

Standard Operating Procedures SOP for Fuel Systems and Components

Introduction

A critical part of a fuel system design is communicating how the system should work through a written Standard Operating Procedure or SOP. The benefits of doing this work upfront are several:

1. Facility owner buy-in on the design phase eliminates changes at facility turnover.
2. Eliminates unnecessary RFIs making for efficient use of design engineer time.
3. Facilitates coordination amongst specialist subcontractors and suppliers during construction

And its not that complicated. Each component of a fuel system such as a day tank has a standard operating procedure. A system SOP is a group of these component SOPs with some smart editing at the end to define the special requirements for the project.

Here are some standard SOP paragraphs for the fuel system components

Duplex Pump Set Operation: The duplex pump controller monitors day tanks, boilers, and other equipment for fuel requirements. In the AUTO mode, when a fuel request is received, the primary or lead pump starts and continues to operate until the fuel request is satisfied. The start and stop of pumps is delayed as required to allow operation of automatic valves in the system and to prevent short cycling. The pump operation is monitored by a flow switch or current sensor. When pump operation is not detected, the controller automatically starts the secondary pump and an alarm is indicated. Pump operation is selected by the operator as lead-lag, alternating, or twin. In the MANUAL mode the pump starts and operates until the mode is de-activated. A leak sensor and emergency stop at the pump disable the pump operation when activated.

Monitoring: The controller shall monitor the following information and provide status the BMS: (a) Pump 1: Manual Mode, Auto Mode, Off Mode, Run / Active, Lead / Lag, Normal / Alarm, Run Hours, (b) Pump 2: Manual Mode, Auto Mode, Off Mode, Run / Active, Lead / Lag, Normal Alarm, Run Hours, (c) General: Status Normal / Alarm / Trouble, Leak, (d) Logging: All alarm conditions and Pump Stop / Start.

Filtration / Polisher Operation: The filtration polisher controller operates on a time cycle to circulate fuel in a tank and monitors the filter condition. The operator sets the filter operation in AUTO mode as Day of Week – Start Hours – Run Hours, and in Manual Mode as Run Hours upon Activation. The controller shall provide for operator selection of multiple tanks where indicated. When the Start condition is satisfied, the controller starts the fuel circulation pump and continues until the end condition is satisfied. Where required, fuel tank supply and return

valves are operated to provide flow for the active tank. The controller monitors the pump operation using a flow or current sensor input. The pump is stopped in the event of no-flow or leak or emergency stop activation. The filters are monitored for high differential pressure and water accumulation level.

Monitoring: The controller shall monitor the following information and provide status to the BMS: (a) Settings: Mode, Start Time, Duration, (b) Cycle Status Active / Standby, Time Elapsed / Remaining, (c) Pump Active / Standby, Run Hours, (d) Filter: differential pressure alarm, water alarm, (e) General: Status: Normal / Alarm. Trouble, Leak. (f) Logging: All alarm conditions and Pump Start / Stop.

Day Tank Operation: The day tank control monitors the day tank level switches to allow fuel transfer into the day tank and maintain normal fuel levels for the generators. In the AUTO mode, when the fuel level is lowered to the 75% re-fill start level, the controller activates an output signal to remote fuel supply pumps and opens the inlet solenoid valves to allow fuel flow into the tank. When the 85% normal fill level sensor is activated, the remote pump signal ceases and the inlet solenoid valve closes. The 50% low level sensor acts as a redundant re-fill start signal and provides an alarm condition. The 25% critical low level sensor provides an alarm condition. The 95% high level sensor acts as a redundant fill stop signal, activates to close the normally open inlet solenoid valve, and provides an alarm condition. In the MANUAL mode, the controller opens the inlet solenoid valve and send a signal to start remote pumps, unless a high level condition in the day tank is indicated. The leak sensor activation disables the tank re-fill operation in AUTO mode and provides an alarm condition.

Optional Equipment Operation: The return flow pump activates when a high level condition occurs and continues operating until a normal level is reached in the day tank.

Monitoring: The controller shall monitor the following information and provide status to the BMS: (a) Mode: Manual-Off-Auto, (b) Status Active / Standby, (c) Level: Normal, High, Low, Critical Low (d) General: Status: Normal / Alarm. Trouble, Leak Alarm. (e) Logging: All alarm conditions and Fill Start / Stop.

Tank Fill Operation: The tank fill station controller monitors high levels in the fuel tanks and allows fuel transfer into the tank from delivery trucks. At the fill station the operator selects the tank to be filled, or a single tank is enabled. The actuated valve in the fill line is energized to open, and the valve limit switches indicated the valve position on the controller screen. When the tank level reaches 85%, the sensor activation provides an input for an audible and visual warning. At the 95% tank level, the tank level sensor provides a signal for a 90% high level alarm and the tank fill valve closes. The operator may move the selector to the OFF position and then back to the FILL position to activate the jog mode, and the valve will open for 2 minutes to allow draining of the fuel delivery hose contents. At 95% tank level the sensor activates a critical high level audible and visual alarm and the valve in the fill line is disabled in the closed position, until the tank level is lowered to 85%. The tank level in % full or gallons may be displayed using an input from a tank level transmitter or indirectly through the tank level monitor.

Monitoring: The controller shall monitor the following information and provide status to the BMS: (a) Mode: Fill-Off (b) Tank Status Active / Standby, (c) Tank Level: Normal, 85% High Warning, 90% High Alarm, 95% Critical High Alarm Low (d) General: Status: Normal / Alarm, Trouble (e) Tank Level Gallons and % Full if Level Transmitter (f) Logging: All alarm conditions and Fill Start / Stop.

Multi-Tank Selection Operation: The Master controller shall monitor tank levels and fuel request signals from point of use to select tanks from a multi-tank installation and activate control valves in fuel oil supply and return piping. Supply tanks are monitored for high and low level and actuated ball valves in fuel supply and return piping include limit switches for position indication. The operator selects the lead fuel supply tank and the secondary fuel supply tanks in order at the fuel system control panel. The selection may be manual, or automatic based on the largest available volume per tank, or alternating on consecutive fuel requests. When fuel is required at a point of use, the controller opens the primary fuel supply valves in the supply and return piping. Where submersible pumps are used only fuel oil return piping valves may be applicable. When the fuel request ends the fuel supply valves are moved to a closed position. The system maintains one fuel return valve always in an open position to provide a return flow path for overfills. When a tank level reaches a low level alarm condition, then the tank is disabled and active operation automatically switches to the secondary tank. When a tank reaches a high level condition the fuel oil return valve is moved to a closed position. The system monitors the valve position limit switches so that only the active tank valves are open, while other system valves remain closed. The controller indicates the position of all valves and provides an alarm for valve position error, if valve position is not confirmed within 60 seconds. In the Manual mode, the supply and return valves for the selected tank are moved to the open position, and the system allows only one tank active in Manual mode at one time.

Monitoring: The controller shall monitor the following information and provide status to the BMS: (a) Tank Mode: Manual-Off -Auto (b) Tank Status Active / Standby, (c) Tank Level: Normal, 90% High, 10% Low (d) General: Status: Normal / Alarm, Trouble (e) Valve position: Open / Closed (f) Logging: All alarm conditions and Active Tank Start / End.

Tank Level Gauging and Leak Detection: The tank level gauging and leak detection monitor provides information on the status of fuel storage tanks, piping, and sumps. For underground tank installations the system shall comply with all applicable environmental regulations. Level transmitters in each tank provide a signal to the monitoring panel. Transmitters shall have an integral temperature sensor. The tank level provides the following information: tank level gallons, tank level inches, temperature compensated gallons, tank ullage, tank ullage to 90%, tank temperature. The tank level monitor has programmable level alarms which are set at 90% High Alarm, 85% High warning, 50% Re-order Warning, 25% Low Alarm, or as indicated on the drawings. The tank monitor shall monitor leak detection sensors for tank interstitial space, tank sumps, and piping sumps. Upon activation the monitor shall provide an audible and visual alarm and display of the active sensor identification. The tank monitor shall integrate electronic line leak detection, and vacuum leak monitoring systems where required by local codes. The monitor has a serial communication port for integration, and output relays for alarm conditions.

Monitoring: The tank level gauge and leak detection system controller shall monitor the following information and provide status to the BMS: (a) Tank level gallons tank level inches, tank level temperature compensated volume, (b) Alarm Conditions: High Warning, High Alarm, Re-Order Level, Low Alarm, Any Leak Condition, (c) Test: Line Leak Active / Normal / Fail, or Vacuum Active / Normal / Fail where required by local regulations, (d) General: Status: Normal / Alarm, Trouble (e) Valve position: Open / Closed.