

AUTOMATIC FUEL OIL TRANSFER PUMP SET

Suggested Specifications

1. Application

Supply a self-contained, automatic fuel oil transfer and monitoring system to ensure a reliable supply of fuel oil to the emergency generators or boilers included in this project. The system shall include automatic pump set lead/lag, storage tank and day tank level monitoring, leak monitoring, LCD operator display, manual back-up stations, time and date stamped alarm and event summary, and the system shall include the capability to simultaneously communicate to a Data Acquisition System (DAS), Building Automation System (BAS) or Building Management System (BMS) via Modbus protocol, and dial out to an alphanumeric pager system via field installable plug-in option modules in the future. The control system shall be microprocessor-based and can be expanded by adding additional FSC modules. The Automatic Fuel Oil Transfer Pump Set and monitoring system shall be Preferred Utilities Mfg. Corp. Danbury, CT Model ATPSF-____ rated at ____GPH of (No. 2), (No. 4), (Diesel) oil against a discharge pressure of ____PSIG.

2. Pump Set and Control Cabinet

The pump set and control cabinet shall be completely pre-wired and tested to ensure job site reliability. The pump set and control cabinet shall be the product of one manufacturer for single source responsibility. Provide a factory assembled NEMA 4 steel enclosure with all operator interface control switches, indicators and displays physically separated from any field terminations.

3. Controller Hardware

Each microprocessor controller shall include the following inputs and outputs:

- (24) 120 VAC digital inputs
- (5) 2 A relay outputs
- (5) 1/2 HP (10 A) relay outputs
- (8) loop-powered 4-20 mA analog inputs
- (3) 4-20 mA analog outputs

Each controller shall include two RS-485 NodeNet communication ports for communicating to the other controllers in the distributed control system. In addition, each controller shall include two RS-485 communication ports for connection to a color touchscreen or other external device.

4. Operating Displays

The fuel system controller shall be equipped with a 4" color touchscreen Operating Interface Terminal (OIT) for pump set status, storage tank level indication, alarm listing, and trouble shooting functions. Provide dedicated pushbuttons for alarm silence and for the home page display and a "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. Should a switch be put into the "off" position, the controller shall log the event with a time/ date stamp and store within the controller memory. Provide an Elapsed Time Recorder (ETR) to measure running time for each pump. Provide a fuel oil overview display (home page) capable of simultaneous viewing of pump set status, day tank status and main storage tank status. The fuel oil overview display shall include the following information:

- a) Lead pump selection – auto/manual
- b) Pump status – off/ run/ standby
- c) Day tank status – normal/ high/ low/ leak
- d) Main tank status – normal/ high/ low/ leak
- e) Three most recent alarms

The touchscreen shall communicate to the controller via RS-485 Modbus protocol. The touchscreen shall be pre-programmed at the factory with graphic pages for operation, setup, trouble-shooting, and alarm indication. Each touchscreen shall be capable of displaying information from any of the controllers in the distributed control system.

The touchscreens can communicate to an external controller, building automation system, or energy management system via RS-485 Modbus, Ethernet TCP/IP, or BacNet IP protocol.

5. Reliability

The controllers shall communicate using two NodeNet Communication Ports (A and B) that continuously communicate between all controllers wired in series (up to 10 controllers maximum). All of the information from all of the controllers will travel through all of the units. Upon start up NodeNet A will be the lead communication port with NodeNet B being the back up. In the event of a loss of communication NodeNet B will become the lead communication port. If one controller in the network fails, a common alarm will be activated and the other controllers will continue to function.

6. Alarm and event Logs

The control system shall include a 200 alarms, events and operator actions memory minimum. Provide an alarm display page for viewing the most recent eight alarms/ events with scrolling capability to view the complete 200 point alarm/ event memory. Each event and alarm condition must be displayed with a distinct, descriptive, English language description and time and date stamp. New alarms shall trigger the common alarm output relay. Events shall be recorded, but shall not trigger an alarm. A dedicated alarm silence button shall silence the alarm output. The control system shall record and annunciate the following alarms: pump thermal overload, pump loss of flow, pump set failure, day tank leak, day tank high level and day tank low level. The control system shall record the following events: pump started, pump control switch in "off" position, pump set prime test OK, and pump selected as lead.

7. Fuel Pump Alternation and Lead-Lag Operation [Day Tank Fuel Oil Supply Applications]

Provide automatic, microprocessor-based day tank level control. The lead fuel pump shall be energized when day tank oil level falls below 50%. The lead pump shall continue to operate until the day tank level is greater than 80%. Upon the next call for fuel, the lead pump shall be automatically alternated. The control system shall automatically energize the back-up pump upon detecting a low level condition (40% full condition). Both pumps shall then continue to operate until the level of oil reaches the high level point (90% full condition). Upon detection of loss of flow or lead pump thermal overload, the control system shall automatically energize the backup pump and de-energize the lead pump.

8. Fuel Pump Alternation and Lead-Lag Operation [Loop Fuel Oil Supply Applications]

Provide automatic, microprocessor-based fuel oil transfer pump control based upon a call for oil. The lead fuel pump shall be energized upon a call for oil from the boiler and run continuously until the demand is removed. Upon the next call for fuel, the lead pump shall be automatically alternated. The lead pump shall automatically rotate every 1 to 168 hours or shall be manually selected by the operator. Upon detection of loss of flow or pressure or lead pump thermal overload, the control system shall automatically energize the backup pump and de-energize the lead pump.

9. Automatic Pump Prime and Suction Line Integrity Check

The control system shall include a real-time clock and must be capable of automatically energizing the lead pump once every day. This is to verify suction piping integrity and pump prime and verify pump operation. Once the lead pump has proven satisfactory operation, the lag pump shall be energized and run through the same test. These tests shall be recorded in the controller memory with a time/ date stamp for later verification. If either lead or lag pump fails any of these tests, the control system shall generate an audible and visual alarm and log the "failed pump" condition.

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10. Main Storage Tank Monitoring

The control system shall include main storage tank level sensor and discriminating leak sensor monitoring. Provide a continuous display of tank content, in both gallons and inches of product, within the main storage tank. Tank alarm displays shall not interfere with the display of the tank content. Provide data recall of the instantaneous display of tank content at the time of leak alarm condition. The control system shall include an overfill alarm circuit test pushbutton to provide instantaneous proving of audible and visual alarm circuitry associated with instrument overfill alarm contact. The system must be field expandable by adding additional FSC modules. Provide all equipment capabilities specified in this paragraph even if connecting level and leak sensors are not included in this project.

11. Piping And Mounting

Provide a duplex pump and straining set that is factory assembled with components piped and mounted on a continuously welded steel plate containment basin with 3" steel side rails. Provide a ½" containment basin plugged drain connection. 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.

12. Positive Displacement Pumps

Provide and mount two (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.

13. Motors

Provide and mount two (2) TEFC, 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.

14. 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 valves to provide full flow while open and positive shutoff when closed. Additionally, two (2) check valves shall be provided and mounted, one (1) located on the discharge of each pump.

15. Fuel Oil Strainer

Provide and mount two (2) simplex strainers with 40 mesh baskets, one (1) located on the suction side of each pump.

16. Relief Valves

Provide and mount two (2) 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 valved 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. Relief valves shall be Preferred Model R.

17. Compound And Pressure Gauges

Provide and mount a compound gauge on the suction side of the strainer. The gauge shall read 30" vacuum - 15 PSIG. Provide and mount a pressure gauge on the discharge side of each pump. Each gauge shall be equipped with an isolation ball valve.

18. Pump Automatic Sequencing Flow Switch

Provide a time delayed flow sensing switch on the discharge of the pump set to energize 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 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.

19. Quality Assurance

The control cabinet shall be manufactured and labeled in accordance with UL 508A (CSA C22.2 #14 for use in Canada). 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 UL 508A. Inspection and labeling shall be supervised by UL or other OSHA approved Nationally Recognized Test Lab (NRTL). The system must be manufactured by a nationally recognized trade union (I.B.E.W. or similar trade union). Lack of an NRTL certified UL 508A wiring methods inspection and label or lack of a trade union label will be grounds for rejection.

20. Factory Testing

Pump sets must be fully tested prior to shipment. Testing shall include both a pressure and vacuum testing period. First, the complete pump set shall be pressure tested to rated pressure using an air pressure source. The test shall confirm that the pump set piping system can maintain rated pressure for four hours. Next, the complete pump set shall be brought to a vacuum greater than 25" Hg. The test shall confirm that the pump set piping system can maintain vacuum for four hours. Following a pressure and vacuum test the pump set shall be given a full operational test. The pump set shall be connected to a fuel oil supply and return. The pump set shall be operated normally. Motor amps shall be noted at no load and full load for each motor. The motor amps shall be within 10% of rated motor amps. During the test the relief valve shall be set and tested. Operation of pump set instrumentation shall be tested. A copy of the test procedures shall be sent to the consulting engineer and owner. The owners and or the consulting engineer, at their discretion, shall observe this and all other tests. A certificate of factory testing, together with a copy of the wiring and arrangement diagrams shall be placed in the control cabinet prior to shipment.