**SECTION 33 56 16**

**BELOW-GROUND FUEL STORAGE TANKS**

**BASED ON DFD MASTER SPECIFICATION DATED 10/1/2012**

***(Note to the designer: This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.***

**P A R T I - G E N E R A L**

**SCOPE**

The work under this section shall consist of providing all materials, labor, equipment, and supervision necessary to deliver, unload, store, protect, and install all equipment so as to provide a complete operating system. This will include all excavation and backfilling for the proper installation of the specified***(quantity, sizes)*** gallon double-walled ***(fiberglass/steel/composite)*** underground petroleum storage tank***(s)*** with appropriate openings, appurtenances, dispensing system, and related secondary containment piping to meet the needs of the system required in these specifications and on the drawings. It will include installation of concrete anchor pads for the tank***(s)***. It will include installation of a leak ***(detection/monitoring)*** system for the tank***(s)*** and all underground piping, with associated electrical control panel and wiring work. Steel tank installation will include a cathodic protection system. Concrete work and electrical work described under Part III - Execution herein shall be installed in accordance with respective division/sections of the Project Manual The finished product of the work shall comply with all applicable administrative regulatory codes. ***(Note to the designer: Include brief description of the work and locations, if necessary).*** Included are the following topics:

PART 1 - GENERAL

Scope  
Related Work   
Reference

Reference Standards  
Quality Assurance

Protection of Existing Work and Facilities

Provisions for Future Work  
Construction Limits

Notification/Permits

Shop Drawings

Operation and Maintenance Data  
Record Drawings

PART 2 - MATERIALS

General

State-Furnished Materials  
Underground Tanks

Dispensers and Pumps

Piping and Fittings

Leak Detection/Monitoring System

Automatic Tank Gauging System

Power Cutoff Switch

Corrosion Protection

Overfill Protection

Emergency Equipment

PART 3 - EXECUTION  
General

Barricades and Warning Devices

Site Demolition

Installation

Testing and Guarantee

Site Restoration

Construction Verification Items

Agency Training

**RELATED WORK**

Section 01 91 01 or 01 91 02 – Commissioning Process

Division 3 – Concrete

Division 26 – Electrical

Division 31 – Earthwork

Section 33 08 00 – Commissioning of Utilities

**REFERENCE**

Applicable provisions of Division1 shall govern work under this section.

**REFERENCE STANDARDS**

Work shall conform to procedures and practices in the following regulatory guidelines and industry standards:

WI Admin. Code COM 10, “Flammable and Combustible Liquids”.

National Fire Protection Association, NFPA 30, “Flammable and Combustible Liquids Code”.

National Fire Protection Association, NFPA 30A, “Automotive and Marine Service Station Code”.

National Fire Protection Association, NFPA 31, “Standard for the Installation of Oil-Burning Equipment”.

Underwriters Laboratories, Inc., UL Standard 58, “Standard for Steel Underground Tanks for Flammable and Combustible Liquids”.

Underwriters Laboratories, Inc., UL Standard 1746, “Standard for External Corrosion Protection Systems For Steel Underground Storage Tanks”.

Underwriters Laboratories, Inc., UL Standard 1316, “Standard for Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products”.

**QUALITY ASSURANCE**

Comply with applicable rules, regulations, codes, and ordinances of local, State, and Federal authorities and regulations of public utility companies having jurisdiction over the work.

Only qualified persons certified by the Department of Commerce shall perform tank testing and installation.

Obtain and pay for necessary permits, licenses and certificates required.

Obtain and pay for necessary permits and certificates required and give proper notices for and during performance of site demolition and tank installation work.

Comply with local Fire Department requirements.

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Article 7.

Where equipment, accessories, or materials are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated in the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

**PROTECTION OF EXISTING WORK AND FACILITIES**

The Contractor shall verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, lights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work, both inside and outside the construction limits. The Contractor shall take all measures necessary to safeguard all existing work and facilities which are outside the limits of the work or items which are within the construction limits but are intended to remain.

Provide and maintain adequate catch platforms, warning lights, barricades, guards, weather protection, dust protection, fences, planking, bracing, shoring, piling, signs, and other items required for proper protection of work.

Provide protection for workmen, public, adjacent construction, and occupants of existing building(s).

Burning of debris on property not permitted.

Provide adequate fire protection.

Explosives shall not be used.

Provide protection for adjacent private property.

Proper erosion control practices shall be employed to minimize surface runoff to adjacent properties, nearby streams, or other surface waters. Erosion control shall comply with the Wisconsin Construction Site Management Practices Handbook ***(Also see Specifications Section - Erosion Control, that may be used to reinforce this requirement if needed.)***

Be responsible for any public sidewalk, curb, gutter or street paving damaged by any operation under this contract, and be responsible for the repair of all damage in compliance with local municipality rules and regulations at no additional expense to the State.

Make repairs or provide new replacement of all damage which is not part of the work on project site or to adjacent property to Architect/Engineer or user agency's satisfaction.

**PROVISIONS FOR FUTURE WORK**

***(Note to the designer: in this subsection explain what future extensions, options, or additions to the currently proposed work may need to be preserved by the Contractor in this work.)***

The Contractor shall coordinate hiswork and site access requirements to the site with the DFD Project Representative and user agency prior to start of work to avoid conflicts with other site activities or future work.

Coordinate work and access to the site with the work and access requirements of all other Contractors prior to the start of work -- especially when such work will connect to, or be connected to, other work.

**CONSTRUCTION LIMITS**

The work of this Section shall be confined to the Construction Limits as indicated on the drawings. In the absence of such a designation on the drawings, the work shall be confined to the minimum area reasonably necessary to undertake the work as determined by the Engineer. All areas disturbed by the site demolition, excavation, and tank removal work, plus such additional areas as are disturbed by construction related

activities including construction access and storage shall be considered the "Construction Area."

**NOTIFICATION/ PERMITS**

Notify in writing the local fire department chief, the local WI Department of Commerce authorized agent, and the Project Engineer of installation schedule at least 15 days prior to beginning tank installation work. Obtain permits, coordinate with local fire officials, and comply with local ordinances governing underground tank installations.

**SHOP DRAWINGS**

Submit manufacturer's pre-production (shop) drawings showing details of construction and materials for underground storage tank systems, including the associated leak detection/monitoring system, tank accessory fittings, underground fiberglass pipe and fittings, flexible piping connectors, and spill containment sumps to the Engineer for approval prior to the start of installation. Submittals are also required for pumps and fuel dispensing equipment.

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

***Delete the following if there are no additional requirements.***

In addition to the general content specified under GENERAL REQUIREMENTS,,supply the following additional documentation:

1. ***[A/E and commissioning provider to define detailed operation and maintenance data requirements for equipment specifications added to this section.]***

**RECORD DRAWINGS**

Refer to Section GR - General Requirements.

Maintain record drawings of all underground tank installations, piping and dispenser connections, electrical power and instrumentation routing, and other points of connection made as part of this project and for future connections on original drawings prepared by the installing Contractor/subcontractor. Include copies of record drawings with the Operating and Maintenance instructions.

**P A R T II - M A T E R I A L S**

***(Note to the designer: bold text usually indicates an opportunity for the designer to choose between two or more specifications.)***

**GENERAL**

Conform all materials to the size and type shown on the plans or as called for in the specifications and to applicable Laws, Codes, and Ordinances.

All products and materials are to be new, undamaged, clean, and in good condition. Existing products and materials are not to be reused unless specifically indicated.

Be responsible for the safe storage and handling of all materials utilized in the work -- including any materials furnished by the State. Store all materials in areas designated by the Construction Representative in cooperation with the Owner. Store and/or handle materials so as to not adversely affect traffic, drainage, fire protection, or public safety. Inconveniences to the general public from the storage and handling of materials shall be kept to a minimum.

Perform all work in accordance with any applicable manufacturer's instructions.

**STATE-FURNISHED MATERIALS**

***(This article is intended to alert the Contractor that the State will be furnishing some equipment or materials that will have to be received, stored, installed and/or which will need final connection for the completed project. In some cases, it may be appropriate to refer to other sections for a more complete description of the equipment being furnished or the work involved in installation.)***

**UNDERGROUND TANKS**

***(Note to the designer: Due to the ever-increasing number of underground storage tank products introduced to the market annually, the following listing of tank options is far from exhaustive. The designer is encouraged to insert a suitable recommended alternate product, as long as the needs of the user facility are met, all applicable product standards enumerated below are satisfied, and the product meets all requirements of the regulatory codes in effect at the time of construction.)***

The underground tank system shall include:

• -gallon spill containment basin  
 • 18-inch minimum top water-tight manway

• Interstitial leak monitoring system  
 • All appurtenances shall meet requirements set forth in COM 10.51-10.60.

The dimensions of the tank shall not exceed *(specify maximum)* inches diameter or *(specify maximum)* feet in length, without prior approval of the Engineer.

STEEL DOUBLE WALL TANKS:

The ***(type of fuel)*** tank shall be made of steel in accordance with NFPA 30 Chapter 2 and COM 10.51 for use with ***(type of fuel)*** product .

The tank***(s)*** shall be built in accordance with recognized standards of design. The tank*(s)* shall be built and installed within the scope of the Standards for Steel Underground Tanks for Flammable and Combustible Liquids, and UL 58. The tank*(s)* shall bear the UL 58 label specifying underground flammable liquid use.

The UL listed steel storage tank*(s)* shall be no less than *( )*-inch thick, enclosed completely (360 degrees) within a secondary containment tank of steel no less than *( )*-inch thick.

The tank*(s)* shall be an sti-P3 Protected Underground Storage Tank, and come from the factory with an sti-P3 label.

FIBERGLASS REINFORCED PLASTIC (FRP) DOUBLE WALL TANKS:

Tank shall be double wall fiberglass reinforced plastic (FRP) with a primary (inner) and a secondary (outer) tank. The secondary tank shall completely enclose (360 degrees) the primary tank.

Both the primary and secondary tanks shall be constructed of a composite laminate manufactured from fiberglass reinforcement and thermo-setting isopathic resin.

The tank shall meet the requirements of UL 1316 and bear the listing mark of Underwriters Laboratories, Inc., with the UL label permanently affixed to the exterior of the tank.

The interstitial space (annulus) between the primary and secondary tanks shall be constructed so as to allow for free flow and containment of any leaked product from the inner tank. The interstitial space shall allow for insertion of an interstitial monitoring device probe for the detection of product leakage.

The FRP tank shall meet the following minimum design criteria:

1. External hydrostatic pressure: Tank shall withstand being buried in ground with 7 feet of overburden, with hole fully flooded, and yet maintain a 5:1 safety factor against buckling.

2. Internal load:

a. Positive pressure: Tank shall withstand a 5 psig air pressure test with a 5:1 safety factor against rupture.

b. Vacuum: Tank shall withstand a test of a minimum of 3 inches mercury (1.5 psi) vacuum applied to the internals of the primary (inner) tank, secondary (outer) tank and the interstitial space without structural failure of the tank.

3. Surface loads: Tank shall withstand surface traffic H-20 loads (32,000 lbs. weight) without structural failure, when tank is installed strictly in accord with the manufacturer’s current installation instructions.

4. Tank shall support installation of accessory equipment such as manways, ladders, droptubes, fill and suction piping and connections, etc. when installed according to the tank manufacturer’s recommendations and limitations.

The FRP tank shall be capable of storing liquids with specific gravity up to 1.1 without tank integrity failure.

The FRP tank shall be capable of storing liquids with up to a maintained maximum temperature of 150 degrees Fahrenheit at the interior surface of the tank.

The FRP tank shall be chemically inert to petroleum products.

The FRP tank shall be equipped with the following accessories:

1. Provide FRP anchor straps. Number and location of straps required shall be as per tank manufacturer’s recommendation and shall be standard as supplied by the tank manufacturer. Each individual strap shall be capable of withstanding at least 18,000 pounds buoyancy force. Each end of every strap shall be fitted with the tank manufacturer’s standard integral eye thimble made of corrosion-resistant steel and of adequate opening size to accommodate tank hold-down turnbuckle hooks.

2. Provide anchors (loops) to be poured into the concrete anchor pad, in the number and size recommended by the tank manufacturer. Provide one turnbuckle assembly for each anchor. Anchor loops and turnbuckles shall be made of galvanized steel.

**DISPENSERS AND PUMPS**

Each product dispenser unit shall include U.L.-listed 15 gpm minimum pump with flow meter, reset register, totalizer, 12’ x 3/4” hose, and shear valve. Each pump shall be equipped with a filter, auto shut-off nozzle, safety sever valve, and anti-siphon valve.

The Contractor shall provide a liquid tight dispenser containment pan, to be installed under the product dispenser to prevent any leaks or spills from escaping into the environment. Dispenser containment pans shall be installed in accordance with the manufacturer’ current installation instructions.

Each product dispenser shall be equipped with a remotely located emergency power shutoff control switch which conforms to the requirements for fuel dispensing systems as specified by NFPA 30A, Sections 4-1.2 and 8-5.3.

**PIPING AND FITTINGS**

Piping, valves, and fittings shall comply with Chapter 3 of NFPA 30.

All aboveground piping shall be of steel and coated to inhibit corrosion.

All underground piping shall be UL-rated fiberglass reinforced epoxy piping for petroleum products in sizes as shown on the design drawings and manufactured by Ciba-Geigy or A.O. Smith-Inland, or equivalent as approved by the Engineer. All underground iron or steel fittings shall be coated with Black Asphaltum coating. All pipe shall be sloped toward the tank to prevent air pockets.

**LEAK MONITORING SYSTEM**

The supplied unit shall detect the presence of hydrocarbons in the interstitial space of the aboveground storage tank and any appurtenant double wall piping.

A system monitoring unit shall be installed to provide a leak detection access tube located in the interstitial space between the inner tank and the secondary barrier. In the event of a leak from the primary tank, the leaked fuel will flow to the detection tube and be detected by an electronic liquid petro-sensor installed within the tube. The petro-sensor probe shall be connected to the tank monitoring panel to provide a warning signal in the event the sensor probe detects leaked product within the secondary containment interstitial space. The unit shall be capable of performing a test of overall system operation and integrity.

**AUTOMATIC TANK GAUGING SYSTEM**

The monitoring system shall include an automatic tank gauge for measuring and recording product inventory for each tank from the panel location in the auto shop. The monitoring panel shall have a printer, and be programmed to provide a daily inventory of tank product volume. The gauging system shall include liquid level sensing equipment that measures product level to a resolution of 0.001 inches. The monitoring panel shall also be configured to monitor the petro-sensor probe within the interstitial space of the secondary containment for each tank. The system must also be capable of measuring water level on the bottom of the tank to the nearest 1/8 inch. The monitoring system shall be as manufactured by Gilbarco, EMCO Wheaton, or approved equal (as approved by the Engineer).

**POWER CUTOFF SWITCH**

A standard power on/off control switch for each dispenser pump shall be located in close proximity to the monitoring panel , as indicated in the drawings. Switches shall supply or cut off power to each dispensing pump to facilitate fueling activities. Power feeds between the dispensing pumps and the on/off control switches shall be on dedicated lines and will be independent of the power feeds to the dispensing system and monitoring panel for the purposes of leak detection and automatic tank gauging.

**CORROSION PROTECTION**

Corrosion protection for steel underground storage tanks shall be provided in the form of the sti-P3 system, consisting of the following:

1. Electrical isolation: Dielectric nylon reducing bushings or flange isolators to be used in each tank opening to isolate the tank from connecting steel pipes.

2. Electrically insulating exterior protective coating: Coating shall be tested in accordance with sti-P3 specifications.

3. Cathodic protection shall be provided and installed as per manufacturer’s recommendations and requirements set forth in COM 10.51.

**OVERFILL PROTECTION**

Overfill protection shall be provided by a 95% valve installed in the fill line which reacts to high levels of product in the tank by closing off the fill line to prevent further product introduction.

**EMERGENCY EQUIPMENT**

Provide a fire extinguisher with a 20BC rating for each tank. Extinguishers shall be installed in the locations indicated on the drawings. Extinguishers shall be installed in a manner that will protect them from adverse weather conditions and will maintain the extinguishers in good working condition.

**P A R T I I I - E X E C U T I O N**

**GENERAL**

The tank system including appurtenances shall be installed in strict accordance with the manufacturer’s recommendations and applicable fire and environmental codes. State and local permits shall be obtained prior to installation.

Tanks and systems shall be installed by certified installers in accordance with COM 10.91.

**BARRICADES AND WARNING DEVICES**

Refer to Section 02835 - Temporary Construction Site Barriers.

**SITE DEMOLITION**

Refer to Section 33.56.10 – Fuel Storage Tank Demolition

**INSTALLATION**

Tanks shall be installed in accordance with the requirements prescribed in the tank manufacturer’s instructions and any other installation requirements not indicated in the contract documents but specified in COM 10.

FUEL DISPENSERS AND PUMPS:

The product dispensers and their corresponding spill containment pans shall be installed at the locations indicated on the drawings.

The dispensers shall be installed and wired, and attached to the piping by a qualified installer and in accordance with Division 26 - Electrical.

PIPING AND FITTINGS:

All underground piping shall be buried a minimum of 30 inches beneath finished grade as shown on the design drawings.

Underground piping shall be installed on a firm smooth bedding layer at the bottom of the trench, free from sudden changes in elevation. Large stones and rocks shall be removed and shall not come in contact with the pipe. Backfill shall be free of sharp stones and large chunks of materials which could stress the pipe during backfill operations.

Upon completion of their installation, the pipelines shall be pressure tested to four times the anticipated operating pressure and maintained within accepted limits for one hour.

ELECTRICAL:

Electrical work shall be in accordance with applicable codes and shall be rated for hazardous area as required. Electrical system for dispenser pumps shall include an emergency shutoff switch located per code requirements. Tanks shall be electrically grounded in accordance with NFPA 78 and as shown on the drawings. Refer to Division 26. Electrical.

The tank system installations shall be inspected and approved by the system supplier or its certified contractor. The system supplier shall submit a comprehensive checklist of quality and safety items critical to the system and verify that the installation has been performed in accordance with these standards applicable fire and environmental codes.

State and local permit applications shall be completed using the correct forms. **System installation shall not start before obtaining the required State and local permits and approvals.**

**TESTING AND GUARANTEE**

Test all newly installed equipment for compliance with requirements of local, state, and federal regulations and to determine that the system is operating properly.

Upon completion of the installation work, submit to the Construction Representative a submittal packet which includes an as-built drawing and copies of all state and local government required paperwork and plan reviews, as well as manufacturers descriptions and specifications for all components of the system that were installed as part of the contract. In addition, provide a copy of the start-up test for the automatic tank gauge and monitoring panel.

Furnish copies of an updated Underground Petroleum Product Tank Registration Form (SBD-7437) and the Checklist for Underground Tank Installation (SBD-6294) to the Wisconsin Department of Commerce - Safety and Buildings Division, Bureau of Petroleum Inspection and Fire Protection, P.O. Box 7969, Madison, Wisconsin 53707, and to the Construction Representative.

Furnish the local fire department with a copy of a location drawing which includes a description of the updated underground storage tank and fuel dispensing system.

**SITE RESTORATION**

Unless otherwise specified or noted on the drawings, fully and completely restore the surface of all disturbed areas to a like condition of the surface prior to the work. Sawcut all pavements to straight and neat lines and repair with like materials to the full depth of the pavement as existed prior to the work. Topsoil, fertilize, seed, and mulch (or sod) all disturbed landscaped areas with a minimum of four (4) inches of topsoil, fertilizer, seed, and mulch (or sod), or provide for the restoration of other landscaping materials as necessary.

Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

Burning is not permitted.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 33 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

# AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of one hour. Training session must also include instructions on leak detection and record keeping as required by the Wisconsin Department of Commerce. Guidance must also be given as to how to respond in the event the monitoring panel indicates a leak in the system.

END OF SECTION