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- C618** Fly Ash and Raw or **Calcinated** Natural **Pozolan** for Use as a Mineral Admixture in Portland Cement Concrete.
- D1556** Density of Soil in Place by the Sand-Cone Method.
- D1557** Moisture-Density Relation of Soils.
- D2922** Nuclear-Density of Soil and Soil-Aggregate in Place by Nuclear Methods.
- D4021** Glass Fiber Reinforced Polyester Underground Petroleum Storage Tanks.

**13-1.2.4** National Association of Corrosion Engineers (NACE).-

- RP-01** Recommended Practice-Control of External Corrosion of Underground or Submerged Metallic Piping System.
- RP-02** Recommended Practice-Control of External Corrosion on Metallic, Buried, Partially Buried or Submerged Liquid Storage Systems.

**13-1.2.5** National Fire Protection Association (NFPA).-

- 30** Flammable and Combustible Liquids Code.
- 31** Standard for Installation of Oil Burning Equipments.
- 70** National Electrical Code.
- 329** Underground Leakage of Flammable and Combustible Liquids.

**13-1.2.6** Steel Tank Institute (STI).-

- STI-P3** Specification for Corrosion Protection of Underground Steel Storage Tanks.
- STI-86** Specification for Corrosion Protection of Containment Systems for Underground Steel Storage Tanks.

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**13-1.3.1.1 Loading conditions.-** Design tanks to withstand external hydrostatic pressure equivalent to 7 feet of overburden, with the ground completely saturated, and a safety factor of **5:1** against buckling. Primary tank and annular space shall withstand pressure test of 5 psi on tanks of 4 feet through **10** feet diameter with a safety factor of **5:1**. Tanks shall be designed to support accessory equipment such as **manways**, ladders, and other equipment as indicated. Lifting lugs shall be capable of withstanding the weight of the tank with a safety factor of **3:1**. Allowable axle loads shall be **H-20 (32000 lbs/axle)**.

**13-1.3.2 Fiberglass tanks.-** Comply with ASTM **D4021** and **UL 1316**. Fiberglass tanks shall be double walled, **UL** labeled, underground storage tanks. Primary and secondary tanks shall be manufactured with **100** percent **isophthalic** polyester resin and glass fiber reinforcement with no sand fillers. Tanks shall have a space between primary and secondary shell walls to allow for the free flow and containment of any leaked fuel from the primary tank.

**13-1.3.2.1 FRP hold-down straps.-** Standard product of the tank manufacturer. Number and location of the straps as recommended in manufacturer's current installation instructions.

**13-1.3.2.2 Striker plates.-** Tanks shall be provided with **FRP** encased steel striker plates located under each tank opening where indicated.

**13-1.3.2.3 Internal ribs.-** Outer and inner walls shall be separated by high-strength fiberglass internal ribs. Ample flow channels shall be provided in the ribs along the full length of the tank to assure free flow of leaked fuel to the monitoring sensors.

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**13-1.3.3 Steel tanks.-** Steel tanks shall be **UL** Type II, double walled, **UL** labeled, underground storage tanks with full **360** degree (**100** percent) secondary containment. Type II tanks shall be fabricated with outer tank physically separated from the inner primary containment tank by standoffs. The inner tank shall be completely contained within the outer tank. A means for monitoring the **annulus** for a leak in either tank shall be provided. Construct type II tanks as a **UL 142** tank inside a **UL 58** tank separated by C-channel standoffs. Construct tanks in compliance with **STI-P3** with **STI-86** containment system.

**13-1.3.3.1 Corrosion protection.-** Steel tanks shall be cathodically protected in accordance with API **1632**, **STI-P3**, **NACE RP-01**, and **NACE RP-02**. Cladding shall consist of a **isophthalic** resin and chopped strand glass fibers combined to form a final thickness of **100** mills, minimum.

**13-1.3.3.2 Electrical isolation.-** Dielectric nylon **reducing bushings** or flange isolators shall be used in each tank connection in order to isolate the tank from connecting steel pipes.

**13-1.3.3.3 Hold-down straps.-** Standard product of the tank manufacturer. Number and location of the straps as recommended in manufacturer's current installation instructions.

**13-1.3.3.4 Striker plate.-** Tanks shall be provided with **FRP** encased steel striker plates located under each tank opening where indicated.

**13-1.3.3.5 Internal standoffs.-** Outer and **inner** walls shall be separated by internal standoffs. Ample flow channels shall be provided along the full length of the tank to assure the free flow of leaked fuel to the monitoring sensors.

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**13-1.3.4 Piping systems.**-

**13-1.3.4.1 Piping system for double wall steel tank system.**- All fuel supply, return, vent, and fill lines and sensor insertion risers shall be Schedule **40** black steel pipe with Class **150**, black malleable-iron threaded fittings. Vent lines above grade shall be as specified above except pipe and fittings shall be galvanized. Fuel lines and insertion risers and fittings below grade shall be coated with cold applied coal tar, tape coat coating, and **TC** cold primer or approved equal. Fuel supply and return lines below grade shall be complete with **FRP** secondary containment piping and fittings. Secondary containment piping and fittings shall be **UL** listed, Red Thread II, manufactured by Smith Fiberglass Products, Inc. (A subsidiary of A.O. Smith, Inc.), Little Rock, Arkansas, or approved equal. Threaded pipe connections shall be made with suitable thread compound after removing burrs. Fuel lines shall be connected to engine fuel bracket with flexible sections provided with engine generator. Steel pipe below grade without secondary containment shall be cathodically protected with **10** pound magnesium anodes cadwelded to pipe. Furnish double poppet foot valve with strainer, vent valve, fill pipe and accessories, double poppet angle check valve and aluminum fill tube as indicated. Furnish angle check valve extractor tool. Steel fuel piping entering the building and steel vent piping leaving the ground shall be isolated with dielectric bushing or flanged isolators.

**13-1.3.4.2 Piping system for double wall fiberglass tank system.**- All fuel supply and return lines shall be Schedule **40** black steel pipe with Class **150** black malleable-iron threaded fittings. All fuel vent lines shall be as specified above except pipe and fittings shall be galvanized. All fuel vent lines, fill lines and sensor insertion risers located below grade shall be single wall **FRP** pipe and fittings. All steel piping and fittings below grade shall be coated and taped as specified. Fuel supply and return lines shall be furnished with **FRP** secondary containment piping and fittings. **FRP** piping and

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**13-1.3.5 Monitoring system.-** Furnish continuous monitoring system for double wall fiberglass and steel tanks and the piping sump. Locate liquid sensor in the lowest part of the tank annular space and in the piping sump as indicated. Locate a hydrocarbon vapor sensor in the tank annular space at a position **90** degrees from the vertical. The alarm output of the monitor shall send two separate digital voltage signals to indicate either the presence of fuel or fuel vapor. The monitor shall also produce an audible and visual alarm to alert FAA personnel of leakage. The monitoring system shall be in accordance with jurisdictional codes, **NFPA** and **NEC**. Furnish control unit, liquid sensors, vapor sensors, necessary conduit and wires from the sensors to the central unit. Underground conduits, junction boxes, fittings and couplings shall be water tight to prevent leakage of ground water into conduit. Design tank annular space **to** be air-tight and to withstand 5 psi internal test pressure.

Furnish necessary power supply as indicated to control unit. Monitoring system including control unit, sensors and accessories shall be **Pollulert** manufactured by Mallory Electrical/Electronics Group, **EMCO Wheaton** Leak Sensor

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Furnish necessary power supply as indicated to control unit. Monitoring system including control unit, sensors and accessories shall be **Pollulert** manufactured by Mallory Electrical/Electronics Group, **EMCO Wheaton** Leak Sensor

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non-magnetic starter, overload protection, and fuse adequately. Arrange so that the starter is connected after the generator and before the generator circuit breaker in order to operate when the generator is running. When the auxiliary fuel pump is DC operated, connect to the engine starting batteries in order to operate only when the engine is running. Provide overload protection and fuse adequately. The pump shall be connected into the fuel supply line after the first fuel filter on diesel engines. Where required by state or local regulations the auxiliary fuel pump shall be explosion-proof. Auxiliary fuel pump shall be Webster Model **SPM 15-1, 120 VAC** or approved equal.

**13-1.3.8** Electrical control power conduits and fittings. Provide all necessary power and sensing conduits, fittings, junction boxes, and flexible connectors for fuel leak monitoring system and tank gauging monitoring system. All conduit and wiring shall be in accordance with the **NFPA** and the N-EC.

**13-1.3.9** Filtration/separation fabric.- A non-woven fabric, needle punched and heat fused of **100** percent polypropylene staple fiber; permeable to moisture transmission, minimum **4.5** ounces per square yard; and conforming to the following additional criteria:

Grab strength, length direction, lb. =	<b>90</b>
Grab strength, width direction, lb. =	<b>110</b>
Elongation at break, length direction, percentage	<b>65</b>
Elongation at break, width direction, percentage	<b>65</b>
Coefficient of permeability <b>K</b> ,	<b>c/Sec</b> $5 \times 10^{-2}$



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**13-1.3.9** Filtration/separation fabric.- A non-woven fabric, needle punched and heat fused of **100** percent polypropylene staple fiber; permeable to moisture transmission, minimum **4.5** ounces per square yard; and conforming to the following additional criteria:

Grab strength, length direction, lb. =	<b>90</b>
Grab strength, width direction, lb. =	<b>110</b>
Elongation at break, length direction, percentage	<b>65</b>
Elongation at break, width direction, percentage	<b>65</b>
Coefficient of permeability <b>K</b> ,	<b>c/Sec</b> $5 \times 10^{-2}$

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**13-1.3.19 Tank fill manhole.**- Furnish containment type manhole as indicated. Manhole shall be lockable watertight and capacity shall be three-gallons minimum. Containment manhole shall be **12** inches in diameter and shall be Model **A-1003** manufactured by **EMCO Wheaton** or approved equal.

**13-1.3.20 Tank access manholes.**- Furnish cast iron manhole covers and frames as indicated.

#### **13-1.4 Installation.**-

**13-1.4.1 General.**- Installation shall be in accordance with the tank manufacturer's current installation instructions, the approved shop drawings, and **NFPA 30, 31 and 70**.

**13-1.4.2 Piping.**- Exterior piping shall be buried a minimum of **18** inches **below grade** and pitched toward the tank, without traps. Double wall pipe penetration at the sump shall be designed to provide the drainage of any leaked fuel or ground water 'in the secondary containment into the piping sump. Vent pipe terminal shall not be located within 5 feet of engine exhaust. Install swing joints pipe connection at the fuel tank. Above ground vent piping shall be supported and mechanically protected from possible damage. one-inch by **12-inch** redwood boards shall be laid over fuel piping to identify underground location at fuel lines. Vent line shall be extended above the roof line of the building.

**13-1.4.3 Fuel tank.**- Ballast and anchor tank to the concrete ballast pad using hold down anchor straps in accordance with the manufacturer's installation instructions. Install fuel tank with a **2-inch** minimum, end to end slope.

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**13-1.4.6.2 Precision Test.**- Precision test shall be in accordance with **NFPA 329**. This precision test shall be conducted for all new tank installations after backfilling has taken place. The test method shall be approved by the **COR** prior to use.

**13-1.5. Quality assurance.**-

**13-1.5.1 Submittals.**- Conform to the procedures specified.

**13-1.5.1.1 Literature.**- Provide product data, installation instructions, maintenance, operating and testing instructions for underground storage system, fuel monitoring system, and tank gauging system.

**13-1.5.1.2 Shop drawings.**- Provide complete shop drawings showing the exact location of tank, leak monitoring system, tank gauging system and related piping system. Show interface with the **RMMS**.

**13-1.5.1.3 Checklist.**- Provide an installation checklist certifying that installation has been completed in accordance with the manufacturer's recommendation.

**13-1.5.2 Certification plate.**- **UL** label shall be affixed to each tank.

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U.S. Department  
of Transportation  
Federal Aviation  
Administration

**FAA-C-2812**  
March **25, 1988**

U.S. Department of Transportation  
-- Federal Aviation Administration  
**SPECIFICATION**

**Fuel Storage Tank, Underground**