

2. AMENDMENT/MODIFICATION NO. 0003	3. EFFECTIVE DATE 05/17/02	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
6. ISSUED BY CODE		7. ADMINISTERED BY (If other than Item 6) CODE	
US ARMY ENGINEER DISTRICT, HONOLULU CORPS OF ENGINEERS, BUILDING S-200 FORT SHAFTER, HAWAII 96858-5440 CONTRACT SPECIALIST: JODY MURAOKA			

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)	(X)	9A. AMENDMENT OF SOLICITATION NO.
	X	DACA83-02-R-0004
		9B. DATED (SEE ITEM 11) 04/10/02
		10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)
CODE		FACILITY CODE

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. Accounting and Appropriation Data (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(X)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc). SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
 FY02 DLA MILCON KNMD 003002, Replace Hydrant Fuel System, Hickam Air Force Base, Oahu, HI

See Page 2 of 2 Pages

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF SIGNER (Type or print)
15B. CONTRACTOR/OFFEROR	16B. UNITED STATES OF AMERICA
15C. DATE SIGNED	16C. DATE SIGNED
_____ (Signature of person authorized to sign)	BY _____ (Signature of Contracting Officer)

1. CHANGES TO THE SOLICITATION. Attached hereto are new and revised pages to the solicitation. The revision mark "(Am-0003)" is shown on each new and revised page.

a. REVISED PROVISIONS/CLAUSES/PAGES. Following are revised pages to the solicitation. Changes are indicated in **bold** print. Although the entire sections are being re-issued under Am-0003, only the following pages/paragraphs/provisions/clauses changed in these sections.

Section 00120

Paragraph 2.6

Section 01000

Section 01354 - paragraphs: 3.1.3
Section 01900 - paragraphs: 1.18, 1.18.1, 1.18.2, 1.18.3, and 1.18.4
Section 09900 - paragraph: 3.10
Section 15050 - paragraphs: 2.12.1
Section 15060 - paragraphs: 2.3 and 2.9.1
Section 16375 - paragraphs: 2.4.1.3

2. CHANGES TO DRAWINGS.

REVISED DRAWINGS (NOT ISSUED). Following are revisions made to the drawings listed. These drawings will not be issued with this amendment but will be furnished to the successful offeror at the time of award of the contract.

(1) Sheet No. C-1. At Zone G5, under GENERAL NOTES, note 6, add the following to the end of the existing note, "THE CONTRACTOR NEEDS TO COORDINATE ITS SCHEDULE WITH THE RESIDENT OFFICE."

(2) Sheet No. A-1. At Zone A1, under Wall Legend & Symbols, revise note for CMU wall, second symbol, to read "2-HR RATED 8" CMU WALL, SOLID GROUT ALL CELLS, 5/8" GYP BOD ON 1-1/4" FURRING CHANNELS @ 16" OC, TYP."

(3) Sheet No. A-8. At Zones E/F5, delete 6" dimension from Window/Louver Types "B" and "C".

(4) Sheet No. M-6. At Zone C2, insert 6"x4" reducer between BPCV-1 and FE-002. In Zone D2, change "6" (150) SS" to "4" (100) SS."

(5) Sheet No. M-10. At Zone D4, insert 4"x2" reducer upstream of OV-1.

(6) Sheet No. M-11. At Zone B5, V-92, replace "DBB" with "BALL VALVE" and change symbol accordingly. At Zone C5, V-51, replace "DBB" with "BALL VALVE" and change symbol accordingly.

(7) Sheet No. M-18. At Zone E4, in table for Detail B, for LSHH on Tank 4, replace "45'-0" " with "45'-10" ." At Zone D4, Note 2 for Detail B, replace second sentence with the following, "LSH SHALL ALARM AT 95% OF TANK HOLDING VOLUME AND LSHH SHALL ALARM AT 98% OF TANK HOLDING VOLUME." At Zones E3 and F3, Section 1, replace "3/8" (10)" with "1/2" (13)" in four places.

(8) Sheet No. M-20. At Zone E2, replace "12" (300) SS PLUG VALVE" with "12" (300) SS BALL VALVE" and change symbol accordingly.

(9) Sheet No. M-21. At Zone E5, replace "12" (300) SS PLUG VALVE (N.C.)" with "12" (300) SS BALL VALVE (N.C.)" and change symbol accordingly.

(10) Sheet No. M-32. At Zones B4 and D4, replace "4" (100) DBB" with "4" (100) BALL VALVE" in two places. At Zone G1, add Note "4. INSTALL FLANGED SWIVEL JOINTS BETWEEN THE TANK TRUCK UNLOADING HOSE AND PIPING (TYPICAL 24 PLACES)."

(11) Sheet No. M-34. At Zone F3, replace "2" (50) DBB" with "2" (50) BALL VALVE."

(12) Sheet No. M-37. At Zone C5, insert 4"x2" reducer upstream of OV-1.

(13) Sheet No. E-26. At Zone G5, delete short between line (hot) and TD1. Change flow switch from normally closed to normally open (closes on flow).

3. The proposal due date of May 28, 2002, 2:00 P.M., Hawaiian Standard Time, remains unchanged.

SECTION 00120

PROPOSAL SUBMISSION REQUIREMENTS AND EVALUATION FACTORS

1.0 GENERAL

1.1. Cost of Preparing Proposals

The Government will not reimburse any Offeror any costs incurred in the preparation and submittal of an offer in response to this solicitation.

1.2. Inquiries

Address all inquiries regarding this Request for Proposals to:

U.S. Army Engineer District, Honolulu
Attn: Ms. Jody Muraoka (CEPOH-CT-C)
Building S-200
Fort Shafter, Hawaii 96858-5440
Phone No. (808) 438-8575
Fax No. (808) 438-8588
E-Mail: jody.muraoka@usace.army.mil

1.3 Submittal of Proposals

Submit proposal packages to the US Army Corps of Engineers (“the Government”) as shown in Block 8 of Standard Form 1442.

Proposals received by the Government after the date and time set for receipt of proposals will be handled in accordance with the requirements of Provision “52.215-1, Instructions to Offerors—Competitive Acquisition (May 2001),” subparagraph (c), found in Section 00100.

1.4 Proposal Evaluation

Numerical scores and other point-scoring techniques will not be used in the evaluation process. Each factor or subfactor will be rated on an adjectival rating system. The Government will evaluate offers in accordance with the NON-PRICE EVALUATION FACTORS described in paragraph 2.5 of this section and the offeror’s proposed total price.

Offerors are advised that the Government intends to award without discussions. Upon completing the evaluation of all proposals, the Contracting Officer will, in accordance with the provisions of this solicitation and applicable acquisition regulations, proceed to award without discussions. However, if discussions are determined necessary, the Contracting Officer will establish a competitive range and conduct discussions with those Offerors only within the competitive range. Upon conclusion of discussions, if necessary, the Contracting Officer will request final proposal revisions from the Offerors remaining in the competitive range and may, upon receipt of final proposal revisions, proceed to award a contract without further discussions or notice.

1.5 Contract Award

The Government intends to award a contract to the Offeror whose proposal has been determined to represent the best value to the Government, non-price and price factors considered. Award will be made to the Offeror whose proposal has the best non-price evaluation and the lowest price. However, if there is no Offeror meeting both these criteria, the Government intends to implement a “Best Value” process involving a cost-technical tradeoff process. In this case, award may be made to other than the lowest price Offeror or other than the highest non-price-rated Offeror.

2.0 PROPOSAL FORMAT

2.1 General

Proposals shall be submitted in three (3) separate envelopes. All proposal revisions shall be submitted as page replacements with revised text readily identifiable, e.g. bold face print or underlining. Proposal replacement pages shall be clearly marked "REVISED", shall show the date of revision, shall be submitted in the appropriate number of copies (e.g., if four copies of the original page was required, then four copies of the revised page will also be required), and shall be of a different color than the original pages they are to replace.

2.1.1 Volume I, Non-Price Proposal

One envelope shall be clearly marked, "VOLUME I, NON-PRICE PROPOSAL, RFP NO. DACA83-02-R-0004." It shall contain an original and six (6) copies of the items provided in response to the Non-Price Factors listed in paragraph 2.5.

2.1.2 Volume II, Price Proposal

The second envelope shall be clearly marked, "VOLUME II, PRICE PROPOSAL, RFP NO. DACA83-02-R-0004." It shall contain one original and two copies of the Offeror's completed Standard Form (SF) 1442, using a printed copy of the SF 1442 included in this solicitation.

Volume II shall also include the following:

- One original and two copies of Section 00010, Price Proposal Schedule. Indicate whether or not Facilities Capital Cost of Money is included in the Offeror's costs of performing the work. Proposals that state that Facilities Capital Cost of Money is not included, or proposal that do not address Facilities Capital Cost of Money, will be deemed to have waived Facilities Capital Cost of Money.
- Original and two copies of Price Breakdown (See Paragraph 2.6, Volume II, Price Proposal of Section 00120).
- One original and one copy (certified as a true copy) of the Offeror's executed joint venture agreement and identify the size status for each member of the JV (if the Offeror is a joint venture).
- One original and one copy of the Offeror's completed Section 00600, Representations and Certifications, using a printed copy of Section 00600 included in this solicitation.
- One original and one copy of the Offeror's completed, if applicable, SF LLL, Disclosure of Lobbying Activities, using a printed copy of the SF LLL included as Appendix A in Section 00600.

2.1.3 Volume III, Subcontracting Plan (Large Business Concerns)

If the Offeror is a large business concern, the Offeror shall submit a subcontracting plan in accordance with FAR 52.219-9 (See Section 00100, Appendix A for a sample).

The third envelope shall be clearly marked, "VOLUME III, SUBCONTRACTING PLAN, RFP NO. DACA83-02-R-0004." Volume III will not be evaluated or rated. Only the selected Offeror's plan will be reviewed and must be approved prior to award of the contract.

2.1.4 Table of Contents

Proposal volumes shall be tabbed. Each of the proposal volumes shall include a Table of Contents that includes the title of the subject matter discussed therein and the page number where the information can be

found. The volumes shall be organized in the same order described in paragraph 2.4 of this Section. Each evaluation factor and subfactor shall be separately tabbed. Proposals that are not correctly tabbed may be considered non-responsive.

2.2. Proposal Presentation

Proposals shall be prepared in the English language.

Proposals shall completely address the requirements of the RFP. Elaborate format, binders, special reproduction techniques, and the like are not necessary. However, the proposal shall be neatly organized and bound. All pages, except divider tabs, shall be numbered. Except for divider tabs and revisions sheets, as noted above, plain white 8-1/2" x 11" bond shall be used. However, if drawings or other graphics are included, Offerors may reduce them only to the extent that legibility is not lost.

There is no limit to the number of pages in the non-price proposal. Pages may be single or double sided and shall be typed. Type pitch shall be 10 pitch or larger.

Information presented should be organized so as to pertain to only the evaluation factor or subfactor in which section the information is presented. Information pertaining to more than one evaluation factor or subfactor should be repeated in the tab for each factor or subfactor.

2.3 Proposal Content

Proposals shall be in a narrative format, organized and titled so that each section of the proposal follows the order and format of the factors and subfactors set forth below in paragraph 2.5, "VOLUME I, NON-PRICE PROPOSAL".

Any information, presented in a proposal that the Offeror wants safeguarded from disclosure to other parties must be identified and labeled in accordance with the requirements of Provision "52.215-1, Instructions to Offerors—Competitive Acquisition (May 2001)," subparagraph (e), which is found in Section 00100 of this solicitation. The Government will endeavor to honor the restrictions against release requested by Offerors, to the extent permitted under United States law and regulations.

The proposal must set forth full, accurate, and complete information as required by this solicitation. The Government will rely on such information in the award of a contract. By submission of an offer, the Offeror agrees that all items in its proposal (key managerial and technical home office and on-site personnel, subcontractors, material and equipment manufacturers, targets for utilization of eligible SDB concerns, etc.) will be used throughout the duration of the contract and any substitutions of any item will require prior approval of the Contracting Officer.

2.4 Evaluation Factors

All proposals will be evaluated on non-price and price factors. Offerors are required to provide data addressing all stated factors. If an Offeror does not have data relating to a specific factor, it shall be clearly stated. Offers that do not address all factors may be considered non-responsive and may not receive further consideration.

Non-price evaluation factors are listed in descending order of importance. All subfactors within a factor have equal importance. Non-price factors are approximately equal in weight to price.

NON-PRICE FACTORS (Volume I):

Factor I, Key Personnel

Factor II, Past Performance

Subfactor A - Past Performance Ratings

Subfactor B - Customer Satisfaction

Factor III, Past Experience

Factor IV, Small Business Program

Subfactor A - Extent of proposed small business subcontracting participation in the performance of the proposed contract.

Subfactor B - Past performance in complying with Small Business Subcontracting Plan goals.

Subfactor C - Extent of participation of small disadvantaged business (SDB) concerns in the performance of the proposed contract in the authorized North American Industrial Classification System (NAICS) Industry Subsector

PRICE (Volume II)

2.5 Volume I, Non-Price Proposal

Data provided in response to the non-price factors described below shall be included in Volume I, "Non-Price Proposal". All references to Offeror shall include any proposed subcontractors meeting the criteria stated in paragraph 2.5.2.1 below.

2.5.1 Relevant Experience

Relevant experience refers to construction of military Type III hydrant fueling systems (or equivalent commercial aircraft fueling systems), welding of stainless steel pipe, fuel piping (aboveground and underground), and fuel pumping systems and equipment work; computer-based pump control systems; construction of large vertical above ground fuel storage tanks; and the removal, transportation, and disposal of underground fuel storage tanks and associated piping.

If experience is based upon "equivalent commercial aircraft fueling system", the Offeror shall include a comprehensive and detailed analysis, which explains why the Offeror's cited commercial experience is similar or equivalent to actual Type III experience. This analysis shall include a breakdown and discussion of various project elements and technical challenges in a Type III project. The analysis shall compare the Offeror's commercial experience with the benefits of actual Type III experience on each element as well as overall project integration and management issues.

2.5.2 Construction Team

The construction team shall include the key personnel, joint venture partners, subcontractors, outside associates, or consultants identified in the Offeror's proposal.

2.5.2.1 Subcontract Experience/Credentials

Subcontractors may be included as part of the proposed construction team. The Government will consider the past ~~performance and~~ experience of a subcontractor where the prime contractor provides in its proposal, evidence of a binding teaming agreement or other contractual agreement which creates legal responsibility on the part of the subcontractor. However, the level of consideration will depend on the extent to which the proposal demonstrates the subcontractor's commitment to the project and legal accountability. A copy of all written agreements from each proposed subcontractor shall be included in the proposal. Proposed subcontractors that have not provided a contractual agreement may not be considered in the evaluation of the proposal.

Furthermore, if an Offeror intends to use a subcontractor's past experience ~~or performance~~ information to supplement its own, the subcontractor must provide written consent allowing the Government to hold

discussions with the Offeror on the subcontractor's performance experience history. A copy of all consents shall be included in the proposal.

If an Offeror is awarded a contract, all subcontractors that are included in the Offeror's proposal and have provided written commitments to perform in the contract shall be used on the contract. Substitution of any subcontractor(s) included in a successful Offeror's proposal must be submitted for review and acceptance by the Contracting Officer prior to the start of any work by that subcontractor. The Contractor is informed that the Government may take up to 30 days to respond. Any delays resulting from this post-award process shall be the responsibility of the contractor and shall not be a basis for any equitable contract adjustment.

2.5.3 Factor I, Key Personnel

Identify the individuals proposed to fill the key positions --project manager, project superintendent, contractor quality control system manager, and system start-up personnel. Provide resumes for each individual. Resumes must support the individual's qualifications to perform in the identified position, including any special skills or experiences deemed worthy of note. Resumes shall include a List of projects completed by the proposed individual. The list shall include contract number, completion date, title, detailed description, and dollar value. Preference will be given to individuals with past relevant experience (see paragraph 2.5.1 above).

If an Offeror is awarded a contract, all individuals that are included in the Offeror's proposal shall be used on the contract. Substitution or addition of any individual(s) not included in a successful Offeror's proposal must be submitted for review and acceptance by the Contracting Officer prior to the start of work by that individual. The Contractor is informed that the Government will be allowed a minimum of 30 days to respond. Any delays resulting from this substitution process shall be the responsibility of the contractor and shall not be a basis for any equitable contract adjustment.

2.5.3.1 Project Manager

The Project Manager shall be responsible for the contractor's overall management and coordination of this contract and shall be the central point of contact with the Government for performance of all work under this contract, including warranty. The Project Manager shall oversee contract accomplishment, administer all instructions, and answer all questions from the Contracting Officer pertaining to the contract during the life of the contract, including the warranty period. The Project Manager shall be responsible for the complete coordination of all work in this contract. The Project Manager will be responsible for ensuring that adequate internal controls and review procedures are followed in order to eliminate conflicts, errors and omissions, and for ensuring that all technical requirements are met. Another individual may be designated to temporarily act for the Project Manager, however, forty-eight (48) hours advance notice in writing of such change shall be requested to the Contracting Officer, and no change shall be made without prior acceptance by the Contracting Officer. The Project Manager shall have no other duties.

The Project Manager shall have a recognized four-year college degree in engineering, related technical field, or business/management, and five years experience in managing and supervising government construction projects of similar size and scope.

2.5.3.2 Project Superintendent

A Project Superintendent shall be assigned to the contract. This individual shall have a minimum of five years experience as a superintendent on Government construction projects similar in size and scope to this contract. The project superintendent shall have overall responsibility for all operations on the jobsite. The superintendent shall have no other duties.

2.5.3.3 Contractor Quality Control System Manager (CQCSM)

The requirements for the CQCSM are defined in Section 01451.

2.5.3.4 System Start Up Personnel

The requirements for the System Start Up Personnel are defined in Section 15899.

2.5.3.5 Evaluation Standards

Outstanding	The proposal includes all requested information for the factor. Each of the proposed key personnel have at least 10 years of experience on Type III hydrant system construction, plus at least 5 years of other relevant experience and are from the Offeror's organization or committed subcontractors.
Above Average	The proposal includes all requested information for the factor. Each of the proposed key personnel have at least 5 years of experience on Type III hydrant system construction, plus at least 5 years of other relevant experience and are from the Offeror's organization or committed subcontractors.
Satisfactory	The proposal includes all requested information for the factor. All proposed key personnel meet the minimum qualification standards described above and are from the Offeror's organization or committed subcontractors.
Marginal	The proposal does not include all of the requested information for the factor. Not all key personnel are identified, or identified personnel do not meet minimum qualification standards. All proposed key personnel are from the Offeror's organization or committed subcontractors.
Unsatisfactory	The proposal does not include all of the requested information for the factor. Not all key personnel are identified and not all identified personnel meet minimum qualification standards.

2.5.4 Factor II, Past Performance

Data provided in support of this factor shall clearly demonstrate the Offeror's ability to meet the requirements of the contract based on his past performance history on relevant projects similar in size and scope to this contract. Only past performance considered relevant to this project will be considered (see paragraph 2.5.1 above).

2.5.4.1 Information Quality

Offerors should submit complete and accurate information. The Government may elect not to request additional information to perform the evaluation.

2.5.4.2 Subfactor A, Past Performance Ratings

For each of the contracts identified in Volume I, Factor III, Experience, indicate the final overall performance rating received. Only performance ratings for the Offeror will be considered. Projects submitted to demonstrate subcontractor experience will not be included in the evaluation of this subfactor. Provide documentation of the indicated rating in this tab. Undocumented performance ratings will not be considered.

2.5.4.2.1 Evaluation Standards

Outstanding	The Offeror has provided projects meeting the criteria for Factor III, Past Experience. Of the projects meeting the criteria for Past Experience (see paragraph 2.5.5), none of the final performance ratings are less than Satisfactory and at least half are Outstanding.
Above Average	The Offeror has provided projects meeting the criteria for Factor III, Past Experience. Of the projects meeting the criteria for Past Experience (see paragraph 2.5.5), none of the final performance ratings are less than Satisfactory and at least half are Above Average.
Satisfactory	The Offeror has provided projects meeting the criteria for Factor III, Past Experience. Of the projects meeting the criteria for Past Experience (see paragraph 2.5.5), none of the final performance ratings are less than Satisfactory.
Marginal	The Offeror has provided projects meeting the criteria for Factor III, Past Experience. Of the projects meeting the criteria for Past Experience (see paragraph 2.5.5), none of the final performance ratings are less than Marginal.

Unsatisfactory	The Offeror has provided projects meeting the criteria for Factor III, Past Experience. Of the projects meeting the criteria for Past Experience (see paragraph 2.5.5), at least one received an Unsatisfactory final performance rating, or documented performance ratings were not submitted.
Neutral	Offerors will not be rated favorably or unfavorably if the Offeror does not have a record of relevant past performance. However, an Offeror with no past performance history may be considered less favorably than an Offeror with a favorable past performance history.

2.5.4.3 Subfactor B, Customer Satisfaction

A customer survey sheet is provided at the end of this section as Attachment 2. For each of the contracts identified in Volume I, Factor III, Offerors shall complete Part A. Offerors shall send the partially completed forms to the selected survey respondents for completion of Part B. The respondent shall return completed surveys directly to the Contracting Officer at the following address:

US Army Engineer District, Honolulu
CEPOH-CT-C
Attn: DACA83-02-R-0004, Customer Survey
Bldg. 230
Fort Shafter, HI 96858-5440

Fax: 808-438-8588

Respondents should be requested to return surveys by the closing date of the solicitation. Surveys received directly from offerors will not be considered in the evaluation.

A copy of page 1 of all partially completed survey sheets sent shall be included in this tab. Ensure that the reference number is completed on each survey sheet to correctly match surveys to the projects listed in Factors III.

2.5.4.3.1 Evaluation Standards

Outstanding	Surveys were received for all of the projects listed in Volume I, Factor III. On all surveys received, all of the ratings for questions 2 through 8 were above average or better and at least half of the ratings for question 9 were outstanding.
Above Average	Surveys were received for all of the projects listed in Volume I, Factor III. On all surveys received, none of the ratings for questions 2 through 8 were less than satisfactory and at least half of the ratings for question 9 were above average or better.
Satisfactory	Surveys were received for all of the projects listed in Volume I, Factor III. On all surveys received, none of the ratings for questions 2 through 9 were less than satisfactory.
Marginal	Surveys were not received for all of the projects listed in Volume I, Factor III; and on the surveys received, none of the ratings for questions 2 through 9 were less than satisfactory.
Unsatisfactory	Surveys were not received for all of the projects listed in Volume I, Factor III; and on the surveys received, one or more of the ratings for questions 2 through 9 were less than satisfactory.
Neutral	Offerors will not be rated favorably or unfavorably if the Offeror does not have a record of relevant past performance or information on past performance is not available. However, an Offeror with no past performance history may be considered less favorably than an Offeror with a favorable past performance history.

2.5.5 Factor III, Past Experience

Data provided in support of this factor shall clearly demonstrate the Offeror's ability to meet the requirements of the contract based on his past experience on relevant projects similar in size and scope to this contract (see paragraph 2.5.1). Only experience considered relevant to this project will be considered.

For each of the projects provided in support of this factor, a Project Data Sheet shall be completed. This sheet is included as Attachment 1 to this specification section. All requested information shall be provided. Failure to provide any of the requested data may be cause to eliminate a project from consideration in the evaluation.

2.5.5.1 Past Experience

Offerors shall identify contracts demonstrating relevant experience completed after 1995, or still underway and awarded prior to 2001, in which they were/are the prime contractor.

If the Offeror intends to rely on its joint venture partner's or subcontractor's past experience/~~past performance for the system supplier or tank installation, etc.~~, the Offeror shall submit the information shown in Attachment 1 for each ~~subcontractor~~ committed member of the proposed construction team (see also paragraph 2.5.2 and 2.5.2.1 above).

In order to demonstrate the depth of its experience, Offerors may submit data for themselves and their committed construction team members for the same project. However, the submission of data for multiple team members on the same project will only be counted as a single project.

2.5.5.2 Evaluation Standards

Outstanding	The Offeror has provided at least 8 relevant projects meeting the stated criteria.
Above Average	The Offeror has provided at least 6 relevant projects meeting the stated criteria.
Satisfactory	The Offeror has provided at least 4 relevant projects meeting the stated criteria.
Marginal	The Offeror has provided at least 2 relevant projects meeting the stated criteria.
Unsatisfactory	None of the projects provided by the Offeror are relevant or meet the stated criteria.

2.5.6. Factor IV, Small Business Program

Offerors shall submit data that demonstrate its use of Small Business Concerns for Subfactors A and B. Small Business Concerns include small disadvantaged businesses (SDB), women-owned small businesses, HUBZone small businesses, veteran-owned small businesses and service disabled veteran-owned small businesses. Offerors shall submit data that demonstrate its use of SDB's for Subfactor C.

2.5.6.1 Subfactor A - Extent of proposed small business subcontracting participation in the performance of the proposed contract

- If the offeror is submitting a proposal as a joint venture (JV), identify the size status of each member of the JV.
- Identify in terms of dollar value and percentage of the total proposed contract price, the extent of work the offeror will perform as the prime contractor.
- Identify in terms of dollar value and percentage of the total proposed contract price, the work to be subcontracted to small business concerns, SDB concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and if applicable, historically black colleges or universities/minority institutions (HBCU/MI).

2.5.6.1.1 Evaluation Standards

Outstanding	All USACE subcontracting goals are exceeded. Specific SB, SDB and WOSB are identified as subcontractors or team members. Offerors from small business concerns will be given an outstanding rating.
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Above Average	All USACE subcontracting goals are at least met and some are exceeded. Specific SB, SDB and WOSB are identified as subcontractors or team members.
Satisfactory	USACE subcontracting goals are met: SB will perform 62 % of the total subcontract value; 10 % of the total subcontract value will go to SDB; 5% of the total subcontract value will go to WOSB. Specific SB, SDB and WOSB are identified as subcontractors or team members.
Marginal	Most of the USACE subcontracting goals are met, specific SB subcontractors or team members are not identified.
Unsatisfactory	None of the USACE subcontracting goals are met and no justification is provided.

2.5.6.2 Subfactor B - Past performance in complying with Small Business Subcontracting Plan goals.

- Provide SF 294's, "Subcontracting Report for Individual Contracts" for projects of similar scope and magnitude.
- Provide information on awards received for outstanding support of the small business program.
- Provide information on any existing or prior mentor-protégé agreements.

2.5.6.2.1 Evaluation Standards

Outstanding	All goals were exceeded, the Offeror has received awards for outstanding support of the small business program, and the Offeror is or has participated in mentor-protégé agreements or other outreach. Offerors from small business concerns will be given an outstanding rating.
Above Average	All goals were met or exceeded and the Offeror is or has participated in mentor-protégé agreements or other outreach.
Satisfactory	All goals were met.
Marginal	Not all goals were met.
Unsatisfactory	No goals were met.

2.5.6.3 Subfactor C - Extent of participation of small disadvantaged business (SDB) concerns in the performance of the proposed contract in the authorized North American Industrial Classification System (NAICS) Industry Subsector.

- The offeror shall provide targets expressed as dollars and percentages of the total contract value, in each of the applicable, authorized NAICS Industry Subsector, for SDB participation by the contractor, including joint venture partners and team members, and a total target for SDB participation by subcontractors. (The authorized NAICS Industry Subsectors as determined by the Department of Commerce are posted at <http://www.arnet.gov/References/sdbadjustments.htm>.)
- Targets for subcontractors shall be listed separately. The offeror shall provide a listing of the name, address, telephone number, type of work to be performed and target for each SDB subcontractor. Any targets will be incorporated into and become part of the resulting contract.

2.5.6.3.1 Evaluation Standards

Outstanding	SDB participation targets in each of the applicable, authorized NAICS Industry Subsector are provided. Targets are challenging. Specific SDB concerns are identified.
Above Average	SDB participation targets in each of the applicable, authorized NAICS Industry Subsector are provided. Targets are realistic. Specific SDB concerns are identified.
Satisfactory	SDB participation targets in each of the applicable, authorized NAICS Industry Subsector are provided. Targets are realistic. Specific SDB concerns are not

	Subsector are provided. Targets are realistic. Specific SDB concerns are not identified.
Marginal	No SDB participation targets in the applicable, authorized NAICS Industry Subsector are provided. Satisfactory justification is provided.
Unsatisfactory	No SDB participation targets in the applicable, authorized NAICS Industry Subsector are provided. No justification is provided.

2.6 Volume II, Price Proposal

A price breakdown shall be included in Volume II, "Price Proposal". The Offeror's proposed total price for Bid Item No. 1 shall be broken down according to the following items of work as described on sheet D-I of the contract drawings. Only a lump sum price for each of the items identified below is required. Do not submit a cost breakdown.

A. Work under Phase IA to include: New facility at Fill Stand Area, fill and unloading stands, transfer fuel piping and all temporary work as required. Costs will be broken down by:

- 1) Mechanical costs under Division 15.
- 2) Electrical costs under Division 16.
- 3) All other costs associated with Phase IA.

B. Work under Phase IB to include: Demolition of fuel Area 5, new Diesel Fueling Facility and all temporary work as required. Costs will be broken down by:

- 1) 30,000 gallon diesel fuel tanks No. **1 and 2**.
- 2) All other mechanical costs under Division 15.
- 3) Electrical costs under Division 16.
- 4) All other costs associated with Phase IB.

C. Work under Phase 2A to include: Demolition of fuel Area 11, new Operations Area including tanks, and all facilities in the Fuel Operations Area. Costs will be broken down by:

- 1) Operating tanks No. **3 and 4**.
- 2) Mechanical costs under Division 15.
- 3) Electrical costs under Division 16.
- 4) All other costs associated with Phase 2A.

D. Work under Phases 2B thru 2I to include: Installing new Fuel Distribution System including excavation, shoring, dewatering, fuel piping, pits, backfill, testing and all items necessary to complete the system. Costs will be broken down by:

- 1) Dewatering and care of water.
- 2) All other costs associated with Phase 2B thru 2I.

E. Work under Phase 3A thru 3C to include: Demolition and abandonment of existing fuel system and restoration work.

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SECTION 01354

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 261 Identification and Listing of Hazardous Waste

ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps on Engineers Safety and Health Requirements Manual

STATE OF HAWAII DEPARTMENT OF HEALTH (HIDOH)

HIDOH, Chapter 43 Administrative Rules, Title 11, Community Noise Control for Oahu

HIDOH, Chapter 59 Administrative Rules, Ambient Air Quality Standards

HIDOH, Chapter 60 Administrative Rules, Air Pollution Control

1.2 GENERAL REQUIREMENTS

This section covers prevention of environmental pollution and damage as the result of construction operations under this contract and for those measures set forth in the TECHNICAL REQUIREMENTS. For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.

1.2.1 Subcontractors

Assurance of compliance with this section by subcontractors will be the responsibility of the Contractor.

1.2.2 Notification

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or costs or damages allowed to the Contractor for any such suspension.

1.3 SUBMITTALS

Government approval is required for submittals with "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G.

Within 30 calendar days of receipt of Notice to Proceed, the Contractor shall submit in writing an environmental protection plan. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures. The environmental protection plan shall include but not be limited to the following:

- a. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
- b. Methods for protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection; i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archeological, and cultural resources.
- c. Procedures to be implemented to provide the required environmental protection and to comply with the applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures set out in accordance with the environmental protection plan.
- d. Location of the solid waste disposal area.

- e. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.
- f. Environmental monitoring plans for the job site, including land, water, air, and noise monitoring.
- g. Traffic control plan.
- h. Methods of protecting surface and ground water during construction activities.
- i. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas.
- j. Plan of borrow area(s).
- k. Training for his personnel during the construction period.

1.3.1 Spill Control Plan

The Contractor shall include as part of the environmental protection plan, a Spill Control Plan. The plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by the Emergency Response and Community Right-to-Know Act or regulated under State or local laws or regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:

- a. The name of the individual who will be responsible for implementing and supervising the containment and cleanup.
- b. Training requirements for Contractor's personnel and methods of accomplishing the training.
- c. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.
- d. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.
- e. The methods and procedures to be used for expeditious contaminant cleanup.
- f. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Contracting Officer in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a

reportable quantity spill occurs. The plan shall contain a list of the required reporting channels and telephone numbers.

1.3.2 Recycling and Waste Minimization Plan

The Contractor shall submit a Recycling and Waste Minimization Plan as a part of the Environmental Protection Plan. The plan shall detail the Contractor's actions to comply with the following recycling and waste minimization requirements:

- a. The Contractor shall participate in State and local government sponsored recycling programs to reduce the volume of solid waste materials at the source.
- b. The Contractor shall comply with Base-sponsored recycling programs. Contact the Base Recycling Coordinator at the Environmental Flight of the Civil Engineering Squadron of Hickam Air Force Base (15CES/CEV) for current information about Base-sponsored recycling programs.

1.3.3 Contaminant Prevention Plan

As a part of the Environmental Protection Plan, the Contractor shall prepare a contaminant prevention statement identifying potentially hazardous substances to be used on the job site and intended actions to prevent accidental or intentional introduction of such materials into the air, water, or ground. The Contractor shall detail provisions to be taken to meet Federal, State, and local laws and regulations regarding the storage and handling of these materials.

1.3.4 Project Cultural Resources Management Plan

Base Archaeologist; G

Submit plan detailing Contractor's archaeological survey of the project site and procedures for monitoring excavations and managing artifacts and other cultural resources.

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

The Contractor shall comply with all applicable Federal, State, and local laws and regulations. The Contractor shall provide environmental protective measures and procedures to prevent and control pollution, limit habitat disruption, and correct environmental damage that occurs during construction as stated in the Environmental Protection Plan. Safety and health documents and procedures for underground storage tank (UST) removal are specified in Section 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST) and Section 02115 UNDERGROUND STORAGE TANK REMOVAL.

1.4.1 Protection of Features

This section supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. The Contractor shall prepare a list of features requiring protection under the

provisions of the contract clause which are not specially identified on the drawings as environmental features requiring protection. The Contractor shall protect those environmental features, indicated specially on the drawings, in spite of interference which their preservation may cause to the Contractor's work under the contract.

1.4.2 Permits

This section supplements the Contractor's responsibility under the contract clause PERMITS AND RESPONSIBILITIES to the extent that the Government has already obtained environmental permits. The Government has obtained permits for storm drainage under the National Pollutant Discharge Elimination System (NPDES) and air quality under an EPA Title V operating permit. The Base's NPDES permit does not cover construction activities such as stormwater discharges from construction sites or effluent discharge from construction dewatering activities. The contractor shall comply with the terms, and conditions of these permits. The contractor shall also comply with other environmental commitments made by the Government. Copies of permit terms and conditions as well as those other commitments made by the Government are included at the end of this section.

1.4.3 Special Environmental Requirements

The Contractor shall comply with the special environmental requirements included at the end of this section. These special environmental requirements are an outgrowth of environmental commitments made by the Government during the project development.

1.4.4 Environmental Assessment of Contract Deviations

The Contract specifications have been prepared to comply with the special conditions and mitigation measures of an environmental nature which were established during the planning and development of this project. The Contractor is advised that deviations from the drawings or specifications (e.g., proposed alternate borrow areas, disposal areas, staging areas, alternate access routes, etc.) could result in the requirement for the Government to reanalyze the project from an environmental standpoint. Deviations from the construction methods and procedures indicated by the plans and specifications which may have an environmental impact will require an extended review, processing, and approval time by the Government. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PROTECTION OF ENVIRONMENTAL RESOURCES

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall

confine his activities to areas defined by the drawings and specifications.

3.1.1 Land Resources

Prior to the beginning of any construction, the Contractor shall identify all land resources to be preserved within the Contractor's work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without special permission from the Contracting Officer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

3.1.1.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that are not required to accomplish all work to be performed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

3.1.1.2 Protection of Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

3.1.1.3 Reduction of Exposure of Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in instances where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be cleared in total. Clearing of such areas shall progress in reasonably sized increments as needed to use the areas developed as approved by the Contracting Officer.

3.1.1.4 Protection of Disturbed Areas

Such methods as necessary shall be utilized to effectively prevent erosion and control sedimentation, including but not limited to the following:

- a. Retardation and Control of Runoff: Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses, and any measures required by area wide plans

approved under Paragraph 208 of the Clean Water Act.

- b. Erosion and Sedimentation Control Devices: The Contractor shall construct or install all temporary and permanent erosion and sedimentation control features as indicated on the drawings. Temporary erosion and sediment control measures such as berms, dikes, drains, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

3.1.1.5 Contractor Facilities and Work Areas

- a. Location of Field Offices, Storage, and Other Contractor Facilities: The Contractors' field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only on approval by the Contracting Officer.
- b. Borrow Areas on Government Property: Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters.
- c. Spoil Areas on Government Property: Spoil areas shall be managed and controlled to limit spoil to areas designated on the drawings and prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings.
- d. Temporary Excavations and Embankments: Temporary excavations and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

3.1.1.6 Commercial Borrow

Prior to bringing commercially obtained borrow material onsite, the Contractor shall provide the Contracting Officer with the location of the pit or pits, the names of the owners and operators, and the types and estimated quantities of materials to be obtained from each source.

3.1.1.7 Soil Disposal Areas on Government Property

Excess soil shall not be disposed of on Government property. Hazardous, toxic, and radiological wastes (HTRW) shall not be disposed of on Government property. Disposal operations shall be managed and controlled to prevent erosion of soil or sediment from entering nearby waters or wetlands. Disposal operations shall be developed and managed in accordance with the grading plan shown on the drawings or as approved by the Contracting Officer.

3.1.2 Disposal of Wastes

Disposal of wastes shall be as specified in Section 01900 MISCELLANEOUS PROVISIONS and as specified hereinafter.

3.1.2.1 Solid Wastes

Solid wastes are rubbish, debris, waste materials, garbage and other discarded solid materials (excluding clearing debris and hazardous waste as defined below and elsewhere in the specification) shall be placed in containers which are emptied on a regular schedule. All handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed such that no hazardous or toxic waste will become commingled with solid waste. The Contractor shall transport all solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. The Contractor shall comply with site procedures and with Federal, State, and local laws and regulations pertaining to the use of landfill areas.

3.1.2.2 Chemical Wastes:

Chemical wastes shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State, and local laws and regulations.

Chemicals shall be dispensed in a way to adequately ensure no spillage to ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant containers with care taken to ensure compatibility. Collection drums shall be monitored and removed to a staging or storage area when contents are within six inches of the top. All waste shall be disposed of in accordance with Federal and local laws and regulations.

3.1.2.3 Hazardous Wastes

Hazardous wastes are as defined in 40 CFR 261, and as defined by applicable state and local regulations. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. The Contractor shall segregate hazardous waste from other materials and wastes, and shall protect it from weather by placing it in a safe covered location, precautionary measures against accidental spillage such as berming or other appropriate measures shall be taken. The Contractor shall transport all hazardous waste off Government property and dispose of it within 60 days and in compliance with Federal and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer. Cleanup and cleanup costs due to spills shall be the responsibility of the Contractor. Hazardous waste shall be accumulated, stored, and disposed of in accordance with the June 2000 15th Air Base Wing Hazardous Waste Management Plan. This plan is maintained by the Environmental Flight of the Civil Engineering Squadron of Hickam Air Force Base (15CES/CEV).

3.1.3 Historical, Archeological, and Cultural Resources

According to Hickam Air Force Cultural Resources Management Plan, the project is in an area likely to contain archaeological and cultural resources. See plans for additional information.

3.1.4 Water Resources

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Special management techniques as set out below shall be implemented to control water pollution by the listed construction activities which are included in this contract. In particular, toxic or hazardous chemicals shall not be applied to soil or vegetation in a manner that may cause contamination of the fresh water reserve.

3.1.4.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. These waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates so that pollutants are separated from the water. Analysis shall be performed and results reviewed and approved by the Government before water in retention ponds is discharged.

3.1.4.2 Cofferdam and Diversion Operations

The Contractor shall plan his operation and perform all work necessary to minimize adverse impact of violation of the local water quality standards. Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to limit the impact of water turbidity on the habitat for wildlife and impacts on water quality for downstream use.

3.1.4.3 Monitoring of Water Areas:

Monitoring of water areas affected by construction activities shall be the responsibility of the Contractor. All water areas affected by construction activities shall be monitored by the Contractor.

3.1.5 Fish and Wildlife Resources

The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife. Species that require specific attention along with measures for their protection will be listed by the Contractor prior to beginning of construction operations.

3.1.6 Air Resources

The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with HDOH, Chapter 59, HDOH, Chapter 60, and all Federal

emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained for those construction operations and activities specified in this section. Special management techniques as set out below shall be implemented to control air pollution by the construction activities which are included in the contract.

3.1.6.1 Particulates

- a. Dust particles, aerosols, and gaseous by-products from all construction activities, processing and preparation of materials, such as from asphaltic batch plants, shall be controlled at all times, including weekends, holidays and hours when work is not in progress.
- b. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned in paragraph Air Resources, herein before, to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

3.1.6.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

3.1.6.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

3.1.6.4 Monitoring of Air Quality

Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the construction activities shall be monitored by the Contractor.

3.1.7 Clearing Debris

Clearing debris is trees, tree stumps, tree trimmings, and shrubs, and leaves, vegetative matter, excavated natural materials (e.g., dirt, sand, and rock), and demolition products (e.g., brick, concrete, glass, and metals).

a. The Contractor shall collect trees, tree stumps, tree trimmings, shrubs, leaves, and other vegetative matter; and shall transport from Government property for proper disposal in compliance with Federal, State, and local requirements. The Contractor shall segregate the matter where appropriate for proper disposal. Untreated and unpainted scrap lumber may be disposed of with this debris where appropriate.

b. Excavated natural materials other than soil to be used as backfill within the project shall be transported from Government property for proper disposal in compliance with Federal, State, and local requirements.

c. Demolition products shall be transported from Government property for proper disposal in compliance with Federal, State, and local requirements.

3.1.8 Fuels and Lubricants

Fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants and waste oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with Federal, State, and local laws and regulations.

3.1.9 Sound Intrusions

The Contractor shall keep construction activities under surveillance, and control to minimize damage to the environment by noise. The Contractor shall comply with the provisions of HIDOH, Chapter 43.

3.2 POST CONSTRUCTION CLEANUP

The Contractor shall clean up area(s) used for construction.

3.3 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plan submitted for approval by the Contracting Officer. This work will be accomplished at the Contractor's expense.

3.4 MAINTENANCE OF POLLUTION CONTROL FACILITIES

The Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.5 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL

The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers,

and instruments required for monitoring purposes) to ensure adequate and continuous environmental pollution control. Anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants, shall also be discussed. Other items to be discussed shall include recognition and protection of archaeological sites and artifacts.

Where excavations must be dewatered for below-grade demolition or construction, wastewater (effluent) shall not be discharged to waterways, storm drains, ditches, or other existing drainage systems unless it has been previously authorized by and complies with general permit coverage under a National Pollutant Discharge Elimination System (NPDES) General Permit issued by the State of Hawaii Department of Health to authorize discharges associated with construction dewatering activities. It is preferred that effluent from dewatering activities shall be discharged into the nearest section of open trench, pit, or other excavation where it can seep back into the subsurface. In the event that seepage pits must be excavated solely for the disposal of dewatering effluent, the width of such pits must be greater than their depth.

If the effluent discharge contains separate-phase liquids other than water, such as floating oil or other petroleum product, the Contractor shall separate and remove those liquids from the water before effluent is discharged. The separate-phase liquids shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with federal, state, and local laws, regulations, and requirements.

Wastewater derived from other construction activities shall be transported from government property for proper disposal in compliance with federal, state, and local requirements.

Refer to Section 02111, EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL for additional guidance regarding management of contaminated materials encountered with the project.

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SECTION 01900

MISCELLANEOUS PROVISIONS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Progress Chart; G

Inspection of Existing Conditions

A written report with color photographs noting the condition of the existing facilities at the time of the inspection. One copy of the report including photographs shall be submitted to the Contracting Officer, prior to construction.

Dust Control; G

Method(s) of dust control.

Excavation/Trenching Clearance

Condition of Contractor's Operation or Storage Area

The Contractor shall submit to the Contracting Officer photographs and/or videos depicting the condition of the Contractor's Operation or Storage Area.

SD-03 Product Data

Equipment Data

A list of all equipment furnished under this contract. This list shall include, but not be limited to, each piece of equipment with a serial number, and shall include all information shown on the manufacturer's nameplate, so as to positively identify the piece of equipment. This list shall also include the cost of each piece of equipment (less installation costs) F.O.B. construction site. This list shall be furnished as soon as possible after equipment is purchased. The list shall consist of one (1) reproducible and three (3) copies, and shall be furnished to the Contracting Officer not later than thirty (30) calendar days prior to completion of any segment of the contract work which has an incremental completion date.

Recovered Material Report

The Contractor shall provide a report listing all products meeting EPA guidelines for products containing recovered materials and quantity used for this project.

SD-11 Closeout Submittals

The Contractor shall provide a report listing all products meeting EPA guidelines for products containing recovered materials and quantity used for this project.

As-Built Drawings

1.2 CONTRACTOR QUALITY CONTROL

To assure compliance with contract requirements, the Contractor shall establish and maintain quality control for materials and work covered by all sections of the TECHNICAL REQUIREMENTS in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Records shall be maintained for all operations including sampling and testing.

1.3 AS-BUILT DRAWINGS

As-built drawings shall be in accordance with Section 01780 CLOSEOUT SUBMITTALS.

1.4 DUST CONTROL

The amount of dust resulting from the Contractor's work shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as flooding and pollution. Measures shall also be taken for dust control along haul routes and equipment parking areas.

1.5 PROTECTION

The Contractor shall take all necessary precautions to insure that no damages to private or public property will result from his operations. Any such damages shall be repaired or property replaced by the Contractor in accordance with the CONTRACT CLAUSES entitled "PERMITS AND RESPONSIBILITIES" and "PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS", without delay, and at no cost to the Government.

1.5.1 Warning Signs and Barricades

The Contractor shall be responsible for posting warning signs or erecting temporary barricades to provide for safe conduct of work and protection of property.

1.5.2 Protection of Grassed and Landscaped Areas

The Contractor's vehicles shall be restricted to paved roadways and driveways. Vehicles shall not be driven or parked on grassed and/or landscaped areas except when absolutely necessary for the performance of the work and approved in advance by the Contracting Officer. Grassed or landscaped areas damaged by the Contractor shall be restored to their original condition without delay and at no cost to the Government.

1.5.3 Protection of Trees and Plants

Where necessary, tree branches and plants interfering with the work may be temporarily tied back by the Contractor to permit accomplishment of the work in a convenient manner, so long as they will not be permanently damaged thereby. If this is not feasible, they may be pruned, subject to written approval by the Contracting Officer.

1.5.4 Protection of Building From the Weather

The interior of the building and all materials and equipment shall be protected from the weather at all times.

1.6 RESTORATION WORK

Existing conditions or areas damaged or disturbed by the Contractor's operations shall be restored to their original condition, or near original condition as possible, to the satisfaction of the Contracting Officer. Inspection of Existing Conditions shall be completed prior to construction.

1.7 REMOVAL AND DISPOSAL

The Contractor shall salvage or recycle waste to the maximum extent practical as it relates to the capabilities of local industries. A record of the quantity of salvaged or recycled materials shall be maintained by the Contractor during the length of the project and submitted to the Contracting Officer at acceptance of the project. Quantities shall be recorded in the unit of measure of the industry. Reuse of materials on the site shall be considered a form of recycling. An example of such reuse would be the use of acceptable excavated materials as fill.

1.7.1 Title to Materials

Title to all materials and equipment to be removed, except as indicated or specified otherwise, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after the Contractor's receipt of notice to proceed. Items indicated to be removed shall be removed and disposed of by the Contractor outside the limits of Government-controlled property at the Contractor's responsibility and expense before the completion and final acceptance of the work for each facility, and such materials shall not be sold on the site.

1.7.2 Rubbish and Debris

Rubbish and debris shall be removed from Government-controlled property daily unless otherwise directed, so as not to allow accumulation inside or outside the building. Materials that cannot be removed daily shall be stored in areas designated by the Contracting Officer.

1.8 INTERFERENCE WITH GOVERNMENT OPERATIONS

The Contractor shall establish work procedures and methods to prevent interference with existing operations within or adjacent to the construction area. Free passage into adjoining or adjacent buildings not in the contract will not be permitted except as approved by the Contracting Officer. Procedures and methods shall also provide for safe conduct of work and protection of property which is to remain undisturbed.

1.8.1 Coordination

The Contractor shall coordinate all work with the Contracting Officer to minimize interruption and inconvenience to the occupants or to the Government. Scheduling and programming of work will be established during the pre-construction conference.

1.8.2 Utilities and Facilities

All utilities and facilities within the area shall remain operable and shall not be affected by the Contractor's work, unless otherwise approved in writing in advance by the Contracting Officer.

1.8.3 Staking and Flagging Existing Utilities

The Contractor, prior to start of any excavation or trenching work, shall verify the location of all utility lines shown on the drawings which are within the areas of work, and shall mark, stake, or flag each utility line along trench alignments and under areas of excavation under this project, as approved. Existing utility lines shall be located by walking trench alignments with approved equipment for locating underground pipes and cables. Utility lines so located shall be noted on the drawings.

1.9 CONTRACTOR'S OPERATIONS OR STORAGE AREA

At the request of the Contractor, an open operations or storage area will be made available within the installation, the exact location of which will be determined by the Government. The Contractor shall be responsible for the security necessary for protection of his equipment and materials, and shall maintain the area free of debris. No rusty or unsightly materials shall be used for providing the secure measure and such measure shall be erected in a workmanlike manner. Before any construction commences on establishing the operation/storage area, Contractor shall take photographs and/or videos of the site in order to establish the original condition of Contractor's operation or storage area. A duplicate set shall be made and submitted to the Government for its files. Upon completion and prior to the final acceptance of the contract work, the Contractor shall restore the area to its original condition.

1.10 GOVERNMENT PROJECT OFFICE

The Contractor shall provide, for use by Government supervisory and inspection personnel, a job-site office space with a floor area not less than 150 square feet. This office space may be within the Contractor's project office building if adjacent to the job site and if separated by a solid partition; otherwise a separate facility, adjacent to the job site, shall be provided with windows and screens, electricity, including a minimum of four (4) wall outlets and two (2) ceiling lights, a telephone, a desk with drawers, a layout table, two (2) chairs, a legal size five-drawer locking file cabinet, and a fire extinguisher. Potable drinking water and temporary toilet facilities shall be made available to Government personnel, not necessarily within the project office, but in close proximity thereof. The cost of utilities including telephone, and operation and maintenance costs of the Government project office shall be borne by the Contractor. The Government will be responsible for its long-distance calls. Upon completion of the project, the project office and furnishings shall be removed and disposed of by the Contractor.

1.11 INSPECTION

1.11.1 Final Inspection and Acceptance

The Contractor shall give the Contracting Officer, a minimum of fourteen (14) calendar days advance notice prior to final inspection of each building for acceptance by the Contracting Officer. All deficiencies found on final inspection of each building shall be promptly and satisfactorily corrected by the Contractor upon notification by the Contracting Officer.

1.12 WORKING DIRECTIVES

1.12.1 Working Hours

All work shall be performed between the hours of 0730 to 1600 HST, Monday through Friday. No work shall be accomplished on Saturdays, Sundays, and all federal holidays without written permission from the Contracting Officer. Such written permission shall be available at the job site at all times during construction.

1.12.2 Occupancy

Facilities to be renovated under this contract may be occupied during the time of construction. At times, and as directed by the Contracting Officer, the Contractor will be required to deviate from the approved schedule to accomplish work in the areas that have been recently vacated, and to work out of sequence for the occupants' convenience. If a facility becomes unavailable on the scheduled availability date due to extingency, the Government reserves the right to cancel the item of work, to substitute another facility, or to reschedule the particular area at a later date.

1.12.3 Force Protection Condition (FPCON) Procedures

Contractor shall be aware of the Force Protection Condition (FPCON) Procedures which may delay or impact access onto the Hickam AFB as a result

of the heightened security measures required based on the FPCON. The following are the FPCON which may be in effect and posted in the front of the guard post.

1.12.3.1 FPCON Alpha

This condition is declared as a general warning of possible terrorist activity, the nature and extent of which are unpredictable, when the circumstances do not justify full implementation of the measures contained in a higher FPCON. However, it may be necessary to implement selected measures from FPCON BRAVO. The measures in FPCON ALPHA must be capable of being maintained indefinitely. Vehicles will be checked for appropriate vehicle identification/identification/registration. Appropriate ID card checks will be made on a random basis, and when vehicle registration is not available. Delay can be expected if vehicles are not registered properly.

1.12.3.2 FPCON Bravo

This condition is declared when there is an increased and more predictable threat of terrorist activity, even though no particular target has been identified. Same as for FPCON Alpha except that appropriate ID checks will be made for everyone entering Hickam AFB. Delay can be expected if vehicles are not registered properly.

1.12.3.3 FPCON Charlie

This condition is declared when an incident occurs or when intelligence is received indicating that some form of terrorist action is imminent. Implementation of these measures for more than a short period and will probably create hardship and will affect peacetime activities of Hickam AFB. Same as for FPCON Bravo. Entry and exit points to Hickam AFB will be limited to one exit and one entry point. Barriers and obstacles to control traffic flow will be in place. Vehicle will be randomly checked by the MPs. Drivers can expect an extended delay at the entry point to Hickam AFB and shall plan accordingly.

1.12.3.4 FPCON Delta

This condition applies in the immediate area where a terrorist attack has occurred, or when intelligence has been received that terrorist action against a specific location is likely. Normally, this THREATCON is declared as a localized warning. Same as for FPCON Charlie. 100 percent of all vehicles and personnel entering the installation will be checked. Contractor personnel may or may not be allowed to enter Hickam AFB. Drivers can expect a very long delay at the entry point to the installation and shall plan accordingly.

1.13 EQUIPMENT DATA

A list of Equipment Data shall be provided.

1.14 PROJECT COORDINATION

The project involves the replacement and upgrade of a portion of the

existing Base fuel system which includes the design elements and features which can be broken down into the four new primary work areas; 1) the Operations Area, 2) Fill Stand Area, 3) Diesel Fueling Area, and 4) Airfield Hydrant Distribution System. General information regarding these areas the related coordination issues is described below in narrative form.

The contract documents form the detailed definition of the project elements.

1.14.1 Operations Area - Tank Storage and Pumphouse Facility

The Operations Area will be located in the existing Tank Storage and Truck Fill Stand Area (Area 11), on the south side of McClelland Street. The site is currently within a fenced secure area. The site is approximately 300 feet x 450 feet, encompassing approximately 3 acres. Currently, the Operations Area site includes a 20,000-barrel aboveground JP-8 jet fuel storage tank, a 10,000-barrel aboveground JP-8 jet fuel storage tank, and a 2,300-barrel aboveground diesel fuel storage tank. The site also contains three truck fill stands (six positions) with associated canopy structures, multiple off-loading positions for tank filling, two small JP-8 jet fuel reclaim tanks, several filter separators with pumps, and underground utilities.

A concrete secondary containment wall surrounds the 20,000-barrel storage tank, while the other two storage tanks are surrounded by an earth berm containment. Additional demolition will include three truck fill stands (six positions) with associated canopies, two small JP-8 jet fuel reclaim tanks, filter separators and pumps, aboveground and below grade fuel piping, miscellaneous tanker truck off-loading equipment, PCC and AC pavement, trench drain for storm water collection, water distribution system piping, light poles, and two small storage sheds.

The Operations Area to be constructed will include two 25,000-barrel, aboveground, vertical JP-8 fuel storage tanks. The storage tanks will be surrounded by a 5-foot-high concrete wall secondary containment area. Other facilities will include an enclosed pumphouse, aboveground and below grade fuel piping systems, spill containment drainage systems with a spill control valve structure, emergency generator, electrical transformer, PCC pavement and AC pavement, utility connections, and security fencing and gates.

1.14.2 Fill Stand Area - Truck Loading and Unloading

The proposed location of the Truck Fill Stand facility is the vacant paved area south of Building 2125, on the west side of Engine Test Cell Road. The site is currently within a fenced secure area. The site is approximately 420 feet x 220 feet, encompassing approximately 2 acres. There are a few underground utilities at the site which generally consist of sanitary sewer and underground electrical duct bank.

Demolition in the new Fill Stand Area will predominantly be the removal of the existing AC pavement and reconfiguring of the security fence and gates.

A segment of existing underground sanitary sewer line and manhole structure will have to be rerouted to accommodate new underground fuel lines associated with Fill Stand.

The Fill Stand Area to be constructed will have five positions for truck loading and four positions for truck unloading. One loading position will be configured to accommodate testing and checkout of the hydrant hose truck vehicles. Other facilities will include below grade fuel piping systems, PCC pavement, AC pavement drainage and security fencing and gates.

1.14.3 Diesel Fueling Area

The proposed location for the new Diesel Fueling Area is the existing Area 5 site, at the northwest corner of the intersection of Moffet Street and McClelland Street. Area 5 is currently the site of the storage and pumping facility that supplies fuel for Apron Row 23 fuel hydrants. Currently, the Diesel Fueling Area site includes three 50,000-gallon underground storage tanks (USTs). USTs have been constructed such that earth embankment material is mounded over the top, above the surrounding grade. An associated pumphouse structure is constructed on top of a portion of the tanks. Two above grade fuel product recovery tanks are located at the site as well as an abandoned JP-4 vapor burning facility. The site is triangular in shape and encompasses approximately 1 acre.

Demolition in the new Diesel Fueling Area site will include the following: three 50,000-gallon USTs; pumphouse building and foundation; a 2,000-gallon UST; a small aboveground storage tank with a retaining wall; aboveground and below grade fuel piping; JP-4 vapor burning facility; existing AC pavement and PCC curb; and security fencing.

The Diesel Fueling Area to be constructed will consist of two self-contained aboveground storage tanks (two 30,000-gallon diesel fuel tanks). Other facilities will include AC pavement drainage, fire hydrant relocation, and security fencing and gates.

1.14.4 Airfield Fuel Distribution System

The new fuel distribution system will be constructed primarily at the aircraft parking apron adjacent to Taxiway "HB," the aircraft parking apron adjacent to Taxiway "HA," and Apron Row 23. The portions of the airfield where the new fuel distribution system will be constructed in paved aircraft parking apron areas. Portions of the fuel line will be installed in areas outside of the secure fence area and include the area north of the AMC terminal building and north and west of the fire station.

At this stage of design, the only anticipated demolition required for the Airfield Fuel Distribution System will be removal of the existing AC and PCC pavement areas and removal of all noted existing fuel hydrant pits and valve vaults. All existing pavement will be saw cut prior to removal to accommodate pipe trenching activities.

There will be minimal visible site development features in the airfield. All the fuel distribution system components, including piping, fuel hydrants, isolation valves, high point vents, and low point drains will be below grade. The fuel hydrants, isolation valve pits, high point vents, and low point drains will be installed in concrete pits or vaults for surface access. All covers for the pits and vaults within the airfield

limits will be aircraft rated. PCC slabs will be cast around the tops of each of the fiberglass fuel structures to minimize fuel spill deterioration of AC pavement and distribute aircraft loading to surrounding apron grades.

1.14.5 General

The following non-comprehensive and non-exhaustive list of general scope items are provided to summarize in general nature the items that require contractor participation and coordination:

- a. All permitting for the project is the responsibility of the contractor to accomplish the work as described in the construction documents.
- b. Contractor is responsible for specific detailed project phasing and construction sequencing and contractor's plan shall be submitted and approved by contracting officer prior to mobilization. Approved phasing shall be coordinated with outline requirements given on drawing D-1, applicable base personnel (i.e. airfield operations, base area users, and other contractors doing work in adjacent areas, etc).
- c. See general construction sub-phasing project schedule table, drawing D-2 for a detailed listing of anticipated airfield / base area downtimes expected as a result of project sequencing.
- d. Area 11 and all existing fuel pits (except Row 23 pits) to remain fully functional during phase one (1) project phasing.
- e. For fuel supply pumps on new Fill Stand, temporary fuel lines (and power and controls) will be routed outside Area 11 and connected to above grade piping south of building 2170.
- f. Both Truck Fill Stand and Diesel fueling Facilities shall be constructed, commissioned, and fully functioning prior to any demolition activities in Area 11.
- g. All requirements within a phase must be completed prior to starting the next phase per drawing D-1. Contracting officer must approve alterations or deviations to the approved sequencing plan or adjustments to subphase tasks.
- h. During demolition activities at Area 5, Area 11, and existing fuel valve pits, all salvaged control plug valves and lateral control pit control valves shall be returned to the Base (Hickam Liquid Fuels shop) - Building 4016, phone 448-2351.
- i. Demolition requiring special procedures and methods to remove and dispose of asbestos and lead-based-paint shall be accomplished in compliance with specifications.
- j. Extreme care and caution must be maintained during trenching adjacent to any of the existing fiberglass fuel lines due to their frail material nature and past maintenance difficulty at the Base.

- k. Existing fuel tank demolition shall be accomplished per specifications including tank draining, cleaning, sludge removal, and demolition safety requirements.
- l. Relocation of all existing airfield security fence shall be accomplished in a manner maintain complete security at all times and meet all existing Hickam AFB airfield access security requirements.
- m. Advance notification and coordination of contractor work areas on the airfield shall be required and as approved by the Hickam Air Operations manager to minimize airfield disruption. Contractor's personnel access to airfield may be altered during the course of the project to adjust to changing security conditions.
- n. Construction sites for all airfield construction shall be outlined conspicuously with low profile barricades. The low profile barricades shall be provided as shown on drawings. All barricades shall be lighted with yellow flashers. The contractor shall be responsible for maintaining the lights, ensuring these lights are 100 percent operational throughout the construction period. The contractor shall provide and place barricades at locations designated by the Contracting Officer. Maximum spacing between barricades is 50 feet. A rope shall be strung between the barricades, with colored streamers attached to the rope at 5-foot maximum intervals. At the end of the project, barricades not rented by the Contractor and in usable condition shall be turned over to the Base at the discretion of the Base.
- o. Portions of existing aircraft pavement striping shall be removed when doing work within a specified phasing subarea in an effort to maintain clear access and routes for airfield aircraft movements. Temporary striping may also be required by airfield operations to accommodate ongoing airfield activities.
- p. Upon completion of final paving restoration activities within an individual work area, all new striping and existing pavement striping which is to be removed shall be performed prior to moving to next phase. Final approved pavement marking must clearly identify new airfield aircraft parking positions to avoid possible confusion.
- q. Contractor's efforts for fuel line installation within airfield consists of (but not limited to):
 - (1) Full depth sawcutting of existing paved areas (double sawcutting as required to minimize damage to adjacent pavement).
 - (2) Continuous hydrocarbon screening of trenched excavation.
 - (3) Lab testing of excess potentially contaminated soil to determine suitability.

- (4) Hauling to on-base location for staging of excess unsuitable hydrocarbon contaminated soil.
 - (5) Hauling to off-site location for all excess soil material.
 - (6) Continuous dewatering and stabilization of trench excavation areas.
 - (7) Testing and disposal of dewatering liquids per specified requirements.
 - (8) Installation of pipe, bedding, fuel structures, and subsequent utilities (ductbank).
 - (9) Restoration of surface pavement or grassed area.
- r. At new fuel line crossings of existing storm culverts, provide demolition, temporary rerouting of storm flows, and construct / restore reinforced concrete box drainage culverts at locations identified on drawings.
 - s. At two (2) storm box culvert crossing locations shown on drawings, install new fuel lines with casing pipes using horizontal drilling / bore-and-jack type methods.
 - t. Replacement of airfield apron pavement in trenched areas including Portland Cement Concrete (PCC) pavement or Asphaltic Concrete (AC) pavement including base material.
 - u. For AC pavement replacement, final surface course to be cured for specified number of days prior to application of fuel-resistant sealer.
 - v. Abandon and grout fill existing fuel lines, demo all fuel pits and vaults, and restore surface paving at aircraft line 23 area and aircraft parking lines 1-4.
 - w. Abandon and grout fill existing fuel lines, demo all fuel pits and vaults, and restore surface paving for fuel system between lower ramp and fuel area 11.

1.15 PROGRESS CHART

The Contractor shall prepare and submit for approval by the Contracting Officer a progress chart in accordance with the CONTRACT CLAUSE entitled "SCHEDULE FOR CONSTRUCTION CONTRACTS" twenty-one (21) calendar days prior to initiation of any work. Any material change to the progress chart must be approved in writing in advance by the Contracting Officer. Any proposed changes to the approved schedule shall be requested by the Contractor in writing a minimum of fourteen (14) calendar days prior to the proposed start of work.

1.16 EXCAVATION/TRENCHING CLEARANCE

Prior to start of any excavation or trenching work, the Contractor shall obtain clearance, in writing, from the appropriate communications agency and base or area engineer. Copies of all correspondence shall be provided the Contracting Officer. Normal coordination time for obtaining the necessary permits is approximately fifteen (15) calendar days. The Contractor shall advise the Contracting Officer promptly when it appears that the normal coordination time will be exceeded.

1.17 USE OF PRODUCTS CONTIANING RECOVERED MATERIALS

Recovered materials are materials manufactured from waste material and by-products that have been recycled or diverted from solid waste. The Contractor shall give preference to products containing recovered material when price, performance, and availability meet project requirements. A listing of products, including the recommended recovered material content, is provided by the Environmental Protection Agency at <http://www.epa.gov/cpg/products.htm>. Only those products having recovered material content equal to or greater than EPA guidelines shall be used to meet this requirement. The Contractor shall provide a Recovered Material Report for products used on this project, which meet EPA requirements.

1.18 KEY PERSONNEL

The Contractor's staff shall include, at minimum, the key personnel identified below. These individuals shall be the same as those included in the Contractor's accepted proposal. Substitution or addition of any individual(s) who was not included in the Contractor's accepted proposal must be submitted for review and acceptance by the Contracting Officer prior to the start of work by that individual. Any request for substitution shall be in writing to the Contracting Officer, shall allow 30 days for a response, and shall include the following: 1) the reason for the proposed substitution; 2) documentation demonstrating that the substitute possesses past performance, experience, personnel qualifications, and operating capacity at least equal to those of the individual that the substitute will replace; and 3) revised Proposal Summary pages reflecting the proposed substitution. Any associated cost or time loss resulting from this substitution process shall be the responsibility of the Contractor and shall not be a basis for any claim.

1.18.1 Project Manager

The Project Manager shall be responsible for the contractor's overall management and coordination of this contract and shall be the central point of contact with the Government for performance of all work under this contract, including warranty. The Project Manager shall oversee contract accomplishment, administer all instructions, and answer all questions from the Contracting Officer pertaining to the contract during the life of the contract, including the warranty period. The Project Manager shall be responsible for the complete coordination of all work in this contract. The Project Manager will be responsible for ensuring that adequate internal controls and review procedures are followed in order to eliminate conflicts, errors and omissions, and for ensuring that all technical requirements are met. Another individual may be designated to temporarily act for the Project Manager, however, forty-eight (48) hours advance notice

in writing of such change shall be requested to the Contracting Officer, and no change shall be made without prior acceptance by the Contracting Officer. The Project Manager shall have no other duties.

The Project Manager shall have a recognized four-year college degree in engineering, related technical field, or business/management, and five years experience in managing and supervising government construction projects of similar size and scope.

1.18.2 Project Superintendent

A Project Superintendent shall be assigned to the contract. This individual shall have a minimum of five years experience as a superintendent on Government construction projects similar in size and scope to this contract. The project superintendent shall have overall responsibility for all operations on the jobsite. The superintendent shall have no other duties.

1.18.3 Contractor Quality Control System Manager (CQCSM)

The requirements for the CQCSM are defined in Section 01451 CONTRACTOR QUALITY CONTROL.

1.18.4 System Start Up Personnel

The requirements for the System Start Up Personnel are defined in Section 15899 FUELING SYSTEMS START-UP.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

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SECTION 09900

PAINTING, GENERAL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values (1999) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150 (1998a) Portland Cement

ASTM D 3273 (1994) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber

ASTM D 3274 (1995) Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation

ASTM D 4258 (1999) Surface Cleaning Concrete for Coating

COMMERCIAL ITEMS DESCRIPTION (CID)

CID A-A-1500 (Rev A; Notice 1) Sealer, Surface (Latex Block Filler)

CID A-A-2246 (Rev B) Paint, Latex

CID A-A-2247 (Basic) Paint, Latex (Semigloss, Interior)

CID A-A-2542 Sealer, Terrazzo and Concrete Floors, Waterbased

CID A-A-2867 Coating, Polyurethane, Single Component Moisture Cure, Aliphatic

CID A-A-2994 Primer Coating, Interior, for Walls and

Wood

FEDERAL SPECIFICATIONS (FS)

FS TT-C-555	(Rev B; Am 1) Coating, Textured (for Interior and Exterior Masonry Surfaces)
FS TT-E-2784	(Rev A) Enamel (Acrylic-Emulsion, Exterior Gloss and Semigloss) (Metric)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 23	(1991) Latex Primer for Steel surfaces
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 2	(1995) Hand Tool Cleaning
SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 7/NACE 4	(1994) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Paint

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials when the required quantity of a particular batch is 50 gallons or less.

Mixing and Thinning
Application

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

SD-06 Test Reports

Paint

A statement as to the quantity represented and the intended use, plus the following test report for batches in excess of 50 gallons:

a. A test report showing that the proposed batch to be used meets specified requirements:

b. A test report showing that a previous batch of the same formulation as the batch to be used met specified requirements, plus, on the proposed batch to be used, a report of test results for properties of weight per gallon, viscosity, fineness of grind, drying time, color, and gloss.

SD-07 Certificates

Lead
Mildewcide and Insecticide
Volatile Organic Compound (VOC) Content

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons.

Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings

other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH Limit Values, or as required by a more stringent applicable regulation.

1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MDSS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

PART 2 PRODUCTS

2.1 PAINT

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform

to the requirements listed in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used. Additional requirements are as follows:

2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy and urethane paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.2 Mildewcide and Insecticide

Paint specified for all coats applied to fabrics and vapor barrier jackets over insulation and surfaces in all area shall contain a mildewcide that will not adversely affect the color, texture, or durability of the coating.

The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfigurement rating of 8 or greater when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274.

Mercurial mildewcide shall not be used in interior paint. Insecticides shall not be used in paint.

2.1.3 Lead

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

2.1.4 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.5 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Concrete and Masonry Surfaces

Concrete and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Surfaces shall be cleaned in accordance with ASTM D 4258. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the manufacturer's recommended conditioner prior to application of the first coat.

3.2.2 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7/NACE 4. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.2.3 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1.

3.2.4 Gypsum Board Surfaces

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

3.2.5 Mastic-Type Surfaces

Mastic-type surfaces shall be prepared by removing foreign material.

3.2.6 Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless

otherwise authorized. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer, before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set, and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with subsequent coatings.

3.3 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.3.1 Cement-Emulsion Filler Coat

Cement and aggregate shall be dry-mixed so that uniform distribution and intermixing are obtained. Mixing liquid and one-half of the total amount of water shall be premixed and added gradually to the white portland cement and aggregate with constant stirring until a thick, smooth material is obtained. Emulsion paint shall then be added to the mixture and stirred until uniformity is obtained. The blend shall have a thick, creamy consistency. The remainder of the water shall be added if necessary to obtain a material with adequate application properties. Blending resin emulsion or emulsion paint with any other component shall be done with caution; too rapid an agitation will cause air entrapment and foaming.

3.3.2 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.4 APPLICATION

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so

dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH Limit Values, or as required by a more stringent applicable regulation. Interior work zones having a volume of 10,000 cubic feet or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.4.3 First Coat

The first coat on plaster, gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. The first coat on both faces of wood doors shall be applied at essentially the same time. Glazed doors and sashes shall be given the specified coating system within 3 weeks of the time they are glazed, but not before the glazing material has set; paint shall overlay glass about 70 mils all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.4.5 Fillers

Concrete and masonry surface voids shall be filled; however, surface irregularities need not be completely filled. The dried filler shall be uniform and free of pinholes. Filler shall not be applied over caulking compound.

3.4.5.1 Cement-Emulsion Filler

Immediately before filler application, surfaces shall be dampened uniformly and thoroughly, with no free surface water visible, by several applications of potable water with a fog spray, allowing time between the sprayings for water to be absorbed. Cement-emulsion filler shall be scrubbed into the surface vigorously with a stiff-bristled brush having tampico or palmyra bristles not longer than 2-1/2 inches. At least 24 hours shall elapse before applying exterior emulsion paint over cement-emulsion filler. When the ambient temperature is over 85 degrees F, cement-emulsion filler surfaces shall be dampened lightly with a fog spray of potable water immediately prior to application of the subsequent paint coat.

3.4.5.2 Latex Filler

Latex filler, CID A-A-1500, shall be applied according to the manufacturer's instructions. Surface voids shall be filled and excess filler shall be removed from the surface with a rubber squeegee. The filler shall be allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint.

3.4.6 Textured Coating

Application of textured coating, FS TT-C-555, shall be as specified in the manufacturer's printed directions.

3.4.7 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.5 PIPE COLOR CODE MARKING

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 40 foot spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend	
Cold water (potable)	Green	White	POTABLE WATER	
Fire protection water	Red	White	FIRE PR. WATER	
Fire Sprinkler Water	Red	White	FIRE SPR. WATER	
Hot water (domestic)	Green	White	H.W.	
Hot water recirculating (domestic)	Green	White	H.W.R.	
High temp. water supply	Yellow	Black	H.T.W.S.	
High temp. water return	Yellow	Black	H.T.W.R.	
Boiler feed water	Yellow	Black	B.F.	
Low temp. water supply (heating)	Yellow	Black	L.T.W.S.	
Low temp. water return (heating)	Yellow	Black	L.T.W.R.	
Condenser water supply	Green	White	COND. W.S.	
Condenser water return	Green	White	COND. W.R.	
Chilled water supply	Green	White	C.H.W.S.	
Chilled water return	Green	White	C.H.W.R.	
Treated water	Green	White	TR. WATER	
Chemical feed	Yellow	Black	CH. FEED	
Compressed air	Blue	White	COMP. AIR	
Natural gas	Yellow	Black	NAT. GAS	
Propane Gas	Yellow	Black	PROP. GAS	
Refrigerants	Blue	White	REFRIGERANT	
Fuel oil	Yellow	Black	FUEL OIL	
Steam	Yellow	Black	STEAM	
Condensate	Yellow	Black	CONDENSATE	
Hydraulic fluid under 600 psi	Green	White	HYDRAULIC FLUID-_____PSI	
Hydraulic fluid 600 psi and Greater		Yellow	Black	HYDRAULIC FLUID-_____PSI

TABLE II. COLOR CODE MARKING SIZES

Outside Diameter of Pipe Covering (Inches)	Length of Color Band (inches)	Arrow Length x Width (Inches)	Size of Legend Letters and Numerals (Inches)
Less than 1-1/2	8	8 x 2-1/4	1/2
1-1/2 to 2-3/8	8	8 x 2-1/4	3/4
2-1/2 to 7-7/8	12	8 x 2-1/4	1-1/4
8 to 10	24	12 x 4-1/2	2-1/2
Over 10	32	12 x 4-1/2	3-1/2

3.6 MISCELLANEOUS PAINTING

3.6.1 Lettering

Lettering shall be provided as scheduled on the drawings, shall be block or Gothic type, and shall be black enamel or water-type decalcomania, finished with a protective coating of spar varnish. Samples shall be approved before application.

3.7 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled. Also, paint exposed factory finished items mounted on the exterior wall or roof to match color of adjacent surface, and hydrant, valve, low-point drain and high-point vent covers.

3.8 SURFACES NOT TO BE PAINTED

Surfaces in the following areas shall not to be painted: a. Concrete floor, b. Vapor barrier jacket, aluminum in unexposed areas not requiring color coding, c. Unexposed interior ferrous surfaces, d. Factory finish painted equipment, located in building interior. In addition, surfaces of hardware, fittings, and other factory finished items shall not be painted.

3.9 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

3.10 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by -----or----- between optional systems or coats.

EXTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
Concrete masonry units.	Cement-emulsion filler (CMU exposed to weather)	FS TT-E-2784 Type III	None
	CID A-A-1500 (Pump Bldg.)	FS TT-E-2784 Type III	None

EXTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
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NOTE: Cement-emulsion filler coat shall be acrylic-based and shall consist of the following ingredients in the proportion stated: white portland cement, ASTM C 150, Type I, 16.5 pounds; aggregate 33.5 pounds; mixing liquid, factory-prepared acrylic containing 46 to 47 percent solids, 0.75 gallon; potable water 1.0 gallon maximum; exterior emulsion paint, FS TT-E-2784 Type III 1.0 gallon. Aggregate shall consist of Washed silica sand of the following gradation:

<u>U.S. Sieve Size</u>	<u>Percent Sand (by Weight) Passing Individual Sieve</u>
0.850 mm (20)	100
0.600 mm (30)	95 - 100
0.300 mm (50)	30 - 65
0.150 mm (100)	0 - 10
0.075 mm (200)	0 - 1

Concrete, and split face CMU, unless otherwise specified. System DFT: Per manufacturer	MPI 34	MPI-9	MPI-9
Ferrous Metal unless otherwise specified	SSPC Paint 23	FS TT-E-2784 Type I	FS TT-E-2784 Type I
Galvanized metal.	FS TT-E-2784 Type III	FS TT-E-2784 Type I	FS TT-E-2784 Type I
Aluminum, Aluminum-Alloy, and other nonferrous metal.	CID A-A-2867	CID A-A-2867	None

INTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
Gypsum board, concrete, and concrete masonry units not requiring a smooth finish, unless otherwise specified	CID A-A-2994 Type II	CID A-A-2247	CID A-A-2247
Gypsum board in restroom	CID A-A-2994 Type II	FS TT-E-2784 Type I	FS TT-E-2784 Type I
Concrete: floors requiring dust reduction in following areas Pump Room, Generator Bldg.	CID A-A-2542 Type I	None	None
Ferrous metal, unless otherwise specified	SSPC Paint 23	FS TT-E-2784 Type I	FS TT-E-2784 Type I
Ferrous metal factory-primed mechanical and electrical equipment.	Two coats of paint as recommended by the equipment manufacturer		None
Galvanized metal:	FS TT-E-2784 Type III	FS TT-E-2784 Type I	None
Wood: unless otherwise specified.	CID A-A-2994 Type I	CID A-A-2247	None
Aluminum and Galvanized Surface Metal: Convactor	FS TT-E-2784	CID A-A-2246	CID A-A-2246

enclosures,
electrical
conduit runs
metallic tubing
uninsulated
ducts and pipes,
pipe hangers,
louvers, grilles,
and air outlets,
in areas having
painted adjacent
surfaces.

-----or-----
CID A-A-2247 CID A-A-2247

Facing of vapor barrier jackets of presized or adhesive finished cloth cover insulation on pipes, ducts, and equipment in following area: Pump Bldg.	Two coats of paint to match adjacent areas	None
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DIVISION 15 - MECHANICAL

SECTION 15050

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GUIDE SPECIFICATION FOR CONSTRUCTION

SECTION 15050

MECHANICAL EQUIPMENT, FUELING

PART 1 GENERAL

1.1 REFERENCES

Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects,
HQ AFCESA/CESM (01/29/96).

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

ASME INTERNATIONAL (ASME)

ASME B16.5 (1996) Pipe Flanges and Flanged Fittings
NPS 1/2 through NPS 24

ASME B40.1 (1991) Gauges--Pressure Indicating Dial
Type--Elastic Element

AMERICAN PETROLEUM INSTITUTE (API)

API RP 1615 (1996) Installation of Underground
Petroleum Storage Systems

API STD 2000 (1992) Venting Atmospheric and Low
Pressure Storage Tanks (Nonrefrigerated
and Refrigerated)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 182/A 182M (2000) Forged or Rolled Alloy-Steel Pipe
Flanges, Forged Fittings and Valves and
Parts for High-Temperature Service

ASTM C 827 (1987) Standard Test Method for Change in
Height at Early Ages of Cylindrical
Specimens of Cementitious Mixtures

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 40 CFR Part 280 Underground Storage Tanks; Technical
Requirements and State Program Approval,
Final Rules

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (1990) Flammable and Combustible Liquids Code

NFPA 70 (1996) National Electric Code

MILITARY SPECIFICATIONS (MS)

MS MIL-P-24441 (Rev. B, 1991; Supp. 1) General Specification for Paint, Epoxy - Polyamide

MS MIL-T-83133 (Rev. C, 1990; Amend. 1) Turbine Fuels, Aviation, Kerosene Types, NATO F-34(JP-8) and NATO F-35

MILITARY STANDARDS (MIL-STD)

MIL-STD-130 (Rev. G, 1988) Identification Marking of U.S. Military Property

MIL-STD-161 (Rev. F, 1985; Notice 2) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3275A (1994) Acrylonitrile Butadiene (NRB) Rubber Sheet, Non-Asbestos Fiber Fuel and Oil Resistant

STEEL TANK INSTITUTE (STI)

STI P3 (1987) Exterior Corrosion Protection of Underground Steel Storage Tanks

UNDERWRITERS LABORATORIES (UL)

UL 58 (1986) Steel Underground Tanks for Flammable and Combustible Liquids

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pressure Gages; G

Automatic Pump Controls; G

Meters; G

Product Recovery Tank and Accessories; G

Hydrant Outlet Pits; G

Isolation Valve Pits; G

High Point Vent Pits; G

Low Point Drain Pits; G

Operating Tank Level Switches; G

Water Draw-Off System; G

Venturi Tubes; G

Differential Pressure Transmitter; G

Unloading Level Switches; G

SD-02 Shop Drawings

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the equipment and systems.

Meters; G

Venturi Tubes; G

Water Draw-off System; G

Product Recovery Tank and Accessories; G

Hydrant Outlet Pits; G

Isolation Valve Pits; G

High Point Vent Pits; G

Low Point Drain Pits; G

Product Recovery Tank ; G

Provide the product recovery tank drawings as one package with the design analysis. Shop fabrication drawings shall include type of material, configuration, thickness, and necessary details of construction of the steel tank and vault. Shop drawings shall also show the steel grating and supports.

SD-06 Test Reports

Tank Tightness Test Reports; G

Leak Detection Monitor; G

SD-07 Certificates

System Supplier Qualifications and Experience Statement; G

Valve List; G

Coating; G

U.L. Labeled; G

STI P3 Label; G

Hydrant Outlet Pits; G

Isolation Valve Pits; G

High Point Vent Pits; G

Low Point Drain Pits; G

Hydrant Outlet Frame and Cover; G

Isolation Valve Frame and Cover; G

High Point Vent Frame and Cover; G

Low Point Drain Frame and Cover; G

SD-10 Operation and Maintenance Data

Operation and maintenance information shall be submitted for the equipment items or systems listed below. Refer to Section 01730 FACILITY OPERATION AND MAINTENANCE MANUAL for the information to be submitted for various type of equipment and systems.

Pressure Gages

Automatic Pump Controls

Pressure Indicating Transmitters

Unloading Level Switches

Flow Switches

Venturi Tubes

Differential Pressure Transmitter

Meters

Orifice Meter

Hydrant Outlet Pits

Isolation Valve Pits

High Point Vent Pits

Low Point Drain Pits

Product Recovery Tank and Accessories

Water Draw-off System

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Components shall be suitable for use with JP-8 turbine fuel; specific gravity 0.81 at 60 degrees F., viscosity 1.62 CS at 60 degrees F., Reid vapor pressure less than 0.05 psi, MS MIL-T-83133. Components to be ANSI Class 150 (275 PSIG at 100 degrees F.) unless noted otherwise. Components to be suitable for outside, unsheltered location, and to function normally in ambient temperatures between 63 degrees F. and 86 degrees F.

2.2 COMPOSITION OF MATERIALS

Materials in contact with the fuel shall be noncorrosive. No zinc-coated metals, brass, bronze, iron, lead or lead alloys, copper or copper alloys, or other light metal alloys containing more than 4% copper shall be used in contact with the fuel.

2.3 ELECTRICAL WORK

Motors, manual or automatic motor control equipment except where installed in motor control centers, and protective or signal devices required for the operation specified herein shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

2.4 MATERIALS AND EQUIPMENT

All items of material and equipment shall be new and of the best quality used for the purpose in commercial practice and shall be products of reputable manufacturers. Each major component of equipment shall have the manufacturer's name, address and catalog number on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent only will not be acceptable. The gears, couplings, projecting set screws, keys and other rotating parts located so that any person may come in close proximity thereto shall be fully enclosed or properly guarded. Equipment, assemblies and parts shall be marked for identification in accordance with MIL-STD-130 and MIL-STD-161. Valve identification tags made of brass, stainless steel,

or engraved anodized aluminum, indicating valve number and normally open (NO) or normally closed (NC) shall be installed on valves. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No 12 AWG, copper wire, stainless or aluminum hanging wires, or chrome-plated beaded chain designed for that purpose. Submit valve list with valve type, valve identification number and location.

2.4.1 System Supplier

The entire fuel delivery system, including but not limited to pumps, pump control panel, filter separators, computer hardware and software, venturi tubes, transmitters, hydraulic control valves, and all field instrumentation, shall be furnished by a single system supplier, henceforth referred to as the "Supplier", that is regularly engaged in the supplying of such equipment for aircraft hydrant refueling system construction. The Supplier shall be responsible to the contractor for satisfactory start-up and operation of the entire system, and shall assist the Contractor to ensure proper installation of all piping, mechanical equipment and controls. Deviations from these specified Supplier responsibilities will not be accepted. Offeror shall provide a System Supplier Qualifications and Experience Statement with its proposal. The Supplier shall also be responsible to the contractor for Scheduling all Contractor, Sub-Contractor and manufacturer's service personnel during system start-up and final commissioning (Section 15899).

- a. The Supplier shall provide and integrate the Pump Control and Annunciation System (Section 15970) with all sensors, transmitters and controlled equipment, so that the hydrant system operates as designed to provide safe and efficient aircraft refueling.
- b. The Supplier shall review contract drawings and specifications, and identify design problems, deficiencies and/or enhancements for Government review, prior to ordering materials and equipment.
- c. The Supplier shall communicate with the Major Command Fuels Engineer, construction agent, and Architect-Engineers, to clearly understand the design intent and to verify that all design expectations are achievable. The Supplier shall also communicate with the system operators regarding auxiliary equipment intended for use with the system (refueling trucks, hydrant hose carts, hydrant servicing vehicles, portable pantographs, etc), and verify system compatibility and proper calibration settings.
- d. The Supplier shall provide and integrate suitable components (regardless of manufacturer) to provide an efficient, accurate repeatable and reliable system that meets all specified performance characteristics.
- e. The Supplier shall work with the Contractor and Sub-Contractors to ensure that equipment and materials are stored and installed properly to prevent damage, minimize air entrapment, and maintain cleanliness of the installed system.

- f. The Supplier shall work closely with both mechanical and electrical subcontractors to insure proper installation of equipment, instrumentation, wiring and coordination between trades.
- g. The Supplier shall work closely with the Contractor during system start-up and commissioning activities per Section 15899, FUELING SYSTEMS START-UP. The Supplier shall conduct an on-site verification of proper equipment installation, programming, wiring, calibration, set-point adjustments, hydraulic control settings, pressure relief settings, alarm settings, etc, prior to initial fuel receipt. The Supplier shall assist the Contractor with developing the System Start-up Plan, shall coordinate the work of manufacturer's field technicians, shall oversee the system performance tests and final performance demonstration, and provide a 7-channel recorder to plot the system profile during those operations. The Supplier shall also coordinate government-provided equipment and manpower support for start-up and commissioning activities.
- h. The Supplier shall provide equipment data for inclusion in the Operations and Maintenance Manuals for the project per Section 01730, OPERATION AND MAINTENANCE SUPPORT INFORMATION (OMSI) which is clear and detailed enough to facilitate both installation and maintenance.
- i. The Supplier shall participate in Contractor-provided training on the system per Section 01730, OPERATION AND MAINTENANCE SUPPORT INFORMATION (OMSI) to insure that Government operators and maintenance personnel are proficient in their respective areas of responsibility prior to system acceptance. As a minimum, the Supplier shall provide training on the control system (computer hardware, computer software, electronics sensors and transmitters, auto control valves, etc) that enables the Base Liquid Fuels Maintenance Shop to properly accomplish maintenance, annual calibrations, diagnostic testing, troubleshooting, and repairs.

2.5 PRESSURE GAGES

Pressure gages shall conform to ASME B40.1 with metal cases and 4-inch diameter white dials. Gages shall be bottom connected, without back flanges. A pulsation dampener, adjustable to the degree of dampening required, shall be provided for each gage. Range of gages shall be as indicated. A ball valve shall be provided for each pressure gage. Gages shall have all parts immersed in silicone oil. Gages shall be labeled with the calibration date. Range for each pressure gage is as indicated on the drawings.

2.6 GASKETS

Gaskets shall be in accordance with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.7 BOLTS AND NUTS

Bolts and nuts shall be in accordance with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.8 AUTOMATIC PUMP CONTROLS

The pressure and flow transmitters specified in this paragraph shall be obtained from a single supplier of such products. The same supplier shall also furnish the associated venturi tubes and GPM meter. The supplier shall be responsible for furnishing components that are compatible and that operate as a system to perform the required pump control functions. Control tubing between controls/instruments and fuel lines shall be installed to eliminate air entrapment. Control tubing shall be as specified in Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM. Each item of equipment specified hereafter shall have manufacturer's authorized service personnel present to assist in PERFORMANCE TESTING as specified in Section 15899 FUELING SYSTEMS START-UP.

Items specified under this paragraph shall be submitted for approval concurrently with items specified in Section 15970 PUMP CONTROL AND ANNUNCIATION SYSTEM.

2.8.1 Pressure Indicating Transmitters

Pressure indicating transmitters shall consist of a capacitance sensor operating on a differential in pressure of fuel (one side being open to atmospheric pressure). The output shall be a 4 - 20 mA dc, linear signal between 0 - 100% of the input. It simultaneously will produce a digital HART (Highway Addressable Remote Transducer) output signal. Loop power shall be provided from remote power supply located in the pump control panel (PCP).

a. Transmitter body shall be stainless steel with stainless steel diaphragm capsule process connecting to a 1/2 inch NPT. Drain and vent valves to be stainless steel. Accuracy shall be ± 20 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

b. One pressure indicating dial shall be supplied with each pair of transmitters. Pressure indicating dials shall consist of a bellows type pressure sensing element operating on a differential in pressure of fuel (one side being open to atmospheric pressure) and a mechanical indicator (driven by the bellows unit). The bellows shall be dual opposed, liquid filled, rupture-proof type with bellows movement converted to rotation and transmitted by a torque tube. Bellows housing shall be stainless steel and shall have a rated working pressure of not less than 500 psi with a minimum differential pressure range of 0 to 250 psi. Liquid used to fill the bellows shall be suitable for the expected minimum ambient temperature. The indicating dial shall be at least 6 inches in diameter with a weatherproof glass cover. The case shall be finished with a weather resistant epoxy resin enamel. The indicating pointer shall traverse a 270 degrees arc. The scales shall be graduated over the selected pressure ranges so that the pressure can be read in pounds per square inch gage (psig). Indicator accuracy shall be 0.75 percent of full scale. Pressure indicating dial shall be provided with suitable over-range protection.

c. Pressure transmitters shall be UL, FM, or CSA listed for Class 1, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating T2D (419 degrees F). Each transmitter and dial shall be supplied with a factory assembled two valve stainless steel manifold. Vent valves shall be furnished on upper ports of each transmitter and dial. Pressure transmitters and the indicating dial shall be suitable for mounting on a 2-inch pipe stand. Complete installation shall be in accordance with manufacturer's recommendations.

d. Provide a HART (Highway Addressable Remote Transducer) protocol interface handheld calibration device.

2.8.2 Flow Switches

Switches shall be actuating vane type flow switch with single adjustable set-point. Switches shall mount on ASME B16.5 Class 150 raised face flange. Provide snap action switch mechanism U.L. listed for Class I, Division 1, Group D hazardous locations. Switches to be double pole double throw (DPDT). Switch power shall be 120 volts, single phase, 60 hertz, 10 amps minimum.

2.8.3 Venturi Tubes

a. The venturi tubes shall be provided in conjunction with Section 15970 PUMP CONTROL AND ANNUNCIATION SYSTEM.

b. Start-up, adjustments and calibration, and instruction of personnel in the operation and maintenance of the venturi tubes shall be considered as a required portion of the controls package.

c. The venturi tubes shall be low loss differential pressure producers consisting of a short housing piece and a fully machined, contoured throat section providing a restriction at the center, with both inlet approach and exit having geometrically symmetrical curves. They shall be velocity head, impact, differential producing devices designed to measure differential pressure of JP-8 fuel. They shall be constructed of 304L stainless steel with ANSI Class 150 flanges on each end and be suitable for operation of 275 psig at 100 degrees F. They shall be of sufficient thickness to with-stand the same stresses as the upstream and downstream piping. Each venturi tube shall have a minimum of four 1/2-inch connections. An individual head-capacity curve shall be furnished for each venturi tube.

d. Operating conditions for the venturi tubes shall be as follows:

- (1) Issue Venturi Tube. Minimum inlet-to-throat differential pressure at 3,000 gpm: 200 in. H2O.
- (2) Return Venturi Tube. Minimum inlet-to-throat differential pressure at 600 gpm: 200 in. H2O.

- (3) Venturi tubes discharge coefficient "C" to be greater than or equal to 0.97 over pipe Reynolds number range between 200,000 and 1,000,000 and shall be independent of Beta over a Beta range of 0.4 to 0.75. Pressure loss shall be less than 24 percent of differential pressure generated by the venturi tube. Repeatability of the discharge coefficient "C" shall be 2 percent for Reynolds number range of 10,000 to 1,000,000.

- (4) Provide two portable GPM Meters, one for each size of venturi. The meters shall be complete with valves, hoses and connecting disconnects, and carrying case. The meters shall have stainless steel bellows, mounting bracket, 500 psi swp, 6-inch dial with 270 degrees arc. Dial shall read GPM Jet Fuel. Range of scale shall be 1.5 times GPM flow requirement. The venturi manufacturer shall provide the portable meters with the venturi in order to be compatible. The venturi tubes shall also be provided with a suitable table to convert inches differential pressure to gallons per minute.

2.8.4 Differential Pressure Transmitter

Differential pressure transmitter shall consist of a capacitance sensor operating on a differential in pressure of fuel. The output shall be a 4 - 20mA dc, square root signal between a minimum of 4 - 100% of the input. It may be linear between 0 - 4%. It simultaneously will produce a digital HART (Highway Addressable Remote Transducer) output signal. Loop power shall be provided from remote power supply located in the pump control panel (PCP).

- a. Transmitter body shall be stainless steel with stainless steel diaphragm capsule process connecting to a 1/2 inch NPT. Drain and vent valves to be stainless steel. Accuracy shall be " 0.20 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

- b. One differential pressure dial shall be supplied with each pair of transmitters. Differential pressure dial shall consist of a bellows type pressure sensing element, operating on a differential in pressure of fuel, and a mechanical indicator, driven by the bellows unit. The bellows shall be dual opposed, liquid filled, rupture-proof type with bellows movement converted to rotation and transmitted by a torque tube. Displacement of bellows shall be 1.5 cubic inches for full scale travel. Bellows housing shall be stainless steel and shall have a rated working pressure of not less than 500 psi. Liquid used to fill the bellows shall be suitable for the expected minimum ambient temperature. The indicating dial shall be at least 6 inches in diameter with a weatherproof glass cover. The case shall be finished with a weather resistant epoxy resin enamel. The indicating pointer shall traverse a 270 degree arc. The scales shall be graduated

over the selected pressure ranges so that the flow rate can be accurately read in gallons per minute. Indicator accuracy shall be 0.5 percent of full scale. Differential pressure indicating dial shall be provided with built-in pulsation damper and suitable over-range protection.

c. Differential pressure ranges shall be selected as necessary to operate in conjunction with associated venturi tube:

(1) Issue Venturi Tube - 0 to 3000 GPM (full range)

(2) Return Venturi Tube - 0 to 800 (full range)

Each venturi tube shall have two transmitters and one indicating dial per function and shall be installed as indicated on the drawings.

d. Differential pressure transmitters shall be UL, FM, or CSA listed for Class 1, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating T2D (419 degrees F). Each transmitter and indicating dial shall be supplied with a factory assembled five valve stainless steel manifold. Vent valves shall be furnished on upper ports of each transmitter and indicating dial. Differential pressure transmitters and the indicating dial shall be suitable for mounting on a 2-inch pipe stand. Complete installation shall be in accordance with manufacturer's recommendations. Provide calibration meter for differential pressure transmittals.

2.9 METERS

Meter shall be a one-way flow, positive displacement type meter designed for a continuous flow of 600 GPM at the truck fill stand. Meter shall have ANSI Class 150 flanges and body working pressure of not less than 200 psig and shall be suitable for hydrostatic testing of 275 psig. Meter shall be factory calibrated for JP-8 jet fuel and capable of being calibrated in the field. The register shall have a non-setback total indicator and a setback type run indicator so that individual runs can be registered without affecting the total of all runs as shown on the indicator. The total indicator shall have a minimum of seven figures and the setback run indicator shall have a minimum of six figures. The register shall read in gallons and the smallest unit of indicated delivery shall be 1 gallon. Accuracy shall be within +0.3 percent between ten percent and maximum rated flow. Provide temperature volume compensation for the register. Provide a ticket printer with Zero Start. Meters shall be provided with a suitable drain at the bottom, equipped with a ball valve.

2.9.1 Pressure Loss

Pressure loss through the meter shall not exceed 3 psi at 600 gpm flow rate.

2.9.2 Materials of Construction

Materials of construction shall be stainless steel, aluminum or nonferrous

material except meter case may be steel with electrolyses nickel plated internals coated to 3 mil thickness. No ferrous or zinc-coated material bronze, brass or other copper bearing alloys shall be used in contact with the fuel.

2.10 ORIFICE METER

Provide a 4-inch orifice meter complete with a local electronic display in gallons per minute. The orifice flanges shall be stainless steel in accordance with ASTM A 182/A 182M and meet the ANSI 150 lb. class. The orifice plate shall be 304/304L stainless steel and sized to measure flow rates from 700 gpm to 300 gpm. Differential pressure transmitter shall read the pressures from tapped point on the orifice flanges. Refer to paragraph 2.8.4 of this Section for requirements for differential pressure transmitter. Tubing to the transmitter shall be stainless steel. Provide a valve manifold with air venting and draining. Components in contact with the JP-8 shall be compatible with jet fuel.

2.11 PRODUCT RECOVERY TANK AND ACCESSORIES

2.11.1 Tank Construction

Product recovery tank shall be a U.L. labeled, double wall, steel tank, with interstitial monitor. Tank shall be provided with calibrated gage stick and strapping chart. Tank shall be provided with a steel vault attached to tank. Vault shall be provided with a rolling pit cover and removable access grating.

2.11.1.1 Steel Tank With Vault

a. The design, fabrication, erection, testing, and inspection of the double wall tank shall conform to the requirements of UL 58, Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids, Type II. The exterior tank walls shall be separated from the interior walls by standoffs. Provide Drawings. Provide tank tightness test reports.

b. Tank manufacturer shall design the steel vault with the tank. The steel vault shall be 1/4-inch thick steel and designed to support the weight of the rolling cover.

c. Material shall be carbon steel plate.

d. Lifting lugs shall be located at the balance points.

e. Provide anchor straps to attach tank to hold down slab. Straps shall be separated from the tank by a pad made of inert insulating material. Number and location of straps shall be as indicated on the drawings.

f. Tank capacity, connections and appurtenance shall be as shown on the drawings and as described under "Monitor."

g. A complete system of cathodic protection shall be provided for the tank and vault in accordance with Section STI P3 System Requirements.

h. The interior and exterior surfaces of tank and vault shall be coated for corrosion protection. The interior surface shall be coated in accordance with MS MIL-P-24441, Formulas 150, 151, and 152. The exterior surface shall be coated in accordance with STI P3 and the tank shall bear the STI P3 label. Provide a test station between tank and anode.

2.11.1.2 Leak Detection Monitor

a. An annular space shall be provided between the primary and secondary shells to allow for the free flow and containment of all leaked product from the primary tank.

b. The tank shall be provided with a leak monitoring system capable of sensing leaks in the secondary containment space and in the vault. The system shall detect a leak of fuel through the inner shell to the area between the inner and outer shells or a leak of ground water through the outer shell into the area between the inner and outer shells. The detector and any equipment in the area of the fuel tanks and valve pits shall be intrinsically safe or explosion proof. The system shall be a continuous surveillance type. The sensor shall be intrinsically safe discriminating type and shall be connected to a remote panel. Totally flooded containment space reservoir system shall not be permitted. The panel shall provide an audible and visible alarm if a leak is detected and shall indicate if the leak is fuel or water. The alarm shall be manually reset at the panel. An inert gas that is heavier than air shall be used in containment space of the tanks to prevent the forming of condensation. Contractor shall provide instructions and equipment required for calibration of the monitoring system. Contractor shall also provide calibration maintenance schedule. Access shall be provided to the tank sensor for testing and maintenance. The control panel shall be located where shown on the plans. Remote alarm shall be provided at the pump control panel(PCP), see Section 15970, PUMP CONTROL AND ANNUNCIATOR SYSTEM. This control panel shall have a sign located adjacent to it indicating that the alarm indicates a leak in the fuel tank or the vault. The Contractor shall provide system operating instructions inside of the control panel.

c. Monitoring shall be continuous and shall be remotely indicated. The control console shall generate a visual and audible alarm and shall provide one DPDT contact closure on alarm for remote alarm annunciation.

2.11.1.3 Tank Appurtenances and Fittings

Tank appurtenances and fittings shall be provided as indicated. Nozzles for appurtenances and steel vault shall be as indicated or per manufacturer's recommendations and shall be installed plumb with all above grade flange faces level. Gravity fill line shall be provided with locking cap. The flange on the Product Recovery Pump pumpway shall be an ASME Class 150 flange.

2.11.1.4 Tank Vent

Tank vent shall be stainless steel pipe. Vent shall be a breather (pressure-vacuum) with hinged or guided pallets. Moving or striking parts

shall be nonferrous metal. Design shall be such that moisture cannot collect on the pallet. Size pressure and vacuum relief vent in accordance with API STD 2000. Vent opening shall be covered with insect screen and terminate 12 feet aboveground.

2.11.1.5 Manway

A 36-inch round manway shall have U.L. listed gasket with bolted cover. A fiberglass or stainless steel ladder shall be provided inside the tank at the manway.

2.11.1.6 Sampling and Gauging hatch

A sampling and gauging hatch shall be provided and shall consist of a foot-operated, hinged cover with a flexible sealing ring and provision for padlocking. The hatch shall be non-sparking and shall have a flanged connection for installation on 4-inch steel pipe. Provide a datum plate beneath gauge opening, and stencil reference height on gauge/sampling hatch piping.

2.11.1.7 Product Recovery Pump (PRP-1)

Refer to Section 15140 PUMPS, FUELING SYSTEM

2.11.1.8 Electric Pump

The electric pump shall be a sliding vane type rotary pump. The pump construction shall permit the removal of the rotor and sliding vanes without disconnecting the pump. Pump capacity shall be 5 gallons per minute with a 15 feet suction head and a discharge head of 25 feet. The pump and motor shall be mounted on a cast iron or steel subbase. The motor shall have sufficient power for the service required, shall be of a type approved by the pump manufacturer shall be suitable for available electric service, shall be totally enclosed, fan cooled, TEFC, and shall conform to the requirements specified in Section 16415, ELECTRICAL WORK, INTERIOR. Pump shall be provided with stainless suction screen, stainless steel pipe, and aluminum 1 1/2-inch cam type quick disconnect with dust cap.

2.11.1.9 Lockable Cap

A lockable cap shall be provided for the 2-inch gravity fill line.

2.11.1.10 Overfill Valve (OV-1)

Refer to Section 15101, CONTROL VALVES, FUELING SYSTEM

2.11.1.11 Tank Calibration

Provide a certified tank calibration chart in 1/8 inch increments reading in gallons.

2.12 HYDRANT OUTLET PITS AND ISOLATION VALVE PITS

Hydrant hose truck hydrant outlet pits and isolation valve pits shall be

prefabricated units that are the standard products of a firm regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least (3) years prior to bid opening. The basic pit shall consist of .50-inch-thick fiberglass walls and floor with main body dimensions as shown on the drawings. The pit shall contain twelve (minimum) integral concrete anchors or two integral anchors that run continuous on three sides of pit. The integral fiberglass top flange shall require no exposed corrosive material, weldments, or strongbacks within the pit to support the aluminum cover assembly. The manufacturer shall have had a minimum of three years successful experience in the production and usage of their fiberglass service pits and shall supply proof of experience at time of submittals. Pits shall be provided with a 2-inch pump-out line terminating with a male cam type bronze connector with female dustcap. Pits shall be provided with removable aluminum grating platform suitable for loading of 400 pounds per square foot. The grating shall cover the entire opening when the lid is in the open position.

2.12.1 Pit Cover

The pit cover assembly shall consist of a completely removable one-piece aluminum lid attached to a rigid frame which is an integral part of the fiberglass pit. The lid shall be attached to the frame with hinges which do not carry wheel loads applied to the top surface of the lid in its closed position. The lid shall be equipped with a device to hold the lid in its fully-opened position. This lid-staying device shall automatically engage when the lid is opened to its fully-opened position. The device shall also be provided with a quick-release mechanism designed to be operated with one hand. The lid shall be considered fully-open when it is rotated approximately 90 degrees from its closed position. Each cover lid shall move smoothly through its entire range of motion and shall be counterbalanced sufficiently to require an externally-applied opening force of 35 pounds (maximum) to be applied to the center of the long side of the cover (opposite the hinge side). Similarly, the maximum closing force required to be applied at the same point shall be approximately 50 pounds. In addition, the cover shall be counterbalanced in such a fashion that the cover will not close under its own weight if released when open to any angle greater than 70 degrees (from its closed position). Operation of the lid will not have spring assist. Lifting handles (two minimum) shall be provided for each lid. Each handle shall provide comfortable, secure grip for and average adult male's full (gloved) hand. All covers shall be provided with a latch, operable from the exterior of the vault, to securely hold the lid to the frame in the closed position. The latch will be capable of being released from either lifting handle. Tools shall not be required to engage (or disengage) the latch or the lid lifting handles. Latch and handle designs shall be weather-resistant with features to preclude freeze-up and the collection of dirt and precipitation. **The pit and cover assemblies shall present a surface which is 2-inch above the concrete pavement upon completing their installation.** Projections of the lid's hinges, lifting handles, or latches above the plane of the lid, whether temporary or permanent, shall not be allowed. The weight bearing flange surfaces of both the fiberglass pit liner and the aluminum cover lid shall be machined flat to assure uniform weight distribution. The word FUEL shall be integrally cast in raised letters on the top surface of each

lid. The lettering shall be a minimum of 1-inch high and raised to 0.0625-inch.

2.12.2 Pit Cover Materials, Design, and Testing

All cover lids and frames shall be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 200,000-pound test-load applied perpendicular to a 200-square-inch contact area (10 inches by 20 inches) of the cover's top surface. The aluminum alloy material selected for design shall be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers shall be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects shall not be allowed. Minor cosmetic welding is acceptable. The cover shall be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized yielding or cracking or excessive deformations shall be considered as failure. Actual load-tests shall be performed on a minimum of 10 percent of all the covers supplied. Load-tested units shall be randomly selected. Load-test conditions shall model field-installed conditions as nearly as practicable. The 200 Kip test-load shall be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load shall not exceed 1/180th of the minimum interior opening dimension of the fiberglass pit body. Maximum deflection of the cover lids) remaining after removal of the test load shall be ± 0.010 -inches to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame shall be carefully examined for cracks or localized areas of permanent deformation. All results shall be submitted for review and approval. A single failure to meet any of the stated criteria shall be considered sufficient grounds for the testing of 50 percent of the units. Provide test results from Hydrant Outlet Frame and Cover and Isolation Valve Frame and Cover. Provide a waterproof seal to prevent water from entering the pit through a closed lid.

2.12.3 Pipe Seal

The pipe penetrations through the pit wall shall be sealed by means of a Buna-N boot. The boot shall be secured to a metal collar welded to the pipe riser and to a steel pipe sleeve at the pit penetration by stainless steel clamps. Collar shall be fabricated from the same material as the pipe. Buna-N (Nitrile Butadiene) material shall be in accordance with SAE AMS 3275A.

2.12.4 Sleeve Seals

Sleeve seals indicated for sealing the annular space between pipe and pipe sleeves in concrete walls shall have sealing material resistant to brackish water and JP-8. Seals shall consist of an inner link type seal can be installed (or replaced) with the carrier pipe in place. All metal parts incorporated in the seal system shall be stainless steel. The seal system shall be capable of holding at least 10 psig of pressure without leaking.

2.12.5 Hydrant Outlet Pit Equipment

At the Contractor's option, hydrant pits may be furnished complete with hydrant control valves and shutoff valves assembled in a pipe riser. All valves and piping furnished by the pit manufacturer shall comply with the requirements specified herein. Control valves are specified in Section 15101, CONTROL VALVES, FUELING SYSTEM. All control valves shall be of the same manufacturer. Piping, fittings, valves and etc. shall comply with Section 15060, PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.12.6 Isolation Valve Pit End Seal

End seals for isolation valve pits shall be furnished as shown on drawings. Provide polyethylene pipeline crossing insulator.

2.12.7 Isolation Valve Pit Equipment

At the Contractor's option, isolation valve pits may be furnished complete with isolation valves, high point vent valves or low point drain valves. All valves and piping furnished by the pit manufacturer shall comply with the requirements specified herein, piping, fittings, valves and etc. shall comply with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.13 HIGH POINT VENT PITS AND LOW POINT DRAIN PITS

2.13.1 Pit Assembly

Each pit shall incorporate the following items built into a self-contained assembly.

2.13.2 Pit

The basic pit shall consist of 0.25-inch wall fiberglass liner with a main body approximately 23-inches in diameter and a minimum of 37-inches deep. The pit shall contain four integral concrete anchors. The fiberglass top flange shall require no exposed corrosive material, weldments, or strongbacks within the pit to support the cast aluminum ring and cover assembly. The pits shall be the standard products of a firm regularly engaged in the manufacture of such product and shall essentially duplicate items that have been in satisfactory use for at least three (3) years prior to bid opening. Proof of experience shall be submitted.

2.13.3 Pit Cover, General Requirements

The pit cover shall include a removable outer ring frame and an interior 23.5-inch diameter (clear opening) hinged lid that opens 180 degrees. Each cover lid shall move smoothly through its entire range of motion and shall require a maximum opening force of 25 pounds to be applied at a single lifting handle. Each handle shall provide a comfortable, secure grip for an average adult male's full gloved hand. Tools shall not be required to engage the lifting handle. Projections of the lid's hinges or handles above the plane of the lid, whether temporary or permanent, shall not be allowed. The pit service shall be integrally cast in raised letters on the top surface of each lid. The lettering shall be a minimum of 1-inch high and raised to 0.0625-inch. The weight bearing flanges of the fiberglass pit liner and the aluminum cover frame (and lid) shall be machined to

assure uniform weight distribution.

2.13.4 Pit Cover Materials, Design, and Testing

The cover frames and lids shall be designed and manufactured by a qualified company having a minimum of five years successful experience in the production of similar airport apron slab fixtures. All cover lids and frames shall be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 200,000-pound test-load applied perpendicular to a 200-square-inch contact area (10 inches by 20 inches) of the cover's top surface. The aluminum alloy material selected for design shall be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers shall be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects shall not be allowed. Minor cosmetic welding is acceptable. The cover shall be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized yielding or cracking or excessive deformations shall be considered as failure. Actual load-tests shall be performed on a minimum of 10 percent of all the covers supplied. Load-tested units shall be randomly selected. Load-test conditions shall model field-installed conditions as nearly as practicable. The 200 Kip test-load shall be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load shall not exceed 1/180th of the interior diameter of the fiberglass pit body. Maximum deflection of the cover lids) remaining after removal of the test load shall be ± 0.010 -inches to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame shall be carefully examined for cracks or localized areas of permanent deformation. All results shall be submitted for review and approval. A single failure to meet any of the stated criteria shall be considered sufficient grounds for the testing of 50 percent of the units. Provide test results for aircraft rated High Point Vent Frame and Cover and aircraft rated Low Point Drain Frame and Cover.

2.13.5 Pipe Riser Seal

The riser pipe penetration through the pit floor shall be sealed by means of a Buna-N boot. The boot shall be secured to a metal collar welded to the pipe riser and to a flange at the floor opening by stainless steel clamps. Collar shall be fabricated from the same material as the pipe.

2.13.6 Pit Equipment

Piping, fittings, valves and couplers shall comply with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.14 OPERATING TANK LEVEL SWITCHES

System shall be designed and installed in such a way that the system shall be continuously and automatically self-checking without manual check. Electronic level sensors shall be thermistors or optic type, and be intrinsically safe Class I, Division 1, Group D for hazardous environments, with recognized FM, CSA or UL approval. Both high electronic level sensors

shall be contained in a single multi-sensor holder/junction box. The sensor holder/junction box shall be accessible from the tank top or stairway.

2.14.1 Electronic Level Alarms

Level alarms shall be mechanically and electrically independent and be totally isolated from the gauging system. Two electronic high level alarms and one low level alarm shall be provided for each tank. A High Level Alarm (HLA) shall be set at approximately 90 percent of the safe tank filling height and be arranged to actuate an audible alarm signal located where shown on the drawings and an indicator light at the control panel. A High High Level Alarm (HHLA) shall be set at approximately 95 percent of the safe filling height. HHLA shall actuate an audible and visual alarm where shown on the drawing and an indicator light at the control panel. A Low Level Alarm (LLA) shall be set at 4'-0" (1220) above bottom of tank shell. When the LLA is activated, the associated tank's GDP low level light shall light. If the outlet valve is not fully closed, the alarm annunciator's critical alarm sequence activates, fueling pumps running in automatic mode shall be disabled and no pump shall be allowed to start automatically. If all tanks are at low level, no fueling pumps shall start automatically. Alarms shall be annunciated at Pump Control Panel

2.15 WATER DRAW-OFF SYSTEM

A water draw-off system shall be provided for each Operating Tank. Water draw-off system shall gravity drain. Each system shall include tank, water draw-off pump, start/stop switch, disconnect switch, motor starter, and all necessary pipe, valves, and fittings.

2.15.1 Tank

Water draw-off tank shall be a 55-gallon fabricated stainless steel tank with supporting legs as shown. Tank and support legs shall be fabricated from Type 304 stainless steel.

2.15.2 Sight Glass

Sight glasses for tank shall be standard tubular gages with density ball and shut-off valves on each end. Wetter parts other than sight glass shall be stainless steel. If glass breakage should occur, a stainless steel ball in the valve shall close preventing product loss. Glass shall be protected by minimum of four guard rods.

2.15.3 Water Draw-Off Pump

Water Draw-off pump (WDP-3 and WDP-4) shall have the capacity of not less than 10 gpm against a total head of 55 feet when driven at 1800 rpm. The pump shall have flange connections and shall be constructed of stainless steel or aluminum so as to have no zinc, brass or other copper bearing alloys in contact with the fuel. The unit shall be explosion-proof, Class I, Division 1, Group D with maximum temperature rating of ("T2D" -419 degrees F). The motor shall not be overloading at any point on the pump curve. Contractor has the option of selecting either centrifugal or

positive displacement type pump with the restriction of the positive displacement type pump shall include a pressure relief between the discharge and suction protecting the pump from overloading.

2.15.4 Anchoring

All units of the water draw-off system shall be installed plumb and level and secured in place by anchor bolts.

2.16 UNLOADING LEVEL SWITCHES

- a. Level control switches on unloading standpipe as indicated.
- b. Wide differential with stainless steel displacers.
- c. Heavy-duty mercury contacts rated 5 amps at 120Vac.
- d. NEMA 7/9 enclosure for Class 1 hazardous location.
- e. Adjustable settings for low, high and high high pump control levels.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

Install equipment and components in position, true to line, level and plumb, and measured from established benchmarks or reference points. Follow manufacturer's recommended practices for equipment installation. Provide required clearances between equipment components. Equipment, apparatus, and accessories requiring normal servicing or maintenance to be accessible.

3.1.2 Anchoring

Anchor equipment in place. Check alignment of anchor bolts before installing equipment and clean-out associated sleeves. Do not cut bolts because of misalignment. Notify Contracting Officer of errors and obtain the Contracting Officer's acceptance before proceeding with corrections. Cut anchor bolts of excess length to the appropriate length without damage to threads. Where anchor bolts or like devices have not been installed, provide appropriate self-drilling type anchors for construction condition.

3.1.3 Grouting

Equipment which is anchored to a pad to be grouted in place. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing water, debris, oil, rust, and coatings which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and rust by hand or power tool methods. Provide necessary formwork for placing and retaining grout. Grout to be non-metallic, non-shrink, fluid precision

grout of a hydraulic cementitious system with graded and processed silica aggregate, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum powder agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, pre-mixed and packaged at factory with only the addition of water required at the project site. Grouting shall be in accordance with ASTM C 827. Perform all grouting in accordance with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.1.4 Leveling and Aligning

Level and align equipment in accordance with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or wedges to support, level or align equipment. Install only flat shims for leveling equipment. Place shims to fully support equipment. Wedging is not permitted. Shims to be fabricated flat carbon steel units of surface configuration and area not less than equipment bearing surface. Shims to provide for full equipment support. Shim to have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges not acceptable.

3.1.5 Direct Drives

Alignment procedure follows:

3.1.5.1 Rotation Direction and Speed

Check and correct drive shaft rotation direction and speed.

3.1.5.2 End Play

Run drive shafts at operational speed. Determine whether axial end play exists. Run drive shaft at operational speed and mark drive shaft axial position when end play exists. Block drive shaft in operating position when aligning drive shaft with driven shaft.

3.1.5.3 Shaft Leveling and Radial Alignment

Check shaft leveling by placing a spirit level across the half faces. Radially align shafts by placing a straightedge across the two coupling half faces in both horizontal and vertical planes.

3.1.5.4 Angular Alignment and End Clearance

Check angular alignment and end clearance by inserting a feeler gage at 4 points, 90 degrees apart around outer edges of coupling halves.

3.1.5.5 Final Recheck

Check adjustments with dial indicator after completing recheck. Align shafts within 0.001 inch tolerance, except as other-wise required by more stringent requirements of equipment manufacturer.

3.2 INSTALLATION OF UNDERGROUND TANKS

Installation shall be per tank manufacturer's recommendations, API RP 1615, NFPA 30, EPA 40 CFR Part 280, state and local codes and as specified herein. If recommendations require tank to be filled, only fuel will be allowed in tanks. Water filling is not acceptable. Before being placed in service, tank shall be tightness tested in accordance with NFPA 30.

3.2.1 Coating

The coating shall be examined for flaws and tested for thickness. The Contractor shall provide the facilities, personnel, and equipment for testing for flaws and thickness. Thickness shall be measured electronically. Coating shall be tested directly before placement of the tank with an electric flaw detector, equipped with a bell, buzzer, or other type of audible signal that operates when a flaw is detected. The detector for the type of coating used shall have an operating voltage of 10,000 to 35,000 volts. Check of the holiday detector potential may be made by the Contracting Officer at any time to determine the suitability of the detector. Damaged areas shall be repaired with materials identical to those used originally, and after drying, shall be retested electrically.

3.2.2 Steel Tanks

a. Cover the concrete hold down slab with 12 inches of tank bedding backfill evenly graded and thoroughly compacted, prior to tank placement.

b. Each tank is to be unloaded and placed on the sand bed using cranes and the rigging procedures provided by the tank manufacturer. Use the tank lifting lugs for lifting the tank into place. The use of slings around the tank is not permitted, nor is the use of chock blocks of any sort. During handling, carefully inspect the tanks for coating damage and repair any damage whatsoever before proceeding. After placement, check each tank to ensure it is sloped as required. The elevation shall be confirmed.

c. Before proceeding with backfill, install the hold down straps and tighten the turnbuckles securely and evenly throughout the length of the tanks. The bottom and sides of the tanks to be fully and evenly supported by hand shoveling and tamping. Use tank bedding backfill up to 12 inches above the top of tank. Hand-guided power equipment can be used to place fill in 6-inch layers, compacted to a minimum of 95 percent maximum density, after the bottom quadrant is filled. A minimum of four density tests per tank to be performed. Clean, noncorrosive, well tamped gravel to be used for backfill from a point 12 inches above the tanks to finished grade.

d. Do not fill the tank, even partially, before the bottom quadrant is backfilled. The level of fuel product not to exceed the level of compacted backfill at any time.

e. Coordinate tank installation with the installation of cathodic

protection.

3.3 INSTALLATION OF FIBERGLASS PITS

The Contractor shall submit recommended installation procedures and setting tolerances from the pit manufacturer/supplier for the fiberglass pit and the aluminum cover. These procedures shall indicate recommended methods of supporting the pit in its proper position in the open excavation prior to and during concrete placement operations. Also, required installation tolerances, especially for flatness/levelness of the fiberglass pit lip, shall be provided. The Contractor shall follow these recommendations and shall apply other procedures as required to ensure the integrity of the pit liner and cover assemblies in their installed positions. All penetrations through the fiberglass pit liner shall be tightly sealed by suitable means to preclude water infiltration, with consideration for potential relative movements between the penetrating objects and the pit liner. Reference the Contract drawings for additional installation requirements.

3.4 POSTED OPERATING INSTRUCTIONS

For each designated system or equipment item, provide instructions for guidance of operating and maintenance personnel. Following approval of content, prepare these instructions in a form and scale that will be readily legible when displayed in appropriate locations, to be designated by the Contracting Officer and meet the following requirements:

3.4.1 Each System

For each system, include diagrams of equipment, piping, wiring and control. Define control sequences.

3.4.2 Each Tank

For each tank provide certified tank calibration chart in 1/8-inch increments reading in gallons.

3.4.3 Each Item

For each equipment item, include starting, adjustment, operation, lubrication, safety precautions and shut-down procedures. Identify procedures to be performed in event of equipment failure. Provide other instructions recommended by the manufacturer.

3.4.4 Diagrams

The Contractor shall provide a professionally prepared isometric piping diagram of the fueling system apparatus. Diagram shall be 36 inches x 54 inches and shall be color coded to match PCP color diagrams. Diagram shall show the entire facility and shall include all equipment and the operational sequences of all equipment with equipment numbers displayed. Diagram shall show all valves along with the valve numbers shown on the drawings and listed as normally open/closed. It shall be wall mounted under glass.

3.4.5 Volume of Fuel

The Contractor shall provide a certified system inventory of fuel in the pipe, tank, pumphouse, etc. The piping will show length of pipe, size of pipe, gallons per foot, and total gallons. Verify during initial fill.

-- End of Section --

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SECTION 15060

PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects,
HQ AFCESA/CESM (01/29/96).

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z49.1 (1988) Safety in Welding and Cutting

AMERICAN PETROLEUM INSTITUTE (API)

API SPEC 5L (1995) Line Pipe

API SPEC 6D (1994) Pipeline Valves (Gate, Plug, Ball, and Check Valves)

API STD 526 (1969) Flanged Steel Safety Relief Valves for use in Petroleum Refineries

API STD 594 (1991) Wafer and Wafer-lug Check Valves

API STD 607 (1993) Fire Test for Soft-Seated Quarter-Turn Valves

API STD 608 (1995) Ball Valves

API Bull 1529 (1998) Aviation Fueling Hose

API 1584 (2001) Four-inch Hydrant System Components and Arrangements

API RP 1110 (1991) Pressure Testing of Liquid Petroleum Pipeline

ASME INTERNATIONAL (ASME)

ASME BPV VIII Div 1 (1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Steel Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	(1981; R 1992) Square and Hex Bolts and Screws Inch Series
ASME B18.2.2	(1987) Square and Hex Nuts (Inch Series)
ASME B31.1	(1995) Power Piping
ASME B31.3	(1999) Process Piping

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1992) Structural Steel
ASTM A 53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 105	(1996) Forgings, Carbon Steel, for Piping Components
ASTM A 106	(1999e1) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 181	(1995b) Carbon Steel Forgings, for General Purpose Piping
ASTM A 182	(1996e) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 193	(1996b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194	(1996) Carbon and Alloy Steel Nuts for

Bolts for High-Pressure and
High-Temperature Service

ASTM A 234	(1996a) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 269	(1996) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A 312	(1991c) Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A 358	(1995) Electric-Fission-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High-Temperature Service
ASTM A 403	(1996) Wrought Austenitic Stainless Steel Piping Fittings
ASTM D 229	(1991) Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM E 94	(1991) Radiographic Testing
ASTM F 436	(1991) Hardened Steel Washers

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1993) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(1989) Welding Terms and Definitions Including Terms for Brazing, Soldering, Thermal Spraying and Thermal Cutting
AWS A5.1	(1991) Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.4	(1981) Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Electrodes
AWS A5.5	(1981) Low-Alloy Steel Covered Arc Welding Electrodes

FEDERAL SPECIFICATIONS (FS)

FS L-T-1512	(Rev A; Reinst) Tape, Pressure Sensitive Adhesive, Pipe Wrapping
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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

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

MSS SP-58 (1988) Pipe Hangers and Supports-Materials, Design and Manufacture

MSS SP-69 (1991) Pipe Hangers and Supports-Selection and Application

MILITARY SPECIFICATIONS (MS)

MS MIL-N-5877 (Rev E) Nozzle, Pressure Fuel Servicing, Locking, Type D-1, D-2, D-2R Nominal 2-1/2 inch diameter

MIL-R-6855 (Rev. E; Supp. 1) Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes

MS MIL-S-13789 (Rev D) Strainers, Sediment: Pipeline, Basket Type

MILITARY STANDARDS (MIL-STD)

MIL-STD-161 (Rev F; Notice 2) Bulk Petroleum Products System Including Hydrocarbon Missile Fuels

MIL-STD-271 (Rev F) Nondestructive Testing Methods

MIL-STD-24484 (Rev J) Adapter, Pressure Fuel Servicing, Nominal 2.5 inch diameter

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (1990) Flammable and Combustible Liquids Code

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J 514 (1989) Hydraulic Tube Fittings, Standard

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 10 (1994) Near-White Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES:

SD-03 Product Data

Piping; G

Fittings; G

Ball Valves; G

Plug Valves; G

Check Valves; G

Relief Valves; G

Surge Absorber; G

Sight Flow Indicators; G

Strainers; G

Isolating Gasket Kits; G

Gaskets; G

Lightning Surge Arrester; G

Exterior Protective Pipe Coatings; G

Pipe Wrap; G

Sample Connections; G

Flanged Swivel Joints; G

Fuel Hose; G

Pressure Fueling Nozzle; G

Nozzle Adapter (SPR); G

Pig Launcher and Receiver; G

Flexible Hoses; G

Valve Tags; G

Automatic Air Eliminator; G

Pressure Sensitive Labels; G

Instrument Valves; G

Unloading Dry Break Coupler; ; G

Quick Coupling; G

SD-06 Test Reports

Holiday Test

Pneumatic Test; G

Hydrostatic Pressure Test; G

SD-07 Certificates

Qualifications of Welders; G

Certificate of Fusion Bonded Epoxy Applicator Experience

Piping; G

Fittings; G

Pipe/Fitting Inspector; G

Pipe Weld Radiograph Inspector's Certification; G (for field welds)

Isolating Gasket Kits; G

Survey of final elevation of buried fuel pipe; G

Survey giving elevation at each joint, elbow, and tee.

SD-10 Operation and Maintenance Data

Operation and maintenance information shall be submitted for the equipment items or systems listed below. Refer to Section 01730 FACILITY OPERATION AND MAINTENANCE MANUAL for the information to be submitted for various type of equipment and systems.

Ball Valves
Strainer
Sample Connections
Isolating Gasket Kits
Gaskets
Flexible Hoses
Plug Valves
Check Valves
Surge Absorber
Sight Flow Indicators
Flanged Swivel Joints
Nozzle Adapter
Pig Launcher and Receiver
Lightning Surge Arrester
Automatic Air Eliminator

Instrument Valves
Unloading Dry Break Coupler
Quick Coupling

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Design conditions shall be as specified in Section 15050 MECHANICAL EQUIPMENT, FUELING SYSTEM.

2.2 MATERIALS

2.2.1 General

Pipe and fittings in contact with fuel shall be stainless steel or, carbon steel as indicated on the drawings. No zinc coated metals, brass, bronze or other copper bearing alloys shall be used in contact with the fuel. All carbon steel and stainless steel underground piping shall have a protective coating and shall be cathodically protected in accordance with Section 13112 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT). Identification of piping shall be in accordance with MIL-STD-161 unless specified otherwise. Material for manual valves shall be as specified hereinafter.

2.2.2 Carbon Steel Piping

Each length of pipe shall be subjected to factory hydrostatic testing and ultrasonic testing in accordance with their respective pipe specification.

a. Piping 12-Inches and Larger: Seamless, ASTM A 53 Grade B having a wall thickness of 0.375-inch.

b. Piping 2 1/2-Inches through 10-Inches: Seamless, Schedule 40 API SPEC 5L Grade B or ASTM A 53 Grade B.

c. Piping Two-Inches and Smaller: Seamless, Schedule 80 API SPEC 5L Grade B or ASTM A 53 Grade B.

d. Welding Electrodes: E70XX low hydrogen electrodes conforming to AWS A5.1 or AWS A5.5.

2.2.3 Stainless Steel Piping

a. Piping 2 1/2-Inches and Larger:

(1) ASTM A 358, Grade 304L, Class 1 or Class 3 with supplementary requirements of S1, S2 and S3, or ASTM A 312 Type 304L, seamless (only). Any agreements between the purchaser and the manufacturer or supplier as referenced in the applicable ASTM shall include the Contracting Officer as a party to the agreement. All piping welds will receive 100 percent radiographic inspection, 100 percent liquid penetrant inspection, 100 percent visual inspection and all tests as required by the applicable ASTM

Standard. Piping shall be provided with a nominal wall thickness as shown in Table A for ASTM A 358 with the deviation from the nominal wall thickness less than 0.01-inch. ASTM A 312 seamless piping shall be provided with a minimum schedule 10S wall thickness.

(2) Pipe Ends: All Piping shall be provided with beveled ends per Chapter V, ASME B31.3, and shall be shipped with the ends capped.

(3) Seam and End Welds: All sections of the piping provided shall be accepted on the project site if the seam welds meet the requirements of the paragraph K341 of ASME B31.3 and Appendix 4 of ASME BPV VIII Div 1. One hundred spots may be reinspected at the project site prior to installation and backfilling at the request of the Contracting Officers Representative. End welds shall be properly aligned prior to welding per Chapter V of the ASME B31.3. Welds found to be defective shall be repaired as per Chapter V of the ASME B31.3 at no additional cost to the government. Observation by the Contracting Officers Representatives of the manufacturing and field procedures shall be allowed under this contract.

(4) Welders Qualifications: Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

(5) Factory Testing and Inspection Records: Per Table K341.3.2A of Chapter VII of ASME B31.3, visual, radiographic and liquid penetrant tests shall be performed for each section of piping provided as all sections are subjected to cyclic conditions. All testing and inspections records shall be submitted to the Contracting Officers Representative and shall indicate the pipe mark and installed location of what piping section on the project site. Observation by the Contracting Officers Representatives of the manufacturers and the fields testing and inspection procedures shall be allowed under this contract. Contractor shall notify the Contracting Officer 90 days in advance when the piping for this contract will be manufactured. Pipe certification along with pipe markings shall be submitted before the pipe arrives on the job site.

(6) Welding Inspectors for Stainless Steel Piping: The contractor shall submit the qualifications of all the testing personnel that will perform all field tests as requested by the Contracting Officer. The qualifications of all personnel on the job site that will perform welding inspection shall be submitted for approval. These inspectors shall meet the qualifications as defined in Chapter VI of the ASME B31.3, and may use the methods as defined in Table K341.3.2 B of the ASME B31.3. Provide a Pipe Weld Radiograph Inspector's Certification for each inspector.

(7) The Contractor shall provide a qualified pipe/fitting inspector in accordance with Chapter VI of ASME B31.3. to act as the owner's inspector (for the Government) at the pipe manufacturer's facility in addition to the manufacturer's inspector.

(8) Quality Assurance Plan shall be submitted for the welding, inspecting and testing of the welded seam pipe. All underground piping welds shall be 100% radiographed.

TABLE A

<u>Nominal Pipe Size</u>	<u>Nominal (Average)</u>	
	<u>Pipe O.D.</u>	<u>Wall Thickness(tn)</u>
16 in.	16.000 in.	0.312 in.
14 in.	14.000 in.	0.312 in.
12 in.	12.750 in.	0.250 in.
10 in.	10.750 in.	0.250 in.
8 in.	8.625 in.	0.250 in.
6 in.	6.625 in.	0.219 in.
4 in.	4.500 in.	0.219 in.
2 1/2 in.	2.875 in.	0.156 in.

b. Piping Two-Inches and Smaller: Schedule 80 ASTM A 312 seamless Type 304L for threaded piping and schedule 40 (unless otherwise indicated) ASTM A 312 seamless Type 304L for welded piping.

c. Stainless Steel Control Tubing: Seamless, fully annealed tubing conforming to ASTM A 269, Grade TP316, Rockwell hardness B80 or less. Wall thickness for 1/2-inch tubing to be 0.049-inch.

d. Welding Electrodes: E308L conforming to AWS A5.4.

2.2.4 Protective Coatings for Aboveground Carbon Steel Piping

Provide coating of aboveground piping, piping in pits, pipe supports, filter separators, and miscellaneous metal and equipment in accordance with Section 09971 EXTERIOR COATING OF STEEL STRUCTURES.

2.2.5 Exterior Protective Pipe Coatings for Buried Steel Piping

Provide underground pipe with factory applied Fusion Bonded Epoxy exterior coating system. Coating applicator shall have a minimum of 5 years of certifiable experience in the type of coating work required. Submit experience. Surface preparation shall be grit blast to SSPC SP 10, with minimum profile depth of 2.5 mils. Shop apply the first coat, fusion bonded epoxy powder. Apply at 20 mils minimum dry film thickness. Provide a 2 inch cutback at pipe ends. Touch Up coat is a field applied, two component catalyzed epoxy specifically for use with specified first coat and of same color, for large areas. Coating system total thickness shall

be 20 mils dry film thickness. Extend coating to a minimum 6" above finished grade or inside vaults.

2.2.5.1 Pipe Wrap

Fittings, couplings, irregular surfaces, damaged areas of pipe coating, and existing piping affected by the Contractor's operations shall be clean, dry, grease free, and primed before application of tape. Tape shall overlap the pipe coating not less than three inches. Waterproof shrink sleeves may be provided in lieu of tape and shall overlap the pipe coating not less than six inches. Pipe coating and adhesive undercoat surfaces to be wrapped with tape shall be primed with a compatible primer prior to application of tape. Primer shall be as recommended by tape manufacturer and approved by pipe coating manufacturer.

a. Damaged Areas of Pipe Coating: Provide FS L-T-1512, 20 mils nominal thickness of tape over damaged areas. Residual material from damaged areas of pipe coating shall be pressed into the break or trimmed off. Apply tape spirally with one-third overlap as tape is applied. A double wrap of one full width of tape shall be applied at right angles to the axis to seal each end of the spiral wrapping.

b. Fittings, Couplings, and Regular Surfaces: Provide FS L-T-1512, 10 mils nominal thickness tape overlapped not less than 1.0 inch over damaged areas. Initially stretch and apply first layer of tape to conform to component's surface. Then apply and press a second layer of tape over first layer of tape.

2.2.5.2 Testing of Protective Coatings

Perform tests with an approved silicone rubber electric wire brush or an approved electric spring coil flaw tester. Tester shall be equipped with an operating bell, buzzer, or other audible signal which will sound when a holiday is detected at minimum testing voltage equal to 1,000 times the square root of the average coating thickness in mils. Tester shall be a type so fixed that field adjustment cannot be made. Calibration by tester manufacturer shall be required at six-month intervals or at such time as crest voltage is questionable. Certify in writing the calibration date and crest voltage setting. Maintain the battery at ample charge to produce the crest voltage during tests. Areas where arcing occurs shall be repaired by using material identical to original coating or coating used for field joints. After installation, retest the exterior surfaces, including field joints, for holidays. Promptly repair holidays. Provide Holiday Test report.

2.2.6 Fittings

2.2.6.1 General

Welding ells, caps, tees, reducers, etc., to be of materials compatible for welding to the pipe line in which they are installed, and wall thickness, pressure and temperature ratings of the fittings shall be not less than the

adjoining pipe line. Unless otherwise required by the conditions of installation, all elbows shall be the long radius type. Miter joints shall not be acceptable. Make odd angle offsets with pipe bends or elbows cut to the proper angle. Butt weld fittings to be factory-made wrought fittings manufactured by forging or shaping. Fabricated fittings shall not be permitted. Welding branch fittings shall be insert type suitable for radiographic inspections specified herein.

2.2.6.2 Carbon Steel Fittings

a. Fittings 2-1/2 Inches and Larger: Butt weld, conforming to ASTM A 234, grade WPB and ASME B16.9 of the same wall thickness as the adjoining pipe. All welds shall be radiographically examined throughout the entire length of each weld. Each fitting shall be subjected to the Supplementary Requirements S3 and S4, Liquid Penetration examination and Magnetis-Particle Examination. Detectable flaws shall not be accepted in the supplementary examinations. Fittings shall be identified to relate them to their respective radiograph.

b. Fittings 2 Inches and Smaller: Forged (socket welded or if indicated on drawings, threaded), 2,000-pound W.O.G., conforming to ASTM A 105, Grade 2 and ASME B16.11. Threaded fittings shall only be used for above grade applications. Underground low point drain pipe and high point vent pipe shall be butt welded.

c. Flanges: One-hundred-fifty-pound weld neck, forged flanges conforming to ASTM A 181, Grade 2, and ASME B16.5. Flanges to be 1/16-inch raised face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flange face shall be machined to match valves or equipment furnished. Use of spacing rings or gaskets discs are not allowed. Flanges shall be subjected to the Supplementary Requirements S4 and S5, Liquid Penetrant Examination, and Magnetic-Particle Examination. Detectable flaws shall not be accepted.

2.2.6.3 Stainless Steel Fittings

a. Fittings 2-1/2 Inches and Larger: Butt weld stainless steel conforming to ASTM A 403, Class WP, Type 304L, seamless or welded, and ASME B16.9 of the same minimum wall thickness as the adjoining pipe. Welded fittings shall be tested and inspected the same as the welded seam pipe and meet the same requirements as for the pipe.

b. Fittings 2-Inches and Smaller: Forged Type 304 or 304L (socket welded or if indicated on drawings, threaded), 2,000-pound W.O.G. conforming to ASTM A 182 and ASME B16.11. Threaded fittings shall only be used for above grade applications. Underground low point drain pipe and high point vent pipe shall be butt welded.

c. Unions: Conforming to ASTM A 312, Grade 304 or 316.

d. Flanges: One-hundred-fifty-pound weld neck, forged Type 304 or 304L stainless steel flanges conforming to ASTM A 182 and ASME B16.5, except flanges that are to be connected to the fueling/defueling pumps shall be 300-pound. Flanges to be 1/16-inch raised-face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flanges shall be subjected to the Supplementary Requirements S4, Liquid Penetrant Examination.

e. Stainless Steel Tube Fittings: Flareless, 316 stainless steel fittings conforming to SAE J 514.

2.2.6.4 Isolating Gasket Kits (Insulating) for Flanges

Provide ASTM D 229 electrical insulating material of 1,000 ohms minimum resistance; material shall be resistant to the effects of aviation hydrocarbon fuels. Provide full face insulating gaskets between flanges. Provide full surface 0.03-inch thick wall thickness, spiral-wound mylar insulating sleeves between the bolts and the holes in flanges; bolts may have reduced shanks of a diameter not less than the diameter at the root of threads. Provide 0.125-inch thick high-strength phenolic insulating washers next to flanges and provide flat circular stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 0.5-inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts. Exterior above grade flanges separated by electrically isolating gasket kits shall be provided with weatherproof lightning surge arrester devices. The surge arrester shall bolt across flanges separated by insulating gasket kits per detail on contract drawings. The arrester shall have the following features:

- a. Weatherproof NEMA 4 enclosure.
- b. Bidirectional and bipolar protection.
- c. Constructed of solid state components, no lights, fuses or relays shall be used that will require maintenance or replacement.
- d. Withstand unlimited number of surges at 50,000 Amperes.
- e. Maximum clamping voltage of 700 Volts based on a IEEE C62.41 8x20 microsecond wave form at 50,000 Amperes peak measured at the device terminals (zero lead length).
- f. A UL listed arrester for installation in Class 1, Division 2, Group D, hazardous areas.

Install the mounting bracket and leads on the flange side of the bolt insulating sleeve and washer, and size in accordance with this schedule.

Line Size (Inches)	Bolt Size (Inches)
2	5/8
2-1/2	5/8

3	5/8
4	5/8
6	3/4
8	3/4
10	7/8
12	7/8
14	1
16	1

(Note: Allowance must be made for the 1/32-inch thickness of the insulating sleeve around the bolts when sizing the mounting lugs.)

2.2.7 Bolts and Nuts

Bolts and nuts for pipe flanges, flanged fittings, valves and accessories shall conform to ASME B18.2.1 and ASME B18.2.2, except as otherwise specified. Bolts shall be of sufficient length to obtain full bearing on the nuts and shall project no more than two full threads beyond the nuts with the bolts tightened to the required torque. Bolts shall be regular hexagonal bolts conforming to ASME B18.2.1 with material conforming to ASTM A 193, Grade B7. Bolts shall be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Nuts shall conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A 194, Grade 8. Nuts shall be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Provide washers under bolt heads and nuts. Washers to be ASTM F 436, flat circular stainless steel. Torque wrenches shall be used to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tightening pattern shall be as recommended by the gasket manufacturer. Anti-seize compound shall be used on stainless steel bolts.

2.2.8 Gaskets

ASME B16.21, composition ring, using a Buna-N binder, 0.1250-inch thick. Gaskets shall be resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Full-face gaskets shall be used for flat-face flanged joints. Ring gaskets shall be used for raised-face flanged joints. Gaskets shall be of one piece factory cut.

2.2.9 Field Applied Protective Coatings

The field joints and fittings of all underground piping shall be coated as herein specified.

2.2.9.1 Welded Joints

Heat shrinkable radiation-cross-linked polyolefin wraparound type sleeves shall be applied to all welded joints. Joints shall not be coated until pressure testing is complete. Apply sleeves consisting of 40 mil polyolefin backing and 40 mil thermoplastic mastic adhesive in accordance with the manufacturer's instructions.

2.2.9.2 Fittings

Fittings and other irregular surfaces shall be tape wrapped. The tape shall be a plastic mastic laminated tape having 6 mil plastic backing of either polyethylene or polyvinylchlorine and 29 to 44 mil of synthetic elastomer.

2.2.10 Threaded Joints

Threaded joints, if indicated on the drawings, shall be made tight with manufacturer recommended teflon tape or a mixture of graphite and oil, inert filler and oil, or with a graphite compound, applied with a brush to the male threads. Not more than three threads shall show on made up joints. Threaded joints, mechanical couplings and flanges will not be permitted in buried piping. Threaded joints shall not get welded.

2.2.11 Welded Joints

Welded joints in steel pipe shall be as specified in Part 3 "EXECUTION."

2.3 MANUAL VALVES

All portions of a valve coming in contact with fuel in stainless steel pipe lines shall be of noncorrosive material. **Valves in stainless steel pipe lines shall be Type 304 or Type 316 stainless steel or carbon steel internally plated with chromium or nickel or internally electroless nickel plated. Valves in carbon steel piping systems shall have carbon steel bodies. Stem and trim shall be stainless steel for all valves.** Manually operated valves six inches and larger shall be worm-gear operated and valves smaller than six inches shall be wrench operated. Valves smaller than two inches shall have lever-type handles. Valves installed more than eight (8) feet above finished floor shall have chain operators and a position indicators visible from ground level. Sprocket wheel for chain operator shall be aluminum.

2.3.1 Ball Valves

Ball valves shall be fire tested and qualified in accordance with the requirements of API STD 607 and API STD 608. Ball valves shall be nonlubricated valves that operate from fully open to fully closed with 90 degree rotation of the ball. Valves two inches and larger shall conform to applicable construction and dimension requirements of API SPEC 6D, ANSI Class 150 and shall have flanged ends. Valves smaller than 2 inches shall be ANSI class 150 valves with one piece bodies with flanged ends, unless noted otherwise. The balls in valves 10 inches full port and 12 inch regular port and larger shall have trunnion type support bearings. Except as otherwise specified, full port valves shall be provided upstream and downstream of all control valves and where indicated. All ball valves downstream of thermal relief valves shall be furnished with locking devices and shall be locked open.

2.3.1.1 Materials

Ball shall be stainless steel. Ball valves shall have tetrafluoroethylene

(TFE) or Viton seats, body seals and stem seals. Valves 2 inches and smaller shall have a locking mechanism.

2.3.2 (Double Block and Bleed) Plug Valves

API SPEC 6D, Type III, ANSI Class 150, non-lubricated, resilient, double seated, trunnion mounted, tapered lift plug capable of two-way shutoff. Valve shall have stainless steel or carbon steel body with chrome-plated interior, tapered plug of steel or ductile iron with chrome or nickel plating and plug supported on upper and lower. Sealing slips shall be steel or ductile iron, with Viton seals which are held in place by dovetail connections. Valve design shall permit sealing slips to be replaced from the bottom with the valve mounted in the piping. Valves shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Valves shall have weatherproof operators with mechanical position indicators. Minimum bore size shall be not less than 65 percent of the internal cross sectional area of a pipe of the same nominal diameter unless bore height of plug equals the nominal pipe diameter and manufacturer can show equal or better flow characteristics of the reduced bore size design. Provide valves with full bore where indicated and as double block and bleed where indicated.

2.3.2.1 General

Valves in the operating tank suction lines shall be provided with a factory-installed limit switch that is actuated by the valve closure. Each switch shall have one double pole double throw contacts, and shall be watertight and U.L. listed for Class I, Division 1, Group D hazardous areas with (T2D-419 F) temperature limitation.

2.3.2.2 Valve Operation

Rotation of the handwheel toward open shall lift the plug without wiping the seals and retract the sealing slips so that during rotation of the plug clearance is maintained between the sealing slips and the valve body. Rotation of the handwheel toward closed shall lower the plug after the sealing slips are aligned with the valve body and force the sealing slips against the valve body for positive closure. When valve is closed, the slips shall form a secondary fire-safe metal-to-metal seat on both sides of the resilient seal. Plug valves located in Isolation Valve Pits shall be provided with handwheel extensions through the platform.

2.3.2.3 Relief Valves

ANSI Class 150. Provide plug valves with automatic thermal relief valves to relieve the pressure build up in the internal body cavity when the plug valve is closed. Relief valves shall open at 25 psi differential pressure and shall discharge to the throat of, and to the upstream side, of the plug valve.

2.3.2.4 Bleed Valves

ANSI Class 150, stainless steel body valve. Provide manually operated bleed valves that can be opened to verify that the plug valves are not

leaking when in the closed position.

2.4 CHECK VALVES

Check valves shall be non-slamming, springloaded, dual plate wafer style suitable for 275 psi working pressure, designed and tested to API STD 594. Valve ends shall be suitable for installation between ANSI Class 150 with flanged end connections. Check valves shall have 316 SS plate, pins and springs and resilient viton seat. Valve body material shall match the piping system.

2.5 THERMAL RELIEF VALVES (TRV)

Relief valves shall be the fully enclosed, spring loaded, angle pattern, single port, hydraulically operated type with plain caps, and shall be labeled in accordance with ASME BPV VIII Div 1. Valve stems shall be fully guided between the closed and fully opened positions. The valves shall be factory-set to open at the set pressure indicated on the drawings. Operating pressure shall be adjustable by means of an enclosed adjusting screw. The valves shall have a minimum capacity of 20 GPM at 10 percent overpressure and shall operate at rated capacity with a back pressure not exceeding 50 psi. Valves shall have a replaceable seat.

2.5.1 Materials

Valve body material shall match the piping. Valve bonnets with stainless steel springs and trim. Seat material shall be compatible with JP-8. Valves shall be Class 150 flanged end connections.

2.6 SIGHT FLOW INDICATORS

Sight flow indicators shall be ANSI Class 150 and shall have flanged end connections. Sight flow indicators shall consist of a housing containing a rotating propeller that is visible through a glass observation port. The housing shall be stainless steel when installed in stainless steel lines and carbon steel when installed in carbon steel lines. The glass in the indicator shall also meet the Class 150 rating. The indicator down stream of the Pressure Control Valve (PCV) shall contain a bi-directional flapper instead of a propeller.

2.7 PIPING ACCESSORIES

2.7.1 Pipe Sleeves

Pipe sleeves shall be installed at all points where the piping passes through concrete construction. Such sleeves shall be of sufficient inside diameter to provide a minimum clear distance between the pipe and the sleeve of 1/2-inch. Sleeves through concrete pits or slabs shall be standard weight carbon steel pipe with a protective coating. Each sleeve shall extend through the respective pit wall or slab and shall be provided with a Buna-N sleeve boot seal. Use stainless steel band to secure the boot seal.

Alignment of the sleeve and piping shall be such that the pipe is

accurately centered within the sleeve by a nonconductive centering element (pipeline crossing insulators). The sleeve shall be securely anchored to prevent dislocation. Closure of space between the pipe and the pipe sleeve shall be by means of a mechanically adjustable segmented elastomeric seal (sleeve seal). The seal shall be installed so as to be flush.

2.7.2 Strainers

2.7.2.1 Basket Type

Strainer shall be in compliance with MS MIL-S-13789, except as specified otherwise. Strainer end connections shall be designed in accordance with ASME B16.5, Class 150. Strainers shall have stainless steel bodies, stainless steel shall be Types 304 or 316. Strainers shall have removable baskets of 60 mesh wire screen with larger wire mesh reinforcement; wire shall be stainless steel, Type 316. Pressure drop for clean strainer shall not exceed three psig at maximum design flow rate. The ratio of net effective strainer area to the area of the connecting pipe shall be not less than three to one. Each strainer shall be provided with a suitable drain at the bottom, equipped with a ball valve. Strainer shall be the single inlet, single outlet design. Strainer shall be supplied with a piston type direct reading differential pressure gage as specified in SECTION 15880 FILTER SEPARATOR.

2.7.2.2 Cone Type (Temporary)

Strainer shall be stainless steel type 304 or 316, 60 mesh screen with the ratio of net open area of strainer to the area of the connecting pipe shall be not less than one to one.

2.7.3 Pipe Hangers and Supports

2.7.3.1 General

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69. Supports shall be provided at the indicated locations. Support channels for drain lines shall be epoxy coated on all surfaces or hot-dip galvanized after the channels are cut to length. Coated supports shall be coated with fusion bonded epoxy resin applied by the fluidized bed method. Thickness of the coating shall be not less than 10 mils. Surface preparation and coating application shall be in accordance with the epoxy manufacturer's instructions. The coating shall be pinhole free when tested with a low voltage holiday detector set at no more than 100 times the mil thickness of the coating. All pinholes shall be marked, repaired and retested to ensure a pinhole free film. The coating material shall be a 100 percent solids, thermosetting, fusion-bonded, dry powder epoxy resin. The manufacturer shall certify that the material is suitable for fluidized bed application and that it is approved by the Environmental Protection Administration.

2.7.3.2 Adjustable Pipe Supports

Adjustable pipe supports shall consist of a cast iron saddle and a threaded nipple connected to a carbon steel pipe by means of a special reducer conforming to MSS SP-69. The supports shall be provided with neoprene

insulation strips.

2.7.3.3 Low Friction Supports

Low friction supports shall be self-lubricating antifriction element composed of reinforced TFE. Units shall be factory designed and manufactured.

2.7.3.4 Concrete and Grout

Concrete and grout for anchors and supports shall comply with SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.7.4 Sample Connections

Sample connections shall be factory assembled units specifically designed for obtaining representative samples from fuel pipelines. Each connection shall include a 1/4-inch sampling probe where the probe faces upstream, ball valve and 1/4-inch quick disconnect coupling (valved dry break) with dust plug, all assembled into a unit that is suitable for installation in a pipe nipple. The sampling probe shall extend not less than one inch into the fuel pipe. All materials in the sample connections shall be stainless steel or aluminum.

2.7.4.1 Sampling Hoses

Furnish two sampling hose assemblies to the Contracting Officer at the project site. Each assembly shall consist of a six-foot length of 1/4-inch clear plastic tubing with internal bonding/grounding wire. One end of the tubing will contain a male connector that actuates flow when inserted into the quick disconnect coupler. Each end of the bonding/grounding wire shall be equipped with clips for attaching to the pipe and metal sample container.

2.7.5 Flanged Swivel Joints

Flanged swivel joints shall be capable of rotating 360 degrees. Welded swivel joints and welding of swivel joints to the pipe and/or elbow is not permitted. Swivel joints shall be of the non-lubricated, maintenance free type with nonlubricated bearings and no lubricating fitting. Swivel joint shall be flanged at the end connecting to the piping system and threaded (female NPT) at the end connecting to the fuel hose. No leakage shall be permitted under positive or negative pressure conditions. No leakage shall be permitted under high or low temperature conditions. Welding of swivel joint to six-bolt flange connector is permitted. The swivel joints shall be warranted for two years against leakage. There must be electrical continuity from one flange to the other without the use of ground straps.

2.7.6 Monitoring Points

At the following locations, provide half-inch pipe, flanged ball valve, and blind flange for future test equipment connections:

- a. At the Hydrant Hose Truck Checkout, inlet to Hydrant Valve.

b. At the inlet to the Back Pressure Control Valve in the Pumphouse.

c. At both sides of the isolation valve in all the isolation valve pits.

2.7.7 Fuel Hose

Fuel hose shall conform to API Bull 1529, Grade 2, Type C, threaded, male NPT, both ends.

2.7.8 Pressure Fueling Nozzle

Nozzles shall conform to MS MIL-N-5877, Type D-2. Nozzles and nozzle components shall be compatible with the fuel to be handled. Nozzles shall be provided with an internal 60 mesh stainless steel strainer and a fuel sample connection tapping. Nozzle design shall be for single point fueling of aircraft. Nozzles shall be provided with a compatible dry break quick disconnect swivel. Coupler shall allow for quick disconnect and reconnect of fueling nozzles with corresponding adapters. Coupler and adapter shall provide a positive, leak proof connection under constant or surge flow. Coupler shall be designed to prevent blowout of internal poppet.

2.7.9 Nozzle Adapter (SPR)

Adapter shall be a nominal 2-1/2 inches with self-closing valve in accordance with MIL-STD-24484. Adapter shall have a 4 inch flange mounting and metal sealing, vacuum tight, locking dust cap using the SPR (single point receptacle) lugs.

2.8 SURGE ABSORBER

Contained bladder style charged with nitrogen. Designed to have a net gas capacity of 80 gallons. Working fluid is jet fuel JP-8 with a specific gravity of 0.81 ± 0.05 . Carbon steel chamber to be rated at 275-psig working pressure in accordance with the ASME Pressure Vessel Code. Removable stainless steel top shall include charging valve and pressure gauge. Bladder to be Buna-N conforming to MIL-R-6855. Furnish (one) spare bladder. Connection shall be (4)-inch, (150)-pound ANSI raised face flange. The piping connection shall be provided with an energy dissipation device designed to provide unrestricted flow into the vessel and restricted flow from the vessel. Absorber shall be provided with charging and gauging assembly.

2.9 PIG LAUNCHER AND RECEIVER

2.9.1 General

Pig launcher and pig receiver assemblies shall be skid mounted, factory fabricated and factory tested units. The manufacturer shall have not less than 5 years' experience in manufacturing these assemblies. Each assembly shall be capable of launching and receiving pipeline cleaning type pigs. The launcher shall be designed to allow for convenient insertion of the

various "pigs" and propel the cleaning pig into the 14-inch diameter hydrant line. The receiver shall be designed to trap, hold and allow convenient removal of the cleaning "pigs," following isolation from the 14-inch diameter hydrant line. Dimensions, configuration and overall arrangement indicated on the drawings are minimum values. The assemblies and their components shall be catalog products of the manufacturer. Provide catalog data and shop drawings. **The hydrant system working pressure is 130 psi and 150 lb ANSI Class.**

2.9.2 Construction

Assemblies shall be designed, fabricated, and hydrostatically tested in accordance with ASME BPV VIII Div 1. Qualify welding processes and welding operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX. Unacceptable welds shall be repaired, rewelded and reradiographed as required by the code. Provide results of the factory pressure testing of both assemblies.

2.9.2.1 Materials

Provide ASTM A 106 Grade B seamless, schedule 80 minimum wall thicknesses piping. Fittings shall be ASTM A 234 Grade WPB and match the piping. Flanges shall be Class 300 forged steel weld-neck conforming to ASME B16.5.

For fittings 50 mm and smaller fittings shall conform to ASME B16.11 and ASTM A 105 Grade II. All flanges shall be raised face design and conform to ASME B16.5. Provide nonasbestos filler type 304 ss windings type gaskets. The skid material shall conform to ASTM A 36.

2.9.3 Skid Mounting

Each assembly shall be arranged on a structural steel skid constructed on main skid runners and at least four wide flange cross members. The piping shall be mounted on steel saddles, which cover 120 degrees of the pipe and supported on welded steel legs. Furnish a minimum of two steel saddles per pipe. Saddles, support legs and skid shall be all welded construction and fabricated from rolled shapes and plates conforming to ASTM A 36. Provide lifting lugs at each end of the assemblies suitable for balanced lift.

2.9.4 Coating

Each assembly shall be a factory prepared and coating applied according to Section 09971, EXTERIOR COATING SYSTEM OF STEEL STRUCTURES. The finish color shall be as indicated.

2.9.5 Accessories

Provide each assembly with the following:

- a. Four-inch fuel bypass connection.
- b. One-inch ball valve vent connection at the high point of the assembly with plug and visual flow detection.
- c. Two-inch ball valve drain connection at the low point of the

assembly.

- d. Full bore plug valves in size as indicated on the drawings. Valves shall be as specified within this Section.
- e. Valves shall be certified "fire safe" per API STD 607 and shall be rated for ANSI Pressure Class as indicated for adjoining piping.
- f. Hinged quick opening closure, which opens on the horizontal axis shall be provided at the end of both the launcher and receiver assemblies. Design of the closure shall permit convenient removal of the cleaning "pig." The closure shall incorporate two intrinsically safe bleeder locks, which ensure that any residual pressure is released before the closure is opened. Closure sealing mechanism shall be designed such that as the assembly's pressure increases the sealing action also becomes more efficient. Nonmetallic sealing elements shall be designed for use with JP-8.
- g. Provide a pig signaler, which gives a visual indication that the "pig" has passed the signaler location. Pig signaler shall be the manufacturer's standard catalog item. Provide a flanged connection.
- h. Thermal relief valves shall comply with API STD 526. Relief valves shall have steel bodies. All other wetted metal parts shall be stainless steel. Seat material shall be compatible for JP-8. Relief valves and appurtenances shall be as required by ASME Code.
- i. Pressure gauge and instrument valve assembly shall be as specified in Section 15050, "Mechanical Equipment, Fueling."

2.10 FLEXIBLE HOSES

Flexible hoses for fueling pumps shall have ANSI Class 300 flanges of stainless steel construction conforming to ASME B16.5. Flexible hoses shall be of stainless steel flexible metal hose consisting of an inner corrugated stainless steel tube with stainless steel braid cover. All components to be suitable for not less than 275 psig. Length and application of flexible hoses shall be per manufacturer's written recommendations. Provide control rods for flexible hoses mounted on the pump discharges.

2.11 VALVE TAGS

Provide a 1-3/8-inch diameter, 3/16-inch thick brass tag. Stamp or engrave the valve number using 1/4-inch high letters and numbers, as indicated on the drawings and as directed by the Contracting Officer. Using a brass chain and S-hook, secure the valve tag to the valve.

2.12 AUTOMATIC AIR ELIMINATOR

Air eliminator shall be 1 inch with stainless steel body and cover, stainless steel float, and Buna-N seat. All wettable surfaces shall be

compatible with JP-8. Air eliminator stainless steel ball check valve with viton seals shall be installed above air eliminator. A manual air vent shall be provided between the air eliminator and the pipe. The air eliminator shall release at pressures up to 150 psi with no fuel leakage.

2.13 PRESSURE SENSITIVE LABELS

Identification of piping shall be in accordance with MIL-STD-161 and as indicated. Provide pressure sensitive labels for flow direction and identification of piping as indicated instead of stenciling. Contractor shall place labels in locations as required by Contracting Officer.

2.14 INSTRUMENT VALVES

Instrument valves for mounting single port, pressure sensing, instruments shall be needle type valves which allow mounting of pressure gauge on vertical or horizontal header. Instrument valves shall be bar stock valves with 1/2-inch male NPT and with an integral body mounted manual bleed valve for depressuring gauge side of valve. Instrument valves for mounting on carbon steel lines shall have carbon steel bodies and stainless steel trim. Instrument valves for mounting on stainless steel lines shall have stainless steel bodies and trim. Provide operation and maintenance manual.

2.15 UNLOADING DRY BREAK COUPLER

Coupler shall mate with 4-inch adapters conforming to API 1584. All wetted parts shall be aluminum or stainless steel. Shall have an interlock such that coupler cannot be opened unless coupled to adapter. Unit cannot be uncoupled from an adaptor while in the open position. Provide dust cap.

2.16 QUICK COUPLING

Provide a dry break cam and groove style coupler with dust plug in size indicated. Material of coupler and plug shall be stainless.

PART 3 EXECUTION

3.1 WELDING

3.1.1 General

All joints unless indicated otherwise, in carbon steel and stainless steel piping systems shall be welded. Unless otherwise approved, all girth welds shall be complete penetration groove welds made in accordance with qualified welding procedures. Welding operations, qualifications of welders and welding procedures shall comply with the provisions of ASME B31.3 and the requirements specified herein. To minimize slag formation on the inside of pipes root pass on stainless steel and carbon steel pipe shall be by the GTAW process using only unfluxed welding rods, fluxed rods shall not be used on root passes.

a. Definitions shall be in accordance with AWS A3.0.

b. Symbols shall be in accordance with AWS A2.4 for welding and nondestructive testing, unless otherwise indicated.

c. Safety Precautions shall conform to ANSI Z49.1.

d. Weld Preparation shall comply with the requirements of ASME B31.3 and the qualified Welding Procedure Specification. The use of "rice paper" as purge blocks is not permitted. Contractor shall submit alternate method for approval.

e. Backing Rings. The use of backing rings for making or repairing welds shall not be permitted.

3.1.2 Qualifications of Welders

Welders and welding procedures shall be qualified in accordance with requirements of ASME B31.3. Submit for each pipe material a Welding Procedure, a Welding Procedure Qualification and Welder Qualifications to the submitted Welding Procedure for each welder.

3.1.2.1 Weld Identification

Each qualified welder shall be assigned an identification symbol. All welds shall be permanently marked with the symbol of the individual who made the weld.

3.1.2.2 Defective Work

Welders found making defective welds shall be removed from the work or shall be required to be requalified in accordance with ASME B31.3.

3.1.3 Tests

All steel pipe field welds, including high point vent pipe and low point drain pipe, shall be examined by radiographic methods to determine conformance to the paragraph "Standards of Acceptance." The services of a qualified commercial or testing laboratory approved by the Contracting Officer shall be employed by the Contractor for testing of piping welds. Costs of testing, including retesting or repaired welds, shall be borne by the Contractor.

3.1.3.1 Radiographic Inspection

Procedures for radiographic inspection shall be in accordance with MIL-STD-271 or ASTM E 94. Weld ripples or surface irregularities that might mask or be confused with the radiographic image of any objectional defect shall be removed by grinding or other suitable mechanical means. The weld surface shall be merged smoothly with the base metal surface.

3.1.4 Standards of Acceptance

Interpretation of test results and limitations on imperfections in welds shall comply with the requirements for 100 percent Radiography, per ASME B31.3, Chapter VII, Table K341.3.2A.

3.1.5 Corrections and Repairs

Defects shall be repaired in accordance with approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Whenever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners. After a defect is thought to have been removed, and prior to rewelding, the area shall be examined by suitable methods to insure that the defect has been eliminated.

After repairs have been made, the repaired area shall be reinspected and shall meet the standards of acceptance for the original weld. Any indication of a defect shall be regarded as a defect unless reevaluation by nondestructive methods and/or by surface conditioning shows that no defect is present.

3.1.5.1 Defect Removal

Defective or unsound weld joints shall be corrected by removing and replacing the entire weld joint, or for the following defects corrections shall be made as follows:

a. Excessive Convexity and Overlap: Reduce by removal of excess metal.

b. Excessive Concavity of Weld, Undersized Welds, Undercutting: Clean and deposit additional weld metal.

c. Excessive Weld Porosity, Inclusions, Lack of Fusion, Incomplete Penetration: Remove defective portions and reweld.

d. Crack in Weld or Base Metal: Remove crack throughout its length, including sound weld metal for a distance of twice the thickness of the base metal or two inches, whichever is less, beyond each end of the crack, followed by the required rewelding. Complete removal shall be confirmed by magnetic particle inspection for carbon steel or liquid penetrant inspection for stainless steel. Inspection procedures shall comply with the requirements of ASME B31.3.

e. Poor Fit-Up: Cut apart improperly fitted parts, and reweld.

3.1.5.2 Methods of Defect Removal

The removal of weld metal or portions of the base metal shall be done preferably by chipping, grinding, sawing, machining, or other mechanical means. Defects also may be removed by thermal cutting techniques. If thermal cutting techniques are used, the cut surfaces shall be cleaned and smoothed by mechanical means. In addition, at least 1/8-inch of metal shall be removed by mechanical means from the cut surfaces of stainless steel.

3.1.5.3 Rewelding

Repair welds shall be made using an electrode or filler wire preferably

smaller than that used in making the original weld. Rewelding shall be done using qualified welding procedures. The surface shall be cleaned before rewelding. Repair welds shall meet the requirements of this specification.

3.1.5.4 Peening or Caulking

The use of force (peening) or foreign materials to mask, fill in, seal, or disguise any welding defects shall not be permitted.

3.2 INSTALLATION

3.2.1 Precautions

Special care shall be taken by the Contractor to insure that the protective coating on buried pipe is not damaged during installation and that the completed system is free of rocks, sand, dirt, and foreign objects. The Contractor shall take the following steps to insure these conditions.

a. Coated pipe shall be handled only with canvas or nylon slings or padded clamps. Any coating damaged by improper handling or storage shall be repaired as specified.

b. Pipe brought to the site shall be stored on blocks or horses at least 18 inches above the ground. Padded blocks or horses shall be used for coated pipe. The method and height of storing coated pipe shall be in accordance with the coating manufacturer's instructions.

c. Visual inspection shall be made of the inside of each length of pipe to ensure that it is clear and clean prior to installation.

d. The open ends of the pipe system shall be closed at the end of each day's work or when work is not in progress and shall not be opened until the work is resumed.

e. A swab, with a leather or canvas belt disc to fit the inside diameter of pipe, shall be pulled through each length of pipe after welding in place.

f. Obstruction remaining in the pipe after completion of the system shall be removed at the expense of the Contractor.

g. Completed piping segments shall be drained of liquid and filled with nitrogen.

3.2.2 Protective Coatings

3.2.2.1 Application of Tape Wrapping

Surfaces to receive tape shall be clean, dry, grease-free and dust-free. Fusion bonded epoxy coating and adhesive undercoat surfaces to be tape wrapped shall be primed with a compatible primer prior to application of the tape. The primer shall be as recommended by the tape manufacturer and approved by the fusion bonded epoxy coating manufacturer. Weld beads shall

be wire brushed. Burrs and weld spatter shall be removed. Weld beads shall be covered with one wrap of tape prior to spiral wrapping. Fittings shall be wrapped spirally beginning with one complete wrap three inches back from each edge of the fusion bonded epoxy coating. For pipe less than four-inch size, one layer half-lapped shall be used. For pipe four-inch size and larger, two layers half-lapped shall be used, with the second layer wrapped opposite hand to the first. On irregular surfaces one layer shall be applied half-lapped and stretched to conform to the surface, followed by a second layer half-lapped and applied with the tension as it comes off the roll.

3.2.2.2 Inspection and Testing

The condition of factory coated, field coated and wrapped piping shall be the responsibility of the Contractor and all damage to the protective covering during transit and handling shall be repaired by the Contractor at no additional cost to the Government. All field coating and wrapping shall be subject to approval by the Contracting Officer. The entire pipe shall be inspected as specified in sub-paragraph "Testing of Protective Coatings" under paragraph "Protective Coatings for Buried Carbon Steel and Stainless Steel Piping." The inspection for holidays shall be performed just prior to lowering the pipe into the ditch and every precaution shall be taken during lowering and backfilling to prevent damage to the protective covering.

3.2.2.3 Damage Repair

Damaged areas of fusion bonded epoxy coating shall be repaired by tape wrapping as specified in the preceding paragraph for fittings. All areas to be taped shall be primed, and the tape shall be applied half-lapped.

3.3 VERIFICATION OF DIMENSIONS

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

3.4 CLEANING OF PIPING

The Contractor shall keep the interior and ends of all new piping affected by the Contractor's operations thoroughly cleaned of foreign matter and water before and after being installed. Piping systems shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings shall be closed so that no water or other foreign substance shall enter the pipes or fittings.

Piping shall be inspected before placing into position. The interior of each length of pipe shall be cleaned after welding. The Contractor shall take all actions necessary to keep the interior of all installed piping free of dirt, loose and adherent weld slag, construction debris, water and other foreign matter that may be harmful to valves, mobile refueling equipment or aircraft.

3.5 TRENCHING AND BACKFILLING

Trenching and backfilling shall conform to Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS and the following bedding and backfill requirements. The pipe shall be laid in a bed of sand six inches deep, compacted to the elevation of the bottom of the pipe. The full length of each section of pipe without any protective covering shall be excavated to permit installation of the protective covering. Pipe that has the grade or joint disturbed after laying, shall be taken up and relaid. Pipe shall not be laid in water or when the trench or weather conditions are unsuitable for such work. After testing and application of protective covering to joints, sand backfill shall be placed and compacted around the pipe or protective coating. The remainder of the backfill shall be the same as for other types of pipe.

3.6 INSTALLATION OF UNDERGROUND PIPE

Underground fuel pipelines shall be pitched as shown on the drawings. Where not indicated they shall be pitched a minimum of 2 inches per 100 feet. Branch lines to the hydrant pits shall slope up to the pit. Two-inch pipe size valved drain connections shall be provided at all low points and 1 1/2-inch pipe size valved outlet vent connections shall be provided at all high points. Vent and drain lines shall terminate in male cam-type locking end dry breaks with matching female dust covers and installed in pits. The pipe shall have cover as shown on the drawings. Drain lines shall be installed at the slopes indicated.

3.6.1 Pipe Assembly

Pipe shall be strung parallel and adjacent to or above a trench. The pipe shall be supported on padded skids during welding and inspection of joints. Protective coating shall be inspected and repaired prior to lowering the pipe into the trench. The pipe shall be lowered using only canvas or nylon slings. The sling shall be dug from underneath the pipe after placements and shall not be pulled from underneath the pipe while in contact with it. Care shall be taken to prevent damage to the pipe, welded joints or coating and any such damage shall be repaired as directed by the Contracting Officer. Pressure testing of the pipe shall be done after it has been placed in final position in the trench.

3.6.2 Warning Tapes in Earth Trenches

For the purpose of early warning and identification of buried pipes outside of building walls during future trenching or other excavation, continuous identification tapes shall be provided in the trench. Tape shall be nonmagnetic plastic tape or aluminum foil plastic backed tape manufactured for the purpose of early warning and identification of utilities buried below the tape. Tape shall be at least three inches in width. Color of tape shall be as standard with the manufacturer with respect to the type of utility buried below the tape. Tape shall have lettering at least one inch high with not less than the following identification on the tape: BURIED JET FUEL PIPING BELOW. Tape shall be installed in accordance with the printed recommendations of the tape manufacturer, as modified herein. Tapes shall be buried at a depth of six inches from the top of the subgrade.

3.6.3 Clearances

Install pipe to be clear of contact with other pipes, pipe sleeves, casings, reinforcing steel, conduits, cables, or other metallic structures.

Where pipes cross other pipes or structures with a separation of less than six inches, install an insulating separator. Protect the pipe from contact with a 12-inch square by 1 inch thick bituminous-impregnated cane fiber board.

3.6.4 Protective Coating

When the protective coating on pipe is damaged, the Contracting Officer shall be notified and shall inspect the pipe before the coating is patched.

If the damage to the pipe is deeper than 0.050-inch, the damage shall be repaired by welding in accordance with paragraph "WELDING". If the pipe is dented, out of round or damaged to the point that welding will not make it good as new, the length of pipe shall be rejected.

3.7 PIPING LAYOUT REQUIREMENTS

3.7.1 Pipe Fabrication

Fabricate piping to measurements established on the project site and position into place without springing or forcing. Make provisions for absorbing expansion and contraction without undue stress in any part of the system.

3.7.2 Gas Free Conditions

A number of modifications and inconNECTIONS are planned for this work. Gas free conditions are necessary to complete the work safely. All operations in the construction area that involve open flames or the possibility of arcing or sparking shall be conducted in a "Gas-Free" condition. These operations shall include but not be limited to the following:

1. Use of internal combustion engines not equipped with Underwriters' approved spark and flame eliminators.
2. Use of electric motors or electric devices with arcing brushes or sliding contacts that could produce arcing or sparking.
3. Use of tools which may produce impact sparks.
4. Electric or gas welding.
5. Use of cutting or other torches or other open-flame equipment.
6. Holiday testing.
7. Use of equipment with hot surfaces or flowing elements.
8. Use of any other equipment or procedure that could create a fire hazard.

Contractor shall monitor the use and suitability of the equipment and

procedures on the job and maintain a safe "Gas-Free" condition when necessary during construction.

Prior to commencing any phase of the Work requiring a gas-free condition, Contractor shall make the following provisions:

1. Empty pipes containing fuel and purge of all vapors.
2. Isolate, blank off, and adequately ventilate open piping sections so that no part of the pipe containing fuel or vapors is exposed.
3. Drain and ventilate fuel tanks prior to work inside tanks or on any of the tank connections.
4. Make certain that there are no open pools or reservoirs of fuel exposed in the vicinity of the Work.
5. Perform all other safety precautions necessary to ensure that these operations are conducted in a safe manner in accordance with all applicable codes.

Use a combustible gas analyzer to make certain no combustible gas concentrations exist in the construction area when performing these operations.

3.7.3 Interferences and Measurements

Provide offsets, fittings, and accessories required to eliminate interferences and to match actual equipment connection locations and arrangements. Verify measurements before commencing work. Submit discrepancies for clarification before proceeding with the installations to the Contracting Officer.

3.7.4 Space and Access

Keep piping, control tubing, which is not detailed close to structures and columns so as to take up a minimum amount of space. Ensure that access is provided for maintenance of equipment, valves and gauges.

3.7.5 Location

Do not place unions in locations that will be inaccessible after the completion of the work. Place unions on each side of equipment.

3.7.6 Piping and Equipment

Provide anchors where required to absorb or transmit thrust or eliminate vibration or pulsation. Provide hangers and supports near each change of direction. Select support components which do not restrict the movement of the pipe due to thermal expansion. Space hangers uniformly and arrange symmetrically.

3.7.7 Structural Support

Provide supplementary or intermediate steel or other structural members as required for transmission of loads to members forming part of the supporting structure.

3.7.8 Grade

Where profiles of piping lines are shown on the drawings, grade the line uniformly between changes in slope or direction. Maintain gradient to within $\pm 1/4$ -inch over the entire length of pipe. Provide survey of final elevation of buried fuel pipe. When backfilling has been completed to the top of the pipe, the pipe shall be surveyed at each joint, logged by station number, and submitted to the Contracting Officer and approved before backfilling can continue.

3.7.9 Size Changes

Make changes in pipe size with reducing fittings. Do not use bushings. In lieu of welding reducing outlet tees for piping 2 inches and larger, welding branches suitable for 100 percent radiographic inspection may be used. Do not use weldolets unless specifically called out (labeled) on the drawings.

3.7.10 Direction Changes

Make changes in the horizontal direction of pipes with long radius fittings. Provide special fittings when required. Do not make miter welds. Make odd-angle offsets with pipe bends or elbows cut to the proper angle.

3.8 TESTING

Piping shall be tested by pneumatic and hydrostatic pressure. Testing shall comply with applicable requirements of ASME B31.3, NFPA 30 and the requirements specified herein. Hydrostatic testing shall be performed using fuel, JP-8, as the liquid. Water shall not be introduced into the system for testing. Pressure and hydrostatic testing shall be performed only after welding inspection has been completed.

3.8.1 General

Piping to be installed underground shall not receive field applied protective covering at the joints or be covered by backfill until the piping has passed the pneumatic test described herein. To facilitate the tests, the Contractor shall isolate various sections of the piping system and test each one separately. Where such sections terminate at flanged valve points, the line shall be closed by means of blind flanges in lieu of relying on the valve. The Contractor shall furnish tapped flanges that can be attached to the end of the section of line being tested, and that will permit a direct connection between the piping and the air compressor and/or pressurizing pump. No taps in the permanent line shall be permitted. The Contractor shall furnish all necessary equipment for testing; all gauges shall be subject to testing and approval of the Contracting Officer. The air used for pneumatic testing shall have a residual humidity of not over 20 percent. The Contractor shall provide dehumidifying equipment on the

suction or discharge side of the air compressor used to provide air for testing. Pressurizing pump shall not exceed 10 cfm.

3.8.1.1 Pneumatic Test

Special safety measures, including the wearing of face mask, shall be taken during testing under pressure. Only authorized personnel shall be permitted in the area during testing. Use dry compressed air at 20 degrees F. The pneumatic test pressure shall be applied in increments. A preliminary 25 psig test shall be applied. Examine joints with soap solution. Leaks revealed by this test shall be repaired. Increase the pressure in steps and hold the pressure long enough to equalize the pipe strains until the full test pressure has been applied. Unless otherwise directed by the Contracting Officer, all piping shall be tested at a pressure of 100 psig for not less than 2 hours, during which time there shall be no drop in pressure, only pressure rises with temperature. The pressure source shall be disconnected during the final test period. Any leaks revealed by the test shall be repaired and the test repeated.

3.8.1.2 Preliminary Hydrostatic Pressure Test

Apply a liquid pressure test with a JP-8 approved by Contracting Officer to the piping segments following the pneumatic pressure test. Equipment which is not rated by manufacturer for the 400 psi test pressure shall be removed prior to testing. Install temporary connections as necessary.

The pressure shall be gradually increased until a gauge pressure which is one-half the test pressure, 200 psig, is attained, at which time a preliminary check shall be made, including examination of exposed joints in accordance with ASME B31.3. Thereafter, the pressure shall be gradually increased in steps until the test pressure of 400 psig is reached, holding the pressure at each step long enough to equalize piping strains.

The test pressure of 400 psig shall be maintained for at least 4 hours.

Decrease pressure by venting at high points and then increase again to the test pressure and hold again for a 8-hour period.

Provide calibrated temperature and pressure instruments and chart recorders to provide continuous temperature (fuel and ambient) and pressure reading variations during the tests. Record ambient and fuel temperatures. Instruments shall be calibrated for temperature and pressure immediately prior to each test. Recorder charts and test report shall be submitted to the Contracting Officer for review prior to final acceptance of piping.

Repair any leaks in a manner approved by Contracting Officer.

3.8.1.3 Final Hydrostatic Test

Upon completion of pneumatic testing, after partial backfilling and completion of Preliminary Hydrostatic Test, hydrostatically test each complete piping system with fuel at 275 psig in accordance with ASME B31.3 and API RP 1110. No leakage or reduction in gauge pressure shall be detectable for four hours. The pressure shall be gradually increased in

steps until a gauge pressure, which is one-half the test pressure, 138 psig, is attained, at which time a preliminary check shall be made, including examination of exposed joints in accordance with ASME B31.3. Thereafter, the pressure shall be gradually increased in steps until the test pressure of 275 psig is reached, holding the pressure at each step long enough to equalize piping stems. Hold pressure for 8 hours.

Provide calibrated temperature and pressure instruments and chart recorders to provide continuous temperature (fuel and ambient) and pressure reading variations during the tests. Record ambient and fuel temperature. Instruments shall be calibrated for temperature and pressure immediately prior to each test. Recorder charts and test report shall be submitted to the Contracting Officer for review prior to final acceptance of piping.

The Contractor shall furnish electricity, instruments, connecting devices, and personnel for test. Fuel shall be furnished by the Government. Defects in work provided by the Contractor shall be corrected by him at his own expense, and the test repeated until the work is proven to be in compliance with the Contract requirements.

3.8.2 Performance Testing

The completed fuel system shall be cleaned and performance tested as specified in Section 15899 SYSTEM START UP, FUELING SYSTEM. All control valves, both manual and automatic, shall be checked for leaks (any area wetted with fuel) and proper operation and adjusted, repaired or replaced to correct any defects.

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SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C37.72	(1987) Manually-Operated Dead-Front, Padmounted Switchgear with Load-Interrupting Switches and Separable Connectors for Alternating-Current Systems
ANSI C57.12.21	(1995) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; (High-Voltage, 34 500 Grd Y/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller)
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVa and Smaller
ANSI C57.12.28	(1996) Switchgear and Transformers - Padmounted Equipment - Enclosure Integrity
ANSI C80.1	(1995) Rigid Steel Conduit - Zinc Coated
ANSI C119.1	(1986) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI O5.1	(1992) Specifications and Dimensions for Wood Poles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 123/A 123M	(1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 3	(1995) Soft or Annealed Copper Wire
ASTM B 8	(1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM D 923	(1991) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 4059	(1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994) Cross-linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection
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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE ANSI/IEEE C37.20.3	(1987; R 1992) Metal-Enclosed Interrupter Switchgear

IEEE ANSI/IEEE C37.34	(1994) Test Code for High-Voltage Air Switches
IEEE ANSI/IEEE C37.41	(1994; C37.41e) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
IEEE ANSI/IEEE C57.12.00	(1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE ANSI/IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 48	(1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1996) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 404	(1993; errata) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 592	(1990; R 1996) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FB 1	(1993) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit and Cable Assemblies
NEMA LA 1	(1992) Surge Arresters
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA WC 7	(1991; Rev 1) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1991; Rev 1; Rev 2) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 467	(1993; Rev thru Aug 1996) Grounding and Bonding Equipment
UL 486A	(1997) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
UL 510	(1994; Rev thru Nov 1997) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(1996; Rev Jul 1998) Metallic Outlet Boxes
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 1072	(1995; Rev Mar 1998) Medium-Voltage Power Cable
UL 1242	(1996; Rev Apr 1997) Intermediate Metal Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions. Seismic details shall conform to Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

- a. Altitude 13 feet
- b. Outdoor Ambient Temperature 87 degrees F
- c. Frequency 1%
- d. Seismic Parameters Zone 2

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Electrical Distribution System; G

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

Detail drawings shall as a minimum depict the installation of the following items:

a. Medium-voltage cables and accessories including cable installation plan.

b. Transformers.

c. Substations.

d. Switchgear.

e. Pad-mounted loadbreak switches.

f. Surge arresters.

As-Built Drawings

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction.

The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-03 Product Data

Fault Current Analysis; G
Protective Device; G

Coordination Study; G

The study shall be submitted with protective device equipment submittals. No time extension or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Nameplates; G

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

Material and Equipment

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

General Installation Requirements

As a minimum, installation procedures for transformers, substations, switchgear, and medium-voltage cable terminations and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-06 Test Reports

Factory Tests; G

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing; G

A proposed field test plan, 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Operating Tests; G

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Cable Installation

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling tensions.
- f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Material and Equipment

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute

of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements.

The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Joints

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. 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 and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

Cable Installer Qualifications

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

SD-10 Operation and Maintenance Data

Electrical Distribution System; G

In addition to the operation and maintenance information requested in this section, see Section 01730, Facility Operation and Maintenance Manual, for additional information to be submitted for each item of equipment and each system.

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ANSI O5.1. Handling of wood poles shall be in accordance with ANSI O5.1, except that pointed tools capable of producing indentations more than 1 inch in depth shall not be used. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.5 EXTRA MATERIALS

One additional set of spare fuses or fuse elements for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers, circuit breakers, meters, switches, and switchgear.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE ANSI/IEEE C57.12.00. Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 50 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 50 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which

shall withstand 480 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTING, GENERAL.

2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.4.1 Medium-Voltage Cables

2.4.1.1 General

Cable construction shall be Type MV, conforming to NFPA 70 and UL 1072. Cables shall be manufactured for use in duct applications.

2.4.1.2 Ratings

Cables shall be rated for a circuit voltage of 15 kV.

2.4.1.3 Insulation

Cable insulation shall be ethylene propylene rubber insulation conforming to the requirements of NEMA WC 7 and AEIC CS5. A 133 percent insulation level shall be used on 15 kV rated cables.

2.4.1.4 Shielding

Cables rated for 2 kV and above shall have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper wire shield for each phase. The shield wire shall be sized to meet IEEE C2 requirements for a ground fault availability of 10,000 amperes.

2.4.1.5 Jackets

Cables shall be provided with a PVC jacket.

2.4.2 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70, and must be UL listed for the application or meet the applicable section of either ICEA or NEMA standards.

2.4.2.1 Conductor Material

Underground cables shall be annealed copper complying with ASTM B 3 and ASTM B 8.

2.4.2.2 Insulation

Insulation must be in accordance with NFPA 70, and must be UL listed for the application or meet the applicable sections of either ICEA, or NEMA standards.

2.4.2.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

2.4.2.4 In Duct

Cables shall be single-conductor cable, in accordance with NFPA 70.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592.

Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Joints shall have ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

2.5.2 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B.

Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

2.5.3 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene

monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

2.5.3.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Leakage distances shall comply with wet withstand voltage test requirements of IEEE Std 48 for the next higher Basic Insulation Level (BIL) level. Anti-tracking tape shall be applied over exposed insulation of preformed molded elastomer terminations.

2.5.3.2 Taped Terminations

Taped terminations shall use standard termination kits providing terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 20 inches long from the end of the tapered cable jacket to the start of the terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

2.6 CONDUIT AND DUCTS

Ducts shall be single, round-bore type, with wall thickness and fittings suitable for the application. Duct lines shall be concrete-encased, thin-wall or thick-wall type. Communication ducts run elsewhere may be direct-burial, thick-wall type.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.6.2 Nonmetallic Ducts

2.6.2.1 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

2.6.2.2 Direct Burial

UL 651 Schedule 40 and Schedule 80 as indicated, or NEMA TC 6 Type DB.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478, ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.8 TRANSFORMERS AND SWITCHGEAR

Transformers, substations, and switchgear shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be 15 kV between phases for 133 percent insulation level.

2.8.1 Pad-Mounted Transformers

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of the radial type. Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock.

2.8.1.1 High-Voltage Compartments

The high-voltage compartment shall be dead-front construction. Primary switching and protective devices shall include loadbreak switching,

oil-immersed, current-limiting, bayonet-type fuses, medium-voltage separable loadbreak connectors, universal bushing wells and inserts or integral one piece bushings and surge arresters. Fuses shall comply with the requirements of paragraph METERING AND PROTECTIVE DEVICES. The switch shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OPEN" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stencilled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN." Surge arresters shall be fully insulated and configured to terminate on the same bushing as the primary cable by means of a loadbreak, feed-through bushing insert.

2.8.1.2 Load-Break Switch

Radial-feed oil-immersed type rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break of 200 ampere, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

2.8.1.3 Transformer Tank Sections

Transformers shall comply with IEEE ANSI/IEEE C57.12.00, ANSI C57.12.21, and ANSI C57.12.26 and shall be of the mineral oil-insulated type. Transformers shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided 2 above and 2 below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as follows:

Three-phase capacity.....1000 kVA.
Impedance.....5.75%.
Temperature Rise.....65 degrees C.
High-voltage winding.....11,500 volts.
High-voltage winding connections.....delta.
Low-voltage winding.....480Y/277 volts.
Low-voltage winding connections.....wye.

2.8.1.4 Low-Voltage Cable Compartments

Neutrals shall be provided with fully-insulated bushings. Clamp type cable terminations, suitable for copper conductors entering from below, shall be provided as necessary.

2.8.1.5 Accessories

High-voltage warning signs shall be permanently attached to each side of transformer stations. Voltage warning signs shall comply with IEEE C2. Copper-faced steel or stainless steel ground connection pads shall be provided in both the high- and low-voltage compartments. Dial-type thermometer, liquid-level gauge, and drain valve with built-in sampling device shall be provided for each transformer station. Insulated-bushing-type parking stands shall be provided adjacent to each separable load-break elbow to provide for cable isolation during sectionalizing operations.

2.8.2 Pad-Mounted, Air Interrupter Switch

The air interrupter switch shall be configured with one incoming compartment for radial-feed, equipped with air-insulated, fused load-interrupter switch, as indicated.

2.8.2.1 Ratings at 60 Hz shall be:

Nominal voltage (kV).....	11.5.
Rated maximum voltage (kV).....	15.
Rated continuous current (A).....	600.
Maximum symmetrical interrupting capacity (kA).....	40.
Maximum asymmetrical interrupting capacity (kA).....	40.
Three-second short-time current-carrying capacity (kA).....	25.
BIL (kV).....	95.

2.8.2.2 Operators, Devices, and Controls

Operators and controls shall be provided for the air interrupter switch as follows:

- a. Switch shall be provided with a manual, handle-type quick-make, quick-break operator. The switch shall be 3-pole, 2-position air insulated. The switch shall be padlockable and operable from the front of the NEMA 3R enclosure. This disconnect switch shall be suitable for interrupting transformer full-load current, front operated by external handle having visible position indicator, and having provisions for padlocking in open position. Disconnect switch shall have spring-loaded closing to prevent manual "teasing" of contacts. Bottom conduit entry feed. Include one extra set of three primary fuses of each ampere rating required.
- b. Cable Entrances, Supports and Connectors: Provide for number and size of feeders as indicated; entering from (below) and terminating means shall accommodate (single) circuits. provide

space and supports for bushings, potheads, stress cones, or other terminating means. Provide a hinged rear door that is secured with bolts for access to terminations.

- c. Incoming Feeders: Identify switch by permanent nameplate indicating primary feeder designation.
- d. Provide interlock on access door to high-voltage compartment to prevent opening door when switch is in the "ON" position and to prevent closing switch when the door is open. Provide window in door for viewing switch blade position.
- e. Provide "Danger High Voltage" sign on the front and rear doors of the switch.
- f. Fuses shall be current-limiting type.

2.8.2.3 Enclosures

Switchgear enclosures shall be of freestanding, self-supporting, stainless steel construction provided with separate incoming and outgoing compartments configured for bottom cable entry. Enclosures shall be of deadfront construction, provided with a hinged door for access to each compartment, and conform to the requirements of ANSI C57.12.28, ANSI C37.72, and IEEE ANSI/IEEE C37.20.3, Category A.

2.9 METERING AND PROTECTIVE DEVICES

2.9.1 Fuses, Medium-Voltage, Including Current-Limiting

2.9.1.1 Construction

Units shall be suitable for outdoor use. Fuses shall have integral blown-fuse indicators. All ratings shall be clearly visible.

2.9.1.2 Ratings

Expulsion-type power fuses shall have ratings in accordance with ANSI C37.46 and as follows:

Nominal voltage.....	11.5kV.
Rated maximum voltage.....	15kV.
Maximum symmetrical interrupting capacity.....	50kA.
Rated continuous current.....	1600A.
BIL.....	95kV.

2.9.1.3 E-Rated, Current-Limiting Power Fuses

E-rated, current-limiting, power fuses shall conform to ANSI C37.46.

2.10 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, IEEE C62.2, and IEEE C62.11 and shall be provided where indicated. Arresters shall be distribution class, rated as shown. Arresters for use at elevations in excess of 6000 feet above mean sea level shall be specifically rated for that purpose. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the metal-oxide varistor type.

2.11 GROUNDING AND BONDING

2.11.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used.

2.11.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.12 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section 03200 CONCRETE REINFORCEMENT.

2.13 PADLOCKS

Padlocks shall comply with Section 08700 'Builders' Hardware

2.14 CABLE FIREPROOFING SYSTEMS

Cable fireproofing systems shall be listed in FM P7825a as a fire-protective coating or tape approved for grouped electrical conductors and shall be suitable for application on the type of medium-voltage cables provided. After being fully cured, materials shall be suitable for use where exposed to oil, water, gases, salt water, sewage, and fungus and shall not damage cable jackets or insulation. Asbestos materials are not acceptable.

2.14.1 Fireproof Coating

Cable fireproofing coatings shall be compounded of water-based thermoplastic resins, flame-retardant chemicals, and inorganic noncombustible fibers and shall be suitable for the application methods used. Coatings applied on bundled cables shall have a derating factor of less than 5 percent, and a dielectric strength of 95 volts per mil minimum after curing.

2.14.2 Fireproofing Tape

Fireproofing tape shall be at least 2 inches wide and shall be a flexible, conformable, polymeric, elastomer tape designed specifically for fireproofing cables.

2.14.3 Plastic Tape

Preapplication plastic tape shall be pressure sensitive, 10 mil thick, conforming to UL 510.

2.15 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

2.16 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

- a. Transformers: Manufacturer's standard tests in accordance with IEEE ANSI/IEEE C57.12.00.
- b. Transformers rated 200 kVA and above: Reduced full-wave, chopped-wave, and full-wave impulse test on each line and neutral terminal, in accordance with IEEE ANSI/IEEE C57.98.
- c. High-Voltage Air Switches: Manufacturer's standard tests in accordance with IEEE ANSI/IEEE C37.34 and IEEE ANSI/IEEE C37.41.
- d. Factory Preformed Terminations: Wet withstand voltage tests in accordance with IEEE Std 48 for the next higher BIL level.
- e. Electrical Power Insulators: Manufacturer's standard tests in accordance with ANSI C29.1.

2.17 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment selected and system constructed meet the contract requirements for equipment ratings,

coordination, and protection. They shall include a load flow analysis, a fault current analysis, and a protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.17.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at: the nearest upstream device in the existing source system and extend through the downstream devices at the load end.

2.17.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the commercial power company for fault current availability at the site.

2.17.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provided, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

2.17.4 Fault Current Analysis

2.17.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

2.17.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be documented in the report.

2.17.5 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination

is not achievable due to device limitations (an analysis of any device curves which overlap); coordination between upstream and downstream devices; and any relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.

2.17.6 Study Report

- a. The report shall include a narrative describing: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.
- b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.
- c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristics curves, current transformer ratios, and relay device numbers and settings.
- d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.
- e. The report shall provide the calculation performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Provide as-built drawings as a record of the construction as installed.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of

NFPA 70 and IEEE C2 as applicable.

3.1.2 Verification of Dimensions

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

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE AND BUSWAY INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then prepare a checklist of significant requirements which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS. Provide cable installer qualifications for cable pulling supervisor.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.
- b. List of cable installation equipment.
- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall thrust pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

3.2.2 Duct Line

Cables shall be installed in duct lines where indicated. Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Cable joints in medium-voltage cables shall be made in

manholes or approved pullboxes only. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

3.2.3 Electric Manholes

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with IEEE C2.

3.3 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to that of the associated cable. Armored cable joints shall be enclosed in compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.4 FIREPROOFING

Each medium-voltage cable and conductor in manholes shall be fire-proofed for their entire length within the manhole. Where cables and conductors have been lubricated to enhance pulling into ducts, the lubricant shall be removed from cables and conductors exposed in the manhole before fireproofing.

3.4.1 Tape Method

Before application of fireproofing tape, plastic tape wrapping shall be applied over exposed metallic items such as the cable ground wire, metallic outer covering, or armor to minimize the possibility of corrosion from the fireproofing materials and moisture. Before applying fireproofing tape, irregularities of cables, such as at cable joints, shall be evened out with insulation putty. A flexible conformable polymeric elastomer fireproof tape shall be wrapped tightly around each cable spirally in 1/2 lapped wrapping or in 2 butt-jointed wrappings with the second wrapping covering the joints of the first.

3.4.2 Sprayable Method

Manholes shall be power ventilated until coatings are dry and dewatered and the coatings are cured. Ventilation requirements shall be in accordance with the manufacturer's instruction, but not less than 10 air changes per hour shall be provided. Cable coatings shall be applied by spray, brush, or glove to a wet film thickness that reduces to the dry film thickness approved for fireproofing by FM P7825a. Application methods and necessary safety precautions shall be in accordance with the manufacturers instructions. After application, cable coatings shall be dry to the touch

in 1 to 2 hours and fully cured in 48 hours, except where the manufacturer has stated that because of unusual humidity or temperature, longer periods may be necessary.

3.5 DUCT LINES

3.5.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes or handholes.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to withstand specified surface loadings. Tops of concrete encasements shall be not less than 5 feet below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling

or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

3.5.4 Nonencased Direct-Burial

Top of duct lines shall be not less than 24 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.5.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.5.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.5.6 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

3.6 MANHOLES, HANDHOLES, AND PULLBOXES

3.6.1 General

Manholes shall be constructed approximately where shown. The exact location of each manhole shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole and handhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 1/2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

3.6.2 Electric Manholes

Cables shall be securely supported from walls by hot-dip galvanized cable racks with a plastic coating over the galvanizing and equipped with adjustable hooks and insulators. The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of high-glazed porcelain. Insulators will not be required on spare hooks.

3.6.3 Handholes

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

3.6.4 Pullboxes

Pullbox tops shall be flush with sidewalks or curbs or placed 1/2 inch above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Low-Voltage" and provided with 2 lifting eyes and 2 hold-down bolts. Each box shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

3.6.5 Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

3.7 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose. Three-phase transformers shall be installed with ABC phase sequence.

3.7.1 Concrete Pads

3.7.1.1 Construction

Concrete pads for pad-mounted electrical equipment may be either pre-fabricated or poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished paving or grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.7.1.2 Concrete and Reinforcement

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with Section 03200 CONCRETE REINFORCEMENT.

3.7.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7.2 Padlocks

Padlocks shall be provided for pad-mounted equipment and for each fence gate. Padlocks shall be keyed as directed by the Contracting Officer.

3.8 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 2 feet below finished grade as specified and provided under Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed to prevent entrance of moisture or gases into buildings.

3.9 GROUNDING

A ground ring consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At least 2 connections shall be provided from a transformer, and a switchgear ground bus to the ground mat. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.9.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.
- b. Ground ring - A ground ring shall be installed as shown consisting of bare copper conductors installed 12 inches, plus or minus 3 inches, below finished top of soil grade. Ground ring conductors shall be sized as shown.
- c. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be up to three, 10 foot rods spaced a minimum of 10 feet apart driven perpendicular to grade. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.9.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with

bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process.

3.9.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.9.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

3.9.5 Manhole, Handhole, or Concrete Pullbox Grounding

Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Grounding electrode conductors shall be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

3.10 FIELD TESTING

3.10.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 3 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.10.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.10.3 Ground-Resistance Tests

The resistance of the ground ring shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Ground ring - 10 ohms.

3.10.4 Medium-Voltage Cable Test

After installation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds or metallic shieldings or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed, except that 28 kV and 35 kV insulation test voltages shall be in accordance with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

3.10.5 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

R in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet)

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

3.10.6 Liquid-Filled Transformer Tests

The following field tests shall be performed on all liquid-filled transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications.

- a. Insulation resistance test phase-to-ground.
- b. Turns ratio test.
- c. Correct phase sequence.
- d. Correct operation of tap changer.

3.10.7 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

- a. Pad-mounted transformers
- b. Primary switch

3.10.8 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.11 MANUFACTURER'S FIELD SERVICE

3.11.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training session shall be submitted.

3.11.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.12 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --