1. IMMERSIBLE FUEL OIL PUMP SET
2. Acceptable manufacturers subject to compliance with the specifications:
3. Critical Fuel Systems
4. Viking Pump
5. IMO Pump
6. Provide and install a factory assembled "Packaged" Automatic Fuel Oil Transfer and Monitoring System to ensure a reliable supply of fuel oil to the emergency generators and/or boilers included in this project. The system shall be designed to work in flooded conditions with all types of water (polluted, salt-water, etc.) The system is made of two units, one placed above the flood plain (Hydraulic Power Unit: HPU) with the other located in an area subject to possible flooding (Hydraulic Pump – Fuel Oil Pump: HP-FOP). The system is to be factory fabricated/tested and certified as a complete unit. Field assembled pump set are not acceptable, but because of the different locations of these two units, there will be field assembly of hydraulic piping and sensor wiring. All components that make up the system (pumps, motors, valves, etc.) shall be visible with requiring the removal of any covers. The pump set for generator applications must be provided by the same manufacturer as the day tank controls and sensors provided to assure that all the controls work together. The supplied system shall be a Model True Guard (TG-XXXX-YYY-ZD)

Consult with CFS for proper sizing, XXXX is the flow rate in GPH, YYY is the design discharge pressure in PSI

1. The system shall be provided with a duplex fuel oil transfer pump set (HP-FOP), refer to schedule for flow rate and motor sizing, rated for full flow at the pressure shown on the equipment schedule. The Hydraulic Power Unit is located above the flood plain and is composed of two hydraulic pumps mounted to a single hydraulic oil tank sized to meet the requirements of the application (see equipment schedules).

A typical system is composed of an HPU that has two hydraulic pumps mounted on a single hydraulic storage tank. A supply and return hydraulic lines are piped between each hydraulic pump and the associated hydraulic pump at the HP-FOP. The HP-FOP has to pump assemblies each with a hydraulic driver and a fuel oil pump. The system can make use of two hydraulic storage tanks at the HPU to make this function also redundant. These are commonly referred to as a duplex system. If a simplex is used it will include one hydraulic pump mounted on a single hydraulic storage tank with a single hydraulic driver and a single fuel oil pump.

1. Consult the drawings for the type of hydraulic fluid that is to be used, if not shown make use of mineral oil or other environmentally friendly fluids (CFS recommends “Bio-Fleet Hydraulic Fluid ISO 32”.) Provide the amount of hydraulic oil to fill the hydraulic oil storage tank plus 10 gallons to fill the transfer lines, consult the equipment schedule for the size of the hydraulic fluid storage tank.
2. Each fuel oil pump in the Duplex Pump Set shall be sized to provide full specified flow capacity from each hydraulically powered pump.
3. In order to ensure compliance with NFPA70e the Hydraulic Power Unit shall be provided with two separate electrical panels, 1) Electrical Motor Controller Module, and 2) 24vdc Logic Control Module. These control panels can be provided mounted to the pump skid or for wall mounting close by. The Hydraulic Power Unit can also be provided in an enclosure where the controls are mounted separately in all cases.
4. The pump set shall be preassembled and tested by the manufacturer at their facility; job site assembly of the two pump skids will not be permitted. All skid piping shall be schedule 40, or heavier, black pipe suitable for use with fuel oil. Hydraulic piping from the Hydraulic Power Unit to the hydraulically powered fuel pump set skid shall be hard piped and/or using hoses that meet the pressure requirements of the hydraulic pump (see equipment schedule). Fuel oil pipe fittings shall be malleable steel fittings rated for 150 psi and suitable for use with fuel oil. The use of galvanized pipe or fittings is forbidden in the construction of these systems. Threaded connections are satisfactory except where noted on the drawings. On welded pump set systems, where threaded connections are necessary, by design of individual components, a threaded nipple and welded flange shall be used. The pump set shall be finished with industrial enamel, suitable for this application. All electrical conduits will be liquid tight or better.
5. Hydraulic Power Unit (HPU) (located above flood plain):
6. Pumps – Electric driven hydraulic pump (1 or 2; see equipment schedule)
7. Electric Powered Motor (XX HP, 1800rpm, one or three phase)
8. Hydraulic Fluid Storage Tank: A single carbon steel storage of the volume shown on the equipment schedule. The electric driven hydraulic pump(s) shall be mounted on top.
9. Hydraulic fluid filter mounted on the suction of the pump located inside of the tank.
10. Relief Valve piped back into the storage tank.
11. Isolation valves at the supply and return of the hydraulic piping.
12. Provide spin on filter on the hydraulic system.
13. The size of the electric motor along with electrical service is shown on the equipment schedule.
14. Provide all hydraulic fittings and hoses as required for the application with the HPU.
15. Control panel shall include PLC based controller with 10-inch touch screen operator interface.
16. Hydraulically powered fuel pump set (HP-FOP) (located in flood prone area):
17. Pumps - Positive displacement hydraulic drive pump and fuel oil pump with cast iron housings shall be provided, bronze or brass housed pumps are not allowed. The hydraulic drive and fuel oil pump assembly shall be permanently aligned with a precision permanent alignment bracket to the OEMs published standards. Pumps and drives shall be mounted with bolts threaded into the steel channel for ease of maintenance, mounting bolts shall not penetrate the secondary containment basin. The pumps shall be provided with self-adjusting mechanical seals, packing type shaft seals are not allowed. Pumps that have aluminum, brass or bronze housing or rotors are not acceptable. The hydraulic pump and fuel pump combination shall be able to work in polluted water up to 90 feet deep. All components of the hydraulic and fuel handling equipment shall be visible without removal of any equipment. All components are visible while operating. This will allow for easy inspection at any time. No special gaskets are to be used to protect electrical components.
18. Pump Isolation and Check Valves: Provide and mount four (4) pump isolation valves. 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, rated 600WOG, include stainless steel ball and Teflon seat. Valves to provide full flow while open and positive shutoff when closed. Additionally, two (2) class 125# spring check valves shall be provided and mounted, one (1) located on the discharge of each pump.
19. Relief Valves: Provide for each fuel oil pump a relief valve sized to relieve the full outlet flow of the pump at rated pressure without causing the pump motor to overload or any of the pump set component’s pressure rating to be exceeded if the discharge is inadvertently closed off or restricted. Relief valves are to be mounted remotely from the pumps and piped to return this oil to the tank it is being pumped from (typically the main tank) as shown on the drawings. Pump internal relief valves are normally not accepted except if shown on the drawings.
20. A Model STR-D cast iron simplex strainer with a 1/16 perforated basket shall be provided for each Hydraulic Pump – Fuel Pump combination. The strainer shall be rated for oil service at a minimum 150psi working pressure. If the system is operating while flooded, and a strainer starts to clog the other pump with its own strainer can be started. No special tools shall be required for operation or maintenance. The strainer shall be selected by the pump set manufacture to meet the capacity of the pump set with a maximum, “clean basket”, pressure drop of 1” Hg.

Optional 80 mesh and 100 mesh

1. Strainer shall be equipped with a factory mounted and wired differential pressure switch to indicate that the basket needs to be checked and cleaned. Indicating scale plate shall be three-position color-coded for easy indication of strainer basket status. The DP switch will be wired so that power to the switch is turned off if the area becomes flooded.
2. Compound and Pressure Gauges: Provide and mount a compound gauge on the common suction header feeding the pumps. The gauge shall read 30” vacuum and 30 psi pressure (30” Hg-0-30psi). Provide and mount a pressure gauge on the discharge side of each pump with the normal pump pressure shown at mid-scale. All gauges shall be provided with an isolation ball valve with 21/2” or 4-inch dials.
3. Pump Bases - The pump bases shall be designed and constructed to act as a containment basin with a minimum 3” continuously welded reservoir wall providing containment. Electrical motors and components shall be mounted above maximum liquid level of containment basin. To minimize trip hazards and equipment damage all pump set components shall be located within the perimeter of the containment basin walls, no extrusions are allowed. The pump set base shall use no less than 3/8” plate, using less than this thickness will be grounds for rejection. Provide ½” plugged containment basin drainage connection. Both the skid located above the flood plain and the skid with the hydraulic pump – fuel pump will have base pans.
4. Leak Switch - A Model PLS float switch shall be provided to detect a flooded containment basin. The switch shall be normally closed, opening on a rise in liquid level of the containment basin. The float switch shall be compatible with fuel oil and be located within the perimeter of the containment basin.
5. The HP-FOP skid will have a floor flooded switch. This will be used to alert the operators of a flood in the low area and will also cause power to be cut to all sensors in the flooded area to protect from short circuits affecting the operation of the system. The flow switch that is normally located at the outlet of the pump set and is part of the pump skid, will be located at the point of use above the flood plain. All sensors on the HP-FOP skid will be wired to the control panel located at the HPU.
6. Pump Automatic Sequencing Flow Switch: Provide a time delayed flow sensing switch (Model FS) on the discharge of the pump set to bring on the lag pump should the lead pump fail to maintain flow. Flow switch shall be vane operated to actuate a single double throw snap switch. Switch shall be rated for 1450 psig. Provide a flow switch outlet isolation valve for maintaining the flow switch without draining the fuel system.
7. Controls (Mounted at the Hydraulic Power Unit above the flood plain)
8. The Logic Control Module shall provide all logic to operate the pump set, monitor and control levels for the day tanks, and any other control requirements.
9. Start, stop and rotate fuel pumps
10. Logic Control Module - A fully functioning, 24 VDC, UL 508 listed motor control panel shall be provided and permanently mounted on fuel oil pump skid and integrated with the Motor Control Module.
11. NEMA 4 rated metal enclosure.
12. Preprogrammed and configured nonproprietary PLC hardware
13. Touchscreen HMI

Consult the controls section of the CFS specification for further information.

1. The motor control module shall provide field wiring terminal and pilot devices for remote operation of the fuel pump set and monitoring of system safeties and components.
2. Provide for local-manual operation of individual fuel pump or select auto for operation by control system.
3. Alarm upon input from logic control system.
4. Provide flooded basin and strainer D/P alarm discreet signals to control system, alarm shall be energized upon switch opening.
5. Provide individual positive pump flow discreet signal to control system.
6. Communication Interface to Building Automation Systems:
7. Modbus, BACnet or other IP Interface shall be provided as shown on drawings.
8. The interface shall provide monitoring on the following point:
9. Pump Run Status
10. Flow Switch Status (if supplied)
11. Leak Switch Status (if supplied)
12. High Strainer DP Status (if supplied)
13. General Alarm
14. If no interface is used the system shall provide discrete contact outputs for the following
15. Pump 1 Run
16. Pump 2 Run
17. Leak Switch Status
18. Strainer DP Status
19. Environmental Conditions may be dirty, dusty, and damp. All of the equipment shall be suitable for use in this environment.
20. The pump motor shall be TEFC/TEPE.
21. The motor control module enclosure shall be NEMA 4 rated with NEMA 4 pilot devices.
22. All wiring shall be enclosed in liquid tight conduit in accordance with NEC standards.
23. Quality Control and Factory Testing –
24. The fuel pump set shall be tested for tightness and proper operation prior to leaving factory. The pressure test for tightness shall be a “wet” test with fluorescent liquid; the system shall be brought to pressure and after 60 minutes, each joint shall be visually inspected under pressure with a fluorescent lamp. If any leaks are detected repairs must be made and the system shall be retested in its entirety. Simply testing the system with air pressure and soap bubbles is unacceptable.
25. After a successful pressure test and documentation of those results each pump shall be energized, checked for proper rotation and operation. The motor full load amps shall be read and recorded. The manufacturer shall set all pressure relief and regulating valves, the settings shall be recorded on tags affixed to each individual device and noted in the installation/operation manual shipped provided to installing contractor.
26. The system shall be tested in the factory with mineral oil to perform a complete system test.
27. The testing liquid shall be purged.
28. The owner or the owner’s representative may witness the testing. This factory acceptance test requirement is to be noted in the submittal approval. It is the responsibility of the owner or his representative to coordinate his schedule with the manufacturer so as not to affect manufacturing or delivery schedules.
29. Wiring – The wiring between the Logic Control Module, the Motor Control Module and individual pump set components shall be installed by the manufacturer, at his facility, to provide a single location for connection of field wiring. The wiring shall be done in accordance with NEC with special attention being paid to ensure conduits are not overfilled. If the Logic Control Module is to be mounted separately from the pump set, this will require field wiring by a qualified electrician.
30. Manufacturers acceptable shall have at least 10 years of experience designing and building fuel oil pump sets and shall have, on staff, degreed engineers to provide assistance to the installing contractors, owners and operators. The equipment shall be Critical Fuel Systems Model True Guard (TG-XXXX-YYY-ZD).