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**PART 1 GENERAL****1.1 RELATED DOCUMENTS**

- A. The requirements of the General Conditions, Supplementary Conditions and the following Specification sections apply to all Work herein:
1. Section 22 00 10 - General Requirements
  2. Section 22 00 20 - Plumbing Scope of Work
  3. Section 22 05 07 - Design Conditions
  4. Section 22 05 93 - Testing, Balancing and Adjusting

**1.2 SUMMARY**

- A. Furnish and install a complete fuel oil systems serving the emergency power generating system herein specified and as indicated on the Drawings.

**1.3 REFERENCE STANDARDS**

- A. All tanks, pumps, piping, controls and accessories shall be designed, manufactured and tested in accordance with the latest applicable standards including the following:
1. ASME
  2. Underwriters Laboratories
  3. American Welding Society
  4. API 650
  5. API 2000
  6. EPA
  7. NEMA
  8. NFPA 30
  9. NFPA 31
  10. NFPA 37
  11. NFPA 70
  12. NFPA 110
  13. ANSI B31
  14. UL 2085
  15. Uniform Fire Code
  16. Uniform Building Code
- B. All equipment and material to be furnished and installed on this Project shall be UL or ETL listed, in accordance with the requirements of the authorities having jurisdiction, and suitable for its intended use on this Project.

**1.4 SUBMITTALS**

- A. The following submittal data shall be furnished according to the General Conditions and Section 22 00 10 and shall include, but not be limited to:
1. Tanks, complete with controls, gauges, materials, accessories, etc.\*
  2. Pumps.
  3. Controls.\*
  4. Submit Shop Drawings of the tanks and accessories for Engineer's re-view before fabrication of the tanks (and prior to commencing the fuel piping systems for standby generating system fuel storage tanks).
  5. Piping System Shop Drawings for review prior to fabrication.
- B. All items or equipment listed above with asterisks (\*) shall be certified by the manufacturer using Manufacturer Certification "MCA" as set forth in Section 22 00 10. See Section 22 00 10 for certification requirements.

**1.5 WARRANTY**

- A. Comply with the requirements of the General Conditions, Section 22 00 10 and this specification Section.

**PART 2 PRODUCTS****2.1 ACCEPTABLE MANUFACTURERS**

- A. If it complies with these Specifications, concrete encased aboveground fuel tank manufactured by one of the following manufacturers will be acceptable:
1. Convault
  2. STI Fireguard
  3. Supervault MH
- B. If it complies with these Specifications, fuel maintenance systems manufactured by one of the following manufacturers will be acceptable:
1. FuelTech, Inc.
- C. If it complies with these Specifications, fuel oil transfer pumps manufactured by one of the following manufacturers will be acceptable:
1. Red Jacket/Marley
  2. Tokhiem
- D. If it complies with these Specifications, fuel tank monitoring systems manufactured by one of the following manufacturers will be acceptable:
1. Veeder Root

**2.2 FUEL OIL PIPING**

- A. The fuel piping system for the emergency generator shall be furnished and installed by this Subcontractor under the direction of the emergency generator system manufacturer as specified in Division 26. The emergency generator system is furnished under Division 26. See Division 26 Specification Section 26 32 13 titled "Engine Generators" for requirements.
- B. All above ground fuel oil piping shall be sized as indicated on the drawings and shall comply with Underwriters Laboratories standards, the latest edition of NFPA 37, all current EPA Standards, as well as all state and local codes. Vent piping, fuel oil supply and return piping including secondary containment pipe shall be steel pipe, ASTM A53, Schedule 40. Pipe, valves and fittings shall meet the requirements of ANSI B31.4 as required by NFPA 37. Pipe wall thickness shall be determined according to the provisions of ANSI B31.3 and ANSI B34.1.
1. Pipe fittings shall be welded, Class 150 ANSI B16.9.
  2. All fuel oil piping, between fuel oil pump and day tank and from day tank to storage tank within the building shall be installed in Schedule 40 piping and completely encased with an approved two (2) hour (minimum) fire rated closure for horizontal and vertical run.
- C. Fuel oil piping shall comply with the following:
1. The inner product piping shall be centered within the outer containment piping by using carrier guides, permitting continuous leak monitoring. All components of the double containment system shall be manufactured by the pipe manufacturer and intended for installation as an integral system. The inner product pipe and the outer containment pipe shall slope towards the fuel storage tank. Provide a flexible piping connection at least 12" long of the wire reinforced type suitable for diesel fuel oil application at the connection to each generator and each pump.
- D. Slope piping a minimum of 1% away from generator room. Drain piping shall terminate in a full size quick disconnect type couplings with caps chained to pipe. Quick disconnect couplings shall be manufactured by Andrews or Sealtest.

- E. Fuel oil piping stop valves up to and including 2" in size shall be Nibco T-580-70 or Engineer approved equal ball valves. Ball valves shall be red brass, cast bronze or yellow forged bronze with brass body and stainless steel or bronze ball and stem, 400 psig nonshock WOG at 200°F.
- F. Furnish and install a UL listed thermally actuated safety valve in fuel supply line leaving bulk storage tank. Safety valve shall automatically close in the event of a fire (fusible link set to melt at 160°F). Valve shall have carbon steel body with all internal wetted working parts of Type 316 stainless steel. Valve shall be provided with internal bypass valve. Thermally activated shutoff valve shall be similar and Engineer approved equal to a Proctoseal C3000T.
- G. Furnish and install a UL listed full port, normally open, internal pilot operated solenoid valve in fill line to bulk storage tank. No differential pressure shall be required to open valve. Coil shall be Class "H" construction, 120V AC and 60 hertz. Solenoid valve shall be explosion proof and water tight construction suitable for oil service at a maximum differential pressure of 100 psig and maximum temperature of 212°F solenoid valve shall be similar and approved equal to Magnetrol Model No. F36AR47-0 with Model No. STN-7 bronze strainer and stainless steel screens.
- H. All piping connected to storage tank shall have double swing joints to permit tank or building to settle without impairing the tightness of the pipe connection.
- I. Fill line shall terminate in a liquid tight, recessed fill box, similar and Engineer approved equal to Dover (OPW) Model No. 101BG-265SC, complete with spill basin and locking cover.
- J. See Specification 22 05 93 titled "Testing, Balancing, and Adjusting" for fuel oil piping system leak testing requirements.
- K. Submit Shop Drawings for review before fabrication of the piping system is commenced.

### 2.3 ABOVEGROUND FUEL STORAGE TANK SYSTEM

- A. General:
  - 1. Provide concrete encased aboveground tank system with secondary containment and minimum 2-hour fire rating. The tank and its enclosure shall be listed as an assembly by Underwriters Laboratories, Inc. per UL 2085. Vaulted tank design shall have been in manufacturing production and commercial use for a minimum of five years. The aboveground fuel storage tank shall have a concrete exterior with a textured architectural finish in a color selected by the Owner.
  - 2. The tanks shall be constructed, tested and installed in accordance with NFPA 30 and 31 recommendations and shall be furnished with a UL label. In addition, tank construction and installation shall be suitable for the intended application and service in accordance with the manufacturer's recommendations. These recommendations shall include published recommendations and additional written recommendations associated with the particular conditions of this Project.
- B. Tank:
  - 1. The primary tank shall be minimum 0.18-inch thick carbon steel approved per UL Standard 142 and meeting the requirements of NFPA 30. The tank shall be warranted for 10 years by the manufacturer.
  - 2. The concrete encasement shall be 6-inches thick with a minimum design strength of 3000 psi. The concrete design shall include the following for long term durability: air entrainment, water-reducing admixture, and steel reinforcement. Concrete placement shall be monolithic, and placement methods shall ensure the absence of voids beneath the steel tank.
  - 3. The tank encasement system shall be designed and tested to provide 2-hour fire protection for the primary tank. No steel members shall penetrate the walls or floor of the concrete encasement. The fire resistance of the tank shall be tested in accordance with the procedure established in UL 1709 at a certified fire testing facility.
  - 4. The tank construction shall include thermal insulation equivalent to 0.25 inches of polystyrene.
  - 5. The tank system shall include an impervious barrier of polyethylene to contain leaks from the primary tank. Containment shall be no more than 105% capacity. A leak detection access tube shall be located between the inner tank and secondary barrier.
  - 6. The fill pipe shall be recessed into the container so that it is the lowest opening on the tank
  - 7. Overfill protection shall be provided by both of the following methods:
    - a. Valve located within fill pipe to close automatically at 95% fill level.

- b. Audible/visual high level alarm activated by a float switch at 90% fill level.
  8. The tank system shall include a textured architectural finish on the top and sides. The finish system shall be furnished by a single supplier and factory-applied to the fuel tank exterior. Materials shall be compatible with the concrete tank exterior. The prime coat shall consist of a silicone emulsion with fine aggregate to provide uniform substrate absorption and finish color. The second coat shall consist of a silicone-based emulsion textured coating with graded marble aggregate. The final coat shall be a clear fuel resistant coating.
  9. The tank system shall include a properly sized combination standard and emergency vent.
  10. Where product piping extends below the top of the tank, the piping shall include a shutoff valve and normally closed safety valve. The safety valve shall be an approved anti-siphon valve or electronic solenoid valve.
- C. Product Storage Requirements:
1. Tanks shall be capable of storing liquids with specific gravity up to 1:1.
  2. Maximum temperature. Tanks shall be capable of storing diesel fuel at temperatures not to exceed 150° F. at the tank interior surface.
  3. Tanks shall be chemically inert to petroleum products.
- D. Annular Space:
1. Tank shall have a space between the primary and secondary steel walls to allow for the free flow and containment of all leaked product for the primary tank.
  2. Tank shall be designed to provide monitoring capability as noted:
    - a. Accessibility to the tank bottom between the primary and secondary walls at both ends of the tank. Tanks shall have a fitting located at each end of the tank.
- E. Accessories:
1. Certification Plate - Underwriters' Laboratory label shall be permanently affixed to each tank.
  2. One (1) Carbon Steel Ladder or fiberglass reinforced plastic (FRP) shall be supplied by the tank manufacturer attached to the end with mounting lugs.
  3. Man-way:
    - a. The standard man-way on tank shall be 18" I.D.
    - b. The man-way shall be furnished complete with U.L. listed gaskets, bolts and covers.
- F. Fittings – Threaded NPT:
1. General: All threaded fittings on tanks shall be of a material of construction consistent with the requirements of the U.L. label. All fittings to be supplied with threaded plugs.
  2. Size: All standard threaded fittings shall be 4" diameter and shall be half couplings. Reducers shall be used for smaller sizes where specified and provided by Subcontractor.
  3. Thread Standards: All threaded fittings shall have machine tolerances in accordance with the ANSI standard for each fitting size.
  4. Strength: NPT fittings shall withstand a minimum of 150 foot-pounds of torque and 1,000 foot-pounds of bending, both with 2:1 factor of safety.
  5. Supply Line for Fueling System: Shall be installed on site by the Subcontractor. Diameter of pipe, grade and schedule shall be as specified in Section 22 21 13 and as shown on the Drawings.
  6. Return Line: Shall be installed on the project site by the Subcontractor. Diameter of pipe, grade and schedule shall be as specified in Section 22 21 13 or as shown on the Drawings.
  7. Vent Line: Shall be installed on the site by the Subcontractor. Diameter of pipe, grade and schedule shall be as shown on the Drawings.
  8. Piping Terminations: All rigid piping shall be terminated a minimum of 4" from the bottom of four (4), six (6), eight (8) and 10' diameter tanks and a minimum of 6" from the bottom of twelve foot diameter tanks.
  9. Fuel Oil Gauge: Provide one 4-inch fuel oil gauge transmitter unit fitting located so to be accessible from top of tank.
- G. Leak Detector Sensor:
1. An electronic leak sensor, which continuously monitors the interstitial space of this double wall tank shall be furnished and installed in leak monitor tube provided with tank. Connect the sensor to the tank monitoring panel. Probe to be Veeder Root model 794390-420 or approved equal.
  2. Provide for an alarm interface with the Division 25 Building Control System.
- H. Foundation:

1. The tanks shall be set on concrete foundations as recommended by the manufacturer.
- I. Submittal:
1. The manufacturer of the tank shall submit Shop Drawings of the tank for approval. The Shop Drawings shall indicate the size, construction data, tapping connection and location of the tappings.

## 2.4 DAY TANK AND ACCESSORY EQUIPMENT

- A. Furnish and install a double wall UL 142 day tank on level 3. Pressure test on-site as per SFFD requirements. Signage as per SFFD requirements.
- B. Product Label: NFPA required stickers and "no smoking signs" for product being stored.
- C. Solenoid valves: Line size Magnatrol or Morrison Brothers, 120 volt coil, viton trim.
- D. Analog Level Probe: Provide 4-20ma analog level probe as manufactured by Madison or Gems.
- E. Atmospheric Vent:
1. Diesel or Fuel Oil:
    - a. Provide an upward flow vent cap with a flame retardant 40-mesh screen.
- F. Annular Space:
1. Tank shall have a space between the primary and secondary steel walls to allow for the free flow and containment of all leaked product for the primary tank.
  2. Tank shall be designed to provide monitoring capability as noted:
    - a. Accessibility to the tank bottom between the primary and secondary walls at both ends of the tank. Tanks shall have a fitting located at each end of the tank.
  3. The fill pipe shall be recessed into the container so that it is the lowest opening on the tank
  4. Overfill protection shall be provided by both of the following methods:
    - a. Valve located within fill pipe to close automatically at 95% fill level. Audible/visual high level alarm activated by a float switch at 90% fill level
- G. All piping connected to Day tank shall have double swing joints to permit tank or building to settle without impairing the tightness of the pipe connection.

## 2.5 FUEL MAINTENANCE SYSTEM

- A. The fuel oil storage tank shall be equipped with an FM approved, automated fuel maintenance system to remove particulate through 3 microns and 99.5% water from stored diesel fuel. The system shall consist of pump, filter package, and controller housed in a NEMA 3R enclosure.
- B. Pump/Motor Ratings:
1. The system shall be design with a 3 gpm fuel transfer pump.
  2. The pump motor shall be 115/230V AC, 1 phase, 60/50 Hz, ODP, thermally protected motor, 1/3 HP with 15.0 ft. suction lift.
- C. The filter package shall consist of seven (7) stages particulate and water removal.
1. Stage 1: 100 wire mesh media strainer
  2. Stage 2: Coalescence water separator
  3. Stage 3: Water separator and removal
  4. Stage 4: 30 micron water block media
  5. Stage 5: 10 micron particulate removal
  6. Stage 6: Emulsion water removal
  7. Stage 7: 3 micron particulate removal

- All filters shall be spin-on removable and/or replaceable element type.
- D. Controller:
1. The controller shall be a UL listed 16-bit high speed programmable controller using no volatile technology with built-in six (6) day programmable clock and replaceable back-up battery.
  2. The controller shall be capable of being programmed to provide timed operation of the fuel circulation pump.
  3. The controller shall monitor each of the seven (7) stages of filtration and provide an audible and visual alarm for required filter maintenance.
  4. The controller shall be capable of a computer link function (allowing the operator to read and write the contact information and data register content from a host computer, such as data collection and monitoring of operating conditions).
- E. Touch Pad:
1. The controller membrane key pad shall be 8-key with tactile feedback type rated at 1,000,000 actuations per key (rated NEMA 4X).
- F. Display:
1. The display shall be an LCD backlit liquid crystal with 40-character output (2 lines of 20).
- G. Enclosure:
1. The complete assembly shall be housed in an enclosed cabinet manufactured to NEMA 3R standards designed for wall mounting. Leak detection to be provided in enclosure.

## 2.6 FUEL OIL TANK INFORMATION PANEL SYSTEM

- A. Furnish and install a wall mounted master aboveground fuel oil tank information and alarm system cabinet.
- B. System shall be of code gauge sheet steel gasketed for NEMA 12, continuously welded and ground smooth. All components within the master cabinet shall be mounted on a self-ventilating perforated metal sub-plate, with color-coded stranded wiring with removable covers and numbered terminal strips for identification of external connections. (Interconnecting external wiring from remote power source and probe assembly shall be brought to the terminal point by contractor). Cabinet shall be primed coated, and finished with textured polyurethane based gray enamel, resistant to water, chemical, solvent and abrasion.
- C. Provide engraved tank identification data and complete wiring diagrams showing panel terminal connections and interconnections with fuel tank reservoir liquid probe assembly and other remote devices.
- D. The electronic control panel provides continuous monitoring and instant alarm for the tank. Provide liquid sensing probe assembly to install in tank (Subcontractor provides the wiring from the probe assembly to the control panel). The electronic control panel senses the presence of the liquid in the reservoir. The control panel is complete with audible alarm, panel display and transmission contacts for remote alarm.
- E. Specifications for System Panel:
1. Control Panel(s): Panel Veeder Root TLS-300C or equal monitors the tank.
  2. Power Source: 120V AC.
  3. Intrinsically safe circuit for probe assembly utilizing 16 AWG Type MTW or 14 AWG Type THNN.
  4. Electrical components rating: UL listed.
  5. Panel display for each circuit (normal and alarm).
  6. Alarm test button for each circuit.
  7. Audible alarm.
  8. Alarm bell silence switch.
  9. RS232 communications interface to fuel system integration panel.
  10. Mounting hardware.
  11. Integral printer.
  12. Inputs for:
    - a. Interstitial leak detection
    - b. Fill sump leak sensor
    - c. Hydrostatic level sensor

13. Provide a RS-485 communication interface with the Division 25 Building Control System for the following:
    - a. Fuel filter alarm
    - b. Tank volume
  14. High level alarm
  15. Low level alarm
  16. Interstitial leak detection alarm
  17. Tank leak alarm
  18. Storage tank fuel temperature
- F. Leak Detection:
1. In the event that the interstitial space fuel detector probe senses fuel, the control panel alarm will be activated - the warning light will illuminate, the audible alarm will sound and the transmission contacts will activate any remote alarm indication.
  2. In the event that the overfill sump detector senses fuel, the control panel alarm will be activated - the warning light will illuminate, the audible alarm will sound and the transmission contacts will activate any remote alarm indication.
- G. The system shall include remote reading electric tank gauging capability, utilizing level float type level sensor to provide a continuous indication of fuel level, and shall provide a digital indication of the actual tank contents in gallons. Tank gauging probe shall be Veeder Root Model 847390 or approved equal.
- H. Alarm functions of the tank gauging systems follows:
1. Low level on tank: Flashing display on gauge and sounding of local audible alarm. Alarm silencing push button silences alarm, display continues to flash until situation corrected.
  2. Output shall be 4-20 mA, which shall interface with strip chart recorder.
- I. Remote overfill prevention shall be provided including a visual/audible overfill device, a Weatherproof visual and audible alarm interconnected to the fuel tank monitoring panel to alarm on overfill detection. Remote alarm shall be Veeder Root Model 790091-001, or approved equal. Locate overfill alarm as directed by Architect.
- J. The fuel tank monitor and alarm system shall be the product of Veeder Root or equal, as approved. All interconnecting wiring shall be by the Division 22 Subcontractor.

## 2.7 FUEL OIL TRANSFER PUMP AND CONTROL SYSTEM

- A. Provide a submersible fuel oil pump and control system as schedule and detailed on drawings.
1. Provide and install a submersible diesel fuel transfer pump. Pumps shall have a capacity as indicated on drawings. Pump and motor shall be a complete unit mounted on tank fitting. Pump shall be UL listed, explosion proof and rated at 1/3 HP, 208V, single phase.
- B. Control Module: The pump set shall be controlled by a microprocessor based control module. The module shall have single point electrical connection, motor starters with thermal protection, and a main disconnect operated from the panel exterior. The unit shall receive a pump on signal from a day tank level controller to activate and deactivate the pump set. The unit shall monitor a flow switch in the fuel discharge. A "No Flow" condition for 15 seconds after the start of Pump 1 shall automatically activate Pump 2. The module shall have exterior hand-off-auto mode selector switches for each pump. Indicator lights shall be provided for power on, pump on, and flow failure alarm. The controller shall provide automatic alternation of pumps. Provide pump flow switch and wiring to module.
- C. All control wiring for pump control system including connection to day tank shall be by Division 22 Subcontractor.

**PART 3 EXECUTION****3.1 GENERAL**

- A. All tanks and vessels shall be installed in accordance with the latest industry standards, per the manufacturer's recommendations and as indicated on the Drawings.
- B. Provide suitable structural support as required for each compression tank as indicated on the Drawings.
- C. See Section 22 21 13 titled "Pipes, Valves, Fittings, and Accessories", subsection titled "Standby Generator Fuel Storage Piping" for all piping requirements for standby generating system. The Division 22 Subcontractor shall install all piping as necessary from the fuel transfer pumps to the day tanks, including accessories and valves.
- D. The Division 22 Subcontractor will install all control wiring interlocks required for the standby generating system fuel transfer pumps to be controlled automatically by the demand for fuel at the day tanks for the emergency generators. See Division 26 Specification Section 26 32 13 titled "Engine Generators" for requirements.
- E. All standby generating system fuel tanks shall be installed in accordance with the manufacturer's instructions, EPA Standards and all national, State, and/or local codes where applicable for the type of installation indicated.
- F. Tank and concrete vault shall be finished as one unit at factory and require no assembly, construction, or completion at installation site.
- G. The tank system, including accessories, 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.
- H. Tanks shall be installed on a reinforced concrete base slab designed to support the fully loaded tank. A 1/4-inch of non-shrink grout shall be placed between the footings and the concrete slab to provide uniform bearing and insure integrity of structure.
- I. Tanks shall be marked on all sides with warning signs: "FLAMMABLE" or "COMBUSTIBLE", "NO SMOKING", product identification, and other signs as required by the applicable codes.
- J. Electrical work shall be in accordance with applicable codes and shall be rated for hazardous area as required. Electrical for dispensing pumps shall include an emergency shutoff switch located per code requirements. Tanks shall be electrically grounded in accordance with NFPA 78.
- K. The system installation shall be inspected and approved by the system supplier or its certified Contractor. The system supplier shall submit a comprehensive check-list of quality and safety items critical to the system and verify that the installation has been in accordance with these standards and applicable fire and environmental codes.
- L. The Division 22 Subcontractor shall provide the fuel oil control wiring diagram in coordination with Fuel Oil Control Panel manufacturer and provide dry contacts for BMS contractor to connect.
- M. Contractor shall provide a SPCC (Spill Prevention, Control, and Countermeasure) Plan as mandated by the EPA for tanks over 660 gallons or 1320 gallons per site.
- N. The Division 22 Subcontractor shall furnish and install a fully functional system including all wiring, conduit, sensors, etc.
- O. The Division 22 Subcontractor shall test the entire fuel oil system
- P. Refer to Division 26 specifications for provision of fuel oil for the system to facilitate testing / commissioning and final fill.

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**3.2 FACTORY TESTING**

- A. All tanks and vessels shall be tested in accordance with the latest applicable industry standards.

**3.3 FIELD TESTING**

- A. Refer to Section 22 05 93 for additional testing requirements for tanks and vessels.

**END OF SECTION 22 13 23**