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USACE / NAVFAC / AFCESA / NASA **UFGS-33 56 10 (January 2008)**

Preparing Activity: USACE **Superseding**
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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2012
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DIVISION 33 - UTILITIES

SECTION 33 56 10

FACTORY-FABRICATED FUEL STORAGE TANKS

01/08

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SECTION 33 56 10

FACTORY-FABRICATED FUEL STORAGE TANKS
01/08

****
NOTE: This guide specification covers the requirements for factory-fabricated fuel storage tanks.

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).
****

PART 1 GENERAL

****
NOTE: This specification is intended for systems using factory-fabricated storage tanks with capacities less than or equal to 200,000 L (50,000 gal). Additional equipment/devices necessary to meet state and local regulations will be added by the designer. Design and install tank storage applications in accordance with UFC 3-460-01 "Design: Petroleum Fuel Facilities".
****

1.1 SUMMARY

This section defines the requirements for factory-fabricated fuel storage

tanks.

1.1.1 Related Sections

1.1.1.1 Earthwork

****
NOTE: For underground tank installations, the designer developing the earthwork specifications will evaluate the need for a filter fabric to be installed between the native soil and the new backfill material. The intent of a filter fabric would be to prevent the displacement of new backfill material with native soil due to a high water table. If the new backfill material is displaced, it could affect the structural integrity of the tank specifically if the new tank(s) is the FRP type. If a filter fabric is determined to be necessary, include the requirements for the new fabric in the excavation and backfilling specifications.

Require backfill for Fiberglass Reinforced Plastic (FRP) tanks to be pea gravel or crushed stone. Require backfill for steel tanks to be pea gravel, crushed stone, or sand.

Require pea gravel to be between 3 and 20 mm (1/8 and 3/4 inch) in diameter. Require crushed stone to be between 3 and 13 mm (1/8 and 1/2 inch) in diameter. Require sand to be a fine aggregate that is washed and thoroughly dried, contains no more than 500 ppm chlorides, contains no more than 500 ppm sulfates, and has a pH greater than 7.
****

Excavation and backfilling for tanks shall be as specified in [Section 31 00 00 EARTHWORK] [Section 31 23 00.00 20 EXCAVATION AND FILL].

1.1.1.2 Leak Detection

Leak detection shall be as specified in Section 33 58 00 LEAK DETECTION FOR FUELING SYSTEMS.

1.1.1.3 Cathodic Protection

Provide buried metallic components including pipe, anchors, conduit, etc., with a cathodic protection system as specified in [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES] [and] [Section 26 42 17.00 10 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)] [Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT]. Cathodic protection for metal components that attach to a tank shall be coordinated and compatible with the tank corrosion control system.

1.2 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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN PETROLEUM INSTITUTE (API)

API MPMS 2.2A	(1995; R 2007) Measurement and Calibration of Upright Cylindrical Tanks by the Manual Strapping Method
API MPMS 2.2E	(2004; Errata 2009; R 2009) Petroleum and Liquid Petroleum Products - Calibration of Horizontal Cylindrical Tanks - Part 1: Manual Methods
API RP 1615	(2011) Installation of Underground Petroleum Storage Systems
API RP 2003	(2008; 7th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API RP 540	(1999; R 2004) Electrical Installations in Petroleum Processing Plants
API Std 1631	(2001) Interior Lining and Periodic Inspection of Underground Storage Tanks

ASME INTERNATIONAL (ASME)

ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for

Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A193/A193M	(2012a) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2012) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A27/A27M	(2010) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A48/A48M	(2003; R 2008) Standard Specification for Gray Iron Castings
ASTM A563	(2007a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B26/B26M	(2012) Standard Specification for Aluminum-Alloy Sand Castings
ASTM D3308	(2006) PTFE Resin Skived Tape
ASTM F844	(2007a) Washers, Steel, Plain (Flat), Unhardened for General Use

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1100	(2005) Emerald Book IEEE Recommended Practice for Powering and Grounding Electronic Equipment
IEEE 142	(2007) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2012; Errata 2011; Errata 2011) Flammable and Combustible Liquids Code
NFPA 30A	(2012; Errata 2011) Code for Motor Fuel

	Dispensing Facilities and Repair Garages
NFPA 407	(2012; TIA 11-1) Standard for Aircraft Fuel Servicing
NFPA 70	(2011; Errata 2 2012) National Electrical Code
NFPA 77	(2007) Recommended Practice on Static Electricity
NFPA 780	(2011) Standard for the Installation of Lightning Protection Systems

STEEL TANK INSTITUTE (STI)

STI F894	(2010) ACT-100 (R) Specification for External Corrosion Protection of FRP Composite Steel USTs
STI F911	(1998) Standard for Diked Aboveground Storage Tanks
STI P3	(2010) Specification and Manual for External Corrosion Protection of Underground Steel Storage Tanks
STI R912	(2009) Installation Instructions for Shop Fabricated Aboveground Tanks for Flammable, Combustible Liquids

UNDERWRITERS LABORATORIES (UL)

UL 1316	(1994; Reprint May 2006) Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures
UL 142	(2006; Reprint Feb 2010) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 1746	(2007) External Corrosion Protection Systems for Steel Underground Storage Tanks
UL 2085	(1997; Reprint Sep 2010) Protected Aboveground Tanks for Flammable and Combustible Liquids
UL 58	(1996; Reprint Jul 1998) Steel Underground Tanks for Flammable and Combustible Liquids

1.3 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.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Grounding and Bonding

SD-03 Product Data

Aboveground Storage Tank[; G][; G, [_____]]
Underground Storage Tank[; G][; G, [_____]]
Tank Protective Coatings
Automatic Level Alarm System
Tank Gauges
Manway Containment Sump
Tank Mounted Fuel Dispensing Unit
Fuel Heaters

SD-06 Test Reports

Aboveground Storage Tank Tightness Tests[; G][; G, [_____]]
Underground Storage Tank Tightness Tests[; G][; G, [_____]]
Tank Manufacturer's Tests
Tank Fill Tests

SD-07 Certificates

Contractor Qualifications[; G][; G, [_____]]

Permitting
Registration
Licensed Personnel
Demonstrations

SD-08 Manufacturer's Instructions

Aboveground Storage Tank
Underground Storage Tank
Automatic Level Alarm System
Tank Gauges
Fuel Heaters

SD-10 Operation and Maintenance Data

Aboveground Storage Tank
Underground Storage Tank
Automatic Level Alarm System
Tank Gauges
Fuel Heaters

1.4 QUALITY ASSURANCE

1.4.1 Contractor Qualifications

****
NOTE: Include specific local regulatory requirements into the specification as applicable.
****

Each installation Contractor shall have successfully completed at least 3 projects of the same scope, and the same size or larger within the last 6 years, and demonstrated specific installation experience in regard to the specific system installation to be performed. Each installation Contractor shall have taken, if applicable, manufacturer's training courses on the installation of storage tanks and shall meet all applicable licensing requirements in the state. Submit a letter listing prior projects, the date of construction, a point of contact for each prior project, the scope of work of each prior project, and a detailed list of work performed. The letter shall also provide evidence of prior manufacturer's training, state licensing, and other related information.

1.4.2 Regulatory Requirements

1.4.2.1 Permitting

Obtain necessary permits in conjunction with the installation of underground storage tanks as required by federal, state, or local authority.

1.4.2.2 Registration

Obtain and complete all required tank registration forms required by federal, state, and local authorities. Submit all tank registration forms within 30 days after contract award. The Contracting Officer will submit the forms to the proper regulatory agencies.

1.4.2.3 Licensed Personnel

Tank installers shall be licensed/certified by the state when the state

requires licensed installers.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 PROJECT/SITE CONDITIONS

Exposed moving parts, parts that produce high operating temperatures and pressures, parts that may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Install safety devices so that proper operation of equipment is not impaired.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 General

Provide materials and equipment that are standard products of a manufacturer regularly engaged in the manufacturing of such products, that are of a similar material, design and workmanship. Provide materials and equipment that have been in satisfactory commercial or industrial use for a minimum 2 years prior to bid opening. The 2 year period shall include applications of the equipment and materials under similar circumstances and of similar size. Provide materials and equipment that have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.[Products having less than a 2 year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours, exclusive of the manufacturer's factory tests, can be shown.]

2.1.2 Nameplates

****

NOTE: In a salt water environment, substitute acceptable non-corroding metal such as, but not limited to, nickel-copper, 304 stainless steel, or monel. Aluminum is unacceptable. Nomenclature (or system identification) should be established by the designer.

Require melamine plastic nameplates for all NAVFAC projects. Also for NAVFAC projects, require nameplates to be associated or keyed to system charts and schedules.

****

Attach nameplates to all specified equipment defined herein. List on each nameplate the manufacturer's name, address, [contract number,] [acceptance date,] component type or style, model or serial number, catalog number, capacity or size, and the system that is controlled. Construct plates of [anodized aluminum] [stainless steel] [melamine plastic, 3 mm 0.125 inch thick, UV resistance, black with white center core, matte finish surface and square corners] [_____]. Install nameplates in prominent locations

with nonferrous screws, nonferrous bolts, or permanent adhesive. Minimum size of nameplates shall be 25 by 65 mm one by 2.5 inches. Lettering shall be the normal block style with a minimum 6 mm 0.25 inch height. Accurately align all lettering on nameplates. [For plastic nameplates, engrave lettering into the white core.] [Key the nameplates to a chart and schedule for each system. Frame charts and schedule under glass, and locate where directed near each system. Furnish two copies of each chart and schedule. Each nameplate description shall identify its function.]

2.2 MATERIALS

****
NOTE: Include the bracketed information if aviation fuel will be handled.
****

Internal parts and components of equipment, piping, piping components, and valves that could be exposed to fuel during system operation shall not be constructed of zinc coated (galvanized) metal[, brass, bronze, or other copper bearing alloys]. Do not install cast iron bodied valves in piping systems that could be exposed to fuel during system operation.

2.3 ELECTRICAL WORK

****
NOTE: Coordinate the ignition temperature of the fuel(s) to be handled with the electrical design. Ignition temperatures will be as defined in NFPA 497M. Fuel ignition temperatures will dictate the maximum allowable temperature rating of the electrical equipment.
****

Provide controllers, integral disconnects, contactors, controls, and control wiring with their respective pieces of equipment. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide switches and devices necessary for controlling and protecting electrical equipment. Controllers and contactors shall have a maximum of 120-volt control circuits and shall have auxiliary contacts for use with the controls provided.

2.3.1 Underground Wiring

Enclose underground electrical wiring in PVC coated conduit. Dielectrically isolate conduit at any steel storage tank connection.

2.3.2 Grounding and Bonding

Grounding and bonding shall be in accordance with NFPA 70, NFPA 77, NFPA 407, NFPA 780, API RP 540, API RP 2003, IEEE 142, and IEEE 1100. Provide jumpers to overcome the insulating effects of gaskets, paints, or nonmetallic components.

2.4 ABOVEGROUND STORAGE TANK

****
NOTE: Two types of aboveground storage tanks are defined herein: single-walled steel tanks and secondarily contained tanks.

A single-walled steel tank has no inherent spill containment and can be mounted either on saddles or skids. For dike or spill containment designs refer to UFC 3-460-01 "Design: Petroleum Fuel Facilities" and/or 40 CFR 112 as applicable. When evaluating the application of a dike, note that a dike offers poor aesthetics and requires extensive maintenance following rainfall. The water and water/fuel mix contained in a diked area must be evaluated after each rain and then properly disposed.

Secondarily contained tanks are provided from the manufacturer with some type of secondary containment. Additional dikes and containment systems are not required for these tanks. Three types of secondarily contained tanks are defined herein: open-top, fully-enclosed steel, and fully-enclosed concrete. The cost of the fully-enclosed type reservoirs are significantly higher than the open-top type; however, the enclosed type may be desired because of maintenance concerns following rainfall. The water and water/fuel mix contained in an open-top reservoir must be evaluated after each rain and then properly disposed. Note that one of the primary advantages of an enclosed tank is the added vandalism protection that it provides verses a conventional metal tank. In areas where vandalism is probable, fully-enclosed tanks should be considered.

Note that waste oil or hazardous wastes should be stored in aboveground storage tanks. Even though EPA allows the storage of these products below ground, a majority of state and local regulations prohibit underground storage of such products. If a design requires underground storage of waste oil or hazardous wastes, confirm that the storage is allowed by state and local regulations. The storage of waste oil or hazardous wastes is bound by the same EPA requirements as is the storage of any other petroleum product.

****

2.4.1 Steel Tank With Integral Steel Supports

Provide a factory-welded, single wall [stainless] steel tank that conforms to NFPA 30, NFPA 30A, and UL 142. Tank shall be designed and manufactured for a [horizontal cylindrical] [vertical cylindrical] [rectangular] installation. Tank shall be mounted on the tank manufacturer's standard UL listed [tank saddles] [support skid] that elevates the tank above the underlying concrete slab a minimum of 305 mm 12 inches. [Support skid shall span the entire length of the tank.] [Provide a minimal 19 L (5 gallon) 5 gal overfill containment box on the tank fill line. The containment box shall be lockable and shall contain any spillage encountered at the tank during tank filling operations.]

2.4.2 Secondarily Contained Steel Tank

****
NOTE: Include 1 of the secondary containment subparagraphs listed below (open-top, steel containment, or concrete containment) and delete the others according to the project requirements.
****

Provide a factory-assembled unit that includes a primary storage tank and an integral factory-fabricated secondary containment. Tank assembly shall be in accordance with NFPA 30 and NFPA 30A and be designed and manufactured for a [horizontal cylindrical] [rectangular] installation. Primary storage tank shall be factory-welded, [stainless] steel that conforms to UL 142. Tank assembly shall be mounted on the tank manufacturer's standard UL listed support skid that elevates the tank assembly above the underlying concrete slab a minimum of 305 mm 12 inches. Tank assembly shall have lifting lugs that allow tank relocation. [Provide tank assembly with the manufacturer's standard external ladder and platform assembly, except as modified herein. The ladder and platform assembly shall be constructed of structural steel and shall allow personal access to the top of the tank system.] [Provide a minimal 19 L (5 gallon) 5 gal overfill containment box on the tank fill line. The containment box shall be lockable and shall contain any spillage encountered at the tank during tank filling operations.]

2.4.2.1 Open-Top Containment

The secondary containment reservoir shall be the factory-fabricated, open-top, [stainless] steel type that conforms to STI F911. The primary storage tank shall be supported within the containment reservoir with steel tank saddles, or other similar supports, fabricated and attached by the tank manufacturer. [The containment reservoir shall be designed to minimize entry of rainwater or blowing debris.] The containment reservoir shall be equipped with a 75 mm 3 inches drain that includes a full line size carbon steel drainage line and a full line size [ball][gate] valve.

2.4.2.2 Fully-Enclosed Steel Containment

****
NOTE: Tanks that conform to UL 2085 are referred to as protected tanks by NFPA 30A (2-hour fire rating when exposed to temperatures up to 2000 degrees F). Manufacturer's typically meet this 2-hour rating by using either concrete or some type of lightweight thermal insulation between the primary tank and the outer containment reservoir. The UL listing also includes minimum requirements for the assembly supports. Delete the bracketed information in this paragraph if a protected type assembly is not required.

These type tanks should always require a pressure testable and verifiable interstitial space between the primary tank and the containment reservoir regardless if the 2-hour rating is specified or not.
****

The secondary containment reservoir shall be the factory-fabricated,

[stainless] steel type that fully-encloses the primary storage tank. The containment reservoir shall conform to UL 142. The interstitial space between the primary tank and the containment reservoir shall be both pressure testable and verifiable. [The entire tank assembly shall conform to UL 2085. Tank assembly shall bear the UL 2085 label as a protected tank.] The primary storage tank shall be supported within the containment reservoir with steel tank saddles, or other similar supports, fabricated and installed by the tank manufacturer.

2.4.2.3 Fully-Enclosed Concrete Containment

The secondary containment reservoir shall be the factory-fabricated, concrete type that fully-encloses the primary storage tank. Concrete shall have a minimum 20.7 MPa (3000 psi) 3000 psi strength, be monolithically poured, and be properly reinforced for the application. The primary storage tank shall be isolated from the exterior concrete containment with either insulation, an inert material, or minimum 50 mm 2 inches standoffs. The interstitial space between the primary tank and the containment reservoir shall be both pressure testable and verifiable. The entire tank assembly shall conform to UL 2085. Tank assembly shall bear the UL 2085 label as a protected tank. No exterior enclosure shall be allowed to cover the reinforced concrete.

2.5 UNDERGROUND STORAGE TANK

****

NOTE: Provide a concrete anchor pad(s) or deadmen for any tank that will be installed in areas subject to high water tables or flooding. Size the pad(s) or deadmen in accordance with API RP 1615. Require the tank to be connected to the pad(s) or deadmen in accordance with the tank manufacturer's recommendations.

Delete the bracketed sentences if concrete anchor pads or deadmen are not required.

****

Provide a factory-fabricated, double-walled type storage tank that conforms to NFPA 30 and NFPA 30A. Tank shall be designed and manufactured for an underground, horizontal installation. The exterior tank walls shall be separated from the interior tank walls by standoffs; thus creating an open or interstitial space (Type II). The entire interstitial space shall be monitorable for leaks. [For tanks requiring concrete anchor pads or concrete deadmen, provide holddown straps and accessories as recommended by the tank manufacturer. Use filler strips between the tank shell and any metal holddown straps that conform to the tank manufacturer's requirements.]

2.5.1 Double-Walled Steel Tank

Tank shall be constructed of steel and shall conform to UL 58, Type II. Tanks constructed with lap welded shell or head joints shall be continuous fillet welded; on both the interior and exterior surfaces. The UL 58 label shall be affixed to the exterior surface of the tank.

2.5.2 Double-Walled FRP Tank

Tank shall be constructed of fiberglass reinforced plastic (FRP) and shall conform to UL 1316. The UL 1316 label shall be affixed to the exterior

surface of the tank.

2.6 TANK PROTECTIVE COATINGS

2.6.1 Interior Surfaces

****
NOTE: Delete this paragraph if FRP tanks are the only type tanks specified.

For Navy projects, reference Section 09 97 13.15. For Air Force projects, reference Section 09 97 13.17. For Army projects handling aviation fuel, reference either Section 09 97 13.15 or Section 09 97 13.17 as applicable. For Army projects dealing with non-aviation fuels, reference API Std 1631.
****

Coat 100 percent of a metal tank's interior surfaces including all metal piping and metal appurtenances as specified in [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] [API Std 1631].

2.6.2 Exterior Surfaces, Aboveground Tanks

****
NOTE: For Navy and Air Force projects, reference Section 09 97 13.27.
****

Protect the exterior surfaces of each aboveground tank [as specified in Section 09 97 13.27 EXTERIOR COATING OF STEEL STRUCTURES] [with the manufacturer's standard coating system as modified herein] [as specified in Section 09 90 00 PAINTS AND COATINGS].

2.6.3 Exterior Surfaces, Underground Tanks

****
NOTE: Delete this paragraph if FRP tanks are the only type tanks specified.
****

Provide steel tanks with one of the following corrosion protection systems.

2.6.3.1 FRP Coating System

****
NOTE: Steel tanks using an FRP coating system do not require any additional cathodic protection systems.
****

Coating system shall be in accordance with UL 1746 or STI F894. The integrity of the coating shall be certified by the manufacturer as meeting the thickness requirements and having no flaws prior to shipment. The UL and/or STI label(s) shall be affixed and visible on the exterior surface of each coated tank.

2.6.3.2 STI P3 System

****
NOTE: An STI P3 system provides an exterior protective coating, cathodic protection, and electrical isolation for corrosion protection. Electrical designer will verify that standard STI P3 protection is adequate for the site.
****

Coating system shall be in accordance with STI P3. Tank manufacturer shall be licensed by the Steel Tank Institute as an applicator of the STI P3 system. The STI label shall be affixed and visible on the exterior surface of each coated tank.

2.7 TANK COMPONENTS

2.7.1 Tank Manway

****
NOTE: Indicate the number, size, and location of each tank manway required.

Provide tanks 3,780 L (1,000 gallons) and larger with a minimum of 1 tank manway to allow for internal tank access. Provide tanks larger than 18,900 L (5,000 gallons) with a minimum of 2 tank manways (1 manway for access). Piping will not penetrate through access manways.

Provide tanks of 3,780 to 18,900 L (1,000 to 5,000 gallons) capacity with 760 mm (30 inch) diameter manways. Provide tanks larger than 18,900 L (5,000 gallons) with 915 mm (36 inch) diameter manways.
****

Tank manway shall have an internal diameter of [760 mm 30 inches] [915 mm 36 inches]. Provide each manway with a matching flanged watertight manway cover. Manway covers shall be UL listed, be constructed of pressed or mild steel, and include a UL listed gasket. [Frame and cover assembly shall be rated to withstand H-20 highway loading as defined by AASHTO HB-17.]

2.7.2 Tank Piping Penetrations

****
NOTE: Use tank manways as the primary point of entry for piping penetrations to underground storage tanks unless unavoidable. Pipe penetrations into a underground tank are the most likely place for a leak to occur. Designing pipe penetrations to enter through a tank manway allows each of the penetrations to be contained in a manway containment sump.

Where stand alone tank piping penetrations are required, indicate on the drawings the required number, size, and location of each penetration.
****

Provide a welded-in-place double tapered National Pipe Thread (NPT) coupling for each tank piping connection.

2.7.3 Tank Striker/Impact Plates

Provide an interior striker/impact plate under each tank manway and pipe connection. Each plate shall be a minimum of 6 mm 1/4 inch in thickness, be larger in diameter than the tank penetration, fit the curvature of the tank bottom, and be completely coated in the same fashion as the interior tank bottom coating. Each plate shall be welded to the tank bottom at the factory (full circumference connection).

2.7.4 Tank Cleanout and Gauge Assembly

Provide a combination cleanout and gauge assembly. The assembly shall include a bronze top-seal type adapter with a corresponding locking type cap (adapter and cap both externally-mounted to the top of the tank) and a steel or aluminum pipe mounted internal to the tank. The pipe shall be a minimum 50 mm 2 inches in size and extend downward through the top of the tank to within 75 mm 3 inches of the tank bottom. Provide the entire length of pipe inside the tank with 13 mm 1/2 inch wide by 300 mm 12 inches long slots at alternate locations. Coat the pipe in the same fashion as the interior tank bottom coating.

2.7.5 Tank Ladder

****
NOTE: Coordinate the need of an internal ladder with the user. Recommend providing tanks larger than 18,900 L (5,000 gallons) with an internal tank ladder. Internal ladders may not be appropriate on smaller tanks with only 1 manway. Indicate on the drawings which tank manway is to be provided with an internal ladder.
****

Provide interior tank ladders constructed of either fiberglass or steel. If steel, coat the ladder in the same fashion as the tank interior. The two stringers shall be a minimum 10 mm 3/8 inch thick and a minimum 50 mm 2 inches wide. The rungs shall be a minimum 20 mm 3/4 inch rod on 300 mm 12 inches centers. Members of the ladder shall be securely affixed. Ladder shall be of sufficient length to extend from the bottom of the tank to the top surface of the tank. Ladder shall be rigidly connected to the tank bottom in accordance with the tank manufacturer's standard. Ladder shall be connected to the top of the tank with pipe guides or slip bars to accommodate expansion of the two stringers.

2.7.6 Aboveground Tank Emergency Vent

****
NOTE: Delete this paragraph if aboveground storage tanks are not specified. Emergency venting is not required for underground tanks. Refer to NFPA 30, UL 142, and API Bulletin 2000 for vent sizing. Indicate the size and capacity of each vent on the drawings.
****

Vent shall be the normally-closed, UL listed type that vents outward and

upward. Vent shall conform with NFPA 30 and UL 142. Provide vent with the Liters per second (L/s) cubic feet per minute (cfm) rating permanently labeled on the the vent's exterior.

2.8 AUTOMATIC LEVEL ALARM SYSTEM

****

NOTE: UFC 3-460-01 requires an automatic level alarm system for both aboveground and underground tanks. Include the first bracketed sentence if multiple tanks are to be monitored as part of the design.

Coordinate the use of overfill valves with Section 33 57 00 or Section 33 52 10 as applicable.

****

Provide a system that will monitor 3 programmable liquid level setpoints. The system shall delineate between each individual setpoint [as well as each individual tank]. The system shall produce an audible and visible alarm in the event of monitoring an alarm condition. Mechanically-actuated float assemblies shall be field adjustable. The system shall be totally independent of the tank gauging system.

2.8.1 Setpoints

****

NOTE: For underground tanks, require the high and high-high setpoints to be 90 and 95 percent tank capacity respectively. For aboveground tanks, require the high and high-high setpoints to be 95 and 98 percent tank capacity respectively. Since horizontal tanks fill extremely fast in the last 5 percent of their volume, closely consider choosing lower setpoints based upon actual filling rates, tank size, and time needed to react.

The suggested low level alarm setpoint for both aboveground and underground tanks is 15 percent tank capacity. Modify this level accordingly in order to insure that air will not be drawn into the piping system.

****

Configure the alarm system's 3 setpoints in accordance with the following.

a. High Level Setpoint. Produce an alarm condition when a tank's liquid level rises above [90] [95] [_____] percent capacity.

b. High-High Level Setpoint. Produce an alarm condition when a tank's liquid level rises above [95] [98] [_____] percent capacity.

c. Low Level Setpoint. Produce an alarm condition when a tank's liquid level drops below [15] [_____] percent capacity.

2.8.2 Control Panel

****

NOTE: Indicate on the drawings the location of the

system control panel. Panels located outdoors will require NEMA 4 enclosures. Panels located indoors will only require a standard industrial enclosure. Explosion-proof enclosures are typically unavailable.

****

Install the control panel for the alarm system in a [NEMA 4 rated enclosure in accordance with NEMA 250] [standard industrial enclosure]. Panel doors shall swing left or right.

2.8.2.1 Audible Alarm

****

NOTE: If speakers external to the panel are necessary, indicate their location on the drawings.

****

Panel shall have [internal] [external] speakers that produce a buzzer sound of [70] [_____] decibels or greater in the event of a detected alarm condition.

2.8.2.2 Visual Alarm

Panel shall have a visual alarm that illuminates in the event of a detected alarm condition. The visual alarm shall include either individual lights for each alarm condition or shall include a single light and a liquid crystal display (LCD) panel that displaces information regarding each alarm condition.

2.8.2.3 Acknowledge Switch

Panel shall have a manual acknowledge switch that will deactivate the audible alarm. The acknowledge switch shall not deactivate subsequent audible alarms unless depressed manually again for each occurrence. Under no circumstance shall this acknowledgement switch extinguish the visual alarms until the alarm condition has been corrected. The acknowledge switch shall be an integral component located on the front of the control panel. The switch shall be either a key switch or push button.

2.9 TANK GAUGES

****

NOTE: Provide each tank with a stick gauge and tank calibration chart. Provide a minimum of one additional gauge for each tank. The additional gauge can be either the analog, hydrostatic, or digital type. Indicate on the drawings the location of each gauge display.

Provide tank gauges that meet federal, state and local requirements for aboveground and underground tanks. Digital tank gauges may be used as the primary alternative for meeting the regulatory requirements; however, for small fueling systems (i.e. single building's heating system) where a digital tank gauge and panel are not economical, analog or hydrostatic should be used. For underground tanks, new tank gauge alternatives must follow the requirements of 40 CFR 280.

****

2.9.1 Stick Gauge

For each tank, provide 2 wooden stick gauges. Gauge length shall allow the measurement of the entire level of fuel in the corresponding tank. Gauges shall be compatible with the fuel to be measured (no swelling or damage from fuel contact). Provide gauge with non-sparking caps on each end. Mark gauges in m and mm feet and inches. The smallest unit of measure on the gauge shall be 1 mm 1/16 inch.

2.9.2 Tank Strapping Table

****

NOTE: Choose the reference API MPMS 2.2E for horizontal tank applications. Choose API MPMS 2.2A for vertical tank applications.

****

Furnish [2] [_____] [API MPMS 2.2E] [API MPMS 2.2A] certified strapping tables (calibration charts) for each tank. Tables shall indicate the liquid contents in L gallons for each 1 mm 1/16 inch of tank depth. For each tank, provide an electronic media file of each strapping table.

2.9.3 Analog Tank Gauge

Gauge shall be the level sensing, mechanically actuated type that provides the tank level readout in a sealed glass cap contained in a gauge box. Gauge shall be accurate to plus or minus 6 mm 1/4 inch and shall measure the liquid level over the full range of a tank's height. Gauge shall have vapor tight seals to prevent condensation from fogging the viewing glass.

2.9.4 Hydrostatic Tank Gauge System

System shall be the dial type calibrated in Liters gallons. Gauge shall be manually actuated using a built-in hand pump. The transmission line from the gauge to the tank shall be seamless copper tubing run in Schedule 80 PVC carrier pipe. The tank assembly (fittings, air bells, and tubing) shall be installed according to the gauge manufacturer's recommendations.

2.9.5 Digital Tank Gauge System

****

NOTE: The digital readout provided by a digital tank system can be sent to a stand-alone electronic panel or the signal can sent to the same panel that is used for leak detection monitoring.

If both leak detection monitoring and digital tank gauge systems are to be used in the same project, then require the digital readout from both systems be sent to the same electronic monitoring/alarm panel provided under Section 33 58 00.

If a leak detection system is not required as part of the project, then require a stand-alone electronic panel to present the digital readout from the gauge system. Indicate the location of the panel on the drawings. Panels located outdoors will

require NEMA 4 enclosures. Panels located indoors will only require a standard industrial enclosure.
****

Gauge system shall be the mechanically or electronically actuated type that can continuously monitor a tank's usable liquid level storage capacity. The system shall provide a digital readout of a tank's liquid level in terms of mm and L inches and gallons. The system shall be accurate to plus or minus 2 mm 1/16 inch. The system shall measure water accumulation in mm inches from 20 to 125 mm 3/4 to 5 inches off the bottom of a storage tank. Construct system components to be chemically compatible with the fuel to be handled. For each tank monitored, provide a sending unit that transmits the digital readout from a tank to [the electronic monitoring/alarm panel defined in Section 33 58 00 LEAK DETECTION FOR FUELING SYSTEMS] [an electronic display panel. Panel shall be [a NEMA 4 enclosure as defined by NEMA 250] [standard industrial enclosure]. Panel doors shall swing left or right. The panel shall display the digital readout of each monitored tank on an LCD mounted exterior to the panel. The panel shall also have external controls to allow operators to toggle between information on the LCD without having to open the panel.]

2.10 MANWAY CONTAINMENT SUMP

****
NOTE: Delete this paragraph if underground storage tanks are not specified.

Require on the drawings a containment sump to be installed directly above each tank manway. Do not require the sump to be connected in any way to the surfaces above (e.g., street manway cover, concrete, etc.).

Typical installations include a street manway cover to be installed directly above each sump in order to allow access to the sump and the tank manway below. Size the manway cover large enough to allow the removal of the sump access cover below.
****

Sump shall be the factory-fabricated, direct-buried type that provides a watertight connection either directly to the exterior of the tank or to a flanged manway opening. Sump shall be constructed of either fiberglass reinforced plastic or molded polyethylene. Sump construction shall be chemically compatible with the type of products being handled within the connecting tank. Sump shall allow access to a tank manway cover without disturbing surrounding backfill. Sump shall be larger in diameter than the connecting tank manway. Sump shall be designed to withstand the underground burial loads. Sump assembly shall prevent the influx of rainfall drainage or ground water.

2.10.1 Piping Penetrations

Sump sides shall allow the penetration of carrier pipes, exterior containment pipes, conduits, and vapor pipes as required. Sump penetrations shall be booted or sealed to ensure that liquid will not escape from the sump in the event that the liquid level within the sump rises above the pipe penetration. Boots and seals used shall be compatible with the fuel to be handled. Boots and seals shall be water resistant to

the influx of water from outside the sump. Boots and seals shall be designed and installed to accommodate the anticipated amount of thermal expansion and contraction in the piping system.

2.10.2 Access Cover

****
NOTE: Require watertight covers if high ground water is a problem and frequent access to the manway below is not necessary. Watertight covers are generally bolted down. Friction fit covers will prevent the influx of rainwater and are easily removable by hand.
****

Where indicated, the entire top of a containment sump shall be capped with a [friction fit] [bolted down, watertight] access cover. Cover shall be constructed of the same material as the sump. Cover shall have a larger diameter than the tank manway cover below.

2.11 TANK MOUNTED FUEL DISPENSING UNIT

****
NOTE: Tank mounted dispensing units are optional systems that are typically provided directly from the tank manufacturer. The units are mounted directly to aboveground storage tank assemblies and are intended for use in low-volume, simple fueling applications where detailed fuel metering is not a concern.

Per NFPA 30A, only specify these type dispensing units if they are used in conjunction with a protected aboveground tank that conforms to UL 2085 (fully-enclosed concrete contained aboveground tank or fully-enclosed steel contained aboveground tank). These type dispensing units will not be used with any other type storage tank.
****

Provide fuel dispensing unit with integral UL labeled suction pump as supplied by the tank manufacturer. Unit shall include all necessary appurtenances for operation. Unit shall include a visible register to indicate individual deliveries up to 999.9 liters 99.9 gallons with a reset meter. Pump shall have a delivery capacity of 0.95 liters/sec 15 gpm. Hose shall be a minimum 20 mm 3/4 inch inside diameter, 4.6 meters 15 ft long, and fuel resistant. The dispensing nozzle shall be of the automatic shutoff type with graduated notches for various delivery speeds. Dispensing unit shall provide a means for locking of the nozzle to the pump when the pump is shutoff. [Diesel fuel dispensing unit cabinet shall be painted yellow from the manufacturer.] [Gasoline dispensing unit shall be painted red from the manufacturer.] Units shall be clearly marked for the fuel they are dispensing.

2.12 FUEL HEATERS

****
NOTE: Indicate on the drawings the maximum temperature fuel is to be heated as well as the

recovery rate required of the fuel heater. If steam or hot water are to be used as the heating medium, indicate their corresponding supply temperature, pressure, and flow rate on the drawings.

Electric type heaters are typically mounted at the bottom level of a tank. Require the tank manufacturer to provide a properly sized pipe nozzle at the bottom end of a tank to accommodate the heater.

****

2.12.1 In-Tank Heater

2.12.1.1 Fintube Type

Provide a vertical, manway-mounted, fintube immersion heater. Construct entire assembly to be compatible with the product to be heated. Entire assembly shall be removable as a unit. Construct heater's coil of [carbon steel] [stainless steel] tubes and fins. Construct heater to work with a heating medium of [steam] [hot water] supplied at [_____] degrees C degrees F and [_____] kPag psig. Construct heater's tank mounting flange of steel with a bolt pattern to match the corresponding tank manway. Provide ASME B16.5, Class 150 flanges on the heating medium inlet and outlet. Extend assembly within 150 mm 6 inches of the tank bottom.

2.12.1.2 Electric Type

Provide a flanged, horizontally-mounted, immersion type electric heater. Heater shall be UL listed and be compatible with the product to be heated. Construct heater's mounting flange of steel with a bolt pattern to match the corresponding tank nozzle. Heating element shall be non-coking for the intended application. Entire assembly shall be removable as a unit. If support brackets are required internally in a tank to mount the heating element above the tank bottom, provide heater manufacturer's standard support brackets. Install support brackets directly on a tank's internal striker plates. Mounting a heater's support brackets directly to a tank's bottom shall not be allowed.

2.12.2 Tank Suction Heater

2.12.2.1 Shell-and-Tube Type

Provide a vertical, manway-mounted, shell-and-tube type suction heater. Construct heater in accordance with ASME BPVC SEC VIII D1 with a rated working pressure of 1034 kPa (gage) 150 psig. Assembly shall be compatible with the product to be heated. Entire assembly shall be removable as a unit. Construct heater's shell and tube bundle of [carbon steel] [stainless steel]. Construct heater to work with a heating medium of [steam] [hot water] supplied at [_____] degrees C degrees F and [_____] kPag psig. Construct heater's tank mounting flange of steel with a bolt pattern to match the corresponding tank manway. Provide ASME B16.5, Class 150 flanges on the heating medium inlet and outlet as well as the suction discharge piping. Extend assembly within 150 mm 6 inches of the tank bottom. Provide heater with drain, vent, thermometer, and pressure gage.

2.12.2.2 Electric Type

Provide a flanged, horizontally-mounted, electric type suction heater.

Heater shall be UL listed and be compatible with the product to be heated. Construct heater's mounting flange of steel with a bolt pattern to match the corresponding tank nozzle. Heating element shall be non-coking for the intended application. Entire assembly shall be removable as a unit. Provide ASME B16.5, Class 150 flanges on the suction discharge piping. Provide heater with drain, vent, thermometer, and pressure gage. If support brackets are required internally in a tank to mount the heating element up off the tank bottom, provide heater manufacturer's standard support brackets. Install support brackets directly on a tank's internal striker plates. Mounting a heater's support brackets directly to a tank's bottom shall not be allowed.

2.12.3 Pipe In-Line Heater

Provide a horizontal, shell-and-tube type in-line heater. Construct heater in accordance with ASME BPVC SEC VIII D1 with a rated working pressure of 1034 kPa (gage) 150 psig. Construct entire assembly to be compatible with the product to be heated. Construct heater's shell and tube bundle of [carbon steel] [stainless steel]. Construct heater to work with a heating medium of [steam] [hot water] supplied at [_____] degrees C degrees F and [_____] kPag psig. Provide ASME B16.5, Class 150 flanges on the heating medium inlet and outlet as well as the fuel inlet and outlet connections. Provide heater with manufacturer's standard support brackets. Provide heater with drain, vent, thermometer, and pressure gage.

2.12.4 Temperature Controls

Provide heater with automatic temperature controls that can regulate the discharge product temperature as indicated. Provide necessary sensors and wiring needed for a fully functional control system. Construct controls to allow for adjustable discharge product temperatures. Provide an automatic high limit safety heater shutoff that is field adjustable. Provide a manual "on-off" switch in series with the automatic temperature controls in order to allow manual shutdown/startup. Provide temperature control components in a mountable and prewired NEMA 4 enclosure that conforms to NEMA 250.

2.13 INSPECTION WELL

****
NOTE: Delete this paragraph if underground storage tanks are not included in the project. Each site should have a maximum of 2 inspection wells located at opposing corners of the storage tank site. Sites with one storage tank should only require one inspection well. Inspection wells will not be used as monitoring wells. Inspection wells can serve as an inexpensive means of providing secondary verification of a leak as well as serving as a pump-out well for contaminated sites.
****

Inspection well shall be constructed of Schedule 40 PVC pipe that is 150 mm 6 inches in diameter. Pipe shall be factory slotted from the bottom to within 300 mm 12 inches of grade. With the pipe installed vertically, slots shall be horizontal and have a width of 0.5 mm 0.02 inch with not less than 30 slots per 300 mm ft. Slots shall encompass at least 80 percent of the pipe's 360 degree perimeter with the pipe maintaining its structural integrity. Slots shall allow fluid within the soil to

infiltrate into the pipe without allowing sediment to fill the pipe. Each well shall extend down 600 mm 2 ft below the deepest buried storage tank. Well shall have a permanently fixed bottom cap. Well shall have a removable top cap that is protected from traffic with a watertight street manway and cover as indicated. Well shall have a 10 mm 3/8 inch vent hole located directly below the top cap to vent the well. The top cap of each well shall be accessible from the surface through a 300 mm 12 inches diameter manhole. The manhole ring shall be constructed of steel, cast iron, or fiberglass, have a cast iron cover, be a minimum of 300 mm 12 inches deep, and withstand H-20 highway loading as defined by AASHTO HB-17. Each manhole cover shall have the words "DO NOT FILL - INSPECTION WELL" cast permanently into the top. The letters shall be a minimum of 13 mm 1/2 inch in size. Each manhole cover shall have a white circle with a black triangle painted on the surface.

2.14 ACCESSORIES

2.14.1 Concrete Anchor Bolts

Concrete anchors shall conform to ASTM A307, Grade C, hot-dipped galvanized.

2.14.2 Bolts and Studs

Carbon steel bolts and studs shall conform to ASTM A307, Grade B, hot-dipped galvanized. Stainless steel bolts and studs that conform to ASTM A193/A193M, Grade 8.

2.14.3 Nuts

Carbon steel nuts shall conform to ASTM A563, Grade A, hex style, hot-dipped galvanized. Stainless steel nuts shall conform to ASTM A194/A194M, Grade 8.

2.14.4 Washers

Provide flat circular washers under each bolt head and each nut. Washer materials shall be the same as the connecting bolt and nut. Carbon steel washers shall conform to ASTM F844, hot-dipped galvanized. Stainless steel washers shall conform to ASTM A194/A194M, Grade 8.

2.14.5 Polytetrafluoroethylene (PTFE) Tape

Tape shall conform to ASTM D3308.

2.14.6 Street Manway Assembly

****
NOTE: Delete this paragraph if street manway assemblies are address in the Civil specifications.

Style A frames are for manways up to 760 mm (30 inches) in diameter. Style B frames are for manways between 915 and 1070 mm (36 and 42 inches) in diameter.
****

Round street manhole frames and covers shall be the straight traffic type. Frames and covers shall be constructed of [cast steel in accordance with ASTM A27/A27M, grade 60-30 as a minimum] [cast iron in accordance with

ASTM A48/A48M] [aluminum in accordance with ASTM B26/B26M] [or] [a engineered lightweight laminate material]. [Covers shall be the solid plate type with a checker pattern.] Covers shall form a watertight seal with the manhole frame to prevent surface water inflow. Frame and cover assembly shall be rated to withstand H-20 highway loading as defined by AASHTO HB-17.

2.15 FINISHES

2.15.1 Factory Coating

****
NOTE: For all Navy projects (regardless of location), the 500 hour salt spray test is required and must be specified.

For Army projects, a salt spray test is optional. The 125 hour test is suggested for mild or noncorrosive environments. The 500 hour test is suggested for extremely corrosive environments.
****

Unless otherwise specified, provide equipment and components fabricated from ferrous metal with the manufacturer's standard factory finish. [Each factory finish shall withstand [125] [500] hours exposure to the salt spray test specified in ASTM B117. For test acceptance, the test specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 3 mm 1/8 inch on either side of the scratch mark immediately after completion of the test.] For equipment and component surfaces subject to temperatures above 50 degrees C 120 degrees F, the factory coating shall be appropriately designed for the temperature service.

PART 3 EXECUTION

3.1 INSTALLATION

****
NOTE: During design, layout equipment and components to allow adequate access for routine maintenance. Do not rely solely on the Contractor to make these judgments. Show access doors where applicable for maintenance.
****

Install work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Handle storage tanks with extreme care to prevent damage during placement and install in accordance with the manufacturer's installation instructions and NFPA 30 or NFPA 30A, as applicable. Inspect the exterior surface of each tank for obvious visual damage prior to and during the placement of each storage tank. Repair surface damage to a storage tank according to manufacturer's requirements before proceeding with the system installation. Provide the termination of fill lines within a tank with an antisplash deflector. Provide nylon dielectric bushings on pipe connections to a steel tank.

3.1.1 Underground Storage Tank

Install underground storage tanks in accordance with API RP 1615 except as

modified herein. Place tank on a 3 mm per 30 mm 1/8 inch per foot slope with the fill point at the low end and the vent connection at the high end. Locate tank so that the fuel discharge pipes slope up uniformly toward the fuel outlet. Install containment sumps prior to any backfill being added above the storage tanks.

3.1.1.1 Steel Tank Handling

Store, handle, and place externally coated steel tanks with care and in a manner that will minimize damage to the coating and will not reduce its protective value. Place coated tanks in position carefully and with a minimum of handling. Prior to backfilling a tank, visually inspect the tank exterior protective coating for damage. Repair any damaged tank coating in accordance with the appropriate UL or STI standard (UL 1746, STI F894, or STI P3).

3.1.1.2 Steel Tank Installation Procedures

[Set tank on a minimum of 150 mm 6 inches of backfill material.] [Anchor tank to a reinforced concrete anchor pad as indicated using manufacturer's supplied holddown straps. Separate tank from an anchor pad by a minimum of 300 mm 12 inches of backfill material. Coat metal straps, turnbuckles, anchors, and accessories to resist corrosion.] Uniformly place backfill material around the entire tank and extend to grade level. Inspect tank cathodic protection anodes, if applicable, to ensure integrity during backfill operations.

3.1.1.3 FRP Tank Handling

Handle tank with extreme care to prevent damage during installation and transportation to the site. Any damaged tank shall be replaced or repaired and tested under direct supervision and advice of the tank manufacturer, using the manufacturer's written procedures.

3.1.1.4 FRP Tank Installation Procedures

[Set tank on a minimum of 150 mm 6 inches of backfill material.] [Anchor tank to a reinforced concrete anchor pad as indicated through the use of manufacturer's supplied holddown straps. Separate tank from an anchor pad by a minimum of 300 mm 12 inches of backfill material.]

3.1.2 Equipment

Properly level, align, and secure equipment in place in accordance with manufacturer's instructions. Provide supports for equipment, appurtenances, and pipe as required. Install anchors, bolts, nuts, washers, and screws where required for securing the work in place. Sizes, types, and spacings of anchors and bolts not indicated or specified shall be as required for proper installation.

3.2 FIELD QUALITY CONTROL

3.2.1 Aboveground Storage Tank Tightness Tests

Perform tightness tests on each aboveground storage tank prior to making piping connections. Perform testing in accordance with STI R912 except as modified herein. Gauges used to monitor the tests shall have a scale with a maximum limit of 69 kPa 10 psig. Repair leaks discovered during the tightness tests in accordance with tank manufacturer's instructions.

Following any repair, re-test the tank until the tank successfully passes the testing requirements of this paragraph.

3.2.2 Underground Storage Tank Tightness Tests

****
NOTE: Pneumatic tests are the preferred type of tightness tests. Brine level tests will only be specified for FRP tanks. Delete the inapplicable tests.
****

Perform a tightness test on each underground storage tank on-site just prior to their placement into the ground. Pneumatically pressurize each storage tank's primary chamber to 35 kPa 5 psig and monitor for a drop in pressure over a 2-hour period during which there shall be no drop in pressure in the tank greater than that allowed for thermal expansion and contraction. Following the successful completion of the primary chamber test, bleed the pressure from the primary chamber into the interstitial space. Maintain this pressure while applying soapsuds or equivalent material over the exterior of the tank. While applying the soapsuds, visually inspect the entire tank, including the bottom surfaces, for leaks (bubble formations). Inspection of the bottom surfaces of a tank may be performed by rotating the tank; however a tank shall only be rotated in strict accordance with the manufacturer's recommendations. Do not rotate a tank more than 90 degrees from the upright position. During testing, install a pressure relief device that relieves at the tank manufacturer's suggested pneumatic pressure limit. Gauges used in pneumatic tests shall have a scale with a maximum limit of 69 kPa 10 psig.

3.2.2.1 Brine Level Test

In lieu of the pneumatic testing procedures described above, a brine level test may be performed on the interstitial space of double-walled FRP tanks (not applicable to steel tanks). For a brime level test, completely fill a FRP tank's interstitial space with a brine solution. Connect a riser pipe to the interstitial space that will allow the solution to rise up within the riser at least 300 mm 12 inches. After filling the interstitial space, the tank shall set approximately 3 hours. Following the 3-hour period, measure and record the level of solution within the riser. After a subsequent 4-hour period, again measure and record the level of solution within the riser. If the level of solution within the interstitial decreases anytime during the test, the tank is considered leaking and therefore fails the test.

3.2.2.2 Repairs

Repair leaks discovered in either the primary chamber or the interstitial space in accordance with the tank manufacturer's instructions. Following any tank repairs, re-test the tank until the tank successfully passes the testing requirements defined herein.

3.2.3 Tank Manufacturer's Tests

In addition to the tests required herein, perform any additional tests (i.e., leak tests, cathodic protection verification tests, etc.) on each storage test that is required by the tank manufacturer's written test procedures. Manufacturer's tests that are redundant to tests already required by this specification will only be performed once per tank.

Repair all leaks discovered during the tests in accordance with manufacturer's instructions. Following tank repairs, re-test the tank until the tank successfully passes the manufacturer's testing requirements.

3.2.4 System Commissioning

System commissioning shall conform to Section 33 08 55 COMMISSIONING OF FUEL FACILITY SYSTEMS.

3.3 DEMONSTRATIONS

Conduct a training session for designated Government personnel in the operation and maintenance procedures related to the equipment/systems specified herein. Include pertinent safety operational procedures in the session as well as physical demonstrations of the routine maintenance operations. Furnish instructors who are familiar with the installation/equipment/systems, both operational and practical theories, and associated routine maintenance procedures. The training session shall consist of a total of [_____] hours of normal working time and shall start after the system is functionally completed, but prior to final system acceptance. Submit a letter, at least 14 working days prior to the proposed training date, scheduling a proposed date for conducting the onsite training.

3.4 Tank Fill Tests

Tank fill tests shall not be performed until after the flushing, cleaning, and adjusting requirements defined in Section 33 08 55 COMMISSIONING OF FUEL FACILITY SYSTEMS. For the tank fill tests, initially fill each storage tank with fuel in order to verify the tank level alarm system operates properly and the tank overfill protection device functions as designed. Stop filling each tank immediately once the overfill devices operates. Do not overfill any storage tank more than the 98 percent level. Drain the system below the low liquid level setpoint to verify operation of the low level alarm. Correct and retest any problems with the level alarm system or the overfill device until each operate as specified herein. During the tests, verify that all tank gauges are calibrated and operating appropriately.

3.5 FIELD PAINTING

Painting required for surfaces not otherwise specified shall be field painted as specified in [Section 09 97 13.27 EXTERIOR COATING OF STEEL STRUCTURES][Section 09 90 00 PAINTING, GENERAL]. Do not paint stainless steel and aluminum surfaces. Do not coat equipment or components provided with a complete factory coating. Prior to any field painting, clean surfaces to remove dust, dirt, rust, oil, and grease.

-- End of Section --