sundays or holidays, the Subcontractor shall submit an application to the NTR. The Subcontractor shall allow ample time to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. At night, the Subcontractor shall light the different parts of the work in an approved manner.

3.5.2 Security Requirements

Subcontractor shall comply with general security requirements in accordance with Section C of the Basic Contract. No employee or representative of the Subcontractor 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 NTR.

3.5.2.1 Extraordinary Security Requirements

The clause of the Contract Clauses entitled "Identification of Employees" and the following apply:

a. Subcontractor Registration: Register with the Pass Office located at the main gate.

b. Equipment Markings: Equipment owned or rented by the company will have the company name painted or stenciled on the equipment in a conspicuous location. Rented equipment is to be conspicuously marked with a tag showing who rented it. Register the equipment with the truck investigation team.

c. Procedure Information: For additional information regarding registration procedures, contact the Officer in Charge of Subcontractors at 910-451-2326.

3.6 ACTIONS REQUIRED OF THE SUBCONTRACTOR

The Subcontractor shall comply with all requirements stated in Section C, Part 2.0, of the Basic Contract.

3.6.1 Base Permits

Permits are required for, but not necessarily limited to, welding, digging, and burning. Allow 7 calendar days for processing of the application. One copy of all applicable permits shall be posted at the job site.

3.7 PUBLIC RELEASE OF INFORMATION

The Subcontractor shall comply with all requirements stipulated in Section C, Part 2.0, of the Basic Contract.

3.8 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows.

3.8.1 Disposal of Rubbish and Debris

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows:

3.8.1.1 Removal from Government Property

a. Provide 24-hour advance written notice to the NTR of Subcontractor's intention to dispose of off-base.

b. Disposal at sites or landfills not holding a valid State of North Carolina permit is specifically prohibited. The prohibition also applies to sites where a permit may have been applied for but not yet obtained.

c. Off-base disposal of construction debris outside the parameters of this paragraph at sites without state permits and/or not in accordance with all regulatory requirements shall require the Subcontractor at his own expense to remove, transport, and relocate the debris to a state approved site. The Subcontractor shall also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris.

3.8.1.2 Removal to a Base Sanitary Landfill

a. Haul rubbish and debris to the Government Landfill site indicated or specified. Conform to Regulations of Base Sanitary Landfill.

Each category of construction debris shall be separated at the construction site and delivered separately to the landfill.

Each category of construction debris shall be placed in the landfill at a location designated by the landfill operator.

Each and every vehicle delivering debris must be weighed upon entrance and weighed upon exiting. All debris must be covered.

b. Metals will not be accepted at the Base Sanitary Landfill. Materials which may be deposited in the landfill include:

(1) Mixed Debris
The following materials shall be placed in e landfill in a location designated by the landfill operator. These items may be mixed together.

Sheetrock - plaster - glass (broken).

Non-asbestos insulation - (fiberglass and mineral wool shall be bagged).

Packaging paper, styrofoam, and pasteboard boxes.

Non-asbestos roofing materials such as shingles, built-up and single ply roofing.

Painted wood such as doors, windows, siding and trim.

Plastic/fiberglass such as pipe, electrical boxes, cover plates, etc.

Ceramic and vinyl flooring or tile - ceiling tile.

(2) Masonry and Concrete

Concrete, block, brick, mortar shall be delivered to the landfill separately from any other items and placed in a location designated by the landfill operator. All reinforcement wire and rebar must be removed flush with exposed surfaces.

(3) Nonrecycleable Cardboard

Corrugated cardboard boxes shall be delivered to the base recycling center located at Building 913. If base personnel rejects the cardboard, they shall be taken to the landfill.

(4) Nonrecycleable Wood Pallets

All useable pallets shall be delivered to the base recycling center located at building 913. If base personnel rejects the pallets, they shall be taken to the landfill.

(5) Treated Wood

Treated wood such as piling, power poles, etc., shall be delivered to the landfill, separated from any other items and placed in locations as designated by the landfill operator.

(6) Untreated/Unpainted Wood

Such as lumber, trees, stumps, limbs, tops, etc., shall be delivered to the landfill separated from any other items and placed in a location designated by the landfill operator.

(7) Organic Matter

Such as leaves, pine straw, grass clippings, and shrub clippings shall be delivered to the landfill separated from any other items and placed in a location designated by the landfill operator. No bags or containers are allowed.

(8) Fiberglass Tanks (550-gallon or less)

Tanks must be cleaned before delivery to landfill.

(9) Asphalt Pavement

Remove from Government Property and delivery to an asphalt recycling establishment. The Subcontractor shall provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling establishment receiving the removed asphalt.

(10) Asbestos

Dispose as directed by the NTR.

(11) Lead Based Paint Materials

Dispose as directed by the NTR.

(12) Metals

Metals will not be accepted at the landfill. Metals shall be removed from each and every category before delivery to the landfill.

(Example: Removal all hardware from doors and windows.)

Metal construction debris disposal shall be disposed of at DRMO Bldg. TC-861 - Camp Geiger.

Aluminum
Brass
Copper
Lead
Other Metal
Electrical Wiring
Cable (Cut in 3-foot or less sections)

3.8.2 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.

3.8.3 Fire Protection

COE EM-385-1-1, NFPA 241, and activity for regulations. Obtain approval from the activity Fire Chief prior to commencement of hot work operations.

3.8.3.1 Notification of Fire

Post the activity fire poster in conspicuous locations and at telephone in construction shacks.

3.8.4 Quarantine for Imported Fire Ant (4/82)

Onslow, Jones and Cartaret Counties and portions of Dublin and Craven Counties have been declared a generally infested area by the United States Department of Agriculture (USDA) for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth in USDA Quarantine No. 81 dated 9 October 1970, and USDA Publication 101.81-2A of 23 July 1976, is required for operations hereunder. Pertinent requirements of the quarantine for materials originating on the Camp Lejeune reservation, the Marine Corps Air Station (Helicopter), New River and the Marine Corps Air Station, Cherry Point, which are to be transported outside Onslow "County or adjacent suppression areas, include the following:

a. Certification is required for the following articles and they shall not be moved from the reservation to any point outside Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an Officer of the Plant Protection and Quarantine Program of the U. S. Department of Agriculture.

(1) Bulk soil.

(2) Used mechanized soil-moving equipment. (Used mechanized soil-moving equipment is exempt if cleaned of loose noncompacted soil.)

(3) Other products, articles, or means of conveyance,if it is determined by an inspector that they present a hazard of transporting spread of the imported fir ant and the person in possession thereof has been so notified.

b. Authorization for movement of equipment outside the imported fire and regulated area shall be obtained from USDA, APHIS, PPQ, Box 83, Goldsboro, North Carolina, 27530, Attn: Mr. Haywood Cox, telephone (919) 735-1941. Requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Soil on or attached to equipment, supplies, and materials shall be removed by washing with water or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as necessary and as directed.

3.9 REQUIRED INSURANCE

(a) Within fifteen (15) days after award of this contract, the Subcontractor shall furnish the Contracting Officer a Certificate of Insurance as Evidence of the existence of the following insurance coverage in amounts not less than the amount specified below in accordance with the FAR 52.228-05, "Insurance - Work on a Government Installation (Sep 1989)" clause, Section I. This insurance must be maintained during the entire performance period.

Coverage

Comprehensive General Liability: $500,000

Automobile Liability: $200,000 per person; $500,000 per occurrence for bodily injury; $20,000 per occurrence for property damage.

Workmens' Compensation: As required by Federal and State Workers' compensation and occupational disease statutes.

Employer's Liability Coverage: $100,000 except in states where workers' compensation may not be written by private carriers.

Other as required by state law.

(b) Above insurance coverages are to extend to Subcontractor personnel operating Government owned equipment and vehicles.

(c) The Certificate of Insurance shall provide for thirty (30) days written notice to me Contracting Officer by the insurance company prior to

cancellation or material change in policy coverage. Other requirements and information are contained in the aforementioned "Insurance" clause.

SECTION II

MECHANICAL SUBCONTRACTOR

PART 1 GENERAL

Refer to Section I Part 1 of this specification

PART 2 PRODUCTS (SERVICES)

The P&ID, civil, mechanical, electrical, etc., drawings necessary to perform required works defined in scope of this specification are provided in Attachment C to this specification.

2.1 EQUIPMENT INSTALLATION

Within the scope of the Mechanical Subcontractor is to install all project equipment provided by several various manufacturers. Project Mechanical Equipment List is Attachment A to this specification.

Delivered equipment shall be unloaded, transported to the assigned place, assembled, aligned, anchored and if necessary painted, heat traced and insulated.

All installation shall be performed in accordance with Engineering and Manufacturers' instructions, drawings, manuals, specifications, etc.

Equipment delivered to the job site will be in various stages of assembly. Some equipment will require ground up assembly. See Jet Aeration System Specification Section 11272 Attachment F to this specification.

Some equipment will be completely assembled, painted and insulated (in form of the skid) and will require only anchoring and connecting to the system. See Compressed air System Specification Section 15487 - Attachment E to this specification.

Equipment installation shall be closely coordinated with Structural Subcontractor which will provide foundations, Electrical Subcontractor which will provide electrical connections, I&C Subcontractor which will provide controls.

If any interference occurs, the Project Coordinator shall be notified.

2.2 PIPING AND VALVING INSTALLATION

Within the scope of the Mechanical Subcontractor is to procure, fabricate, install, paint and if necessary heat trace and insulate all equipment connecting pipes, fittings, flanges, valves, couplings, meters, orifices, drains, vents, etc.

All fabrication shall be performed in accordance with:

a. Manufacturer Drawings. See Equipment Connection Drawings provided with each equipment.

b. Engineering Drawings. See Project Drawings - Attachment C to this specification.

c. Engineering Specifications. For procurement, fabrication and installation see referenced attachments provided below with each piping system.

2.2.1 Process Piping System

This system consists of the following:

a. Contaminated groundwater piping and valving. See Specification Section 15401 - Attachment G to this specification, and applicable paragraph 1.1 and 2.5 of the Specification Section 02900 - Attachment H to this specification.

b. Contaminated Sludge piping and valving. See Specification Section 15404 - Attachment I to this specification.

c. Seal water piping and valving. See Attachment G.

2.2.2 Plumbing System

This system includes sanitary, emergency showers, eyewash, fire protection, and drain piping. See Specification Section 15400 - Attachment J to this specification.

2.2.3 Air Piping System

This system consists of service air and instrument air piping and valving. See Specification Section 15405 - Attachment K to this specification.

2.2.4 Chemical System Piping

This system consists of the following:

a. Caustic (NaOH) piping and valving. See Specification Section 15402 - Attachment L to this specification.

b. Acid (H2SO4) piping and valving. See Specification Section 15403 - Attachment M to this specification.

c. Polymer piping and valving. Either of the two above specifications apply.

2.3 DRAINAGE AND WASTEWATER PUMPING STATION INSTALLATION

a. Furnish and install Wet Well 6 ft. sections of reinforced concrete pipe, in accordance with ASTM C 478, Wall thickness to ASTM C-76.

b. Furnish and install wet well pre-cast concrete top including Access Hatch.

All equipment, anchor bolt sizes, locations, clearances, etc., shall be in conformance with the manufacturer's recommendations and approved shop drawings.

c. Furnish, install, provide supports and attach to the piping all drainage and wastewater pumps.

2.4 FIBERGLASS ENCLOSURES INSTALLATION

Install prefabricated fiberglass enclosures for wellheads and prefabricated fiberglass metering manholes per Specification Section 13135 - Attachment R to this specification.

2.5 WELDING AND BRAZING

Qualified welders and brazers shall weld and braze joints in piping. Qualifications for welding and brazing procedures, welders, brazers, and welding operators shall be in accordance with ANSI B312.1. Subcontractor shall furnish six copies of qualifications to the NTR for approval.

2.5.1 Equipment and Protection

Protection welders and brazers from the light of the arc or flame by approved goggles, shields, helmet, and gloves. Closed spaces shall be properly ventilated when welding or brazing is being done therein. Take care to avoid risk of fire.

Safety in welding and cutting shall conform to ANSI Z49.1.

2.5.2 Surface to be Welded

Surface to be welded shall be free from loose scale, slag, rust, point, 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.

2.5.3 Finished Welds

Surface of finished welds shall have a bright metallic luster after cleaning;

fairly smooth with regular, even ripples, and uniform in contour. Except as necessary to correct defects, do not dress, smooth, or finish surfaces for improving their appearance. Provide sound welds throughout and fuse thoroughly. Free inside of pipe from globules of weld metal which would restrict pipe area or might become loose. Visual examination of welds and acceptance standards shall be in accordance with ANSI B31.1.

2.5.4 Brazed Joints

Prepared brazed joints in accordance with a qualified and approved brazing procedure. 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 defective joint shall be unsweated, reprepared as a new joint, inspected for defects on pipe and fittings and rebrazed.

2.6 PAINTING

All painting where applicable shall be applied in accordance with Specification Section 09900. Attachment N to this Specification.

2.7 INSULATION

All insulation where applicable shall be applied in accordance with Specification Section 15250 - Attachment O of this specification. All exterior piping which requires heat trace and insulation shall be applied in accordance with Specification Section 02696 - Attachment Q to this Specification.

PART 3 EXECUTION

See Section I, Part 3 of this Specification.

SECTION 15011

GENERAL HVAC REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. General:

1. Provide all labor, materials, tools, equipment, design services, supervision and coordination, to perform HVAC work, in accordance with provisions of the contract documents.

2. Completely coordinate with the work and requirements of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary items or appurtenances and devices necessary for a sound, secure and complete installation.

B. Drawings Use and Interpretation:

1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed.

2. Intention is to show approximate sizes, capacities, locations, direction and general relationship of one work phase to another but not exact detail or arrangement.

3. Field verify locations, arrangements and capacities of all existing systems and equipment to be utilized at this site.

C. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings, design-build drawings, and field coordination drawings.

D. Description of Systems: Furnish and install all materials to provide functioning systems in compliance with performance requirements specified, and any modifications resulting from reviewed shop drawing, design-build drawings or field coordination drawings.

E. Scope of Work: Without limiting or restricting the volume of work and solely for the convenience of the contractor, the work to be performed, in general, comprises of the following:

1. Provide a complete and operating HVAC installation in accordance with the HVAC equipment as shown in the "HVAC Equipment Data." The HVAC system shall comply with these specifications, performance requirements and accompanying contract drawings. This shall include all required labor, materials, apparatus, design and construction supervision.

2. Apparatus, appliance or work not shown on the plans, but mentioned in the specifications or vice versa, or any accessories necessary to make the work complete and ready for operation, even though not specified or shown on the plans, shall be furnished and installed without additional expense to the owner.

3. Furnish and install heating ventilation and air conditioning systems to meet the requirements of the Basis of Design report, these specifications, and as indicated. Design criteria for equipment sizing and load calculations shall be as described in the 1993 ASHRAE Fundamentals Handbook, and as outlined in the Naval Facilities Engineering Command (NAVFACENGCOM) "Design manual for Heating, Ventilation, Air Conditioning and Dehumidifying Systems". Design temperatures shall be as indicated.

4. Furnish and install propane piping system including interior and exterior piping, storage tank, and pressure regulators.

5. Furnish and install process system industrial exhaust system.

6. Furnish and install exhaust system including FRP fan and ductwork for the sulfuric acid and the sodium hydroxide storage area. Install an emergency start push button at the exit.

7. Furnish and install two (2) two-speed roof mounted exhaust fans and two in-line exhaust fans; one for the Storage Room and the other for the Electrical Room.

8. Furnish and install one (1) through-the-wall packed room heat pump units with a supplemental electric heating element and minimum 20 percent outside air capacity conforming to ARI 380 and UL 484. Provide wall sleeves with weather-tight seals and mounts. One unit will service the Building Office, and the other the Electrical Room.

9. Furnish and install a baseboard electric heater in the toilet room. Provide an exhaust fan sized for eight (8) air changes per hour which operates when the lights are turned on.

10. Furnish and install control systems to operate the mechanical systems in accordance with the following sequence of operation. Reference specification 15971, Space Temperature Control Systems, for detailed descriptions of applicable control system components.

a. Chemical storage area exhaust fan shall start when the emergency start switch mounted at the exit is activated.

b. Propane unit heaters shall have unit mounted thermostats.

c. Office through-the-wall heat pump and toilet room electric heater to incorporate integral control system. Toilet room exhaust shall be connected to light switch.

d. Furnish and install a 12 gauge galvanized sheet metal canopy hood complete with a roof exhaust fan, ductwork, power and control wiring over the filter press as indicated on the drawing. Also, provide a plastic draft curtain around the filter press area. The exhaust fan shall be activated by a motion detector.

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 C2	1993 National Electrical Safety Code

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117	1990 Salt Spray (Fog) Testing

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	1987 (Rev. 1-2) Motors and Generators
NEMA MG 10	1983 (R 1988) Energy Management Guide for Selection and Use of Polyphase Motors
NEMA MG 11	1977 (R 1992) Energy Management Guide for Selection and Use of Single-Phase Motors
NFPA 70	1993 National Electrical Code

1.3 RELATED REQUIREMENTS

This section applies to all sections of Division 15, of this project specification, unless specified otherwise in the individual section.

1.4 QUALITY ASSURANCE

1.4.1 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.

1.4.2 Level of Performance

The subcontractor shall be completely responsible that equipment, materials, and services furnished under this specification are of appropriate industry standard in every respect including adherence to all applicable codes and standards, with first-class workmanship throughout. Therefore, if any requirement of this specification is deemed by the Subcontractor to be incorrect, unsuitable, contradictory, or such that conformance therewith would diminish or adversely affect in any way the Subcontractor's responsibility, the Bidder shall specifically delineate his objections and the reasons therefor in his proposal, so that they may be resolved before the purchase order is placed. In all other respects, the Subcontractor, by accepting the purchase order, shall be deemed to have agreed that conformance with the specification's requirements will not prejudice in any way, the Purchaser's rights under warranty.

1.4.3 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.

1.4.4 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.

1.5 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.

1.6 SAFETY REQUIREMENTS

1.6.1 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.

1.6.2 Lockout of Energy Sources

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

1.7 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."

1.8 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

2.1 HVAC EQUIPMENT DATA

All data and design information shall be shown on the HVAC Drawings.

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

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

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 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.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint. 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. Immediately after cleaning, metal surfaces 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.

SECTION 15250

INSULATION OF MECHANICAL 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 within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 547	1977 Mineral Fiber Preformed Pipe Insulation
ASTM C 552	1991 Cellular Glass Thermal Insulation
ASTM C 553	1992 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 612	1993 Mineral Fiber Block and Board Thermal Insulation
ASTM E 84	1991 (Rev. A) Surface Burning Characteristics of Building Materials

1.2 System Description

Provide new field-applied mechanical insulation for HVAC systems and existing insulated HVAC systems affected by the Mechanical Subcontractor's operations. HVAC system includes heating, ventilating, and air conditioning equipment, HVAC ducts, and HVAC piping which is located within, on, under, and adjacent to buildings; and for utility plumbing systems. Obtain Navy's Technical Representative's (NTR) written approval of each system before applying field-applied insulation.

1.3 Submittals

Bidder to submit the following in accordance with Section C, Part 7 of the Basic Contract.

1.3.1 SD-02, Manufacturers Catalog Data (4 copies with quote)

a. Piping insulation and jacket

b. Duct insulation and jacket

PART 2 PRODUCTS

2.1 Insulation Materials

Provide new asbestos-free insulation materials.

2.2 Piping Insulation and Jacket

2.2.1 Mineral Fiber Preformed Pipe Insulation

ASTM C 547, minimum density of 3 pcf. Provide piping insulation jacket.

2.2.2 Piping Insulation Jacket

Provide manufacturer's standard fire-retardant vapor barrier jacket, except vapor barrier is not required for hot only piping. Jacket shall be suitable for painting. Provide factory prefabricated one-piece PVC insulation covers and mineral fiber insulation inserts of the same thickness as piping insulation for fittings, valves, and flanges.

2.3 Duct Insulation and Jacket

2.3.1 Blanket Type Duct Insulation

ASTM C 553, minimum density of one pcf. Provide duct insulation jacket.

2.3.2 Rigid Type Duct Insulation

ASTM C 612, minimum density of three pcf. Provide duct insulation jacket.

2.3.3 Duct Insulation Jacket

Provide manufacturer's standard fire-retardant vapor barrier jacket, except vapor barrier is not required for heating only ducts. Jacket shall be suitable for painting.

PART 3 EXECUTION

3.1 Installation of HVAC Insulation

Clean exterior of mechanical systems prior to the application of field-applied insulation. Install field-applied mechanical insulation in accordance with the manufacturer's recommendations and as specified herein. The completed installation shall have a fire hazard rating in accordance with ASTM E 84; flame-spread rating shall not exceed 25 and smoke developed raring shall not exceed 150 for polyurethane insulations. Insulation shall be clean and dry when installed and prior to the application of jackets and coatings. Do not use short pieces of insulation materials where a full length section shall fit. Provide insulation materials and jackets with

smooth and even surfaces, with jackets drawn tight, and smoothly secured on longitudinal laps and end laps. Insulate fittings and piping accessories with premolded, precut, or field fabricated pipe insulation of the same material and thickness as the adjoining pipe insulation. Provide unions, flanges, and piping accessories with readily removable sections of insulation and jacket. Provide insulation continuous through pipe hangers, pipe supports, pipe sleeves, wall openings, and ceiling openings, except at fire dampers in duct systems. Provide a complete moisture and vapor seal wherever insulation terminates against hangers, anchors, and other projections through insulation on cold surfaces; fill joints, breaks, punctures, and voids with vapor barrier compound and cover with vapor sealed material. Do not conceal equipment nameplates. Cover ends of exposed insulation with waterproof mastic.

3.2 Piping Insulation

Provide factory preformed insulation for piping systems. For insulation protection shields; provide rigid-pipe insulation of the same thickness as adjacent pipe insulation and having a minimum compressive strength of 35 psi or provide hardwood plugs having a minimum of one square inch bearing surface with the wood grain perpendicular to the pipe, between the insulation protection shields and the pipe; except insulation having a minimum density of 7 pcf may be provided between the insulation protection shields and the pipe for piping 2 inches or smaller. Install pipe insulation with joints tightly butted. Overlap longitudinal jacket laps not less than 1.5 inches. Wrap butt joints with butt strips not less than 3 inches wide of identical materials as jacket. Cement jacket laps and butt strips on both surfaces with fire-resistant, waterproof bonding adhesive or with factory-applied self-sealing system. Staples shall be stainless steel, outside clinched without complete penetration of insulation. If vapor barrier jacket is pierced or punctured, brush coat with vapor barrier coating to provide a vapor-tight covering. For concealing hot piping, adhesive is not required when jacket is secured with flared staples of 4 inch centers. If molded or mitered fitting covers are used, join with fire-resistant, waterproof bonding adhesive or wire in place and provide with a smooth coat of finishing cement. For cooper tubing sizes one inch and less, pipe insulation for elbows, tees, and valves may be metered.

3.2.1 Insulation for Water Piping and Cold Drain Piping

Provide mineral fiber preformed pipe insulation for hot and cold domestic water.

a. Insulation Thickness for Hot Water and Cold Water Piping: Provide hot and cold domestic water piping sizes less than 3 inches with minimum of one inch thick mineral fiber pipe insulation, except recirculating hot domestic water piping loop shall have minimum of 1.5 inch thick mineral fiber pipe insulation. Pipe sizes of 3 and 4

inches shall have minimum of 1.5 inch thick fiber pipe insulation. Pipe sizes of 5 inches and larger shall have minimum of 2 inch thick mineral fiber pipe insulation. Rigid cellular phenolic preformed pipe insulation having an insulating efficiency not less than that of the specified thickness of mineral fiber pipe insulation may be provided in lieu of mineral fiber pipe insulation.

3.2.2 Piping Insulation Covering Exposed to The Weather

Provide piping insulation with piping insulation jacket, except for plastic preformed pipe insulation.

3.3 Duct Insulation

Provide duct insulation and jacket on exterior of outside air intake ducts, plenums for HVAC units, and flue vents from unit heaters and heating and ventilating units. Apply insulation with joints tightly butted. Space pins or anchors at maximum of 12-inch centers; secure insulation with washers and clips. Pins and anchors shall be metal electrically welded to duct surface or shall be metal attached to duct surface with waterproof adhesive especially designed for attachment to metal surfaces. Sagging of duct insulation shall not be permitted. Insulation shall be tightly and smoothly applied to the ducts. Secure insulation to metal ducts with a fire-resistant, waterproof bonding adhesive applied in 4 inch wide strips on 12-inch centers. Provide minimum thickness of 2 inches of blanket type duct insulation in other locations.

3.3.1 Blanket Type Duct Insulation

Secure blanket type insulation to bottom of rectangular horizontal and sloping ducts more than 24 inches wide, in addition to adhesive, by impaling over pins or anchors.

3.3.2 Rigid Type Duct Insulation

Secure rigid type insulation to duct by impaling over pins or anchors located not more than 3 inches from edge of insulation and spaced at maximum 12-inch centers.

3.3.3 Vapor Barrier

Fill joints, breaks, punctures, and voids with vapor barrier coating compound and cover with vapor barrier jacket. At joints, the vapor barrier jacket for insulation shall be covered with 4 inch wide pressure-sensitive vapor seal tape of material identical to jackets, or shall have 2 inch wide laps drawn tight and secured with vapor seal adhesive. The joints and openings where the facing is pierced or punctured by pins, staples, or other means shall be brush coated with 2 inch wide strips of vapor barrier coating compound.

3.4 Field Inspections

Visually inspect the insulation of all mechanical systems to ensure that materials conform to requirements specified herein.

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 A112.36.2M	1991 Cleanouts
ANSI B16.18	1984 Cast Copper Alloy Solder Joint Pressure Fittings
ANSI B16.23	1992 Cast Copper Alloy Solder Joint Drainage Fittings - DWV
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

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 1010	1984 Drinking-Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.6.1M	1988 Supports for the Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.18.1M	1994 Plumbing Fixture Fittings
ASME/ANSI A112.19.1M	1987 Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	1990 Vitreous China Plumbing Fixtures
ASME A112.19.5	1979 (R 1990) Trim for Water-Closet Bowls, Tanks, and Urinals

ASME A112.21.1M	1991 Floor Drains
ASME/ANSI B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings
ANSI/ASME B16.3	1992 Malleable Iron Threaded Fittings Classes 150 and 300
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
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 1019	1978 Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Types

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	1990 Ferritic Malleable Iron Castings
ASTM A 53	1993 (Rev. A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	1992 Cast Iron Soil Pipe and Fittings
ASTM B 32	1993 Solder Metal
ASTM B 42	1993 Seamless Copper Pipe, Standard Sizes
ASTM B 88	1993 Seamless Copper Water Tube
ASTM B 306	1992 Copper Drainage Tube (DWV)
ASTM C 564	1991 (Rev. A) Rubber Gaskets for Cast Iron Soil Pipe and Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	1990 Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water

AWWA C105/A21.5	1988 Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
AWWA C110/A21.10	1987 Ductile Iron and Gray Iron Fittings, 3 in Through 48 in. for Water and Other Liquids
AWWA C111/A21.11	1990 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
AWWA C115/A21.15	1988 Flanged Ductile Iron Pipe with Threaded Flanges
ANSI/AWWA C151/A21.51	1991 Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C500	1986 Gate Valves for Water and Sewerage Systems
AWWA C651	1992 Disinfecting Water Mains

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI HSN	1985 Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings
CISPI 301	1990 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	1990 Couplings for Use in Connection with Hubless Cast Iron Soil Pipe and Fitting

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-USC	1992 List of Approved Backflow Prevention Assemblies

FEDERAL SPECIFICATIONS (FS)

FS WW-H-1991	(Rev. D) Heater, Fluid, Industrial (Instantaneous, Steam, Water convertor Type)

MILITARY SPECIFICATIONS (MIL)

MIL-R-6855	(Rev. E) (Supp. 1) Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1993 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	1994 Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC NSPC	1993 (Supp. 1994) National Standard Plumbing Code - Illustrated

UNDERWRITERS LABORATORIES, INC. (UL)

UL 174	1989 (R 1991) Household Electric Storage Tank Water Heaters

1.2 RELATED REQUIREMENTS

Section 15011, "General Mechanical," applies to this section with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Provide 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 NAPHCC NSPC. Plumbing systems include piping less than 5 feet outside of building walls.

1.4 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.4.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Pipe and fittings

b. Valves

c. Plumbing fixtures

d. Water heaters

e. Pipe hangers and supports

f. Drains

g. Backflow preventers

h. Electric water coolers

1.4.2 SD-19, Operation and Maintenance Manuals (7 copies 4 weeks after order)

a. Water heaters, Data Package 2

b. Electric water coolers, Data Package 2

1.5 QUALITY ASSURANCE

Plumbing systems including fixtures, 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 Cast-Iron Hubless Pipe and Fittings

CISPI 301 with CISPI 310 couplings.

2.1.1.2 Cast-Iron Hub and Spigot Pipe and Fittings

ASTM A 74 with ASTM C 564 or CISPI HSN rubber compression gasket joints.

2.1.2 Aboveground Piping

2.1.2.1 Cast-Iron Hubless Pipe and Fittings

CISPI 301 with CISPI 310 couplings.

2.1.2.2 Cast-Iron Hub and Spigot Pipe and Fittings

ASTM A 74 with ASTM C 564 or CISPI HSN rubber compression gasket joints.

2.1.2.4 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.

2.1.3 Cleanouts

ANSI A112.36.2M; provide threaded bronze cleanout plugs.

2.1.3.1 Floor Cleanouts

Provide cast-iron or ductile-iron floor cleanout with 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.

2.1.3.3 Cleanouts Exterior to Buildings

Provide cast-iron cleanouts and countersunk plugs. Provide 24- by 24- by 4-inch thick concrete slab with top one inch above grade with cleanout located in center of slab.

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.

2.1.5 Acid Resistant DWV Pipe, Fittings, and Couplings

Provide acid-resistant DWV pipe, fittings, and couplings of the mechanical, bell and spigot, or fusion type joints. Material for buried piping and aboveground piping shall be ASTM A 518, silicon-iron composition. ASTM C 1053, borosilicate glass pipe and fitting may be provided for aboveground piping, except vent piping through and above roofs shall be silicon-iron composition. Provide cleanouts and drains as specified for DWV piping, except material shall be silicon-iron composition.

2.2 DOMESTIC WATER PIPING

2.2.1 Buried Piping and Aboveground Piping

2.2.1.1 Copper Tubing

ASTM B 88, Type L or M for aboveground piping, Type K for buried piping, with 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 solder end connections for connections between bronze valves and copper tubing. Ball valves may be provided in lieu of gate valves. Provide blue finish and red finish on handwheels for valves in cold domestic water piping and hot domestic water piping, respectively.

2.2.2.1 Gate Valves

MSS SP-80, Class 125

2.2.2.2 Globe and Angle Valves

MSS SP-80

2.2.2.3 Check Valves

MSS SP-80, Class 125, swing check.

2.2.2.4 Ball Valves

Full port design, copper alloy valves shall have two-position lever handles.

2.2.2.5 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.

2.2.2.6 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.

2.2.3 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.

2.2.4 Dielectric Connections

Provide at connections between copper and ferrous metal piping materials.

2.2.5 Valve Boxes

For each buried valve provide cast-iron, ductile-iron, or plastic box of a suitable size. Provide cast-iron, ductile-iron, or plastic cover for the box with the word "WATER" cast on the cover. Plastic boxes shall be constructed of ABS plastic or inorganic fiber-reinforced black polyolefin plastic. Coat cast-iron and ductile-iron boxes with bituminous paint.

2.2.6 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 local code. Listing of the particular make, model/design, and size in the current local code will be acceptable as the required proof.

2.3 MISCELLANEOUS PIPING MATERIALS

2.3.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors,

walls, and ceilings in exposed spaces. Provide chromium-plated or polished stainless steel finish on copper alloy plates in finished spaces. Provide paint finish on metal in unfinished spaces.

2.3.2 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 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 Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one-inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of 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. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

a. Sleeves in masonry and concrete walls, floors, and roofs: Provide steel pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

b. Sleeves in other than masonry and concrete walls, floors, and roofs: Provide 26 gage galvanized steel sheet.

2.3.5 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.

2.4 PLUMBING FIXTURES

Provide the following types of plumbing fixtures as indicated. Provide plumbing fixture faucets, fittings, trim, accessories, and supplies as specified in paragraph entitled, "Plumbing Fixture Faucets, Trim and Fittings."

2.4.1 Flush Tank Water Closets

ASME A112.19.2M, white vitreous china, siphon jet, round bowl, floor-mounted, floor or wall outlet as indicated. Nonfloat swing type flush tank valves are not acceptable. The water flushing volume shall not exceed 3 gallons per flush for floor outlet water closet and 3.5 gallons per flush for wall outlet water closet. Water closet rim height above floor shall be approximately 15 inches, except wheelchair water closet rim height above floor shall be 17 to 19 inches. Provide white solid plastic round close-front seat with cover.

2.4.2 Wall Hung Lavatory

ASME A112.19.2M, white vitreous china, straight back type, minimum dimensions of 19 inches wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets, and openings for concealed arm carrier installation. Provide ASME A 112.6.1M concealed chain carriers with concealed arms for the lavatory. Mount lavatory with the front rim 34 inches above floor and with 29 inches minimum clearance from bottom of the front rim to floor.

2.4.3 Emergency Eyewash and Shower Equipment

ANSI Z358.1, floor supported free standing unit. Provide deluge shower head, stay-open ball valve operated by pull rod and ring or triangular handle. Provide eyewash and stay-open ball valve operated by foot treadle or push handle.

2.5 PLUMBING FIXTURE FAUCETS, TRIM AND FITTINGS

ANSI/ASME A 112.18.1M-94 for plumbing fixture faucets. The finish of plumbing fixture faucets, trim, valves, and fitting exposed to view shall be chromium-plated or polished stainless steel except as modified herein. Handles may be clear plastic. Bolts, nuts, and screws shall be copper alloy or stainless steel. Provide glove valves or angle valves, and union connections in each supply to each faucet; chromium-plated finish is not required. Faucets shall be washerless type and shall have threaded type end connections, coupling nuts, or union connections. Faucets may be of the single control type. Provide washers and locknuts to secure faucets to lavatories and sinks.

a. Traps: Provide P-traps for each plumbing fixture which does not have integral traps. Provide 1.5 inch white PVC adjustable P-traps and

tubing with slip nuts and gaskets; chromium-plated finish is not required.

b. Lavatory Faucets: Provide washerless faucets including aerators, drain outlets, and drain tail pieces for each lavatory. Provide perforated grid strainers for each lavatory. Faucet handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist; maximum force required to operate faucet handles shall be 5 pounds of force. Faucets for indicated wheelchair lavatories shall have gooseneck spout with aerator 5 inches above rim and shall have handles which open within one-quarter turn in opposite directions.
c. Sink Faucets: Provide washerless faucets including swing spouts with aerators. Provide Top mounted faucets for countertop sinks.

2.6 DOMESTIC WATER HEATERS (ELECTRIC)

UL Listed. "Point of Use" Instantaneous electric water heaters capable of providing a 60 degree F temperature rise.

2.7 PUMPS

Select the pump so that the operating point on the characteristic performance curve for the impeller size to be furnished shall be to the left (shut-off side) of and not more than 5 percent below the point of maximum efficiency for the impeller to be furnished. Provide lifting attachments on pumps large than 2 horsepower. Provide operating instructions for pumps.

2.7.1 Submersible Sump Pumps

Provide factory assembled and tested submersible type pumps for operation under water. Pump shall be complete with cast-iron casing, bronze impeller, stainless steel shaft, sealed heavy-duty ball bearings, water-cooled hermetically-sealed motor, built-in automatic reset thermal protection, float switches, and waterproof three-conductor cables and grounding plugs. Pump and pump assembly shall be constructed of materials capable of handling acid fluids. Provide high water alarm and check valve.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of plumbing systems including fixtures, equipment, materials, and workmanship shall be in accordance with the 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; 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. Do not thread metal pipe into plastic pipe piping.

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 Piping to Receive Insulation

Provide temporary wood spacers between the insulation protection shield and the pipe in order to properly slope the piping and to establish final elevations. Temporary wood spacers shall be of the same thickness as the insulation to be provided under Section 15250, "Insulation of Mechanical Systems."

3.1.3.2 Maximum Spacing Between Supports

a. Vertical Piping: Support metal piping at each floor, but at not more than 10-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 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 0.25-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 the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a 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.

3.1.7 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

3.4 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 Plumbing Code, except as modified herein. Correct defects in the work provided by the Subcontractor, 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 100 psig 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. 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.

3.4.2.3 Backflow Preventers

Backflow preventers shall be tested by a locally approved and certified backflow assembly tester. A copy of the test report shall be provided to the Contracting Officer prior to placing the domestic water system into operation, or no later than 5 days after the test.

3.5 DISINFECTION

Disinfect new water piping and existing water piping affected by Subcontractor's operations 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 domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 parts per million, or the 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 the results prior to the new water piping being placed into service. Disinfection of systems supplied by nonpotable water is not required.

-- End of Section --

SECTION 15401

CONTAMINATED GROUNDWATER PIPING AND VALVING

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)

ASME A112.18.1M	1994 Plumbing Fixture Fittings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1019	1993 Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Types

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1993 (Rev. A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 183	1983 (R 1990) Carbon Steel Track Bolts and Nuts
ASTM B 32	1993 Solder Metal

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C500	1993 Gate Valves for Water and Sewerage Systems
AWWA C701	1988 Cold-Water Meters - Turbine Type, for Customer Service

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-USC	1992 List of Approved Backflow Prevention Assemblies

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1993 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application
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	1994 Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC NSPC	1993 (Supp. 1994) National Standard Plumbing Code - Illustrated

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G101	1985 Testing and Rating Procedure for Grease Interceptors
PDI WH201	1983 Water Hammer Arrestors

1.2 RELATED REQUIREMENTS

Section 15010, "General Mechanical," applies to this section with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Provide new contaminated groundwater piping system, complete and ready for operation. Piping system including manufacturer's products shall be in accordance with the required and advisory provisions of the Plumbing Code (NAPHCC NSPC). Piping systems include piping less than 5 feet outside of building walls.

1.4 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.5.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Pipe and fittings

b. Valves

c. Plumbing fixtures

d. Pipe hangers and supports

e. Pressure gages

f. Water meters

g. Water hammer arresters

h. Backflow preventers

1.5 QUALITY ASSURANCE

Contaminated groundwater piping systems including fixtures, 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 NTR.

PART 2 PRODUCTS

2.1 PIPING AND VALVING FOR CONTAMINATED WATER SERVICE

All piping and valving (above and below ground) to be rated for 150 psig ambient.

2.1.1 Pipe

4" and smaller	-	Steel, ASTM A 54, Type F (welded).
6" to 20" inclusive	-	Steel, ASTM A 53, Grade B, Type E (ERW).

API 5L, Grade B line pipe and rolled steel plate pipe (A 283/A 283M, Grade C) are approved equal.

Pipe to be of the following Schedule or wall thickness.

2" and smaller	-	Schedule 80, PE
2 1/2" to 6" inclusive	-	Schedule 80, BE
8" to 12" inclusive	-	Schedule 40, BE

2.1.2 Fittings

2" and smaller	-	300# MI, screwed.
2 1/2" to 6" inclusive	-	Schedule 80, FS, weld reducers and LR weld ells.
8" to 12" inclusive	-	Schedule 40, FS, weld reducers and LR weld ells.

2.1.3 Unions

2" and smaller	-	300# MI, iron to iron seat, screwed.

2.1.4 Branch Connections

2" and smaller on pipe 2 1/2" and larger	-	3000# thredolet, extra heavy full coupling, or welded offtake.
2 1/2" and larger on pipe 2 1/2" and larger	-	Fabricated flanged nozzle, welded offtake or weld tee if dictated by design.

2.1.5 Flanges

2 1/2" to 12" inclusive	-	ANSI Class 150 slip-on flg., RF, FS

Welding neck flanges may be specified when dictated by design or availability. Specify flat face flanges as companion to CI flanges as at CI valves and pump nozzles.

2.1.6 Gaskets

2 1/2" to 12" inclusive	-	Ring type, 1/16" thick, compressed non-asbestos, Garlock 3200.

Specify full face gaskets at all cast iron flanges.

2.1.7 Bolts and Nuts

Bolts	-	ASTM A 307, Grade B, heavy hex-head.
Nuts	-	ASTM A 307, cold punched, heavy hex, series.

2.1.8 Angle Valves

2" and smaller	-	Use Globe Valve - 150#, AI, ISRS, screwed.
2 1/2" to 6" inclusive	-	125#, AI, OS&Y, flanged.

2.1.9 Ball Valves

2" and smaller	-	150#, AI, screwed.
2 1/2" to 8"	-	150#, AI, flanged.

2.1.10 Check Valves

2" and smaller	-	300#, MI, alloy trim, swing check, screwed.
2 1/2" to 12" inclusive	-	125#, AI, swing check, flanged.

2.1.11 Gate Valves

2" and smaller	-	125#, AI, ISRS, screwed.
2 1/2" to 36" inclusive	-	125#, AI, OS&Y, flanged.

2.1.12 Globe Valves

2" and smaller	-	150#, AI, ISRS, screwed.
2 1/2" to 6" inclusive	-	125#, AI, OS&Y, flanged.
8" to 14" inclusive	-	125#, AI, OS&Y, flanged.

2.2 INSULATION

Above ground piping outside of the treatment system building shall be provided with an appropriate layer of insulation. Flanges, valves, couplings and any other elements in the outside piping lines also shall be appropriately insulated.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of contaminated groundwater piping system including materials and workmanship shall be in accordance with the Plumbing Code.

3.1.1 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread paste. 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 flanged valves.

3.1.3.1 Piping to Receive Insulation

Provide temporary wood spacers between the insulation protection shield and above ground outside piping in order to properly slope the piping and to establish final elevations. Temporary wood spacers shall be of the same thickness as the insulation.

3.1.3.2 Maximum Spacing Between Supports

a. Vertical Piping: Support metal piping at not more than 10-foot intervals, with pipe riser clamps or offset pipe clamps.

b. Horizontal Piping: Support steel piping 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

3.1.6 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 the 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.

3.2 NAMEPLATES

Provide laminated plastic nameplates for equipment, gages, thermometers, and valves. 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

3.4 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 tests specified in the Plumbing Code. Correct defects in the work and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

-- End of Section --

SECTION 15402

CAUSTIC PIPING AND VALVING

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 A40	1993 Safety Requirements For Plumbing

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.18.1M	1994 Plumbing Fixture Fittings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1993 (Rev. A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 183	1983 (R 1990) Carbon Steel Track Bolts and Nuts
ASTM B 32	1993 Solder Metal

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-USC	1992 List of Approved Backflow Prevention Assemblies

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1993 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC NSPC 1993 (Supp. 1994) National Standard Plumbing Code - Illustrated

1.2 RELATED REQUIREMENTS

Section 15010, "General Mechanical," applies to this section with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Provide new caustic piping system, 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 (NAPHCC NSPC).

1.4 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.4.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Pipe and fittings

b. Valves

c. Plumbing fixtures

d. Pipe hangers and supports

e. Backflow preventers

1.5 QUALITY ASSURANCE

Caustic piping systems including fixtures, 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 NTR.

PART 2 PRODUCTS

2.1 PIPING AND VALVING FOR CAUSTIC SERVICE

All piping and valving to be rated for 150 psig ambient.

2.1.1 Pipe

2" and smaller - Teflon tubing encased in steel, ASTM A 53, type F (welded), galvanized, Schedule 40, PE.

2.1.2 Fittings

2" and smaller - As recommended by pipe manufacturer.

2.1.3 Unions

2" and smaller - As recommended by pipe manufacturer.

2.1.4 Branch Connections

Use fittings.

2.1.5 Check Valves

2" and smaller - Kynar or Teflon.

2.1.6 Plug Valves: (preferred)

2" and smaller - Kynar or Teflon.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of caustic piping system including materials and workmanship shall be in accordance with the Plumbing Code and ANSI A40.

3.1.3 Pipe Supports (Hangers)

Provide additional supports at the concentrated loads in piping between supports, such as for flanged valves.

Vertical Piping: Support steel containment piping at not more than 10-foot intervals, with pipe riser clamps or offset pipe clamps.

Horizontal Piping: Support steel containment piping 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

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 tests specified in the Plumbing Code. Correct defects in the work and repeat tests until work is in compliance with contract requirement. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

-- End of Section --

SECTION 15403

ACID PIPING AND VALVING

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 A40	1993 Safety Requirements For Plumbing

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.18.1M	1994 Plumbing Fixture Fittings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1993 (Rev. A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 183	1983 (R 1990) Carbon Steel Track Bolts and Nuts
ASTM B 32	1993 Solder Metal

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-USC	1992 List of Approved Backflow Prevention Assemblies

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1993 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC NSPC 1993 (Supp. 1994) National Standard Plumbing Code - Illustrated

1.2 RELATED REQUIREMENTS

Section 15010, "General Mechanical," applies to this section with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Provide new acid piping system, complete and ready for operation. Piping system including manufacturer's products shall be in accordance with the required and advisory provisions of the Plumbing Code (NAPHCC NSPC).

1.4 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.4.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Pipe and fittings

b. Valves

c. Plumbing fixtures

d. Pipe hangers and supports

e. Backflow preventers

1.5 QUALITY ASSURANCE

Acid piping systems including fixtures, 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 NTR.

PART 2 PRODUCTS

2.1 PIPING AND VALVING FOR ACID SERVICE

All piping and valving to be rated for 150 psig ambient.

2.1.1 Pipe

2" and smaller - Teflon tubing encased in steel, ASTM A 53, type F (welded), galvanized, Schedule 40, PE.

2.1.2 Fittings

2" and smaller - As recommended by pipe manufacturer.

2.1.3 Unions

2" and smaller - As recommended by pipe manufacturer.

2.1.4 Branch Connections

Use fittings.

2.1.5 Check Valves

2" and smaller - Kynar or Teflon.

2.1.6 Plug Valves (preferred)

2" and smaller - Kynar or Teflon.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of acid piping system including materials and workmanship shall be in accordance with the Plumbing Code.

3.1.1 Pipe Supports (Hangers)

Provide additional supports at the concentrated loads in piping between supports, such as for flanged valves.

Vertical Piping: Support steel containment piping at not more than 10-foot intervals, with pipe riser clamps or offset pipe clamps.

Horizontal Piping: Support steel containment piping as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One & 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

3.2 FIELD QUALITY CONTROL

3.2.1 Inspections

Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer's submittals.

3.2.2 Field Testing

Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the tests specified in the Plumbing Code. Correct defects in the work and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

-- End of Section --

SECTION 15404

CONTAMINATED SLUDGE PIPING AND VALVING

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)

ASME A112.18.1M	1989 Plumbing Fixture Fittings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1993 (Rev. A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 183	1983 (R 1990) Carbon Steel Track Bolts and Nuts
ASTM B 32	1993 Solder Metal

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C500	1986 Gate Valves for Water and Sewerage Systems
AWWA C701	1988 Cold-Water Meters - Turbine Type, for Customer Service

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-USC	1992 List of Approved Backflow Prevention Assemblies

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1993 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application

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	1994 Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC NSPC	1993 (Supp. 1994) National Standard Plumbing Code - Illustrated

1.2 RELATED REQUIREMENTS

Section 15010, "General Mechanical," applies to this section with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Provide new contaminated sludge piping systems, complete and ready for operation. Piping systems including manufacturer's products shall be in accordance with the required and advisory provisions of the Plumbing Code (NAPHCC NSPC).

1.4 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.4.1 Manufacturer's Catalog Data (4 copies with quote)

a. Pipe and fittings

b. Valves

c. Plumbing fixtures

d. Pipe hangers and supports

e. Pressure gages

1.5 QUALITY ASSURANCE

Contaminated sludge piping system including fixtures, 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 NTR.

PART 2 PRODUCTS

2.1 PIPING AND VALVING FOR CONTAMINATED SLUDGE SERVICE

All piping and valving to be rated for 150 psig ambient.

2.1.1 Pipe

4" and smaller	-	Steel, ASTM A 53, Type F (welded).
6" to 20" inclusive	-	Steel, ASTM A 53, Grade B, Type E (ERW).

API 5L, Grade B line pipe and rolled steel plate pipe (A 283/A 283M, Grade C) are approved equal.

Pipe to be of the following Schedule or wall thickness.

2" and smaller	-	Schedule 80, PE
2 1/2" to 6" inclusive	-	Schedule 80, BE
8" to 12" inclusive	-	Schedule 40, BE

2.1.2 Fittings

2" and smaller	-	300# MI, screwed.
2 1/2" to 6" inclusive	-	Schedule 80, FS, weld reducers and LR weld ells.
8" to 12" inclusive	-	Schedule 40, FS, weld reducers and LR weld ells.

2.1.3 Unions

2" and smaller	-	300# MI, iron to iron seat, screwed.

2.1.4 Branch Connections

2" and smaller on pipe 2 1/2" and larger	-	3000# thredolet, extra heavy full coupling, or welded offtake.
2 1/2" and larger on pipe 2 1/2" and larger	-	Fabricated flanged nozzle, welded offtake or weld tee if dictated by design.

2.1.5 Flanges

2 1/2" to 12" inclusive - ANSI Class 150 slip-on flg, RF, FS.

Welding neck flanges may be specified when dictated by design or availability. Specify flat face flanges as companion flanges to CI flanges as at CI valves and pump nozzles.

2.1.6 Gaskets

2 1/2" to 12" inclusive - Ring type, 1/16" thick, compressed non-asbestos, Garlock 3200.

Specify full face gaskets at all cast iron flanges.

2.1.7 Bolts and Nuts

Bolts - ASTM A 307, Grade B, heavy hex-head.
Nuts - ASTM A 307, cold punched, heavy hex, series.

2.1.8 Angle Valves

2" and smaller - Use Globe Valve - 150#, AI, ISRS, screwed.
2 1/2" to 12" inclusive - 125#, AI, swing check, flanged.

2.1.9 Ball Valves

2" and smaller - 150#, AI, screwed.
2 1/2" to 8" - 150#, AI, flanged.

2.1.10 Check valves

2" and smaller - 300#, MI, alloy trim, swing check, screwed.
2 1/2" to 12" inclusive - 125#, AI, swing check, flanged.

2.1.11 Gate Valves

2" and smaller - 125#, AI, ISRS, screwed.
2 1/2" to 36" inclusive - 125#, AI, OS&Y, flanged.

2.1.12 Globe Valves

2" and smaller - 150#, AI, ISRS, screwed.
2 1/2" to 6" inclusive - 125#, AI, OS&Y, flanged.
8" to 14" inclusive - 125#, AI, OS&Y, flanged.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of contaminated sludge system including materials and workmanship shall be in accordance with the Plumbing Code.

3.1.1 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread paste; 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 items 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 flanged valves.

Vertical Piping: Support metal piping at not more than 10-foot intervals, with pipe riser clamps or offset pipe clamps.

Horizontal Piping: Support steel piping 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

3.1.4 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 the 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.

3.2 NAMEPLATES

Provide laminated plastic nameplates for equipment, gages, thermometers, and valves. 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

3.4 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 tests specified in the Plumbing Code. Correct defects in the work and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

-- End of Section --

SECTION 15405

AIR PIPING AND VALVING

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
ANSI B16.23	1984 Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ANSI B16.24	1991 (Errata 1991) Cast Copper Alloy Pipe Flanges and Flanged Fittings Class 150, 300, 400, 600, 900, 1500, and 2500
ANSI Z358.1	1990 Emergency Eyewash and Shower Equipment

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.18.1M	1994 Plumbing Fixture Fittings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1993 (Rev. A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 183	1983 (R 1990) Carbon Steel Track Bolts and Nuts
ASTM B 32	1993 Solder Metal

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	1993 Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 1991 Pipe Hangers and Supports - Selection and Application

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC NSPC 1993 (Supp. 1994) National Standard Plumbing Code - Illustrated

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 1992 National Fuel Gas Code

1.2 RELATED REQUIREMENTS

Section 15010, "General Mechanical," applies to this section with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Provide new air piping system, complete and ready for operation. Piping systems including manufacturer's products shall be in accordance with the required and advisory provisions of the Plumbing Code (NAPHCC NSPC).

1.4 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.4.1 SD-02, Manufacturer's Catalog Data (4 copies with quote)

a. Pipe and fittings

b. Valves

c. Fixtures

d. Pipe hangers and supports

e. Pressure gages

1.5 QUALITY ASSURANCE

Air piping systems including 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 NTR.

PART 2 PRODUCTS

2.1 PIPING AND VALVING FOR AIR SERVICE

All piping and valving to be rated for 150 psig ambient.

2.1.1 Pipe

4" and smaller	-	Steel, ASTM A 53, Type F (welded).
6" to 20" inclusive	-	Steel, ASTM A 53, Grade B, Type E (ERW).

API 5L, Grade B line pipe and rolled steel plate pipe (A 283/A 283M, Grade C) are approved equal.

2.1.2 Fittings

2" and smaller	-	300# MI, screwed.
2 1/2" to 6" inclusive	-	Schedule 40, FS, weld reducers and LR weld ells.
8" to 12" inclusive	-	Schedule 20, FS, weld reducers and LR weld ells.

2.1.3 Unions

2" and smaller	-	300# MI, brass to iron seat, screwed, Stockham 895.

2.1.4 Branch Connections

2" and smaller on pipe 2 1/2" and larger	-	3000# thredolet, extra heavy full coupling, or welding offtake.
2 1/2" and larger on pipe 2 1/2" and larger	-	Fabricated flanged nozzle, welded offtake or weld tee if dictated by design.

2.1.5 Flanges

2 1/2" to 12" inclusive	-	ANSI Class 150 slip-on fig., RF, FS.

Welding neck flanges may be specified when dictated by design or availability. Specify flat face flanges as companion flanges to CI flanges as at CI valves and pump nozzles.

2.1.6 Gaskets

2 1/2" to 12" inclusive	-	Ring type, 1/16" tick, compressed non-asbestos, Garlock 3200.

Specify full face gaskets at valves with flat face flanges.

2.1.7 Bolts and Nuts

Bolts	-	ASTM A 307, Grade B, heavy hex-head.
Nuts	-	ASTM A 307, cold punched, heavy hex, series.

2.1.8 Angle Valves

2" and smaller	-	125#, bronze, ISRS, screwed.
2 1/2" to 6 " inclusive	-	125#, IBBM, OS&Y, flanged.

2.1.9 Ball Valves (preferred)

2" and smaller	-	200#, bronze, Buna-N seats, screwed.

2.1.10 Butterfly Valves

2 1/2" to 24" inclusive	-	125#, CI Buna-N seats, wafer valve, with gear operator.

2.1.11 Check Valves

2" and smaller	-	125#, bronze, swing check, screwed.
2 1/2" to 24" inclusive	-	125#, IBBM, swing check, flanged.

2.1.12 Gate Valves

2" and smaller	-	125#, bronze, ISRS, screwed, Crane 428.
2 1/2" to 36" inclusive	-	125#, IBBM, OS&Y, flanged, Crane 465 1/2.

2.1.13 Globe Valves

2" and smaller	-	125#, bronze, ISRS, screwed.
2 1/2" to 10" inclusive	-	125#, IBBM, OS&Y, flanged.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of air piping system including materials and workmanship shall be in accordance with the Plumbing Code.

3.1.1 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread paste; 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 flanged valves.

Vertical Piping: Support steel piping at not more than 10-foot intervals, with pipe riser clamps or offset pipe clamps.

Horizontal Piping: Support steel piping 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

3.1.4 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 the 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.

3.2 NAMEPLATES

Provide laminated plastic nameplates for equipment, gages, thermometers, and valves. 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 tests specified in the Plumbing Code. Correct defects in the work and repeat tests until work is in compliance with contract requirements. Furnish air, electricity, instruments, connecting devices, and personnel for performing tests.

-- End of Section --

SECTION 15487

COMPRESSED AIR SYSTEM

SECTION I PROJECT REQUIREMENTS

PART 1 GENERAL

1.1 LOCATIONS

All aspects of this project are located at Operable Unit No. 2, Marine Corps Base, Camp Lejeune, North Carolina.

1.2 PROJECT DESCRIPTION

The project is a soil and groundwater remediation task. Various areas of concern (AOC) have been established which demonstrate abnormally high levels of chemical contamination.

Several shallow and deep wells will be drilled to access the contaminated groundwater. The water will be pumped to a groundwater treatment building where it will be processed to the extent required to make if fit for human consumption.

The fully processed water will be released back to the ground by a nearby creek. For a more detailed description, refer to the Process Description and Control Philosophy Report in Attachment B and Project Drawings in Attachment D.

1.3 SCOPE

By solicitation of competitive bids and subsequent evaluation thereof, OHM Remediation Services Corp. (OHM) intends to, via this Bid Specification, secure the services of a Subcontractor of the compressed air system and to define the extent of their activities.

In general, the Subcontractor is required to provide complete compressed air system, with regard to equipment, instrumentation and controls. Subcontractor is responsible for providing documentation, procurement, delivery, installation, electrical termination, calibration, testing and fully commissioning of the compressed air system.

1.3.1 Work Included

The extent of the Subcontractor's responsibility for the work defined in the scope section is as follows:

A. Provide applications engineering services to specify equipment and components of the compressed air system.

B. Documentation and drawings submittal to OHM for review and comments. Refer to Attachment C, Vendor Drawings/Data Requirements.

C. Equipment procurement and delivery to the job site.

D. Equipment pre-installation, provide necessary anchoring, piping, fittings, valves, insulation, etc., required for system installation (by others).

Provide all necessary conduits, electrical wiring, electrical motors, conductors termination etc. Provide all instrumentation and controls.

E. Pre-operational checkout and calibration of mechanical, electrical and I&C equipment and components.

F. Start-up testing and full system commissioning.

1.3.2 Work Not Included

The extent of the Subcontractor's responsibility does not include the following:

A. System installation will be done by the mechanical Subcontractor (others)

B. Power and control wiring will be done by the electrical Subcontractor (others).

C Hydrostatic system piping testing will be done by the mechanical subcontractor (others).

1.4 LEVEL OF PERFORMANCE

The Subcontractor will be completely responsible that equipment, materials, and services furnished under this specification are of appropriate industry standard in every respect including adherence to all applicable codes and standards, with first-class workmanship throughout. Therefore, if any requirement of this specification is deemed by the Subcontractor to be incorrect, unsuitable, contradictory, or such that conformance therewith would diminish or adversely affect in any way the Subcontractor's responsibility, the Bidder will specifically delineate his objections and the reasons therefor in his approval, so that they may be resolved before the purchase order is placed. In all other respects, the Subcontractor, by accepting the purchase order, will be deemed to have agreed that conformance with the specification's requirements will not prejudice in any way, the purchaser's rights under warranty.

1.5 DEFINITIONS

Bidder - A company submitting a proposal to fulfill the requirements of this specification.

Subcontractor - The company accepting the purchase order for fulfilling the requirements of this specification.

General Contractor - OHM Remediation Services Corp., 5335 Triangle Parkway, Suite 450, Norcross, GA 30092

Purchaser - Department of the Navy Naval Facility Engineering Command, Atlantic Division (LANTDIV)

Approved - This word, when applied by the General Contractor to the subcontractor's drawings or documents, means that the drawings or documents are satisfactory from the standpoint of interfacing with all non-subcontractor-furnished components of the installation, and/or that the General Contractor have not observed any statement or feature that appears to deviate from the specification's requirements. Except for the interfacing with all non-subcontractor-furnished components, the Subcontractor will retain the entire responsibility for complete conformance with all specification requirements and performance guarantees.

Approved as Revised - These words, when applied by the General Contractor to the subcontractor's drawings or documents, mean that the drawings or documents are approved as defined above except that the changes shown are required for the proper interfacing with non-subcontractor-furnished components of the installation or are necessary to be in conformance with the specification requirements. On the basis that the subcontractor shall retain the entire responsibility for compliance with all specification requirements (except those affected by interfacing with non-Subcontractor-furnished components), the subcontractor shall either:

1. Incorporate the changes into his drawing or document and resubmit to the General Contractor, or

2. Inform the General Contractor that the changes cannot be made without prejudice to the subcontractor's responsibility under warranty, and resubmit with explanation of the reasons therefor.

Not Approved - These words, when applied by the General Contractor to the subcontractor's drawings or documents, mean that the drawings or documents are being returned to the subcontractor for his remediation. After remediation, the drawings shall be resubmitted to the General Contractor.

Shall - Indicates a mandatory requirement.

1.6 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTES (ANSI)

ANSI C2	**1993 National Electrical Safety Code**
B16.18-84	Cast Bronze Solder Joint Pressure Fittings
B16.22-89	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B16.26-88	Cast Copper Alloy Fittings for Flared Copper Tubes
B31.1-92	Power Piping
B40.1-91	Gauges, Pressure Indicating, Dial Type, Elastic Element
Z21.22-86	Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
Z49.1-88	Safety in Welding and Cutting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

B 32-93	Solder Metal
B 88-93	Seamless Copper Water Tube
B117	1994 Salt Spray (Fog) Testing

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME	1992 Boiler and Pressure Vessel Code and Interpretations Section VIII Division 1, Pressure Vessels Section IX Welding and Brazing Qualifications

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

SP-80-87	Bronze Gate, Globe, Angle, and Check Valves

OCCUPATIONAL SAFETY HEALTH ACT (OSHA) STANDARD

29 CFR 1910.219	Mechanical Power-Transmission apparatus
29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)

FEDERAL SPECIFICATIONS (FS)

FS L-P-387	(Rev. A) (Int Am. 2) Plastic Sheet, Laminated, Thermosetting (for Design Plates)

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

IEEE 100	1992 Dictionary of Electrical and Electronic Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	1988 (Rev. 1) Enclosures for Industrial Control and Systems
NEMA MG 1	1993 Motors and Generators
NEMA MG 10	1983 (R. 1988) Energy Management Guide for Selection and Use of Polyphase Motors
NEMA MG 11	1977 (R. 1992) Energy Management Guide of Selection and Use of Single-Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code

Additional Standards apply. See Section II, paragraph 2.1.0.3 and 2.6.1 of this specification.

1.7 QUALITY ASSURANCE

1.7.1 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.

1.7.2 Alternative Qualifications

Products having less than a 2-year field service record shall be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.7.3 Service Support

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

1.7.4 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.

1.7.5 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 Navy's Technical Representative (NTR).

1.8 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.

1.9 SAFETY REQUIREMENTS

1.9.1 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.

1.9.2 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."

1.10 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.

1.11 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.

1.12 ELECTRICAL REQUIREMENTS

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

1.12.1 Motors and Equipment

Provide motors, controllers, integral disconnects, and contactors with their respective pieces of equipment, except controllers indicated as part of the motor control centers.

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.

1.12.2 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.

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

1.12.3 High Efficiency Motors

1.12.3.1 High Efficiency Single-Phase Motors

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

1.12.3.2 High Efficiency Polyphase Motors

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

1.13 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

2.1 SUBMITTAL

Submit copies of the following: shop drawings, diagrams, catalog cuts, specifications, data sheets, performance curves, etc., in accordance with the Vendor Drawing/Data Requirements listed in Attachment C and with Section C, Part 7 of the Basic Contract.

2.1.1 Compressed Air System Mechanical/Electrical

a. Shop drawings (four copies) shall be provided for the complete system and shall include but not be limited to:

   1. System overview P&ID diagram, showing major equipment, connecting piping, valves, drains, vents, etc., and their instrumentation and logic control, electrical schematic diagram showing signal and power interconnecting wiring.

   2. Scaled equipment and components, panel/enclosure drawings, fully dimensioned with itemized bill of materials (BOM).

   3. Electrical schematic and connection (point-to-point wiring) diagrams for all input/output devices and panel/enclosure internal wiring.

   4. Recommended Spare Parts List

   5. Installation instructions for all equipment

   6. Simplified logic block diagrams or flow charts

   b. Four (4) copies of purchase specifications, calculations, data sheets, performance curves and catalog cuts.

c. Seven (7) copies of operations and Maintenance (O&M) manual for the complete system.

2.1.2 Instrumentation and Control Equipment

a. Shop drawings shall be provided for all I&C equipment associated with compressed air system.

b. Recommended Spare Part List.

c. Instrument installation instructions

d. Operations and Maintenance (O&M) manual for each instrument

2.1.3 Final Submittal

All final submittals shall be completely representative of the as-build design. Any and all field modification details shall be fully incorporated into all affected drawings and O&M manuals.

PART 3 EXECUTION

3.1 SCHEDULE REQUIREMENTS

The General Contractor has prepared a preliminary schedule for the project which identifies the major milestones that must be met. These milestones are presented in Attachment E of this specification. The bidder shall prepare and submit (with the Bid Proposal) a summary level schedule that incorporates the milestones and that represents the bidder's plan to execute the scope of work.

The subcontractor shall also submit to the General Contractor unpriced copies of all purchase orders issued for the procurement of permanent orders issued for the procurement of permanent components (pump, motor, electrical controls, valves, etc.) to verify that commitments have been made.

3.2 COMMUNICATIONS/CORRESPONDENCE

All correspondence from the Subcontractor shall consist of an original plus three copies and shall contain the following subject heading:

SPECIFICATION NO. 15487
TITLE: COMPRESSED AIR SYSTEM
PROJECT: Soil and Groundwater Remediation, Operable Unit No. 2, MCB Camp Lejeune, NC

All correspondence/communications shall be addressed to the General Contractor, specifically:

OHM Remediation Services Corp., 5335 Triangle Parkway, Suite 450, Norcross, GA 30092

3.3 REJECTED WORK AND MATERIALS

The Subcontractor, upon written notice from the contractor, shall remove from the premises all work and materials rejected as defective, unsound, improper, or in any way failing to conform to the requirements of the contract documents. The Subcontractor shall at his sole expense make good all work damaged by such removal and shall promptly replace materials damaged or improperly worked by him and re-execute his own work in accordance with the contract. This includes re-executing replacing the work of any other Subcontractor that is in any way affected by the removal of the defective work.

Failure of the Subcontractor to comply with this requirement within 10 days of notification from the contractor, will authorize the contractor to take appropriate action to implement such repair or removal. The Subcontractor will be back charged for all such expenses incurred to implement such repair or removal, including the purchaser's supervision costs.

SECTION II

COMPRESSED AIR SYSTEM

PART 1 GENERAL

1.1 SUMMARY

Provide compressed air system complete and ready for operation. Compressed air system includes: air compressor, separator, receiver, refrigerated air dryer, filters, piping valves, fittings, electrical wiring, control panel, instrumentation and controls, insulation, etc.

Materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME Boiler and Pressure Vessel Code, and ANSI B31.1 except as modified herein. In the publications 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," shall be interpreted to mean the Navy Technical Representative.

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation since January 1992. Equipment shall be supported by a service organization that is, in the opinion of the NTR, reasonably convenience to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.2 SUBMITTALS

Submit the following in accordance with Section C, Part 7.0, of the Basic Contract and Section I of this specification.

1.2.2 Manufacturer's Catalog Data (4 copies with quote)

Detailed data shall be provided for the following equipment:

a. Air compressor

b. Compressor motor

c. Intake filters

d. Silencer

e. Aftercooler

f. Separator

g. Receiver

h. Refrigerated air dryer

i. Coalescing air filter

j. Particulate air filter

k. Control Panel

l. Temperature, pressure, humidity controls

m. Instrumentation

n. Electrical wires, switches, relays, etc.

o. Pipes and fittings

p. Valves (shut-off, relief, regulating, etc.)

q. Drain traps

1.2.2 General Arrangement Drawings (4 copies 4 weeks after order)

Shop detailed drawing shall be provided for the following equipment:

a. Air compressor and associated equipment (motor, intake filter, silencer, aftercooler, etc.)

b. Separator

c. Receiver

d. Refrigerated air dryer

e. Coalescing air filter

f. Particulate air filter

g. Control panel, controls and instrumentation

h. Electrical components

i. Pipes and armature (valves, drain traps, fittings, etc.)

1.2.3 Operation and Maintenance Manuals (7 copies, 4 weeks after order)

For each size and type, submit the complete operation and maintenance manuals indicated in the Vendor Date Requirement form.

a. Air compressor, Data package 4
b. Refrigerated air dryer, Data package 4

Compressor performance curves and compete wiring and termination diagrams shall be included in the Vendor data and Operation and Maintenance Manuals.

1.3 GENERAL REQUIREMENTS

Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "General Electrical Requirements."

PART 2 PRODUCTS

2.1 AIR COMPRESSOR

Provide one duplex tank mounted, electric motor driven, air cooled, two stage, reciprocating type air compressor including motors, controllers, alternator, pressure switches, belt guards, air intake filters, and silencers. Piston speed shall not exceed 450 fpm. Pressure switches shall start compressor at 90 psig and stop compressor at 100 psig. Each compressor shall supply compressed air at 100 psig continuously. Centrifugal unloader mechanism shall be provided with each compressor. All controls shall be suitable for wet locations.

2.1.1 Scope

This section specifies Air Compressors and related components.

The subcontractor shall assign unit responsibility to the air compressor manufacturer for the combined equipment consisting of the air compressor and associated appurtenances specified herein.

2.1.2 Operating Requirements

Air compressors and accessories shall be designed and selected for continuous duty operation and shall deliver clean, oil-free air. Compressors shall at all times deliver air which meets the operating requirements listed in this section. Inlet air shall be filtered with a medium efficiency filter before distribution as specified herein.

1. Discharge pressure, psig	100
2. Capacity at rated discharge pressure, acfm for both compressors combined	100
3. Rotative speed, nominal, rpm	1,725
4. Inlet pressure, maximum, psig	15.50
5. Installed motor horsepower, maximum for both compressors combined	30

2.1.3 Manufacturers

Air compressors shall be manufactured by one of the following:

a. Ingersoll Rand
b. Champion
c. Quincey

The compressors shall be suitable for floor-mounting and should be modified to provide specified features.

2.1.4 Materials

Materials employed for the construction of equipment furnished under this section shall be as follows:

Component	Material
Piston rings	TFE Teflon
Cylinders and counterweights	Gray iron, ASTM A48, Class 30B
Low pressure piston	Aluminum alloy, A1S1 S-132
High pressure piston and heads	Gray iron, ASTM A48, Class 25B
Crankshaft and connecting rods	Forged steel, or ductile iron
Frame and intercooler manifolds	Gray iron, ASTM A48, Class 20A
Baseplate	Fabricated steel
Gaskets	Teflon
Valves	304 or 316 stainless steel

2.1.5 Equipment

A. General

The instrument air compressors shall be constructed with a nonlubricated type piston. The nonlubricated piston shall be separated from the crosshead piston so that there is no overlap. There shall be a chamber between the crosshead and the nonlubricated piston designed to prevent lubricant from entering the nonlubricated section of the compressor.

The instrument air compressors shall be either V-configuration or vertical one stage compressors with deep ribbed construction for maximum heat dissipation. The units shall be capable of continuous operation without thermal damage to the nonlubricated components. Valves shall be readily accessible. Connecting rods shall be of forged steel and babbitt-lined crankpin bearings. The

crankshaft shall be balanced, and single-forging. Crankshaft bearings shall be Class M3, designed for the radial and thrust loads imposed by the operating conditions specified.

Each compressor shall be provided with an ASME relief valve, set at 110 percent of the compressor's rated discharge pressure and sized for not less than the unit's maximum capacity, located on each compressor's discharge piping. The discharge of each compressor shall be provided with an adjustable high discharge air temperature switch rated at 5 amps SPDT at 120 volts. Switch shall be housed in a NEMA 4 enclosure.

B. Drive Unit

Each compressor shall be driven by a Type 2 energy-efficient motor in accordance with Section I, Paragraph 1.13 of this specification.

C. Aftercooler and Separator

Each IA compressor shall be provided with a single water cooled, shell and tube, counterflow aftercooler complete with a centrifugal type separator and an automatic condensate drain valve. The aftercooler shall be capable of cooling compressed air at the rated flow of one instrument air compressor and at compressor's discharge temperature. The aftercooler shall be sized to handle the maximum continuous heat rejection using 85 degrees F cooling water, maximum 20 degrees F water temperature rise, and 10 degrees F air approach temperature. The aftercooler shall meet ASME Heat Exchanger Code requirements and shall be suitable for working pressure of 150 psig. The aftercooler shall have a cast iron case and steel tubes. Sufficient water flow rate will be provided from the 3W water system. The separator shall be of the centrifugal impingement type selected for airflows specified herein. The separator condensates drain valve shall be the float-type. The valve shall open automatically based upon condensate water level in the float chamber.

D. Inlet Filter Silencer

Each compressor set shall be equipped with a two-stage dry type filter and inlet silencer. The filter elements shall be of the cleanable type. Each filter silencer shall be provided with threaded or flanged connections and mounting brackets suitable for proper installation. Interior surfaces shall receive a rust-inhibitive coating, and exterior surfaces shall be prime coated. Each filter-silencer shall be sized so that the back pressure produced will not adversely affect performance of the compressor to which it is connected. Filter shall be 99 percent efficient at 10 micron rating.

E. Belt Guard

Compressor shall be provided with totally enclosed belt guard.

2.2 COMPRESSED AIR RECEIVER

Provide steel receiver constructed and labeled in accordance with the ASME Boiler and Pressure Vessel Code for not less than 125 psig service. Provide a pressure gauge, a pressure relief (safety) valve, a service valve (3/4" ball), and an automatic receiver drain valve. Set pressure relief valve at 125 psig.

Two pressure switches shall be provided on the receiver of the duplex unit to provide a "lead-lag" mode of operation.

2.3 REFRIGERATIVE AIR DRYER

2.3.1 Scope

This section specifies Refrigerative Air Dryer and related components.

2.3.2 Operating Requirements

Air dryers shall be rated in accordance with Recommended Standard NFPA/T3.27.2-1975 of the National Fluid Power Association for Class H (33 degree F to 39 degree F) pressure dew point. Rating conditions are 100 degrees F inlet temperature, 100-psig inlet pressure, 100-percent relative humidity, and 100-degree F ambient temperature. Maximum pressure drop across each air dryer is 3.5 psi. Actual operating conditions are as follows:

Item	
Rated capacity, acfm	100
Operating pressure, psig	100
Maximum compressor horsepower/voltage, hp/volts/phases	1/208/1

2.3.3 Manufacturers and Equipment

Air dryers shall be Ingersoll-Rand, Series HG, Hankison International, Series PR or equal. A single power supply will be provided at the same voltage as the compressor. Air dryers shall be equipped with the following accessories:

1. Refrigerant flow control valves
2. Refrigerant compressor overload switch
3. Refrigerant filter dryer
4. High evaporator temperature light
5. Air cooled condenser
6. Automatic drain valve (mechanical)
7. Control panel (NEMA 1)

2.4 Coalescing Air Filter

The inlet filters (prefilter) shall be a coalescing fiber type capable of providing 99.9 percent removal efficiency of 0.6 micron (average) particle size. A solenoid type automatic drain trap shall be connected to the filter.

2.5 PARTICULATE FILTER

The outlet air filter shall be a particulate mechanical separation and interception type. Filter elements shall be replaceable and one-directional, and shall be constructed of resin impregnated polyester fiber.

Elements shall be replaceable without breaking air connections. Housing shall be cast aluminum alloy and shall incorporate an automatic flood drain.

Particular filter shall provide nominal 1 micron filtration for 100 scfm air at 100 psig. Inlet pressure drop shall not exceed 1 psi at the operating conditions. Filter shall be rated for inlet temperature of 250 degrees F.

2.6 COMPRESSED AIR PIPING

2.6.1 System Description

Provide new air piping system, complete and ready for operation. Piping systems including manufacturer's products shall be in accordance with the required and advisory provisions of the Plumbing Code (NAPHCC NSPC).

2.6.2 Products - Pipes, Fittings, etc.

All piping and valving to be rated for 150 psig ambient.

2.6.2.1 Pipe

4" and smaller	-	Steel, ASTM A 53, Type F (welded).
6" to 20" inclusive	-	Steel, ASTM A 53, Grade B, Type E (ERW).

API 5L, Grade B line pipe and rolled steel plate pipe (A 283/A 283M, Grade C) are approved equal.

2.6.2.2 Fittings

2" and smaller	-	300# MI, screwed.
2 1/2" to 6" inclusive	-	Schedule 40, FS, weld reducers and LR weld ells.
8" to 12" inclusive	-	Schedule 20, FS, weld reducers and LR weld ells.

2.6.2.3 Unions

2" and smaller	-	300# MI, brass to iron seat, screwed, Stockham 895.

2.6.2.4 Branch Connections

2" and smaller on pipe 2 1/2" and larger	-	3000# thredolet, extra heavy full coupling, or welding offtake.
2 1/2" and larger on pipe 2 1/2" and larger	-	Fabricated flanged nozzle, welded offtake or weld tee if dictated by design.

2.6.2.5 Flanges

2 1/2" to 12" inclusive	-	ANSI Class 150 slip-on fig., RF, FS.

Welding neck flanges may be specified when dictated by design or availability. Specify flat face flanges as companion flanges to CI flanges as at CI valves and pump nozzles.

2.6.2.6 Gaskets

2 1/2" to 12" inclusive	-	Ring type, 1/16" tick, compressed non-asbestos, Garlock 3200.

Specify full face gaskets at valves with flat face flanges.

2.6.2.7 Bolts and Nuts

Bolts	-	ASTM A 307, Grade B, heavy hex-head.
Nuts	-	ASTM A 307, cold punched, heavy hex, series.

2.6.2.8 Pipe Nipples

Copper alloy for use in copper tubing and Schedule 80 steel pipe for use in steel piping.

2.6.2.9 Flexible Connections

Vibration isolation, wire braid reinforced corrugated metal hose type, line-sized, with bronze and connections, suitable for pressure indicated.

2.6.2.10 Quick Disconnect Couplings

Provide all brass suitable for a working pressure of not less than indicated system pressure. 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.

2.6.2.11 Angle Valves

2" and smaller	-	125#, bronze, ISRS, screwed.
2 1/2" to 6 " inclusive	-	125#, IBBM, OS&Y, flanged.

2.6.2.12 Ball Valves (preferred)

2" and smaller - 200#, bronze, Buna-N seats, screwed.

2.6.2.13 Butterfly Valves

2 1/2" to 24" inclusive - 125#, CI Buna-N seats, wafer valve, with gear operator.

2.6.2.14 Check Valves

2" and smaller - 125#, bronze, swing check, screwed.
2 1/2" to 24" inclusive - 125#, IBBM, swing check, flanged.

2.6.2.15 Gate Valves

2" and smaller - 125#, bronze, ISRS, screwed, Crane 428.
2 1/2" to 36" inclusive - 125#, IBBM, OS&Y, flanged, Crane 465 1/2.

2.6.2.16 Globe Valves

2" and smaller - 125#, bronze, ISRS, screwed.
2 1/2" to 10" inclusive - 125#, IBBM, OS&Y, flanged.

2.6.2.17 Pressure Relief Valves

ANSI Z21.22 and ASME bronze or cast iron body, with test lever, and shall be suitable for the intended service.

2.6.2.18 Pressure Regulating Valves

Spring loaded type, with nominal pressure rating of not less than inlet system pressure indicated. Provide pressure regulating valves capable of being adjusted to indicated flow and pressure, and suitable for intended service.

2.6.2.19 Solenoid Valve

The aftercooler solenoid valve shall be 3/4-inch pipe size, direct acting with NEMA 4 enclosure. Valve shall be fail-open design, and coil shall be 120 VAC.

2.6.2.20 Traps

Steel body, internals of stainless steel, minimum of ANSI Class 150, and of the types indicated.

2.6.2.21 Pressure Gauges

ANSI B40.1 steel or brass case, shatterproof safety glass, and a pressure blowout back to prevent glass from flying out in case of an explosion. Gauges shall have a 3.5 inch minimum diameter dial and a dial range of approximately twice working pressure. Provide gauge, snubber and cock.

2.3 INSTRUMENTATION AND CONTROLS

All controls for the system shall be suitable for wet locations.

Compressors shall be provided with a duplex control panel. Provide a main disconnect switch with the handle accessible from outside the control panel door. The control panel shall have a NEMA 4X nonmetallic enclosure. The control panel shall be provided with a NEMA-rated motor starter for each compressor. The control panel shall be provided with an alarm light for each shutdown condition. A reset pushbutton shall be provided for cancellation of alarms.

Alarm lights, reset pushbutton, and other operator controls shall be located on the front of the panel door. Each compressor shall be provided with a run-time meter and a HAND-OFF-AUTO switch (with a spring return to "OFF" from the "HAND" position) on the panel door. Panel shall include an alternator that shall alternate the two compressors between a "lead" and "lag" mode. Alternation shall be performed manually via a two-position selector switch with "1-2" and "2-1" positions.

Compressor controls shall monitor external pressure switches mounted on the receiving tank. High discharge air temperature shall shut down the faulted compressor and activate an alarm light. Alarm light shall remain illuminated until alarm condition has been rectified and reset pushbutton has been depressed.

At atmospheric pressure, the three external pressure switch contacts (PS-1, PS-2, and PS-3) are normally closed. With controls in automatic, both compressors start and run until they both shut off at the maximum control pressure setting of the external pressure switch contact PS-3 (opens). As the service air is used, the pressure in the receive decreases to the PS-2 setting (closes) and the lead compressor is started. If the pressure continues to decrease to the pressure setting of PS-1 (closes), the lag compressor will start.

In summary, the action of the external pressure switches is as follows:

PS-1 Normally closed, closes on decreasing pressure to start lag compressor.

PS-2 Normally closed, closes on decreasing pressure to start lead compressor.

PS-3 Normally closed, opens on increasing pressure to stop lead and lag compressor.

NOTE: Pressure switch designations, PS-1, PS-2 and PS-3 are for the purposes of explanation. Actual pressure switch designations will be identified with ISA tag numbers on the documents.

When the compressor runs, the aftercooler 3W valve opens; when the compressor stops, the aftercooler 3W valves closes. The valve fails in the open position.

Compressed air system shall have at least the following indicators: Inlet air pressure gauge, discharge air pressure gauge, inlet air temperature gauge, heat exchanger, temperature gauge, refrigerative air dryer, inlet and outlet pressure gauges, green "power on" light, power interruption light, and the high temperature light.

2.4 ELECTRICAL REQUIREMENTS

The Subcontractor is responsible for all electrical wiring of the Compressed Air System up to and including Control Panel.

Control Panel shall be UL listed or CSA approved and shall be wired for single 480 VAC, 3-phase, 3-wire, power service.

Electrical installations shall conform to ANSI C2, NFPA 70, IEEE 100 and other specified standards, see Section, Paragraph 1.6 for references.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The equipment shall be assembled and installed by the Mechanical Subcontractor (others) in accordance with the manufacturer's drawings and instruction manuals to conform to the particular application involved with the details shown. Electrical connection will be made by others after the mechanical Subcontractor completes equipment installation.

Subcontractor shall test each piece of the equipment and shall furnish written certification that it has been installed in accordance with the manufacturer's requirements, and is calibrated and ready to begin the operation.

-- End of Section --

SECTION 15492

FUEL GAS PIPING AND 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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.11	1991 Forged Steel Fittings, Socket-Welding and Threaded
ANSI B16.33	1990 Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (Sizes 1/2 Through 2)
ANSI B18.2.1	1981 Square and Hex Bolts and Screws Inch Series
ANSI Z21.41	1989 (Addenda 1990 and 1992) Quick-Disconnect Devices for Use with Gas Fuel
ANSI Z21.45	1992 (Addenda 1993) Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI Z21.69	1992 (Addenda 1993) Connectors for Movable Gas Appliances

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	1989 Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI/ASME B1.20.1	1983 (Rev 1992) Pipe Threads, General Purpose (Inch)
ANSI/ASME B16.3	1992 Malleable Iron Threaded Fittings
ASME/ANSI B16.5	1988 (Errata 1988) Pipe Flanges and Flanged Fittings

ASME/ANSI B16.9	1993 Factory-Made Wrought Steel Buttwelding Fittings
ANSI/ASME B16.38	1985 Large Metallic Valves for Gas Distribution (Manually Operated, NPS 2 1/2 to 12, 125 psig Maximum)
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 B31.8	1992 Gas Transmission and Distribution Piping Systems
ASME BPVC SEC VIII D1	1992 (Addenda 1992) Boiler and Pressure Vessel Code: Section VIII Pressure Vessels, Division 1

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1993 (Rev. A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 193/A 193M	1994 (Rev. A) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	1994 Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM D 2513	1994 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2683	1993 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

CODE OF FEDERAL REGULATIONS (CFR)

49 CFR PT 192	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Supply Standards
49 CFR PT 195	Transportation of Hazardous Liquids by Pipeline

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	1993 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application
MSS SP-89	1985 Pipe Hangers and Supports - Fabrication and Installation Practices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	1992 National Fuel Gas Code
NFPA 58	1992 Storage and Handling of Liquified Petroleum Gases

1.2 RELATED REQUIREMENTS

Section 15011, "General HVAC Requirements," applies to this section, with additions and modifications specified herein.

1.3 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a Pipe and fittings

b Hangers and supports

c Pressure regulator

d Gas equipment connectors

e. Valves

f Warning and identification tape

g. Risers

h. Transition fittings

i. LPG containers and accessories

1.3.2 SD-06, Instructions (4 copies each 4 weeks after order)

a. PE pipe and fittings

Submit manufacturer's installation instructions and manufacturer's visual joint appearance chart.

1.3.3 SD-08, Statements (4 copies each 4 weeks after order)

a. Welder's qualifications

b. PE welder's qualifications

c. Welder's identification symbols

Submit a copy of a certified ASME B31.8 qualification test report for each welder and welding operator. Submit the assigned number, letter, or symbol that shall be used in identifying the work of each welder.

1.3.4 SD-13, Certificates (4 copies each 4 weeks after order)

a. PE pipe and fittings

b. Transition fittings

c. LPG containers and accessories

1.4 QUALITY ASSURANCE

1.4.1 Welder's Qualifications

Comply with ASME B31.8. The steel welder shall have a copy of a certified ASME B31.8 qualification test report. The PE welder shall have a certificate from a PE pipe manufacturer's sponsored training course. Contractor shall also conduct a qualification test. Submit each welder's identification symbols, assigned number, or letter, used to identify work of the welder. Affix symbols immediately upon completion of welds. Welders making defective welds after passing a qualification test shall be given a requalification test and, upon failing to pass this test, shall not be permitted to work this contract.

1.4.2 PE Welder's Qualifications

Prior to installation, Subcontractor shall have supervising and installing personnel trained by a PE pipe manufacturer's sponsored course of not less than one week duration, or present proof satisfactory to the Contracting Officer that personnel are currently working in the installation of PE gas distribution lines.

1.4.3 Safety Standards

49 CFR PT 192 and 49 CFR PT 195.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, transport, and store plastic pipe and fittings carefully. Plug or cap pipe ends during transportation or storage to minimize dirt and moisture entry. Do not subject to abrasion or concentrated external loads. Discard PE pipe sections and fittings that have been damaged.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Conform to NFPA 54 and with requirements specified herein. Supply piping to appliances or equipment shall be at least as large as the inlets thereof.

2.2 PIPE AND FITTINGS

2.2.1 Aboveground and Within Buildings and Vaults

a. Pipe: Black steel in accordance with ASTM A 53, Schedule 40, threaded ends for sizes 2 inches and smaller; otherwise, plain end beveled for butt welding.

b. Threaded Fittings: ANSI/ASME B16.3, black malleable iron.

c. Socket-Welding Fittings: ANSI B16.11, forged steel.

d. Butt-Welding Fittings: ASME/ANSI B16.9, with backing rings of compatible material.

e. Unions: ASME/ANSI B16.39, black malleable iron.

f. Flanges and Flanged Fittings: ASME/ANSI B16.5 steel flanges or convoluted steel flanges conforming to ASME BPVC SEC VIII D1. Flange faces shall have integral grooves of rectangular cross sections which afford containment for self-energizing gasket material.

2.2.2 Underground Polyethylene (PE)

PE pipe and fittings are as follows:

a. Pipe: ASTM D 2513, 100 psig working pressure, Standard Dimension Ratio (SDR), the ratio of pipe diameter to wall thickness, 11.5 maximum.

b. Socket Fittings: ASTM D 2683.

c. Butt-Fusion Fittings: ASTM D 2513, molded.

2.2.3 Risers

Manufacturer's standard riser, transition from plastic to steel pipe with 7-to-12 mil thick epoxy coating. Use swaged gas-tight construction with O-ring seals, metal insert, and protective sleeve. Provide remote bolt-on or bracket or wall-mounted riser supports as indicated.

2.2.4 Transition Fittings

a. Steel to Plastic (PE): As specified for "riser" except designed for steel-to-plastic with tapping tee or sleeve. Coat or wrap exposed steel pipe with heavy plastic coating.

b. Plastic to Plastic: Manufacturer's standard fused tapping (PE-to-PE) tee assembly with shutoff feature.

2.3 VALVES, ABOVEGROUND

Provide lockable valves where indicated.

2.3.1 Shutoff Valves, Sizes Larger Than 2 Inches

Cast-iron or steel body ball valve with flanged ends in accordance with ANSI/ASME B16.38. Provide PTFE seats.

2.3.2 Shutoff Valves, Sizes 2 Inches and Smaller

Bronze body ball valve in accordance with ANSI B16.33, full port pattern, reinforced PTFE seals, threaded ends, and PTFE seat.

2.3.3 Pressure Regulator

Self-contained with spring-loaded diaphragm pressure regulator, psig to inches water reduction, pressure operating range as required for the pressure reduction indicated, volume capacity not less than indicated, and threaded ends for sizes 2 inches and smaller, otherwise flanged.

2.3.4 Gas Safety Shut-off Valve

Provide a 2-way electric actuated gas safety shut-off valve. The valve shall have 120 VAC solenoid and shall fail close on loss of power and shall be explosion proof. The valve shall be capable to operate with no minimum pressure or flow and to shut off and remain closed against moderate amount of back pressure. The electrical compartment of the valve shall be fully isolated from the process compartment to prevent flammable liquids or gases from contacting the electrical portion. Each valve shall be provided with a visual position indicator, a DPDT limit switch, and a handle for the emergency manual opening or closing of the valve. All valve material shall be carbon steel in accordance with ANSI B31.1. The valve design shall be in accordance with NFPA and FM codes as applicable.

2.4 GAS EQUIPMENT CONNECTORS

a. Flexible Connectors: ANSI Z21.45.

b. Quick Disconnect Couplings: ANSI Z21.41.

c. Semi-Rigid Tubing and Fittings: ANSI Z21.69.

2.5 CASING

Where indicated at railroad or other crossing, provide ASTM A 53, galvanized pipe, Schedule 40 , with extruded polyethylene coating.

2.6 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

Provide detectable aluminum-foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3-inch minimum width, color-coded yellow for natural gas, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be "CAUTION BURIED GAS PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.7 HANGERS AND SUPPORTS

MSS SP-58, as required by MSS SP-69.

2.8 WELDING FILLER METAL

ASME B31.8.

2.9 PIPE-THREAD TAPE

Antiseize and sealant tape of polytetrafluoroethylene (PTFE).

2.10 BOLTING (BOLTS AND NUTS)

Stainless steel bolting; ASTM A 193/A 193M, Grade B8M or B8MA, Type 316, for bolts; and ASTM A 194/A 194M, Grade 8M, Type 316, for nuts. Dimensions of bolts, studs, and nuts shall conform with ANSI B18.2.1 and ASME/ANSI B18.2.2 with coarse threads conforming to ASME B1.1, with Class 2A fit for bolts and studs and Class 2B fit for nuts. Bolts or bolt-studs shall extend through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Bolts shall have American Standard regular square or heavy hexagon heads; nuts shall be American Standard heavy semifinished hexagonal.

2.11 GASKETS

Fluorinated elastomer, compatible with flange faces.

2.12 IDENTIFICATION FOR ABOVEGROUND PIPING

MIL-STD-101 for legends and type and size of characters. For pipes 3/4-inch od and larger, provide printed legends to identify contents of pipes and arrows to show direction of flow. Color code label backgrounds to signify levels of hazard. Make labels of plastic sheet with pressure-sensitive adhesive suitable for the intended application. For pipes smaller than 3/4-inch od, provide brass identification tags 1 1/2 inches in diameter with legends in depressed black-filled characters.

2.13 (LIQUEFIED PETROLEUM GAS) LPG CONTAINER AND ACCESSORIES

NFPA 58, ASME container with appurtenances, system working pressure, minimum design pressure, that is LPG vapor pressure at 100 degrees F, and water capacity as required. Provide a 2,000-gallon container with piping and fittings, fuse plugs, hose and flexible hose connectors, strainer, and marking conforming to NFPA 58.

PART 3 EXECUTION

3.1 INSTALLATION

Install gas piping, appliances, and equipment in accordance with NFPA 54. Install distribution piping in accordance with ASME B31.8. Install and store liquefied petroleum gas piping, appliances, and equipment in accordance with NFPA 58.

3.1.1 Excavating and Backfilling

Perform excavating and backfilling of pipe trenches as specified in Section 02220, "General Excavation, Filling, and Backfilling." Place pipe directly in trench bottom and cover with minimum 3 inches of sand to top of pipe. If trench bottom is rocky, place pipe on a 3-inch bed of sand and cover as above. Provide remaining backfilling. Coordinate provision of utility warning and identification tape with backfill operation. Bury utility warning and identification tape with printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

3.1.2 Piping

Cut pipe to actual dimensions and assemble to prevent residual stress. Provide supply connections entering the buildings as indicated. Within buildings, run piping parallel to structure lines and conceal in finished spaces. Terminate each vertical supply pipe to burner or appliance with tee, nipple and cap to form a sediment trap. To supply multiple items of gas-burning equipment, provide manifold with inlet connections at both ends.

3.1.2.1 Cleanliness

Clean inside of pipe and fittings before installation. Blow lines clear using 80-to-100 psig clean dry compressed air. Rap steel lines sharply along entire pipe length before blowing clear. Cap or plug pipe ends to maintain cleanliness throughout installation.

3.1.2.2 Aboveground Steel Piping

Determine and establish measurements for piping at the job site and accurately cut pipe lengths accordingly. For 2-inch diameter and smaller, use threaded or socket-welded joints. For 2 1/2-inch diameter and larger, use flanged or butt-welded joints.

a 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. Provide threads smooth, clean, and full-cut. Apply anti-seize paste or tape to male threads portion. Work piping into place without springing or forcing. Backing off to permit alignment of threaded joints shall not be permitted. Engage threads so that not more than three threads remain exposed. Use unions for connections to valves for which a means of disconnection is not otherwise provided.

b. Welded Joints: Weld by the shielded metal-arc process, using covered electrodes and in accordance with procedures established and qualified in accordance with ASME B31.8.

c. Flanged Joints: Use flanged joints for connecting welded joint pipe and fittings to valves to provide for disconnection. Install joints so that flange faces bear uniformly on gaskets. Engage bolts so that there is complete threading through the nuts and tighten so that bolts are uniformly stressed and equally torqued.

d. Pipe Size Changes: Use reducing fittings for changes in pipe size. Size changes made with bushings shall not be accepted.

e. Painting: Paint new ferrous metal piping, including supports. Do not apply paint until piping tests have been completed.

f. Identification of Piping: Identify piping aboveground in accordance with MIL-STD-101, using adhesive-backed or snap-on plastic labels and arrows. In lieu of labels, identification tags may be used. Apply labels or tags to finished paint at intervals of not more than 50 feet. Provide two copies of the piping identification code framed under glass and install where directed.

3.1.2.3 Buried Plastic Lines

Provide totally PE piping. Prior to installation, obtain printed instructions and technical assistance in proper installation techniques from pipe manufacturer.

a. PE Piping: Prior to installation, Contractor shall have supervising and installing personnel, certified in accordance with paragraph entitled "Welder's Qualifications." Provide fusion-welded joints except where transitions have been specified. Use electrically heated tools thermostatically controlled, and equipped with temperature indication.

b. Laying PE Pipe: Bury pipe 24 inches below finish grade. Lay in accordance with manufacturer's printed instructions.

3.1.2.4 Wrapping

Where connection to existing steel line is made underground, tape wrap new steel transition fittings and exposed existing pipe having damaged coating. Clean pipe to bare metal. Initially stretch first layer of tape to conform to the surface while spirally half-lapping. Apply a second layer, half-lapped and spiralled as the first layer, but with spirals perpendicular to first wrapping. Use 10-mil minimum thick polyethylene tape. In lieu of tape wrap, heat shrinkable 10-mil minimum thick polyethylene sleeve may be used.

3.1.3 Valves

Install valves approximately at locations indicated. Orient stems vertically, with operators on top, or horizontally. Provide support for valves to resist operating torque applied to PE pipes.

3.1.3.1 Pressure Regulator

Provide plug cock or ball valve ahead of regulator. Install regulator outside of building and 18 inches aboveground on riser. On outlet side of regulator provide a union and a 3/8-inch gage tap with plug.

3.1.3.2 Stop Valve and Shutoff Valve

Provide stop valve on service branch at connection to main and shutoff valve on riser outside of building. Install main gas safety shut-off valve in the main at the entrance to the building and a break glass switch at the exit of the building.

3.1.4 Pipe Sleeves

Where piping penetrates concrete or masonry wall, floor or firewall, provide pipe sleeve poured or grouted in place. Make sleeve of steel or cast-iron pipe of such size to provide 1/4-inch or more annular clearance around pipe. Extend sleeve through wall or slab and terminate flush with both surfaces. Pack annular space with oakum, and caulk at ends with silicone construction sealant.

3.1.5 Piping Hangers and Supports

Selection, fabrication, and installation of piping hangers and supports shall conform with MSS SP-69 and MSS SP-89, unless otherwise indicated.

3.1.6 Final Connections

Make final connections to equipment and appliances using rigid pipe and fittings.

3.2 FIELD QUALITY CONTROL

3.2.1 Metal Welding Inspection

Inspect for compliance with NFPA 54 and ASME B31.8. Replace, repair, and then reinspect defective welds.

3.2.2 PE Fusion Welding Inspection

Visually inspect butt joints by comparing with, manufacturer's visual joint appearance chart. Inspect fusion joints for proper fused

connection. Replace defective joints by cutting out defective joints or replacing fittings. Inspect 100 percent of all joints and reinspect all corrections. Arrange with the pipe manufacturer's representative in the presence of the Contracting Officer to make first time inspection.

3.2.3 Pressure Tests

Use test pressure of 1 1/2 times maximum working pressure, but in no case less than 50 psig. Do not test until every joint has set and cooled at least 8 hours at temperatures above 50 degrees F. Conduct testing before backfilling; however, place sufficient backfill material between fittings to hold pipe in place during tests. Test system gas tight in accordance with NFPA 54 or ASME B31.8. Use clean dry air or inert gas, such as nitrogen or carbon dioxide, for testing. Systems which may be contaminated by gas shall first be purged as specified. Make tests on entire system or on sections that can be isolated by valves. After pressurization, isolate entire piping system from sources of air during test period. Maintain test pressure for at least 8 hours between times of first and last reading of pressure and temperature. Take first reading at least one hour after test pressure has been applied. Do not take test readings during rapid weather changes. Provide temperature same as actual trench conditions. There shall be no reduction in the applied test pressure other than that due to a change in ambient temperature. Allow for ambient temperature change in accordance with the relationship PF + 14.7 = (P1 + 14.7) (T2 + 460) / (T1 + 460), in which "T" and "PF" represent Fahrenheit temperature and gage pressure, respectively, subscripts "1" and "2" denote initial and final readings, and "PF" is the calculated final pressure. If "PF" exceeds the measured final pressure (final gage reading) by 1/2 psi or more, isolate sections of the piping system, retest each section individually, and apply a solution of warm soapy water to joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. In performing tests, use a test gage calibrated in one-psi increments and readable to 1/2 psi.

3.2.4 System Purging

After completing pressure tests, and before testing a gas contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clear completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to NFPA 54 and ASME B31.8.

-CAUTION-

Failure to purge may result in explosion within line when air-to-gas is at correct mixture.

SECTION 15620

UNIT HEATERS

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 Z83.8	1990 (Addenda 1990 and 1992) Gas Unit Heaters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	1989 (Rev. A) Zinc (Hot-Dip Galvanized)Coatings on Iron and Steel Products
ASTM B 117	1994 Salt Spray (Fog) Testing
ASTM D 1654	1992 Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

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	1993 Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	1992 National Fuel Gas Code
NFPA 70	1993 National Electrical Code
NFPA 90A	1993 Installation of Air Conditioning and Ventilating Systems

NFPA 90B	1993 Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	1992 Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying
NFPA 211	1992 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances

UNDERWRITERS LABORATORIES INC. (UL)

UL 441	1991 Gas Vents

1.2 RELATED REQUIREMENTS

Section 15011, "General HVAC Requirements," applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Bidder to submit the following in accordance with Section C, Part 7, of the Basic Contract.

1.3.1 SD-02, Manufacturer's Catalog Data (4 copies each with quote)

a. Unit heaters

1.3.2 SD-19, Operation and Maintenance Manuals (7 copies each 4 weeks after order)

a. Unit heaters, Data Package 2

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

PART 2 PRODUCTS

2.1 UNIT HEATERS

Self-contained and factory assembled, propeller fan with capacities expressed as Btu per hour output and cubic foot-per-minute air delivery, operating conditions, and mounting arrangements as indicated. Average fan bearing life shall be minimum 200,000 hours at operating conditions. Provide fan motor with direct drive. Also, provide power venter. Construct fan-guard motor mount of steel wire. Equip each heater with individually adjustable package discharge louver. Louvers may be substituted by discharge cones or diffusers. Provide unit mounted thermostats. Furnish circuit breaker disconnect switch.

2.1.1 Gas-Fired Unit Heater

ANSI Z83.8 and AGA label.

2.1.1.1 Casing

Minimum 22 gage steel. Provide removable access panels.

2.1.1.2 Heat Exchanger

Minimum 20 gage all-welded steel construction with corrosion-resistant aluminum finish.

2.1.1.3 Burners

Die-formed, slot ports, and steel construction with aluminum paint.

2.1.1.4 Draft Diverter

All-welded steel construction and an integral part of each heat exchanger section. Allows backdrafts to bypass burner assembly without affecting normal operation.

2.1.1.5 Controls

Consisting of a combination pressure regulator, main shutoff valve, pilot cock, pilot safety switch for 100 percent shutoff, high temperature limit switch, and time-delay fan switch. Provide two-stage gas control with intermittent pilot ignition. Include power and control connections in an integral junction box.

2.1.1.6 Efficiency

Minimum steady state efficiencies shall be 78 percent at maximum rated capacity and 75 percent at minimum rated capacity that is provided and allowed by the controls.

2.1.1.7 Accessories

Provide propane-gas conversion kit and automatic electric pilot recognition kit.

2.2 FAN

Provide steel fans with ball or roller bearings for motors over 1/8 horsepower (hp) and sleeve bearings for motors 1/8 hp and under. Provide sleeve bearings with oil reservoir, if not permanently lubricated.

2.3 MOTOR AND STARTER

NEMA MG 1, NEMA ICS 2, and NEMA ICS 6, respectively.

Provide continuous-duty motor with built-in automatic reset thermal overload protection. For motor 1/2 hp and larger, use three-phase. Provide single-phase motor of permanent split capacitor or capacitor start. Limit motor speed at 1800 r/min. All motors shall be high efficiency and TEFC. Wire motor to heater power supply source.

2.4 GAS PIPING SYSTEM AND FLUE VENT

Comply with Section 15492, "Fuel Gas Piping and Equipment," for gas valves and piping. Use UL 441 flue vents and gas-vent roof jacks of galvanized steel.

2.5 SOURCE QUALITY CONTROL

Special protection is not required for equipment that has a zinc coating conforming to ASTM A 123. Otherwise, protect affected equipment items by manufacturers' corrosion-inhibiting coating or paint system that has proved capable of withstanding salt-spray test in accordance with ASTM B 117. Test indoor and outdoor equipment for 125 hours; test outdoor equipment used in a marine atmosphere for 500 hours. For each specimen, perform a scratch test as defined in ASTM D 1654.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment where indicated and as recommended by manufacturer's recommendations, NFPA 54, NFPA 90A, NFPA 90B, NFPA 91 and NFPA 211.

3.1.1 Suspensions of Equipment

Provide equipment supports including beam clamps, turnbuckles and twist links or weld-wire chains, wire ropes with rope clips and rope thimbles, threaded-eye rod hangers with lock nuts and heat-duct hangers, threaded-eye bolts with expansion screws, brackets, platform and mounting frame, and vibration isolators. Locate equipment in such a manner that working space is available for servicing, such as burner removal, access to automatic controls, and lubrication. Provide electrical isolation of dissimilar metals. Clean interior of casings or cabinets before and after completion of installation.

3.1.2 Vents

NFPA 54 and NFPA 211.

Provide vents with weatherproofing flashings.

3.1.3 Electrical Work

NFPA 70 and Division 16, "Electrical Work." When replacing original control wires, provide No. 16 AWG with minimum 105 degrees C insulation.

3.2 FIELD QUALITY CONTROL

Administer, schedule, and conduct specified tests. Furnish personnel, instruments and equipment for such tests. Correct defects and repeat the respective inspections and tests. Conduct inspections and testing in the presence of the Contracting Officer.

3.2.1 Test Instruments and Apparatus

Provide instruments and apparatus currently certified as being accurate to within one percent of their full scale. Use gages with a maximum scale between 1 1/2 and 2 times test pressure.

3.2.2 Field Inspection

Prior to initial operation, inspect equipment installation to ensure that indicated and specified requirements have been met.

3.2.3 Field Tests

3.2.3.1 Fuel Piping Pressure Tests

Pneumatically test gas piping at 1 1/2 times operating pressure and check for leakage with soap solution.

3.2.3.2 Fire Tests for Nonelectrical Heating Equipment

Test combustion controls and equipment with specified fuel at 100 percent full rated load. During tests, verify proper operation of controls. Adjust burners for maximum efficiency using Orsat or similar apparatus. Maintain firing for at least four hours. For acceptable combustion efficiency, allow maximum 4.5 percent carbon dioxide in flue gases.

3.2.3.3 Insulation-Resistance Tests for Electrical Equipment

At the completion of wiring, test 600 volt wiring to verify that no short circuits exist before or after the attachment of electrical heating equipment to the power source. Make tests with an instrument which

applies a voltage of approximately 500 volts for a direct reading of insulation resistance.

3.2.3.4 Operational Tests

After completing fire tests and insulation-resistance tests, operate equipment continuously under varying load conditions to verify functioning of combustion controls, electrical controls, flame safeguard controls, safety interlocks, and specified operating sequence. Run each test for a minimum period of one hour.

SECTION 15871

INDUSTRIAL VENTILATION AND EXHAUST SYSTEMS (DUCTS AND FANS)

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 CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 2080	1992 Industrial Ventilation

ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION (AFBMA)

AFBMA 9	1990 Load Ratings and Fatigue Life for Ball Bearings
AFBMA 11	1990 Load Ratings and Fatigue Life for Roller Bearings

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 99	1986 Standards Handbook
AMCA 99-0401-66	Classification for Spark Resistant Construction
ANSI/AMCA 201	1990 Fan Application Manual - Fans and Systems
ANSI/AMCA 210	1985 Testing Fans for Rating
AMCA 211	1987 Certified Ratings Program for Air Moving Devices
AMCA 261	1992 Directory of Products Licensed to Use the AMCA Seal
AMCA 300	1985 (R 1987) Reverberant Room Method for Sound Testing of Fans
AMCA 500	1991 Louvers, Dampers and Shutters

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI IP-20	1988 Drives Using Classical V-Belts and Sheaves Cross Sections, A, B, C, and D

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	1989 (Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 525	1991 (Rev. B) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 527/A 527M	1990 Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock-Forming Quality
ASTM B 117	1990 Salt Spray (Fog) Testing
ASTM C 582	1987 Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion Resistant Equipment
ASTM D 1330	1985 (R 1990) Rubber-Sheet Gaskets
ASTM D 1654	1992 Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 4167	1991 Fiber-Reinforced Plastic Fans and Blowers

AMERICAN WELDING SOCIETY, INC. (AWS)

ANSI/AWS Z49.1	1988 Safety in Welding and Cutting

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	1988 (Rev. 1-2) Industrial Control and Systems
NEMA ICS 2	1988 Industrial Control Devices, Controllers and Assemblies
NEMA ICS 6	1988 (Rev. 1) Enclosures for Industrial Control and Systems
NEMA MG 1	1987 (Rev. 1-2) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code
NFPA 91	1992 Exhaust System for Air Conveying of Materials

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA APIDC	1975 Accepted Industry Practice for Industrial Duct Construction
SMACNA HVACADLTM	1985 HVAC Air Duct Leakage Test Manual
SMACNA RIDCS	1980 Rectangular Industrial Duct Construction Standards
SMACNA RIDCSTD	1977 Round Industrial Duct Construction Standards

UNDERWRITERS LABORATORIES INC. (UL)

UL 181	1990 (R 1990) Factory-Made Air Ducts and Air Connectors
UL 214	1976 (Bul. 1992) Flame-Propagation of Fabrics and Films

1.2 GENERAL REQUIREMENTS

1.2.1 SMACNA Duct Construction Manuals

The recommendations in the Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) duct construction manuals shall be considered mandatory requirements. Substitute the word "shall" for "should" in these manuals.

1.2.2 Related Requirements

Conform to Section \=15011=\, "Mechanical General Requirements" as well as additional requirements specified herein.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.3.1 SD-02, Manufacturer's Catalog Data

a. Fans

b. Dampers

c. Flexible connectors

d. Gaskets

e. Protective coating materials

f. Sealants

g. Access ports

h. Damper regulators

i. Supports and hangers

j. Vibration isolators

k. Steel ducts

l. Fiberglass ductwork

1.3.1.1 Fan Data

For fans include fan curves or rating tables and derating factors. Provide certified performance curves showing total pressure, HP, and mechanical efficiency versus flow rate of the operating density and fan speed. All areas of unstable operation shall be indicated. For fans equipped with adjustable capacity controls such as variable inlet or vaneaxial fans with adjustable blade settings, minimum and maximum performance shall be indicated along with performance for fire intermediate settings.

1.3.2 SD-04, Drawings

a. Industrial ventilation and exhaust systems

1.3.2.1 Industrial Ventilation and Exhaust Systems

Submit drawings including fan installation drawings; duct systems, supports and anchor location and load imposed.

1.3.3 SD-08, Statements

a. Welding procedures

b. Welding test agenda

c. Welding test procedures

d. Welders' identification

e. Work plan

f. Fiberglass fan servicer experience information

1.3.3.1 Welders' Identification

Submit a listing of the names and identification symbols to be used to identify the work performed by the welder or welding operator who after completing a welded joint shall identify it as his work by applying his assigned symbol for a permanent record.

1.3.3.2 Work Plan

Submit a detailed agenda of the proposed work to the NTR prior to starting any work.

1.3.3.3 Fiberglass Fan Servicer Experience Information

Submit text.

1.3.4 SD-10, Test Reports

a. Fan tests, including sound power level tests

1.3.5 SD-12, Field Test Reports

a. Ventilation and exhaust system start-up tests

b. Sound level tests

1.3.5.1 Start-Up Tests

Submit start-up tests reports in accordance with the paragraph entitled "Testing, Adjusting and Balancing." Submit final test report for the systems tested, describing all test apparatus, instrumentation calculations, factors, flow coefficients, sound levels, and equipment data based on ACGIH 2080 recommended forms or reasonable facsimiles thereof to suit project conditions. Adjustment and setting data shall be included

in test report. Submit sound level test reports for high noise level equipment.

1.3.6 SD-18, Records

a. Posted operating instructions

Submit text of posted operating instructions for ventilation and exhaust systems.

1.3.7 SD-19, Operation and Maintenance Manuals

a. Fans, Data Package 2

b. Industrial ventilation and exhaust systems, Data Package 2

Submit operation and maintenance data in accordance with Section \=01730=\, "Operation and Maintenance Data."

1.4 QUALIFICATIONS

1.4.1 Qualified Personnel

Operations involving joining fiberglass ductwork by laminating shall be performed by personnel certified by the manufacturer as qualified for the work.

1.4.2 Qualification of Welders

Qualify each welder or welding operator by tests using equipment, welding procedures and a base metal and electrode or filler wire from the same compatible group number that will be encountered in the applicable welding test procedures. Welders or welding operators who make acceptable procedure qualification test welds will be considered performance qualified for the welding procedure used. Determine performance qualification in accordance with AWS D1.1. Notify the NTR 24 hours in advance as to the time and place of tests and wherever practical perform the tests at the work site.

1.5 POSTED OPERATING INSTRUCTIONS

Provide for ventilation and exhaust system. In addition, permanently mark, drill, and pin as an integral part of device, final adjustment and settings pursuant to testing, adjusting, and balancing.

1.6 SAFETY PRECAUTIONS

1.6.1 Guards and Screens

Provide metal personnel safety guards for normally accessible unducted fan inlets and discharges and moving power transmission components in accordance with OSHA 29 CFR 1910.219.

1.6.2 Welding

Conform to ANSI/AWS Z49.1 for safety in welding and cutting.

PART 2 PRODUCTS

2.1 FANS, GENERAL REQUIREMENTS FOR

2.1.1 General Performance, Component, and Other Requirements

Fans shall have certified performance ratings as evidenced by conformance to the requirements of AMCA 211, and shall be listed in AMCA 261, or shall be currently eligible for such listing. Fans shall generally be in accordance with AMCA 99 unless superseded by other requirements stated elsewhere herein. Determine performance data for fans in accordance with ANSI/AMCA 210. Select fans to minimize the exposure of personnel working in or occupying the immediate installation area. The total sound power level of the fan tests shall not exceed 90 dBA when tested per AMCA 300 and rated per AMCA 301, or it shall be provided with an appropriate attenuation device or devices. Scheduled fan performance is the performance required under specified or indicated installation conditions with specified or indicated accessories. The net installed air performance of the fan, with accessories/appurtenances in place, shall be sufficient to meet the scheduled performance within the limits of the fan rating certification tolerance. Affix the manufacturer's product identification nameplate to each unit. Apply additional requirements for specific service or generic type or class of fan. If nonuniform air flow conditions are likely to be encountered, contact the fan manufacturer to ensure that the fan is rated for the additional fan inlet and outlet effect. Install fans to minimize fan system effect in accordance with ANSI/AMCA 201. Fans shall be listed in the Directory of Products licensed to use AMCA seal.

2.1.2 Bearings and Lubrication

Precision anti-friction or sleeve type with provisions for self-alignment and for radial and thrust loads imposed by the service. Provide water-cooled bearings where required for the service or recommended by the manufacturer.

2.1.2.1 Anti-friction Bearings

Constructed of steel alloys with a certified L-10 minimum rated life of 80,000 hours under load conditions imposed by the service. Rated and selected in accordance with AFBMA 9 and AFBMA 11. Provide with dust-tight seals suitable for environment and lubricant pressures encountered; cast ferrous metal housing, bolted-split pillow block type where located within fan casings; grease lubricated with provisions to prevent overheating due to excess lubricant; surface ball check type grease supply fittings. Provide manual or automatic grease pressure relief fittings visible from normal maintenance locations. Include lubrication extension tubes where necessary to facilitate safe maintenance during operation and fill tubes with lubricant prior to equipment operation. Prelubricated, sealed, anti-friction bearings, which conform to above specified materials and L-10 life requirements, may be provided for fans requiring less than 1/2 horsepower.

2.1.2.2 Sleeve Bearings

Premounted, self-aligning, continuous oil supply, single or double ring lubricated, insert type, with suitable provisions for shaft expansion and such thrust as may be imposed by service loads. Provide water cooling for shaft surface speed exceeding 1200 feet per minute. Provide each sleeve bearing with approximately 16-ounce capacity constant level oiler and oil level gage. Include on sleeve bearing submittal data: Bearing manufacturing source, type, lubricant, clearances, "L/D" ratio, antifriction metal, belt angle, shaft speed, shaft critical speed, Brinell hardness at journal, and shaft surface finish at journal in micro-inches.

2.1.3 Motors and Motor Starters

Conform to NEMA MG 1 and NEMA ICS 1 and NEMA ICS 2. Motors shall not exceed 1800 rpm, unless otherwise indicated, and shall be totally enclosed fan cooled type. Provide magnetic-across-the-line type motor starters with general-purpose NEMA 1 enclosure in accordance with NEMA ICS 6. Provide single-phase motors with inherent thermal overload protection with manual reset. Provide three-phase motors with thermal overload protection in the control panel. Provide permanently lubricated or grease-lubricated ball or roller bearings; auxiliary lubrication and relief fittings on outside of fan casing; arrange grease lines to minimize pressure on bearing seals. Motor horsepower shall not be less than brake horsepower required with blades set at maximum pitch angle at any air delivery from the indicated amount down to 50 percent thereof.

2.1.4 Guards and Screens

Construct guards and screens to provide, as applicable: required strength and clearance with minimal reduction in free area at fan inlets and

discharges; cooling; access panels for tachometer readings; ease of sectional disassembly for maintenance and inspection functions where guard total weight exceeds 50 pounds; weather protection where components are weather exposed. Installed guards and screens shall not negate noise control and vibration isolation provisions.

2.1.5 Power Transmission Components

2.1.5.1 Fan Drives

Direct or V-belt type as indicated. Drives shall be applied in accordance with the manufacturer's published recommendations, unless specified otherwise. Base horsepower rating of a V-belt drive on maximum pitch diameter of sheaves. Provide classical belt section adjustable sheave type, with a minimum service factor of 1.5 for drives with motors rated up to and including 30 hp. Provide at least two belts for drives with motors rated one hp and above.

2.1.5.2 Sheaves

Statically and dynamically balanced, machined cast ferrous metal or machined carbon steel, bushing type, secured by key and keyway. Pitch diameter or fixed sheaves and adjustable sheaves, when adjusted to specified limits, shall not be less than that recommended by NEMA MG 1. Select adjustable sheaves that provide the required operating speed with the sheave set at midpoint of its adjustment range. The adjustment range for various size and type belts shall be: 16 percent, minimum for Classical section belts; 12 percent, minimum for Narrow section belts. Belt deflection in adjustable sheave drives shall not exceed 1 1/2-degrees. Provide companion sheaves for adjustable sheave drives with wide groove spacing to match driving sheaves, except that standard fixed pitch spacing may be used for all two-through-four groove drives whose center-to-center dimensions exceed the following: "A" and "B" Section 16 inches; "C" Section 25 inches; "D" Section 36 inches. Furnish endless, static dissipating, oil-resistant, synthetic cloth or filament reinforced elastomer construction belts.

2.2 CENTRIFUGAL FANS

2.2.1 General Requirements for Centrifugal Fans

Provide fan of backward inclined blades. Arrange fans for indicated service, and construct for the applicable AMCA 99 Class pressure ratings as indicated for system design pressure and temperature. Fan shaft shall be solid steel, ground and finished as required for the service, with first critical speed a minimum 25 percent higher than cataloged fan speed. Select fan for maximum efficiency, minimum noise, and stability during all modes of system operation. Vibration isolation mountings shall be spring

type and limit vibration transmissibility to a maximum 5 percent of the unbalanced force at lowest equipment speed, unless otherwise specified or indicated. Arrangement and drives shall be as indicated.

2.2.2 Fiberglass Centrifugal Fans

ASTM D 4167. Construct of fire retardant fiberglass with a flame spread rating at least equal to or less than that of the duct system. Housing and fan impeller shall be fiberglass. Shaft and fan support stand shall be steel with protective coating. Provide exterior gel coat, coating, or paint with ultraviolet light inhibiting properties for fans exposed to sunlight. Fiberglass fans shall be suitable for the intended service. Provide with flanged outlet and inlet connections, threaded and plugged scroll drain, bolted access and inspection doors, and epoxy coated steel fan base and motor mount.

2.3 BASIC MATERIALS

2.3.1 Coated and Uncoated Carbon Steel Sheets, Plates, and Shapes

2.3.1.1 Mill Galvanized Steel Sheet

ASTM A 527/A 527M, lock forming quality, Coating G-90

2.3.1.2 Mill Galvanized Steel Shapes

ASTM A 36/A 36M galvanized in accordance with ASTM A 123.

2.3.3 Corrosion Protection

Treat equipment fabricated from ferrous metals that do not have a zinc coating conforming to ASTM A 123 for prevention of corrosion with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test except that equipment located outdoors shall withstand 500 hours. Perform salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, evaluate and rate the coating or paint system in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8 inch). The rating of the unscribed area shall be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Filler Metal, Welding

AWS filler metal specification and grade compatible with base materials to develop full joint strength.

2.4.2 Flashing Materials

Mill galvanized, phosphatized, steel sheet with minimum spangle, conforming to ASTM A 525, Coating G90, 24-gage minimum thickness. Mill No. 1 or 2D finished, stainless steel, fully annealed, soft temper, conforming to ASTM A 167, Type 304, 0.015-inch minimum thickness. Mill finished copper, conforming to ASTM B 152, minimum 16 ounces per square foot.

2.4.3 Flexible Connectors

2.4.3.1 General Service

Airtight, fire-retardant, fume and vapor resistant, chloroprene or chlorosulfonated polyethylene impregnated, woven fibrous glass fabric, rated for continuous service at 250 degrees F, conforming to UL 214, with 20-ounce per square yard weight for service at 2 inches water gage and under and 30-ounce per square yard weight for service over 2 inches water gage. Provide with or without integral 24-gage mill galvanized sheet metal connectors.

2.4.3.2 Fume Service

1/8 thick, single-ply, synthetic fabric reinforced chloroprene suitable for 225 degrees F.

2.4.4 Gaskets

2.4.4.1 Elastomer Buna N

Sheet, 1/8-inch thick, conforming to ASTM D 2000, Type 2BG410B14.

2.4.4.2 Elastomer Chloroprene

Sheet, 1/8-inch thick, conforming to ASTM D 2000, Type 2BE410B14.

2.4.4.3 Rubber

Sheet, 1/8-inch thick red or black, natural, reclaimed, synthetic rubber or mixture thereof, conforming to ASTM D 1330.

2.4.5 Protective Coating Materials

2.4.5.1 Baked Unmodified Phenolic

MIL-V-12276, Type II.

2.4.5.2 Inorganic Zinc Coating

SSPC Paint 20, Type I-C (Self-cure type).

2.4.5.3 Galvanizing Repair Paint

Conform to MIL-P-21035.

2.4.6 Sealants

2.4.6.1 Elastomeric

Sealant specified in these specifications or referenced standards as elastomeric or without further qualification, shall be silicone, polyurethane, polysulfide, polyisobutylene, or acrylic terpolymer suitable for the service. For sealing of nongasketed duct joints during fabrication or assembly, sealant shall be polyurethane, acrylic terpolymer or polysulfide. Sealants shall conform to the following:

a. Silicone: Conforming to FS TT-S-001543, single component type, not requiring primed substrate, with manufacturer published estimated life of 30 years and a maximum 5 percent shrinkage when cured.

b. Polyurethane: Conforming to FS TT-S-00230, Type 2, Class A, single component type, not requiring primed substrate, with manufacturer published estimated life of 20 years and a maximum 10 percent shrinkage when cured.

c. Polysulfide: Conforming to FS TT-S-00230, Type 2, Class A, single component type, not requiring primed substrate, with manufacturer published estimated life of 20 years and a maximum 10 percent shrinkage when cured.

d. Polyisobutylene/Butyl: Conforming to FS TT-S-001657, Type 1, single component type, not requiring primed substrate, with manufacturer published estimated life of 10 years and a maximum 15 percent shrinkage when cured.

e. Acrylic Terpolymer: Conforming to FS TT-S-00230, single component type, not requiring primed substrate, with manufacturer's

published estimated life of 20 years and a maximum 10 percent shrinkage when cured.

2.4.6.2 Hard Cast Caulking for Exterior Ducts

Mineral and adhesive impregnated woven fiber tape with adhesive activator for exterior round or rectangular duct joints.

2.4.6.3 Caulking of Building Surface Penetration

Foamed silicones, two-component, fire-resistant, low-exotherm, room temperature vulcanizing silicone.

2.5 SPECIALTIES

Steel, nonferrous metal, or plastic to match duct construction, or as indicated.

2.5.1 Access Ports, Test

With gasketed screw cap and flange, to suit exhaust service.

2.5.2 Damper Regulators

Incremental position indicating and locking type, with satin finish chrome plated, flush surface mounting cover and regulator box where concealment is required in finished spaces. For splitter dampers, provide splitter tip mounted trunion brackets with self-locking screw regulator or rods with external swivel joint brackets.

2.6 SUPPORTS AND HANGERS

2.6.1 General Requirements for Supporting Elements

Provide ducting systems and equipment supporting elements including but not limited to building structure attachments; supplementary steel; hanger rods, stanchions and fixtures; vertical duct attachments; horizontal duct attachments; anchors; supports. Design supporting elements for stresses imposed by systems, with a minimum safety factor of 4.0 based on duct being 50 percent full of particulate conveyed. Supporting elements shall conform to SMACNA APIDC, SMACNA RIDCSTD, SMACNA RIDCS, and NFPA 91, as applicable, and modified and supplementary requirements specified herein. Do not use weld studs and powder actuated anchoring devices to support mechanical systems components without prior approval.

2.6.2 Vertical Attachments

Provide in accordance with SMACNA Standards, except mill galvanized iron straps shall be a minimum of one-inch wide, 16-gage thick.

2.6.3 Horizontal Attachments

Provide as indicated in accordance with SMACNA Standards.

2.6.4 Supplementary Steel

Provide where required to frame structural members between existing members or where structural members are used in lieu of commercially rated supports. Such supplementary steel shall be fabricated in accordance with the AISC S335.

2.6.5 Vibration Isolators

Provide vibration isolators with in-series, contained, steel springs, chloroprene elastomer elements, and fasteners for connecting to building structure attachments. Devices shall be loaded by support system in operating condition to produce required static spring deflection without exceeding 75 percent of device maximum load rating.

2.7 FIBERGLASS DUCTWORK

Ductwork, Fiberglass for Nonflammable Fume Exhaust:

2.7.1 Fiberglass Ductwork

Construct ductwork, fittings, accessories, and material of construction in accordance with NFPA 91, and ASTM C 582. Fabricate supplementary steel in accordance with the AISC S335.

2.7.2 Basic Ductwork Materials

Fabricate ducts, accessories and components in sheet form from materials conforming to ASTM C 582. Provide exterior gel coat, coating or paint with ultraviolet light inhibiting properties for ducts exposed to sunlight. Construct metal components, when permitted to be located interior to the duct, of Type 316 corrosion resistant steel.

2.7.3 Fasteners

Where penetration of duct surfaces is approved or specified, provide Type 316 corrosion resistant steel fastener assemblies encapsulated with polyester on duct interior, unless total disassembly is intended. Provide flange fastener bolts and nuts of hex type only, cadmium plated, unless

exposed to corrosive fumes; in which case provide Type 316 stainless steel. Equip bolted assemblies with two oversized washers, except where assembled with metallic reinforcement contact. Plastic bolting is prohibited.

2.7.4 Joint Gaskets

Provide 1/8-inch thick acid resistant chloroprene.

2.7.5 Fabrication

Construct water washable, watertight, self-draining, and airtight ductwork as specified or indicated. Provide required reinforcements, bracing, supports, framing, gasketing, sealing, resilient mounting, drainage provisions, and fastening to guarantee rigid construction and freedom from vibration, airflow induced motion and noise, and excessive deflection at specified maximum system pressure and velocity.

2.7.5.1 Flanges

Provide flanges at all branches on maximum 20-foot centers in ducting sized 16 inches and under, on maximum 8-foot centers in duct sized over 16 inches, where required for ease of access to equipment, at hoods, enclosure connections and where indicated. Furnish one piece, heat, adhesive, or solvent vulcanized or bonded full face gaskets at flange joints. Provide flanges at dissimilar material joints, such as between fiberglass reinforced plastic (FRP) and PVC.

2.7.5.2 Access Plates

Provide access plates upstream and downstream of equipment in ducts at locations to facilitate duct cleaning, and where indicated. Locate access openings at least 2 inches above bottom of duct and externally frame with welded and ground miter joint steel which is isolated from duct interior. Construct access plate with fiberglass on interior side, backed with steel on exterior side. Provide Type 316 stainless steel access plate fasteners. For ductwork cleaning access, provide 8-inch diameter gasketed access plates on not more than 10-foot centers, except where access is available through an air terminal device or other required access provision.

2.8 STACKHEADS

Provide SMACNA APIDC no loss type stackheads for vertical discharge to the atmosphere unless indicated otherwise. Weather caps are prohibited. Provide bracing or guy wires for wind loads on stacks as indicated. Discharge stacks should be vertical and terminate at a point where height or velocity prevents reentry of exhaust air.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Installation Requirements

Install in accordance to NFPA 91, and SMACNA RIDCSTD, and SMACNA RIDCS. Provide mounting and supports for equipment, ductwork, and accessories, including structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors, and dampers. Install accessories in accordance with the manufacturer's instructions. Construct positive pressure duct inside buildings airtight.

3.1.2 Electrical Ground Continuity

Where electrical ground continuity is required, provide brazed connection insulated, multi-strand, copper wire jumpers across points of discontinuity. Provide connection to ground and continuity testing as part of the work of Division 16.

3.1.3 Special Requirements for Installation of Fiberglass Ductwork

Requirements for Installation of Fiberglass Ductwork for Nonflammable Corrosive Fume and Vapor Exhaust:

3.1.3.1 Slope

Slope horizontal ducts one inch in 40 feet in the direction of airflow or one inch in 10 to the direction of airflow. Where necessary, slope duct to common drainage point.

3.1.3.2 Drains

Provide drains at all low points, at internal drainage restrictions, at base of risers, and where indicated. Provide drain connections of one-inch IPS couplings with polytetrafluoroethylene paste lubricated plug where drainage piping is not indicated, and where piping is indicated, provide PVC Type DWV piping conforming to ASTM D 2665 to points indicated. Provide a trap of one inch greater depth than the positive or negative pressure in the duct but not less than 2 inches.

3.1.3.3 Duct Supports

Isolate duct support contact surfaces from supporting steel by 1/4-inch thick closed-cell foamed cellular elastomer insulation material of a width greater than support. Design duct supporting system to include additional weight due to collection of condensate and washing water in nondrainable, deflected surface and other areas.

3.1.4 Miscellaneous Sheet Metal Work

Provide and fabricate from mill galvanized steel as indicated. Sheet metal thickness, reinforcement and fabrication, where not indicated, shall conform to SMACNA APIDC.

3.1.5 Building Penetrations

3.1.5.1 General Penetration Requirements

Provide properly sized, fabricated, located, and trade coordinated sleeves and prepared openings, for duct mains, branches, and other item penetrations, during the construction of the surface to be penetrated. Provide sleeves for round duct 15 inches and smaller and prepared openings for round duct larger than 15 inches and square or rectangular duct. Fabricate sleeves, except as otherwise specified or indicated, from 20-gage, 0.0396-inch thick mill galvanized sheet metal. Sleeves penetrating load bearing surfaces shall be standard weight galvanized steel pipe. Provide roof penetrations as shown in SMACNA APIDC.

3.1.5.2 Framed Opening

Provide framed openings in accordance with approved shop drawings.

3.1.5.3 Clearances

Provide a minimum one inch clearance between penetrating and penetrated surfaces. Fill clearance space with bulk fibrous glass or mineral wood or foamed silicone and seal and close.

3.1.5.4 Tightness

Penetration shall be weathertight.

3.1.5.5 Sealants

Provide sealant of elastomeric type or foamed silicone type, as specified under paragraph entitled "Sealants," in this section. Apply to oil free surfaces to a minimum 3/8-inch depth.

3.1.5.6 Closure Collars

Provide a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around penetrating item without contact. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts

15 inches in diameter or less from 20-gage, 0.0396-inch nominal thickness, mill galvanized steel. Attach collars a minimum of 4 fasteners to where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20-gage, 0.0396 inch nominal thickness, mill galvanized steel. Fabricate collars for round, square, and rectangular ducts with minimum dimension over 15 inches from 18-gage, 0.0516 inch in nominal thickness, mill galvanized steel. Install collars with fasteners a maximum of 6-inches on center.

3.1.6 Installation of Flexible Connectors

Flexibly connect duct connected and vibration isolated fans and specified or indicated components. When fans are started, stopped, or operating, flexible connector surfaces shall be curvilinear, free of stress induced by misalignment or fan reaction forces, and shall not transmit vibration. Leakage shall not be perceptible to the hand when placed within 6 inches of the flexible connector surface or joint. Provide a minimum of 6 inches and a maximum of 2 feet active length with a minimum of one inch of slack, secured at each end by folding in to 24-gage sheet metal or by metal collar frames.

3.1.7 Installation of Supports

3.1.7.1 Selection

Select duct and equipment support system taking into account the best practice recommendations and requirements of SMACNA RIDCSTD, SMACNA RIDCS, and NFPA 91; location and precedence of work under other sections; interferences of various piping and electrical work; facility equipment; building configuration; structural and safety factor requirements; vibration and imposed loads under normal and abnormal service conditions. Indicated support sizes, configurations, and spacings are the minimal type of supporting component required for normal loads. Where installed loads are excessive for the normal support spacings, provide heavier duty components or reduce the element spacing. After system start-up, replace or correct support elements which vibrate and cause noise or possible fatigue failure. Exercise special care to prevent cascading failure.

3.1.7.2 General Requirement for Supports

Securely attach supporting elements to building structural steel or structural slabs. Where supports are required between building structural members provide supplementary structural steel as specified for work under this section. On submittals show location of supports and anchors and loads imposed on each point of support or anchor. Do not hang ductwork or

equipment from piping, or other ducts or equipment. Attach supports to structural framing member and concrete slab. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required, between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips. A maximum span of 10 feet shall exist between any two points, with lesser spans as specified or as required by duct assemblies, interferences, and loads imposed or permitted. Provide a minimum one set of two vertical support elements for each point of support and each length of duct, except as otherwise specified. Install supports on both sides of all duct turns, branch fittings, and transitions. Cross-brace hangers sufficiently to eliminate sway. Perforated strap hangers are prohibited. Where ductwork system contains heavy equipment, hang such equipment independently of the ductwork. Duct supports shall be vibration isolated from structure at points indicated. The location of supporting elements shall be limited by the allowable load on the purlin which shall be limited to that no greater than the moment produced by one Kip load at mid-span of purlin. When the hanger load exceeds these limits, provide reinforcing of purlins or additional support beams. When an additional beam is used, the beam shall bear on the top chord of the roof trusses and bearing shall be over gusset plates of top chord. Stabilize beam by connection to roof purlin along bottom flange.

3.1.7.3 Methods of Attachment

Clamp, or weld when approved, attachment to building structural steel in accordance with AWS D1.1. Construct masonry anchors selected for overhead applications of ferrous materials only. Install masonry anchors in rotary, non-percussion, electric drilled holes. Self-drilling anchors may be used provided masonry drilling is performed with electric hammers selected and applied in such a manner as to prevent concrete spalling or cracking. Pneumatic tools are prohibited.

3.1.8 Welding

Welding test agenda shall be done in accordance with the applicable provisions of AWS D1.1 and AWS D1.3.

3.1.9 Test Ports

Provide test access ports at points required for work under paragraph entitled "Testing, Adjusting, and Balancing," in this section. Locate test ports in straight duct as far as practical downstream of fans, change of direction fittings, takeoffs, interior to duct accessories, and like turbulent flow areas.

3.1.10 Ductwork Cleaning

Protect duct openings from construction debris using temporary caps, flanges, or other approved means. Clean dirty duct interior with high velocity water and oil-free air streams or by vacuum cleaning as required by project conditions. Test watertight duct work for proper support, leakage, and unacceptable drainage provisions by intermittently spraying interior with garden hose nozzle, at a rate of 3 gallons per minute, exercising care to prevent excessive water accumulation. After construction is complete but accessible and prior to acceptance, remove all construction debris from exterior surfaces. Do not close duct inspection ports until inspected by the NTR.

3.1.11 Protective Coating Work

3.1.11.1 General Requirements for Protective Coating Work

Provide protective coating on interior surfaces of system as specified hereafter. Prime coat exterior surfaces of inorganic zinc coating as part of work under this section. Brush primer, or protective coating where no primer is specified, onto corners and into crevices and welds, working the material into irregular surfaces for a holiday free finish.

3.1.11.2 Baked, Unmodified Phenolic System

a. General: The following shall govern for a protective coating system based on unmodified phenol-formaldehyde resin intended for shop application to surfaces in fume exhaust service with possibility of materials concentration by condensation and subsequent evaporation. Shop apply coating by an applicator approved or licensed by the coating manufacturer.

b. Surface Preparation: Clean and blast surfaces with dry abrasive to "White Metal" and critical profile and anchor pattern in accordance with SSPC SP 5, and requirements and recommendations of the coating manufacturer.

c. Application: The complete system shall include the application of two coats of red pigmented base followed by not less than one coat of the clear finish, to provide a total minimum dry film thickness of 6 mils. Apply coating materials by conventional industrial pressure spray equipment. Use only those thinners and cleaners in amounts recommended by the manufacturer. Heat-cure each coat between coats and bake surfaces after the last coat in accordance with manufacturer's applicable published instructions and specific instructions for the specified application. Baking time between coats shall be a minimum 1 1/2 to 2 hours at 200 to 250 degrees F. Baking after top coat shall be one hour at 200 to 350 degrees F,

plus 2 hours final bake at a temperature of 350 degrees F. Other baking schedules to achieve required quality coating may be proposed.

d. Repair: Return damaged surfaces to the applicator's shop for repair, unless otherwise approved by the NTR.

3.1.11.3 Inorganic Zinc Coating System

a. General Requirements, Inorganic Zinc Coating System: The following shall govern for a protective coating system primer based on inorganic zinc coating intended for shop application to black carbon steel surfaces with subsequent field finishing with compatible tie coat and epoxy top coat.

b. Surface Preparation: SSPC SP 5.

c. Application: Apply one coat at 2 to 3 mils dry film thickness by airless or conventional spray equipment. Use only those thinners and cleaners in amounts recommended by the manufacturer.

d. Repair: Field repair damaged surfaces in accordance with manufacturer's instructions.

3.1.11.4 Field Inspection of Protective Coating Work

Visually inspect coated surfaces from a maximum distance of 5 feet with special attention given to corners and crevices. Check coating thickness in accordance with SSPC Paint 2. Perform inspection immediately prior to erection of ductwork and equipment and in the presence of the NTR. Repair coating as required. Apply additional coating if thickness is not sufficient.

3.1.12 Factory and Field Painting and Finishing

3.1.12.1 Factory Work

Factory finish interior ferrous metal and other specified metallic equipment and component surfaces with manufacturer's standard surface preparation, primer, and finish coating. Factory finish exterior to building space ferrous metal surfaces and other exterior to building and interior to building metallic or nonmetallic surfaces with specified protective coating system in accordance with the paragraph entitled "Protective Coating Material," in this section and otherwise with manufacturer's standard surface preparation, primer and finish which meet the requirements of paragraph entitled "Corrosion Prevention."

3.1.12.2 Field Work

Touch-up or if necessary, repaint factory applied finishes which are marred, damaged, or degraded during shipping, storage, handling, or installation to match the original finish. Clean and prime field or shop fabricated ferrous metals required for the installation specified under this section.

3.2 TESTING, ADJUSTING, AND BALANCING

3.2.1 Ductwork Structural Integrity and Leakage Testing

Inspect and test systems pressure rated higher than 2 inches (51 mm) water gage for structural integrity and leakage as systems or sections during construction but after erection, as work progresses, in system or section lengths not exceeding 100 feet. Test for structural integrity at 50 percent in excess of system fan positive or negative total pressure. Test for leakage at 50 percent in excess of system fan positive or negative total pressure. Leakage test procedure and apparatus shall be in accordance with SMACNA HVACADLTM. Total leakage, prorated to length of duct under test, shall not exceed one percent of system capacity. Do not permit leakage in positive pressure ducts in buildings carrying flammable or toxic materials.

3.2.2 Power Transmission Components Adjustment

Test and adjust V-belts and sheaves for proper alignment and tension preliminary to operation and after 72 hours of operation at final speed, in the presence of the NTR. Belts on drive side shall be uniformly loaded, not bouncing.

3.2.3 Preliminary Tests

Conduct an operational test on the entire exhaust duct systems, components, and equipment for a period of not less than 6 hours after power transmission components are adjusted. Replace filters, if any, after preliminary tests and prior to conducting final acceptance tests.

3.2.4 Testing, Adjusting, and Balancing Work

Perform work in accordance with the applicable and recommended procedures of: ACGIH 2080. Provide apparatus, certified, calibrated, instrumentation including that to measure sound levels, motor current, and power factor. Unless approved otherwise, instruments shall be limited to manometers and approved aneroid type gages (such as a Magnehelic). Velometers may be used for low velocity measurements if approved by the NTR.

3.2.5 Systems Volume Acceptance Criteria

Systems final volume shall be within the following limits:

Fan	Plus 10 percent, minus zero percent of design volume at design temperature
Hood or Equipment	Plus or minus 5 percent of design volume at design temperature

Note: Tolerances shall be taken on clean or dirty conditions as indicated on the drawings.

3.2.6 Sound Level Tests

Report to the NTR in writing, sound levels higher than 84 dBA at hoods or at workers' normal operating positions at equipment in addition to being included in the required test reports.

3.3 SYSTEM OPERATION DEMONSTRATION

After systems and equipment testing, adjusting, and balancing has been completed and accepted, demonstrate the complete and correct functioning of systems equipment and controls by operation through normal ranges and sequences, and by simulation of abnormal conditions. Manually and automatically cause every device to function as intended. Readjust, as necessary, any settings and after sufficient operating time, but not less than 6 hours, verify ability of equipment and controls to establish and maintain stable and accurate operation and required system performance. Note any abnormal deviations, such as excessive vibration, noise, and heat, binding damper mechanisms, and incorrect fan rotation. Make any necessary repairs, replacements or adjustments.

-- End of Section --

SECTION 15997

TESTING INDUSTRIAL VENTILATION SYSTEM

PART 1 GENERAL

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.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	1989 National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning System

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 2080	1992 Industrial Ventilation

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 201	1990 Fan Application Manual - Fans and Systems

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB PSTABES	1983 Testing, Adjusting, Balancing of Environmental Systems

1.3 DEFINITIONS

a. Capture velocity: Air velocity at a point in front of the hood or at the hood opening necessary to overcome opposing air currents and to capture contaminated air at that point to cause it to flow into the hood.

b. Capture zone: Controlled space around an industrial process that ensures a safe and healthy workspace for the worker.

c. Equilibrium performance point: The condition where an air pollution control device operates for sufficient start-up time and reaches optimum efficiency. The manufacturer recommends the minimum start-up time for each device.

d. Facility: A building or portion of a building in which

contaminated air is controlled by the industrial ventilation system. This includes the shop space, equipment room, offices, restrooms and locker rooms which are affected by the industrial process being controlled.

e. Full load condition: Condition in the shop or facility where exhaust and replacement air systems operate simultaneously, as installed by the Contractor in accordance with the design plans and specifications.

f. Heating equipment: Equipment used to condition air in the facility. Equipment includes but is not limited to: heat exchangers and heating and cooling coils.

g. Hood static pressure: Static pressure, in inches of water (gauge), taken at 3 duct diameters from the hood for flanged or plain hoods and 1 duct diameter from a tapered hood.

h. Manometer: An instrument for measuring pressure. Electronic or U-tube manometers with water or light oil are acceptable. Mercury manometers are acceptable for measuring vacuum or low volume, high velocity ventilation systems.

i. Replacement air system: The mechanical system supplying air to a building to replace air being exhausted.

j. Test agency: Subcontractor who is independent from the Contractor and the mechanical subcontractor except by the affiliation established by this contract.

k. Transport velocity: Minimum air velocity, in feet per minute, necessary, to prevent the contaminant from settling or condensing in the ductwork.

l. Velocity pressure: The kinetic pressure in the direction of flow necessary to cause a fluid at rest to flow at a given velocity. It is usually expressed in inches of water, gauge.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7.0, of the Basic Contract.

1.3.1 SD-08, Statements

a. Work plan

b. Qualifications of installer

c. List of test instruments

1.3.1.1 Work Plan

Submit 60 calendar days prior to beginning the test, steps to be taken by the lead engineer to accomplish the required testing. Submit the following:

a. Prerequisite work checklist.

b. Memorandum of test procedure.

(1) Proposed dates for the preliminary review, proposed test dates.

(2) Plan view showing proposed test locations.

(3) Pitot traverse reading locations.

c. Test equipment to be used.

d. Other equipment required, such as, scaffolding.

e. Personnel support, such as, factory representatives.

1.3.1.2 Qualifications of Installer

Use the sample form, "Test Agency Qualifications Sheet," to submit the following information:

a. Verification of 5 years of experience as an agency in testing industrial ventilation systems.

b. References from five facility managers of facilities with industrial ventilation systems that the agency has tested. A minimum of three facilities shall have processes and contaminants similar to those generated by the facility in this project.

c. Registration for Professional Engineer (PE) license or Certification for an Industrial Hygienist (CIH) for the lead test engineer. Submit PE license or CIH registration number, discipline, date of issue, and expiration date. Engineers shall include the state of issue.

d. Confirmation of 5 years of industrial ventilation test experience for the lead test engineer. References from five facility

managers for facilities where the lead engineer has supervised industrial ventilation systems tests in the last 5 years.

e. Verification of length of time lead engineer has been employed by a test and balance agency.

1.3.1.3 List of Test Instruments

Submit a signed and dated list of test instruments, their application, manufacturer, model, serial number, range of operation, accuracy and date of calibration.

1.3.2 SD-12, Field Test Reports

a. Preliminary review report

b. Smoke tests report

c. Fan operating points report

d. Static pressure report

e. Volume and velocity flow rates report

f. Pitot traverse report

Submit 6 copies of an organized report which is bound in a durable, water-resistant binder. Report shall contain a table of contents, an executive summary, an introduction, a results section and a discussion of the results. Document unmet design requirements which were identified during testing. Submit field data and report forms in appendices separated according to the fan system tested. Include the preliminary review report as an Appendix. Report daily temperature, humidity and barometric pressure readings. Note weather and barometric pressure changes during the day, for example, "clear in the morning and thunderstorm in the afternoon." Forms other than those listed may be used; however, information required by these forms shall be submitted. Include completed forms in the report appendix. Use the sample forms, "Replacement Air System Test Data" and "Exhaust Air System Test Data," to summarize the tests for the appropriate fan.

1.3.2.1 Preliminary Review Report

Submit a preliminary review report 15 calendar days prior to beginning the test.

1.3.2.2 Smoke Tests Report

Describe turbulent air flow and dead air spaces in the hood capture zone.

Describe smoke flowing from the capture zone. Report leaks in the ductwork, access door, and fan to duct connectors. Report smoke behavior as it exits from the exhaust stack and describe entrainment around the tested facility, nearby structures and geographical features.

1.3.2.3 Fan Operating Points Report

From test data and manufacturer's performance data for the duct system and fans, determine the difference between measured and design volume flow rate and fan static pressure at the point of operation. Show the design and measured operating point for each fan on the corresponding fan curve. Report fans that can not operate at speeds 25 percent greater than the measured speed while remaining within the boundaries of the fan curve and fan class.

1.3.2.4 Static Pressure Report

Report static pressures using tables to summarize test results by system, fan static pressure for replacement and exhaust air systems, and the static pressure, as compared to atmosphere, of each room in the facility. Note static pressures that are inconsistent and report the reason. Inconsistencies include:

a. Inconsistent static pressure drop or increase in one or a series of hoods on the same branch;

b. Different static pressures for similar systems in the facility;

c. Decreasing static pressures as the hoods get closer to the exhaust fan inlet; and

d. Increasing static pressures as the replacement air branches get closer to the fan outlet.

1.3.2.5 Volume and Velocity Flow Rates Report

Report volume flow rates and velocities in standard cubic feet per minute and feet per minute, respectively. Compare measured volume flow rate with design value for each hood, the total exhaust air system, each replacement air distribution point and the total replacement air system. Report the transport velocity for each branch and main duct in the exhaust air system. In tabular form, list the measured and design values and indicate if the test value is adequate or inadequate. Adequate hood volume flow rates and transport velocities are those with measured values within plus or minus 5 percent of design values. Adequate total system volume flow rates are those with measured values within plus 10 percent of the design values.

1.3.2.6 Pitot Traverse Report

Use the "Pitot Traverse Data" sample form to record pitot traverse readings. As a minimum the following data is required for each pitot traverse:

a. Velocity pressure readings and converted velocities;

b. Average velocity;

c. Duct area; and

d. Total measured volume flow rate.

1.3.2.7 Deadline

All work and the report shall be completed at least 60 calendar days before the contract completion date.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

a. Test agency experience data;

b. Test agency personnel experience data; and

c. Professional engineer license or industrial hygienist certification data.

1.4.2 Modification of References

Comply with the referenced standards of ACGIH, NEBB, AMCA, and AABC when testing the industrial ventilation system except as modified by this section. Advisory or recommended provisions shall be considered mandatory.

1.4.3 Test Requirements

The Contractor shall adjust and balance the industrial ventilation system in accordance with NEBB PSTABES or AABC MN-1.

1.4.4 Test Engineer

1.4.4.1 Field Work

The lead test engineer shall be present at the project site while testing is performed and shall be responsible for conducting, supervising, and managing of test work. Management includes health and safety of test

agency employees.

1.4.4.2 Reporting Work

The test agenda, equipment list and certified report shall be prepared, signed and dated by the lead test engineer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 TEST PROCEDURE

Test the industrial ventilation system and report results for the following rooms: Office and toilet room.

3.1.1 Preliminary Review

Conduct a preliminary review of the facility 45 calendar days prior to beginning the test. Perform the following tasks and report the results of each task in the preliminary review report.

a. Locate industrial ventilation system components including hoods, hood transitions, ductwork, branch to main duct entries, elbows, expansions and contractions, fans, exhaust stacks, weather protection, and distribution devices. Show each component on single line drawings which are segregated according to the fan servicing the component.

b. Review design drawings, specifications, and shop drawings to verify that testing can be performed on the system. Record locations of planned pitot traverses of mains and branches, and calculated velocities. Report potential test problems, such as inadequate space, to the NTR.

c. Use AMCA 201 to report systems effects that occur at the inlet and outlet of each replacement and exhaust air fan.

d. Verify that ductwork sizes, elbows and fittings, exhaust stacks and weather protection meet the design plans and specifications for both replacement and exhaust air systems.

e. Verify that fans are rotating in the proper direction.

f. Identify equipment such as fans, heating coils, and controls, that do not meet the design plans and specifications.

g. Obtain fan performance data from the manufacturer.

h. Verify that replacement air terminals including louvers, grills are installed in accordance with the design plans and specifications.

i. Obtain manufacturer's differential pressure data and maximum operating pressures for air filtration devices including dirty and clean replacement air filters.

j. Obtain the temperature and pressure control diagram.

k. Identify on each system single-line drawing the location of pressure differential sensors and static pressure sensors.

l. Record the nameplate data from each fan, motor, and other applicable components installed per this design.

m. Record motor starter sizes and thermal overload protection devices installed per this design.

n. Perform all calculations that can be performed prior to the start of actual field testing.

o. Verify the following requirements unless otherwise specified in the individual section:

(1) The fan bearings have a minimum rated life of 200,000 hours.

(2) Sound and vibration isolation equipment has been installed to prevent sound and vibration transmission to the ductwork and floor or fan mounting structure.

(3) Fan bases are level.

(4) Fan wheels are balanced and clear the housing.

(5) Fan shafts are of uniform diameter.

(6) Access to fan grease fittings and other routine maintenance equipment.

(7) Safety equipment, such as fan belt guards, are in place.

(8) Drive alignment and belt tension are correct for each fan.

3.2 FIELD TESTS

3.2.1 Preliminary Procedures

Provide instruments and consumable equipment required to test the industrial ventilation system. Test the facility under full load conditions. Close windows and doors in the facility. Ensure that exhaust and replacement air ductwork and air intake sources are free from debris and dirt. Conduct the testing with the replacement air prefilters loaded to the manufacturer's recommended maximum-load condition.

3.2.2 Test Method

Test in accordance with ACGIH 2080, Chapter 9 and this section. The test engineer is authorized to readjust and rebalance the system if minor adjustments will bring the system into compliance with the design. Minor adjustments include adjusting the fan sheave, correcting fan rotation and resetting dampers. Balance the system without blast gates. Record quantitative readings on sample forms, "Pitot Traverse Data," Rectangular or Round Duct," "Exhaust Air System Test Data," and "Replacement Air System Test Data."

3.2.2.1 Smoke Test

Prior to performing quantitative tests on the industrial ventilation system, test each hood with smoke generators or titanium tetrachloride to verify contaminant control in the capture zone. Smoke simulates the contaminant. Comply with restrictions on the use of incendiary devices. When large quantities of smoke are expected, inform the fire department or other responsible parties.

3.2.2.2 Air Quantity Readings

Using a pitot tube and manometer, test the exhaust and replacement air systems for velocity pressure. Use pitot traverse measurements. Determine the number of velocity pressure readings and access holes required at traverses for round and rectangular ducts in accordance with ACGIH 2080. Traverse access holes shall be drilled. Round ducts require two traverse access holes positioned 90 degrees apart. Rectangular ducts may require several traverse access holes. Make pitot traverses at a point which is at least 7.5 duct diameters of straight duct after the fan outlet, or 5 duct diameters of straight duct prior to the fan inlet, away from air disturbing devices including elbows, branch entries, duct expansions, and hood transitions. When these distances of straight duct are not available, use a schematic drawing to note the disturbance producing device, and distance between the pitot traverse and the device. Number of velocity pressure readings in a pitot traverse shall depend on the duct configuration and dimensions. After completing a traverse,

confirm one velocity pressure reading for each access hole. Accept traverse data when the difference between the original and confirmation measurement is less than 5 percent; otherwise repeat the traverse. Convert velocity pressure readings to velocity values before averaging the duct velocity. Plug holes with cap plugs immediately after each traverse. Velocity and volume flow rates calculated from velocity pressure readings are required at the following locations:

a. Replacement air fan outlet;

b. Replacement air duct branch;

c. Exhaust air duct branch, including hoods and submains;

d. Exhaust fan inlet or outlet;

e. Outside air ducts in recirculating replacement air system.

3.2.2.3 Velometer Readings

A flow hood may be used for measuring office and restroom replacement air quantities. Velometer readings shall not be substituted for manometer and pitot tube readings. Use velometers to estimate the following:

a. Velocity exiting from replacement air systems without ductwork;

b. Crossdrafts in a room;

c. Hood capture velocity; and

d. Duct velocities less than 600 feet per minute.

3.2.2.4 Static Pressure Readings

Take static pressure readings using a pitot tube and manometer. Take hood static pressure readings in the direction of the air flow away from the hoods. Take readings at a distance of one duct diameter from tapered hoods, and 3 diameters from plain or flanged hoods. Take other static pressure readings where velocity pressure readings are taken. The following readings are required:

a. Hood static pressure;

b. Replacement and exhaust fan inlet and outlet static pressure;

c. Room static pressure as compared to outdoors

d. Branch static pressure in the replacement and exhaust air system submain ductwork.

3.2.2.5 Control System Check-Out

Test warning system controls for the industrial ventilation system including above and below range alarms for room static pressure, fan motor operating lights, set screws tightened allowing dampers to be operated by the control motor.

3.2.2.6 Other Readings

Take the following readings on each day testing is performed:

a. Take the following temperature readings after the system has stabilized and has been running for at least 4 hours:

(1) Wet bulb and dry bulb temperature of ancillary rooms, workspaces, replacement air and outside air.

(2) Temperature for fan and motor bearings on ventilation equipment.

b. Record barometric pressure and altitude. Base weather station data is acceptable when the test engineer does not have barometric pressure test equipment.

3.2.3 System Markings

To re-evaluate the industrial ventilation system during follow-up tests, mark the settings and test ports. Before submitting the report, label test points. Use spray paint or another accepted practice to mark the airflow adjusting devices so they can be returned to their original position if an adjustment is changed.

3.2.4 Test Verification

In the presence of the NTR, the test engineer shall repeat at least 10 percent of the test for each replacement and exhaust air system to verify the results. As a minimum, re-test the following readings: total volume flow for each fan, inlet and outlet static pressure for each fan, and volume flow and hood static pressure for the hood with the longest duct run from the exhaust fan. Retest hood volume flow rates and total system volume flow rates which disagree with the design value.

3.2.4.1 Test Result Disagreements

The difference between test and verification readings for static and

velocity pressure shall be within plus or minus 5 percent. When the difference between test and verification readings are greater than these acceptable values, the test engineer shall:

a. Recalibrate test equipment

b. Retest the entire system

c. Reverify the results

3.2.5 Test Engineers Out-Brief

Verbally summarize for the NTR the condition of the industrial ventilation system. Report test data that does not meet the design criteria as defined in paragraph entitled "Field Test Reports."

-- End of Section --

TEST AGENCY QUALIFICATION SHEET

DATE _____
COMPLETED BY_____

A. Agency Qualifications

Agency Name _____
Address _____
Telephone Number _____
Years of experience testing industrial ventilation systems_____

Industrial facilities tested (5 required - use additional pages)

Facility _____
Address _____
Point of contact _____
Telephone number _____
Dates of test _____
Type of operation _____
Contaminants _____
Number of fans _____
Type of exhaust hoods _____
Air cleaning devices _____
Personnel performing the test _____

Attach letters of recommendation for tests performed at these facilities. Three facilities shall be of the type of operation to be tested.

B. Lead Test Engineer Qualifications

Name _____

Length of time lead engineer has worked with Agency _____

Years of experience testing industrial ventilation systems _____

Professional Engineering Information

discipline _____
license number _____
issue date _____
recertification date _____
state of registration _____

Industrial facilities tested (5 required - use additional pages)

Facility _____
Address _____
Point of Contact _____
Telephone number _____
Dates of Test _____
Type of Operation _____
Contaminants _____

Number of Fans _____
Type of Exhaust Hoods _____
Air Cleaning Devices _____

PITOT TRAVERSE DATA - Rectangular Duct

Test Date _____
Readings By _____
Traverse By _____
Static Pressure _____
Room _____ Air Temperature _____
System/Unit _____ Barometric Pressure _____
Traverse Location _____ Inside/Outside Duct Width _____
Distance to Resistance Causing Component Inside/Outside Duct Height _____
Component Distance Inside Duct Area _____
before _____ _____ Required Velocity _____
after _____ _____ Required Actual Volume Flow Rate ___
Velocity Pressure Reported as _ Units

Pitot Traverse Matrix

Velocity Point Position	Pressure Readings (minimum center distance is 6 inches)										
	1	2	3	4	5	6	7	8	9	10	Confirm
A											
B											
C											
D											
E											
F											
G											
H											
I											
J											

Velocity Point Position	Pressure Readings Converted to Velocity (FPM)									
	1	2	3	4	5	6	7	8	9	10
A										
B										
C										
D										
E										
F										
G										
H										
I										
J										

Subtotal

Total Velocity/# Readings = Avg. Velocity x Duct Area = Actual Volume Flow Rate

_____FPM / _____ = _____ FPM x ____ SQ. FEET = _____ ACFM

REMARKS

PITOT TRAVERSE DATA - Round Duct

Test Date _____
Readings By _____
Traverse By _____
Static Pressure _____
Room Number _____
System/Unit _____
Traverse Location _____
Distance to Resistance Causing Component

	Component	Distance
before	_____	_____
after	_____	_____

Air Temperature _____
Barometric Pressure _____
Inside/Outside Duct DIA. _____
Inside Duct Area _____
Required Velocity _____
Required Actual Volume Flow Rate __
Velocity Pressure Reported as_Units

Pitot Traverse Matrix

Duct Diameter	0-6 in. 12 readings 6/traverse)	6-48 in. 20 readings 10/traverse)	More than 48 in. or unstable velocities 0 readings 20/traverse)		
TEST POINT	Velocity Pressure	Velocity	#	Velocity Pressure	Velocity
1	_____	_____	21	_____	_____
2	_____	_____	22	_____	_____
3	_____	_____	23	_____	_____
4	_____	_____	24	_____	_____
5	_____	_____	25	_____	_____
6	_____	_____	26	_____	_____
7	_____	_____	27	_____	_____
8	_____	_____	28	_____	_____
9	_____	_____	29	_____	_____
10	_____	_____	30	_____	_____
11	_____	_____	31	_____	_____
12	_____	_____	32	_____	_____
13	_____	_____	33	_____	_____
14	_____	_____	34	_____	_____
15	_____	_____	35	_____	_____
16	_____	_____	36	_____	_____
17	_____	_____	37	_____	_____
18	_____	_____	38	_____	_____
19	_____	_____	39	_____	_____
20	_____	_____	40	_____	_____
Confirm 1 _____			Confirm 1 _____		
Confirm 2 _____			Confirm 2 _____		

Velocity Sum (Without Confirm Value) _____

Velocity Sum/# Readings = Average Velocity x Duct Area = Actual Volume Flow Rate _____ FPM / _____ = _____ FPM x _____ SQ. FEET = _____ ACFM

REMARKS

EXHAUST AIR SYSTEM TEST DATA

Test Dates _____
Readings By _____

Unit Number _____
Unit Location _____
Make Model _____
Model _____
Serial Number _____

Damper Positions
Hoods _____
Submains_____

Total Volume Test Location
Duct dia. before fan _____
Duct dia. after fan _____

Resistance Causing Elements

Type	Relationship to Fan before/after	Duct dia.
elbow	_____	_____
damper	_____	_____
expansion	_____	_____
contraction	_____	_____
plenum	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Pressures (in. w.c.)
Fan Inlet Static _____
Fan Outlet Static _____
Fan Inlet Velocity _____
Fan Static _____
Fan Total _____

Differential Pressure across air cleaning device

Device	Delta P (in. w.g.)
_____	_____
_____	_____

Fan Speed (RPM) _____
Motor Speed (RPM) _____

Pulley - Center to Center Distance
_____

Amperage - T1, T2, T3 _____
Voltage - T1-2, T2-3, T3-1_____

Temperature (W.B./D.B.)
Outside Air _____
Replacement Air _____

VOLUME FLOW RATES (Standard Cubic Feet per Minute)

SYSTEM	ACTUAL	DESIGN	ADEQUATE	INADEQUATE
Total Volume				
SUBMAIN				
Submain name_____				
Submain name_____				
Submain name_____				
HOODS				
Hood name_____				
Hood name_____				
Hood name_____				
Hood name_____				
Hood name_____				
Hood name_____				
Hood name_____				
Hood name_____				
Hood name_____				
Hood name_____				
Hood name_____				

REPLACEMENT AIR SYSTEM TEST DATA

Test Dates _____
Readings By _____

Unit Number_____
Unit Location _____
Make _____
Model _____
Serial Number _____

Pressures (in. w.c.)
Fan Inlet Static_____
Fan Outlet Static_____
Fan Inlet Velocity _____
Fan Static _____
Fan Total _____

Damper Positions
Terminals_____
Submains_____
across Cooling Coil_____
across Preheat Coil_____

Differential Pressure
across Filters _____
across Reheat Coil_____

Total Volume Test Location
Duct dia. before fan _____
Duct dia. after fan _____

Fan Speed (RPM) _____
Motor Speed (RPM) _____

Resistance Causing Elements

Type	Relationship to Fan before/after	Duct dia.
elbow		
damper		
expansion		
contraction		

Pulley - Center to Center Distance
_____

Amperage - T1, T2, T3 _____
Voltage - T1-2, T2-3,T3-1_____

plenum	_____	_____	
_____	_____	_____	Temperature (W.B./D.B.)
_____	_____	_____	Outside Air _____
_____	_____	_____	Replacement Air _____
			Mixed Air _____

VOLUME FLOW RATES (Standard Cubic Feet per Minute)

SYSTEM	ACTUAL	DESIGN	ADEQUATE	INADEQUATE
Total Volume	_____	_____	_____	_____
Outside Air Volume	_____	_____	_____	_____
Return Air	_____	_____	_____	_____
Ratio: Outside/Return	_____	_____	_____	_____
BRANCH				
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____

SECTION 16011

ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

a. General

1. Provide labor, tools, some materials and equipment, supervision and coordination to perform all electrical works required in accordance with the provision of the project and contract documents.

2. Completely coordinate with the work and requirements of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary items or appurtenances and devices necessary for a sound, secure and complete installation.

b. Drawings Use and Interpretation

1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed.

2. Intention is to show approximate sizes, capacities, locations, direction and general relationship of one work phase to another. But not exact detail or arrangement.

3. Field verify locations, arrangements and capacities of all existing systems and equipment to be utilized at this site.

c. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings, construction plan and field coordination drawings.

d. Description of Systems: Furnish and install all materials to provide functioning systems in compliance with performance requirements specified, and any modifications resulting from reviewed shop drawing, construction plan drawings or field coordination drawings.

e. Scope of Work: Without limiting or restricting the volume of work and solely for the convenience of the contractor, the work to be performed, in general, comprises of the following:

1. Provide a complete and operating electrical installation in accordance with these specifications, performance requirements and accompanying contract drawings. This shall include all required labor, materials, apparatus, design and construction supervision.

2. Apparatus, appliance or work not shown on the plans, but mentioned in the specifications or vice versa, or any accessories necessary to make the work complete and ready for operation, even though not specified or shown on the plan, shall be furnished and installed without additional expense to the owner.

3. Furnish and install temporary power and lighting in construction areas in accordance with Governmental requirements.

4. Provide a primary distribution system from the existing 12.47 kV 3-phase overhead power line at Piney Green Road which is approximately 1300 feet south of the site. The primary distribution system shall start at Piney Green Road with a overhead pole mounted fused cutouts rated and fused at 100 amperes, 7.8 kV underground. Distribution shall be overhead #2 AWG cables strung on crossarm mounted porcelain insulators. Pole lines shall be equally spaced where practical with a typical spacing not to exceed 175-feet. Spanning of lines shall be based on a medium load rating in accordance with those requirements established by the National Electrical Safety Code (ANSI C2) latest edition. Standard sag and conductor tables shall be used in determining the correct sag for the span of cables at the temperature nearest the actual at time of installation. Include all overhead conductors, fuse cutouts, poles, porcelain insulators, crossarms, pole line hardware, terminations, anchors, transformers etc. necessary to complete the job per requirements of the Government.

5. Furnish and install a secondary power distribution system from the pole mounted transformer secondaries to the groundwater treatment building and from the treatment building to the respective pump systems. Include all conduits, conductors, terminations, etc., per requirements of the Government.

6. Furnish and install all underground and overhead conduits, cables and handholes for power and control of remote site pump locations as shown on plan.

7. Furnish and install 480Y/277 volt, 3 phase, 4 wire power distribution system.

8. Furnish and install 480 volt-208Y/120 volt transformers.

9. Furnish and install 208Y/120 volt, 3 phase 4 wire power distribution system.

10. Furnish and install emergency lighting system.

11. Furnish and install lighting system and controls.

12. Furnish and install branch circuit wiring.

13. Furnish and install 120 volt convenience receptacles and all special receptacles.

14. Furnish and install starters and disconnects.

15. Furnish and install all power and control wiring to all motors, valve drives, process control equipment starters and disconnects that are furnished by this contractor or as part of equipment supplied by others.

16. Furnish and install a grounding system.

17. Furnish and install telephone raceway system, terminal board, and outlet boxes.

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 C2 1993 National Electrical Safety Code

CODE OF FEDERAL REGULATIONS (CFR)

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

FEDERAL SPECIFICATIONS (FS)

FS L-P-387 (Rev. A) (Int Am. 2) Plastic Sheet, Laminated, Thermosetting (for Design Plates)

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

IEEE 100 1992 Dictionary of Electrical and Electronics Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6 1988 (Rev. 1) Enclosures for Industrial Control and Systems

NEMA MG 1 1987 (Rev. 1-2) Motors and Generators

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

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 1993 National Electrical Code

1.3 RELATED REQUIREMENTS

This section applies to certain sections of Division 2, "Site Work," Division 11, "Equipment," Division 13, "Special Systems," and Division 15, "Mechanical". This section applies to all sections of Division 16, "Electrical," of this project specification unless specified otherwise in the individual sections.

1.4 DEFINITIONS

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

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.5 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 12.47 kV primary, three phase, three wire, 60 Hz, and 480/277 volts and 208Y/120 secondary, three phase, four wire. Final connections to the power distribution system at the existing pole line shall be made by the Contractor as directed by the NTR.

1.6 SUBMITTALS

Submittals required in the sections which refer to this section shall conform to the requirements of Section C, Part 7.0 of the Basic Contract and following 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 installation are unacceptable and shall be returned without approval.

1.6.1 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 shall 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.

1.6.2 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.

1.6.3 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.

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

1.6.4.1 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 shall be acceptable evidence of compliance.

1.6.4.2 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 NTR. 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.

1.6.5 SD-19, Operation and Maintenance Manuals

Comply with the requirements of Section 01730 and the technical sections.

1.6.5.1 Operating Instructions

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

1.7 QUALITY ASSURANCE

1.7.1 Material and Equipment Qualifications

Provide material 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. 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.

1.7.2 Regulatory Requirements

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

1.7.3 Alternative Qualifications

Products having less than a 2-year field service record shall 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.

1.7.4 Service Support

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

1.7.5 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 shall not be acceptable.

1.7.6 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 NTR.

1.8 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.

1.9 NAMEPLATES

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.

1.10 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 first position on the tag shall denote the voltage. The second through sixth positions on the tag shall identify the circuit. The next to last position shall denote the phase of the circuit and shall include the Greek "phi" symbol. The last position shall denote the cable size. Tag legend shall be as indicated. 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, Phase A, sized at 500 MCM.

1.10.1 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.

1.11 ELECTRICAL REQUIREMENTS

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

1.11.1 Motors and Equipment

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". Motors, controllers, integral disconnects, and contactors shall conform to Section 16470, "Panelboards, Motor Starters, Disconnect Switches." 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.

1.11.2 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.

1.11.3 High Efficiency Motors

1.11.3.1 High Efficiency Single-Phase Motors

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

1.11.3.2 High Efficiency Polyphase Motors

Unless otherwise specified, polyphase motors shall be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG1.

1.12 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Purchaser 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 Purchaser 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.

1.13 LOCKOUT REQUIREMENTS

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PAINTING OF EQUIPMENT

3.1.1 Factory Applied

Electrical equipment shall have factory-applied painting systems which shall, a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test.

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.

3.2 NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as ind indicated. Fasten nameplates to the devices 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 andy cabling or wiring in the manholes, handholes, and vaults.

- END OF SECTION -

SECTION 16301

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 CONCRETE INSTITUTE (ACI)

ACI 315	1980 (R 1986) Details and Detailing of Concrete Reinforcement
ACI 318	1989 (R 1992) Building Code Requirements for Reinforced Concrete

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB14	1992 Highway Bridges
AASHTO M198	1990 Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

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

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
ASTM C 309	1991 Liquid Membrane-Forming Compounds for Curing Concrete

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA RN 1	1989 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	1990 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC 3	1990 PVC Fittings for Use with Rigid PVC Conduit and Tubing
NEMA TC 8	1990 Extra-Strength PVC Plastic Utilities Duct for Underground Installation
NEMA TC 9	1990 Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation
NEMA WC 7	1988 (Rev. 1)Cross-Linked-Thermosetting-Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	1988 (Rev. 1) 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

UNDERWRITERS LABORATORIES INC. (UL)

UL 6	1993 Rigid Metal Conduit
UL 83	1991 (R 1992) (Bul. 1991, 1992, and 1993) Thermoplastic-Insulated Wires and Cables
UL 467	1984 (R 1986) Grounding and Bonding Equipment
UL 486A	1991 (Errata 1991 and 1992) (R 1992) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 510	1986 (R 1986) Insulating Tape

UL 514A	1991 (R 1993) (Bul. 1993) Metallic Outlet Boxes
UL 514B	1989 (Errata 1991) (Bul. 1993) (R 1993) Fittings for Conduit and Outlet Boxes
UL 651	1989 (R 1989) (Bul. 1993) Schedule 40 and 80 Rigid PVC Conduit
UL 854	1991 (Bul. 1992 and 1993) (R 1993) Service-Entrance Cables

1.2 RELATED REQUIREMENTS

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

1.2.1 Underground Service

Terminate underground service into buildings at a point 5 feet outside the buildings and projections thereof, except that service conductors shall be continuous to the interior terminating point indicated. Connections of the underground service to the service switch, panelboard, or load center is included in Section 16402, "Interior Wiring Systems." Protect ends of underground conduit with threaded metal caps or plastic plugs as applicable until connections are made.

1.2.2 Electrical Characteristics

Electrical characteristics for this project shall be as indicated in Section 16011 "Electrical General Requirements."

1.3 DEFINITIONS

a. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

b. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints," are used interchangeably and have the same meaning.

1.4 SUBMITTALS

Submit the following in accordance with Section 16011 and Section C, Part 7, of the Basic Contract.

1.4.1 Manufacturer's Catalog Data

a. Conduit

b. Fittings

c. Insulating tape

d. Conductor rated 600 volts and less

e. Medium voltage cable

f. Medium voltage cable terminators

g. Cable lubricants

h. Ground rods

i. Precast concrete structures

j. Handhole frames and covers

k. Sealing material for precast manhole and handhole joints

l. Cable tags

1.4.2 Drawings

a. Precast manhole and handhole

1.4.2.1 Precast Manhole and Handhole

Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered professional engineer including:

1. Material description (i.e., f'c and Fy)

2. Manufacturer's printed assembly and installation instructions

3. Design calculations

4. Reinforcing shop drawings prepared in accordance with ACI 315.

1.4.3 Statements

a. Cable splicer qualifications

1.4.3.1 Cable Splicer Qualifications

a. In order to establish the cable workman's competency, the Contractor shall be required to submit the following within 30 days prior to commencement of the splice/termination:

1 Documentation to verify that the individual has completed a splice-termination of the type to be installed under this contract. The test splice-termination shall be performed at the job site for this contract under the supervision of the cable accessory manufacturer or his representative and witnessed by the Government.

2. Documentation that said splice-termination has undergone and passed the following tests by the splice-termination manufacturer or an independent testing laboratory.

	Minimum Valve		
	5 kV	15 kV	35 kV
Discharge Ext. Vale with 3 pc or less	13 kV	20 kV	35 kV
AC withstand, 1 minute	35 kV	50 kV	75 kV
DC withstand, 15 minutes	65 kV	75 kV	100 kV

These results shall be attached for review

3. A statement of the number of years in which the individual has been splicing/terminating medium voltage cable.

b. Criteria for Waiver

Items a.1 and a.2 above may be waived on subsequent jobs provided the following criteria is satisfied:

1. Documentation of prior completion of items a.1 and a.2 be submitted.

2. A list of the last three jobs where the specific splices/terminations were installed within the past 12 consecutive months. The tabulation shall include splice/termination manufacturer, catalog number, and the number of splice/terminations installed.

c. Requalifications

Requalification to items a.1 and a.2 in above paragraph may be required (LANTNAVFACENGCOM) if the splice installer cannot demonstrate a prior history of splice/termination installation during the previous 12 consecutive months. The contractor shall furnish the material for splices and terminations.

1.4.4 Test Reports

a. Medium voltage cable qualifications and production tests G.

1.4.4.1 Medium Voltage Cable Qualification and Production Tests

Results of AEIC CS6 qualification and production tests as applicable for each type of medium voltage cable.

1.4.5 Field Test Reports

a. 600 volt cable tests G

b. Medium voltage cable field acceptance tests G

c. Ground resistance test G

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, as well as the resistance and soil conditions at the time the measurements were made.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Conduit

2.1.1.1 Rigid Metal Conduit

UL 6, galvanized steel, threaded type.

2.1.1.2 Rigid Metal Conduit, PVC Coated

UL 6, galvanized steel, threaded type, coated with a polyvinyl chloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mils thick, conforming to NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, tensile strength shall be a minimum 3500 psi, and aging shall be minimum 1000 hours.

2.1.1.3 Plastic Conduit for Direct Burial

NEMA TC 2, EPC-40-PVC

2.1.1.4 Plastic Utilities Duct for Concrete Encasement

NEMA TC 6, Type EB

2.1.2 Fittings

2.1.2.1 Metal Fittings

UL 514B, threaded type.

2.1.2.2 PVC Conduit Fittings

NEMA TC 3 UL 514B UL 651

2.1.2.3 PVC Duct Fittings

NEMA TC 9.

2.1.2.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit shall be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and shall conform to UL 514A.

2.1.3 Tape

2.1.3.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.1.3.2 Buried Warning and Identification Tape

Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried cable and conduit. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 2 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED ELECTRIC CABLE BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.1.4 Wire and Cable

Wire and cable conductor sizes are designated by American Wire Gauge (AWG) and Thousand Circular Mils (Kcmil). Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than 12 months prior to date of delivery to the site shall not be used.

2.1.4.1 Conductors Rated 600 Volts and Less

Service entrance and direct buried conductors shall conform to UL 854, Type USE. Conductors in conduit other than service entrance shall conform to UL 83, Type THWN. 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 ties and plates or heat shrink type sleeves. Control circuit terminations shall be properly identified. Conductors No. 10 AWG and smaller shall be solid copper. Conductors No. 8 AWG and smaller shall be solid copper. Conductors No. 8 AWG and larger shall be stranded copper. All conductors shall be copper.

a. Colors for coding conductors shall be:

208-VOLT SYSTEM	480-VOLT SYSTEM
Neutral - White	Neutral - White
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Grounding Conductor - Green	Grounding Conductor - Green

2.1.4.2 600 Volt Wire Connector and Terminals

Shall provide a uniform compression over the entire contact surface. Solderless terminal lugs shall be used on stranded conductors.

a. For use with copper conductors: UL 486A

2.1.4.3 Splices for 600 Volt Class Cables

ANSI C119.1.

2.1.4.4 Medium Voltage Cable

Cable for 12.47 kV underground distribution system shall be ozone resistant ethylene-propylene-rubber-insulated (EPR) cable conforming to NEMA WC 8, as

applicable. Cable shall be single conductor, employing concentric, Class B stranded copper conductors. Cable shall have conductor and insulation shielding. Insulation shielding shall be metal tape type consisting of a concentric serving of wires according to NEMA WC 8 or NEMA WC 8. Cable shall be rated 15 kV with insulation and jacket thickness of 220 and 80 mils, respectively. Cable shall have a polyvinyl chloride jacket.

2.1.5 Medium Voltage Cable Terminators

IEEE 48, Class 1. Components shall be from one manufacturer. Furnish installation instructions including stress relief cones.

2.1.5.1 Termination; Modular, Molded Rubber Type Terminator

IEEE 48 Class 1. Provide terminator as specified herein for terminating single conductor, solid insulated, nonmetallic jacketed type cables for service voltage up to 35 KV indoor and outdoor. The terminator shall be product of one manufacturer who shall furnish components in the form of a "UL listed" 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 include stress control, ground clamp, nontracking rubber skirts, crimp-on connector, rubber cap, and aerial lug. Do not use separate parts of copper or copper alloy in contact with aluminum or aluminum alloy parts in the construction or installation of the terminator. The terminator shall be:

a. Heat Shrinkable Type
Consisting 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. Provide heat shrinkable sheds or skirts of the same material as well as ground braid and clamp.

2.1.5.2 Termination; Separable Insulated Connector Type

Provide as specified in Section 16462, "Pad-Mounted Transformers."

2.1.6 Grounding and Bonding Equipment

UL 467. Ground rods shall be copper clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and 10 feet long unless otherwise indicated.

2.1.7 Underground Structures

2.1.7.1 Handholes

Provide type indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets.

2.1.7.2 Metal Frames and Covers

Provide steel frames and covers of rolled steel floor plate for handholes.

2.1.8 Cable Tags in Handholes

Provide as specified in 16011, "Electrical General Requirements."

PART 3 EXECUTION

3.1 INSTALLATION

Underground installation shall conform to ANSI C2 and NFPA 70 except as otherwise specified or indicated.

3.1.1 Contractor Damage

The Contractor shall promptly repair any indicated utility lines or systems damaged by Contractor operations. Damage to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the General Provisions of the contract. If the 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 any event, the Contractor shall immediately notify the NTR of any such damage.

3.1.2 Concrete

Concrete work for electrical requirements shall be 3000 psi minimum ultimate 28-day compressive strength with 1-inch minimum aggregate conforming to the requirements of Section 03300 "Cast-in-Place Concrete."

3.1.3 Underground Conduit/Duct Without Concrete Encasement

The type of conduit shall be EPC-40-PVC, PVC-coated rigid galvanized steel, rigid galvanized steel field wrapped with 0.010-inch-thick pressure-sensitive plastic tape applied with a 50 percent overlap.

3.1.3.1 Conduit Installation

The top of the conduit shall be 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. 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 paragraph "BURIED WARNING AND IDENTIFICATION TAPE".

3.1.3.2 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3-inch concrete cover around ducts. The concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks. Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, shall be zinc-coated, rigid steel,jacked into place.

3.1.3.3 Multiple Conduits

Separate multiple conduits by a minimum distance of 2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches. Stagger the joints of the conduits by rows and layers to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, and top spacers to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.1.4 Underground Duct with Concrete Encasement

Construct underground duct banks of individual conduits encased in concrete. Except where rigid galvanized steel conduit is indicated or specified, the conduit shall be PVC, Type EB. Do not mix different kinds of conduit in any one duct bank. Ducts shall be a minimum of 2 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 around ducts. Separate conduits by a minimum concrete thickness of 2 inches, except separate light and power conduits from control, signal, and telephone conduits by a minimum concrete thickness of 3 inches. Provide color, type and depth of warning tape as specified in paragraph "BURIED WARNING AND IDENTIFICATION TAPE~.

3.1.4.1 Depth of Encasement

The top of the concrete envelope shall be a minimum of 18 inches below grade, except under roads and pavement, concrete envelope shall be a minimum of 24 inches below grade.

3.1.4.2 Slope of Encasement

Duct banks shall have a continuous slope downward toward underground structures and away from buildings with a minimum pitch of 3 inches in 100 feet. Except at conduit risers, changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet; sweep bends may be composed 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. Excavate trenches along straight lines from structure to structure before ducts are laid or structure constructed so the elevation can be adjusted, if necessary, to avoid unseen obstruction.

3.1.4.3 Conduit

Terminate conduits in end-bells where ducts enter underground structures. Stagger the joints of the conduits by rows and layers to strengthen the duct bank Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, and top spacers to provide a completely enclosed and locked-in duct bank. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of duct bank. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring shall be done by driving reinforcing rods adjacent to every other duct spacer assembly and attaching the rod to the spacer assembly.

3.1.4.4 Test Mandrel

As each section of a duct bank is completed from structure to structure, a testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the inside diameter of the conduit shall be drawn through each conduit, after which a stiff-bristled brush, having the diameter of the conduit shall be drawn through until the conduit is clear of earth, sand, and gravel particles. Conduit plugs shall then be immediately installed.

3.1.4.5 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.1.5 Underground Conduit for Service Feeders Into Buildings

Shall be galvanized rigid steel from the service equipment to a point 5 feet beyond the building and projections thereof. Protect the ends of the conduit by threaded metal caps or bushings; coat the threads with graphite grease or other coating. Clean and plug conduit until conductors are installed.

3.1.6 Conduit Protection at Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations shall be PVC coated 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).

3.1.7 Buried Warning and Identification Tape

Bury tape with the printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

3.1.8 Cast-In-Place Handholes

Underground structures shall be cast in place or may be of precast construction as specified herein. Horizontal concrete surfaces of floors shall have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound shall conform to ASTM C 309. Cast-in-place handholes shall be standard type as indicated on Drawings. Covers for underground structures shall fit the frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets.

3.1.8.1 Optional Precast Concrete Construction

In lieu of cast-in-place concrete manholes and handholes, the Contractor may, provide precast concrete 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 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 areas 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 ultimate 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast 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. Design for Precast Structures: ACI 318. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

Angle of Internal Friction (phi) = 30 degrees

Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

Coefficient of Lateral Earth Pressure (K_a) = 0 33

Ground Water Level = 3 feet below ground elevation

Vertical design loads shall include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads shall consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load shall be for H20 highway loading per AASHTO H)314.

Horizontal design loads shall include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, shall be considered, along with a pulling-in iron design load of 6000 pounds.

Each structural component shall be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

Design shall also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

c. Construction Structure top, bottom and wall shall be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels designed for future duck bank entrances shall not be permitted. Quantity, size, and locatio of duck bank entrance windows shall be as directed, and cast completely open by the precaster. Size of windows shall exceed the nominal duck bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duck 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 or precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duck bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duck 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.

d. Joints: Provide tongue-and-groove 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.

3.1.8.2 Metal Frames and Covers for Handholes

Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rolled-steel floor plate having an approved antislip surface. Hinges shall be of galvanized steel with bronze hinge pin 5 by 5 inches by approximately 3/16-inch thick, without screw holes, and shall be for full surface application by fillet welding. Hinges shall have nonremovable pins and five knuckles. The surfaces of plates under hinges shall be true after the removal of raised antislip surface, by grinding or other approved method.

3.1.8.3 Grounding in Handholes

Provide two No. 6 AWG bare copper cables on walls of each handhole. The cables shall be exothermically welded to the reinforcing bars, shall connect to the ground rod in the handhole, and shall be accessible for future grounding requirements.

3.1.8.4 Precast 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 handhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator. Installation shall conform to the manufacturer's instructions.

3.1.8.5 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. Steel frames not buried in masonry and steel covers shall be cleaned of mortar, dirt and grease by an approved blasting process. Surfaces that cannot be cleaned satisfactorily by blasting shall be cleaned to bare metal by wire brushing or other mechanical means. Surfaces contaminated with rust, dirt, oil, grease, or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning, surfaces shall be coated with a pretreatment coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, treated surfaces shall be primed with a coat of zinc-chromate primer and one coat of synthetic exterior gloss enamel.

3.1.9 Cable Pulling

Test existing ducts 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. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with tape or wire shield shall have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.1.9.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables. Lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.

3.1.9.2 Cable Pulling Tensions

Tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.

3.1.9.3 Secondary Cable Runs, 600 Volts and Less

Include an insulated copper equipment grounding conductor sized as required by the rating of the overcurrent device supplying the phase conductors, for secondary cable runs, 600 volts and less.

3.1.9.4 Installation of Cables in Handholes

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, without interference to duct entrances, and support on brackets and cable insulators at a maximum of 4 18 inches. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath.

3.1.9.5 Cable Markers (or Tags) in Handholes

Provide as specified in Section 16011, "Electrical General Requirements."

3.1.9.6 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, unless otherwise indicated.

3.1.10 600 Volt Cable Splicing and Terminating

Provide splicing and terminating devices and materials to protect 600 volts insulated power and lighting cables from accidental contact, deterioration of coverings and moisture. Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer.

3.1.10.1 Splices for 600 Volt Class Cables

Splices in underground distribution systems shall be made only in accessible locations such as manholes and handholes, with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are 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 heavy wall heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied by a clean burning propane gas torch. Cables may be moved when joint is cool to the touch.

3.1.11 Medium Voltage Cable Terminations

Provide terminating devices and materials to protect medium voltage cable terminations from accidental contact, deterioration of coverings, and moisture. Make terminations by using materials and methods indicated or specified herein or as designated by the written instruction of the cable manufacturer and termination kit manufacturer. Termination for high-voltage cables shall be rated, and be capable of withstanding test voltages, in accordance with IEEE 48. Terminations of single- and multiconductor cables shall include the securing and sealing of the sheath and insulation of the cable conductors, stress relief and grounding of cable shields of shielded cable, and grounding of neutral conductors, metallic sheaths, and armor. Adequately support cables and cable terminations to avoid any excessive strain on the termination and the conductor connection.

3.1.12 Grounding Systems

Noncurrent-carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid earth ground not exceeding the following values:

Pad-mounted transformers without protective fences	5 ohms
Ground in manholes, handholes, and vaults	5 ohms
Grounding other metal enclosures of primary voltage electrical and electrically-operated equipment	5 ohms

Grounded secondary distribution system neutral and noncurrent-carrying metal parts associated with distribution systems and grounds not otherwise covered	5 ohms

When work in addition to that indicated or specified is directed in order to obtain the specified ground resistance, the provisions of the contract covering "Changes" shall apply.

Shall be as indicated, and as required by NFPA 70 and ANSI C2.

3.1.12.1 Grounding Electrodes

Provide cone pointed ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.

3.1.12.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. 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.

3.1.12.3 Grounding Conductors

Grounding conductors shall be stranded-bare copper conforming to ASTM B 8, Class B, for sizes No. 6 AWG and larger, and shall be solid-bare copper conforming to ASTM B 1 for sizes No. 8 and smaller. Cable sheaths, cable shields, conduit, and equipment shall be grounded with No. 6 AWG . Surge arresters shall be grounded to ground rods with No. 4 AWG.

3.1.12.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.1.13 Excavating, Backfilling, and Compacting

Provide under this section as specified in Section 02220, "General Excavation, Filling, and Backfilling."

3.1.14 Reconditioning of Surfaces

3.1.14.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality 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 seeding.

3.1.14.2 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 to 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.

Furnish labor, equipment, and incidentals required for testing, except that the Government will provide electric power required for the tests. Correct defects in the work provided by the Contractor and repeat tests until the work is in compliance with contract requirements. Show by demonstration in service that circuits and devices are in good operating condition. Tests shall be such that each item of control equipment will function not less than five times.

3.2.1 600 Volt Cable Tests

After wiring is completed, connected, and ready for operation, but prior to placing systems in service and before any branch circuit breakers are closed, perform insulation resistance tests in all circuits. Measure the insulation resistance between conductors and between each conductor and ground. Use an instrument capable of making measurements at an applied potential of 1000 volts dc. Take readings after the voltage has been applied for a minimum of one minute. Minimum insulation resistance values shall be not less than 2 megohms.

3.2.2 Medium-Voltage Cables

After installation of cable, splices and terminators and before terminating to equipment, perform medium voltage cable field acceptance tests on cable systems in accordance with NETA ATS. Field acceptance test voltage for 15 kV cable shall be 55 kV dc and 53 kV dc with insulated connectors for 15 minutes. If cable system fails to pass initial test, correct defects and perform subsequent acceptance tests until the work is in compliance with contract requirements.

3.2.3 Ground Rods

Perform ground resistance tests for ground rods before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Ground resistance shall also be measured for each piece of equipment and medium voltage cable splice to the ground electrode. Use a portable ground testing meter to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one copy of the ground meter manufacturer's directions, indicating the method to be used.

-- End of Section --

SECTION 16370

OVERHEAD 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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2	1993 National Electrical Safety Code
ANSI C29.3	1986 Wet Process Porcelain Insulators - Spool Type
ANSI C29.4	1989 Wet-Process Porcelain Insulators - Strain Type
ANSI C37.42	1989 Switchgear - Distribution Cutouts and Fuse Links
ANSI O5.1	1992 Wood Poles

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.11	1991 Forged Fittings, Socket-Welding and Threaded

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 153	1982 (R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 475	1989 Zinc-Coated Steel Wire Strand
ASTM B 2	1988 Medium Hard Drawn Copper Wire

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C1	1992 All Timber Products - Preservative Treatment by Pressure Processes
AWPA C4	1992 Poles - Preservative Treatment by Pressure Processes
AWPA C25	1992 Sawn Crossarms - Preservative Treatment by Pressure Processes

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

IEEE 48	1990 High-Voltage Alternating-Current Cable Terminations

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

RURAL ELECTRIFICATION ADMINISTRATION (REA)

REA 43-5	1989 List of Materials Acceptable for Use on Systems of REA Electrification Borrowers
REA 50-17	1987 Wood Crossarms (Solid and Laminated), Transmission Timber and Pole Keys (DT-5B:PE-16)
REA 50-18	1987 Wood Poles, Stubs, and Anchor Logs

UNDERWRITERS LABORATORIES INC. (UL)

UL 6	1993 Rigid Metal Conduit
UL 510	1986 (R 1986) Insulating Tape

1.2 RELATED REQUIREMENTS

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

1.3 UNDERGROUND SERVICE

Terminate underground service into buildings at a point 5 feet outside the buildings and projections thereof, except that service conductors shall be continuous to the interior terminating point indicated. Connections of the underground service to the service switch, panelboard, or load center is included in Section 16402, "Interior Wiring Systems." Protect ends of underground conduit with threaded metal caps or plastic plugs as applicable until connections are made. Underground service from 5 feet outside the building to the underground terminal pole shall be provided under this section and have materials and installation as specified in Section 16301, Underground Electrical Work.

1.4 SUBMITTALS

Submit the following in accordance with Section 16011 and Section C, Part 7, of the Basic Contract.

1.4.1 Data

a. Calculations

1.4.2 Manufacturer's Catalog Data

a. Conductors G

b. Insulators

c. Cutouts G

d. Guy strand

e. Anchors

1.4.3 Statements

a. Qualifications of cable splicer

For cable splicer and terminator personnel, submit documentation specified in paragraph entitled "Qualifications of Cable Splicer."

1.4.4 Test Reports

a. Wood poles

b. Wood crossarms

Furnish an inspection report from an independent inspection agency, approved by the NTR, stating that offered products comply with applicable AWPA and REA standards. The REA approved Quality Mark "WQC" on each pole and crossarm will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

1.4.5 Field Test Reports

a. Ground rod tests

b. High Voltage Cable test G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications of Cable Splicer

For qualifications of cable splicer refer to Section 16301, "Underground Electrical Work."

1.6 DELIVERY, STORAGE, AND HANDLING

Store and handle poles held in storage more than 2 weeks in accordance with ANSI O5.1. Exception, do not use pointed tools capable of producing indentations of more than one inch in depth. Nails and holes are not permitted in top of poles.

1.7 SCHEDULING

Notify the NTR in writing at least 15 days prior to date connections are required. Obtain approval before interrupting service.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Consider materials specified herein or shown on contract drawings which are identical to materials listed in REA 43-5 as conforming to requirements.

2.2 WOOD POLES

Wood poles machine trimmed by turning, Southern Yellow Pine conforming to ANSI O5.1 and REA 50-18. Gain, bore and roof poles before treatment. Pressure treat poles with ammoniacal copper arsenate (ACAO, or chromated copper arsenate (CCA), except that Douglas Fir shall not be treated with CCA in accordance with AWPA C1 and AWPA C4 as referenced in REA 50-18. The quality of each pole shall be ensured with "WQC" (wood quality control) brand on each piece, or by an approved inspection agency report.

2.3 WOOD CROSSARMS

Wood crossarms shall be 8 feet and conform to REA 50-17. Pressure treat crossarms with pentachlorophenol, chromated copper arsenate (CCA), or ammoniacal copper arsenite (ACA). Treatment shall conform to AWPA C25.

2.3.1 Crossarm Braces

Provide as indicated steel angle for 38-inch span with 8-foot crossarm.

2.4 HARDWARE

Hot dip galvanized conforming to ASTM A 153.

2.5 INSULATORS

Provide wet-process porcelain insulators which are radio interference free.

a. Line Post Type Insulators: ANSI C29.7, Class 15 1L.

b. Suspension Insulators: ANSI C29.2, Class 2/52-1.

c. Spool Insulators: ANSI C29.3, Class 53-2.

d. Guy Strain Insulators: ANSI C29.4, Class 54-4.

e. Pin Insulators: ANSI CS9.5, Class 55-5.

2.6 OVERHEAD CONDUCTORS

Conductors of bare copper of sizes and types indicated.

2.6.1 Solid Copper

ASTM B 2, medium-hard-drawn, ASTM B 7, stranded.

2.7 GUY STRAND

ASTM A 475, extra-high strength, Class A or B, galvanized strand steel cable. Guy strand shall be 3/8-inch in diameter with a minimum breaking strength of 11,500 pounds. Provide guy terminations designed for use with the particular strand and developing at least the ultimate breaking strength of the strand.

2.8 ROUND GUY GUARDS

Vinyl or PVC material, yellow colored, 8 feet long and shatter resistant at sub-zero temperatures.

2.8.1 Guy Attachment

Thimble eye guy attachment.

2.9 ANCHORS AND ANCHOR RODS

Anchors shall be screw anchors. Anchor rods shall be twin thimble-eye, one inch diameter by 8 feet long. Anchors and anchor rods shall be hot dip galvanized.

2.9.1 Screw Anchors

Screw type anchors having a manufacturer's rating of not less than 20,000 pounds if loose to medium sand/clay soil, Class 6 and extra heavy pipe rods conforming to ASTM A 53, Schedule 80, and couplings conforming to ASME B16.11.

2.10 GROUND RODS

Copper clad steel ground rods at least 3/4 inch in diameter and 10 feet long. Die-stamp each near top with name or trademark of manufacturer and length of rod in feet. Rods shall have a hard, clean, smooth, continuous, surface throughout length of rod.

2.10.1 Ground Wire

Provide soft drawn copper wire ground conductors a minimum No. 4 AWG. Ground wire protectors may be either PVC or half round wood molding. Wood molding shall be fir, pressure treated in accordance with AWPA C25, or shall be cypress or cedar.

2.11 FUSED CUTOUTS

Open type fused cutouts rated 100 amperes and 10,000 amperes symmetrical interrupting current at 8.3/15 kV gnd Y conforming to ANSI C37.42. Type K fuses conforming to ANSI C37.42 with ampere ratings equal to 150 percent of the transformer full load rating. Open link type and fuse cutouts are not acceptable.

2.12 CONDUIT RISERS AND CONDUCTORS

Rigid galvanized steel conduit conforming to UL 6.

2.13 CABLE TERMINATIONS

2.13.1 Terminator, Porcelain Insulator Type

Provide terminators for solid insulation nonmetallic jacketed cables of porcelain insulator type. Apply terminators to single conductor cables or to each conductor of multiple conductor cables. Provide terminator and

components from one manufacturer and furnished in a package or kit form compatible with insulation and conductor material. The kit shall include complete assembly and installation instructions. The terminator shall comply with requirements of IEEE 48 Class 1 except that requirements of design tightness test need not be met. The terminator shall not extrude filler compound under either test or service. Terminator shall consist of a porcelain insulator, cable connector-hoodnut assembly and aerial lug as required, metal body and support bracket, sealed cable entrance, and internal stress relief device for shielded cable, and insulating filler compound or material.

2.14 ELECTRICAL TAPES

Tapes shall be UL listed for electrical insulation and other purposes in wire and cable splices. Terminations, repairs and miscellaneous purposes, electrical tapes shall comply with UL 510.

2.15 CAULKING COMPOUND

Compound for sealing of conduit risers shall be of a putty-like consistency workable with hands at temperatures as low as 35 degrees F, shall not slump at a temperature of 300 degrees F, and shall not harden materially when exposed to air. Compound shall readily calk or adhere to clean surfaces of the materials with which it is designed to be used. Compound shall have no injurious effects upon the workmen or upon the materials.

PART 3 EXECUTION

3.1 INSTALLATION

Provide overhead pole line installation conforming to requirements of ANSI C2 for Grade B construction of overhead lines in light loading districts and NFPA 70 for overhead services. Provide material required to make connections into existing system and perform excavating, backfilling, and other incidental labor. Consider street, alleys, roads and drives "public." Pole configuration shall be as indicated.

3.1.1 Pole Setting

Provide pole holes at least as large at the top as at the bottom and large enough to provide 4-inch clearance between the pole and side of the hole.

3.1.1.1 Setting Depth of Pole

Pole setting depths shall be as follows:

Length of Pole (feet)	Setting in Soil (feet)	Setting in Solid Rock (feet)
40	6.0	4.0

3.1.1.2 Setting in Soil, Sand, and Gravel

"Setting in Soil" depths, as specified in paragraph entitled "Setting Depth of Pole," apply where the following occurs:

a. Where pole holes are in soil, sand, or gravel or any combination of these;

b. Where soil layer over solid rock is more than 2 feet deep;

c. Where hole in solid rock is not substantially vertical; or

d. Where diameter of hole at surface of rock exceeds twice the diameter of pole at same level.

3.1.1.3 Setting in Solid Rock

"Setting in Solid Rock," as specified in paragraph entitled "Setting Depth of Pole," applies where poles are to be set in solid rock and where hole is substantially vertical, approximately uniform in diameter and large enough to permit use of tamping bars the full depth of hole.

3.1.1.4 Setting With Soil Over Solid Rock

Where a layer of soil 2 feet or less in depth over solid rock exists, depth of hole shall be depth of soil in addition to depth specified under "Setting in Solid Rock" in paragraph entitled "Setting Depth of Pole," provided, however, that such depth shall not exceed depth specified under paragraph entitled "Setting in Soil."

3.1.1.5 Setting on Sloping Ground

On sloping ground, always measure hole depth from low side of hole.

3.1.1.6 Backfill

Thoroughly tamp pole backfill for full depth of the hole and mound excess fill around the pole.

3.1.1.7 Setting Poles

Set poles so that alternate crossarm gains face in opposite directions, except at terminals and dead ends where gains of last two poles shall be on side facing terminal or dead end. On unusually long spans, set poles so that crossarm comes on side of pole away from long span. Where pole top pins are used, they shall be on opposite side of pole from gain, with flat side against pole.

3.1.1.8 Alignment of Poles

Set poles in alignment and plumb except at corners, terminals, angles, junctions, or other points of strain, where they shall be set and raked against the strain. Set not less than 2 inches for each 10 feet of pole length above grade, nor more than 4 inches for each 10 feet of pole length after conductors are installed at required tension. When average ground run is level, consecutive poles shall not vary more than 5 feet in height. When ground is uneven, poles differing in length shall be kept to a minimum by locating poles to avoid the highest and lowest ground points. If it becomes necessary to shorten a pole, a piece shall be sawed off the top. Holes shall be dug large enough to permit the proper use of tampers to full depth of hole.

3.1.2 Anchors and Guys

Place anchors in line with strain. The length of the guy lead (distance from base of pole to the top of the anchor rod) shall be as indicated.

3.1.2.1 Setting Anchors

Set anchors in place with anchor rod aligned with, and pointing directly at, guy attachment on the pole with the anchor rod projecting 6 to 9 inches out of ground to prevent burial of rod eye.

3.1.2.2 Screw Anchors

Install screw anchors by torquing with boring machine. Anchor rod eye shall extend 6 to 9 inches above grade.

3.1.2.3 Setting Guy Strands

Complete anchor and guy installation, dead end to dead end, and tighten guy before wire stringing and sagging is begun on that line section. Provide strain insulators at a point on guy strand 8 feet minimum from the ground and 6 feet minimum from the surface of pole.

3.1.3 Hardware

Provide hardware with washer against wood and with nuts and lock nuts applied wrench tight. Provide locknuts on threaded hardware connections. Locknuts shall be M-F style and not palnut style.

3.1.4 Grounding
Grounding shall conform to ANSI C2 except that each separate ground electrode shall have a resistance to solid earth not exceeding 5 ohms. When work in addition to that indicated or specified is directed in order to obtain specified ground resistance, provisions of the contract covering changes shall apply.

3.1.4.1 Ground Rod Connections

Make ground rod connections on pole lines by exothermic weld or by using a compression connector for ground wire or wire to rod connections. Make exothermic welds strictly in accordance with manufacturer's written recommendations. Welds which have puffed up or which show convex surfaces indicating improper cleaning, are not acceptable. No mechanical connectors are required at exothermic weldments. Compression connectors shall be type that uses a hydraulic compression tool to provide correct pressure. Provide tools and dies recommended by compression connector manufacturer. An embossing die code or similar method shall provide visible indication that a connector has been fully compressed on ground wire.

3.1.4.2 Other Metal Parts

Ground noncurrent carrying metal parts of equipment or enclosures.

3.1.4.3 Protective Molding

Protect grounding conductors which are run on surface of wood poles by wood molding or plastic molding of equal mechanical strength extending from ground line throughout communication and transformer spaces.

3.1.5 Conductors

Conductors shall be handled with care necessary to prevent nicking, kinking, gouging, flattening, or otherwise deforming or weakening conductor or impairing its conductivity. Remove damaged sections of conductor and splice conductor.

3.1.5.1 Splices

Conductor splices, as installed, shall exceed ultimate rated strength of conductor and shall be of type recommended by conductor manufacturer. No splice shall be permitted within 10 feet of a support.

3.1.5.2 Ties

Provide ties on pin insulators tight against conductor and insulator and ends turned down flat against conductor so that no wire ends project.

3.1.5.3 Reinstalling Conductors

Existing conductors to be reinstalled or resagged shall be strung to "final" sag table values for the particular conductor type and size involved.

3.1.5.4 New Conductor Installation

String new conductors to "initial" sag table values recommended by the manufacturer for conductor type and size of conductor and ruling span indicated.

3.1.5.5 Fittings

Dead end fittings, clamp or compression type, shall conform to written recommendations of conductor manufacturer and shall develop full ultimate strength of conductor.

3.2 FIELD QUALITY CONTROL

As an exception to requirements that may be state elsewhere in contract, the NTR shall be given 5 working days' notice prior to each test.

3.2.1 Ground Rod Tests

Prior to connecting, test ground rods for ground resistance value. Use a portable ground testing meter to test each ground or group of grounds. Make ground resistance measurements in normally dry weather, not less than 48 hours after a rainfall. Follow the directions provided by the equipment manufacturer for proper use of the equipment.

3.2.2 Devices Subject to Manual Operation

After installation of cable, splices, and terminators and before terminating to equipment, perform a field acceptance test on cable systems in accordance with NETA ATS. Field acceptance test voltage for 15 kV cable shall be 55 kV dc for 15 minutes. If cable system fails to pass initial test, correct defects and perform subsequent acceptance tests until the work is in compliance with contract requirements. For underground cables, perform field acceptance test as specified in Section 16301, "Underground Electrical Work."

3.2.4 Large Overhead Systems Test

Perform field acceptance test after installation but before placing system in

service. Prior to testing, disconnect transformers, switches, and other such items from overhead system. With service voltage applied, take thermographic or infrared readings of overhead system in accordance with test equipment manufacturer's procedures.

-- End of Section --

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 L-P-387	(Rev. A) (Int Am. 2) Plastic Sheet, Laminated, Thermosetting (for Design Plates)

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 RN 1	1989 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit
NEMA ST 20	1992 Dry-Type Transformers for General Applications
NEMA TC 2	1990 Electrical Plastic Tubing (EPT) and Conduit EDC-40 and EPD-80
NEMA TC 3	1990 PVC Fittings for Use with Rigid PVC Conduit and Tubing
NEMA WD 1	1983 (R 1989) Wiring Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code

UNDERWRITERS LABORATORIES INC. (UL)

UL 1	1985 (R 1992) Flexible Metal Conduit
UL 6	1993 Rigid Metal Conduit
UL 50	1992 (Bul. 1993) Safety Enclosures for Electrical Equipment
UL 67	1988 (R. 1993) Panelboards
UL 83	1991 (R 1992) (Bul. 1991, 1992, and 1993) Thermoplastic-Insulated Wires and Cables
UL 360	1986 (Bul. 1991) (R 1993) Liquid-Tight Flexible Steel Conduit
UL 467	1984 (R 1986) Grounding and Bonding Equipment
UL 486A	1991 (Errata 1991 and 1992) (R 1992) Wire Connector for Use with Copper Conductors
UL 486C	1991 (R 1992) Splicing Wire Connectors
UL 489	1991 (R. 1992) (Bul. 1992 and 1993) Molded-Case Circuit Breakers and Circuit-Breaker

	Enclosures
UL 498	1991 (R 1992) (Bul. 1993) Attachment Plugs and Receptacles
UL 506	1989 Specialty Transformers
UL 508	1993 (Bul. 1993) Industrial Control Equipment
UL 510	1986 (R 1986) Insulating Tape
UL 514B	1989 (Errata 1991) (R 1993) (Bul. 1993) Fittings for Conduit and Outlet Boxes
UL 854	1991 (Bul. 1992 and 1993) (R. 1993) Service-Entrance Cables
UL 869	1989 (R 1991) (Bul. 1992 and 1993) Service Equipment
UL 943	1985 (Bul. 1991) (R 1993) Ground-Fault Circuit Interrupters

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 C, Part 7 of the Basic Contract.

1.3.1 Manufacturer's Catalog Data

a. Conduit and fittings (each type)

b. Outlet boxes

c. Junction boxes

d. Wires and cables

e. Splices and termination components

f. Device plates

g. Switches G

h. Receptacles G

i. Circuit breakers G

j. Combination motor controllers G

k. Transformers G

l. Combination motor controllers G

m. Ground rods G

1.3.2 Drawings

a. Panelboards G

b. Transformers G

c. Wireways G

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, rigid nonmetallic conduit, plastic coated rigid steel and liquid tight flexible conduit, conforming to the following:

2.2.1 Rigid Steel Conduit (Zinc-Coated)

ANSI C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, accordance with NEMA TC 2, or fiberglass conduit, in accordance with NEMA TC 14.

2.2.3 Plastic-Coated Rigid Steel

NEMA RN1, Type 40 (40 mils thick).

2.2.3.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.4 Fittings for Metal Conduit, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium - or zinc-coated in accordance with UL 514B.

2.2.4.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.3 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.4 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.

2.4.1 Conductors

Conductors No. 8 and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.4.1.1 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.

2.4.1.2 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.

2.4.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 208/120 volt, 3-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, 3-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

2.4.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN remote-control and signal circuits shall be Type TW, THW, or TF. Conductors shall conform to UL 83 except that XHHW shall conform to UL 44. Where lighting fixtures require 90 degrees C conductors, provide only conductors with 90 degree C insulation or better.

2.4.4 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.

2.4.5 Service Entrance Cables (Type SE)

Service Entrance (SE) and Underground Service Entrance (USE) Cables, UL 854.

2.4.6 Cable Tray Cable

UL listed; Type TC

2.5 SPLICES AND TERMINATION COMPONENTS

UL 486A for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.6 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, 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. Plates on finished walls shall be satin finish stainless steel or brushed-finish aluminum, minimum 0.03-inch thick. 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."

2.7 SWITCHES

2.7.1 Toggle Switches

NEMA WD 1, No. 1121 for single pole, No. 1122 for double pole, No. 1123 for three-way, and No. 1124 for four-way, totally enclosed with bodies of thermosetting plastic and mounting strap with grounding screw. 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.

2.7.2 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 white.

2.7.3 Disconnect Switches

NEMA KS 1. Provide heavy duty-type 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 12 enclosures per NEMA ICS 6.

2.7.4 Breakers Used as Switches

For 120- and 277-volt fluorescent fixtures, mark breakers "SND" in accordance with UL 489.

2.8 RECEPTACLES

UL 498 and NEMA WD 1, heavy-duty, grounding type. Ratings and configurations shall be as indicated. Bodies shall be of brown thermosetting plastic supported on a metal mounting strap. Wiring terminals shall be screw-type, side-wired. Connect grounding pole to mounting strap.

2.8.1 Duplex Receptacles

Duplex receptacles shall be 15 amperes, 125 volts, No. 5242.

2.8.2 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. Receptacle shall be UL listed for use in "wet locations."

2.8.3 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.

2.9 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating as indicated. 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. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Main breaker shall be "separately" mounted "above" branch breakers. Where "space only" is indicated, make provisions for future installation of breakers. Panelboard locks shall be keyed same. Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to

panelboard (e.g., Panel PA served form Panel MDP). Type directories and mount in holder behind transparent protective covering.

2.9.1 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses 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.

2.9.2 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Plug-in circuit breakers and series rated circuit breakers are unacceptable.

2.9.2.1 Multiple Breakers

Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.10 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch and 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 TRANSFORMERS

NEMA ST 20, general purpose, dry-type, self-cooled, unventilated. Provide transformers in NEMA 3R enclosure. Transformer shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C. Transformer of 115 degrees C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating. Transformers shall be quiet type with maximum sound level of minimum 3 decibels less than NEMA standard level for transformer rating indicated.

2.12 MOTORS

Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits shall have terminal voltage rating of 460 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.

2.12.1 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided.

2.13 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. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. 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 25,000 rms symmetrical amperes.

2.13.1 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide fuses in each ungrounded primary feeder.

2.13.2 Enclosures for Starters and Controllers

NEMA ICS 6.

2.13.3 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.

2.13.4 Pilot and Indicating Lights

Provide transformer, resistor, or diode type.

2.13.5 Terminal Blocks

NEMA ICS 4.

2.14 MANUAL MOTOR STARTERS

Single or Three pole designed for surface mounting with overload protection and pilot lights.

2.15 COMBINATION MOTOR CONTROLLERS G

UL 508 and requirements in paragraphs entitled, "Motors" and "Motor Controllers." Controller shall employ fusible switch with clips for R-type fuses for branch circuit protection. Minimum short circuit withstand rating of combination motor controller shall be 22,000 rms symmetrical amperes.

2.16 TELEPHONE SYSTEM

Provide system of telephone wire-supporting structures, including: conduits with pull wires, terminal boxes, outlet and junction boxes, other accessories for telephone outlets, and backboards.

2.16.1 Cover Plates

Modular telephone type with same finish specified for receptacle and switch cover plates.

2.16.2 Conduit Sizing

Conduit for single outlets shall be minimum of 3/4 inch and for multiple outlets minimum of one inch. Size conduits for telephone risers to telephone cabinets, junction boxes, and telephone service.

2.16.3 Backboards

Interior grade plywood, 3/4-inch thick, 4 by 8 feet minimum.

2.16.4 Receptacles for Telephone Service

Provide receptacle 125 volts, 20 amps, single phase, 60 Hz adjacent to telephone backboards served from panelboard circuit.

2.17 GROUNDING AND BONDING EQUIPMENT

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

2.18 WIREWAYS

UL 870. Material shall be steel galvanized 16 gauge for sizes 2-1/2 by 2-1/2; 4 by 4; 6 by 6 inches, 14 gauge for sizes 8 by 8; 12 by 12 inches. Provide in length required for the application with screw cover NEMA 12 enclosures per NEMA ICS 6.

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 labeled or identified as such.

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 conforming to paragraph entitled "Nameplates." 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 rigid steel conduit, or rigid nonmetallic conduit, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Provide insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated, green equipment grounding conductor for circuit installed in conduit or raceways. Minimum conduit size shall be 3/4 inch in diameter for low voltage lighting and power circuits. Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors shall be metallic on both sides of fire-rated walls, fire-rated partitions, or fire-rated floors for minimum distance of 6 inches.

a. Restrictions applicable to PVC Schedule 40 and PVC Schedule 80

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use in penetrating fire-rated walls or partitions, fire-rated floors, etc.

3.1.3.1 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph entitled "Flexible Connections."

3.1.3.2 Service Entrance Conduit, Underground

PVC, Type EPC-40, or galvanized rigid steel. Convert monmetallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid steel conduit before rising through floor slab; plastic coating shall extend minimum 6 inches above floor.

3.1.3.3 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; Type EPC-40; or fiberglass. Convert nonmetallic conduit, other than PVC Schedule 40 or 80, to rigid steel conduit before rising through floor slab. Plastic coating shall extend minimum 6 inches above floor.

3.1.3.4 Conduit in Floor Slabs

Rigid steel; or PVC, Type EPC-40.

3.1.4 Conduit Installation

Conceal conduit under floor slabs and exposed on walls and ceilings. 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 Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations through vapor barrier.

3.1.4.2 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finish slab.

3.1.4.3 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. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit

crossed building expansion joints, provided suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means.

3.1.4.4 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.

3.1.4.5 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-pound tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.4.6 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.

3.1.4.7 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 necessary to provide minimum one-inch cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings shall allow horizontal and vertical movement of raceway. 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. Where nonmetallic conduit is used, raceway must be converted to rigid steel before rising above floor, unless specifically indicated.

3.1.4.8 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.

3.1.4.9 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.

3.1.4.10 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquid-tight flexible conduit throughout 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 throughout when surface mounted on outside of exterior surfaces. 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. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports, or make adequate provisions for distributing load over ceiling support members in an approved manner. 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 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 and for wall-mounted telephones. Telephone outlets shall be minimum of 4 inches square by 1 1/2 inches deep except for wall-mounted telephones.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 compatible with nonmetallic raceway systems, except where cast-metal boxes are required. Provide 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.

3.1.6 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controllers and disconnecting switches so height of operating mechanism at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor, receptacles 36 inches above finished floor, and other devices as indicated. Outlet boxes for wall-mounted telephones shall be 2 inches by 4 inches; mounted at height 60 inches above finished floor. 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.

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 and nonmetallic 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 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact NTR for further instructions.

3.1.10.2 Telephone Service

Provide main telephone service equipment ground consisting of separate No. 6 AWG ground wire in conduit between equipment backboard and readily accessible grounding connection. Equipment end of ground wire shall consist of coiled length at least twice as long as terminal cabinet or backboard height.

3.1.11 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this

section of the specifications but shall be provided under the section specifying the associated equipment.

3.2 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give NTR 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 Transformer Tests

Perform test classified as routine in accordance with NEMA ST 20 on each transformer.

3.2.3 600-Volt Wiring Test

Test 600-volt wiring and less 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.

3.2.4 GFCI Receptacle Test

Test GFCI receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

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 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 NTR, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

SECTION 16462

PAD-MOUNTED TRANSFORMER

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2	1993 National Electrical Safety Code
ANSI C12.1	1988 Code for electricity Metering
ANSI C12.4	1984 (R 1990) Mechanical Demand Registers
ANSI C12.7	1987 Watthours Meter Sockets
ANSI C12.10	1987 Electromechanical Watthour Meters
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-Cooled, 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	1992 (REV. B) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM D 117	1989 Electrical Insulating Oils of Petroleum Design
ASTM D 1535	1989 Specifying Color by the Munsell System
ASTM D 3487	1988 Mineral Insulating Oil Used in Electrical Apparatus

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

IEEE 386	1985 (R 1991) 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	1987 (R 1992) Power and Distribution Transformers
ANSI/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 C57.13	1978 (R 1987) Instruments Transformers
ANSI/IEEE C57.98	1986 (R 1992) Transformer Impulse Tests
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, "Submittal." Code 404, Atlantic Division, Naval Facilities Engineering Command will review and approve all submittals in this section requiring Government approval.

1.3.1 Data

a. Transformer guaranteed losses G

b. Transformer loss calculations G

1.3.2 Manufacturer's Catalog Data

a. Pad-mounted transformers, dead-front G

Submittal shall include manufacturer's information for each component, device, and accessory provided with the transformer.

1.3.3 Drawings

a. Pad-mounted transformer drawings G

1.3.3.1 Pad-Mounted Transformer Drawings

Drawings shall indicate, but not be limited to the following:

a. Overall dimensions, front view, and sectional views.

b. ANSI nameplate data, including manufacturer's name, catalog number, and ratings of fuses.

c. Elementary diagrams and wiring diagrams with terminals identified of watt hour meter and current transformers.

d. One-line diagram, including switch(es), current transformers, meters, and fuses.

e. Manufacturer's published time-current curves (on full size logarithmic paper) of the transformer high side fuse.

1.3.4 Reports

a. Pad-mounted transformer design tests G

b. Pad-mounted transformer routine and other tests G

Submit certified copies of the following ANSI/IEEE C57, 12.00 and ANSI/IEEE C57.12.90 transformer tests.

1.3.4.1 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 (complete with test data, explanations, formulas, and

results), in the same submittal package as the catalog data and drawings for the specified transformer.

a. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (OA), the same temperature rise rating, and the same insulating liquid as the transformer specified.

b. Lightning impulse test report: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests shall include both the primary and secondary windings of that transformer.

(1) ANSI/IEEE C57.12.90 and ANSI/IEEE C57.98.

(2) State test voltage levels

(3) Provide oscillograms with test report.

c. Lifting and moving devices: "Basically the same design" for the lifting and moving devices test means a transformer in the same weight range as the transformer specified.

d. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

1.3.4.2 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. Polarity and phase relation

c. Ratio

d. No-load losses (NLL) and excitation current

e. Impedance voltage and load loss (LL)

f. Lightning impulse tests:

(1) ANSI/IEEE C57.12.90 and ANSI/IEEE C57.98

(2) State test voltage levels

(3) Provide oscillograms with test reports. As an alternative, oscillograms may be hand-delivered at the factory witness test.

g. Low frequency dielectric

(1) Applied voltage

(2) Induced voltage

h. Leak

1.3.5 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

1.3.5.1 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.

1.3.6 Records

a. Transformer test schedule.

1.3.6.1 Source Quality Control

The Government reserves the right to witness tests. Provide Transformer Test Schedule for tests to be performed at the manufacturer test facility. Submit required reports and notify the Purchaser 30 days before scheduling test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled dates and locations for testing.

1.3.7 Operation and Maintenance Manuals

a. Pad-mounted transformers, Data Package 5

1.3.7.1 Additions to Operation and Maintenance Manuals

In addition to requirements of Data Package 5, include the following on the actual pad-mounted transformer provided:

a. An instruction manual with pertinent items and information highlighted

b. An outline drawing, including front view and sectional views with items and devices identified.

c. Prices for spare parts and supply list

d. Routine and field acceptance test reports

e. Fuse curves for primary fuses

f. Information on watthour demand meter, CTs, and fuse block

g. Actual nameplate diagram

h. Date of purchase

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 16301, "Underground Electrical Work," Section 16370, "Overhead 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.

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-brake connectors, six high voltage busing wells with inserts configured for radial application, load-break switch handle, access to dry-well fuse canisters dead-front surge arrestors, tap changer handle, connector parking stands, protective caps, and ground pad.

a. Insulated high voltage load-break connectors: IEEE 386, rated 15 kV, 95 KV BIL. Current rating: 200 amperes rms continuous. Short time 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. Connectors shall have a steel reinforced hook-stick eye, grounding eye, test point and arc-quenching contact material.

b. Bushing well inserts: IEEE 386, 200 amperes, 15 kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise.

c. Load-break switch: Radial-feed oil-immersed type rated at 15 kV, 95 kV 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.

d. 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 serving the transformer. Interlock fuse canisters with the load-break switch so that the fuses may be removed only when the switch is in the "off" position. Fuses shall remove the transformer from service in case of an internal fault. Size fuses to approximately 150 percent of the transformer primary full load current rating and in accordance with fuse manufacturer's recommendations for dry-well mounting. 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.

e. Surge arresters: ANSI/IEEE C62.11, rated 12 kV, fully shielded, dead-front, elbow type suitable for plugging into bushing well inserts. Provide three arresters for radial feed circuits.

f. Parking stands: Provide a parking stand near each bushing well.

2.2.1.2 Low Voltage

Low voltage compartment shall contain low-voltage bushings with NEMA spade terminals, accessories, metering, stainless steel diagrammatic transformer nameplate, and ground pad.

a. Accessories shall include drain valve with sampler device, fill plug, pressure relief device, liquid level gauge, pressure-vacuum gauge, and dial type thermometer and maximum temperature indicator.

b. Metering

Shall consist of a socket-mounted outdoor watthour meter surface mounted flush against the side of the low-voltage compartment as indicated.

(1) Meter: ANSI C12.10. Provide watthour meter coordinated to ratios of current transformers and transformer secondary voltage. Meter shall be Class 20, Form 9S, suitable for 480Y/277 volt, three-phase, four-wire system with three current transformers. Meter shall meet Class II finish requirements. Meter cover shall be polycarbonate and the entire meter and socket assembly shall be lockable to protect against tampering and unauthorized meter removal. Provide watthour meter with not less than four pointer-type kilowatt-hour registers and mechanical demand register. Demand register shall be Scale Class 6 and shall be sweep pointer indicating type, with a 15-minute interval conforming to ANSI C12.4. Meter accuracy shall be within plus or minus one percent. Provide correct multiplier on face of meter.

(2) Meter fusing: Provide a fuse block mounted in the secondary compartment containing one fuse per phase to protect the voltage input to the watthour meter. Size fuses as recommended by the meter manufacturer.

(3) Socket: ANSI C12.7. Provide NEMA Type 3R, box-mounted socket having automatic circuit-closing bypass and having jaws compatible with requirements of the meter. Cover unused hub openings with blank hub plates. Paint box Munsell 7GY3.25/1.5 green to match the pad-mounted transformer to which the box-mounted socket is attached. The Munsell color notation is specified in ASTM C 1535.

(4) Current Transformers: ANSI/IEEE C57.13. Provide three current transformers with a metering accuracy Class of 0.3 through B-0.5 with a minimum RF of 3.0 at 30 degrees C, with 600-volt insulation, and 10 kV BIL. Size current transformers as indicated. Provide butyl-molded window type current transformers mounted on the low-voltage bushings. Route current transformer leads in a location as remote as possible from the power transformer secondary cables to permit current measurements to be taken with hook-on-ammeters.

2.2.2 Transformer

a. Oil-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.

b. Transformer shall be rated 1,000 kVA, 95 kV BIL.

c. Transformer voltage ratings: 12.47 kV Delta - 480WYE/277 V.

d. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage.

e. Minimum tested impedance shall not be less than 5 percent.

f. Audible sound levels shall comply with the following:

kVA	Decibels (MAX)
1000	56

g. Transformer shall include lifting lugs and provisions for jacking under base. 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.

2.2.2.1 Transformer Losses

a. "A" and "B" are given loss factors. A = 5.2; B = 2.1

b. "C" is the cost of losses. C = $9,600.00

c. "NLL" and "LL" are the transformer no-load losses (watts) and load-losses (watts), respectively.

2.2.2.2 Transformer Guaranteed Losses

Submit certified calculated values from the manufacturer, with the design test submittal, for the NLL and LL for each transformer. The calculated values submitted shall become the basis by which the losses determined during the routine tests are compared. If the routine test values differ from the previously submitted calculated values by more than the tolerances allowed by Table 19 in ANSI/IEEE C57.12.00, the transformer is unacceptable. The guaranteed losses as described in this paragraph in no way affect the price adjustments in the paragraph entitled "Deduct Clause.

2.2.2.3 Deduct Clause

After routine test results are available, Contractor shall perform actual transformer loss calculations (D) using test result values for NLL and LL,

and values specified above for A and B. Submit calculations for each transformer with the routine test submittal. Calculate using equation D = A(NLL) + B(LL).

a. If D ≤ C :

No adjustment will be made to contract price.

b. If D > C:

A unilateral contract modification will be issued in the amount of difference between C and D.

c. If D > 1.25(C): The transformer is unacceptable.

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 304 or 304L. Base shall include any part of pad-mounted transformer that is within 3 inches of concrete pad. 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. Paint coating system shall comply with ANSI C57.12.28 regardless of base, cabinet, and tank material. 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" and "Type II mineral oil" on the nameplate.

2.3 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" and Section 16370, "Overhead Electrical Work." Connect ground conductors to the upper end of the ground rods by exothermic weld. Provide compression connectors at equipment end of ground conductors.

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. Exothermic welds shall be installed as specified in Section 16301, "Underground Electrical Work," paragraph entitled, "Grounding."

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

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.

3.3.1 Meters and Current Transformers

ANSI C12.1.

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 6-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 protect at least 8 inches beyond the equipment. Provide conduit turn-ups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistance caulking or sealant. 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. Include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.5.1.1 Pad-Mounted Transformers

a. Visual and mechanical inspection

(1) Compare equipment nameplate information with approved shop drawings

(2) Inspect for physical damage, cracked insulators, tightness of connections, and general mechanical and electrical conditions

(3) Verify proper liquid level in tank

(4) Perform specific inspections and mechanical tests are recommended by manufacturer

(5) Verify proper equipment grounding

b. Electrical Tests

(1) Perform insulation-resistance tests

(2) Perform turns-ratio tests

(3) Sample insulating liquid. Sample shall be laboratory tested for:

(a) Dielectric breakdown voltage
(b) Acid neutralization number
(c) Specific gravity
(d) Interfacial tension
(e) Color
(f) Visual condition
(g) Power factor
(h) Water content

(4) Perform dissolved gas analysis (DGA)

(5) Test for presence of PCB

(6) Perform insulation power-factor tests or dissipation-factor tests on windings

3.5.1.2 Current Transformers

a. Visual and Mechanical Inspection

(1) Inspect for physical damage and nameplate information for compliance with approved shop drawings.

(2) Verify proper connection of transformers with system requirements.

(3) Verify tightness of bolted connections and ensure that adequate clearances exist between primary circuits and secondary circuit wiring.

(4) Verify that required grounding and shorting connections provide good contact.

b. Electrical Tests

(1) Perform insulation-resistance test

(2) Perform a polarity test

(3) Perform a ratio-verification test

3.5.1.3 Watthour Meter

a. Visual and Mechanical Inspection

(1) Examine for broken parts, shipping damage, and tightness of connections

(2) Verify that meter type, scales, and connections are in accordance with approved shop drawings

(3) Verify that when viewed from the top, the direction of rotation of the meter rotor is counter-clockwise

b. Electrical Tests

(1) Determine accuracy of meter

(2) Calibrate watthour meters to one-half percent

(3) Verify that correct multiplier has been placed on face of meter, where applicable

3.5.1.4 Grounding System

a. Visual and Mechanical Inspection

(1) Inspect ground system for compliance with contract plans and specifications

b. Electrical Tests

(1) Performance ground-impedance measurements utilizing the three-point method

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 NTR 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 C78.1353	1990 Electric Lamps - 70-Watt, 52-Volt, S62 Single-Ended High-Pressure Sodium Lamps
ANSI C82.11	1993 High-Frequency Fluorescent Lamp Ballasts
ANSI C82.4	1985 (Supp. 1988) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

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 A 580/A580M	1993 Stainless and Heat-Resisting Steel Wire
ASTM A 853	1991 Steel Wire, Carbon, for General Use

FEDERAL SPECIFICATIONS (FS)

FS QQ-N-281	(Rev. D) (Am. 2) Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IES)

IES LHBK	Lighting Handbook, References and Application 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 773	1987 (Bul. 1992) Plug-In, Locking Type Photocontrols for Use with Area Lighting
UL 773A	1989 Nonindustrial Photoelectric Switches for Lighting Control
UL 924	1990 (R 1991) Emergency Lighting and Power Equipment
UL 935	1984 (R 1992) Fluorescent-Lamp Ballasts
UL 1029	1986 (R 1991) High-Intensity-Discharge Lamp Ballasts
UL 1570	1988 (Bul. 1991) (R 1993) Fluorescent Lighting Fixtures
UL 1572	1991 (R 1992) High Intensity Discharge Lighting Fixtures

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." Lighting fixtures and accessories mounted on exterior surfaces of building are specified in this section.

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.

1.3.2 Total Harmonic Distortion (THD)

The root mean square (RMS) of all harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

Submit the following in accordance with Section 16011 and Section C, Part 7 of the Basic Contract. Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IES LHBK, as applicable, for the lighting system specified.

a. Exit signs

1.4.1 Manufacturer's Catalog Data

a. Fluorescent lighting fixtures G

b. Fluorescent electronic ballasts G

c. Fluorescent electromagnetic ballasts G

d. Fluorescent lamps G

e. High-intensity-discharge (HID) lighting fixtures G

f. HID ballasts G

g. High-pressure sodium (HPS) lamps G

h. Photocell switch G

i. Emergency lighting equipment G

j. Exit signs G

1.4.2 Statements

a. Qualification of manufacturer G

Certify that the manufacturer of fluorescent electronic ballasts meets requirements specified under paragraph entitled, "Qualification of Manufacturer."

1.4.3 Field Test Reports

a. Operating test

Submit test results as stated in paragraph entitled, "Field Quality Control."

1.4.4 Samples

a. Lighting fixtures, complete with lamps and ballasts G

1.4.4.1 Lighting Fixtures, Complete with Lamps and Ballasts

Submit one sample of each fixture type and large order item for inspection, review, and approval. The sample shall be retained for comparison against the remainder of the fixtures. The sample may be used in the final fixture installation.

1.4.5 Records

a. Information card G

For each electronic ballast manufacturer used in the construction, furnish a typewritten card, laminated in plastic. Card shall be 8-1/2 by 11 inches minimum and shall contain the information listed on Form 1 located at the end of this section. The card shall be turned over to the officer in charge of construction with warranty and equipment information. Send a photostatic paper copy to LANTNAVFACENGCOM, Code 1613, 1510 Gilbert Street, Norfolk, VA 23511-2699.

1.5 QUALITY ASSURANCE

1.5.1 Qualification of Manufacturer

Electronic ballast manufacturer shall be regularly employed in the manufacture of electronic ballasts and have a minimum of 3 years experience in manufacturing electronic ballasts in the United States. The date for determination of the experience claimed by the Contractor shall be the date specified for receipt of bids as shown on Standard Form 1442. Furnish evidence that specified ballasts are manufactured in the United States. The ballast manufacturer shall submit the following information for verification of successful electronic ballast installation. The submittal shall include a minimum of three separate installation contracts with at least the same quantity and quality ballasts as the specified project.

a. Installation location and mailing address

b. The installations' current facility manager and phone number

c. Installation completion date

d. System description including quantity and type of lamps and ballasts

e. Prime Contractor's name, address, and current phone number

1.6 ELECTRONIC BALLAST WARRANTY

Furnish the electronic ballast manufacturer's warranty. The warranty shall be directly between the manufacturer and the Government. The warranty period shall not be less than 5 years from the date of manufacture of the electronic ballast. Ballast assembly in the lighting fixture, transportation, and on-site storage shall not exceed 12 months, thereby permitting 4 years of the ballast 5-year warranty to be in service and energized. The warranty shall state that the malfunctioning ballast shall be exchanged by the manufacturer and promptly shipped to the using Government facility. the replacement ballast shall be identical to, or an improvement upon, the original design of the malfunctioning ballast.

PART 2 PRODUCTS

2.1 FLUORESCENT LIGHTING FIXTURES

UL 1570 Fluorescent fixtures shall have electronic ballasts unless specifically indicated otherwise.

2.1.1 Fluorescent Electronic Ballasts

The electronic ballast shall as a minimum meet the following characteristics:

a. Ballast shall comply with UL 935, ANSI C82.11, and NFPA 70 unless specified otherwise. Ballast shall be designed for operation of the lamps in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.

b. Power factor shall be 0.95 (minimum). Lamp current crest factor shall be 1.7 (maximum).

c. Ballast shall operate at a frequency of 20,000 Hertz (minimum).

d. Ballast shall have light regulation of plus or minus 10 percent lumen output with a plus or minus 10 percent input voltage regulation. Ballast shall have 10 percent flicker (maximum) using any compatible lamp.

e. Ballast shall be UL listed Class P with a sound rating of "A."

f. Ballast enclosure size shall conform to standards of electromagnetic ballasts. Ballast shall have circuit diagrams and lamp connections displayed on ballast packages. Ballast shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed. Ballast lamp lead wire color code shall comply with ANSI C82.11 for parallel or independent lamp operation.

g. Ballast shall operate in an instant start mode.

h. Ballast factor shall be 85 percent (minimum).

i. Electronic ballast shall have a full replacement warranty of 5 years from date of manufacture as specified in paragraph entitled "Electronic Ballast Warranty" herein.

2.1.1.1 T-8 Lamp Ballast

a. Ballasts shall be capable of starting and maintaining operation at a minimum of 50 degrees F for F32T8 lamps, unless otherwise indicated.

b. Total harmonic distortion (THD): Shall be less than 20 percent.

c. Input wattage:

(1) 62 watts (maximum) when operating two F32T8 lamps.

2.1.1.2 Electromagnetic Ballasts for Compact Fluorescent Lamps

Provide electromagnetic ballasts for compact fluorescent lamps as indicated on NL sketches.

2.1.2 Fluorescent Lamps

a. T-8 rapid start lamps shall be rated 32 watts (maximum), 2800 initial lumens (minimum), CRI or 75 (minimum), color temperature of 3500 K, and an average rated life of 20,000 hours.

b. Compact fluorescent lamps shall be 3500 K, 10,000 hours average rated life, and as follows.

(1) T-4, twin tube, rated 7 watts, 400 initial lumens (minimum).

Average rated life is based on 3 hours' operating per start.

2.1.3 Compact Fluorescent Fixtures

Compact fluorescent fixture shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Providing assemblies designed to retrofit incandescent fixtures is prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall use lamps as indicated.

2.2 HIGH-INTENSITY-DISCHARGE (HID) LIGHTING FIXTURES

UL 1572.

2.2.1 HID Ballasts

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 the voltage system to which they are connected.

b. Designed for installation in a normal ambient temperature of 40 degrees C.

c. Constructed so that open circuit operation shall not reduce the average life.

High-pressure sodium (HPS) ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 3500 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 degrees C in any mode.

2.2.2 High-Pressure Sodium (HPS) Lamps

HPS lamps shall be:

a. 70 watt conforming to ANSI C78.1353

2.3 SUSPENDED FIXTURES

Provide hangers capable of supporting twice the combined weight of the fixtures supported by the hangers. Hangers shall allow fixtures to swing within an angle of 20 degrees. Brace pendants 4 feet or longer to limit swinging. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple unit or continuous row fluorescent fixtures shall have a tubing of stem for wiring at one point and a tubing or rod suspension.

2.4 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide cell rated 277 volts ac, 60 Hz with single-throw contacts rates 1000 watts and 277 volts. Provide switch integral to the fixture in a high-impact-resistant noncorroding and nonconductive molded plastic housing with a locking-type receptacle conforming to ANSI C136.10. Switch shall turn on below 3 footcandles and off at 3 to 10 footcandles A time delay shall prevent accidental switching from transient light sources.

Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.

2.5 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered.

2.5.1 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. 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.

2.6 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated.

2.6.1 Emergency Lighting Unit

Provide as indicated. 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. Equip unit with brown-out sensitive circuit to activate battery when ac input falls to 75 percent of normal voltage.

2.7 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

2.7.1 Wires

ASTM A 853, grade 1010, annealed, light zinc-coated finish 0.1055 inches in diameter (12-gauge).

2.7.2 Wires, for Humid Spaces

ASTM A 580/A 580M, composition 302 or 304, condition annealed stainless steel or FS QQ-N-281, Class A nickel-copper alloy, 0.1055 inches in diameter (12-gauge).

2.7.3 Straps

Galvanized steel, 1-inch by 3/16-inch, conforming to ASTM A 526/A 526M, with a light commercial zinc coating or

2.7.4 Rods

Threaded steel rods, 3/16-inch diameter, zinc or cadmium coated.

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. Recessed and semi-recessed fixtures may be supported from suspended ceiling support system ceiling tees when the ceiling system support wires or rods are provided at a minimum of four wires or rods per fixture and located not more than 6 inches from each corner of each fixture. For recessed fixtures, provide support clips securely fastened to ceiling grid members, a minimum of one at or near each corner of each fixture. For round fixtures or fixtures smaller in size than the ceiling grid, provide a minimum of four wires or rods per fixture and locate at each corner of the ceiling grid in which the fixture is located. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently or with at least two 3/4-inch metal channels spanning, and secured to, the ceiling tees. Provide wires or rods for lighting fixture support in this section.

3.1.1 Exit Signs and Emergency Lighting Units

Wire exit signs and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area.

3.1.1.1 Exit Lights

Wire exit lights on separate circuits and serve from a separate breaker. Lights shall have only one control, which shall be the separate breaker. Paint control device red and provide lockout.

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 16910

PLC SYSTEM AND CONTROL WIRING INTERFACE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

The following are also related documents to this specification:

a. Process Description and Control Philosophy Report for Marine Corps
Base Camp Lejeune, North Carolina
Groundwater Treatment System, Operable Unit No. 2
Contract Task Order (CTO)-222
Baker Job No. 62470-222-1000-05401

b. ANSI/ISA - S5.01 - Instrumentation Symbols and Identification

c. Related Sections: The following sections contain requirements that elate to this section:

Section 16011 - General Requirements
Section 16301 - Underground Electrical Work
Section 16402 - Interior Wiring System
Section 16920 - Instrumentation Installation

1.2 SUMMARY

This section includes a Programmable Logic Controller (PLC) complete with input/output (I/O) racks, internal and external power supplies, communication modules, isolated analog input and output cards, isolated digital input and output cards, hardware and software. As part of the overall system a PC workstation and interface software will be included. The control wiring interface shall include all necessary conduit, wire, cables, etc., to interconnect all devices and control equipment. System installation, start-up and testing including services of trained technicians shall be included in order to make the system function as indicated and intended.

PC Workstation: personal computer to provide English driven menu commands with graphs to interface with relay logic utilized by the PLC.

1.3 SYSTEM DESCRIPTION

The PLC shall be a solid state relay ladder diagram processor unit that performs all of the monitoring and control of the function identified. The

PLC shall be connected to a PC workstation that will enable an English language menu and interface between an operator and the PLC. The PC workstation software shall be Windows Version 3.1 based and provide the necessary programming and graphic displays to enable an operator to control, monitor and modify the control system operations. The PLC shall be interfaced with the system instrumentation, process controls, contactors, starters and other controlling/monitoring devices. All external devices shall be interfaced to the respective I/O cards at the PLC or its remote unit. Interface between the PLC and analog signal devices shall be by instrument cable installed in conduit. The PLC shall be properly programmed to provide the functions as identified by the Process Description and Control Philosophy Report.

1.4 SUBMITTAL

Submit Contractor Drawings, diagrams, catalog cuts, etc., in accordance with Section 01010, "General Paragraphs" for the following:

1.4.1 Manufacturer's Catalog Data

a. Programmable Logic Controller G

b. PC Workstation Software G

c. PC Workstation G

1.4.2 Drawings

a. Working Drawings for Complete System G

1.4.2.1 Working Drawings

Working Drawings shall be provided for the complete system and shall show location of all field devices, conduit sizes, cable/wire sizes and quantities and cable/wire schedules. Simplified logic block diagrams or flow charts shall be provided during the development of the PLC application software. Working drawings shall include the following:

a. System Overview Schematic Diagram showing signal and power interconnecting wiring

b. Scaled Panel/Enclosure Drawings

c. Schematic and Connection Diagrams for all Input/Output devices

d. Complete Application (ladder diagram) Program

e. Testing procedures, recommended spare parts list, installation instruction for all equipment

1.4.3 Operation and Maintenance Manual

Submit an Operations and Maintenance (O&M) manual in accordance with Section 01730, "Operation and Maintenance," for the complete system, including all field modifications, PLC system and PC workstation. All information included in the O&M manual shall be marked up and modified to properly present the system and components installed including all options, etc.

a. Programmable Logic Controller System, Data Package 5 G

b. PC Workstation, Data Package 4 G

1.5 QUALITY ASSURANCE

The PLC system shall be supplied by a systems manufacturer or systems house experienced in the design, configuration, and programming of process systems using programmable logic controllers for groundwater treatment systems and the waste water industry.

a. The Supplier must have a minimum of 3 years experience in the industry and must have at least three completed similar systems successfully operating in the field.

b. The Supplier shall have the capability of providing prior to system delivery a complete system factory test and simulation which will include connection and operation of system inputs/outputs and verification and functional and operational requirements.

c. The Supplier shall submit evidence of completion and references for at least three similar projects.

d. Comply with the following codes, regulations, etc.

1. Components and installation: NFPA 70 National Electrical Code, 1993 Edition.

2. Listing and Labeling: Provide products specified in this section that are listed and labeled as defined by article 100 of the National Electrical Code.

3. NEMA Compliance: NEMA ICS2, "Industrial Control Devices, Controllers and Assemblies."

4. UL Compliance: UL508, "Electrical Industrial Control Equipment."

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.1.1 Programmable Logic Controller

Programmable Logic Controller (PLC): The PLC subject to compliance with requirements provide products by one of the following:

1. Allen-Bradley Company
2. General Electric Company
3. Siemens
4. Gould-Modicon

2.1.2 PC Workstation Software

PC workstation software subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to:

1. ICOM, Inc.
   Milwaukee, WI
2. Wonderware
   Irvine, CA

2.2 GENERAL REQUIREMENTS

1. Equipment furnished for front panel enclosure mounting shall be suitable for flush mounting.
2. Equipment shall return to accurate measurement upon restoration of power after a power failure.
3. Control panels, electrical equipment, meter, and controls, etc., shall be furnished with six spare fuses of each different size used and 12 lamps of each different kind used.
4. Panel-mounted equipment, switches, controls, etc., shall be identified with engraved plastic nameplates.
5. Wiring diagrams shall be furnished for the PLC cabinet and control panels. The diagrams shall be revised to show "as-built" circuitry and equipment and shall show connections from numbered terminal blocks to external equipment. Color coding and relay terminal numbers shall also be indicated.

6. Material 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 two years prior to bid opening.

7. Field-mounted instruments shall be identified by loop number and function, using engraved tags permanently affixed to each item.

8. Interconnecting cables required for complete system operation shall be provided with the system. These cables shall include instrument cables, data highway cables, AC and DC power, and control cables. Accessories, such as special test equipment and tools, shall be provided.

9. A minimum of 10 percent of each type of circuit board or module provided in the system shall be provided as spare (1 board or module for each 10 boards or modules actually used in the system). A minimum of 1 of each type of circuit board of module provided in the system shall be provided as spare. A minimum of 100 percent circuit board or module space shall be provided in the card rack assembly for the installation of additional Input/Output circuit boards or modules. Special maintenance hardware and software required to operate, maintain, test, and troubleshoot the system shall also be provided.

2.2.1 Power Supply Requirements

1. Instruments and devices provided, except as otherwise specified, shall operate on 120-volt plus or minus 10 percent, 60-hertz, plus or minus 1 hertz, single-phase power. A regulator or power supply shall be provided for instruments or devices requiring closer regulation or a different voltage.

2. An integral on-off switch and fuse shall be provided for each instrument requiring electric power connections.

3. Remote-motor-operated or electrically operated equipment shall have a separate 120-volt control circuit.

4. Controls for remote electrically operated or motor-driven equipment shall be complete, including necessary auxiliary relays, so as to require only wiring and connection to the equipment control circuit. Contacts for control of remote motor operation or electrically operated equipment shall be rated not less than 50 percent above the required rating.

2.3 Programmable Logic Controller (PLC)

2.3.1 General

a. A complete microprocessor-based programmable logic controller (PLC) system shall be provided to control and monitor the operation of process equipment as identified in the Process Description and Control Philosophy Report and as shown on the drawings and as specified herein.

b. The programmable logic controller and associated equipment shall be installed in a NEMA enclosure to be located in the control room.

c. The PLC enclosure shall house the PLC, card racks, power supplies, I/O modules, labeled terminal blocks for field wiring terminations, ground bus, fuse blocks, and other associated equipment. Enclosure shall be completely pre-wired by systems manufacturer or systems house in a free standing, two door, 12 gauge steel, NEMA 12 enclosure. Enclosure to be provided with cooling fans, filter intake grill, internally mounted duplex convenience receptacle. Enclosure doors to be provided with ON (Red)/OFF(Green) indicator lights controlled from a door mounted main power ON/OFF key locking pistol grip switch. Doors to be provided with emergency stop push button for control of process, "common" alarm annunciator light, "common" alarm annunciator horn and horn/light reset pushbutton.

d. System hardware shall be of the latest solid-state modular design and shall be surge protected to ensure proper operation on an industrial power system.

e. The programmable logic controller system shall be Model PLC-5/20 manufactured by Allen-Bradley or equal. The drawings and specifications indicate the Allen-Bradley system configuration. Contractor to verify and coordinate voltage, wiring and interface requirements of process equipment furnished by this contractor, or as a part of a vendor supplied package which may alter the system configuration and wiring requirements of the system shown and specified.

2.3.2 Components

a. All hardware components shall be capable of operation in an environment of 0 to 60 degrees C (32 to 140 degrees F) in an atmosphere of 5 to 95-percent relative humidity with no condensation.

b. The programmable controller shall provide a means for mounting the chassis in a standard cabinet or 19 inch rack.

c. The CPU shall have the capacity of addressing 960 discrete input and output points and 96 analog points. It shall also have the ability to communicate with up to 16 physical locations.

d. Each input and output module shall be a self-contained unit housed within an enclosure. These input/output enclosures with their respective modules shall be field expandable up to 128 unique locations.

e. The programmable controller shall include as a standard feature the capability of addressing remote input and output modules up to 10,000 cable feet from the processor. The communication link between the CPU and any remote input and output distribution chassis shall be either via a 20 AWG tinned copper twin-axil cable with braided and foil shields or via fiber optic cable.

f. The communication rate between the CPU and the remote input/output modules shall be user selectable on a per channel basis. At a distance of 10,000 cable feet between the processor and the input and output modules the transmission rate shall be no less than 57.6 Kbaud. If the distance in cable feet is reduced, then this transmission rate may be increased.

g. The programmable controller shall use two independent, asynchronous scans. One scan shall be designated for processing of input and output information only, with the second scan dedicated exclusively to the processing of the logic program. With this criterion it shall be possible to group remote discrete input and output devices to achieve an I/O update time of 7-10 milliseconds per 128 I/O. Input and output devices located in the same backplane (local I/O) as the CPU should be scanned in under 2 milliseconds. Concurrent with this I/O update time, the processing of a typical logic program shall not exceed 2 milliseconds for 1024 relay type instructions with a maximum overhead of 4 milliseconds.

h. The programmable controller shall have the ability to communicate with a remote I/O rack configured with multiple I/O chassis. Each logical rack of remote I/O can be configured with one or more chassis containing 2, 4, 6, or 8 I/O groups. I/O status and control information indicated rack faults, reset commands, and inhibit commands at the chassis level. Both rack status and control information allowing for indications of rack faults and control including I/O rack reset and inhibit control bits shall be available to the quarter rack level.

2.3.3 Main Frame Hardware

a. The CPU shall be a self-contained unit, and will provide Ladder Rung program execution and support remote or local programming. This

device will also supply I/O scanning and inter-processor and peripheral communication functions.

b. The operating system shall be contained in removable programmable devices which allow for easy field replacement.

c. In a single chassis system all system and signal power to the CPU, support modules shall be distributed on a single motherboard or backplane. No interconnecting wiring between these modules via plug-terminated jumpers shall be acceptable.

d. The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating a "green" indicator when no-fault is detected and a "red" indicator when a fault is detected.

e. All modules within the system shall be mechanically interlocked to prevent insertion or removal of modules under power which in turn helps to prevent damage to the modules and/or system.

f. The main CPU shall include a connector that provides inter-processor communications to peripheral support devices.

g. The main chassis front panel shall include indicators showing the following status information:

1. If power is applied to the CPU
2. Program or Run mode of the CPU
3. The Run/Fault status of the CPU
4. Enabled/Disabled state of outputs
5. State of the I/O adapters
6. If forcing is active
7. If a remote device is talking via the inter-processor communications link

h. Processor mode and status of the I/O shall be selected by a toggle/key switch mounted on the front panel of the CPU.

i. Non-volatile memory shall store the operating system information to protect against loss in the case of power loss or system shut-down. Only at the time of a hardware change or system software program change shall this configuration status be altered or re-entered.

2.3.4 Power Supplies

a. The programmable controller shall operate in compliance with an electrical service of 120 VAC, single phase, in the frequency range from 47 to 63 Hz, or 24 VDC.

b. The manufacturer shall provide as standard equipment a system power supply capable of converting 120 VAC line power to the DC power required to operate the programmable controller system.

c. A single main power supply shall have the capability of supplying power to the CPU and local input/output modules. Auxiliary power supplies shall provide power to remotely located racks.

d. The power supply shall automatically shut down the programmable controller system whenever its output current is detected as exceeding 125% of its rated current.

e. The power supply shall monitor the incoming AC line voltage for proper levels. When the power supply is wired to utilize 120 VAC power, the system shall function properly within the range of 97 to 132 VAC. If the voltage level is detected as being out of range for more than one-half line cycle, the power supply shall automatically shut down the system and remain disabled until the proper voltage level returns. In addition, the power supply shall provide surge protection, isolation, and outage carry-over up to 2 cycles of the AC line.

2.3.5 Program Storage

a. The program storage medium shall be of a solid state RAM (volatile) type.

b. The programmable controller system shall be capable of addressing up to 12 K words, where each word is comprised of 16 data bits.

c. Memory shall be available in 6K, 10K, 13K, 14K, 17K, or 21K word segments of RAM. Memory capacity shall be sized to allow for the most economical match to the intended application. As a means of upgrading the system each memory segment shall be field expandable up to the maximum number of memory words addressable by the programmable controller.

d. Memory shall contain battery back-up capable of retaining all stored program data through a continuous power outage for 12 months under worst case conditions. The capability shall exist to remove all batteries from the system without removing system power.

e. The operator shall be able to backup volatile memory, including data and program logic onto either a 3 1/2 inch diskette or winchester hard disk, at their option.

f. A minimum of 6144 16 bit words shall be allocated from main memory for the purpose of data storage. The programmable controller system shall be capable of storing the following data types:

1. External Output Status
2. External Input Status
3 Timer Values
4. Counter Values
5. Signed Integer Numbers (16 bit)
6. Floating Point Numbers
7. Decimal Numbers
8. Binary Numbers
9. Direct and Indexed Addressing
10. Internal Processor Status Information
11. ASCII and Control Structures

g. If contacts or entire rungs are intentionally deleted from an existing logic program, the remaining program shall be automatically repositioned to fill this void. Whenever contacts or entire rungs are intentionally inserted into an existing program, the original program shall automatically be repositioned to accommodate the enlarged program.

h. To reduce the effective scan time in order to detect short pulse duration inputs, it shall be possible to program a select logic rung more than once into memory.

i. The number of times a normally open (N.O.) and/or normally closed (N.C.) contact of an internal output can be programmed shall be limited only by the memory capacity to store these instructions.

2.3.6 Input and Output - General

a. Each input or output module shall be a self-contained unit housed within an enclosure.

b. The input/output enclosure (chassis) with its respective modules shall be of universal type and compatible with any, programmable controller manufactured by the supplier.

c. During normal operation, a malfunction in any remote input/output channel shall affect the operation of only that channel and not the operation of the CPU of any other channel.

d. Any remote input/output channel shall be field selectable to shut down the CPU upon failure of that channel.

e. Isolation shall be used between all internal logic and external power circuits. This isolation shall meet the minimum specification of 1500 VRMS.

f. It shall be possible to replace any input or output module without disturbing field wiring.

g. Each I/O module shall contain a visual indicator to display ON/OFF status of individual input or output points.

h. Discrete output modules shall be provided with self-contained fuses for overload and short circuit protection of the module. These cards shall also be capable of having fused swing arms per point so as not to disturb the card and/or wiring while changing a blown fuse.

i. All user wiring to I/O modules shall be through a heavy-duty terminal strip.

j. All input/output modules shall be color coded and titled with a distinctive label.

k. All input modules shall have a specified filter time constant to limit the effects of voltage transients.

2.3.7 Input and Output Modules

a. The programmable controller manufacturer shall offer discrete input/output hardware consisting of the following types:

2.3.7.1 Inputs

1. AC input for devices which operate at 120 VAC, 50/60 Hz.

2. Isolated AC input which provides isolation of 120 VAC input signals.

2.3.7.2 Outputs

1. AC output for devices which operate at 120 VAC, 50/60 Hz.

2. Isolated AC output which provides six isolated outputs capable of switching 120 VAC or 220 VAC power.

3. Contact output which provides four (4) normally open and four (4) normally closed reed relay outputs.

4. Contact output which provides eight (8) normally open and eight (8) normally closed reed relay outputs.

b. Analog I/O modules of the following types shall be offered by the manufacturer:

Analog input which accepts analog signals and converts them to three digit BCD, four digit BCD or sixteen (16) bit binary values. Digital resolution shall be available in 1 part in 256, 1 part in 1000 (BCD), or 1 part in 4096 (binary). Analog inputs shall be available in single-ended, sourcing, differential, and differential isolated versions. Analog inputs shall be available in the following ranges:

1. Voltage range: 0 to plus 5 VDC, plus 1 to plus 5 VDC, 0 to plus 10 VDC, minus 5 to plus 5 VDC,minus 10 to plus 10 VDC.

2. Current range: 4 to 20 mA, 0 to 20 mA, minus 20 to plus mA.

Analog output which converts a three digit BCD number, a four digit BCD number, or a 16 bit binary number into an equivalent single-ended analog output signal. Output isolation shall be available. Analog outputs shall be available in the following ranges:

1. Voltage range: plus 1 to plus 5 VDC, 0 to plus 10 VDC, minus 10 to plus 10 VDC.

2. Current range: 4 to 20 mA, 0 to 50 mA.

2.4 PC Workstation

The PC Workstation shall enable the operator to communicate with the PLC. The Workstation shall operate in conjunction with the PLC and shall include an IBM compatible 80486 Dx computer complete with 8 Meg of RAM, 5 1/4 inch 3-1/2-inch diskette drive and 40 Meg hard drive, alphanumeric keyboard, mouse, PLC interface card, modem, 19-inch (1024 x 768) VGA touch screen color monitor with 256 color driver card, 15-inch wide carriage 20-pin dot matrix printer and necessary cabling.

a. The PC Workstation software shall be Windows based using Version 3.1 and/or Workgroups 3.11.

b. The interface software between the PC and the PLC shall be ICOM-WINtelligent Linx for acquiring PLC data for data logging, process monitoring and reporting functions.

c. Provide WINtelligent Logic 5 ladder logic development and maintenance software package to allow mouse-based editing, cut and past, symbolic addressing, import/export functions and I/O monitoring.

d. Provide WINtelligent View software for creation of graphics screens indicating animation of process including visual action/reactions for changes in process set points, operator passwords for multiple level security access, alarm conditions and alarm acknowledgements via keyboard or mouse response

e. Provide interface software to transmit "critical" alarms via modem to the Public Works Center Control Station, or a location designated by the Government. Interface Software, Modem Transmission Rate and Modem Type to be compatible with the receiving equipment at the Public Works Center Control Station.

PART 3 EXECUTION

3.1 Installation

Equipment shall be installed as recommended by the manufacturer to conform to the particular application involved in accordance with the details shown. Installation of equipment and connections to equipment shall be completed in every detail in a first-class workmanlike manner. The electrical control loop drawings and system architecture drawings shown are for purposes of guidance and to show functional requirements only. They do not necessarily contain or show components required to accomplish the desired results or components required to interface equipment. Parts, equipment, devices, etc. necessary to meet the functional and interface requirements shall be provided by this contractor. Prior to acceptance, the contractor shall test each piece of equipment and shall furnish written certification that it has been installed in accordance with the manufacturer's requirements, and is calibrated and ready to begin operation.

Conduit, power wiring, control and signal wiring, fittings, and related material shall be provided in accordance with Section 16011 and 16402.

3.2 Manufacturer's Start-up Services and Calibration

The services of a factory-trained, qualified service representative of the equipment supplier shall be provided for a minimum of 5 days to inspect the complete equipment installation to ensure that it is installed in accordance with the manufacturer's recommendations, to verify the calibration and proper operation of all field instruments, to make adjustments necessary to place the system in trouble-free operation, and to instruct the operating personnel in the proper care and operation of the equipment provided. This requirement shall include living expenses and travel to and from the factory or service center and the jobsite.

3.3 Testing

The entire Process Control System shall be tested as follows:

3.3.1 Factory Acceptance Testing

The entire programmable logic controller system, including all input/output units, PC-workstation etc. shall be assembled and tested before shipment to the site. This testing shall include a complete system simulation with inputs and outputs connected to simulation test equipment. Test and simulation

procedures shall be submitted and approved prior to testing. The tests shall ensure that all hardware and software are operating properly. As a minimum, the factory testing shall include the following:

a. Demonstrate all functions and features of the system described in the specifications.

b. Demonstrate the complete sequence of operation for the facility as described in Process Description and Control Philosophy Report.

c. Simulate all analog and discrete input signals, and demonstrate proper operation of all analog and discrete output signals.

d. Demonstrate all system interlocks and alarm functions.

3.3.2 Preliminary Inspection/Test

a. Repeat all factory tests and simulations to verify that the system is properly interconnected and was not damaged during shipment.

b. Electrical wiring shall be checked for continuity, and instruments shall be checked for proper installation and operation.

c. Contractor shall submit complete procedures for testing and checking instrumentation system as part of the submittal of contractor's Drawings. Testing procedures shall be approved by the Government prior to testing. Equipment to be used by the contractor or his subcontractors and/or suppliers during the performance of the testing shall be specified in the procedures by manufacturer and model number.

d. After the complete Process Control System, including panels and input/output cabinets, field-mounted equipment, wiring, and piping has been installed and checked for proper operation by the appropriate field service engineers, the Subcontractor shall check the complete system for functions specified and indicated per the Process Description and Control Philosophy Report.

e. Verify that each analog and discrete input and output point is connected to the system in accordance with the Subcontractor's Drawings and operates properly.

f. Start and stop all equipment manually from the PLC by forcing the appropriate output device on and off a minimum of three times for each unit.

g. Demonstrate all system interlocks and alarms.

3.3.3 Prefinal Inspection/Test

Prefinal inspection/test will not be required; however, the system shall be required to operate continuously within established parameters including alarms for a 7 day period with no failures before it will be accepted by the Government.

3.3.4 Test Reports

Complete test procedures, final test reports, and results shall be submitted in accordance with Section 01010.

4.1 Training Requirements

1. The PLC System supplier shall provide on-site training to cover the following topics:

   a. System hardware.

   b. Operation and programming.

   c. Maintenance, repair, and troubleshooting.

2. A minimum of 5 (8-hour) days of training shall be provided by competent instructors on each topic listed above for a minimum of three personnel. Required training materials, audio-visual aids, O&M manuals, and documents shall be provided. The training shall stress hands-on experience and shall be specific to the equipment and software provided and to the system application in particular.

--End of Section--

SECTION 16920

INSTRUMENTATION INSTALLATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

The following are also related documents to this specification:

a. Process Description and Control Philosophy Report for Marine Corps Base Camp Lejeune, North Carolina
Groundwater Treatment System, Operable Unit No. 2
Contract Task Order (CTO)-222
Baker Job No. 62470-222-1000-05401

b. Revised "Instrument List Operable Unit No. 2 MCB Camp Lejeune North Carolina Groundwater Treatment"
CTO-222
Baker Job No. 62470-222-1000-05401

c. ANSI/ISA - S5.1 Instrumentation Symbols and Identification

d. Related Sections: The following Sections contain requirements that relate to this Section:

Section 05500 - Metal Fabrications
Section 16011 - General Requirements
Section 16301 - Underground Electrical Work
Section 16402 - Interior Wiring Systems
Section 16910 - PLC System and Control Wiring Interface

e. Relation Drawings: The following Drawings contain requirements that relate to this Section:

Type of Drawing	Drawing No.
*P&ID Drawings	P-3 through P-7
*Electrical Site/Building Drawings	E-1 through E-7
*Electrical Control Loop Drawing	E-8 through E-23
*Instrument Installation Details	E-24 and E-25
*Electrical Instrumentation System	E-26 through E-28
Architectural Drawings	A-1 through A-4

1.2 SUMMARY

The work to be performed under the terms of this specification shall consist of furnishing all materials (except as specifically noted as "vendor furnished" with packaged units noted on Drawings), labor, supervision, transportation, tools and services required to properly size and furnish, fabricate, erect and/or install, check-out, test and start-up all equipment and materials necessary to complete the instrumentation installation work described herein. The scope of Instrumentation work to be furnished and installed is defined by the Instrument list noted in Section 1.1.b above. Instrumentation provided shall meet the control parameters as described in the Process Description and Control Philosophy noted in Section 1.1a above and shall interface with the Programmable Logic Controller (PLC) as noted in Section 16910 of this specification.

1.3 SUBMITTALS

Submit Shop Drawings, Diagrams, catalog cuts, data sheets, etc. in accordance with Section 01010, "General Paragraphs" for the following:

1.3.1 Manufacturer's Catalog Data

a. Shop Drawings, Catalog cuts and Data Sheets G

1.3.1.1 Shop Drawings, Catalog Cuts and Data Sheets

Shall be provided for system instrumentation and shall include but not limited to:

a. Flow Control Valves (I/P converter operated)
b. Flow Meters
c. Totalizing/Indicating Flow Meters
d. Flow Transmitters
e. Field Mounted Hand Switches (HOA)
f. Level Transmitters
g. Level/Indicating Transmitters
h. Level Switches
i. Pressure Gauges
j. Pressure Transmitters
k. Temperature Indicators
l. Restricting Orifice Plates
m. pH Meter/Transmitters
n. Flow Valves (solenoid operated)
o. Variable Speed Motor/Controllers
p. Weir Box Flow Meter/Level Transmitter

1.3.2 Drawings

a. Schematic Diagrams

1.3.2.1 Schematic Diagrams

Provide schematic diagrams showing signal and power interconnection wiring for all transmitters, controllers, process meters, etc.

1.3.3 Operation and Maintenance Manuals

a. Operations and Maintenance (O&M) Manual Data Package 4 G

1.3.3.1 Manual

Submit an Operations and Maintenance (O&M) manual in accordance with Section 01730, "Operation and Maintenance Data" for each instrument with associated hardware, control element, etc., including all field modifications. All information included in the O&M manual shall be marked up and modified to properly represent the components installed including all options etc. O&M manual shall include routine and preventative maintenance schedules for each piece of equipment.

1.4 QUALITY ASSURANCE

The Instrumentation equipment shall be supplied by an Instrumentation Systems House experienced in providing control Equipment/Instrumentation for the waste water industry. It shall be the responsibility of this equipment supplied to coordinate all interfacing requirements with the PLC systems house to insure a complete and operational system as described in the Process Description and Control Philosophy Report.

a. The supplier must have a minimum of 3 years experience in the industry and must have completed at least three similar projects which are successfully operating in the field.

b. The supplier shall submit evidence of completion and references for at least three similar projects.

c. Material, workmanship, and performance shall comply with applicable parts of the following codes and standards.

ISA - Instrument Society of America
OSHA - Occupational Safety and Health Act
NEC - National Electrical Code
IEEE - Institute of Electrical and Electronic Engineers
UL - Underwriters laboratories, Inc.
ASTM - American Society for Testing and Material
NEMA - National Electrical Manufacturers Association

PART 2 PRODUCTS

2.1 Manufacturers

Instrumentation Equipment Supplier Manufacturers are subject to compliance with requirements of Final Design parameters and manufacturers as recommended by OHM Remediation Services Corp.

2.2 General Requirements

a. Instruments furnished for front panel enclosure mounting shall be suitable for flush mounting. Electronic/Electrical instrumentation shall be mounted in NEMA 12 enclosures.

b. Instruments shall return to accurate measurement upon restoration of power after a power failure.

c. Control panels, instruments, meters, and controls, etc., shall be furnished with six spare fuses of each different size used and 12 lamps of each different kind used.

d. Instruments, switches, controls, etc., shall be identified with engraved plastic nameplates.

PART 3

3.1 GENERAL REQUIREMENTS

The equipment shall be assembles and installed in accordance with the manufacturer's drawings and instruction manuals to conform to the particular application involved with the details shown. The contractor shall adhere to all dimensions, clearances, tolerances and manufacturer~s methods of assembly and installation. All equipment shall be thoroughly inspected, cleaned, and properly protected during storage, erection, and installation. Construction materials including; impulse tubing, fittings, flange bolts, gaskets, pipe stands, instrument isolation valves, supports, unions, mounting hardware, welding materials, and all other necessary materials and labor to provide for the proper installation and functional operation of all instrumentation shall be provided by the Contractor. Prior to acceptance, the Contractor shall test each piece of equipment and shall furnish written certification that it has been installed in accordance with the manufacturer's requirements, and is calibrated and ready to begin operation.

3.2 Instrument Mounting

Instrument Installation details provided on contract drawings show typical mounting details for most instruments. If manufacturers instructions differ from the provided details, the manufacturers details shall govern the installation. For instruments with no mounting details shown, the Contractor

shall follow the instrument manufacturer's mounting/installation drawings and/or instructions. Provide for the fabrication and painting of all mounting hardware per Section 05500.

3.3 Instrument Location

Drawings do not show the exact location of instruments, the Contractor shall be responsible for properly locating and mounting this equipment. All instruments shall be located with as much consideration as practical given to:

a. Ambient temperature must not exceed the Instrument Manufacturer's recommendations.

b. Good accessibility for maintenance.

c. Support should be free of vibration.

d. Minimum exposure to dust, corrosive fumes, water, etc

e. Instruments shall not obstruct open areas, walkways, etc.

f. Instruments shall not be mounted on equipment that requires periodic removal or replacement or maintenance.

g. Pipe runs before or after instruments should be of straight lengths as required by the instrument manufacturer (as applicable).

3.4 Testing

a. Manufacturer's Start-up Services and Calibration

The services of a factory-trained, certified manufacturers representative of the Instrumentation Supplier shall be provided to inspect the instrument installations to insure that they have been installed in accordance with the manufacturer's recommendations, to calibrate all field instruments, and to assist the PLC Systems House Representative in the preliminary and prefinal inspection/tests as indicated in Section 16910.3.3.2 and 16910.3.3.3. This requirement shall include all expenses and travel to the jobsite.

b. Test Reports

Complete test procedures, final test reports, and results shall be submitted in accordance with Section 01010.

-- End of Section --