UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2014
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STEEL TANKS WITH FIXED ROOFS

05/12

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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2014
****

SECTION 33 56 13.13

STEEL TANKS WITH FIXED ROOFS
05/12

****
NOTE: This guide specification covers the requirements for design and installation of aboveground steel tanks with fixed cone roofs.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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****
NOTE: Tanks used to store products having a true vapor pressure less than 10.3 kPa 0.5 psi usually are not equipped with floating pans. This specification is however written generally based on JP-5 and JP-8 jet fuel and does contain requirements for a floating pan. Other products with a true vapor pressure greater than 10.3 kPa 0.5 psi, i.e. gasoline, may require additional fire protection provisions such as foam chambers which are not included in this specification.
****

****
NOTE: Earthwork, concrete work, piping, and other work in connection with the tanks should be included in the appropriate sections of the project specification or in a separate project specification.
****

****
NOTE: The following information shall be shown on the project drawings:

1. The extent of the work included in the project should be indicated on drawings showing the site layout, location of outlets and inlets, water drawoff connection, manholes, other tank appurtenances, and other data required for design by the Contractor.

2. If concrete foundation work is provided under a separate contract, Government work should include foundations, setting anchor bolts, concrete retaining ring, and other pertinent work such as sand for sand cushion, water for testing, and furnishing and installing any tank accessories not a part of this specification.
****

****
NOTE: This section is not intended for tanks with aluminum geodesic dome roofs.

NOTE: This section is not intended to be used without Section 33 56 13.15 UNDERTANK INTERSTITIAL SPACE and Section 33 52 43.13 AVIATION FUEL PIPING or Section 33 52 43 AVIATION FUEL DISTRIBUTION (NON-HYDRANT). For piping, pipe fittings, flanges, gaskets, and bolting, refer to Section 33 52 43.13 AVIATION FUEL PIPING or Section 33 52 43 AVIATION FUEL DISTRIBUTION (NON-HYDRANT).
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

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

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI E 1	(2011) Steel Plate Engineering Data Series - Design of Plate Structures, Volumes I & II

AMERICAN PETROLEUM INSTITUTE (API)

API MPMS 2.2A	(1995; R 2012) Measurement and Calibration of Upright Cylindrical Tanks by the Manual Strapping Method
API MPMS 2.2B	(1989; R 2007) Manual of Petroleum Measurement Standards Chapter 2: Tank Calibration - Section 2B: Calibration of Upright Cylindrical Tanks Using the Optical Reference Line Method
API MPMS 2.2C	(2002; R 2008) Manual of Petroleum Measurement Standards Chapter 2: Tank Calibration - Section 2C: Calibration of Upright Cylindrical Tanks Using the Optical Triangulation Method
API MPMS 2.2D	(2003; R 2009) Manual of Petroleum Measurement Standards Chapter 2: Tank Calibration - Section 2D: Calibration of Upright Cylindrical Tanks Using the Internal Electro-Optical Distance Ranging Method
API RP 2009	(2002; R 2007; 7th Ed) Safe Welding, Cutting, and Hot Work Practices in Refineries, Gasoline Plants, and Petrochemical Plants
API Std 2000	(2009) Venting Atmospheric and Low-Pressure Storage Tanks
API Std 650	(2013; Errata 2013) Welded Tanks for Oil Storage
API Std 653	(2009; Addendum 1 2010; Addendum 2 2012; Addendum 3 2013) Tank Inspection, Repair, Alteration, and Reconstruction

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT SNT-TC-1A	(2011; Text Correction 2013) Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing

AMERICAN WELDING SOCIETY (AWS)

AWS A5.10/A5.10M	(2012) Welding Consumables - Wire Electrodes, Wires and Rods for Welding of Aluminum and Aluminum-Alloys - Classification
AWS QC1	(2007) Standard for AWS Certification of Welding Inspectors

ASME INTERNATIONAL (ASME)

ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.3	(2012) Process Piping
ASME B73.1	(2012) Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process
ASME B73.2	(2003; R 2008) Specification for Vertical In-Line Centrifugal Pumps for Chemical Process

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A325	(2010; E 2013) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A325M	(2013) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM A492	(1995; R 2013) Standard Specification for Stainless Steel Rope Wire
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B241/B241M	(2012; E 2013) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B247	(2009) Standard Specification for Aluminum

	and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM B247M	(2009) Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings (Metric)
ASTM E329	(2013b) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

NACE INTERNATIONAL (NACE)

NACE SP0178	(2007) Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be for Immersion Service

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2011; Errata 2012) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2012; Errata 2011; Errata 2011) Flammable and Combustible Liquids Code
NFPA 70	(2014; AMD 1 2013; Errata 2013; AMD 2 2013) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-5624	(2013; Rev V) Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-83133	(2011; Rev H; Am 1 2012) Turbine Fuels, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35 and JP-8 + 100 (NATO F-37)
MIL-PRF-23236	(2009; Rev D) Coating Systems for Ship Structures

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.23	Guarding Floor and Wall Openings and Holes
29 CFR 1910.24	Fixed Industrial Stairs
29 CFR 1910.27	Fixed Ladders

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have

designated those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Include emergency vent in SD-03 and SD-05 only on tanks smaller than 15.24 meters 50 feet in diameter and without a floating pan.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][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 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Copies of API Publications[; G][; G, [_____]]

NACE Visual Comparator[; G][; G, [_____]]

Acknowledgement of surface finish requirements[; G][; G, [_____]]

Acknowledgement of API Std 650[; G][; G, [_____]]

SD-02 Shop Drawings

Steel tank[; G][; G, [_____]]

Tank Bottom Shimming and Grouting Plan[; G][; G, [_____]]

Floating pan[; G][; G, [_____]]

Overflow/Circulation Vents[; G][; G, [_____]]

Channel mounting pads[; G][; G, [_____]]

Water Draw-Off System[; G][; G, [_____]]

Product saver tank[; G][; G, [_____]]

Sidestream Filtration System[; G][; G, [_____]]

SD-03 Product Data

[Emergency Vent[; G][; G, [_____]]

] Carbon steel, pipe fittings, flanges, gaskets, and bolting[; G][; G, [_____]]

Structural steel[; G][; G, [_____]]

[Tank Bottom to Foundation Gasket[; G][; G, [_____]]

][Tank Grout[; G][; G, [_____]]

][Tank Shims[; G][; G, [_____]]

] Floating pan[; G][; G, [_____]]

Sample Gauge hatch[; G][; G, [_____]]

Mechanical tape level gauge[; G][; G, [_____]]

Center roof vent[; G][; G, [_____]]

Stairway step and platform tread grating[; G][; G, [_____]]

Gaskets for Manhole Covers and Stilling Well Flanges[; G][; G, [_____]]

Aluminum piping[; G][; G, [_____]]

Aluminum flanges[; G][; G, [_____]]

Antiseize compound[; G][; G, [_____]]

Stairway bolting[; G][; G, [_____]]

Sidestream Filtration System[; G][; G, [_____]]

Floating Seal and Retrieval Winch[; G][; G, [_____]]

SD-04 Samples

Tank Bottom to foundation gasket[; G][; G, [_____]]

SD-05 Design Data

Steel tank design[; G][; G, [_____]]

Floating pan design[; G][; G, [_____]]

[Emergency ventilation calculations[; G][; G, [_____]]

] SD-06 Test Reports

Visual examination of vertical shell-seam tack welds

Visual examination of initial pass of internal shell-to-bottom weld

Vacuum box testing of internal shell-to-bottom initial weld pass

Visual examination of completed internal and external shell-to-bottom welds

Radiographic examination of shell butt weld

Visual examination of shell butt welds

Visual examination of fillet welds

Visual examination of tank bottom plates

Vacuum box testing of tank bottom fillet weld

Pneumatic tests of reinforcing plates

Hydrostatic testing

Approval of professional engineer in lieu of hydrostatic testing

Shell settlement measurements taken before, during, and after hydrostatic testing

Internal bottom elevation readings taken before and after hydrostatic testing

Shell Plumbness

Shell Roundness

Maximum local deviations, shell

Tightness test records

Tank bottom puddle test

Roof puddle test

Submit reports for inspection of welds and radiographs to the Contracting Officer

SD-07 Certificates

Welding Procedure Specifications (WPS)

Welding Procedure Qualification Records (PQRs)

Welder Performance Qualification Records (WPQ)

Qualifications of tank erector

Qualifications of floating pan manufacturer

Qualifications of API Std 653 Inspector

Weld Inspector Certification

NDE Personnel Certification

Qualifications of Testing Agency

Tank calibration experience

SD-09 Manufacturer's Field Reports

Floating pan prototype fire test[; G][; G, [_____]]

Mill test reports[; G][; G, [_____]]

Impact Test Data[; G][; G, [_____]]

SD-10 Operation and Maintenance Data

Tank calibration table, Data Package 2

Electronic Calibration Table, Data Package 2

API Std 653 inspection reports, Data Package 2

Maintenance instructions,, Data Package 2

Operator instructions, Data Package 2

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.3 COPIES OF API PUBLICATIONS

Provide four copies of API RP 2009, API Std 650, and API MPMS 2.2A, API MPMS 2.2B, API MPMS 2.2C and API MPMS 2.2D to the Contracting Officer.

1.4 RELATED REQUIREMENTS

****
NOTE: If fuel is other than JP-5 or JP-8, consult UFC 3-460-01, "Design: Petroleum Fuel Facilities", Chapter 2-2 for ASTM or MIL-DTL specification number, and list below.

In the electrical design, include the following: potted explosion proof MI cable for connections to electric actuators in the dike area; tank grounding system; conduit routing such that it cannot be stepped upon; supporting conduit on cast-in-place concrete supports inside the secondary containment area; considering conduit supports during design and addressing aboveground and belowground conduit and locations of boxes, lights, etc
****

Materials, design, fabrication, welding, erection, testing, and appurtenances shall be in accordance with API Std 650 and as indicated and specified herein. Submit acknowledgement of API Std 650 as required standard. Product[s] to be stored in the tank [is][are] [_____] [MIL-DTL-5624 Grade JP-5][and][MIL-DTL-83133 JP-8]. Section [23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS] [05 50 13 MISCELLANEOUS METAL FABRICATIONS] and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM apply to this section except as specified otherwise

1.5 DESIGN REQUIREMENTS

****
NOTE: Insert design information for loads on tanks as given in UFC 3-460-01, "Design: Petroleum Fuel Facilities". Insert the size and volume of the tank. Edit as required for project. Coordinate with structural drawing notes.
****

Design tank [repairs] to resist the[following] loads and forces[:][listed on the structural drawings and for the following:]

[a. Wind: [_____] kilometers per hour [_____] mph]

b. Design specify gravity of liquid is [_____] to [_____].

c. Design shell and nozzles for a design liquid level equal to overflow condition.

1.5.1 Seismic Design Requirements

Seismic loads and forces shall be in accordance with API Std 650 Appendix E.

****
NOTE: Allow only one roof support column in floating roof tanks of 80,000 bbls and larger.

Do not allow roof support columns in floating pan tanks smaller than 80,000 bbls nominal size.

****

[1.5.1.1 Columns

Provide tank with no more than 1 roof support column.

Design roof support columns to resist the forces caused by sloshing of the liquid contents during a seismic event. Roof support columns shall not be allowed.

]1.5.1.2 Shell Height

Shell height shall provide clearance between the pan at full overflow (bottom of pan at top of overflow) and the fixed roof that includes an allowance of at least 300 mm 12 inches for sloshing due to seismic event.

1.5.2 Tank Nozzles

Design tank nozzles to accommodate external piping loads in accordance with

API Std 650.

1.5.3 Tank Roof

Provide tank roof plates, lap welded with inner plates on top, and at least 6 mm 1/4 inch thick (includes 1.5 mm 1/16 inch corrosion allowance). Support beams shall be designed so as to minimize uncoatable surfaces. Provide solid web or HSS (Hollow Structural Section) type roof beams. Open web trusses shall not be permitted. Do not attach roof support members to the roof plate. Provide a roof with every part having a slope between 1-1/2:12 and 2:12.

****
NOTE: On tanks 15.24 m 50 feet or more in diameter that do not have a floating pan, include the first bracketed paragraph. On tanks less than 15.24 m 50 feet in diameter that do not have a floating pan, include the second bracketed paragraph. On tanks with floating pans, delete both paragraphs.
****

1.5.3.1 [Emergency Ventilation

Provide emergency ventilation by a frangible roof design. The weld attaching the roof plate to the top angle shall not be greater than 5 mm(3/16 inch).

]1.5.3.2 [Emergency Vent Devices

Submit emergency ventilation calculations for selection of emergency vents.

]1.5.4 Corrosion Allowance

Provide corrosion allowance of 1.6 mm 1/16 inch in thickness of steel for the interior of the shell, roof, and interior structural members.

1.5.5 Design Metal Temperature

****
NOTE: Insert design metal temperature for locations not covered by API Std 650. Obtain low temperature from weather data. Determine the design metal temperature in accordance with API Std 650.
****

API Std 650 [[_____] degrees C] [[_____] degrees F].

1.5.6 Tank Bottom

Tank bottom and annular ring shall be as indicated. Bottom plates shall be lap welded with inner plates on bottom.

1.6 QUALIFICATIONS OF TANK ERECTOR

****
NOTE: For NAVFAC projects, include the following requirement in the Project Information Form (PIF).
****

The Contractor shall be regularly engaged in the erection of API Std 650

tanks. The Contractor shall certify successful completion of at least 12 field erected API Std 650 aboveground tanks in the past three years. The information provided in the Contractor's certification shall include the date of the notice to proceed, date of completion, location of tank, Owner, Owner's point of contact, tank size, configuration (e.g. vertical AST, horizontal AST), product stored, and material of construction.

1.6.1 Welding Qualifications

Submit Welding Procedure Specifications (WPS), Welding Procedure Qualification Records (PQRs), and Welder Performance Qualification Records (WPQ). Qualify all welders on site. Complete all WPQs specifically for this project. Give the Contracting Officer notice and opportunity to witness each of the welder performance qualification tests 24 hours in advance of the performance of each of the tests.

1.7 TANK CALIBRATION EXPERIENCE

Perform calibration of the tank using a qualified organization that can certify to having performed successful and accurate calibration of at least eight tanks of comparable type and size within the last two years. Submit certified data on tank calibration experience.

1.8 QUALIFICATIONS OF FLOATING PAN MANUFACTURER

****
NOTE: For NAVFAC projects include the following requirement in the Project Information Form (PIF)
****

The floating pan manufacturer shall be regularly engaged in the manufacture and installation of floating pans in API Std 650 tanks. The manufacturer shall certify successful manufacture and installation by the manufacturer of at least 10 floating pans of the type specified in field erected API Std 650 aboveground tanks within the past five years. A minimum of five of those installations shall have been performed on US military installations. The information provided in the manufacturer's certification shall include the date of the notice to proceed, date of completion, location of tank, customer project number or construction contract number, Owner's point of contact, tank size, and construction type.

1.9 QUALITY ASSURANCE

1.9.1 Delivery and Storage Handling

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.9.2 Steel Tank Drawing Requirements

****
NOTE: See UFC 1-300-09N, "Design Procedures" for professional engineer requirements.
****

Drawings for the steel tank and floating pan shall be prepared, sealed, signed, and dated by a registered professional engineer. Include erection

diagrams and detail drawings of the tank roof, shell plates, wind girders, openings, and connections for fittings and appurtenances. The steel tank drawings shall include the following:

a. Tank erection details showing dimensions, sizes, thickness, gages, materials, finishes, and erection procedures.

b. Tank component details to include as a minimum:

(1) Floating pan (including details of support legs, manways, periphery seals, joint attachments, anti-rotation cables, and grounding cables).

(2) Locations of floating pan pressure/vacuum vents and rim seals.

(3) Internal pipe and fittings, including supports and bearing plates.

[

(4) Tank Bottom to foundation gasket.

][(5) Tank Bottom Shimming and Grouting plan and details.

(6) Tank Anchors.

]

(7) Location of alarm and control switches.

(8) Location of nozzles including nozzles for gauges and alarms.

(9) Roof support system details.

(10) Roof manhole.

(11) Circulation vents/inspection hatches.

(12) Center roof vent.

(13) Overflow port/circulation vent.

(14) Shell manholes and davits.

(15) Stairway, including replaceable stair tread installation and platforms.

(16) Channel mounting pads.

(17) Tank Data Plate Plan and Information

(18) Shell to bottom connection.

(19) Tank bottom to ringwall interface.

(20) Stilling wells.

(21) Grounding lugs.

(22) Sump.

(23) Scaffold Table Support.

(24) Shell circulation vents.

1.9.3 Data Requirements

Calculations for the steel tank design and floating pan design shall be prepared by a State registered Professional Engineer. Include calculations for the buoyancy of the floating pan and the structural stability of the floating pan when resting on the support legs. Steel tank design calculations shall include calculations for the design of the shell, as well as calculations for the design of the roof [frangible roof connection], [tank anchorage] [emergency vent] and roof support.

1.9.4 Weld Inspector Certification

Contractor shall arrange for the services of an independent (not employee) weld inspector certified by the American Welding Society to oversee all weld tests and examinations required by API Std 650.

1.9.5 Test Reports

Test Reports shall consist of the following:

a. Records made by the AWS certified inspector for all duties performed per paragraph 4.2 of AWS QC1.

b. All Nondestructive Examination (NDE) (e.g.; radiograph, ultrasound, etc) reports with unique weld ID for each weld tested.

c. "Weld Map". These maps/drawings correlate the shop drawings submitted to the NDE reports. The NDE report that shows a weld number as acceptable is correlated with weld number on the drawings.

Provide the location of each weld, what procedure was used, which welder made the weld, the results of the visual test, and the results of the NDE.

1.9.6 Inspection and NDE Personnel

All inspection and NDE personnel shall be qualified in accordance with the following requirements. The contractor shall submit the qualifications of all the testing personnel that will perform all field tests for review by the Contracting Officer. The qualifications of all personnel on the job site that will perform welding inspections and NDE shall be submitted for approval. All inspectors and NDE examiners shall have a minimum of one (1) year experience inspecting the piping or plate material being used and five (5) years in military or commercial fueling systems or petroleum refineries, power generating plants, or chemical process plants.

1.9.6.1 NDE Personnel Certification

A written procedure/quality assurance program for the training, examination, certification, control and administration of NDE personnel shall be established. The procedures shall be based on appropriate specific and general guidelines of training and experience recommended by ASNT SNT-TC-1A. Submit proof of compliance of nondestructive test examiners with API Std 650 including, but not limited to, examiners performing radiographic (RT), visual (VT), penetrant (PT), ultrasonic (UT), and/or magnetic particle (MT) testing.

1.9.6.2 Qualifications of Testing Agency

The testing agency, testing laboratory, technical consultant or contractor's approved quality assurance organization shall meet the requirements of ASTM E329.

1.9.7 Qualifications of API Std 653 Inspector

Contractor shall arrange for the services of an independent (not employee) API Std 653 inspector. API Std 653 Inspector shall have a minimum of five years of experience. Submit copy of current certificate.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the following requirements except that materials not definitely specified shall conform to API Std 650.

2.1.1 Materials for Equipment, Pipe, and Fittings

****
NOTE: Unless otherwise specified: In corrosive environments (such as near the ocean or humid locations) select the first option; in non-corrosive environments select the second option.
****

a. [All piping and fittings outside the tank (except for the tank fill line, tank issue line, and tank low suction line) shall be stainless steel. The tank fill line, tank issue line, and tank low suction line piping and fittings shall be interior and exterior coated carbon steel. All valves (except DBB valves) and ball joints shall be stainless steel. DBB valves shall be as specified.] [All piping, and fittings 63 mm 2.5 inches and larger shall be interior and exterior coated carbon steel. All piping and fittings 50 mm 2 inches and smaller shall be stainless steel. All valves larger than 63 mm 2.5 inches shall be carbon steel with stainless steel trim. All valves 50 mm 2 inches and smaller shall be stainless steel. DBB valves shall be as specified.]

b. All piping and fittings inside the tank shall be exterior and interior epoxy coated carbon steel except for piping 50 mm 2 inches and smaller which shall have an uncoated interior. Stilling well and ladder material shall be as indicated.

c. Do not weld stainless steel to carbon steel, except where specifically indicated or specified.

d. If materials for equipment are not specified, they shall be stainless steel.

e. Provide stainless steel HLV float control chamber, pilot, level switch housings, and level switch probe holders.

2.2 STRUCTURAL STEEL

API Std 650. Provide mill test reports for shell plates, shell nozzle reinforcing plates, shell insert plates, and all steel plate used in

construction of shell penetrations. Provide impact test data when required by API Std 650 for the material group and thickness provided.

2.3 CARBON STEEL, PIPE FITTINGS, FLANGES, GASKETS, AND BOLTING

****
NOTE: Ensure bolting on interior of tank is stainless steel.
****

Carbon steel, pipe fittings, flanges, gaskets, and bolting shall be provided in accordance with Section 33 52 43.13 AVIATION FUEL PIPING or Section 33 52 43 AVIATION FUEL DISTRIBUTION (NON-HYDRANT), except gaskets inside tank and on roof nozzles shall be non-asbestos, fuel resistant composition, or preformed type. Flanges shall be weld-neck type in accordance with ASME B16.5. Threaded fittings shall conform to ASME B16.11 (3000 lb), and butt-welded fittings shall conform to ASME B16.9.

2.4 STAINLESS STEEL PIPE, FITTINGS, FLANGES, GASKETS, AND BOLTING

Stainless steel pipe, pipe fittings, flanges, gaskets, and bolting shall be provided in accordance with Section 33 52 43.13 AVIATION FUEL PIPING or Section 33 52 43 AVIATION FUEL DISTRIBUTION (NON-HYDRANT) and API Std 650, except: flanges shall be weld-neck type in accordance with ASME B16.5, threaded fittings shall conform to ASME B16.11 (3000 lb), and butt-welded fittings shall conform to ASME B16.9.

2.5 ALUMINUM PIPING FOR STILLING WELLS

Aluminum pipe shall be ASTM B241/B241M, alloy 6061-T6, Schedule 40 for pipe sizes 50 mm 2 inches through 300 mm 12 inches; Schedule 80 for pipe sizes 50 mm 2 inches and smaller.

2.6 BOLTING AND ALUMINUM FLANGES FOR STILLING WELLS

Aluminum flanges shall be ASME B16.5, Class 150 or Class 300 where indicated, Flat Face Type, except aluminum shall conform to ASTM B247M ASTM B247, alloy 6061-T6 or alloy 356-T6. Aluminum flanges may be welding neck or slip-on type. Provide bolting in accordance with Section 33 52 43.13 AVIATION FUEL PIPING or Section 33 52 43 AVIATION FUEL DISTRIBUTION (NON-HYDRANT). Provide electrical isolation for separation of dissimilar metals.

2.7 WELDING FOR ALUMINUM PIPING

2.7.1 Process for Aluminum

ASME B31.3, Gas Tungsten Arc Welding (GTAW) Process or Gas Metal Arc Welding (GMAW) Process. Backing rings shall not be permitted.

2.7.2 Aluminum Welding Electrodes and Rods

AWS A5.10/A5.10M, ER5356 electrodes.

2.8 BOLTING FOR SHELL MANHOLE COVERS

Bolting for shell manholes shall be in accordance with Section 33 52 43.13 AVIATION FUEL PIPING or Section 33 52 43 AVIATION FUEL DISTRIBUTION (NON-HYDRANT).

2.9 GASKETS FOR MANHOLE COVERS AND STILLING WELL FLANGES

Provide composition asbestos-free, fuel and fire-resistant gaskets for shell manhole covers and stilling well flanges.

2.10 TANK BOTTOM TO FOUNDATION SEAL

****
NOTE: Include the first bracketed paragraph for self anchored tanks. Include the second bracket paragraph for anchored tanks.
****

2.10.1 [Tank Bottom to Foundation Gasket - Self Anchored Tanks

Tank bottom to foundation gasket for self anchored tanks shall be 12 mm 1/2 inch thick, nonporous Buna-N with a Shore A Durometer Hardness of not more than 40 and a rated tensile strength of at least 10,300kPa 1,500 psi. The inside and outside edge of the gasket shall be cut on a radius. Provide gasket in segments at least 2.4 meters 8 feet long. Provide three samples of the tank bottom-to-foundation gasket material measuring 13mm 1/2 inch by 75 mm 3 inches by 225 mm 9 inches.

]2.10.2 [Tank Shims and Tank Grout - Anchored Tanks

Grout shall be non-shrink type and consist of 1 part Portland cement to 1-1/2 parts sand by volume. Do not use calcium chloride admixtures. When the ambient temperature is expected to fall below 16 degrees C 60 degrees F within the next 48 hours, the cement used shall be "high early strength" type.

****
NOTE: Include the following in the products section of the exterior coating specification and require product data submittal:

"X.X.X. Tank Bottom to Foundation Sealant

The tank bottom perimeter to foundation ring wall mastic sealant shall be liquid applied non-sagging, two part polysulfide rubber joint sealant composed of 100 percent solids, and conforming to ASTM C920, Class 25. The sealant shall be suitable for use on steel, epoxy coated surfaces and concrete. The sealant shall be rated with a Shore A Hardness of not more than 30, a minimum tensile strength of 1,000 kPa 150 psi, a minimum elongation of 100 percent at 350kPa 50 psi without breaking, and a minimum elongation of 200 percent at 550 kPa 80 psi without breaking. The sealant shall be resistant to jet fuel, sunlight, cold, and ozone without shrinking; and shall have a rated life expectancy of at least 15 years. Use with bond breaker tape recommended by the manufacturer."

****

]2.11 INTERIOR PROTECTIVE COATING SYSTEM

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NOTE: NOTE: In order to protect product quality and to extend the life of the tank, the prescribed interior surfaces of steel petroleum storage tanks shall be coated in accordance with UFC 3-460-01, "DESIGN; PETROLEUM FUEL FACILITIES".

NOTE: Other guidance as to interior surface treatment is as follows:

1. Specify bare interior metal surfaces and coating with SAE-30 weight oil if the coating is to be done at a later date. Uncoated surfaces shall be cleaned of contaminants, including mill scale. Delete reference to Section 09 97 13.15 EPOXY/FLUOROPOLYURETHANE INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS and Section 09 97 13.17 THREE COAT EPOXY INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS if not applicable.

2. Include Section 09 97 13.15 EPOXY/FLUOROPOLYURETHANE INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS when erecting a new Navy tank or replacing the interior coating of a Navy tank with expected service life of more than 10 years. Otherwise, include Section 09 97 13.17 THREE COAT EPOXY INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS.

3. Include instructions in the coating specification to seal all uncoatable areas of the roof support structure by caulking all gaps and joints in roof beams including between coated beams and roof plates.

4. Include instructions in coating specification to caulk the underside of roof plate seams that are not welded on the underside.

****

[Section 09 97 13.15 EPOXY/FLUOROPOLYURETHANE INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS.][Section 09 97 13.17 THREE COAT EPOXY INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS.][Interior of the tank shall be bare steel. Coat interior of tank with SAE 30 oil for temporary protection.]

2.12 EXTERIOR PROTECTIVE COATING SYSTEM

Section 09 97 13.27 EXTERIOR COATING OF STEEL STRUCTURES.

2.13 APPURTENANCES

2.13.1 Floating Pan Installation Hatch

Provide permanent floating pan installation hatch on the tank roof. Provide with bolted cover and water tight gasket.

2.13.2 Floating Pan

The floating pan shall be naturally buoyant by means of honeycomb cell aluminum sandwich panels, be suitable for operation with liquids having a specific gravity of 0.70, be internal to the tank, have full surface contact with the fuel, be equipped with a seal at each penetration, and meet the requirements of API Std 650 Appendix H. A rim shall be provided around the floating pan periphery and extend a minimum of 150 mm 6 inches above the free liquid surface. The rim shall contain turbulence and prevent fuel from splashing up onto the top surface of the floating pan.

2.13.2.1 Pan Integrity

The floating pan shall support the following loading conditions without causing damage to the pan, sinking the pan, or allowing product to spill onto the top surface of the pan in the event the pan is punctured.

a. A uniform load of three times the weight of the pan.

****
NOTE: NOTE: Include the first bracketed sentence for tanks larger than 9144 mm 30 feet in diameter, and the second for smaller tanks.
****

[b. A point load of 227 kg on a 93,000 sq mm 500 pounds on a one square foot area anywhere on the floating pan while it is floating or resting on the legs.]

[c. A point load of 113 kg on a 93,000 sq mm 250 pounds on a one square foot area anywhere on the floating pan while it is floating or resting on the legs.]

2.13.2.2 Floating Pan Prototype Fire Test

Perform a fire test on another floating pan design of the same manufacturer that is constructed from the same materials and joining method of the pan being proposed and that meets the floating pan specification in aviation turbine fuel or motor gasoline with a flash point of less than 49 degrees C 20 degrees F. Submit manufacturer's certification of fire test indicating the manufacturer's floating pan design has been successfully fire tested and that both of the following tests were successfully performed, without significant damage to the pan, sinking the pan or the fire spreading to the whole surface of the fuel.

a. Hole Fire: The test-floating pan shall have a 300 mm 12 inch or larger diameter hole cut through it. After being lit, the fuel in the hole shall burn for a minimum of 2 hours.

b. Rim Fire: After being lit, the fuel around the test rim section shall burn for a minimum of 2 hours.

2.13.2.3 Joint Connections

Aluminum sandwich panels shall be joined together by means of a gasketed joint that transmits loads without structural failure or leakage.

2.13.2.4 Aluminum Extrusions

Extrusions shall be made from alloy 6063-T6 in accordance with ASTM B209M ASTM B209.

2.13.2.5 Aluminum Sandwich Panels

Panels shall be made from alloy 3003 H14, 3003 H16, 3105 H14, or 5010 H24 in accordance ASTM B209M ASTM B209. The skin of the panels shall have a minimum thickness of 0.356 mm 0.014 inches. The core of the panels shall be 25 mm one inch aluminum honeycomb.

2.13.2.6 Support Legs

Floating pan shall be provided with two position self-draining legs that are designed to support a uniform load of 600 Pa 12.5 pounds per square foot. The legs shall be tubular structural members at least 50 mm 2 inches in diameter and ride with the pan when the fuel level is above the high leg position. The low position shall be as indicated and the high position shall be 1900 mm 75 inches above the shell-to-bottom joint. The exact location and number of the support legs shall be as recommended by the floating pan manufacturer. Provide each support leg with a 63 mm 2.5 inch polytetrafluoroethylene (PTFE) foot securely fastened to the bottom end of the leg. The portion of the PTFE foot below the metal leg shall be 25 mm 1 inch thick. The PTFE foot shall be slotted on one side to allow for drainage. The legs shall be capable of allowing a person, standing on top of the floating pan while the tank is in service, to perform the following functions:

a. Change from the high to the low position.

b. Change from the low to the high position.

c. Completely remove the legs.

d. Adjust the legs vertically a distance equal of plus or minus 75 mm 3 inches.

2.13.2.7 Periphery Seals

Periphery seals shall be flexible wiper squeegee and made of closed cell cast urethane. The periphery seal shall fit the space between the tank shell and the outer edge of the floating pan with two flexible seals, a primary and a secondary. The seals, primary and secondary as a unit, shall accommodate a deviation between the path of the floating pan relative to the tank shell of an additional 100 mm 4 inches of compression and an additional extension of 50 mm 2 inches from its normal compressed position at any fluid level. The primary seal shall be above the liquid level. Foam filled coated-fabric seals shall not be accepted. The secondary seal shall be above the primary seal. Seals shall be capable of being replaced during tank operations, be durable in the tank's environment, be abrasion resistant, and not discolor or contaminate the liquid stored in the tank.

2.13.2.8 Penetrations

All penetrations shall have a rim that extends a minimum of 150 mm 6 inches above the free liquid to contain product turbulence and prevent the tank product from splashing up onto the top surface of the floating pan.

****
NOTE: Review Federal, State, and local regulations to ensure compliance with air emission regulations. Consider the slotted stilling wells in the review. At least one 900 mm 36 inch diameter combination manhole and pressure/vacuum vent shall be provided for each floating pan to provide access to the tank interior when the floating pan is on its supports and the tank is empty; provide two for tanks larger than 50,000 bbl.
****

2.13.2.9 Manhole

Provide [_____] 900 mm 36 inch combination floating pan manhole[s] and pressure/vacuum vent. Manhole shall have a clear inside diameter of at least 900 mm 36 inches. Manhole shall have a rim that extends a minimum of 75 mm 6 inches above the free liquid to contain product turbulence and prevent the tank product from splashing up onto the top surface of the floating pan. The manhole cover shall be equipped with a ground cable connected to the floating pan.

2.13.2.10 Grounding Cables

Provide two or more 5 mm 3/16-inch diameter, stranded, extra-flexible, stainless steel, wire rope ground cables. Each cable shall extend from the top of the floating pan to the fixed roof and shall be long enough to accommodate the full travel of the pan. The exact location, number, and size of grounding cables shall be as recommended by the floating pan manufacturer.

2.13.2.11 Anti-Rotation Cable

Provide a minimum of three 6 mm 1/4-inch diameter anti-rotation cables made of 304 stainless steel conforming to ASTM A492. Fittings for anti-rotation cables including cable clamps, pins, sockets, turnbuckles, U-bolts and nuts, etc. shall be 304 stainless steel. Cable shall be made taut by means of the turnbuckle. The exact location, number, and size of the anti-rotation cables shall be as recommended by the floating pan manufacturer.

2.13.3 Sample Gauge Hatch

Provide sample gauge hatch on top of stilling well where indicated for manual gauging. Equip hatch with a self-closing, foot-operated, lockdown cover of nonferrous metal. Provide gasket for dissimilar metal protection.

2.13.4 Floating Seal and Retrieval Winch

Provide a floating seal, retrieval cable, weight, and a retrieval winch on sample gauge roof nozzle equipped with fully slotted stilling well. Floating seal shall move freely inside the stilling well with the rise or fall in liquid level while providing a double seal against the escape of vapors from the stilling well. Seal elastomers shall be Buna-N and shall seal at approximately the same level as the stilling well floating pan penetration seal (approximately 150 mm 6 inches above the level of the liquid). Retrieval winch and cable shall be capable of retrieving floating seal into a storage compartment mounted on top of the stilling well nozzle. All fasteners shall be stainless steel; all other metallic

components of float and seal shall be aluminum. Storage compartment and components, except for bearings, shall be stainless steel. The retrieval cable shall be 3 mm 1/8 inch stainless steel. Storage compartment shall be equipped with a latch and hinge so that the compartment (with a fully retrieved float, cable, and weight) and winch can be temporarily moved out of the way to provide access to the stilling well. Latch and hinge shall be designed to hold the compartment securely to the nozzle in winds up to 200 km/h 125 mph. Storage compartment flange shall also be provided with a rain lip to provide a weather tight seal around the top of the roof nozzle. Winch shall be hand operated, shall require no more than 22 N 5 pounds of force to operate, and shall be equipped with an anti-reverse mechanism and operator that may be disengaged from the retrieval spool when not being operated manually. When disengaged from the winch, the retrieval spool shall maintain tension on the retrieval cable not exceeding the weight of the cable and the weight.

2.13.5 Mechanical Tape Level Gauge

****
NOTE: Include Bracketed sentences on Navy projects.
****

The mechanical tape level gauge shall be complete with all necessary incidental pipe, pulleys, fittings, supports, support brackets, tension springs, and guide wire assemblies. The gauge shall automatically provide the location of the floating pan within plus or minus 1.6 mm 1/8 inch of the actual liquid level. The head shall be made of aluminum and shall be mounted on the exterior of the tank shell approximately 1370 mm 54 inches above the tank bottom. The head shall contain a glass covered window complete with an inside wiper. The seals shall be made of Teflon. The shafts, graduated tape, and tape drum assembly shall be made of stainless steel. The tape shall be of sufficient length to measure the liquid level from the bottom to the top of the storage tank. Gauge measurements shall be graduated in 1.6 mm 1/16 inch increments. The tape shall be carried over pulleys housed in elbow assemblies at each change of direction. [Gauge shall transmit data to control room readout.]

2.13.6 Venting

Provide tank venting as indicated.

****
NOTE: Insure overflow capacity is adequate to protect the tank from damage in the event of an overflow with all receipt pumps running.
****

2.13.6.1 Overflow/Circulation Vents

Provide open overflow/circulation vents on the upper shell as indicated and in accordance with API Std 650, Appendix H. Provide vents with stainless steel bird screen with 0.2 square meters 2.0 square feet of net open area minimum. Insect screens shall not be allowed.

2.13.6.2 Center Roof Vent

Provide open vent at the center or at the highest elevation of the roof. Open vent shall have a stainless steel weatherhood as indicated and stainless steel bird screen with 13 mm 1/2 inch openings welded in place.

Weatherhood shall be removable. Insect screens shall not be allowed.

2.13.7 Circumferential Stairway and Platforms

****
NOTE: In corrosive environments include bracketed text to provide bolt-on, removable, hot dip galvanized, double stringer stairway as indicated. For the remote locations only (e.g Guam), provide alternate test to allow thermal spray/metalizing as an alternative to hot dip galvanizing only with Government approval of an acceptable process, approach, materials, and equipment.

In non-corrosive environments (e.g. desert locations), include double bracketed text to provide circumferential stairway with tread welded directly to the tank shell and coat stairway in accordance with the coating specification for the exterior of the tank.
****

OSHA 29 CFR 1910.24 and 29 CFR 1910.23. Provide [bolt-on removable double stringer] circumferential stairways as indicated. [Hot-dip galvanize stairway in accordance with ASTM A123/A123M Grade 100. All bolted connections shall be galvanized prior to erection. Hot dip galvanize stairway and platform sections after all welding is complete. No welding on the stairway shall be permitted after galvanizing. Cold spray-on galvanizing is not allowed as a substitute for hot dip galvanizing or its repair. Provide stairway with replaceable galvanized stairway step and platform tread grating. The stairway shall be of bolted construction to allow for complete removal after construction to avoid interference with coating operations. Stairway bolting shall be ASTM A325M ASTM A325, hot dipped galvanized. All mounting brackets, used to connect the stairway to the tank, shall be welded to the tank using seal welded mounting plates and shall be coated with the tank. Provide three approach steps on the secondary containment concrete as indicated.] [Coat stairway in accordance with the tank exterior coating specification. Provide one approach step on the secondary containment concrete as indicated.] Provide shell mounted metal bar stairway step and platform tread grating with non-slip nosings. Support the stairway and platforms completely on the shell of the tank with bottom-of-shell-mounted portion clear of and not structurally supported or connected to the ground or approach steps. Provide rise and run of stairway steps as indicated, adjusting slightly to suit final layout of the tank and its appurtenances, but with rise and run consistent from the ground level to the top platform. Construct stairway entirely of steel. Provide landings for accessing the upper manhole, high level alarm switches, level control float pilot chamber, and tank roof. Railings shall be continuous around the platforms, except for access openings, and shall be constructed similar to the roof perimeter guardrail. At access openings, any space wider than 25 mm one inch between the tank and the platform shall be floored. Ends of handrails, guardrails, and posts shall be sealed by welding. [Guardrails shall be constructed in welded sections and their posts seal welded or bolted to the stringers]. Seal butt welded platform guardrail toeboards to guard rail posts.

****
NOTE: The following paragraph is intended for use when no berm is provided and the ring wall is

elevated. Delete manhole access platform paragraph if berm is provided.

****

2.13.8 [Manhole Access Platforms

Provide platform and dike floor mounted steps for accessing the lower shell manhole and circumferential stairway as indicated and in accordance with Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

]

2.13.9 Roof Perimeter Guardrail

Construction of roof perimeter guardrail shall be as-detailed on the drawings and in accordance with OSHA. Finishing of roof perimeter guardrail shall be similar to the stairway.

2.13.10 Internal Ladders

OSHA 29 CFR 1910.27. Provide an internal ladder extending from the roof manhole to the tank bottom as indicated. Provide with aluminum safety rail as indicated. Provide removable aluminum safety rail extension as indicated. Provide two 63 mm 2 1/2 inch sch 40 pipe 2 1/2 inches long. Weld one of the pipes to the top rail of the roof perimeter guardrail near the roof manhole. Weld the second pipe to the toeboard directly below the first for storing the removable safety rail extension.

2.13.11 Roof Manhole

Provide roof manhole as indicated for access to the interior of the tank through the roof.

****

NOTE: On tanks 15.24 meters 50 feet or more in diameter that do not have a floating pan, delete the bracketed paragraph. On tanks less than 15.24 meters 50 feet in diameter that do not have a floating pan, include the bracketed paragraph. On tanks with floating pans, delete the bracketed paragraph.

****

2.13.12 [Emergency Vent

Provide emergency vent devices in accordance with API Std 2000 and NFPA 30.

]2.13.13 Roof Circulation Vent/Inspection Hatches

Provide stainless steel roof vent/inspection hatches in the fixed roofs of aboveground storage tanks as indicated and in accordance with API Std 650, Appendix H. Each roof vent/inspection hatch shall be provided with a roof reinforcing plate the same thickness as the roof plate. Provide with stainless steel bird screen with 13 mm 1/2 inch square openings and 0.2 square meters 2.0 square feet of net open area minimum. Insect screens shall not be allowed.

2.13.14 Water Draw-Off System

Provide a water draw-off system complete with all equipment and controls and connected to the AST as indicated. System shall remove fuel from its associated storage tank, separate the fuel and water by gravity, return the

fuel back to the storage tank, and discharge the water. The system and its components shall meet the requirements of the specification herein. The system shall include, but is not limited to, the following piping, fittings, valves, equipment, and controls:

****
NOTE: In cold climates, typically north of Baltimore, Maryland in CONUS, include the "In Cold Climates" option.
****

a. Product Saver Tank: Provide a product saver tank with the tank, piping and fittings packaged and fabricated as a single system. Fabricate from Type 304 stainless steel with tank volume as indicated. Provide tank with removable top, 25 mm 1 inch inlet line, 25 mm 1 inch drain line, and other lines as indicated, all with full port ball valves and cam-type connections. Provide concrete mounting pad and anchor tank to it.

[b. In Cold Climates: In cold climates provide the product saver tank system with a sump heater and insulate and heat trace the piping.]

c. Product Saver Pump: Pump shall be a close coupled centrifugal having a capacity of 0.6 lps 10 gpm at not less 18 meters 60 feet of head and with a Net Positive Suction Head of more than 1 meter 3 feet. Pump motor shall be in accordance with NEMA MG 1. All pump components in contact with fuel shall be stainless steel. The unit shall be UL listed and labeled for use in Class I, Division 2, Group D hazardous environments as defined by NFPA 70, with a maximum temperature rating of ["T2D"-419 degrees F] [_____]. The motor shall be non-overloading at every point on the pump curve.

d. Piping, Valves, Fittings, and Instruments,: Pipe, pipe fittings, flanges, manual valves, gaskets, and bolting shall be in accordance with Section 33 52 43.13 AVIATION FUEL PIPING or Section 33 52 43 AVIATION FUEL DISTRIBUTION (NON-HYDRANT). Materials of construction shall be as described in this specification section in "Materials for Equipment, Pipe, and Fittings" except as modified herein.

e. Controls: Provide a pump start/stop pushbutton station with red (run) and green (stop) lights. All lights shall be to push to test type. All equipment shall be rated for Class I, Division 1, Group D service.

f. Electrical: Provide completely prewired with single point of service connection at horsepower rated disconnect switch. Provide combination motor/starter with HOA switch for pump motor. Provide suitable for Class I, Division 1, Group D service.

2.13.14.1 Basis of Design of Water Draw-Off System

The system shall be arranged in the same general configuration as indicated. However, these are not fabrication drawings and are for basis of design only. The Contractor shall be responsible for providing a complete and usable system.

2.13.14.1.1 Detail Drawing

Submit detailed drawings showing the Water Draw-Off System, including types, sizes, location, and installation details for:

a. Pipe hangers and supports
b. Grounding
c. Tank
d. Pump
e. Controls
f. Valves
g. Piping

****
NOTE: As an option, provide additional side stream filtration system. Delete bracketed paragraph if sidestream filtration system is not provided.
****

2.13.15 [Sidestream Filtration System

Provide a packaged, skid mounted, pre-engineered, factory assembled, factory tested, sidestream filtration system complete with all equipment and controls. System shall remove fuel from its associated storage tank at 6.3 lps 100 gpm, filter the fuel to remove particulate matter and water, and then return the clean, dry fuel back to the storage tank. The system and its components shall meet the requirements of the specification herein. The system shall include, but is not limited to, the following piping, fittings, valves, equipment, and controls:

****
NOTE: In cold climates, typically north of Baltimore Maryland in CONUS, include the "In Cold Climates" option.
****

a. Filter Separator: 6.3 lps 100 gpm, horizontal construction, EI 1581 Fifth Edition, Category M100, Type S, 1034 KPa 150 psi ASME code compliant construction, raised face flanged connections, carbon steel construction, MIL-PRF-23236 epoxy coated interior in accordance with Section 33 52 43.28 FILTER SEPARATOR, AVIATION FUELING SYSTEM. Provide with automatic air vent, safety relief valve, differential pressure gage, sampling probes, water interface control, ASME code stamp, water slug flow control valve (with check feature), high water level conductance probe, manual drain full port ball valve with Kamlock connection and sight glass with density ball and isolation valves. Provide two sets of spare elements. Coalescer and Separator element length shall be 1092 mm 43 inches.

b. Water Slug Control Valve: Shall be of same manufacturer as HLV.

[c. In Cold Climates: In cold climates provide the filter/separator with a sump heater and insulate and heat trace the drain piping.]

d. Pumps: In-line ASME B73.1 or ASME B73.2 chemical process pump, cast steel construction with stainless steel impeller, shaft and trim, and with mechanical seals. Capacity shall be 6.3 lps 100 gpm at 30.5 meters 100 feet TDH (minimum). Motor shall be explosion proof, 7.5 KW 10 HP (maximum), 1800 RPM, 460 volts, 3 phase, 60 hertz and shall be non-overloading at any point on the curve with a 1.0 service factor.

e. Basket Strainer: The basket strainer shall be carbon steel with ANSI Class 150 raised-face flanges and with side drain port. Provide with

same differential pressure gage used for filter/separator; use stainless steel tubing and ball valves. Mount DP gage to SS heavy gage mounting channel and securely support from skid frame.

f. Piping, Valves, Fittings, and Instruments: Pipe, pipe fittings, flanges, manual valves, thermal relief valves, pressure indicators, flow switches, gaskets, and bolting shall be in accordance with Section 33 52 43.13 AVIATION FUEL PIPING or Section 33 52 43 AVIATION FUEL DISTRIBUTION (NON-HYDRANT). Materials of construction shall be as described in this specification section in "Materials for Equipment, Pipe, and Fittings" except as modified herein.

g. Suction Hose: Smooth bore, corrugated hose with static wire. Hose shall be suitable for [JP-5] [JP-8] [__] service, vacuum rated, with a minimum of 200 mm 8 inches bend radius. End connections shall be as indicated.

h. Vent Tank: 19 liter 5 gallon capacity vent tank shall be fabricated from 304 SS and shall receive discharge from filter/separator automatic air vent, manual air vent, and safety relief valve only. Provide with removable top, 25 mm 1 inch inlet line, 25 mm 1 inch drain line with full port ball valve and cam-type connection. Provide with high and high-high level switch system; sensors shall be electronic (either thermistor or optic type). The system shall be designed and installed in such a way that it shall be continuously and automatically self-checking, all in accordance with Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT.

i. Mounting Skid: Mounting skid shall be fabricated from carbon steel and epoxy coated. Provide concrete mounting pad. Anchor mounting skid to mounting pad.

j. Controls: Provide with integral sidestream filtration system control panel with start/stop pushbuttons, audible horn, visual alarm light, and with acknowledge and reset pushbuttons. Provide a pump start/stop pushbutton station with green (run) and red (stop) lights. Provide a paddle type flow switch downstream of the pump to energize the alarm circuits as indicated and de-energize the pump motor if flow is blocked. Provide a conductance probe in the filter/separator sump to energize the alarm circuits as indicated and de-energize the pump motor in the presence of water. Provide the vent tank with high and high-high level alarms, which shall energize the alarm circuits and de-energize the pump as indicated. Interlock the limit switches on the low suction line double block and bleed valve and on the tank fill line double block and bleed valve to allow the pump to be started only if both limit switches indicate the valves are in the open position. Interlock the skid control panel with the Emergency Fuel Shutdown system to de-energize the skid if any ESD pushbutton is depressed. All lights shall be the push to test type. All equipment shall be rated for Class I, Division 1, Group D service.

k. Electrical: Provide complete prewired with single point of service connection at horsepower rated disconnect switch. Provide combination motor/starter with HOA switch for pump motor. Provide all electrical equipment, conduit and fittings suitable for Class I, Division 1, Group D service.

2.13.15.1 Basis of Design of Sidestream Filtration System

The system shall be arranged in the same general configuration as indicated. However, these are not fabrication drawings and are for basis of design only. The Contractor shall be responsible for providing a complete and usable system.

2.13.15.2 Detail Drawing

Submit detailed drawings showing the Sidestream Filtration System including types, sizes, location, and installation details for:

a. Pipe hangers and supports
b. Bonding
c. Filter/Separator
d. Fuel pump
e. Tank truck off-loading control valve
f. Flow switches
g. Air eliminator assembly
h. Hoses
i. Valves
j. Piping

]2.13.16 Shell Manholes

Provide shell manholes, manhole covers with filler drums, and davits as indicated. Hinged covers shall not be allowed.

2.13.17 Scaffold Cable Support

Provide two scaffold cable supports on the tank roof in accordance with API Std 650. Locate the support near the center of the tank and in a manner that supported cables will have maximum range and flexibility of operation with minimum interference with other tank fittings.

2.13.18 Antiseize Compound

Provide marine grade antiseize compound for fasteners on tank exterior flanges and bolted connections and covers. On tank interior fasteners, use oil only.

2.13.19 Channel Mounting

Provide seal welded channel mounting pads with seal welded stainless steel bolting studs for mounting channel to support conduit, tubing, and level alarm test/drain piping. Rack tubing, small piping, and conduit parallel to the shell as indicated. Do not mount within 2 meters 7 feet above stairway.

2.13.20 Anchors

When anchors are required by API Std 650 provide with anchor bolt chairs conforming to AISI E 1 Steel Plate Engineering Data and as indicated.

PART 3 EXECUTION

3.1 SAFETY PRECAUTIONS

API RP 2009 for fire and explosion hazard areas.

3.2 API Std 653 INSPECTION REPORTS

The API Std 653 inspector shall inspect the completed tank in accordance with API Std 653 and deliver a full report to the Contracting Officer. The report shall include a record of ultrasonic thickness measurements (UTMs), exclusive of the coating, of each tank bottom plate, each bottom shell course plate at 5 random locations per plate, the shell along the circumferential stairway at 5 locations per shell course. The record of UTMs shall include sketches of the tank bottom plate and shell plate layouts. The location on each plate, where each ultrasonic thickness measurement (UTM) is taken, shall be recorded. Five UTMs shall be recorded on each tank bottom plate and on each lowest shell course plate. Five UTMs shall be recorded for each of the shell courses above the lowest shell course and shall be taken along the circumferential stairway. The report shall include the tank dataplate information and photograph of the tank data plate. Provide electronic copies of the tank inspection reports to MAJCOM, Service Headquarters, Service Control Points, and DLA-Energy. The paper and electronic copies of the report and UTMs shall be provided to the Contracting Officer for filing with the tank's "as-built drawings." Refer to Section 01 45 00.00 20 QUALITY CONTROL for API Std 653 inspector certification requirements.

3.3 CONSTRUCTION

3.3.1 Accessibility

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access in locations freely accessible through access doors.

3.3.2 Tank Erector Site Superintendent

Tank erector site superintendent shall be on site at all times during any work by that crew.

3.3.3 Floating Pan Superintendent

Floating pan superintendent shall be on site at all times during any work by the crew.

3.3.4 Tank

****
NOTE: Provide a reinforced concrete ring wall for all tanks, regardless of size. Include reference to API Std 650 requirement for level tolerances in concrete specification.
****

Provide tank of welded construction and support tank on a concrete ring wall. On the side of the tank furthest from the sump, slope the tank bottom down to the sump approximately 150 mm 6 inches for each 3.00 meters 10 feet of tank radius. Butt weld or lap weld bottom plates with the outer plates on top. Lap annular ring on top of bottom plates or butt weld to the bottom plates. Reinforce openings larger than 50 mm 2 inches in diameter through plating of the tank shell and roof. Provide structural stiffening, consisting of rings, thicker plates, or other approved means,

to maintain roundness when the tank is subjected to wind or seismic loads.

****
NOTE: Include tank data plate information in as-built drawings.
****

3.3.5 Roof Plate Seams

****
NOTE: Include the second (bracketed) sentence below in the Pacific and all other locations that have not proven to be non-corrosive.
****

Tank roof plate shall be lap welded with the plates closer to the center of the tank on top. [Seal weld the underside of all roof plate lapwelded seams.]

3.3.5.1 Prohibition of Protective Coatings on Surfaces to be Welded

Remove protective coatings on surfaces to be welded and on surfaces not less than 25 mm one inch from weld preparation. "Weld-through" inorganic zinc coatings and similar coatings will not be permitted.

3.3.6 Roof Supports

[When columns are provided in the tank, provide column base plates and 13 mm 1/2 inch thick bearing plates. Weld the columns to the column base plates. Center the column base plates on the bearing plates and weld the column base clip-guides to the bearing plates. Do not weld the column base plates to their bearing plates. Continuously seal weld the bearing plates to the tank bottom so as to provide a seal against the entry of water or other liquids into the space between the column bearing plates and the tank bottom. Bearing plates shall be larger than the base plates by at least 150 mm 6 inches in either direction. Provide seal-welded cap plates on all columns. Roof support columns shall be of pipe or round structural tubing.] [Roof support columns shall not be allowed.]

3.3.7 Surface Finishing

Provide Contracting Officer with NACE visual comparator as described in NACE SP0178 Section 4. Finish interior surfaces before hydrotesting, in accordance with Section 4 of NACE SP0178 and accompanying Visual Comparator, to the condition described and shown for NACE Weld Designation "C" welds. Finish exterior surfaces, in accordance with Section 4 of NACE SP0178 and accompanying Visual Comparator, to the condition described and shown for NACE Weld Designation "D" welds. Submit acknowledgement of surface finish requirements. Remove all weld splatter, sharp corners, edges and points from all carbon steel surfaces before coating.

3.3.8 Tank Bottom To Foundation Seal

****
NOTE: Include the first bracketed paragraph for self anchored tanks. Include the second bracket paragraph for anchored tanks.

****

[After welding of tank bottom annular ring butt welds of self anchoring tanks are complete, provide specified tank bottom to foundation gasket between the top of the foundation and the tank bottom with no gaps or overlaps between segments.]

[All anchored tanks are to be grouted before loading with water or product and before tightening anchor bolts. Prepare the top of the foundation for shimming and grouting by removing all dirt, sand, and loose material. Provide 25 mm 1 inch shim on top of foundation at high point and develop all other shim stacks to match the elevation of the shim at the high point of the foundation. Place shims a minimum of 38 mm 1 1/2 inches inside the perimeter of the tank bottom and under the tank shell. Do not retemper (add water) to a stiffening grout mix. Place grout within 30 minutes after mixing with water or discard the mix.]

****

NOTE: Include the following instructions in the execution section of the exterior coating specification:

After the exterior coating is cured, provide specified bond breaker tape on the outer perimeter of the tank bottom to foundation gasket as recommended. Seal the outer edge of the joint between the concrete foundation and the tank bottom plate by caulking with specified polysulfide sealant.

****

3.3.9 Attachments

All exterior shell and roof attachments shall be connected to the tank using continuously welded mounting plates. Mounting plates shall exceed the size of the attachment by a minimum of 25 mm 1 inch. All mounting plate corners shall have a 25 mm 1 inch radius. Attachment shall be seal welded to the mounting plate with structurally sound welds of sufficient size to support the intended loads.

3.3.10 Nozzles

All shell nozzles shall be flanged type. Shell nozzles sizes 50 mm(2 inches)or larger shall have a reinforcing plate. Nozzles for pipe connections inside the tank shall be flanged inside near the shell. Reinforcing plates for shell nozzles shall be rolled to the curvature of the shell.

3.3.11 Tank Bottom Sump

Weld sump to the underside of the tank bottom at the lowest point of the tank bottom as indicated.

3.4 INSTALLATION OF INTERNAL FLOATING PAN

Install floating pan after coating of the interior of the tank is complete. Protect tank coatings during installation of floating pan to prevent damage. Repair damage to the coating that may occur during the installation of the pan.

****
NOTE: Modify the coating specification to provide additional coating inspection after the floating pan is installed to ensure damage to the coating that may result from installation of the pan is properly repaired by the contractor.
****

3.5 END CONNECTIONS FOR EQUIPMENT, VALVES, PIPE, AND FITTINGS

All valve, equipment, pipe and fitting connections including, but not limited to, piping for the Water Draw-Off System, Sidestream Filtration System, drains, thermal reliefs, HLV float pilot chamber, and level switches shall be welded or flanged except as indicated. Piping and fittings 63 mm 2.5 inches and larger shall be butt welded. Piping and fittings 50 mm 2 inches and smaller may be butt welded or socket welded. Threaded connections shall not be allowed except where welded or flanged connections to appurtenances are not available, e.g., pressure gauges, fuel sample connections, level switch probes, HLV float pilot chamber, etc.

3.6 FIELD QUALITY CONTROL

The Contracting Officer will conduct field inspections and witness field tests and trial operations specified in this section. The Contractor shall perform all trial operations and field tests and provide all labor, equipment and incidentals required for testing.

3.6.1 Tank Calibration Table

****
NOTE: Delete paragraph if it is in the best interest of the Government to enter into a separate contract for tank calibration.
****

After installation of the tank is complete, provide two calibration tables stamped by a Professional Engineer, one in English units and one in metric units. Tables shall be laminated. Both tables shall show the volume of the fuel for all liquid levels in the tank starting at the bottom of the sump and going up to the level of the overflow. The English unit calibration table shall show the volume of fuel in gallons and in barrels of 42 gallons and the level of the fuel in 1/16-inch increments. The metric table shall show the volume of the fuel in liters and in m3 and the level of the fuel in 2.0 mm increments. The table shall include notes at the bottom indicating 42 gallons = 1 barrel; and one kiloliter = one cubic meter. Volume calculations shall be in the smaller units. Larger units may be obtained by rounding off. The 0 mm 0 inch level shall be the level of the bottom of the shell. Level below the bottom of the shell shall be shown in negative units starting at the bottom of the shell. The level of the bottom of the shell, alarm set points, high level shut off valve actuation point, and the level of the overflows shall be identified on the calibration table (strapping chart). The table shall not include tank volume above the level of the overflows. Also, provide Electronic Calibration Table compatible with the Electronic Automatic Tank Gauging System. Contact Contracting Officer for direction on required format.

3.6.1.1 Tank Calibration Method

The tank gauging systems shall be calibrated in accordance with the API Manual of Petroleum Measurement Standards (API MPMS) for critical measurement using methods outlined in one of the following chapters.

a. API MPMS 2.2A, Measurement and Calibration of Upright Cylindrical Tanks by the Manual Strapping Method.

b. API MPMS 2.2B, Calibration of Upright Cylindrical Tanks Using the Optical Reference Line Method.

c. API MPMS 2.2C, Calibration of Upright Cylindrical Tanks Using the Optical Triangulation Method.

d. API MPMS 2.2D, Calibration of Upright Cylindrical Tanks Using the Internal Electro-Optical Distance Ranging Method.

3.6.2 Weld Inspection

Perform inspection of welds in accordance with API Std 650. Inspect butt welds requiring complete penetration and complete fusion by the radiographic method. Inspect roof support column welds below design liquid level by visual and dye penetrant methods. Submit the following weld inspection reports to the Contracting Officer:

a. Visual examination of vertical shell-seam tack welds, if left in place, in butt welds.

b. Visual examination of initial pass of internal shell-to-bottom weld.

c. Vacuum box testing of internal shell-to-bottom initial weld pass.

d. Visual examination of completed internal and external shell-to-bottom welds.

e. Radiographic examination of shell butt weld.

f. Visual examination of shell butt welds.

g. Visual examination of fillet welds.

h. Visual examination of tank bottom plates after welding.

i. Vacuum box testing of tank bottom fillet weld.

j. Pneumatic tests of reinforcing plates.

3.6.3 Reports of Other Tests and Examinations

Submit reports of the results of the following examinations and tests required by API Std 650 to the contracting officer:

a. Hydrostatic testing.

b. Shell settlement measurements taken before, during, and after hydrostatic testing.

c. Internal bottom elevation readings taken before and after hydrostatic

testing.

d. Shell Plumbness.

e. Shell Roundness.

f. Maximum local deviations, shell.

3.6.4 Tightness Tests

Perform tightness tests described under this paragraph in accordance with API Std 650, as modified herein. Perform the tests after finishing welds in accordance with paragraph titled "Surface Finishing," but prior to blast cleaning and application of the protective coating. Submit tightness test records to the Contracting Officer.

3.6.4.1 Penetrating Oil Test

Inspect tank shell-to-bottom, inside corner welds using the penetrating oil test prior to any vacuum box testing. After the initial inside fillet weld is made, apply No. 2 Diesel to the outside of the inside corner weld (before the outside weld is made). After 4 hours, inspect the inside fillet weld for oil penetration through defects. The contractor shall correct any defects. Remove oil completely prior to finishing weld joint. Then, complete the remainder of the shell-to-bottom weld joint.

3.6.4.2 Vacuum Box Test of Tank Bottom

Perform a vacuum box test of the tank bottom immediately after installation and after completion of the penetrating oil test[and prior to installing any columns]. Test seams in bottom of tank and shell-to-bottom joint by applying a commercial soap film and subjecting the seam to a vacuum. Use a glass top vacuum box with hypalon or neoprene sealing gasket. Apply a commercial bubble forming solution to the weld or area to be tested; position the vacuum box over the area and slowly pull a partial vacuum. Observe the solution film for bubble formation between 0-14 kPa 0-2 psi differential pressure. Continue to open the valve until a differential pressure of 34.5 kPa 5 psi or 3.50 meters 11.5 feet of water or 259 mm 10.2 inches of mercury is achieved and hold for at least 20 seconds while continuing to observe the solution for bubbles.

****

NOTE: Check geotechnical report for expected tank settlement and adjust duration of hydrostatic testing to maintain tank full of water until the remainder of the expected consolidated settlement is within limits of flexibility designed into piping systems.

****

3.6.4.3 [Hydrostatic Test and] Settlement [During Fill Test]

****

NOTE: Availability of utilities services and charges are established by the activity and should be stated in Division 1 of the contract specifications. Contact authority having jurisdiction to determine what kind of water can be used, what flow rate is available for filling, days

and hours of availability, allowable disposal rate, required testing, and characteristics.

Use alternate test methods for testing shell, only if water supply is inadequate for filling the tank, only if tank is located in Alaska, Hawaii, or outside the CONUS, and only with service headquarters approval.

Include location regulatory requirements for water disposal permits, treatment, and testing of test water prior to disposal. Verify water discharge may be dumped without treatment.

****

Perform hydrostatic test with fresh water only. Prior to [hydrostatic] [fill] testing, check the capacity and condition of the tank venting and overflows to insure they are adequate to handle the potential rate of fill. This procedure shall be accomplished prior to application of coatings and before connecting product/operating piping to the tank. Shell settlement shall be measured before, during, and after [hydrostatic testing] [fill testing] in accordance with API Std 650. Hydrostatic test the shell by filling tank with water and maintaining it full for a period of not less than [24][_____] hours or until the settlement of the tank stabilizes, then inspect shell for leaks. The appearance of damp spots shall be considered evidence of leakage. Minimize water retention time to limit rusting of tank interior.[Adequate water for hydrostatic testing is not expected to be available. Contractor shall obtain approval of professional engineer in lieu of hydrostatic testing and shall perform alternate testing of shell in accordance with API Std 650 in addition to testing specified in the paragraph titled "Fill Test."] Repair leaks disclosed by the test; then, retest the tank to prove the tank is leak-free. [Sufficient] water to hydrostatically test [the tanks] [one tank] will [not] be provided free of charge by the Government [at a maximum rate of [_____]]. Water used on one tank shall be recycled to the fullest extent possible for use in testing subsequent tanks. No water shall be released to the sanitary or storm sewer systems without the expressed, written approval of the Contracting Officer.

3.6.5 Tank Bottom Puddle Test

Test slope of the tank bottom in the presence of the Contracting Officer by examining the plate immediately after hydrotesting. Puddling deeper than 5 mm 3/16 inch anywhere on the tank bottom plates shall not be accepted.

3.6.6 Fill Test and Related Miscellaneous Tests

3.6.6.1 Fill Test

After other tightness testing is complete and after application and cure of the interior and exterior coatings, fill test the tank using fuel. Tank piping and appurtenances shall be ready for service. The Government will provide the necessary fuel and labor to fill the tank with fuel. Advise the Contracting Officer, in writing, at least 14 calendar days in advance of the need for this service and provide access to the interior of the tank for the Contracting Officer's inspection to ensure the tank is clean and dry to the Government's satisfaction prior to receiving fuel.

****

NOTE: In the specification containing level alarms, include instructions to check the operation of the low-low, low, high, and high-high level alarms and verify operation of the alarm horn and light during the fill test, shut-off of pump at low level, and closure of issue MOV at low-low level.

****

a. Floating Pan Tests

Following the installation of a floating pan, the deck penetrations and rim area shall be subjected to a visual inspection for seal tightness. Leaks or seal deformations shall be corrected according to manufacturer's recommendations. Following the seal inspection, the floating pan shall be subjected to a flotation test. The tank shall be filled to the 3 meter 10 foot level with fuel and the top of the floating pan shall be visually inspected for fuel leakage. The appearance of damp spots on the top of the floating pan shall be considered evidence of leakage; the Contracting Officer shall be notified and the fuel removed immediately. Leaks shall be repaired and the flotation test performed again.

b. Fill Test Stages

Check to ensure drain valves are closed; fill tank to 50 percent of full capacity; and check tank for leaks. Keep tank half full the first 12 hours of test, then fill tank to within 75 mm 3 inches of the bottom of the overflows; check that drain valves are closed and check tank for leaks. Monitor tank level hourly during the first 24 hours of the fill test and notify the Contracting Officer immediately of any damp spots or leaks detected. Padlock drain valves closed for the duration of the test and provide one set of keys to the Contracting Officer. After the temperature of the fuel has become stabilized, take daily readings of the fuel level for a period of 10 calendar days. If there are no damp spots, discoloration, leaks or a measurable drop in the fuel level during this period, the tank will be accepted. If leakage becomes apparent during the filling or the test period, immediately notify the Contracting Officer and Government personnel will pump the fuel from the tank. Free the tank of vapor, clean it, and then carefully inspect the tank for evidence of failures at the Contractor's expense. Repair defects found and repeat fill tests.

c. Tank High Level Shutoff Valve

Check the operation of the high level shutoff valve on the inlet to the tank to insure that the valve closes completely and as indicated, no later than the high-high level. [Check closing by the float valve and the solenoid pilot valve separately.]Before the tank high level is reached, verify operation of the valve by[the manual operation of the float][and solenoid pilot] [as well as by] filling the level switch chamber[and again by filling the float chamber] with fuel. Check for proper operation when the tank is filled using appropriate safety measures.

d. Water Draw-Off System

Check System Operation

e. Side-Stream Filtration System

Check System Operation

****
NOTE: Insure systems that include new pumps or modifications that include pumps and piping are designed with pump overpressure recirculating relief. On projects that connect to existing receipt systems, include the following paragraph.
****

Consider the consequences of closing the valve against active pumps and take precautions to avoid damaging the system. Insure receipt pumps used to perform the test are equipped with overpressure recirculation relief or other means to protect the system from damage. If the test cannot be performed without risk of damage, notify the Contracting Officer.

3.6.7 Roof Puddle Test

After coating, test slope of the finished tank roof plate in the presence of the Contracting Officer by applying water for five minutes, evenly in all directions, at a rate of not more than 20 liters 5 gallons per minute, near the center of the roof, and examining the roof plate for puddling. Puddling deeper than 5 mm 3/16 inch anywhere on the tank roof plates shall not be accepted.

3.6.8 Retesting

Deficiencies found shall be rectified and work effected by such deficiencies shall be completely retested at the Contractor's expense.

3.6.9 Maintenance Instructions

Provide the following instructions in the Operation and Maintenance Data as follows: Schedule periodic recalibration of ATG at 15 year intervals in accordance with API Manual of Petroleum Measurement Standard (API MPMS) Chapter 2.0 for tanks in custody transfer service and at 15-20 year intervals for all others, or when operating variables of the storage tank change, or when internal dimensions and structural variables of the tank change.

3.6.10 Operator Instructions

Provide the following instructions in the Operation and Maintenance Data as follows:

a. Inspect the tank bottom to foundation perimeter mastic seal quarterly for deterioration and request maintenance when deterioration is found.

b. Keep the leak detection tell-tale valve/valves normally closed. Temporarily open the valves to check for tank bottom leaks on a monthly basis.

c. Test the low-low, low, high and high-high level alarm switches semiannually. Test level switches by simulating product levels either manually or by operating the water stripping system pump and level

alarm/control test/drain header valves.

d. Examine and clear the tank venting semi-annually to insure the vents have not become plugged.

-- End of Section --