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05-88-8114

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION
NORFOLK, VIRGINIA

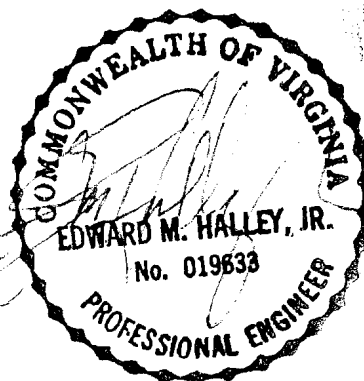
GROUND WATER REMEDIATION SYSTEMS
AT VARIOUS LOCATIONS (TT + JP-5)
MARINE CORPS AIR STATION, NEW RIVER, NORTH CAROLINA
MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

DESIGN BY:

O'BRIEN & GERE ENGINEERS, INC.
440 VIKING DRIVE
SUITE 250
VIRGINIA BEACH, VIRGINIA 23462

SPECIFICATION PREPARED BY:

Civil/Structural: O'Loughlin/Shaffer
Mechanical: O'Loughlin/Shaffer
Electrical: Cardinal/Condie
Date: 26 June 1991



SPECIFICATION APPROVED BY:

Specification Branch Head: C.R. Rose, P.E.
Engineering and Design Director: K.E. Godfrey, P.E.
For EFD for Commander, NAVFAC: _____
Date: _____

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INSTRUCTIONS TO BIDDERS (CONSTRUCTION CONTRACT)

PART 1 GENERAL

1.1 SUMMARY

1.2 REFERENCES

Not used.

1.3 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)

1.4 BIDS

1.4.1 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.

1.4.2 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 Bond" 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.

1.4.3 Basis of Bid

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

1.4.3.1 Base Bid

- a. Price for the entire work, complete in accordance with the drawings and specifications.

1.5 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), Jacksonville, North Carolina, telephone: (919) 451-2581.

1.6 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.

1.7 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (MAY 1986)

Any contract awarded as a result of this solicitation will be a C2D0 rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS)(15 CFR 350), and the Contractor will be required to follow all of the requirements of this regulation. (FAR 52.212-7)

1.8 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)

1.9 AVAILABILITY OF DOCUMENTS

- a. Availability of Specifications Listed in the DOD Index of Specifications and Standards (DODISS) (APR 1984)

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. In case of urgency, telephone or 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. 4D
700 Robbins Avenue

Philadelphia, Pennsylvania 19111-5094
Telephone Number (For (215) 697-2667 or 2179
Inquiries Only)

- b. Availability of Specifications and Standards not Listed in DODISS, Data Item Descriptions not Listed in DOD Directive 5000.19-L, Volume II, and Plans, Drawings, and Other Pertinent Documents (SEP 1987)

The specifications, standards, plans, drawings, descriptions, and other pertinent documents cited in this solicitation may be obtained by submitting request to:

Atlantic Division, Naval Facilities Engineering Command
Engineering and Design Division, Specifications Branch
Code 406, Room 396, Building N-26
Naval Station, Norfolk, Virginia 23511-6287

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. (FAR SUPP 52.210-7002)

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 (JUN 1977)

The specifications, standards, plans, drawings, descriptions, and other pertinent documents cited in this solicitation may be examined at the following locations: (FAR SUPP 52.210-7003)

Atlantic Division, Naval Facilities Engineering Command
Engineering and Design Division, Specifications Branch
Code 406, Room 396, Building N-26
Naval Station, Norfolk, Virginia 23511-6287

1.10 SMALL BUSINESS SIZE STANDARD

This project is not set aside for small business; however, for purposes of executing Representations and Certifications the data below applies.

<u>SIC CODE</u>	<u>INDUSTRY, SUBINDUSTRY OR CLASS OF PRODUCTS</u>	<u>ANNUAL SIZE STANDARD</u>
_____	_____	_____

1.11 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.

1.12 BID BOND (MAR 1989)

- a. The offeror (bidder) shall furnish a separate bid bond, or United States bonds, Treasury notes or other public debt obligations of the United States, in the proper form and amount, by the time set for opening of bids. Failure to do so may be cause for rejection of the bid. The Contracting Officer will return bonds or notes of the United States (1) to unsuccessful bidders as soon as practicable 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.
- b. 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.
- c. Unless otherwise specified in the bid, the bidder will (1) allow sixty (60) days for acceptance of its bid; and (2) give bond within ten (10) days after receipt of the forms by the bidder.
- d. 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. The bid bond, or bonds or notes of the United States, is available to offset the difference.

1.13 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)

1.14 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)

1.15 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)

1.16 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)

Notify Western Union to telex telegram concerning bid modifications or withdrawals to LANTNAVFACENGCOM.

1.17 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.

1.18 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)

1.19 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 acceptance, regardless of when performance and payment bonds are executed.

1.20 COST LIMITATION

A bid which does not contain separate bid prices for the items identified as subject to a cost limitation may be considered nonresponsive. A bidder by signing his bid certifies that each price bid on items subject to a cost limitation include an appropriate apportionment of all applicable estimated costs, direct and indirect, as well as overhead and profit. Bids may be rejected which (i) have been materially unbalanced for the purpose of bringing affected items within cost limitations or (ii) exceed the cost limitations unless such limitations have been waived by the Under Secretary of Defense (Research and Engineering) prior to award. (APR 1974) (FAR SUPP 52.236-7081)

1.21 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)

1.22 ADDITIVE OR DEDUCTIVE ITEMS (APR 1968)

The low bidder for purposes of award shall be the conforming responsible bidder offering the low aggregate amount for the first or base bid item, plus or minus (in the order of priority listed in the schedule) those additive or deductive bid items providing the most features of the work within the funds determined by the Government to be available before bids are opened. If addition of another bid item in the listed order of priority would make the award exceed such funds for all bidders, it shall be skipped and the next subsequent additive bid item in a lower amount shall be added if award thereon can be made within such funds. For example, when the amount available is \$100,000, and a bidder's base bid and four successive additives are \$85,000, \$10,000, \$8,000, \$6,000, and \$4,000, the aggregate amount of the bid for purposes of award would be \$99,000 for the base bid plus the first and fourth additives, the second and third additives being skipped because each of them would cause the aggregate bid to exceed \$100,000. In any case all bids shall be evaluated on the basis of the same additive or deductive bid items, determined as above provided. The listed order of priority needs to be followed only for determining the low bidder. After determination of the low bidder as stated, award in the best interests of the Government may be made to him on his base bid and any combination of his additive or deductive bid for which funds are determined to be available at the time of the award, provided that award on such combination of bid items does not exceed the amount offered by any other conforming responsible bidder for the same combination of bid items.

1.23 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 (GSCA), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from Commander, Atlantic Division, Naval Facilities Engineering Command, Naval Station, Norfolk, Virginia 23511-6287 (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 GSCA or within one day of filing a protest with the GAO. (FAR 52.233-2)

1.24 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.

1.25 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 field 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.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

GENERAL PARAGRAPHS

1.2 REFERENCES

SUPERINTENDENT OF DOCUMENTS

Construction Contractors -- Affirmative Action Requirements

Construction Equipment Ownership and Operating Expense Schedule

1.4 GENERAL DESCRIPTION

- 1.5 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL
EMPLOYMENT OPPORTUNITY (APR 1984)

- 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	Goals for female participation
----------------------------------	--------------------------------

for each trade	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 areas" are 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 law.		

1.6.2 Insurance--Work on a Government Installation (September, 1989)

- a. The Contractor shall, at its own expense, provide and maintain during the entire performance period of this contract at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.
- b. Before commencing work under this contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.
- c. The Contractor shall insert the substance of this clause, including this paragraph c., in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' 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 station 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 7300/30 (7/83), 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)).

- c. Affidavit to accompany invoice (LANTDIV NORVA Form 4-4235/4 (Rev 5/81)).
- d. Updated copy of submittal status log.
- 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. The Contractor has the option to use the Government furnished progress schedule and record form. 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 status log - 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 the Contracting Officer, the Commander, Naval Facilities Engineering Command, who shall designate an officer of the Civil Engineer Corps, United States Navy, or other officer or representative of the Government, as Officer in Charge of Construction, referred to as the "OICC." Except in connection with the "Disputes" clause, the Officer in Charge of Construction shall be the authorized representative of the Contracting Officer, and have complete charge of the work and exercise full supervision of the work, so far as it affects the interest of the Government. For the purposes of the "Disputes" clause, "Contracting Officer" shall mean the Commander, Naval Facilities Engineering Command, the acting commander, their successors, or their representatives specially designated to act in their stead.
- b. The provisions of this paragraph or elsewhere in this contract regarding supervision, approval, or direction by the Contracting Officer or the OICC, or action taken pursuant thereto, are not intended to and shall not relieve the Contractor of responsibility for the accomplishment of the work regarding sufficiency or the time of performance, except as expressly otherwise provided herein.

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 EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" is available for review at:

Commander
Atlantic Division
Naval Facilities Engineering Command (Code 02)

Building N-26, Room 266
Norfolk, Virginia 23511-6287

- 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 EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule," Region 111 (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 SUMMARY

1.2 REFERENCES

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

ARMY CORPS OF ENGINEERS (COE)

COE EM-385-1-1

1984 Safety and Health Requirements
Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241

1986 Safeguarding Construction,
Alteration, and Demolition Operations

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.

EFD	NAVFAC	
<u>Dwg. No.</u>	<u>Dwg. No.</u>	<u>Title</u>
318650	4218650	Cover Sheet
318651	4218651	JP-5 Line Area Location & Site Plan
318652	4218652	Tarawa Terrace Location & Site Plan
318653	4218653	JP-5 Line Area Treatment Pad Plan & Process Schematic
318654	4218654	Tarawa Terrace Area Treatment Pad Plan & Process Schematic
318655	4218655	Details
318656	4218656	Details
318657	4218657	Electrical Legend, Abbreviations & Power Pole Detail
318658	4218658	JP-5 Area Treatment Pad Electrical Plan, Riser Diagram & Elevations
318659	4218659	Tarawa Terrace Treatment Pad Electrical Plan, Riser Diagram & Elevations
318660	4218660	Treatment System Elementaries & Schedules

1.3.1 Drawing Verification and Control

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 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 CONSTRUCTION CATEGORIES

The construction categories listed shall apply to work covered by this specification. The construction categories may be modified by the Contracting Officer as necessary during the course of the work.

Category Code	Description
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

1.6 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 330 calendar days after receiving the Award.

1.7 SUBMITTALS

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

1.7.1 SD-93, Administrative or Closeout Submittals

- a. Equipment guarantee list
- b. Subcontractors and personnel list
- c. As-built drawings

1.8 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))

1.9 MATERIALS AND EQUIPMENT TO BE SALVAGED

Contract Clause entitled "Salvage Materials and Equipment" is hereby deleted. 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.

1.10 OPERATION OF STATION UTILITIES

The Contractor shall not operate nor disturb the setting of control devices in the station 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.

1.11 AVAILABILITY OF UTILITIES SERVICES

Contract Clause entitled "Availability and Use of Utility Services" applies. Reasonable amounts of utilities will be made available without charge except that utilities for any office trailers where reasonable amounts of utilities will be made available to the Contractor at the prevailing Government rates. These rates may be obtained upon application to the Commanding Officer, MCB Camp Lejeune, by way of the Resident Officer in Charge of Construction (ROICC). The Contractor will be responsible for making connections, providing transformers and meters, and making disconnections; and for providing backflow preventer devices on connections to domestic water lines.

1.12 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.

1.13 EQUIPMENT GUARANTEES

1.13.1 Equipment Guarantee List

Obtain and furnish to the Contracting Officer written guarantees 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.

1.13.2 Equipment Warranty Tags and Guarantor's Local Representative

The Contractor shall furnish with each guarantee 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 guarantee during the guarantee period, and will provide the services prescribed by the terms of the guarantee. 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.....

STATION PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE

1.14 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 1987.

- d. NFPA 241.
- e. Work in Confined Spaces. In addition to the requirements in Section XXVII of the COE EM-385-1-1, "Work in Confined Spaces," the following provisions apply:
 - (1) Entry into a confined or enclosed space by personnel for any purpose, including hot work, shall be prohibited until the qualified person has conducted appropriate tests to assure the confined or enclosed space is safe for the work intended.
 - (a) Confined Space. Refers to a space which by design has limited openings for entry and exit; unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy. Confined spaces include but are not limited to storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.
 - (b) Qualified Person. A person designated by the Contractor, in writing, as capable (by education or specialized training) of anticipating, recognizing, and evaluating employee exposure to hazardous substances or other unsafe conditions in a confined space. This person shall be capable of specifying necessary control and protective action to ensure worker safety. Where work involves work on existing fuel storage or fuel distribution systems this qualified person shall be a certified gas free engineer or NFPA certified marine chemist.
 - (2) Daily Confined Space Entry Permit (LANTDIV NORVA 3-5100/4 (New 3-83)) shall be completed by the qualified person. The permit shall be posted in a conspicuous place close to the confined space entrance with a copy to the Resident Officer in Charge of Construction (ROICC).
 - (3) The Contractor shall submit to the ROICC a letter of certification for the qualified person. The letter shall state the qualified person's name and qualifications and delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions.

1.15 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.

1.16 SCHEDULING

1.16.1 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 7:30 to 16:00, Monday through Friday.

1.16.2 Special Scheduling Requirements

- a. The Activity will remain in operation during the entire construction period and the Contractor shall conduct his operations so as to cause the least possible interference with the normal operations of the activity.
- b. Permission to interrupt utility service shall be requested in writing at least 15 days in advance and approval of the Contracting Officer shall be received before service is interrupted. Interruptions of utility services will be allowed only when they will cause no interference with the operations of the activity. Utility cutovers shall be made after regular working hours or on weekends; anticipated costs shall be included in the bid.
- c. Notify the ROICC 48 hours prior to starting excavation work in order to permit making arrangements with public works personnel to scan the area for unmarked utilities.

1.17 FORWARDING SUBMITTALS FOR NON-CONTRACTOR QUALITY CONTROL (CQC) PROJECTS

1.17.1 Samples Required of the Contractor

As soon as practicable, and before installation, submit to the Architect-Engineer: O'Brien & Gere Engineers, Inc., 440 Viking Drive, Suite 250, Virginia Beach, Virginia 23452, for approval, samples of materials and equipment as may be requested, including samples required in the technical sections of this specification.

1.17.2 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 Architect-Engineer: O'Brien & Gere Engineers, Inc., 440 Viking Drive, Suite 250, Virginia Beach, Virginia 23452, the shop drawings, and product data required in the technical sections of this specification in accordance with Section 01300, "Submittals." The Architect-Engineer for this project will review and approve surveillance for the Contracting Officer if the 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.

1.18 APPROVAL OF SAMPLES, CUTS, AND DRAWINGS

Matter submitted for approval shall be accompanied by complete information concerning the material, articles, and design proposed for use in sufficient detail to show compliance with the specification, and shall be approved before incorporation into the work. Approval thereof will not be construed as relieving the Contractor of compliance with the specification, even if such approval is made in writing, unless the attention of the Contracting Officer is called to the noncomplying features by letter accompanying the submitted matter. Partial submittals or submittals of less than the whole of a system made up of interdependent components, will not be considered. Approval of drawings, cuts, and samples by the Contracting Officer shall not be construed as a complete check or approval of the detailed dimensions, weights, gauges, and similar details of the proposed articles. The conformance of such details with the contract requirements, together with the necessary coordination of dimensions and details between the various elements of the work and between the various subcontractors and suppliers, shall be solely the responsibility of the Contractor, approval of submitted matter notwithstanding. The drawings accompanying this specification shall not be used as shop drawings; for example, the editing of the drawings accompanying this specification and returning these edited drawings as shop drawings is prohibited.

1.19 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.

1.20 AS-BUILT DRAWINGS

During the progress of the work, one full-size print 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.

1.21 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."

1.22 OMISSIONS AND MISDESCRIPTIIONS

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))

1.23 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.

1.24 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.

1.25 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.

1.26 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.

1.27 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.

1.28 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.

1.29 PROTECTING MATERIALS AND EQUIPMENT IN EXISTING BUILDINGS

Extreme hazards may be caused by rain or other natural elements entering the building through temporary openings, particularly at roofs during reroofing. It is, therefore, essential that the Contractor take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

1.30 SUBMITTALS AND THE USE OF THE CONTRACTOR'S SUBMITTAL TRANSMITTAL FORM

The instructions specified herein represent applicable instructions provided to Contractors on projects administered by the Atlantic Division, Naval Facilities Engineering Command. Instructions are specified here to integrate submittal presentation requirements, as well as to place them in full force in the contract. The instructions appear as Appendix A at the end of this section.

1.31 SUPERVISION

Have at least one qualified supervisor capable of reading, writing, and conversing fluently in the English language on the job site during working hours. In addition, if a Contractor Quality Control Representative (CQCR) is required on the contract, then that individual must also have fluent English communication skills.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

APPENDIX A

ADDITIONAL INSTRUCTIONS ON SUBMITTALS AND THE
USE OF THE CONTRACTOR'S SUBMITTAL TRANSMITTAL FORM

1. Submittals shall be clearly marked to indicate the specific items submitted for approval.
2. Items submitted for approval shall be accompanied by complete information concerning the item proposed in sufficient detail to show compliance with the contract requirements.
3. When more than one item is included in the Submittal Transmittal Form, each sheet or bound set of sheets of attached submittals shall be identified by the item numbers assigned on the transmittal form.
4. Approval of an item cannot be construed as relieving the Contractor of responsibility to comply with the contract requirements unless the Contractor calls attention to the noncomplying features (subparagraph 5f).
5. The following instructions apply to the use of the Contractor's Submittal Transmittal Form:
 - a. Transmittals shall be numbered consecutively as submitted. Resubmittals should bear the original transmittal number with the letter "A" added to identify the first resubmittal. The letters "B," "C," etc., may be used if additional resubmittals are necessary.
 - b. Each transmittal form must be restricted to submittals for one section of the project specifications.
 - c. Each transmittal form must be restricted to submittals in only one of the following categories: (1) Contractor Approved (Contractor Quality Control Representative approval items only), (2) OICC Approval, or (3) Deviation or Substitution for OICC Approval.
 - d. The item number next to the project specification section and paragraph and project drawing number block should match the item number on the submittal log for that specification section or drawing number. This will ensure that required submittals from each section of the contract specification are received.
 - e. Project specification section and paragraph number and project drawing number describe and require the item or the project drawing that is being detailed. Referenced LANTDIV plates, if applicable, should be entered here.
 - f. When approval of a deviation is requested, the following supporting data must be submitted on a separate sheet attached to the transmittal form:
 - (1) Identify and describe proposed deviations or substitutions.

- (2) Reason for each proposed deviation or substitution.
 - (3) If material or equipment is unavailable, the Contractor's efforts to procure must be documented (contact with minimum of three different suppliers or manufacturers).
 - (4) Complete technical data on the proposed substitution, sufficient to determine acceptability.
 - (5) Warrant that the entire contract has been reviewed to establish that a deviation, if incorporated, will be compatible with other elements of construction. Also, warrant that any necessary action or additional expense which may arise by reason of incorporating the proposed deviation, including but not limited to change in this or other elements of construction resulting from the incompatibility of the proposed deviation with any other element of construction, will be the responsibility of the Contractor.
 - (6) Separate cost estimates for each specified item and each proposed item and proposed change, if any, in the contract time.
- g. Each submittal will be signed by the Contractor's representative after the Contractor's comments block.
- h. The Contractor's Submittal Transmittal Form will be filled out by the Contractor on Contractor Quality Control Contracts as stated above, and additionally as follows:
- (1) For contractor approved submittals, the authorized reviewer shall annotate the results of his/her review of the submittal data in the "reviewer use only" block with an appropriate action code, initials, and date. For government approved submittals, the "reviewer use only" block should be left blank. The authorized reviewer should always indicate concurrence of the submittal package by signing the contractor's submittal stamp, regardless of who approves the submittal.
 - (2) The CQCR will sign the submittal in the "Contractor's Representative" signature block.
 - (3) The CQCR will make no marks in the reviewer's blocks below the double line under the Contractor's representative signature block.
- i. Product literature and catalog data will be conspicuously marked to indicate the specific item, product, or option being offered for consideration by the Contractor. Failure to mark the product literature or catalog data will be cause for return of the submittal data by the Government.

-- End --

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

Not used.

1.3 DEFINITIONS

1.3.1 Submittal Definition

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

1.3.2 Types of Submittals

- 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. Types are as listed in the paragraph entitled "Schedule of Submittal Descriptions (SD)."
- 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. Types are as listed in the paragraph entitled "Schedule of Submittal Descriptions (SD)."
- c. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship, 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. Types are as listed in the paragraph entitled "Schedule of Submittal Descriptions (SD)."
- d. Administrative and Closeout Submittals: Submittals of data for which reviews and approval will be 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. Types are as listed in the paragraph entitled "Schedule of

Submittal Descriptions (SD)."

1.3.3 Approving Authority

The person who is authorized to approve a submittal.

1.3.4 Work

As used in this Section, the 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 and including materials, products, equipment, and systems produced both on- and off-site.

1.4 SUBMITTALS

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

1.4.1 SD-93 Administrative or Closeout Submittals

a. Submittal status log

List each submittal. Include for each submittal the specification section number; SD number; description of item for which the submittal is required; and the Contractor's scheduled date for the submittal. Submit the log on copies of the form "Submittal Status Log," attached. Submit the log within 30 days after notice to proceed.

1.5 PROCEDURES FOR SUBMITTALS

1.5.1 Approving Authority

The approving authority, from whom approval is sought, shall be in accordance with Section 01401, "Contractor Inspection System."

1.5.2 Limits and Constraints Regarding Submittals

- a. Submittals shall be complete for each portion of the work; components of the work interrelated as a system shall be submitted at the same time.
- b. When submittal acceptability is dependent on conditions, items, or materials included in separate subsequent submittals, the submittal will be returned without review.
- c. Submittals of information not required as a submittal, or covering work for which the submittals have been returned as "approved" or "approved as noted" 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.
- e. The work shall conform to approved submittals, except conform to the Contract requirements and resubmit the submittal if a previously approved submittal has an error or omission.

1.5.3 Scheduling of Submittals

- a. Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittal processing. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination with another.
- b. Except as specified otherwise, allow a review period, beginning with receipt by the approval authority, that includes at least 15 working days for relatively simple submittals or 20 working days for more complex submittals and for potential requirements to resubmit.
- c. For submittals requiring approval by the Fire Protection Engineer, allow a review period, beginning with receipt by the Contracting Officer, of 40 calendar days for return of the submittal to the Contractor.

1.5.4 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. Where variations are proposed for consideration, submit a written request, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to the Government. The proposed variation shall be identified separately and included along with the required submittal for the item. When a variation is submitted for approval, the Contractor warrants the following.

1.5.4.1 Variation Is Compatible

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

1.5.4.2 Contractor Is Responsible

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

1.5.5 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. Ensure that material is clearly legible. Ensure required specialty stamps are affixed and signed.
- c. Stamp each sheet of each submittal with the Contractor's certificating stamp, 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. Word the submittal stamp as follows:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated into Contract Number N62470- 88-B-8114 is in compliance with the Contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by _____ Date _____"

- d. Sign the Contractor's certification. The person signing the certification shall be one designated in writing by the Contractor as having that authority. The signature shall be in original ink. Stamped signatures are not acceptable.
- e. Transmit submittals to the approving authority in orderly sequence, in accordance with the Submittal Status Log, and to prevent project delays and delays in work by the Government or separate contractors.
- f. Advise the approving authority of variation, as required by the paragraph entitled "Variations."
- g. 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.
- h. Retain a copy of approved submittals at the project site, including the Contractor's copy of approved samples.
- i. Furnish additional copies of submittals if requested by the Contracting Officer, to a limit of 20 submittals.
- j. Ensure no work is begun until the 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.

1.5.6 Approving Authority's Responsibilities

- a. Submittals will be reviewed for approval with reasonable promptness and only for conformance with project design concepts and compliance with the Contract documents.
- b. Submittals will be returned with one of the following notations:
 - (1) Submittals marked "not reviewed" will indicate the submittal has been previously reviewed and approved, is not required as a submittal, does not evidence being reviewed and approved by the Contractor, or is not complete. Submittal so marked will be returned with an explanation as to 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.

- (2) Submittals marked "approved" or "approved as submitted" authorize the Contractor to proceed with the work covered.
- (3) Submittals marked "approved as noted" authorize the Contractor to proceed with the work as noted provided the Contractor takes no exception to the notations.
- (4) Submittals marked "revise and resubmit" or "disapproved" indicate the submittal does not comply with the design concept or the requirements of the Contract documents and shall be resubmitted with appropriate changes.

1.6 FORMAT AND QUANTITY OF SUBMITTALS

1.6.1 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 transmitted form and required in the paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.6.2 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 Section by which the submittal is required.
- d. The submittal description (SD) number of each component of the submittal.
- e. If a resubmission, an alphabetic suffix on the submittal description, for example, SD-70A, 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.

1.6.3 Format and Quantity for Shop Drawings

- a. For shop drawings presented on sheets larger than 8 1/2-inches by 14 inches, submit one reproducible and seven prints of each required shop drawing prepared for this project.
 - (1) Transmit reproducibles rolled in mailing tubes.
 - (2) 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."
- b. For shop drawings presented on sheets 8 1/2-inches by 14 inches or less, conform to the format and quantity requirements for product data, and present as a part of the bound volume for the submittals required by the Section.
- c. Dimension drawings, except diagrams and schematic drawings; prepare dimensioned drawings to scale. Identify materials and products for work shown.
- d. Shop drawings shall be not less than 8 1/2 by 11 inches nor more than 30 by 42 inches.

1.6.4 Format and Quantity for Product Data

- a. Submit seven copies of submittals of product data
 - (1) After review, the approving authority will return three copies with notations resulting from the review.
- b. 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.
- c. Indicate, by prominent notation, each product which is being submitted; indicate the Section and paragraph numbers to which it pertains.
- d. Supplement product data with material prepared for the project to satisfy submittal requirements for which product data does not exist. Note that the material is developed specifically for the project.

1.6.5 Format and Quantity 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, such as, conduit and handrails: 10-inch length or length to be supplied, if less than 10 inches.
- (5) Sample of non-solid materials, such as, sand and paint: Pint.
- (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. Quantity, unless otherwise specified:
 - (1) 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.
 - (2) Submit one sample panel. Include components listed in technical section or as directed.
 - (3) Submit one sample installation, where directed.
- d. 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.
- e. 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.
- f. 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.

1.6.6 Format and Quantity of Administrative and Closeout Submittals

- a. Unless otherwise specified, submit administrative and closeout submittals in the format and quantities required for shop drawings.
- b. If 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.

- c. Operation and Maintenance Manual data shall include components required in the various technical sections.

1.7 SCHEDULE OF SUBMITTAL DESCRIPTIONS (SD)

SD-01, Project Submittal Schedules

Schedule of delivery of other submittals required for this project. A type of administrative and closeout submittal.

SD-03, Progress Reports

Monthly progress reports on scheduled submittal transmissions. A type of administrative and closeout submittal.

SD-05, Survey Data

Field survey data shall be submitted on construction layouts, buildings, pipe, and roadways. A type of administrative and closeout submittal.

SD-10, Design Analysis and Calculations

Design analyses and supporting calculations performed in support of design verification of the individual end items. The Contractor shall be responsible for obtaining and verifying the supporting data provided by a subcontractor or supplier. A type of shop drawing.

SD-11, Mix Designs (Contractor and Job)

Mix designs for each type of concrete, grout, or blended material including a complete list of ingredients and admixtures. The applicable test reports shall verify that the mix has been successfully tested and meets design requirements. A type of shop drawing.

SD-12, System Analysis

System analysis development data, including logic diagram analysis, shall include data on accumulative operating probabilities, such as the impact of accumulative tolerances on performance of a system. Logic diagrams shall indicate the probability of unbalance on a system if out-of-tolerance power exists. Logic data shall depict possible failure modes, probable failure rates, and detailed system level analysis. A type of shop drawing.

SD-13, 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-15, Equipment and Performance Data

Data providing information on use life, system functional flows, safety features, mechanical automated details, automatic interlocks, and such

features as electrical system protective device ratings.

Curves indicating tested and certified equipment response and performance characteristics. A type of product data.

SD-16, Equipment Foundation Data

Data; including equipment weight and operating loads; horizontal and vertical loads (dead load, live load, and impact); starting torques and their direction; rpm of equipment; size, location and projection of anchor bolts; horizontal and vertical clearances for installation, operation, and maintenance; plan dimensions of foundations and relative elevations; and installation requirements such as noise abatement, vibration isolation, and utility services. A type of shop drawing.

SD-17, 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-20, Connection Diagrams

Diagrams indicating the relations and connections of devices and apparatus by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices. A type of shop drawing.

SD-21, Control Diagrams

Diagrams depicting the physical and functional relationship of equipment, electrical diagrams showing size, type, and capacity of the systems, and pneumatic diagrams for air and gas systems. A type of shop drawing.

SD-22, Elementary Diagrams

Diagrams indicating, in straight-line form and without regard for physical relationship, supporting systems and elements of equipment and associated apparatus. A type of shop drawing.

SD-23, Schematics

Drawings depicting the functional flow of systems and their interfaces with facilities and other systems. Functional and physical interfaces shall be indicated. Schematics need not be to scale. Schematics may be structural, mechanical, electrical, or a combination of these. A type of shop drawing.

SD-30, Coordination Drawings

Coordination drawings shall be composite drawings showing coordination of work of one trade with that of other trades and with the structural and architectural elements of the work. Drawings shall be in

sufficient detail to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Drawings shall indicate where conflicts or clearance problems exist between the various trades. A type of shop drawing.

SD-31, Detail Drawings

Detail drawings consisting of fabrication and assembly drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements of the contract documents. A type of shop drawing.

SD-32, Equipment Room Layout Drawings

Room layout drawings, consolidated for all trades, to scale, and showing pertinent structural, fenestration features, and items requiring installation that could reduce the available space. Mechanical and electrical equipment and accessories shall be shown to scale in plan, elevation, or section, in their installed positions. Ductwork and piping shall also be detailed. A type of shop drawing.

SD-33, Fabrication/Erection/Installation Drawings

Fabrication, erection, installation, and checkout drawings and specifications indicating equipment arrangement, with elevations, sections, and enlarged details. Details shall indicate proper methods of fabrication, construction, and installation. A type of shop drawing.

SD-34, Outline Drawings

Outline drawings indicating overall physical features, dimensions, ratings, service requirements, and weights of equipment. A type of shop drawing.

SD-35, Drawings

Scaled drawings, diagrams, schematic drawings, or other drawings, primarily graphic in nature, illustrating details, configuration, components, physical or functional relationship, and connections of a part of the work and the relationship of one part of the work to others or illustrating relationships among various parts of the work. A type of shop drawing.

SD-39, Qualifications

Materials which establish that the qualifications required to perform the work have been met. A type of shop drawing.

SD-40, Listing of Product Installations

A manufacturer's certified list shall include identification, of a minimum of 5, of his installed units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. The list shall include purchaser, address of installation,

service organization, and date of installation. A type of shop drawing.

SD-41, Manufacturer's Standard Color Charts

Preprinted brochures of illustrations showing the color range of a material. Color selection samples may be submitted in lieu of color charts. A type of product data.

SD-42, Material, Equipment and Fixture Lists

Lists of materials, equipment, and fixtures to be incorporated in the work. These lists shall include manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site. A type of shop drawing.

SD-43, Construction Equipment List

List of proposed equipment to be used in performance of construction work, including descriptive data. A type of shop drawing.

SD-44, Manufacturer's Instructions

Preprinted material describing the 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-50, Samples

Physical examples of products, materials, equipment, and assemblies to illustrate quality, finish, or workmanship and referred to in the technical sections as "samples." A type of sample.

SD-51, Color Selection Samples

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

SD-52, Sample Panels

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

SD-53, 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-55, Schedules

A tabular listing of information pertaining to the work or a tabular listing 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-56, Record of Existing Conditions

Results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work shall constitute acceptance of existing conditions. A type of shop drawing.

SD-60, Safety Plan

Detailed procedures defining the Contractor's provisions for accident prevention, health protection, and construction activity including the name, location, and responsible representative(s) for the medical facility to be used for treatment of sick or injured Contractor personnel. A type of administrative and closeout submittal.

SD-61, Protection Plan

Detailed formulation of procedures to prevent damage to existing facilities or infrastructures. If accidents do occur, sufficient detail will address repair and replacement of damaged property at the Contractor's expense. A type of administrative and closeout submittal.

SD-62, Work Plan

Detailed procedures defining the Contractor's provisions for construction activity. A type of administrative and closeout submittal.

SD-63, Concrete Placement and Inspection Plan

Detailed calculations, for concrete placement volume, quantity, product(s) to be delivered, labor, procedures, and equipment. A type of shop drawing.

SD-64, Quality Assurance Plan

Detailed procedures defining methods to ensure compliance to contract drawings and specifications by drawing control, inspection and procurement records, system and material testing, and certification records. A type of administrative and closeout submittal.

SD-65, Demolition Plan

Detailed procedures defining the Contractor's provisions for construction activity. A type of shop drawing.

SD-66, 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-70, 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-71, Inspection Reports

Daily reports identifying activity by contract number, location, craft discipline, quantity of material placed, and timed events or milestones. A type of administrative and closeout submittal.

SD-72, Training Data

Information describing training to be provided, training aids to be used, samples of training materials to be provided, and schedules of training. A type of shop drawing.

SD-73, 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-74, Welding Procedures and Qualifications

Contractor prepared welding procedure for qualification of operators for each type weld to be used. A type of shop drawing.

SD-75, Installation Procedures

Installation procedures, including diagrams, drawings, instructions, and precautions required to erect or install the manufacturer's product with minimal impedance. A type of product data.

SD-76, Certificates of Compliance

A written statement, signed by an authorized official of the manufacturer of a product, system, or material attesting that the product, system, or material conforms to the requirements of the Contract documents. The certificate of compliance must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address. Except for test reports and factory test reports required as separate submissions, the certificate of compliance shall be submitted with substantiating test reports and other supporting data. A type of shop drawing.

SD-77, 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-80, Operation and Maintenance Manuals

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

SD-81, Operating Instructions

Instructions consisting of standard operating procedures including startup, shutdown, and emergency operation. A type of administrative and closeout submittal.

SD-82, Preventive Maintenance and Inspection

Procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication, and cleaning necessary to minimize corrective maintenance and repair. A type of administrative and closeout submittal.

SD-83, Special Tools

List of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor. A type of administrative and closeout submittal.

SD-84, Safety Considerations

Information relating to load limits, speeds of operation, environmental criteria (temperature and pressure limitations), and personnel hazards and equipment safety precautions. A type of administrative and closeout submittal.

SD-85, Repair Requirements

Instructions necessary to checkout, troubleshoot, repair, and replace components of the systems, including integrated electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting after acceptance of the system. A type of administrative and closeout submittal.

SD-86, Parts List

A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delay. A type of administrative and closeout submittal.

SD-87, Posted Instructions

Labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation. A type of administrative and closeout submittal.

SD-90, As-Built Drawings

Drawings that provide current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible. A type of administrative and closeout submittal.

SD-91, Records

Letters of record expressing Contractor and Contracting Officer communication and records of historical field data. A type of administrative and closeout submittal.

SD-92, Spare Parts Data

Data for each different item of material and equipment listed. Data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to ensure efficient operation for a period of 120 days at the particular installation. A type of administrative and closeout submittal.

SD-93, Administrative or Closeout Submittals

Documentation to ensure compliance with an administrative requirement or to establish an administrative mechanism and referred to in the technical sections as "administrative or closeout submittals." A type of administrative and closeout submittal.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

SUBMITTAL STATUS LOG
INSTRUCTIONS

1. The Submittal Status Log form shall be used by the Contractor for listing submittals. It is intended to be enlarged and used on 8-1/2 x 14 inch paper.

2. Except as noted in Notes 5 and 6, columns (b) through (h) shall be completed by the Contractor for all submittals that are required by the specification. This partially completed form then becomes the submittal log portion of the CQC Plan, for a CQC project, and the material submitted for approval as the submittal status log.

3. As submittals are received and processed, the remaining columns are to be completed by the Contractor.

4. Column (a) shall be a consecutive number assigned by the Contractor. This number must be placed in the appropriate block of the "Submittal Transmittal Form" when submittals are processed.

5. Columns (b) and (c) together form a unique number for each submittal in the project and are to be used to identify submittals throughout. The second portion of column (c) is filled out only to designate a resubmission, with a capital letter.

6. Column (g) is filled in by the Contractor only to the extent that the CQC Representative will be the approving authority for CQC projects.

7. Column (h) is the principal or first occurring paragraph in the specification Section, where a material or product is specified.

-- End of Section --

SECTION 01401

CONTRACTOR INSPECTION SYSTEM

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D3666	1983 Evaluation of Inspection and Testing Agencies for Bituminous Paving Materials, Practice for
ASTM D3740	1980 Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction, Practice for
ASTM E329	1977 (R 1983) Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as used in Construction, Recommended Practice for
ASTM E543	1983 Nondestructive Testing Agencies, Practice for Determining the Qualification of
ASTM E548	1979 Testing and Inspection Agencies, Practice for Generic Criteria for Use in the Evaluation of

1.3 QUALITY CONTROL

Quality control of this contract shall be accomplished under the Contract Clause entitled, "Inspection of Construction."

1.3.1 Contractor Inspection Plan

The Contractor shall furnish four copies of the Contractor Inspection (CI) plan to the Contracting Officer within 15 calendar days after receipt of the Notice of Award. The CI plan shall detail the procedures, instructions, and reports to be used to assure compliance with the contract. Unless specifically authorized by the Contracting Officer in writing, no construction will be started until the CI plan is approved. This plan will include, as a minimum:

- a. The quality control organization in chart form, showing the relationship of the quality control organization to other elements of

the firm.

- b. Names and qualifications of personnel in the quality control organization.
- c. Area of responsibility and authority of each individual in the quality control organization.
- d. A listing of outside organizations such as testing laboratories, architects, and consulting engineers that will be employed by the Contractor, and a description of the services these firms will provide.
- e. Procedures for reviewing all detail drawings, samples, certificates, or other submittals for contract compliance, including the name of the person(s) authorized to sign the submittals for the Contractor, as complying with the contract.
- f. An inspection schedule, keyed to the construction schedule and following the order of the specification technical sections, indicating what inspections and tests, the names of persons responsible for the inspection and testing for each segment of work, and the time schedule for each inspection and test. The phases of control, which are the preparatory, initial, and follow-up, will be addressed.
- g. The procedures for documenting quality control operation, inspection, and testing, with a copy of all forms and reports to be used for this purpose. The Contractor shall include the submittal status log, specified in Section 01300, "Submittals," listing all submittals required by the specifications and stating the action required by the Contractor or the Government. The Contractor shall also prepare and maintain a testing plan which shall contain a listing of all tests required in the contract. Sample form for the Testing Plan is attached and may be used by the Contractor for these purposes; any other formats must contain the same information as shown on the sample forms.

1.3.2 Contractor Inspection (CI) Plan Meeting

At least 5 days after the CI Plan is submitted, but before construction operations begin, the Contractor shall meet with the Contracting Officer to discuss quality control requirements. The purpose of the meeting shall be to develop a mutual understanding relative to details of the system, including forms to be used for recording the inspection operations, tests, approvals, certifications, administration of the system, and Government surveillance.

1.4 DEFINITIONS

1.4.1 Factory Tests

Tests made on various products and component parts prior to shipment to the job site, including but not limited to such items as transformers, boilers, air conditioning equipment, electrical equipment, and precast concrete.

1.4.2 Field Tests

Tests or analyses made at, or in the vicinity of, the job site in connection with the actual construction.

1.4.3 Product

The term "product" includes the plural thereof and means a type or a category of manufactured goods, constructions, installations, and natural and processed materials or those associated services whose characterization, classification, or functional performance determination is specified by standards.

1.4.4 Person

The term "person" means associations, companies, corporations, educational institutions, firms, government agencies at the Federal, State, and local level, partnerships, and societies, as well as divisions thereof, and individuals.

1.4.5 Testing Laboratory

The term "testing laboratory" means any "person," as defined above, whose functions include testing, analyzing, or inspecting "products," as defined above, evaluating the designs or specifications of such "products" according to the requirements of applicable standards.

1.4.6 Certified Inspection Reports

Reports signed by approved inspectors attesting that the items inspected meet the specification requirements other than any exception included in the report.

1.5 SUBMITTALS

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

1.5.1 SD-93, Administrative or Close-out Submittals

- a. Contractor inspection plan
- b. Qualifications of testing laboratories

1.6 PROJECT SUBMITTAL SCHEDULES

The Contractor shall maintain at the job site an up-to-date log showing the status of all submittals required by the contract.

1.7 TESTING

1.7.1 Test Results

Reports shall cite the contract requirements, the test or analysis procedures used, the actual test results, and include a statement that the

item tested or analyzed conforms or fails to conform to the specification requirements. Each report shall be conspicuously stamped on the cover sheet in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements as the case may be. All test reports shall be signed by a representative of the testing laboratory authorized to sign certified test reports. The Contractor shall arrange for immediate and direct delivery of the signed original of all reports, certifications, and other documentation to the Contracting Officer.

1.7.2 Tabulation of Factory Tests and Field Tests

Prior to final payment, the Contractor shall obtain from each laboratory a tabulation of all tests it has performed in connection with the construction contract. Conforming, nonconforming, and retesting shall be tabulated. The tabulation(s) shall be certified as complete, and signed by the authorized representative of the laboratory, and shall be delivered to the Contracting Officer.

1.7.3 Formwork, Falsework, and Erection Procedures Certification

When the Contractor is required by a specification section to submit a certification for erection procedures, the appropriate daily inspection reports must indicate each time the work is inspected and approved for conformance to the certification. A specific statement for these items rather than a general statement is required.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 QUALITY CONTROL REQUIREMENTS

The Contractor shall inspect and test all work under the contract and maintain records of the inspections and tests. Approvals, except those required for field installations, field applications, and field tests, shall be obtained before delivery of materials and equipment to the project site. Surveillance of the inspection system will be performed by the Contracting Officer.

3.1.1 Field Inspections and Tests by the Contractor

The Contractor shall furnish all equipment, instruments, qualified personnel, and facilities necessary to inspect all work and perform all tests required by the contract. All inspections and tests performed and test results received each day shall be included in the Daily Report to Inspector.

3.1.1.1 Inspection Procedures

Inspection procedures shall include, as a minimum:

- a. Preparatory Inspection: Preparatory inspection shall be performed before beginning work and, in addition, before beginning

each segment of work. Preparatory inspection shall include a review of the contract requirements, the review and approval of shop drawings and other submittal data, a check to assure that required control testing will be provided, a physical examination to assure that all materials and equipment conform to approved shop drawings and submittal data, and a check to assure all required preliminary work has been completed. The Contracting Officer shall be notified at least 24 hours in advance of the preparatory inspection.

- b. Initial Inspection: Initial inspection shall be performed as soon as a representative segment of the particular item of work has been accomplished. Initial inspection shall include performance of scheduled tests, examination of the quality of workmanship, a review for omissions or dimensional errors, and approval or rejection of the initial segment of the work. The Contracting Officer shall be notified at least 24 hours in advance of the initial inspection.
- c. Follow-Up Inspections: Follow-up inspections shall be performed daily and more frequently as necessary, and shall include continued testing and examinations to assure continued compliance with the contract requirements.

3.1.2 Field Inspections and Tests by the Government

If deemed necessary by the Contracting Officer, field inspections and tests will be made in accordance with the Contract Clause entitled, "Inspection of Construction."

3.1.3 Approval of Testing Laboratories

All laboratory work under this contract shall be performed by a laboratory approved by the Government. The basis of approval includes the following:

- a. Testing laboratories performing work in connection with concrete, steel, and bituminous materials shall comply with ASTM E329 and ASTM D3666, respectively.
- b. Testing laboratories engaged in the testing and inspection of soils and rock or performing non-destructive testing shall comply with ASTM D3740 and ASTM E543, respectively.
- c. Testing laboratories performing work not in connection with concrete, steel, bituminous materials, soils and non-destructive testing shall comply with ASTM E548.

3.1.3.1 Laboratory Inspection

Prior to approval, the laboratory shall submit in writing the following:

- a. Functional description of the laboratory's organizational structure, operational departments, and support departments and services.

- b. A list and resumes of the personnel assigned to the proposed testing, including the person charged with engineering managerial responsibility.
- c. Affidavit of compliance with the applicable ASTM publication and certification that the laboratory performs work in accordance with technical requirements as required by the contract specifications.
- d. A list of test and inspection equipment for each of the proposed test procedures and certification that the equipment is calibrated at prescribed intervals to ensure the validity of the test and inspection data.
- e. A copy of the latest Laboratory Inspection Report by an independent agency with laboratory certification that deficiencies (if any) have been corrected.

3.1.4 Repeated Tests and Inspections

The Contractor shall repeat tests and inspections after each correction made to nonconforming materials and workmanship until tests and inspections indicate the materials, equipment, and workmanship conform to the contract requirements. The retesting and reinspections shall be performed at no additional cost to the Government.

3.1.5 Daily Report to Inspector

The signed "Daily Report to Inspector" Form NAVFAC 4330/34 shall be delivered to the Contracting Officer by 10:00 a.m. on the working day following the day the work was performed.

3.1.6 Monthly Report to Contracting Officer

A summary report shall also be delivered at the end of each month. This shall contain the work done during that month, test results, diagrams, etc.

-- End of Section --

SECTION 01560

ENVIRONMENTAL PROTECTION

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.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 261	Regulations Identifying Hazardous Waste
40 CFR 262	Regulations for Hazardous Waste Generators
40 CFR 263	Regulations for Hazardous Waste Transporters
40 CFR 264	Regulations for Owners and Operators of Permitted Hazardous Waste Facilities
49 CFR 178	Regulations for Shipping Container Specifications

VIRGINIA SOIL AND WATER CONSERVATION COMMISSION

1980 Virginia Erosion and Sediment Control Handbook

1.3 DEFINITIONS

1.3.1 Sediment

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

1.3.2 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.

1.3.3 Rubbish

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

1.3.4 Debris

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

1.3.5 Chemical Wastes

This includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

1.3.6 Sanitary Wastes

1.3.6.1 Sewage

Wastes characterized as domestic sanitary sewage.

1.3.6.2 Garbage

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

1.3.7 Hazardous Waste

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

1.3.8 Oily Waste

Petroleum products and bituminous materials.

1.4 SUBMITTALS

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

1.4.1 SD-77, Field Test Reports

- a. Sandblasting or abrasive blasting waste materials laboratory analysis. Submit a copy of an approved laboratory analysis of materials collected as a result from sandblasting or abrasive blasting operations before disposing of waste materials.
- b. Soils from recovery well drill holes. Submit a copy of an approved laboratory analysis of soils collected as a result of drilling recovery wells before disposing of waste materials.

1.4.2 SD-93, Administrative or Closeout Submittals

- a. Solid waste disposal permit
- b. Disposal permit for hazardous waste

1.4.2.1 Solid Waste Disposal Permit

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

1.4.2.2 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.

1.5 ENVIRONMENTAL PROTECTION REQUIREMENTS

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

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.

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully preserve and report immediately to the Contracting Officer items having possible historical or archaeological interest which are discovered in the course of work. Protect monuments, markers, and works of art.

3.3 EROSION AND SEDIMENT CONTROL MEASURES

3.3.1 Burnoff

Burnoff of the ground cover is not permitted.

3.3.2 Borrow Pit Areas

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

3.3.3 Protection of Erodible Soils

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

3.3.4 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

3.3.4.1 Mechanical Retardation and Control of Runoff

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

3.3.4.2 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.

- a. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to reestablish a suitable stand of grass.

3.3.5 Erosion and Sediment Control

Provide and maintain in accordance with the Virginia Soil and Water Conservation Commission Publication entitled "1980 Virginia Erosion And Sediment Control Handbook".

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 (non-hazardous)

Dispose of rubbish at the Base Sanitary Landfill.

3.4.2 Garbage Disposal

Remove and dispose garbage off Government property.

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 a station sanitary sewage system, or construct and maintain an approved type of adequate sanitary convenience for the use of persons employed on the work in accordance with the General Paragraphs titled, "SANITATION." Include provisions for pest control and elimination of odors.

3.5 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

3.5.1 Hazardous Type Waste

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

3.5.2 Petroleum Products

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

3.6 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. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shaking bags of cement, concrete mortar, or plaster.

3.6.1 Disposal Requirements

3.6.1.1 Sandblasting Operations

Collect dust, sand, paint, and other debris resulting from sandblasting operations and store in 55-gallon drums with watertight lids. Take a representative sample of this material, and test for EP toxicity with respect to lead, chromium, and cadmium content. The sampling and testing shall be performed in accordance with 40 CFR 261. Hazardous material shall be transported only by a transporter licensed and permitted for transportation of hazardous materials. Hazardous material shall be disposed of in an EPA-approved and permitted facility specifically designated for hazardous waste disposal.

3.6.1.2 Drilling Operations

Collect soil and other debris resulting recovery well drilling and store in 55-gallon drums with watertight lids. Take a representative sample of this material and test for characteristics of hazardous waste, in accordance with 40 CFR 261. Hazardous material shall be transported by only a transporter licensed and permitted for transportation of hazardous materials. Hazardous material shall be disposed of in an EPA-approved and permitted facility specifically designated for hazardous waste disposal.

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUMMARY

1.2 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 H 4-1

Federal Supply Code for Manufacturers
(FSCM); United States and Canada - Name to
Code, June 1982

1.3 SUBMISSION OF OPERATION AND MAINTENANCE DATA

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

1.3.1 Quantity

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

1.3.2 Package Content

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

1.3.3 Delivery

All O&M data to Contracting Officer for review and acceptance 60 days prior to Navy assuming operation; submittal data specified for a given item within 30 calendar days after the item is delivered to the contract site.

1.3.4 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.

1.4 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.4.1 Operating Instructions

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

1.4.1.1 Safety Precautions

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

1.4.1.2 Operator Prestart

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

1.4.1.3 Startup, Shutdown, and Postshutdown Procedures

Include a control sequence for each of these operations.

1.4.1.4 Normal Operations

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

1.4.1.5 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.

1.4.1.6 Operator Service Requirements

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

1.4.1.7 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.

1.4.2 Preventive Maintenance

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

1.4.2.1 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.

1.4.2.2 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.

1.4.3 Corrective Maintenance

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

1.4.3.1 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.

1.4.3.2 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.

1.4.3.3 Maintenance and Repair Procedures

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

1.4.3.4 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.

1.4.3.5 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.

1.4.3.6 Corrective Maintenance Man-Hours

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

1.4.4 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:

1.4.4.1 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:

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

List FSCM in accordance with DLA H 4-1.

1.4.4.2 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.

1.4.4.3 Personnel Training Requirements

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

1.4.4.4 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.

1.4.4.5 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.

1.5 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:

1.5.1 Data Package 1

- a. Safety precautions
- b. Environmental conditions
- c. Preventive maintenance plan and schedule
- d. Removal and replacement instructions
- e. Spare parts and supply list
- f. Warranty information
- g. Contractor information

1.5.2 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

1.5.3 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. Trouble shooting 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

1.5.4 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. Trouble shooting 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

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 02050

DEMOLITION AND REMOVAL

PART 1 GENERAL

1.1 SUMMARY

1.2 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI A10.6 1983 Demolition Operations - Safety
Requirements

1.3 GENERAL REQUIREMENTS

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

1.4 SUBMITTALS

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

1.4.1 SD-66, Statements

a. Demolition plan

Submit proposed demolition and removal procedures to the Contracting Officer for approval before work is started. Include procedures for coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.5 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."

1.6 DUST AND DEBRIS CONTROL

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

1.7 PROTECTION

1.7.1 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.

1.7.2 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 structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.7.3 Facilities

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

1.8 BURNING

Burning will not be permitted.

1.9 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 as shown on the contract drawings.

3.1.2 Paving and Slabs

Remove sawcut concrete and asphaltic concrete paving and slabs including aggregate base as indicated to a depth of 30 inches below existing adjacent grade. Provide neat sawcuts at limits of pavement removal as indicated.

3.1.3 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain and to facilitate the installation of new work. Where new masonry adjoins existing, the new work shall abut or tie into the existing construction as indicated.

3.1.4 Patching

Wherever existing surfaces are damaged during the performance of the work (including unfinished areas resulting from the removal of materials and equipment), repair and finish such surfaces to match adjacent undamaged surfaces.

3.2 DISPOSITION OF MATERIAL

3.2.1 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.

3.3 CLEANUP

3.3.1 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. Conform to other applicable requirements under Section 01560, "Environmental Protection."

-- End of Section --

SECTION 02200

EARTHWORK

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C136	1983 Sieve Analysis of Fine and Coarse Aggregates
ASTM D698	1978 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop
ASTM D1140	1954 (Rev. 1971) Amount of Material in Soils Finer Than the No. 200 (75-um) Sieve
ASTM D1556	1982 Density of Soil in Place by the Sand-Cone Method
ASTM D1557	1978 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 kg) Rammer and 18-in. (457-mm) Drop
ASTM D2487	1969 (Rev. 1975) Classification of Soils for Engineering Purposes
ASTM D2922	1981 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017	1978 Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D4318	1984 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ARMY CORPS OF ENGINEERS (COE)

COE EM-385-1-1	1981 Safety and Health Requirements Manual, April
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FEDERAL SPECIFICATIONS (FS)

FS O-F-241	(Rev. D) Fertilizers; Mixed, Commercial
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1.3 DESCRIPTION OF WORK

The work includes clearing, grubbing, stripping, excavating, filling, backfilling, and site grading to establish the lines and grades indicated.

1.4 SUBMITTALS

1.4.1 SD-70, Test Reports

Certified Test Reports:

- a. Select material
- b. Fill and backfill

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered.
- ~~c.~~ c. Groundwater elevation is 10 feet below existing surface elevation.
- d. Blasting will not be permitted. Remove material in an approved manner.

1.7 PROTECTION

1.7.1 Supporting Systems

Provide shoring, bracing, and sheeting in accordance with the COE EM-385-1-1, Section 23A & B.

1.7.2 Site Drainage

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

1.7.2.1 Surface Drainage

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

1.7.2.2 Subsurface Drainage

Base on site surface and subsurface conditions, available soil, and hydrological data. Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation. Use filters on the dewatering devices to prevent the removal of fines from the soil. Provide erosion control at the end of the piping to prevent erosion.

1.7.3 Protection of Underground Utilities

Contact the ROICC 15 days prior to construction for underground locations of existing utilities. The location of the existing utilities indicated are approximate. The Contractor shall physically verify the location and elevation of existing utilities prior to starting construction.

1.7.4 Movement of Machinery and Equipment

Movement of construction machinery and equipment over any pipes during any stage of 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.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

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

2.1.1 General Site Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

2.1.2 Backfill and Fill

ASTM D2487, classification GW, GP, GM, GC, SW, SP, SM, SC with a maximum ASTM D4318 liquid limit of 35, maximum ASTM D4318 plasticity index of 12 and a maximum of 25 percent by weight passing ASTM D1140, No. 200 sieve.

2.1.3 Topsoil

Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 1.0 inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

2.1.4 Select Material

ASTM D2487, classification GW, GP, SW, SP with a maximum of 10 percent by weight passing ASTM D1140, No. 200 sieve.

2.2 BORROW

Obtain borrow materials conforming to general site fill and backfill and fill material from the station borrow pit or from sources outside the station. Obtain other borrow materials from sources outside the station. The station borrow pit is located within a haul distance of 15 miles from the worksite. If the station borrow pit is used, the Contractor shall perform clearing, grubbing, and stripping required for providing access to suitable borrow material. Dispose of materials from clearing and grubbing operations off Government property. Strip the top 12 inches of soil material from the borrow area and stockpile. After removal of the borrow material, regrade the borrow pit using stockpiled soil material to contours which will blend in with the adjacent topography. Maximum side slopes shall be two horizontal to one vertical. Excavation and backfilling of the borrow pit shall ensure proper drainage.

2.3 Utility Identification Tape

Aluminum foil plastic-backed tape or magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously over entire tape length. Warning and identification shall read "CAUTION BURIED (INTENDED SERVICE) LINE BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Stripping

~~Strip existing topsoil to a depth of 4 inches without~~
~~contamination by subsoil material. Stockpile topsoil separately from other~~
~~excavated material and locate convenient to finish grading area. Stripping~~
~~is not required under areas of fill more than 4 feet in depth.~~

3.1.2 Unsuitable Material

Remove vegetation, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs and from fills less than 4 feet deep.

3.2 EXCAVATION

Excavate to the contours, elevation, and dimensions indicated. Reuse excavated materials meeting 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 select material fill and compact to 95 percent of ASTM D1557 maximum density. Unless specified

otherwise, refill excavations cut below indicated depth with backfill and fill material select material and compact to 95 percent of ASTM D1557 maximum density.

3.2.1 Pipe Trenches

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

3.3 FILLING AND BACKFILLING

Fill and backfill to the contours, elevations, and dimensions indicated. Compact each lift before the overlaying lift is placed.

3.3.1 General Site Fill

Provide for the general site. Place in 6-inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

3.3.2 Backfill and Fill

Provide for paved areas and under concrete slabs, except where select material is provided. Place in 6-inch lifts. Place backfill adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

3.3.3 Select Material

Provide _____ where indicated. Place in 6-inch lifts. Backfill adjacent to structures shall be placed as the structural elements have been completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

3.3.4 Trench Backfilling

Backfill as rapidly as the construction, testing, and acceptance of the work permits. Place and compact backfill in 6-inch lifts to the top of the trench.

3.3.4.1 Pipe Bedding

Provide bedding in pipe trenches as shown on Contract Drawings.

3.3.5 Utility Identification Tape Placement

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

3.4 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.

3.4.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5-foot line of the structure to 85 percent of ASTM D1557.

3.4.2 Structures, Spread Footings, and Concrete Slabs

Compact the top 12 inches of subgrades to 95 percent of ASTM D698. Compact fill and backfill and select material to 95 percent of ASTM D698.

3.4.3 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D698.

3.4.4 Paved Areas

Compact the top 12 inches of subgrades to 95 percent of ASTM D1557. Compact fill and backfill and select material to 95 percent of ASTM D1557.

3.5 FINISH OPERATIONS

3.5.1 Grading

Finish grades as indicated within one-tenth of a 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.

3.5.2 Seed

Scarify the existing subgrade. Provide 4 inches of topsoil for newly graded finish earth surfaces and areas disturbed by the Contractor. If there is insufficient on-site topsoil meeting specified requirements for topsoil, use available topsoil as directed. Provide topsoil required in excess of that available. Seed shall match existing vegetation. Provide seed at 5 pounds per 1000 square feet. Provide FS O-F-241, Type I, Class 2, 10-10-10 analysis fertilizer at 25 pounds per 1000 square feet. Provide mulch and water to establish an acceptable stand of grass.

3.5.3 Protection of Surfaces

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

3.6 DISPOSITION OF SURPLUS MATERIAL

Dispose at the Base Sanitary Landfill surplus or other soil material not required or suitable for filling or backfilling, and all brush, refuse,

stumps, roots, and timber.

3.7 FIELD SAMPLING AND TESTING

3.7.1 Sampling

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

3.7.2 Tests

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

3.7.2.1 Fill and Backfill

ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and ASTM D4318 for plastic limits; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.7.2.2 Select Material

ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.7.2.3 Density Tests

ASTM D1556 or ASTM D2922 and ASTM D3017. Test each lift at randomly selected locations every 2000 square feet of existing grade in fills for structures and concrete slabs, and every 1000 square feet for other fill areas and every 1000 square feet of subgrade in cut.

-- End of Section --

SECTION 02690

PAVEMENT REMOVAL AND REPLACEMENT

Part 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publication 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.

1.1.1 American Association of State Highway and Transportation Officials (AASHTO):

M140	1970	Emulsified Asphalt
M208	1972	Cationic Emulsified Asphalt
M226	1978	Viscosity Graded Asphalt Cement

1.1.2 American Society for Testing and Materials (ASTM) Publications:

D1557	1978	Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb (4.54 kg) Hammer and 18-inch (457 mm) drop
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1.1.3 North Carolina Department of Transportation (NCDOT-RS):

1990	North Carolina Standards Specifications for Roads and Structures
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1.2 SUBMITTALS:

1.2.1 SD-76, Certificates of Compliance: Submit the following for approval:

- a. Concrete materials
- b. Base materials
- c. Asphalt and asphalt cement
- d. Bituminous Concrete mix
- e. Concrete Mix

1.2.2 SD-70, Test Reports: The testing requirements for materials incorporated in referenced documents will be waived provided the manufacturer submits certificates stating: previously manufactured materials have been tested by recognized laboratories; such materials meet testing requirements specified; and the materials furnished for this project are of the same type, quality, manufacture and make as that tested. Do not submit copies of the test reports unless specifically requested by the Contracting Officer.

PART 2 - PRODUCTS

2.1 MATERIALS:

2.1.1 Bituminous Concrete: NCDOT-RS, Section 645, Type I-1 for materials and mix. Provide crushed stone aggregate for the bituminous mix.

2.1.2 Stone Base Course: NCDOT-RS, Section 1005 and 1010 for aggregate base course, standard size no. ABC.

2.1.3 Bituminous Tack Coat

2.1.3.1 Emulsified Asphalt: 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 asphalt at the rate of one part water to one part asphalt.

2.1.3.2 Cationic Emulsified Asphalt: AASHTO M208, Grade CRS-1, CSS-1, and CSS-1h; NCDOT-RS Section 1020, Grade CRS-1h. Dilute the SS-1 and SS-1h asphalt 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.

2.1.4 Concrete Mix: Provide as specified in Section 03302 "Cast-In-Place Concrete".

PART 3 - EXECUTION

3.1 CONSTRUCTION

3.1.1 Existing Surface Treatments: Where trenches, pits or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment to the same thickness and in the same kind as previously existed, except as otherwise specified. Restored areas shall match and lie into the adjacent and surrounding existing surfaces in a neat and acceptable manner.

3.1.2 Pavement Removal: Make a straight line cut 12 inches beyond the edge of the excavation to permit proper replacement. Where bituminous concrete is overlaid on concrete paving, remove the bituminous concrete along straight lines to at least 6 inches beyond the edge of the concrete removal. Using a saw, score edges of concrete to a depth of 1.5 inches unless bounded by joints. Cut reinforcing bars or mesh through the center and bend to edge of cut to provide work clearance. At cuts which are to become expansion joints and at locations where the broken edge of the concrete cannot be effectively concealed in the finished work, grind the break smooth or saw cut clear through the concrete. Removed pavement debris and spoil material shall be removed from the limits of the station.

3.1.3 Backfilling and Tamping: Replace materials under pavement in layers not to exceed 6 inches of loose depth and compact to at least 95 percent of the maximum dry density determined in accordance with ASTM D1557, method D.

3.1.4 Bituminous Surface: Except as otherwise specified, provide in accordance with NCDOT-RS Standard Specifications for Roads and Structures (1990). Provide a stone base course a minimum of 6 inches thick. Paint the cut edges of the bituminous pavement with a bituminous tack coat and provide bituminous concrete pavement.

3.1.5 Concrete Surface: Provide new reinforcing to match existing. Restore continuity of reinforcing with adequate laps. Provide concrete in accordance with Section 03302, "Cast-In-Place Concrete". Maintain existing joint patterns in the new work. Make repairs such that the repaired surfaces are as inconspicuous as possible.

3.1.6 Bituminous Surface on Concrete Base Pavement: In restoring concrete pavement, provide new reinforcing to match existing. Restore continuity of reinforcing with adequate laps. Provide concrete in accordance with Section 03302 "Cast-In-Place Concrete". Maintain existing joint patterns in the new work. Provide tack coat on the restored concrete base applied at the rate of 0.10 gallons of residual asphalt per square yard and coat the cut edges of the bituminous concrete pavement. Allow the tack coat to cure such that it is tacky when the surface course is placed. Provide a bituminous concrete surface of thickness to match adjoining pavement surface. Apply the bituminous tack coat and place the bituminous concrete pavement only when the concrete base surface is clean and dry.

END OF SECTION

SECTION 02696

INSULATION FOR EXTERIOR PIPING

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B209	1986 Aluminum and Aluminum-Alloy Sheet and Plate
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ASTM C591	1985 Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
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1.3 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals."
Submit within 90 days after the contract award date and prior to commencing work on the system.

1.3.1 SD-17, Manufacturer's Catalog Data

- a. Insulation
- b. Jackets

1.4 RELATED REQUIREMENTS

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

PART 2 PRODUCTS

2.1 PIPING INSULATION

Products containing asbestos will not be permitted.

2.1.6 Polyurethane and Polyisocyanate Pipe Insulation

ASTM C591, minimum density of 1.7 pcf.

2.2 PIPE INSULATION

Pipe insulation shall be provided where noted on the Contract Drawings. Insulation shall be flexible, closed cell tubular pipe insulation with inherent vapor barrier. Unless otherwise noted, insulation shall be 1-1/2-inch thick. Elastomeric tube insulation shall have a low flame

spread classification of 25 or less and shall be in accordance with ASTM E 84.

A metal jacket shall be installed over exterior above grade piping where indicated on the Contract Drawings. Metal jacket shall be 0.016-inch aluminum magnesium alloy with built-in insulation felt. Jacket shall have a minimum lap seal joint.

2.3 ALUMINUM JACKET

ASTM B209, Temper H14, minimum thickness of 0.016 inch, with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated aluminum covers for insulation on fittings, valves, and flanges.

PART 3 EXECUTION

3.1 INSTALLATION

Install heat trace cable, and clean and test piping systems prior to the application of insulation. Insulation shall be clean, dry, and installed prior to the application of insulation jacket. Do not use short pieces of insulation and jacket materials where a full length section will fit. Provide insulation materials and jackets with smooth and even surfaces, with jackets drawn tight, and secured on longitudinal and end laps. Insulate fittings and piping accessories with premolded, precut, or field-fabricated pipe insulation of the same pipe insulation material and thickness as the adjoining pipe insulation. Provide unions, flanges, and piping accessories with removable sections of insulation. Provide insulation continuous through pipe hangers and pipe supports. Do not step on or walk on insulation or jacket.

3.2 INSULATION JACKET

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

-- End of Section --

SECTION 02831

FENCE, CHAIN LINK

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.

FEDERAL SPECIFICATIONS (FS)

FS FF-P-101	(Rev. F) Padlocks
FS RR-F-191	(Rev. J) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories) (General Specification)
FS RR-F-191/1	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric) (Detail Specification)
FS RR-F-191/2	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Gates) (Detail Specification)
FS RR-F-191/3	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)
FS RR-F-191/4	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) (Detail Specification)

1.3 SUBMITTALS

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

1.3.1 SD-17, Manufacturer's Catalog Data

- a. Fencing components
- b. Accessories

1.3.2 SD-44, Manufacturer's Instructions

- a. Fencing

1.3.3 SD-76, Certificates of Compliance

- a. Fabric
- b. Posts
- c. Braces
- d. Framing
- e. Rails
- f. Tension wire
- g. Gates
- h. Padlocks

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 CHAIN-LINK FENCING AND ACCESSORIES

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

2.1.1 Fabric

FS RR-F-191/1; Type I, zinc-coated steel, 9-gauge. Mesh size, 2 inches. Provide selvage knuckled at both selvages. Height of fabric, as indicated.

2.1.2 Gates

FS RR-F-191/2; Type II, double swing as indicated. Shape and size of gate frame, as indicated. Framing and bracing members, round of steel. Steel member finish, zinc-coated. Gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade except that steel pipe frames shall be 1.90 inches od, 0.120 inches minimum wall thickness. Gate fabric, as specified for fencing fabric. Coating for steel latches, stops, hinges, keepers, and accessories, galvanized. Gate latches, fork type. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding will not be permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

2.1.3 Posts, Top Rails and Braces

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

2.1.4 Fencing Accessories

FS RR-F-191/4. Provide wire ties constructed of the same material as that specified for chain-link fabric or framework.

2.1.5 Concrete

Provide as specified in Section 03302, "Cast-in-Place Concrete (Minor Construction)".

2.1.6 Grout

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

2.1.7 Padlocks

FS FF-P-101, Type EPA or EPB, 1 3/4-inch size, with chain.

PART 3 EXECUTION

3.1 FENCE INSTALLATION

Install fence on prepared surfaces to line and grade indicated. Allow for proper operation of components. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.1.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10-feet on center. Provide gate posts spaced as necessary for size of gate openings. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade.

3.1.2 Post Setting

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

3.1.2.1 Earth and Bedrock

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

3.1.2.2 Concrete Slabs and Walls

Set posts into zinc-coated sleeves, with a minimum diameter of 3 inches larger than the outside diameter of the fence post. Fill sleeve joint with lead, nonshrink grout, or other approved material.

3.1.3 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence.

3.1.4 Top Rails

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

3.1.5 Bottom Tension Wires

Install bottom tension wires before installing chain-link fabric, and pull wires taut. Place bottom tension wires within 8 inches of respective fabric line.

3.1.6 Fabric

Pull fabric taut and secure fabric to top rail and bottom wire, close to both sides of each post and at maximum intervals of 24 inches on center. Secure fabric to posts using stretcher bars, ties or clips spaced 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post. Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is 2 inches above slab level.

3.2 ACCESSORIES INSTALLATION

3.2.1 Post Caps

Design post caps to accommodate top rail. Install post caps as recommended by the manufacturer.

3.2.2 Gates

Install swing gates to swing through 180 degrees from closed to open.

3.2.3 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

3.3 GROUNDING

Ground fencing as indicated.

3.4 CLEANUP

Remove waste fencing materials and other debris from the station.

-- End of Section --

SECTION 02900

RECOVERY SYSTEM, JP-5 LINE AREA

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: 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.

1.1.1 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, Welded and Seamless
A 312	1989 (Rev.A)	Seamless 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 150	1989	Type I or II Portland Cement
C 478	1989	Precast Concrete Manhole Sections
C 494	1986	Chemical Admixtures for Concrete
D 1785	1989	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D 2241	1989	Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR-Series)
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	1985	Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.1.2 U.S. Environmental Protection Agency (EPA) Publication:

570/9-75-001

Manual of Water Well Construction Practices

1.1.3 Standard Methods for The Examination of Water and Wastewater, Fifteenth Edition

1.1.4 National Fire Protection Association (NFPA)

NFPA 70

1990

National Electrical Code

1.1.5 Manufacturers Standardization Society of Valve and Fittings Industry (MSS) Publication:

SP-58

1988 Pipe Hangers and Supports - Materials, Design and Manufacturer

1.2 DESCRIPTION OF WORK: The work includes the installation of one (1) product recovery system as shown and specified. The recovery system includes one recovery system control panel controlling two (2) wells. Each well shall be provided with a water depression pump (drawdown ejector), product pump (product ejector), two remote valve assemblies, bellows liquid level control, discharge valves and associated piping. Well construction, including materials, equipment, installation and workmanship shall be in accordance with EPA Manual of Water Well Construction Practices, except as modified herein. In the manual referred to herein, the "shall" has been substituted for the word "should" wherever it appears. Reference to the "Project Representative" and the "Owner" shall be interpreted to mean the Contracting Officer.

1.3 CERTIFIED GEOLOGIST: A state certified professional geologist shall be provided to start up, balance and provide to the government a report for oil recovery operations, as specified herein.

1.4 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and be in accordance with Section 01300, "Submittals".

1.4.1 SD-17, Manufacturer's Catalog Data:

- a. Well Casing
- b. Well Screen
- c. Filter Pack Gradation Analysis
- d. Product Recovery Equipment, Complete (The recovery system shall be provided complete by one manufacturer.)
- e. Manhole Sections, Slabs, Steps, Frames and Cover
- f. Casing Pipe
- g. Control Panel

1.4.2 SD-20, SD-21, SD-22, SD-23, Shop Drawings:

- a. Control Panel

1.4.3 SD-66, Statements:

- a. Certified Professional Geologist's Plans and Reports
- b. Laboratory Tests

1.4.4 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 titled "Operation and Maintenance Data".

- a. Product Recovery Equipment, as delineated in paragraph 2.4 of this section (Data Package 4).

1.4.5 SD-77, Field Test Reports:

- a. System Operation (as delineated in 02900, paragraph 3.9)

1.5 EARTHWORK: Provide in accordance with Section 02200 "Earthwork" and other sections as applicable.

1.6 ENVIRONMENTAL PROTECTION: Provide in accordance with Section 01560 "Environmental Protection."

1.7 GENERAL REQUIREMENTS: Provide in accordance with Sections 15011 "Mechanical General Requirements" and 16011 "Electrical General Requirements".

1.8 RELATED WORK:

1.8.1 Section 02901 Ground Water Treatment System, JP-5 Line Area".

PART 2 - PRODUCTS

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

2.2.2 Recovery Well Screens: Wire wound, continuous slot, 6 inch inside diameter. Type 304 stainless steel, Schedule 5 midbody and Schedule 40 ends (ASTM A-530). 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 be Morie #0 or a commercially available filter pack material with gradation specifications within the following ranges:

<u>Sieve Number</u>	<u>Cumulative Percent Retained</u>
16	0-5
18	5-15
20	30-46

25
3070-86
88-100

2.2.4 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 bag (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 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.

2.3.2 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 Frames and covers shall be in accordance with ASTM A-48, Class 30A. Covers shall be of dimensions shown with the smaller off-center access lid of dimensions shown. 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. Covers shall be of the self sealing type with a continuous gasket secured within a dovetail groove.

2.4 PRODUCT RECOVERY EQUIPMENT: The product recovery system shall include the following components: (The Recovery System Control Panel, Drawdown Ejectors, Product Ejectors, Bellows Liquid Level Controllers, and Remote Valve Assemblies shall be supplied as a coordinated package.)

2.4.1 Drawdown Ejector: Each drawdown ejector shall be a bottom fill pneumatic type unit suitable for placement inside the recovery well. The ejector casing material shall conform to the requirements of ASTM A-53 for Schedule 10 steel pipe. 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.

2.4.2 Product Ejector: Each product ejector shall be a top fill unit suitable for placement inside indicated well. The ejector casing material shall conform to the requirements of ASTM A-530 for 304 stainless steel, Schedule 10 pipe. The top of ejector shall be provided with a 1/2" inlet disc check valve, 1/2" airline connection and 1/2" discharge with poppet check valve. Integral to the ejector shall be a float valve that shall have a specific gravity less than 1 and greater than the product to be recovered. The float valve shall operate an opening in the bottom of the vessel by which water may be expelled into the well prior to product discharge. There shall be a disc type check valve on the water port discharge port to prevent water inflow during the fill cycle. The ejector shall pump product only without requiring any filters, or specialized liquid level controls.

2.4.3 Remote Valve Assemblies:

2.4.3.1 Drawdown Pump Air Supply: Drawdown 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 product 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 regulator with pressure gauge range of 0-30 PSI
- h. 3-way pneumatically operated air valve

2.4.3.2 Product Ejector Air Supply: Product ejector remote valve assembly shall consist of the following:

- a. Air supply connection from air compressor
- b. Pilot signal connection from control panel
- c. Air supply to product ejector
- d. Air supply shut-off valve
- e. Product ejector pressure regulator with pressure gauge range of 0-100 PSI
- f. 3-way pneumatically operated air valve

2.4.4 Bellow Liquid Level Controller: Bellows liquid level controller shall independently maintain proper liquid level in each well by throttling the air supply to the drawdown 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 product ejector
- c. Air supply connection from remote valve assembly
- d. Air supply connection to drawdown ejector

2.4.5 Recovery System Control Panel: The control panel enclosure shall be suitable for installation in Wet Locations. The control panel shall require electrical connections to 120 VAC, single phase power and the Recovered Product Tank High Level float switch and the Surge Tank High-High Level float switch. The control panel shall require airline connections as indicated on the Contract Drawings. Wiring of the Recovered Product Tank High Level and Surge Tank High-High Level float switches shall utilize intrinsically safe, barrier relays and shall be suitable for installation in Class I, Division 1, Group D Hazardous Locations. The control panel shall be capable of controlling two recovery wells.

The control panel shall be provided with ON/OFF switch with integral indicating light, 5 amp fuse, High-Recovered-Product-Tank indicating light, and 200 W panel heater. The control panel shall also be provided with a main air valve (timer controlled), supply pressure shut-off valve, bubbler pressure regulator, ejector pressure regulator, bubbler pressure gauge, ejector pressure gauge, cycle counter, adjustable "fill" timer, and adjustable "empty" timer to control and monitor the operation of the product recovery system. The adjustable range "fill" and "empty" timers shall be capable being adjusted to vary an ejector's pumping rate. The pumping rates shall be capable of being varied from 0.0 GPM to 1.5 GPM for the product ejectors and from 0.0 GPM to 5 GPM for the drawdown ejectors. Each timer shall have the following adjustments: Range - 1 second, 10 seconds, 1

minute, 10 minutes, 1 hour, and 10 hours; and Multiplier - 0-100%. The "fill" timer shall be adjusted to control the length of time the ejector is allowed to fill (no air is supplied to the ejector during this period). The "empty" timer shall be adjusted to control the length of time the ejector is allowed to discharge its contents at a given ejector pressure (air is supplied to the ejector during this time period to pressurize it and force recovered product out of the ejector through the discharge line).

The bellows liquid level control shall throttle the ejector pumping rate by restricting the air supply from the main air valve (timer-controlled). The bellows liquid level control shall independently maintain liquid level in each well. The sensing of the liquid in the wells shall utilize low pressure bubbler air and shall operate on the bubbler air method.

The remote valve assembly shall be used to reduce air consumption, increase control distance, and aid in the balancing process.

There shall be a separate remote valve assemblies and bellows liquid level controls at each well. The pumping rate from each well will be automatically varied by the bellows liquid level control to match the production rate of each well. No electrical devices shall be utilized in the wells for liquid level sensing, product sensing or ejector operation. The control panel shall shut down the recovery system upon receiving a high recovered product tank level signal or a high-high surge tank level signal. The product recovery system shall be optimized and balanced in accordance with manufacturer's instructions.

2.4.6 Valves:

2.4.6.1 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.

2.4.6.2 Product Valves: Product valves shall be of the ball type and shall be of the size indicated. Valves shall be provided suitable for use in hydrocarbon fluid. 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.

2.4.6.3 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.

2.4.6.4 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.

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

2.4.6.6 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.

2.4.7 Product and Water Hose: Product and water 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.

2.4.8 Piping:

2.4.8.1 Product and Water Pipe: Where indicated, PVC pipe shall be provided. Piping shall be Schedule 40 PVC and shall conform to ASTM D 1785. PVC pipe joints shall be solvent welded.

2.4.8.2 Product Pipe: Where indicated, ASTM A-53 for Schedule 40 galvanized steel piping shall be provided.

2.4.9 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.

2.4.10 Air Piping: Provided as specified in Section 15481, "Compressed Air Systems."

2.4.11 Recovered Product Tank Full Sensor and Cable: A tank full sensor and cable shall be provided to shut off the groundwater remediation system in the event the recovered product storage tank becomes full. The tank full sensor shall be the float switch type and suitable for use with the product to be recovered. Wiring for the float switch shall be provided intrinsically safe barriers and suitable for installation in Class I, Group D, Division 1 locations.

2.4.12 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, 1/4" product ejector pilot air hose, 1/4" drawdown ejector pilot air hose, 1-1/2" drawdown water hose, and 3/4" recovered product hose 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 pad): 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) 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: Oil recovery operations shall be supervised, directed, and monitored by a certified professional geologist with experience in hydrogeology and oil recovery. Oil 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 oil 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 of 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 base 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 that shall not allow puddling of water around manhole.

3.4 PRODUCT RECOVERY: The product recovery equipment shall be installed, operated, and maintained for 90 days by the contractor. The certified professional geologist shall monitor and direct the initial product recovery operations and shall provide an initial and final report of progress. The progress report shall include the quantity of recovered product, an estimate of the quantity of remaining product to be recovered, static water levels, drawdown levels and hydrogeologic conditions. After the 90 day 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 Drawdown Water: All ground water shall be discharged to the drawdown water treatment system (Section 02901, "Drawdown Water Treatment System, JP-5 Line Area").

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 for 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 Section 01560, "Environmental Protection."

3.5 SPARE PARTS: The 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 two months operation of the system by the Contractor.

3.6 FINAL CLEANUP: Remove waste material and other debris from the site.

3.7 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

3.8 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.

3.9 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 200 psig and shall show no leakage or reduction in gauge pressure after 4 hours. All equipment shall be tested in operation for a continuous period of not less than 90 days. During the tests, all equipment shall be tested under every condition of 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 tests. 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

3.4.1 Discharge of Drawdown Water: All ground water shall be discharged to the drawdown water treatment system (Section 02901, "Drawdown Water Treatment System, JP-5 Line Area").

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 for 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 Section 01560, "Environmental Protection."

3.5 SPARE PARTS: The 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 two months operation of the system by the Contractor.

3.6 FINAL CLEANUP: Remove waste material and other debris from the site.

3.7 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

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3.9 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 200 psig and shall show no leakage or reduction in gauge pressure after 4 hours. All equipment shall be tested in operation for a continuous period of not less than 90 days. During the tests, all equipment shall be tested under every condition of 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 tests. 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 02901

GROUND WATER TREATMENT SYSTEM, JP-5 LINE AREA

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: 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.

1.1.1 Manufacturers Standardization Society of Valve and Fittings Industry (MSS) Publication:

SP-58	1983	Pipe Hangers and Supports - Materials, Design, and Manufacture
SP-80	1987	Bronze Gate, Globe, Angle and Check Valves

1.1.2 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

1.1.3 Code of Federal Regulations (CFR)

1983	40 CFR 136	Guidelines Establishing Test Procedures for the Analysis of Pollutants
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1.1.4 National Fire Protection Association (NFPA)

NFPA 70	1990	National Electric Code
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1.1.5 Federal Specifications

FS WW-V-35

1.2 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and be in accordance with Section 01300, "Submittals".

1.2.1 SD-17, Manufacturer's Catalog Data:

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

1.2.2 SD-20, SD-21, SD-22, SD-23, Shop Drawings:

- a. Control Panel

1.2.3 SD-77, Field Test Reports:

- a. System Operation (as delineated in 02901, paragraphs 3.4, 3.5, and 3.6)

1.2.4 Operations 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, titled "Operation and Maintenance Data".

- a. Drawdown Water 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:

1.3.2 11301 Packed Gravity Oil / Water Separator

1.3.3 11302 Aluminum Air Stripping Tower

1.3.4 11303 Centrifugal Pumps

1.3.5 11304 Carbon Contactors

1.3.6 11347 Above Grade Horizontal Tanks

1.3.7 Other sections as applicable

1.4 TREATMENT PAD: Provide in accordance with:

1.4.1 02200 Earthwork

1.4.2 02831 Fence, Chain Link

1.4.3 03302 Cast in Place Concrete

1.4.4 13121 Pre-engineered Metal Buildings (Rigid Frame)

1.4.5 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 a drawdown water treatment system, including treatment pad, an oil water separator, a surge tank, an air stripper, carbon contactor, and all associated pumps, blowers, piping, and controls. The drawdown water treatment system shall begin at the treatment pad header.

1.8 RELATED WORK: Section 02900 "Recovery System, JP-5 Line Area".

PART 2 - PRODUCTS

2.1 PIPING AND VALVES:

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

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

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

2.1.1.3 Provide heat tracing as specified in Section 16402 and pipe insulation all for all above grade water piping which does not drain, including but not limited to:

- a. Oil water separator influent pipe
- b. Booster pump suction pipe
- c. Booster pump casing
- d. Booster pump discharge pipe extending to and including stripper inlet.
- e. Air stripper outlet to sump tank
- f. Carbon contactor pump suction and discharge piping
- g. Carbon contactor pump casing

2.1.2 Below-grade water pipe shall be SDR-26 PVC (ASTM 2241) 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 30 gpm. Packings and seals shall be hydrocarbon resistant. Body, bonnet, disk, and stem shall be bronze. Globe valves 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 seat 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 Product and Water Hoses: Product and 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: Treatment system control panel enclosure shall be suitable for installation in Wet Locations. Panel shall be provided with 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 intrinsically safe circuit wiring. Control panel shall operate on 120 VAC power.

PART 3 - EXECUTION

3.1 GENERAL: Provide the following in accordance with the applicable section (s):

3.1.1 Reinforced Concrete Treatment Pad and Carbon Contactor Building

3.1.2 Oil Water Separator. Oil water separator shall be installed on a 12 inch high concrete platform to insure gravity flow to the surge tank. Install the oil water separator and surge tank such that the oil/water separator effluent connection is higher than the surge tank fill connection.

3.1.3 Surge Tank.

3.1.4 Recovered Product Tank.

3.1.5 Booster Pump.

3.1.6 Blower: Install the air stripper and blower under the direct supervision of the manufacturer's field representative. Provide the services of the representative.

3.1.7 Sump Tank.

3.1.8 Carbon Contactor Pump.

3.1.9 Carbon Contactors.

3.1.10 Piping, Power, Controls, Accessories, and Appurtenances: Provide in accordance with the manufacturer's recommendations 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 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 The OIL/WATER SEPARATOR shall remove free product from the drawdown water stream. 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 recovered product pump at the oil water separator.

3.3.2 Drawdown water from the oil water separator shall gravity flow to the SURGE TANK. The surge tank shall contain four float switches and one free product detector:

3.3.2.1 High - High: Set at 90% of tank volume. The high - high float switch shall shut down the drawdown and product ejectors. The high - high float switch shall not shut down the blower and booster pump.

3.3.2.2 High: Set at 80% of tank volume. The high float switch shall activate the blower and booster pump.

3.3.2.3 Low: Set at 3 inches above the top of the tank draw off. The low float switch shall shut down the blower and booster pump. The blower shall shut down 2 minutes after the booster pump. The low float switch shall not shut down the drawdown and product ejectors.

3.3.2.4 Low - Low: Set at 1 inch above the top of tank draw off. The low - low switch shall function identically to the low float switch.

3.3.2.5 Free Product Detector: The free product detector shall be set to detect an oil/water interface 2 inches above the top of tank draw off. The free product detector shall shut down the booster pump and blower, but shall not shut down the drawdown and product ejectors.

3.3.3 The AIR STRIPPER shall remove dissolved hydrocarbons from the drawdown water stream. The air stripper shall discharge to the sump tank on the treatment pad.

3.3.4 The SUMP TANK shall contain four float switches:

3.3.4.1 High-High: Set at 28" above the tank bottom. The high-high float switch shall shut down the booster pump. When the High-High condition clears, the booster pump shall automatically restart.

3.3.4.2 High: Set at 24" above the tank bottom. The high float switch shall activate the carbon contactor pump.

3.3.4.3 Low: Set at 7" above the tank bottom. The low float switch shall shut down the carbon contactor pump.

3.3.4.4 Low-Low: Set at 6" above the tank bottom. The low-low float switch shall function identically to the low float switch.

3.3.5 The CARBON CONTACTORS shall remove dissolved hydrocarbons from the drawdown water stream. The carbon contactors shall discharge to the Lift Station as indicated.

3.4 STARTUP AND INITIAL TESTING

3.4.1 General: The Contractor shall provide all startup and testing services, and make all required adjustments, at his own expense.

3.4.1.1 Drawdown water generated during system startup and testing shall be discharged per the direction of the Contracting Officer. Unless otherwise noted, drawdown water from the recovery system shall be used for testing.

3.4.1.2 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.

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

3.4.1.4 Upon completion of start up and testing, treated drawdown water shall be discharged to the Lift Station as indicated only after the approval of the Contracting Officer.

3.4.2 Oil Water Separator: Test in accordance with Section 11301, "Packed, Gravity Oil Water Separator" prior to connecting the effluent pipe to the surge tank. The oil water separator shall be fully functional, and in full compliance with Section 11301 "Packed Gravity Oil Water Separator" prior to making the connection to the surge tank.

3.4.3 Surge Tank: Conduct the following tests prior to connecting drawoff pipe to air stripper booster pump:

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.

3.4.3.2 Free Product Detector: Using a minimal volume of product from the free product tank, establish an oil/water interface in the surge tank. Test the operation of the free product sensor; record the thickness of the product layer which activates the detector. The maximum acceptable thickness shall be 1/2-inch. Drain product from tank and return to recovered product tank. Thoroughly clean and flush surge tank following completion of this test, and prior to connecting drawoff pipe to air stripper booster pump.

3.4.4 Air Stripper: Test in accordance with Section 11302 "Aluminum Air Stripping Tower". Complete all testing prior to operating carbon contactors.

3.4.5 Sump Tank

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 OPERATION: The drawdown water treatment system shall be operated and maintained by the Contractor for a period of 90 days. The drawdown water treatment system shall treat drawdown water from the recovery system. A certified professional geologist shall monitor the drawdown water 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 90 days of operation by the Contractor, the Navy shall assume operation of the equipment. The Contractor shall provide training (three 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 "Recovery System, JP-5 Line Area". The training shall include one 8 hour day of training by the air stripper manufacturer's field representative.

3.5.1 Weekly water quality analysis of air stripper effluent shall be for volatile petroleum hydrocarbons and solvents by purge and trap / GC, as outlined in 40 CFR 136. Laboratory analysis shall be by an independent certified testing laboratory.

3.6 FINAL CLEANUP: Remove waste material and other debris from the site.

3.6 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 system shall be hydrostatically tested at not less than 1½ 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 90 days. 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 tests. 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 02950

RECOVERY SYSTEM, TARAWA TERRACE

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: 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.

1.1.1 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, Welded and Seamless
A 312	1989 (Rev.A)	Seamless 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, Schedules 40, 80, and 120
D 2241	1989	Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR-Series)
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	1985	Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.1.2 U.S. Environmental Protection Agency (EPA) Publication:

570/9-75-001

Manual of Water Well Construction Practices

1.1.3 Standard Methods for The Examination of Water and Wastewater, Fifteenth Edition

1.1.4 National Fire Protection Association (NFPA)

NFPA 70 1990 National Electrical Code

1.1.5 Manufacturers Standardization Society of Valve and Fittings Industry (MSS) Publication:

SP-58 1988 Pipe Hangers and Supports - Materials, Design and
Manufacturer

1.2 DESCRIPTION OF WORK: The work includes the installation of one (1) ground water remediation system as shown and specified. The system includes one system control panel controlling two (2) wells. Each well shall be provided with a water depression pump (drawdown ejector), a remote valve assembly, bellows liquid level control, discharge valves and associated piping. Well construction, including materials, equipment, installation and workmanship shall be in accordance with EPA Manual of Water Well Construction Practices, except as modified herein. In the manual referred to herein, the "shall" has been substituted for the word "should" wherever it appears. Reference to the "Project Representative" and the "Owner" shall be interpreted to mean the Contracting Officer.

1.3 CERTIFIED GEOLOGIST: A state certified professional geologist shall be provided to start up, balance and provide to the government a report for the ground water remediation operations, as specified herein.

1.4 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and in accordance with Section 01300, "Submittals".

1.4.1 SD-17, Manufacturer's Catalog Data:

- a. Well Casing
- b. Well Screen
- c. Filter Pack Gradation Analysis
- d. Recovery Equipment, Complete (The recovery system shall be provided complete by one manufacturer.)
- e. Manhole Sections, Slabs, Steps, Frames and Cover
- f. Casing Pipe
- g. Control Panel

1.4.2 SD-20, SD-21, SD-22, SD-23, Shop Drawings:

- a. Control Panel

1.4.3 SD-66, Statements:

- a. Certified Professional Geologist's Plans and Reports
- b. Laboratory Tests

1.4.4 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, titled "Operation and Maintenance Data".

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

1.4.5 SD-77, Field Test Reports:

- a. System Operations (as delineated in 02950, paragraph 3.9)

1.5 EARTHWORK: Provide in accordance with Section 02200 "Earthwork" and other sections as applicable.

1.6 ENVIRONMENTAL PROTECTION: Provide in accordance with Section 01560 "Environmental Protection."

1.7 GENERAL REQUIREMENTS: Provide in accordance with Sections 15011 "Mechanical General Requirements" and 16011 "Electrical General Requirements".

1.8 RELATED WORK:

1.8.1 Section 02951 Ground Water Treatment System, Tarawa Terrace".

PART 2 - PRODUCTS

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

2.2.2 Recovery Well Screens: Wire wound, continuous slot, 6 inch inside diameter. Type 304 stainless steel, Schedule 5 midbody and Schedule 40 ends (ASTM A-530). 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 be Morie #0 or a commercially available filter pack material with gradation specifications within the following ranges:

<u>Sieve Number</u>	<u>Cumulative Percent Retained</u>
16	0-5
18	5-15

20	30-46
25	70-86
30	88-100

2.2.4 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 bag (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 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 and accomodate frame and covers.

2.3.2 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 Frames and covers shall be in accordance with ASTM A-48, Class 30A. Covers shall be of dimensions shown with the smaller off-center access lid of dimensions shown. 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. Covers shall be of the self sealing type with a continuous gasket secured within a dovetail groove.

2.4 PRODUCT RECOVERY EQUIPMENT: The product recovery system shall include the following components. The Recovery System Control Panel, Drawdown Ejectors, Bellows Liquid Level Controllers, and Remote Valve Assemblies shall be supplied as a coordinated package.

2.4.1 Drawdown Ejector: Each drawdown ejector shall be a bottom fill pneumatic type unit suitable for placement inside the recovery well. The ejector casing material shall conform to the requirements of ASTM A-53 for Schedule 10 steel pipe. 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.

2.4.2 Remote Valve Assemblies:

2.4.2.1 Drawdown Pump Air Supply: Drawdown 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 bellows liquid level control drawdown ejector bubbler line

- d. Air supply to bellows liquid level 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 regulator with pressure gauge range of 0-30 PSI
- h. 3-way pneumatically operated air valve

2.4.3 Bellow Liquid Level Controller: Bellows liquid level controller shall independently maintain proper liquid level in each well by throttling the air supply to the drawdown 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 drawdown ejector
- c. Air supply connection from remote valve assembly
- d. Air supply connection to drawdown ejector

2.4.4 Recovery System Control Panel: The control panel enclosure shall be suitable for installation in Wet Locations. The control panel shall require electrical connections to 120 VAC, single phase power and the Recovered Product Tank High Level float switch and the Surge Tank High-High Level float switch. The control panel shall require airline connections as indicated on the Contract Drawings. Wiring of the Recovered Product Tank High Level and Surge Tank High-High Level float switches shall utilize intrinsically safe, barrier relays and shall be suitable for installation in Class I, Division 1, Group D Hazardous Locations. The control panel shall be capable of controlling two recovery wells.

The control panel shall be provided with ON/OFF switch with integral indicating light, 5 amp fuse, High-Recovered-Product-Tank indicating light, and 200 W panel heater. The control panel shall also be provided with a main air valve (timer controlled), supply pressure shut-off valve, bubbler pressure regulator, ejector pressure regulator, bubbler pressure gauge, ejector pressure gauge, cycle counter, adjustable "fill" timer, and adjustable "empty" timer to control and monitor the operation of the product recovery system. The adjustable range "fill" and "empty" timers shall be capable being adjusted to vary an ejector's pumping rate. The pumping rates shall be capable of being varied from 0.0 GPM to 5 GPM for the drawdown ejectors. Each timer shall have the following adjustments: Range - 1 second, 10 seconds, 1 minute, 10 minutes, 1 hour, and 10 hours; and Multiplier - 0-100%. The "fill" timer shall be adjusted to control the length of time the ejector is allowed to fill (no air is supplied to the ejector during this period). The "empty" timer shall be adjusted to control the length of time the ejector is allowed to discharge its contents at a given ejector pressure (air is supplied to the ejector during this time period to pressurize it and force recovered product out of the ejector through the discharge line).

The bellows liquid level control shall throttle the ejector pumping rate by restricting the air supply from the main air valve (timer-controlled). The bellows liquid level control shall independently maintain liquid level in each well. The sensing of the liquid in the wells shall utilize low pressure bubbler air and shall operate on the bubbler air method.

The remote valve assembly shall be used to reduce air consumption, increase control distance, and aid in the balancing process.

There shall be a separate remote valve assemblies and bellows liquid level controls at each well. The pumping rate from each well will be automatically varied by the bellows liquid level control to match the production rate of each well. No electrical devices shall be utilized in the wells for liquid level sensing, product sensing or ejector

operation. The control panel shall shut down the recovery system upon receiving a high recovered product tank level signal or a high-high surge tank level signal. The product recovery system shall be optimized and balanced in accordance with manufacturer's instructions.

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 Water Hose: Water 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 Water Pipe: Where indicated, PVC pipe shall be provided. Piping shall be Schedule 40 PVC and shall conform to ASTM D 1785. PVC 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 the Buna-N core. Sleeve and end connections shall be brass.

2.4.9 Air Piping: Provided as specified in Section 15481, "Compressed Air Systems."

2.4.10 Recovered Product Tank Full Sensor and Cable: A tank full sensor and cable shall be provided to shut off the groundwater remediation system in the event the recovered product storage tank becomes full. The tank full sensor shall be the float switch type and suitable for use with the product to be recovered. Wiring for the float switch shall be provided intrinsically safe barriers and suitable for installation in Class I, Group D, Division 1 locations.

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, 1/4" drawdown ejector pilot air hose, and 1-1/2" drawdown water hose, 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 pad): 3/4" air supply hose, and 1/4" drawdown ejector pilot air hose shall be encased in 4" PVC Schedule 40 (ASTM 1785) 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: Operations shall be supervised, directed, and monitored by a certified professional geologist with experience in hydrogeology and groundwater remediation. Remediation 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 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 of 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 base 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 that shall not allow puddling of water around manhole.

3.4 RECOVERY SYSTEM: The recovery equipment shall be installed, operated, and maintained for 90 days by the contractor. The certified professional geologist shall monitor and direct the initial recovery operations and shall provide an initial and final report of progress. The progress report shall include the effects of current recovery efforts, an estimate of remaining recovery, static water levels, drawdown levels and hydrogeologic conditions. After the 90 day operation of the systems by the Contractor, the Navy will assume operation of the system. 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 Drawdown Water: All ground water shall be discharged to the drawdown water treatment system (Section 02951, Ground Water Treatment System, Tarawa Terrace").

3.4.3 Waste Disposal: All soil removed from drill holes shall be tested for 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 Section 01560, "Environmental Protection."

3.5 SPARE PARTS: The 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 two months operation of the system by the Contractor.

3.6 FINAL CLEANUP: Remove waste material and other debris from the site.

3.7 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

3.8 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.

3.9 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 200 psig and shall show no leakage or reduction in gauge pressure after 4 hours. All equipment shall be tested in operation for a continuous period of not less than 90 days. During the tests, all equipment shall be tested under every condition of 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 tests. 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 02951

GROUND WATER TREATMENT SYSTEM, TARAWA TERRACE

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: 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.

1.1.1 Manufacturers Standardization Society of Valve and Fittings Industry (MSS) Publication:

SP-58	1983	Pipe Hangers and Supports - Materials, Design, and Manufacture
SP-80	1987	Bronze Gate, Globe, Angle and Check Valves

1.1.2 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

1.1.3 Code of Federal Regulations (CFR)

1983	40 CFR 136	Guidelines Establishing Test Procedures for the Analysis of Pollutants
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1.1.4 National Fire Protection Association (NFPA)

NFPA 70	1990	National Electric Code
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1.1.5 Federal Specifications

FS WW-V-35

1.2 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and be in accordance with Section 01300, "Submittals".

1.2.1 SD-17, Manufacturer's Catalog Data:

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

1.2.2 SD-20, SD-21, SD-22, SD-23, Shop Drawings:

- a. Control Panel

1.2.3 SD-77. Field Test Reports:

- a. System Operation (as delineated in 02951, paragraphs 3.4, 3.5 and 3.6)

1.2.3 Operations 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, titled "Operation and Maintenance Data".

- a. Drawdown Water 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:

1.3.2 11301 Packed Gravity Oil / Water Separator

1.3.3 11302 Aluminum Air Stripping Tower

1.3.4 11303 Centrifugal Pumps

1.3.5 11304 Carbon Contactors

1.3.6 11347 Above Grade Horizontal Tanks

1.3.7 Other sections as applicable

1.4 TREATMENT PAD: Provide in accordance with:

1.4.1 02200 Earthwork

1.4.2 02831 Fence, Chain Link

1.4.3 03302 Cast in Place Concrete

1.4.4 13121 Pre-engineered Metal Buildings (Rigid Frame)

1.4.5 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 a drawdown water treatment system, including treatment pad, an oil water separator, a surge tank, an air stripper, carbon contactor, and all associated pumps, blowers, piping, and controls. The drawdown water treatment system shall begin at the treatment pad header.

1.8 RELATED WORK: Section 02950 "Recovery System, Tarawa Terrace".

PART 2 - PRODUCTS

2.1 PIPING AND VALVES:

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

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

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

2.1.1.3 Provide heat tracing as specified in Section 16402 and pipe insulation for all above grade water piping which does not drain, including but not limited to:

- a. Oil water separator influent pipe
- b. Booster pump suction pipe
- c. Booster pump casing
- d. Booster pump discharge pipe extending to and including stripper inlet.
- e. Air stripper outlet to sump tank
- f. Carbon contactor pump suction and discharge piping
- g. Carbon contactor pump casing

2.1.2 Below-grade water pipe shall be SDR-26 PVC (ASTM 2241) 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 30 gpm. Packings and seals shall be hydrocarbon resistant. Body, bonnet, disk, and stem shall be bronze. Globe valves 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 seat 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 Product and Water Hoses: Product and 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 Treatment System Control Panel: Treatment system control panel enclosure shall be suitable for installation in Wet Locations. Panel shall be provided with 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 intrinsically safe circuit wiring. Control panel shall operate on 120 VAC power.

PART 3 - EXECUTION

3.1 GENERAL: Provide the following in accordance with the applicable section (s):

3.1.1 Reinforced Concrete Treatment Pad and Carbon Contactor Building

3.1.2 Oil Water Separator. Oil water separator shall be installed on a 12 inch high concrete platform to insure gravity flow to the surge tank. Install the oil water separator and surge tank such that the oil/water separator effluent connection is higher than the surge tank fill connection.

3.1.3 Surge Tank.

3.1.4 Recovered Product Tank.

3.1.5 Air Stripper Booster Pump.

3.1.6 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.

3.1.7 Sump Tank.

3.1.8 Carbon Contactor Pump.

3.1.9 Carbon Contactors.

3.1.10 Piping, Power, Controls, Accessories, and Appurtenances: Provide 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 valves. Laminated plastic shall be 0.125-inch hick 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 The OIL/WATER SEPARATOR shall remove free product from the drawdown water stream. 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 recovered product pump at the oil water separator.

3.3.2 Drawdown water from the oil water separator shall gravity flow to the SURGE TANK. The surge tank shall contain four float switches and one free product detector:

3.3.2.1 High - High: Set at 90% of tank volume. The high - high float switch shall shut down the drawdown and product ejectors. The high - high float switch shall not shut down the blower and booster pump.

3.3.2.2 High: Set at 80% of tank volume. The high float switch shall activate the blower and booster pump.

3.3.2.3 Low: Set at 3 inches above the top of the tank draw off. The low float switch shall shut down the blower and booster pump. The blower shall shut down 2 minutes after the booster pump. The low float switch shall not shut down the drawdown and product ejectors.

3.3.2.4 Low - Low: Set at 1 inch above the top of tank draw off. The low - low switch shall function identically to the low float switch.

3.3.2.5 Free Product Detector: The free product detector shall be set to detect an oil/water interface 2 inches above the top of tank draw off. The free product detector shall shut down the booster pump and blower, but shall not shut down the drawdown and product ejectors.

3.3.3 The AIR STRIPPER shall remove dissolved hydrocarbons from the drawdown water stream. The air stripper shall discharge to the sump tank on the treatment pad.

3.3.4 The SUMP TANK shall contain four float switches:

3.3.4.1 High-High: Set at 28" above the tank bottom. The high-high float switch shall shut down the booster pump. When the High-High condition clears, the booster pump shall automatically restart.

3.3.4.2 High: Set at 24" above the tank bottom. The high float switch shall activate the carbon contactor pump.

3.3.4.3 Low: Set at 7" above the tank bottom. The low float switch shall shut down the carbon contactor pump.

3.3.4.4 Low-Low: Set at 6" above the tank bottom. The low-low float switch shall function identically to the low float switch.

3.3.5 The CARBON CONTACTORS shall remove dissolved hydrocarbons from the drawdown water stream. The carbon contactors shall discharge to the Lift Station as indicated.

3.4 STARTUP AND INITIAL TESTING

3.4.1 General: The Contractor shall provide all startup and testing services, and make all required adjustments, at his own expense.

3.4.1.1 Drawdown water generated during system startup and testing shall be discharged per the direction of the Contracting Officer. Unless otherwise noted, drawdown water from the recovery system shall be used for testing.

3.4.1.2 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.

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

3.4.1.4 Upon completion of start up and testing, treated drawdown water shall be discharged to the existing 6 inch sanitary sewer line as indicated only after the approval of the Contracting Officer.

3.4.2 Oil Water Separator: Test in accordance with Section 11301, "Packed, Gravity Oil Water Separator" prior to connecting the effluent pipe to the surge tank. The oil water separator shall be fully functional, and in full compliance with Section 11301 "Packed Gravity Oil Water Separator" prior to making the connection to the surge tank.

3.4.3 Surge Tank: Conduct the following tests prior to connecting drawoff pipe to air stripper booster pump:

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.

3.4.3.2 Free Product Detector: Using a minimal volume of product from the free product tank, establish an oil/water interface in the surge tank. Test the operation of the free product sensor; record the thickness of the product layer which activates the detector. The maximum acceptable thickness shall be 1/2-inch. Drain product from tank and return to recovered product tank. Thoroughly clean and flush surge tank following completion of this test, and prior to connecting drawoff pipe to air stripper booster pump.

3.4.4 Air Stripper: Test in accordance with Section 11302 "Aluminum Air Stripping Tower". Complete all testing prior to operating carbon contactors.

3.4.5 Sump Tank

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 OPERATION: The drawdown water treatment system shall be operated and maintained by the Contractor for a period of 90 days. The drawdown water treatment system shall treat drawdown water from the recovery system. A certified professional geologist shall monitor the drawdown water 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 90 days of operation by the Contractor, the Navy shall assume operation of the equipment. The Contractor shall provide training (three 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 02950 "Recovery System, Tarawa Terrace". The training shall include one 8 hour day of training by the air stripper manufacturer's field representative.

3.5.1 Weekly water quality analysis of air stripper effluent shall be for volatile petroleum hydrocarbons and solvents by purge and trap / GC, as outlined in 40 CFR 136. Laboratory analysis shall be by an independent certified testing laboratory.

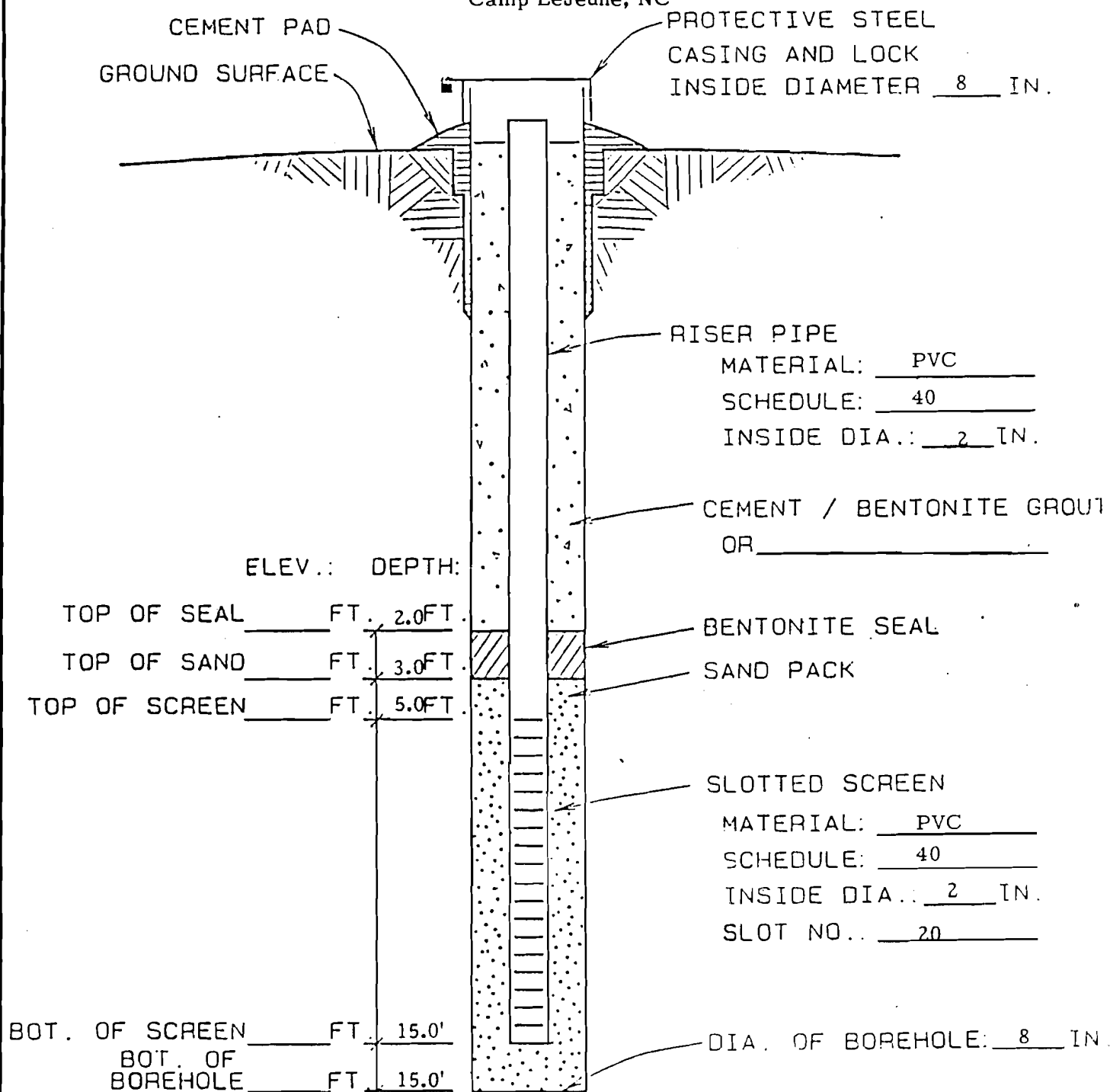
3.6 FINAL CLEANUP: Remove waste material and other debris from the site.

3.6 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 system shall be hydrostatically tested at not less than 1½ 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 90 days. 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 tests. 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

3542.002.320

U.S. Navy
Hadnot Point Tank Farm
Camp LeJeune, NCWell No. MW 10

TYPICAL OVERBURDEN MONITORING WELL

N.T.S.

SECTION 03302

CAST-IN-PLACE CONCRETE (MINOR CONSTRUCTION)

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 CONCRETE INSTITUTE (ACI)

ACI 301	1984 (Rev. 1988) Specifications for Structural Concrete for Buildings
ACI 304	1973 (Rev. 1983) Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	1977 (Rev. 1982) Hot Weather Concreting
ACI 306R	1978 (Rev. 1983) Cold Weather Concreting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A185	1985 Welded Steel Wire Fabric for Concrete Reinforcement
ASTM A497	1986 Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A615	1987 (Rev. A) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A616/A616M	1987 Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A617/A617M	1987 Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A706/A706M	1987 Low-Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM C33	1986 Concrete Aggregates
ASTM C94	1986 (Rev. B) Ready-Mixed Concrete
ASTM C143	1978 Slump of Portland Cement Concrete
ASTM C150	1986 Portland Cement

ASTM C171	1969 (Rev. 1986) Sheet Materials for Curing Concrete
ASTM C172	1982 Sampling Freshly Mixed Concrete
ASTM C173	1978 Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231	1982 Air Content for Freshly Mixed Concrete by the Pressure Method
ASTM C260	1986 Air-Entraining Admixtures for Concrete
ASTM C309	1981 Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	1986 Chemical Admixtures for Concrete
ASTM C920	1987 Elastomeric Joint Sealants
ASTM D1190	1974 (Rev. 1980) Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D1751	1983 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	1984 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ARMY CORPS OF ENGINEERS (COE)

COE CRD-C572	1974 Specification for Polyvinylchloride Waterstop
COE CRD-C621	1983 Handbook for Concrete and Cement, Specification for Nonshrink Grout, Volume II (1949 Edition)

1.3 GENERAL REQUIREMENTS

In the ACI publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears; reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" shall be interpreted to mean the Contracting Officer.

1.4 SUBMITTALS

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

1.4.1 SD-76, Certificates of Compliance

- a. Cement
- b. Aggregates
- c. Admixtures
- d. Reinforcement
- e. Joint filler
- f. Joint sealant

1.5 DELIVERY

Do not deliver concrete until ready for concrete placement.

1.6 STORAGE

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. Concrete shall have a 28-day compressive strength of 4000 psi. Slump shall be between 2 and 4 inches in accordance with ASTM C143. Provide ASTM C33 aggregate Size No. 57 or 67 and 4 to 6 percent air entrainment for concrete exposed to freeze-thaw conditions. Accomplish air-entrainment using an air-entraining admixture.

2.1.2 Ready-Mixed Concrete

ASTM C94, 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 C150, Type I or II, except as modified herein.

2.2.2 Water

Water shall be potable.

2.2.3 Aggregates

ASTM C33. 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 C260 for air-entrained concrete. ASTM C494 for water reducing (Type A, D, or E), accelerating (Type C), and retarding (Type B or D), to be used only when approved.

2.2.5 Reinforcement

2.2.5.1 Reinforcing Bars

ASTM A706/A706M, Grade 60; ASTM A615 and ASTM A617/A617M, Grade 60; or ASTM A616/A616M, Grade 60.

2.2.5.2 Welded Wire Fabric

ASTM A497 or ASTM A185, 6 by 6, W2.9 by W2.9, unless otherwise indicated. Provide flat sheets for slabs.

2.2.6 Materials for Curing Concrete

2.2.6.1 Impervious Sheeting

ASTM C171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

2.2.6.2 Liquid Membrane-Forming Compound

ASTM C309, white-pigmented, Type 2, free of paraffin or petroleum. Do not use where finished appearance is important. Use where approved only.

2.2.7 Expansion-Joint Filler

ASTM D1751 or ASTM D1752, 1/2-inch thick, unless otherwise indicated.

2.2.8 Joint Sealants

2.2.8.1 Horizontal Surfaces (3 percent slope, maximum)

a. Outside Buildings: ASTM D1190.

2.2.8.2 Vertical Surfaces (greater than 3 percent slope)

ASTM C920, Type M, Grade NS, Class 25, Use T.

2.2.9 Polyvinylchloride Waterstops

COE CRD-C572.

2.2.10 Nonshrink Grout

COE CRD-C621.

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 Construction Joints

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

3.2.4 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 304, except as modified herein. ASTM C94; 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, snow, and ice 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 306R. 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.

3.4.2 Floated Finish

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

3.4.3 Broomed Finish

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

3.4.4 Pavement Finish

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straight edge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained. Round edges and joints with an edger having a radius of 1/8 inch.

3.5 MISCELLANEOUS CONSTRUCTION

3.5.1 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet, unless otherwise indicated. Cut contraction joints 3/4 inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction, where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space joints not more than 50 feet apart. Provide a transverse slope of 1/4 inch per foot. Limit variation in cross section to 1/4 inch in 5 feet.

3.5.2 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

3.5.3 Curbs and Gutters

Provide contraction joints spaced every 10 feet maximum, unless otherwise indicated. Cut contraction joints 3/4 inch deep with a jointing tool after

the surface has been finished. Provide expansion joints 1/2 inch thick and spaced every 100 feet maximum, unless otherwise indicated. Provide a broom finish.

3.6 CURING AND PROTECTION

ACI 301. Protect concrete from injurious action by sun, rain, wind, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the curing period. Forms may be removed 48 hours after concrete placement.

3.6.1 Moist Curing

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

3.6.1.1 Ponding or Immersion

Continually immerse the concrete throughout the curing period. Water temperature shall not be more than 20 degrees F than the temperature of the concrete. For temperature between 40 and 50 less degrees F, increase the curing period by 50 percent.

3.6.1.2 Fog Spraying or Sprinkling

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

3.6.1.3 Previous 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.

3.6.2 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.

3.6.3 Liquid Membrane-Forming Compound Curing

Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Provide and maintain compound on the concrete surface throughout the curing period. Provide a continuously wetted, permeable cover as specified in paragraph entitled, "Hot Weather."

3.6.3.1 Application

Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance, and before joints are sawed. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound, unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Respray concrete surfaces subjected to rainfall within 3 hours after the curing compound application.

3.6.3.2 Protection of Treated Surfaces

Prohibit foot and vehicular traffic and other sources of abrasion for not less than 72 hours after compound application. Maintain continuity of the coating for the entire curing period and immediately repair any damage.

3.6.4 Curing Periods

Allow 7 days.

3.7 SAMPLING AND TESTING

3.7.1 Sampling

ASTM C172. Collect samples of fresh concrete to perform tests specified.

3.7.2 Testing

3.7.2.1 Slump Tests

ASTM C143. 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.

3.7.2.2 Air Content

ASTM C173 or ASTM C231. 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 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.

ALUMINUM ASSOCIATION, INC. (AA)

AA SAA46 1979 Standards for Anodized Architectural Aluminum

AA DAF45 1980 Designation System for Aluminum Finishes

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC M011 1980 Manual of Steel Construction, 8th Edition

AISC S326 1978 "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings"

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI A10.3 1977 Safety Requirements for Powder Actuated Fastening Systems

ANSI B18.2.1 1981 Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws

ANSI B18.2.2 1972 Square and Hex Nuts

ANSI B18.22.1 1972 Lock Washers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36 1984 Structural Steel

ASTM A53 1984 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A123 1978 Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip

ASTM A153	1982 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A500	1984 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A501	1984 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A525	1980 Steel Sheets, Zinc-Coated (Galvanized), by the Hot-Dip Process, General Requirements (Metric)
ASTM A687	1984 Steel Bolts and Studs
ASTM B26	1984 Aluminum-Alloy Sand Casting
ASTM B108	1982 Aluminum-Alloy Permanent Mold Castings
ASTM B209	1984 Aluminum and Aluminum Alloy Sheet and Plate
ASTM B221	1983 Aluminum and Aluminum Alloy Extruded Bar, Rod, Wire, Shape and tube

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1	1985 Structural Welding Code, Steel
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FEDERAL SPECIFICATIONS (FS)

FS FF-P-395	(Rev. B) Pin, Drive, Guided and Pin Drive, Power Actuated
FS FF-S-85	(Rev. C) Screws, Cap, Slotted and Hexagon Head
FS FF-S-92	(Rev. B) Screws, Machine: Slotted, Cross Recessed or Hexagon Head
FS FF-S-111	(Rev. D) Screw, Wood
FS FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS FF-W-84	(Rev. A) Washers, Lock (Spring)
FS TT-P-645	(Rev. A) Primer, Paint, Zinc-Chromate, Alkyd Type
FS TT-P-664	(Rev. C) (Amd. 2) Primer Coating, Synthetic, Rust-Inhibiting, Lacquer-Resisting

FS TT-V-51 (Rev. F) Varnish; Asphalt

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

MILITARY SPECIFICATIONS (MIL)

DOD-P-21035 (Rev. A) Paint, High Zinc Dust Content, Galvanizing Repair

MILITARY STANDARDS (MIL-STD)

MIL-STD-889 (Rev. B) Dissimilar Metals

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MFM 1975 Metal Finishes Manual, Third Edition (Revised)

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP6 1963 Surface Preparation Specifications No. 6, Commercial Blast Cleaning

1.3 SUBMITTALS

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

1.3.1 SD-17, Manufacturer's Catalog Data

- a. Corrugated Galvanized Sheet Metal Siding
- b. Cover plates and frames
- c. Hinge

1.3.2 SD-35, Drawings

- a. Corrugated Galvanized Sheet Metal Siding
- b. Cover plates and frames
- c. Hinge

Submit drawings along with templates, and erection and installation details, indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1.3.3 SD-76, Certificates of Compliance

a. Corrugated Galvanized Sheet Metal Siding

1.4 QUALIFICATION OF WELDERS

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

1.5 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.1 MATERIALS

Products shall conform to the respective reference specifications and standards and to the requirements specified herein.

2.1.1 Steel and Iron

If not specified otherwise, use standard mill finished structural steel shapes or bar iron in compliance with AISC S326 Specifications for Design, Fabrication and Erection of Structural Steel for Buildings.

2.1.2 Structural Carbon Steel

ASTM A36.

2.1.3 Structural Tubing

ASTM A500 or ASTM A501.

2.1.4 Steel Pipe

ASTM A53, Type E or S, Grade B.

2.1.5 Fittings for Steel Pipe

Standard malleable iron fittings.

2.1.6 Corrugated Sheet Metal

Use 20 guage Galvanized Sheet Metal for weather cover as indicated.

2.1.7 Anchors and Fasteners

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

2.1.7.1 Expansion Shields

FS FF-S-325, of group, type, class, and style best suited for the purpose. Provide shields recessed not less than 2 1/2-inches into concrete or masonry, unless indicated otherwise. Devices of Groups IV, V, VI, and VII shall not be used in sizes greater than 3/8 inch unless so indicated.

2.1.7.2 Lag Screws and Bolts

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

2.1.7.3 Bolts, Nuts, Studs and Rivets

ANSI B18.2.2 and ASTM A687.

2.1.7.4 Powder Driven Fasteners

FS FF-P-395 or FS GGG-D-777. Use when permitted by ANSI A10.3. Follow safety provisions of ANSI A10.3.

2.1.7.5 Screws

FS FF-S-85, FS FF-S-92, and FS FF-S-111.

2.1.7.6 Lock Washers

Circular washers shall conform to ANSI B18.22.1. Beveled washers for American Standard beams and channels shall be square or rectangular, taper in thickness, and be smooth. Lock Washers shall conform to FS FF-W-84.

2.1.8 Aluminum Alloy Products

Shall conform to ASTM B209 for sheet plate, ASTM B221 for extrusions and ASTM B26 or ASTM B108 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 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 the surfaces with a coat of bituminous paint, a coat of varnish conforming to FS TT-V-51, or a coat of zinc chromate primer conforming to FS TT-P-645 or FS TT-P-664 to prevent galvanic or corrosive action.

PART 3 EXECUTION

3.1 FABRICATION

By mechanics skilled in the trade and in accordance with the manufacturer's directions. Metalwork shall be well formed to shape and size, with sharp lines, angles, and true curves. All work shall be fabricated to allow for expansion and contraction of materials. Provide welding and bracing of adequate strength and durability, with tight, flush joints, dressed smooth

and clean.

3.2 MEASUREMENTS

Before fabrication, provide necessary field measurements and verify all measurements.

3.3 METAL SURFACES

Shall be clean and free from mill scale, flake rust and rust pitting; well formed and finished to shape and size, with sharp lines, angles, and smooth surfaces. Shearing and punching shall leave clean true lines and surfaces. Weld or rivet permanent connections. Welds and flush rivets shall be used and finished flush and smooth on surfaces that will be exposed after installation. Do not use screws or bolts where they can be avoided; when used, heads shall be countersunk, screwed up tight and threads nicked to prevent loosening.

3.4 CONSTRUCTION

Thickness of metal and details of assembly and supports shall give ample strength and stiffness for the minimum loads specified or indicated. Joints exposed to weather shall be formed to exclude water.

3.5 FASTENING

Provide the necessary rabbets, lugs, and brackets so that the work can be assembled in a neat and substantial manner. Holes for bolts and screws shall be drilled. Joints exposed to the weather shall be formed to exclude water. Conceal fastenings where possible.

3.6 SHOP FABRICATION

Fabrication and assembly shall be done in the shop to the greatest extent possible.

3.7 MISCELLANEOUS ITEMS

3.7.1 Equipment Weather Covers

Fabricate from 20 guage Galvanized Steel Corrugated Sheet metal bolted to steel frame. Provide access door hinged to frame. Construct frame of 3"x3"x1/4" steel ells.

3.8 ANCHORAGE, FASTENINGS, AND CONNECTIONS

3.8.1 Anchorage

Provide anchorage for fastening work securely in place. Set anchors in concrete as the work progresses and space not more than 2 feet on centers unless indicated otherwise. Sizes, kinds, and spacings of anchors not indicated or specified shall be as necessary for the purpose, as approved. Anchorage not otherwise specified or indicated includes 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. Provide inserts of suitable and approved types where required for support or anchorage of equipment and finish construction. Inserts shall be gray or malleable iron castings or galvanized steel unless indicated or specified otherwise. Slotted inserts shall be of types required to engage with anchors. Anchors and anchor bolts in exterior walls shall be zinc-coated and all other anchors and anchor bolts shall be heavily coated with bituminous paint.

3.8.1.1 Fastenings

Do not use wood plugs in any material. Use non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, and harmonizing with the material to which fastenings are applied. Conceal fastenings where practicable. Drill and punch to produce clean true lines and surfaces. Countersink metalwork to receive hardware.

3.8.1.2 Threaded Connections

Make threaded connections up tight so that treads are entirely concealed. Make bolted work up tight and nick the threads or bush the stem to prevent loosening. Rivet, bolt, and screw heads shall be flat and countersunk in exposed work and elsewhere as required. Machine removable members and fit and secure by means of screws or bolts of proper size and approved spacing.

3.8.1.3 Anchors and Connecting Members

Provide in concrete or masonry as the work progresses, to avoid unnecessary cutting and drilling. Cut, fit, and drill as necessary so all materials are properly set in place and to permit engaging work to be properly installed.

3.8.1.4 Design Connections

Where not shown or indicated, connection details shall be in accordance with AISC M011 and connections shall be provided using common steel bolts. Provide necessary holes for securing work to building. Use lock washers under nuts.

3.8.1.5 Built-In Work

Metal work built-in with concrete or masonry shall be formed for anchorage, or be provided with suitable anchoring devices as shown or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.9 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1. Weld in a manner to prevent permanent distortion of the connected parts. Weld continuously along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Grind smooth visible welds in the finished installation.

3.10 FINISHES

3.10.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123, ASTM A153 and ASTM A525, as applicable. Galvanized surfaces shall not be passivated or "stabilized".

3.10.1.1 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

3.10.1.2 Repair of Zinc-Coated Surfaces

Repair surfaces damaged by welding or other means with galvanizing repair paint conforming to DOD-P-21035 or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved. Clean areas to be repaired and remove the slag from the welds. Surfaces to which stick or paste material is applied, shall be heated 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.

3.10.2 Shop Cleaning and Painting

After surface preparation, apply pretreatment and primer as specified. Do not coat surfaces of items to be embedded in concrete. Recoat 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.

3.10.2.1 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when the metallic surfaces temperature is within 5 degrees F of the dew point of the surrounding air, or when the surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.10.2.2 Surface Preparation

Unless otherwise specified herein, abrasive blast clean surfaces in accordance with SSPC SP6. 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. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.10.3 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with the manufacturer's standard practice. On surfaces concealed in the finished construction or

not be accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 0.1 mil. Tint the additional prime coat with a small amount of tinting pigment.

3.10.4 Nonferrous Metal Surfaces

Protect by plating, anodic, organic, or other coatings as specified.

3.10.5 Aluminum Surfaces

3.10.5.1 Surface Condition

Before finishes are applied, exposed aluminum sheets, plates, and extrusions shall be free of roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and any other defects which will affect uniform appearance of finished surfaces.

3.10.5.2 Aluminum

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Castings shall have sandblast finish, medium, equal to NAAMM MFM, Metal Finishes Manual, Designation AA-M43 or AA SAA46, Standards for Anodized Architectural Aluminum and AA DAF45 Designation System for Aluminum Finishes of The Aluminum Association Publications.

-- End of Section --

SECTION 09900

PAINTING

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.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000	Occupational Safety and Health Standards
29 CFR 1910.1025	Occupational Safety and Health Standards (Lead)

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1558	Paint, Stencil
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FEDERAL SPECIFICATIONS (FS)

FS TT-P-102	(Rev. E) (Int Amd. 1) Paint, Oil (Alkyd Modified, Exterior, White and Tints)
FS TT-P-00791	(Rev. B) (GSA-FSS) (Amd. 2) Putty: Linseed-Oil Type, (For Wood-Sash-Glazing)

FEDERAL STANDARDS (FED-STD)

FED-STD-313	(Rev. B) (Change Notice 2) Material Safety Data Sheets Preparation and Submission of
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MILITARY SPECIFICATIONS (MIL)

MIL-P-24441/1	(Rev. B) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type I (QPL)
MIL-P-28577	(Rev. B) Primer, Water-borne, Acrylic or Modified Acrylic, for Metal Surfaces
MIL-P-28582	(Notice 1) Primer Coating, Exterior, Lead Pigment-Free (Undercoat for Wood, Ready-Mixed, White and Tints)

MILITARY STANDARDS (MIL-STD)

MIL-STD-101	(Rev. B) Color Code for Pipelines and for
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Compressed Gas Cylinders

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint-1	1982 Shop, Field, and Maintenance Painting
SSPC Paint-3	1982 A Guide to Safety in Paint Application
SSPC SP1	1982 Solvent Cleaning

1.3 SUBMITTALS

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

1.3.1 SD-44, Manufacturer's Instructions

- a. Paint 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.

1.3.2 SD-66, Statements

- a. Applicator's qualifications
- b. Evidence of acceptable variation

1.3.2.1 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.

1.3.2.2 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.

1.3.3 SD-76, Certificates of Compliance

- a. Coating
- b. Sealant

For each type of coating, sealant, or other product furnished, submit a certificate from the manufacturer stating that the product conforms to requirements of the referenced specification. If the referenced specification has a Qualified Products List (QPL), certify that the product has been tested and approved for inclusion in the QPL.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications of Airless Spray Applicators

Satisfactory application of paint by airless spray at a minimum of two sites.

1.4.2 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.

1.5 REGULATORY REQUIREMENTS

1.5.1 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.5.2 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.5.3 Asbestos Content

Materials shall not contain asbestos.

1.6 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.

1.7 SAFETY METHODS

Apply coating materials using safety methods and equipment in accordance with the following:

1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC Paint-3.

1.7.2 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.
- 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).

1.8 ENVIRONMENTAL CONDITIONS

1.8.1 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.

1.9 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.

1.10 LOCATION AND SURFACE TYPE TO BE PAINTED

1.10.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New finished surfaces (factory and shop) that require identification or color coding and factory finished surfaces (factory and shop) that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

1.10.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

1.10.3 Exterior Painting

Includes new surfaces, existing coated surfaces, and existing uncoated surfaces, of the buildings and appurtenances as indicated. Also included are existing coated surfaces made bare by cleaning operations.

1.10.4 Mechanical and Electrical Painting

Includes field coating of 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

1.10.5 Exterior Painting of Site Work Items

Field coat the following items:

New Surfaces

- a. Conduit and Electrical Equipment Supports
- b. Supports for Mechanical Piping and Equipment
- c. Equipment not having a Contracting Officer approved factory applied coating.
- d. Plywood control board panel
- e. Mechanical equipment covers, backs, and supports

1.10.6 Equipment: Shop or Factory

Coat equipment as specified in Division 11 (Equipment)

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the specifications and standards referenced in PART 3. For materials specified that are on the 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 New Ferrous Surfaces: (SSPC SP6 Blast Cleaned)

Provide one coat of primer in the shop except where otherwise specified.

3.3.2 Galvanized Surfaces

- a. New Galvanized: Solvent clean in accordance with SSPC SP1. Apply intermediate coat as soon as practicable after primer (pre-treatment) has dried.

3.3.3 Aluminum, Other Non-Galvanized, and Non-Ferrous Surfaces

- a. Surface Cleaning: Solvent clean in accordance with SSPC SP1 and wash with a mild detergent to remove dirt and water soluble contaminants. Apply intermediate coat as soon as practicable after primer (pretreatment) has dried.

3.4 PREPARATION OF WOOD AND PLYWOOD SURFACE

3.4.1 New Surfaces

New Plywood and Wood Surfaces, Except Floors, to Receive Natural Finish:

- a. Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.
- b. Cosmetic Repair of Minor Defects:
 - (1) Knots and Resinous Wood: Prior to application of paint, treat with an application of commercially available knot sealer.
 - (2) Open Joints and Other Openings: Fill with whiting putty, FS TT-P-00791. Sand smooth after putty has dried.
 - (3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.
- d. Prime Coat For New Exterior Surfaces: Prime coat before wood becomes dirty, warped.
- e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.

3.5 APPLICATION

3.5.1 Coating Application

Apply coating materials in accordance with SSPC Paint-1. SSPC Paint-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.

- 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 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.

3.5.2 Equipment

Apply coatings with approved brushes, approved rollers, or approved spray equipment, unless specified otherwise. Spray areas made inaccessible to brushing by items such as ducts and other equipment.

3.5.3 Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

3.5.4 Coating Systems

- a. **Systems by Substrates:** Apply coatings that conform to the respective specifications listed in the following Tables:

Table

I Exterior Metal Surfaces

VI Exterior Wood and Plywood Surfaces

- b. **Minimum Dry Film Thickness (DFT):** Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise 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, fillers, and primers need not be provided on surfaces where existing coatings are soundly adhered and in good condition.
- f. Damaged shop/factory finishes: 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

3.6 COATING SYSTEMS FOR METAL

- a. Primer: Apply specified ferrous metal primer on the same day that surface is cleaned. If flash rusting occurs, re-clean the surface prior to application of primer.
- (1) Inaccessible Surfaces: Prior to erection, use two coats of the specified primer on metal surfaces that will be inaccessible after erection.
 - (2) Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
 - (3) Surface Previously Coated with Epoxy or Urethane: Apply MIL-P-24441/1, Formula 150, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
 - (4) Pipes and Tubing; The semitransparent film applied to pipes and tubing at the mill is not to be considered a shop coat. Apply specified ferrous metal primer prior to application of subsequent coats.
 - (5) Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer, MIL-P-28577.
- b. Apply coatings of Table I. "DFT" means dry film thickness in mils.

3.7 COATING SYSTEMS FOR WOOD AND PLYWOOD

- a. Apply coatings of Table VI.
- b. Prior to erection, apply two coats of the specified primer to treat

and prime wood and plywood surfaces which will be inaccessible after erection.

- c. Apply stains in accordance with the manufacturer's printed instructions.

3.8 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.

3.9 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

Note: The following materials are based on using products from Tenemec Co. (804) 780-3077.

	SURFACE/ AREA	PRIMER	DFT	INTERMED- IATE COAT	DFT	TOPCOAT	DFT
A.	New Steel	90-97 Tenemec Zinc	3.0	Series 104 H.S. Epoxy	6.0	Series 73 Endurashield III	3.0
B.	New Galvanized Surfaces	Series 32-1210 Tenemec-Grip Vinyl Wash Primer	0.3	Series 50-330 Poly Ura-Prime	2.0	Series 73 Endurashield III	3.0

TABLE - VI

EXTERIOR WOOD AND PLYWOOD SURFACES

	SURFACE/ AREA	PRIMER	DFT	INTERMED- IATE COAT	DFT	TOPCOAT	DFT
A.	Wood and Plywood	MIL-P-28582	1.5	FS TT-P-102	1.5	FS TT-P-102	1.5

TABLE - VI
EXTERIOR WOOD AND PLYWOOD SURFACES

SURFACE/ AREA	PRIMER	DFT	INTERMED- IATE COAT	DFT	TOPCOAT	DFT
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-- End of Section --

SECTION 11301

PACKED, GRAVITY OIL/WATER SEPARATOR

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: 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.

1.1.1 Federal Specification (Fed. Spec.):

SS-S-210A	Sealing Compound, Preformed Plastic, For Expansion Joints and Pipe Joints
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1.1.2 Military Specification (Mil. Spec.):

DOD-P-23236(A)	Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast
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MIL-S-45180D	Sealing Compound, Gasket, Hydrocarbon Fluid and Water Resistant
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1.1.3 American National Standards Institute (ANSI) Publication:

B16.5	1981	Pipe Flanges and Flanged Fittings
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1.1.4 American Public Health Association (APHA) Publication:

Standard Methods for the Examination of Water and Wastewater

1.1.5 American Society for Testing and Materials (ASTM) Publications:

A 36	1988b	Structural Steel
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1.1.6 American Welding Society (AWS) Publication:

D1.1	1984	Structural Welding Code, Steel
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1.1.7 United States Environmental Protection Agency (EPA) Publication:

Methods for Chemical Analysis of Water and Wastes

1.2 GENERAL REQUIREMENTS: Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "Electrical General Requirements"

1.3 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and be in accordance with Section 01300, "Submittals".

1.3.1 Shop Drawings: Shop drawings for separator and accessory equipment 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 (SD-17, SD-21, SD-22, SD-23).

1.3.2 Manufacturer's Service Representative's Report and Certificate: 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 (SD-66, SD-73).

1.3.3 Verification: 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 (SD-66).

1.3.4 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, titled "Operation and Maintenance Data".

- a. Oil/Water separator, including pump, controls, and all necessary equipment (Data Package 4).

1.3.5 SD-77, Field Test Reports:

- a. Equipment Operation (as delineated in 11301 Part 3.)

1.4 DELIVERY, STORAGE, AND HANDLING MATERIALS:

1.4.1 Delivery and Storage: Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, 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.

1.4.2 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 no cost to Government.

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 30 gallons per minute (gpm). The influent is further characterized as follows:

Operating Temperature:	32 - 60°F
Separator Ambient Temperature	10 - 95°F
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 or 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 dewatering 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 $\frac{1}{4}$ -inch Class A carbon steel conforming to ASTM A 36. 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:

<u>DESCRIPTION</u>	<u>NUMBER*</u>	<u>SIZE</u>	<u>TYPE CONNECTION</u>
Separator inlet	3	inch	flange
Oil pump discharge	1	inch	NPT
Clean water outlet	3	inch	flange
Tank drain	3	inch	flange

* Blank off spares as necessary

2.1.1.1 Flanges: Use only flat face flanges and drill 150-pound ANSI Standard bolt circle. Use flanged piping connections that conform to ANSI B16.5.

2.1.1.2 Tank shall be provided with lifting lugs for handling and installation. Each lug shall carry the total dry weight of the tank and attendant appurtenances.

2.1.1.3 Covers: Parts subject to wear or requiring adjustment, inspection, repair or cleaning shall be provided with covers. 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.

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 will be 3/4" maximum. Flow through the pack will be sinusoidal to induce oil droplet impingement on the plate surfaces. Coalesced oil will flow unimpinged along the plate surface to the top of the separation chamber where it is automatically decanted. Coalescing plate ribs shall form a 55 degree settling shelves to enhance particular solids removal. Media shall be encased in a stainless steel frame and is easily 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 A 36.

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 1/4-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 a gravity pipe discharge. This discharge pipe shall be provided with a 1/4-inch sampling valve.

2.1.7 Recovered product pump: A rotary gear pump shall be provided to pump out the 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 elevation.

2.1.7.1 Pump motor shall operate on 120VAC, single phase, 60 HZ power. The pump motor shall be totally enclosed, explosion-proof, suitable for Class I, Group D, Division I Hazardous Locations.

2.1.8 Motor Starter: Recovered product pump motor starter shall only require power connections and consist of a manual motor starter, "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

2.1.8.1 Motor starter shall be housed in an enclosure suitable for installation in wet locations. The enclosure shall be explosion proof and suitable for Class I, Group D, Division I Hazardous Locations.

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 uplift and ensure unit stability. Use a lifting bar through lugs to insert plate or tube pack into tank and place on supports. Caulk around 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 pack and the tank walls and pack supports to avoid damage. System installation shall be conducted in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL:

3.2.1 Field Hydrostatic Test: After separator has been leveled and secured to foundation and separation ribbed plate pack is in place, level effluent overflow weir at elevation specified by manufacturer and hydrostatically test unit for no leakage for 8 hours by filling with potable water.

3.3 TESTS: After hydrostatic test has been successfully completed and unit has been properly connected to influent and effluent piping, allow influent to flow into separator filled with potable water. Adjust and level surface oil overflow weir to optimize oil skimming and minimize water overflow to oil recovery. Recovered product pump shall be tested in accordance with subsection 3.2 of Section 11303, "Centrifugal Pumps". Optimize operation of unit within 5 working days. Operate unit for a minimum of ten tank volume changes prior to testing for hydrocarbon removal.

3.3.1 Test for Contaminants: Test influent and effluent for hydrocarbons described in paragraph titled "Performance". Test shall be performed by an independent certified testing laboratory.

3.3.2 Analytical Methods: Test and sample preservation methods for test contaminants shall be in accordance with the latest revisions of APHA Standard Methods for the Examination of Water and Wastewater, EPA Methods for Chemical Analysis of Water and Wastes, or those substitute methods approved by the governing regulatory agencies having jurisdiction.

3.3.3 Sampling Procedures: Collect influent and effluent samples from sampling ports provided as part of the separator. Purge each sampling port to remove built-up solids or other material prior to collecting sample. Collect samples in clean glass containers. Collect duplicate samples in separate glass containers. Collect duplicate samples immediately after collecting the first samples. Do not attempt to split sample.

3.4 TEST CRITERIA: If separator does not meet requirements of this specification, the unit may be rejected. If unit is not operating at design efficiency 5 days after installation, Government may reject system. In the event Government rejects unit Contractor shall remove separator or defective components and replace with acceptable unit or components.

*** END OF SECTION ***

SECTION 11302

ALUMINUM AIR STRIPPING TOWER
INTERNALS AND ACCESSORIES

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. References to Table 1 are to the table at the end of this specification entitled "Air Stripping Column - Table 1". References to Table 2 are to the table at the end of this specification entitled "Blower and Blower Motor - Table 2".

1.1.1 American Society of Mechanical Engineers (ASME) Publication

1986 Boiler and Pressure Vessel Code

1.1.2 Occupational Safety and Health Act (OSHA) Standard:

29 CFR 1910.219 Mechanical Power-Transmission Apparatus

1.1.3 Code of Federal Regulations

1984 40 CFR 136, Guidelines for Establishing Test
Procedures for the Analysis of Pollutants

1.1.4 Aluminum Association

SAS-30-1986 Specifications for Aluminum Structures

1.1.5 Air Movement and Control Association (AMCA)

AMCA-99 Classifications of Spark Resistant Construction

1.2 GENERAL REQUIREMENTS: Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "Electrical General Requirements"

1.3 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and be in accordance with Section 01300, "Submittals".

1.3.1 SD-17, Manufacturer's Catalog Data:

- a. Tower Shell
- b. Anchor Base Ring and Anchor Bolts
- c. Flanged Connections
- d. Packing
- e. Packing Support Plates
- f. Distributor Tray
- g. Liquid Redistribution Rings
- h. Mist Eliminator

- i. Blower
- j. Motor
- k. Flexible wire reinforced cloth ductwork
- l. Guy wires, including anchoring details

1.3.2 SD-73, Factory Test Reports: Submit the manufacturer's complete signed report of results of inspection and tests. Report shall include detailed descriptions of points inspected, tests, quantitative results obtained if such are specified, and suggestions for precautions to be taken to insure proper operation and maintenance.

1.3.2.1 Pressure Testing: The tower shell will be pressure tested at three times the rated blower static pressure to insure the shell is free of imperfections such as cracks, pinholes or incomplete welds. The tower shell will hold the required pressure for one hour and soap solution will be used to positively locate imperfections. All such problems shall be corrected and the unit retested before approval. An accurate log of the test shall be kept for submittal.

1.3.3 SD-76, Manufacturer's Certificate of Compliance: Submit the manufacturer's certificate of compliance that the equipment conforms to the specified requirements.

1.3.3.1 Performance: The certificate of compliance shall explicitly state raw water flow rate, raw water characteristics, air flow rate, finished water characteristics, and operating temperature range. (Section 1.5).

1.3.3.2 Fabrication: The certificate of compliance shall explicitly state that the column was constructed in accordance with this specification including recommendations and calculations concerning the use of guy wires.

1.3.4 SD-39, Qualifications: Submit on the manufacturer's letterhead, the manufacturer's qualifications to:

- a. Fabricate the air stripper
- b. Direct air stripper installation
- c. Provide air stripper startup and testing services
- d. Provide training

1.3.5 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 titled "Operation and Maintenance Data".

- a. Air Stripper (Data Package 4)
- b. Blower (Data Package 4)
- c. Accessory Equipment (Data Package 4)

1.3.6 SD-17, Field Test Reports:

- a. Equipment Operation (as delineated in 11302 Part 3.)

1.4 DELIVERY, STORAGE, AND HANDLING MATERIALS:

1.4.1 Delivery: During shipment all equipment shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the equipment. If special shipping and handling precautions are required, prominently and legibly stencil such precautions on outside of equipment or its crating.

1.4.2 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.

1.5 PERFORMANCE: See Table 1 for the capacity that shall be provided for each air stripping tower and the finished water quality in part per billion (ppb) at an air and raw water temperature of 55°F.

1.6 MANUFACTURERS:

1.6.1 The following manufacturers can meet the requirements of this specification:

- a. Hydrogroup, Inc. (800) 524-2725
- b. Refinite Water Conditioning Co. (803) 324-7600
- c. R.E. Wright Associates, Inc. (717) 944-5501

PART 2 - PRODUCTS

2.1 FABRICATION

2.1.1 The air stripper shall be constructed in a fabrication shop which has an ASME "U" stamp.

2.1.2 Welding of the vessel and internals shall be in accordance with 1986 ASME Boiler and Pressure Vessel Code.

2.1.3 The equipment specified herein shall be provided as a package by a single manufacturer/supplier.

2.1.4 All components of the column shall be provided in accordance with the manufacturer's recommendation to meet the removal criteria.

2.2 AIR STRIPPING COLUMN

2.2.1 Tower Shell

2.2.1.1 The columns shall have a minimum effective internal cross-sectional area as shown in Table 1. The columns shall be constructed entirely of 5000 Series Structural Grade Aluminum designed and manufactured in accordance with the specifications of the Aluminum Association (SAS-30-1986). Design snow and wind loads shall be as per relevant American National Standard Institute Codes; the design wind load shall not be less than 100 mph. Earthquake and vibrational effects shall also be

considered. The tower shells shall have a minimum thickness of 3/16 inch throughout. It shall be properly rolled, welded and reinforced where required.

2.2.1.2 An anchor base ring with sufficient anchoring points shall be provided to be compatible with the concrete treatment pad design. All fasteners shall be stainless steel sized in accordance with the manufacturer's recommendation.

2.2.1.3 Anchoring equipment and guy wires shall be sized in accordance with the column manufacturer's recommendations.

2.2.1.4 The towers shall be provided with the connections as shown in Table 1. Two 18" flanged manways, 1/2" diameter flanged drain nozzle (with gasket and blind flange), base anchor ring, lifting lugs, and support brackets for piping shall be provided.

2.2.1.4.1 Each air inlet center line shall be 48" above the anchor ring base.

2.2.1.4.2 Each effluent nozzle center line shall be 6" above the anchor ring base.

2.2.2 Column Internals

2.2.2.1 Sufficient high efficiency packing shall be provided to yield a minimum packing depth as shown in Table 1. The packing shall be 2-inches in diameter and made of polypropylene material. The packing shall have a surface area of approximately 48 square feet/cubic foot and 93% void space. The pressure drop under operating conditions shall be in accordance with Table 1. Packing shall be Jaeger Tripacks.

2.2.2.2 One packing support plate shall be provided and shall be compatible with the packing furnished. The support plate shall be of fiberglass reinforced plastic grating. The support plate will be designed and supported so that the maximum deflection in the tray is less than one quarter inch when supporting the maximum load.

2.2.2.3 A distributor tray shall be provided to uniformly distribute the water flow over the surface of the packing and uniformly collect the exhaust air. The distributor shall be capable of handling a water flow range shown in Table 1. The distributor tray will be constructed of structural grade aluminum and be complete with influent velocity breaker, air exhaust stacks, and distributor orifices. The air exhaust stacks will be sized to provide a gas velocity not exceeding 25 feet per second. The distribution orifices shall be sufficient in number to provide even distribution and sized to retain a static head of water in the tray over the full range of liquid flow rates anticipated. The bottom of the tray shall be stiffened to withstand the maximum hydrostatic head anticipated without excessive deflection. The structural design shall conform to the standards of the Aluminum Association (SAS-30-1986). Spray nozzles or pipe distributors will not be acceptable.

2.2.2.4 Liquid redistribution rings shall be provided at even intervals throughout the height of packing, as required for efficient packing performance. A minimum of four (4) redistributors shall be provided.

2.2.2.5 A moisture separation system shall be provided which will eliminate water droplets in the exhaust air stream. A polypropylene mesh-type mist eliminator shall be provided for this purpose. All air inlet and outlet openings will be provided with 24 mesh insect screens.

2.3 BLOWER, MOTOR, DUCTWORK

2.3.1 Two blowers shall be provided, one at each site. Each blower performance shall be as shown in Table 2.

2.3.2 Each blower shall be a centrifugal blower of 319 cast aluminum construction having a minimal thickness of 3/16". The blower shall be Type B in accordance with standards adopted by Air Movement and Control Associates (AMCA) for industrial fans. The blower shall be designed for outdoor use. The blower housing shall be suitably braced to resist vibration or pulsation. The blower shaft shall be medium carbon steel (1040-45 SAE) and shall not operate above 70% of the first critical speed. The bearings shall be heavy duty, flange type and include two individual ball or roller bearings with provisions for grease lubrication. The bearings shall be sized to produce a L10 life of not less than 40,000 hours.

2.3.3 Each blower fan wheels shall be dynamically balanced after construction. The entire fan assembly shall be given a final dynamic balance.

2.3.4 Each blower shall be provided with a vented weather cover, belt guard, a drain connection and an inlet screen.

2.3.5 Each blower manufacturer shall be licensed to bear the AMCA Certified Air Rating Seal.

2.3.6 Each blower motor shall be squirrel cage induction type, suitable for installation in wet locations. The motor shall be designed as shown in Table 2. Motor starter shall be as specified in Division 16.

2.3.7 Each blower shall be provided with wire reinforced, cloth flex ductwork to the column.

2.3.8 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.

2.4 TOWER ACCESSORIES

2.4.1 Inlet Riser Piping: The inlet riser piping shall be 2 inch diameter, Schedule 80 PVC and shall extend from inside the tower at the center of the water distribution tray to a flanged face at the bottom of the tower.

2.4.2 Fasteners: All fasteners shall be 304 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 The contractor shall install the tower shell, tower packing, fans and the air duct assemblies under the direct supervision of the Manufacturer's Field Representative. The Contractor shall provide, at his own expense, the services of the field representative. Electrical connection to the

blowers and any instruments or monitoring devices shall be provided by the Contractor as specified elsewhere.

3.1.2 The manufacturer shall provide a template to insure accurate setting of base ring anchor bolts. The column shall be anchored using stainless steel anchor bolts and shall be of dimensions as recommended by the column manufacturer. As a minimum, 3/4" diameter, 6" imbedment, 3" stickup shall be required.

3.1.3 The Contractor shall install guy wire anchors in accordance with the column manufacturer's recommendation, and where shown on the Contract Drawings.

3.2 START UP AND INITIAL TESTING: During startup, on-site tests shall be performed in the presence of the manufacturer's representative with a gas chromatograph to provide data on the air stripper's performance. The Contractor shall provide services of the gas chromatograph. Alternatively, grab samples may be obtained for off-site analysis. Influent and effluent water quality data shall be obtained hourly for two periods of a minimum of six consecutive hours of operation. Water shall be analyzed for benzene, toluene, ethylbenzene, and xylene. Data for the second period shall not be obtained until data from the first period has been reviewed by the Contracting Officer. All data shall be recorded and submitted to the Contracting Officer for approval. The Contractor shall, at his own expense, make all adjustments and modifications necessary to the air stripper such that it meets the requirements of paragraph 1.5 of this section.

AIR STRIPPING COLUMN - TABLE 1

	<u>JP-5 LINE AREA</u>		<u>TARAWA TERRACE</u>	
Capacity (gpm)	20		30	
Water Quality Conc. (ppb at 55°F):	Raw	Finished	Raw	Finished
Benzene	23	*	16600	360
Toluene	718	*	41000	1010
Ethyl Benzene	520	*	3000	80
Xylene	1586	*	17600	560
Min. Internal Cross Section (sq.ft)	0.83		1.25	
Overall Height (ft)	15±		29±	
Nozzle Diameter (in):				
Air Influent	6		6	
Water Influent	2		2	
Water Effluent	2		2	
Min. Packing Depth (ft)	10		20	
Max. Pressure Drop at Operating Conditions (inches of water per foot of packing):	0.08		0.08	
Water Flow Range for Distributor tray (gpm)	10 to 20		20 to 30	

* Total Benzene, Toluene, Ethylbenzene and Xylene (BTEX)
concentration less than 2000 mg/l

BLOWER AND BLOWER MOTOR - TABLE 2

	<u>JP-5 LINE AREA</u>	<u>TARAWA TERRACE</u>
Blower Design:		
Flow (scfm)	220	220
Water Static Pressure (in)	2.3	3.1
Blower Motor Design:		
Horsepower	1/3	1/3
VAC, Phase, Hz	120, 1, 60	120, 1, 60

END OF SECTION

SECTION 11303
CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below are part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publications:

A-48 1983 Gray Iron Castings
B-62 1986 Bronze Castings

1.1.2 Occupational Safety and Health Act (OSHA) Standard:

29 CFR 1910.219 Mechanical Power-Transmission Apparatus

1.2 GENERAL REQUIREMENTS: Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, General Electrical Requirements

1.3 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and be in accordance with Section 01300, "Submittals".

1.3.1 SD-76, Certificate of Compliance: Submit the manufacturers certificate of compliance that each pump is constructed and will perform as specified and the report of factory operation test.

1.3.2 SD-17, Manufacturer's Catalog Data: Submit shop drawings, including the manufacturers' data, on the following:

- a. Pump
- b. Motor
- c. Channel Base
- d. Pump Head/Capacity Curve

1.3.3 SD-73, Factory Test Reports:

- a. Centrifugal Pump Operation (as delineated in 11303 Part 3.)

1.3.4 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, titled "Operation and Maintenance Data".

- a. Air stripper booster pump, including motor and controls
- b. Carbon contactor pump, including motor and controls

1.3.5 SD-77, Field Test Reports:

- a. Centrifugal Pump Operation (as delineated in 11303 Part 3.)

1.4 PERFORMANCE:

1.4.1 JP-5 Line Area: The centrifugal pumps shall perform as follows:

- a. Air Stripper Booster Pump

<u>Capacity (GPM)</u>	<u>Total Discharge Head (Ft.)</u>
10	21
20	17

- b. Carbon Contactor Pump

<u>Capacity (GPM)</u>	<u>Total Discharge Head (Ft.)</u>
10	15.5
20	12.0

1.4.2 Tarawa Terrace: The centrifugal pumps shall perform as follows:

- a. Air Stripper Booster Pump

<u>Capacity (GPM)</u>	<u>Total Discharge Head (Ft.)</u>
10	41
20	38
30	32

- b. Carbon Contactor Pump

<u>Capacity (GPM)</u>	<u>Total Discharge Head (Ft.)</u>
10	15.8
20	13.5
30	10.5

PART 2 - MATERIALS**2.1 Pumps**

- a. Pump casing: Cast Iron (ASTM A-48)
- b. Case Wearing Rings: Bronze (ASTM B-62)
- c. Impellers: Bronze (ASTM B-62), dynamically balanced
- d. Shafts: Stainless Steel (AISI 416)
- e. Mechanical Seals: Stainless Steel (AISI 316) with Buna-N elastomeric parts
- f. Bearings: two year minimum B-10 bearing life. Provide fittings for grease lubrication.
- g. Pump Casing Gasket: Hydrocarbon resistant "O" ring.

2.2 Motors

2.2.1 Pump motors shall meet the requirements of the pump manufacturer. Motor shafts shall be stainless steel.

2.2.2 Pump motors shall be suitable for installation in Wet Locations. Motor starters shall be as specified in Division 16.

2.2.3 Motor Characteristics**2.2.3.1 JP-5 Line Area:**

	<u>Air Stripper Booster Pump</u>	<u>Carbon Contactor Pump Motor</u>
Rated speed	1750 rpm	1750 rpm
Rated horsepower	3/4 hp	1/3 hp
Rated voltage	208 VAC	120 VAC
Phase	3	1

2.2.3.2 Tarawa Terrace:

	<u>Air Stripper Booster Pump</u>	<u>Carbon Contactor Pump Motor</u>
Rated speed	1750 rpm	1750 rpm
Rated horsepower	3/4 hp	1/3 hp
Rated voltage	208 VAC	120 VAC
Phase	3	1

2.3 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.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Each pump shall be installed on a steel channel base 2" high x 8" wide x the length of the pump and motor. The channel base shall be anchored to the treatment pad using anchor bolts.

3.1.2 Each pump shall be installed level

3.1.3 Provide unions at each pump suction and discharge.

3.2 TESTING

3.2.1 Each pump shall be factory tested and have a field running test which shall consist of verifying the following:

1. Unit has been properly installed
2. Unit has been properly aligned and connected
3. Unit is free from undue vibration
4. Unit is free from overloading or overheating.

3.2.2 Each pump shall also be included in accordance with subsections 3.4, 3.5 and 3.6 of Section 02901, "Ground Water Treatment System - JP-5 Line Area" and Section 02951, "Ground Water Treatment System - Tarawa Terrace".

END OF SECTION

SECTION 11304
CARBON CONTACTORS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below are part of this specification to the extent referenced.

[Not Used]

1.2 GENERAL REQUIREMENTS: Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "General Electrical Requirements".

1.3 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and be in accordance with Section 01300, "Submittals".

1.3.1 SD-17, Manufacturer's Catalog Data: Submit shop drawings on the following:

- a. Contactor vessels, including principle dimensions, materials of construction, inlet and outlet fittings.
- b. Granulated Activated Carbon

1.3.2 SD-76, Manufacturer's Certificate of Compliance: Submit the manufacturer's certificate of compliance that the equipment conforms to the specified requirements.

1.3.3 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, titled "Operation and Maintenance Data".

1.4 MANUFACTURERS: The following manufacturers can meet the requirements of this specification:

- a. Calgon Carbon Corporation (412) 787-6700
- b. Carbtrol Corporation (800) 242-1150

PART 2 - PRODUCTS

2.1 CONTACTOR VESSELS: The contactor vessels shall have a 55-gallon capacity and shall be constructed of high density polyethylene (HMWPE) or carbon steel. The exterior of carbon steel vessels shall be coated with an enamel finish. The vessel shall hold approximately 165 pounds of granulated activated carbon. The vessel shall withstand internal pressures of 7.5 psig. The flow capacity of each unit shall be 10 gallons per minute. The vessel inlet shall distribute water over the top of the carbon bed. Outlet piping shall extend to the bottom of the vessel to minimize short circuiting.

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

3.1.1 The carbon contactors shall be installed in accordance with the manufacturer's recommendation and shown on the Contract Drawings.

3.1.2 All piping and hose connections shall be made up tight and shall not leak under operating conditions.

END OF SECTION

SECTION 11347

ABOVE GRADE HORIZONTAL TANKS

PART 1 - GENERAL

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

1.1.1 Underwriters' Laboratories, Inc. (UL) Publications

UL 142	1987	Above Ground Welded Steel Tank
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1.1.2 American Petroleum Institute

API 650	1988	Welded Steel Tanks for Oil Storage
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1.1.3 National Fire Protection Association

NFPA 30	1987	Flammable and Combustible Liquids Code
NFPA 70	1990	National Electric Code

1.1.4 American Society for Testing and Materials (ASTM)

ASTM B117	1985	Salt Spray (Fog) Testing
D2247	1987	Testing Water Resistance of Coatings in 100% Relative Humidity
D3359	1987	Measuring Adhesion by Tap Test
D4060	1984	Abrasion Resistance of Organic Coatings by the Taber Abraser

1.1.5 Steel Structures Painting Counting (SSPC)

SP6	1989	Commercial Blast Cleaning
Paint 20	1982	Zinc Rich Primers (Type I, Inorganic and Type II, Organic)
PA1	1982	Shop, Field and Maintenance Painting

1.2 SUBMITTALS: All submittals shall be reviewed and approved by the Contracting Officer and be in accordance with Section 01300, "Submittals".

1.2.1 SD-17, Manufacturer's Catalog Data: Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings and manufacturers' data of all equipment for each tank including:

- a. Manway
- b. Vent
- c. External connections
- d. Liquid level sight glass

- e. Saddles
- f. Tank support calculations
- g. Anchor bolt sizing and placement
- h. Tank finish
- i. Tank grounding
- j. Free product sensor
- k. 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 (SD-21).

1.2.2 SD-76, Certificates of Compliance:

1.2.2.1 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.

1.2.2.2 The manufacturer will witness all tests and provide certifications of all test results. Tanks shall be guaranteed by the manufacturer to be tight.

1.2.3 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, titled "Operation and Maintenance Data".

- a. Float Switch Controls (Data Package 4)
- b. Free Product Detector (Data Package 4)

1.3 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.

1.4 GENERAL REQUIREMENTS: Provide in accordance with Section 15011, "Mechanical General Requirements" and Section 16011, "General Electrical Requirements".

PART 2 - PRODUCTS

2.1 GENERAL TANK REQUIREMENTS (Recovered Product, Surge, Sump)

2.1.1 Tanks shall be of size and capacity indicated.

2.1.2 Each tank shall be single walled and shall be factory fabricated using hot-rolled 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, including all pipe openings, wear (striker) plates, manholes and

emergency vents of the type and number shown that will limit the operating pressure such that the pressure in the tank cannot exceed 2.5 psig.

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 5°F of the dewpoint of the surrounding air, or when the surface temperature is below 45°F, or over 95°F, unless approved by the Contracting Officer.

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)
CS-17 wheel, 1000 grams, two coats
1000 cycles | Max. 120 mg long |
| 2. | Adhesion (ASTM D3359)
SSPC SP5, two coats
Three trials | Min. rating of 5 |
| 3. | Salt Spray (ASTM B117)
No blistering, cracking or
delamination of film; no rust
creepage at scribe or edges | 3500 hours exposure |

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)
CS-17 wheel, 1000 gram load
1000 cycles | Max. 95 mg loss |
| 2. | Adhesion (ASTM D3359), Method B | Min. rating of 5 |
| 3. | Humidity (ASTM D2247)
No blistering, cracking, softening,
or delamination of film | 600 hours |
| 4. | Salt Spray (ASTM B117)
No blistering, cracking, softening,
or delamination of film. No rust
creepage at scribe and a max. 1
percent rusting at edges | 1000 hours |

d. Acceptable Coating System: The following coating system, as manufactured by Tenemec Co., Inc., meets the requirements of this specification (local representative (804) 780-3077):

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 (EACH TANK): Tank accessories shall be of the size, location and quantity indicated.

2.2.1 Manway: Tanks, with the exception of the sump tank, shall be provided with a manway and cover. The manway shall extend beyond the shell of tank the minimum distance required by API 650. The cover shall be a minimum of 1/2-inch in thickness and shall be of the same material as the tank. The cover shall be bolted to the manway using long bolts, per NFPA 30, and shall provide emergency venting such that the pressure in the tank cannot exceed 2.5 pounds per square inch.

2.2.2 Vent: A normal tank vent shall be provided. The vent shall be made from Schedule 40 steel and shall be welded to tank shell.

2.2.3 Connections: Provide fittings as required to adapt piping and sensors 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.

2.2.4 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.

2.2.5 Tank Grounding: Tanks shall be grounded in accordance with manufacturer's recommendations.

2.3 RECOVERED PRODUCT TANK

2.3.1 The capacity of the Recovered Product Tanks for each location shall be as follows:

JP-5 Line Area - 3000 gallons (approximately 5'-4" diameter x 18' long)
Tarawa Terrace - 550 gallons (approximately 4'-2" diameter x 5'-6" long)

2.3.2 Tank Saddles: Provide a minimum of three tank saddles for the JP-5 Line Area and two for Tarawa Terrace.

2.3.3 Liquid Level Sight Glass: 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.

2.3.4 Tank Full Sensor: A tank full sensor and cable to shut off product recovery system in the event the tank becomes full shall be provided under Section 02900, "Recovery System - JP-5 Line Area" and Section 02950, "Recovery System - Tarawa Terrace". Provide a suitable tank opening for the tank full sensor as shown on Contract Drawings.

2.4 SURGE TANK

2.4.1 Capacity: 550 gallons (approximately 4'-2" diameter x 5'-6" long)

2.4.2 Tank Saddles: Provide a minimum of two tank saddles. Tank saddles shall have a maximum height of 3-inches.

2.4.3 Level Switches

2.4.3.1 A multiple level switch assembly shall be installed in the surge tank to provide indications of point levels. The assembly shall be provided with four level switches with level settings as follows:

Low-low level:	1" above top of tank draw-off
Low level:	3" above top of tank draw-off pipe
High level:	80% of volume
High-high level:	90% of volume

2.4.3.2 The level switch assembly shall consist of a total of eight conductors, two conductors per level contact. The level switches shall provide the control as indicated on the Contract Drawings.

2.4.3.3 Switch wiring shall be as indicated on the Contract Drawings. Switch assembly shall be suitable for installation in Class I, Group D, Division 1 Hazardous Locations.

2.4.3.4 Switch assembly shall be provided as a vertical mounted unit with fully adjustable floats. Floats shall be constructed of materials suitable for use with water or fuel oil. All parts shall be constructed of corrosion-resistant materials. An explosion-proof junction box shall be provided at the end of the switch assembly for termination of conductors. Switch assemblies shall be provided with explosion-proof fittings and accessories necessary to install the units on the tank.

2.4.4 Free Product Sensor:

2.4.4.1 A single point level switch shall be installed in the surge tank to provide a contact signal to the control panel indicating that the water/product interface low level has been reached in the tank. The sensing system shall consist of a probe with integrally mounted wiring box, coaxial cable and electronics unit.

2.4.4.2 The probe shall be constructed of stainless steel and shall be provided in sufficient length to allow detection of the product/water interface within 2-inches of the bottom of the tank. Probe shall be mounted from the top of the tank. Reference Contract Drawings for tank openings. Coaxial cable shall be provided by the manufacturer of the sensor and shall be provided in sufficient length to install the system. Probe, wiring box and cable shall be intrinsically safe, suitable for installation outdoors in Class I, Group D, Division I Hazardous Locations. Probe shall be provided with heavy duty spark protection. Corrosion-resistant housing for wiring box shall be provided.

2.4.4.3 The electronics unit shall be mounted at the control board and shall housed in an enclosure suitable for installation in Wet Locations. The electronics unit shall operate on 120 VAC, single phase power.

2.4.4.4 The point of water/product interface detection shall be fully adjustable over the entire range of the probe and shall be initially set at 2" above the top of the tank draw-off pipe. All couplings, fittings and accessories required to install the probe assembly shall be provided with the probe.

2.5 SUMP TANK

2.5.1 Capacity: 150 gallons (approximately 30" diameter x 4'-0" long)

2.5.2 Tank Saddles: Provide a minimum of two tank saddles. Tanks saddles shall have a maximum height of 3-inches.

2.5.3 Level Switches:

2.5.3.1 A multiple level switch assembly shall be installed in the sump tank to provide indications of point levels. The assembly shall be provided with four level switches with level settings as follows:

Low-low level: 6" above tank bottom
Low-level: 7" above tank bottom
High-level: 24" above tank bottom
High-high level: 28" above tank bottom

2.5.3.2 The level switch assembly shall consist of a total of eight conductors, two conductors per level contact. The level switches shall provide the control as indicated on the Contract Drawings.

2.5.3.3 Switch wiring shall be as indicated on the Contract Drawings.

2.5.3.4 Switch assembly shall be provided as a vertical mounted unit with fully adjustable floats. Floats shall be constructed of materials suitable for use with water or fuel oil. All parts shall be constructed of corrosion-resistant materials. A junction box shall be provided at the end of the switch assembly for termination of conductors. Switch assemblies shall be provided with fittings and accessories necessary to install the units on the tank.

PART 3 - EXECUTION

3.1 INSPECTION

3.1.1 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.

3.1.2 The Contractor shall verify that the installation can be made in accordance with all pertinent codes and regulations.

3.2 PIPING, VALVES AND FITTINGS

3.2.1 Materials and installations of all piping, valves and fittings shall be provided in accordance with NFPA-30 and in compliance with all State and local fire codes.

3.3 TANK HANDLING

3.3.1 The Contractor shall provide adequate lifting mechanisms for the tank in accordance to manufacturer's recommendations.

3.4 GROUNDING

3.4.1 Tanks and supports shall be grounded to the grounding grid.

3.4.2 Electrical and instrumentation equipment shall be grounded in accordance with NFPA-70.

3.5 INSTALLATION

3.5.1 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.

3.6 TESTING

3.6.1 Tanks shall be tested according to subsection 3.4 of Section 02901 and Section 02951.

*** END OF SECTION ***

SECTION 13121

PREENGINEERED METAL BUILDINGS (RIGID FRAME)

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 INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S335 1989 Structural Steel Buildings -
Allowable Stress Design and Plastic Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG671 1986 Specification for the Design of
Cold-Formed Steel Structural Members

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI A58.1 1982 Minimum Design Loads for Buildings
and Other Structures

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A463 1988 Steel Sheet, Cold-Rolled,
Aluminum-Coated Type 1 and Type 2

ASTM A755 1983 Steel Sheet Zinc-Coated
(Galvanized) by the Hot-Dip Process and
Coil-Coated for Roofing and Siding, General
Requirements

ASTM A792M 1985 (Rev. A) Steel Sheet, Aluminum-Zinc
Alloy-Coated by the Hot Dip Process (Metric)

ASTM B117 1985 Salt Spray (Fog) Testing

ASTM B209 1988 Aluminum and Aluminum-Alloy Sheet
and Plate

ASTM D822 1986 Operating Light- and Water-Exposure
Apparatus (Carbon-Arc Type) for Testing
Paint, Varnish, Lacquer, and Related Products

ASTM E84 1989 Surface Burning Characteristics of
Building Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION, INC. (BHMA)

BHMA A156.1	1988 Butts and Hinges
BHMA A156.2	1983 Bored and Preassembled Locks and Latches
BHMA A156.3	1984 Exit Devices
BHMA A156.4	1986 Door Controls - Closers

FEDERAL SPECIFICATIONS (FS)

FS TT-C-1796	1974 (Rev. A) Caulking Compounds, Metal Seam and Wood Seam
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METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA LRMBSM	1986 Low Rise Metal Building Systems Manual
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STEEL DECK INSTITUTE (SDEI)

SDEI DDM	1987 Steel Deck Institute Diaphragm Design Manual; Second Edition
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STEEL DOOR INSTITUTE (SDI)

SDI 100	1985 Standard Steel Door and Frames
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1.3 DESIGN REQUIREMENTS

MBMA LRMBSM, and AISI SG671, except as specified otherwise herein. Design loads shall be as indicated and as specified herein. Wind loads shall be as indicated and as specified below.

1.3.1 Roof Dead, Live, and Snow Loads

Loads shall be applied on the horizontal projection of the roof structure. The minimum roof design live load shall be 20 psf.

1.3.2 Wind Loads

Main wind-force resisting systems, building components, and cladding as defined in Appendix A, paragraph entitled "Main Wind-force Resisting Systems," shall be designed for applicable wind pressures corresponding to peak gust wind speed, V (115 mph). Procedures for determining and applying wind pressures shall be in accordance with Appendix A.

1.3.3 Seismic Loads

As required for Seismic Zone 1.

1.3.4 Deflection

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. 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.

1.3.5 Description of Building

Provide for the Carbon Contactor Building, rigid frame type, similar to AISC S335, Type I construction, utilizing uniform depth columns and beams with connections as necessary to maintain original angles between intersecting members after erection and loading. Spacing columns shall be a minimum of 4-feet. End walls shall be of rigid frame design. Roof slope shall be a minimum of 2 inches per foot to a maximum of 5 inches per foot. Roof slope shall be not less than that indicated.

1.3.6 Fasteners

Design fastening system to withstand the design loads specified.

1.4 SUBMITTALS

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

1.4.1 SD-13, Design Data

Submit design data showing that the preengineered metal building meets the requirements of paragraph 1.3 of this section.

1.4.2 SD-17, Manufacturer's Catalog Data

a. Preengineered metal building materials

Submit sufficient data indicating conformance to specified requirements on materials provided under this section.

1.4.3 SD-35, Drawings

- a. Anchor bolt layouts and sizes
- b. Structural connections
- c. Roofing and siding connections
- d. Joint sealing and caulking
- e. Door and window frame installation
- f. Flashings

g. Accessory installation

Submit as necessary to erect the building and install components.

1.4.4 SD-41, Manufacturer's Standard Color Charts

a. Factory-finished components

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.

1.4.5 SD-76, Certificates of Compliance

a. Preengineered metal building materials

Submit certificates attesting that materials comply with this specification.

1.5 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.

PART 2 PRODUCTS

2.1 MATERIALS

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

2.1.1 Minimum Thickness

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

Items	Minimum Thickness (Uncoated)
Steel Structural Members Other Than Roof and Wall Panels	18 Manufacturer's Standard (MFG STD) gauge, .0478 inch
Roof and Wall Panels	
Steel	26 MFG STD gauge, .0179 inch
Aluminum	0.032 inch
Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings, and Liner Panels	
Steel	26 MFG STD gauge, .0179 inch
Aluminum	0.032 inch
Louvers	
Steel	18 MFG STD gauge, .0478 inch

Items	Minimum Thickness (Uncoated)
Aluminum	0.064 inch

2.1.2 Steel Framework

Structural members having cross sectional areas other than those indicated and connections that differ from the connections indicated may be used, provided they conform to design requirements, and provided drawings indicating such changes are submitted and approved.

2.1.3 Roof and Wall Panels

- a. Fabricated of zinc-coated steel aluminum-coated steel aluminum/zinc-coated steel or aluminum except as specified otherwise.
- b. Preformed.
- c. Factory-insulated to provide weathertight joint upon installation, with:

Inner and outer sheets formed and joined at edges into a tongue-and-groove joining system with vinyl seals, closed cell foam tape, or factory-applied nonskinning butyl sealant

- d. If designed as diaphragm, roof decks shall be designed in accordance with SDEI DDM.

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.

2.1.4 Zinc-Coated Steel Sheet

ASTM A755, Coating Class G-90.

2.1.5 Aluminum-Coated Steel Sheet

ASTM A463, Type 1 or Type 2.

2.1.6 Aluminum/Zinc-Coated Steel Sheet

ASTM A792M. Total coating weight shall be not less than 0.50 ounces per square foot.

2.1.7 Aluminum Sheet

Alloy 3004 Alclad conforming to ASTM B209.

2.1.8 Liner Panels

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

2.1.9 Sheet Metal Accessories

Of same material and finish as used for adjacent wall or roof panels, except as specified otherwise herein.

2.1.9.1 Caps, Strips, and Plates

Form ridge caps, eave and edge strips, fascia strips, miscellaneous flashings, and miscellaneous sheet metal accessories, unless specified otherwise herein, from the same material and gauge 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-gauge.

2.1.9.2 Fixed Blade Louvers

Provide combination louvers of the sizes and design indicated. Exterior blades shall be stationary, interior blades shall be fully closeable. Fold or bead blades at the edges, set at an angle to exclude driving rains, and firmly secure to the frames by riveting or welding, whichever is standard with the 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 wire shall be not less than 0.0475 inch in diameter.

2.1.10 Closure Strips

Formed of approved compressed rubber, synthetic rubber, bituminous impregnated materials, or metal of the same respective type as the roof and wall panels, and as standard with the manufacturer. Molded closure strips shall be free of open voids and shall not absorb or retain water. Form closure strips to match the corrugations or configurations of the roofing or siding used. Provide closure strips where indicated and where necessary to ensure weathertight construction.

2.1.11 Joint Sealing Material

Seal side and end laps with Type II, Class B ribbon form sealant conforming to FS TT-C-1796, except that bituminous type materials shall not be used. Minimum sizes of ribbons shall be 3/32 by 1/2 inch or 3/16 by 1/4 inch for rectangular areas and 1/4-inch diameter for circular areas. Seal joints at doors, windows, accessories, and flashings.

2.1.12 Fasteners

Fasteners for attachment to structural supports and to adjoining panels shall be as approved, and in accordance with the manufacturer's recommendation.

- a. Either self-tapping screws, self-drilling screws, bolts and nuts, self-locking rivets, self-locking bolts, end-welded studs, bolted or riveted studs, or step rivets held by aluminum straps unless specified otherwise herein.
- b. Stainless steel, zinc-coated steel, cadmium-plated steel, aluminum, or coated steel which has comparable corrosion-resistant properties as found in zinc coating.

Other types of fasteners of the building manufacturer's standard type may be used if prior approval is obtained from the Contracting Officer. The fastening system shall be fabricated to withstand the design loads specified herein. Fasteners, with the exception of those having integral hex washer heads or aluminum drive caps, shall have composite metal and EPDM washers. Fasteners having integral hex washer heads or aluminum drive caps shall have EPDM washers. Side laps of roofing panels having configurations 3/4-inch deep or less shall be fastened at a maximum spacing of 12 inches on center.

2.1.13 Doors and Windows

2.1.13.1 Swinging Personnel Doors and Frames

SDI 100, Grade II, Model 1, 2, 3, or 4, design as indicated, zinc-coated and shop primed, exterior mounting. Hardware shall conform to BHMA A156.1, BHMA A156.2, BHMA A156.3, and BHMA A156.4. Doors shall be provided with the following hardware:

DOOR NO.	HARDWARE REQUIRED
1	Hasp and lock
2	Slide bolt

2.1.14 Finish

2.1.14.1 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.

2.1.14.2 Factory Finishing

Exterior and interior exposed surfaces of metal roof and wall panels, roof ventilators, louvers, gutters, downspouts, and metal accessories shall be provided with a factory-applied, baked-on enamel finish. The finish shall consist of cleaning, pretreatment, and one coat of baked-on finish applied to a dry film thickness of not less than 1.0 mil.

2.1.15 Grouting Mortar

A mixture of one part of blended portland cement to two parts of well-graded fine aggregate, and enough water to provide a maximum water cement ratio of 0.50. The blended portland cement shall be a mixture of cement with 1/4 ounce of aluminum powder to each sack of cement.

2.2 SOURCE QUALITY CONTROL

2.2.1 Factory-Finish

Materials of the same types and finishes as proposed for this project shall have been tested and have passed the following tests:

- a. Salt Spray Test: A 3- by 8-inch or 4- by 12-inch sample with a minimum of two raw cut edges shall withstand a salt spray test for a minimum of 500 hours in accordance with ASTM B117. Undercutting of the paint film from the score line shall not exceed 1/16 inch.
- b. Accelerated Weathering Test: A 3- by 9-inch maximum size sample with a minimum of two raw cut edges shall withstand a weathering test for a minimum of 1000 hours in accordance with ASTM D822 without checking, cracking, or loss of adhesion.
- c. Flexibility: When formed over a conical mandrel, the film shall show no crack beyond a point where the mandrel diameter is equal to five times the metal thickness.
- d. Adhesion: There shall be no film removed by pulling off sharply No. 600, 3/4-inch wide cellophane tape applied to 10 parallel cuts spaced 1/16 inch apart plus 10 similar cuts at right angles. Cuts shall be made with a sharp knife.

2.2.2 Insulation

Factory or field installed insulation shall have a flame spread rating of 75 or less and a smoke development factor of 150 or less when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.1 ERECTION

Erect in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise. 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. Plumb, guy, and stay columns and rigid frames in both directions, and accurately space framing elements to ensure proper fit of prefabricated wall and roof panels. When installing wall and roof systems, install closure strips, flashing, sealing material, and other accessories in a manner approved by the Contracting Officer so that the systems are weathertight, 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.

3.1.1 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.

3.1.2 Rigid Frames, Bases, and Sill Members

Set accurately, using a nonshrinking grouting mortar to obtain uniform bearing on the concrete and to maintain a level base line elevation. Anchors and anchor bolts for securing rigid frames, columns, or sill members to foundations shall be unpainted steel, set accurately to templates, and of proper size to adequately resist applicable design loads at the base. 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.

3.1.3 Wall Construction

Apply panels with the configurations in a vertical position. Apply panels full wall heights from base to eave with no horizontal joints except at the junctions of door frames, louver panels, and similar locations. Seal side and end laps with the joint sealing material specified herein as 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.

3.1.4 Roof Construction

Apply roofing panels with the configurations parallel to the slope of the roof. Apply the roofing panels in full lengths from ridge to eave with no

transverse joints. 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 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-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.

APPENDIX A

WIND LOADS

1. GENERAL: The procedures given in this appendix, together with the various equations, coefficients, and correction factors, are intended to apply to structures of regular shape and regularly used for human occupancy or containing valuable properties. Tornadoes have not been considered in developing these criteria. Conditions at variance with the above should be the subject of special consideration. The criteria contained in this appendix are based on ANSI A58.1, modified for simplicity of application and interpretation.
2. WIND PRESSURE: Buildings shall be designed to withstand applicable wind pressure.
- 2.1 Velocity Pressure: Velocity pressure (q) is determined by:

$$q = 0.00256 V^2 C_h \quad (\text{EQN. 1})$$

where

q = velocity pressure of wind (psf)
 C_h = height correction factor
 V = peak gust wind speed (mph)

- 2.1.1 Wind Velocity: Peak gust wind speeds as indicated.
- 2.1.2 Gust Factors: Gust factors are incorporated in the peak gust wind speeds. Use of the peak gust speed eliminates the need for estimation of the gust factor. The gust factor is variable, dependent on the general wind speed level at the particular location. The peak gust velocity indicated is assumed to be sustained for an interval of 2 to 3 seconds, and therefore ordinarily will be treated as a steady wind because the natural response period of most structures is less than 1.5 seconds. When the response period of the structure exceeds 1.5 seconds, appropriate methods of analyses for dynamic forces shall be used.
- 2.1.3 Correction Coefficient for Height: Height correction factor, C_h , for h greater than 30 feet shall be determined by:

$$C_h = \frac{(h)^{2/7}}{(30)} \quad \text{for } h > 30 \text{ feet} \quad (\text{EQN. 2})$$

The correction factor for h less than or equal to 30 feet shall be taken as 1.0.

$$C_h = 1.0 \quad \text{for } h \leq 30 \text{ feet}$$

- 2.1.4 Correction for Exposure Conditions: Correction coefficients for exposure are not to be used with criteria in this appendix.
- 2.2 Design Wind Pressure for Elements of Buildings: Shall be determined

by the velocity pressure, q (obtained in accordance with Equation 1), multiplied by the applicable pressure coefficient, C_p (Tables I through V and Figures 1 and 2).

$$p = qC_p \quad (\text{EQN. 3})$$

where

p = design wind pressure
 q = EQN. 1, velocity pressure
 C_p = pressure coefficients from Tables I through V and Figures 1 and 2

3. MAIN WIND-FORCE RESISTING SYSTEM: Defined as an assemblage of major structural elements assigned to provide the support of building components and cladding. The system primarily receives wind loading from relatively remote locations.

Examples: Rigid and Braced Frames
Space Frames
Roof and Floor Diaphragms
Shear Walls

System shall be designed for appropriate external pressure. The inclusion of internal pressure may give the most critical loading, in which case, the internal pressure must be considered. Normally on enclosed structures internal pressures are not included when designing the main-force resisting system. Use EQN. 3, Tables I, IV, and V, and Figures 1 and 2 as required.

4. BUILDING COMPONENTS AND CLADDING: Defined as structural elements that are either directly loaded by the wind or receive wind loads originating at relatively close locations and transfer those loads to the main wind-force resisting system.

Examples: Girts
Purlins
Sheathing
Walls
Siding
Fastenings

Building components and cladding shall be designed for the following: (Use EQN. 3, Tables II, III, IV, and V, and Figures 1 and 2 as required.)

- a. Negative external pressure (suction) plus internal pressure acting outward as a bursting force.
- b. Positive external pressure plus internal pressure acting inward as an internal suction.

In the above loading combinations, the internal pressures are assumed to be uniformly distributed over the interior surface of the building.

TABLE IV
INTERNAL PRESSURE COEFFICIENTS, C_p , FOR BUILDINGS

Condition	C_p
1. Percentage of total wall area occupied by openings in one wall exceeds that of all other walls by 10% or more, and openings in all other walls do not exceed 20% of respective wall area.	+0.50 -0.17
2. All other cases.	± 0.17

NOTES:

1. Internal pressures are additive to external pressures in accordance with $P_{\text{total}} = P_{\text{external}} + (- P_{\text{internal}})$.
2. Percentage of openings is based on gross area of wall.

TABLE V
PRESSURE COEFFICIENTS FOR FLAT ROOFS OVER OPEN BUILDINGS
AND OTHER STRUCTURES

Pressure Coefficient, C_p							
θ	B/L						
	1/5	1/3	1/2	1	2	3	5
10°	0.20	0.25	0.30	0.45	0.55	0.70	0.75
15°	0.35	0.45	0.50	0.70	0.85	0.90	0.85
20°	0.50	0.60	0.75	0.90	1.00	0.95	0.90
25°	0.70	0.80	0.95	1.15	1.10	1.05	0.95
30°	0.90	1.00	1.20	1.30	1.20	1.10	1.00

Location of Center of Pressure, X/L							
θ	B/L						
	1/5 to 1/2			1	2 to 5		
10°	0.35			0.30	0.30		
15°	0.35			0.30	0.30		
20°	0.35			0.30	0.30		
25°	0.35			0.35	0.40		
30°	0.35			0.40	0.45		

NOTES:

1. Wind forces act normal to surface and may be directed inward or outward.
2. The wind shall be assumed to deviate by $\pm 10^\circ$ from horizontal.
3. Notation:
 - θ : Angle between wind and plane of roof.
 - X: Distance to center of pressure from windward edge of roof.
 - B: Building plan dimension, perpendicular to wind direction.
 - L: Building plan dimension, parallel to wind direction.

-- End of Section --

SECTION 15011

MECHANICAL GENERAL REQUIREMENTS

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B117 1985 Salt Spray (Fog) Testing

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910-SUBPART O Machinery and Machine Guarding

29 CFR 1910.219 Mechanical Power-Transmission Apparatus

1.3 RELATED REQUIREMENTS

This section applies to certain sections of Division 1, "General Requirements" and Division 2, "Site Work"; Division 11, "Equipment"; all sections of Division 15, "Mechanical" of this project specification, unless specified otherwise in the individual section.

1.4 SUBMITTALS

Submittals required in the sections which refer to this section shall conform to the requirements of Section 01300 "Submittals" and 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 paragraph reference, applicable Federal, Military, industry, and technical society reference standards, years of satisfactory service, and other information necessary to establish contract compliance of each item the Contractor proposes to be provided. Photographs of existing installations are unacceptable and will be returned without approval.

1.4.1 Manufacturer's Catalog Data

Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

1.4.2 Drawings

Submit drawings a minimum 14 by 20 inches in size, using a minimum scale of 1/8 inch per foot. Include floor plans, sectional views, wiring diagrams, and installation details of equipment; and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.4.3 Manufacturer's Instructions

Where installation procedures or part of installation procedures are required to be in accordance with the manufacturer's instructions, submit printed copies of those instructions prior to installation. Installation of the item shall not proceed until the manufacturer's instructions are received. Failure to submit can be cause for rejection of the equipment or material.

1.4.4 Certificates of Compliance

Submit a certificate of compliance from the manufacturer for approval for products, finishes, and equipment as specified in the technical sections whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance. The certificate shall identify the manufacturer, the products, equipment, or materials and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to the requirements specified.

1.4.4.1 Reference Standards Compliance

Where equipment or materials are specified to conform to industry and technical society reference standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters Laboratories (UL), submit proof of such conformance. If an organization uses a label or listing to indicate compliance with a particular reference standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections.

1.4.4.2 Independent Testing Organization Certificate

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

1.4.5 Operation and Maintenance Manuals

Comply with the requirements of Section 01300 and the technical sections.

1.4.6 Operating Instructions

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

1.5 QUALITY ASSURANCE

1.5.1 Material and Equipment Qualifications

Provide materials and equipment that are 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.

1.5.2 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.

1.5.3 Manufacturer's Nameplate

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

1.5.4 Modification of References

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

1.6 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.

1.7 POSTED OPERATING INSTRUCTIONS

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

- a. System Descriptive Information: Wiring diagrams, control diagrams, piping diagrams, control sequence and operating points for each principal system and item of equipment. Post instructions where directed.
- b. Equipment Instructions: Attach to or post adjacent to each principal item of equipment and include directions.
 - (1) Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - (2) Safety precautions, procedure in the event of equipment failure.
 - (3) Other areas as recommended by the manufacturer of each system or item of equipment.

Print or engrave, and frame under glass or in approved laminated plastic. Operating instructions exposed to the weather shall be made of weatherproof materials or enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.8 SAFETY REQUIREMENTS:

1.8.1 Equipment Safety

Fully enclose or properly guard in accordance with 29 CFR 1910.219 belts, pulleys, chains, gears, couplings, projecting setscrews, keys, rotating parts, and other power transmission apparatus, located where persons can come in close proximity thereto. Points of operation, ingoing nip points, and machinery producing flying chips and sparks shall be guarded in accordance with the applicable portions of 29 CFR 1910-SUBPART O. 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.

1.8.2 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

deenergized.

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under Section 16402, "Interior Wiring Systems." Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 16402, "Interior Wiring System."

1.9 INSTRUCTION TO GOVERNMENT PERSONNEL

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

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 FACTORY PAINTING OF EQUIPMENT

Factory applied painting of equipment shall be as specified herein, and provided under each section. 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 B117. 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 in lieu of the shop painting systems, submit certifications that the manufacturer's standard factory painting system conforms to the heat resistance requirement in addition to other certifications.

3.2 PAINTING OF NEW EQUIPMENT

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

3.2.1 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 B117. 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 in lieu of the shop painting systems, certifications that the manufacturer's standard factory painting system conforms to the heat resistance requirement shall be submitted in addition to other certifications.

3.2.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces shall 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.

3.2.2.1 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.

3.2.2.2 Temperatures Between 120 and 400 Degrees F

Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

3.2.2.3 Temperatures Greater Than 400 Degrees F

Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

-- End of Section --

SECTION 15481

COMPRESSED AIR SYSTEMS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: 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.

1.1.1 American National Standards Institute (ANSI) Publications:

B16-18	1984	Cast Bronze Solder Joint Pressure Fittings
B16.22	1980	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B16.26	1983	Cast Copper Alloy Fittings for Flared Copper Tubes
B31.1	1986	Power Piping
B40.1	1985	Gauges, Pressure Indicating, Dial Type, Elastic Element
Z21.22	1986	Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
Z49.1	1983	Safety in Welding and Cutting

1.1.2 American Society for Testing and Materials (ASTM) Publications:

B 32	1987	Solder Metal
B 88	1986	Seamless Copper Water Tube

1.1.3 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

1.1.4 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Publications:

SP-80	1987	Bronze Gate, Globe, Angle, and Check Valves
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1.1.5 Occupational Safety and 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 word "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 to the Contracting Officer.

1.3.1 SD-17, Manufacturer's Catalog 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

Shop drawings shall include compressor performance curves and complete wiring and termination diagrams (SD-20, SD-21, SD-22, SD-23).

1.3.2 SD-76, Certificates of Compliance:

- a. Pipe and fittings
- b. Valves
- c. Coatings
- d. Welding and brazing
- e. Air compressor
- f. Receiver
- g. Alternator panel and pressure controls

1.3.4 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 entitled "Operation and Maintenance Data".

- a. Air Compressor (Data Package 4)
- b. Receiver (Data Package 4)
- c. Accessory Equipment (Data Package 4)

1.3.5 SD-77, Field Test Reports:

a. System Operation (as delineated in 15481 - Part 3.)

1.4 FIELD PAINTING: Provide painting of valves, piping accessories, supports, and miscellaneous metal under this section as specified in section titled "Painting."

1.5 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 duplex electric motor driven, air cooled, two stage, reciprocating type air compressors mounted on a single compressed air receiver for recovery system including motors, compressor control panel, pressure switches, belt guards, air intake filters, silencers and accessories. 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 27.3 cfm at 75 psig continuously, total 54.6 cfm from each duplex unit. Centrifugal unloader mechanism shall be provided with each compressor.

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 Compressor Control Panel: A control board mounted, compressor control panel shall be provided. Panel shall include fusible disconnect switches, motor starters, and an alternating relay which shall automatically alternate the "lead" compressor on successive start-ups. A panel mounted reset pushbutton shall be provided to allow reset of thermal overloads. A panel mounted, red, "run" indicating light shall be provided for each compressor. A panel mounted, three-position selector switch shall be provided for control of the compressors and shall have the selections "Compressor A (only) - Compressor B (only) - Alternate." Alternator panel enclosure shall be suitable for installation 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 Each compressor shall be provided with a low oil level protection switch.

2.1.5 Compressor shall be provided with a totally enclosed belt guard.

2.1.6 Each compressor motor shall be 7.5 horsepower (maximum) and shall operate on 208 VAC, 3-phase.

2.2 COMPRESSED AIR PIPING:

2.2.1 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.

PART 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 foundations 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.

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 Surfaces 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 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 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. The compressed air receiver shall be inspected by the Government Boiler Inspector. Provide a minimum of 2 weeks notice to the Contracting Officer prior to the date of inspection.

3.9.2 Hydrostatic and Leak Tightness Tests:

3.9.2.1 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.

3.9.2.2 After satisfactory completion of hydrostatic pressure test, blow systems dry with clean, oil-free compressed air and test with clean, dry air at design working pressure. Brush joints with soapy water solution to check for leaks. Install a calibrated test pressure 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 test system for compliance with specifications.

*** END OF SECTION ***

ELECTRICAL GENERAL REQUIREMENTS

1.1 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

FEDERAL SPECIFICATIONS (FS)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1.2 RELATED REQUIREMENTS

1.3 DEFINITIONS

- SECTION 16011 PAGE 1

that describe products, systems, installation procedures, equipment, and test methods.

1.4 DESIGN REQUIREMENTS

1.4.1 Electrical Characteristics

Electrical characteristics for this project shall be 208 VAC, three phase, 208 VAC, single phase, and 120 VAC, single phase as shown on the Drawing and specified. Final connections for incoming electrical services shall be as specified for each location's service entrance in Section 16402, "Interior Wiring Systems."

1.4.2 Hazardous Locations

Electrical materials, equipment, and devices for installation in Hazardous Locations, as defined by NFPA 70, shall be specifically approved by Underwriters' Laboratories, Inc., or Factory Mutual for particular "Class," "Division," and "Group" of Hazardous Locations involved. Boundaries and classifications of Hazardous Locations shall be as noted on the Drawings.

1.4.3 Wet Locations

Electrical materials equipment, and devices for installation in Wet Locations, as defined by NFPA 70, shall be suitable for installation in such locations. All outdoor locations shall be considered Wet Locations.

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. 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 Manufacturers' 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 of Compliance

Submit manufacturer's certifications as required for products, materials, finishes, and equipment as specified in the technical sections. Certifications 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. Certifications 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 organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), 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.

1.6 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 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.

1.6.4 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.

1.6.5 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.

1.7 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

Furnish motors, controllers, and contactors with their respective pieces of equipment. Motors, controllers, and contactors shall conform to Section 16402, "Interior Wiring Systems" and shall meet all additional requirements specified in the sections covering associated mechanical equipment. Extended voltage range motors will not be permitted. Control voltage for controllers and contactors shall not exceed 120 volts nominal. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment.

1.9.2 Wiring and Conduit

Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Provide power and control wiring and conduit for field-installed equipment under Section 16402, "Interior Wiring Systems" and Section 16375, "Underground Electrical Work."

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.

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.

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.

-- End of Section --

SECTION 16370

OVERHEAD ELECTRICAL WORK

PART 1 GENERAL

1.1 SUMMARY

1.2 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.11	1980 Forged Steel Fittings, Socket-Welding and Threaded
ANSI C2	1990 National Electrical Safety Code
ANSI C29.3	1986 Wet Process Porcelain Insulators - Spool Type
ANSI C29.4	1989 Wet-Process Porcelain Insulators - Strain Type
ANSI C29.5	1984 Wet-Process Porcelain Insulators - Low- and Medium-Voltage Types
ANSI C29.7	1983 Wet-Process Porcelain Insulators - High-Voltage Line-Post Type
ANSI C37.42	1989 Switchgear - Distribution Cutouts and Fuse Links
ANSI C57.12.00	1987 Liquid-Immersed Distribution, Power, and Regulating
ANSI C57.12.20	1988 Overhead-Type Distribution Transformers, 500 kVA and Smaller: High- Voltage, 34,500 Volts and Below; Low-Voltage, 7970/13800Y Volts and Below

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A53	1989 (Rev. A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A153	1982 (R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A475	1989 Zinc-Coated Steel Wire Strand

AMERICAN WOOD PRESERVERS ASSOCIATION (AWPA)

AWPA C25 1989 Sawn Crossarms -- Preservative
Treatment by Pressure Process

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

IEEE 48 1975 High-Voltage Alternating-Current
Cable Terminations

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC 7 1982 (R 1988) (Rev. 1-4)
Cross-Linked-Thermosetting-Polyethylene-
Insulated Wire and Cable for the Transmission
and Distribution of Electrical Energy

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS 1987 Electrical Power Distribution
Equipment and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 1990 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)

UNDERWRITERS LABORATORIES INC. (UL)

UL 510 1986 Insulating Tape

1.3 RELATED REQUIREMENTS

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

1.4 OVERHEAD SERVICE

Overhead service conductors shall be installed, terminated, and spliced
with existing service drop conductors as indicated on the Contract Drawings
and specified herein.

1.5 SUBMITTALS

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

1.5.1 SD-17, Manufacturer's Catalog Data

- a. Conductors
- b. Insulators
- c. Fused Cutouts
- d. Transformers
- e. Tapes
- f. Guys and anchors

1.5.2 SD-35, Drawings

- a. Overhead electrical system

Show locations and installation details for pole mounting of transformers, tapping of overhead conductors, and splicing of secondary conductors.

1.5.3 SD-44, Manufacturer's Instructions

- a. Cable terminations

1.5.4 SD-66, Statements

- a. Qualifications of cable splicer

Submit cable splicer's certificate of competency as specified in paragraph titled "Cable Splicer Certification."

1.5.5 SD-76, Certificates of Compliance

- a. Transformers

Certify that routine tests per ANSI C57.12.00 have been made on each transformer, including design tests.

1.5.6 SD-77, Field Test Reports

- a. Ground resistance tests

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. 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 cables. The certification shall also list a minimum of three splices/terminations that have been in operation for more than one year. In addition, the individual may be required to perform a dummy or practice splice/termination in the presence of the Contracting Officer, before being approved as a qualified cable splicer. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice/termination kit, and detailed manufacturer's instructions for the cable to be spliced. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for certification of an alternate cable splicer.

1.7 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 CROSSARMS

Conform to REA 50-17. Pressure treat crossarms with pentachlorophenol. Treatment shall conform to AWPA C25.

2.2.1 Crossarm Braces

Provide flat steel for 38-inch span with 8-foot crossarm.

2.3 HARDWARE

Hot dip galvanized conforming to ASTM A153.

2.4 INSULATORS

Provide wet-process porcelain insulators which are radio interference free.

- a. Line Post Type Insulators: ANSI C29.7, Class 57-1L.
- b. Spool Insulators: ANSI C29.3, Class 53-2.
- c. Guy Strain Insulators: ANSI C29.4, Class 54-4.

d. Pin Insulators: ANSI C29.5, Class 55-3.

SUBPART

2.7 SECONDARY-SERVICE CONDUCTORS

Secondary conductors shall be copper, triplex 600-volt cross-linked polyethylene insulation on the phase wires. Neutral shall be bare hard drawn copper messenger. Minimum size shall be No. 2 AWG stranded unless otherwise indicated. Conductors shall conform to NEMA WC 7 for cross-linked polyethylene insulation.

2.5 GUY STRAND

ASTM A475, high-strength, Class A or B, galvanized strand steel cable. Guy strand type and size will be 3-bolt clamp guy terminations designed for use with the particular strand and developing at least the ultimate breaking strength of the strand.

2.6 ROUND GUY GUARDS

Vinyl or PVC material, yellow colored, 8 feet long and shatter resistant at sub-zero temperatures.

2.6.1 Guy Attachment

Thimble eye guy attachment with a lift plate on the down side.

2.7 ANCHORS AND ANCHOR RODS

Anchor rods shall be thimble-eye, 3/4 inch diameter by 8 feet long. Anchors and anchor rods shall be hot dip galvanized.

2.7.1 Screw Anchors

Screw type anchors having a manufacturer's rating as required and extra heavy pipe rods conforming to ASTM A53, Schedule 80, and couplings conforming to ANSI B16.11, fitting Class 6000.

2.8 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.

2.8.1 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.

2.9 FUSED CUTOUTS

Extra heavy drop-out fused cutouts rated 100 amperes continuous and 16,000 amperes asymmetrical interrupting current, 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.

2.10 CABLE TERMINATIONS

2.10.1 Terminator, Modular, Molded Rubber Type

The terminator as specified herein shall be provided for terminating single conductor, or the single conductor of multiconductor, solid insulated, nonmetallic jacketed type cables for service voltage up to 35 kV outdoor. The terminator shall be the product of one manufacturer who shall furnish components in the form of a kit, including complete instructions which shall be followed for assembly and installation, suitable for the type and materials of the cable terminated. The terminator shall conform to IEEE 48 for Class 1 terminations. The terminator shall include stress relief, ground clamp, nontracking rubber skirts, crimp-on connector, rubber cap, and aerial lug. Separate parts of copper or copper alloy shall not be used in contact with aluminum or aluminum alloy parts in the construction and installation of the terminator.

2.11 TRANSFORMERS (POLE TYPE)

ANSI C57.12.20 self-cooled, 65 degrees C continuous temperature rise, mineral oil-immersed type. Provide transformer rated 25 kVA, single phase, 95 kV basic impulse level (BIL), voltage rating 12470/7200 volt primary and 240/120 volt secondary. Transformer shall be connected for operation on a 12.47 kV wye primary system and 240/120 volts single phase secondary. Minimum impedance shall be 3.0 percent. Transformers shall have four 2 1/2-percent full rated kVA high voltage taps, two above and two below rated primary voltage. Provide transformers fully self-protected using integral lightning arresters, integral high voltage fuse links and secondary circuit breakers. Tank finish coat shall be the manufacturer's standard gray. Show transformer's kVA capacity clearly by 2 1/2-inch Arabic numerals placed near the low-voltage bushing.

2.12 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.

2.13 CAULKING 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 caulk or adhere to clean surfaces of the materials with which it is designed to be used. Compound shall have no injurious effects upon the hands of workmen or upon the materials.

PART 3 EXECUTION

3.1 INSTALLATION

Provide overhead pole line installation conforming to requirements of ANSI C2 and NFPA 70 for overhead services. Furnish material required to tap existing overhead conductors and make connections into existing system and perform other incidental labor. Consider street, alleys, roads and drives "public."

3.1.1 Anchors and Guys

Place anchors in line with strain and as nearly as possible a distance from pole equal to the vertical distance from the pole ground line to the point of guy attachment on the pole.

3.1.1.1 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.

3.1.1.2 Backfilling Near Anchors

Backfill anchors with tightly tamped coarse rock 2 feet immediately above anchor and then with tightly tamped earth filling remainder of hole.

3.1.1.3 Screw Anchors

Install screw anchors by torquing with boring machine. Anchor rod eye shall extend 6 to 9 inches above grade.

3.1.1.4 Setting Guy Strands

Complete anchor and guy installation, dead end to dead end, and tighten guy before wire stringing and sagging is begun. 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 guys in conformance with ANSI C2.

3.1.2 Hardware

Provide hardware with washer against wood and with nuts and lock nuts applied wrench tight. Provide locknuts on threaded hardware connections. Locknuts should be M-F style and not palnut style.

3.1.3 Grounding

Grounding shall conform to ANSI C2.

3.1.3.1 Ground Rod Connections

Make ground rod connections on pole lines by using a compression connector for ground wire or wire to rod connections. 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.

3.1.3.2 Other Metal Parts

Ground noncurrent carrying metal parts of equipment or enclosures.

3.1.3.3 Surge Arresters

Connect grounding terminal of each arrester to ground. Surge arrester grounding conductor shall be separate from the other grounding conductors.

3.1.3.4 Transformer Tank and Neutrals

Primary and secondary neutrals and tank of each transformer shall be connected to ground.

3.1.3.5 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.

3.1.4 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.

3.1.4.1 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.

3.1.4.2 Ties

Provide ties on pin insulators tight against conductor and insulator and ends turned down flat against conductor so that no wire ends project.

3.1.4.3 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.

3.1.4.4 Fittings

Dead end fittings shall conform to written recommendations of conductor manufacturer and shall develop full ultimate strength of conductor.

3.2 FIELD QUALITY CONTROL

As an exception to requirements that may be stated elsewhere in contract, the Contracting Officer shall be given 5 working days' notice prior to each tests.

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 Test Transformer

Perform visual and mechanical inspection and electrical test in accordance with NETA ATS and check transformer secondary voltages and adjust voltage at the transformer to provide a secondary voltage of 240/120 VAC, single phase.

3.2.3 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least three times, demonstrating satisfactory operation each time.

-- End of Section --

SECTION 16375

UNDERGROUND ELECTRICAL WORK

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI C2	1987 National Electrical Safety Code
ANSI C119.1	1986 Electric Connectors-Sealed Insulated Underground Connector Systems Rated 600 Volts

FEDERAL SPECIFICATIONS (FS)

FS RR-F-621	(Rev. D) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA RN1	1986 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC2	1983 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC6	1983 PVC and ABS Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1987 National Electrical Code
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UNDERWRITERS LABORATORIES, INC. (UL)

UL 44	1983 (Rev. 1988) Rubber-Insulated Wires and Cables
UL 467	1984 (Rev. 1986) Grounding and Bonding Equipment
UL 486A	1980 (Rev. 1987) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 510	1986 (Rev. 1986) Insulating Tape

1.2 RELATED REQUIREMENTS

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

1.3 DEFINITIONS

In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

1.4 SUBMITTALS

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

1.4.1 SD-17, Manufacturer's Catalog Data

- a. Conduit
- b. Insulating tape
- c. Precast handhole
- d. Cable lubricants
- e. Warning tape
- f. Conductors
- g. Grounding and bonding equipment
- h. Handhole frame and cover
- i. Sealing material for precast handhole joints

1.4.2 SD-35, Drawings

- a. Conduit
- b. Insulating tape
- c. Precast handhole
- d. Handhole frame and cover
- e. Cable lubricants
- f. Sealing material for precast handhole joints

1.4.3 SD-44, Manufacturer's Instructions

- a. Ground megger
- b. Terminator

Submit for use of ground megger with proposed method indicated.

1.4.4 SD-76, Certificates of Compliance

- a. Precast handhole accessories
- b. Handhole frame and cover

1.4.5 SD-77, Field Test Reports

- a. Insulation resistance test
- b. Continuity test
- c. 600 volt cable tests
- d. Grounding electrodes and system tests

Identify each cable for 600-volt tests. When testing grounding electrodes and systems, identify each electrode and system for each test.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Conduit

2.1.1.1 Rigid Metal Conduit, PVC Coated

NEMA RN1.

2.1.1.2 Plastic Conduit

NEMA TC2, Type EPC-40-PVC or EPC-80-PVC

2.1.1.3 PVC Fittings

NEMA TC6

2.1.2 Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.1.3 Power Wire and Cable

2.1.3.1 Wire and Cable Conductor Sizes

As designated by American Wire Gauge (AWG). Conductors shall be copper. Insulated conductors shall bear the date of manufacture imprinted on the wire insulation with other identification. Do not use wire and cable manufactured more than 6 months before delivery to the job site. Provide conductor identification within each enclosure where a tap, splice or termination is made.

2.1.4 600 Volt Wires and Cables

UL 44 RHW. Only use wires with "W" type designation. Use No. 12 minimum sized conductors rated 600 volts for power and control wiring, unless otherwise specified or indicated on the Drawings. Service entrance conductors shall be rated for service entrance use.

2.1.5 600 Volt Wire Connector and Terminals

- a. For use with Copper Conductors: UL 486A.

2.1.6 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. Grounding conductors shall be copper, stranded, size No. 2/0 AWG. Grounding connectors shall be compression type.

2.1.7 Underground Structures

2.1.7.1 Handholes

Provide as necessary to limit maximum pulling distance of conductors to 150 feet. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cast the word "ELECTRIC" in the top face of power handhole covers. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.

2.1.8 Metal Frames, Covers, and Gratings

Provide cast iron frames, covers, and gratings conforming to FS RR-F-621.

2.1.9 Hazardous and Wet Locations

Electrical materials, equipment, and devices for installation in Hazardous Locations, as defined by NFPA 70, shall be specifically approved by Underwriters' Laboratories, Inc., or Factory Mutual for particular "Class," "Division," and "Group" of hazardous locations involved. Boundaries and classifications of Hazardous Locations shall be as noted on the Drawings. Electrical materials, equipment and devices shall, in addition, be suitable for installation in Wet Locations.

PART 3 EXECUTION

3.1 INSTALLATION

NFPA 70 and ANSI C2.

3.1.1 Concrete

Concrete work for electrical requirements shall conform to the requirements of Section 03302, "Cast-in-Place Concrete."

3.1.2 Earthwork

Excavation, backfilling, and pavement repairs for electrical requirements shall conform to the requirements of Section 02200, "Earthwork" and Section 02690, "Pavement Removal and Replacement."

3.1.3 Underground Duct with Concrete Encasement

Construct underground duct lines of individual conduits encased in concrete. The conduit shall be EPC-40-PVC. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 inches. Provide a plastic warning tape in backfill approximately 12 inches below grade. Use a red plastic tape with integral warning legend repeated continuously throughout the entire length of the tape.

- a. Under roads, paved areas, encase ducts in concrete. Extend the concrete encasement at least 5 feet beyond the edges of paved areas and roads. Where conduit runs under existing roads, cut and patch the pavement as necessary.
- b. The top of the concrete encasement shall not be less than 24 inches below grade.
- c. Contractor shall coordinate installation of encased ducts as to not interfere with existing underground utilities.

3.1.3.1 Termination and Cleaning of Conduit

During construction, protect partially completed duct lines from the entrance of debris such as mud, sand, and dirt with suitable conduit plugs. As each section of a duct line is completed, draw a stiff bristle brush having the same diameter of the duct through the duct, until duct is clear of particles of earth, sand, and gravel; then immediately install end plugs.

3.1.3.2 Connections to New Handholes

Construct concrete-encased duct lines connecting to underground structures to have a flared section adjacent to the manhole to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the

encasement and the wall of the structure.

3.1.4 Precast Handholes

Provide complete with accessories, drain facilities, and strengths as required for cast-in-place handholes. Identify each casting by having the manufacturer's name and address cast into an interior face or permanently attached thereto. Rate the complete assembly, including neck, collar, frame and cover for nontraffic.

3.1.5 Cable Pulling

Pull cables down grade with the feed-in point at the point of the highest elevation. Use flexible cable feeds to convey cables into duct runs. Accumulate cable slack where space permits by forming one complete loop. Maintain minimum allowable bending radii in forming such loops.

3.1.5.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables. Cable lubricants shall be soapstone, graphite, or talc for rubber or plastic jacketed cables. Lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.

3.1.5.2 Cable Pulling Tensions

Tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.

3.1.5.3 Secondary Cable Runs in Nonmetallic Duct Conduit

Include an insulated copper equipment grounding conductor sized as required by the rating of the overcurrent device supplying the phase conductors, in all duct conduit, for secondary cable runs, 600 volts and less.

3.1.5.4 Installation of Cables in Handholes

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators at a maximum of 18 inches. Install cables at middle and bottom of cable racks, leaving top space opening for future cables. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.1.6 Cable Terminating

Protect terminations of insulated power and lighting cables from accidental contact, deterioration of coverings and moisture by providing terminating devices and materials. Install terminations of insulated power and lighting cables in accordance with the manufacturer's requirements. Make terminations with materials and methods as indicated or specified herein or as designated by the written instructions of the cable manufacturer and termination kit manufacturer.

3.1.6.1 Splices for 600 Volt Class Cables

Splice in underground systems only in accessible locations such as handholes, with a compression connector on the conductor and by insulating and waterproofing by one of the following methods suitable for continuous submersion in water and pass ANSI C119.1.

- a. Provide cast-type splice insulation by means of molded casting process employing a thermosetting epoxy resin insulating material applied by a gravity poured method or by a pressure injected method. Provide component materials of the resin insulation in a packaged form ready for convenient mixing without removing from the package. Do not allow the cables to be moved until after the splicing material has completely set.
- b. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which includes a mold suitable for the cables to be spliced. When the mold is in place around the joined conductors, prepare the resin mix and pour into the mold. Do not allow cables to be moved until after the splicing materials have completely set.
- c. Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which should be applied by a clean burning propane gas torch. Cables may be moved when joint is cool to the touch.

3.1.7 Grounding

Noncurrent carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid "earth" ground not exceeding the following values:

Grounds in manholes, handholes, and vaults	10 ohms
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Grounding other metal enclosures of primary voltage electrical and electrically operated equipment	10 ohms
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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.

3.1.7.1 Grounding Electrodes

Provide cone pointed driven, copper, ground rods driven full depth plus 6 inches, installed when indicated to provide an earth ground of the value before stated for the particular equipment being grounded.

3.1.7.2 Grounding Connections by Exothermite Type Process

Make grounding connections which are buried or otherwise normally inaccessible, excepting specifically those connections for which access for periodic testing is required, by exothermite type process. Make thermit welds strictly in accordance with the weld manufacturer's written

recommendations. Welds which have "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at thermit weldments.

3.1.7.3 Compression Ground Grid Connector

For accessible connections in lieu of a thermit type process, a compression ground grid connector of a type which uses a hydraulic compression tool to provide the correct circumferential pressure may be used. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.7.4 Grounding Conductors

Bare soft-drawn copper wire No. 2/0 AWG.

3.1.7.5 Ground Rod Connections

Connect copper-clad steel ground rods only to copper ground conductor and weld the connection. Insulate entire area of the rod in the vicinity of the weld and the connecting wire and seal against moisture penetration.

3.1.7.6 Conduit

Provide empty conduits with a No. 14 AWG zinc coated steel wire or a plastic rope having a breaking strength of at least 200 lbs. Leave 24 inches of spare at each end of the pull.

3.1.8 Earthwork For Utilities

Section 02200, "Earthwork" and Section 02690, "Pavement Removal and Replacement."

3.1.9 Reconditioning of Surfaces

Section 2690, "Pavement Removal and Replacement."

3.1.10 Concrete

Concrete for electrical requirements shall conform to the requirements of Section 03302, "Cast-in-Place Concrete."

3.2 FIELD QUALITY CONTROL

As an exception to requirements that may be stated elsewhere in the contract, notify the Contracting Officer 5 working days prior to each tests.

3.2.1 Distribution Conductors 600 Volt Class

Test 600 volt class conductors to verify that no short circuits or accidental grounds exist. Make tests using an instrument which applies a voltage of approximately 500 volts to provide a direct reading in resistance; minimum resistance shall be 250,000 ohms.

3.2.2 Ground Rods

Test ground rods for ground resistance value before connecting wires. Use a portable ground testing megger to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one copy of the megger manufacturer's directions for use of the ground megger indicating the method to be used.

-- End of Section --

SECTION 16402

INTERIOR WIRING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B1	1985 Hard-Drawn Copper Wire
ASTM B8	1986 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM E814	1983 Fire Tests of Through-Penetration Fire Stops

FEDERAL SPECIFICATIONS (FS)

FS L-P-387	(Rev. A) (Int Amd. 2) Plastic Sheet, Laminated, Thermosetting (for Design Plates)
FS W-S-896	(Rev. E) (Amd. 2) Switches, Toggle (Toggle and Lock), Flush Mounted

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS1	1983 (Rev. 1-4) Industrial Control and Systems
NEMA ICS2	1983 (Rev. 1-4) Industrial Control Devices, Controllers and Assemblies
NEMA ICS4	1983 Terminal Blocks for Industrial Use
NEMA ICS6	1983 (Rev. 1-3) Enclosures for Industrial Controls and Systems
NEMA MG1	1978 (Rev. 1-8) Motors and Generators
NEMA RN1	1986 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1987 National Electrical Code
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UNDERWRITERS LABORATORIES, INC. (UL)

UL 50	1980 (Rev. 1987) Cabinets and Boxes,
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Electrical

UL 67	1979 (Erratum 1986) Panelboards
UL 83	1983 (Rev. 1986) Thermoplastic-Insulated Wires and Cables
UL 360	1986 Liquid-Tight Flexible Steel Conduit
UL 486A	1980 (Rev. 1987) Wire Connector and Soldering Lugs for Use with Copper Conductors
UL 486C	1983 (Rev. 1987) Splicing Wire Connectors
UL 489	1986 (Rev. 1987) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 506	1979 (Rev. 1988) Specialty Transformers
UL 508	1984 (Rev. 1988) Industrial Control Equipment
UL 510	1986 Insulating Tape
UL 514B	1982 (Rev. 1987) Fittings for Conduit and Outlet Boxes
UL 854	1987 Service-Entrance Cables
UL 869	1984 (Rev. 1987) Service Equipment
UL 886	1985 (Rev. 1988) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 943	1985 Ground-Fault Circuit Interrupters

1.2 RELATED REQUIREMENTS

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

1.3 SUBMITTALS

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

1.3.1 SD-17, Manufacturer's Catalog Data

- a. Circuit breakers
- b. Switches
- c. Conduit and fittings (each type)
- d. Light fixtures

- e. Insulated conductors
- f. Enclosures, junction, and pull boxes
- g. Panelboards
- h. Control panels
- i. Motor controllers
- j. Heaters and heater controls

1.3.2 SD-35, Drawings

- a. Panelboards
- b. Control panels
- c. Motor controllers
- d. Conduit layouts
- e. Heaters and heater controls

1.3.3 SD-77, Field Test Reports

- a. 600-volt wiring test

1.3.3.1 Format

Submit test results for approval in report form.

1.4 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70. All materials, equipment and devices shall be suitable for use in Wet Locations. Materials and equipment installed in Hazardous Locations as indicated on the Drawings shall be Factory Mutual approved for installation in such locations.

2.2 CONDUIT AND FITTINGS

2.2.1 Plastic-coated Rigid Steel

NEMA RN1, Type 40 (40 mils thick).

2.2.1.1 Conduit Fittings

UL 514B

2.2.1.2 Fittings for Use in Hazardous Locations

UL 886

2.2.1.3 Liquid-Tight Flexible-Metallic Conduit

UL 360

2.2.1.4 Seal Off Fittings

Conduit seal off fittings shall be suitable for use in Class I, Division 1, Group D, Hazardous Locations. Fittings shall be filled with sealing compound in accordance with manufacturer's instructions.

2.3 CABINETS, JUNCTION BOXES, AND PULL BOXES

Cabinets, junction boxes, and pull boxes installed in Hazardous Locations shall be suitable for installation in Class I, Group D, Division I, Hazardous Locations.

Cabinets, junction boxes, and pull boxes installed outdoors shall be suitable for installation in Wet Locations.

2.4 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.4.1 Conductors

No. 10 AWG and smaller diameter shall be solid; No. 8 AWG and larger diameter shall be stranded. Conductor sizes and ampacities shown are based on copper.

2.4.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 120/208 volt, 3-phase:

- (1) Phase A - black
- (2) Phase B - red
- (3) Phase C - blue.

b. 120 volt, 1-phase: black and red.

2.4.3 Insulation

Power, lighting, and control wires shall be 600-volt, Type RHW. Conductors shall conform to UL 83.

2.4.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.4.5 Service Entrance Cables

Service Entrance (SE) Cables, UL 854.

2.5 SPLICES AND TERMINATION COMPONENTS

UL 486A, as applicable, for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.6 SWITCHES

2.6.1 Toggle Switches

FS W-S-896, total 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, rated for a minimum of 15 amperes, with number of poles as indicated on the Drawings.

Switches installed outdoors shall be suitable for installation in Wet Locations.

Switches installed in Hazardous Locations shall be suitable for installation in Class I, Group D, Division I, Hazardous Locations.

2.7 RECEPTACLES

2.7.1 Ground-Fault Circuit Interrupter (GFI) Receptacles

UL 943, duplex type for mounting in weatherproof 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 GFIC devices.

2.8 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. Main and branch circuit breakers shall be sized and rated as indicated on the Drawings. Panelboard shall be rated for operation on 120/208 VAC, three phase, four wire service. Panelboards shall be provided with a typed directory within panelboard; identifying circuit, number of poles, and circuit breaker size. Panelboard enclosure shall be rated NEMA 4X.

2.8.1 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.

2.8.2 Circuit Breakers

UL 489 thermal magnetic-type with interrupting capacity as indicated on the Drawings. Breaker terminals shall be UL listed as suitable for type of conductor provided.

2.8.2.1 Multipole Breakers

Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes 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.

2.8.2.2 Circuit Breaker with GFIC

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 GFIC devices. Circuit breakers with GFIC shall be provided in heat trace circuits installed in Hazardous Locations only.

2.9 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers, service entrance rated, with voltage and continuous current ratings and number of poles as indicated on the Drawings. Circuit breakers shall have an interrupting capacity of 22,000 amperes symmetrical minimum at 240 VAC. Enclosure shall be NEMA 4X. Provide solid copper neutral. Circuit breakers shall be capable of being locked in the "open" position.

2.10 MOTORS

NEMA MG1; 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 shall operate on voltages as specified in individual equipment sections. Provide motors designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating. Refer to technical sections for motor specifications and requirements. All motors shall be suitable for installation in Wet Locations. Motors installed in Hazardous Locations as indicated on the Drawings shall be explosion-proof, suitable for installation in Class I, Group D, Division 1 Hazardous Locations.

2.10.1 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.

2.11 MOTOR STARTERS

UL 508, NEMA ICS1, and NEMA ICS2. Starters shall be provided with thermal overload protection in each phase. Overload protective devices shall be thermal inverse, time limit-type, and shall include manual reset-type pushbutton on outside of starter enclosure. Motor thermal overload relays shall be sized to provide protection for the motor being served. Control circuit wiring shall be as indicated on the Contract Drawings. Accessories shall be provided as required to perform control requirements as indicated on the Contract Drawings and as specified. Cover of motor starter 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. Motor starter enclosures shall be suitable for installation in Wet Locations.

Manual motor starters switches shall be provided for the control and protection of single phase motors unless otherwise shown on the Contract Drawings. Switches shall provide thermal overload protection for the motor, including trip free operation and a manual reset on overload. Overloads shall be melting alloy type. Integral start-stop pushbuttons or on-off toggle switches shall be provided. Switches shall be rated for 230 VAC minimum. Starter shall not be operable with the thermal unit in place.

2.11.1 Control Circuits

Control circuits shall operate on 120 volts derived from control power transformer installed 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 fuses in each ungrounded primary feeder. One secondary lead shall be fused; other shall be grounded.

2.11.2 Enclosures for Starters and Controllers

NEMA ICS6. Enclosures shall be suitable for installation in Wet Locations. Where enclosure are installed in Hazardous Locations as indicated, such enclosures shall be explosion-proof, suitable for installation in Class I, Group D, Division I, Hazardous Locations.

2.11.3 Pilot Lights

Provide transformer, resistor, or diode type.

2.11.4 Terminal Blocks

NEMA ICS4.

2.12 HEATERS

Provide size, in terms of KW, as shown on the Drawings. Heater shall be UL listed and suitable for use in Class I, Group D, Division I, Hazardous Locations as defined by NFPA 70. Heater shall operate on 208 VAC, single phase power. Heater shall be constructed of sturdy steel framework supporting a long low-watt density Fintube element with steel sheath and brazed steel fins. Heater shall be furnished with an explosion-proof external wiring connection within the heater enclosure for conduit connection. Heater shall be wall mounted utilizing integral mounting brackets. Recess mounting shall not be permitted. Carbon contactor wall shall be reinforced as required to support mounting of heater.

2.12.1 HEATER CONTROLS

Provide thermostat suitable for use in Class I, Group D, Division I, Hazardous Locations as defined by NFPA 70. Thermostat shall be UL listed and shall operate on 208 VAC, single phase power. Thermostat shall be heavy duty and shall have an adjustable temperature range from 40 - 90 degrees F. Thermostat shall be provided with an external coiled sensing element. Thermostat shall be rated for 22 amps/5280 watts at 240 VAC.

2.13 HEAT TRACING

Heat tracing installed in Hazardous Locations shall operate on 120 VAC, single phase power and shall be suitable for installation in Class I, Division 1, Group D Hazardous Locations. Separate controls shall be provided for each heat tracing line installed in Hazardous Locations.

Heat tracing installed in Non-Hazardous Locations shall operate on 120 VAC, single phase power and shall be suitable for installation in Wet Locations.

Ground-fault interrupting circuit devices shall be used on all heat tracing

circuits in accordance with manufacturer's recommendations and Article 427 of the National Electrical Code.

2.14 HAZARDOUS AND WET LOCATIONS

Electrical materials, equipment, and devices for installation in Hazardous Locations, as defined by NFPA 70, shall be specifically approved by Underwriters' Laboratories, Inc., or Factory Mutual for particular "Class," "Division," and "Group" of Hazardous Locations involved. Boundaries and classifications of Hazardous Locations shall be as noted on the Drawings. Electrical materials, equipment, and devices installed outdoors shall be suitable for installation in Wet Locations.

2.15 NAMEPLATES

FS L-P-387. Provide as specified in Section 16011, "Electrical General Requirements."

2.16 LIGHT FIXTURES

Fixtures shall be 100 watt incandescent and 100 watt explosion-proof indicated as SI-100 and EL-100, respectively, on the Contract Drawings. Fixtures shall operate on 120 VAC, single phase, shall be suitable for installation in Wet Locations. Fixtures shall be provided with 100 watt incandescent bulbs and wall mounting bracket for mounting on the control board and Carbon Contactor Building wall. Where lights are shown to be installed in Hazardous Locations (EL-100), light fixtures shall be explosion-proof, suitable for installation in Class I, Group D, Division 1 Hazardous Locations.

2.17 SOURCE QUALITY CONTROL

Test opening around electrical penetrations through fire resistive-rated walls, partitions, floor or ceiling for fire resistive integrity in accordance with ASTM E814.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

3.1.1 Hazardous and Wet Locations

Work in Hazardous Locations, as defined by NFPA 70, shall be performed in strict accordance with NFPA 70 for particular "Class," "Division," and "Group" of Hazardous Locations involved. Provide conduit and cable seals where required by NFPA 70. Provide intrinsically safe circuits and barriers where required by NFPA 70.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, or enclosures shall be labeled or identified as such. The following devices are to be service

entrance rated at both locations: service entrance conductors (SE-1), enclosed circuit breakers on the load side of the transformer (100 AF, 100 AT, three pole), and lighting panelboards LP1.

3.1.2.1 Tarawa Terrace Service Entrance

Contractor shall coordinate and provide all work and materials as shown on Contract Drawings and as required by Carolina Power & Light to install the electrical service.

Carolina Power & Light will furnish the following items for installation by the Contractor:

1. Electric meter and meter socket.

Carolina Power & Light will furnish and install the following items:

1. Overhead service conductors to the top of the service entrance pole.

The Contractor shall furnish and install the following items for the incoming electrical service:

1. One chemically treated wooden post, 6" diameter (minimum) by 20 feet long, with adequate supports for mounting the meter, meter socket, and service entrance circuit breaker.
2. Service entrance circuit breaker on the load side of the meter and meter socket with a stainless steel nameplate describing it as the service entrance main disconnect for the treatment system. Circuit breaker shall be rated for 240 VAC and shall be 100 ampere trip, 100 ampere frame, three pole with a 22,000 RMS ampere interrupting capacity at 240 VAC. Circuit breaker shall be suitable for operation on 120/208 VAC and shall be provided with a NEMA 4X enclosure.
3. 3-inch PVC coated rigid steel conduit and weatherhead with service entrance conductors from the meter and meter socket extending up to the top of the service entrance pole for connecting to the overhead feed from CP&L.
4. Grounding of service entrance disconnect and connection to the facility ground grid.

3.1.2.2 JP-5 Line Area Service Entrance

Contractor shall tap secondary side of existing, pole mounted, 120/208 VAC transformer bank as indicated on the Drawings. Secondary conductors shall be installed in 3-inch PVC coated rigid steel conduit to service entrance circuit breaker. Contractor shall furnish and install service entrance circuit breaker on existing pole as indicated on the Drawings. From service entrance circuit breaker, Contractor shall install conductors, underground, to panelboard LP1 as indicated on the Drawings. Tapping of transformer secondaries shall be coordinated with base utilities.

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 insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated, green conductor for grounding conductors installed in conduit or raceways. Provide intrinsically safe control circuits where required by NFPA 70.

3.1.4 Conduit Installation

Provide conduit seal off fittings where conduits enter/leave junction boxes, pull boxes, panels, and enclosures in conduit runs that originate/terminate in Hazardous Locations. Seal off fittings shall be installed a maximum of 18 inches from junction box, pull box, panel, or enclosure. Conduit installed above ground shall be PVC coated rigid steel. Minimum conduit size shall be 1/2 inch in diameter.

3.1.4.1 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.

3.1.4.2 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.

3.1.4.3 Conduit Installed in Concrete Slabs

Conduit installed in concrete slabs shall be Type EPC-40-PVC. 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 minimum 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.

3.1.4.4 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

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.

3.1.4.5 Stub-ups

Provide conduits stubbed up through concrete floor for connection to equipment and enclosures with adjustable top or coupling threaded inside for plugs, set flush with slab floor. Extend conductors to equipment in PVC coated rigid steel conduit.

3.1.4.6 Flexible Connections

Provide liquid-tight, explosion-proof flexible connections of short length, 6-foot maximum, suitable for installation in Class I, Group D, Division I, Hazardous Locations for motors connection made in Hazardous Locations. Provide separate ground conductor across flexible connections.

Provide liquid-tight, flexible metallic conduit of short length, 6-foot maximum, suitable for installation in Wet Locations for motor connections made in Non-Hazardous Locations. Provide separate ground conductor across flexible connections.

3.1.5 Boxes and Supports

Provide boxes in wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. 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. Provide gaskets for boxes installed in Wet Locations. Boxes shall be supported by corrosion resistant struts mounted in concrete pad. Box locations shall be coordinated with equipment installation.

3.1.5.1 Boxes

Boxes installed in Hazardous Locations shall be explosion-proof, suitable for use in Wet Locations and for installation in Class I, Group D, Division I, Hazardous Locations. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

Boxes installed in Non-Hazardous Locations shall be suitable for installation in Wet Locations. 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 slab. Mount lighting switches 48 inches above slab. Mount receptacles 18 inches above slab.

3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations.

3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.9 Grounding and Bonding

In accordance with NFPA 70. Ground-exposed, noncurrent carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, neutral conductor of wiring systems, and equipment as indicated. Make ground connection to driven grounding grid as indicated. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.9.1 Grounding Conductor

Provide insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated, green conductor for grounding conductors installed in conduit or raceways.

3.1.9.2 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

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 Test on 600-volt Wiring

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 resistance to ground is not excessive. 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 --