UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2019
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SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 56 10

FACTORY-FABRICATED FUEL STORAGE TANKS

05/19

-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA | **UFGS-33 56 10 (May 2019)**

Preparing Activity: USACE | **Superseding UFGS-33 56 10 (January 2008)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 33 56 10

FACTORY-FABRICATED FUEL STORAGE TANKS
05/19

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NOTE: This guide specification covers the requirements for factory-fabricated fuel storage tanks. Tanks associated with equipment like generators but not integral to the equipment are also covered by this specification. Generator base tanks or belly tanks are not covered by this specification and must meet the requirements of Section 26 32 13.00 20 SINGLE OPERATION GENERATOR SETS.

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 item(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

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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. For larger tank sizes, contact Service Headquarters. Additional system components/devices necessary to meet state and local regulations must be added by the designer. Design and install tank storage applications in accordance with UFC 3-460-01 "Design: Petroleum Fuel Facilities."

The design and installation of all aboveground and underground factory-fabricated fuel storage tanks must be coordinated with Base Environmental.
****

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 must 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 must be as specified in Section 33 58 00 LEAK DETECTION FOR FUELING SYSTEM.

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 must 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 Reference Identifier (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 2017) Manual of Petroleum Measurement Standards Chapter 2-Tank Calibration Section 2A-Measurement and Calibration of Upright Cylindrical Tanks by the Manual Tank 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	(2015; 8th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API RP 540	(1999; R 2004) Electrical Installations in

Petroleum Processing Plants

ASME INTERNATIONAL (ASME)

ASME B16.5	(2017) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME BPVC SEC VIII D1	(2017) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A193/A193M	(2017) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2018) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A27/A27M	(2017) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM B26/B26M	(2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings
ASTM D3308	(2012; R 2017) PStandard Specification for TFE Resin Skived Tape
ASTM F844	(2007a; R 2013) 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; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2018) Flammable and Combustible Liquids Code
NFPA 30A	(2018) Code for Motor Fuel Dispensing Facilities and Repair Garages
NFPA 31	(2016) Standard for the Installation of Oil-Burning Equipment
NFPA 407	(2017) Standard for Aircraft Fuel Servicing
NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
NFPA 704	(2017) Standard System for the Identification of the Hazards of Materials for Emergency Response
NFPA 77	(2014) Recommended Practice on Static Electricity
NFPA 780	(2017) Standard for the Installation of Lightning Protection Systems

STEEL TANK INSTITUTE (STI)

STI 020-50-1000	(2010) ACT-100 Specification for External Corrosion Protection of FRP Composite Steel USTs
STI 700-50-5007	(2010) Installation Instructions for Shop Fabricated Aboveground Tanks for Flammable, Combustible Liquids
STI F911	(1998; Reissued 2009) Standard for Diked Aboveground Storage Tanks
STI P3	(2011) Specification and Manual for External Corrosion Protection of Underground Steel Storage Tanks
STI SP001	(2018, 6th Ed) SP001 Standard for The Inspection of Aboveground Storage Tanks
STI SP131	(2014) SP131 Standard for Inspection & Repair Underground Steel Tanks

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-161	(2005; Rev G; Notice 1 2010) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

UNDERWRITERS LABORATORIES (UL)

UL 1316	(2018) UL Standard for Safety Fiber Reinforced Underground Tanks for Flammable and Combustible Liquids
UL 142	(2006; Reprint Jul 2013) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 1746	(2007; Reprint Dec 2014) 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	(2018) UL Standard for Safety Steel Underground Tanks for Flammable and Combustible Liquids
UL 80	(2007; Reprint Jan 2014) Standard for Steel Tanks for Oil-Burner Fuels and Other 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.

The "S" following a submittal item indicates that the submittal is required for the Sustainability eNotebook to fulfill federally mandated sustainable

requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. Locate the "S" submittal under the SD number that best describes the submittal item.

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.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. 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 (Single Wall Steel); G[, [_____]]

Aboveground Storage Tank (Double Wall Steel); G[, [_____]]

Aboveground Storage Tank (Double Wall, Concrete Encased); G[, [_____]]

Underground Storage Tank; G[, [_____]]

Tank Protective Coatings; G[, [_____]]

Atmospheric Vent; G[, [_____]]

Pressure/Vacuum Vent; G[, [_____]]

Emergency Vent; G[, [_____]]

Independent Level Alarm System; G[, [_____]]

Tank Gauges; G[, [_____]]

Manhole Containment Sump; G[, [_____]]

Tank Mounted Fuel Dispensing Unit; G[, [_____]]

Fuel Heaters; G[, [_____]]

SD-06 Test Reports

Aboveground Storage Tank Tightness Tests; G[, [_____]]

Underground Storage Tank Tightness Tests; G[, [_____]]

Tank Manufacturer's Tests

Tank Fill Tests

Tank Inspection Reports; G[, [_____]]

SD-07 Certificates

Contractor Qualifications; G[, [_____]]

Manufacturer's Certification; G[, [_____]]

State Certification; G[, [_____]]

Pollution Liability Insurance

Permitting

Registration

Licensed Personnel

Demonstrations

STI SP001 Inspector's Certification; G[, [_____]]

SD-08 Manufacturer's Instructions

Aboveground Storage Tank

Underground Storage Tank

Independent Level Alarm System

Tank Gauges

Fuel Heaters

SD-10 Operation and Maintenance Data

Aboveground Storage Tank; G[, [_____]]

Underground Storage Tank; G[, [_____]]

Independent Level Alarm System; G[, [_____]]

Tank Gauges; G[, [_____]]

Fuel Heaters; G[, [_____]]

1.4 QUALITY ASSURANCE

1.4.1 Contractor Qualifications

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

Each installation Contractor must have successfully completed at least 5

projects of the same scope, and the same size or larger within the last 3 years and demonstrated specific installation experience in regard to the specific system installation to be performed. Each installation Contractor must have taken, if applicable, manufacturer's training courses on the installation of storage tanks and must meet all applicable licensing requirements in the state. If applicable, state certified installers must be provided by the Contractor. Installers must also be trained and certified by the manufacturer to install the equipment and materials being installed and must be STI certified. Installers must submit certification from the [manufacturer][and][State]. If installing underground storage tanks and piping systems, installation Contractor must have Pollution Liability Insurance. 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 must 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 storage tanks as required by federal, state, or local authority.

1.4.2.2 Registration

****

NOTE: The designer must confirm with the DoD Installation the number of days required to obtain the permit documentation.

****

Obtain and complete all tank registration forms required by federal, state, and local authorities. Submit all completed tank registration forms within [30][_____] days after contract award to the Contracting Officer. The Contracting Officer will ensure the Base Environmental staff for the DoD Installation submits the forms to the proper regulatory agencies.

1.4.2.3 Licensed Personnel

Tank installers must be licensed/certified by the state when the state requires licensed installers.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect system components and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer, upon recommendation by Base Environmental for the DoD Installation. 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 must 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.

1.7 WARRANTY

All factory-fabricated storage tanks must come with a manufacturer's warranty of a minimum period of 30 years. All warranty paperwork will be completed and submitted by Contractor to both the tank and system component manufacturers, the Contracting Officer, and the Base Environmental for the DoD Installation. This includes all applicable completed manufacturers' equipment installation checklists.

PART 2 PRODUCTS

2.1 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 497. Fuel ignition temperatures will dictate the maximum allowable temperature rating of the electrical system components.
****

Provide controllers, integral disconnects, contactors, controls, and control wiring with their respective pieces of system components. Provide electrical system components, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Any wiring required for the operation specified herein, but not shown on the electrical plans, must be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM[, Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION][, Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION].

2.1.1 Grounding and Bonding

Grounding and bonding must 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.

2.2 MATERIALS AND SYSTEM COMPONENTS

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

Provide materials and system components 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 system components that have been in satisfactory commercial or industrial use for a minimum 3 years prior to bid opening. The 3 year period must include applications of the system components and materials under similar circumstances and of similar size. Provide materials and system components that have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 3 year period.

Internal parts and components of system components, piping, piping components, and valves that could be exposed to fuel during system operation must not be constructed of zinc coated (galvanized) metal [,

brass, bronze, or other copper alloys]. Do not install cast iron bodied valves in piping systems that could be exposed to fuel during system operation.

2.3 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 system components 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 must be 25 by 65 mm one by 2.5 inches. Provide manufacturer's storage tank nameplates as required. [On concrete-encased tanks, provide a minimum smooth flat mounting surface of 300 by 300 mm 12 by 12 inches for attaching nameplates.] Lettering must 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 must identify its function.]

2.4 ABOVEGROUND STORAGE TANK

****

NOTE: Two types of aboveground storage tanks are defined herein: single wall tanks and double wall tanks.

A single wall steel tank has no inherent integral secondary spill containment and can be mounted either on saddles or skids. Single wall steel tanks are required to be installed within a secondary containment system (e.g. dike area or integral skid mounted containment). 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.

Double wall tanks are provided from the manufacturer with some type of integral secondary containment. Additional dikes and containment systems are not required for these tanks. Three types of double wall tanks are defined herein: double wall steel tank (non-fire resistant, non-protected), double wall steel tank (fire resistant, protected), and double wall tank (concrete encased).

Note that used or waste oil and 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 used oil, waste oil, or hazardous wastes, confirm that the storage is allowed by state and local regulations. The storage of used or waste oil and hazardous wastes is bound by the same EPA requirements as is the storage of any other petroleum product. Contact the Base Environmental for storage of used oil, waste oil, or hazardous wastes.

****

2.4.1 Aboveground Storage Tank (Single Wall Steel)

****

NOTE: UL 80 tanks are typically 60 to 660 gallon storage tanks primarily used to store heating oil. These tanks are not very common in DoD fuel system.

****

Provide a factory-welded, single wall [stainless] steel tank manufactured to [UL 80][UL 142] and equipped to comply with [NFPA 30 for use as a flammable or combustible liquid storage tank][NFPA 30A for use as a motor vehicle dispensing tank][NFPA 31 for use as a heating oil tank]. Tank must be designed and manufactured for a [horizontal cylindrical] [vertical cylindrical] installation. Tank must be mounted on the tank manufacturer's standard UL listed [tank saddles] [support skid] that elevates the tank above the underlying concrete slab and/or concrete support a maximum of 305 mm 12 inches. [Support skid must span the entire length of the tank.] Tank assembly must have lifting lugs that allow tank relocation. [Provide tank assembly with the manufacturer's standard [stairway][external ladder] and platform assembly, except as modified herein. The [stairway][ladder] and platform assembly must be constructed of structural steel and must allow personal access to the top of the tank system.] [Provide a minimal 19 L 5 gal overfill containment box on the tank fill line. The containment box must be lockable and must contain any spillage encountered at the tank during tank filling operations.]

2.4.1.1 Integral Skid Mounted Containment

****

NOTE: Limit the use of these tanks to locations with lower amount of rainfall. For other areas, it is recommended that these tanks be installed under a canopy.

****

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

2.4.2 Aboveground Storage Tank (Double Wall Steel)

****

NOTE: Include one of the double wall tank subparagraphs listed below: double wall steel tank or double wall steel tank (fire-resistant, protected) and delete the others according to the project requirements.

UL 80 tanks are typically 60 to 660 gallon storage tanks primarily used to store heating oil. These tanks are not very common in DoD fuel system.

****

Provide a factory-assembled unit that includes a factory-fabricated primary storage tank and an integral secondary containment. Tank assembly must be in accordance with [NFPA 30] [NFPA 30A] [NFPA 31] and be designed and manufactured for a [horizontal cylindrical] [rectangular] [vertical cylindrical] installation. Primary storage tank must be factory-welded, [stainless] steel that conforms to [UL 80] [UL 142]. [Tank assembly must be mounted on [the tank manufacturer's standard UL listed support skid that elevates the tank assembly above the underlying concrete slab [or][support saddles] a maximum of 305 mm 12 inches].] Tank assembly must have lifting lugs that allow tank relocation. [Provide tank assembly with the manufacturer's standard [stairway][external ladder] and platform assembly, except as modified herein.] [The [stairway] [ladder] and platform assembly must be constructed of structural steel and must allow personal access to the top of the tank system.] [Provide [stairway][ladder] and platform as indicated on the drawings.] [Provide a minimal 19 L 5 gal spill container on the tank fill line. The container must be lockable and must contain any spillage encountered at the tank during tank filling operations.]

2.4.2.1 Double Wall Steel Tank

****

NOTE: These tanks do not conform to UL 2085. They are not fire-resistant or ballistic/vehicular impact resistant. The UL listing also includes minimum requirements for the assembly supports.

These type tanks should always require a pressure testable and verifiable interstitial space between the primary tank and the secondary containment (outer) tank.

****

The secondary containment (outer) tank must be a factory-fabricated,

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

2.4.2.2 Double Wall Steel Tank (Fire-Resistant, Protected)

****

NOTE: Tanks that conform to UL2085 are referred to as protected tanks by NFPA 30A (2-hour fire rating when exposed to temperatures up to 1093 degrees C (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 (outer) tank must be a factory-fabricated, [stainless] steel, tank that fully-encloses the primary storage tank and must conform to UL 142. The interstitial space between the primary tank and the containment tank must be both pressure testable and verifiable. The entire tank assembly must conform to UL 2085 and bear the UL 2085 label. The primary storage tank must be supported within the containment tank with steel tank saddles, or other similar supports, fabricated and installed by the tank manufacturer.

2.4.3 Aboveground Storage Tank (Double Wall, Concrete Encased)

****

NOTE: These tanks are fire-resistant and ballistic/vehicular impact resistant conforming to UL 2085. These tanks have a primary (inner) steel tank surrounded by insulation and HDPE liner. The entire assembly is encased in concrete. These tanks are designed and manufactured for a rectangular installation. Per UFC 3-460-01, these tanks are limited to 5,000 gallons and below. Delete this paragraph if these tanks are not being provided.

****

The primary (inner) storage tank must be a factory-fabricated [stainless] steel tank and must conform to UL 142. The primary storage tank must be insulated. The secondary containment must be a minimum of 30 mil thick high density polyethylene (HDPE) liner encased in concrete that fully-encloses the primary storage tank. Concrete must have a minimum 27.57 MPa 4000 psi strength, be monolithically poured, and be properly reinforced for the application. The primary storage tank and insulation

must be isolated from the exterior concrete encasement. The interstitial space between the primary tank and the containment reservoir must be verifiable for leaks. The entire tank assembly must conform to UL 2085 and bear the UL 2085 label.

2.5 UNDERGROUND STORAGE TANK

****

NOTE: Include one of the underground storage tank subparagraphs listed below: double wall steel tank (STI P3), double wall tank (steel with non-metallic jacket), and double wall FRP tank and delete the others according to the project requirements.

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 wall type storage tank that conforms to NFPA 30, NFPA 30A, or NFPA 31. Tank must be designed and manufactured for an underground, horizontal installation. The exterior tank walls must be separated from the interior tank walls by standoffs; thus creating an open or interstitial space (Type II). The entire interstitial space must 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 Wall Steel Tank (STI P3 Tank)

Tank must be constructed of steel and must conform to UL 58 Type II, UL 1746 Part I, and STI P3. Tanks must be cathodically protected and allow on-going monitoring of corrosion protection. Tanks constructed with lap welded shell or head joints must be continuous fillet welded; on both the interior and exterior surfaces. The UL 58 and STI P3label must be affixed to the exterior surface of the tank.

2.5.2 Double Wall Tank (Steel with Non-Metallic Jacket)

The primary tank must be constructed of steel and jacketed with a non-metallic secondary containment tank. The entire tank assembly must conform to UL 58 Type II and UL 1746 Part III. The UL 58 label must be affixed to the exterior surface of the tank.

2.5.3 Double Wall FRP Tank

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

2.6 TANK PROTECTIVE COATINGS

[For tanks coated in California and where required by the State or local regulations, provide tank coating system in accordance with California Air Resources Board (CARB).]

2.6.1 Interior Surfaces

****

NOTE: Delete this paragraph if FRP tanks are the only type tanks specified. E-85 tanks must not be internally coated.

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 miscellaneous use tanks, consider using standard manufacturer's coating system.

For all products, except for stainless steel tanks, tank interiors must be 100 percent coated. Tanks containing E85 are not to be coated internally unless otherwise approved by Service Headquarters. For all products, coat the interior of 3 inch and larger carbon steel piping and exterior of all carbon steel piping located inside the tank, and steel appurtenances inside all tanks. Carbon steel piping, and carbon steel appurtenances located inside of tanks containing E85 are not to be coated internally unless otherwise approved by Service Headquarters.

****

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 LOW VOC POLYSULFIDE INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS] [Section 09 97 13.17 THREE COAT EPOXY INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS][with the manufacturer's standard coating system as modified herein].

2.6.2 Exterior Surfaces, Aboveground Tanks

****

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

For miscellaneous use tanks, consider using standard manufacturer's coating system.

****

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 must be in accordance with UL 1746 Part IV and UL 58. The integrity of the coating must be certified by the manufacturer as meeting the thickness requirements and having no flaws prior to shipment. The UL label must be affixed and visible on the exterior surface of each coated tank.

2.6.3.2 STI P3 Coating System

****
NOTE: This 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.
****

Exterior tank must be coated with a dielectric coating system, cathodically protected, and electrically isolated. Coating system must be in accordance with STI P3, UL 1746 Part I, and UL 58. Tank manufacturer must be licensed by the Steel Tank Institute as an applicator of the STI P3 system. The STI label must be affixed and visible on the exterior surface of each coated tank.

2.6.4 Tank Labeling

****
NOTE: Applicable to aboveground storage tanks (ASTs) only.
****

Tank must be labelled with the following information at a minimum:

a. Product Stored and Tank Capacity (Per MIL-STD-161).

b. Tank Number and Facility Number.

c. NFPA 704 Diamond Hazmat Label.

2.7 TANK COMPONENTS

****
NOTE: The following tank components are for

aboveground and underground storage tanks, unless specifically stated otherwise.

****

2.7.1 Tank Manhole

****

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

Provide tanks 18,900 L 5,000 gallons and smaller with a minimum of one 760 mm 30 inch tank manhole to allow for internal tank access. Provide tanks larger than 18,900 L 5,000 gallons with a minimum of two 915 mm (36 inch) tank manholes (one manhole for access). Diesel and bio-diesel tanks at military service stations are to be provided with a 813 mm (32 inch) access manhole. Piping will not penetrate through access manholes.

****

Tank manholes must have an internal diameter of [760 mm 30 inches] [813 mm 32 inches] [915 mm 36 inches]. Provide each manhole with a matching flanged watertight manhole cover. Manhole covers must be UL listed, be constructed of pressed or mild steel, and include a UL listed gasket. [Frame and cover assembly must be rated to withstand H-20 highway loading as defined by AASHTO HB-17.]

2.7.2 Tank Piping Penetrations

****

NOTE: For underground storage tanks, use tank manholes as the primary point of entry for piping penetrations unless unfeasible. Pipe penetrations into an underground storage tank are the most likely place for a leak to occur. Designing pipe penetrations to enter through a tank manhole allows each of the penetrations to be contained in a manholecontainment sump. The piping that penetrates the manhole must be flanged on both sides of the manhole hatch. This will allow the piping to be removed from the manhole and allow removal of the manhole without having to cut the piping. Note the aboveground piping may be required to be a spool piece.

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

Flanged nozzles must be installed in locations with ISO Corrosivity Categories C3, C4, and C5 while threaded nozzles can be installed in locations with ISO Corrosivity Categories C1 and C2.

****

Provide a welded-in-place [double tapered National Pipe Thread (NPT) coupling] [flanged pipe nozzle] for each tank piping connection. All unused or spare tank piping penetrations must be sealed with [malleable iron

plugs] [steel plugs] [steel flanges] [or] [as indicated].

2.7.3 Tank Striker/Impact Plates

****
NOTE: Striker plates under all openings used for manual gauging in steel tanks and all openings in fiberglass tanks.
****

Provide an interior striker/impact plate under each tank manhole and pipe connection. Each plate must 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 must be welded to the tank bottom at the factory (full circumference connection). The welds must be non-destructive tested using the appropriate means.

2.7.4 Manual Gauging/Sampling Hatch

Provide a combination gauging and sampling hatch assembly. The assembly must 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] stilling well pipe.] [The stilling well pipe must be a minimum 100 mm 4 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 one manhole. Indicate on the drawings which tank manhole 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 must be a minimum 10 mm 3/8 inch thick and a minimum 50 mm 2 inches wide. The rungs must be a minimum 20 mm 3/4 inch rod on 300 mm 12 inches centers. Members of the ladder must be securely affixed. Ladder must be of sufficient length to extend from the bottom of the tank to the top surface of the tank. Ladder must be rigidly connected to the tank bottom in accordance with the tank manufacturer's standard. Ladder must be connected to the top of the tank with pipe guides or slip bars to accommodate expansion of the two stringers.

2.7.6 Tank Venting

****
NOTE: The aboveground termination point of a storage tank's vent piping will be provided with either an atmospheric vent or a pressure\vacuum

vent. The decision on which item to use will be based upon the characteristics of the fuel to be handled (refer to NFPA 30, 30A and UL 142 as applicable). Delete paragraphs as required.

****

2.7.6.1 Atmospheric Vent

Provide atmospheric, updraft type cap. Cap must be constructed of aluminum or carbon steel. Cap must have an internal brass or bronze insect screen, minimum 40-mesh. Cap must prevent rain, snow, or ice from entering the vent piping.

2.7.6.2 Pressure/Vacuum Vent

Tank vent outlet must be equipped with pressure-vacuum breather vent, aluminum construction with weather hood and with fluoroelastomer (FKM, Viton) pallet seat inserts, high density screens, stainless steel internals, with pressure relief setting, vacuum relief setting, and venting/vacuum capacity per tank manufacturer.

2.7.6.3 Emergency Vent

****

NOTE: Delete this paragraph if underground storage tanks are specified. Emergency venting is not required for underground tanks. Refer to NFPA 30, UL 142, and API Std 2000 for vent sizing. The use of long-bolt manhole covers is not permitted for emergency venting.

****

Vent must be the normally-closed, UL listed type that vents outward and upward. Vent must conform with NFPA 30 and UL 142 and must be sized by the tank manufacturer. Provide vent with the Liters per second (L/s) cubic feet per minute (cfm) rating permanently labeled on the vent's exterior. [For double wall or protected type tanks, provide a second emergency vent to protect the interstitial space.] [This second emergency vent is not to be provided on concrete encased tanks.]

2.8 INDEPENDENT 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. Alarms for tanks less than 112,500 L 30,000 gallons must be provided by an automatic tank gauging system. Alarms for tanks equal to or greater than 112,500 L 30,000 gallons must be provided by an independent level alarm system (see below) in addition to an automatic tank gauging system.

Coordinate the use of overfill valves with Section 33 57 55 or Section 33 52 10 as applicable.

****

Provide an independent level alarm system that will monitor 4 programmable liquid level setpoints. The system must delineate between each individual setpoint [as well as each individual tank]. The system must produce an audible and visible alarm in the event of monitoring an alarm condition. Mechanically-actuated float assemblies must be field adjustable. The system must 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 4 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.

d. Low-Low Level Setpoint. Produce an alarm condition when a tank's liquid level drops below [the minimum pump submergence level at] [_____] percent capacity.

2.8.2 Independent Level Alarm 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 must 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 must 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 must have a visual alarm that illuminates in the event of a detected alarm condition. The visual alarm must include either individual lights for each alarm condition or must 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 must have a manual acknowledge switch that will deactivate the audible alarm. The acknowledge switch must not deactivate subsequent audible alarms unless depressed manually again for each occurrence. Under no circumstance must this acknowledgement switch extinguish the visual alarms until the alarm condition has been corrected. The acknowledge switch must be an integral component located on the front of the control panel. The switch must be either a key switch or push button.

2.8.2.4 Test Pushbutton

Panel must have a manual test pushbutton that will enable operators to verify that the panel is powered, and the visual and audible alarms are working properly.

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, 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. Provide tank gauging to comply with UFC 3-460-01 and STD 123-335-03. Automatic 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 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 must allow the measurement of the entire level of fuel in the corresponding tank. Gauges

must 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 must 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. For tanks smaller than 19,000 L 5,000 gallons, choose tank manufacturer certified strapping tables.

****

Furnish [2] [_____] [API MPMS 2.2E] [API MPMS 2.2A] [tank manufacturer]certified strapping tables (calibration charts) for each tank. One of the tables must indicate the liquid contents in L for each 1 mm of tank depth and the other in gallons for 1/16 inch of tank depth. Strapping table volumes for all tanks 19,000 L 5,000 gallons and larger must be determined using physical measurements and not calculated values. For each tank, provide an electronic media file of each strapping table. [For tanks larger than 19,000 L 5,000 gallons tank strapping must be performed after installation at the site.]

2.9.3 Mechanical Clock Gauge

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

2.9.4 Automatic Tank Gauge System (ATG)

****

NOTE: The digital readout provided by a digital tank system can be sent to a stand-alone electronic panel or the signal can be 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 must be the mechanically or electronically actuated type that can continuously monitor a tank's usable liquid level storage capacity. The system must provide a digital readout of a tank's liquid level in terms

of mm and L inches and gallons. The system must be accurate to plus or minus 2 mm 1/16 inch. The system must 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 SYSTEM] [an electronic display panel. Panel must be [a NEMA 4 enclosure as defined by NEMA 250] [standard industrial enclosure]. Panel doors must swing left or right. The panel must display the digital readout of each monitored tank on an LCD mounted exterior to the panel. The panel must also have external controls to allow operators to toggle between information on the LCD without having to open the panel.]

2.10 MANHOLE 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 manhole. Do not require the sump to be connected in any way to the surfaces above (e.g., street manhole cover, concrete, etc.).

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

****

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

2.10.1 Piping Penetrations

Sump sides must allow the penetration of carrier pipes, exterior containment pipes, conduits, and vapor pipes as required. Sump penetrations must 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 must be compatible with the fuel to be handled. Boots and seals must be water resistant to the influx of water from outside the sump. Boots and seals must 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 manhole below is not necessary. Watertight covers are generally bolted or strapped down. Strapped down covers provide easy access to the sumps without the use of tools. Friction fit covers will prevent the influx of rainwater and are easily removable by hand.

****

Where indicated, the entire top of a containment sump must be capped with a [friction fit] [bolted down, watertight] [strapped down, watertight] access cover that allows water to flow away from the manhole. Cover must be constructed of the same material as the sump. Cover must have a larger diameter than the tank manhole cover below. Cover must be lightweight and not exceed 35 pounds 16 kilograms.

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 must include all necessary appurtenances for operation. Unit must include a visible register to indicate individual deliveries up to 999.9 liters 99.9 gallons with a reset meter. Pump must have a delivery capacity of 0.95 liters/sec 15 gpm. Hose must be a minimum 20 mm 3/4 inch inside diameter, 4.6 meters 15 ft long, and fuel resistant. The dispensing nozzle must be of the automatic shutoff type with graduated notches for various delivery speeds. Dispensing unit must provide a means for locking of the nozzle to the pump when the pump is shutoff. [Diesel fuel dispensing unit cabinet must be painted yellow from the manufacturer.] [Gasoline dispensing unit must be painted red from the manufacturer.] Units must 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, manhole-mounted, fintube immersion heater. Construct entire assembly to be compatible with the product to be heated. Entire assembly must 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 [_____] kPa (gage) psig. Construct heater's tank mounting flange of steel with a bolt pattern to match the corresponding tank manhole. 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 must 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 must be non-coking for the intended application. Entire assembly must 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 will not be allowed.

2.12.2 Tank Suction Heater

2.12.2.1 Shell-and-Tube Type

Provide a vertical, manhole-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 must be compatible with the product to be heated. Entire assembly must 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 manhole. 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 must 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 must be non-coking for the intended application. Entire assembly must 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 will 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 two 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 must be constructed of Schedule 40 PVC pipe that is 150 mm 6 inches in diameter. Pipe must be factory slotted from the bottom to within 300 mm 12 inches of grade. With the pipe installed vertically, slots must be horizontal and have a width of 0.5 mm 0.02 inch with not less than 30 slots per 300 mm ft. Slots must encompass at least 80 percent of the pipe's 360 degree perimeter with the pipe maintaining its structural integrity. Slots must allow fluid within the soil to infiltrate into the pipe without allowing sediment to fill the pipe. Each well must extend down 600 mm 2 ft below the deepest buried storage tank. Well must have a permanently fixed bottom cap. Well must have a removable top cap that is protected from traffic with a watertight street manhole and cover as

indicated. Well must 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 must be accessible from the surface through a 300 mm 12 inches diameter manhole. The manhole ring must 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 must have the words "DO NOT FILL - INSPECTION WELL" cast permanently into the top. The letters must be a minimum of 13 mm 1/2 inch in size. Each manhole cover must have a white circle with a black triangle painted on the surface.

2.14 ACCESSORIES

2.14.1 Concrete Anchor Bolts

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

2.14.2 Bolts and Studs

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

2.14.4 Washers

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

2.14.5 Polytetrafluoroethylene (PTFE) Tape

Tape must conform to ASTM D3308.

2.14.6 Street Manhole Assembly

****

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

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

****

Round street manhole frames and covers must be the straight traffic type. Frames and covers must 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 must be the solid plate type with a checker pattern.] Covers must form a watertight seal with the manhole frame to prevent surface water inflow. Frame and cover assembly must be rated to withstand H-20 highway loading as defined by AASHTO HB-17.

PART 3 EXECUTION

3.1 INSTALLATION

****
NOTE: During design, layout system 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, NFPA 30A, or NFPA 31 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 Underground Storage 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 020-50-1000, or UL 58).

3.1.1.2 Steel Underground Storage Tank Installation Procedures

****
NOTE: Provide straps and anchors designed to prevent flotation of underground tanks located in areas with high groundwater level or subject to flooding. Provide electrical isolation strips between hold-down straps and metal tanks. Anchors may be concrete anchor slab under the tank or concrete deadmen. Tailor paragraph to suit design. Underground storage tanks occasionally rely on backfill and top slab to hold the tank in place in addition to the hold down straps and concrete deadman. When new or existing USTs are exposed, the contractor must take steps to ensure the tank

remains safely in place without damage. Manufacturer's suggestions for installation of new tanks must be followed (ballast added to the tank etc.) and used on existing tanks until the tank is safe from damage due to a sudden or slow influx of water. Existing hold down straps must be inspected to assure they are adequate for holding the tank in place and compromised hold downs reported to the Resident Engineer with a suggested solution. The recommendations of API 1615 must also be followed.

****

[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 Underground Storage Tank Handling

Handle tank with extreme care to prevent damage during installation and transportation to the site. Any damaged tank must 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 Underground Storage Tank Installation Procedures

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NOTE: Provide straps and anchors designed to prevent flotation of underground tanks located in areas with high groundwater levels or subject to flooding. Anchors may be a concrete anchor slab under the tank or concrete deadmen. Tailor paragraph to suit design. Underground storage tanks occasionally rely on backfill and top slab to hold the tank in place in addition to the hold down straps and concrete deadman. When new or existing USTs are exposed, the contractor must take steps to ensure the tank remains safely in place without damage. Manufacturer's suggestions for installation of new tanks must be followed (ballast added to the tank etc.) and used on existing tanks until the tank is safe from damage due to a sudden or slow influx of water. Existing hold down straps must be inspected to assure they are adequate for holding the tank in place and compromised hold downs reported to the Resident Engineer with a suggested solution. The recommendations of API 1615 must also be followed.

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[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 Aboveground Storage Tank

Install aboveground storage tanks in accordance with STI 700-50-5007 (STI R912) except as modified herein. Place tank that is equal to or greater than 18,900 L 5,000 gallons 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 and issue pump at the high end. [Place tank that is less than 18,900 L 5,000 gallons on a level surface.]

3.1.2.1 Steel Aboveground Storage 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 amount of handling. Repair any damaged tank coating in accordance with the appropriate UL or STI standard (UL 1746, STI 020-50-1000, or UL 58). Do not move the tank unless it is empty.

[3.1.2.1.1 Concrete Encased Aboveground Storage Tank Handling

Store, handle, and place concrete encased aboveground storage tanks with care and in a manner that will minimize damage to the tank. Place tanks in position carefully and with a minimum of handling. Do not move the tank unless it is empty.

]3.1.2.2 Steel Aboveground Tank Installation Procedures

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NOTE: Provide anchors designed to prevent flotation of tanks located in areas subject to flooding and in high seismic areas. Tailor paragraph to suit design.
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Tanks should be secured to the associated tank pad per tank manufacturer's recommendations using fasteners installed through the tank saddle base plate.

[3.1.2.2.1 Concrete Encased Aboveground Storage Tank Installation Procedures

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NOTE: Concrete encased tanks are not typically anchored. Tailor paragraph to suit design.
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Concrete encased tanks do not need to be secured.

]3.1.3 System Components

Properly level, align, and secure system components in place in accordance with manufacturer's instructions. Provide supports for system components, 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 must 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 700-50-5007 (STI R912)except as modified herein. Gauges used to monitor the tests must have a scale with a maximum limit of 103 kPa 15 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

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NOTE: Pneumatic tests are the preferred type of tightness tests. Brine level tests will only be specified for FRP tanks. Delete the inapplicable tests.
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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 must 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 must 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 must have a scale with a maximum limit of 103 kPa 15 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 brine 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 within the riser at least 300 mm 12 inches. After filling the interstitial space, the tank must 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 must conform to [Section 33 08 55 FUEL DISTRIBUTION SYSTEM START-UP (NON-HYDRANT)] [Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START-UP].

3.2.5 Tank Inspection Reports

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NOTE: Underground storage tanks must be inspected in accordance with STI SP131.
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Prior to system commissioning, a STI SP001 certified inspector must inspect the completed [aboveground] [underground] tank in accordance with [STI SP001] [STI SP131] and deliver a full report to the Contracting Officer. The report must include a record of ultrasonic thickness measurements (UTMs), exclusive of the coating, of each single wall [aboveground] [underground] tank shell. The report must include the tank dataplate information and photograph of the tank data plate. Provide electronic copies of the tank inspection reports to Service Headquarters, Service Control Points, and DLA-Energy. The paper and electronic copies of the report and UTMs must 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 STI SP001 Inspector's Certification requirements.

3.3 DEMONSTRATIONS

Conduct a training session for designated Government personnel in the operation and maintenance procedures related to the system components and 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/system components and systems, both operational and practical theories, and associated routine maintenance procedures. The training session must consist of a total of [_____] hours of normal working time and must 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 must not be performed until after the flushing, cleaning, and adjusting requirements defined in Section 33 08 55 FUEL DISTRIBUTION SYSTEM START-UP (NON-HYDRANT). 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 must 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 system components 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 --