SECTION 231300 - FACILITY FUEL-STORAGE TANKS

This Section includes underground tanks, aboveground tanks, and leak detection system normally encountered in fuel oil systems.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting the requirements of this specification.

This Section includes performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

This Section includes the term Architect/Engineer. "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See the Drawing Coordination Considerations for information needed to coordinate this specification Section with the Drawings.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Underground fuel storage tanks.

Aboveground fuel storage tanks.

Aboveground steel secondary containment dike tank.

Leak detection and location system.

* + - * 1. Related Sections:

Section 033000 - Cast-In-Place Concrete: Product requirements for concrete ballast and fill pads for underground tank for placement by this section.

Section 055000 - Metal Fabrications: Product and execution requirements for bollards for placement by this section.

Section 260526 - Grounding and Bonding for Electrical Systems: Product and execution requirements for grounding for placement by this section.

Section 310000 - Earthwork: Product and execution requirements for excavation and backfill required by this section.

Section 310001 – Earthwork Materials: Requirements for backfill to be placed by this section

Section 315000 – Excavation Support and Protection: Requirements for excavation and backfill required by this section.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. American Petroleum Institute:

API 12P - Fiberglass Reinforced Plastic Tanks.

API 650 - Welded Steel Tanks for Oil Storage.

API 1615 - Installation of Underground Petroleum Storage Systems.

API 1632 - Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems.

API 2000 - Venting Atmospheric and Low-Pressure Storage Tanks: Nonrefrigerated and Refrigerated.

* + - * 1. NACE International:

NACE RP-02-85 - Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.

* + - * 1. National Electrical Manufacturers Association:

NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

* + - * 1. National Fire Protection Association:

NFPA 30 - Flammable and Combustible Liquids Code.

NFPA 31 - Standard for the Installation of Oil-Burning Equipment.

* + - * 1. Petroleum Equipment Institute:

PEI 100 - Recommended Practices for Installation of Underground Liquid Storage Systems.

* + - * 1. Steel Tank Institute:

STI ACT-100 - Specification for External Corrosion Protection of FRP Composite Steel Underground Storage Tanks.

* + - * 1. Underwriters Laboratories Inc.:

UL 58 - Steel Underground Tanks for Flammable and Combustible Liquids.

UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids.

UL 567 - Pipe Connectors for Flammable Liquids and Combustible Liquids and LP-Gas.

UL 913 - Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous Locations.

UL 1316 - Glass Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures.

UL 2085 - Standard for Safety for Insulated Aboveground Tanks Flammable and Combustible Liquids.

* + - 1. SYSTEM DESCRIPTION

Use this article carefully; restrict statements to describe components used to assemble system. Do not repeat statements made in Summary article; "Section includes" paragraph.

The following are performance type statements. Retain when Drawings do not indicate these items. Suggest adding paragraph to describe type of system and design system temperatures. Use carefully and edit to meet project requirements.

* + - * 1. Provide [**aboveground] [underground**] <\_\_\_\_\_\_\_\_> tank of [**single] [double**] wall of [**welded** **steel] [fiberglass construction**] <\_\_\_\_\_\_\_\_>.

[**Provide tank with tank gage**.]

[**Provide tank with cathodic protection**.]

[**Provide tank with** <\_\_\_\_\_\_\_\_>.]

Tank Capacity:

Volume: <\_\_\_\_\_\_\_\_> gallons.

Diameter: <\_\_\_\_\_\_\_\_> inches.

Overall Length: <\_\_\_\_\_\_\_\_> inches.

* + - 1. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        4. Section 013300 - Submittal Procedures: Submittal procedures.
        5. Shop Drawings:

Tanks: Indicate for fuel oil tanks dimensions; number, size, and location of openings; number, size, and location of manholes; number and location of hold down straps, and accessories. Indicate dimensions, reinforcing steel size, and reinforcing steel location of [**pads] [foundations**].

* + - * 1. Product Data:

Tanks: Submit manufacturer's catalog information including capacity.

Leak Detection and Location System: Submit manufacturer's catalog information for controller, alarm unit, cable type, [**and**] <\_\_\_\_\_\_\_\_>.

* + - * 1. Test Reports: Submit written test results for tank pressure test.
        2. Manufacturer's Installation Instructions: Submit [t**anks,] [and] [leak detection and location system**] data.
        3. Manufacturer's Certificate:

Certify [**Products**] <\_\_\_\_\_\_\_\_> meet or exceed [**specified requirements**] <\_\_\_\_\_\_\_\_>.

Submit certificate of evaluation of leak detection and location system by independent third party.

* + - * 1. Manufacturer's Field Reports: Submit report of each visit of manufacturer's [**personnel**] [**representative**] <\_\_\_\_\_\_\_\_> to provide technical assistance during installation.
      1. CLOSEOUT SUBMITTALS
         1. procedures.
         2. Project Record Documents: Record actual locations of manholes, tanks, and leak detection and location system.
         3. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
         4. Operation and Maintenance Data: Submit spare parts lists **[, exploded assembly views]** for **[tanks,] [leak detection and location system] [and**] <\_\_\_\_\_\_\_\_>.
      2. QUALITY ASSURANCE
         1. Perform Work in accordance with [**NFPA 30] [NFPA 31**].
         2. Evaluate leak detection and location system by independent third party according to Third Party Procedures developed according to US EPS's "Standard Test Procedure for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors." Evaluation results to verify system manufacturer's claim regarding sensitivity, range and other performance data.

Include the following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**one** **copy**] [<\_\_\_\_\_\_\_\_> **copies**] of [**each**] document on site.
      1. QUALIFICATIONS
         1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' [**documented**] experience.
         2. Above Ground Fuel Storage Tanks: Company specializing in manufacturing products specified in this section with minimum [**three**] <\_\_\_\_\_\_\_\_> years' [**documented**] experience.
         3. Leak Detection Systems: Company specializing in manufacturing products specified in this section with minimum [**three**] <\_\_\_\_\_\_\_\_> years' [**documented**] experience.
         4. Installer: Company specializing in performing Work of this section with minimum three years [**documented**] experience [**approved by manufacturer**].
      2. PRE-INSTALLATION MEETINGS
         1. Section 013000 - Administrative Requirements: Pre-installation meeting.
         2. Convene minimum [**one**] <\_\_\_\_\_\_\_\_> week prior to commencing work of this section.
      3. DELIVERY, STORAGE, AND HANDLING
         1. Product storage and handling requirements.
      4. ENVIRONMENTAL REQUIREMENTS
         1. Do not install underground tank when bedding is wet or frozen.
         2. Do not install tank foundations when bedding is wet or frozen.
      5. COORDINATION
         1. Section 013000 - Administrative Requirements: Requirements for coordination.
         2. Coordinate [**trenching] [excavating] [bedding] [backfilling**] <\_\_\_\_\_\_\_\_> of **[underground tanks] [aboveground tank foundations**] <\_\_\_\_\_\_\_\_> with requirements of Section <\_\_\_\_\_\_\_\_>.
      6. WARRANTY

This article extends warranty period beyond one year. Extended warranties increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Product warranties and product bonds.
        2. Furnish [**five] [30**] <\_\_\_\_\_\_\_\_>-year manufacturer's warranty for tanks.
        3. Furnish [**five**] <\_\_\_\_\_\_\_\_>-year manufacturer's warranty for leak detection and location system.

1. PRODUCTS
   * + 1. UNDERGROUND FUEL STORAGE TANKS

In this article, list manufacturers acceptable for this Project.

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:  
           Hall Tank Co.

Hamilton Tanks.

Highland Tank & Manufacturing Company, Inc.

Kennedy Tank and Manufacturing Company, Inc.

Modern Welding Company, Inc.

Palmer Manufacturing and Tank Company.

Steel Tank and Fabricating Corporation (STAFCO).

Watco Tanks, Inc.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Tank: [**STI ACT-100] [API 12P] [UL 1316**], UL listed and labeled, closed [**single] [double**] wall type. Reinforced glass fiber polyester, capable of storage of liquid with specific gravity of [**1: 1**] <\_\_\_\_\_\_\_\_> and temperatures up to 150 degrees F.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Tank: [**API 650] [UL 58] [UL 142**], UL listed and labeled, closed [**single] [double**] wall type, welded steel, cleaned and coated with [**corrosion-resistant asphalt base paint] [hot applied bitumen] [epoxy] [coal tar epoxy**].
        2. Furnish tank with the following:

[**Anchor] [Hold down**] straps and attachments.

Lifting lugs.

Fittings and taps for accessories.

[**22**] [**24**] <\_\_\_\_\_\_\_\_> inch diameter [**fiberglass**] <\_\_\_\_\_\_\_\_> manhole with [**4**] <\_\_\_\_\_\_\_\_> inch fittings in cover.

[**4**] <\_\_\_\_\_\_\_\_> inch shell wall service fitting.

[**4**] <\_\_\_\_\_\_\_\_> inch monitor fitting.

Fiberglass Reservoir.

* + - * 1. Filler Cap: 3 inch watertight brass with lock [, **recessed box and cover**].
        2. Gage: Remote reading, electronic, for two wire, 24 volt power, with wall mounted direct reading gage.
        3. Cathodic Protection: [**API 1632**,] Galvanic type with sacrificial magnesium anodes welded to tank [, **to NACE RP-02-85] [, to STI ACT-100].**

Use the following paragraphs for one or more identical units. Include schedule when specifying units with different criteria.

* + - * 1. Capacity:

Volume: <\_\_\_\_\_\_\_\_> gallons.

Diameter: <\_\_\_\_\_\_\_\_> inches.

Overall Length: <\_\_\_\_\_\_\_\_> inches.

Tank Fittings:

Fill: <\_\_\_\_\_\_\_\_> inch.

Vent: <\_\_\_\_\_\_\_\_> inch, galvanized, including "T" and elbow assembly with 1/4 inch square mesh screen over inlet.

Suction: <\_\_\_\_\_\_\_\_> inch anti-siphon connection to tank bottom with foot valve.

Return: <\_\_\_\_\_\_\_\_> inch.

Gage fitting <\_\_\_\_\_\_\_\_> inch.

Connections: UL 567 “Pipe Connectors for Flammable Liquids and Combustible Liquids and LP-Gas”, dielectric bushings.

Manway: [**18] [22**] <\_\_\_\_\_\_\_\_> inch diameter, with cover and gasket, and extension sleeve; located at top of tank.

Leak Detector System: Model <\_\_\_\_\_\_\_\_> manufactured by <\_\_\_\_\_\_\_\_>.

* + - 1. ABOVEGROUND FUEL STORAGE TANKS

In this article, list manufacturers acceptable for this Project.

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Brown Tank, LLC.

Buffalo Tank Company, Inc.

Hall Tank Co.

Hamilton Tanks.

Highland Tank & Manufacturing Company, Inc.

Modern Welding Company, Inc.

Palmer Manufacturing and Tank Company.

Steel Tank and Fabricating Corporation (STAFCO).

Watco Tanks, Inc.

We-Mac Manufacturing, Inc.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

The following specification is for multi-hazard aboveground tank. Research applicable local codes and standards because tank can be rated for fire test, hose stream test, and bullet resistance test. Add text to meet local requirements.

* + - * 1. Product Description: Tank rated for multiple hazards and constructed of multiple layers consisting of inner steel tank surrounded by insulating concrete and outer steel tank providing multi-hazard rating including 4 hour fire resistance to meet requirements of UL 2085 “Standard for Safety for Insulated Aboveground Tanks Flammable and Combustible Liquids”.
        2. Tank Configuration: [**Rectangular] [Cylindrical**].

Generally, 3/16 inch thick steel is used for tanks with capacity of less than 4,000 gallons (15,150 liters) and 1/4 inch thick steel for tanks 4,000 gallons (15,150 liters and larger.)

* + - * 1. Primary Tank: Single wall steel tank constructed in accordance with UL 142 “Steel Aboveground Tanks for Flammable and Combustible Liquids” not less than **[3/16] [1/4**] inch thick.
        2. Insulation: 6 inches of lightweight insulating concrete furnishing thermal protection. No metal-to-metal connections of inner tank and outer tank are allowed except at tank nozzles.
        3. Outer Tank: Single wall steel tank constructed in accordance with UL 142 “Steel Aboveground Tanks for Flammable and Combustible Liquids” not less than [**3/16**] <\_\_\_\_\_\_\_\_> inch thick.
        4. Finish: Factory painted with industrial epoxy and urethane coating with dry film thickness of 4 mils. Color: [**light ivory] [white**] <\_\_\_\_\_\_\_\_>.
        5. Fill Connection: Furnish fill containment assembly with capacity of not less than 15 gallons. Furnish with hinged locking cover, stainless steel hinges, handle, safety chain, and lock hasp.
        6. Normal Vent: Furnish each compartment of primary tank with 2 inch updraft venting device exhausting upward at elevation of at least 12 feet aboveground. Size vent in accordance with NFPA 30 “Flammable and Combustible Liquids Code”.
        7. Emergency Vent: Furnish each compartment of primary tank with emergency vent sized in accordance with NFPA 30 “Flammable and Combustible Liquids Code”. Do not use access openings for emergency venting purposes.
        8. Monitor Port: Minimum 2 inch steel pipe with locking cap to be used for detecting leaks between primary and outer tanks.
        9. Accessories:

Level Gage: Mechanical float activated level gage capable of indicating approximate fluid level in tank reading in feet and inches.

Tank Decals: Furnish [**warning] [and] [tank identification**] signs located prominently on tank following [**local [fire] code**] <\_\_\_\_\_\_\_\_> requirements.

Use the following when tank fill adapter is located higher than 42 inches aboveground surface.

Access Steps: Furnish galvanized access platform with working surface of minimum of [**24**] <\_\_\_\_\_\_\_\_> inches in width, [**20**] <\_\_\_\_\_\_\_\_> inches in length, and 36 inches below top of tank.

<\_\_\_\_\_\_\_\_>.

Use the following paragraphs for one or more identical units. Include schedule when specifying units with different criteria.

* + - * 1. Capacity:

Volume: <\_\_\_\_\_\_\_\_> gallons.

Diameter: <\_\_\_\_\_\_\_\_> inches.

Overall Length: <\_\_\_\_\_\_\_\_> inches.

Tank Fittings:

Fill: <\_\_\_\_\_\_\_\_> inch.

Vent: <\_\_\_\_\_\_\_\_> inch, galvanized, including "T" and elbow assembly with 1/4 inch square mesh screen over inlet.

Suction: <\_\_\_\_\_\_\_\_> inch anti-siphon connection to tank bottom with foot valve.

Return: <\_\_\_\_\_\_\_\_> inch.

Gage fitting <\_\_\_\_\_\_\_\_> inch.

Manway: [**18] [22**] <\_\_\_\_\_\_\_\_> inch diameter, with cover and gasket, and extension sleeve; located at top of tank.

Leak Detector System: Model <\_\_\_\_\_\_\_\_> manufactured by <\_\_\_\_\_\_\_\_>.

* + - 1. ABOVEGROUND STEEL SECONDARY CONTAINMENT DIKE TANK

In this article, list manufacturers acceptable for this Project.

* + - * 1. A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Areo Power Tanks, LLC.

Buffalo Tank Company, Inc.

Hall Tank Co.

Hamilton Tanks.

Highland Tank & Manufacturing Company, Inc.

Kennedy Tank and Manufacturing Company, Inc.

Modern Welding Company, Inc.

Watco Tanks, Inc.

We-Mac Manufacturing, Inc.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

Generally dike tank is sized for 100 to 150 percent of storage tank capacity.

* + - * 1. Product Description: Aboveground, single wall, steel storage tank with aboveground steel secondary containment dike. Manufactured in accordance with UL 142 “Steel Aboveground Tanks for Flammable and Combustible Liquids” and labeled.
        2. Storage Tank: Welded steel, round with steel support saddles. [**Furnished with factory coating of red oxide primer.] [Commercial grit blast (SSPC-6), epoxy primer coat**.] <\_\_\_\_\_\_\_\_.>
        3. Dike Tank: Welded steel, rectangular with steel supports. [**Furnished with factory coating of red oxide primer.] [Commercial grit blast (SSPC-6), epoxy primer coat**.] <\_\_\_\_\_\_\_\_>
        4. Finish: Factory painted with [**polyurethane coating**] <\_\_\_\_\_\_\_\_> with dry film thickness of <\_\_\_\_\_\_\_\_> mils. Color: <\_\_\_\_\_\_\_\_>.
        5. Storage Tank: Fabricated with the following:

[**2] [4] [6**] inch threaded connections. Furnish thread protectors inserted in threaded openings prior to shipment.

Number of threaded connections: <\_\_\_\_\_\_\_\_>.

<\_\_\_\_\_\_\_\_> inch 150 Class flanged connections with flange protectors.

Number of flanged connections: <\_\_\_\_\_\_\_\_>.

The following are available accessories or options, edit to meet project conditions.

* + - * 1. Accessories:

Manway [**18] [22**] <\_\_\_\_\_\_\_\_> inches in diameter with bolted and gasketed lid.

Loose-bolt manway <\_\_\_\_\_\_\_\_> inches in diameter with bolted and gasketed lid.

Emergency vent.

External ladder.

External ladder and platform.

External stairway.

Pump platform.

Walkway with handrails.

Internal Ladder.

Internal coating: <\_\_\_\_\_\_\_\_>.

Level sensing system.

Overfill containment chamber.

* + - * 1. Capacity:

Storage Tank:

Volume: <\_\_\_\_\_\_\_\_> gallons.

Diameter: <\_\_\_\_\_\_\_\_> inches.

Overall Length: <\_\_\_\_\_\_\_\_> inches.

Secondary Containment Dike Tank:

Volume: <\_\_\_\_\_\_\_\_> gallons.

Diameter: <\_\_\_\_\_\_\_\_> inches.

Overall Length: <\_\_\_\_\_\_\_\_> inches.

Tank Fittings:

Fill: <\_\_\_\_\_\_\_\_> inch.

Vent: <\_\_\_\_\_\_\_\_> inch, galvanized, including "T" and elbow assembly with 1/4 inch square mesh screen over inlet.

Suction: <\_\_\_\_\_\_\_\_> inch anti-siphon connection to tank bottom with foot valve.

Return: <\_\_\_\_\_\_\_\_> inch.

Gage fitting <\_\_\_\_\_\_\_\_> inch.

* + - 1. CONCRETE ENCASED PROTECTED FUEL STORAGE TANKS
         1. Tanks shall be listed as secondary containment in accordance with UL 2085, and shall be marked for fire resistance, and protected from vehicle impact and projectile hazards.
         2. Type: Double wall steel interior tank enclosed within a 6 inch thick concrete secondary tank.

Concrete Tank:

Minimum Compressive Strength of Concrete: 3000 psi.

Finish: Clear acrylic coating on exposed aggregate tank surface.

Top of Tank including Chamfered Edges: Elastomeric coating on exposed aggregate tank surface.

Concrete Tank Surface: Free of voids, cracks and patches.

* + - 1. LEAK DETECTION AND LOCATION SYSTEM

In this article, list manufacturers acceptable for this Project.

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Caldwell Systems Corporation.

Containment Solutions, Inc.

Franklin Fueling Systems.

Gems Sensors & Controls Inc.

Highland Tank & Manufacturing Company, Inc.

In-Situ, Inc.

PermAlert.

Pneumercator Inc.

Veeder-Root Company (The).

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers' products specified above.

* + - * 1. Product Description: Microprocessor based monitoring unit, sensor cable, probes, system layout map, and auxiliary equipment to provide continuous monitoring of sensing strings for leaks, shorts, breaks, and probe activation. When any of these conditions occur at any point along cable, alarm sounds, type of condition is identified and location displayed. System monitors interstitial space of double contained tanks. Construct system to meet requirements of UL 913 “Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous Locations”.
        2. Performance:

Use 0.1 percent for water and 0.2 percent for hydrocarbons.

Detect and identify location of first leak within [**0.1] [0.2**] percent of sensor string length or 5 feet, whichever is greater. Identify type of alarm.

Sensing String Length: Monitor up to [**15,000] [10,000] [5,000] [2,000**] feet of cable for each sensor string from single monitoring unit.

Multiple Leaks: Detect and locate multiple leaks or additional liquid on sensor cable.

Breaks and Shorts: Identify location of breaks and shorts on cable. When faults occur, sound alarm, and display on front of monitoring unit type of fault and location of fault.

Liquids Detected: [**Detect liquids, including aqueous, hydrocarbon, conductive, and nonconductive liquids.] [Furnish two cables to detect and differentiate between hydrocarbons or solvents and aqueous liquids.] [Only hydrocarbons are to be detected**.]

Remote Annunciation: Furnish relays for remote indication of alarm conditions. Relays indicate no alarm conditions exist, alarm condition exists but has not yet been acknowledged, and alarm condition exists and has been acknowledged. Communications available via RS-232 and ASCII communication protocols to allow central point monitoring and control via remote computer.

Archives: Record significant events in nonvolatile memory with capacity of 900 events. When memory becomes full, recorded events are deleted from memory on first-in-first-out basis. Each recorded event includes time and date event occurred. Archives retrievable through RS-232 and ASCII communication protocols.

System Status: Continuously give positive indication of monitoring sensing string and status of sensing string. System clock indicates time and date on LCD of monitoring panel. System clock is programmable. Include time and date indication for events recorded in memory.

Security: Assignable password security for varying levels of system access. Minimum of 20 passwords available within system. System to not allow unauthorized modifications to sensing string to be made without causing alarm condition.

Sensor Types: Capable of monitoring sensor cables, probe sensors, and switch sensors such as float switches, and pressure switches, from same monitoring panel. English language displays indicate status of sensors.

Sensitivity: System to not detect incidental liquid contact. Sensitivity field adjustable to increase or decrease amount of wetted cable needed to cause alarm.

* + - * 1. Components:

Monitoring Unit:

Indicates when liquid comes in contact with sensor cable by sounding alarm, actuating output relays, displaying message leak has been detected and giving location of leak on sensing string.

Unit furnished with green LED on panel front indicates unit is powered. Furnish two line by forty character backlit LCD visible from front of unit to provide system data. Red LED on panel front indicates alarm condition has occurred. Unit power requirements: 120/240 VAC, 100 VA, 50/60 Hz, single phase. Equip with RS-232 communication port and minimum of one common and one SPDT output relay for each cable, rated for 250 VAC, 10 amp.

Enclose in modified NEMA 250 “Enclosures for Electrical Equipment (1000 Volts Maximum)” Type [**12] [4X] [7**] <\_\_\_\_\_\_\_\_> enclosure. UL listed to provide connections for intrinsically safe sensor circuits for use in hazardous locations. Ability to locate leak does not depend on battery backed up functions. In event of power failure, store system conditions and parameters in nonvolatile memory allowing unit to automatically resume monitoring, without resetting, upon restoration of power. Furnish on-off switch in panel.

Sensor Cable: Coaxial construction consisting of insulated copper center conductor, spacer material, and outer braid. Center conductors not less than 20 AWG for mechanical strength. Cables field repairable.

1. EXECUTION
   * + 1. EXAMINATION
          1. Section 013000 - Administrative Requirements: Coordination and project conditions.
          2. Verify excavations are to required grade, dry, and not over-excavated.
          3. Verify [**concrete ballast pad] [tank foundation**] <\_\_\_\_\_\_\_\_> are ready for tank installation.
       2. INSTALLATION - UNDERGROUND TANKS
          1. Install underground tanks in accordance with [**API 1615,] [PEI 100,] [NFPA 30,] [and] [NFPA 31**].
          2. Check factory installed equipment and accessories for loosening during transit.
          3. Clean and flush tanks [**prior to delivery to site.] [after installation**.] Seal until pipe connections are made.
          4. Install underground tanks on concrete ballast pad with mass equal to tank capacity. Refer to Section 033000. Secure with hold-down straps and turnbuckles.
          5. Install single-wall underground tanks in concrete vault or provide impermeable liner in excavation around tank. Refer to Section <\_\_\_\_\_\_\_\_> for vault.
          6. Install piping connections to tanks with unions and swing joints. Provide venting in accordance with API 2000 “Venting Atmospheric and Low-Pressure Storage Tanks: Nonrefrigerated and Refrigerated”.
          7. Seal unused tank openings using threaded pipe plugs, flanges, or caps.
          8. Extend fill line and cover to grade and provide minimum 24 x 24 x 6 inches concrete pad. Refer to Section 033000.
          9. Tank Accessories:

Install tank accessories shipped loose with tank.

Install the following tank accessories: [**anti-siphon devices,] [overfill shutoff and alarms,] [vents,] [gages,] [emergency vents] [and**] <\_\_\_\_\_\_\_\_>.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Install tank accessories as indicated on Drawings.

* + - * 1. Install underground tanks with minimum [**24**] <\_\_\_\_\_\_\_\_> inches cover.
        2. Backfill steel tanks in accordance with [**NFPA 30] [and] [NFPA 31**].
        3. Adjust liquid level gages before initial start-up and after filling of tank.
        4. Install underground tanks in accordance with [<\_\_\_\_\_\_\_\_> [**applicable**] code] [**authority having jurisdiction**] <\_\_\_\_\_\_\_\_>.
      1. INSTALLATION - ABOVEGROUND TANKS
         1. Install aboveground tanks in accordance with [**API 1615,] [PEI 100,] [NFPA 30,] [and] [NFPA 31**].
         2. Check factory installed equipment and accessories for loosening during transit.
         3. Clean and flush tanks [**prior to delivery to site.] [after installation**.] Seal until pipe connections are made.
         4. Install aboveground tanks on concrete foundation. Refer to Section 033000. Secure with [**hold-down straps and turnbuckles**] <\_\_\_\_\_\_\_\_>.
         5. Install aboveground tank [**supports] [anchor bolts**] <\_\_\_\_\_\_\_\_> in accordance with [<\_\_\_\_\_\_\_\_> [**applicable**] **code**] [**authority having jurisdiction**] <\_\_\_\_\_\_\_\_>.
         6. Install grounding for aboveground tanks in accordance with Section 260526.
         7. Protect aboveground tanks by installing pipe bollards spaced [**as indicated on Drawings**] <\_\_\_\_\_\_\_\_>. Refer to Section 055000.
         8. Install piping connections to tanks. Provide venting in accordance with API 2000 “Venting Atmospheric and Low-Pressure Storage Tanks: Nonrefrigerated and Refrigerated”.
         9. Tank Accessories:

Install tank accessories shipped loose with tank.

Install the following tank accessories: [**anti-siphon devices,] [overfill shutoff and alarms,] [vents,] [gages,] [emergency vents] [and**] <\_\_\_\_\_\_\_\_>.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Install tank accessories as indicated on Drawings.

* + - * 1. Adjust liquid level gages before initial start-up and after filling of tank.
        2. Install aboveground tanks in accordance with [<\_\_\_\_\_\_\_\_> [**applicable] code] [authority having jurisdiction**] <\_\_\_\_\_\_\_\_>.
      1. INSTALLATION - LEAK DETECTION AND LOCATION SYSTEM
         1. Install cable on flat surfaces with hold down clips every 8 feet and cable tags every 50 feet.
         2. Graphic Locator Map: Provide location map with system reflecting actual installation showing system configuration and sensing string layout. Furnish length along cable as references to locate leaks. Base footage on calibration points.
         3. Calibration Points: Record calibration points along sensing string in accordance with manufacturer's procedures. Provide sensor cables with cable tags every 50 feet.
         4. Direct Buried of Hydrocarbon Sensing Cable:

Replace cable damaged during installation.

Seal cable ends to prevent moisture ingress.

Install cable so connectors are accessible in junction boxes at grade or in manholes, valve pits or other locations.

Install cable from underground to grade using PVC pipe.

Install on prepared bedding.

Backfill cable with 6 inches of [**sand] [material in accordance with 02320**] <\_\_\_\_\_\_\_\_> placed on top of cable and compacted prior to pipe installation.

Where cable is to be covered by concrete or other structures, install sensor cable in slotted PVC pipe. Install with access points space <\_\_\_\_\_\_\_\_> feet apart to allow replacing and servicing.

* + - 1. FIELD QUALITY CONTROL
         1. Field inspecting, testing, adjusting, and balancing.
         2. Pressure test [**aboveground] [underground**] tanks in accordance with the following:

Pressure test [**tank] [inner tank] with air to [5**] <\_\_\_\_\_\_\_\_> psig. [**Pressure [tank interstitial space**] <\_\_\_\_\_\_\_\_> with air to [**5**] <\_\_\_\_\_\_\_\_> psig.]

Repair leaks.

Retest until no leaks are detected.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Pressure test [**aboveground] [underground**] tanks in accordance with [**NFPA 30] [NFPA 31**] <\_\_\_\_\_\_\_\_>.
        2. Field Testing Leak Detection System:

Perform tests to demonstrate ability of system to detect and locate breaks, shorts and probes on sensor string.

Perform leak testing in accordance with the following procedure to verify operation and ability to work with condensation pools or other static moisture:

Wet sensor cable near start of sensor string and acknowledge detection or location alarm and recheck system.

Wet sensor cable near end of sensor string with first location still wetted and acknowledge detection or location alarm and recheck system.

Wet sensor cable in [**three**] <\_\_\_\_\_\_\_\_> additional locations between first and second leak locations with each detection or location alarm being acknowledged and prior leak locations still wetted.

Retain last sentence in the following subparagraph for direct buried hydrocarbon use only.

Prepare and submit report verifying each leak location and detection accuracy. Furnish history print out of test results from panel. [**Submit TDR traces for each test run to allow verification of wet locations**.]

* + - 1. MANUFACTURER'S FIELD SERVICES
         1. Requirements for manufacturer’s field services.
         2. Furnish [**factory trained representative**] <\_\_\_\_\_\_\_\_> for [**8] [16**] <\_\_\_\_\_\_\_\_> hours of on-site time during [**underground] [aboveground**] tanks installation.
         3. Furnish [**factory trained representative**] <\_\_\_\_\_\_\_\_> of system supplier for [**8] [16**] <\_\_\_\_\_\_\_\_> hours of on-site time during leak detection and location system sensor and electronics installation.
         4. Furnish [**factory trained representative**] <\_\_\_\_\_\_\_\_> for [**8] [16**] <\_\_\_\_\_\_\_\_> hours of on-site time during final checkout of [**underground] [aboveground**] tanks installation.
         5. Furnish [**factory trained representative**] <\_\_\_\_\_\_\_\_> of system supplier for [**8] [16**] <\_\_\_\_\_\_\_\_> hours of on-site time during final checkout of leak detection and location system.
      2. SCHEDULES

Include schedule when more than one piece of unique equipment is required. Complete schedule in conjunction with identification method used on Drawings, or include schedule on Drawings. No units of measurement are indicated; these may be added to schedule legend or included within each insert.

Consider the following examples when developing Project schedule.

* + - * 1. Tanks:

Tank Tag: T-1:

Location: <\_\_\_\_\_\_\_\_>.

Service: <\_\_\_\_\_\_\_\_>.

Capacity: <\_\_\_\_\_\_\_\_>.

Diameter: <\_\_\_\_\_\_\_\_>.

Length: <\_\_\_\_\_\_\_\_>.

Fitting Sizes: <\_\_\_\_\_\_\_\_>.

Inlet: <\_\_\_\_\_\_\_\_>.

Outlet: <\_\_\_\_\_\_\_\_>.

Vent: <\_\_\_\_\_\_\_\_>.

Gage: <\_\_\_\_\_\_\_\_>.

Fill: <\_\_\_\_\_\_\_\_>.

Auxiliary: <\_\_\_\_\_\_\_\_>.

Access Size: <\_\_\_\_\_\_\_\_>.

Tank Tag: T-2:

Location: <\_\_\_\_\_\_\_\_>.

Service: <\_\_\_\_\_\_\_\_>.

Capacity: <\_\_\_\_\_\_\_\_>.

Diameter: <\_\_\_\_\_\_\_\_>.

Length: <\_\_\_\_\_\_\_\_>.

Fitting Sizes: <\_\_\_\_\_\_\_\_>.

Inlet: <\_\_\_\_\_\_\_\_>.

Outlet: <\_\_\_\_\_\_\_\_>.

Vent: <\_\_\_\_\_\_\_\_>.

Gage: <\_\_\_\_\_\_\_\_>.

Fill: <\_\_\_\_\_\_\_\_>.

Auxiliary: <\_\_\_\_\_\_\_\_>.

Access Size: <\_\_\_\_\_\_\_\_>.

END OF SECTION 231300