

SECTION 15063

FUEL OIL & PROPANE SYSTEMS

PART 1 – DESIGN DIRECTIVES

1.1 QUALITY ASSURANCE

- A. Installation and replacement of gas piping, gas utilization equipment or accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified is defined as experienced (having a minimum of 5 previous projects similar in size and scope to this project) in such work, familiar with precautions required, and has complied with the requirements of the authority having jurisdiction. Installation of specialty piping, such as underground plastic piping, flexible interior hose, etc., will require the on-site installer to have a current certificate for installing said pipe.
- B. Comply with the requirements of the following codes:
  - 1. NFPA 54 - National Fuel Gas Code, for gas piping materials and components, gas piping installations, and inspection, testing, and purging of gas piping systems.
  - 2. NFPA 31 - Standard for the Installation of Oil Burning Equipment, for oil piping materials and components, oil piping installations, and inspection, and testing of fuel oil piping systems.
  - 3. Regulated tanks shall comply with the State of New Hampshire Department of Environmental Services, sections ENV-1401 & ENV-1402.

1.2 DESIGN CRITERIA

- A. Underground Storage Tanks (UST) for oil services shall be avoided whenever possible, use only where there are no other options. Designer shall evaluate soil conditions where underground tanks are to be installed to determine the need for ballast pads. Ballast pads shall be designed for the loads imposed when the tank is full and empty.
- B. Emergency generator tanks usable fuel capacity shall be sized to provide 24 hours of operation without filling while operating at 100% of capacity. Usable fuel capacity of fuel oil tanks is the amount of fuel that can be withdrawn from the tank allowing for the distance of the suction pipe above the tank bottom and that the tank is filled to 90% capacity. Usable fuel capacity of propane tanks is the amount of fuel that can be withdrawn from the tank when filled to 80% capacity.
- C. Where day tanks are required for fuel oil devices, provide a factory assembled pump set assembly with control panel located remote of the fuel-burning device. The day tank shall be equipped with sensors that communicate with the control panel. Above ground fuel oil pipe shall be single wall.
- D. Generally, interior piping for fuel oil systems and propane systems shall be installed in steel pipe with final connections using copper tube. Final connections to generators shall be made with flexible hose connectors specifically listed for use with the applicable fuel.
- E. Natural gas is not available in Hanover, NH. Systems requiring gas fuels will need to be propane stored in dedicated tanks. The propane fuel supplier will provide the tank and high-pressure piping & appurtenances from the tank up to & including the regulator. Where tanks are installed in the ground, the contractor is responsible for the excavation & backfill of the tank(s). Emergency power systems may not be supplied fuel from the same tank that provides non-emergency power systems. The DC project manager will provide the consultant / contractor with the name of the current fuel supplier.

- F. Interior LP gas shall normally be piped in steel with final connections made in copper. Use of flexible pipe is allowed only when specifically approved by DC-FO&M. Underground LP gas may be installed in non-metallic tubing up to the regulator providing a metallic ‘finder’ strip is installed above the tubing.

**1.3 WARRANTY**

- A. Provide a written warranty for the underground fuel oil storage tanks, executed by the manufacturer, agreeing to repair the failure or replace the failed tanks. Warranty shall protect the Owner for a period of 30 years from the date of original purchase, against structural failures of the tanks, including cracking, breakup, or collapse; and failure of the tanks due to external or internal corrosion.

**PART 2 – PRODUCTS**

**2.1 PIPE, TUBING, AND FITTING MATERIALS**

- A. Refer to Part 3, Article “PIPE APPLICATION”, and the following chart for identification of materials to be used in piping systems.

ITEM	SIZE	ASTM SPEC NO.	MATERIAL WEIGHT & TYPE
Pipe	≤11/8" OD	B88 copper or B280	Seamless copper tube
	all sizes	A53, grade B, type S or E	Schedule 40, ANSI B36.10
Fittings	≤11/8" OD	Cast copper alloy for flared copper tube	ANSI B16.26
	≤2"	A197, Malleable Iron	Standard, threaded, ANSI B16.3
	>2"	A234, WPB, wrought carbon steel	Schedule 40, butt weld, ANSI B16.9
Flanges	≤2"	A105, forged carbon steel	class 150, RF, threaded, ANSI B16.5
	>2"	A105, forged carbon steel	class 150, RF, weld neck or slip on, ANSI B16.5
Bolts	all sizes	A193, grade B7 carbon steel	Hex head (ANSI B18.2.1), B1.1, class 2A course thread
Nuts	all sizes	A194, Grade 2H, Carbon steel	Heavy hex (ANSI B18.2.2), B1.1, class 2B course thread
Gaskets	Per flange standard	A304, stainless steel, Grafoil filled, spiral wound	class 150, RF, ring style, ANSI B16.20

- B. Flexible metallic hose shall be considered within buildings where conventional piping materials are not practical. Metallic hose must be approved by BOCA and by the owner prior to construction. Approved manufacturer is Gastite, model Titeflex, or approved equal.
- C. Double wall pipe shall be a manufactured product produced specifically for use with the fluid to be conveyed. The system shall include all appurtenances to insure liquid tight connections to manway bulkheads. The outer casing shall be capable of a five pound air test.

**2.2 JOINING MATERIALS**

- A. Rectorseal No. 5 for all threaded pipe connections.
- B. Teflon tape specifically designed for LP gas may be used in LP gas piping systems only.

**2.3 VALVES**

- A. Ball valve type gas cocks 3" and smaller shall be 150 psi WOG, bronze body, reinforced TFE seats and stem, packing seals, two piece body, U.L. listed guide #'YSDT', with threaded ends, Apollo #80-100 series or Watts Regulator #B-6000-UL series.
- B. Anti siphon valves shall be bronze body with oil proof gaskets and spring loaded poppet. Valves shall be sized for the hydrostatic head imposed on the valve.
- C. Lever handle valves shall be normally closed valves held open via aircraft cable that has a fusible link located above the fuel burning device, Firomatic No. xx-L series or Preferred Utilities type 110.
- D. Bronze or brass body fusible valves shall automatically close when heat actuated at 165°F. The fusible link shall be integral to the handwheel and be replaceable, Firomatic series xx-F & xx-CF.

**2.4 FUEL OIL TANKS**

**A. UNDERGROUND FUEL OIL TANKS (UST)**

- 1. Underground fuel oil tanks shall be double wall construction with the inner skin constructed of steel and the outer skin constructed of an inert, non conductive material. The interstitial space shall be homogeneous to allow leak detection to determine a breach in either inner or outer skin.
- 2. Tanks shall be equipped with manways to allow access to the tank interior, piping connections, monitoring devices, etc. All manways shall be liquid tight to the outer casing of the tank.
- 3. Tank accessories shall include a 5 gallon spill containment sump with hand pump, a well for the interstitial monitor, tapping for a fuel level monitoring sensor, drop tube with overflow prevention valve, and strike plate at the outlet of the drop tube.
- 4. All at grade covers shall be heavy-duty, water-resistant ductile-iron manhole frame, gasket, and lid, 24" diameter inside opening dimension for manways. Use 12" diameter cast iron access openings for interstitial monitoring openings.

**B. ABOVEGROUND FUEL OIL TANKS (AST)**

- 1. Exterior AST's shall be constructed of double wall steel with the interstitial space completely sealed from the elements. Tanks shall be equipped with 5 gallon spill containment at the fill (with drop tube), vent tapping with vapor I pressure/vacuum vent topper, and tapping for a fuel dispenser.
- 2. Interior AST's shall be constructed of single wall steel with a rupture basin. The primary tank shall be placed inside of a secondary open (rupture) tank, the secondary tank 125% capacity of the primary tank. The primary tank shall be vented to outside the building, be equipped with a float type gauge accurate to 2% of the tank volume (Scully Golden Gauge or equal), and have a float actuated manual fuel shut-off in the supply line. The return fuel connection shall be internally piped to within 3" of the tank bottom.
- 3. Interior AST's shall be constructed of 10 gauge steel and be single wall type. Tank accessories shall consist of a float type gauge, whistle, Fusimatic valve, and oil filter.

C. DAY TANKS (AST)

1. Day tanks shall bear the UL label, be constructed of welded steel and equipped with welded steel rupture basins. The rupture basin shall be monitored for liquids and be equipped with a plugged drain. Minimum primary tank connections shall include burner supply and return, overflow, tank fill (from main tank), inspection port, vent, tank gauge (Skully Golden Gauge or equal), drain (penetrating the rupture tank), and level controller. Manufacturer shall be Preferred Utilities model DT or equal.

2.5 FUEL PUMP SETS

- A. Fuel pump sets shall be factory assembled and mounted on a containment base (with leak detection). Pump sets shall include the following:
  1. Two pumping systems separated by isolation valves. Each system shall consist of:
    - a. Pumps
    - b. Relief valve
    - c. Check valve
    - d. Pressure gauge with valved connections on both sides of the pump
    - e. Pump run meter
  2. Control panel shall be skid or remote mount, and shall be relay based analog type. Panel shall include the following:
    - a. Integral lead / lag control
    - b. H-O-A switches for each pump
    - c. Each pump shall be electrically isolated
    - d. Test switch
    - e. Audible alarm horn with silence button
    - f. Digital output for alarms to be connected to the building control system. Alarm points to include:
      - 1.) Strainer high differential alarm.
      - 2.) Pump set leak alarm.
      - 3.) Pump failure alarm.
      - 4.) Low day tank level
      - 5.) High day tank level
      - 6.) Day tank rupture
      - 7.) System off
  3. Duplex strainer with gauge.

2.6 MONITORING DEVICES

- A. All UST's and AST's used for non-heating purposes shall be equipped with monitoring devices. Devices shall be capable of sending an alarm (remote) through Automatic Temperature Control system (DDC) or, in those buildings not so equipped, the monitoring device shall have an integral modem that notifies the DC Central Plant. Local alarm shall also be sounded when the monitored points are actuated. System shall also be capable of inventory monitoring. The interior panel shall be equipped with a printer to record events. An exterior alarm panel shall be installed indicating when the tank is 90% full, provide an audible & visual alarm, and be equipped with a silence button. Manufacturer shall be Veeder-Root model 300. Points monitored shall be in conformance of the following chart:

<b>Non- Generator Point Chart</b>			
Point	Exterior	Local	Remote
Interstitial	No	Yes	Yes
Liquid in tank sump	No	Yes	Yes
Fuel level	No	Yes	No
98% High level fuel alarm	No	Yes	Yes
Low level fuel alarm	No	Yes	Yes
90% fuel fill alarm	Yes	Yes	No
Water variance in fuel alarm	No	Yes	Yes

- B. All AST's used for emergency generators shall be equipped with monitoring devices. Devices shall be capable of sending an alarm (remote) through Automatic Temperature Control system (DDC) or, in those buildings not so equipped, the monitoring device shall have an integral modem that notifies the DC Central Plant. Local alarm shall also be sounded when the monitored points are actuated. The interior panel shall be equipped with a printer to record events. An exterior alarm panel shall be installed indicating when the tank is 90% full, provide an audible & visual alarm, and be equipped with a silence button. Manufacturer shall be Veeder-Root model 300C. Points monitored shall be in conformance of the following chart:

<b>Emergency Generator Point Chart</b>			
Point	Exterior	Local	Remote
Interstitial	No	Yes	Yes
Liquid in tank sump	No	Yes	Yes
High level fuel alarm	No	Yes	Yes
Low level fuel alarm	No	Yes	Yes
90% fuel fill alarm	Yes	Yes	No

**2.7 GASOLINE FUEL FILL PUMP**

- A. Pump shall be tank mounted direct drive rotary vane style, explosion proof construction, with pressure relief valve, bypass valve, and counter. Hose shall be 3/4" diameter with integral static discharge wire, and manual self-closing nozzle. Manufacturer shall be Gas Boy, electric model #1820, manual model #1230C.

**PART 3 – EXECUTION**

**3.1 HANDLING FLAMMABLE LIQUIDS**

- A. Immediately advise DC-Environmental Health & Safety (EH&S) at 646-1762 of spills of any petroleum products.

**3.2 PIPE APPLICATIONS**

- A. Install steel pipe with threaded joints and fittings for 2" and smaller, and with welded joints for 2-1/2" and larger.
- B. All petroleum fuel and vent lines located below grade, within a building foundation or outside the foundation, shall be installed in double wall pipe. Double wall fuel pipe shall be continuously pitched (1/4" in 10') to the sump with the fuel monitoring probe. Prior to backfill perform an air test on the outer casing for a minimum of 2 hours. While backfilling, maintain a 5 psig pressure in the interstitial space to insure the outer casing is not breached.

- C. All tanks that will be supplied fuel via a pressurized system (ie, an on-truck pump) shall be equipped with a 2" threaded 'Scully' connector. Tanks that will have gravity transit deliveries shall have 4" connections.

### 3.3 PIPING INSTALLATIONS

- A. Install a drip leg in propane piping at points where condensate may collect, before connections to equipment, and in a location readily accessible to permit cleaning and emptying. Do not install drips where condensate is likely to freeze.
- B. Construct drips and sediment traps using a tee fitting with the bottom outlet plugged or capped. Drip leg shall be the same size as the connected pipe and be a minimum of 3 pipe diameters in length.
- C. In multiple single wall interior AST installations, each tank shall have a dedicated 2" fill pipe and a common 2" vent pipe.
- D. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
- E. Connect branch outlet pipes from the top or sides of horizontal lines, not from the bottom.
- F. Teflon tape is not allowed in diesel or #2 fuel oil or diesel systems.
- G. Install unions in pipes 2" and smaller, adjacent to each valve, and at connections near each piece of equipment to facilitate equipment removal. Install flanges on valves, apparatus, and equipment having 2-1/2" and larger connections.
- H. Install underground warning tape above all underground pipe.

### 3.4 VALVE APPLICATIONS

- A. Install anti siphon valves in oil piping applications where the top of the fuel tank is higher than the inlet of the fuel burning device. The valve shall be sized for the specific application.
- B. Fusible link valves shall be installed on all oil fuel burning devices and at the outlet of all AST's.

### 3.5 TERMINAL EQUIPMENT CONNECTIONS

- A. Install gas cock upstream and within 6' of gas appliance. Install a union or flanged connection downstream from the gas cock to permit removal of equipment.

### 3.6 TANK INSTALLATIONS

- A. Tanks with secondary containment shall be installed in all Dartmouth College buildings except residential (one & two family dwellings). Single wall tanks shall be installed in one & two family dwellings.
- B. Interior AST tanks serving generators shall have rupture tanks as the secondary containment.
- C. All tanks shall be installed in strict accordance with the manufacturer's written installation instructions for UL listed tanks. Accurate as-built drawings shall be documented during construction and filed with the DC-FO&M and, where required, with the State of New Hampshire.
- D. The contractor shall fill the tank(s) or provide 300 gallons of fuel whichever is less. Coordinate with the FO&M project representative to confirm fuel type prior to ordering.

- E. All tanks shall be vented to the exterior of the building.
- F. Where tanks are provided with overflow taps, use one of the following piping systems:
  - 1. Pipe the overflow back to the main tank. Install a flow switch that goes into alarm upon detection of flow.
  - 2. Install a trap in the overflow pipe with the pipe terminating in the rupture basin.

**3.7 FUEL PUMP SETS**

- A. Fuel pump sets shall be started and operation verified by a manufacturer authorized agent. Systems check out shall include a written report to be included in the O & M Manual and provided to the commissioning agent (if applicable).

**3.8 FILL STATION**

- A. Provide signage stating to call EH&S at 646-1762 in case of a spill and instructions to shut off the fuel delivery when the alarm is activated.

**3.9 ELECTRICAL BONDING AND GROUNDING**

- A. Install above ground portions of gas piping systems, upstream from equipment shutoff valves electrically continuous and bonded to a grounding electrode in accordance with NFPA 70 - "National Electrical Code."
- B. Do not allow gas piping to be used as a grounding electrode.

END OF SECTION 15063