04.07-06/18/93-01563

DEPARTMENT OF THE NAVY

ATLANTIC DIVISION, NAVAL FACILITIES ENGINEERING COMMAND

NAVAL STATION, NORFOLK, VIRGINIA

HADNOT POINT INDUSTRIAL AREA SHALLOW AQUIFER GROUNDWATER TREATMENT SYSTEM

AT

MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

LANTDIV Construction Contract No. N62470-92-B-2255

NAVFAC Specification No. 05-92-2255

Specification Prepared by:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

JUNE 18, 1993

A/E Contract No. N62470-89-D-4814
Contract Task Order 0134

Specification Approved by:

Specification Branch Head: M. Mutter, P.E.
Engineering and Design Director: William Crone, P.E.
For EFD for Commander, NAVFAC: _____
Date: _____

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SECTION 00101

INSTRUCTIONS TO BIDDERS (CONSTRUCTION CONTRACT)

PART 1 GENERAL

1.1 REFERENCES

Not used.

1.2 SOLICITATION DEFINITIONS - SEALED BIDDING (JUL 1987)

a. "Government" means United States Government.

b. "Offer" means "bid" in sealed bidding.

c. "Solicitation" means an invitation for bids in sealed bidding.

(FAR 52.214-1)

1.3 BIDS

1.3.1 General Information

Instructions to Bidders and Standard Form 1442 (Solicitation, Offer, and Award) shall be observed in the preparation of bids. Bidders shall affix their names and return addresses in the upper left corner of the bid envelope. Envelopes containing bids must be sealed.

1.3.1.1 Procurement Integrity - Notice

Complete and return the Certificate of Procurement Integrity. Failure to submit the signed certificate with the bid shall render the bid nonresponsive.

1.3.2 Bid Requirements

Bids shall be submitted in triplicate on Standard Form 1442 (Rev. 4-85) and, for bids of $25,000 or greater, shall be accompanied by a bid guarantee as stipulated in paragraph titled "Bid Guarantee" of this section. Bid security shall be in the sum of 20 percent of the largest amount for which award can be made under the bid submitted, but in no case to exceed $3 million. The bid guarantee bond shall be accompanied by a verifax or other facsimile copy of the agent's authority to sign bonds for the surety company.

1.3.3 Basis of Bid

The basis of bid shall be lump sum price for the following items:

1.3.3.1 Base Bid

a. Price for the entire work, complete in accordance with the drawings and specifications, but excluding additional extraction wells

as described in Additive Item No. 1.

b. Price for installation of additional extraction wells complete in accordance with the drawings and specifications and in accordance with the following schedule:

ITEM	UNIT	UNIT PRICE	NO. UNITS	EXTENSION
Extraction wells	Linear feet	$_____	600	$_____

1.3.3.2 Additive Item No. 1

Price for adding work in connection with additional extraction wells complete in accordance with the drawings and specifications.

1.3.3.3 Bid Notes

a. The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for--

(1) Furnishing all plant, labor, equipment, appliances, and materials; and

(2) Performing all operations required to complete the work in conformity with the drawings and specifications.

b. The Contractor shall include in the prices for the items listed in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

c. Award will be made on the total sum of Bid Item (1) and the sum of the extensions under Bid Item (2). For Bid Item (2), bidders shall enter the unit prices and the extended totals in the spaces provided. If there is a difference between a unit price and the extended total, the unit price will be held to be the intended bid and the total recomputed accordingly. If a bidder provides a total but fails to enter a unit price, the total divided by the specified quantity will be held to be the intended unit price.

1.3.4 Submission of Bids

Hand delivered bids must be deposited in the bid box at the office of LANTNAVFACENGCOM, Contract Division, Room 266, 1510 Gilbert Street, Norfolk, Virginia 23511-2699 prior to the time and date set for bid opening. Any bids submitted by hand after the time set for receipt will not be accepted.

1.4 PRE-BID SITE VISITATION

To inspect the site of the work prior to bid opening, an appointment must be made with the Assistant Resident Officer in Charge of Construction (AROICC),Marine Corps Base, Camp Lejeune, telephone: (919) 451-2581.

1.5 SITE CONDITIONS

Bidders should visit the site and take such other steps as may be reasonably necessary to ascertain the nature and location of the work, and the general and local conditions which can affect the work or the cost thereof. Failure to do so will not relieve bidders from responsibility for estimating properly the difficulty or cost of successfully performing the work. The Government will assume no responsibility for any understanding or representations concerning conditions made by any of its officers or agents prior to the execution of the contract, unless included in the invitation for bids, the specifications, or related documents.

1.6 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be [ ] DX rated order; [X] DO rated certified for national defense use under the Defense Priorities and Allocations System (DPAS)(15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation. (FAR 52.212-7)

1.7 EXPLANATION TO PROSPECTIVE BIDDERS (APR 1984)

Any prospective bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective bidders before the submission of their bids. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective bidder concerning a solicitation will be furnished promptly to all other prospective bidders as an amendment to the solicitation, if that information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective bidders. (FAR 52.214-6)

NOTE: All inquiries may be sent via facsimile transmission to (804) 445-4665. Identify inquiry with solicitation number and title.

1.8 AVAILABILITY OF DOCUMENTS

a. Availability of Specifications Listed in the DOD Index of Specifications and Standards (DODISS) (SEP 1990)

Single copies of specifications cited in this solicitation may be obtained by submitting a written request to the supply point listed below. The request must contain the title of the specification, its number, date, applicable amendment(s), and the solicitation or contract number. A telephone order entry system is available with the use of a touch tone telephone. A Customer Number is required to use this system and may be obtained by written request to the address listed below or by telephone (215-697-2179). In case of urgency, telegraphic requests are acceptable. Voluntary standards, which are not available to offerors and Contractors from Government sources, may be obtained from the organization responsible for their preparation, maintenance, or publication. (FAR 52.210-2)

Standardization Documents Order Desk
Bldg. 4, Section D

700 Robbins Avenue
Philadelphia, Pennsylvania 19111-5094
Telex Number.....834295
Western Union Number.....710-670-1685
Telephone Number.....(215) 697-3321 (Express shipment pickup)
Telephone Order Entry System (TOES) Numbers...215-697-1187 through and including 215-697-1197

b. Availability of Specifications and Standards not Listed in DODISS, Data Item Descriptions not Listed in DOD 5010.12-L, and Plans, Drawings, and Other Pertinent Documents (DEC 1991)

Offerers may obtain the specifications, standards, plans, drawings, data item descriptions, and other pertinent documents cited in this solicitation by submitting a request to:

Commander, LANTNAVFACENGCOM
Engineering and Design Division, Specifications Branch
Code 406, Room 396, Building N-26
1510 Gilbert Street, Norfolk, Virginia 23511-2699

Requests should give the number of the solicitation and the title and number of the specification, standard, plan, drawing or other pertinent document requested, exactly as cited in this solicitation. (DOD FAR SUPP 252.210-7001)

Commercial specifications, standards, and descriptions are not available from Government sources. They may be obtained from the publishers.

c. Availability for Examination of Specifications, Standards, Plans, Drawings, Data Item Descriptions, and Other Pertinent Documents (DEC 1991)

The specifications, standards, plans, drawings, data item descriptions, and other pertinent documents cited in this solicitation may be examined at the following location: (DOD FAR SUPP 252.210-7002)

Commander, LANTNAVFACENGCOM
Engineering and Design Division, Specifications Branch
Code 406, Room 396, Building N-26
1510 Gilbert Street, Norfolk, Virginia 23511-2699

1.9 SIC CODE AND SMALL BUSINESS SIZE STANDARD (JAN 1991)

a. The standard industrial classification (SIC) code for this acquisition is _____.

b. (1) The small business size standard is _____.

(2) The small business size standard for a concern which submits an offer in its own name, other than on a construction or

service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees. (FAR 52.219-22)

1.10 BIDDER'S QUALIFICATIONS

Before bid is considered for award, the bidder may be requested by the Government to submit a statement regarding his previous experience in performing comparable work, his business and technical organization, financial resources, and plant available to be used in performing the work.

1.11 BID GUARANTEE (APR 1984)

a. Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

b. The offeror (bidder) shall furnish a bid guarantee in the form of a firm commitment, such as a bid bond, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practical after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.

c. If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or give a bond(s) as required by the solicitation within the time specified, the Contracting Officer may terminate the contract for default.

d. Unless otherwise specified in the bid, the bidder will (1) allow 60 days for acceptance of its bid and (2) give bond within 10 days after receipt of the forms by the bidder.

e. In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference. (FAR 52.228-1)

1.12 PREPARATION OF BIDS - CONSTRUCTION (APR 1984)

a. Bids must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a bid must initial each erasure or change appearing on any bid form.

b. The bid form may require bidders to submit bid prices for one or more items on various bases, including--

(1) Lump sum bidding;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of subparagraphs (1) through (3) above.

c. If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

d. Alternate bid will not be considered unless this solicitation authorizes their submission. (FAR 52.214-18)

1.13 SUBMISSION OF BIDS (DEC 1989)

a. Bids and bid modifications shall be submitted in sealed envelopes or packages (unless submitted by electronic means) (1) addressed to the office specified in the solicitation and (2) showing the time specified for receipt, the solicitation number, and the name and address of the bidder.

b. Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.

c. Facsimile bids, modifications, or withdrawals will not be considered unless authorized by the solicitation. (FAR 52.214-5)

1.14 AMENDMENTS TO INVITATIONS FOR BIDS (DEC 1989)

a. If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

b. Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on the form for submitting a bid, (3) by letter or telegram, or (4) by facsimile, if facsimile bids are authorized in the solicitation. The Government must receive the acknowledgment by the time and at the place specified for receipt of bids. (FAR 52.214-3)

1.15 LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF BIDS (DEC 1989)

a. Any bid received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it--

(1) Was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of bids (e.g., a bid submitted in response to a solicitation requiring receipt of bids by the 20th of the month must have been mailed by the 15th);

(2) Was sent by mail or, if authorized by the solicitation, was sent by telegram or facsimile, and it is determined by the Government that the late receipt was due solely to mishandling by the Government after receipt at the Government installation; or

(3) Was sent by U.S. Postal Service Express Mail Next Day Service - Post Office To Addressee, not later than 5:00 p.m. at the place of mailing, 2 working days prior to the date specified for receipt of bids. The term "working days" excludes weekends and U.S. Federal holidays.

b. Any modification or withdrawal of a bid is subject to the same conditions as in paragraph a of this provision.

c. The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date, or the bid, modification, or withdrawal shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, bidders should request the postal clerk to place a hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

d. The only acceptable evidence to establish the time of receipt at the Government installation is the time/date stamp of that installation on the bid wrapper or other documentary evidence of receipt maintained by the installation.

e. The only acceptable evidence to establish the date of mailing of a later bid, modification, or withdrawal sent by U.S. Postal Service Express Mail Next Day Service - Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service - Post Office to Addressee" label and the postmark on the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph c of this provision, excluding postmarks of the Canadian Postal Service. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

f. Notwithstanding paragraph a of this provision, a late modification of an otherwise successful bid that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

g. Bids may be withdrawn by written notice or telegram (including mailgram) received at any time before the exact time set for

receipt of bids. If the solicitation authorizes facsimile bids, bids may be withdrawn by facsimile received at any time before the exact time set for receipt of bids, subject to the conditions specified in the provision entitled "Facsimile Bids." A bid may be withdrawn in person by the bidder or its authorized representative if, before the exact time set for receipt of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid. (FAR 51.214-7)

1.16 PUBLIC OPENING OF BIDS

Bids will be publicly opened at the time set for opening in the invitation for bids. The content of the bids will be made public for the information of bidders and others interested, who may be present either in person or by representative.

1.17 CONTRACT AWARD - SEALED BIDDING - CONSTRUCTION (FEB 1986)

a. The Government will evaluate bids in response to this solicitation without discussions and will award a contract resulting from this solicitation to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the Government, considering only price and the price related factors specified elsewhere in the solicitation.

b. The Government may reject any or all bids, and waive informalities or minor irregularities in bids received.

c. The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the bid. (FAR 52.214-19)

1.18 CONTRACT AND BONDS

(Applicable only to bids of $25,000 or more.) Within 10 days after receipt of awards the bidder to whom award is made shall furnish two bonds, each with satisfactory security; namely, a performance bond (Standard Form 25) and a payment bond (Standard Form 25A). The performance bond shall be in a penal sum equal to 100 percent of the contract price. The payment bond shall be equal to 50 percent of the contract price, except that it shall be 40 percent of the contract price if that price is more than $1 million and not more than $5 million, and in the fixed sum of $2 1/2 million if the contract price is more than $5 million. The bond of any surety company holding a certificate of authority from the Secretary of the Treasury as an acceptable surety on Federal bonds will be accepted. Individual sureties will be accepted in accordance with FAR 28.203. Options in lieu of corporate or individual sureties may be provided in accordance with FAR 28.204. The contract time for purposes of fixing the completion date, default, and liquidated damages shall begin to run 15 days from the mailing of contract award, regardless of when performance and payment bonds are executed.

1.19 COST LIMITATION (DEC 1991)

a. Certain items in this solicitation are subject to statutory cost limitations. The limitations are stated in the Schedule.

b. An offer which does not state separate prices for the items identified in the Schedule as subject to a cost limitation may be considered nonresponsive.

c. By signing its offer, the Offeror certifies that each price stated on items identified as subject to a cost limitation includes an appropriate apportionment of all costs, direct and indirect, overhead, and profit.

d. Offers may be rejected which--

(1) Are materially unbalanced for the purpose of bringing items within cost limitations; or

(2) Exceed the cost limitations, unless the limitations have been waived by the Government prior to award. (DOD FAR SUPP 252.236-7006)

1.20 FALSE STATEMENTS IN BIDS (APR 1984)

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001. (FAR 52.214-4)

1.21 ADDITIVE OR DEDUCTIVE ITEMS (DEC 1991)

a. The low offeror and the items to be awarded shall be determined as follows--

(1) Prior to the opening of bids, the Government will determine the amount of funds available for the project.

(2) The low offeror shall be the Offeror that--

(a) Is otherwise eligible for award; and

(b) Offers the lowest aggregate amount for the first or base bid item, plus or minus (in the order stated in the list of priorities in the bid schedule) those additive or deductive items that provide the most features within the funds determined available.

(3) The Contracting Officer shall evaluate all bids on the basis of the same additive or deductive items.

(a) If adding another item from the bid schedule list of priorities would make the award exceed the available funds for all offerors, the Contracting Officer will skip that item and go to the next item from the bid schedule of priorities; and

(b) Add that next item if an award may be made that includes that item and is within the available funds.

b. The Contracting Officer will use the list of priorities in the bid schedule only to determine the low offeror. After determining the low offeror, an award may be made on any combination of items if--

(1) It is in the best interest of the Government;

(2) Funds are available at the time of award; and

(3) The low offeror's price for the combination to be awarded is less than the price offered by any other responsive, responsible offeror.

c. Example: The amount available is $100,000. Offeror A's base bid and four additives (in the order stated in the list of priorities in the bid Schedule) are $85,000, $10,000, $8,000, $6,000, and $4,000. Offeror B's base bid and four additives are $80,000, $16,000, $9,000, $7,000, and $4,000. Offeror A is the low offeror. The aggregate amount of offeror A's bid for purposes of award would be $99,000, which includes a base bid plus the first and fourth additives. The second and third additives were skipped because each of them would cause the aggregate bid to exceed $100,000. (DOD FAR SUPP 252.236-7007)

1.22 SERVICE OF PROTEST (NOV 1988)

a. Protests, as defined in Section 33.101 of the Federal Acquisition Regulation (FAR), that are filed directly with the agency, and copies of any protests that are filed with the General Accounting Office (GAO) or the General Services Administration Board of Contract Appeals (GSBCA), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from Commander, LANTNAVFACENGCOM, 1510 Gilbert Street, Norfolk, Virginia 23511-2699 (Attention: Code 021).

b. The copy of any protest shall be received in the office designated above on the same day a protest is filed with the GSBCA or within one day of filing a protest with the GAO. (FAR 52.233-2)

1.23 SMALL BUSINESS DISADVANTAGED BUSINESS GOAL

In submitting the information required by FAR Clause 52.219-9, "Small Business and Small Disadvantaged Business Subcontracting Plan," the goal submitted for small disadvantaged business must be, as a minimum, 5 percent.

1.24 PLEDGES OF ASSETS (FEB 1990)

a. Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond -

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

b. Pledges of assets from each person acting as an individual surety shall be in the form of -

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government sureties held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide -

(a) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(b) Evidence of the amount due under any encumbrance shown in the evidence of title;

(c) A copy of the current real estate tax assessment of the property of a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation. (FAR 52.228-11)

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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.

CODE OF FEDERAL REGULATIONS (CFR)

41 CFR 60.4	Construction Contractors - Affirmative Action Requirements

CORPS OF ENGINEERS (COE)

COE EP 1110-1-8	1988 Construction Equipment Ownership and Operating Expense Schedule

1.2 SUBMITTALS

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

1.2.1 SD-18, Records

a. Schedule of Prices G

b. As-built record of materials G

1.3 GENERAL INTENTION

It is the declared and acknowledged intention and meaning to provide and secure the Hadnot Point Shallow Aquifer Groundwater Treatment System complete and ready for use.

1.4 GENERAL DESCRIPTION

a. The work includes installing groundwater pump and treatment systems, recovery wells and incidental related work.

b. Work shall be located at the Marine Corps Base, Camp Lejeune, Jacksonville, North Carolina approximately as shown. The exact location will be indicated by the Contracting Officer.

1.5 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION

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

a. The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

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

Goals for minority participation for each trade	Goals for female participation for each trade
23.5	6.9

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

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

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

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

(2) Estimated dollar amount of the subcontract;

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

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

e. As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is the counties of Columbus, Duplin, Onslow, and Pender, North Carolina (FAR 52.222-23)

1.6 REQUIRED INSURANCE

1.6.1 Minimum Coverage

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

Type of Insurance	Per Person	Per Occurrence	Property Per Occurrence
1. Comprehensive General Liability		$500,000	
2. Automobile Liability	$200,000	$500,000	$20,000

3. Workmen's Compensation: As required by Federal and State workmen's compensation and occupational disease statutes.

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

5. Other: As required by State and Federal law.

1.6.2 Insurance--Work on a Government Installation (Sept 1989)

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

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

c. The Contractor shall insert the substance of this clause, including this paragraph c, in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The contractor shall maintain a copy of all subcontractor's proof of required insurance, and shall make copies available to the Contracting Officer upon request. (FAR 52.228-5)

1.7 STATION REGULATIONS

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

1.8 SCHEDULING

The Contractor shall schedule the work as to cause the least amount of interference with station operations. Work schedules shall be subject to the approval of the Officer in Charge of Construction. Permission to interrupt roads, railroads, or utility service shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

1.9 SCHEDULE OF PRICES

Within 5 calendar days of receipt of award, the Contractor shall prepare and submit to the Officer in Charge of Construction, via the Resident Officer in Charge of Construction, nine copies of a Schedule of Prices (Construction Contract) on the forms furnished for this purpose. The Schedule of Prices shall consist of a detailed breakdown of the contract price, giving the quantities for each of the various kinds of work, the unit prices, and the total prices thereof. The detailed breakdown shall be segregated under each of the construction categories given in Section 01011, "Additional General Paragraphs." The required schedule must be based on the actual breakdown of the bid price. Accordingly, subcontractors who may be involved in work under more than one of these categories shall be advised of this requirement in order to furnish such data without delay. The submission of the required data shall not otherwise affect the contract terms. Each item in the Schedule of Prices shall be structured so as to identify the section of the specifications to which it applies. Further, the section number shall be listed, and then each item of work within that section shall be listed. Specification sections shall be referred to by five-digit CSI numbers which apply. Where more than one category code applies to a given section, the Schedule of Prices shall further show the quantities and prices applicable to the respective category code as specified in paragraph entitled "Construction Categories" of Section 01011, "Additional General Paragraphs." Pursuant to clause entitled "Payments Under Fixed-Price Construction Contract" of the Contract Clauses, payments will not be made until the Schedule of Prices has been submitted and approved.

1.10 CONTRACTOR'S INVOICE

1.10.1 Content of Invoice

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

a. Contractor's Invoice on NAVFAC Form 7300/41 (7/85), which shall

show, in summary form, the basis for arriving at the amount of the invoice.

b. Contractor's Monthly Estimate for Voucher (LANTNAVFACENGCOM Form 4-4330/110 (New 7/84)), with subcontractor and supplier payment certification.

c. Affidavit to accompany invoice (LANTDIV NORVA Form 4-4235/4 (Rev 5/81)).

d. Updated copy of submittal register.

e. Updated copy of progress schedule. Furnish as specified in clause entitled "Schedules for Construction Contracts" of the Contract Clauses.

1.10.2 Quantities of Monthly Invoices and Supporting Forms

Forms will be furnished by the Contracting Officer. Requests for payment shall be processed in accordance with the Contract Clause entitled "Payments Under Fixed-Price Construction Contracts." Invoices and supporting forms for work performed shall be submitted to the Contracting Officer in the following quantities:

a. Contractor's Invoice - Original and five copies

b. Contractor's Monthly Estimate for Voucher - Original and two copies shall be required on jobs where there is a schedule of prices

c. Affidavit - Original

d. Updated submittal register - Two copies

e. Progress schedule - Two copies

1.11 AS-BUILT RECORD OF MATERIALS USED IN BUILDINGS

Prior to completion of the contract, the Contractor shall furnish an as-built record of materials used in the construction. Submission of this data is a condition for final payment under the contract. Where several manufacturers' brands, types, or classes of the item listed have been used in the project, the specific areas where each item was used shall be designated. Designations shall be keyed to the areas and spaces depicted on the contract drawings.

1.12 PROFIT

When profit is an element of price for any negotiated price adjustment pursuant to any clause of the subject contract, profit shall be analyzed in accordance with Subpart 15.9 of the DOD FAR supplement in effect on the date of this contract.

1.13 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 Officer in Charge of Construction. The Contractor shall allow ample time to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. At night, the Contractor shall light the different parts of the work in an approved manner. Utility cutovers shall be made after regular working hours or on weekends. Anticipated costs shall be included in the bid.

1.14 EXISTING WORK

a. The disassembling, disconnecting, cutting, removal, or altering in any way of existing work shall be carried on in such a manner as to prevent injury or damage to portions of existing work, whether they (1) remain in place, (2) are re-used in the new work, or (3) are salvaged and stored.

b. Portions of existing work which have been cut, damaged, or altered in any way during construction operations shall be repaired or replaced in kind in an approved manner to match existing or adjoining work. Work of this nature shall be performed by the Contractor at his expense and shall be as directed. Existing work shall, at the completion of operations, be left in a condition as good as existed before the new work started.

1.15 SUPERVISION BY GOVERNMENT REPRESENTATIVES

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

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

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

1.16 WORK BY THE CONTRACTOR

1.16.1 Performance of Work by the Contractor (Apr 1984)

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

1.16.2 Description of Work Performed by the Contractor

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

1.17 EQUITABLE ADJUSTMENTS

1.17.1 Waiver of Claims

Whenever the Contractor submits a claim for equitable adjustment under any clause of this contract which provides for equitable adjustment of the contract, such claim shall include all types of adjustments in the total amounts to which the clause entitles the Contractor. The adjustments include, but are not limited to, adjustments arising out of delays or disruptions or both caused by such change. Except as the parties may otherwise expressly agree, the Contractor shall be deemed to have waived: (1) any adjustments to which he otherwise might be entitled under the clause where the claim fails to request equitable adjustments, and (2) any increase in the amount of equitable adjustments in addition to those requested in the claim.

1.17.2 Release of Claims

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

1.18 ORAL MODIFICATION

No oral statement of any person other than the Contracting Officer or the Contracting Officer's representative, as provided in the clause in this contract entitled "Changes," shall in any manner or degree modify or otherwise affect the terms of this contract.

1.19 NO WAIVER BY GOVERNMENT

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

1.20 SANITATION

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

1.21 PAYMENTS TO CONTRACTOR

Payments made in accordance with the clause entitled "Payments Under Fixed-Price Construction Contract" of the Contract Clause shall be made on submission of itemized requests by the Contractor and shall be subject to reduction for overpayments or increase for underpayments on preceding payments to the Contractor. The obligation of the Government to make the payments required under the provisions of this contract shall, in the discretion of the OICC, be subject to (1) reasonable deductions on account of defects in material or workmanship, and (2) any claims which the Government may have against the Contractor under or in connection with this contract. Any overpayments to the Contractor shall, unless otherwise adjusted, be repaid to the Government upon demand.

1.22 SPECIFICATIONS AND STANDARDS

The specifications and standards referenced in the project specification, including addenda, amendments, and errata listed, will govern in all cases where references thereto are made. In case of differences between the specifications or standards and the project specification or its accompanying drawings, the project specification and its accompanying drawings will govern. Otherwise, the referenced specifications and standards will apply. The requirement for packaging, packing, marking, and preparation for shipment or delivery included in the referenced specifications apply only to materials and equipment furnished directly to the Government and not to materials and equipment furnished and installed by the Contractor.

1.23 SECURITY REQUIREMENTS

No employee or representative of the Contractor will be admitted to the work site unless he furnishes satisfactory proof that he is a citizen of the United States or is specifically authorized admittance by the OICC.

1.24 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

Whenever a contract or modification of contract price is negotiated, the

Contractor's cost proposal for equipment ownership and operating expenses shall be determined in accordance with the following requirements. A copy of COE EP 1110-1-8 is available for review at:

Commander, LANTNAVFACENGCOM
1510 Gilbert Street
(Code 02)
Building N-26, Room 266
Norfolk, Virginia 23511-2699

a. Allowable cost for construction, marine plant, and equipment in workable condition, owned or controlled, and furnished by a Contractor or subcontractor at any tier shall be based on actual cost data when the Government can determine both ownership and operating costs for equipment or equipment groups of similar serial numbers and series from the Contractor's accounting records. When both ownership and operating costs cannot be determined from the Contractor's accounting records, equipment costs shall be based on the applicable provisions of COE EP 1110-1-8, Region III (the schedule). Working conditions shall be considered to be average for determining equipment rates using the schedule unless otherwise specified by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retrospective pricing the schedule in effect at the time the work was performed shall apply.

b. Equipment rental costs are allowable, subject to FAR 31.105(d)(2)(ii) and FAR 31.205-36, when substantiated by certified copies of paid invoices. Rates for equipment rented from an organization under common control, lease purchase, or sale-lease back arrangements will be determined using the schedule except that rental costs leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees are allowable. Costs for major repairs and overhaul are not allowed.

c. When actual equipment costs are proposed and the total amount of the pricing action is over $25,000, submit cost or pricing data on Standard Form 1411, "Contract Pricing Proposal Cover Sheet." By submitting cost or pricing data, the Contractor grants to the Contracting Officer or an authorized representative the right to examine those books, records, documents and other supporting data that will permit evaluation of the proposed equipment costs. After price agreement the Contractor shall certify that the equipment costs or pricing data submitted are accurate, complete, and current.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section

SECTION 01011

ADDITIONAL GENERAL PARAGRAPHS

PART 1 GENERAL

1.1 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

15 CFR 372	Individual Validated Licenses and Amendments
15 CFR 373	Special Licensing Procedures

CORPS OF ENGINEERS (COE)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	1989 Safeguarding Construction, Alteration, and Demolition Operations

1.2 SUBMITTALS

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

1.2.1 SD-14, Samples

a. Color boards G

1.2.2 SD-18, Records

a. Equipment warranty list G

b. Subcontractors and personnel list G

c. As-built drawings G

d. Safety program G

1.3 DRAWINGS ACCOMPANYING SPECIFICATION

The following drawings accompany this specification and are a part thereof. Drawings are the property of the Government and shall not be used for any purpose other than that contemplated by the specification. The drawings included with this specification are half-size. Full-size drawings are available at the bidder's or Contractor's expense. Information on procuring these full-size drawings may be obtained from the Contracting

Officer. Full-size drawings may be inspected during regular working hours at the office of the Contracting Officer.

EFD Dwg. No.	NAVFAC Dwg. No.		Title
368820	4268820	T-1	Cover Sheet and General Notes
368821	4268821	C-1	New Piping Plan - North Remediation Area
368822	4268822	C-2	Site Plan - North Remediation Area Groundwater Treatment Plant
368823	4268823	C-3	New Piping Plan - South Remediation Area
368824	4268824	C-4	Site Plan - South Remediation Area Groundwater Treatment Plant
368825	4268825	C-5	Groundwater Treatment - Schematic Flow Diagram
368826	4268826	C-6	Equipment Layout
368827	4268827	C-7	Equipment Elevations
368828	4268828	C-8	Details
368829	4268829	C-9	Details
368830	4268830	S-1	Foundation Plan and Details
368831	4268831	S-2	Building Drainage Plan and Details
368832	4268832	S-3	Details
368833	4268833	A-1	Building Elevations
368834	4268834	M-1	Heating and Ventilation Schedules, Details, and Abbreviations
368835	4268835	M-2	Heating and Ventilation Equipment Layout
368836	4268836	E-1	Legend and Fixture Schedule
368837	4268837	E-2	Site Plan - North and South Remediation Areas
368838	4268838	E-3	Lighting Plan - North Groundwater Treatment Plant
368839	4268839	E-4	Power Plan - North Groundwater

EFD Dwg. No.	NAVFAC Dwg. No.		Title
			Treatment Plant
368840	4268840	E-5	Lighting Plan - South Groundwater Treatment Plant
368841	4268841	E-6	Power Plan - South Groundwater Treatment Plant
368842	4268842	E-7	Electrical Main Distribution and Details
368843	4268843	E-8	Electrical Ladder Diagrams
368844	4268844	E-9	Electrical Panel Diagrams

1.3.1 Notification of Drawing Discrepancies

The Contractor shall check all drawings furnished him immediately upon their receipt and shall promptly notify the Contracting Officer of any discrepancies. Figures marked on drawings shall in general be followed in preference to scale measurements. Large scale drawings shall in general govern small scale drawings. The Contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby. (FAR SUPP 52.236-7002(c))

1.4 SPECIFICATIONS AND PRINTS FURNISHED TO CONTRACTOR

Five copies of the project specification, five sets of half-size prints, and one set of full-size reproducibles of each drawing accompanying this specification will be furnished the Contractor without charge. Additional prints required by the Contractor shall be reproduced by and at the expense of the Contractor.

1.5 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK

The Contractor shall be required to (a) commence work under this contract within 10 calendar days, (b) prosecute the work diligently, and (c) complete the entire work ready for use within 150 calendar days after receiving the award.

1.6 LIQUIDATED DAMAGES--CONSTRUCTION (APR 1984)

a. If the Contractor fails to complete the work within the time specified in the contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of $200.00 for each day of delay. (FAR 52.212-5(a))

b. If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work. (FAR 52.212-5(b))

c. If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted. (FAR 52.212-5(c))

1.7 MATERIALS AND EQUIPMENT TO BE SALVAGED

Except where specified otherwise herein, existing materials and equipment which are required to be removed or disconnected to perform the work, but are not indicated or specified for use in the new work, shall become the property of the Contractor and shall be removed from Government property.

1.8 OPERATION OF STATION UTILITIES

The Contractor shall not operate nor disturb the setting of control devices in the 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 Contracting Officer giving reasonable advance notice when such operation is required.

1.9 AVAILABILITY OF UTILITIES SERVICES

Reasonable amounts of utilities will be made available to the Contractor at the prevailing Government rates and may be obtained upon application to the Base Maintenance Officer, Bldg. 1202, Marine Corps Base, Camp Lejeune. A refundable security deposit to the Resident Officer in Charge of Construction shall be made prior to application for services. The Contractor shall be responsible for providing transformers, meter bases, electrical service poles and drops for electrical services, and backflow preventer devices on connections to domestic water lines. Final taps and tie-ins to the Government utility grid will be made by Base Maintenance who will also provide and seal a 120- or 208-volt, three-wire kWh meter. Tap-in cost, if any, shall be the responsibility of the Contractor. Tampering or movement of a sealed meter without notification to base maintenance is grounds for discontinuance of electrical service. The Contractor shall be responsible for providing larger meters required if not available from the Government. The Contractor shall be responsible for the cost of utility services required until the date of Government acceptance. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water.

1.10 TRAILERS OR STORAGE BUILDINGS

In accordance with Contract Clause entitled "Operations and Storage Areas," trailers or storage buildings will be permitted, where space is available, subject to the approval of the Contracting Officer. The trailers or storage buildings shall be suitably painted and kept in a good state of repair. 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.

1.11 EQUIPMENT WARRANTIES

1.11.1 Equipment Warranty List

Obtain and furnish to the Contracting Officer written warranties for equipment furnished under the contract, and prepare a complete listing of such equipment. The equipment list shall state the specification section applicable to the equipment, duration of the warranty therefor, start date of the warranty, ending date of the warranty, and the point of contact for fulfillment of the warranty. This listing shall be fully executed and delivered to the Contracting Officer prior to final acceptance of the facility, and acceptable listing shall be a condition to final acceptance of the facility.

1.11.2 Equipment Warranty Tags and Guarantor's Local Representative

The Contractor shall furnish with each warranty the name, address, and telephone number of the guarantor's representative nearest to the location where the equipment and appliances are installed. The guarantor's representative, upon request of the using service's representative, will honor the warranty during the warranty period, and will provide the services prescribed by the terms of the warranty. At the time of installation, tag each item of warranted equipment with a durable, oil- and water-resistant tag approved by the Contracting Officer. Tag shall be attached with copper wire and sprayed with a clear silicone waterproof coating. Leave the date of acceptance and inspector's signature blank until project is accepted for beneficial occupancy. Tag shall show the following information:

EQUIPMENT WARRANTY TAG

Type of Equipment.....
Accepted Date.....
Warranted Until.....
Under Contract N62470-.....
Inspector's Signature.....

BASE PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE

1.12 SAFETY PROGRAM

The Contractor shall implement a safety program conforming to the requirements of Federal, state and local laws, rules, and regulations. The program shall include, but is not limited to, the following:

a. Occupational Safety and Health Standards.

b. COE EM-385-1-1.

c. Contract Clause entitled "Accident Prevention." In this clause the date of COE EM-385-1-1 should be 1 October 1992.

d. NFPA 241.

e. Hazard Communication Program. The program shall include the

following:

(1) Inventory list of all chemicals on the work site.

(2) Approved labeling system to identify contents on all containers on site.

(3) Posted Material Safety Data Sheet (MSDS) available at the work site where the product is in use.

(4) Provide required training and personnel protective equipment specified by MSDS for the manufactured product in use.

1.13 PROPRIETARY NAMES

Names indicated for colors, textures, and patterns of materials are for the purpose of color, texture, and pattern selection only. Other manufacturers' materials are acceptable provided materials closely approximate colors, textures, and patterns indicated and conform to all other requirements.

1.14 SCHEDULING

1.14.1 General Scheduling Requirements

Notwithstanding the requirements of the Contract Clause entitled "Schedules for Construction Contracts," immediately after award the Contractor shall meet with the Contracting Officer and present a schedule of work, prepared in accordance with said clause, for review by the Contracting Officer. The schedule will be reviewed at the meeting and will be retained by the Contracting Officer for final review and approval. The regular working hours are 0730 to 1600, Monday through Friday.

1.15 SUBCONTRACTORS AND PERSONNEL

Promptly after the award of the contract, submit to the Contracting Officer, in triplicate, a list of subcontractors and the work each is to perform. On this form shall appear the names of the key personnel of the Contractor and subcontractors, together with their home addresses and telephone numbers, for use in event of an emergency. From time to time as changes occur and additional information becomes available, amplify, correct, and change the information contained in previous lists.

1.16 AS-BUILT DRAWINGS

During the progress of the work, two full-size prints of each of the drawings accompanying this specification shall be neatly and clearly marked in red to show variations between the construction actually provided and that indicated or specified in the contract documents. The as-built drawings shall be kept up-to-date at the work site at all times during the contract, and shall be available for inspection by the Contracting Officer upon request. The Contractor shall also mark the drawings to indicate the exact location of underground utility lines discovered in the course of the work. Where a choice of materials or methods, or both, is permitted herein, and where variations in the scope or character of the work

indicated or specified are permitted either by award on bidding items specified for that purpose or by subsequent change to the contract, the as-built drawings shall define the construction actually provided. The representation of such variations shall conform to standard drafting practice and shall include such supplementary notes, legends, and details as may be necessary for legibility and clear portrayal of the as-built construction. The marked prints shall be subject to approval of the Contracting Officer before acceptance. Upon completion of the work, the completed as-built drawings shall be presented to the Contracting Officer.

1.17 LOCATION OF UNDERGROUND UTILITIES

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

1.18 OMISSIONS AND MISDESCRIPTIONS

Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications. (FAR SUPP 52.236-7002(b))

1.19 PRECEDENCE

In the event of conflict or inconsistency between provisions of the various portions of this contract (the reconciliation of which is not otherwise provided for here), precedence shall be given in the following order, the provisions of a particular portion prevailing over those of a subsequently listed portion.

a. Typewritten portions of the contract.

b. The specifications referred to in Standard Form 1442 (including addenda, and mechanical and technical but not contractual aspects of incorporated provisions) as specifically amended herein, if amended.

c. Printed provisions of the contract form, including printed provisions of added slip sheets.

1.20 EMERGENCY MEDICAL CARE

Emergency medical care only is available at Government facilities at Marine Corps Base, Camp Lejeune for Contractor employees who suffer on-the-job injury or disease. Emergency care will be rendered at the prevailing rates

established in NAVMEDCOM Instruction 6320.4 series. Reimbursement shall be made by the Contractor to the Naval Regional Medical Center Collection Agent upon receipt of a monthly statement.

1.21 QUARANTINE FOR IMPORTED FIRE ANT (4/82)

Onslow, Jones, and Cartaret Counties and portions of Duplin and Craven Counties have been declared a generally infested area by the United States Department of Agriculture 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 301.81-2A 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 conveyances, if it is determined by an inspector that they present a hazard of transporting spread of the imported fire ant and the person in possession thereof has been so notified.

b. Authorization for movement of equipment outside the imported fire ant 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.

1.22 SUBMITTAL OF PROOF OF QUALIFICATIONS AND EXPERIENCE

Where qualifications or experience requirements are set forth in the specifications with respect to equipment and equipment installers, written proof of such qualifications or experience must be provided within 45 calendar days after contract award, and before placing any order for such equipment or before dispatching equipment installers to the project site.

1.23 PROJECT IDENTIFICATION SIGNBOARD

Two project identification signboards shall be provided. Each signboard shall be 4 feet high by 8 feet long constructed at a conspicuous location on the job site where directed by the Contracting Officer. The field of the sign shall consist of one 4- by 8-foot sheet of grade B-B, medium density overlaid exterior plywood, not less than 3/4 inch thick. The signboard shall have a 2- by 2-inch frame applied to the face surface of the field and nailed from the back of the field with 6 penny galvanized nails. Corners of frame shall be mitered and nailed. A 3/4-inch quarter round shall be provided next to the 2- by 2-inch frame on the inner side and nailed with 6 penny finish nails, set and puttied. The completed signboard shall be secured to two 4- by 4-inch posts with 10 penny aluminum nails, 6 inches on center, driven slightly recessed and puttied. The posts shall be set 3 feet into the ground and tamped tight. Each post shall extend to the top of the signboard and shall have a 2- by 4-inch diagonal brace nailed near the top of the post and extending down to a 3 foot, 2- by 4-inch stake driven 2 feet, 6 inches into the ground. A 2- by 4-inch strut shall be provided from brace to brace midway from top to bottom, and nailed at each brace with three 10 penny nails. The posts shall be set 5 feet center to center. Lumber shall be B or Better Southern pine, pressure-preservative treated with pentachlorophenol. Nails shall be aluminum or galvanized steel. The entire signboard and supports shall be given one coat of exterior alkyd primer and two coats of exterior alkyd enamel paint. The lettering and sign work shall be performed by a skilled sign painter using paint known in the trade as bulletin colors. The frame shall be painted black, the quarter round shall be painted gray, the field white, and the lettering bulletin blue. The lettering style shall be "Gothic," "Roman capitals," or "Thick and Thin." See identification signboard detail at the end of this section.

1.24 IDENTIFICATION OF CONTRACTOR VEHICLES

Each Contractor provided vehicle and towed trailer shall show the Contractor's name so that it is clearly visible on both front doors of the vehicle and both sides of a towed trailer and shall at all times display a valid state license plate and safety inspection sticker. Contractor vehicles operated on Government property shall be maintained in a good state of repair.

1.25 GENERAL PROVISIONS CLAUSES

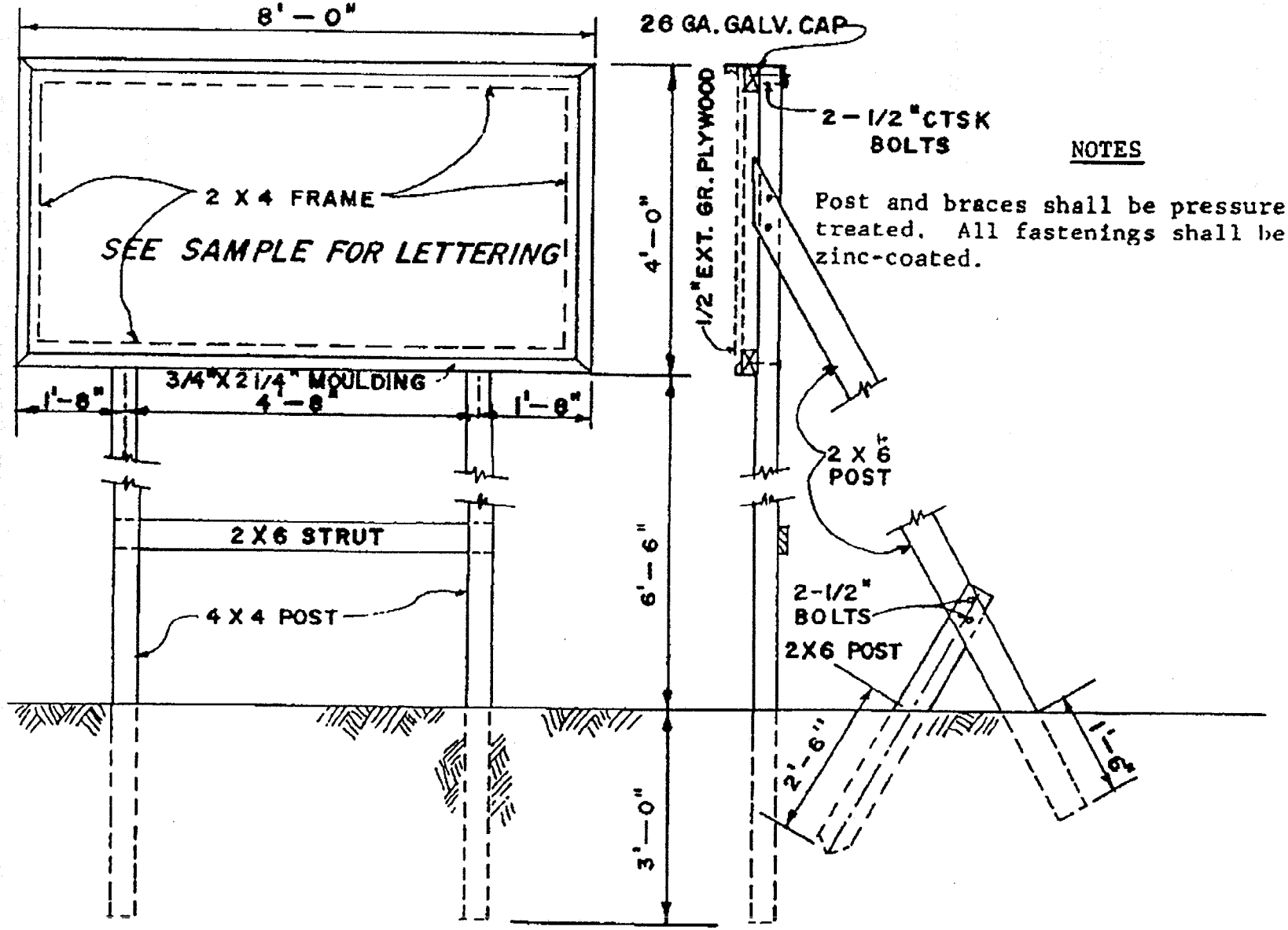
Wherever a reference to a clause of the General Provisions occurs in the technical sections of the specifications, it shall be taken to mean the Contract Clause having the same title as the referenced General Provisions Clause.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

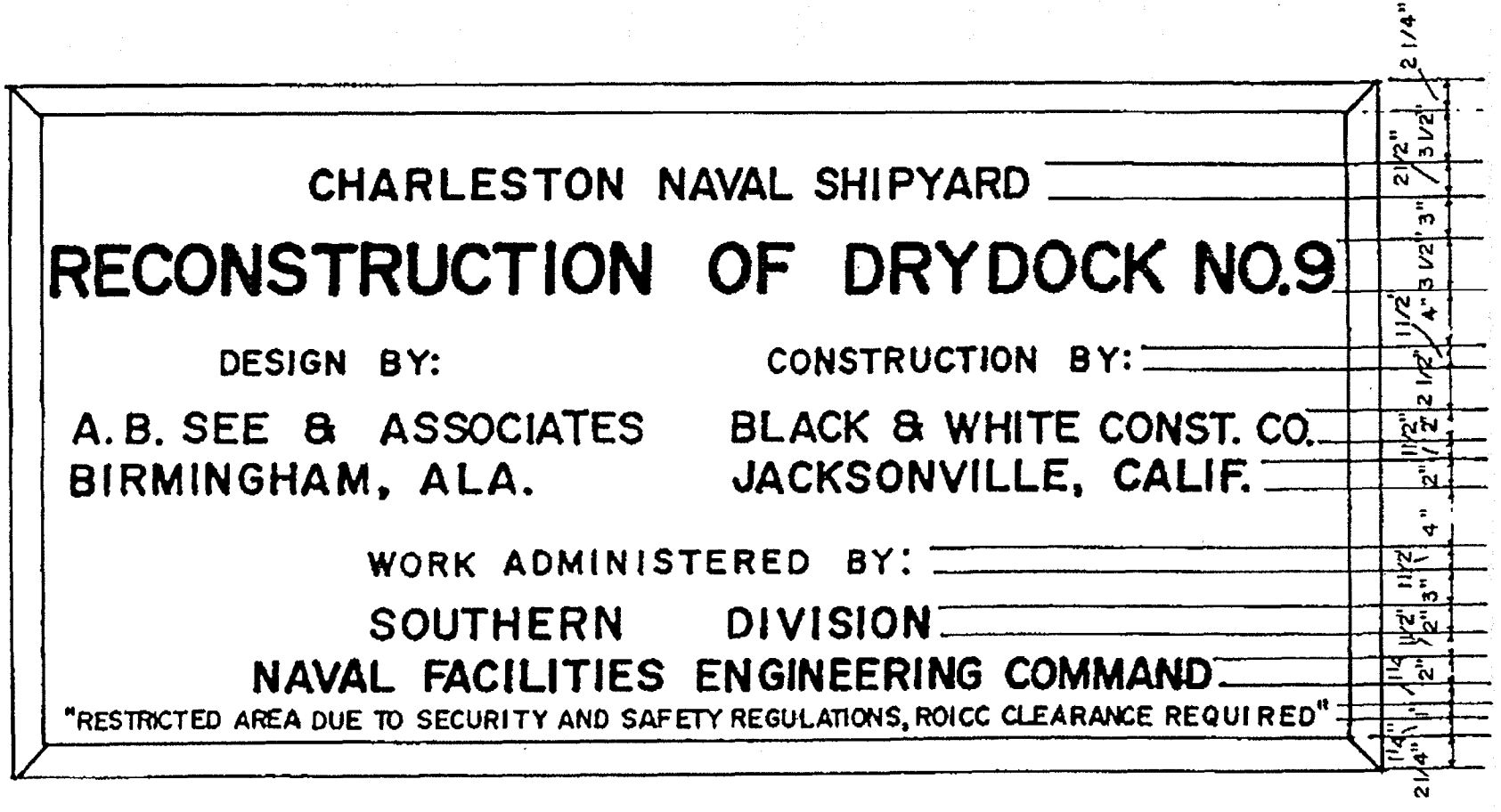


NOTES

Post and braces shall be pressure-treated. All fastenings shall be zinc-coated.

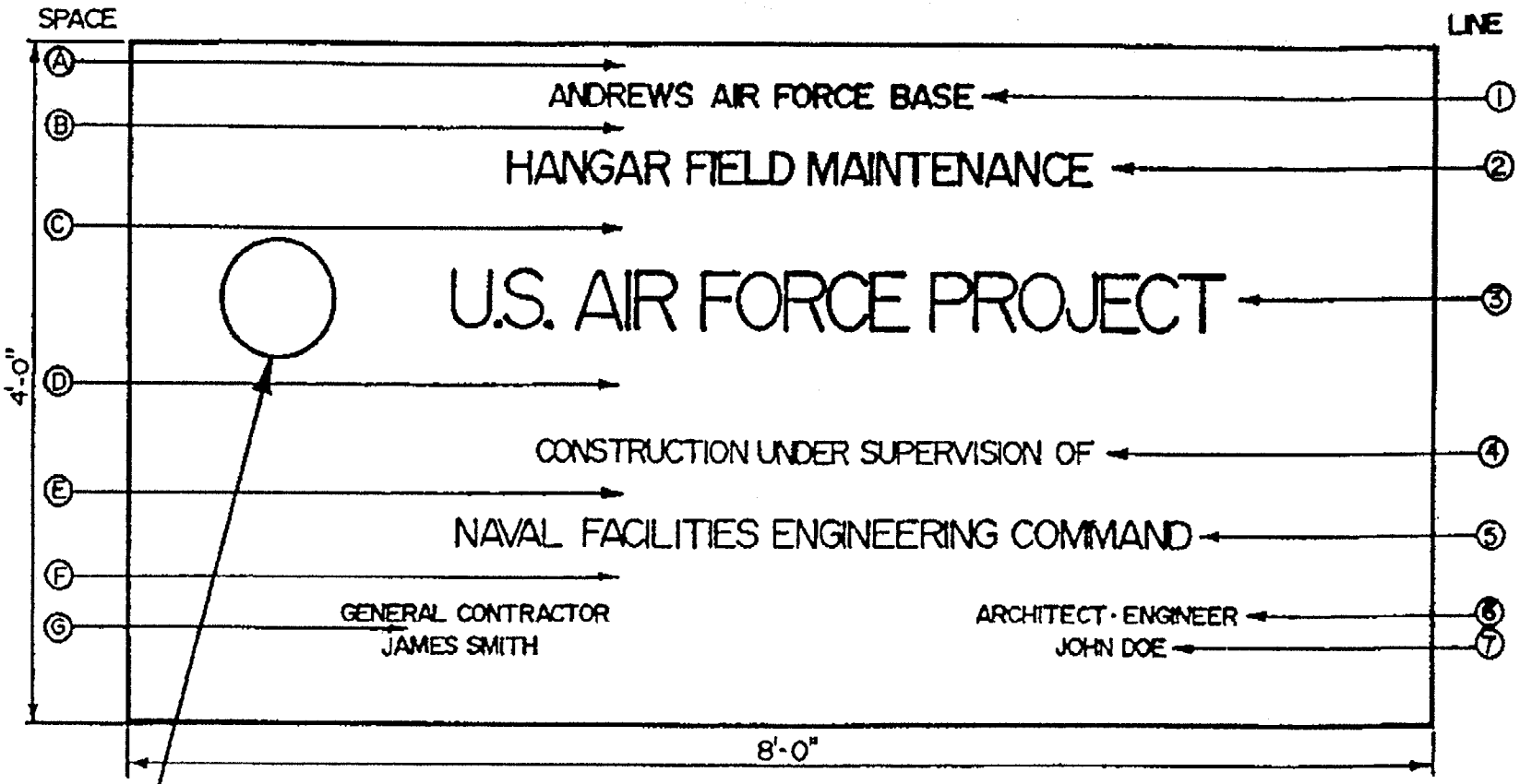
TYPICAL CONSTRUCTION SIGN

NOT TO SCALE



NOTES: (1) IN SPACE HEADED "DESIGN BY:" SHOW NAME OF ARCHITECT/ENGINEER FIRM.
(2) " " " "CONSTRUCTION BY:" SHOW NAME OF PRIME CONTRACTOR.

SAMPLE LETTERING FOR CONSTRUCTION SIGN (NAVY)



AIR FORCES ENGINEERING AND SERVICES SHIELD DECAL. (AVAILABLE FROM ROICC)

SAMPLE LETTERING FOR CONSTRUCTION SIGN (AIR FORCE)

SCHEDULE

SPACE	HEIGHT	LINE	DESCRIPTION	LETTER HEIGHT	STROKE
A	2 1/2"	1	LOCATION *	2 3/8"	1/4"
B	2 5/8"	2	PROJECT NOMENCLATURE *	2 3/4"	3/8"
C	5 3/4"	3	U.S. AIR FORCE PROJECT	4"	1/2"
D	8"	4	CONSTRUCTION UNDER THE SUPERVISION OF	1 1/2"	1/8"
E	4"	5	CONSTRUCTION AGENCY *	2 3/8"	1/4"
F	4"	6	GENERAL CONTRACTOR *	1 3/8"	3/16"
G	1"	7	GENERAL CONTRACTOR *	1 3/8"	3/16"

* WILL VARY TO SUIT PROJECT REQUIREMENTS

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

Not used.

1.2 DEFINITIONS

1.2.1 Submittal

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

1.2.2 Types of Submittals

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

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

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

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

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

1.2.3 Approving Authority

The person authorized to approve a submittal.

1.2.4 Work

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

1.3 SUBMITTALS

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

1.3.1 SD-18, Records

a. Submittal register G

1.3.1.1 Submittal Register

State for each submittal the Contractor's Planned submittal date. Submit within 15 days after notice to proceed. Insert dates on copies of the "Submittal Register." Obatin the original from the following source:

a. From a register with submittal items filled in which will be available from the Contracting Officer at the time of the notice to proceed. The specification section number, SD number, description of item for which the submittal is required, and approving authority will be listed by the Government.

1.3.1.2 Submittal Register Preparation

Maintain a submittal register. Forms are attached after the end of section for use in developing the submittal register. The submittal register with columns (a), (b), (c), (d) completed by the Contractor is designated the initial submittal register required as a part of the quality control plan. Information for completing columns (a), (b), (c), (d) of the submittal register shall be obtained through the submittal requirements of the technical specification sections. The information needed to suit columns (a), (b), (d) is self-explanatory. For column (c), the specification paragraph number which contains the performance requirements for submittal item is intended. Other columns on the submittal register forms shall be completed as required by the approved quality control plan. Additional details concerning the use of the submittal register will be explained at the preconstruction conference.

1.4 PROCEDURES FOR SUBMITTALS

1.4.1 Reviewing, Certifying, Approving Authority

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

1.4.2 Constraints

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

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

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

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

1.4.3 Scheduling

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

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

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

1.4.4 Variations

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

1.4.4.1 Variation Is Compatible

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

1.4.4.2 Contractor Is Responsible

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

1.4.4.3 Review Schedule Is Modified

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

1.4.5 Contractor's Responsibilities

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

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

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

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

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

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

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

1.4.6 QC Organization Responsibilities

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

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

c. Review submittals for conformance with project design concepts and

compliance with the Contract documents.

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

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

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

e. Ensure that material is clearly legible.

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

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

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

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

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

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

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

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

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

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

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

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

j. When the approving authority is the QC Manager, forward two copies of each approved submittal, except "Samples," where one set is required, to the Contracting Officer.

1.4.7 Government's Responsibilities

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

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

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

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

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

1.4.8 Actions Possible

Submittals will be returned with one of the following notations:

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

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

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

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

1.5 FORMAT OF SUBMITTALS

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to the office of the approving authority. Transmit submittals with a transmittal form prescribed by the Contracting Officer and standard for the project. The transmittal form shall identify the Contractor, indicate the date of the submittal, and include information prescribed by the transmittal form and required in the paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.5.2 Identifying Submittals

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

a. Project title and location.

b. Construction Contract number.

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

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

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

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

g. Product identification and location in project.

1.5.3 Format for Product Data

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

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

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

1.5.4 Format for Shop Drawings

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

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

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

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

1.5.5 Format of Samples

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

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

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

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

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

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

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

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

(8) Sample Installation: 100 square feet.

b. Samples Showing Range of Variation: Where variations are

unavoidable due to the nature of the materials, submit sets of samples of not less than three units showing the extremes and middle of the range.

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

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

e. When a color, texture or pattern is specified in naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.6 Format of Administrative Submittals

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

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

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies of Product Data

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

1.6.2 Number of Copies of Shop Drawings

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

(1) Transmit reproducibles rolled in mailing tubes.

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

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

1.6.3 Number of Samples

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

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

c. Submit one sample installation, where directed.

d. Submit one sample of non-solid materials.

1.6.4 Number of Copies of Administrative and Closeout Submittals

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

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

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

1.7 FORWARDING SUBMITTALS

1.7.1 Samples Required of the Contractor

Submit samples to the Commander, LANTNAVFACENGCOM, Code 05, Naval Station, Norfolk, Virginia 23511-6287, Architect-Engineer: Baker Environmental, Inc., Airport Office Park, Building 3, 420 Rouser Road, Coraopolis, Pennsylvania, 15108, for approval.

1.8.2 Shop Drawings and Product Data

As soon as practicable after award of the contract, and before procurement or fabrication, submit, except as specified otherwise, to the Commander, LANTNAVFACENGCOM, Code 05, 1510 Gilbert Street, Norfolk, Virginia 23511-2699, Architect-Engineer: Baker Environmental, Inc., Airport Office Park, Building 3, 420 Rouser Road, Coraopolis, Pennsylvania, 15108, the shop drawings and product data required in the technical sections of this specification. The Architect-Engineer for this project will review and provide surveillance for the Contracting Officer to determine if Contractor-approved submittals comply with the contract requirements, and will review and approve for the Contracting Officer those submittals not permitted to be Contractor approved to determine if submittals comply with the contract requirements. One copy of the transmittal form for submittals shall be forwarded to the Resident Officer in Charge of Construction. Submit to the Commander, LANTNAVFACENGCOM, Code 05, 1510 Gilbert Street, Norfolk, Virginia 23511-2699 submittals for the following:

a. Environmental protection plans

1.8 SCHEDULE OF SUBMITTAL DESCRIPTIONS (SD)

SD-01, Data

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

SD-02, Manufacturer's Catalog Data

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

SD-03, Manufacturer's Standard Color Charts

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

SD-04, Drawings

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

SD-05, Design Data

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

SD-06, Instructions

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

SD-07, Schedules

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

SD-08, Statements

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

shop drawing.

SD-09, Reports

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

SD-10, Test Reports

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

SD-11, Factory Test Reports

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

SD-12, Field Test Reports

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

SD-13, Certificates

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

SD-14, Samples

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

SD-17, Sample Installations

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

SD-18, Records

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

SD-19, Operation and Maintenance Manuals

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SUBMITTAL REGISTER
INSTRUCTIONS

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

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

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

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

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

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

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

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

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

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

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

forwarding submittals to the QC organization.

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

Contractor

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

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

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

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

QC organization

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

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

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

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

Government

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

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

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

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

date submittal is returned to Contractor via QC organization.

-- INSERT GRAPHICS HERE --

TO PRINT SECTION TEXT WITH GRAPHICS

1. In CCB, select SPECS from the main menu
2. Select NAVFAC Guide Specifications
3. Highlight Section
4. Select PRINT
5. Select items in PRINT BOX
6. Press ENTER

TO PRINT GRAPHICS ONLY

1. In CCB, select SPECS from the main menu
3. Select NAVFAC Guide Specifications
4. Select NAVFAC Guide Specifications Graphics
5. Select the graphic you want to print
6. Select PRINT
   - Select the appropriate buttons in the print box
   - Select PRINT button

- OR -

1. In CCB, select SPECS from the main menu
2. Select NAVFAC Guide Specificaitons
3. Select the section to VIEW
4. From the horizontal menu bar across the top, select GRAPHICS
5. Select the graphic to print
6. Select the PRINT button

-- INSERT GRAPHICS HERE --

TO PRINT SECTION TEXT AND GRAPHICS: INSTRUCTION IS SHOWN ON FIRST PAGE OF GRAPHIC

Contract Number: 19134-40-SRN | Project Title: HADNOT POINT SHALLOW AQUIFER REMEDIAL DESI

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 01010	SD-18, Records	1.2.1				
2)	Schedule of Prices	1.9	G			
3)	As-built record	1.11	G			
4) 01011	SD-14, Samples	1.2.1				
5)	Color boards		G			
6) 01011	SD-18, Records	1.2.2				
7)	Equipment warranty list	1.11.1	G			
8)	Subcontractors and personnel	1.15	G			
9)	As-built drawings	1.16	G			
10)	Safety program	1.12	G			
11) 01300	SD-18, Records	1.3.1				
12)	Submittal register		G			
13) 01400	SD-18, Records	1.2.1				
14)	Quality Control (QC) plan		G			
15) 01560	SD-08, Statements	1.3.1				
16)	Preconstruction survey	1.4.1				
17) 01560	SD-18, Records	1.3.2				
18)	Solid waste disposal permit	1.3.2.1				
19)	Disposal permit for hazardous	1.3.2.2				
20)	waste					

* Navy Notes:
Approved by:
G: Contracting Officer
Blank: CQC Manager

* NASA Notes:
Approved by:
Blank: Contracting Officer

* Army Notes:
Classification:
GA: Gov't Approval
FIO: For Information Onl

Contract Number: 19134-40-SRN | Project Title: HADNOT POINT SHALLOW AQUIFER REMEDIAL DESI

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL / MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 01561	SD-02, Manufacturer's Catalog Data	1.3.1				
2)	Filter Barriers					
3)	Silt Fence					
4)	Erosion Control Matting					
5)	Dust Suppressors					
6) 01561	SD-04, Drawings	1.3.2				
7)	Erosion Control Plan	1.3.2.1	G			
8) 02050	SD-08, Statements	1.3.1				
9)	Demolition plan	1.3.1.1				
10) 02220	SD-08, Statements	1.3.1				
11)	Shoring and sheeting plan	1.3.1.1				
12)	Dewatering plan	1.3.1.2				
13) 02220	SD-12, Field Test Reports	1.3.2				
14)	Fill and backfill					
15)	Select material					
16)	Porous fill					
17)	Density and moisture tests					
18) 02571	SD-05, Design Data	1.2.1				
19)	Job mix formula	1.2.1.1				
20) 02571	SD-13, Certificates	1.2.2				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Tack coat	2.1.3				
2)	Stone base course	2.1.2				
3) 02610	SD-13, Certificates	1.3.1				
4)	Stone Materials					
5) 02661	SD-02, Manufacturer's Catalog Data	1.4.1				
6)	Water service line	2.1				
7)	Corporation stops	2.1.2.1				
)	Valve boxes					
9)	Indicator posts					
10)	Water meters	2.2				
11)	Backflow preventer	2.3				
12)	Anti-freeze device					
13) 02661	SD-05, Design Data	1.4.2				
14)	Design calculations for water					
15)	piping					
16) 02661	SD-06, Instructions	1.4.3				
17)	Installation	3.1.1				
18) 02661	SD-13, Certificates	1.4.4				
19)	Water service line	2.1				
20)	Backflow preventer	2.3				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Anti-freeze device					
2) 02730	SD-02, Manufacturer's Catalog Data	1.4.1				
3)	Pipeline materials	2.1				
4) 02730	SD-13, Certificates	1.4.2				
5)	Pipeline materials	2.1				
6) 02900	SD-02, Manufacturer's Data	1.3.1				
7)	Well Casing					
8)	Well Screen					
9)	Filter Pack Gradation Analysis					
10)	Groundwater Recovery Equipment,					
11)	Complete					
12)	Manhole Sections, Slabs, Steps,					
13)	Frames and Cover					
14)	Casing Pipe					
15)	Carrier Pipe					
16) 02900	SD-13, Certificates	1.3.2				
17)	Certified Professional					
18)	Geologist's Plans and Reports					
19) 02900	SD-12, Field Test Reports	1.3.3				
20)	Laboratory Tests					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 02900	SD-19, Operation and Maintenance M	1.3.4				
2) 02901	SD-02, Manufacturer's Catalog Data	1.2.1				
3)	Piping and Fittings					
4)	PVC Solvent Cement					
5)	Ball Valves					
6)	Globe Valves					
7)	Treatment System Control Panel					
8) 02901	SD-12, Field Test Reports	1.2.2				
9)	Oil Water Separator					
10)	Surge Settling Tank (Controls)					
11)	Air Stripper					
12)	Carbon Contactors					
13)	Backwash Tank (Controls)					
14) 02901	SD-19, Operations and Maintenance	1.2.3				
15)	Groundwater Treatment System					
16) 03302	SD-13, Certificates	1.2.1				
17)	Cement	2.2.1				
18)	Aggregates	2.2.3				
19)	Admixtures	2.2.4				
20)	Reinforcement	2.2.5				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Expansion-joint filler					
2)	Joint sealant	2.2.7				
3) 05500	SD-02, Manufacturer's Catalog Data	1.2.1				
4)	Handrails	2.4				
5)	Ladders					
6)	Structural steel door frames					
7)	Window guards					
) 05500	SD-04, Drawings	1.2.2				
9)	structural steel door frames					
10)	Access doors and panels					
11)	Cover plates and frames					
12)	Handrails	2.4				
13)	Ladders					
14)	Window guards					
15)	angles and plates	2.5				
16) 05500	SD-13, Certificates	1.2.3				
17)	certificate	1.2.3.1				
18) 05500	SD-14, Samples	1.2.4				
19)	Aluminum surfaces	2.2.6				
20) 05510	SD-04, Drawings	1.3.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 05510	SD-06, Instructions	1.3.2				
2) 09900	SD-06, Instructions	1.2.1				
3)	Application instructions					
4)	Manufacturer's material safety	1.6.2				
5)	data sheets					
6) 09900	SD-07, Schedules	1.2.2				
7)	Piping and conduit	3.6				
8)	identification					
9) 09900	SD-08, Statements	1.2.3				
10)	Applicator's qualifications	1.2.3.1				
11)	Evidence of acceptable variation	1.2.3.2				
12) 09900	SD-13, Certificates	1.2.4				
13)	Coating	1.2.4.1				
14)	Sealant	1.2.4.1				
15) 11300	SD-04, Drawings	1.3.2				
16) 11300	SD-06, Instructions	1.3.3				
17) 11300	SD-19, Operation and Maintenance M	1.3.4				
18) 11302	SD-04, Drawings	1.2.1				
19)	Separator		G			
20)	Accessory Equipment		G			

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 11302	SD-05, Design Data	1.2.2				
2)	Separator		G			
3)	Accessory Equipment		G			
4) 11302	SD-06, Instruction	1.2.3				
5)	Separator System		G			
6) 11302	SD-11, Factory Test Results	1.2.4				
7)	Shop Hydrostatic Test		G			
8) 11302	SD-12, Field Test Reports	1.2.5				
9)	Inspection					
10)	Field Hydrostatic Test					
11)	Preoperational Test					
12)	In-service Test					
13) 11302	SD-13, Certificates	1.2.6				
14)	Separator Corrosion Protection		G			
15) 11302	SD-19, Operation and Maintenance D	1.2.7				
16) 11303	SD-01 Data	1.3				
17)	Materials and Equipment					
18) 11303	SD-04 Drawings	1.3				
19)	Centrifugal Pump System					
20) 11303	SD-06 Instructions	1.3				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Centrifugal Pump System					
2) 11303	SD-09 Reports	1.3				
3)	Tests					
4) 11303	SD-19 Operation and Maintenance Ma	1.3				
5)	Centrifugal Pump System					
6) 11304	SD-02, Manufacturer's Catalog Data	1.3.1				
7) 11304	SD-04, Drawings	1.3.2				
8)	Bolt down cover					
9)	Vent					
10)	External connections					
11)	Anchor bolt sizing and placement					
12)	Tank finish					
13)	Tank grounding					
14)	Tank mixer					
15) 11304	SD-06, Instructions:	1.3.3				
16) 11304	SD-19, Operation and Maintenance M	1.3.4				
17) 11305	SD-02, Manufacturer's Catalog Data	1.3.1				
18) 11305	SD-04, Drawings	1.3.2				
19)	Bolt down cover					
20)	Vent					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	External connections					
2)	Liquid level controls mounting					
3)	brackets					
4)	Anchor bolt sizing and placement					
5)	Tank finish					
6)	Tank grounding					
7)	Float switch assembly					
8) 11305	SD-19, Operation and Maintenance M	1.3.3				
9) 11306	SD-02, Manufacturer's Catalog Data	1.2.1				
10) 11306	SD-19, Operation and Maintenance M	1.2.4				
11) 11307	SD-02, Manufacturer's Catalog Data	1.3.1				
12) 11307	SD-04, Shop Drawings	1.3.2				
13) 11307	SD-19, Operation and Maintenance M	1.3.3				
14) 11308	SD-02, Manufacturer's Catalog Data	1.3.1				
15) 11308	SD-04, Drawings	1.3.2				
16) 11308	SD-06, Instructions	1.3.3				
17) 11309	SD-02, Manufacturer's Catalog Data	1.4.1				
18) 11309	SD-04, Drawings	1.4.2				
19) 11309	SD-06, Instructions	1.4.3				
20) 11309	SD-09, Operation and Maintenance M	1.4.4				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 11310	SD-02, Manufacturer's Catalog Data	1.3.1				
2) 11310	SD-04, Drawings	1.3.2				
3)	External connections					
4)	Liquid level controls mounting					
5)	bracket					
6)	Anchor bolt sizing and placement					
7)	Tank finish					
)	Tank grounding					
9)	Float switch assembly					
10) 11310	SD-06, Instructions	1.3.3				
11) 11311	SD-02, Manufacturer's Catalog Data	1.3.1				
12) 11311	SD-04, Drawings	1.3.2				
13)	Bolt down cover					
14)	Vent					
15)	External connections					
16)	Liquid level controls mounting					
17)	bracket					
18)	Anchor bolt sizing and placement					
19)	Tank finish					
20)	Tank grounding					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Float switch assembly					
2)	Floating skimmer assembly					
3) 11312	SD-02, Manufacturer's Catalog Data	1.3.1				
4) 11312	SD-04, Drawings	1.3.2				
5) 11312	SD-06, Instructions	1.3.3				
6) 11312	SD-19, Operation and Maintenance M	1.3.4				
7) 11313	SD-01 Data	1.3				
8)	Materials and Equipment					
9) 11313	SD-04 Drawings	1.3				
10)	Positive Displacement Pump					
11)	System					
12) 11313	SD-06 Instructions	1.3				
13)	Positive Displacement Pump					
14)	System					
15) 11313	SD-09 Reports	1.3				
16)	Tests					
17) 11313	SD-19 Operation and Maintenance Ma	1.3				
18)	Positive Displacement Pump					
19)	System					
20) 11315	SD-01 Data	1.3				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Materials and Equipment					
2) 11315	SD-04 Drawings	1.3				
3)	Pneumatic Pumping System					
4) 11315	SD-06 Instructions	1.3				
5)	Pneumatic Pumping System					
6) 11315	SD-09 Reports	1.3				
7)	Tests					
8) 11315	SD-19 Operation and Maintenance Ma	1.3				
9)	Pneumatic Pumping System					
10) 11347	SD-02, Manufacturer's Data	1.3.1				
11)	External connections					
12)	Liquid level indicators					
13)	Saddles					
14)	Tank support calculations					
15)	Anchor bolt sizing and placement					
16)	Tank finish					
17)	Tank grounding					
18) 11347	SD-04, Shop Drawings	1.3.2				
19)	External connections					
20)	Liquid level indicators					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Saddles					
2)	Tank support calculations					
3)	Anchor bolt sizing and placement					
4)	Tank finish					
5)	Tank grounding					
6) 13121	SD-02, Manufacturer's Catalog Data	1.6.1				
7)	materials	2.1				
) 13121	SD-03, Manufacturer's Standard Col	1.6.2				
9)	Factory color finish	2.10.2	G			
10) 13121	SD-04, Drawings	1.6.3				
11)	Preengineered building	1.6.3.1				
12)	anchor bolts	1.6.4.1				
13)	Structural connections					
14)	Roofing and siding connections					
15)	Door and window frame					
16)	installation					
17)	Garage door frame installation					
18)	Roof penetrations and flashings					
19)	Accessories					
20) 13121	SD-05, Design Data	1.6.4				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Building	1.6.4.1				
2)	Foundation loads	1.3.3				
3)	Anchor bolts	1.6.4.1				
4)	Purlins and girts					
5)	Bracing					
6) 13121	SD-11, Factory Tests	1.6.5				
7)	Factory Color Finish	2.10.2				
)	Insulation					
9) 13121	SD-13, Certificates	1.6.6				
10)	materials	2.1				
11) 13121	SD-19, Operation and Maintenance M	1.6.7				
12)	Preengineered Building	1.6.3.1				
13) 13321	SD-02, Manufacturer's Catalog Data	1.3.1				
14)	equipment	2.1				
15)	Read-out device					
16) 13321	SD-06, Instructions	1.3.2				
17)	equipment	2.1				
18) 13321	SD-12, Field Test Reports	1.3.3				
19)	calibration	1.3.3.1				
20)	Open channel	1.3.3.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Dimensional inspection	1.3.3.1				
2)	Closed channel	1.3.3.1				
3) 13321	SD-19, Operation and Maintenance D	1.3.4				
4) 15200	SD-02, Manufacturer's Catalog Data	1.6.1				
5)	Isolators	2.3				
6)	Flexible connectors					
7)	Flexible duct connectors	2.4				
8)	Machinery manufacturer's sound	1.6.1.1				
9)	data					
10) 15200	SD-06, Instructions	1.6.2				
11)	Vibration and noise isolation	3.1.1				
12)	components					
13) 15200	SD-12, Field Test Reports	1.6.3				
14)	Equipment vibration tests	3.2.2.1				
15)	Equipment sound level tests	3.2.2.2				
16) 15200	SD-13, Certificates	1.6.4				
17)	Neoprene	2.2				
18)	Flexible duct connectors	2.4				
19)	Flexible connectors					
20) 15400	SD-02, Manufacturer's Catalog Data	1.4.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Pipe and fittings	2.1				
2)	Valves	2.2.2				
3)	Plumbing fixtures					
4)	Pipe hangers and supports	2.3.5				
5)	Pumps	2.5				
6)	Pressure gages	2.2.5				
7)	Water meters	2.2.3				
)	Strainers	2.2.4				
9)	Drains	2.1.4				
10)	Water hammer arresters	2.2.7				
11)	Backflow preventers	2.2.9				
12)	Electric water coolers					
13)	Thermometers					
14) 15400	SD-19, Operation and Maintenance M	1.4.2				
15)	Pumps	2.5				
16) 15501	SD-02, Manufacturer's Catalog Data	1.4.1				
17)	Electric warm air furnaces					
18)	General exhaust fans	2.1.2				
19) 15501	SD-04, Drawings	1.4.2				
20)	Temperature control systems	1.4.2.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 15501	SD-06, Instructions	1.4.3				
2)	Installation manual	1.4.3.1				
3) 15501	SD-19, Operation and Maintenance M	1.4.4				
4)	Electric warm air furnaces					
5)	Exhaust fans					
6) 15620	SD-02, Manufacturer's Catalog Data	1.4.1				
7)	Unit heaters	2.1				
) 15620	SD-19, Operation and Maintenance M	1.4.2				
9)	Unit heaters	2.1				
10) 15871	SD-02, Manufacturer's Catalog Data	1.4.1				
11)	Fans	2.1				
12)	Sleeve bearings	2.1.2.2				
13)	Dampers					
14)	Gaskets	2.4.1				
15)	Protective coating materials					
16)	Sealants	2.4.3				
17)	Damper regulators	2.5.1				
18)	Supports and hangers	2.6				
19)	Vibration isolators	2.6.5				
20)	Thermoplastic ductwork					

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SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 15871	SD-04, Drawings	1.4.2				
2)	Industrial ventilation and	1.4.2.1				
3)	exhaust systems					
4) 15871	SD-08, Statements	1.4.3				
5)	Work plan	1.4.3.1				
6) 15871	SD-10, Test Reports	1.4.4				
7)	Fan tests	2.1.1				
8) 15871	SD-12, Field Test Reports	1.4.5				
9)	start-up tests	1.4.5.1				
10)	Sound level tests	3.2.6				
11) 15871	SD-18, Records	1.4.6				
12)	Posted operating instructions	1.6				
13) 15871	SD-19, Operation and Maintenance M	1.4.7				
14)	Fans	2.1				
15)	Industrial ventilation and	1.4.2.1				
16)	exhaust systems					
17) 15895	SD-02, Manufacturer's Catalog Data	1.5.1				
18)	Dampers	2.7				
19)	Flexible ducts and connectors					
20)	Bird screens					

* Navy Notes:
Approved by:
G: Contracting Officer
Blank: CQC Manager

* NASA Notes:
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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Registers and grilles	2.4				
2)	Metal ducts	2.1				
3)	Test holes					
4)	Motor operated dampers					
5) 15895	SD-04, Drawings	1.5.2				
6)	test holes					
7)	Duct hangers and supports	3.1.2				
8) 15895	SD-05, Design Data	1.5.3				
9)	Duct span versus reinforcement	1.5.3.1				
10)	schedule					
11) 15895	SD-06, Instructions	1.5.4				
12)	Ductwork and ductwork	1.5.4.1				
13)	accessories					
14) 15895	SD-07, Schedules	1.5.5				
15)	Registers and grilles	2.4				
16)	Duct hangers and supports	3.1.2				
17) 15895	SD-08, Statements	1.5.6				
18)	Certified personnel list					
19) 15895	SD-10, Test Reports	1.5.7				
20)	Automatic dampers					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Sound pressure level rating	1.5.7.2				
2) 15895	SD-12, Field Test Reports	1.5.8				
3)	Air duct leakage tests	3.2.1				
4)	Testing and balancing of air					
5)	systems					
6) 15895	SD-13, Certificates	1.5.9				
7)	Automatic dampers					
) 15996	SD-08, Statements	1.5.1				
9)	Independent TAB agency	1.5.1.1				
10)	personnel qualifications					
11)	Design review report	1.5.1.2				
12)	Pre-field DALT preliminary	1.5.1.3				
13)	notification					
14)	Pre-field TAB engineering report	1.5.1.4				
15)	Advanced notice for DALT field	1.5.1.5				
16)	work					
17)	Advanced notice for Season 1	1.5.1.5				
18)	TAB field work					
19)	Check out list for Season 1	1.5.1.6				
20)	certified DALT report	1.5.2.1				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 15996	SD-12, Field Test Reports	1.5.2				
2)	Certified DALT report	1.5.2.1				
3)	Certified TAB report					
4) 16370	SD-01, Data	1.5.1				
5)	Calculations	1.5.1.1				
6) 16370	SD-02, Manufacturer's Catalog Data	1.5.2				
7)	Conductors	2.6				
)	Insulators	2.5				
9)	Pole top switch	2.17				
10)	Recloser					
11)	Sectionalizer					
12)	Cutouts	2.13				
13)	Transformer	2.16				
14)	Metering equipment	2.18				
15)	Meters	2.18.3				
16)	Surge arresters	2.12				
17)	Guy strand	2.8				
18)	Anchors	2.10				
19) 16370	SD-08, Statements	1.5.3				
20)	Qualifications of cable splicer	1.6.2				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 16370	SD-10, Test Reports	1.5.4				
2)	Wood poles	2.2				
3)	Wood Crossarms	2.3				
4) 16370	SD-11, Factory Test Reports	1.5.5				
5)	Transformer tests	1.5.5.1				
6) 16370	SD-12, Field Test Reports	1.5.6				
7)	Ground rod tests	3.2.1				
8)	High voltage cable test	3.2.5				
9)	Transformer field tests	3.2.2				
10)	Large overhead systems test					
11) 16370	SD-13, Certificates	1.5.7				
12)	transformer	2.16				
13)	Design and Other Tests	1.5.7.1				
14) 16370	SD-18, Records	1.5.8				
15)	Transformer test schedule	1.5.8.1				
16) 16402	SD-02, Manufacturer's Catalog Data	1.4.1				
17)	Receptacles	2.9				
18)	Circuit breakers	2.10.2				
19)	Switches	2.8				
20)	Conduit and fittings	2.2				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Ground rods	2.18				
2)	Device plates	2.7				
3)	Wires and cables	2.5				
4)	Outlet boxes and covers	2.3				
5)	Transformers	2.13				
6) 16402	SD-04, Drawings	1.4.2				
7)	Panelboards	2.10				
8)	Transformers	2.13				
9) 16402	SD-08, Statements	1.4.3				
10)	Fuses	2.12				
11) 16402	SD-11, Factory Test Reports	1.4.4				
12)	Transformer tests	1.4.4.1				
13) 16402	SD-12, Field Test Reports	1.4.5				
14)	600-volt wiring test	3.2.2				
15)	Grounding system test	3.2.3				
16) 16510	SD-02, Manufacturer's Catalog Data	1.4.1				
17)	Fluorescent lighting fixtures	2.1				
18)	Fluorescent lamps	2.1.1				
19)	Fluorescent core and coil	2.1.2				
20)	ballasts					

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(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	High-Intensity-Discharge (HID)	2.2				
2)	lighting fixtures					
3)	HID Ballasts	2.2.1				
4)	HPS lamps	2.2.2				
5)	Incandescent lighting fixtures	2.3				
6)	Incandescent lamps	2.3.1				
7)	Lighting contactor	2.6				
)	Photocell switch	2.7				
9)	Time switch					
10)	Emergency lighting equipment	2.9				

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SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 880	1989 Criteria for Use in Evaluation of Testing Laboratories and Organizations for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
ASTM C 1077	1991 (Rev. A) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 3666	1991 (Rev. A) Evaluating and Qualifying Agencies and Inspecting Bituminous Paving Materials
ASTM D 3740	1988 Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	1990 Evaluation of Testing and Inspection Agencies as Used in Construction
ASTM E 543	1989 (Rev. A) Determining the Qualification of Nondestructive Testing Agencies

1.2 SUBMITTALS

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

1.2.1 SD-18, Records

a. Quality Control (QC) plan G

Submit a QC plan within 15 calendar days after receipt of Notice of Award.

1.3 INFORMATION FOR THE CONTRACTING OFFICER

Deliver the following to the Contracting Officer:

a. Combined Contractor Production Report/Contractor Quality Control

Report (1 sheet): Original and 1 copy, by 10:00 AM the next working day after each day that work is performed;

b. QC Specialist Reports: Originals and 1 copy by 10:00 AM the next working day after each day that work is performed;

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

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

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

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

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

1.4 QC PROGRAM REQUIREMENTS

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

1.5 QC ORGANIZATION

1.5.1 QC Manager

1.5.1.1 Duties

Provide a QC Manager at the work site to manage and implement the QC program. The QC Manager is required to attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review and approval except those designated for Contracting Officer approval, ensure testing is performed and prepare QC certifications and documentation required in this Contract. In addition to managing and implementing the QC program, the QC Manager may perform the duties of project superintendent.

1.5.1.2 Qualifications

An individual with a minimum of 3 years experience as a foreman, superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts which included the major trades that are part of this Contract.

1.6 QC PLAN

1.6.1 Requirements

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

a. Name and qualifications, in resume format, for the QC Manager.

b. A letter signed by an officer of the firm appointing the QC Manager and stating that he/she is responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of non-conforming work.

c. Procedures for reviewing, approving and managing submittals. Provide the names of the persons authorized to review and certify submittals prior to approval. Provide the initial submittal or the Submittal Register as specified in Section 01300, "SUBMITTALS".

d. Testing laboratory information required by the paragraphs entitled "Accredited Laboratories" or "Testing Laboratory Requirements", as applicable.

e. A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

f. Procedures to identify, record, track and complete rework items.

g. Documentation procedures, including proposed report formats.

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

1.6.2 Preliminary Work Authorized Prior to Approval

The only work that is authorized to proceed prior to the approval of the QC plan is mobilization and surveying.

1.6.3 Approval

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

1.6.4 Notification of Changes

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

1.7 COORDINATION AND MUTUAL UNDERSTANDING MEETING

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

1.8 QC MEETINGS

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

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work:

- Work or testing accomplished since last meeting
- Rework items identified since last meeting
- Rework items completed since last meeting;

c. Review the status of submittals:

- Submittals reviewed and approved since last meeting
- Submittals required in the near future;

d. Review the work to be accomplished in the next 2 weeks and documentation required. Schedule the three phases of control and testing:

- Establish completion dates for rework items
- Preparatory phases required
- Initial phases required
- Follow-up phases required
- Testing required
- Status of off-site work or testing

- Documentation required;

e. Resolve QC and production problems; and

f. Address items that may require revising the QC plan:

- Changes in QC organization personnel
- Changes in procedures.

1.9 THREE PHASES OF CONTROL

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

1.9.1 Preparatory Phase

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

a. Review each paragraph of the applicable specification sections;

b. Review the Contract drawings;

c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;

d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

e. Examine the work area to ensure that the required preliminary work has been completed;

f. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

g. Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

h. Discuss construction methods;

1.9.2 Initial Phase

Notify the Contracting Officer at least 2 work days in advance of each initial phase. When construction crews are ready to start work on a

definable feature of work, conduct the initial phase with the superintendent, and the foreman responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

a. Establish the quality of workmanship required;

b. Resolve conflicts;

c. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and

d. Ensure that testing is performed by the approved laboratory.

1.9.3 Follow-Up Phase

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

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

b. Maintain the quality of workmanship required;

c. Ensure that testing is performed by the approved laboratory; and

d. Ensure that rework items are being corrected.

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

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

1.10 SUBMITTAL REVIEW AND APPROVAL

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

1.11 TESTING

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

1.11.1 Testing Laboratory Requirements

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

to the following requirements:

a. Sampling and testing shall be under the technical direction of a Registered Professional Engineer (P.E) with at least 5 years of experience in construction material testing.

b. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C 1077.

c. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D 3666.

d. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.

e. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A 880. Laboratories shall meet the requirements of ASTM E 329.

f. Laboratories engaged in nondestructive testing (NDT) shall meet the requirements of ASTM E 543.

1.11.2 Accredited Laboratories

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

1.11.3 Inspection of Testing Laboratories

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

1.11.4 Capability Check

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

1.11.5 Test Results

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

1.12 QC CERTIFICATIONS

1.12.1 Contractor Quality Control Report Certification

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

1.12.2 Invoice Certification

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

1.12.3 Completion Certification

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

1.13 DOCUMENTATION

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

1.13.1 Contractor Production Report

Reports are required for each day that work is performed and shall be attached to the Contractor Quality Control Report prepared for the same day. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Production Reports are to be prepared, signed and dated by the project superintendent and shall contain the following information:

a. Date of report, report number, name of contractor, Contract number, title and location of Contract and superintendent present.

b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.

c. A list of Contractor and subcontractor personnel on the work site, their trades, employer, work location, description of work performed and hours worked.

d. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results on the following:
- Was a job safety meeting held? (If YES attach a copy of the meeting minutes)
- Were there any lost time accidents? (If YES attach a copy of the completed OSHA report)
- Was trenching/scaffold/high voltage electrical/high work done? (If YES attach a statement or checklist showing inspection performed)
- Was hazardous material/waste released into the environment? meetings held and accidents that happened.

e. A list of equipment/material received each day that is incorporated into the job.

f. A list of construction and plant equipment on the work site including the number of hours used, idle and down for repair.

g. Include a "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site.

1.13.2 Contractor Quality Control Report

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

a. Identify the control phase and the definable feature of work.

b. Results of the Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the drawings and specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.

c. Results of the Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed and include a list of who performed the tests.

d. Results of the Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed and include a list of who performed the tests.

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

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

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

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

i. Contractor Quality Control Report certification.

1.13.3 Testing Plan and Log

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

1.13.4 Rework Items List

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

1.13.5 As-Built Drawings

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

1.13.6 Report Forms

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

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

b. Testing Plan and Log

c. Rework Items List

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

CONTRACTOR PRODUCTION REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

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

WORK PERFORMED TODAY

WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

JOB SAFETY

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

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

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

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

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

LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED

☐ SAFETY REQUIREMENTS HAVE BEEN MET.

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB

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

REMARKS

CONTRACTOR/SUPERINTENDENT _____ DATE _____

FORM 01400-1 6/91

CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

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

			TESTING PERFORMED & WHO PERFORMED TEST
INITIAL	PRELIMINARY WORK WAS DONE CORRECTLY.		
	SAMPLE HAS BEEN PREPARED/APPROVED.		
	WORKMANSHIP IS SATISFACTORY.		
	TEST RESULTS ARE ACCEPTABLE.		
	WORK IS IN COMPLIANCE WITH THE CONTRACT.		

			TESTING PERFORMED & WHO PERFORMED TEST
FOLLOW-UP	WORK COMPLIES WITH CONTRACT AS APPROVED IN INITIAL PHASE.		

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

REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

REMARKS

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.

AUTHORIZED QC MANAGER AT SITE — DATE

GOVERNMENT QUALITY ASSURANCE REPORT

DATE

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

GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE — DATE

FORM 01400-1 8/91

Sheet of

CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE	
CONTRACT NO.	REPORT NO.

PREPARATORY

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

IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND *LIST PERSONNEL PRESENT*

INITIAL

PHASE	Y - YES; N - NO, SEE REMARKS; BLANK - NOT APPLICABLE	
	PRELIMINARY WORK WAS DONE CORRECTLY.	
	SAMPLE HAS BEEN PREPARED/APPROVED.	
	WORKMANSHIP IS SATISFACTORY.	
	TEST RESULTS ARE ACCEPTABLE.	
	WORK IS IN COMPLIANCE WITH THE CONTRACT.	

IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND *LIST PERSONNEL PRESENT*

TESTING PERFORMED & WHO PERFORMED TEST

FORM 01400 2 8/91

CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

CONTRACT NO.

REPORT NO.

PHASE

Y - YES; N - NO, SEE REMARKS; BLANK - NOT APPLICABLE

IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND *LIST PERSONNEL PRESENT*

FOLLOW-UP

WORK COMPLIES WITH CONTRACT AS APPROVED IN INITIAL PHASE	TESTING PERFORMED & WHO PERFORMED TEST

FORM 01400-2 6/91

(Back)

Sheet of

TESTING PLAN AND LOG

CONTRACT NUMBER	PROJECT TITLE AND LOCATION	CONTRACTOR

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

Page _____ of _____

REWORK ITEMS LIST

Contract No. and Title: _____

Contractor: _____

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

SECTION 01560

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910-SUBPART G	Occupational Health and Environmental Control
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
49 CFR 178	Shipping Container Specification

CORPS OF ENGINEERS (COE)

COE EP-1165-2-304	1976 Flood Plain Regulations for Flood Plain Management

1.2 DEFINITIONS

1.2.1 Sediment

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

1.2.2 Solid Waste

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

1.2.3 Rubbish

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

1.2.4 Debris

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

1.2.5 Chemical Wastes

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

1.2.6 Sanitary Wastes

1.2.6.1 Sewage

Wastes characterized as domestic sanitary sewage.

1.2.6.2 Garbage

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

1.2.7 Hazardous Waste

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

1.2.8 Oily Waste

Petroleum products and bituminous materials.

1.3 SUBMITTALS

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

1.3.1 SD-08, Statements

b. Preconstruction survey report

1.3.2 SD-18, Records

a. Solid waste disposal permit

b. Disposal permit for hazardous waste

1.3.2.1 Solid Waste Disposal Permit

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

1.3.2.2 Disposal Permit for Hazardous Waste

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

permitted facilities.

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

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

1.4.1 Preconstruction Survey

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

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

3.1.1 Land Resources

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

3.1.1.1 Protection

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

3.1.1.2 Replacement

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

3.1.1.3 Temporary Construction

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

3.1.2 Water Resources

3.1.2.1 Oily Wastes

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

3.1.3 Fish and Wildlife Resources

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

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

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

3.3 EROSION AND SEDIMENT CONTROL MEASURES

3.3.1 Burnoff

Burnoff of the ground cover is not permitted.

3.3.2 Protection of Erodible Soils

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

3.3.3 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

3.3.3.1 Mechanical Retardation and Control of Runoff

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

3.3.3.2 Vegetation and Mulch

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

3.4 CONTROL AND DISPOSAL OF SOLID AND SANITARY WASTES

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

3.4.1 Disposal of Rubbish and Debris

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

3.4.1.1 Removal From Government Property

Remove and dispose rubbish and debris from Government property.

3.4.2 Garbage Disposal

Place garbage in approved containers, and move to a pickup point or disposal area, where directed by the Contracting Officer.

3.4.3 Sewage, Odor, and Pest Control

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

3.5 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

3.5.1 Hazardous Type Waste

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

3.5.2 Petroleum Products

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

3.5.3 Equipment (Hazardous Material)

Make available to the Contracting Officer or the Contracting Officer's Representative, one, complete set of the proper personal protective equipment as required herein for entry into the inspection of the hazardous control area. Provide equivalent training to the Contracting Officer or a designated representative in the use of the required personal protective equipment as that provided to Contractor employees. Provide manufacturer's certificate of compliance for all equipment required.

3.5.3.1 Protective Clothing

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

3.6 DUST CONTROL

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

3.7 NOISE

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

3.8 HAZARDOUS WASTE GENERATION

Handle generated hazardous waste in accordance with 40 CFR 262.

3.9 HAZARDOUS WASTE DISPOSAL

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

-- End of Section --

SECTION 01561

EROSION AND SEDIMENT CONTROL

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 Raods and Structures

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

NCDEHNR	1988 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

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

1.3.1 SD-02, Manufacturer's Catalog Data

a. Filter Barriers

b. Silt Fence

c. Erosion Control Matting

d. Dust Suppressors

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 filter barrier may be provided in lieu of the indicated filter barrier except that the filter fabric shall be as specified, and the height of the structure shall be as indicated.

2.1.2 Posts

2 inch by 4 inch wood posts. Posts shall be a minimum of 12 inches long.

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.

PART 3 EXECUTION

3.1 FILTER BARRIERS AND SILT FENCE

Install posts a maximum of 6 feet on center, and at an angle between 2 degrees and 20 degrees towards the potential silt load area. The height of the filter barrier shall be a minimum of 15 inches and shall not exceed 18 inches. The height of the silt fence shall not exceed 36 inches. Do not attach filter fabric to existing trees. Secure filter fabric to the post and wire fabric using staples, tie wire, or hog rings. Attach filter fabric as shown in the drawings. Splice filter fabric at support pole using a 6 inch overlap and securely seal. Top of the filter fabric shall have a 1 inch tuck or a reinforced top end section.

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 Contracting Officer 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 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 CLEAN UP

At the completion of the job, or when directed or approved by the Contracting Officer, 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 Contracting Officer.

-- End of Section --

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 REFERENCES

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

DEFENSE LOGISTICS AGENCY (DLA)

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

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

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

1.2.1 Quantity

Submit five copies of the manufacturers' O&M information specified herein for the components, assemblies, subassemblies, attachments, and accessories. The item for which O&M data/manual are 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 Contractor fails to deliver O&M Data/Manuals within the time limits set forth above, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such data/manuals are associated.

1.2.3 Delivery

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

1.2.4 Changes to Submittals

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

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.3.1 Operating Instructions

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

1.3.1.1 Safety Precautions

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

1.3.1.2 Operator Prestart

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

1.3.1.3 Startup, Shutdown, and Postshutdown Procedures

Include a control sequence for each of these operations.

1.3.1.4 Normal Operations

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

1.3.1.5 Emergency Operations

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

1.3.1.6 Operator Service Requirements

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

1.3.1.7 Environmental Conditions

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

1.3.2 Preventive Maintenance

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

1.3.2.1 Lubrication Data

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

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

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

c. A lubrication schedule showing service interval frequency.

1.3.2.2 Preventive Maintenance Plan and Schedule

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

1.3.3 Corrective Maintenance

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

1.3.3.1 Troubleshooting Guides and Diagnostic Techniques

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

1.3.3.2 Wiring Diagrams and Control Diagrams

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

1.3.3.3 Maintenance and Repair Procedures

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

1.3.3.4 Removal and Replacement Instructions

Include step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.3.3.5 Spare Parts and Supply Lists

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

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

1.4 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

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

1.4.1 Data Package 1

a. Safety precautions

b. Maintenance and repair procedures

c. Warranty information

d. Contractor information

1.4.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan and schedule

f. Maintenance and repair procedures

g. Removal and replacement instructions

h. Spare parts and supply list

i. Parts identification

j. Warranty information

k. Contractor information

1.4.3 Data Package 3

a. Safety precautions

b. Normal operations

c. Emergency operations

d. Environmental conditions

e. Lubrication data

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring diagrams and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Parts identification

m. Warranty information

n. Testing equipment and special tool information

o. Contractor information

1.4.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and postshutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Corrective maintenance man-hours

p. Parts identification

q. Warranty information

r. Personnel training requirements

s. Testing equipment and special tool information

t. Contractor information

1.4.5 Data Package 5

a. Safety precautions

b. Environmental conditions

c. Preventive maintenance plan and schedule

d. Troubleshooting guides and diagnostic techniques

e. Wiring and control diagrams

f. Maintenance and repair procedures

g. Spare parts and supply list

h. Warranty information

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 02050

DEMOLITION AND REMOVAL

PART 1 GENERAL

1.1 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6	1983 Demolition Operations - Safety Requirements

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 61-SUBPART M	National Emission Standard for Asbestos

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations. Store materials that cannot be removed daily in areas specified by the Contracting Officer.

1.3 SUBMITTALS

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

1.3.1 SD-08, Statements

a. Demolition plan

Submit proposed demolition and removal procedures to the Contracting Officer for approval before work is started.

1.3.1.1 Required Data

Demolition plan shall include procedures for coordination with other work in progress, a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.4 REGULATORY AND SAFETY REQUIREMENTS

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

1.4.1 Notifications

Furnish timely notification of demolition projects to Federal, state, regional, and local authorities in accordance with 40 CFR 61-SUBPART M. Notify the state's environmental protection agency, local air pollution control district/agency and the Contracting Officer in writing 10 days prior to the commencement of work in accordance with 40 CFR 61-SUBPART

M.

1.5 DUST AND DEBRIS CONTROL

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

1.6 PROTECTION

1.6.1 Traffic Control Signs

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

1.6.2 Existing Work

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

1.6.3 Trees

Conform to Section 01560, "Environmental Protection," for protection of natural resources.

1.6.4 Facilities

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

1.7 BURNING

Burning will not be permitted.

1.8 RELOCATIONS

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Structures

Remove indicated existing structures to 1 foot below existing grade.

3.1.2 Utilities and Related Equipment

Remove existing utilities uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer. If utility lines are encountered that are not shown on drawings, contact the Contracting Officer for further instructions.

3.1.3 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated to a depth of 6 inches below existing adjacent grade. Provide neat sawcuts at limits of pavement removal as indicated.

3.1.4 Concrete

Saw concrete along straight lines to a depth of not less than 2 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.

3.1.5 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

a. Holes and depressions caused by previous physical damage or left as a result of removals in existing masonry walls to remain shall be completely filled with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.

c. Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.2 FILLING

Fill holes, open basements, and other hazardous openings in accordance with Section 02220, "General Excavation, Filling and Backfilling".

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

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

3.4 CLEANUP

3.4.1 Debris and Rubbish

Remove and transport debris and rubbish in a manner that will prevent spillage on pavements, streets or adjacent areas. Clean up spillage from pavements, streets and adjacent areas potential. Conform to other applicable requirements under Section 01560, "Environmental Protection."

-- End of Section --

SECTION 02220

GENERAL EXCAVATION, FILLING, AND BACKFILLING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	1990 Concrete Aggregate
ASTM C 136	1984 (Rev. A) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	1963 (R 1990) Particle-Size Analysis of Soils
ASTM D 698	1978 (R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1140	1954 (R 1990) Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve
ASTM D 1556	1990 Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	1978 (R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2321	1989 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2487	1990 Classification of Soils for Engineering Purposes
ASTM D 2680	1990 Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2774	1972 (R 1983) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2922	1981 (R 1990) Density of Soil and Soil-Aggregate in Place by Nuclear Methods

(Shallow Depth)

ASTM D 3017	1988 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3786	1987 Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method
ASTM D 4253	1983 Maximum Index Density of Soils Using a Vibratory Table
ASTM D 4254	1983 Minimum Index Density of Soils and Calculation of Relative Density
ASTM D 4318	1984 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4355	1984 Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	1989 Water Permeability of Geotextiles by Permittivity
ASTM D 4533	1985 (R 1990) Trapezoidal Tearing Strength of Geotextiles
ASTM D 4632	1986 (R 1990) Breaking Load and Elongation of Geotextiles (Grab Method)
ASTM D 4751	1987 Determining the Apparent Opening Size of a Geotextile
ASTM D 4759	1988 Determining the Specification Conformance of Geosynthetics
ASTM D 4833	1988 Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA M23	1980 PVC Pipe - Design and Installation
AWWA C600	1987 Installation of Ductile-Iron Water Mains and Their Appurtenances

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909	Fertilizer

CORPS OF ENGINEERS (COE)

COE EM-385-1-1	1987 Safety and Health Requirements Manual

DEPARTMENT OF AGRICULTURE (DOA)

DOA SSIR	April 1984 Soil Survey Investigation Report No. 1, Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples, Soil Conservation Service

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA TC 2	1983 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC 6	1990 PVC and ABS Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	1990 Flammable and Combustible Liquids Code
NFPA 70	1990 National Electrical Code

STATE OF NORTH CAROLINA, DEPARTMENT OF TRANSPORTATION STANDARD

SSS-1990	Standard Specifications for Roads and Structures; Dated 1990.

1.2 DEFINITIONS

1.2.1 Hard Materials

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

1.2.2 Cohesive Materials

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

1.2.3 Cohesionless Materials

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

1.2.4 Compaction

The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 698 or ASTM D 1557 for general soil types or ASTM D 4253 or ASTM D 4254 (Relative Density) for isolated cohesionless materials, abbreviated in this specification as "95 percent ASTM D 698 maximum density."

1.2.5 Granular Pipe Bedding

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

1.2.6 Capillary Water Barrier

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

1.3 SUBMITTALS

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

1.3.1 SD-08, Statements

a. Shoring and sheeting plan

b. Dewatering plan

1.3.1.1 Shoring and Sheeting Plan

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

1.3.1.2 Dewatering Plan

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

1.3.2 SD-12, Field Test Reports

a. Fill and backfill test

b. Select material test

c. Porous fill test for capillary water barrier

d. Density and moisture tests Submit within 14 days.

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

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials. Store synthetic fiber filter fabric to prevent exposure to direct sunlight.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Approximate surface elevations are as indicated.

b. Ground water elevation varies from approximately 7 feet below existing surface elevation to 15 feet below existing surface elevation.

c. Blasting will not be permitted. Remove material in an approved manner.

1.6 REGULATORY REQUIREMENTS

Materials and workmanship specified herein with reference to NCDOT SSS-1990 State Standard shall be in accordance with the referenced articles, sections, and paragraphs of the standard except that contractual and payment provisions do not apply. Where the term "Engineer" is used, it shall mean the Contracting Officer. Where the term "state" is used, it shall mean "Federal Government."

1.7 PROTECTION

1.7.1 Dewatering Plan

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

1.7.2 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Provide soil material 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 Backfill

Bring trenches to grade indicated on the drawings using material excavated on the site of this project. This material will be considered unclassified and no testing other than for compaction will be required before use as backfill.

2.1.2 Sand

Clean, coarse-grained sand classified in Sections 1005 and 1014 of the NCDOT Standard Specifications for materials and gradation. The size used shall be Standard Size No. 25 or 2 MS as listed and defined in Table 1005-2, "Aggregate Gradation", of the NCDOT Standard Specification.

2.1.3 Gravel

Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as No. 57, 67, or ABC in accordance with NCDOT Standard Specifications.

2.1.4 Topsoil Material

Salvaged topsoil from stockpile. Furnish additional topsoil from approved sources off the site if stockpiled material is insufficient to complete work indicated.

2.1.5 Borrow

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

2.1.6 Select Material

ASTM D 2487, classification GW, GP, SW, SP with a maximum of 10 percent by weight passing ASTM D 1140, No. 200 sieve.

2.1.7 Capillary Water Barrier

Provide a capillary water barrier under concrete floor slabs consisting of clean crushed stone, crushed gravel, or uncrushed gravel conforming to ASTM C33 coarse aggregate grading size 57, 67, or 7.

2.2 MATERIAL FOR PIPE CASING

2.2.1 Casing Pipe

ASTM A 139, Grade B, or ASTM A 252, Grade 2, smooth wall pipe. Casing size shall be of the outside diameter and wall thickness as indicated. Protective coating is not required on casing pipe.

2.3 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch-minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Blue:	Water Systems
Green:	Sewer Systems

2.3.1 Detectable Warning Tape for Non-Metallic Piping

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

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Unsuitable Material

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

3.2 PROTECTION

3.2.1 Protection Systems

Provide shoring, bracing, and sheeting in accordance with COE EM-385-1-1 , except that banks may be sloped only when approved by the Contracting Officer.

3.2.2 Site Drainage

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

3.2.3 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. 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.

3.2.4 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 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.

3.3.1 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement.

3.4 PIPELINE CASING UNDER RAILROAD AND PAVEMENT

Provide new smooth wall steel pipeline casing under existing railroad and pavement by the boring and jacking method of installation. Provide each new pipeline casing, where indicated and to the lengths and dimensions shown, complete and suitable for use with the new piped utility as indicated.

3.4.1 Earthwork for Pipeline Casings

Provide excavation, sheet piling, shoring, dewatering, and backfilling for pipeline casings under this section.

3.5 FILLING AND BACKFILLING

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

3.5.1 Common Fill Placement

Provide for general site. Place in 6 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 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 6-inch lifts to top of trench and in 6-inch lifts to one foot over pipe outside structures and paved areas.

3.5.2.1 Bedding Requirements

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide ASTM D 2321 materials as follows:

a. Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

b. Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.

3.6 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.7 COMPACTION

Expressed as a percentage of maximum density. Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required.

3.7.1 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.

3.7.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D 698. Compact fill, backfill, porous fill, and adjacent area material to 95 percent of ASTM D 698 .

3.7.3 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.

3.8 FINISH OPERATIONS

3.8.1 Grading

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

3.8.2 Seed

Scarify existing subgrade. Provide 4 inches of topsoil for newly graded finish earth surfaces and areas disturbed by the Contractor. Additional topsoil will not be required if work is performed in compliance with stripping and stockpiling requirements. 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.

3.8.3 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.9 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.

3.10 FIELD QUALITY CONTROL

3.10.1 Sampling

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

3.10.2 Testing

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

3.10.2.1 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.

3.10.2.2 Density Tests

Test density in accordance with ASTM D 1556, or ASTM D 2922 and ASTM D 3017. When ASTM D 2922 and ASTM D 3017 density tests are used, verify density test results by performing an ASTM D 1556 density test at a location already ASTM D 2922 and ASTM D 3017 tested as specified herein. Perform as ASTM D 1556 density test at the start of the job, and for every 5 ASTM D 2992 and ASTM D 3017 tests thereafter. Test each lift at randomly selected locations every 2000 square feet of existing grade in fill for structures and concrete slabs, and every 2500 square feet for other fill areas and every 2000 square feet of subgrade in cut.

-- End of Section --

SECTION 02571

PAVEMENT REMOVAL AND REPLACEMENT

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	1987 (R 1988) Emulsified Asphalt
AASHTO M208	1987 Cationic Emulsified Asphalt
AASHTO M226	1980 (R 1986) Viscosity Graded Asphalt Cement

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 698	1978 (R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1557	1978 (R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop

DEPARTMENT OF TRANSPORTATION (DOT)

DOT D-6.1	1988 Uniform Traffic Control Devices for Streets and Highway

FEDERAL SPECIFICATIONS (FS)

FS SS-S-200	(Rev. E) (Am. 1) Sealant, Joint, Two-Component, Jet-Blast Resistant, Cold-Applied, For Portland Cement Concrete Pavement

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT RS	1990 Roads and Structures

1.2 SUBMITTALS

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

1.2.1 SD-05, Design Data

a. Job mix formula

1.2.1.1 Job Mix Formula

Submit the mix design, including mixing temperature, for approval. The bituminous 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.

1.2.2 SD-13, Certificates

a. Tack coat

b. Stone base course

1.3 QUALITY ASSURANCE

1.3.1 Modification to References

Except as specified herein, 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 mean the Contracting Officer.

1.4 BARRICADES AND SIGNALS

Provide and maintain temporary signs, signals, lighting devices, markings, barricades, and channelizing and hand signaling devices in accordance with DOT D-6.1 to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the Contracting Officer. Work shall be conducted to permit a minimum of one traffic lane on two lane streets, and two traffic lanes on four lane streets, to be open for traffic at all times.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Bituminous Concrete

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

2.1.2 Stone Base Course

NCDOT RS, Sections 1005 and 1010 for aggregate base course, standard size no. ABC.

2.1.3 Bituminous Tack Coat

2.1.3.1 Emulsified Asphalts

AASHTO M140, Grades RS-1, MS-1, HFMS-1, SS-1, and SS-1h ; NCDOT RS, Section 1020, Grade RS-1h. Dilute the SS-1 and SS-1h asphalts at the rate of one part water to one part asphalt.

2.1.3.2 Cationic Emulsified Asphalts

AASHTO M208, Grades CRS-1, CSS-1, and CSS-1h ; NCDOT RS, Section 1020, Grade CRS-1h. Dilute the CSS-1 and CSS-1h asphalts at the rate of one part water to one part asphalt.

2.1.3.3 Asphalt Cements

AASHTO M226, Grade AC-20 as modified by NCDOT RS, Section 1020.

PART 3 EXECUTION

3.1 PAVEMENT INSTALLATION

The work includes the removal of existing pavement and the provision of new pavement where trenches, pits, and other excavations are made in the existing pavement. Except as otherwise indicated, the restored pavement area shall be the same kind and thickness as previously existed, and shall match and tie into the surrounding pavement in a neat and acceptable manner.

3.2 ROADS AND PARKING AREAS

3.2.1 Pavement Removal

Make a straight line sawcut 12 inches beyond the edge of the excavation to a minimum depth of 2 inches for bituminous concrete pavement and 6 inches for portland cement concrete pavement. Portland cement concrete pavement overlaid with bituminous concrete shall be sawcut to a minimum depth of 8 inches. The pavement shall be broken up and removed, along with its base and subgrade, to the depth indicated or specified.

3.2.2 Subgrade Placement

Provide as specified in Section 02220, "General Excavation, Filling, and Backfilling."

3.2.3 Stone Base Placement

Provide a stone base course a minimum of 8 inches thick, unless indicated otherwise. Place the stone base in two equal lifts, with each lift compacted to 100 percent ASTM D 698 maximum density. At the Contractor's option, bituminous concrete may be provided in lieu of stone base material.

3.2.4 Bituminous Concrete Placement

Provide a tack coat on the exposed edges of the cold joints and on the bituminous concrete base when provided, and provide a minimum 2-inch thick

bituminous concrete surface course, unless indicated otherwise, in accordance with NCDOT RS. Place in maximum of 2-inch lifts with each lift compacted to 96 percent of maximum laboratory density. The finished surface shall be uniform in texture and appearance and free of cracks and creases.

3.2.5 Portland Cement Concrete Pavement

Provide as specified in Section 03302, "Cast-in-Place Concrete (Minor Construction)." Provide reinforcing to match existing reinforcing. The concrete surface shall be struck off, screeded, tamped, and finished to the same surface elevation and texture as the adjacent existing concrete. Cure concrete for 7 days. Maintain existing joint patterns.

3.2.6 Bituminous Concrete Overlay

For portland cement concrete pavement overlaid with bituminous concrete pavement, provide the portland cement concrete pavement and bituminous concrete pavement as specified above, except provide a tack coat at the rate of 0.10 gallon of residual asphalt per square yard on the restored portland cement concrete base. Allow tack coat to become tacky prior to bituminous concrete placement. Apply the tack coat and bituminous concrete pavement only when the portland cement concrete base surface is clean and dry, and has cured for a minimum of 7 days.

3.3 MATERIAL DISPOSAL

Removed pavement, base and subgrade materials shall be removed from Government property.

-- End of Section --

SECTION 02610
GRAVEL PAVING (VA & NC)

PART 1 - GENERAL

1.1 REFERENCES

The references listed below form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO-T96	1983 Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION AND HIGHWAY SAFETY (NCDOT)

NCDOT-SSRS	Jan. 1984 Standard Specifications for Roads and Structures

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS

ASTM D698	1978 Moisture-Density Relations of Soils and Aggregate Mixtures Using 5-lb (4.54 kg) and 12-inch (457 mm) Drop

1.2 MATERIAL TESTS AND TEST REPORTS

The testing requirements for materials incorporated in referenced documents will be waived provided the manufacturer submits certificates stating that previously manufactured materials have been tested by recognized laboratories, that such materials meet testing requirements specified, and that the materials furnished for this project are of the same type, quality, manufacture and make as that tested. Copies of the test reports need not be submitted except as specifically requested by the Contracting Officer.

1.3 SUBMITTALS

1.3.1 SD-13, Certificates:

Submit certificates from the manufacturer attesting that the following products conform to all requirements of this specification and of reference documents:

a. Stone Materials

1.4 REQUIREMENTS

The work includes construction of gravel paving surface course. Preparation of the subgrade shall be as specified under the section of this specification entitled "Earthwork." Except as specified herein or indicated on the drawings, all work and materials shall be in accordance with the NCDOT "Standard Specifications for Roads and Structures". The provisions therein for method of measurement and payment do not apply.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Stone Base Course

Materials shall be in accordance with the NCDOT "Standard Specifications for Roads and Structures," Sections 905, size ABC or ABC (M).

PART 3 EXECUTION

3.1 Gravel Paving Course

Spreading of the gravel material shall begin at the point nearest the source of supply. Hauling shall be done and traffic permitted over the gravel to assist in compaction. Any ruts formed by the traffic shall be carefully filled and re-rolled. After the gravel course is in place, machining and rolling shall continue until the surface is smooth, hard, well bonded, and true to the designed cross section. Compaction of 100 percent of maximum density, as determined by ASTM D 698, Method D, shall be obtained in the gravel course. The gravel shall be machined as often as necessary to maintain it smooth and true to grade and cross section.

3.2 TESTS

The following minimum number of tests shall be performed to insure compliance with the thickness and compaction requirements for gravel paving course:

a. Thickness of gravel paving course - one test for each 500 square yards or fraction thereof.

b. Density of gravel paving course - one laboratory test for the project and one field test for each 1000 square yards or fraction thereof of each lift.

-- 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 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	1985 Malleable Iron Threaded Fittings Classes 150 and 300
ANSI/ASME B16.4	1985 Cast Iron Threaded Fittings Classes 125 and 250
ASME/ANSI B16.22	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	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 139	1990 Electric-Fusion (ARC)- Welded Steel Pipe (NPS 4 and Over)

ASTM A 252	1990 Welded and Seamless Steel Pipe Piles
ASTM A 307	1992 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 536	1984 Ductile Iron Castings
ASTM A 563	1991 (Rev. C) Carbon and Alloy Steel Nuts
ASTM A 746	1986 (R 1991) Ductile Iron Gravity Sewer Pipe
ASTM B 32	1991 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	1991 (Rev. A) Ready-Mixed Concrete
ASTM D 1785	1991 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	1989 Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2466	1990 (Rev. A) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	1991 (Rev. A) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe 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 C500	1986 Gate Valves for Water and Sewerage Systems
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	1989 Reduced-Pressure Principle Backflow-Prevention Assembly
AWWA C651	1989 (Addendum 1990) Disinfecting Water Mains
AWWA C700	1990 (Addendum 1991) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C800	1989 Underground Service Line Valves and Fittings
AWWA C900	1989 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

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

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements," applies to this section with additions and modifications specified herein.

1.3 DESIGN REQUIREMENTS

1.3.1 Water Service Lines

Provide water service lines indicated as less than 4-inch diameter, from water distribution main to building service at the point[s] indicated. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances where specified and where indicated.

Submit design calculations for water piping.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

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

b. Corporation stops

c. Valve boxes

d. Indicator posts

e. Water meters

f. Backflow preventer

g. Anti-freeze 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-05, Design Data

a. Design calculations for water piping

1.4.3 SD-06, Instructions

a. Installation procedures for water piping

1.4.4 SD-13, Certificates

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

b. Backflow preventer

c. Anti-freeze 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 SERVICE LINE MATERIALS

2.1.1 Piping Materials

2.1.1.1 Copper Tubing and Associated Fittings

Tubing shall conform to ASTM B 88, Type K. Fittings for solder-type joint shall conform to ANSI B16.18 or ANSI/ASME B16.22; fittings for compression-type joint shall conform to ASME/ANSI B16.26, flared tube type.

2.1.1.2 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.

2.1.1.3 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 Water Service Line Appurtenances

2.1.2.1 Corporation Stops

Ground key type; made of bronze conforming to ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ASME/ANSI B16.26.

2.1.2.2 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.

2.1.2.3 Curb 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.

2.1.2.4 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.

2.1.2.5 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.

2.1.2.6 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.

2.1.2.7 Valve Boxes

Provide for each gate valve on buried piping. Valve boxes shall be of cast iron 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.

2.2 WATER METERS

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

2.3 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 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 building, unless otherwise indicated on drawings. 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 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.

3.1.2 Installation of Water Service Piping

3.1.2.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line; such water service lines shall be closed with plugs or caps.

3.1.2.2 Service Line Connections to Water Mains

Connect service lines to the main by a corporation stop and gooseneck and install a service stop below the frostline as indicated.

3.1.2.3 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.

3.1.3 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.

3.1.4 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 Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing . The Contractor shall produce evidence, when required, that any item of work has been constructed properly in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test water 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 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 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 RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA 1-5	1991 Pipelines

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME/ANSI B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings
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 C 94	1992 Ready-Mixed Concrete
ASTM C 150	1992 Portland Cement
ASTM D 2321	1989 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	1987 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 758	1990 Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F 794	1991 Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C900	1989 Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution
AWWA M23	1980 PVC Pipe - Design and Installation

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 15011,"Mechanical General Requirements," applies to this section with additions and modifications as specified herein.]

1.3 SYSTEM DESCRIPTION

1.3.1 Sanitary Sewer Pressure Lines

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

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Pipeline materials including joints, fittings, and couplings

Submit manufacturer's standard drawings or catalog cuts.

1.4.2 SD-13, Certificates

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

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 Pressure Pipe and Associated Fittings

2.1.1.1 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.

2.1.1.2 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.

2.1.2 Piping Beneath Railroad Right-of-Way

Where pipeline passes under the right-of-way of a commercial railroad, piping shall conform to the specifications for pipelines conveying nonflammable substances in AREA 1-5, except as otherwise specified in this paragraph. For casing pipe provide ductile-iron pipe in lieu of cast-iron soil pipe. Ductile-iron pipe shall conform to and have strength computed in accordance with ASTM A 746.

2.2 CONCRETE MATERIALS

Concrete materials shall be as specified in Section 03302, "Cast-in-Place Concrete."

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

Apply except where specific exception is made in the following paragraphs entitled, "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building , unless otherwise indicated. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 2 feet below bottom of water line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

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. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper

dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 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.

3.1.2.2 Pipeline 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 1-5.

3.1.2.3 Cleanouts

Construct cleanouts of cast iron soil pipe and fittings.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. 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 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 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 in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS:

A 48	1983	Gray Iron Castings
A 53	1989 (Rev. A)	Pipe, Steel Black and Hot-Dipped, Zinc-Coated, Welding and Seamless
A 312	1989 (Rev. A)	Stainless and Welded Austenitic Stainless Steel Pipe
A 530	1989	General Requirements for Specialized Carbon and Alloy Steel Pipe
A 536	1984	Ductile Iron Castings
C 478	1989	Precast Concrete Manhole Sections
C 494	1986	Chemical Admixtures for Concrete
C 150	1989	Type I or II Portland Cement
D 1785	1989	Poly (Vinyl Chloride) (PVC) Plastic Pipe
D 2241	1989	Poly (Vinyl Chloride) PVC Plastic Pipe (SDR PR)
D 2564	1988	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
D 3139	1989	Standard Specification for Joints for Plastic Pressure Pipe Using Flexible Elastometric Seals
F 477	1976 (Rev. 85)	Elastometric Seals (Gaskets) for Joining Plastic Pipe

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) PUBLICATIONS:

570/9-75-001	Manual of Water Well Construction Practices

STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, FIFTEENTH EDITION

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 CERTIFIED GEOLOGIST:

A North Carolina state certified professional geologist shall be provided to start up, balance, and provide to the government a report for groundwater recovery operations, as specified herein.

1.3 SUBMITTALS:

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

1.3.1 SD-02, Manufacturer's Data:

a. Well Casing
b. Well Screen
c. Filter Pack Gradation Analysis
d. Groundwater Recovery Equipment, Complete
e. Manhole Sections, Slabs, Steps, Frames and Cover
f. Casing Pipe
g. Carrier Pipe

1.3.2 SD-13, Certificates:

a. Certified Professional Geologist's Plans and Reports

1.3.3 SD-12, Field Test Reports:

a. Laboratory Tests

1.3.4 SD-19, Operation and Maintenance Manuals:

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

1.4 EARTHWORK:

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

1.5 ENVIRONMENTAL PROTECTION:

Provide in accordance with Section 01560 "Environmental Protection."

1.6 GENERAL REQUIREMENTS:

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

PART 2 - PRODUCTS

2.1 MATERIALS:

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

2.2 RECOVERY WELLS:

2.2.1 Recovery Well Casings:

Type 304 Schedule 5, midbody stainless steel (ASTM A-530), threaded for joining to well screen.

2.2.2 Recovery Well Screens:

Wire wound, continuous slot, type 304, Schedule 5, midbody Schedule 40 ends, stainless steel (ASTM A-530) well screens with a 6-inch inside diameter. 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 0.020 inch.

2.2.3 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 a uniformity coefficient of 2.5 or less. The filter pack shall have with gradation specifications within the following ranges:

Sieve Number	Cumulative Percent Retained
16	0-5
18	5-15
20	30-46
25	70-86
30	87-100

2.2.4 Cement Grout:

Provide neat cement grout as indicated, Type I or II portland cement conforming to ASTM C 150 and water. The mixed grout shall contain no more than 7 gallons per gab (1.0 cubic foot or 94 pounds).

2.2.4.1 Admixtures: ASTM C 494.

2.3 RECOVERY WELL HEAD:

Precast concrete manholes shall include standard manholes complete with frames and covers, manhole's steps and appurtenances of the type indicated.

2.3.1 Riser Sections

Manhole's riser sections shall be constructed of precast reinforced concrete pipe sections. All precast manholes shall consist of the combination of barrel sections resulting in the fewest number of joints. Precast concrete pipe riser sections and slabs shall be reinforced in accordance with ASTM C-478, with a minimum wall thickness of 5 inches and with joints having an "O" ring seal. Manhole section shall be waterproofed on the exterior. Riser sections shall be dimensioned as indicated and shall be adequate to withstand H-20 wheel loads. All top riser sections shall have eccentric openings. The edge of eccentric openings for flat top sections shall be a maximum of 2 inches from the inside wall of the barrel section.

2.3.2 Base Sections

Base sections shall have reinforced flat bottoms protruding 6 inches beyond the outside face of the riser section unless otherwise specified. The base section shall be a minimum of 6 inches in thickness.

2.3.3 Steps

Manhole steps shall be made from copolymer polypropylene plastic. The plastic steps shall be hand driven into preformed holes in cured concrete. The steps shall be a minimum of 12 inches wide and shall be in accordance with OSHA regulations. The quantity shall be as indicated.

2.3.4 Frames and Covers

Frames and covers shall be in accordance with ASTM A-48, Class 30A. Covers shall be provided with a minimum of two 1-1/2" x 3/4" slots unless otherwise specified. Frames and covers shall be adequate to bear H-20 wheel loads and shall be provided with machined bearing surfaces. Material shall be ductile iron and shall conform to ASTM A 536 Grade 65-45-12. Cover shall be of the self sealing type with a continuous gasket secured within a dovetail groove.

2.4 GROUNDWATER RECOVERY EQUIPMENT:

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

2.4.1 Pneumatic Control Panel:

See Section 11315. A pneumatic control panel shall be provided for each groundwater ejector pump. The pneumatic control panel shall provide for complete automatic operation of each groundwater ejector pump.

2.4.2 Groundwater Ejector:

Each groundwater ejector shall be a bottom or top fill pneumatic type unit suitable for placement inside the recovery well. The ejector casing material shall be stainless steel. All openings shall be through fittings securely welded to the ejector casing. Openings through the top shall include a 1/2" airline connection and a 3/4" discharge connection with a

stainless steel double flapper check valve. At the bottom of the ejector vessel shall be a 2-1/2" stainless steel double flapper check valve to act as the ejector inlet.

2.4.3 Remote Valve Assemblies:

2.4.3.1 Groundwater Recovery Pump Air Supply:

Ejector remote valve assembly shall consist of:

a. Air supply connection from air compressor
b. Pilot signal connection from control panel
c. Bubbler air supply connection to liquid level bellows control for bubbler line to groundwater ejector
d. Air supply to liquid level bellows control for drawdown ejector supply
e. Air supply shutoff valve
f. Drawdown ejector pressure regulator with pressure gauge range of 0-100 PSI
g. Bubbler regulatory with pressure gauge range of 0-30 PSI
h. 3-way pneumatically operated air valve

2.4.4 Liquid Level Controller:

The liquid level controller shall independently maintain proper liquid level in each well by throttling the air supply to the groundwater ejector. The controller shall consist of the following:

a. Bubbler air supply connection from remote valve assembly with air filter
b. Bubbler air supply connection to groundwater ejector
c. Air supply connection from remote valve assembly

2.4.5 Valves:

2.4.5.1 Air Valves (for use with air hose):

Air valves shall be of the ball type and shall be of the size indicated. Valves provided shall be suitable for use in compressed air systems. Valves shall be of the 1/4 turn operation. Valve body and stem shall be made from brass or bronze with the valve handle being made from black nylon with metal position stops. Valve packing shall be made from pure, high density TFE machined from extruded rod. Support rings shall be made from TFE coated brass. Valves shall have a minimum working pressure rating of 150 PSIG. These valves shall be provided for use in air hose.

2.4.5.2 Water Valves:

Water valves shall be of the globe type and shall be of the size indicated. Valves shall be suitable for use in hydrocarbon contaminated fluids. Packing and seals shall be hydrocarbon resistant. Body, bonnet, disk, and stem shall be bronze or brass. Valves shall have a minimum working pressure rating of 150 PSIG.

2.4.5.3 Double flapper check valves:

Double flapper check valves shall be of the size indicated. Valve body, stem discs and seat shall be made from stainless steel.

2.4.5.4 Disc check valves:

Disc check valves shall be of the size indicated. Valve body, disc and seat shall be cast from brass or bronze.

2.4.5.5 Poppet check valves:

Poppet check valves shall be of the size indicated. Valve body, disc and seat shall be cast from brass or bronze. The spring shall be made from cold wound alloy steel and shall have a compression setting on disc to prevent backflow for its intended use.

2.4.6 Groundwater Hose:

Groundwater hose shall be sized as indicated. Hose shall be provided with a reinforced single ply of high tensile strength braided synthetic cord. A PVC/Nitrile covering over ply shall resist abrasions and protect core. Core shall be Buna-N. Sleeve and end connections shall be brass.

2.4.7 Piping:

2.4.7.1 Groundwater Pipe:

Where indicated HDPE pipe shall be provided. Piping shall be Schedule 40HDPE and shall conform to ASTM D 1785. Pipe joints shall be solvent welded.

2.4.8 Air Hose:

Air hose shall be sized as indicated. Hose shall be provided with a reinforced single ply of high tensile strength braided synthetic cord. A PVC/Nitrile covering over ply shall resist abrasions and protect core. Core shall be Buna-N. Sleeve and end connections shall be brass.

2.4.9 Air Piping:

Provided as specified in Section 15483, "Compressed Air Systems."

2.4.10 Winch Assembly:

Winch assembly shall be provided for the vertical adjustment of groundwater ejector. Winch shall be manually operated ratchet type with hardened steel drive gears and stainless steel ratchet spring, with permanently lubricated sleeve bearings, copper brazed gears and arc welded reel assembly. Winch frame shall be constructed of heavy gauge steel with a rust-resistant finish. winch gear ratio shall be minimum of 4:1. Winch cable shall be 3/16-inch stainless steel and shall be a minimum or 50 feet in length. Winch shall be capable of adjusting the drawdown pump when full of water. The product ejector will be suspended by a 3/16-inch stainless steel cable attached to a stainless steel nut clip on the well casing.

2.4.11 Other:

Provide fittings, adaptors, vents, and other appurtenances as required to insure a complete and operable system.

2.5 CASING PIPE

2.5.1 Below Grade:

3/4" air supply hose and a 2" groundwater pipe shall be encased in 6" PVC SDR-26 (ASTM 2241) pipe with ASTM F 477 gaskets and push-on joints (ASTM 3139).

2.5.2 Above Grade (at treatment plant):

3/4" air supply hose, 1/4" Product ejector pilot air hose, and 1/4" drawdown ejector pilot air hose shall be encased in 4" PVC Schedule 40 (ASTM 1785-86) PVC pipe with union joints. Provide pipe supports (MSS-SP-58) at 6-foot intervals.

2.5.3 Header Casing Pipe:

6" PVC Schedule 40 (ASTM 1785) pipe. Provide solvent-welded coupling between 6" Schedule 40 and 6" SDR 26 casing piping below grade.

PART 3 - EXECUTION

3.1 GENERAL:

Groundwater operations shall be supervised, directed, and monitored by a certified 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 certified professional geologist. Prior to beginning work, the certified professional geologist shall meet with the Contracting Officer to discuss the groundwater recovery plan including work procedures and safety precautions.

3.2 RECOVERY WELLS:

The recovery wells shall be drilled at the locations shown on drawings. The drill holes shall be a minimum of 12 inches in diameter. The 6 inch diameter casings and well screens shall be installed concentrically in the drill hole. It may be necessary to install a temporary 12 inch diameter well casing in order to keep the borehole open for installation of the 6 inch diameter casing and well screens, and filter pack. Fill the void between the casing/screen and the drill hole with the filter pack. contractor shall seal the bottom of the deepest screen with a threaded or welded type 304 stainless steel plug consisting of the same thickness as the screen body.

3.2.1 Filter Pack:

Contractor shall fill the entire annular space between the screen and outside wall of the hole with a filter pack. Place the aggregate with a tremie pipe in accordance with Articles 54 and 50 the EPA Manual of Water Well Construction Practices. The speed of aggregate replacement shall be controlled to prevent bridging and to allow for settlement of the filter pack. Equipment and methods required to place the aggregate shall be approved by the Contracting Officer prior to commencement of work.

3.2.2 Development Upon completion of the Installation of the Recovery Wells:

The wells will be air developed by air surging and periodic air pumping until the groundwater is clear and sediment-free. The air supply used shall be capable of developing a minimum pressure of 125 psi (862 kPa). the air line shall have a minimum size of 1-inch.

3.3 PRECAST MANHOLE BASE:

The precast manhole base shall have a hole cut in the center to fit recovery well casing as indicated. Precast manhole bases shall be installed level on a flat stable subgrade. The top of the manhole shall be sloped as indicated toward drainage hole in riser section. Where an unstable material exists, the Contractor shall excavate the unstable material and replace with compacted granular material. All joints on the inside and outside of the manhole shall be filled with mortar to provide a smooth and continuous surface. A hole shall be core drilled in the side of the riser section to allow drainage of accumulated water from manhole as indicated. The rim of the manhole shall be set at an elevation 6" above existing grade.

3.4 GROUNDWATER RECOVERY:

The groundwater recovery equipment shall be installed, operated, and maintained for three months by the contractor. The three month operational period will start only after all components of the system have been through the startup and initial testing and the Contracting Officer has accepted the system in its entirety. The certified professional geologist shall monitor and direct the initial groundwater recovery operations and shall provide an initial and final report of progress. The progress report shall include the quantity of recovered product, static water levels, drawdown levels and hydrogeologic conditions. After three months operation of the systems by the Contractor the Navy will assume operation of the system. All recovered product shall remain the property of the Government. Notify the Contracting Officer 15 days prior to the storage tanks becoming full so that the Contracting Officer can coordinate having the tanks emptied. The Contractor is to provide training for the Navy personnel in how to properly operate and maintain the system. This training shall be given by the certified professional geologist for five 8-hour working days.

3.4.1 Discharge of Groundwater:

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

3.4.2 Discharge of Recovered Oil Product:

Petroleum product recovered is to be discharged to the product storage tank as indicated.

3.4.3 Waste Disposal:

All soil removed from drill holes shall be tested fro characteristics of hazardous waste as specified in Section 01560, Environmental Protection; disposal shall be in accordance with test results. Soil not reused in trenches shall be considered debris and shall be disposed of as specified in Sections 01560, "Environmental Protection," and 02220 "General Excavation, Filling, and Backfilling."

3.5 SPARE PARTS:

Contractor 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 prior to the completion of the initial three months' operation of the system by the Contractor.

3.6 FINAL CLEANUP:

Remove waste material and other debris from the site.

3.7 SEQUENCE OF OPERATION:

Each ejector control panel shall be capable of controlling the recovery well pump. The control panel shall have separate adjustable range timers, filter regulators and solenoid valves for the ejector pilot lines and the system. Through the adjustment of these regulators and timers, the pumping rate to the treatment pad for the wells on the system shall be capable of being varied from 0.0 GPM to 5 GPM for the groundwater ejector. The control panel shall be designed to deliver air, which is the control medium to each ejector on the system.

The groundwater ejectors shall be controlled by the use of a bubbler liquid level control. There shall be a separate remote valve assembly and bubbler control for each groundwater ejector. The pumping rate from each well will be automatically varied by the bubbler liquid level control to match the production rate of each well. The operation bubbler and the sensing of the liquid in the wells shall utilize the low pressure bubbler air. The actual liquid level sensing shall be the bubbler air method. No electrical devices shall be utilized in the wells for liquid level sensing or ejector operation.

3.8 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. 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

3.9 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.

3.10 TESTS:

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 systems shall be hydrostatically tested at not less than 1-1/2 times the working pressure; but in no case 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 2 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. All defects in the work provided by the Contractor shall be corrected by him at his own expense and the test repeated until proven satisfactory. 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 Contracting Officer. Responsibility for adjustment of controls and balancing of systems shall extend for one year after the completed systems are put in operation. The Contractor shall furnish all materials and labor to make all repairs required for one year after the systems are accepted by the Contracting Officer.

-- 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.

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

SP-58-83	Pipe Hangers and Supports - Materials, Design, and Manufacture
SP-80-87	Bronze Gate, Globe, Angle and Check Valves

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS:

A 53	1983 Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless
A 234	1988 Pipe Fittings of Wrought Carbon Steel and Alloy Steel
D 1785	1989 Poly (Vinyl Chloride) (PVC) Plastic Pipe
D 2241	1989 Poly (Vinyl Chloride) PVC Plastic Pipe (SDR PR)
D 2466	1988 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings
D 2564	1988 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
D 3139	1989 Standard Specification for Plastic Pressure Pipe Using Flexible Elastomeric Seals
F 477	1976 (Rev. 85) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

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

FEDERAL SPECIFICATIONS

FS WW-V-35

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data:

a. Piping and Fittings
b. PVC Solvent Cement
c. Ball Valves
d. Globe Valves
e. Treatment System Control Panel

1.2.2 SD-12, Field Test Reports:

a. Oil Water Separator
b. Surge Settling Tank (Controls)
c. Air Stripper
d. Carbon Contactors
e. Backwash Tank (Controls)

1.2.3 SD-19, Operations and Maintenance Data:

a. Groundwater Treatment System (Data Package 4). (Provide O&M package for drawdown water treatment system as a complete and operable unit. Provide individual component data packages as specified in the applicable section.)

1.3 EQUIPMENT

Provide in accordance with the following Sections of these specifications:

11300 Polymer Feed System

11302 Packed Gravity Oil/Water Separator

11303 Centrifugal Pumps

11304 Flocculation Tank and Appurtenances

11305 Surge/Settling Tank and Appurtenances

11306 Multilayer Sand Filters

11307 Low Profile Air Stripper Package

11308 Cartridge Filter Units

11309 Carbon Adsorbers

11310 Backwash Tank and Appurtenances

11311 Sludge Holding Tank and Appurtenances

11312 Dewatering Press

11347 Above Grade Horizontal Tanks

Other sections as applicable

1.4 TREATMENT PAD

Provide in accordance with the following Sections of these specifications:

02200 Earthwork

03302 Cast in Place Concrete

13121 Pre-engineered Metal Buildings (Rigid Frame)

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 "Environmental Protection."

1.7 DESCRIPTION OF WORK

The work includes the installation of groundwater treatment systems as shown on the contract drawings, and specified-herein, each system shall include: concrete slab on grade, an oil water separator, a polymer mixing and feed system, a surge tank, two (2) multimedia sand filters, an air stripper, two (2) carbon contractor, and all associated pumps, blowers, piping, and controls. The groundwater treatment systems shall begin at the treatment pad header.

PART 2 - PRODUCTS

2.1 PIPING AND VALVES

2.1.1 Piping and Fittings

Above-grade water piping and fittings shall be Schedule 40 PVC conforming at ASTM 1785 and ASTM 2466.

2.1.1.1 Joints

Joints shall be solvent welded in accordance with ASTM 2564. Provide unions or flanged connections at all valves and equipment.

2.1.1.2 Pipe Supports

Provide pipe supports conforming to MSS-SP-58 at 6 foot intervals, and at valves and changes in direction.

2.1.2 Below-grade Water Pipe

Below-grade water pipe shall be high density polyethylene (HDPE) pipe with ASTM F477 gaskets and push-on joints (ASTM 3139). Provide solvent-welded coupling between Schedule 40 and SDR-26 PVC pipe.

2.1.3 Valves

Provide as indicated on the contract drawings.

2.1.3.1 Ball Valves

Ball valves shall be bronze with 1/4 turn operation. The packing, seat ring, and seals shall be reinforced TFE. The ball and stem shall be type 316 stainless steel. The handle shall be zinc plated steel with a vinyl cover. Ball valves shall be rated for 125 psi service and shall conform to FS-WW-V-35.

2.1.3.2 Globe Valves

Globe valves shall be capable of throttling flow from 0 to 100 gpm. packings and seals shall be hydrocarbon resistant. Body, bonnet, disk, and stem shall be bronze. Globe valve shall be rated for 125 psi service and shall conform to MSS-SP-80.

2.1.3.3 Check Valves

Check valves shall be bronze. The valves shall be horizontal, single disc, swing type with renewable bronze sent rings, bronze discs, and bronze disc hinges and pins. Check valves shall be designed to give a full diameter passage. Discs shall be carefully mounted and shall swivel on disc hinges. Pins, discs and other parts shall be properly adjusted to operate satisfactorily. An arrow indicating flow direction shall be provided. Check valves shall conform to MSS-SP-80.

2.1.4 Water Hoses

Water hoses shall be sized as indicated. Hose shall be provided with a reinforced single ply of high tensile strength braided synthetic cord. A PVC/Nitrile over ply shall resist abrasions and protect the core. Core shall be Buna-N. Sleeve and end connections shall be brass.

2.1.5 Product Piping

Provide Schedule 40 galvanized steel piping and fittings as indicated on the contract drawings. Piping shall conform to ASTM A-53; fittings shall conform to ASTM A234.

2.1.6 Treatment System Control Panel

A groundwater treatment system control panel shall be provided. Panel shall include on/off switch, green power indicating light, alarm indicating lights, and controls and relays as shown on the Drawings. Control circuit wiring for the float switches shall be intrinsically safe. Intrinsically safe barriers shall be provided in the control panel for the float switch circuits. Control panel shall operate on 120 VAC power.

PART 3 - EXECUTION

3.1 GENERAL

Install the following in accordance with the applicable section(s):

Reinforced Concrete Floor and Pre-engineering Metal Building (rigid frame).

Polymer Mixing and Feed System.

Oil Water Separator

Flocculation Tank.

Surge/Setting Tank.

Recovered Product Tank.

Air Stripper Feed Pumps (Primary Feed Pump).

Two Multimedia Sand Filters with Backwash Pump.

Air Stripper and Blower: Install the air stripper and blower under the direct supervision of the manufacturer's field representative. Provide the services of the representative for a period of two (2) days at each site.

Air Stripper Effluent Pumps (Secondary Feed Pump).
Two Cartridge Filters.

Two Carbon Contactors with Backwash Pump.

Backwash Tank.

Two Effluent Pumps with Controls.

Sludge Holding Tank and Transfer Pumps.

Dewatering Press.

Piping, Power, Controls, Accessories, and Appurtenances: Install 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 Division 16.

3.2 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. 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 SEQUENCE OF OPERATION

3.3.1 Polymer Mixing and Feed System

The Polymer Mixing and Feed System shall mix liquid polymer and water at an adjustable concentration and feed the polymer mixture into the flocculation tank.

3.3.2 Effluent Flow

Groundwater shall be pumped to the Oil/Water Separator. The oil/water separator shall remove free product from the groundwater stream. Any recovered free product shall accumulate in a sump in the oil water separator, and shall be pumped to the recovered product tank by a float switch activated pump at the oil water separator.

Groundwater from the oil water separator shall gravity flow to the Flocculation Tank, where liquid polymer will be added. Effluent from the Flocculation Tank will flow to the Surge/Settling Tank. The Surge/Settling Tank shall contain four float switches.

3.3.3 Float Switches

3.3.3.1 Alarm

Set as shown on drawings: The alarm float switch shall shut down the groundwater system (drawdown ejectors) to prevent the tank from overflowing. The high-high float switch shall not shut down the treatment system (air stripper blower and booster pumps). The high-high float switch shall also activate a red indicating alarm light on the treatment panel.

3.3.3.2 Highwater Level

Set as shown on the drawings: The high float switch shall activate the lag feed pump.

3.3.3.3 Start

Set as shown on the drawings. The start float switch shall start the treatment system (air stripper blower and feed pump).

3.3.3.4 Stop

Set as shown on the drawings. The stop switch shall shut down the treatment system. The blower shall shut down 2 minutes after the feed pump to ensure proper stripping of groundwater in the air stripper.

3.3.4 Air Stripper

The Air Stripper shall remove volatile organic compounds from the groundwater. The air stripper shall discharge to two (2) cartridge filters.

3.3.5 Cartridge Filters

The Cartridge Filters shall remove suspended solids from the groundwater. Effluent from the two (2) cartridge filters shall discharge to the carbon contactors.

3.3.6 Carbon Contactors

The two Carbon Contactors shall remove any remaining volatile organic compounds and dissolved hydrocarbons from the groundwater stream. The carbon contactors shall discharge to a backwash tank.

3.3.7 Backwash Tank

The Backwash Tank shall contain four float switches:

3.3.7.1 Alarm

Set as shown on the drawings. The alarm float switch shall shut down the air stripper booster feed pumps and activate a red indicating alarm light on the treatment panel.

3.3.7.2 High

Set as shown on the drawings. The high float switch shall activate the lag effluent pump.

3.3.7.3 Start

Set as shown on the drawings. The start float switch shall deactivate the effluent pump.

3.3.7.4 Stop

Set as shown on the drawings. The stop float switch shall shut down the effluent pumps.

3.3.8 Effluent Pumps

The two Effluent pumps shall discharge through a PVC Force main to the sanitary sewer system at the locations shown on the Drawings.

3.3.9 Sludge Holding Tank

3.3.10 Dewatering Press

3.4 STARTUP AND INITIAL TESTING

3.4.1 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 Contracting Officer. Unless otherwise noted, groundwater from the system 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 Contracting Officer for approval.

Upon completion of startup and testing, treated groundwater shall be discharged to the sanitary sewer only after the approval of the Contracting Officer.

3.4.2 Oil Water Separator

Test in accordance with Section 11302, "Packed, gravity Oil Water Separator" prior to connecting the effluent pipe to the surge/setting tank. the oil water separator shall be fully functional and in full compliance with Section 11302 "Packing Gravity Oil Water Separator" prior to making the connection to the surge/setting tank.

3.4.3 Surge/Settling Tank

Conduct the following tests prior to connecting drawoff pipe to air stripper feed pumps.

3.4.3.1 Float Switches

Test and insure the proper operation of all float switches; make adjustments as required to meet the requirements of paragraph 3.3 of this section. Potable water may be used for this test.

3.4.4 Air Stripper

Test in accordance with Section 11307 "Air Stripper System." Complete all testing prior to operating carbon contactors.

3.4.5 Backwash

3.4.5.1 Float Switches

Test and insure the proper operation of all float switches; make adjustments as required to meet the requirements of paragraph 3.3 of this section. Potable water may be used for this test.

3.5 OPERATIONS

The groundwater treatment 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 Contracting Officer has accepted the system in its entirety. A certified professional geologist 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. After three months operation by the Contractor, the Navy shall assume operation of the equipment. The Contractor shall provide training (five 8 hour days) for Navy personnel in how to properly operate and maintain the system. this training shall be in addition to the training required by Section 02900 "Product Recovery System." The training shall include one 8 hour day of training by the air stripper manufacturer's field representative.

3.5.1 Water Quality Analyses

Weekly water quality analysis of air stripper effluent shall be for volatile organic compounds and hydrocarbons by purge and trap/GC, as outlined in 40 CFR, part 136. Laboratory analysis shall be by an independent certified testing laboratory.

3.6 FINAL CLEANUP

Remove waste material and other debris from the site.

3.7 FINAL TESTING

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 systems shall be hydrostatically tested at not less than 1-1/2 times the working pressure; but in no case 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 2 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. All defects in the work provided by the Contractor shall be corrected by him at his own expense and the test repeated until proven satisfactory. 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 Contracting Officer. Adjustment of controls and balancing of systems shall extend for one year after the completed systems are put in operation. The Contractor shall furnish all materials and labor to make all repairs required one year after the systems are accepted by the Contracting Officer.

-- End of Section --

SECTION 03302

CAST-IN-PLACE CONCRETE (MINOR CONSTRUCTION)

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301	1989 Structural Concrete for Buildings
ACI 304R	1989 Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	1991 Hot Weather Concreting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	1990 (Rev. A) Steel Welded Wires Fabric, Plain, for Concrete Reinforcement
ASTM A 497	1990 (Rev. B) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615	1990 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 616/A 616M	1990 Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617/A 617M	1990 Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 706/A 706M	1990 Low-Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM C 33	1990 Concrete Aggregates
ASTM C 94	1990 Ready-Mixed Concrete
ASTM C 143	1990 (Rev. A) Slump of Hydraulic Cement Concrete
ASTM C 150	1989 Portland Cement
ASTM C 171	1991 Sheet Materials for Curing Concrete
ASTM C 172	1990 Sampling Freshly Mixed Concrete
ASTM C 173	1978 Air Content of Freshly Mixed

	Concrete by the Volumetric Method
ASTM C 231	1991 Air Content for 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 494	1990 Chemical Admixtures for Concrete
ASTM C 595	1989 Blended Hydraulic Cements
ASTM C 618	1991 Fly Ash and Raw or Calcined Natural Pozzolan For Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 920	1987 Elastomeric Joint Sealants
ASTM C 989	1989 Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1107	1991 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D 1190	1974 (R 1980) Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 1751	1983 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	1984 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1850	1974 (R 1979) Concrete Joint Sealer, Cold-Application Type
ASTM D 4397	1984 (R 1989) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

CORPS OF ENGINEERS (COE)

COE CRD-C-572	1974 Polyvinylchloride Waterstop

1.2 SUBMITTALS

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

1.2.1 SD-13, Certificates

a. Cement

b. Aggregates

c. Admixtures

d. Reinforcement

e. Expansion-joint filler

f. Joint sealant

1.3 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 CONCRETE

2.1.1 Contractor Mix Design

ACI 301, except as modified herein. Unless indicated otherwise, concrete shall have a 28-day compressive strength of 4000 psi. Slump shall be between 2 and 4 inches in accordance with ASTM C 143. Provide ASTM C 33 aggregate Size No. 57 or 67. Accomplish air-entrainment using an air-entraining admixture.

2.1.2 Ready-Mixed Concrete

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

2.2 MATERIALS

2.2.1 Cement

ASTM C 150, Type I or II or ASTM C 595, Type IP(MS) or IS(MS) blended cement, except as modified herein. The blended cement shall consist of a mixture of ASTM C 150 cement and one of the following materials: ASTM C 618 pozzolan or fly ash, or ASTM C 989 ground iron blast furnace slag. The pozzolan/fly ash content shall not exceed 25 percent nor the ground iron blast furnace slag 50 percent by weight of the 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 Type N and F. Add with cement.

2.2.2 Water

Water shall be potable.

2.2.3 Aggregates

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

2.2.4 Admixtures

ASTM C 260 for air-entrained concrete. ASTM C 494 for water reducing (Type A, D, or E), accelerating (Type C), and retarding (Type B or D), to be used only when approved. Calcium chloride shall not be used as an admixture.

2.2.5 Reinforcement

2.2.5.1 Reinforcing Bars

ASTM A 706/A 706M, Grade 60; ASTM A 615 and ASTM A 617/A 617M, Grade 40 or ASTM A 616/A 616M, Grade 50.

2.2.5.2 Welded Wire Fabric

ASTM A 497 or ASTM A 185, 6 by 6, W2.9 by W2.9, unless otherwise indicated.

2.2.6 Materials for Curing Concrete

2.2.6.1 Impervious Sheeting

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

2.2.7 Joint Sealant

2.2.7.1 Horizontal Surfaces (3 percent slope, maximum)

a. Outside Buildings: ASTM D 1190.

b. Inside Buildings: ASTM D 1190 or ASTM D 1850.

2.2.7.2 Vertical Surfaces (greater than 3 percent slope)

ASTM C 920, Type M, Grade NS, Class 25, Use T.

2.2.8 Vapor Barrier

ASTM D 4397 polyethylene sheeting, minimum 6 mil thickness.

PART 3 EXECUTION

3.1 FORMS

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

3.2 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

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

3.2.1 Cover and Splicing

ACI 301, unless otherwise indicated.

3.2.2 Setting Miscellaneous Material

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

3.2.3 Vapor Barrier

Provide beneath the on-grade concrete floor slab. Lap 12 inches minimum. Remove torn, punctured, or damaged vapor barrier material and provide with new material prior to placing concrete. Place concrete to prevent damage to the vapor barrier material. Place a 2-inch layer of clean concrete sand on vapor barrier before placing concrete.

3.2.4 Construction Joints

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

3.2.5 Expansion Joints and Contraction Joints

ACI 301. For slabs on grade, provide at edges of interior floor slabs, adjacent to walls, and as indicated. Make expansion joints 0.5 inch wide, except as indicated otherwise. Fill expansion joints not exposed to weather with performed joint material. Seal joints exposed to weather with 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.

3.3 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE

ACI 304R, except as modified herein. ASTM C 94; machine mix concrete and provide mandatory batch ticket information for each load of ready mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time to 60 minutes if the air temperature is greater than 85 degrees F. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. 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. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris, and water from within the forms. Consolidate concrete slabs greater than 4 inches depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by tamping, spading, and settling with a heavy leveling straight edge.

3.3.1 Cold Weather

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

3.3.2 Hot Weather

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

3.4 SURFACE FINISHES

ACI 301 for repair and finish, unless otherwise specified. Slope floors uniformly to drains where drains are provided. After troweling is completed, apply a liquid chemical sealer-hardener to interior slabs that do not receive floor covering.

3.4.1 Defects

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

3.5 CURING AND PROTECTION

ACI 301. Protect concrete from injurious action by sun, rain, wind, flowing water, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the curing period. Forms may be removed 48 hours after concrete placement.

3.5.1 Moist Curing

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

3.5.1.1 Pervious Sheeting

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

3.5.2 Impervious-Sheeting Curing

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

3.5.3 Curing Periods

Allow 7 days.

3.6 SAMPLING AND TESTING

3.6.1 Sampling

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

3.6.2 Testing

3.6.2.1 Slump Tests

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

3.6.2.2 Air Content

ASTM C 173 or ASTM C 231. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

-- End of Section --

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

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

THE ALUMINUM ASSOCIATION, INCORPORATED (AA)

AA 45	1980 Aluminum Finishes
AA 46	1978 Anodized Architectural Aluminum

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S302	1987 Steel Buildings and Bridges
AISC S328	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 A14.3	1984 Ladders - Fixed - 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 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

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1	1990 Structural Welding Code Steel

FEDERAL SPECIFICATIONS (FS)

FS FF-S-325	(Int Am. 3) Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS FF-P-395	(Rev. C) Pin, Drive Guided and Pin Drive, Powder Actuated (Fasteners for Power Actuated and Hand Actuated Fastening Tools)
FS RR-T-650	(Rev. D) Treads, Metallic and Nonmetallic, Skid Resistant
FS TT-P-664	(Rev. D) Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant
FS GGG-D-777	(Rev. B) Driver, Projectile Unit, Powder Actuated (High Velocity) (Above Water Only); Pin, Drive, Powder Actuated; and Cartridge, Powder Actuated Tool
FS RR-G-1602	(Rev. C) Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)

MILITARY STANDARDS (MIL-STD)

MIL-STD-889	(Rev. B) Dissimilar Metals

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM BG	1988 Metal Bar Grating Manual

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

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

1.2.1 SD-02, Manufacturer's Catalog Data

a. Handrails

b. Ladders

c. Structural steel door frames

d. Window guards

1.2.2 SD-04, Drawings

a. Fabrication drawings of structural steel door frames

b. Access doors and panels, installation drawings

c. Cover plates and frames, installation drawings

d. Handrails, installation drawings

e. Ladders, installation drawings

f. Window guards, installation drawings

g. Embedded angles and plates, installation drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC S302.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1.2.3 SD-13, Certificates

a. Primer certificate

1.2.3.1 Certificate

Submit a certificate from the manufacturer stating that the primer conforms to requirements of FS TT-P-664. Certify that the product has been tested and approved for inclusion in the Qualified Products List (QPL).

1.2.4 SD-14, Samples

a. Aluminum surfaces

Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 QUALIFICATION OF WELDERS

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

1.4 DELIVERY, STORAGE, AND PROTECTION

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

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A 36/A 36M.

2.1.2 Structural Tubing

ASTM A 500.

2.1.3 Steel Pipe

ASTM A 53, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A 47.

2.1.5 Anchors and Fasteners

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

2.1.5.1 Lag Screws and Bolts

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

2.1.5.2 Toggle Bolts

ANSI B18.2.1.

2.1.5.3 Bolts, Nuts, Studs and Rivets

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

2.1.5.4 Screws

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

2.1.5.5 Washers

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

2.1.6 Aluminum Alloy Products

Conform to ASTM B 209 for sheet plate, ASTM B 221 for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings, as applicable. Provide aluminum extrusions at least 1/8-inch thick and aluminum plate or sheet at least 0.050-inch thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A 123, ASTM A 153 or ASTM A 525 G-90, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780 or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved by the Contracting Officer. Clean areas to be repaired and remove the slag from the welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread the molten material uniformly over surfaces to be coated and wipe the excess material off.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within friction-type joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. [On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.]

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Unexposed Sheet, Plate, and Extrusions

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA 45, or AA 46.

2.3 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.

2.4 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.

2.4.1 Steel Handrails, Including Carbon Steel Inserts

Provide steel handrails, including inserts in concrete, steel pipe conforming to ASTM A 53 or structural tubing conforming to ASTM A 500, Grade A or B of equivalent strength. Provide steel railings of 1 1/2-inch nominal size. Railings to be hot-dip galvanized.

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.

2.5 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as 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.

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 powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.3 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 as defined by MIL-STD-889 are in contact, or where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Alkyd is not to be used on metal in contact with concrete or masonry.

3.5.2 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 Contracting Officer.

3.6 COVER PLATES AND FRAMES

Install the tops of cover plates and frames flush with floor.

3.7 HANDRAILS

3.7.1 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 or through-bolted to a back plate or by 1/4-inch lag bolts to studs or solid backing.

3.8 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.

--End of Section--

SECTION 05510

MOVABLE OPERATIONS PLATFORM

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 1990 Structural Steel

1.2 DESCRIPTION OF WORK AND GENERAL REQUIREMENTS

Provide complete and ready for use a movable operations platform.

1.3 SUBMITTALS

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

1.3.1 SD-04, Drawings:

The Contractor shall submit for approval shop drawings of the equipment. These drawings shall be submitted prior to ordering the movable operations platform. Shop drawing information shall include a complete material list, performance data, and both plan and elevation of the platform.

1.3.2 SD-06, Instructions:

Provide assembly instructions.

1.4 EQUIPMENT 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.

1.5 GENERAL REQUIREMENTS

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

PART 2 - PRODUCTS

2.1 MOVABLE OPERATIONS PLATFORM

Platform shall be 40" high, 36" wide with a set of four (4) stair risers at each end, unless otherwise approved. Platform shall be capable of supporting a 500 pound capacity and shall meet OSHA Standard 1910.29 and all applicable federal, state, and local codes.

The Movable Operations Platform shall be shop fabricated and shall consist

of the following items:

Frame - Welded one (1) inch outside diameter tubular frame, dual entry platform, 36" high handrails, and a set of four (4) stair risers at each end of the platform. Steel to be used in the movable operations platform frame shall conform to ASTM A36.

Platform and stair treads - Grip strut safety steel grating. Steel shall conform to ASTM A36.

Wheels - At each end of the stairs will be located an axle with a set of wheels. Each wheel shall have a step lock mechanism and shall consist of ASTM A36 steel rim with a solid rubber tire, unless approved otherwise.

The two man, twin style roll-about safety mobile platform ladder manufactured by the U.S. Gypsum Company generally meets the requirements of this specification.

PART 3 - EXECUTION

3.1 INSTALLATION

Provide Movable Operations Platform and all appurtenances complete and ready for use.

-- End of Section --

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 REFERENCES

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

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	1988 Air Contaminants
29 CFR 1910.1025	1988 Lead

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1500	(Rev. A) Sealer, Surface (Latex Block Filler)
CID A-A-1558	Paint, Stencil

FEDERAL SPECIFICATIONS (FS)

FS TT-P-19	(Rev. D) Paint, Latex (Acrylic Emulsion, Exterior Wood and Masonry)
FS TT-P-28	(Rev. G) Paint, Aluminum, Heat Resisting (1200 Degrees 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-S-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. 2) Coating System, Nonskid, for Roll or Spray Application (Metric)
MIL-P-28577	(Rev. B) Primer, Water-Borne, Acrylic or Modified Acrylic, 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

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

1.2.1 SD-06, Instructions

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

a. Piping and conduit identification

Submit color stencil codes.

1.2.3 SD-08, Statements

a. Applicator's qualifications

b. Evidence of acceptable variation

1.2.3.1 Applicator's Qualifications

Submit evidence that the Contractor or his subcontractor has satisfactorily applied paint by airless spray at a minimum of two sites. Indicate the names and locations of the sites, and type and design of the equipment used, including safety devices.

1.2.3.2 Evidence of Acceptable Variation

If a product proposed for use does not conform to requirements of the referenced specification, submit for approval to the Contracting Officer, evidence that the proposed product is either equal to or better than the product specified. The submittal shall include the following:

a. Identification of the proposed substitute;

b. Reason why the substitution is necessary;

c. A comparative analysis of the specified product and the proposed substitute, including tabulations of the composition of pigment and vehicle;

d. The differences between the specified product and the proposed substitute; and

e. Other information necessary for an accurate comparison of the proposed substitute and the specified product.

1.2.4 SD-13, Certificates

a. Coating

b. Sealant

1.2.4.1 Requirements

For each type of coating, sealant, or other product furnished:

a. Submit a certificate from the manufacturer stating that the product conforms to requirements of the referenced specification.

b. If the referenced specification has a Qualified Products List (QPL), certify that the product has been tested and approved for inclusion in the QPL.

1.3 QUALITY ASSURANCE

1.3.1 Qualifications of Airless Spray Applicators

Satisfactory application of paint by airless spray at a minimum of two sites.

1.3.2 Field Samples and Tests

The Government will take one-pint samples of paint at random from the products delivered to the job site and test them to verify that the products either conform to the referenced specifications or the approved substitution. Products which do not conform shall be removed from the job site and replaced with new products that conform to the referenced specification or the approved substitution.

1.4 REGULATORY REQUIREMENTS

1.4.1 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.

1.4.5 Silica Sand

The use of silica sand is prohibited.

1.5 DELIVERY AND STORAGE

Deliver materials in sealed, labeled containers bearing the manufacturer's name, brand designation, specification number, batch number, color, and date of manufacture. Restrict storage and mixing of materials to locations designated by the Contracting Officer.

1.6 SAFETY METHODS

Apply coating materials using safety methods and equipment in accordance with the following:

1.6.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA 3.

1.6.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to 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.

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.

1.8 COLOR SELECTION

Colors of finish coats shall be as indicated 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 Exterior Painting

Includes new surfaces of the buildings and appurtenances as indicated. Also included are existing coated surfaces made bare by cleaning operations.

1.9.2 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

[b. Do not paint the following, unless indicated otherwise:

(1) New zinc-coated, aluminum, and copper surfaces under insulation ;

(2) New aluminum jacket on piping ; and

(3) New interior ferrous piping under insulation.

1.9.3 Exterior Painting of Site Work Items

Field coat the following items:

New Surfaces

a. Pipe Hangers and Supports

b. Interior piping as directed by Contracting Officer

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.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, 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 2, 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 SP 7	(1)	B Sa 1	C Sa 1	D Sa 1
Near White Blast Cleaning SSPC SP 10	A Sa 2-1/2	B Sa 2-1/2	C Sa 2-1/2	D Sa 2-1/2]

Note: (1) No photograph is available or recommended for 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.

d. 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 APPLICATION

3.4.1 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, and there shall be a visually perceptible difference in shades of successive coats.

c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

3.4.2 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.

3.4.3 Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

3.4.4 Coating Systems

a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

I Exterior Metal Surfaces
II Interior Metal Surfaces
III Interior Concrete, Concrete Masonry, Plaster and Wallboard Surfaces
IV Interior 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 in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.

c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.

d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

(1) One coat of primer.

(2) One coat of undercoat or intermediate coat.

(3) One top coat to match adjacent surfaces.

e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, 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.

3.5 COATING SYSTEMS FOR METAL

a. Primer: Apply specified ferrous metal primer on the same day that surface is cleaned. If flash rusting occurs, re-clean the surface prior to application of primer.

(1) Inaccessible Surfaces: Prior to erection, use two coats of the specified primer on metal surfaces that will be inaccessible after erection.

(2) Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

(3) Surface Previously Coated with Epoxy or Urethane: Apply MIL-P-24441/1, Formula 150, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.

(4) Pipes and Tubing; The semitransparent film applied to pipes and tubing at the mill is not to be considered a shop coat. Apply specified ferrous metal primer prior to application of subsequent coats.

(5) Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer, MIL-P-28577.

b. Apply coatings of Tables I, II and III. "DFT" means dry film thickness in mils.

3.6 PIPING AND CONDUIT IDENTIFICATION

Piping And Conduit Identification, Including Surfaces In Concealed Spaces: Provide in accordance with MIL-STD-101. Place stenciling in clearly visible locations. On piping and conduits not covered by MIL-STD-101, stencil approved names or code letters, in letters a minimum of 1/2-inch high for piping and a minimum of 2-inches high elsewhere. Stencil arrow-shaped markings on the piping and conduit to indicate the direction of flow. Use black stencil paint, CID A-A-1558.

3.7 INSPECTION AND ACCEPTANCE

In addition to meeting the previously specified requirements, demonstrate the mobility of moving components, including but not limited to swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of the coatings have elapsed and prior to invoicing for final payment.

TABLE - I

EXTERIOR METAL SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
******* FERROUS SURFACES *******						
A. New Steel That Has Been Blast-	MIL-P-28577	1.5	MIL-P-28578	2.0	MIL-P-28578	2.0

TABLE - I

EXTERIOR METAL SURFACES

	SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
	cleaned (Up to SSPC SP 6)						
B.	Existing Steel That Has Been Spot-Blasted (Up to) (SSPC SP 6)	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
	******* GALVANIZED SURFACES *******						
C.	New Galva-nized Surfaces	MIL-P-28577	1.5	N.A.		MIL-P-28578	1.5

TABLE - II

INTERIOR METAL SURFACES

	SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
A.	Metal Except on Floors, non-shop- Not Speci- primed fied surfaces Otherwise	FS TT-P-645	2.0	FS TT-E-545	1.5	FS TT-E-509	1.5

TABLE - II

INTERIOR METAL SURFACES

	SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
B.	Metal in Toilets, and Other Interior High-Humidity Areas _____, _____	FS TT-P-645 1 coat on shop-primed surfaces and 2 coats on non-shop-primed surfaces	2.0	FS TT-E-545	1.5	FS TT-E-509 FS TT-E-505	1.5

TABLE - III

INTERIOR CONCRETE, CONCRETE MASONRY, PLASTER AND WALLBOARD SURFACES

	SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
A.	Concrete not Specified Otherwise, Except Floors	FS TT-P-19	1.5	N.A.		FS TT-P-19	1.5
B.	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

TABLE - III

INTERIOR CONCRETE, CONCRETE MASONRY, PLASTER AND WALLBOARD SURFACES

	SURFACE/ AREA	PRIMER	DFT	INTERMEDIATE COAT	DFT	TOPCOAT	DFT
C.	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

TABLE - IV

INTERIOR WOOD AND PLYWOOD SURFACES

	SURFACE/ AREA	PRIMER	DFT	INTERMED-IATE COAT	DFT	TOPCOAT	DFT
A.	Wood and Ply-wood Not Specified Otherwise	FS TT-P-001984 on softwood	1.5	FS TT-P-1511 SemiGloss	1.5	FS TT-P-1511 SemiGloss	1.5

-- End of Section --

SECTION 11300

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 System Composition

Provide, complete, and ready for operation, compact polymer blending system to automatically meter, blend, mix and age concentrated liquid neat and emulsified polymers with dilution water. The capacity of unit shall be 0.01 to 1.0 gph of concentrated polymer using the diaphragm pump. The capacity shall be 4 to 40 gph of diluted polymer solution. The PolyMax Model 4001-40/1.0 as manufactured by Semblex, Springfield, Missouri, generally meets the requirements of this specification.

1.2.2 System Housing and Requirements

The entire blending unit shall be housed in a portable, compact package. 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 75 psig. The blending unit shall be capable of mixing and diluting all types of polymers including semi-diluted dry polymer, emulsion, neat solution and mannich polymers. The blending unit shall provide a diluted polymer, full activated, without fish-eyes and without degradation of the long-chain polymer molecules.

1.2.3 Blending Unit Requirements

Blending unit shall be an integrated equipment package to automatically meter, dilute, activate, and feed liquid polymer and water. The unit shall 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. 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. The mixed and diluted polymer shall flow through an integral detention/aging chamber with a minimum 1.5 minute detention time, constructed with a clear acrylic barrel and internal components to affect complete mixing and aging of polymer.

Units that do not have an integral mixing/aging chamber shall not be allowed.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data:

Provide manufacturer's data on the polymer feed system.

1.3.2 SD-04, 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. Refer to Section 01300, for shop drawing submittal procedure.

1.3.3 SD-06, Instructions

Two printed copies of the installation procedures shall be furnished to the Contracting Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 SD-19, Operation and Maintenance Manuals

Three copies of the Operation and Maintenance (O&M) Manual shall be provided by the contractor. General arrangement equipment drawings and electrical and process flow schematics shall be included with the O&M manual. Refer to Section 01730 "Operation and Maintenance Data" for additional information on O&M manuals.

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 solenoid valve for on-off control of dilution water. Flow indicators with integral rate-adjusting valves shall provide an adjustable water flow rate from 4 to 40 gph total. In order to accomplish maximum activation, via maximum detention time, dilution water from the second flow indicator shall be introduced downstream of the clear acrylic aging chamber. Unit shall be capable of being flushed with clean water, easily backwashed by internal valving and have a drain connection integral with the unit. Units not having integral backwash/drain capabilities shall not be acceptable. An inlet water pressure regulator with gauge, discharge pressure relief valve with discharge pressure gauge

and discharge on-off valve shall be provided with the unit. Also provided shall be a loss of inlet water flow switch that shuts down the metering pump upon low water flow. Increased water flow automatically reactivates the polymer feed pump.

2.2 MIXING/BLENDING COMPONENTS:

Mixing of concentrated polymer with water shall be accomplished without mechanical mixing. Components shall include a multiple of in-line devices, including an inlet mixing block employing thin-film technology, three (3) in-line mixers, and multiple mixing baffles appropriately placed in the piping, such that the entire unit is a total blending system. The various components shall be joined such that they can be easily disassembled for cleaning. The three in-line mixers shall be housed inside clear tubing and mounted on the front of the unit for visual observation of mixing. Units that rely on conventional static mixers only to mix and activate polymer shall not be allowed.

2.3 PUMP:

The polymer transfer 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.

2.4 MIX/AGE CHAMBER:

The mix/age chamber shall provide for intimate mixing and aging of the concentrated polymer solution with water. The chamber shall be constructed of clear plastic, inert to polymer solutions. The circular chamber shall be sandwiched between two end pieces of clear plastic, each two (2) inches thick and held in compression by stainless steel rods, washers, bolt, and nuts. The chamber internals shall be comprised of multiple channels to effect laminar flow while preventing short-circuiting. A mechanical mixing device that could shear the polymer shall not be allowed. Minimum aging time shall be 1.5 minutes.

2.5 CONTROLS:

The front of each feed/dilution assembly shall have a main power on-off switch with running light, solenoid water valve/pump on-off switch with running light, and a gear pump/diaphragm pump selector switch. An alarm light shall energize if water flow falls below a preset level. Upon restoration of water flow, the unit shall automatically resume operation. Each unit shall be equipped with an in-line fuse, and each pump shall have overload protection. Internals of the unit shall be illuminated by a 40 watt incandescent light bulb enclosed in a protective, covered receptacle for the purpose of internal illumination. A common junction box shall be provided on the feed/dilution assembly skid for 120/60/1 power connection via a standard male plug.

2.6 HOUSING:

All components, except for the mixing chamber, shall be housed in a 304 stainless steel case having suitable access for maintenance. A light shall be provided inside the unit to illuminate the internals, rotameters, the three in-line mixing elements, and the detention chamber.

2.7 ACCESSORIES:

2.7.1 Post Dilution:

Additional downstream dilution of polymer shall be accomplished by a post dilution unit. The assembly shall be mounted by the contractor and include a factory pre-piped water control valve, flow meter, mixing block, and static in-line mixing chamber. The contractor shall provide a potable water connection to this equipment as indicated on the drawings.

2.7.2 Floor Stand:

A floor stand, approximately 24" wide x 24" long x 24" high shall be supplied to support the PolyMax. The stand shall be constructed of 304 stainless steel.

2.7.3 Calibration Column:

A clear plastic or polypropelene calibration column shall be supplied for periodic calibration of the metering pump. The column shall be 1,000 ml and also include an inlet tee with charging valve.

2.7.4 Drumpipe-Standpipe:

Provide a 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 a 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.

2.7.7 55 Gallon Drum Adaptor Assembly:

Provide an adaptor assembly and vent to enable metering of polymer from drums when in a horizontal position. The assembly shall include a 2-inch adaptor to screw into a 55 gallon drum bung, quick-disconnect assembly, ball valve, site glass to observe drum contents, and a barbed connector to

accept a 5/8 inch I.D. hose. A vent assembly shall also be provided for the drum consisting of an adaptor for the small drum opening, a 90 ell and vent pipe.

2.7.8 Backflow Preventer:

Provide a low hazard backflow preventer for installation on the discharge end of the polymer feed system.

PART 3 - EXECUTION

3.1 INSTALLATION:

Check-out of final installation, start-up, calibration and instruction of operating personnel shall be performed by an authorized representative of the manufacturer.

-- End of Section --

SECTION 11302

PACKED, GRAVITY OIL/WATER SEPARATOR

PART 1 - GENERAL

1.1 REFERENCES

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

FEDERAL SPECIFICATION (FED. SPEC):

SS-S-210A	Sealing Compound, Preformed Plastic, For Expansion Joints and Pipe Joints

MILITARY SPECIFICATION (MIL. SPEC.):

DOD-P-23236(A)	Painting Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast
MIL-S-45180D	Sealing Compound, Gasket, Hydrocarbon Fluid and Water Resistant

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) PUBLICATION:

B16.5-81	Pipe Flanges and Flanged Fittings

AMERICAN PUBLIC HEALTH ASSOCIATIONS (APHA) PUBLICATION:

Standard Methods for the Examination of Water and Wastewater

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS:

A36-88b	Structural Steel

AMERICAN WELDING SOCIETY (AWS) PUBLICATION:

D1.1-84	Structural Welding Code, Steel

1.2 SUBMITTALS

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

1.2.1 SD-04, Drawings

a. Separator G

b. Accessory Equipment G including principal dimensions and location of fittings.

Shop drawings shall include complete wiring diagrams for controls, details and catalog data on enclosures and catalog data on level switches and recovered product pump.

1.2.2 SD-05, Design Data

a. Separator G

b. Accessory Equipment G

Submit service representative's complete signed report of results of the inspection, operation, adjustments, and tests. Report shall include detailed descriptions of points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. Include the manufacturer's certificate that equipment conforms to specified requirements and is ready for permanent operation and that nothing in installation will render manufacturer's warranty null and void.

1.2.3 SD-06, Instruction

a. Separator System G

1.2.4 SD-11, Factory Test Results

a. Shop Hydrostatic Test G

1.2.5 SD-12, Field Test Reports

a. Inspection

b. Field Hydrostatic Test

c. Preoperational Test

d. In-service Test

1.2.6 SD-13, Certificates

a. Separator Corrosion Protection G

Written verification on the fabricator's letterhead that surface preparation and coating application were performed in accordance with the coating system manufacturer's printed recommendations.

1.2.7 SD-19, Operation and Maintenance Data:

Furnish the data, for the items listed, to the Contracting Officer for review and acceptance; O&M data shall comply with requirements specified in Section 01730, "Operation and Maintenance Data".

a. Oil/Water Separator, including pump, controls, and all necessary equipment (Data Package 3).

1.3 DELIVERY, STORAGE, AND HANDLING MATERIALS

1.3.1 Delivery and Storage:

Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, including subfreezing temperatures, precipitation, and high winds. Store materials susceptible to deterioration by direct sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on ground. If special precautions are required, prominently and legibly stencil instructions for such precautions on outside of equipment or its crating.

1.3.2 Handling:

Handle separator in such a manner as to ensure delivery to final location in sound, undamaged condition. Take special care not to damage interior and exterior surfaces of separator, coalescing plates, or tubes and associated supports and pipe coatings or lining. Make satisfactory repairs to damaged material(s) at not cost to Government.

1.4 GENERAL REQUIREMENTS

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

1.5 QUALITY ASSURANCE

1.5.1 Applications:

The separator shall remove free oil and suspended solids from oil-in-water mixtures of ground water originating from recovery operations. The influent oil-in-water mixture will be pumped to the unit which will not be located in an area with a corrosive atmosphere.

1.5.2 Influent Characteristics:

Provide oil/water separator designed for a maximum average flow of 80 gallons per minute (gpm). The influent is further characterized as follows:

Operating Temperature	32 - 80F
Separator Ambient Temperature	10 - 95F
Specific Gravity of Oil	.76 - .83
Specific Gravity of Water	.98 - 1.02

1.5.3 Performance:

The separator shall remove essentially all free and dispersed oil from the water stream and produce an effluent containing less than 10 mg/l of oil droplets larger than 20 microns. The separator shall effectively contain a

100% oil spill and will effectively process variable influent flows.

1.5.4 Inspection:

Examine each component of separator for compliance with requirements specified in PART 2 - PRODUCTS. Redesign or modification of equipment to comply with specified requirements, or necessary redesign or modification following failure to meet specified requirements, shall receive particular attention for adequacy and suitability. This element of inspection shall encompass visual examinations and dimensional measurements. Noncompliance with specified requirements, or presence of one or more defects preventing of lessening maximum efficiency of separator operation, shall constitute cause for rejection.

PART 2 - PRODUCTS

2.1 FABRICATION:

Provide a slant rib coalescing oil/water separator as indicated to remove hydrocarbons from drawdown pump discharge prior to entering the surge tank. Separator shall be comprised of a tank containing an inlet compartment, separation chamber, sludge chamber, oil reservoir, clean water outlet chamber, and recovered oil pump system.

2.1.1 Tank:

Tank shall be constructed of 1/4-inch Class A carbon steel conforming to ASTM A36. Weld tank in accordance with AWS D1.1 to provide water tight tank that will not warp or deform under load. The exterior of tank shall be coated with coal tar epoxy. The interior of tank shall be coated with a zinc primer. Pipe connections to tank exterior shall be as follows:

DESCRIPTION	NUMBER	SIZE	TYPE CONNECTION
Separator inlet	1	6-inch	flange
Oil pump discharge	1	3-inch	NPT
Clean water outlet	1	6-inch	flange
Tank drain	1	3-inch	flange
Sludge outlet	1	3-inch	flange
Tank vent	2	6-inch	flange

2.1.1.1 Flanges:

Use only flat face flanges and drill 150-pound ANSI Standard bolt circle and remove burrs. Use flanged piping connections that conform to ASME B16.5, Welding Neck Type.

2.1.1.2 Lifting Lugs

Tank shall be provided with lifting lugs for handling and installations. Each lug shall carry the total dry weight of the tank and attendant appurtenances. Prominently display lifting instructions on anondized aluminum plate located on outside of tank.

2.1.1.3 Covers:

Provide tank covers with a vapor proof seal for vapor control with 6-in inside diameter gas vents and suitable hinged access manways to each separator compartment. These covers shall be of the same material as the tank and shall be bolted in place. A rubber gasket shall be provided for water tightness.

2.1.1.4 Instruction plate:

Instruction plate shall describe procedures for operating and servicing equipment and shall include warnings of hazardous procedures. Plates shall be durable and legible throughout equipment life.

2.1.2 Inlet compartment:

The inlet chamber shall be comprised of a non-clog diffuser pipe to distribute the flow across the width of the separation chamber. The diffuser pipe shall be schedule 40 steel pipe. The inlet compartment shall be of sufficient volume to effectively reduce influent suspended solids and dissipate energy.

2.1.3 Separation chamber:

Slant rib oil separation chamber containing PVC oleophilic coalescing media arranged in a configuration that provides a minimum of 40 sq. ft. of oil coalescing surface and 10 sq. ft. of solids settling area per cubic foot of media. Media shall be a minimum volume of 16.75 cubic feet. Plate spacing shall be 3/4" maximum. Flow through the pack shall be sinusoidal to induce oil droplet impingement on the plate surfaces. Coalesced oil shall flow unimpinged along the plate surface to the top of the separation chamber where it is automatically decanted. Coalescing plate ribs shall form 55 degree settling shelves to enhance particular solids removal. Media shall be encased in a stainless steel frame and is installed or removed with lifting lugs.

2.1.3.1 Baffles:

Provide oil retention baffle, adjustable surface oil overflow weir trough, and stationary underflow baffle. Position underflow baffle to prevent resuspension of settled solids. Baffles shall be constructed on 1/4-inch Class A carbon steel conforming to ASTM A36.

2.1.4 Sludge chamber:

The sludge chamber shall be located under the separation chamber and shall provide an adequate volume for the settling of any sludge. The sides of the sludge chamber shall be sloped at 45 degrees to ensure easy and complete removal of the sludge. The sludge chamber shall be made from 1/4-inch carbon steel plate with a zinc primer coating.

2.1.5 Oil reservoir:

The oil reservoir shall be provided with a float switch to control recovered oil pump. The reservoir shall also be provided with a gravity

pipe to the suction side of the recovered oil pump. The reservoir shall be made from 1/2-inch carbon steel plate with a zinc primer coating.

2.1.6 Clean water chamber:

The clean water chamber shall be made from 1/4-inch carbon steel plate with a zinc primer coating. The clean water chamber shall be provided with an adjustable overflow weir and a gravity pipe discharge. This discharge pipe shall be provided with a 1/2-inch sampling valve.

2.1.7 Recovered product pump:

A rotary gear pump shall be provided to pump out the oil reservoir. This pump shall provide a 50 psig discharge pressure. The pump shall be pedestal mounted at an elevation no less than 2 feet above the treatment pad slab elevations. Pump motor shall operate on 120VAC, single phase, 60 Hz power.

2.1.8 Control:

Provide a high-level-low level float switch, mounted in the oil reservoir to automatically turn the pump on and off. Controls for the product pump shall be housed in NEMA 12 local control panel. Control shall consist of a manual motor start, "hand-off-automatic" selector switch, motor overloads, and contacts to provide the following features in automatic mode:

1. Pump start on high reservoir level
2. Pump stop on low reservoir level

PART 3 - EXECUTION

3.1 INSTALLATION:

Lift tank as required without parallel plate pack in place onto level foundation using lifting lugs or lifting supports as indicated. Level tank and bolt to supports for above ground installation to prevent hydrostatic uplifts and ensure unit stability. Use a lifting bar through lugs to insert plate or tube packs into tank and place on supports. Caulk around packs and pack supports with sealing compound conforming to Fed. Spec. SS-S210 or to Mil. Spec. MIL-S45180 to prevent hydraulic short-circuiting. Avoid abrupt contact between the packs and the tank walls and pack supports to avoid damage. System installation shall be conducted in accordance with manufacturer's recommendations.

-- End of Section --

SECTION 11303

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
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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C203	(1986) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	(Jul 1986) Rules and Regulations: Radio

Frequency Devices

FEDERAL SPECIFICATION (FS)

FS TT-E-489	(Rev H) Enamel, Alkyd, Gloss, Low Voc Content FEDERAL STANDARD (FED-STD) FED-STD 595 (Rev B) Colors HYDRAULIC INSTITUTE (HI) HI-01 (1983; 14th Ed) Standards for Centrifugal, Rotary & Reciprocating Pumps

MILITARY SPECIFICATIONS (MS)

MS MIL-R-7575	(Rev C; Am 2; Notice 1) Resin, Polyester, Low-Pressure Laminating
MS MIL-Y-1140	(Rev H; Am 1) Yarn, Cord, Sleeving, Cloth, and Tape-Glass

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

UNDERWRITERS LABORATORIES (UL)

UL 448	(Nov 27, 1984; 7th Ed; Rev thru Sep 19, 1990) Pumps for Fire Protection Service

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 waterworks operation at least 2 years prior to bid opening. Equipment shall be supported by a

service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the jobsite. Pumps of the same types shall each be the product of one manufacturer.

1.2.2 Description

The pumps shall be horizontal and vertical centrifugal water pumps of the types indicated and specified. 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, so located that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

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 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics shall be as indicated. Motor starters shall be provided 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 under this section of the specifications.

1.2.6 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. Pumps having impeller diameters larger than 90 percent of the published maximum diameter of the casing or less than 15 percent larger than the published minimum diameter of the casing will be rejected. Acceptable maximum impeller diameter calculations shall not be based on percentage of impeller diameter range for a given casing.

1.2.7 Conformance With Agency Requirements

Where materials or equipment are specified to be an approved type, the seal or label of approval from a nationally recognized testing agency, adequately equipped and competent to perform such services, shall be attached thereto. A written certificate from the testing agency shall accompany the materials or equipment and shall be submitted to the Contracting Officer stating that the items have been tested and that they conform to the applicable requirements of the specifications and to the standards listed herein. The certificate shall indicate the methods of testing used by the testing agency. In lieu of a certificate from a testing agency, published catalog specification data, accompanied by the manufacturer's certified statement to the effect that the items are in accordance with the applicable requirements of the specifications and the referenced standards, will be considered by the Contracting Officer and may be acceptable as evidence that the items conform with agency requirements.

1.2.8 Verification of Dimensions

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

1.2.9 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 Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

SD-01 Data

Materials and Equipment;

Manufacturer's descriptive data and technical literature, performance charts and curves for all impeller 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.

SD-04 Drawings

Centrifugal Pump System;

A complete listing of equipment and materials. Drawings containing complete wiring and 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.

SD-06 Instructions

Centrifugal Pump System;

Proposed diagrams, instructions, and other sheets, prior to posting. Approved wiring and control diagrams showing the complete layout of the entire system, including equipment , piping valves, and control sequence, framed under glass or in approved laminated plastic, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

SD-09 Reports

Tests;

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

SD-19 Operation and Maintenance Manuals

Centrifugal Pump System;

Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment. One complete set at the time the tests procedure is submitted; remaining sets before the contract is completed. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the building, name of the Contractor, and contract number. Flysheets shall be placed before instructions covering each subject. Instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. Instructions shall include, but not be limited to, the following:

a. System layout showing piping, valves, and controls.

b. Approved wiring and control diagrams.

c. A control sequence describing startup, operation, and shutdown.

d. Operating and maintenance instructions for each piece of equipment,

including lubrication instructions and troubleshooting guide.

e. Manufacturer's bulletins, cuts, and descriptive data; and parts list and recommended spare parts.

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 or multi-stage type, designed for waterworks service in the configurations and capacities listed below.

2.2.1 Pump Characteristics

Primary Feed Pumps (2) : Each shall draw water from the surge/setting tank at a maximum rate of 40 GPM (80 GPM together) and overcoming 50 feet total head; these pumps shall be supplied by the air stripping contractor.

Secondary Feed Pumps (2): Each shall draw water from the air stripper sump at a maximum rate of 40 GPM (80 GPM together) and overcoming 50 feet total head; pumps shall be supplied by the air stripping contractor.

Carbon Backwash Pump (1): Shall draw water from the backwash tank at a rate of 125 GPM when overcoming 80 feet total head.

Sand Filter Backwash Pump (1): Shall draw water from the backwash tank at a rate of 75 GPM when overcoming 50 feet total head.

Effluent Pumps (2): Each shall draw water from the backwash tank at a maximum rate of 40 GPM and overcoming 10 feet total head.

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 directly connected to the driving units through solid shafts, flexible couplings, or free wheeling clutches (as appropriate):

Primary Feed Pump Motors (2)

Rated speed: 1,750 rpm
Rated horsepower: 3 hp
Rated voltage: 480 VAC
Phase: 3

Secondary Feed Pump Motors (2)

Rated speed: 1,750 rpm
Rated horsepower: 3 hp
Rated voltage: 480 VAC
Phase: 3

Carbon Backwash Pump

Rated speed: 1,750 rpm
Rated horsepower: 5 hp
Rated voltage: 480 VAC
Phase: 3

Sand Filter Backwash Pump

Rated speed: 1,750 rpm
Rated horsepower: 3 hp
Rated voltage: 480 VAC
Phase: 3

Effluent Pump Motors (2)

Rated speed: 1,750 rpm
Rated horsepower: 1-1/2 hp
Rated voltage: 480 VAC
Phase: 3

2.2.3 Pump Construction

Except as below specified, centrifugal water pumps including required priming equipment shall be constructed in accordance with the Hydraulic Institute HI-01.

2.3 PUMP CASINGS

Pump casings shall be cast iron, horizontal shaft, and vertical or horizontal split casing, of the following design:

The casings shall be designed to permit replacement of wearing parts. Horizontal-split casings shall have the suction and discharge nozzles cast integrally with the lower half, so that the upper part of the casings may

be removed for inspection of the rotating parts without disturbing pipe connections or pump alignment. 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 or double volute with flanged piping connections conforming to ASME B16.1, Class 125. The direction of shaft rotation shall be conspicuously indicated. The casing shall have tapped openings for air venting, priming, draining, and suction and discharge gauges. A brass or bronze umbrella or vent cock shall be furnished for venting except where automatic air vents are indicated. Drain openings in the volute, intake, or other passages capable of retaining trapped water shall be located in the low point of such passages.

2.3.1 Impellers

Impellers shall be of enclosed design and shall be constructed of bronze carefully finished with smooth water passageways, and shall be statically and dynamically balanced. Impellers shall be securely keyed to the pump shaft. Impellers on vertical-split pumps shall be additionally secured with a self-locking nut.

2.3.2 Wearing Rings

Wearing rings of bronze shall be provided for impellers. Wearing rings of a different composition or of a suitable ferrous material shall be provided for pump casings. Casing rings shall be securely fixed in position to prevent rotation. Rings shall be renewable and designed to ensure ease of maintenance.

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. Bronze 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.

2.3.4 Packing Seals

Packing shall be non-asbestos. Pump shall be shipped to the site without the packing inserted and shall be packed onsite in the presence of the pump or packing manufacturer's representative. At no time during startup or run-in shall the gland drip less water than 80 drops per minute. After not less than 40 operating hours and upon permission of the Contracting Officer, leakage rate may be reduced to 50 drops per minute or to the rate recommended by packing manufacturer.

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.

2.3.4.2 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.

2.3.5 Mechanical Seals

Mechanical seals shall be balanced or unbalanced, 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 construction shall not require external source cooling for pumped-fluid service temperatures up to 250 degrees F. 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-hexafluoropropylene, 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 manufacturer's recommendations.

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 and close-coupled vertical 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. Couplings for vertical pumps other than close-coupled vertical pumps may be of the universal type. Flexible couplings shall not be used to compensate for misalignment of pump.

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 will 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 squared, 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.

2.3.8 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.

2.3.9 Lubrication

Bearings on horizontal-shaft pumps shall be either oil-bath type or grease type. Each oil reservoir shall be liberal in size and provided with an opening for filling, an overflow opening at the proper location to prevent overfilling, an oil-level sight glass, and a drain at the lowest point. Grease type bearings shall be provided with fittings for a grease gun and, if the bearings are not easily accessible, with grease tubing extending to convenient locations. The grease fittings shall be of a type that prevent over lubrication and the buildup of pressure injurious to the bearings.

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 cast iron with a raised lip tapped for drainage, or of welded steel shapes with suitable drainage pan. Horizontal-shaft end suction pumps shall be mounted on a factory furnished channel steel frame. With the exception of close-coupled Pumps, horizontal-shaft end suction pumps shall be frame mounted. The drainage structure shall collect the packing box leakage and shall have a 1/2-inch NPT connection to connect it to a drain.

2.3.11 Cocks, Plugs, and Accessories

The pumps shall be equipped with air cocks, drain plugs, and single gauges indicating discharge pressures for all pumps and suction pressures for pumps without suction lift. Gauges, equipped with a shutoff cock and snubber, shall conform to ASME B40.1, and shall be calibrated in pounds per square inch and feet of water in not more than 2 psi, 5-foot, increments. Gauge ranges shall be appropriate for the particular installation. Normal operating suction and discharge pressures of the pump shall be indicated on the mid-point range of the gauges. Pressure relief valve shall be furnished and installed where indicated.

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.

2.3.13 Finish

Pump shall have painted or enameled finish as is standard with the manufacturer.

2.4 ELECTRICAL EQUIPMENT

Electrical equipment shall conform to Section 16402, "Electrical Work, Interior". Electrical motor driven equipment herein specified shall be provided complete with motors, motor starters, and controls. Motor controls, equipment, and wiring shall be in accordance with NFPA 70.

2.4.1 Electric Motors

Each electric motor-driven pump shall be driven by a weather-protected, totally-enclosed fan cooled continuous-duty electric motor. Motor shall have a 1.15 service factor. Motors shall be squirrel-cage induction motors having normal-starting-torque and low-starting-current characteristics, and shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. Motor bearings shall provide smooth operations under the conditions encountered for the life of the motor. Adequate thrust bearing shall be provided in the motor to carry the weight of all rotating parts plus the hydraulic thrust and shall be capable of withstanding upthrust imposed during pump starting and under variable pumping head conditions specified. Motors shall be rated 480 volts, 3 phase, 60 Hz and such rating shall be stamped on the nameplate.

Manually controlled pumps shall have START-STOP pushbutton in cover. Automatically controlled pumps shall have three-position "MANUAL-OFF-AUTOMATIC" selector switch in cover. Additional controls or protective devices shall be as indicated. A pump low-water cutoff shall be installed in the tanks and shall shut the pump off when the water level in the well reaches the level shown.

2.5 EQUIPMENT APPURTENANCES

2.5.1 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.

2.5.2 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 galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. 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.

2.5.3 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 shall also be furnished. 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 Contracting Officer.

2.5.4 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 manufacturer. Ferrous surfaces not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

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.

3.1.1 Concrete Foundations

Concrete for equipment foundations shall be as specified in Section 03300 CONCRETE FOR BUILDING 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 2,500 psi shall be used in foundations that are entirely separated from the surrounding floor. A premolded filler strip shall be installed between the foundation and floor slab as shown. Foundation bolts, as required, shall be furnished for proper positioning during the placement of the concrete.

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 Contracting Officer 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 Contracting Officer. 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 3 days 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 Contracting Officer, 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 11304

FLOCCULATION TANK AND APPURTENANCES

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4097-88	Specification for Contact Molded Glass-Fiber-Reinforced Thermoset Resin Chemical Resistant Tanks
ASTM A 176-91	Specifications for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

1.2 DESCRIPTION OF WORK

The flocculation tank 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.

1.3 SUBMITTALS:

1.3.1 SD-02, Manufacturer's Catalog Data:

Provide manufacturer's data on the tank mixer.

1.3.2 SD-04, Drawings:

Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings of the flocculation tank and related equipment including:

a. Bolt down cover
b. Vent
c. External connections
d. Anchor bolt sizing and placement
e. Tank finish
f. Tank grounding
g. Tank mixer

Shop drawings shall include quantity, size, material, and locations of all equipment.

1.3.3 SD-06, Instructions:

Two printed copies of the installation procedures shall be furnished to the Contracting Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 SD-19, Operation and Maintenance Manuals

Three copies of the Operation and Maintenance (O&M) Manuals for the flocculation tank mixer and control equipment shall be provided by the contractor. General arrangement equipment drawings and electrical and process flow schematics shall be included with the O&M manual. Refer to Section 01730, "Operation and Maintenance Data" for additional information on O&M manuals.

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 TANK REQUIREMENTS

2.1.1 The internal surface of the flocculation tank, must be able to resist the following chemicals at the anticipated concentrations:

Chemical	Concentration
Benzene	8,000
1,2-Dichloroethylene (T)	42,000
Ethylbenzene	20
Toluene	20
Trichloroethylene	14,000
Vinyl Chloride	400
pH	6.8-7.4

2.2 FLOCCULATION TANK

2.2.1 Dimensions

The flocculation tank shall be 5'-6" diameter by 7'-6" overall height with a nominal capacity of 1,200 gallons. The flocculation tank shall be a flat bottom, open top tank, furnished with a hinged bolt-down cover. The tank shall be constructed of fiberglass reinforced polyester through a centrifugal casting process, fabricated to meet or exceed the strength requirements of ASTM D4097-88. Minimum laminate thickness shall be not less than 3/8". All cut edges shall be coated with resin so that no glass fibers are exposed and all voids filled.

2.2.2 Cover

The tank shall be equipped with a fiberglass bolt-down cover. The cover shall be designed with a 304 stainless steel hinge to provide access to the tank interior. The cover shall be provided on an 8" x 8" shaft cutout for a mixer. The cover shall be furnished with two (2) 6" diameter

non-gussetted flange connections for connection of an air inlet vent and an air exhaust vent to ductwork. Tank cover bolts shall be Type 304 stainless steel, 1/4" diameter hex heads.

2.2.3 Flanged Lip

One (1) fiberglass flanged lip shall be furnished with the tank to allow for installation of a bolt-down cover.

2.2.4 Flanges

One (1) 6" diameter conically gussetted flange connection shall be furnished on the outside tank sidewall at the elevation and location shown on the Drawings, for connection of the flocculation tank influent line (effluent line from the Oil/Water Separator).

One (1) 6" diameter conically gussetted flange connection shall be furnished with a non-gussetted 6" diameter internal flange at the elevation and location shown on the Drawings, for connection of flocculation tank effluent line (influent line to Surge/Settling Tank).

One (1) 2" diameter conically gussetted siphon drain flange connection shall be furnished on the outside tank sidewall at the elevation and location shown on the Drawings, for connection of a drainage line.

2.2.4.1 Hold Down Legs

The flocculation tank shall be furnished with four (4) equally spaced light duty hold down legs. Legs shall be type 304 stainless steel, 1/4" thickness, molded into the bottom sidewall of the tank.

2.3 MIXER

2.3.1 Description

The flocculation tank shall be equipped with a clamp mounted, gear driven, mixer, capable of maintaining homogeneous solutions of polyelectrolytes at viscosities up to 500 CP in the above described tank.

2.3.2 Agitator

The agitator shall be furnished with a heavy duty C-clamp assembly for mounting to the tank wall.

2.3.3 Lower Mixing Shaft

The lower mixing shaft shall be 1 1/4" diameter by 72" long, 304 stainless steel construction, equipped with a single 13.6" diameter, 304 stainless steel A310 energy efficient, high pumping capacity, 3 blade axial flow turbine, operating at 20 to 350 RPM.

2.3.4 Output Speed Controller

Shaft output speed shall be controlled by an AC inverter, with built-in operator control station housed in a NEMA 1 enclosure and designed to

accept 230/1/60 input power. Controller, as manufactured by Adjust-A-Mix, generally meets the requirements of this specification.

2.3.5 Agitator Motor

The agitator shall be driven by a .65 HP, 230/460/3/60 TEFC motor through a single reduction set of helical gears which shall provide a maximum output speed of 1750 RPM. Grip springs shall provide a keyless friction clutch to protect the gears against shock loads. Gear reducer output shaft and impeller shaft shall be connected by a rigid, bolted coupling.

2.3.6 Operation

Agitator shall be suitable for 24 hours per day operation. Lightning Model XJ-65, generally meets the requirements of this specification.

2.4 pH PROBE, METER AND RECORDER

The mixing tank shall be furnished with a permanently mounted pH probe to continuously monitor, display and record the pH of the tank mixture.

The probe shall be attached to the tank wall at a level as to be continuously immersed in the tank contents and shall be removable for cleaning.

Probe shall be attached to a wall mounted display and recorder, Cole Parmer Catalog No. L-05997-35, generally meets the requirements of this specification.

Contractor shall provide connection to 110 VAC power source plug-in connection.

Contractor shall supply a 12-month supply of recording paper.

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 tank shall be installed true and level. Precision gauges and levels shall be used in setting the tank. The tank 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 11305

SURGE/SETTLING TANK AND APPURTENANCES

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D-2103-86	Specifications for Polyethylene Film and Sheeting
ASTM A-167-91	Specifications for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM D 4097-88	Specification for Contact Molded Glass Fiber-Reinforced Thermoset Resin Chemical Resistant Tanks.
ASTM A 167-91	Specifications for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

1.2 DESCRIPTION OF WORK

Provide a complete and ready for operation a surge/settling tank and appurtenances to provide a complete and functional system.

In addition the surge/settling tank manufacturer shall provide and install the liquid level control system to be used in the surge chamber of the surge/settling tank.

The entire system shall be provided by a manufacturer regularly engaged in the manufacturing and supply of this equipment.

1.3 SUBMITTALS:

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

1.3.1 SD-02, Manufacturer's Catalog Data

Provide manufacturer's data on the surge settling tank and float switch assembly.

1.3.2 SD-04, Drawings:

Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings of the surge/settling tank and related equipment including:

a. Bolt down cover
b. Vent
c. External connections

d. Liquid level controls mounting brackets
e. Anchor bolt sizing and placement
f. Tank finish
g. Tank grounding
h. Float switch assembly

Shop drawings shall include quantity, size, material, and locations of all equipment. Shop drawings shall include wiring diagrams of float switch and product sensor controls.

1.3.3 SD-19, Operation and Maintenance Manuals:

Furnish the data, for the Float Switch Controls, to the Contracting Officer for review and acceptance; O&M data shall comply with requirements specified in section 01730 "Operation and Maintenance Data."

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 internal surface of the surge/settling tank must be able to resist the following chemicals at the anticipated concentrations:

Chemical	Concentration
Benzene	8,000
1,2-Dichloroethylene (T)	42,000
Ethylbenzene	20
Toluene	20
Trichloroethylene	14,000
Vinyl Chloride	400 pH 6.8-7.4

2.2 SURGE/SETTLING TANK

2.2.1 Dimensions

The surge/settling tank shall be 10'-0" overall diameter with an 8'-0" inside overflow wall diameter by 7'-0" overall height with a nominal capacity of approximately 2,900 gallons. The overflow wall shall be concentrically centered with the outside wall, leaving a 1'-0" distance between the inside and outside walls at all points. The overflow wall shall be a maximum of 6'-0" high (or 1'-0" below the outside wall height) and shall be fused to the bottom of the tank such that no leaks between the settling chamber (inside) the surge chamber (outside) can occur. A V-notch overflow weir shall be firmly attached and sealed to the outside of the overflow wall as shown on

the drawings. Maximum height of this weir shall be 2" above the top of the overflow wall. The tank shall be a 10 degree cone bottom, open top tank, furnished with a hinged bolt-down cover. The tank shall be constructed of fiberglass reinforced polyester through a centrifugal casting process, fabricated to meet or exceed the strength requirements of ASTM D4097-88. Minimum laminate thickness shall be not less than 3/8". All cut edges shall be coated with resin so that no glass fibers are exposed and all voids are filled.

2.2.2 Cover

The tank shall be equipped with a fiberglass bolt-down cover. The cover shall be designed with a 304 stainless steel hinge to provide access to the tank interior. The cover shall be furnished with two (2) 4" diameter non-gussetted flange connections for connection of an air inlet vent and an air exhaust vent to ductwork. Tank cover bolts shall be Type 304 stainless steel, 1/4" diameter hex heads.

2.2.3 Flanged Lip

A fiberglass flanged lip shall be furnished with the tank to allow for installation of a bolt-down cover.

2.2.4 Flange Connection - 6 inch

One (1) 6" diameter conically gussetted flange connection shall be furnished on the outside tank sidewall at the elevation and location shown on the Drawings, for connection of the influent line to the surge/settling tank.

2.2.5 Flange Connection - 3 inch

One (1) 3" diameter conically gussetted flange connections shall be furnished on the outside tank sidewall at the elevation and location shown on the Drawings, for connection of effluent lines from the surge/settling tank to the air stripper feed pumps.

2.2.6 Siphon Drain Flange

One (1) 3" diameter conically gussetted siphon drain flange connection shall be furnished on the cone bottom as shown on the Drawings, for connection of the filter press feed line.

2.2.7 Lift Lugs

Two (2) lift lugs shall be furnished with the holding tank to facilitate on-site handling.

2.2.8 Flange Connection - 6 inch

Two (2) 6-inch diameter flange connections shall be furnished on the top of the tank as shown on the Construction Drawings, for connection of vent piping.

2.3 LIQUID-LEVEL CONTROL SYSTEM

The liquid-level control system for the surge/settling tank will be supplied as part of the surge/settling tank package, and therefore, specifications for the level control system are not included as part of the tank specification. The liquid-level control system will be installed following tank installation. The manufacturer of the surge/settling tank unit will be responsible for coordination of all work required to supply and install the liquid-level control system.

PART 3 - EXECUTION

3.1 INSPECTION

Prior to all work of this Section, the Contractor shall inspect the installation areas to see that the installed work of other trades has progressed to the point where the tank installations may properly commence.

The Contractor shall verify that the installation can be made in accordance with all pertinent codes and regulations.

3.2 INSTALLATION

The arrangement of the tank, foundation, piping, and ductwork is shown in both plan and section on the Drawings. The arrangement shown is based upon a particular manufacturer's tank. Any manufacturer's tank which meets the requirements of these Specifications will be accepted. Additional costs due to revisions in piping or structures required by the manufacturer for the tank shall be borne by the Contractor.

The surge/settling tank and appurtenances shall be installed in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Drawings.

The tank shall be installed true and level. Precision gauges and levels shall be used in setting the tank.

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 11306

MULTI-LAYER SAND FILTERS

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D-2103-86	Specifications for Polyethylene Film and Sheeting
ASTM A-167-91	Specifications for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip

1.2 DESCRIPTION OF WORK

Provide and install as indicated a factory assembled vertical pressure type filter system shipped with manifold piping attached to the filter tank for ease of installation and start up. The system shall be of an approved design as fabricated by a manufacturer regularly engaged in the production of water treatment equipment. All equipment and materials shall be supplied per the specifications as intended for a complete and operational system.

The filter system is intended for removal of sediment down to 10 microns in size.

1.2 SUBMITTALS

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

1.2.1 SD-02, Manufacturer's Catalog Data

Provide manufacturer's data for the multi-layer sand filter units.

1.2.2 SD-04, Drawings:

Submit shop drawings on the following:

a. Contractor vessels, including principle dimensions, materials of construction, inlet and outlet fittings.

b. Filter media.

1.2.3 Instructions

Two printed copies of the installation procedures shall be furnished to the Contracting Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.2.4 SD-19, Operation and Maintenance Manuals:

Three copies of the Operation and Maintenance (O&M) Manual shall be provided by the Contractor. General arrangement equipment drawings and electrical and process flow schematics shall be included with the O&M manual. Refer to Section 01730, "Operation and Maintenance Data" for additional information on O&M manuals.

1.3 GENERAL REQUIREMENTS

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

PART 2 PRODUCTS

2.1 GENERAL DESCRIPTION

The system, in compliance with equipment specifications is described as an automatic Alternating Twin water filter system meeting the performance and design data requirements as herein specified. Bruner Model ML 30HF-2 Twin generally meets the requirements of this specification.

2.2 PERFORMANCE AND DESIGN DATA

The filter system shall meet the specified effluent quality based on the influent characteristics listed below.

2.2.1 Influent Water Analysis

Calcium	(Ca)	15-25
Iron	(Fe)	20-40
Magnesium	(Mg)	2-10
Manganese	(Mn)	<1
Potassium	(K)	1-5
Sodium	(Na)	5-20
Chloride	(Cl)	20-40
Carbonate (as $CaCO_3$)	(CO3)	ND
Bicarbonate (as $CaCO_3$)	(HCO3)	25-50
TOTAL ALKALINITY (as $CaCO_3$)	(TALK)	25-50
TOTAL HARDNESS (as $CaCO_3$	(TH)	50-80
TOTAL DISSOLVED SOLIDS	(TDS)	100-150
TOTAL SUSPENDED SOLIDS		20-80
pH		6-8

(Constituents above are expressed in ppm or mg/l.)

2.2.2 Effluent Water Quality

Filter effluent shall be free of suspended material larger than 10 microns is size under normal operating conditions.

2.2.3 Design Parameters

Normal System Flow & Pressure Drop	49 GPM @ 6 PSI
Maximum System Flow & Pressure Drop	98 GPM @ 20 PSI
Daily Water Usage	120,000 Gallons/Day
Daily Hours of Water Demand	24 Hours/Day
Backwash Flow	75 GPM
Resin Tank Freeboard	50% Minimum
Operating Temperature Range	40° - 120° F
Operating Pressure Range (System)	30 - 100 PSIG
Electrical Requirements	120 Volt. 60 Hz. Single Phase
System Dimensions (LxWxH)	74" L 41" W 79" H

(Note pressure drop with unit(s) online and backwashed clean.)

2.2.4 Equipment Schedule

Filter Tank(s) - Qty: 2 Dia. 30 in. Side Shell 54 in.
Manifold Pipe - Size: 2 in.
Main Operating Valve - Size: 2 in. Type: Multiport diaphragm
Filter Media - Qty: 10 cu. ft./tank, 20 cu. ft. total
Backwash/Regeneration/Controller Type: Time Clock

2.3 FILTER TANKS

Tanks shall be of electric welded pressure vessel quality low carbon steel construction rated for 100 psig working pressure and hydrostatically tested at 50% in excess of the working pressure.

Tank shall have threaded NPT connections on the service inlet and outlet.

Access opening shall include two 4" diameter or 4" x 6" elliptical handholes; one in top head and one in lower side shell.

Support for tanks shall be structural steel strap legs welded to lower tank head.

Tanks shall be hot dipped galvanized inside and outside after fabrication.

Tanks shall be sandblasted internally to white metal with a 1 to 1-1/2 mil anchor pattern, then coated with 8-10 mils DFT epoxy polyamid. The exterior surface shall be cleaned and coated with 2-3 mils DFT rust resistant primer.

2.4 INTERNAL DISTRIBUTION

Upper distribution system shall be of the baffle type to evenly distribute the water over the entire tank area.

Lower distribution system shall be of a proven design constructed with individual fine slotted non-clogging polyethylene strainers arranged for even flow distribution through the resin bed. Slotted lateral arms are unacceptable. The distribution system shall be embedded in a single layer subfill of washed 1/8" x 1/16" gravel to support the resin bed.

2.5 MAIN OPERATING VALVE

The main operating valve shall be an industrial automatic multiport diaphragm type slow opening and closing, free of water hammer. The diaphragm assembly shall be fully guided on its perimeter when pressure actuated from one position to another to assure a smooth reliable shut-off without sticking. There shall be no contact of dissimilar metals within the valve and no special tools shall be required to service the valve.

The main operating valve shall be manufactured by the manufacturer of the filtration equipment. Valve shall have a treated water sampling cock.

2.6 PIPE AND FITTINGS

Piping shall be schedule 40 galvanized. Threaded Fittings 4" and smaller shall be standard class 150 galvanized malleable iron, 4" and larger flanged fittings shall be cast iron standard class 125.

2.7 FLOW CONTROL

An automatic flow controller shall be provided to maintain proper backwash and flush rates over wide variations in operating pressures and require no field adjustment. Flow controller shall be of the type most commonly specified by the filter manufacturer.

2.8 FILTER MEDIA

The granular media (Multi-layered) shall consist of three (3) distinct filer layers in addition to a support layer. Each layer shall be of a selected density and particle size to stratify in the same order following backwash. The filter layers shall stratify with the coarsest layer at the top and the finest layer at the bottom. Particle retention shall be 10 micron or larger.

2.9 ACCESSORIES

Pressure Gauges for inlet and outlet of each tank. Gauges shall be of the type most commonly provided by the filter manufacturer.

Sampling Cocks for inlet and outlet of each tank.

PART 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

The multi-layer sand filters shall be installed in accordance with the manufacturer's recommendations. Installation of the item will not be allowed to proceed until the recommendations are received.

3.2 INSTALLATION

All piping and hose connections shall be made up tight and shall not leak under operating conditions.

3.3 MANUFACTURER'S REPRESENTATIVE

The services of a trained factory authorized service representative shall be made available to supervise, inspect, and provide operator training as required for initial start-up and system operation. Two (2) full working days of service will be provided.

-- End of Section --

SECTION 11307

LOW PROFILE AIR STRIPPER PACKAGE

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D-2103-86	Specifications for Polyethylene Film and Sheeting
ASTM A-167-91	Specifications for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

1.2 DESCRIPTION OF WORK

Furnish and install a complete and ready for operation low profile air stripping system, complete with sump, cover with mist eliminator, aeration trays, blower, influent and effluent pumps, sump level controls, gauges, pressure switches, and flow meters.

In addition, the air stripper manufacturer shall provide and install the liquid level control system to be used in the surge chamber of the surge/settling tank.

The entire system shall be provided by a manufacturer regularly engaged in the manufacturing and supply of low profile air stripping equipment. Equipment details are presented in Section 2 and on the construction drawings.

1.3 SUBMITTALS

1.3.1 SD-02, Manufacturer's Catalog Data

Provide manufacturer's data on the air stripper and related equipment as well as the liquid level control system for the surge/settling tank.

1.3.2 SD-04, Shop Drawings:

The Contractor shall submit for approval shop drawings of the air stripper and liquid-level control system for the surge/settling tank.

1.3.3 SD-19, Operation and Maintenance Manuals:

Three copies of the Operation and Maintenance Manuals (O&M) shall be provided by the Contractor. General arrangement equipment drawings and electrical and process flow schematics shall be included with the O&M manuals. Refer to Section 01730, "Operation and Maintenance Data", for

additional information on O&M Manuals.

1.4 DELIVERY, STORAGE, AND HANDLING MATERIALS

1.3.4 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 special shipping and handling precautions are required, prominently and legibly stencil such precautions on outside of equipment or its crating.

1.3.5 Storage and Handling:

Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, including subfreezing temperatures, precipitation, and high winds. Store materials susceptible to sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on the ground.

1.4 GENERAL REQUIREMENTS

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

PART 2 - PRODUCTS

2.5 LOW PROFILE AIR STRIPPER

2.5.1 PERFORMANCE REQUIREMENTS

The low profile air stripper shall meet all of the following treatment criteria based on each respective influent contaminant concentration, temperature, and flow rates:

If any effluent efficiency limit is not met at any time during a period of one year after start of operations of the facility controlled by the unit, the Contractor will be responsible for retrofitting or replacing the non-complying unit as required to meet the effluent discharge requirements specified above.

Contaminant	Air Stripper Influent Concentration (ppb)	Air Stripper Effluent Concentration (ppb)
Benzene	7,900	1
1 trans-1,2-Dichloroethylene	42,000	70
Trichloroethylene	14,000	2.8
Vinyl Chloride	360	ND

Temperature: 60 Degrees F
Input Flow Rate: 80 Gal/Min
Air Flow Rate: Not to exceed 1,000 SCFM

The standard of quality for the specified equipment is based on North East Environmental Products, Inc., Model 3641 Shallow Tray Low Profile Air Stripper, with four (4) twelve-inch trays, a 7.5 HP blower delivering 900 SCFM of air based on a flow of 80 GPM, generally meets the requirements of this specification.

2.5.2 Components

The Low Profile Air Stripper system consists of sump, cover with mist eliminator, multiple aeration trays, blower, transfer pump controls and gauges. The blower shall be protected by a removable shroud. Each aeration tray shall consist of a tray support and a stainless steel bubble plate. The sump, tray supports, cover and shroud shall be constructed of high density polyethylene.

2.5.3 Blower

The blower shall be a 7.5 HP, 230VAC, 3-phase regenerative system to push air through the aeration trays. Blower shall be explosion proof and rated for use in Class 1, Div. 1, Group D hazardous locations. The motors shall be equipped with explosion proof power disconnects and thermal overload protection.

2.5.4 Level

The system shall be equipped with a HI-LO/HI-OVERRIDE sump level probe that controls both the primary and secondary feed pumps. The top float shall actuate the HI-OVERRIDE. If the sump should become full, the rising water level will lift this float and shut off the feed pump. The bottom float shall control operation of the transfer pump by actuating HI and LO switches. The transfer pump shall start when the float rises to the HI switch and continue to run until the water level drops the float to the LO switch.

2.5.5 Sump

The sump shall serve both to collect treated water and to support the aeration trays and blower assembly. Intake air screen, fittings for the water effluent pipes and level sensing probe shall be mounted on the sump.

2.5.6 Junction Box

A junction box shall be provided to permit the sump level probe and the low pressure switch to interface with the feed pump and transfer pump controls.

2.5.7 Aeration Tray

The aeration tray supports shall be constructed of 3/16" high density polyethylene (conforming to ASTM D-2103) and molded for vertical stacking on top of the sump. They shall be secured to one another and to the sump by quarter turn fasteners. Flexible gaskets on the mating surfaces shall be provided for an air and water tight fit between trays. Stainless steel bubble plates shall be sandwiched between successive trays for easy removal

of the plates for cleaning and inspection. Contaminant removal efficiencies shall be adjustable by changing the number of aeration trays used with the system.

2.5.8 Cover

The cover shall contain the polypropylene mist eliminator and fit on top of the unit. The cover shall be equipped with fittings for attachment of the influent water and effluent air plumbing and be constructed of 3/16" high density polyethylene.

2.5.9 Gauges

The air stripper manufacturer shall provide gauges to monitor both static pressure in inches of water column and air flow rate in SCFM.

2.5.10 Pressure Switches

Low and High Pressure switches shall 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 (lead or lag). If bubble plate fouling or water entrainment caused the pressure in the system to rise, the High Pressure switch shall shut off the blower. When the blower shuts down, the Low Pressure switch shall shut off the feed pump thereby preventing untreated water from passing through the system.

2.5.11 System Controls

The system controls shall be integrated with the electrical water pump control modules.

2.5.12 Water Flow Gauge

A water flow gauge shall be mounted on the influent water pipe and be a rotameter - or variable-area flow meter - that uses a movable float to indicate flow rate in GPM.

2.5.13 Primary Feed Pumps

Two primary feed pumps shall be supplied by the air stripper manufacturer as shown on the drawings.

Primary feed pumps shall be of 304 stainless steel construction capable of pumping 40 GPM at 50'-TDH. Pump shall be end suction type, coupled to a 3 horsepower high efficiency motor.

PACO type ASP Model 1560-1 feed pumps generally meet the requirements of this specification.

2.5.14 Secondary Feed Pumps

Two secondary feed pumps shall be supplied with the air stripper units shall be centrifugal pumps mounted on the air stripper skid and designed to move water from the sump of the unit through the filter housing units and liquid phase carbon units. Secondary feed pumps shall be supplied with

controls.

Each pump shall have a minimum capacity of 40 GPM at 50 feet TDH. The transfer pump shall be coupled to a 3 horsepower high efficiency motor.

Transfer pumps shall be of 304 stainless steel construction.

2.6 SURGE/SETTLING TANK LIQUID-LEVEL CONTROL SYSTEM

The manufacturer of the low profile air stripper shall furnish a liquid-level control system for the surge/settling tank as part of their system. The liquid-level control system will integrate operation of the well field pumps, primary feed pumps, and the low profile air stripper.

The liquid-level control system shall consist of four (4) level-sensing float switches and a controller/alternator.

2.6.1 Float Switches:

Each float switch shall be constructed of type 316 stainless steel, 5 1/2 " diameter, # 20 gauge. Each float shall be permanently assembled to switch and cable.

Each float switch shall be mercury tilt type, normally opened (NO) or normally closed (NC). Float switches shall have AC resistive rating of 20 Amps at 115 volts, and 10 Amps at 230 volts.

Each float switch shall be furnished with 40 feet of cable. Cable shall be type SO, type with 304 stainless steel jacket, 3-#14 AWG fine-stranded conductors for heavy flexing, underwater service. The float body shall be identified green cable and the switch by black and white. The green conductor shall be run to an electrical ground.

Float switches shall be mounted to a clamp tube, which shall be mounted on the inside tank sidewall of the holding tank, with bracket and U bolts. Clamp tube, bracket and U bolts shall be constructed of type 316 stainless steel.

The float switches shall be positioned on the clamp tube at the locations and elevations shown on the details section of the Drawings.

Float switches shall be guaranteed by manufacturer against defects in workmanship and material for a period of three (3) years from date of shipment from the factory to installation site.

Direct acting float switch, Model 9G, as manufactured by Consolidated Electric Company, generally meets the requirements of this specification.

2.6.2 Controller/Alternator

A controller shall be furnished to provide differential-level operation of the well field pumps, primary feed pumps, blower and alarm circuits.

The controller shall be furnished with a solid-state automatic alternator

for the feed pumps with an on-board 3-position alternator control selector switch providing; "AUTO/1-2/2-1" pump operation. The automatic setting shall provide automatic transposition of two pumps on successive starts. The "1-2" or "2-1" settings shall cause the controlled pumps to operate in the respective sequence each operating cycle.

The pump control circuits shall have normally-open contacts. The high and low alarm circuits shall have form C (SPDT) circuits. All load contacts shall be brought to a job connection terminal block which shall be a barriered screw-clamp device accepting up to #12-22 AWG wires.

The controller/alternator shall be housed in a wall mounted NEMA 3R enclosure for operation on 120 volts.

The controller/alternator shall have four (4) float switch positions. These positions include #1) All Off, #2) Lead On, #3) Lag On, and #4) High Level. At position #1, all pumps and the blower should be non operating. The controller/alternator shall allow manual starting of the lead air stripper feed pump. The lead air stripper feed pump and blower shall be stopped manually, or when the level drops to the low level float (position #1). If the level rises to the lead "on" level float (position #2), the lead primary feed pump and blower will be started (provided Item G below is satisfied). If the level continues to rise to the lag "on" float (position #3), the lag primary feed pump will be started. If the level reaches the high level float (position #4), the well field pumps will be locked out of service until the level recedes to the lag on float.

A dry contact closure shall be provided within the controller/alternator to actuate initiation of the vapor treatment unit heating cycle. The contact will be made when the level reaches the low level float. Once this contact is made and the air inlet damper is opened on the vapor treatment unit, the vapor treatment unit will begin its warm up period.

A dry contact closure will be provided in the control panel of the vapor treatment unit which will activate the lead air stripper feed pump (i.e. the vapor treatment unit is ready to process volatile organic compounds from the low profile air stripping units).

A dry contact closure shall be provided within the controller/alternator to send a signal to the vapor treatment unit which will actuate flame reduction in the vapor treatment unit when the level in the holding tank falls below the low level float.

Equipment shall consist of one (1) control breaker and lightning arrestor, one (1) heater and thermostat (55 watt), one (1) controller/alternator, one (1) relay card, one (1) switch (alternator override), two (2) push buttons (manual start and stop), and one (1) output contact for high-high level alarm.

Model CMC15 Duplex Pump Controller/Alternator as manufactured by Consolidated Electric Co., generally meets the requirements of this specification.

2.7 MULTI-FUNCTION REMOTE CONTROL PACKAGE

2.7.1 Air Stripping Package

The low profile air stripping tower package shall include a multi-function remote control monitoring panel. The panel shall include provisions to monitor the system features provided with the stripping tower package. Features monitored shall include:

Holding tank status
Primary feed pump status
Secondary feed pump status
Alarm status
Blower operation
LEL monitor

2.7.2 Control Panel

The multi-function control panel shall include the following features:

Real time microprocessor based monitoring system
2K battery backed memory
1,200 baud serial communications (modem)
Menu driven user-friendly software (IBM compatible)
Automatic dialing and data retrieval
Full remote access for changing by intervals
Remote password entry for security
Battery back-up for monitoring
An autodialer for remote dial-out in a voice synthesized format for alarms.

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 low profile air stripper shall be installed true and level. Precision gauges and levels shall be used in setting all equipment.

3.3 MANUFACTURER'S REPRESENTATIVE

Low profile air stripper manufacturer shall furnish the services of a qualified and experienced representative to inspect, test, and start-up the installation and to instruct operating personnel in the generation and maintenance of component equipment. Contractor's bid shall include two (2) full working day of such service.

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 Contractor. Equipment shall be subjected to an operational test to demonstrate compliance with specification requirements. The Contraction Officer 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 Contractor, and all expenses in connection with the testing shall be borne by him. Testing shall be conducted after all equipment is properly installed, electrical services are installed, and the denitrification systems are ready for operation. All defects discovered shall be corrected to the satisfaction of the Contracting Officer, and all tests repeated at the expense of the Contractor, until the equipment is in proper working order.

-- End of Section --

SECTION 11308

CARTRIDGE FILTER UNITS

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53-906	Specifications for Pipe, Steel, Black, and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A 197-87	Specification for Cupola Malleable Iron
ASTM A 181	Specification for Forgings, Carbon Steel for General Purpose Piping

1.2 DESCRIPTION OF WORK

Provide Complete and ready for operation, cartridge filter units as described and as shown on the construction drawings. The units shall be provided by a manufacturer regularly engaged in the manufacture and supply of cartridge filter units.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data

Provide manufacturer's data for the carbon adsorption units.

1.3.2 SD-04, Drawings:

The Contractor shall submit for approval shop drawings of the cartridge filter units. These drawings shall be submitted prior to the ordering of any material and/or equipment. Refer to General Conditions Section for shop drawing submittal procedure.

1.3.3 SD-06, Instructions

Two printed copies of the installation procedures shall be furnished to the Construction Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

PART 2 - PRODUCTS

2.1 CARTRIDGE FILTER UNITS

Cartridge filters shall each be capable of handling the design flow rate of 80 gpm and a maximum operating pressure of 150 psi. The vessel, bag 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 in the lid.

Harmsco, Inc., North Palm Beach, Florida, Model HIF BBHP, cartridge filter unit, generally meets the requirements of this specification.

The Contractor shall supply two dozen spare bag filters used with the cartridge filter units rated at 10 micron.

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 and at the location indicated on the Drawings, unless otherwise approved. Installation of the item will not be allowed to proceed until the recommendations are received. Two printed copies of the installation procedures shall be furnished to the Contracting Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

--End of Section--

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 complete and ready for operation a liquid phase carbon adsorption system as described herein and as shown on the construction drawings. The entire system shall be provided by a manufacturer regularly engaged in the manufacture and supply of carbon adsorption equipment.

1.3 GENERAL REQUIREMENTS

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

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

Provide manufacturer's data for the carbon adsorption units.

1.4.2 SD-04, Drawings

Submit shop drawings on the following: Contactor vessels, including principle dimensions, materials of construction, inlet and outlet fittings.

1.4.3 SD-06, Instructions

Two printed copies of the installation procedures shall be furnished to the Contracting Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.4.4 SD-09, Operation and Maintenance Manuals:

Three copies of the Operation and Maintenance Manual (O&M) shall be provided by the Contractor. General arrangement equipment drawings and

electrical and process flow schematics shall be included with the O&M manual. Refer to Section 01730 "Operation and Maintenance Data" for additional information on O&M manuals.

PART 2 - PRODUCTS

2.1 CONTACTOR VESSELS:

2.1.1 Performance Requirements

The contactor vessels each shall be capable of handling up to 80 GPM at an internal pressures of 7.5 psig.

2.1.2 Carbon Adsorption Equipment Description

The adsorption equipment provided shall consist of two adsorber vessels, pre-piped with all process, carbon transfer and utility piping to comprise a complete two-stage adsorption system and mounted on a structural steel skid for unitized shipment and installation.

Adsorber Vessel

The adsorbers shall be 4 foot diameter vertical cylindrical pressure vessels with flanged and dished ASME Code top and bottom heads. The vessel straight side height shall be 8'-0". The vessels shall be designed, constructed, and stamped in accordance with the ASME Code, Section VIII for a design pressure rating of 75 psig at 150°F.

The adsorber shall be equipped with a 14" x 18" elliptical manway, located approximately 4 foot from grade for maintenance access. The adsorber also shall be provided with a 11" x 15" elliptical handhole, 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 pad flanges. The top center nozzle shall be equipped with 1-1/2" diameter polypropylene pipe and a polypropylene full cone spray nozzle, Bete Fog Nozzle Part No. NCF 1516 M or equal, to wash the vessel sides during transfer operation.

The adsorber shall be constructed of carbon steel and shall have all welds and any other sharp edges ground smooth, and all imperfections such as skip welds, delaminations, scabs, slivers, and slag shall be corrected prior to abrasive blasting. All surfaces are 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.

Following cleaning of the exterior, finish painting using an epoxy mastic coating system to a total DFT of 6 mils (in two applications applied to the exterior of the absorber before rust can form. The two-coat system shall

be Sherwin Williams B58 Series consisting of a high solids, polyamine/bisphenol A epoxy formulation or equal.

Underdrain Distribution System

The underdrain distribution system shall be constructed of 3" diameter, 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.

Process and Utility Piping

The process and utility piping on the adsorption system shall include influent water to the system and treated water (2") adsorber vent lines (2"), utility water to each adsorber (1-1/2"), and granular activated carbon supply and discharge piping (2"). Backwash connections are provided at 3" flange connections to vent line (backwash outlet) and underdrain (backwash inlet).

With the exception of GAC discharge piping, all piping shall be carbon steel piping, constructed of ASTM A53 carbon steel rated for 100 spig at 220°F for water service. Pipe shall be threaded Schedule 80 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, and threaded for 2" and smaller or slip-on or weld neck type for 3" connections. 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°F.

Valving for all services, with the exception of the GAC discharge valve shall be ductile iron regular port ball valves with chrome plated steel ball, TFE seats, graphite stem packing and steel wrench handle. 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 2" 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.

The system vent line shall be equipped with a rupture disk for emergency pressure relief. The rupture disk shall be constructed of impervious graphite and shall be designed to relieve pressure at 75 psig +0/-5 percent.

The adsorption system shall be provided with pressure gauges to indicate influent, effluent, and inter-stage (if operated in two-stage mode), pressures. Pressure gauges shall be Weksler AA44-P liquid fill gauges (or equal), consisting of a 4-1/2" diameter, glycerin filled case with bourbon tube, for 0-100 psig service.

Steel Skid Installation

The two adsorbers and all associated piping shall be preassembled on a steel skid for unitized shipment and installation. The steel skid is constructed of C6x13 channel iron with holes provided in the corner gussets for installation on a flat surface (or piers) as required. 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. Printed copies of the recommendations shall be furnished to the Contracting Officer prior to installation. 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 four (4) 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 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 Contractor. Equipment shall be subjected to an operational test to demonstrate compliance with specification requirements. The Contracting Officer 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 Contractor, and all expenses in connection with the testing shall be borne by him. Testing shall be conducted after all equipment is properly installed, electrical services are installed, and the

denitrification systems are ready for operation. All defects discovered shall be corrected to the satisfaction of the Contracting Officer and all tests repeated, at the expense of the Contractor, until equipment is in proper working order.

-- End of Section --

SECTION 11310

BACKWASH TANK AND APPURTENANCES

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4097-88	Specification for Contact Molded Glass-Fiber-Reinforced Thermoset Resin Chemical Resistant Tanks
ASTM A 176-91	Specifications for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

1.2 DESCRIPTION OF WORK

The backwash tank and appurtenances shall be furnished and installed to provide a complete and functional system. Equipment details are provided in Part 2 below.

1.3 SUBMITTALS:

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

1.3.1 SD-02, Manufacturer's Catalog Data

Provide manufacturer's data for the backwash tank and appurtenances.

1.3.2 SD-04, Drawings

Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings of the backwash tank and related equipment including:

a. External connections
b. Liquid level controls mounting bracket
c. Anchor bolt sizing and placement
d. Tank finish
e. Tank grounding
f. Float switch assembly

Shop drawings shall include quantity, size, material and locations of all equipment. Shop drawings shall include wiring diagrams of float switch and product sensor controls.

1.3.3 SD-06, Instructions

Two printed copies of the installation procedures shall be furnished to the Contracting Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 SD-19, Operation and Maintenance Manuals:

Furnish the data, for the Float Switch Controls items listed, to the Contracting Officer for review and acceptance; O&M data shall comply with requirements specified in Section 01730, "Operation and Maintenance Data".

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 BACKWASH TANK

The backwash tank shall be 8'-0" diameter by 7'-0" overall height with a nominal capacity of 2,500 gallons. The tank shall be a flat bottom, open top tank. The tank shall be constructed of fiberglass reinforced polyester through a centrifugal casting process, fabricated to meet or exceed the strength requirements of ASTM D4097-88. Minimum laminate thickness shall be not less than 3/8". All cut edges shall be coated with resin so that no glass fibers are exposed and all voids filled.

One (1) 3" diameter conically gussetted flange connection shall be furnished on the outside tank sidewall at the elevation and location shown on the Drawings, for connection of a 4" diameter effluent overflow pipe.

One (1) 3" diameter conically gussetted flange connection shall be furnished on the outside tank sidewall at the elevation and location shown on the Drawings, for connection of the liquid-phase carbon units backwash suction line.

One (1) 3" diameter conically gussetted flange connection shall be furnished on the outside tank sidewall at the elevation and location shown on the Drawings, for connection of the multimedia filter backwash suction line.

One (1) 4" diameter conically gussetted siphon drain flange connection shall be furnished on the outside tank sidewall at the elevation and location shown on the Drawings, for connection of a drainage line.

Two (2) lift lugs shall be furnished with the service tank to facilitate on-site handling.

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. Printed copies of the recommendations shall be furnished to the Contracting Officer prior to installation. 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. Precision gauges and levels shall be used in setting all tanks.

Tanks and supports shall be grounded to the grounding grid.

Electrical and instrumentation equipment shall be grounded in accordance with local electrical requirements.

-- End of Section --

SECTION 11311

SLUDGE HOLDING TANK AND APPURTENANCES

PART 1 - GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4097-88	Specification for Contact Molded Glass-Fiber-Reinforced Thermoset Resin Chemical Resistant Tanks
ASTM A 167-91	Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM A 176-91	Specifications for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

1.2 DESCRIPTION OF WORK

The sludge holding tank and appurtenances shall be furnished and installed to provide a complete and functional system. Equipment details are presented in Part 2 below.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data

Provide manufacturer's data on the sludge holding tank, float switch and floating skimmer assemblies.

1.3.2 SD-04, Drawings:

Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings of all sludge holding tank related equipment including:

a. Bolt down cover
b. Vent
c. External connections
d. Liquid level controls mounting bracket
e. Anchor bolt sizing and placement
f. Tank finish
g. Tank grounding
h. Float switch assembly
i. Floating skimmer assembly

Shop drawings shall include quantity, size, material, and locations of all equipment. Shop drawings shall include wiring diagrams of float switch and

product sensor controls.

1.3.3 SD-06, Instructions:

Two printed copies of the installation procedures shall be furnished to the Contracting Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 SD19, Operation and Maintenance Manuals:

Furnish the O&M Manual for the Float Switch Controls to the Contracting Officer for review and acceptance; O&M data shall comply with requirements specified in section titled "Operation and Maintenance Data."

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 internal surface of the sludge holding tank must be able to resist the following chemicals at the anticipated concentrations:

Chemical	Concentration
Benzene	8,000
1,2-Dichloroethylene (T)	42,000
Ethylbenzene	20
Toluene	20
Trichloroethylene	14,000
Vinyl Chloride	400
pH	6.8-7.4

2.2 SLUDGE HOLDING TANK

2.2.1 Dimensions

The sludge holding tank shall be approximately 7'-6" diameter by 8'-3" overall height with a nominal capacity of 2,500 gallons. The sludge holding tank shall be a 30 degree cone bottom, open top tank, furnished with a hinged bolt-down cover. The tank shall be constructed of fiberglass reinforced polyester through a centrifugal casting process, fabricated to meet or exceed the strength requirements of ASTM D4097-88. Minimum laminate thickness shall be not less than 3/8". All cut edges shall be coated with resin so that no glass fibers are exposed and all voids filled.

2.2.2 Cover

The tank shall be equipped with a fiberglass bolt-down cover. The cover shall be designed with a 304 stainless steel hinge to provide access to the tank interior. The cover shall be furnished with a 2" diameter conically gussetted flange connection on the inside and outside of the tank cover at the location shown on Drawings. This connection will be used to connect a 2" diameter sludge inlet pipe to the tank. Tank cover bolts shall be Type 304 stainless steel, 1/4" diameter hex heads.

2.2.3 Flanged Lip

A fiberglass flanged lip shall be furnished with the tank to allow for installation of a bolt-down cover.

2.2.4 External Flange

A 2" diameter conically gussetted external flange with a 2" diameter non-gussetted internal flange shall be furnished on the tank cover at the location shown on the Drawings, for connection of the 2" diameter sludge inlet feed pipe.

2.2.5 Downpipe

A 4" diameter, 4' long fiberglass reinforced polyester downpipe shall be installed on the inside tank sidewall at the location and elevation shown on the Drawings. The downpipe will accommodate the 2" diameter sludge inlet pipe to the sludge holding tank. Two (2) brace supports shall be furnished as part of the installation in accordance with the manufacturer's recommendations.

2.2.6 Flanges

A 2" diameter conically gussetted external flange with a 2" diameter non-gussetted internal flange shall be furnished at the location and elevation shown on the Drawings, for connection of a floating skimmer assembly.

A 4" diameter conically gussetted flange connection shall be furnished on the tank cone bottom as shown on the Drawings, for connection of the filter press feed line.

Two (2) 6" diameter non-gussetted flange connections shall be furnished on the tank cover at the locations shown on the Drawings, for connection of an air inlet vent and an air exhaust vent to ductwork.

2.2.7 Legs

The sludge holding tank shall be equipped with three (3) steel pipe angles allowing 12 inch clearance as shown on the Drawings, with a length equal to 44" for 12-inch clearance.

2.2.8 Lift Legs

Two (2) lift legs shall be furnished with the sludge holding tank to facilitate on-site handling.

2.3 FLOATING SKIMMER ASSEMBLY

The sludge holding 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.

The floating suction strainer shall consist of a hard plastic strainer housing a polyurethane foam to provide buoyancy over molded hard plastic housing for removable strainer plates.

The strainer shall be attached to a ten-foot long rubber hose with two stainless steel clamps.

A Dolphin suction strainer, Model #1, as manufactured by Megator Corporation, Pittsburgh, Pennsylvania, generally meets the requirements of this specification.

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. Printed copies of the recommendations shall be furnished to the Contracting Officer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations may be cause for rejection of the material.

3.2 INSTALLATION

The tank shall be installed true and level. 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 11312

DEWATERING PRESS

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
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

A dewatering press and appurtenances shall be furnished complete and ready for operation from manufacturer regularly involved in the manufacture of product and installed to provide a complete and functional system.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data:

Provide manufacturer's data for the dewatering press

1.3.2 SD-04, Drawings:

The Contractor shall submit for approval shop drawings of the dewatering press layout and installation. These drawings shall be submitted prior to ordering any equipment. Refer to Section 01300 for shop drawing submittal procedure.

1.3.3 SD-06, Instructions:

Two printed copies of the installation procedures shall be furnished to the Contracting Officer prior to installation. Failure to furnish these recommendations may be cause for rejection of the equipment.

1.3.4 SD-19, Operation and Maintenance Manuals:

Three copies of the Operation and Maintenance (O&M) Manual shall be provided by the Contractor. General arrangement equipment drawings and

electrical and process flow schematics shall be included with the O&M manual. Refer to Section 01730, "Operation and Maintenance Data" for additional information on O&M manuals.

1.4 DELIVERY, STORAGE, AND HANDLING MATERIALS

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.

Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, including subfreezing temperatures, precipitation, and high winds. Store materials susceptible to sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on the ground.

1.5 GENERAL REQUIREMENTS

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

1.5.1 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 at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the jobsite. Equipment of the same types shall each be the product of one manufacturer.

1.5.2 Nameplates

The dewatering press 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.

1.5.3 Conformance With Agency Requirements

Where materials or equipment are specified to be an approved type, the seal or label of approval from a nationally recognized testing agency, adequately equipped and competent to perform such services, shall be attached thereto. A written certificate from the testing agency shall accompany the materials or equipment and shall be submitted to the Contracting Officer stating that the items have been tested and that they conform to the applicable requirements of the specifications and to the standards listed herein. The certificate shall indicate the methods of testing used by the testing agency. In lieu of a certificate from a testing agency, published catalog specification data, accompanied by the

manufacturer's certified statement to the effect that the items are in accordance with the applicable requirements of the specifications and the referenced standards, will be considered by the Contracting Officer and may be acceptable as evidence that the items conform with agency requirements.

1.5.4 Verification of Dimensions

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

PART 2 - PRODUCTS

2.1 DEWATERING PRESS

The EIMCO Process Equipment Co., Shriver Filter Press, Model 630FB with 3.3 cubic foot capacity (expandable to 5.5) generally meets the requirements of this specification.

2.1.1 Filter Press

The filter press shall be a fully mechanized, hydraulically opened and closed, side bar plate support, caulked, gasketed and recessed plate, floor standing filter press for dewatering a slurry of approximately 5% by weight dry solids at pressures up to 100 psig working pressure.

2.1.2 The following components shall be supplied with the filter press:

1. Filter Press Skeleton:

The filter press skeleton shall be designed for side bar suspension of the plates. The filter press shall have a cake holding capacity of 3.3 cubic feet and shall be provided with plates with a cake thickness of 1.25 inch. The press shall be of the free standing type with the hydraulic power pack mounted on the cylinder bracket with fixed and moving ends fabricated from mild steel slabs.

The side bars shall be fabricated of carbon steel, accurately machined on all bearing surfaces with the top of the side bars fitted with a stainless steel cap. (One side bar shall be equipped with an inverted "vee" guiding design so that the plates will remain centered in the filter press.)

The press shall be fitted with pneumatic/hydraulic opening and closing mechanism driven by a modular hydraulic (air/oil) power pack mounted on the cylinder bracket at operating height for the operator.

The power pack shall be complete with oil reservoir, low and high air-over-oil hydraulic booster pump with the necessary regulators and gauges to indicate low and high oil pressure and inlet air pressure, regulated air pressure, and delivered hydraulic pressure. All necessary hydraulic control valves, piping and pressure switches shall be located in the modular panel with a removable cover for field inspection and a quick-disconnect system so that

SECTION 11313

POSITIVE DISPLACEMENT 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 Voc 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 waterworks operation at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the jobsite. Pumps of the same types shall each be the product of one manufacturer.

1.2.2 Description

The pumps shall be air driven positive displacement pumps of the types indicated and specified. 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, so located that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

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.

1.2.5 Conformance With Agency Requirements

Where materials or equipment are specified to be an approved type, the seal or label of approval from a nationally recognized testing agency, adequately equipped and competent to perform such services, shall be attached thereto. A written certificate from the testing agency shall accompany the materials or equipment and shall be submitted to the Contracting Officer stating that the items have been tested and that they conform to the applicable requirements of the specifications and to the standards listed herein. The certificate shall indicate the methods of testing used by the testing agency. In lieu of a certificate from a testing agency, published catalog specification data, accompanied by the manufacturer's certified statement to the effect that the items are in accordance with the applicable requirements of the specifications and the referenced standards, will be considered by the Contracting Officer and may be acceptable as evidence that the items conform with agency requirements.

1.2.6 Verification of Dimensions

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

1.2.7 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 Contracting Officer.

1.3 SUBMITTALS

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

SD-01 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.

SD-04 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.

SD-06 Instructions

Positive Displacement Pump System;

Proposed diagrams, instructions, and other sheets, prior to posting. Approved drawings showing the complete layout of the entire system, including equipment , piping valves, and control sequence, framed under glass or in approved laminated plastic, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

SD-09 Reports

Tests;

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

SD-19 Operation and Maintenance Manuals

Positive Displacement Pump System;

Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment. One complete set at the time the tests procedure is submitted; remaining sets before the contract is completed. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the building, name of the Contractor, and contract number. Flysheets shall be placed before instructions covering each subject. Instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. Instructions shall include, but not be limited to, the following:

a. System layout showing piping, valves, and controls.

b. A control sequence describing startup, operation, and shutdown.

c. Operating and maintenance instructions for each piece of equipment, including lubrication instructions and troubleshooting guide.

d. Manufacturer's bulletins, cuts, and descriptive data; and parts list and recommended spare parts.

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 AIR OPERATED 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 diaphragm pumps with 2" American Standard 125 lb. suction and discharge flange connections. Each pump shall be self-priming, capable of operating safely unattended and capable of operating with out damage when the discharge line is closed or when the pump runs dry for extended periods of time.

The pumping equipment to be provided shall include pump, quick opening ball check valves, air header assembly, air cylinder, diaphragm stroke indicator and control package.

The diaphragm pumps , model 66615, as manufactured by ARO Corporation, Bryon, Ohio, generally meet the requirements of this specification.

2.2.1 Design Data

1.	Maximum pumping capacity (water) - gpm	50
2.	Volumetric displacement/stroke - gallon	1.25
3.	Maximum strokes/minute	40
4.	Maximum discharge head - ft.	220
5.	Maximum sphere size passing (lined) - inch	7/8
6.	Maximum sphere size passing (unlined) - inch	1-1/8
7.	Maximum pressure against closed discharge line - PSI	100

2.2.2 Pump Casing and Wetted Parts

The pump casing and other wetted parts shall be constructed of ASTM A48 No. 30 gray cast iron. The design of the pump shall allow accessibility to the internal parts by removal of the upper body assembly without removing the pump from the process piping.

2.2.3 Air Cylinder

Air cylinder of 6" minimum diameter shall be provided to return the pump diaphragm on the suction stroke. Cylinder shall conform to NFPA Standards and JIC Standards of construction and dimensions. Each unit will be designed for 250 psi working pressure and be complete with steel ends, high tensile steel piston rod and tie rods, and brass bushing.

2.2.4 Pump Diaphram

The pump diaphragm shall be constructed of heavy duty Hypalon and be connected to the piston rod by means of clamp plates. A positive diaphragm stroke indicator, which is physically measurable, shall be supplied to allow adjustment of line velocities and provide visual evidence of diaphragm operating condition, pump displacement performance, and changes in consistency as a function of variation in pump fill time.

2.2.5 Suction and Discharge Check Valves

Suction and discharge check valves shall be ball check type with quick opening yoke. The wetted parts shall be lined and bonded with 3/16" thick Hypalon. Valves shall be considered an integral part of the pump.

2.2.6 Air Header

The air header shall include separate air pressure regulators for the suction stroke and discharge stroke and two 3-way solenoid valves with external pilot to reduce air surge and diaphragm stresses.

One - normally closed solenoid valve, 3-way external pilot
One - normally open solenoid valve, 3-way external pilot
One - manually adjustable air pressure regulator
One - pilot controlled air pressure regulator
One - solenoid pilot assembly
One - pressure switch
One - ball valve
One - air strainer
One - exhaust air muffler
Miscellaneous pipe and fittings to complete assembly.

2.2.7 Proximity Switch

The proximity switch assembly includes two (2) proximity switches to indicate the top of stroke and bottom of stroke. The output of the switches is sent to the programmable logic controller. The proximity switches are actuated by the stroke indicator.

2.2.8 Logic Controller

A programmable logic controller which automatically adjusts the diaphragm 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 stroke rate is set by the user and is adjustable from 40 to 2.4 strokes per minute. The maximum desired pressure is 100 PSIG and is also 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 Paint

The pump assembly shall be pained with one (1) coat of Rust-Oleum 1573 oil alkyd primer.

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. Special tools shall be high-grade, smooth, forged, alloy, tool steel. One pressure grease gun for each type of grease required for motors shall also be furnished. 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 Contracting Officer.

2.2.11 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 manufacturer. Ferrous surfaces not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

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.

3.1.1 Concrete Foundations

Concrete for equipment foundations shall be as specified in Section 03300 CONCRETE FOR BUILDING 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 2,500 psi shall be used in foundations that are entirely separated from the surrounding floor. A premolded filler strip shall be installed between the foundation and floor slab as shown. Foundation bolts, as required, shall be furnished for proper positioning during the placement of the concrete.

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 Contracting Officer 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 Contracting Officer. 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 Contracting Officer, 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.

3.6 INSTALLATION

Set, shim, and grout pump in strict accordance with the manufacturers published instructions.

-- End of Section --

SECTION 11315

PNEUMATIC PUMPING 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 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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C203	(1986) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	(Jul 1986) Rules and Regulations: Radio Frequency Devices

FEDERAL SPECIFICATION (FS)

FS TT-E-489	(Rev H) Enamel, Alkyd, Gloss, Low Voc

Content

FEDERAL STANDARD (FED-STD)

FED-STD 595	(Rev B) Colors

HYDRAULIC INSTITUTE (HI)

HI-01	(1983; 14th Ed) Standards for Centrifugal, Rotary & Reciprocating Pumps

MILITARY SPECIFICATIONS (MS)

MS MIL-R-7575	(Rev C; Am 2; Notice 1) Resin, Polyester, Low-Pressure Laminating
MS MIL-T-52777	(Rev A) Tanks, Storage, Underground, Glass Fiber Reinforced Plastic
MS MIL-Y-1140	(Rev H; Am 1) Yarn, Cord, Sleeving, Cloth, and Tape-Glass

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1987; Rev 1) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 20	(1990) Installation of Centrifugal Fire Pumps
NFPA 30	(1990) Flammable and Combustible Liquids
NFPA 37	(1990) Installation and Use of Stationary Combustion Engines and Gas Turbines
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:

Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "General Electrical Requirements". See related work in

Section 02900, "Groundwater Recovery System", and Section 02901, "Groundwater Treatment System.

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 waterworks operation at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the jobsite. Pumps of the same types shall each be the product of one manufacturer.

1.2.2 Description

The pumps shall be positive displacement pneumatic water pumps of the types indicated and] specified. The single driving unit for the pumps shall be compressed air as indicated and] specified.

1.2.3 Safety Requirements

Gears, couplings, projecting set-screws, keys, and other rotating parts, so located that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

1.2.4 Nameplates

Pumps and controllers 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. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

1.2.5 Conformance With Agency Requirements

Where materials or equipment are specified to be an approved type, the seal or label of approval from a nationally recognized testing agency, adequately equipped and competent to perform such services, shall be attached thereto. A written certificate from the testing agency shall accompany the materials or equipment and shall be submitted to the Contracting Officer stating that the items have been tested and that they conform to the applicable requirements of the specifications and to the standards listed herein. The certificate shall indicate the methods of testing used by the testing agency. In lieu of a certificate from a testing agency, published catalog specification data, accompanied by the manufacturer's certified statement to the effect that the items are in accordance with the applicable requirements of the specifications and the referenced standards, will be considered by the Contracting Officer and may be acceptable as evidence that the items conform with agency requirements.

1.2.6 Verification of Dimensions

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

discrepancy before performing the work.

1.2.7 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 Contracting Officer.

1.3 SUBMITTALS

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

SD-01 Data

Materials and Equipment;

Manufacturer's descriptive data and technical literature, performance charts and curves for all impeller 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.

SD-04 Drawings

Pneumatic Pumping System;

A complete listing of equipment and materials. Drawings containing complete wiring and 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.

SD-06 Instructions

Pneumatic Pumping System;

Proposed diagrams, instructions, and other sheets, prior to posting. Approved wiring and control diagrams showing the complete layout of the entire system, including equipment , piping valves, and control sequence, framed under glass or in approved laminated plastic, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

SD-09 Reports

Tests;

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

SD-19 Operation and Maintenance Manuals

Pneumatic Pumping System;

Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment. One complete set at the time the tests procedure is submitted; remaining sets before the contract is completed. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the building, name of the Contractor, and contract number. Flysheets shall be placed before instructions covering each subject. Instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. Instructions shall include, but not be limited to, the following:

a. System layout showing piping, valves, and controls.

b. Approved wiring and control diagrams.

c. A control sequence describing startup, operation, and shutdown.

d. Operating and maintenance instructions for each piece of equipment, including lubrication instructions and troubleshooting guide.

e. Manufacturer's bulletins, cuts, and descriptive data; and parts list and recommended spare parts.

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.

1.5 SYSTEM DESCRIPTION

The pneumatic pumping system shall function as follows:

a. Groundwater will flow into each groundwater ejector via check valves situated at both the top and bottom of the ejector vessel. In addition, groundwater will be discharged through a check valve mounted at the top of the ejector vessel.

b. Fill and empty times of the ejector vessels will be independently

controlled at each well head by the controller. Fill and empty times shall have the ability to adapt to varying well conditions without modifications to the system. The pumping system shall be capable of running dry without damage to the system.

c. Liquid level in the well shall be pneumatically controlled. System shall incorporate a differential pressure sensing device to achieve well measurements. The pressure sensing device shall incorporate a diaphragm at least 6 inches in diameter to allow accurate control of the well level.

d. All well functions and well monitoring shall be achieved through a single controller counted at each well head. All aspects of a pumping system shall be controlled via this controller.

e. The controller shall be completely submersible.

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 AIR OPERATED WELL PUMPS

Air operated well pumps shall be provided complete and ready for operation from a manufacturer regularly involved in the manufacture of this product. Air operated total fluids pump and controller, Model 52, as manufactured by Ejector Systems, Inc., Addison, Illinois, generally meets the requirements of this specification. Each pump shall be capable of extracting groundwater from a well. Performance shall not be affected by variance in flow rate. System shall be all pneumatic, and shall be designed to meet the following requirements.

2.2.1 Well Specifications

a. Number of wells = 1 group of 4 wells, 1 group of 5 wells, total of 11 wells

b. Flow per well = 5 gpm maximum

c. Total well depth = 35 feet

d. Available air compressor HP = 25 HP per group of 5 wells

e. Chemicals that may require special pump materials: benzene, 1,2-dichloroethene, trichloroethene, toluene, vinyl chloride

f. Amount of head to overcome above grade = 75 ft.

g. Depending on the type of application, the following factors should

not inhibit system operation: - High solid levels - Varying flow rates - foreign materials in wells

h. The acceptance of the Pneumatic Pumping system shall be based on the proven ability of the system to meet each of the performance criteria listed above. The engineer will be the sole authority in reviewing the performance, as submitted by the pumping system supplier and determining the acceptability of the proposed system to meet the performance requirements, as stated hereinfore, for the project.

2.2.2 Pneumatic Pumping System Characteristics

a. Type: Single well controller, completely pneumatic.

b. Pump Type: Variable diameter ejector with top and bottom inlet.

c. Controller Type: Total air pneumatic with all functions monitored and controlled from a single unit at the well head.

d. Maximum Controller Dimensions: Controller shall not exceed the following dimensions:

2' L x 1' W x 1.5' H

e. System Adaptability: System shall be capable of field conversion to product only recovery and variable flow rates and head requirements. System shall be able to automatically control well level.

2.2.3 Down Hole Ejector

a. Down hole ejector shall be manufactured stainless steel. All check valves (both top and bottom) shall be constructed of 304 SS with Viton. All fittings (i.e., barbs) shall be brass.

b. All down hole pumps shall be 3 inches diameter and 4 feet long with a 1-1/4 inch top inlet.

2.2.4 Pump Hose

a. All hose shall be constructed of a Nitrile inner tube with a Nitrile/PVC blend shell. Maximum working pressure will be 300 PSI.

b. All hose shall be capable of efficient performance at 5 GPM, varying flow rates shall not affect the system.

2.2.5 Controller

a. Controller shall be constructed of Epoxy coated aluminum.

b. Controller shall have separate controls for ejector pressure and bubbler pressure. Fill and empty times shall be independently controlled from the controller.

c. System shall incorporate an auto purge cycle to continuously drain water from the controller components.

d. A pneumatic cycle counter and fill indicator shall be supplied.

e. Controller shall incorporate a water column gauge to measure water level in well.

2.2.6 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 shall also be furnished. All tools shall be delivered at the same time as the equipment. Contractor shall properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the Contracting Officer.

PART 3 - EXECUTION

3.1 INSTALLATION

The pneumatic pumping equipment shall be installed in accordance with the written instructions of the manufacturer and under the direct supervision of the manufacturer's representative.

All piping and hose connections shall be made up tight and shall not leak under operating conditions.

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 Contracting Officer 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 Contracting Officer. 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 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 3 days 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 Contracting Officer, 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 11347

OIL STORAGE TANK

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.

UNDERWRITERS' LABORATORIES, INC. (UL) PUBLICATIONS

UL 142	1987	Above Ground Welded Steel Tank

AMERICAN PETROLEUM INSTITUTE

API 650	1988	Welded Steel Tanks for Oil Storage

NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 30	1987	Flammable and Combustible Liquids Code
NFPA 70	1990	National Electric Code

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B117	1985	Salt Spray (Fog) Testing
ASTM D2247	1987	Testing Water Resistant of Coatings in 100% Relative Humidity
ASTM D3359	1987	Measuring Adhesion by Tap Test
ASTM D4060	1984	Abrasion Resistance of Organic Coatings by the Taber Abraser

STEEL STRUCTURES PAINTING COUNTING (SSPC)

SSPC-SP6	1989	Commercial Blast Cleaning
SSPC-Paint 20	1982	Zinc Rich Primers (Type I, Inorganic and Type II, Organic)
SSPC-PA1	1982	Shop, Field and Maintenance Painting

1.2 GENERAL REQUIREMENTS

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

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Data:

Prior to obtaining any equipment in connection with this section, the Contractor shall submit manufacturer's data of all equipment for each tank including:

a. External connections
b. Liquid level indicators
c. Saddles
d. Tank support calculations
e. Anchor bolt sizing and placement
f. Tank finish
g. Tank grounding

1.3.2 SD-04, Shop Drawings:

Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings of all equipment for each tank including:

a. External connections
b. Liquid level indicators
c. Saddles
d. Tank support calculations
e. Anchor bolt sizing and placement
f. Tank finish
g. Tank grounding

1.3.3 Certificates of Compliance:

To assure tightness of all welds, seams and fittings, all tanks shall be factory tested with compressed air at 5 psig. All fittings, seams and visible dents shall be soaped during the pressure test period and inspected for bubbling. Pressure testing shall be in accordance with UL 142 standards and procedures.

The manufacturer will witness all tests and provide certifications of all test results. Tanks shall be guaranteed by the manufacturer to be tight.

1.4 DELIVERY, STORAGE, AND HANDLING MATERIALS

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.

Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings.

PART 2 - PRODUCTS

2.1 GENERAL TANK REQUIREMENTS

2.1.1 Tank Size

Provide a 250 gallon tank as shown on the Construction Drawings.

2.1.2 Tank Specifications

Each tank shall be single walled and shall be factory fabricated using hot-tolled steel plate in accordance with UL 142 standard for above ground installation and API 650. All joints and fittings shall be welded in accordance with UL requirements and so labeled. The wall thickness shall be a minimum of 1/4-inch thickness steel. The tank shall be equipped with pre-engineered, factory installed appurtenances of the size and type shown on the contract drawings or as specified.

2.1.3 Shop Painting:

After surface preparation, provide the steel coating system specified. Do not coat surfaces of items to be embedded in concrete. Re-coat damaged surfaces using surface preparation, treatment, primer and paint that was applied to the adjacent surfaces upon completion of work. Do not apply bituminous protective coatings to items to be finish painted.

2.1.3.1 Environmental Conditions:

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when the metallic surface temperature is within 5F of the dewpoint of the surrounding air or when the surface temperature is below 45F, or over 95F.

2.1.3.2 Interior Coating Systems:

Provide two coats of epoxy on the interior of the tank, as specified below for the intermediate coat for the exterior steel coating system.

2.1.3.3 Exterior Steel Coating System:

The coating system shall be a zinc-rich primer, an epoxy high building intermediate coat, and a high build acrylic polyurethane enamel finish coat suitable for use on exposed exterior steel. The primer, intermediate coat, and finish coat shall be provided by the same manufacturer, and shall comply with Federal, State, and local VOC regulations. The intermediate and finish coat may be applied in the field.

a. Primer: SSPC Paint 20, Type II

b. Intermediate Coat: Shall be high solids catalyzed epoxy coating with the following characteristics:

1. Abrasion (ASTM D4060) Max. 120 mg. long CS-17 wheel, 1000 grams, two coats 1000 cycles

2. Adhesion (ASTM D3359) Min. rating of 5 SSPC SP5, two coats Three trials

c. Finish Coat: Shall be a high solids, high build, acrylic polyurethane enamel that is highly resistant to abrasion, corrosive fumes and chemical contact, and has the following characteristics:

1. Abrasion (ASTM D4060) Mx. 95 mg loss CS-17 wheel, 1000 gram load 1000 cycles

2. Adhesion (ASTM D3359), Method B Min. rating of 5

3. Humidity (ASTM D2247) 600 hours No blistering, cracking, softening, or delamination of film

4. Salt Spray (ASTM B117) 1000 hours No blistering, cracking, softening, or delamination of film. No rust creepage at scribe and a max. 1 percent rusting at edges

d. Acceptable Coating System: The following coating system, as manufactured by Tenemec Co., Inc., meetings the requirements of this specification:

Primer:	90-97 Tenemec Zinc
Intermediate Coat:	Series 104 HS Epoxy
Finish Coat:	Series 73 Endura-Shield III

2.1.3.4 Application of the Steel Coating System:

The steel shall be SSPC SP6 blast cleaned. The exterior of the tank shall be provided with one coat of primer, one intermediate coat of epoxy and one finish coat of polyurethane enamel; and the interior of the tanks shall be provided with two coats of epoxy. Apply coatings in accordance with SSPC PA1, and in strict accordance with the coating manufacturers recommendations. Maintain steel surfaces free from rust, dirt, oil, grease and other contaminants through final assembly. Touch-up damaged coating and coatings that are cut or drilled. Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying. Provide each coating in the specified condition to receive the next coat. Provide the following minimum dry film thickness.

Primer:	3 mils
Intermediate Coat:	6 mils
Finish Coat:	3 mils

2.2 TANK ACCESSORIES:

Tank accessories shall be of the size, location and quantity indicated on the Drawings.

2.2.1 Connections:

Provide fittings as required to adapt piping to openings. Fittings shall be designed for the use intended. "Forcing" or "cross-threading" will not

be acceptable. Tank drains shall be provided as indicated and shall be fitted with a bronze ball valve. A quick disconnect shall be attached to the valve with a cap and chain.

2.2.2 Tank saddles:

Saddles shall be designed by the manufacturer to be continuously supported along the full length of the base of tank shell. Tank saddles shall be factory fabricated using carbon steel. Each saddle shall be leveled and grouted to assure full bearing. The saddles shall be provided with stainless steel bands to tie tank to saddle. Contractor shall coordinate placement of tank openings so as not to interfere with band placement.

2.3 OIL STORAGE TANK

2.3.1 Capacity:

250 gallons (approximately 3'-0" diameter x 5'-0" long) with adequate lifting mechanisms for the tank in accordance with manufacturer's recommendations.

2.3.2 Tank Saddles:

Provide a minimum of two tank saddles.

2.3.3 Liquid Level Sight Glass:

A liquid level sight glass shall be provided as indicated. The sight glass shall be vertically mounted on the end of the tank. The sight glass dimensions shall be 3/4-inch outside diameter. The thickness of glass shall be suitable for pressures of fluid in tank. The end connections for glass shall be 3/4-inch stainless steel valves with threaded connection to tank shell. The sight glass shall be provided with a center support. This support shall be made from stainless steel and shall join the two glass tubes together as indicated. The end valve connections shall be provided with ball check valves to prevent loss of liquid in case of glass breakage. A neoprene washer shall provide a seal between the center support or end valves and glass tube. A 3/8-inch, stainless steel drain cock shall be provided on the bottom end valve.

PART 3 - EXECUTION

Materials and installation of all piping, valves and fittings shall be provided in accordance with all State and local fire codes.

3.1 INSTALLATION

Tank shall be anchored to the treatment pad using anchor bolts. Anchor bolts shall be sized and placed in accordance with the manufacturer's recommendations. Installation shall be in accordance with manufacturer's recommendations. Printed copies of those recommendations shall be provided to the Contracting Officer prior to installation. Installation shall not be allowed to proceed until recommendations have been received.

3.1.1 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.

-- End of Section --

SECTION 13121

PREENGINEERED METAL BUILDINGS

PART 1 GENERAL

1.1 SUMMARY (Not Used)

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 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

BUILDERS HARDWARE MANFUACTURERS 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)

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA LRMBSM	1986 Low Rise Metal Building Systems Manual

STEEL DECK INSTITUTE (SDEI)

SDEI DDM	1990 Steel Deck Institute Diaphragm Design Manual

STEEL DOOR INSTITUTE (SDI)

ANSI/SDI 100	1991 Standard Steel Door and Frames

STEEL WINDOW INSTITUTE (SWI)

SWI SGSW	1989 Specifier's Guide to Steel Windows

UNDERWRITERS LABORATORIES INC. (UL)

UL 580	1988 (R 1989) Uplift Resistance of Roof Assemblies

1.3 DESCRIPTION OF BUILDING

1.3.1 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 bottom of the rigid frame column base plate. The clear height between finished floor and bottom of roof steel shall be as indicated.

1.3.2 Framing

Provide building with vertical walls and gable roof. Building shall be single-span structures with rigid frame type, similar to AISC S335, Type I construction. End walls shall be of rigid frame. Roof slope shall be a minimum of 1/2 inch per foot to a maximum of 4 inches per foot. Design framed openings structurally.

1.3.3 Foundation Requirements

Design foundations for allowable soil bearing pressure and a minimum bottom of footing depth as indicated. Use a factor of safety of 1.5 for overturning, sliding and uplift, and a concrete compressive strength as specified in Section 03300, "Cast-in-Place Concrete." The foundation loads are supplied by the building manufacturer.

1.4 EXPERIENCE

1.4.1 Manufacturer

Provide the metal building that is the product of a recognized metal building systems manufacturer who has been in the practice of manufacturing metal buildings for a period of no less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and fabricating metal building systems. The manufacturer shall have AISC FCD, category MB certification.

1.4.2 Installer

Erector shall have specialized experience in the erection of metal building systems for a period of at least 3 years.

1.5 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.

1.5.1 Roof Dead and Live Loads

Design loads shall include dead loads and live loads. The minimum roof design live load shall be 40 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.

1.5.2 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.

1.5.3 Seismic Loads

As required for Seismic Zone 1.

1.5.4 Deflection

1.5.4.1 Structural Members

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

1.5.4.2 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.

1.5.4.3 Wall panels

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

1.5.4.4 Openings

Limit deflections of steel framing above and along the side of rolling door openings to a maximum of 1/2 the allowable movement in the telescoping top roller of the doors to ensure proper operation. Frame all equipment openings over 12 inches by 12 inches.

1.6 SUBMITTALS

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

1.6.1 SD-02, Manufacturer's Catalog Data

a. Preengineered metal building materials

Submit sufficient data indicating conformance to specified requirements on materials provided under this section.

1.6.2 SD-03, Manufacturer's Standard Color Charts

a. Factory color finish G

Submit one sample of each color indicated for verification that the color matches the colors indicated. Where colors are not indicated, submit not less than four different samples of manufacturer's standard colors for selection by the Contracting Officer.

1.6.3 SD-04, Drawings

a. Preengineered building

b. Template for anchor bolts

c. Structural connections

d. Roofing and siding connections

e. Door and window frame installation

f. Garage door frame installation

g. Roof penetrations and flashings

h. Accessories

Submit as necessary to erect the building and install components.

1.6.3.1 Preengineered Building

Submit complete design drawings for the preengineered building. Submit drawings for the foundations and anchorage.

1.6.4 SD-05, Design Data

a. Building

b. Foundation loads

c. Anchor bolts

d. Purlins and girts

e. Bracing

1.6.4.1 Building

Submit design calculations for the entire preengineered building and foundations, prepared and stamped by a professional engineer. Also submit for components requested, and stamp with the seal of a professional engineer. Include sizes and location of anchor bolts.

1.6.5 SD-11, Factory Tests

a. Factory Color Finish

b. Insulation

1.6.6 SD-13, Certificates

a. Preengineered metal building materials

Submit certificates attesting that materials comply with this specification.

1.6.7 SD-19, Operation and Maintenance Manuals

a. Preengineered Building, data package 1

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

1.7 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.

1.8 WARRANTY

Provide warranty against water leaks arising out of or caused by ordinary wear and tear by the elements for a period of 20 years. Such warranty shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.

PART 2 PRODUCTS

2.1 WALL AND ROOF MATERIALS

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

2.1.1 Minimum Thickness

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

Items	Minimum Thickness (Uncoated)
Steel Structural Members Other Than Roof and Wall Panels	16 Manufacturer's Standard (MFG STD) gage, .0478 inch
Roof and Wall Panels	
Steel	26 MFG STD gage, .0179 inch
Aluminum	0.032 inch
Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings, and Liner Panels	
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

Items	Minimum Thickness (Uncoated)
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.

c. Factory-insulated to provide weathertight joint upon installation, with:

(1) Inner and outer sheets formed and joined at edges into a tongue-and-groove joining system with butyl sealing compound, closed cell foam tape, or factory-applied nonskinning butyl sealant.

d. If designed as diaphragm, roof decks shall be designed in accordance with SDEI DDM.

Depth of the panels shall be as indicated. Insulation in the cores of the panels shall be asbestos-free composition and provide an overall "U" value of not more than 0.10 for wall panels and 0.05 for roof panels. Insulation in factory-insulated panels shall have a flame spread rating of 75 or less and a smoke development factor of 150 or less.

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.

2.1.2.5 Liner Panels

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

2.2 FRAMING AND STRUCTURAL MEMBERS

2.2.1 Steel

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

2.2.2 Aluminum

ASTM B 221 or ASTM C 308.

2.2.3 Structural Tube

ASTM A 500 or ASTM B 221.

2.3 MISCELLANEOUS ITEMS

2.3.1 Caps, Strips, and Plates

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

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 wall and roof panels of zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum wall and roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both

Items Minimum Thickness (Uncoated)

tensile and shear strength of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8-inch thick. When wall covering is factory color finished, exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering. Nonpenetrating fastener system using concealed clips shall be manufacturer's standard for the system provided.

2.3.5.1 Screws

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

2.3.5.2 End-Welded Studs

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

2.3.5.3 Explosive Actuated Fasteners

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

2.3.5.4 Blind Rivets

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

2.3.5.5 Bolts

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

2.4 GUTTERS

Provide complete with mitered corners, end pieces, and special pieces that may be required. Expansion-type slip joints shall be provided at the center of the runs and at intervals of not more than 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 DOORS AND WINDOWS

2.8.1 Swinging Personnel Doors and Frames

ANSI/SDI 100, Grade II, Model 1, 2, 3, or 4, design as indicated, zinc-coated and shop primed, exterior mounting. Hardware shall conform to ANSI/BHMA A156.1, ANSI/BHMA A156.2, ANSI/BHMA A156.3, and ANSI/BHMA A156.4. Doors shall be provided with the following hardware:

DOOR NO.	HARDWARE REQUIRED
1, 2, and 3	Hinges - 2 pairs Closer Threshold Exterior thumbpiece operator Interior Panic Hardware Key lock

Note: Key all doors to a master key

2.8.2 Steel Windows

a. Steel Windows: SWI SGSW, commercial projected type. Provide manufacturer's standard factory finish, color as indicated Provide ventilating sections with insect screens. Provide windows with thermal barrier features.

2.9 GARAGE DOORS

2.9.1 General

Provide insulated rolling service garage doors, motor operated, and mounted on the interior of the building between jambs and under lintel in a prepared 12' x 10' opening. Doors shall be Atlas Roll-Lite, Alphine Overhead Doors, Inc., or equal and meet the following specifications.

2.9.2 Product Data

Door shall be comprised of glavanized steel flat slats no less than 2 5/8" high x 7/8" thick injected with Polyurethane foam, self-bonding to the two interior galvanized steel surfaces, and providing a minimum U-Value of 0.16. Slat material thickness shall be provided to satisfy a 100 MPH windload. Galvanizing shall be a zinc coating in accordance with ASTM A525. The doors shall be provided with the following hardware:

Bottom Bar - Two Steel angles equipped with vinyl weatherstrip which extends into guides. Min. 1/8" thick.

Endlocks - Ductile cast iron endlocks riveted to ends of alternate slats, with 1/4" rivets. Furnish windlocks as required by manufacturer for 100 MPH windload.

Counterbalance Assembly - Housed in a steel pipe of diameter and wall thickness to restrict maximum deflection to 0.03" per foot of door width. Springs shall be helical torsion type designed to include an overload factor of 25% and for proper balance of door to insure that effort to operate door will not exceed 35 lbs.

Ball bearings shall be sealed to minimize wear of pipe shaft rotation around inner shaft.

Bracket Plates - Galvanized steel plates no less than 1/4" thickness to carry counterbalance shaft and house ends of door coil. Provide ball bearings at rotating support points.

Guide and Wall Angle Assembly - Furnish steel angles of 3/16" minimum thickness and depth of guide to provide adequate slat penetration to satisfy 100 MPH windloading. Provide guide weatherstripping to seal against slat.

Hoods - #24 U.S. Gauge galvanized steel to be used for fabrication of hoods to house coil. Hood shall be laterally reinforced to prevent sag.

Locks - Integral gearing of motor operator to provide locking for door.

Finish - Ungalvanized surfaces shall have a shop coat of rust inhibiting metallic primer applied to all exposed ferrous surfaces, except bearings.

2.10 FINISH

2.10.1 Shop Painting

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

2.10.2 Factory Color Finish

Provide exterior and interior exposed surfaces of metal roof and wall panels, roof ventilators, louvers, gutters, downspouts, and metal accessories with a thermal-cured factory finish. Color shall be selected from manufacturer's standard colors. Provide an exterior finish top coat of 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 1/8 inch apart plus 11 similar cuts at right angles.

e. Impact: ASTM D 2794, no loss of adhesion after direct and reverse impact equal to 1.5 times metal thickness in mils, expressed in inch-pounds.

f. Humidity Resistance: ASTM D 2247, 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 the metal building manufacturer's templates and drawings before setting any steel.

3.2 ERECTION

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

3.2.1 Dissimilar Materials

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

a. Paint the incompatible metal with a coating of manufacturer's standard heavy-bodied paint.

b. Paint the incompatible metal with a prime coat of corrosion inhibitive primer followed by one or two coats of aluminum metal-and-masonry paint, or other suitable protective coating, excluding products containing lead and chromium pigmentation.

c. Provide an approved nonabsorptive gasket.

d. Apply an approved caulking between the aluminum and the incompatible metal.

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

3.2.2 Rigid Frames, Bases, and Sill Members

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

3.2.2.1 Field Welding

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

3.2.2.2 Field Bolting

AISC S329

3.2.3 Wall Construction

Apply panels full wall heights from base to eave with no horizontal joints except at the junctions of door frames, window frames, louver panels, and similar locations. Lay side laps away from the prevailing winds. Seal side and end laps with the joint sealing material recommended by the manufacturer. Flash or seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Flashing will not be required where approved "self-flashing" panels are used. Minimum end laps for all types of panels shall be 2 1/2 inches. Minimum side laps for all types of panels shall be one corrugation, one configuration, or an interlocking joint. Install liner panels to height indicated.

3.2.4 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.

3.2.5 Minimum Fastener Spacing

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

a. 8 inches o.c. at end laps of covering,

b. 12 inches o.c. at connection of covering to intermediate supports,

c. 12 inches o.c. side laps of roof coverings, 18 inches o.c. at side laps of wall.

3.2.6 Installation of Insulation

Provide the following insulation only if thermal panels were not used on the building walls.

3.2.6.1 Roof Insulation

Install over purlins before roof coverings are applied. Hold insulation rigid until secured in place. Insulation facing shall be exposed on the interior side of the building. Fold and staple facing tabs of insulation on 6-inch centers to completely seal joints. If folding and stapling is accomplished from the inside, push the tabs neatly up between the edges of adjoining blankets. Cover side laps of insulation with metal strips formed for this purpose and paint to match the facing material. Install the strips spanning from purlin to purlin and in accordance with the metal building manufacturer's recommendations.

3.2.6.2 Wall Insulation

Install over girts before wall coverings are applied. Hold insulation rigid until secured in place. Expose facing toward the interior side of the building. Fold and staple facing tabs of insulation on 6-inch centers to completely seal joints. If folding and stapling is accomplished from the inside, push the tabs neatly up between the edges of adjoining blankets. Cover side laps of insulation with metal strips formed for this purpose and paint to match the facing material. Install the strips spanning from girt to girt and in accordance with the metal building manufacturer's recommendations.

3.3 FIELD PAINTING

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same color and material used for the shop coat. Section 09900, "Painting," for painting of shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows.

3.4 FIELD QUALITY CONTROL

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

-- End of Section --

SECTION 13321

FLOW MEASURING 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 SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings (ASME/ANSI B16.1)
ASME PTC 19.5	1972 Application Part II of Fluid Meters, Sixth Edition 1971

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 126	1984 Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM B 61	1990 Steam or Valve Bronze Castings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C700	1990 Cold-Water Meters-Displacement Type, Bronze Main Case, First Edition
AWWA C704	1970 (R 1984) Cold Water Meters - Propeller Type for Main Line Applications

MILITARY SPECIFICATIONS (MIL)

MIL-P-24441	(Rev. A) (Supp. 1) Paint, Epoxy-Polyamide

1.2 SYSTEM REQUIREMENTS

The flow measuring equipment shall be the electromagnetic meter type. The design shall permit ease of installation and shall not have any features hazardous to personnel or detrimental to the equipment. Provision shall be made to align and adequately lubricate moving parts. Interior parts shall be easily accessible for adjustment, repair, and replacement.

1.3 SUBMITTALS

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

1.3.1 SD-02, Manufacturer's Catalog Data

a. Flow measuring equipment components

b. Read-out device

1.3.2 SD-06, Instructions

a. Flow measuring equipment components

Submit manufacturer's written recommendation for installation and handling.

1.3.3 SD-12, Field Test Reports

a. Flow measuring equipment calibration

b. Open channel test

c. Dimensional inspection report

d. Closed channel test

1.3.3.1 Requirements

Perform calibration and submit test report for flume in variable head meter for open channel. Submit dimensional inspection report and flow versus differential head curve for variable head meters for closed channel; accuracy shall be plus or minus 1.0 percent over a 10 to 1 flow range. Submit as required in paragraph entitled "Field Tests and Inspections."

1.3.4 SD-19, Operation and Maintenance Data, Data Package 2.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Unless otherwise specified, all materials and equipment shall be standard commercial products in regular production by the manufacturer and suitable for the required service.

2.1.1 Electromagnetic Meter

Provide a magnetic flow meter where indicated. The magnetic flow meter shall measure the flow of 0 to 100 gpm and be suitable for a 3-inch pipe. The magnetic flow meter system shall include a flow tube, local read-out receiver, and interconnecting cable where indicated. The flow meter shall be a chloroprene-lined stainless steel or steel, polyurethane-lined stainless steel or steel or fiberglass tube with the necessary cores and coils to provide a magnetic field without any interference and with 150 psi modified ASME B16.1 Dresser type coupling. Electrodes shall be of stainless steel. The tube shall operate from 240 volts, 50-60 hertz, single-phase ac power. A weatherproof housing shall cover the magnets, coils, and connections. The metering tube shall have an approximate laying length as indicated. Provide all necessary cable between the transmitter and receiver. Accuracy shall be plus or minus one percent over a 10 to 1 range. The receiver shall convert the ac voltage signal generated in the flow tube to a uniform flow signal. There shall be an adjustment for zero and span.

2.2 FLOW RECORDER

Provide the meter with the following read-out device which shall read from 0 to 100 gpm.

2.2.1 Local Read-Out and Remote Transmission

Provide an indicating transmitter, a recording transmitter, and an integrator for local read-out and transmission of flow data to remote read-out. The scale graduation shall be uniform. The read-out shall be visible through a shatterproof clear window. The read-out and transmission mechanism shall not be affected by the intended end use of environment. The transmission shall be impulse duration type or milliampere dc analog signal type to the remote read-out. Actuate all transmission by the output motion or the ac voltage signal of the meter. Power required shall come from the meter and shall be 120 volts, 50-60 hertz, ac. When impulse duration type transmission is used, the system shall have a 15 second maximum cycle actuating a cam-operated contact. The contact shall be of the totally-enclosed type. The unit shall be non-corrosive and weatherproof or provided with a separate weatherproof housing with a sealed door for access to the mechanism, and designed to prevent the accumulation of moisture or fog inside the case. Provide a suitable mounting.

2.2.1.1 Indicator

Shall be a minimum of 6 inches long.

2.2.1.2 Recorder

Shall be a minimum of 10 inches in diameter and shall rotate once weekly. The chart drive shall be driven by a synchronous motor from 120 volts, 50-60 hertz, ac.

2.2.1.3 Integrator

Shall read the total flow in the units specified using only a whole power of 10 multiplier.

2.3 ELECTRICAL REQUIREMENTS

Unless indicated or specified otherwise, the electrical components of the meters, such as chart drives and electrical disconnecting means, are included under this section. Provide wiring for signal circuit as specified by the equipment manufacturer. The interconnecting conduit and wire (except when otherwise specified herein, or when included in factory-assembled equipment) and the electrical connection of the meters to the electrical power circuit are specified in Division 16.

2.4 SPARE PARTS

Provide all standard recommended spare parts as specified in the manufacturer's instruction manuals for each component in the system. Furnish one year's supply of charts and ink for each recording device.

PART 3 EXECUTION

3.1 MATERIALS PROTECTION

The entire tube, except the throat section of the flow nozzle shall receive a series of coats of paint conforming to MIL-P-24441. Apply the paint in the following order: one coat of Formula 150, one coat of Formula 151, one coat of Formula 156, and one coat of Formula 152. The final total dry-film thickness shall be not less than 10 mils. Furnish all other items in accordance with the manufacturer's standard practice suitable for end use environment.

3.2 INSTALLATION

Furnish the services of an engineer representative of the manufacturer of the flow measuring equipment for checking the installation, making the necessary adjustments and calibrations, placing the equipment in operation, and performing the acceptance tests. The representative also shall be available for not less than 2 days to instruct operating personnel in the use, operation, and maintenance of the equipment during the initial operating period. Install all flow measuring equipment in accordance with the recommendations of the manufacturer. Install variable head meter[s] for closed channel[s] in accordance with the ASME PTC 19.5. Install weir[s] with the top exactly level at the elevation indicated.

3.3 FIELD TESTS AND INSPECTIONS

Test and calibrate in place the flow measuring equipment to demonstrate that it meets the accuracy requirements for the full range of flows specified herein. Provide all labor, equipment, and incidentals required for the tests, including electric power and water required for tests. The Contracting Officer will witness all field tests and conduct all field inspections. The Contractor shall give the Contracting Officer ample notice of the dates and times scheduled for tests. Rectify any deficiencies found and retest work affected by such deficiencies at the Contractor's expense. Record data from each field test shall be recorded and documented in a formal field test report.

-- End of Section --

SECTION 15011

MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY (Not Used)

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117	1990 Salt Spray (Fog) Testing

CODE OF FEDERAL REGULATIONS (CFR)

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

1.3 RELATED REQUIREMENTS

This section applies to Division 2, "Site Work"; Division 11, "Equipment"; Division 13, "Special Construction"; and all sections of Division 15, "Mechanical" 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 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.4.3 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These

service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.4.4 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.

1.4.5 Modification of References

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

1.5 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 Warning Sign

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

1.6.3 Lockout of Energy Sources

Provide appropriate lockout devices for energy isolating valves and for machines or other equipment to prevent unexpected start-up or release of stored electrical, mechanical, hydraulic, pneumatic, thermal, chemical, or other energy in accordance with 29 CFR 1910.147. Lockout devices for valves shall provide a means of attachment to which, or through which, a lock can be affixed or shall have a locking mechanism built into it so that

the valve cannot be moved from the lockout position until the lock is removed. Electrical isolation of machines or other equipment shall be accordance with requirements of DIVISION 16 "Electrical."

1.7 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."

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

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

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of 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. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, submit certifications that the manufacturer's standard factory painting system conforms to the heat resistance requirement in addition to other certifications.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and

solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees Fahrenheit (F) shall be cleaned to bare metal. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

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

-- End of Section --

SECTION 15200

NOISE, VIBRATION, [AND SEISMIC] CONTROL

PART 1 GENERAL

1.1 SUMMARY (Not Used)

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.

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 370	1986 Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment
ARI 575	1987 Measuring Machinery Sound Within an Equipment Space

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	1989 (Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM D 471	1979 (R 1991) Rubber Property - Effect of Liquids
ASTM D 2240	1986 Rubber Property - Durometer Hardness

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA APIDC	1975 Accepted Industry Practice for Industrial Duct Construction
SMACNA DCS	1985 HVAC Duct Construction Standards - Metal and Flexible

1.3 RELATED REQUIREMENTS

The provisions of Section 15011, "Mechanical General Requirements," apply to this section.

1.4 DEFINITIONS

1.4.1 Decibels dB

Measure of sound level. Decibels are referenced to either 20 uPa for sound pressure levels or one pW for sound power levels. dBA is the overall "A" weighted sound level.

1.4.2 Machinery

The vibration or noise producing equipment that must be isolated.

1.4.3 Manufacturer

The fabricator or supplier of vibration-isolation or seismic-protection materials and equipment. For mechanical equipment and machinery the term machinery manufacturer will be used.

1.4.4 Micropascal uPa

10 to the minus 6 power newtons per square meter.

1.4.5 Picowatt pW

10 to the minus 12 power watts.

1.5 SYSTEM DESCRIPTION

1.5.1 Machinery Vibration Criteria

Provide vibration isolators for mechanical and electrical machinery and associated ductwork as indicated, to minimize transmission of vibrations and structure borne noise to the building structure or spaces or from the building structure to the machinery. Comply with the following vibration schedule.

TABLE 1
Vibration Isolation Schedule

Equipment	Base Type	Isolator Type	Minimum Deflection (inch)
HV Unit		NP	

NOTES: Equipment Vibration Isolation Schedule Designations

NP - Neoprene pads.

1.5.2 Machinery Airborne Sound Level Criteria

1.5.2.1 Basic Criteria

For each piece of machinery in the human work environment, do not exceed the maximum airborne sound levels 84 dB A-weighted scale, continuous or intermittent, or 140 dB peak sound pressure-level, impact or impulse, noise.

1.5.2.2 Sound Data Schedule

TABLE 2
Sound Data Schedule
(Data Measured 3-Feet from the Sound Source)

Equipment	Maximum Sound [Power] [Pressure] Level (dB) Octave Band Level Center Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
HV Unit	91	91	80	84	82	76	71	65
Exhaust fans	55	50	48	47	48	46	42	37

1.6 SUBMITTALS

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

1.6.1 SD-02, Manufacturer's Catalog Data

a. Isolators

b. Flexible connectors

c. Flexible duct connectors

d. Machinery manufacturer's sound data

1.6.1.1 Machinery Manufacturer's Sound Data

For each piece of indicated machinery to be vibration isolated, the calculated sound power test data or sound pressure test data as levels in dB in the eight octave bands between 63 and 8,000 Hz. Refer sound power levels to one pW and sound pressure levels to 20 uPa. Submit the overall "A" weighted scale sound pressure level in dB. Submit the standard test procedure used to obtain the sound power or pressure data for the applicable vibration isolation equipment size.

1.6.2 SD-06, Instructions

a. Vibration and noise isolation components

1.6.3 SD-12, Field Test Reports

a. Equipment vibration tests

b. Equipment sound level tests

1.6.4 SD-13, Certificates

a. Neoprene

b. Flexible duct connectors

c. Flexible connectors

1.7 QUALITY ASSURANCE

1.7.1 Vibration Isolator Procurement

For each piece of machinery to be isolated from vibration, supply the vibration isolators, and other associated materials and equipment as a coordinated package by a single manufacturer or by the machinery manufacturer. Select isolators that provide uniform deflection even when machinery weight is not evenly distributed. This requirement does not include the flexible connectors or the hangers for the associated piping and ductwork.

1.7.2 Unitized Machinery Assemblies

Mounting of unitized assemblies directly on vibration isolation springs is acceptable if machinery manufacturer certifies that the end supports of the assemblies have been designed for such installation.

PART 2 PRODUCTS

2.1 CORROSION PROTECTION FOR STEEL PARTS

ASTM A 123 hot-dipped galvanized, or equivalent manufacturer standard coatings. Where steel parts are exposed to the weather, provide galvanized coating of at least 2 ounces of zinc per square foot of surface. Coat springs with neoprene.

2.2 NEOPRENE

ASTM D 471 and ASTM D 2240, Grade Durometer 40, 50, or 60, and oil resistant.

2.3 FLOOR-MOUNTED ISOLATORS

2.3.1 Neoprene Isolation Pads

Provide pads at least 1/4-inch thick with cross-ribbed or waffle design. For concentrated loads, provide steel bearing plates bonded or cold cemented to the pads.

2.3.2 Neoprene Isolators

Provide molded neoprene isolators having steel base plates with mounting holes and, at the top, steel mounting plates with mounting holes or threaded inserts. Provide elements of type and size coded with molded letters or color-coded for capacity identification. Embed metal parts completely in neoprene.

2.4 FLEXIBLE DUCT CONNECTORS

Provide flexible duct connectors fabricated in accordance with SMACNA APIDC.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Vibration and Noise Isolation Components

Install vibration-and-noise isolation materials and equipment as indicated and in accordance with machinery manufacturer's instructions.

3.1.2 Flexible Pipe and Duct Connectors

Install flexible connectors in accordance with the manufacturer's instructions.

3.1.3 Machinery

Provide vibration isolators, flexible connectors in accordance with manufacturer's recommendations.

3.1.3.1 Stability

Isolators shall be stable during starting and stopping of machinery without traverse and eccentric movement of machinery that would damage or adversely affect the machinery or attachments.

3.1.3.2 Lateral Motion

The installed vibration isolation system for each piece of floor or ceiling mounted machinery shall have a maximum lateral motion under machinery start up and shut down conditions of not more than 1/4-inch.

3.1.3.3 Unbalanced Machinery

Provide foundation suspension systems specifically designed to resist horizontal forces for machinery with large unbalanced horizontal forces. Vibration isolator systems shall conform to the machinery manufacturer's recommendations.

3.1.3.4 Nonrotating Machinery

Mount nonrotating machinery in systems which includes rotating or vibrating machinery on isolators having the same deflection as the hangers and supports for the pipe connected to.

3.1.4 Electrical Connections

Provide flexible conduit or multiple conductor cable connections for machinery with sufficient extra length to permit 2-inch minimum displacement in any direction without damage.

3.1.5 Systems Not To Be Vibration Isolated

Do not provide vibration isolation for electrical raceways and conduits or for fire protection, storm, sanitary, and domestic water piping systems

which do not include pumps or other vibrating, rotating, or pulsating equipment including control and pressure reducing valves.

3.2 FIELD QUALITY CONTROL

Provide equipment and apparatus required for performing inspections and tests. Notify Contracting Officer 14 days prior to machinery sound, and vibration testing. Rebalance, adjust, or replace machinery with noise or vibration levels in excess of those given in the machinery specifications, or machinery manufacturer's data.

3.2.1 Field Inspections

Prior to initial operation, inspect the vibration isolators for conformance to drawings, specifications, and manufacturer's data and instructions. Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Correct misalignment without damage to connector and in accordance with manufacturer's recommendations.

3.2.2 Tests

Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

3.2.2.1 Equipment Vibration Tests

Perform vibration tests to determine conformance with vibration isolation schedule specified

3.2.2.2 Equipment Sound Level Tests

Measure continuous or intermittent steady state noise with a sound level meter set for low response. Measure impact or impulse noise as dB peak sound pressure level (20 uPa) with an impact noise analyzer. Measure work distance from person to machinery noise center. Perform sound level tests to determine conformance with sound level schedule specified.

a. Interior Machinery Sound

In accordance with ARI 575, measure the sound data for air conditioning and refrigeration machinery, such as fans. Measure the sound pressure levels around mechanical and electrical machinery located in equipment spaces, 3 feet horizontally from the edge closest to the acoustical center of the machinery at points 3 feet and 5.5 feet above floor. Take measurements at the center of each side of the machinery. Locate the microphone at least 3 feet from the observer and measuring instruments. Observer shall not be between the machinery and the measuring instrument.

b. Exterior Machinery Sound

Measure sound data in accordance with ARI 370 for machinery radiating noise outside the building in such applications as grade installations, wall and roof installations for fans,

air conditioning machinery, exhausts, and air intakes.

-- End of Section --

SECTION 15400

PLUMBING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A112.21.2M	1983 Roof Drains
ANSI A112.36.2M	1983 (Errata 1984) Cleanouts
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	1989 Plumbing Fixture Fittings
ASME A112.21.1M	1991 Floor Drains
ASME/ANSI B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings
ANSI/ASME B16.3	1985 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 1003	1981 Water Pressure Reducing Valves for Domestic Water Supply Systems
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	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	1987 Cast Iron Soil Pipe and Fittings
ASTM A 183	1983 (R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 518	1986 (R 1991) Corrosion-Resistant High-Silicon Iron Castings
ASTM A 536	1984 Ductile Iron Castings
ASTM B 32	1991 Solder Metal
ASTM B 42	1992 Seamless Copper Pipe, Standard Sizes
ASTM B 88	1992 Seamless Copper Water Tube
ASTM B 306	1988 Copper Drainage Tube (DWV)
ASTM C 564	1988 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D 2665	1991 (Rev. A) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2846	1990 (Rev. A) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution System
ASTM F 441	1989 Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

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

BUILDING OFFICIALS & CODE ADMINISTRATORS INTERNATIONAL, INC. (BOCA)

BOCA NPC	1990 (Am. 1991) National Plumbing Code

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

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO UPC	1991 Uniform Plumbing Code

MILITARY SPECIFICATIONS (MIL)

MIL-G-1086	(Rev. E) Gasket Material, Synthetic Rubber (For Bolted Steel Tanks)
MIL-T-12295	(Rev. E) (Am. 2) Tanks, Hot Water Storage
MIL-P-16077	(Rev. D) Pumps, Centrifugal, Water Circulating, Electric-Motor-Driven
MIL-V-18433	(Rev. C) Valve, Temperature-Regulating (Thermostatically Controlled)
MIL-P-21251	(Rev. E) Pumping Units, Sewage, Duplex, Centrifugal Automatic, Wet-Pit-Type

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

MSS SP-58	1988 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	1991 Pipe Hangers and Supports - Selection and Application
MSS SP-70	1990 Cast Iron Gate Valves, Flanged and Threaded Ends

MSS SP-71	1990 Cast Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	1987 Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	1985 Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC NSPC	1990 (Supp. 1991 and 1992) National Standard Plumbing Code - Illustrated

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	1988 National Fuel Gas Code

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G101	1985 Testing and Rating Procedure for Grease Interceptors
PDI WH201	1983 Water Hammer Arrestors

SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL (SBCCI)

SBCCI SPC	1991 Standard Plumbing Code

1.2 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements," applies to this section with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Provide new and modify existing 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 and piping beyond 5 feet outside of building walls including connections to existing exterior distribution systems.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Pipe and fittings

b. Valves

c. Plumbing fixtures

d. Pipe hangers and supports

e. Pumps

f. Pressure gages

g. Water meters

h. Strainers

i. Drains

j. Water hammer arresters

k. Backflow preventers

l. Electric water coolers

m. Thermometers

For pumps, include certified pump test curves.

1.4.2 SD-19, Operation and Maintenance Manuals

a. Pumps, Data Package 2

Submit operation and maintenance data in accordance with Section 01730, "Operation and Maintenance Data."

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.

2.1.1.3 Plastic Pipe, Fittings, and Solvent Cement

a. Polyvinyl Chloride (PVC) System: ASTM D 2665.

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.

2.1.2.3 Plastic Pipe, Fittings, and Solvent Cement

a. Polyvinyl Chloride (PVC) System: ASTM D 2665

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.

2.1.2.5 Grooved-End Steel Piping for Roof Drainage Only

ASTM A 53, Schedule 40, hot-dip galvanized, cut grooved-end steel pipe; ASTM A 47 or ASTM A 536, hot-dip galvanized, grooved-end fittings, and mechanical couplings; ASTM A 183 coupling nuts and bolts; ASTM D 2000 rubber gaskets for water service. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer.

2.1.3 Cleanouts

ANSI A112.36.2M; provide threaded bronze or thermoplastic or PVC plastic cleanout plugs.

2.1.3.1 Floor Cleanouts

Provide cast-iron or ductile-iron floor cleanout with [anchor] flange, adjustable height polished bronze, nickel bronze, stainless steel, or chromium-plated copper alloy rim and scoriated floor plate with "CO" cast in the plate, and countersunk screws for installing floor plate flush with finished floor.

2.1.3.2 Wall Cleanouts

Provide polished stainless steel or chromium-plated copper alloy cover plate and secure to cleanout plug with countersunk stainless steel screw.

2.1.3.3 Cleanouts Exterior to Buildings

Provide cast-iron or polyvinyl chloride (PVC) cleanouts and countersunk plugs. Provide cleanouts flush with finished grade or concrete 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.

2.1.4.1 Flush Strainer Floor Drains

Provide with double drainage flange, perforated or slotted cast bronze or nickel bronze, polished stainless steel, or chromium-plated copper alloy strainer, and adjustable collar. Drains of sizes 2, 3, and 4 inches shall have strainers with minimum free drainage area of 5, 11, and 18 square inches, respectively.

2.1.4.2 Extended Rim Floor Drains

Provide as specified for flush strainer floor drains, except strainer body shall have one-inch extended rim installed flush with finished floor.

2.1.4.3 Roof Drains

ANSI A112.21.2M; provide hot-dip galvanized cast-iron or ductile-iron drains, with minimum of 10-inch diameter body, nonpuncturing flashing clamp device with integral gravel stop and deck clamp, and removable cast-iron or ductile-iron or polypropylene locking dome. Free area of dome shall be not less than two times the free area of drain outlet. Provide drain flashing ring seat flush with adjacent roof deck, and secure rigidly in place with deck clamp.

2.1.4.4 Floor Sinks (Drains)

Provide cast-iron body with white acid-resisting porcelain enameled or epoxy interior, double drainage flange, nickel bronze rim and slotted grate, removable stainless steel or aluminum slotted buckets, and P-trap.

2.1.5 Grease Interceptors (Traps)

PDI G101.

2.1.6 Oil Interceptors

Cast iron or welded steel, coated inside and outside with white acid resistant epoxy, with internal air relief bypass, bronze cleanout plug, double wall trap seal, removable combination pressure equalizing and flow

diffusing baffle and sediment bucket, horizontal baffle, adjustable oil draw-off and vent connections on either side, gas and watertight gasketed nonskid cover, and flow control fitting.

2.2 DOMESTIC WATER PIPING

2.2.1 Buried Piping and Aboveground Piping

2.2.1.1 CPVC Plastic Pipe, Fittings, and Solvent Cement

ASTM D 2846, may be provided for sizes 2 inches and smaller. Provide transition union connections or threaded gate valve between copper tubing and chlorinated polyvinyl chloride (CPVC) piping. Provide male threaded adapters with PTFE (polytetrafluoroethylene) pipe thread paste for threaded connections to valves, strainers, and equipment.

2.2.2 Water Valves

Provide valves suitable for minimum of 125 psig and minimum of 180 degrees F hot water. Valves shall have flanged end connections, except sizes smaller than 2.5 inches may have threaded end connections with a union on all but one side of the valve, or solder end connections for connections between bronze valves and copper tubing. Ball valves may be provided in lieu of gate valves.

2.2.2.1 Gate Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-70, Class 125.

2.2.2.2 Globe and Angle Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-85, Class 125.

2.2.2.3 Check Valves

MSS SP-80, Class 125, swing check, except sizes 2.5 inches and larger shall conform to MSS SP-71, Class 125, swing check, cast-iron or bronze body.

2.2.2.4 Ball Valves

Full port design, copper alloy, except sizes 2.5 inches and larger shall be ductile-iron body or cast-iron body. Valves shall have two-position lever handles.

2.2.2.5 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.

2.2.2.7 Combination Pressure and Temperature Relief Valves

ANSI Z21.22 copper alloy body, automatic reseating, test lever, and discharge capacity based on AGA temperature steam rating.

2.2.2.8 Pressure Relief Valves

ANSI Z21.22 copper alloy body, automatic reseating with test lever.

2.2.2.9 Water Pressure Reducing Valves

ASSE 1003.

2.2.3 Water Meters

AWWA C701 turbine type, with register reading in U.S. gallons.

2.2.4 Strainers

Strainers shall have blow off outlet with pipe nipple and gate valve and discharge pipe nipple. Copper alloy or cast-iron body. Provide stainless steel strainer element with perforations of 0.047 inch.

2.2.5 Pressure Gages

Provide single style pressure gage for water with 4.5-inch dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range suitable for the intended service.

2.2.6 Dielectric Connections

Provide at connections between copper and ferrous metal piping materials. ASTM F 441, Schedule 80, CPVC threaded pipe nipples, 4-inch minimum length, may be provided for dielectric connections in pipe sizes 2 inches and smaller.

2.2.7 Water Hammer Arresters

PDI WH201.

2.2.8 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.

2.2.9 Backflow Preventers

Reduced pressure principle type. Furnish proof that each make, model/design, and size of backflow preventer being furnished for the project is approved by and has a current "Certificate of Approval" from the FCCCHR-USC. Listing of the particular make, model/design, and size in the current FCCCHR-USC will be acceptable as the required proof.

2.3 MISCELLANEOUS PIPING MATERIALS

2.3.1 Flanges

ASME/ANSI B16.1, Class 125, for use in ferrous piping; ASME/ANSI B16.22 or ANSI B16.24 for use in copper tubing; with MIL-G-1086 full face flat type synthetic rubber gaskets.

2.3.2 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated or polished stainless steel finish on copper alloy plates in finished spaces. Provide paint finish on metal in unfinished spaces.

2.3.3 Pipe Sleeves

2.3.3.1 Sleeves in Masonry and Concrete Walls, Floors, Roofs

ASTM A 53, Schedule 40 or Standard Weight, hot-dip galvanized steel, ductile-iron or cast-iron pipe sleeves.

2.3.3.2 Sleeves in Non-Masonry or -Concrete Walls, Floors, and Roofs

Provide 26 gage hot-dip galvanized steel sheet.

2.3.4 Pipe 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.

2.3.6 Access Doors

Provide 12- by 12-inch factory prefabricated and primed flush face steel access doors including steel door frame with continuous hinges and turn-screw-operated latch. Door frame shall be for installation in plaster and masonry walls. Furnish doors under this section to provide proper access to concealed valves; install doors under the appropriate section of this specification.

2.3.7 Washing Machine Connector Box

Provide recessed wall box fabricated of aluminum, [PVC plastic] stainless steel, or hot-dip galvanized steel. Provide hot-dip galvanized steel with epoxy or baked-on enamel finish. Provide drain nipple and locknut with cover nut for locking drain outlet to box. Provide brass pipe fittings for connecting each supply pipe to valve and locking to box. Provide hot water and cold water supply valves similar to hose bibbs[, except valve inlet connections shall be of the compression type or union type].

2.4 FIXTURES, FITTINGS, ACCESSORIES, AND SUPPLIES

Provide control-stop valves in each supply to each fixture. The finish of fittings, accessories, and supplies exposed to view shall be chromium-plated per ASME A112.18.1M. Centerset faucets shall be top-mounted with inlets on not greater than 4-inch centers.

2.5 PUMPS

Select the pump so that the operating point on the characteristic performance curve for the impeller size to be furnished will 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 larger than 2 horsepower. Provide posted operating instructions for pumps.

2.5.1 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. Provide high water alarm and check valve.

2.5.2 Sewage Pumps

MIL-P-21251, duplex type with automatic controls to alternate the operation from one pump to the other pump and to start the second pump in the event the first pump cannot handle the incoming flow. 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, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil. Do not thread metal pipe into plastic 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 arts 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, with pipe riser clamps or offset pipe clamps. Support plastic and glass piping at each floor and at midpoint between floors, but at not more than 5-foot intervals.

b. Horizontal Piping: Support cast-iron piping at 5-foot intervals, except for pipe exceeding 5-foot length, provide supports at intervals equal to the pipe length but not exceeding 10 feet. Support plastic and glass piping at 5-foot intervals and support plastic piping at each change of direction. Support steel piping and copper tubing as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One and under	1.25	1.5	2	2.5	3	3.5	4	5	6
Steel Pipe	7	8	9	10	11	12	13	14	16	17
Copper Tube	6	7	8	8	9	10	11	12	13	14

3.1.4 Ductile Iron Pipe Aboveground

Provide flanged joints.

3.1.5 Encased Buried Piping

Completely encase buried copper water piping and cast iron DWV and water piping with polyethylene tube or sheet in accordance with AWWA C105/A21.5.

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. 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

3.3 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

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, 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. Provide materials required to make connections into the existing water supply systems and perform excavating, backfilling, and other incidental labor as required. Furnish the labor and the tapping or drilling machine for making the actual connections to the existing systems.

3.4 FIELD QUALITY CONTROL

3.4.1 Inspections

Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer's submittals.

3.4.2 Field Testing

Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the Plumbing Code, except as modified herein. Correct defects in the work provided by the Contractor, and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

3.4.2.1 Domestic Water Piping

Before applying insulation, hydrostatically test each piping system at not less than 120 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 and a smoke or peppermint test. Perform the air and smoke test with an approved smoke testing machine which shall show a clear passage of smoke and air throughout the entire system. The entire system shall be proven absolutely tight under such test.

3.5 DISINFECTION

Disinfect new water piping and existing water piping affected by Contractor'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 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 the results prior to the new water piping being placed into service.

-- End of Section --

SECTION 15487

COMPRESSED AIR 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 in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTES (ANSI) PUBLICATIONS:

B16-18-84	Cast Bronze Solder Joint Pressure Fittings
B16.22-80	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B16.26-83	Cast Copper Alloy Fittings for Flared Copper Tubes
B31.1-86	Power Piping
B40.1-85	Gauges, Pressure Indicating, Dial Type, Elastic Element
Z21.22-86	Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
Z49.1-83	Safety in Welding and Cutting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS:

B 32-87	Solder Metal
B 88-86	Seamless Copper Water Tube

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) PUBLICATION:

1986	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) PUBLICATIONS:

SP-80-87 Bronze Gate, Globe, Angle, and Check Valves

OCCUPATIONAL SAFETY HEALTH ACT (OSHA) STANDARD:

29 CFR 1910.219	Mechanical Power-Transmission apparatus

1.2 COMPRESSED AIR SYSTEM:

Provide compressed air system complete and ready for operation. Compressed air system, including air compressor, receiver, piping, equipment, 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 work "should" wherever it appears; reference to the "authority having jurisdiction," shall be interpreted to mean the Contracting Officer. Section titled "Mechanical General Requirements" applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS:

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

1.3.1 Manufacturer's Data:

a. Air Compressor
b. Receiver
c. Alternator Panel and Pressure Controls
d. Pipe and fittings
e. Valves
f. Drain traps
g. Intake filters
h. Silencer
i. Compressor Motor
j. Refrigerated Dryer

1.3.2 Shop Drawings:

a. Air Compressor
b. Receiver
c. Alternator Panel and Pressure Controls
d. Pipe and fittings
e. Valves
f. Drain traps
g. Intake filters
h. Silencer
i. Compressor Motor
j. Refrigerated Dryer

1.3.3 Certificates of Compliance:

a. Pipe and fittings
b. Valves
c. Coatings
d. Welding and brazing

1.3.4 Shop drawings shall include compressor performance curves and complete wiring and termination diagrams.

1.3.5 Operation and Maintenance Manuals

a. Air compressor, Data Package 4

b. Air dryer, Data Package 4

1.4 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 for the recovery system 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 75 psig and stop compressor at 100 psig. Each compressor shall be rated to supply 80 cfm at 75 psig continuously. Centrifugal unloader mechanism shall be provided with each compressor. All controls shall be suitable for wet locations.

2.1.1 Compressed Air Receiver:

Provide 240 gallon galvanized 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), a pressure reducing valve, and a receiver drain valve. Set pressure relief valve at 125 psig. Set pressure reducing valve in accordance with recovery system manufacturer's recommendation. Two pressure switches shall be provided on the receiver to provide a "lead-lag" mode of control.

2.1.2 Alternator Panel:

A surface-mounted alternator panel shall be provided. Panel shall include an alternator that shall alternate the two compressors between a "lead" and "lag" mode. Panel shall include motor controllers, control power transformer, disconnect switches and controls for each compressor. A panel mounted red run light shall be provided for each compressor. A selector switch shall be provided for control of the compressors, and shall have the selections "Compressor A - Compressor B - Alternate." Alternator panel shall be suitable for use in wet locations.

2.1.3 Intake Air Filter and Silencer:

Provide dry-type combination intake air filter and silencer with baked enamel steel housing. Filter shall be 99 percent efficient at 10 micron rating. Provide residential class intake air silencer.

2.1.4 Oil Level Switch

Each compressor shall be provided with a low oil level switch in an explosion-proof enclosure.

2.1.5 Belt Guard

Compressor shall be provided with a totally enclosed belt guard.

2.1.6 Compressor Motor

Each compressor motor shall be 25 horsepower (maximum), 480 VAC, 3-phase, TEFC. Motors shall be pre-wired to conjunction boxes.

2.2 COMPRESSED AIR PIPING

ASTM B 88, Type K or Type L, copper tubing with ANSI B16.18 or ANSI B16.22 solder joint fittings using ASTM B 32, 95-5 tin-antimony solder ; or with ANSI B16.26 flared joint fittings.

2.3 VALVES

2.3.1 Gate Valves:

MSS SP-80, Class 125

2.3.2 Globe and Angle Valves:

MSS SP-80, Class 125.

2.3.3 Check Valves:

MSS SP-80, Class 125, swing check.

2.3.4 Pressure Relief Valves:

ANSI Z21.22 and ASME bronze or cast-iron body, with test lever, and shall be suitable for the intended service.

2.3.5 Ball Valves:

Full port design, copper alloy body, except sizes 2.5 inches and larger shall be cast-iron body. Valves shall have two-position lever handles. Ball valves may be provided in lieu of gate valves.

2.3.6 Pressure Reducing Valves:

Spring loaded type, with nominal pressure rating of not less than inlet system pressure indicated. Provide pressure reducing valves capable of being adjusted to indicated flow and pressure, and suitable for intended service.

2.4 PIPING ACCESSORIES

2.4.1 Pressure Gauges:

ANSI B40.1, steel or brass case, nonshatterable 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.

2.4.2 Pipe Nipples:

Copper alloy for use in copper tubing and Schedule 80 steel pipe for use in steel piping.

2.4.3 Threaded Fittings:

ANSI B16.11, or ANSI B16.3, Class 150.

2.4.4 Traps:

Steel Body, internals of stainless steel, minimum of ANSI Class 150, and of the types indicated.

2.4.5 Flexible Connections:

Vibration isolation, wire braid reinforced corrugated metal hose type, line-sized, with bronze end connections, suitable for pressure indicated.

2.4.6 Provide Tetrafluoroethylene tape for screw-jointed pipe.

2.4.7 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.

2.5 LOW PRESSURE COMPRESSED AIR DRYER:

Provide low pressure compressed air dryer of the mechanical refrigeration type, equipped with an automatic temperature shutdown switch to prevent freezing, a regenerative air to air exchanger (in capacity sizes above 10 or 60 scfm as standard with the manufacturer), and a main compressed air cooling exchanger. Refrigeration system shall cool compressed air to dry the air. Dryer shall have no internal traps or filters and shall have pressure drop not greater than (3 psi). Air shall leave the dryer at a temperature of (70) degrees F and dew point of)35) degrees F, based on an inlet temperature of (100) degrees F. Provide internal tubing, wiring, and piping complete, such that only connections to air inlet and outlet, to refrigerant compressor contractor, and to condensate drain are necessary.

2.5.1 Air Circuit

a. Regenerative Heat Exchanger: Inlet compressed air to outlet compressed air heat exchanger designed to reduce cooling load at design conditions 20 degrees F by inlet air precooling.

b. Main Heat Exchanger: Single-pass, with air in the tubes, heat sink, direct expansion, or flooded cooler type.

c. Separator: Fabricated in accordance with ASME B31.1; code stamp not required; moisture separator low velocity type incorporating change of air flow direction to prevent moisture carryover.

d. Dryer Operating Pressure: 125 psig working pressure.

e. Drain Line: Provide with exterior mounted condensate trap to facilitate servicing.

2.5.2 Refrigeration System

a. Refrigeration Compressor: ARI 520. Hermetic, semi-hermetic, or open reciprocating type equipped with automatic start-stop or unloading capacity control; standard components include inherent motor protection, crankcase oil strainer, and suction screen.

b. Dryer Controls: Capable of automatic 0 to 100 percent capacity control. Refrigeration controls shall maintain pressure dew point within the specified range without freezing of condensate. Controls shall include such devices as capillary tube, expansion valve, suction pressure regulator, thermostat, or other approved devices as standard with the manufacturer. Dryer shall have automatic shutdown switch sensor located at point of lowest temperature to prevent freezing.

c. Refrigerant dryer and suction line strainer.

d. Air-cooled condenser, with condenser fan and motor.

2.5.3 Instrumentation and Control

a. Indicators for the Following Services: Inlet air pressure gage, discharge air pressure gage, inlet air temperature gage, main exchanger temperature gage, refrigeration compressor suction pressure gage, refrigeration compressor discharge pressure gage, green "Power On" light, power interruption light, and high temperature light.

b. Electrical Relays: Locate in an enclosed portion of the panel, accessible for ease of servicing.

c. Controls and Interlocks: To maintain required compressed air dew point and to cycle air-cooled condenser with refrigeration compressor (while maintaining head pressure control with low ambient temperature).

PART 3 3 - EXECUTION

3.1 INSTALLATION:

Installation of compressed air system including air compressor, receiver, piping, equipment, materials, workmanship, fabrication, assembly, erection, examination, inspection, and testing in accordance with the ASME and ANSI B31.1 except as modified herein.

3.2 DRAINAGE AND FLEXIBILITY:

Compressed air piping and hoses shall be free of unnecessary pockets and pitched approximately 1-inch per 100 feet in the direction of flow to low points. Provide flexibility by use of fittings, loops, and offsets in piping. Install branches at top of a main to prevent carryover of condensate and foreign matter.

3.3 FOUNDATIONS FOR EQUIPMENT:

Provide foundations for equipment conforming to recommendation of the manufacturer of equipment unless specified otherwise. Provide anchor bolts of ample length with plates on bottom ends, and set by using accurately constructed templates. Level equipment on foundations by means of jacks or steel wedges. Fill spaces between equipment bases and concrete foundation solid with cement mortar. Provide rubber mounting pads between anchor belt and frame, and frame and foundation.

3.4 FLEXIBLE METAL HOSE:

Install 3/4" flexible metal hose from air compressor pressure reducing valve to 3/4" x 3/4" x 3/4" tee at casing pipe, as shown on the contract drawings. Clamp metal hose to pipe support as shown such that metal hose vibration is limited to the compressor side of the clamp. Use saddle clamp such that hose is not crimped. Remaining piping shall be of reinforced single ply high tensile strength braided synthetic cord, as specified in Section 0-2900 (Recovery System).

3.5 CLEANING:

Clean piping, hoses, fittings, valves, unions and other components of the systems of dirt, oil and other contaminants before assembly and installation.

3.6 THREADED CONNECTIONS:

Jointing compound for pipe threads shall be tetrafluoroethylene (TFE) pipe thread tape or TFE powder and oil; apply only on male threads.

3.7 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 B31.1. Contractor shall furnish six copies of qualifications to the Contracting Officer for

approval.

3.7.1 Equipment and Protection:

Protect 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.

3.7.2 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.

3.7.3 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.

3.7.4 Brazed Joints

Prepare 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.

3.8 SAFETY PRECAUTIONS

3.8.1 Welding:

Safety in welding and cutting of pipe shall conform to ANSI Z49.1

3.8.2 Rotating Equipment:

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

3.9 FIELD INSPECTIONS AND TESTS

3.9.1 Inspections:

Prior to initial testing, inspect compressed air system for compliance with drawings, specifications, and manufacturer's submittals.

3.9.2 Hydrostatic and Leak Tightness Tests.

After installation, hydrostatically test piping systems (and hoses) for 30 minutes with water at 1.5 times design working pressure. No leakage or reduction in gauge pressure shall occur. Remove or isolate from the system equipment which would be damaged by water during hydrostatic tests and reinstall after successful completion of tests.

After satisfactory completion of hydrostatic pressure tests, blow systems dry with clean, oil-free compressed air and test with clean, dry air at design working pressure. Brush joints with soapy waste solution to check for leaks. Install a calibrated test pressure gauge in piping system to observe any loss in pressure. Calibrate the test pressure gauge with a dead weight tester and certify by initial and date on dial before using. Maintain required test pressure for a sufficient length of time to enable an inspection of joints and connections.

3.9.3 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 tests system for compliance with specifications.

-- End of Section --

SECTION 15501

HEATING, VENTILATING, AND COOLING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY (Not Used)

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.

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 210	1985 Fans for Rating

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 410	1991 Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	1989 Central-Station Air-Handling Units

ETL TESTING LABORATORIES (ETL)

ETL DLP	1992 Directory of ETL Listed Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1990 National Electrical Code
NFPA 90A	1989 Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES INC. (UL)

UL EAUED	1992 Electrical Appliance and Utilization Equipment Directory

1.3 SYSTEM DESCRIPTION

Provide new heating, ventilating, and cooling (HVAC) systems complete and ready for operation. HVAC systems include equipment, ducts, and piping which are located within, on, under, and adjacent to buildings.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Electric warm air furnaces

b. General exhaust fans

1.4.2 SD-04, Drawings

a. Temperature control systems

1.4.2.1 Temperature Control Systems

Submit drawings for temperature control systems including point-to-point electrical wiring diagrams.

1.4.3 SD-06, Instructions

a. Installation manual

1.4.3.1 Installation Manual

Provide installation manual for each item of equipment.

1.4.4 SD-19, Operation and Maintenance Manuals

a. Electric warm air furnaces, Data Package 3

b. Exhaust fans, Data Package 2

Submit in accordance with Section 01730, "Operation and Maintenance Data."

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Electric Warm Air Furnace

Provide units factory assembled, designed, tested, and rated in accordance with ARI 410 and ARI 430. Units shall include blower fan, filters, heating coil, and controls. Insulate interior of inside unit casing with manufacturer's standard insulation. Units shall be listed in UL EAUED or ETL DLP.

a. Filter section: Provide UL listed throwaway 1-inch thick fiberglass filters, standard dust-holding capacity, 650 fpm maximum face velocity. Provide gasketed hinged access panel with quick opening half-twist latches at end of filter rack.

b. Heating section: Provide UL or ETL listed electric resistance heaters including internal fusing integral with heaters; fan shall run until heater cools.

c. Space temperature controls: Controls shall perform sequence of operation as indicated. Thermostats shall be furnished by unit

manufacturer and installed where indicated. Provide relays, transformers, contactors, and control wiring between transformers, contactors, and control wiring between thermostats and unit.

d. Sequence of operation: Unit fan shall operate continually. Electric heating coil stages shall be energized as required to maintain the thermostat setpoint (65°F, adjustable). When unit is operating, the motor-operated damper shall be energized and remain open. When a static pressure switch located in the unit ductwork senses 80% airflow, a signal shall be sent to the alarm panel.

2.1.2 General Exhaust Fans

AMCA 210 with AMCA seal. Provide centrifugal upblast type exhaust fans with aluminum housing, fan wheel, and bird screen. Motors shall be completely shielded from the airstream. Provide exhaust opening and gravity closing type automatic backdraft dampers. Provide integral disconnect factory wired by unit manufacturer.

a. Sequence of operation: Exhaust fan EF-2 shall run continually. Exhaust fan EF-3 shall be energized when its thermostat senses a temperature of 80°F (adjustable). The fan shall stop when the thermostat senses a temperature of 70°F (adjustable). A photohelic pressure switch in exhaust fan EZ-2 ductwork shall energize EF-3 and send a signal to the alarm panel upon sensing 50 percent airflow. Exhaust fan EF-3 shall energize a motor operated damper to provide airflow through an outdoor air louver whenever it is energized.

2.2 ELECTRICAL

a. Electrical motors, controllers, contactors, and disconnects: Furnish with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to Section 16402, "Interior Wiring Systems." Provide electrical connections under Section 16402, "Interior Wiring Systems." Provide controllers and contactors with maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

b. Electrical work: Provide under Section 16402, "Interior Wiring Systems." Provide control wiring under this section in accordance with NFPA 70.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 HVAC System

Installation of HVAC system including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and

testing shall be in accordance with ASME B31.1, NFPA 70, NFPA 90, and in accordance with the manufacturer's recommendations.

3.2 ADJUSTMENTS

Adjust controls and equipment so as to give satisfactory operation. Air duct systems shall be adjusted and balanced so that air quantities at outlets are as indicated and so that distribution from supply outlets is free from drafts and has uniform velocity over the face of each outlet.

3.3 INSTRUCTING OPERATING PERSONNEL

Upon completion of work and at time designated by Contracting Officer, provide services of competent technician for period of not less than one 8-hour working day for instruction of Government operating personnel in proper operation and maintenance of equipment.

3.4 FIELD QUALITY CONTROL

Upon completion and before final acceptance of work, test each system in service to demonstrate compliance with the contract requirements. Adjust controls and balance systems for one year after final acceptance of completed systems. Test controls through every cycle of operation. Test safety controls to demonstrate performance of required function. Correct defects in work provided by Contractor and repeat tests. Furnish electricity, instruments, connecting devices, and personnel for tests. Clean equipment, ducts, and filters.

3.4.1 Equipment

Test equipment in operation for continuous period of not less than 24 hours under every condition of operation in accordance with manufacturer's recommendation.

3.4.2 Additional Field Testing

Provide testing, adjusting, and balancing (TAB) of ducts and equipment under Section 15996, "Testing/Adjusting/Balancing: Heating/ Ventilating/Cooling Systems."

3.4.3 Testing and Balancing

Balance airflow in accordance with SMACNA and flows indicated. Submit written certificate to report the following:

a. Air-handling unit nameplate data, and actual voltage and ampere consumption.

b. Supply and return terminal airflow, and equipment used to measure airflow.

c. Air-handling unit in and out cfm and temperatures.

d. Ambient outside air temperature, date, and person testing, balancing, and reporting.

-- End of Section --

SECTION 15620

UNIT HEATERS AND INFRARED HEATERS

PART 1 GENERAL

1.1 SUMMARY (Not Used)

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 SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE 33	1978 Forced Circulation Air Cooling and Air Heating Coils

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	1988 Industrial Control Devices, Controllers and Assemblies
NEMA ICS 6	1988 (Rev. 1) Enclosures for Industrial Controls and Systems
NEMA MG 1	1987 (Rev. 1) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1990 National Electrical Code
NFPA 90A	1989 Installation of Air Conditioning and Ventilating Systems
NFPA 90B	1989 Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	1990 Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying

1.3 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements," applies to this section with additions and modifications specified herein.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Unit heaters

1.4.2 SD-19, Operation and Maintenance Manuals

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. 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 integeral thermostats. Furnish circuit breaker disconnect switch.

2.1.1 Electric Unit Heater

UL listed; wattage, voltage, phase, and number of steps as indicated. Provide control-circuit terminals and single source of power supply. Heater 5 Kw and larger shall be three-phase, with load balanced on each of the three phases. Limit leaving air temperature below 140 degrees F at 60 degrees F entering air.

2.1.1.1 Casing

Minimum 21 gage steel.

2.1.1.2 Heating Element

Nickel-chromium heating wire element, free from expansion noise and 60 Hz hum. Embed element in magnesium-oxide insulating refractory. Seal element in high-mass steel or corrosion-resisting metallic sheath with fins. Enclose element ends in terminal box. Space fins at maximum six fins per inch. Limit fin surface temperature 550 degrees F at any point during normal operation.

2.1.1.3 Controls

Include limit controls for thermal overheat protection of heaters. Provide integral thermostat. Provide a control transformer to supply 120-volt thermostat control circuit for each heater.

2.1.1.4 Wiring

Completely factory-prewired to terminal strips, ready to receive branch circuit and control connections for 60 degrees C copper or aluminum wiring.

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, and NEMA ICS 2, and NEMA ICS 6, respectively.
Provide motor starters where indicated. 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. Wire motor to heater power supply source.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment where indicated and as recommended by manufacturer's recommendations NFPA 90A, NFPA 90B, and NFPA 91.

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, 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 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 Insulation-Resistance Tests for Electrical Equipment

At the completion of wiring, test 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.

3.2.3.2 Operational Tests

After completing insulation-resistance tests, operate equipment continuously under varying load conditions to verify functioning of electrical controls, safety interlocks, and specified operating sequence. Run each test for a minimum period of one hour.

-- End of Section --

SECTION 15871

INDUSTRIAL VENTILATION AND EXHAUST SYSTEMS (DUCTS AND FANS)

PART 1 GENERAL

1.1 SUMMARY

1.2 REFERENCES

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

AMERICAN 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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S335	1989 Structural Steel Buildings Allowable Stress Design and Plastic Design

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 99	1986 Standards Handbook
AMCA 201	1990 Fan Application Manual - Fans and Systems
AMCA 210	1985 Fans for Rating
AMCA 300	1985 (R 1987) Certified Sound Rating Program for Air Moving Devices
AMCA 301	1976 Calculating Fan Sound Ratings from Laboratory Test Data
AMCA 302	1973 Application of Sound Ratings for Nonducted Air Moving Devices
AMCA 303	1979 Application of Sound Power Level Ratings for Fans

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI IP-20	1988 Drives Using Classical V-Belts and

	Sheaves Cross Sections, A, B, C, and D
ANSI IP-22	1983 Drives Using Narrow Multiple V-Belts (3V, 5V, and 8V Cross Sections)

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 167	1991 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 527/A 527M	1990 Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock-Forming Quality
ASTM D 1654	1979 (Rev. A) (R 1984) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2000	1990 Rubber Products in Automotive Applications

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1	1992 Structural Welding Code Steel
AWS D1.3	1989 Structural Welding Code - Sheet Steel

FEDERAL SPECIFICATIONS (FS)

FS TT-S-00230	(Rev. C) (Am. 2) Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)
FS TT-S-001543	(Rev. A) Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures)
FS TT-S-001657	Sealing Compound-Single Component, Butyl Rubber Based, Solvent Release Type (For Buildings and Other Types of Construction)

MILITARY SPECIFICATIONS (MIL)

MIL-P-21035	(Rev. B) Paint, High Zinc Dust Content, Galvanizing Repair (Metric)
MIL-P-23236	(Rev. B) (Am. 2) Paint Coating Systems, Fuel and Salt Water Ballast Tanks (Metric)

MIL-P-24441	(Rev. B) (Supp. 1) Paint, Epoxy-Polyamide

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 Controls and Systems
NEMA MG 1	1987 (Rev. 2) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 65	1987 Processing and Finishing of Aluminum
NFPA 70	1990 National Electrical Code
NFPA 91	1992 Exhaust Systems Air Conveying of Materials

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA APIDC	1975 Accepted Industry Practice for Industrial Duct Construction
SMACNA RIDCSTD	1977 Round Industrial Duct Construction Standards

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 5	1991 White Metal Blast Cleaning
SSPC Paint 20	1991 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")

1.3 GENERAL REQUIREMENTS

1.3.1 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.

1.3.2 Related Requirements

Conform to Section 15011, "Mechanical General Requirements" as well as additional requirements specified herein.

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Fans

b. Sleeve bearings

c. Dampers

d. Gaskets

e. Protective coating materials

f. Sealants

g. Damper regulators

h. Supports and hangers

i. Vibration isolators

j. Thermoplastic ductwork

1.4.1.1 Fan Data

For fans include fan curves or rating tables and derating factors. Indicate power, mechanical efficiency, static pressure and total pressure plotted against flow rate cubic feet per minute (cubic meters per second).

1.4.2 SD-04, Drawings

a. Industrial ventilation and exhaust systems

1.4.2.1 Industrial Ventilation and Exhaust Systems

Submit drawings including fan installation drawings; duct systems; supports and anchor location and load imposed.

1.4.3 SD-08, Statements

a. Work plan

1.4.3.1 Work Plan

A detailed agenda of the proposed work shall be submitted to the Contracting Officer prior to starting any work.

1.4.4 SD-10, Test Reports

a. Fan tests, including sound power level tests

1.4.5 SD-12, Field Test Reports

a. Ventilation and exhaust system start-up tests

b. Sound level tests

1.4.5.1 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 facsimilies 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.

1.4.6 SD-18, Records

a. Posted operating instructions

Submit text of posted operating instructions for ventilation and exhaust systems.

1.4.7 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."

1.5 QUALIFICATIONS

1.5.1 Qualified Personnel

Operations involving joining thermoplastic ductwork by solvent or hot gas shall be performed by personnel certified by the manufacturer as qualified for the work.

1.6 POSTED OPERATING INSTRUCTIONS

Provide for ventilation and exhaust system. In addition, final adjustment and settings persuant to testing, adjusting, and balancing shall be permanently marked, drilled, and pinned as an integral part of device.

1.7 SAFETY PRECAUTIONS

1.7.1 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. 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 and tachometer readings; ease of sectional disassembly for maintenance and inspection functions where guard total weight exceeds 50 pounds (23kg); weather protection where components are weather exposed. Installed guards and screens shall not negate noise control and vibration isolation provisions.

PART 2 PRODUCTS

2.1 FANS, GENERAL REQUIREMENTS FOR

2.1.1 General Performance, Component, and Other Requirements

Design, rate, and catalog fans in accordance with AMCA 99. Determine performance data for fans in accordance with AMCA 210. Sound power level ratings of normally ducted fans shall comply with AMCA 301 and results of tests conducted in accordance with AMCA 300. Sound power level ratings shall comply with AMCA 303. Sone loudness ratings of normally nonducted fans shall comply with AMCA 301 and results of tests conducted in accordance with AMCA 300. Sone loudness ratings shall conform to AMCA 302. Select fans so that people occupying or working in the area are not exposed to noise levels that exceed 84 dBA. Base catalog ratings on fan tests performed by an approved testing laboratory. Scheduled fan performance is the performance required under specified or indicated installation conditions with specified or indicated accessories. Proposed equipment shall be rated under these conditions. Affix the manufacturer's product identification nameplate to each unit. Additional requirements shall apply 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 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 200,000 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. Lubrication provisions shall include extension tubes where necessary to facilitate safe maintenance during operation and tubes shall be filled 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 (0.37 kW).

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. Maximum shaft surface speed shall not exceed 1200 feet per minute (6.1 meters per second) without water cooling. Bearing loading pressure, based on effective bearing area, not to exceed 70 pounds per square inch (483 kPa). Provide each sleeve bearing with approximately 16-ounce (473 mL) capacity constant level oiler and oil level gauge. Sleeve bearing submittal data shall include: 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. Motor starters shall be magnetic-across-the-line type with weather resistant NEMA 3R 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.

2.1.4 Power Transmission Components

2.1.4.1 Fan Drives

Direct or V-belt type as indicated. V-belt drives shall conform to ANSI IP-20 and ANSI IP-22. Drives shall be applied in accordance with the manufacturer's published recommendations, unless specified otherwise. Horsepower rating of a V-belt drive shall be based on maximum pitch diameter of sheaves. Drives with motors rated up to and including 10 hp (7.5 kW) shall be Classical belt section, adjustable sheave type, with a minimum service factor 1.5. Drives with motors rated one hp and above shall have a minimum two belts.

2.1.4.2 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. Companion sheaves for adjustable sheave drives shall have 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 (406 mm); "C" Section 25 inches (635 mm); "D" Section 36 inches (914mm). Belts shall be endless, static dissipating, oil-resistant, synthetic cloth or filament reinforced elastomer construction.

2.1.5 Special Construction for Hazardous Areas

2.1.5.1 Spark-Resistant

Construct indicated units in accordance with AMCA 99; Type B. Provide Type B construction and electrical grounding of fan parts and grounding to building structure where fume or vapor handling systems conforming to NFPA 91 are specified. Do not place bearings in the air stream.

2.1.6 Protective Coating for Fans

Prepare and coat fans as follows: Replace bolts required to provide access or adjustment and normally threaded into the coated surface with studs or bolts having heads continuously welded inside. Omit sharp edges, self-tapping screws, and permanent threads protruding into the coated surface. Eliminate hairline cracks and sharp inside corners by continuous welding, brazing, or filling with high melting point solder. Seal wheel hub to the shaft. Construct housing split to use external throughbolts. Flange inlet and outlet and consider as fan interior. Peen or grind welds smooth, and grind outside corners to approximately 1/16-inch radius. Sandblast metal surfaces to white metal in accordance with SSPC SP 5 Coat interior surfaces of housing in contact with airstream, including inlet, wheel and shaft, flange faces, shaft seal, and bearing and motor pedestal. Do not coat bearings, coupling, motor, drive, or other auxiliaries. Coat fan with epoxy. Statically and dynamically balance the fan in two planes after coating and finishing, and where material has been removed, refinish and rebalance the fan as specified herein.

2.2 CENTRIFUGAL FANS

2.2.1 General Requirements for Centrifugal Fans

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. Arrangement and drives shall be as indicated.

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.

2.3.2 Corrosion Resistant (Stainless) Steel

ASTM A 167, Type 304L or Type 316L with mill finish, except as otherwise specified.

2.3.3 Corrosion Protection

Equipment fabricated from ferrous metals that do not have a zinc coating conforming to ASTM A 123 shall be treated 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. The salt-spray fog test shall be in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated 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 Gaskets

2.4.1.1 Elastomer Chloroprene

Sheet, 1/8-inch (3-mm) thick, conforming to ASTM D 2000, Type 2BE410B14.

2.4.2 Protective Coating Material

2.4.2.1 Epoxy Coating

Conform to MIL-P-23236, Type I, Class 1 or MIL-P-24441 system, Formula 150 green primer 3 mils, Formula 151 haze gray 3 mils, and Formula 152 white 3 mils.

2.4.2.2 Inorganic Zinc Coating

SSPC Paint 20, Type I-C (Self-cure type).

2.4.2.3 Galvanizing Repair Paint

Conform to MIL-P-21035.

2.4.3 Sealants

2.4.3.1 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.

2.4.3.2 Caulking of Building Surface Penetration

Foamed silicones, two-component, fire-resistant, low-exotherm, room temperature vulcanizing silicone.

2.5 SPECIALTIES

Steel, cast iron, stainless steel, nonferrous metal, or plastic to match duct construction, or as indicated.

2.5.1 Damper Regulators

Incremental position indicating and locking type, constructed of stainless steel.

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. Supporting elements shall be suitable 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 TDCM, and NFPA 91, as applicable, and modified and supplementary requirements specified herein. Do not use weld studs and powder actuated anchoring devices shall 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-gauge 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

Conform to Section 15200, "Noise, Vibration Control."

2.7 FIBERGLASS REINFORCED PLASTIC (FRP) DUCTWORK

Ductwork, FRP, for Nonflammable Vapor Exhaust:

2.7.1 Fiberglass Reinforced Plastic Ductwork

Ductwork, fittings, accessories, and material of construction shall be constructed in accordance with The National Bureau of Standards (NBS) standard PS 15-69 "Custom Contact-molded Reinforced-polyester Chemical-resistant Process Equipment" and NFPA 91. Supplementary steel shall be fabricated in accordance with the AISC S335.

2.7.2 Product Requirements

Duct system shall be the product of a manufacturer recognized in the field of fabrication of FRP material. Fabricating personnel shall be certified by the manufacturer as qualified to perform the work in accordance with the specified requirements.

2.7.3 Basic Ductwork Materials

Ducts, accessories and components in sheet form shall be fabricated from materials conforming to NBS Standard PS15-69. Extrusions shall be of the same compounds as specified for duct. Connections shall be flanged. Metal components, when permitted to be located interior to the duct, shall

be constructed of Type 316 or 316L stainless steel.

2.7.4 Fasteners

Where penetration of duct surfaces is approved or specified, fastener assemblies shall be of 300 series corrosion resistant steel and shall be encapsulated on duct interior, unless total disassembly is intended. Flange fastener bolts and nuts shall be hex type only, cadmium plated, unless exposed to corrosive fumes, in which case Type 304 stainless steel shall be used. Two oversized washers shall be used in all bolted assemblies, except where assembled with metallic reinforcement contact.

2.7.5 Joint Gaskets

Joint gaskets shall be 1/8-inch (3-mm) thick acid resistant chloroprene.

2.7.6 Fabrication

Water washable, watertight, self-draining, and airtight as specified or indicated. Required reinforcements, bracing, supports, framing, gasketing, sealing, resilient mounting, drainage provisions, and fastening shall be provided for rigid construction and freedom from vibration, airflow induced motion and noise, and excessive deflection at specified maximum system pressure and velocity.

2.7.6.1 Flanges

Flanges shall be provided at connections and where required for ease of access to equipment, enclosure connections and where indicated. Flange joints shall be gasketed with full face gaskets which are one piece, heat, adhesive, or solvent vulcanized or bonded.

2.7.6.2 Access Plates

Provide access plates upstream and downstream of equipment in ducts at locations to facilitate duct cleaning, and where indicated. Access openings shall be a minimum 2 inches (51 mm) above bottom of duct and shall be externally framed with welded and ground miter joint steel which is isolated from duct interior. Access plate shall be FRP on interior side, backed with steel on exterior side. Provide stainless steel access plate fasteners.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Installation Requirements

Installation shall conform to NFPA 91 and SMACNA RIDCSTD. Provide mounting and supports for equipment, ductwork, and accessories, including structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors, blast gates, and dampers. Install accessories in accordance with the manufacturer's instructions. Positive pressure duct inside buildings shall be constructed 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. Connection to ground and continuity testing shall be provided as part of the work of Division 16.

3.1.3 Special Requirements for Installation of FRP Ductwork

Requirements for Installation of FRP Ductwork for Nonflammable Vapor Exhaust:

3.1.3.1 Slope

Slope horizontal ducts one inch in 40 feet ([12]m) as indicated.

3.1.3.2 Duct Supports

Duct support contact surfaces shall be isolated from supporting steel by 1/4-inch (6-mm) thick closed-cell foamed cellular elastomer insulation material of a width greater than support. Duct supporting system shall take into account additional weight due to collection of condensate and washing water in nondrainable, deflected surface and other areas.

3.1.4 Building Penetrations

3.1.4.1 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 and items 15 inches (381 mm) and smaller. Sleeves, except as otherwise specified or indicated, shall be 20-gauge, 0.0396-inch (one-mm) thick mill galvanized sheet metal. Provide roof penetrations as shown in SMACNA APIDC.

3.1.4.2 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.

3.1.4.3 Tightness

Penetration shall be weathertight.

3.1.4.4 Sealants

Sealant shall be 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 (10-mm) depth.

3.1.4.5 Closure Collars

Provide a minimum 4 inches (102 mm) 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. Sharp edges shall be ground smooth to prevent damage to penetrating surface. Collars for round ducts 15 inches (381 mm) in diameter or less shall be fabricated from 20-gauge, 0.0396-inch (one-mm) nominal thickness, mill galvanized steel. Use a minimum of 4 fasteners to attach collars where the opening is 12 inches (305 mm) in diameter or less. Fabricate collars from 20-gauge, 0.0396 inch (one-mm) nominal thickness, mill galvanized steel. Install collars with fasteners a maximum of 6-inches (152-mm) on center.

3.1.5 Installation of Supports

3.1.5.1 Selection

Selection of duct and equipment support system shall take into account the best practice recommendations and requirements of SMACNA RIDCSTD 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.

3.1.5.2 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 (3 m) 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. Coordinate deflection of duct and equipment mountings and conform to Section 15200, "Noise, Vibration, Control."

3.1.5.3 Methods of Attachment

Attachment to building structural steel shall be by clamping and when approved, by welding, in accordance with AWS D1.1. Masonry anchors selected for overhead applications shall be constructed 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.

3.1.6 Welding

Welding test agenda shall be done in accordance with the applicable provisions of AWS D1.1 and AWS D1.3.

3.1.7 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. 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 Contracting Officer.

3.1.8 Protective Coating Work

3.1.8.1 General Requirements for Protective Coating Work

Provide protective coating on interior surfaces of exhaust fan EF-1 as specified hereafter.

3.1.9 Factory and Field Painting and Finishing

3.1.9.1 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."

3.1.9.2 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. Field or shop fabricated ferrous metals required for the installation specified under this section shall be cleaned and primed in accordance with the applicable provisions of

Section 09900, "Painting." Painting of surfaces not otherwise specified and finish painting of items only primed at the factory or elsewhere, are specified as part of the work under Section 09900, "Painting."

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 gauge 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 (30 m). Test for structural integrity at 20 percent in excess of system fan positive or negative total pressure. Test for leakage at 20 percent in excess of system fan positive or negative total pressure. Leakage test procedure and apparatus shall be in accordance with SMACNA DCS. Total leakage, prorated to length of duct under test, shall not exceed one percent of system capacity.

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 Contracting Officer. 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.

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 gauges (such as a Magnehelic). Velometers may be used for low velocity measurements if approved by the Contracting Officer.

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
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

Sound levels higher than 84 dBA at hoods or at workers' normal operating positions at equipment shall be reported to the Contracting Officer in writing, 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 15895

DUCTWORK AND DUCTWORK ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

1.2 REFERENCES

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

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 500	1991 Louvers, Dampers and Shutters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 527/A 527M	1990 Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock-Forming Quality

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	1989 Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA DCS	1985 HVAC Duct Construction Standards - Metal and Flexible

UNDERWRITERS LABORATORIES INC. (UL)

UL 181	1990 (R 1990) Factory-Made Air Ducts and Air Connectors

1.3 RELATED REQUIREMENTS

Section 15011, "Mechanical General Requirements," applies to this section with the additions and modifications specified herein.

1.4 PRESSURE CLASSIFICATION

SMACNA DCS, Section 1, and as indicated.

1.5 SUBMITTALS

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

1.5.1 SD-02, Manufacturer's Catalog Data

a. Dampers

b. Flexible ducts and connectors

c. Bird screens

d. Registers and grilles

e. Metal ducts

f. Test holes

g. Motor operated dampers

1.5.2 SD-04, Drawings

a. Locations of test holes

b. Duct hangers and supports details

1.5.3 SD-05, Design Data

a. Duct span versus reinforcement schedule

1.5.3.1 Duct Span Versus Reinforcement Schedule

Submit maximum duct dimension, board stiffness rating, board thickness, type and spacing of reinforcement, and maximum duct static pressure.

1.5.4 SD-06, Instructions

a. Ductwork and ductwork accessories

1.5.4.1 Ductwork and Ductwork Accessories

Including job inspection checklist, methods of on-site storage and handling, and recommended repair methods.

1.5.5 SD-07, Schedules

a. Registers and grilles

b. Duct hangers and supports

Submit a schedule of inlets and outlets indicating location, catalog model number, manufacturer, dimensional information, sound pressure level rating, nominal rated volumetric flow rate (cfm), neck or face velocity at specified cfm, pressure drop at specified cfm, throw and drop for outlets, range for diffusers, and maximum and minimum cfm modulation.

1.5.6 SD-08, Statements

a. Certified personnel list

1.5.7 SD-10, Test Reports

a. Automatic dampers

b. Sound pressure level rating

1.5.7.1 Automatic Dampers

Submit certification of damper leakage testing and conformance with AMCA 500 and specified maximum leakage or pressure drop requirements.

1.5.7.2 Sound Pressure Level Rating

Submit for inlets and outlets including diffusers, registers and grilles.

1.5.8 SD-12, Field Test Reports

a. Air duct leakage tests

b. Testing and balancing of air systems

1.5.9 SD-13, Certificates

a. Automatic dampers

1.6 QUALITY ASSURANCE

1.6.1 Modification of References

SMACNA Duct Construction Manuals: The SMACNA recommendations shall be considered as mandatory requirements. Substitute the word "shall" for the word "should" in these manuals.

PART 2 PRODUCTS

2.1 METAL DUCTS

2.1.1 Steel Ducts

ASTM A 527/A 527M galvanized steel sheet, lock-forming quality; coating designation G90.

2.2 DUCTS OF PRESSURE CLASSES 3-INCH OR LESS WATER GAGE

Construction, metal gage, hangers and supports, and reinforcements shall conform with SMACNA DCS, except that ducts with pressure classifications below 2 inch water gage that are located outside of the conditioned space shall have a seal class C. Ductwork shall be airtight and shall not vibrate or pulsate when system is in operation. Pressure sensitive tape shall not be used as a primary sealant on ductwork with pressure classifications above one inch water gage. Air leakage shall be

less than 5 percent of the system capacity. Construct ductwork of galvanized steel.

2.2.1 Curved Elbows

Make a centerline radius not less than 1 1/2 times the width or diameter of the duct.

2.2.2 Laps

Make laps at joints in the direction of air flow. Space button-punch or bolt-connection in standing seams at fixed centers not greater than 6 inches. Longitudinal locks or seams, known as "button-punch snap-lock," may be used in lieu of Pittsburg Lock.

2.2.3 Fittings

Elbows, vaned elbows, take-offs, branch connections, transitions, splitters, volume dampers, fire dampers, flexible connections, and access doors shall conform with SMACNA DCS, Section 2. Provide factory fabricated airtight, and noncorrosive test holes with screw cap and gasket.

2.3 FLEXIBLE CONNECTORS

UL 181, Class I, UL listed, SMACNA DCS, and additional requirements herein specified. Provide to connect between rigid ducts and outlets or terminals. There shall be no erosion, delamination, loose fibers, or odors from the ducts into the air stream. At 250 degrees F, minimum rating pressures shall be 2 inches water positive and 1/2-inch negative, up to 2500 fpm.

2.3.1 Materials

Interlocking spiral or helically corrugated type constructed of noncollapsible fire-retardant, chloroprene or chlorosulphonated polyethylene impregnated, minimum 30 ounces per square yard woven mineral fabric.

2.3.2 Joints

Make airtight slip joints, seal with pressure-sensitive vapor-seal adhesive tape or duct sealer, and secure with sheet metal screws. To provide a vaportight joint, provide a corrosion-resistant steel or aluminum clamp over such spacers.

2.4 REGISTERS AND GRILLES

2.4.1 Material and Finishes

Provide factory-furnished registers constructed of steel. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Steel parts shall be factory zinc phosphate treated prior to priming and painting or have a baked-on enamel finish. Colors shall be selected or approved by Contracting Officer.

2.4.2 Sound Pressure Level

Manufacturer certified sound pressure level rating of inlets and outlets. Conform with the following permissible room sound pressure levels:

NC Range, dB	Typical Application
20-40	35

2.4.3 Throw

The distance from the register to the point which the air velocity falls below 125 feet per minute shall not exceed 1.5 times the outlet mounting height.

2.4.4 Drop

Maximum drop of air stream shall not be within 5 feet of the floor at the end of the throw.

2.4.5 Registers

Double-deflection supply registers. Provide manufacturer-furnished volume dampers. Volume dampers shall be of the group-operated, opposed-blade type and key adjustable by inserting key through face of register. Operating mechanism shall not project through any part of the register face.

2.5 DEFLECTORS

Factory-fabricated and factory- or field-assembled units consisting of curved turning vanes for uniform air distribution and change of direction with minimum turbulence and pressure loss. Provide curved vanes for square elbows.

2.6 ACCESS DOORS

Door shall be rigid and airtight with neoprene gaskets and two or more galvanized steel hinges and quick fastening locking devices. Provide doors as large as practical. Mount doors, if possible, so that air pressure holds them closed.

2.7 DAMPERS

Construct dampers with galvanized sheet metal two gages heavier than ducts in which installed. Except as modified herein, the construction shall be of aluminum or galvanized steel with interlocking edges and maximum 10-inch blade width. Conform with SMACNA DCS. Dampers shall be opposed-blade type where indicated.

2.7.1 Backdraft Dampers (Gravity Dampers)

Factory-fabricated, with statically balanced blades that open automatically when the fan starts and close by gravity when the fan stops. Provide the edges of blades with felt or rubber strips to prevent rattling.

2.7.2 Manual Volume Dampers

Balancing, factory-fabricated type. Equip dampers with accessible mechanism such as quadrant operators or 3/16-inch rods brought through the side of ducts with locking setscrew and bushing. Where quadrant operators are furnished, provide chrome plated or enamel painted type with exposed edges rounded.

2.7.3 Motor Operated Dampers

2.7.3.1 Motor Operated Dampers

Motor operated dampers shall be ultra-low leak parallel blade type for 2 position operation. Frames shall be a combination of 16-gauge, formed galvanized steel channels, together with corner brackets riveted to channels to form a rigid unit. Blades shall be constructed of 16 gauge galvanized steel with extruded vinyl or Butyl rubber edge seals. Blades should not exceed 48 inches in length. Bearings shall be self-lubricating, machined nylon, molded Lexan or oilite. Jamb seals shall be compression type spring stainless steel formed for maximum blade edge contact to minimize leakage. Leakage through the closed damper shall be less than 0.5% at 4 inch WG pressure differential and 2000 FPM open damper approach velocity. All dampers shall be sized not to exceed 1500 FPM or 0.10 inch WG pressure drop.

2.7.3.2 Damper Motors

Damper motors shall be piston type electronic motors for 2-position automatic dampers. Motors shall be large enough to operate dampers positively, efficiently and smoothly. Positioners shall be furnished. Correct damper positioning shall be independent of bearing friction or air velocity forces. Damper motor springs shall be fully enclosed. Positioners shall be mounted external to the damper motor to facilitate maintenance, repair and adjustment. Damper motor shall open damper when powered and shall have spring return.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to NFPA 90A and SMACNA DCS. Provide mounting and supporting of ductwork and accessories including, but not limited to, structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors, and dampers. Provide electrical isolation between dissimilar metals. Electrical isolation may be fluorinated elastomers or sponge-rubber gaskets. Install ductwork accessories as indicated and as recommended by manufacturer's printed instruction. Allow clearance for inspection, repair, replacement, and service.

3.1.1 Ductwork

Air distribution systems shall operate with no chatter or vibration.

3.1.1.1 Field Changes to Ductwork

Those required to suit the sizes of factory-fabricated equipment actually furnished, shall be designed to minimize expansion and contraction. Use gradual transitions in field changes as well as modifications to connecting ducts.

3.1.1.2 Dampers

When installed on ducts to be thermally insulated, equip each damper operator with stand-off mounting brackets, bases, or adapters to provide clearance between the duct and operator not less than the thickness of insulation. Stand-off mounting items shall be integral with the operator or standard accessory of damper manufacturer.

3.1.1.3 Deflectors

Provide in square elbows, duct-mounted supply outlets, take-off or extension collars to supply outlets, and tap-in branch-off connections. Adjust supply outlets to provide air volume and distribution as indicated.

3.1.1.4 Access Doors

Provide for automatic dampers, volume dampers, fire dampers, coils, thermostats, temperature controllers, valves, filters, humidifiers and other concealed apparatus requiring service and inspection in the duct systems.

3.1.1.5 Duct Sleeves, Prepared Openings, and Closure Collars

Provide for ductwork penetrations in floors, walls, and partitions through which metallic ductwork passes.

a. Duct Sleeves: Fill space between duct and sleeve or between insulation and sleeve for insulated ducts with mineral fiber, except at grilles, registers, and diffusers.

b. Prepared Openings: Fill space between duct and opening or between insulation and opening for insulated ducts with mineral fiber, except at grilles, registers, and diffusers.

c. Closure Collars: Fit collars snugly around ducts or insulation. Grind edges of collar smooth to preclude tearing or puncturing insulation covering or vapor barrier. Provide nails with maximum 6-inch centers on collars.

3.1.1.6 Packing

Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber.

3.1.2 Duct Hangers and Supports

SMACNA DCS, Section 4. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable intermediate metal framing.

3.1.2.1 Flexible Connectors

Provide flexible connectors between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connectors by zinc-coated steel clinch-type draw-bands. For rectangular ducts, lock flexible connectors to metal collars.

3.1.3 Inspection Plates and Test Holes

Provide, where required, in ductwork or casings for all balance measurements. If possible, test holes should be located at least 7.5 times diameters downstream from a disturbance. Extend cap through insulation.

3.1.4 Flashing

Section 07600, "Flashing and Sheet Metal."

3.1.5 Cleaning of Ducts

Remove all debris and dirt from ducts and wipe clean. Before installing air outlets, force air through entire system at maximum attainable velocity to remove accumulated dust. Provide temporary air filters to protect ductwork which may be harmed by excessive dirt. For large systems, clean duct with high power vacuum machines.

3.2 FIELD QUALITY CONTROL

Administer and direct tests. Furnish instruments, equipment, connecting devices, and personnel for the tests. Notify Contracting Officer 10 days before inspection or testing is scheduled. Correct defects in work. Repeat tests until work is in compliance.

3.2.1 Air Duct Leakage Tests

Perform duct air leakage test in accordance with Section 15996, "Testing/Adjusting/Balancing: Heating/Ventilating/Cooling Systems."

-- End of Section --

SECTION 15996

TESTING/ADJUSTING/BALANCING: HEATING/VENTILATING/COOLING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	1989 National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning System

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.4 (ASA 47)	1983 Sound Level Meters
ANSI S1.11 (ASA 65)	1986 Octave- Band and Fractional-Octave-Band Analog and Digital Filters

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE HA	1991 Handbook, HVAC Applications

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MSV	1977 Measuring Sound and Vibration
NEBB TABES	1991 Testing, Adjusting, Balancing of Environmental Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA HVACADLTM	1988 HVAC Air Duct Leakage Test Manual
SMACNA HVACTAB	1983 HVAC Systems - Testing, Adjusting and Balancing

1.2 RELATED REQUIREMENTS

Perform work required by this section in accordance with the paragraph titled "Subcontractor Special Requirements" in SOUTHWESTNAVFACENGCOM regional Section 01011, Additional General Paragraphs.

1.3 DESCRIPTION OF WORK

The work includes testing, adjusting, and balancing (TAB) of new heating and ventilating air distribution systems including equipment and ducts

located within, on, and adjacent to buildings.

1.3.1 Air Distribution Systems

Systems shall be tested, adjusted, and balanced (TAB'd) in compliance with this section.

1.4 DEFINITIONS

a. DALT: Duct air leakage testing

b. DALT'd: Duct air leakage tested

c. Sound measurements terminology: Defined in AABC MN-1 or NEBB MSV.

d. TAB team supervisor: TAB team engineer.

e. TAB team technician: TAB team assistant.

f. Field check group: One or more systems of the same basic type; the subgroup of a "field check group" is a "system."

g. Out-of-tolerance data: Pertains only to field checking of certified DALT or TAB report. The term is defined as a measurement taken during field checking which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the certified DALT or TAB report for a specific parameter.

h. Season of maximum heating load: Time of year when outdoor ambient temperature at equipment installation site remains within following range throughout the period of data recording for TAB work. Indicated winter outdoor design dry bulb temperature plus 10 to minus 30 degrees Fahrenheit.

1.5 SUBMITTALS

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

1.5.1 SD-08, Statements

a. Independent TAB agency personnel qualifications

b. Design review report

c. Pre-field DALT preliminary notification

d. Pre-field TAB engineering report

e. Advanced notice for DALT field work

f. Advanced notice for Season 1 TAB field work

g. Check out list for Season 1

h. Final certified DALT report

1.5.1.1 Independent TAB Agency Personnel Qualifications

For either type of agency proposed for approval, submit information certifying that: The TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract; the work to be perform by the TAB agency shall be limited to testing, adjusting, and balancing of HVAC air and water systems to satisfy the requirements of this specification section.

Submit following for one of the two types of agencies to Contracting Officer for approval in compliance with Appendix B, "TAB Personnel Qualification Requirements."

a. Independent AABC or NEBB certified TAB agency:

(1) TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification.

(2) TAB team supervisor: Name and copy of AABC or NEBB TAB supervisor certificate and expiration date of current certification.

(3) TAB team field leader: Name and documented evidence that the team field leader meets the qualification requirements.

(4) TAB team field technicians: Names and documented evidence that each field technician meets the qualification requirements.

(5) Current certificates: Registrations and certifications shall be current, and valid for the duration of this contract. Certifications which expire prior to completion of the TAB work, shall be renewed in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification shall not perform TAB work on this contract.

b. Independent experienced TAB agency:

(1) Duration of agency experience: Documented evidence verifying that the agency meets the qualification requirements.

(2) Type of agency experience: Documented evidence of acceptable completion of TAB work which meet the qualification requirements. Submitted evidence shall include:

(a) Reports: The complete TAB reports accepted by the owner or owner's representative for each system offered as experience. Project TAB report forms with formats other than AABC or NEBB forms may be acceptable if on review by the Contracting Officer, the reports are found to include reporting of HVAC system parameters to the extent

required by AABC or NEBB TAB report forms.

(b) Locations: Name and address of building in which each system is located. Name and telephone number of the present maintenance manager of each system. This information will be used to evaluate the actual results in the field of the TAB work offered as experience, and will be considered by the Contracting Officer in approving or disapproving the subject submittal.

(3) P.E. Endorsements: Letters of endorsement from three registered Professional Engineers (P.E.) versed in the field of HVAC design and construction and who are legally independent of the TAB agency. These endorsements shall have been written no more than 3 years prior to this contract's bid opening date. The letters shall endorse the TAB agency. Letters of endorsement of an individual, who is currently a full-time employee of the TAB agency, will not be acceptable as the agency endorsements. Additionally, each endorsement shall include the endorser's typed name, his signature, the typed date of his signature, and the imprint of his registered P.E. seal.

(4) Instruments List: A list of instruments owned by the agency, with the following information detailed for each instrument: manufacturer's name and model number, serial number, and last calibration date.

(5) TAB team supervisor: Name and documented evidence that supervisor meets the qualification requirements.

(6) TAB Team field leader: Name and documented evidence that leader meets the qualification requirements.

(7) TAB team field technicians: Names and documented evidence that each technician meets the qualification requirements.

c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.5.1.2 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.5.1.3 Pre-Field DALT Preliminary Notification

a. Notification: On completion of the duct installation for each system, the Contractor shall notify the Contracting Officer in writing within 5 days after completion.

b. Duct testing: The Contracting Officer shall randomly select sections of the completed duct system for testing by the Contractor. The sections selected shall not exceed more that 20 percent of the total measured linear footage of supply, return, exhaust or plenum duct length. Sections of main ducts, branch main ducts, branch ducts and plenums are subject to testing. From time of receipt of the Contractor's notification of system completion, the Contracting Officer shall provide the Contractor within 7 working days selected locations of duct sections which are to be tested.

c. DALT testing: All DALT testing shall be in accordance with SMACNA HVACADLTM.

1.5.1.4 Pre-Field TAB Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

(1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.

(2) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit AABC or NEBB or SMACNA HVACTAB data report forms with the following pre-field information filled in:

(1) Design data obtained from system drawings, specifications, and approved submittals.

(2) Notations detailing additional data to be obtained from the contract site by the TAB field team.

(3) Designate the actual data to be measured in the TAB field work.

(4) Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. The instrument key number shall be placed in the blank space where the measured data would be entered.

c. Prerequisite HVAC work checkout list: A list of inspections and work items which are to be completed by the Contractor, and submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site. At a minimum, a list of the applicable inspections and work items listed in the NEBB TABES, Section III, "Preliminary TAB Procedures" under paragraph titled, "Air Distribution System Inspection." Also, list as prerequisite work items, the deficiencies pointed out by the TAB engineer in his design review report.

1.5.1.5 Advanced Notices

a. Submit "Advanced Notice for DALT Field Work" in writing.

b. Submit "Advanced Notice for Season 1 TAB Field Work" in writing.

c. Pre-field DALT preliminary notification.

1.5.1.6 Completed Check Out List

a. Check out list for Season 1

Submit "Prerequisite HVAC Work Checkout List" and certify in writing that each item has been checked and is operating as designed.

1.5.2 SD-12, Field Test Reports

a. Certified DALT report

b. Certified TAB report

Submit certified reports in the specified format including the above data.

1.5.2.1 Certified DALT Report

a. Report format: Submit report data on Air Duct Leakage Test Summary Report Forms as shown on Page 6-2 of SMACNA HVACADLTM. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section. The report shall be reviewed and certified by the TAB supervisor.

b. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

c. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

1.5.2.2 Certified TAB Reports

Submit Certified TAB Report for Season 1 in the following manner:

a. Report format: Submit the completed pre-field data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed and certified by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.

b. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded.

c. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

d. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

1.6 QUALITY ASSURANCE

1.6.1 Modifications of References

Accomplish work in accordance with referenced publications of AABC or NEBB except as modified by this section. In the references referred to herein, consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may" wherever they appear. Interpret reference to the "authority having jurisdiction," the "Administrative Authority," the "Owner," or the "Design Engineer" to mean the "Contracting Officer."

1.6.2 Responsibilities

The Contractor shall be responsible for ensuring compliance with the requirements of this section. The following delineation of specific work responsibilities is specified to facilitate execution of the various work efforts by personnel from separate organizations. This breakdown of specific duties is specified to facilitate adherence to the schedule listed in Appendix A.

1.6.2.1 Contractor

a. TAB personnel: Ensure that the DALT work and the TAB work is accomplished by either of the following groups provided they meet the applicable requirements specified in Appendix B.

(1) Independent AABC or NEBB certified TAB agency

(2) Independent experienced TAB agency

b. Pre-DALT/TAB meeting: Attend the meeting with the TAB Supervisor, and ensure that a representative is present for the sheetmetal contractor, mechanical contractor, electrical contractor, and automatic temperature controls contractor.

c. HVAC documentation: Furnish one complete set of the following HVAC-related documentation to the TAB Agency:

(1) Contract drawings and specifications

(2) Approved submittal data for equipment

(3) Construction work schedule

(4) Up-to-date revisions and change orders for the previously listed items

d. Submittal and work schedules: Ensure that the schedule for submittals and work required by this section and specified in Appendix A, is met.

e. Coordination of supporting personnel: Provide the technical personnel, such as factory representatives or HVAC controls installer required by the TAB field team to support the DALT and TAB field measurement work. Provide equipment mechanics to operate HVAC equipment to enable TAB field team to accomplish the DALT and TAB field measurement work. Ensure these support personnel are present at the times required by the TAB team, and cause no delay in the DALT and TAB field work. Conversely, ensure that the HVAC controls installer has required support from the TAB team field leader to complete the controls check out.

f. Deficiencies: Ensure that equipment defects, installation deficiencies, and design deficiencies reported by the TAB team field leader are brought to the attention of the Contracting Officer. Ensure that design deficiencies reported by the TAB field leader, or the TAB team supervisor, are transmitted to the Contracting Officer within 4 calendar days from date of receipt from the TAB agency.

g. Prerequisite HVAC work: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report. List as prerequisite work items, the deficiencies, pointed out by the TAB team supervisor in the design review report. Ensure that the TAB Agency gets a copy of the prerequisite HVAC work checklist specified in the paragraph entitled, "Submittals." Do not allow the TAB team to commence TAB field work until all of the following

are completed.

(1) HVAC system installations are fully complete.

(2) HVAC prerequisite checkout work lists have been completed, submitted, and approved.

(3) DALT field checks for all systems are completed.

(4) HVAC system filters are clean for Season 1 TAB field work.

h. Advance notice: Furnish to the Contracting Officer with advance written notice for each event, the commencement of the DALT field work and for the commencement of the TAB field work.

1.6.2.2 TAB Agency

Provide the services of a TAB team which complies with the requirements of Appendix B.

1.6.2.3 TAB Team Supervisor

a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.

b. Pre-DALT/TAB meeting: Attend meeting with Contractor.

c. Design review report: Review project specifications and accompanying drawings to verify that the air systems and water systems are designed in such a way that the TAB engineer can accomplish the work in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including flow control devices and manual volume dampers.

d. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the pre-field engineering report, the pre-field DALT plan or during the DALT or TAB field work.

e. Pre-field DALT preliminary notification: Monitor the completion of the duct installation of each system and provide the necessary written notification to the Contracting Officer.

f. Pre-field engineering report: Utilizing the following HVAC-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.

g. Prerequisite HVAC work checklist: Ensure the Contractor gets a

copy of this checklist at the same time as the pre-field engineering report is submitted.

h. Technical assistance for DALT work

(1) Technical assistance: Provide immediate technical assistance to TAB field team.

(2) DALT field visit: Near the end of the DALT field work effort, visit the contract site to inspect the HVAC installation and the progress of the DALT field work. Conduct a site visit to the extent necessary to verify correct procedures are being implemented and to confirm the accuracy of the pre-final DALT Report data which has been reported. Also, sufficient evaluation shall be made to allow the TAB supervisor to issue certification of the final report.

i. Certified DALT report: Certify the DALT report. This certification includes the following work:

(1) Review: Review the DALT Pre-final report data. From these field reports, prepare the certified DALT report.

(2) Verification: Verify adherence, by the TAB field team, to the procedures specified in this section.

j. Technical Assistance for TAB Work: Provide immediate technical assistance to the TAB field team for the TAB work.

(1) TAB field visit: Near the end of the TAB field work effort, visit the contract site to inspect the HVAC installation and the progress of the TAB field work. Conduct site visit full-time for a minimum of one 8-hour workday duration. Review the TAB final report data and certify the TAB final report.

k. Certified TAB report: Certify the TAB report. This certification includes the following work:

(1) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.

(2) Verification: Verify adherence, by the TAB field team, to the TAB plan prescribed by the pre-field engineering report and verify adherence to the procedures specified in this section.

l. Design deficiencies: Submit in writing as soon as possible, to the Contractor and the Contracting Officer, each design deficiency reported by the TAB field team. Provide, in this submittal, a complete explanation including supporting documentation detailing the deficiency.

m. TAB Field Check: The TAB team supervisor shall attend and supervise Season 1 TAB field check.

1.6.2.4 TAB Team Field Leader

a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution".

b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.

c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC Checklist, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

1.7 PRE-DALT/TAB MEETING

Meet with the Contracting Officer's TAB representative to develop a mutual understanding relative to the details of the DALT work and TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 DALT PROCEDURES

3.1.1 DALT Field Work

Leak test the HVAC air ducts and sections of each system as selected by the Contracting Officer. Accomplish leak tests in accordance with SMACNA HVACADLTM, except as modified by this section. Use the duct class, seal class, leakage class and the leak test pressure data indicated on the drawings, to comply with the procedures specified in SMACNA HVACADLTM. Provide instruments and consumables required to accomplish the DALT field work. Follow the same basic, procedure specified below in paragraph "TAB Field Work," which include maintenance of and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship and treatment of deficiencies. DALT field work shall be monitored by the QC representative. If any of the duct sections selected by the Government for testing exceed the leakage class during testing, an additional duct section shall be tested at no cost to the Government for each test section that fails initial testing.

3.1.2 Data From DALT Field Work

After completion of the DALT work, prepare a pre-final DALT report using the reporting forms specified. Data required by those data report forms shall be furnished by the TAB team. Prepare the report neatly and legibly; the pre-final DALT report shall be the final DALT report minus the

TAB supervisor's review and certification. Verbally notify the Contracting Officer's TAB representative that the field check of the pre-final DALT report data can commence; give this verbal notice 48 hours in advance of when the field checking shall commence.

3.1.3 Quality Assurance for DALT Field Work

a. Field Check

(1) Pre-final DALT report data: Field check for accuracy, in the presence of the Contracting Officer's TAB representative, the pre-final DALT report data for each system. The TAB team field leader shall be present full-time when the field check of 50 percent of the duct sections for each duct system reported shall be conducted. Pre-final report field checks may be conducted separately for each system to allow phased testing.

(2) Additional system field check: If any data on the DALT report form for a given duct section is out-of-tolerance, then data for one more duct section will be checked. The additional duct section to be checked shall be in addition to the original 50 percent of duct sections to be checked.

(3) Out-of-tolerance: If any of the duct sections checked for a given system are determined to be out-of-tolerance, testing shall be terminated and the pre-final DALT report data for the given system shall be disapproved.

b. Additional field checks: If during the random field checks of the pre-final DALT report data is determined to be out-of-tolerance, the Contractor shall make the necessary corrections and prepare a revised pre-final DALTS report. A field check of the revised report data shall then be rescheduled with the Contracting Officer's TAB representative.

c. Final certified DALT report: On successful completion of all field checks of the pre-final DALT report data for all systems, the TABS Supervisor shall assemble, review, certify and submit the final certified DALT Report.

d. Prerequisite to TAB Field Work: Upon completion of DALT work, field check and correction of outstanding items, including additional field checks, submit the final certified DALT report for Contracting Officer approval. No TAB field work shall commence prior to the completion and approval, for all systems, of the pre-final DALT report field check.

3.2 TAB PROCEDURES

3.2.1 TAB Field Work

Test, adjust, and balance the listed HVAC systems to the state of operation indicated on and specified in the contract design documents. Air systems shall be proportionately balanced and reported in the Season 1

certified TAB report. Only airflow report data which would be affected in terms of accuracy due to outside ambient conditions shall be deferred and reported in the Season 2 certified TAB report. Provide instruments and consumables required to accomplish the TAB work. Conduct TAB work, including sound measurement work, on the listed HVAC systems in conformance with the AABC MN-1, or NEBB TABES, and NEBB MSV, except as modified by this section:

a. Maintenance and calibration of instruments.

b. Accuracy of measurements.

c. Preliminary procedures: Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. Test ports required for testing by the TAB engineer shall be located in the field by the TAB engineer during TAB field work. It shall be the responsibility of the sheetmetal contractor to provide and install test ports as required by the TAB engineer.

d. Air distribution systems TAB work:

(1) Heating and ventilating systems including fans (heating and ventilating unit fans, exhaust fans and winter ventilation fans), coils, ducts, and air distribution devices for supply air, and outside air.

(2) Vapor exhaust fan system including fan, ducts, and tank intakes for exhaust air.

[(3) Unit heaters.]

f. Sound measurement work:

(1) Areas to be sound measured: Measure and record the sound power level for each octave band listed in ASHRAE HA.

(2) Procedure: At the time the sound level is measured, each room shall be unoccupied, except for TAB team, and all HVAC systems that would cause noise in the room shall be operating in their noisiest mode. Record the sound level (dB) in each octave band. Attempt to mitigate the sound level and bring the level to within the specified ASHRAE HA goals, if such mitigation is within the TAB team's control. If sound level cannot be brought into compliance, provide written notice of the deficiency to the Contractor for resolution or correction.

(3) Timing: Sound levels shall be measured at times prescribed by AABC or NEBB.

(4) Meters: Measure sound levels with a sound meter complying with ANSI S1.4 (ASA 47), Type 1 or 2, and an octave band filter set complying with ANSI S1.11 (ASA 65). Measurement methods for overall sound levels and for octave band sound levels shall be as prescribed by NEBB.

(5) Calibration: Sound levels shall be calibrated as prescribed by AABC or NEBB except that calibrators emitting a sound pressure level tone of 94 dB at 1000 hertz (Hz) are also acceptable.

(6) Background noise correction: Determine background noise component of room sound (noise) levels for each (of eight) octave bands as prescribed by AABC or NEBB.

g. TAB work within seasonal limitations:

(1) Season of maximum load: Visit the contract site for at least one TAB work sessions for TAB field measurements. Visit the contract site during the season of maximum heating load, the goal being to TAB the operational performance of the heating systems under the maximum outdoor environment-caused loading. During the seasonal limitations, TAB the operational performance of the heating systems.

(2) Sound measurements within seasonal limitations: Comply with paragraph titled, "Sound Measurement Work," specifically, the requirement that a room must be operating in its noisiest mode at the time of sound measurements in the room. The maximum noise level measurements could depend on seasonally related heat or cooling transfer equipment.

(3) Ambient temperatures: On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. That is, record these temperatures at beginning and at the end of data taking.

h. Workmanship: Conduct TAB work on specified HVAC systems until measured parameters are within plus or minus 10 percent of the design values, that is, the values specified or indicated on the contract documents.

i. Deficiencies: Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled, "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction. Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.2.2 Data From TAB Field Work

After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and certification, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph titled, "Workmanship".

3.2.3 Quality Assurance For TAB Field Work

a. Field check: Test shall be made to demonstrate that capacities and general performance of air systems comply with the contract requirements.

(1) Recheck: During field check, the Contractor shall recheck, in the presence of the Contracting Officer, random selections of data (air quantities, air motion, sound level readings) recorded in the certified report.

(2) Areas of recheck: Points and areas of recheck shall be selected by the Contracting Officer.

(3) Procedures: Measurement and test procedures shall be the same as approved for work for forming basis of the certified report.

(4) Recheck selections: Selections for recheck will not exceed 25 percent of the total number of reported data entries tabulated in the report.

b. Retests: If random tests reveals a measured quantity which is out-of-tolerance, the report is subject to disapproval at the Contracting Officers discretion. In the event the report is disapproved, all systems shall be readjusted and tested, new data recorded, new certified reports submitted, and a new field check conducted at no additional cost to the Government.

c. Approval prerequisite: Compliance with the field checking requirements of this section is a prerequisite to the final approval of the certified TAB report submitted.

3.3 MARKING OF SETTINGS

Permanently mark the settings of HVAC adjustment devices including splitters, and dampers so that adjustment can be restored if disturbed at any time. The permanent markings shall indicate the settings on the adjustment devices which result in the data reported on the submitted certified TAB report.

3.4 MARKING OF TEST PORTS

The TAB team shall permanently and legibly mark and identify the location points of the duct test ports. The location of test ports shall be shown on the as-built mechanical drawings.

-- End of Section --

APPENDIX A

TAB SUBMITTAL AND WORK SCHEDULE

NOTE: Compliance with the following schedule is the Contractor's responsibility.

1. Qualify TAB Personnel: Within 45 calendar days after date of contract award, submit TAB agency and personnel qualifications.

2. Pre-DALT/TAB Meeting: Within 30 calendar days after the date of approval of the TAB agency and personnel, meet with the Contracting Officer's TAB representative.

3. Design Review Report: Within 60 calendar days after the date of the TAB agency personnel qualifications approval, submit design review report.

4. [Pre-Field DALT Preliminary Notification: On completion of the duct installation for each system, the Contractor shall notify the Contracting Officer in writing within 5 days after completion.]

5. Pre-Field TAB Engineering Report: Within 30 calendar days after approval of the TAB Agency Personnel Qualifications, submit the Pre-Field TAB Engineering Report.

6. Notice of DALT Field Work: At a minimum of 14 calendar days prior to commencement of the DALT work, submit the written advanced notice of DALT field work.

7. DALT Field Work: Accomplish DALT field work.

8. Submit Pre-final DALT Report: Within one working day after completion of DALT field work, submit pre-final DALT report. Separate pre-final DALT reports may be submitted to allow phased testing from system to system.

9. DALT Work Field Check: 48 hours after verbal notification of DALT work completion, the field check shall commence.

10. Checklist and Notice of TAB Work: At a minimum of 90 calendar days prior to CCD, submit prerequisite HVAC work checklist certified as complete, and submit advance notice of commencement of TAB field work.

11. TAB Field Work: At a minimum of 30 calendar days prior to CCD, and when the ambient temperature is within Season limits, accomplish TAB field work; submit certified TAB report; and conduct field check.

12. Complete TAB Work: Prior to CCD, complete all TAB work.

APPENDIX B

TAB PERSONNEL QUALIFICATION REQUIREMENTS

1. Independent AABC or NEBB Certified TAB Agency: Provide services of a TAB agency certified by AABC or NEBB to perform and manage TAB work on HVAC air and water systems. This TAB agency shall not be affiliated with any company participating in any other phase of this contract, including design, furnishing equipment, or construction.

1.1 TAB Team Personnel: The TAB team approved to accomplish work on this contract shall be full-time employees of the TAB agency. No other personnel shall do TAB work on this contract.

a. TAB Team Supervisor: Supervisor shall be qualified by AABC or NEBB as a TAB supervisor or a TAB engineer.

b. TAB Team Field Leader: Leader shall have satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

c. TAB Team Field Technician: Technician shall have satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

2. Independent Experienced Agency: In lieu of the services of an independent AABC or NEBB certified TAB agency, provide services of a qualified independent experienced TAB agency to perform and manage TAB work on HVAC air and water systems. The TAB agency shall not be affiliated with any company participating in any other project phase, including design, furnishing equipment, or construction.

2.1 Duration of Experience: The TAB agency shall have been in business satisfactorily performing TAB work in the field for not less than 3 years immediately preceding bid opening date for this contract; this TAB work shall have been overall supervision and management of project TAB work. A successor agency is permitted to utilize the experience of the predecessor agency.

2.2 Type of Agency Experience: The TAB agency shall have acceptably completed TAB work for three HVAC systems of equivalent design, capacity, complexity, and size to this project's system. Each system shall have been owned by a different owner. This TAB work shall have been overall supervision and management of the project TAB work in the field. The subject TAB work shall have been acceptably completed prior to the bid opening date for this contract.

2.3 Professional Engineer Endorsements: The TAB Agency shall be endorsed by three registered Professional Engineers (P.E.).

2.4 Instruments: The type and number of TAB instruments shall meet the minimum requirements specified in AABC MN-1 or NEBB TABES and NEBB MSV.

2.5 TAB Team Personnel: The TAB team approved to accomplish work on this contract shall be full-time employees of the TAB agency. No other personnel shall do TAB work on this contract.

a. TAB Team Supervisor: Comply with the following requirements:

(1) Supervisory Experience: Satisfactory performance of overall supervision and management of TAB work for not less than 3 years immediately preceding this contract's bid opening date.

(2) Non-supervisory Experience: In addition to the preceding requirement, the supervisor must have one of the following:

(a) College Degree and HVAC Experience: An engineering degree (from a 4 year college program) and a minimum of 4 additional years of experience in either HVAC system installation work, HVAC design work, or HVAC TAB field work.

(b) HVAC Experience: A minimum of 6 years of TAB field work experience (not including apprenticeship experience) and a minimum of 4 additional years of experience in either HVAC system installation work or HVAC TAB field work.

b. TAB Team Field Leader: Leader shall have satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

c. TAB Team Field Technician: Technician shall have satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

SECTION 16011

ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY (Not Used)

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	1990 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 Designation Plates)

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

IEEE 100	1988 Dictionary of Electrical and Electronics Terms, Fourth Edition

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	1988 (Rev. 1) Enclosures for Industrial Control and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code

1.3 RELATED REQUIREMENTS

This section applies to certain sections of Division 11, "Equipment". 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 SUBMITTALS

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

1.5.1 Manufacturer's Catalog Data

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

1.5.2 Drawings

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

1.5.3 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.

1.5.4 Certificates

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

1.5.4.1 Reference Standard Compliance

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

1.5.4.2 Independent Testing Organization Certificate

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

1.5.5 Operation and Maintenance Manuals

Comply with the requirements of Section 01730 and the technical sections.

1.5.5.1 Operating Instructions

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

1.6 QUALITY ASSURANCE

1.6.1 Material and Equipment Qualifications

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

1.6.2 Regulatory Requirements

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

1.6.3 Alternative Qualifications

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

1.6.4 Service Support

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.5 Manufacturer's Nameplate

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

1.6.6 Modification of References

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

1.7 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The

operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

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.

1.8 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.

1.9 ELECTRICAL REQUIREMENTS

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

1.9.1 Motors and Equipment

Provide motors, controllers, and contactors with their respective pieces of equipment. Motors, controllers, and contactors shall conform to Section 16402, "Interior Wiring Systems". Extended voltage range motors shall not be permitted. Control voltage for controllers and contactors shall not exceed 120 volts nominal. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. As an exception to these requirements, provide disconnect switches, contactors, and controllers for existing motor-operated equipment under Section 16402, "Interior Wiring Systems."

1.9.2 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. 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.

1.10 INSTRUCTION TO GOVERNMENT PERSONNEL

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

1.11 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, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical sections.

3.1.2 Field Applied

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09900, "Painting."

3.2 NAMEPLATE MOUNTING

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

3.3 WARNING SIGN MOUNTING

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

-- End of Section --

SECTION 16370

OVERHEAD ELECTRICAL WORK

PART 1 GENERAL

1.1 SUMMARY (Not Used)

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
ANSI C12.4	1984 (R 1990) Mechanical Demand Registers
ANSI C12.10	1987 Electromechanical Watthour Meters
ANSI C12.11	1987 Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV (0.6 kV NSV Through 69 kV NSV)
ANSI C29.2	1983 Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type
ANSI C29.3	1986 Wet Process Porcelain Insulators - Spool Type
ANSI C29.4	1989 Wet-Process Porcelain Insulators - Strain Type
ANSI C29.5	1984 Wet-Process Porcelain Insulators - Low- and Medium-Voltage Types
ANSI C57.12.20	1988 Transformers - Overhead-Type Distribution Transformers, 500 kVA and Smaller: High-Voltage, 34,500 Volts and Below; Low-Voltage, 7970/13 800Y Volts and Below
ANSI O5.1	1987 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 1	1990 Hard-Drawn Copper Wire
ASTM B 2	1988 Medium-Hard-Drawn Copper Wire
ASTM B 3	1990 Soft or Annealed Copper Wire
ASTM B 8	1990 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 228	1988 Concentric-Lay- Stranded Copper-Clad Steel Conductors
ASTM B 231	1990 Concentric-Lay- Stranded Aluminum 1350 Conductors
ASTM B 232	1990 Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR)
ASTM B 397	1985 Concentric-Lay- Stranded Aluminum-Alloy 5005-H19 Conductors
ASTM B 399	1992 Concentric-Lay- Stranded Aluminum-Alloy 6201-T81 Conductors

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C1	1990 All Timber Products - Pressure Treatment
AWPA C4	1990 Poles, Pressure Treatment
AWPA C25	1989 Crossarms, Pressure Treatment

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	1987 Thermoplastic and Crosslinked Polyethylene Insulated Shielded Power Cable Rated 5 Through 35 kV
AEIC CS6	1987 (R 1989) Ethylene Propylene Rubber Insulated Shielded Power Cable Rated 5 Through 69 kV

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

IEEE 48	1990 High-Voltage Alternating-Current Cable Terminations
ANSI/IEEE C37.30	Draft 1989 Definitions and Requirements

	for High-Voltage Air Switches, Insulators, and Bus Supports
ANSI/IEEE C57.12.00	1987 Liquid-Immersed Distribution, Power, and Regulating Transformers
ANSI/IEEE C57.12.90	1987 Liquid-Immersed Distribution, Power, and Regulating Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers
ANSI/IEEE C57.13	1978 (R 1987) Instrument Transformers
ANSI/IEEE C57.98	1986 Guide for Transformer Impulse Tests
IEEE C62.1	1989 Gapped Silicon-Carbide Surge Arresters for AC Power Circuits
ANSI/IEEE C62.11	1987 Metal-Oxide Surge Arrestors for AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC 5	1973 (R 1989) (Rev. 1-14) Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 7	1988 Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	1988 Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

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 Timbers and Pole Keys (DT-5B:PE-16)

REA 50-18	1987 REA Specification for Wood Poles, Stubs, and Anchor Logs

UNDERWRITERS LABORATORIES INC. (UL)

UL 6	1981 (R 1991) Rigid Metal Conduit
UL 83	1991 (R 1991) (Bul. 1992) Thermoplastic-Insulated Wires and Cables
UL 414	1986 (Bul. 1987) (R 1990) Meter Sockets
UL 510	1986 (R 1990) Insulating Tape
UL 854	1991 (R 1992) (Bul. 1992) Service-Entrance Cables

1.3 RELATED REQUIREMENTS

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

1.4 OVERHEAD SERVICE

Terminate overhead service conductors into buildings at service entrance fittings or weatherhead outside building. Installation and connection of service entrance equipment to overhead service conductor is included in Section 16402, "Interior Wiring Systems." Nearby support bracket for overhead wires shall be not less than 10 feet above finished grade at building.

1.5 SUBMITTALS

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

1.5.1 SD-01, Data

a. Calculations

1.5.1.1 Transformer Loss Calculations

Submit transformer loss calculations as required by paragraph titled "Transformer Losses."

1.5.2 SD-02, Manufacturer's Catalog Data

a. Conductors

b. Insulators

c. Pole top switch

d. Recloser

e. Sectionalizer

f. Cutouts

g. Transformer

h. Metering equipment

i. Meters

j. Surge arresters

k. Guy strand

l. Anchors

1.5.3 SD-08, Statements

a. Qualifications of cable splicer

Submit cable splicer's certificate of competency as specified in paragraph titled "Cable Splicer Certification."

1.5.4 SD-10, Test Reports

a. Wood poles

b. Wood Crossarms

Furnish an inspection report from an independent inspection agency, approved by the Contracting Officer, 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.

1.5.5 SD-11, Factory Test Reports

a. Transformer tests

1.5.5.1 Transformer Tests

Submit certified copies of the following ANSI/IEEE C57.12.00 and ANSI/IEEE C57.12.90 transformer tests. Tests shall be performed on the actual transformer prepared for this project. Submit test reports, by serial number, for the following tests and receive approval before delivery of equipment to the project site.

a. Resistance measurements

b. Ratio.

c. Polarity and phase relation.

d. No-load losses (NLL) and excitation current.

e. Impedance voltage and load loss (LL)

f. Low frequency dielectric

g. Leak

h. Pressure

i. Lightning impulse Test

(1) ANSI/IEEE C57.12.90, and ANSI/IEEE C57.98.

(2) State test voltage levels.

(3) Submit photo copies of output wave shapes.

1.5.6 SD-12, Field Test Reports

a. Ground rod tests

b. High voltage cable test

c. Transformer field tests

d. Large overhead systems test

1.5.7 SD-13, Certificates

a. Submit manufacturer's certificate that each transformer contains less than 1 ppm of PCB at shipment for this contract.

b. Design and Other Tests

1.5.7.1 Design and Other Tests

Performed on prototype transformer of the same construction, kVA size, and voltage class as the transformer provided for this project, will be acceptable. All tests shall have been performed on the same transformer. Submit certified copies of test reports with catalog cuts and shop drawings.

a. Temperature rise

b. Lightning impulse dielectric

(1) ANSI/IEEE C57.12.90 and ANSI/IEEE C57.98

(2) State test voltage levels

(3) Submit photo copies of output wave shapes

c. Audible sound level

d. Short circuit

1.5.8 SD-18, Records

a. Transformer test schedule

1.5.8.1 Source Quality Control

Provide transformer test schedule for tests to be performed and submit required reports. Notify Contracting Officer 15 calendar days in advance of changes to scheduled dates and location for testing.

1.6 QUALITY ASSURANCE

1.6.1 Modification of References

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

1.6.2 Cable Splicer Certification

Submit for approval, 30 days before splices or terminations are to be made in cables rated 5 to 34.5 kV the qualifications of cable splicer. The certification shall include the training, and experience of the individual on the specific type and classification of cable to be provided under this contract. The certification shall indicate that the individual has had three or more years recent experience splicing and terminating 5 to 34.5 kV cables. The certification shall also list a minimum of three splices/terminations that have been in operation for more than one year. In addition, the individual may be required to perform a dummy or practice splice/termination in the presence of the Contracting Officer, before being approved as a qualified cable splicer. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables alone with the approved type of splice/termination kit, and detailed manufacturer's instructions for the cable to be spliced. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for certification of an alternate cable splicer.

1.7 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.

1.8 SCHEDULING

Notify the Contracting Officer 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 pentachlorophenol, 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

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 30-inch span with 10-foot crossarms.

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 kV.

b. Spool Insulators: ANSI C29.3, Class 15 kV.

c. Guy Strain Insulators: ANSI C29.4, Class 15 kV.

2.6 OVERHEAD CONDUCTORS

Conductors of bare copper of sizes and types indicated.

2.6.1 Solid Copper

ASTM B 1, ASTM B 2, and ASTM B 3, hard-drawn, medium-hard-drawn, and soft-drawn, respectively. ASTM B 8, stranded.

2.6.2 Copper-Clad Steel

ASTM B 228.

2.7 SECONDARY-SERVICE CONDUCTORS

Service conductors shall be copper, triplex with 600-volt THWN insulation on the phase wires. Neutral shall be bare hard drawn copper messenger. Minimum size shall be No. 2 AWG stranded unless otherwise indicated. Minimum size shall be No. 4 AWG. Conductors shall conform to NEMA WC 5 for THWN insulation.

2.8 GUY STRAND

ASTM A 475, high-strength, Class A or B, galvanized strand steel cable. Guy strand type and size shall be 3-bolt clamp guy terminations designed for use with the particular strand and developing at least the ultimate breaking strength of the strand.

2.9 ROUND GUY GUARDS

Vinyl or PVC material, yellow colored, 8 feet long and shatter resistant at sub-zero temperatures.

2.9.1 Guy Attachment

Thimble eye guy attachment with a lift plate on the down side.

2.10 ANCHORS AND ANCHOR RODS

Anchors shall be screw anchors presenting holding area indicated on drawings as a minimum. Anchor rods shall be thimble-eye, 3/4 inch diameter by 8 feet long. Anchors and anchor rods shall be hot dip galvanized.

2.10.1 Screw Anchors

Screw type anchors having a manufacturer's rating at least equal to rating indicated and extra heavy pipe rods conforming to ASTM A 53, Schedule 80, and couplings conforming to ASME B16.11, fitting Class 6000.

2.11 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.

2.11.1 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.

2.12 SURGE ARRESTERS

ANSI/IEEE C62.11, metal oxide surge arresters arranged for crossarm mounting. Rms rating shall be 15 kV. Front of wave sparkover shall be 15 kV or less. Discharge voltage of 10 ka shall be 14 kV or less.

2.13 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 fuses and fuse cutouts are not acceptable.

2.14 CONDUIT RISERS AND CONDUCTORS

Rigid galvanized steel conduit conforming to UL 6.

2.14.1 Secondary Riser

600-volt secondary riser conductors shall be copper, THWN conforming to UL 83.

2.14.2 Primary Riser

Primary riser conductors for 12.47 kV distribution system shall be cross linked thermosetting polyethylene insulated cable conforming to NEMA WC 7, as applicable and AEIC CS5. Cable shall be single conductor, employing stranded copper conductors. Cable shall have copper conductor and insulation shielding. Provide insulation shielding of metal tape consisting of a concentric serving of tape in accordance with NEMA WC 7. Provide cable rated 15 kV with insulation and jacket thickness of .175 and .080 mils, respectively. Provide cable with a polyvinyl chloride jacket.

2.15 CABLE TERMINATIONS

2.15.1 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.

2.16 TRANSFORMER (POLE TYPE)

ANSI C57.12.20 self-cooled, 65 degrees C continuous temperature rise, mineral oil-immersed type. Transformers shall be single phase, conventional type units and have kVA ratings as indicated. Basic impulse level (BIL) shall be 95 Kv. Transformer primary connection shall be phase to phase. Transformers indicated for three phase connection shall be rated

14.47 volts primary and 480 secondary and shall contain 2 high voltage busings(s). Transformers shall be connected delta on the primary and grounded wye on the secondary for 480 volt, three-phase, 4 wire service. Minimum impedance shall be 2 percent. Transformers shall have four 2 1/2 percent full rated kVA high voltage taps, two above and two below rated kVA high voltage. Transformer tank finish coat shall be light gray, ANSI color No. 70. Clearly show the transformer's kVA capacity using 2 1/2-inch Arabic numerals placed near the low-voltage bushing.

2.16.1 Transformer Losses

A = [_____]; B = [_____]; C = $[_____]

Deduct Clause: After factory test results are available as provided under paragraph entitled "SD-11, Factory Test Reports." Contractor shall calculate actual transformer losses (D) using test result values for NLL and LL and values specified above for A and B. Calculate using equation D = A(NLL) = B(LL).

a. If D $\leq$ 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.

2.17 POLE TOP SWITCH

Pole top switch shall be vertical type switches, three-pole gang operated, with a padlock arrangement for locking in both open and closed positions. Steel parts shall be hot-dip galvanized. Operating rods shall be isolated from the switch by an insulating link or section located as close to the switch as possible. Switch shall comply with ANSI/IEEE C37.30 for voltage and current requirements indicated.

2.18 METERING EQUIPMENT

Building mounted metering equipment shall include current transformers, potential transformers, kwh meter, meter test switch block, metering enclosure, wire, conduit and fittings.

2.18.1 Potential Transformers

Potential transformers shall be rated for outdoor service fitted for crossarm mounting and secondary connection box for conduit connection. Voltage rating shall be 600 V to 120 volts ac 60 Hz. Transformers shall conform to the requirements of ANSI C12.11 and ANSI/IEEE C57.13 BIL 45 kV and accuracy Class 0.3 (min.) of 75 VA.

2.18.2 Current Transformers

Current transformers shall be rated for outdoor service with crossarm mounting and secondary connection box for conduit connection. Voltage rating shall be 600 V. Current rating shall be 300 to 5 amperes. Transformers shall conform to requirements of ANSI C12.11 and ANSI/IEEE C57.13, BIL 95 kV and accuracy Class 0.3 at 50 VA.

2.18.3 Watthour Meter

UL 414 socket type, three element, 120 volts, 2 1/2 amperes, 60 Hz with a five dial kWh register. Register ratio shall be selected to provide a meter reading multiplier of even hundreds after applying the product of indicated current transformer ratio and indicated potential transformer ratio. Indicate meter reading multiplier on the meter face. Meters shall comply with ANSI C12.10 form 5S. Provide block interval demand element type for 15 minute interval with dial and sweephand pointer operated by a pusher. Demand register: ANSI C12.4. Provide matching meter socket with manual current short-circuiting device. Meter shall have provisions for future pulse initiation.

2.18.4 Meter Test Block

Provide meter test block with T pole group of open knife type switches designed for the isolation of metering devices at meter location by opening each circuit individually. Current switches shall short circuit current supply before opening meter circuit. Switch handles of potential switches shall be black. Switch handles of current switches shall be red.

2.18.5 Metering Enclosure

Metering enclosure shall be of galvanized steel, weatherproof construction with building mounting bracket, and 3/4-inch exterior plywood, full size backboard and hinged door arranged for padlocking in closed position. Internal space shall be adequate to house equipment and wiring but not smaller than 20 by 30 by 11 inches deep. Paint metal manufacturer's standard finish.

2.19 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.

2.20 CALKING COMPOUND

Compound for sealing of conduit risers shall be of a puttylike 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 medium 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)
20	5.0	3.0
25	5.5	3.5
30	5.5	3.5
35	6.0	4.0
40	6.0	4.0
45	6.5	4.5
50	7.0	4.5
55	7.5	5.0
60	8.0	5.0

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. At corners, dead ends and other points of extra strain, poles 40 feet or more long shall be set 6 inches deeper.

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.

3.1.1.9 Pole Caps

Provide plastic pole caps with 1/4-inch sealing rings and four nailing tabs. Fill sealing area with either a bituminous, elastigum roof cement or an acceptable preservative paste to level of sealing ring to eliminate possibility of condensation. Place on pole top and nail each tab down with a 1 1/4-inch nail.

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 Backfilling Near Anchors

Backfill patent, plate, expanding, concrete, or cone type anchors with tightly tamped earth filling hole.

3.1.2.3 Screw Anchors

Install screw anchors by torquing with boring machine. Anchor rod eye shall extend 6 to 9 inches above grade.

3.1.2.4 Swamp Anchors

Install swamp anchors by torquing with boring machine or wrenches, adding sections of pipe as required until anchor helix is fully engaged in firm soil.

3.1.2.5 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. Effectively ground and bond guys to system neutral.

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 Surge Arresters

Connect grounding terminal of each arrester to ground. Surge arrester grounding conductor shall be separate from the other grounding

conductors.

3.1.4.4 Transformer Tank and Neutrals

secondary neutral and tank of each transformer shall be interconnected and connected to ground.

3.1.4.5 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 Aluminum Protection

Protect ACSR conductors by armor rod at pin insulators and by flat aluminum wire at attachments made of galvanized or coated iron or steel.

3.1.5.6 Fittings

Dead end fittings, clamp or compression type, shall conform to written recommendations of conductor manufacturer and shall develop full ultimate strength of conductor.

3.1.5.7 Aluminum Connections

Make aluminum connections to copper or other material using only splices, connectors, lugs, or fittings designed for that specific purpose. Keep a copy of manufacturer's instructions for applying these fittings at job site for use of the inspector.

3.1.6 Mounted Metering Equipment

3.1.6.1 Meters

Install metering transformers according to manufacturer's drawings. Make connections to metering circuits within each transformer conduit connection box.

3.1.6.2 Installing Meter System

Metering enclosure shall house kWh meter and meter test block. Secure the enclosure to pole at a height of 6 feet above grade to center of the enclosure. Ground enclosure.

a. Connect meter as indicated.

b. Connect meter test block between meter and metering transformers to isolate meter for removal, test or adjustment.

c. Phase sequence and color code of potential and current leads shall be identical. Mark wires which are connected to transformer terminals identified with polarity marks (dots) by a colored plastic tape around the wire at each end.

d. No splices are permissible in metering circuits. Wire shall be trained at sides and bottom of enclosure back board and secured by plastic wraps.

3.1.7 Pole Top Switch Installation

Install pole top switch strictly according to manufacturer's erection drawings and information.

3.1.7.1 Operating Handle

Locate approximately 5 feet above ground on field side of pole.

3.1.8 Risers

Secure conduits on poles by two hole galvanized steel pipe straps spaced no more than 10 feet apart and within 3 feet of any outlet or termination. Ground metallic conduits.

3.2 FIELD QUALITY CONTROL

As an exception to requirements that may be stated elsewhere in contract, the Contracting Officer 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 megger 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 Transformer Field Tests

Perform visual and mechanical inspection and electrical test in accordance with NETA ATS and check transformer secondary voltages. Adjust voltage at the transformer to provide a secondary voltage of 277/480.

3.2.3 Meter

Check disc rotation to ensure that it turns in correct direction for each current-potential phase circuit individually.

3.2.4 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least three times, demonstrating satisfactory operation each time.

3.2.5 High Voltage Cable Test

[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.

-- End of Section --

SECTION 16402

INTERIOR WIRING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY (Not Used)

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 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 Designation Plates)
FS W-C-375	(Rev. B) Circuit Breaker, Molded Case; Branch Circuit and Service
FS W-S-896	(Rev. E) Switches, Toggle (Toggle and Lock), Flush Mounted

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	1991 Molded Case Circuit Breakers and Molded Case Switches
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 MG 1	1987 (Rev. 1) Motors and Generators
NEMA RN 1	1986 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	1986 Dry-Type Transformers for General Applications
NEMA TC 2	1990 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC 3	1990 PVC Fittings for Use with Rigid PVC Conduit and Tubing
NEMA WD 1	1983 (R 1989) Wiring Devices
NEMA WD 6	1988 Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1993 National Electrical Code

UNDERWRITERS LABORATORIES INC. (UL)

UL 1	1985 (R 1992) Flexible Metal Conduit
UL 4	1986 (R 1992) Armored Cable
UL 6	1981 (R 1991) Rigid Metal Conduit
UL 50	1988 (R 1990) Cabinets and Boxes
UL 67	1988 (R 1991) Panelboards
UL 83	1991 (R 1992) Thermoplastic-Insulated Wires and Cables
UL 198C	1986 (R 1990) (Bul. 1992) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198E	1988 (R 1988) (Bul. 1992) Class R Fuses
UL 360	1986 (R 1990) (Bul. 1991) Liquid-Tight Flexible Steel Conduit
UL 467	1984 (R 1986) Grounding and Bonding Equipment

UL 486A	1991 (R 1991) (Errata 1992) Wire Connector and Soldering Lugs for Use with Copper Conductors
UL 486C	1991 (R 1991) Splicing Wire Connectors
UL 489	1991 (R 1991) (Bul. 1992) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 498	1991 (R 1992) Attachment Plugs and Receptacles
UL 506	1989 Specialty Transformers
UL 508	1989 (R 1991) (Bul. 1992) Industrial Control Equipment
UL 510	1986 (R 1986) Insulating Tape
UL 514A	1991 Metallic Outlet Boxes
UL 514B	1989 (R 1990) (Errata 1991) (Bul. 1992) Fittings for Conduit and Outlet Boxes
UL 854	1991 (R 1992) Service-Entrance Cables
UL 869	1989 (R 1991) Service Equipment
UL 943	1985 (R 1990) (Bul. 1991) Ground-Fault Circuit Interrupters

1.3 RELATED REQUIREMENTS

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

1.4 SUBMITTALS

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

1.4.1 SD-02, Manufacturer's Catalog Data

a. Receptacles

b. Circuit breakers

c. Switches

d. Conduit and fittings (each type)

e. Ground rods

f. Device plates

g. Wires and cables

h. Outlet boxes and covers

i. Transformers

1.4.2 SD-04, Drawings

a. Panelboards

b. Transformers

1.4.3 SD-08, Statements

a. Fuses

Submit coordination data as specified in article entitled, "FUSES" of this section.

1.4.4 SD-11, Factory Test Reports

a. Transformer tests

1.4.4.1 Transformer Tests

Submittal shall include routine NEMA ST 20 transformer test results on each transformer and also contain the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

1.4.5 SD-12, Field Test Reports

a. 600-volt wiring test

b. Grounding system test

1.4.5.1 Format

Submit test results for approval in report form.

1.5 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 IMC conduit, and flexible metal conduit, liquid tight flexible conduit, conforming to the following:

2.2.1 Rigid Steel Conduit (Zinc-Coated)

ANSI C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, in accordance with NEMA TC 2, or fiberglass conduit, in accordance with NEMA TC 14.

2.2.3 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

2.2.4 Flexible Metal Conduit

UL 1.

2.2.4.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.5 Fittings for Metal Conduit and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.5.1 Fittings for Rigid Metal Conduit

Threaded-type. Split couplings unacceptable.

2.2.6 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3.

2.3 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.5 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.5.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote-control and signal circuits, classes 1, 2, and 3, may be stranded. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. Conductors indicated to be No. 6 AWG or smaller diameter shall be copper. Conductors indicated to be No. 4 AWG and larger diameter shall be either copper or aluminum, at Contractor's option, unless type of conductor material is specifically indicated, or specified, or unless the equipment manufacture requires a specific type.

2.5.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

2.5.1.2 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2.5.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 208/120 volt, 3-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, 3-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

c. 120/240 volt, single phase: Red and black

2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN conforming to UL 83 or Type XHHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.5.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.6 SPLICES AND TERMINATION COMPONENTS

UL 486A and UL 486B, as applicable, for wire connectors and UL 510 for insulating tapes. Connectors for wires No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.7 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlets, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

2.8 SWITCHES

2.8.1 Toggle Switches

FS W-S-896, totally enclosed with bodies of thermosetting plastic and mounting strap. Handles shall be brown. Wiring terminals shall be screw-type, side-wired. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.8.2 Pilot Lights

Provide yoke-mounted, candelabra-base sockets rated 125 volts and fitted with glass or plastic jewels. Provide clear, 6-watt lamp in each pilot switch. Jewels for use with switches controlling motors shall be green, jewels for other purposes shall be [white] [red] [amber].

2.8.3 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 1, enclosure per NEMA ICS 6.

2.8.4 Breakers Used as Switches

For 120- and 277-Volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

2.9 RECEPTACLES

UL 498 and NEMA WD 1, general grade, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap.

2.9.1 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Provide UL listed receptacle in "wet locations."

2.9.2 Ground-Fault Circuit Interrupter (GFCI) Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFCI devices.

2.10 PANELBOARDS

UL 67 and UL 50. Panelboards for use as service disconnecting means shall additionally conform to UL 869. Panelboards shall be circuit breaker-equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for future installation of breaker sized as indicated. Panelboard locks shall be keyed same. Directories shall indicate load served by each circuit of panelboard. Directories shall also indicate source of service (upstream panel, switchboard, motor control center, etc.) to panelboard. Type directories and mount in holder behind transparent protective covering.

2.10.1 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main 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.

2.10.2 Circuit Breakers

FS W-C-375, UL 489, thermal magnetic-type with interrupting capacity as indicated. Breaker terminals shall be UL listed as suitable for the type of conductor provided. Plug-in circuit breakers unacceptable.

2.10.2.1 Multipole 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.

2.10.2.2 Circuit Breaker With GFCI

UL 943 and NFPA 70. Provide with "push-to-test" button, visible indication of tripped condition, and ability to detect and trip on current imbalance of 6 milliamperes or greater per requirements of UL 943 for Class A GFCI devices.

2.11 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated.

2.12 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible 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.

2.12.1 Cartridge Fuses, Current Limiting Type (Class R)

UL 198E, Class RK-1. Associated fuseholders shall be Class R only.

2.13 TRANSFORMERS

NEMA ST 20, general purpose, dry-type, self-cooled, unventilated. Provide transformers in NEMA 1 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 80 degrees C temperature rise shall be capable of carrying continuously 130 percent of nameplate kVA without exceeding insulation rating.

2.14 MOTORS

NEMA MG 1; Hermetic-type sealed motor compressors shall also comply with UL 984. 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. Coordinate with motors as specified in Division 11 and Division 15.

2.14.1 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.

2.15 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. Selector switch shall have means for locking in any position. For each motor not in sight of controller; or where controller disconnecting means is not in sight of motor location and driven machinery location: controller disconnecting means shall be capable of being locked in open position or, alternatively, manually operated nonfused switch which disconnects motor from source of supply shall be placed within sight of motor location. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so

that cover cannot be opened unless handle of switch or circuit breaker is in "off" position. Coordinate with Division 11 and Division 15.

2.15.1 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide fuses in each ungrounded primary feeder. One secondary lead shall be fused; other shall be grounded.

2.15.2 Enclosures for Starters and Controllers

NEMA ICS 6.

2.15.3 Pushbutton Stations

Provide with "start/stop" momentary contacts having two normally open and two normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

2.15.4 Pilot and Indicating Lights

Provide transformer, resistor, or diode type.

2.15.5 Terminal Blocks

NEMA ICS 4.

2.16 MANUAL MOTOR STARTERS

Single or Three pole designed for surface mounting with overload protection.

2.17 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 telephone cabinets.

2.17.1 Outlet Boxes for Telephone System

Standard type, as specified herein. Outlet boxes for wall-mounted telephones shall be 2 inches by 4 inches by 1-1/2 inches deep; mounted at height 60 inches above finished floor.

2.17.2 Cover Plates

Modular telephone type with same finish specified for receptacle and switch cover plates.

2.17.3 Conduit Sizing

Unless otherwise indicated, 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, distribution centers, and telephone service.

2.17.4 Backboards

Interior grade plywood, 3/4-inch thick, size as indicated 2 by 4 feet minimum.

2.17.5 Receptacles for Telephone Service

Provide receptacle, 125 volts, 20 amps, single phase, 60 Hz, adjacent to telephone backboards, served from panelboard circuit.

2.18 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.

2.19 NAMEPLATES

FS L-P-387. Provide as specified in Section 16011, "Electrical General Requirements."

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

3.1.1 Overhead Service

Overhead service conductors into buildings shall terminate at service entrance fittings or weatherhead outside building. Overhead service conductors and support bracket for overhead conductors are included in the Section 16370, "Overhead Electrical Work."

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, or enclosures shall be labeled or identified as such.

3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels. Use lettering of at least 0.25 inch in height,

and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

3.1.3 Wiring Methods

Provide insulated conductors installed in conduit, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Provide bare or insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide bare or insulated, green conductor for grounding conductors installed in conduit or raceways. Minimum conduit size shall be 3/4 inch in diameter for low voltage lighting and power circuits. 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.

3.1.3.1 Nonmetallic Conduit

a. 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 hazardous (classified) areas.

3.1.3.2 Service Entrance Conduit, Overhead

Rigid steel from service entrance to service entrance fitting or weatherhead outside building.

3.1.3.3 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; PVC, Type EPC-40. Convert nonmetallic conduit, other than PVC Schedule 40 or 80, to rigid steel conduit before rising through floor slab.

3.1.3.4 Conduit in Floor Slabs

Rigid steel; or PVC, Type EPC-40.

3.1.4 Conduit Installation

Unless indicated otherwise, exposure conduit on walls and ceiling and conceal conduit within finished floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where conduit will be visible after completion of project.

3.1.4.1 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finish slab.

3.1.4.2 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with mechanical systems to assure maximum accessibility to all systems. Where conduit crosses building expansion joints, provide suitable expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means.

3.1.4.3 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.4 Pull Wire

Install pull wires in empty conduits in which wire is to be installed by others. Pull wire shall be plastic having minimum 200-pound tensile strength. Leave minimum 12 inches of slack at each end of pull wire.

3.1.4.5 Telephone and Signal System Conduits

Install in accordance with specified requirements for conduit and with additional requirement that no length of run shall exceed 150 feet for trade sizes 2 inches and smaller and shall not contain more than two 90-degree bends or equivalent. Provide pull or junction boxes where necessary to comply with these requirements. Inside radii of bends in conduits one-inch trade size and larger shall be minimum five times nominal diameter. Terminate conduit at bottom edge of backboard with plastic bushing.

3.1.4.6 Conduit Installed in Concrete Floor Slabs

Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits.

Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab. Increase slab thickness as necessary to provide minimum one-inch cover over conduit. Where embedded conduits cross expansion joints, provide suitable watertight expansion fittings and bonding jumpers. Conduit larger than one-inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab. Where nonmetallic conduit is used, raceway must be converted to rigid steel before rising above floor, unless specifically indicated otherwise.

3.1.4.7 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.8 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.9 Flexible Connections

Provide flexible connections of short length, 6-foot maximum, for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow slack. Provide liquid-tight flexible conduit in wet locations. Provide separate ground conductor across flexible connections.

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when installed exposed up to 7 feet above interior floors and walkways, or when installed in hazardous areas. Boxes in other locations shall be sheet steel. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; 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 sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.5.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except that 4-by-2-inch boxes may be used where only one raceway enters outlet. Telephone outlets shall be minimum of 4 inches square by 1 1/2 inches deep.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Furnish boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.6 Mounting Heights

Mount panelboards, circuit breakers, and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor, receptacles 48 inches above finished floor, and other devices as indicated. Measure mounting heights of wiring devices and outlets to center of device or outlet.

3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with Drawings.

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 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 to driven ground rods on exterior of building. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.10.1 Grounding Conductor

Provide bare or insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide bare or insulated, green conductor for grounding conductors installed in conduit or raceways.

3.1.10.2 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.10.3 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.

3.2 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each tests.

3.2.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.2.2 600-Volt Wiring Test

Test 600-volt wiring to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.2.3 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground does not exceed 5 ohms. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- 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 C78.41	1987 Electric Lamps - Low-Pressure Sodium Lamps
ANSI C78.1353	1990 Electric Lamps - 70-Watt, 52-Volt, S62 Single-Ended High-Pressure Sodium Lamps
ANSI C82.1	1985 (Supp. 1990) Ballasts for Fluorescent Lamps
ANSI C82.2	1984 (R 1989) Fluorescent Lamp Ballasts - Methods of Measurement
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 366/A 366M	1985 Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 526/A 526M	1990 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A 580	1990 (Rev. A) Stainless and Heat-Resisting Steel Wire
ASTM A 853	1990 Steel Wire, Carbon, for General Use
ASTM B 633	1985 Electrodeposited Coatings of Zinc on Iron and Steel

FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC RR	1976 Rules and Regulations, Vol. II, Transmittals 1 through 6

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

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

IEEE C62.41	1980 Surge Voltages in Low-Voltage AC Power Circuits (IEEE STD 587)

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IES)

IES LHBK	Lighting Handbook, Reference (1984) and Application (1987) Volumes

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	1988 Industrial Control Devices, Controllers and Assemblies
NEMA ICS 6	1989 (Rev. 1) Enclosures for Industrial Controls and Systems

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 20	1986 (Errata 1988) (R 1991) General-Use Snap Switches, Tenth Edition
UL 773	1987 Plug-In, Locking Type Photocontrols for Use With Area Lighting, Third Edition
UL 773A	1989 Nonindustrial Photoelectric Switches for Lighting Control, Third Edition
UL 924	1990 (R 1991) Emergency Lighting and Power Equipment, Seventh Edition
UL 935	1984 (R 1990) (Bul. 1990) Fluorescent-Lamp Ballasts, Seventh Edition
UL 1029	1986 (R 1990) (Bul. 1990) High-Intensity-Discharge Lamp Ballasts, Fourth Edition
UL 1570	1988 (R 1990) Fluorescent Lighting Fixtures, Third Edition
UL 1571	1984 (R 1991) Incandescent Lighting Fixtures, Second Edition

UL 1572 1984 (Errata 1990) (Bul. 1991) (R 1991) High Intensity Discharge Lighting Fixtures, Second Edition

1.2 RELATED REQUIREMENTS

Section 16011, "Electrical General Requirements," applies to this section, with the additions and modifications specified herein. Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 16402, "Interior Wiring Systems." 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.

1.4 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals." Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IES LHBK, as applicable, for the lighting system specified.

1.4.1 SD-02, Manufacturer's Catalog Data

a. Fluorescent lighting fixtures

b. Fluorescent lamps

c. Fluorescent core and coil ballasts

d. High-Intensity-Discharge (HID) lighting fixtures

e. HID Ballasts

f. HPS lamps

g. Incandescent lighting fixtures

h. Incandescent lamps

i. Lighting contactor

j. Photocell switch

k. Time switch

l. Emergency lighting equipment

PART 2 PRODUCTS

2.1 FLUORESCENT LIGHTING FIXTURES

UL 1570.

2.1.1 Fluorescent Lamps

Provide the number, type, and wattage indicated. Rapid-start lamps shall be rated 40 watts, 3150 approximate initial lumens, 20,000 hours average rated life. Average rated life is based on 3 hours operating per start.

2.1.2 Fluorescent Core and Coil Ballasts

UL 935, ANSI C82.1, and shall be labeled Certified Ballast Manufacturers (CBM) certified by Electrical Testing Laboratories (ETL). Ballasts shall be high power factor type unless indicated otherwise and shall be designed to operate on the voltage system to which they are connected. Ballasts shall be Class P and shall have sound rating "A". Fixtures and ballasts shall be designed and constructed to limit the ballast case temperature to 90 degrees Celsius (C) when installed in an ambient temperature of 40 degrees C.

2.1.2.1 Energy-Saving Ballasts

Provide energy-saving fluorescent ballasts of the CBM certified full light output type. Ballasts shall have an average input wattage of 86 or less when operating two F40T12 lamps tested in accordance with ANSI C82.2 methods.

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 will 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 HPS Lamps

70-watt conforming to ANSI C78.1353.

2.3 INCANDESCENT LIGHTING FIXTURES

UL 1571.

2.3.1 Incandescent Lamps

Provide the number, type, and wattage indicated.

2.4 RECESS- AND FLUSH-MOUNTED FIXTURES

Provide type that can be relamped from the bottom. Access to ballast shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

2.5 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 or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 3/16-inch diameter.

2.6 LIGHTING CONTACTOR

NEMA ICS 2, mechanically held contactor. Contacts shall be rated 600 volts, 10 amps, and 1 pole. Coils shall be rated 120 volts. Provide in NEMA 1 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts and coil clearing contacts and shall require no arcing contacts. Provide contactor with hand-off-automatic selector switch.

2.7 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide cell rated 120 volts ac, 60 Hz with single-throw contacts rated 1000 watts and 120 volts. Provide switch integral to the fixture. 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. Aim switch according to manufacturer's recommendations.

2.8 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered type.

2.8.1 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.

2.9 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated. Provide accessories required for remote-mounted lamps where indicated. Remote-mounted lamps shall be as indicated.

2.9.1 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.

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. Provide wires or rods for lighting fixture support in this section.

3.1.1 Exit and Emergency Lights

3.1.1.1 Exit Lights

Wire exit lights on separate circuits and serve from a fused disconnect switch. Connect this switch ahead of the main service disconnect switch. Lights shall have only one control, which shall be the disconnect switch.

3.1.1.2 Emergency Lights

Wire emergency lights ahead of the switch to the normal lighting circuit located in the same room or area.

3.1.2 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations. Mount switch on or beside each luminaire when switch is provided in cast weather proof aluminum housing with swivel arm.