231100 FUEL OIL SPECIALTIES

Part 1 – GENERAL

1.1 Description

A. This section details the guidelines and expectations for the design and installation of fuel oil equipment and systems. Project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification and approval from the JHFRE Engineering and Energy Department, it is expected that these guidelines will govern the design and specifications.

1.2 Submittals

A. All fuel oil storage, design, repair and removal shall meet the requirements of the local authority holding jurisdiction.

1.3 Quality Assurance

A. Provide electrical components, devices and accessories that are listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use. Comply with ASME B31.9 for fuel oil piping materials, installation, inspection and testing.

B. Unless otherwise indicated, minimum pressure requirement for fuel oil piping is 150psig.

C. Evaluate redundancy requirements on a project-by-project basis including but not limited to fuel tank quantity, interconnecting piping between tanks, redundant piping paths and remote fill operation. A redundant fill connection shall be provided for each fuel system to provide N+1 fuel fill reliability. The redundant connection shall be located at each set of fuel system storage tanks, and shall allow for direct unloading of tanker trucks to the storage tanks. Each redundant fill connection shall be protected from weather and contain a method for securing the fill port.

Part 2 – PRODUCTS

2.1 Fuel oil used for generators shall have a maximum sulfur content of 0.05% product by weight. Fuel oil used for heating shall have a maximum sulfur content of 0.3% product by weight.

2.2 Above ground piping:

A. 2” and smaller shall be schedule 40 Black steel, NPT screw connections.

B. 2-1/2” and larger shall be schedule 40 Black steel, welded connections.

C. Flanged connections shall be provided with Flexitallic CGI spiral wound gaskets, or approved equal.

2.3 Underground piping shall be double-wall fiberglass reinforced plastic (FRP), with an 18 gauge copper tracer wire (following UL 971).

2.4 Install concealed piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

2.5 Hangers and supports for pipe hanger and support devices shall follow NFPA 54 and ANSI SP-69.

2.6 Fuel-oil transfer pumps shall comply with UL 343 and ANSI/HI 3.1-3.5 and be two-stage, internal-gear, positive-displacement, rotary type. Pumps will include steel base, foot-mounted, cast-iron housing, steel gears, bronze bearings, steel shaft, mechanical seals, and built-in pressure relief bypass. Pumps shall use V-belt drives with guard or direct close coupled. Strainers shall be duplex, basket type with corrosion-resistant-metal-screen baskets. Controls shall have automatic operation with pump alternator and broken-line, oil shutoff feature.

A. The primary fuel oil transfer pumps shall be centrifugal, submersible, turbine type. Each primary tank shall have N+1 pump configuration. The pumps shall operate in a lead/lag sequence alternating after each run. The pumps shall be designed so that any pump shall be capable of supplying fuel to all of the day tanks with a 50% safety factor. The pumps shall be installed in an enclosure to provide protection from damage and the elements. The enclosure shall be provided by the fuel tank manufacturer and shall allow for easy access to the pump for inspection and maintenance.

B. The return fuel oil transfer pumps shall be centrifugal, submersible, turbine type. The return pumps shall be used along with the overflow tanks to return any excess fuel back to the primary tanks in the event of a control failure. Two return pumps shall be dedicated to one overflow tank and shall operate in a lead/lag configuration. The minimum capacity of each return pump shall be equal to that of one supply pump.

C. Concrete pad that any transfer pumps are installed on must be higher elevation than the maximum height of the containment wall.

2.7 Fuel tanks shall be Aboveground Storage Tanks (AST) constructed of, at a minimum, 3/16” thick steel in accordance with the UL standard 142. The tank shall have, at a minimum, 1/4” thick Styrofoam insulation and an impervious barrier of 30mil high density polyethylene membrane. The insulation and impervious barrier shall be protected with a reinforced concrete vault, with tanks listed by UL 2085 and 142 standards. The exterior of the concrete vault shall be treated with a two-part water-based epoxy paint to protect tanks from inclement weather. For larger storage volume applications, double-wall steel ASTs (Highland Fireguard, or approved equal) shall be considered.

2.8 Provide dedicated day tanks for each generator. Day tanks shall be double wall, and shall comply with applicable codes. Day tanks shall be sized to provide 8 hours of fuel supply to the generator at full load. The contractor shall take into account pump suction elevation within the tank for tank sizing.

2.9 Overflow tanks shall be provided to return any excess fuel to the primary tanks caused by a control failure. The overflow tank shall be the same capacity as one of the day tanks.

2.10 All tanks shall include overfill protection, venting, support legs, thermal corrosion protection, vehicle and bullet impact protection and shall comply with UFC section 79-7 (Appendix # A-11-F-1) and

galvanized steel access steps where required. Use an ultrasonic sensor for monitoring oil level. Central or local monitoring/alarm shall be as directed by the Project Manager. The fuel storage tanks shall be provided with access stairs and platforms arranged so that access is provided to all equipment located in the tank that requires regular maintenance.

2.11 Urea tubing, piping, valves and fittings shall be stainless steel. Piping shall conform to ASTM A 312/A 312M, Type TP304L, seamless only. Piping smaller than 8" shall be Schedule 40S. Urea piping shall be welded. Fittings 2" and smaller shall be socket welded type and conform to ASME B16.11. Fitting materials shall be stainless steel that conforms to ASTM A 182/A 182M, Type F304L. Connections at valves shall be flanged. Connections at equipment shall be flanged except connections to the diesel engine may be threaded if the diesel-engine manufacturer's standard connection is threaded. Connections to equipment shall be made with stainless steel vibration-isolation type flexible connectors. Urea pumps shall be stainless steel construction including housing, gears and shaft. Underground piping shall be flexible corrugated stainless-steel Piping Type 316L, with polyurethane jacket.

Part 3 – EXECUTION

3.1 Do not locate valves above ceilings. Do not install concealed piping in solid partitions, except where passing through partitions or walls. Prefabricated double wall pipe is preferred over pulled pipe within pipe for oil systems so as to maintain an air gap at containment pipe bottom.

3.2 For valves 4" and larger, provide gear operators.

3.3 Provide electrolysis control between dissimilar materials through the use of dielectric nipples and a non-dielectric union. Dielectric unions are not acceptable.

3.4 Piping containment sumps shall be used as collection points for potential piping leaks. Sumps shall be installed at all low points of the underground piping system and any transitions between steel pipe and non-metallic pipe. The containment pipe of the double-wall pipe shall terminate at the walls of the sump, allowing fuel that leaked from the product pipe to drain into the sump. A leak sensor installed in the sump shall be used to monitor the underground piping system. The containment sumps shall be constructed of fiberglass reinforced plastic or high-density polyethylene. Provide access ladders and traffic rated lids for containment sumps.

3.5 Secondary containment area required around tank(s) shall contain a minimum of 100% of total tank volume. In some local jurisdictions, requirements may be required to provide greater than 100% of total tank volume. Coordinate with the local jurisdiction to ensure requirements are in compliance. Provide rainwater z-type drain and mount tank(s) on concrete pad of sufficient elevation (relating to possible height of retained water) to avoid standing water against the tank. All registration or notification of regulatory requirements for any installation, repair or removal of underground storage tanks, shall be conducted by the Contractor.

3.6 Fuel piping distribution shall be designed to incorporate a header system with the installation of two or more tanks. The tanks shall have isolation capabilities so that any tanks in the grouping can be filled or pumped into each other in the event that a tank needs to be serviced or taken out of service. In the event where the tanks are a distance from a road, a remote fill station with redundant pumps shall

be provided with automatic fill shutoff valves located at the tanks. If there exists a site fuel unloading pumping system and the new tanks are within a reasonable distance, the new tanks shall be piped using existing pumps at the filling station.

3.7 Circulation of urea shall be required for the whole urea system (tank and distribution piping). Provide heating and insulation of urea system components to keep urea above its salt-out temperature. Urea storage tanks shall be UL 142 single-wall, stainless-steel tanks fabricated and tested in accordance with NFPA and UL labeled. Provide controls and accessories typical of fuel oil tanks. Provide independent fuel control system consisting of tank gauging and monitoring, pump control panels, day tank level control panels, separate pump starters, leak detection and fuel polishing. The fuel control system shall interface with the EMCS and SCADA systems.

3.8 Use engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator and specialty valve. Paint exterior service meters, pressure regulators and specialty valves gray and above grade piping brown.

3.9 Cleaning, Flushing, Treating and Testing Fuel Piping

A. Assembled systems shall be blown clean, shall have equipment served isolated from cleaning process, and have oil filters installed after cleaning. When cutting and threading pipe, contractor must clean and verify pipe is free of oil and debris. Pressure test assembled system at 1.5x the expected operating pressure. Inspect and test fuel oil piping according to NFPA 30, Testing Paragraph and NFPA 31, Tests of Piping Paragraph, and according to requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Report test results promptly and in writing to the Project Manager.

C. The intent of the flushing operation is to remove bulk solids and water from the system. All new fuel piping, including the transfer line, receipt system piping, supply and return lines to the storage tanks and day tanks, shall be flushed with fuel. Upon completion of system flushing the Contractor shall remove all temporary strainers and filters and replace with new screens and filter cartridges. All water separators/coalescers shall be drained, inspected, and replaced with new.

D. Temporary 40 mesh cone type strainers shall be installed upstream of all control valves and on the suction side of all polishing system pumps. Any damaged strainers shall be replaced by the Contractor at no additional cost to the University. Remove any accumulated water from storage tanks' sumps and bottoms. Drain water and return fuel via filtration to storage tank until all water is removed.

E. Begin flushing of fuel system pipelines at low flow rates using the fuel polishing system pumps. Slowly increase flushing flow rate to full flow capacity for a minimum of 30 minutes. For gravity, suction, or other non- pumped piping segments, minimum flushing volume shall be four times the pipe volume. Flushing shall continue until the fuel being delivered is free of construction debris to the satisfaction of the Project Manager. Samples of fuel shall be taken and tested by the designated University agency and shall be free of gross contamination and visible free water.