1. OIL HEATING AND PUMPING
2. Acceptable manufacturers subject to compliance with the specifications:
3. Critical Fuel Systems
4. Viking Pumps
5. IMO Pumps

**Piping and Mounting:** Provide an electric heating and pump set that is factory assembled with components piped and mounted on a continuously welded steel plate containment basin with minimum 3" steel side rails. Base pan shall be a minimum thickness of ¼” plate steel for containment. If the pump set base footprint exceeds 31”x 64”, only 3/8” steel plate can be used. Using less than these plate steel thicknesses is grounds for rejection. Base pan assembly shall have inverted steel channel supports welded to the bottom of the base pan for anchoring. Provide a ½" FNPT containment basin drain connection; plugged.  The basin shall be sized to contain (capture) potential leaks from all factory installed piping and components.  Pipe shall be schedule 40 ASTM A-53 Grade “A” with ANSI B16.3 Class 150 malleable iron threaded fittings. Fuel Oil Heating and Transfer Pump and Straining Set shall be Critical Fuel Systems, or equal. Rated at XXX GPH of No. X fuel oil against a discharge pressure of YYY PSIG.

For heavier oil (No 4 or 6) systems where steam powered heating is being used consult the factory for design, sizing, and specifications.

1. **Containment Basin Leak Detection Switch:** Provide, mount and wire a float operated Containment Basin Leak Detection Switch to shut off the pumps and energize an audible and visual alarm should a leak be detected. The level sensor shall be of a plasma welded stainless steel construction. Electrical connections shall be contained in a weatherproof junction box.
2. **Electric Fuel Oil Heater:** Provide, install and wire an Electric Fuel Oil Heater on the discharge of the duplex pump and motor assemblies. When the oil temperature in the system drops below 40° F the heater shall come on and be capable of heating XXX GPH of fuel oil to a XX° F Delta T to a maximum of XX° F.  The heater shall shut off at a field adjustable high limit set point.  The heater shall be controlled by a line voltage thermostat.  The heater shall be listed as standard by Underwriters’ Laboratories, Inc. and shall be installed in a 150 PSI flanged manifold with oil connections not less than 2". Electrical supply voltage shall be 480/3/60.
3. **Positive Displacement Pumps:**
4. Provide and mount one or two (1 or 2) positive displacement rotary type pumps with cast iron housing and self-adjusting mechanical, Carbon ring seals. Pumps that have aluminum, brass, or bronze housings or rotors are not acceptable. Packing gland equipped pumps, close-coupled pumps, Carbonator shaft mounted pumps or centrifugal pumps are not acceptable.
5. **Motors:** Provide and mount TEFC/TEPE, rigid base, standard NEMA frame motors. Pump and motor assemblies shall be factory assembled on a structural steel channel. Rotating parts shall have a steel OSHA guard.
6. **Outdoor Ambient Air Temperature Sensor:** An Outdoor Temperature Sensor shall be provided. It shall be wired to the temperature controller in the Fuel Oil Temperature Control Cabinet.  This sensor and control shall turn the transfer pump on and circulate oil through the supply and return loop when the outdoor temperature falls below 40° F.
7. **Oil Temperature Sensor:** An Oil Temperature Sensor shall be provided and be wired to the temperature control in the Fuel Oil Temperature Control Cabinet. This sensor shall turn on the heater based on oil temperature to maintain an oil temperature setpoint in a tank or header.
8. **Temperature Controller:** An immersion sensor shall be provided with a switch to operate on rise of temperature and shall limit the temperature of the oil discharge. This device functions as a safety interlock in conjunction with the thermostat on the electric oil heater and the flow sensing device in the pump discharge.
9. **Heater Flow Switch:** Provide a time-delayed flow sensing switch on the discharge of the pump set to alarm a “No-Flow” condition when the heater is energized and bring on the lag pump (in a duplex pump system) should the lead pump fail to maintain flow. In a simplex pump system, a no-flow condition will stop the system. Flow switch shall be vane operated to actuate a single pole double throw snap switch. Switch shall be factory wired to the control cabinet for alarm and backup pump operation. Switch shall be rated for 250 PSIG. Provide a flow switch outlet isolation valve for maintaining the flow switch without draining the fuel system.
10. **Oil Thermometers:** Provide two (2) 5" dial Oil Thermometers (0-250° F), for the supply and discharge sides of the pump and heater set. The Thermometers shall be of welded construction, with a shatter-proof polycarbonate lens, and be hermetically sealed to prevent moisture from entering the case. Thermometers shall be mounted in thermowells for easy replacement.
11. **Pump Isolation and Check Valves:** Provide and mount two (2) pump isolation valves for each pump. Locate one (1) valve on the suction and discharge side of each pump. Isolation valves will allow off-line pump maintenance without system loss of availability.  Isolation valves shall be ball type valves to provide full flow while open and positive shutoff when closed. Additionally, check valves shall be provided and mounted on the discharge of each pump.
12. **Relief Valves:** At each pump provide and mount a relief valves sized to relieve the full outlet flow of the pump without causing the pump motor to overload or any component’s pressure rating to be exceeded if the discharge is inadvertently closed off. Relief valves must be externally mounted from the pumps and piped to the return line in the field according to NFPA 30. Pump internal relief valves shall not be accepted. A third valve shall be provided for the electric heater. This valve shall have a set point of 5 PSI above the pump relief valves. This valve shall be used to relieve any build up in pressure due to an inadvertent isolation of an operating heater. Relief Valves shall be Critical Fuel Systems, Model RV.
13. **Fuel Oil Strainer:** Provide and mount a duplex fuel oil strainer on the suction side of the duplex transfer pump set, use simplex strainer for single pump applications. Strainer baskets shall be fabricated of 40 mesh stainless steel. Provide a factory wired differential pressure switch/indicator mounted with isolation values. Strainer to be Critical Fuel Systems Model STR-D.
14. **Compound and Pressure Gauges:** Provide and mount a 2-1/2" or 4” dial compound gauge on the suction side of the strainer and the inlet of each pump. The gauge shall read 30" vacuum - 30 PSIG.  Provide and mount a 2-1/2" or 4” dial pressure gauge on the discharge side of each pump. Gauges selected must provide mid-scale readings under normal operating pressures. Gauges shall be liquid filled to dampen pulsation, with bright finished stainless-steel case, brass movement, bronze bourdon tube, and shall be furnished with a pulsation dampening orifice. Each gauge shall be equipped with an isolation ball valve.
15. Control Cabinet: Provide a completely pre-wired and factory tested control cabinet to ensure job site reliability. The pump and heater set and control cabinet shall be the product of one manufacturer for single source responsibility. Cabinet shall be completely pre-wired, tested, and shipped as an integrated system to ensure job site reliability. The control system enclosure shall be constructed to NEMA 4 standards. Doors shall be fully gasketed with a turned edge, piano hinges, and a lockable latching mechanism. Cabinet interior shall be primed and finished in a white gloss, chemical resistant enamel. Cabinet exterior shall be primed and finished in a durable, chemical resistant, textured enamel, suitable for industrial environments.
16. Controls: The control strategy shall be factory configured and tested. Control hardware shall include combination magnetic motor starters with overload protection and circuit breakers.
17. Operator Interface: As a minimum, the following indications, alarms, control switches and pushbuttons shall be provided. Provide a dedicated “Hand-Off-Automatic” control switch for each fuel pump. In “Hand” position the pump shall be capable of manual operation in the event of a controller failure. The control system shall monitor the position of each “Hand-Off-Automatic” control switch. Provide an Elapsed Time Recorder (ETR) to measure running time for each pump. Provide controls and indicators for the following:
18. Lead Pump Selection and “Hand-off-Auto” control switches for heater and each pump
19. Alarm Silence, Manual Reset, Lamp/Alarm Test Pushbuttons
20. “Pump 1 Run”, “Pump 2 Run”
21. Heater On, “No-Flow”, Over Temperature, Strainer High Differential Pressure, Pump Failure,
22. Discrete alarms for each field mounted sensor
23. An Alarm Horn with alarm silence shall be provided for alarm conditions.
24. Safety Interlocks: Provide safety interlocks to shut down both pumps during any of the following conditions: heater on and “No Flow” detected, over temperature, pump set “leak detected”, interlock from remote equipment as required by the application. These interlocks must continue to ensure safe pump operation even if the controller has failed or is out of service and the pump set is operated in manual “hand” mode.
25. Quality Assurance: The Control Cabinet shall be manufactured in accordance with UL508A. Simply supplying UL recognized individual components is not sufficient. The assembled control cabinet as a whole must be inspected for proper wiring methods, fusing, etc., and must be labeled as conforming to UL508A Inspection and labeling shall be supervised by UL.

When using the Heater Set option on a new installation, specify a new thermally insulated UL 2085 tank or provide for an insulated tank.