

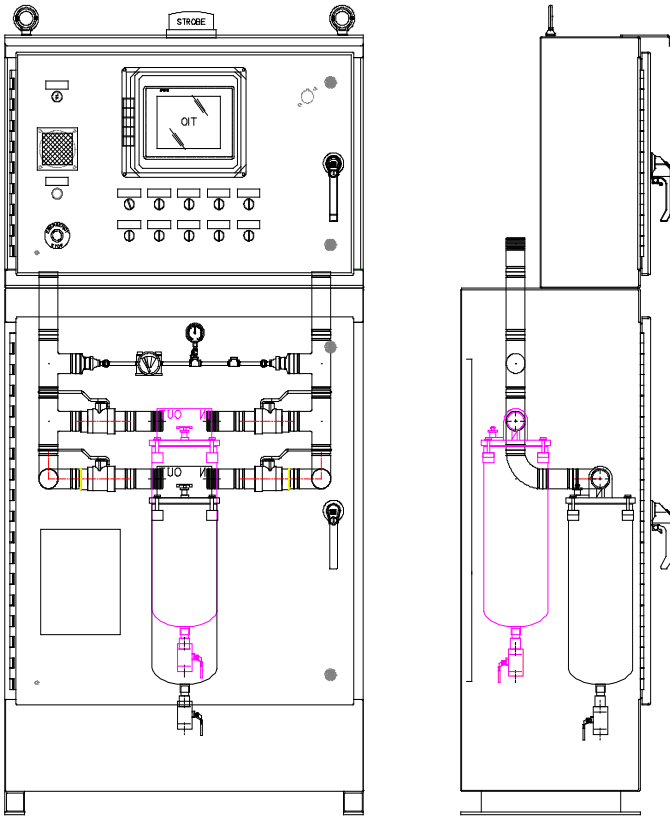


Factory Direct Controls Servicing the Biofuels, Petroleum, and the Chemical Industries for Over 30 Years

Critical Mission Fuel Transfer System

SmartControls™ Series – Critical Mission Fuel Transfer System

Operations Manual



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System Overview

The SmartControls™ Series – Critical Mission Fuel Transfer System is designed for use in critical applications requiring a high degree of reliability such as backup power facilities, data centers, institutional boiler supply, and hospitals. The SmartControls intelligently integrates fuel system monitoring and control functions in one simple automated package. Superior quality components insure years of trouble free service. Integration with our upstream and downstream fuel storage tank and pump systems provides one call service and support from the industry Leader in mission critical fuel systems.

System Monitoring and Control

Main Storage Tanks

The system will display the following information for each main storage tank.

- In “Full Automatic Mode” status.
- Product level in US gallons.
- Product level in inches.
- Product level in Percent of full tank capacity.
- High level alarm status.
- High level warning status.
- Low level warning status.
- Low level alarm status.
- Interstitial (double wall) leak sensor status.
- Supply or return flow indicator Status.
- Control valves status. (optional)
- Present and historical alarm conditions.
- Optional Remote Fill Station enunciator.

Day Tanks

The system will display the following information for each day tank.

- In “Full Automatic Mode” status.
- High level alarm status.
- Pump start level status.

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- Normal product level status.
- Pump stop level status.
- Low level alarm status.
- Interstitial (double wall) leak sensor status.
- Supply or return flow indication.
- Control valves status.
- Present and historical alarm conditions.

Duplex Lead / Lag Pumps

The system will display the following information for each pump.

- In “Full Automatic Mode” status.
- Emergency stop (remote and local) status.
- Pump “Lock out” Status.
- Pump ready status.
- Pump on/off status.
- Lead/Lag pumps selection.
- Pump run elapsed time meter.
- Pump motor starter status.
- Pump motor overload status.
- Pump enclosure leak sensor status.
- Flow indication status.
- Present and historical alarm conditions.

Fuel Polishing / Filtration

The system will display the following information for the fuel polishing / filtration system.

- In “Full Automatic Mode” status.
- Auto fuel polishing start / stop schedule.
- Fuel polishing status.
- Filters differential pressure status.
- Filters water sensor status.
- Enclosure leak sensor status.
- Flow indication status.
- Control valve Status.
- Present and historical alarm conditions.

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System Alarms (all alarms)

The stem is designed to monitor and display the current and historical conditions of the completed system and components. When an alarm occurs the horn will enunciate and the strobe will flash.

- All alarm conditions will be display on the system monitor.
- All alarm conditions will be sent to the remote building management system (BMS).
- All alarm conditions will remain displayed active until acknowledged.
- No active alarm conditions will be cleared until resolved.

End of Section



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System Operations (Modes)

Systems Operations Overview

The system is designed to fully monitor and control the fuel levels of all the main storage tanks, day tanks and the fuel polishing system. All of the conditions will be displayed on the Operator Interface Terminal (OIT) system monitor.

The system monitors and controls the “fuel transfers” by monitoring the following conditions:

- Each main tank, day tank, pumps and filtration system Hand – Off- Auto (H-O-A) Selector switch.
- Day tanks fuel level sensors at the pump start, pump stop, low level and high level set points.
- Main storage tanks fuel level at the low level alarm, low level warning, high level warning and high level alarm set points.
- Duplex pump performance by monitoring the motor starters, motor overloads, flow switch indicators and pump run timers.
- Main tank, day tank and filter piping/enclosure leak sensors.
- Fuel polishing system filters pressure differential and water sensors.

The system will monitor and alarm all leak and level conditions regardless of any “Mode” of operations the system might be in.

Full Automatic Mode (Day Tank Automatic Transfer Mode)

When the system is in the “Full Automatic Mode” it is designed to fully monitor and control the fuel levels of the system. When any day tank is in need of fuel, the system will automatically start and replenish the fuel in the day tank.

To place the system in the Full Automatic Mode:

- **Turn each main tank, day tank, pump and filtration system H-O-A selector switch to the “Auto” position. (Excludes Auto Fuel polishing H-O-A switch)**
- **Note: If the system is using a “Automatic Return Pump” option, the return pump H-O-A selector switch to the “Auto” position.**

When the system is in the “Full Automatic Mode”:

- When any day tank level reaches the pump start set point (Call for Fuel):
 - The system will automatically start a fuel transaction.

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- The lead pump will start and the corresponding day tank fuel supply control valve will open.
- The lag (standby) pump will start if a flow is not indicated after 45 seconds.
- The transfer will stop when day tank reaches the pump stop level set point.
- The pumps will stop and the corresponding day tank fuel supply control valve will close.

- When any day tank reaches a high level alarm set point:
 - An alarm will sound and the day tank will be locked out of service.
 - All fuel transactions will be stopped to all day tanks and fuel polishing.
 - Both the lead/lag pumps will be locked out of service.
 - The system will be taken out of Full Automatic Mode.
 - The system will remain out of Full Automatic Mode until the condition is resolved and all alarms are cleared.

- When any day tank reaches a low level alarm set point:
 - An alarm will sound and the system will automatically start a fuel transfer.
 - The lead (standby) pump will start and the corresponding day tank fuel supply control valve will open.
 - The lag (standby) pump will start if a flow is not indicated after 45 seconds.
 - The transfer will stop when day tank reaches the pump stop level set point.
 - The lead pump will stop and the corresponding day tank fuel supply control valve will close.
 - The alarm condition will remain until the operator acknowledges the condition.

- When any leak sensor senses fuel or water:
 - An alarm will sound and all fuel transactions will stop.
 - The system will be taken out of Full Automatic Mode.
 - The system will remain out of Full Automatic Mode until the condition is resolved and all alarms are cleared.

- When any main tank reaches a high level alarm set point:
 - An alarm will sound.
 - (optional) Remote main tank high level alarm enunciator will activate.
 - The alarm condition will remain until the operator acknowledges the condition.

- When any main tank reaches a high level warning set point:
 - An indicator will illuminate on the monitor only.
 - Remote signal will be sent to the BMS.
 - (optional) Remote main tank high level alarm enunciator will activate.

- When any main tank reaches a low level warning set point:



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- An indicator will illuminate on the monitor only.
- Remote signal will be sent to the BMS.
- When any main tank reaches a low level alarm set point:
 - An alarm will sound and all fuel transactions will stop.
 - The system will be taken out of Full Automatic Mode.
 - The system will remain out of Full Automatic Mode until the condition is resolved and all alarms are cleared.
- When any flow sensor fails to sense flow when a fuel transaction takes place (excludes fuel polishing):
 - An alarm will sound and the system will automatically start the lag (standby) pump.
 - The transfer will stop if after 45 seconds if flow is not sensed and an alarm will sound.
 - The system will be taken out of Full Automatic Mode.
 - The alarm condition will remain until the operator acknowledges the condition.
- When lead pump fails to perform:
 - An alarm will sound and the system will automatically start the lag (standby) pump.
 - The alarm condition will remain until the operator acknowledges the condition.
- When lag standby pump fails to perform:
 - An alarm will sound.
 - The system will be taken out of Full Automatic Mode.
 - The alarm condition will remain until the operator acknowledges the condition.

Automatic Return Pump Mode (optional)

The system is designed to automatically return fuel from a day tank back to a main tank in the event that a day tank is in jeopardy of overfilling. Each day tank is equipped with a return pump, a pump on level sensor and a pump off level sensor.

To place the system in the Full Automatic Mode:

- Turn each main tank, day tank, pump and filtration system H-O-A selector switch to the “Auto” position. (Excludes Auto Fuel polishing H-O-A switch)
- Note: If the system is using a “Automatic Return Pump” option, the return pump H-O-A selector switch to the “Auto” position.

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When the system is in the “Full Automatic Mode”:

- When any day tank level reaches the return pump start level set point:
 - An alarm will sound.
 - The return pump will start.
 - The system will be taken out of Full Automatic Mode.
 - The return pump will turn off when the product reached the return pump off level.
 - The alarm condition will remain until the operator acknowledges the condition.

Automatic Fuel polishing Mode

The system in the automatic mode is designed to fully monitor and control the fuel polishing of the system. The fuel polishing works on a programmable schedule. When the fuel piloting H-O-A switch is in the “Auto” position and when the fuel polishing schedule is active, the fuel polishing transaction will automatically start. The fuel polishing will continue until the H-O-A switch is taken out of “Auto” position or when the fuel polishing schedule is in active.

NOTE: When any day tank “Call for Fuel” condition occurs, the automated fuel polishing transaction will pause and restart after the day tank “Call for Fuel” condition ends if the fuel polishing schedule is active.

To place the system in the Automatic Fuel polishing Mode:

- **The system must be in “Full Automatic Mode” (Day tank automatic transfer mode).**
- **Place the Automatic Fuel polishing H-O-A switch to the Auto Mode.**

When the starts an automatic fuel polishing transaction:

- The starts and stop a fuel polishing transaction based on the programmable schedule.
- If the fuel polishing system flow sensor fails to sense flow:
 - An alarm will sound and the system will automatically start the lag (standby) pump.
 - The transfer will stop if after 45 seconds if flow is not sensed and an alarm will sound.
 - The system will be taken out of Automatic Fuel polishing Mode.
 - The alarm condition will remain until the operator acknowledges the condition.



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Manual Mode (Supervised)

The system in the "Supervised Manual Mode" is designed to manually control the operations of the fuel transactions. All fuel transactions to any day tank (and main tanks if return pump option) will be supervised to not allow any overfills.

To place the system in the "Supervised Manual Mode":

1. Turn each main tank, day tank, pump and filtration system H-O-A selector switch to the "Off" position including the Auto Fuel polishing H-O-A switch. Not until all of the switches are in the "off" position will a manual operation be allowed to take place.
2. Turn one each of the following to the "Hand" Position.
 - Source of fuel (example main tank #2)
 - Destination of the fuel (example day tank #8)
 - Pump to be used. (example pump #2)

Note: Only systems with two or more main storages tanks will have a main tank return control valve.

When the system is in the "Supervised Manual Mode":

- When any day tank level reaches the pump start set point (Call for Fuel):
 - An alarm will sound.
 - The alarm condition will remain until the operator acknowledges the condition.
- When any day tank reaches a high level alarm set point:
 - An alarm will sound.
 - All fuel transactions to the corresponding day tank will be stopped.
 - The alarm condition will remain until the operator acknowledges the condition.
- When any day tank reaches a low level alarm set point:
 - An alarm will sound.
 - The alarm condition will remain until the operator acknowledges the condition.
- When any leak sensor senses fuel or water:
 - An alarm will sound.
 - The alarm condition will remain until the operator acknowledges the condition.
- When any main tank reaches a high level alarm set point:

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- An alarm will sound.
- Remote main tank high level alarm enunciator will activate (optional).
- All (optional) return pump transactions will stop.
- The alarm condition will remain until the operator acknowledges the condition.

- When any main tank reaches a high level warning set point:
 - An indicator will illuminate on the monitor only.
 - Remote signal will be sent to the BMS.
 - Remote main tank high level warning indicator will activate (optional).
 - The alarm condition will remain until the operator acknowledges the condition.

- When any main tank reaches a low level warning set point:
 - An indicator will illuminate on the monitor only.
 - Remote signal will be sent to the BMS.

- When any main tank reaches a low level alarm set point:
 - An alarm will sound.
 - The system will remain out of Full Automatic Mode until the condition is resolved and all alarms are cleared.

Emergency Manual Mode

The system in the "Emergency Manual Mode" is designed to manually control the operations of the fuel transactions in the event of a system component failure. This mode should never be used unless every attempt has been made to transfer has failed in both the "Full Automatic Mode" and in the "Supervised Manual Mode". The "Emergency Manual Mode" should only be used to transfer fuel if the "critical" application is in jeopardy.

WARNING: The "Emergency Manual Mode" the operator will take 100% responsibility in the fuel transfer and "all" product levels.

To place the system in the "Emergency Manual Mode":

1. Turn all main tank, day tank, pump and filtration system H-O-A selector switches to the "Off" position including the Auto Fuel polishing H-O-A switch.

2. Turn the "Emergency Manual Key" to the "On" position.

When the system is in the "Emergency Manual Mode":

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- An alarm will sound
- The system strobe will remain flashing until the system “Emergency Manual Key” turned to the “Off” position.
- When an H-O-A switch is turned to the “Hand” position the device may start, turn on, or open.

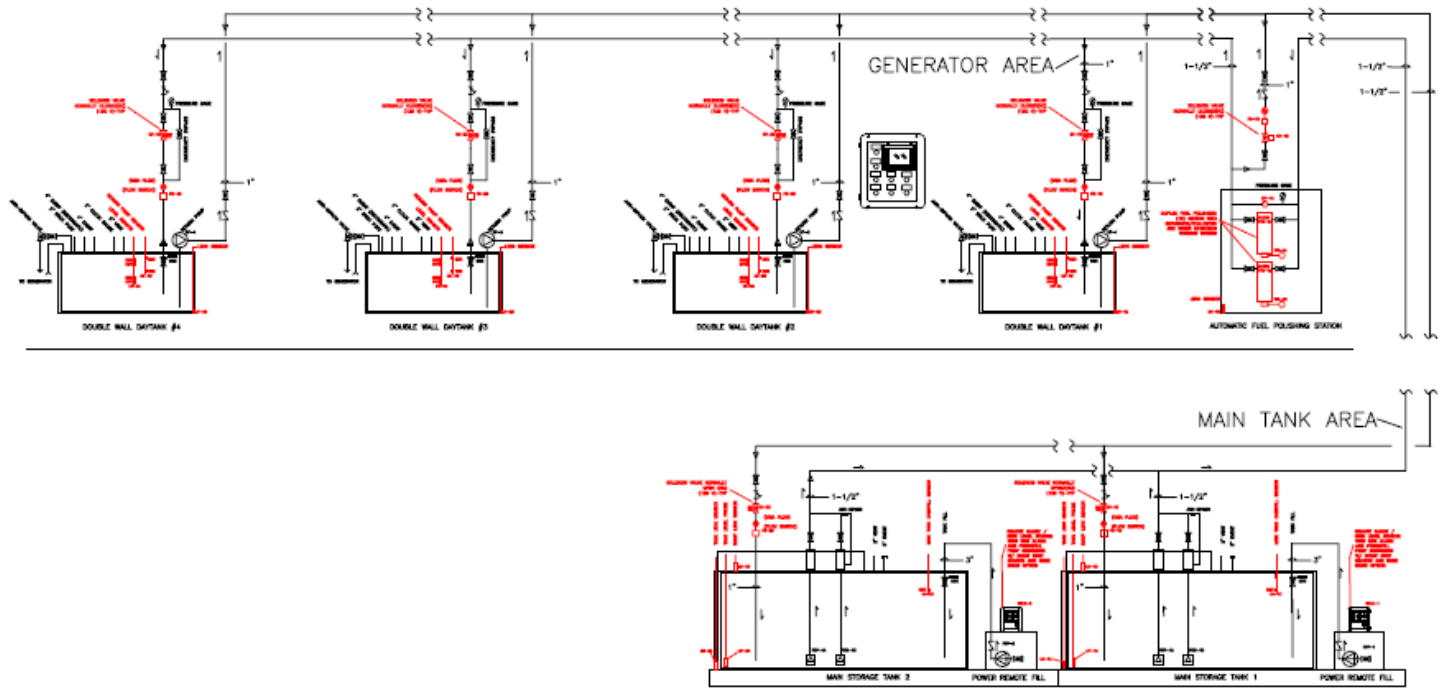
It is recommended before turning any pump to the “Hand” position, to open a source and a destination control valve prior. Examples are: (main tank #2 suction and day tank #8 supply valve)

End of Section

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System Drawings

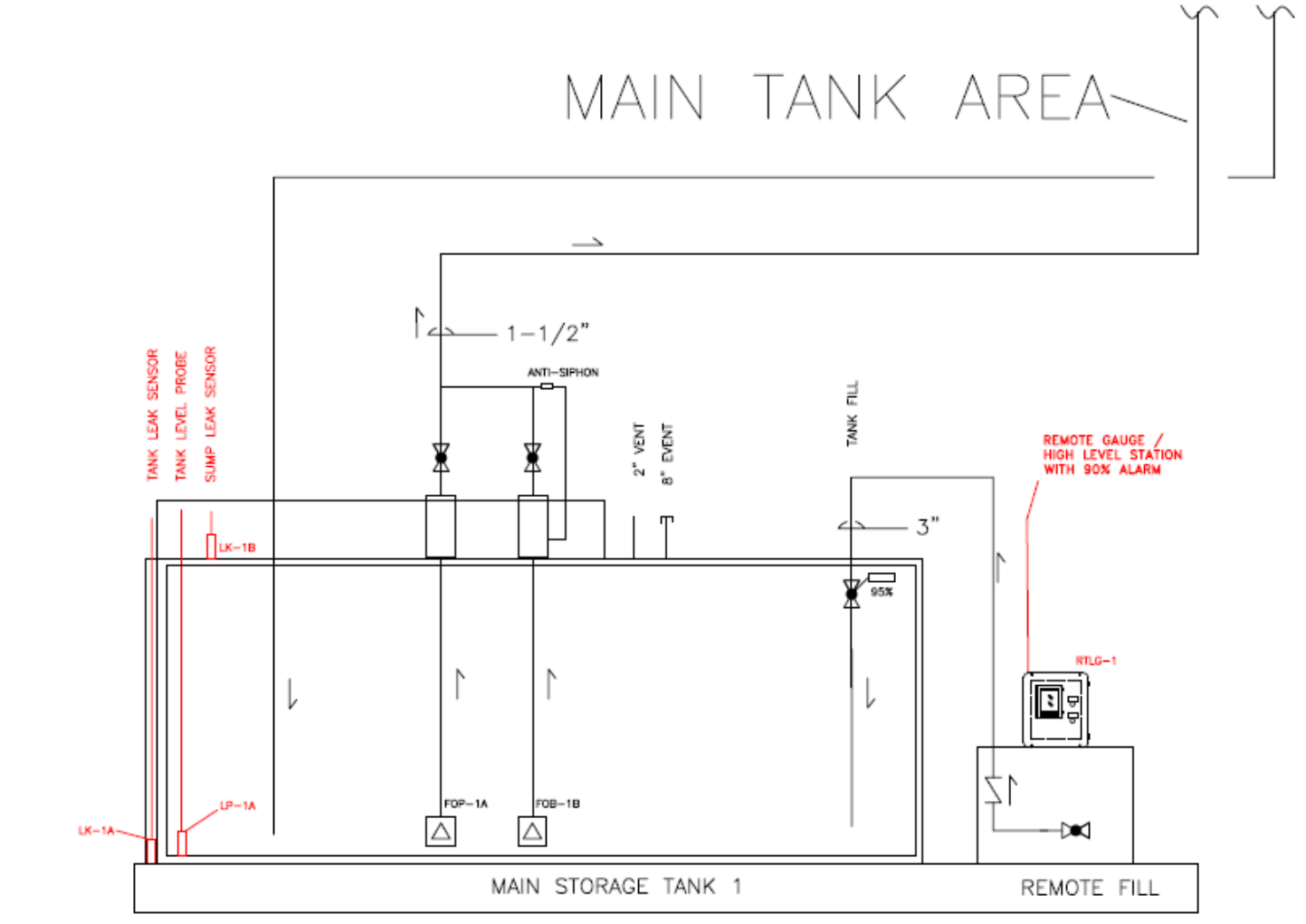
Two Main Tanks and Four Day Tanks (sample)



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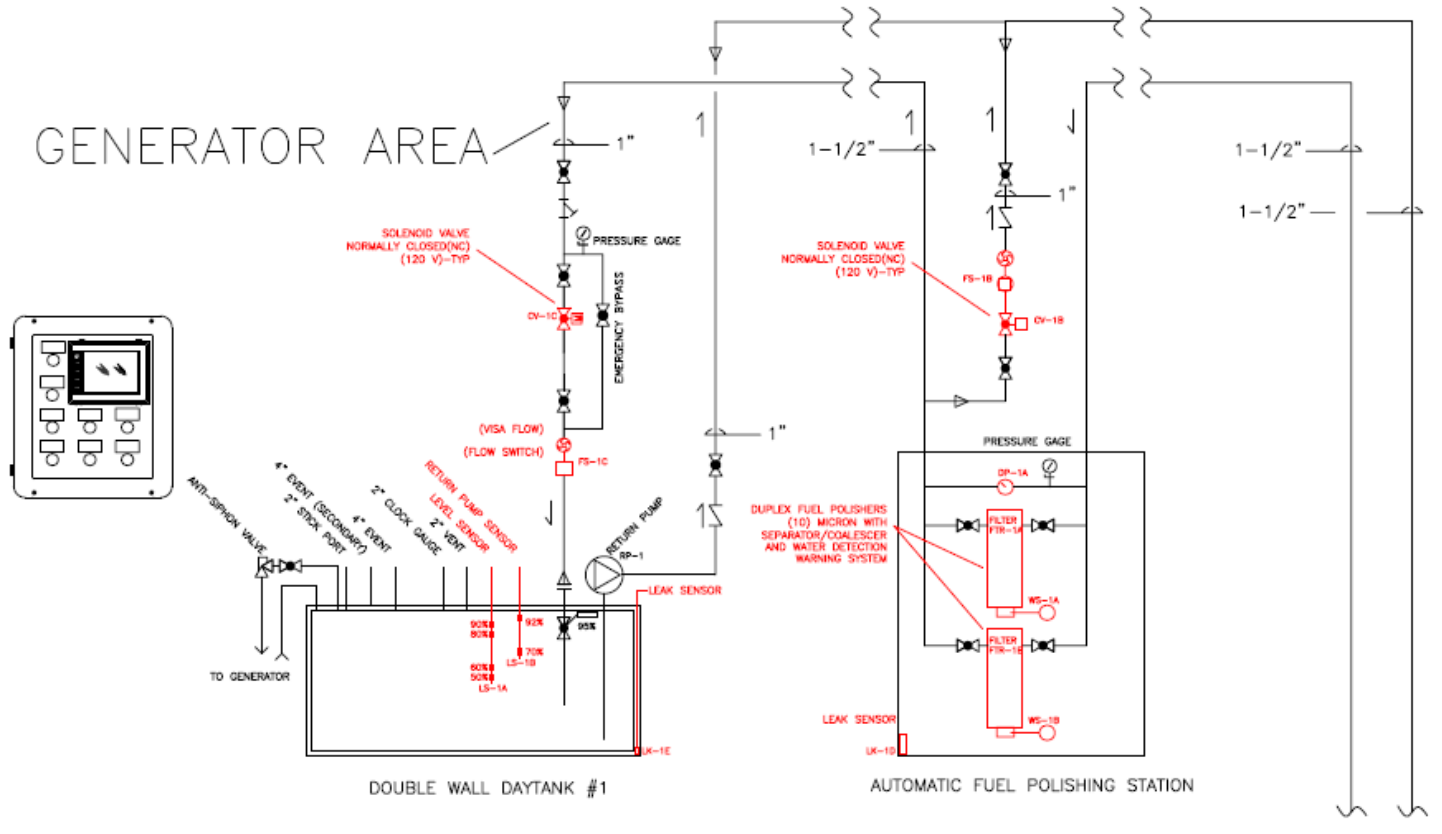
Main Storage Tank (sample)



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Day Tank / Fuel Polishing Drawing (Sample)



End of Section