
USACE / NAVFAC / AFCEA / NASA UFGS-33 56 16 (April 2006)

Preparing Activity: NAVFAC Replacing without change
UFGS-13216 (October 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UML dated 1 April 2006

Latest change not indicated by CHG tags

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04/06

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SECTION 33 56 16

UNDERGROUND PETROLEUM TANKS 04/06

NOTE: This guide specification covers the requirements for underground petroleum storage tanks.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

1.1 REFERENCES

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

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

References not used in the text will automatically

be deleted from this section of the project
specification when you choose to reconcile
references in the publish print process.

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

ASME INTERNATIONAL (ASME)

ASME BPVC SEC VIII D1 (2004) Boiler and Pressure Vessel Code;
Section VIII, Pressure Vessels Division 1
- Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM D 1751 (2004) Preformed Expansion Joint Filler
for Concrete Paving and Structural
Construction (Nonextruding and Resilient
Bituminous Types)

ASTM D 1752 (2004a) Preformed Sponge Rubber and Cork
Expansion Joint Fillers for Concrete
Paving and Structural Construction

ASTM D 4021 (1992) Glass-Fiber-Reinforced Polyester
Underground Petroleum Storage Tanks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (2003) Flammable and Combustible Liquids
Code

NFPA 30A (2003) Code for Motor Fuel Dispensing
Facilities and Repair Garages

NFPA 31 (2001) Installation of Oil Burning
Equipment

NFPA 70 (2005) National Electrical Code

STEEL TANK INSTITUTE (STI)

STI P3 (2002) STI-P3 (R) System for External
Corrosion Protection of Underground
Storage Tanks

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 5 (200: R 2004) White Metal Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-C-4556 (Rev F; Notice 1) Coating Kit, Epoxy, for
Interior of Steel Fuel Tanks

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005

(Basic) Frames.Covers, Gratings, Steps,
Sump and Catch Basin, Manhole

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

29 CFR 1910.1200

Hazard Communication

UNDERWRITERS LABORATORIES (UL)

UL 1316

(1994; Rev Apr 1996)
Glass-Fiber-Reinforced Plastic Underground
Storage Tanks for Petroleum Products,
Alcohols, and Alcohol-Gasoline Mixtures

UL 1746

(1993; Rev thru Feb 2002) External
Corrosion Protection Systems for Steel
Underground Storage Tanks

UL 58

(1996; Rev thru Jul 1998) Steel
Underground Tanks for Flammable and
Combustible Liquids

UL 674

(2003) Electric Motors and Generators for
Use in Division 1 Hazardous (Classified)
Locations

UL 698

(1995; Rev thru Mar 1999) Industrial
Control Equipment for Hazardous
(Classified) Locations

UL 886

(1994; Rev thru Apr 1999) Outlet Boxes and
Fittings for Use in Hazardous (Classified)
Locations

1.2 QUALITY ASSURANCE

1.2.1 Permitting

Contractor shall obtain necessary [permits](#) in conjunction with installation of underground petroleum storage tanks as may be required by federal, state, or local authority. Submit a copy of permits to the Contracting Officer.

1.2.2 Registration

Contractor shall obtain required [tank registration forms](#) from governing regulatory agencies. Forms shall be completed and provided to the Contracting Officer and installation environmental office 30 days after contract award for their submission to the regulatory agency.

1.2.3 Licensed Personnel

Personnel required to install underground fuel storage tanks shall be licensed/certified by the state when the state requires licensed installers. Submit a copy of [license/certification](#) to the Contracting Officer.

1.2.4 Manufacturer's Certification

Tank installers shall be certified by the tank manufacturer on installation procedures. Submit certification from the tank manufacturer to the Contracting Officer.

1.2.5 Safety

Ensure employees are trained in the requirements of 29 CFR 1910.1200 and understand the information contained in the material safety data sheets for their protection against toxic and hazardous chemical effects.

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. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tanks

Accessories

Leak detection system

Material safety data sheets

SD-06 Test Reports

Delivery tank tightness

Leak monitoring system

Cathodic protection continuity

SD-07 Certificates

Permits

Tank registration forms

Personnel license/certification

Manufacturer's certification

SD-08 Manufacturer's Instructions

Tank installation

SD-10 Operation and Maintenance Data

Tanks, Data Package 1

Leak detection system, Data Package 2

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

1.4 QUALITY ASSURANCE

1.4.1 Required Data

Provide six copies of material safety data sheets (MSDS) for materials to be used at the job site in accordance with 29 CFR 1910.1200.

PART 2 PRODUCTS

2.1 FUEL STORAGE TANKS

NOTE: Capacity of storage tanks will be indicated on the drawing. Single-wall storage tanks with a polyester elastomer liner in the excavation are not considered an acceptable substitute due to difficulty of testing liner system integrity after installation.

Underground fuel storage tanks shall be double-wall horizontal type conforming to NFPA 30, NFPA 30A, and NFPA 31. Capacity as indicated.

Outer tank shall enclose and provide leak containment across the total surface of the inner main storage tank by being physically separated from the inner primary containment tank by standoffs; where, the inner tank is completely contained within the outer tank. Provide automatic and manual monitoring of interstitial or annular space between inner and outer walls of tank to detect unauthorized release of hydrocarbons or intrusion of water flow from surrounding soil. A leak at any point on the inner or outer wall shall be detectable. Design and construction of tanks shall comply with [UL 1316](#), [ASTM D 4021](#), [STI P3](#) Type II, or [UL 58](#) Type II with [UL 1746](#) external protection. Tanks constructed with lap shell or head joints in accordance with [UL 58](#) shall be continuous fillet welded; both on the interior and exterior surfaces.

2.2 TANK ACCESSORIES

2.2.1 Manholes

NOTE: Manholes are not required for tanks with capacities less than 3,780 liters 1,000 gallons. Select 750 mm 30 inch diameter for tanks with a capacity of 3,780 liters 1,000 gallons to 45,360 liters 12,000 gallons and 900 mm 36 inch diameter for tanks with capacities greater than 45,360 liters 12,000 gallons. Indicate appropriate design requirements for the manhole covers in accordance with FS A-A-60005 on the drawings.

Provide a minimum of one [750] [900] mm [30] [36] inch minimum inside diameter size access manhole. Each manhole shall have a matching flanged watertight cover conforming to [FS A-A-60005](#). Provide manhole extensions around each manhole of such a length to [extend 200 mm 8 inches above grade] [be flush with the finished grade]. Provide manhole extensions with watertight covers conforming to [FS A-A-60005](#). Piping manholes shall be the same as access manholes with extensions. Provide manways around each piping connection on the tank to prevent soil contamination due to a faulty connection. Combination of piping connections may be grouped in a single manway. Provide piping in accordance with Section 23 11 13.00 20 FUEL OIL PIPING.

2.2.2 Fill Connection

Provide fill line with an overfill protection device which automatically shut off fuel supply into the tank when the tank is 95 percent full to each underground storage tank and shall enter at the top of the tank. Fill line shall be 100 mm 4 inch minimum diameter and extend to within 150 mm 6 inches of tank bottom. From top of tank, fill line shall extend vertically or shall slope upward on a uniform grade and connected to a tight fit fill adapter with a locking type cap. Tight fit fill adapter shall be bronze, fitted with a fluoroelastomer gasket suitable for fuel being provided. Adapter shall match the fill elbow on the delivery hose to prevent vapor emissions at the fill connection. Provide a 11.3 liters 3 gallon minimum fill port containment unit for the fill adapter that allows differential settlement between tank and ground surface.

2.2.3 Suction Connection

Provide suction line located at the opposite end of tank from fill line.

Suction line shall be 100 mm 4 inch minimum diameter and extend to within 100 mm 4 inches of the tank bottom unless indicated otherwise.

2.2.4 Atmospheric Vent

Provide an atmospheric vent conforming to applicable requirements of NFPA 30 or NFPA 30A. Vent pipe shall slope back to tank, terminate at least 3.66 m 12 feet above grade or 0.61 m 2 feet above roofs of adjacent buildings, and located so that discharged vapors will not enter building openings, under building eaves, or downspouts. Provide each tank storing products having a vapor pressure greater than 6.9 kPag one psig with a vent terminal outlet with a pressure and vacuum relief breather valve to ensure vapor recirculation between fuel delivery truck and storage tank. Provide dry disconnect adapter to interconnect tank vent system with the delivery truck vapor space. Size of truck vent line connection shall match equipment connections on fuel delivery truck. Provide each tank storing products having a vapor pressure less than 6.9 kPag one psig with a flame arrestor and sized in accordance with NFPA 30.

2.2.5 Clean-Out and Gage Connection

Provide a combination clean-out and gage connection with each tank and combination shall consist of a 50 mm 2 inch vapor-tight gage box and a 50 mm 2 inch pipe extending downward through top of tank to within 75 mm 3 inches of tank bottom. Manhole outside gage box shall be cast iron and shall be installed in a concrete anchor block. Provide quick opening top lid and malleable iron wrench for removing lid. Provide clean-out and gage pipe assembly with a locking type cap. Provide entire length of pipe inside the tank with 13 mm 1/2 inch wide by 300 mm 12 inch long slots at alternate locations.

2.2.6 Tank Gages

NOTE: Select the desired type of gage and delete the inapplicable provisions. Direct reading gages are more economical, but present fogging problems.

[Provide each tank with a remote reading mechanically-actuated float gage. Provide float gage unit with electrical contacts for high and low level audible alarm settings. High level setting shall be 90 percent capacity of tank.] [Provide each tank with a float-operated direct reading tank gage. Gage shall fit a 100 mm 4 inch tank opening and terminate with a sealed cap and body assembly located in a manhole designed to allow for differential settlement of tank and pavement. Gage shall have dual tapes and floats to allow reading product level and water level independently. Provide means to wipe condensate (fogging) from viewing glass when reading gage.]

2.2.7 Vapor Recovery Connections

Provide each underground storage tank with vapor recovery connections to receive vapor recovery lines from fuel dispensing unit and provide vapor discharge to tank truck during filling operations. Vapor recovery connections are not required on tanks with products having a vapor pressure less than 6.9 kPag one psig.

2.2.8 Sounding Rod

Provide wood sounding rod of required length, evenly graduated and marked to read level of fuel remaining in tank in mm inches. Rod shall be seasoned maple or other close grained wood. Tank end of rod shall have a non-sparking cap. Provide two charts showing tank capacity in liters U.S. gallons in 3 mm 1/8 inch increments.

2.2.9 Sounding Rod Connection

Weld a 300 by 300 by 6 mm 12 by 12 by 1/4 inch thick striker plate directly below rod opening inside steel tanks. On fiberglass reinforced plastic (FRP) tanks provide a 300 by 350 by 6 mm 12 by 14 by 1/4 inch thick aluminum plate laminated on inside bottom surface of tank directly below gauging opening.

2.2.10 Dielectric Bushings

Provide nylon dielectric bushings on metallic piping connections to steel tanks.

2.2.11 Petroleum Heating Equipment

NOTE: Provide heaters in tanks storing No. 6 grade fuel oil. Designer shall determine requirements for heating other grades of fuel oil based on surrounding ground conditions. Choose one of the following.

[Provide vertical type heater installed through a [750] [900] mm [30] [36] inch diameter manhole in top of tank. Weld pipe connections to manhole cover. Entire assembly shall be removable as a unit. Heater shall have capacity to heat [] L/s gpm of No. [] fuel oil from [] to [] degrees C degrees F when supplied with [] kPag psig steam [] L/s gpm of [] degrees C degree F hot water]. Coil shall have steel tubes designed for working pressure of [] kPag psig. Coil shall extend to within 150 mm 6 inches of the tank bottom and shall surround oil suction line. Provide heater with bottom or side suction, inlet and outlet, drains, vent, thermometer, and pressure gage.]

[Provide shell and tube heater with the shell, containing petroleum, constructed of steel with steel or cast iron heads and 19 mm 3/4 inch O.D. by 16 BWG steel tubes with removable bundles rated for [1034] [] kPa [150] [] psig working pressure. Construct unit in accordance with ASME BPVC SEC VIII D1. Heater shall have necessary heating medium connections such as inlet and outlet, drain, vent, thermometer, and pressure gage. Heater shall have capacity to heat [] L/s gpm of No. [] fuel oil from [] to [] degrees C F when supplied with [] kPa psig steam [] L/s gpm of [] degrees C degrees F hot water].]

[Provide electric heater constructed with steel shell and steel flanges designed for [] kPa psig. Heater shall have sufficient capacity to heat [] L/s gpm of No. [] fuel oil from [] to [] degrees C F while operating on [] volts, [] phase, [] hertz electric service. Control electric heater by a magnetic starter with a manually operated "on-off" switch in series with a thermostatic control

with an adjustable range of plus or minus 20 percent of the above discharge temperature.]

2.2.12 Cathodic Protection

Provide steel tanks with a cathodic protection system as specified in Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES. Cathodic protection is not required for steel tanks with UL 1746 protective coatings.

2.3 LEAK DETECTION SYSTEM

NOTE: Indicate panel location on drawings.

Provide a continuous surveillance leak detection system suitable for operation in a NFPA 70, Class I, Division I, Group D environment and located in the leak containment space between the interior and exterior walls of double-wall tanks. System shall detect leakage into containment space by monitoring interstitial pressure, vacuum, or liquid level variations electronically. A liquid sensor in a dry interstitial space will not be acceptable. Sensor output and transmission shall be electronic. Liquids used in containment space shall contain a corrosion inhibitor. Sensors shall be compatible with and detect leakage of materials stored in the tank at a rate of 0.00001 L/s 0.1 gallons per hour with a 95 percent probability of detecting this size leak and a five percent probability of declaring the tank leaking at this rate when, in fact, it may be leaking less as well as ground water which may leak through the outer shell. [System shall be capable of monitoring [_____] zones through use of one central remote panel.] Panel shall be in a NEMA enclosure suitable for the environment and an audible and visual alarm for each zone and battery backup capable of operating the system continuously for a minimum of 48 hours. Panel shall incorporate a self-test system which permits operator verification of proper operation of leak detection equipment. Mount panel where shown on the drawings. Enclose underground cable in PVC coated conduit [isolated from the tanks with a dielectric fitting]. Provide instructions and equipment required for calibration of the leak detection system and manufacturer's recommended calibration maintenance schedule.

2.4 INTERIOR PROTECTIVE COATING FOR STEEL TANKS

NOTE: Delete this paragraph for steel tanks with storage capacities less than 3,780 liters 1,000 gallons. Select first bracketed paragraph for tanks not designated for storing jet fuels or lube oils. Select second bracketed paragraph for tanks designated for jet fuels and lube oil storage.

[Provide each tank with an interior protective coating conforming to MIL-C-4556 from the tank bottom up to 450 mm 18 inches off the bottom. Interior coating shall be a two-coat epoxy coating system consisting of a prime coat and a finish coat to achieve a total dry film thickness of not less than 0.15 mm 6 mils. Apply coating system in accordance with instructions from the coating manufacturer for application, including surface preparation, application equipment, and appropriate safety precautions. Surface preparation for the area to be coated shall include

the following:

- a. Grind rough surfaces on welded seams, sharp edges, and corners to a minimum of a 3 mm 1/8 inch radius.
- b. Abrasive blast surfaces to white metal in accordance with SSPC SP 5.
- c. Clean blasted surfaces to remove oil, dust, sand, or other blasting residue and moisture.
- d. Apply prime coat within eight hours after cleaning. If visible rusting occurs after cleaning, regardless of the time interval, re-blast rusted surfaces prior to applying primer coat.

Prepare and mix primer and finish coats in accordance with the manufacturers written instructions and apply following manufacturers instructions, allowing proper curing time between prime and finish coats. After completion of finished coat, surfaces shall be inspected by the Contractor for pinholes, skips, inadequate coating thickness, and other defects. Repair imperfections found in accordance with the coating manufacturers instructions.]

[Provide the entire interior of steel fuel storage tank, including tank and piping manholes, tank nozzles, manhole covers, sump, and interior ladders (if provided) shall be given an interior protective coating in accordance with Section 09 97 13.15 INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS.]

2.5 NAMEPLATES

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

PART 3 EXECUTION

3.1 EARTHWORK

Excavation and backfilling for tanks shall be as specified in Section 31 00 00 EARTHWORK.

3.2 DELIVERY TIGHTNESS TEST

Pneumatically test the interstitial space of each tank to 20.68 kPag 3 psig. Maintain this pressure and apply soapsuds or equivalent material to the exterior of the tank. Visually inspect for leaks. Repair leaks in accordance with the manufacturer's instructions.

3.3 STORAGE TANK INSTALLATION

NOTE: Site conditions, traffic movement, ground water, and other conditions around the tank will dictate the design of anchoring, concrete mats, depth of cover, and other surrounding design features. Provide these design features as site conditions dictate. In all cases, maintain the minimum backfill depth under and around the tank.

Do not use saddles. If for some specific site conditions saddles are required, then design the tank with additional structural reinforcement and shell thickness to compensate for the added stress, and isolate the tank electrically from the saddles with a dielectric material, such as ASTM D 1751 or ASTM D 1752 filler strips. In no case will saddles be used with fiberglass tanks.

Tank installation shall be in accordance with NFPA 30, NFPA 30A, and NFPA 31 and performed by personnel certified by the tank manufacturer and State Regulations. Install manhole extensions and tank connection access pits to prevent load transfer from the surface to the tank shell. Position tanks so that fuel discharge pipes slope up toward fuel outlet. Each tank fill, clean-out and gage connection, and access manway shall [extend 200 mm 8 inches above finished grade] [be flush with finished grade]. Where tanks are installed under a paved surface, tank connections shall terminate in manhole extensions with tops flush with finished paved surface. Position tanks on a 1 mm per 100 mm 1/8 inch per foot slope with fill port and leak detection sensor located at the low end and vent connection at the high end. Holiday test steel tank coating. Defects found shall be corrected and the tank re-tested prior to backfill. Provide a minimum 300 mm 12 inch thickness of fill material between the bottom of tank and top of the concrete hold-down pad as recommended by the manufacture. Provide fiber glass reinforced plastic hold-down straps and corrosion resistant accessories as recommended by the FRP or composite tank manufacturer. Anchor steel tanks to reinforced concrete mats, separated by fill material and held in place with steel anchor straps. Coat straps, turnbuckles, and anchors to resist corrosion. Provide 25 mm one inch wide insulating dielectric straps conforming to ASTM D 1751 or ASTM D 1752 between tank shell and metal straps. Inspect steel tank anodes to ensure integrity during backfill operations.

3.4 ELECTRICAL WORK

Provide switches and devices necessary for controlling leak monitoring equipment. Wiring, fittings, and components shall be explosion-proof in compliance with applicable requirements of UL 674, UL 698, and UL 886 for Class I, Division 1, Group C and D hazardous locations. Electrical installations shall conform to requirements of NFPA 70.

3.5 INSPECTION

Visually inspect the interior of fuel storage tanks that have an accessible manhole to insure it is free of debris before fuel is placed inside. Prior to entry insure a safe atmosphere exists.

3.6 HYDROCARBON AND WATER MONITORING SYSTEM TEST

Activate leak monitoring system and test in accordance with manufacturer's instruction.

3.7 CATHODIC PROTECTION

Test to prove continuity of electrical connections prior to backfilling coated steel tanks which do not have an exterior coating complying to UL 1746.

3.8 HIGH LEVEL ALARM TEST

Fill each tank with appropriate product and verify the high level alarm functions. Verify overfill protection device functions. The Government will provide product.

-- End of Section --