FPS LX-F

Compact Fuel Maintenance System

The FPS LX-F is a programmable, fullyautomated,fuel maintenance system that removes water, sludge, and other contaminants from fuelstorage tanks.Once installed, the FPSLX-F system operates independently to ensure fuel reliability through routine fuel filtration. The system's fuelpolishing process stabilizes diesel and bio-fuels, eliminating microbial contamination and ensuring the fuel remains clean. These compact fuel maintenance systems are specifically designed for permanent installations indoors, as well as confined spaces, such as inside gen-set enclosures or engine rooms.

FPS LX-F with upgraded TSC70 Touchscreen Controller

FPS LX-F SYSTEM FEATURES:

- Smart Filtration Controller
- Fully Automated and Programmable Operation
- Integration with External Monitoring Systems
- Unique Safety & Alarm Features
- Continuous-Duty Pump, Viton Seals
- System Upgrade Options

For safe operation, the FPS LX-F is equipped with an automatic pump shut-down feature and alert indication to notify users of when the system requires servicing.

FPS LX-F SPECIFICATIONS:

Nominal Flow Rate	10 GPM/600 GPH (38 LPM/2,271.3 LPH)
Primary Filter	10 or 30µ Particulate or 60µ Stainless Steel Screen with Centrifugal Water Separator
Secondary Filter	3, 10 or 25µ Fine Filter or 3, 10µ Water Block
Fuel Conditioner	LG-X 3000 Inline Magnetic Conditioner
Pump	3/4 HP Spur Gear Pump
System Controller	Smart Filtration Controller with Safety and Alarm Features
Power	120V/60Hz/1Ph or 230V/50Hz/1Ph*
Plumbing	Black Iron
Ports	1" Equivalent JIC 37° Flare In 1" Equivalent JIC 37° Flare Out
Construction	Powder Coated Aluminum Back Plate
Dimensions	≈ 26" x 34" x 12" (H x W x D) (66 x 86 x 31 cm)
Weight	≈ 125 lbs (57 kg)

Not for use with fluids that have a flash point below 100°F (37.8°C).

At 50 Hz, nominal flow rate decreases from 10 GPM to 8 GPM

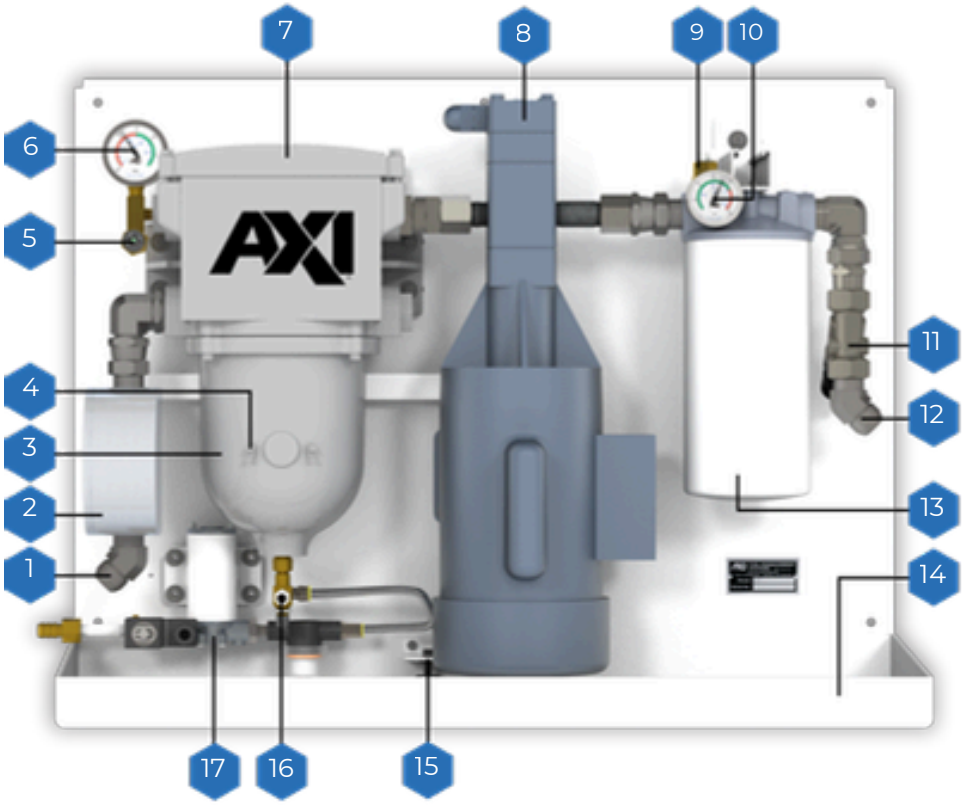
REPLACEMENT FILTER OPTIONS:

Primary Filter	Part No.	Secondary Filter	Part No.
10µ Filter Cartridge	04010	3µ Water Block Filter	WB-3
30µ Filter Cartridge*	04030	10µ Water Block Filter	WB-10
60µ Filter Cartridge	04060S	3µ Fine Filter*	FF-3
		10µ Fine Filter	FF-10
		25µ Fine Filter	FF-25
		3µ X-Glass Media Fine Filter	FFZ-3

***Standard-issue filter element unless requested otherwise**

FPS LX-F

Compact Fuel Maintenance System



1.Fuel Inlet (From Tank)
2.Fuel Conditioner
3.Water Collection Sump
4.Water Level Sensors
5.Vacuum Switch
6.Vacuum Gauge
7.Primary Filter/Water Separator
8.Motor with Coupled Gear Pump
9.Pressure Switch
10.Pressure Gauge
11.Flow Switch
12.Fuel Outlet (To Tank)
13.Fine Filter
14.Drip Tray
15.Leak Detector
16.Manual Drain Valve
17.Auto Water Drain Assembly

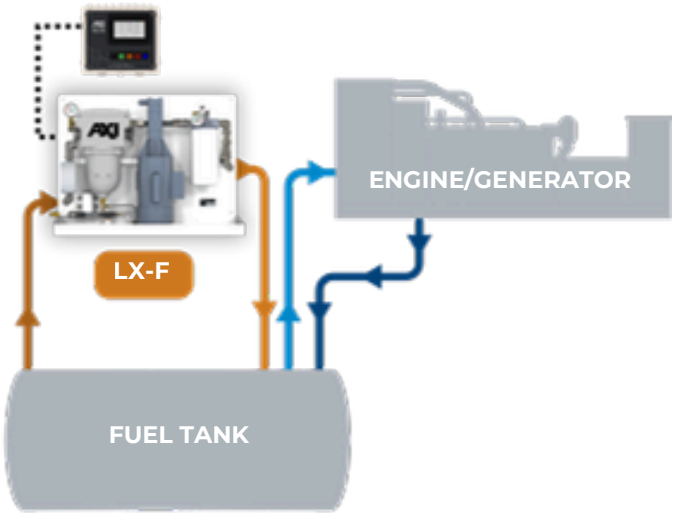
(Optional)

FPS SYSTEM OPTIONS:

Manual Additive Injection	Manually draw additive into the polisher with a dedicated supply port and ball valve
Auto Water Drain (AWD)	Automatically drain water separator of collected water for decreased frequency of maintenance
Pressure Transmitter	Replace standard pressure switch for detailed monitoring of pressure levels in the system
Flow Transmitter	Replace standard flow switch for detailed monitoring of flow rate in the system
Multi-Tank Polishing/Transfer	Polish and transfer fuel between multiple fuel storage tanks
Multi-Point Flow Path	Add multiple supply and return valves for better tank cleaning coverage
Fuel Heater	Warm up circulated fuel to resist gelling in freezing temperatures

Controller upgrade may be required for certain options or combinations of options - See controller specification sheet for more details

FPS SYSTEM INTEGRATION:



FPS

FPS LX-F Operation & Maintenance Manual

COMPACT FUEL MAINTENANCE SYSTEM

Approved v1.0

5400 Division Dr. | Fort Myers, FL 33905
239 690-9589 | Toll Free 877-425-4239 | FAX 239 690-1195
www.AXI-International.com

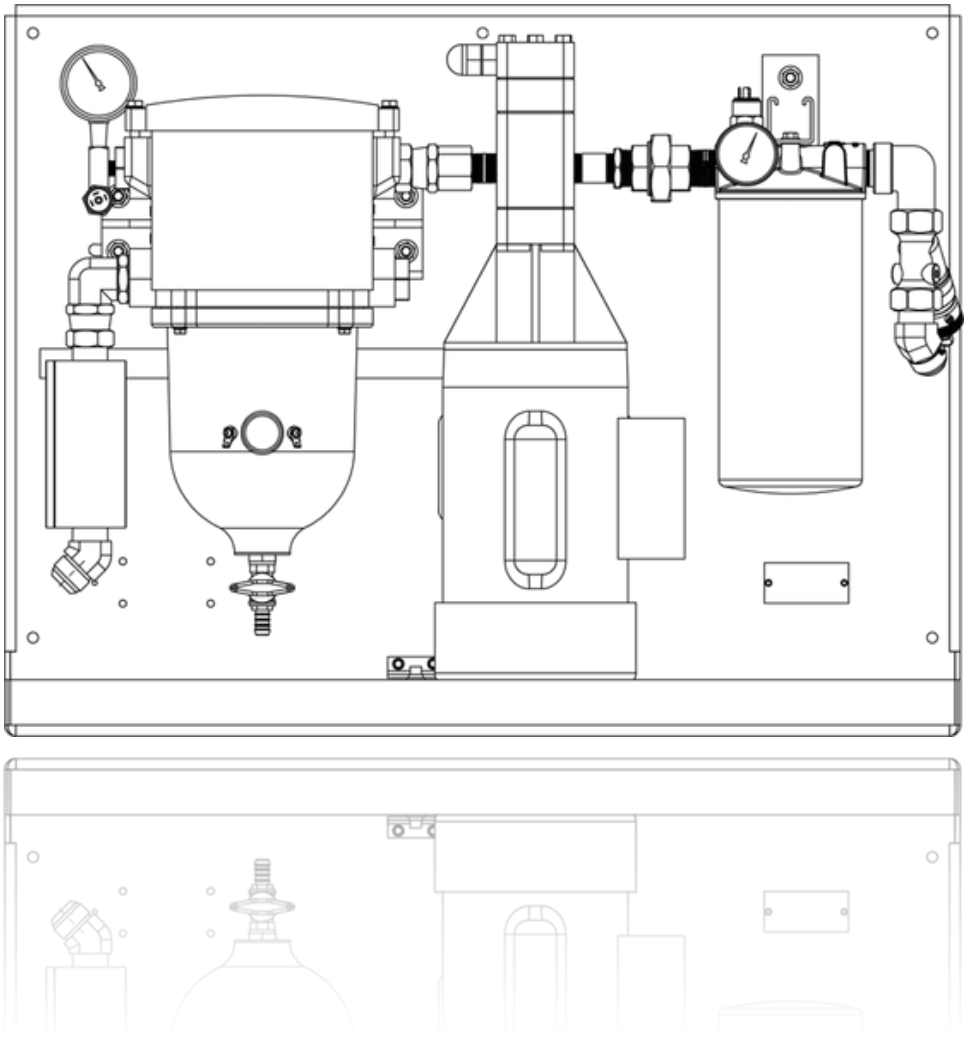


Table of Contents

General Overview

FPS LX-F Specifications

Nominal Flow Rate	10 GPM/600 GPH (38 LPM/2,271 LPH) 4,800 gallons (18,168 liters) per 8-hour shift 14,400 gallons (54,504 liters) per 24-hour shift
Primary Filter	30µ Hydrophobic particulate cartridge filter with water separation and containment[1]
Secondary Filter	3µ Absolute spin-on particulate filter element[1]
Fuel Conditioner	LG-X 3000 Inline Magnetic Conditioner
Plumbing	Black Iron
Inlet Port	1” Equivalent - JIC 37° Flare
Outlet Port	1” Equivalent - JIC 37° Flare
Construction	Open Backplate, Powdercoated Aluminum
Operating Temperature	50 - 140°F (10 - 60°C)[2]
System Controller	SFC or TSC as detailed in the controller manual
Electrical	120V/60Hz/1Ph or 230V/50Hz/1Ph[3]
Pump	¾ HP TEFC External (Spur) Gear Pump
Suction Capability (Primed)	15 ft. vertical lift or 100 ft. horizontal run[4]
Fluid Viscosity	1 - 10 cSt
Outline Dimensions	≈ 26” x 34” x 12” (66 cm x 86 cm x 31 cm) (H x W x D)
System Weight	≈ 125 lbs. (57 kg)

WARNING! This system is not meant for use with gasoline or any other flammable liquids having a flashpoint less than 100°F (37.8° C). Use with gasoline or any flammable liquids at a temperature exceeding their flash point presents an immediate explosion and fire hazard.

Follow any state and local codes for the equipment operation in addition to all instructions in this manual to prevent system damage or user harm.

[1] See the Replacement Filter Chartfor alternative media replacements.
[2] Fuel temperature must be belowflash point and above gel point for safe operation.
[3] At 50 Hz., the nominal flow ratedecreases from 10 GPM/600 GPH to 8 GPM/480 GPH.
[4] When using the recommendedplumbing size with fully primed suction lines.

Getting Started

Primary Inspection

☐	Upon arrival, the system and accessories must be visually inspected before installation. Improper handling during shipping may cause physical or electrical problems. Immediately report or note any damage to the shipper.
☐	Check pump/motor hardware and all plumbing connections for tightness.
☐	Verify that field power at the installation location matches the requirements shown on the wiring diagram.
☐	Verify that all field wiring is the proper temperature rating and wire gauge (AWG) per the wiring diagrams.
☐	Check the entire system for damage that could indicate internal mechanical or electrical problems.
☐	Familiarize the installation team with the requirements of the complete installation to prevent system damage.
☐	Thoroughly review this manual to ensure the system is installed as required.
☐	If any components are missing or damaged, contact AXI International with the provided contact information.

System Overview

The FPS system features a compact open backplate design that provides little to no protection from the elements. System installation must be indoors or inside an enclosure. The system uses a combination of flow, water, and pressure monitoring to ensure the system is operating within safety ranges. There is a single leak basin that has a leak detection sensor for alerting to spill-related issues.

The sequence of components in the system starts with the magnetic fuel conditioner which feeds directly into the primary filter/water separator device. The outlet of the separator features a vacuum switch and vacuum gauge for fuel vacuum monitoring followed by the fuel pump. The pump discharge features a pressure switch and pressure gauge mounted on the inlet of a single secondary filter element for pressure monitoring. Finally, on the outlet of the secondary filter is a flow switch that monitors the pump flow rate.

The secondary process connection of the Water Separator Drain is located on the bottom of the separator vessel and has the level of water within monitored by a single Water Detection device. The drain port includes a locking valve that isolates the vessel drain when not in use.

The majority of the components will be aluminum and steel with some other materials that are diesel compatible. The plumbing components that are steel will be black iron and coated with an anti-corrosion finish. Where applicable, there will be flexible tubing or hose used that is rated for the full vacuum to prevent collapse.

The fluid connection points for the fuel lines are JIC 37° Flare fittings that are intended to be connected to flexible lines for plumbing strain isolation on the system equipment. There is also another point of separation, union joint, available between the pump and the secondary filter element to assist with maintenance and service.

Magnetic Fuel Conditioner

The fuel conditioner ensures that fuel entering the primary filter is optimized for affected water separation and particulate removal and will capture any ferrous particulate that is present in the fuel.

Inline Magnetic Fuel Conditioner

This component is user-serviceable and will need to be periodically inspected for contamination to ensure optimal system operation. There is a service kit that will need to be ordered to complete the Servicing the Fuel Conditioner section.

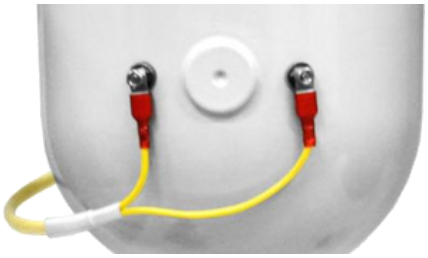
Primary Filter/Water Separator

The primary filter/water separator vessel is a combination filtration and mechanical water separation device. When passing through, the fuel is spun around to facilitate the separation of free water that is present in the fuel. Then the fuel is passed through a filter element for particulate removal.

The filter element is a hydrophobic water removal element that prevents the remaining entrained water from making its way into the pump where the gears would emulsify the water and fuel, making water removal more difficult. This type of media has a limited re-use life, allowing backflushing for filter life extension.

The water bowl is where the separated free water will collect. Installed on the front is the water detection probe that will constantly monitor the level of water in the bowl. This sensor uses conductivity and can be triggered by any fluid, or surface, that has a conductivity similar to water.

Primary Filter/WaterSeparator



Water Detection Probes

The drain valve installed on the separator allows the operator to manually drain the containment vessel when service is necessary. The valve is a locking quarter-turn handle that helps prevent accidental spills.

Fuel Vacuum Monitoring

The inlet of the pump is monitored with a pressure sensor and pressure gauge that represents the vacuum level the pump observes. The vacuum measured is affected by the contamination of all devices before the inlet of the pump like the fuel conditioner, primary filter, and supply plumbing.

Adjustable Vacuum Switch Device

Vaccum is the removal of pressure created by the atmosphere. This means that, in a perfect system, the absolute maximum vacuum level attainable with any device or combination of devices cannot exceed the atmospheric pressure where the system is installed. At sea level, the max level is ***14.7 PSI*** or ***29.92 in-Hg*** full vacuum.

To protect the pump from damage, the vacuum switch is factory calibrated to a safe operating level. This setpoint can be recalibrated to accommodate installation configurations by following the Switch Adjustments.

- **Adjustable Factory Setpoint:** ***16 in-Hg***
- **Safe Maximum Level:** ***18 in-Hg***

Without proper calibration of the switch, the system may not be able to effectively use the entire capacity of the primary filter element. Never exceed the safe maximum level or a catastrophic condition known as cavitation will cause damage to the pump that is not covered under warranty.

Fuel Pump

The fuel pump is designed to offer an optimal flow rate under specific differential pressure conditions. The differential pressure is the combination of the vacuum load and pressure load of the system.

The pump has the capability of creating a maximum differential of 60 PSI under ideal conditions. To protect the pump from over-pressurization, there is an internal flow bypass that operates when the pressure exceeds the setting of the relief valve. This is adjustable as shown in the Internal Pressure Relief Adjustment section.

- **Adjustable Factory Setpoint:** ***40 PSI***.
- **Safe Maximum Level:** ***50 PSI***.

The motor is directly attached to the pump and may be called by either the motor or the pump going forward. It will spin only in one direction as indicated on the motor fan shroud.

Fuel Pressure Monitoring

The outlet of the pump is monitored with a pressure sensor and pressure gauge that represents the positive pressure level the pump observes. The pressure measured is affected by the contamination of all devices after the outlet of the pump like the secondary filter andreturn plumbing.

Adjustable Pressure Switch Device

To protect the pump and secondary filter from damage, the pressure switch is factory calibrated to a safe operating level. This setpoint can be recalibrated to accommodate installation configurations by following the Switch Adjustments.

- **Adjustable Factory Setpoint:** ***22 PSI***.

Without proper calibration of the switch, the system may not be able to effectively use the entire capacity of the secondary filter element. Never exceed the safe maximum level or the system may not detect a high pressure condition and continue to operate under unsafe conditions.

The safe maximum is dependent on the static discharge pressure that the equipment experiences when no fuel is being pumped after the system has been successfully run.

- **Safe Maximum Level:** ***Static system pressure + 25 PSI***.

This capability is only limited by the differential pressure the pump can generate. If the system is configured for a maximum vacuum level, the pressure maximum will be decreased.

Secondary Filter

This filter is installed in the discharge stream from the fuel pump to provide a final means of particulate and/or water removal using a spin-on media. The filter element cannot exceed the differential pressure of 25 PSI or it can implode and send filter chunks and contaminants downstream into the fuel tank.

This media can be used in 1 of 2 configurations. There can be a particulate-only media that will protect by filtering contaminants from the fuel. There may alternatively be a water-block filter that will also provide water signaling using a water-absorbent media. These filters will collect water entrained in the fuel and hold it up in the media until it is completely saturated.

Once either of the media types is fully contaminated, they must be disposed of properly and replaced with a new element to prevent a high pressure condition and continue filtering the fuel.

Fuel Flow Monitoring

The system pump should never be allowed to run dry as this will cause damage to the pump gears that is not covered under warranty. To prevent this from occurring, the system has a flow monitoring device that will signal when sufficient flow is passing through the system.

Adjustable Flow Switch Device

The flow switch is a field adjustable device that allows the system to be calibrated to each installation. There is an indicator that shows when the system is detecting good flow for easy operator identification. The sensor can be adjusted per the Switch Adjustments section.

Adjustable setpoint must be calibrated upon installation.

Without proper calibration of the switch, the system may not be able to effectively detect damaging low flow conditions that can lead to expensive repairs.

Optional Features

Multi-TankAssembly–*IfApplicable*

Using a set of MOVs (Motor Operated Valves) to isolate individual tanks, a single system can circulate fuel from multiple tanks individually. This is accomplished by installing an isolation valve for the supply and return lines for each tank. Each of these lines split off of a common line that is connected to the corresponding inlet/outlet of the system.

MOV Actuator

Straight Port Valve

L-Port Valve

There are 2 methods of lineisolation used depending on the number of tanks. When the system is configured to isolate only 2 tanks, L-port style valvesare provided. These valves have a common center port that is connected to the system's inlet or outlet port. The valve'sactuator can alternate between one of two paths, directing the fuel to or from whatever tank is selected.

When more than 2 tanks are involved, straight port valves are used to isolate individual lines that lead to or from each of the connected tanks. Each tanks' supply and return lines share a common supply or return header that is connected to the system's inlet or outlet port respectively. The isolation valves are installed on each of these headers to open and isolate a single supply and return line according to the tank selection.

For each tank that is part of this system, the external CRH (Overfill Detection) device will need to be able to indicate an overfill condition. These must come from a live sensor to ensure that as the conditions of the fuel level in each tank change, the controller can halt to prevent unsafe operations.

Each valve actuator can be manually driven to override failures and test travel. This should be done in accordance with the system controller manual for safe operation.

There is a simple indication on the top of each actuator that shows the current position of the valve for easy identification from a distance.

Auto Water Drain (AWD) Assembly – ***If Applicable***

The water separator will perform continual water removal that will eventually collect to trigger a high water condition. The AWD option is used to automatically remove the collected water from the separator to allow the system to continue polishing without requiring manual servicing.

This equipment consists of a diverting ball-valve, drain pump, strainer, isolation solenoid, water holding barrel, and water barrel high sensor components. All of the pumping equipment will be factory installed and connected to the water separator's 3-way drain valve for automatic operation.

AWD 3-Way DrainValve

This drain valve allows the operator to select the manual drain or theautomatic drain port. By placing the valve in the middle position, the user can isolate the bowl port completely.

The water holding barrel will be a separate component that must be mounted to the ground. It must be wired to the controller and connected to the drain pump fitting via the flexible tubing and hose clamps for secure attachment.

Manual Additive Injection – ***If Applicable***

During operation, the system can pull a fuel additive into the system via an additional fluid path. This process is entirely manual and all safety precautions must be taken to prevent spills.

The equipment is installed on the suction side of the pump in the form of a system isolation ball valve, manual injection ball valve, and a flexible injection line to allow the operator to connect to a fluid reservoir. There is no check valve installed to prevent fluid from moving in both directions.

When the process is active, there must be sufficient restriction on the system fuel flow path by manipulating the system isolation ball valve. This will allow the user to open the manual injection ball valve to create a high vacuum on the injection line to pull fluid into the system from the connected reservoir.

This process should be used as necessary for fuel dosing and maintenance by qualified personnel only as improper operation can result in a hazardous spill.

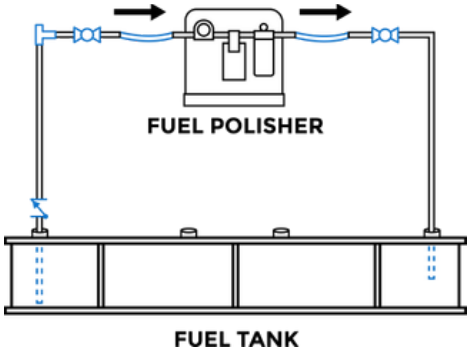
Multi-Point Flow Path Assembly – ***If Applicable***

Multi-Point is designed to clean between tank obstructions such as baffled walls. This is accomplished by installing multiple isolation valves to create various supply and return paths that direct the fuel flow in and across different regions of the tank. Each of these isolation valves is split off of a single supply or return header that originates at the inlet/outlet of the connected system respectively.

Using the isolation valves to create different flow paths, the system can better circulate fuel from various sections in the tank, ensuring a more comprehensive cleaning coverage.

Installation

It is recommended that only qualified, experienced personnel, familiar with this type of equipment, who have read and understood all the instructions in this manual should install, operate, and maintain the system. Plumbing installation must be in accordance with all applicable federal, state, and local rules, laws, standards, and regulations.



Installation Diagram Key:	
	Isolation Ball Valves
	Priming-T
	Flexible Plumbing
	Check Valve

System Installation Diagram

The suction and discharge lines of the system should be independent and separate from the suction and discharge lines of the engine. If that is not possible, appropriate valves must be installed to completely separate the system from the engine and the external shutdown contacts on the controller must be utilized whenever the engine is called to run. This will prevent any possible interference with safe engine operation

Make sure that the motor's power requirements and rated voltage/frequency match your controller specifications (***See wiring diagram***).

Mounting

Ensure the system is level and secure, enabling water to be more accurately sensed in the primary filter's sump and allowing the containment basin to have full capacity in the event of a leak. Use provided mounting holes located on the backplate for proper fastening ***(Refer to mechanical drawing(s) for mounting hole diameter and locations)***.

Be sure to secure the system in a location that allows all piping and electrical wiring to be safely routed to the system. This unit is designed for well-ventilated indoor use within the specified temperature range and should be located as close to the tank as possible.

Allow sufficient room (approximately 7"-8") for servicing the primary filter(s) above the backplate of the system and access to the sides of the system for isolation valves and service.

Plumbing

Use proper quality approved fuel line materials with an equivalent inner diameter (ID) to the inlet/outlet of the system. For suction side plumbing runs, it is always recommended to install oversized pipe, the next plumbing size larger. For extended run applications, it is suggested to use 2 sizes larger for the suction run and 1 size larger for discharge plumbing. See the system FPS LX-F Specifications for details on plumbing limits. Anti-Siphon or other external plumbing devices may be required by state and/or local regulations & codes.

There are no system isolation ball valves installed on the equipment to ensure the system is compact. It is necessary for commissioning and troubleshooting steps that there be a system isolation valve installed on both ends of the system.

Warning! During any site plumbing pressure testing, use the externally installed isolation valves to isolate the system to prevent overpressurization from causing system damage that is not covered under warranty.

Flexible plumbing is strongly recommended for system inlet and outlet connections to the external plumbing in order to avoid issues with thermal expansion, prevent putting any stress on the internal fittings of the system, and enable ease of maintenance/installation.

The pick-up line(s) should originate from the lowest point of the tank to ensure all water is removed and should be kept as short as possible. The return line(s) should be plumbed to the tank as far as possible away from the pick-up tube, close to the tank bottom.

It is recommended that an oversized, low restriction, foot valve be installed at the base of the pickup line or a swing check valve be installed as close to the tank top as possible to keep the system primed. Additionally, a priming tee must be installed at the highest point of the suction plumbing line to enable full priming of the pipelines and system.

The suction capabilities listed in the system's specification table are applicable when the system is connected to the minimum recommended piping size with no additional flow restrictions or plumbing; This includes valves, 90-degree connectors, or other plumbing accessories.

These suction capabilities assume the system will be installed directly above the fuel tank for the vertical lift only or on the same ground level of the tank for the horizontal only installation. Any combination of the 2 versions will reduce the capability of the equipment proportionally.

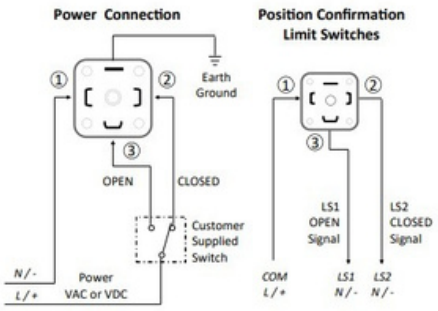
If your installation has high lift conditions near either extreme, it is recommended to complete an accurate lift calculation for the installation to ensure safe operation.

Systems that are installed in configurations that operate near the extreme end of vacuum and pressure limits due to static conditions will have significantly higher service intervals. It is recommended that the installation be optimized to limit the static conditions, allowing longer service intervals.

For continuous optimal performance, make sure suction and discharge lines are free of contamination, nothing is blocking the flow of fuel, and the suction line always stays primed. As the filters become restricted due to continual contamination removal, the system restriction will increase. Servicing of the filters will be required according to the Maintenance section to maintain optimal system performance.

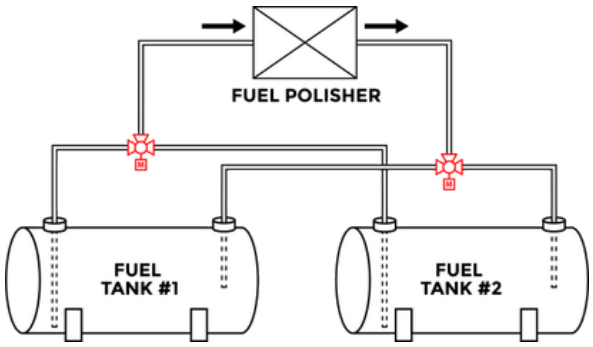
Multi-Tank – *If Applicable*

Each valve will need to be wired to the system controller using the included 90 degree DIN connectors according to the wiring diagrams. Please note that the grey connector is used for control signals to the actuator and the black connector is used for valve position feedback from the actuator[5].

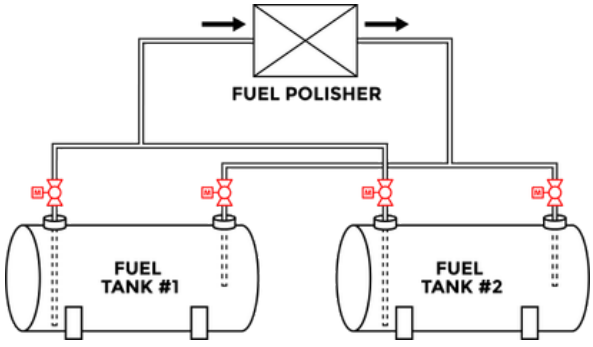


[5] Ensure all external electrical connections are linked to their corresponding ball valve (see controller wiring diagram).

Each tank will need to have the supply and return valves connected to the inlet/outlet headers respectively. This will vary depending on the configuration of the system.



L-Port Installation



Straight Port Installation

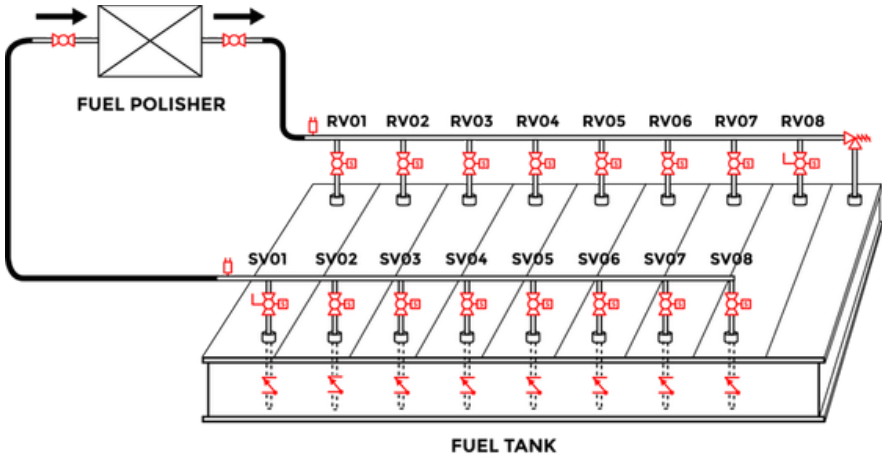
The tank overfill Inputs (***See provided electrical drawings***) must be wired to overfill alarm contacts (CRH) for each tank to avoid overfilling and potential spills. This is a very important safety feature that will shut the system pump down in case a tank reaches an unsafe fuel level. ***See controller manual for more information.***

Multi-Point ***– If Applicable***

Supply and return valves should be paired to ensure a single semi-isolated volume contains a single supply valve and a single return valve as shown below.

A pair of manual override valves will be included to operate in the event control failures are preventing the system from opening the valves properly.

Each valve reference serves as an indication of the valve's header as well as its position on that respective header. Supply header valves will be identified as SV01, SV02, etc. Return header valves will be identified as RV01, RV02, etc.



Installation Diagram Key:	
	Isolation Ball Valves
	Solenoid Valves
	Manual Bypass Solenoid Valves
	Vacuum/Pressure Switch
	Pressure Relief Valve
	Foot Valves

Multi-Point Installation Diagram

Each header is supplied with a vacuum/pressure detection sensor to detect problems due to the control valve operation and restrictions in the header that will hinder the system. These should be installed on the supply and return header respectively, at the end closest to the fuel polishing system, and wired according to the wiring diagram. This will prevent

the system from falsely identifying high vacuum or high pressure conditions that would shut down the system for filter maintenance.

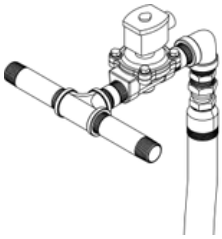
The discharge header is also supplied with a mechanical pressure relief valve that will prevent thermal expansion from causing catastrophic leak conditions.

It is recommended that the foot valves be installed on each supply line to ensure the prime to the system is not lost when the valve is opened for the flow path.

Each valve will need to be wired to the system controller according to the wiring diagrams. The valves will need individual power/control lines from the PLC so they can be independently controlled.

The supply header plumbing should be oversized by at least one size greater than the fuel polishing system's inlet diameter. A pressure relief valve should be installed on the return header unobstructed and lead back to the tank.

All the supply and return plumbing should be installed in accordance with the Plumbing section for optimal performance. Foot valves should be installed on all pick-up lines to ensure the fuel polisher maintains prime while running. Manual bypass solenoid valves should also be installed on each header on opposite sides of the tank for use instead of electric control.



It is strongly recommended to use hard plumbing for both supply and return headers. Solenoid valves should be installed with the actuator pointing upwards. Take into account flow direction as inlets should be plumbed in the direction of flow accordingly.

- Valve orientation on the supply header should be from the tank port to the supply header.
- Valve orientation on the return header should be from the return header to the tank port.

Warning! Do not install the valves in areas exposed to extreme temperatures outside the valve operating range.

To allow the system to operate when the control of the valves is malfunctioning, the system is provided with manual override actuators. It is recommended that these valves be installed on the header nearest to the fuel polisher to help in troubleshooting diagnostics and system commissioning.

The final component of the multi-point assembly is an over-pressure relief valve that will protect the discharge header from thermal expansion which can lead to leaking plumbing and potential component failures. This valve will need to be adjusted according to the MPFP Equipment Adjustment section to ensure the system only activates the relief when the pressure exceeds normal pump operation.

Electrical

Please refer to the provided system controller manual for all electrical installation instructions.

Commissioning/Initial Start-Up

After the initial wiring of the system, briefly verify operation as instructed in the manual runtime section of the controller manual, ensuring that the motor is running in the correct direction. If the motor is running in the wrong direction and is built using 3-phase power, simply switch any 2 of the 3 hot wires provided from a 3-phase delta source.

If this is not the case or switching the wires (3-phase only) does not resolve the problem, contact AXI International immediately.

To fully commission the system, the wiring and plumbing installation must be completed in accordance with the provided instructions, the system must be primed, and all filters and valves must be properly installed.

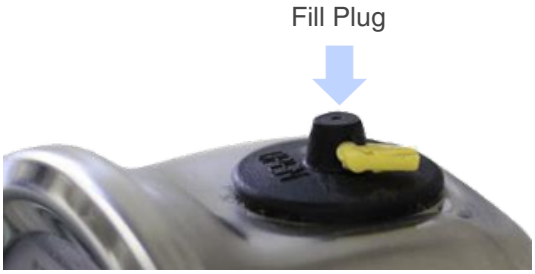
The system will not be calibrated from the factory and must be adjusted to meet the installation setup. Please follow the instructions in the Flow Switch section.

Gauge Venting

After shipment, gauge pointers may not rest at zero due to internal case pressure build-up, which is caused by temperature and/or pressure variations. As a result, the indicated pressure may be inaccurate. To restore the gauges to accurate operating condition, the gauge must be vented.

There is a small plug at the top of the gauge that covers the vent hole. This is plugged during transit to prevent the glycerin from leaking out of the valve. Lift the yellow lever of the fill plug to the open position or remove the black rubber piece from the top of the gauge to vent completely.

Vacuum Gauge



Fill Plug (Locatedon top of gauge)

Priming the System

Warning! The pump supplied with the system is **NOT** self-priming and must not be run dry. The gears must be fully wetted for the pump to achieve the rated performance.

The system installation shall have a priming-tee installed at the highest point, above the pump gears, to allow the system plumbing and all piping up to the system to be filled with fuel. This process will ensure that the plumbing to the pumps is fully wetted to minimize any possibility of the pump being run dry.

The foot valve, or check valve, installed in the supply plumbing will ensure that the prime in the plumbing is held after the system shuts down. This will allow the system to begin moving fuel immediately upon every system startup.

Priming Procedure

The head of the pump on the system is shipped from the factory oiled to facilitate initial lubrication. This will not eliminate the obligation to completely prime the system. The primary filter along with the suction line(s) must be completely filled with fuel (no trapped air) before initial system start-up.

The priming tee must be opened and used to fill the lines of the plumbing. The primary filter/water separator vent will also need to be opened to allow air to be purged from the system to ensure full priming.

Primary Filter/WaterSeparator

Vent Screw (Locatedon top of filter vessel)

When the fuel level rises to the ventscrew, close the vent and stop filling thepriming-tee. The priming location will need to be sealed to prevent any vacuum leaksbefore proceeding to test the system.

The system may be briefly operated again to confirm the plumbing is fully primed. An indication of correct priming will be the fluid in the water separator bowl becoming turbulent.

The system is equipped with a vacuum gauge on the input side of the pump. The gauge should read no more than 15 in-Hg vacuum maximum under normal conditions. Vacuum gauge readings reaching 16 in-Hg indicate excessive flow restriction or a suction height and/or distance that is too great for the pump. This will likely result in a pump shutdown.

The system's pressure gauge should show 22 PSI maximum pressure under normal conditions. Pressure gauge readings above 22 PSI pressure indicate excessive discharge fuel line restrictions and will automatically shut down the pump.

Initial Testing Procedures

All testing procedures require the system to be successfully Priming Procedure before beginning. Each of the following steps will also require the user to interact with the controller for validation. If any step fails to complete as instructed, please refer to the Troubleshooting section.

Set the system to HAND operation and ensure the pump runs without alarms before performing each step as instructed below.

☐	Confirm the flow sensor is indicating proper flow and calibration by an orange indicator on the head of the flow device near the M12 cable connection.
☐	Manually raise the float switch located at the bottom of the leak basin.
☐	The pump will immediately turn off and the system controller will indicate leak detection preventing the pump from operating further.
☐	Drop the float to its seated position to clear the condition.
☐	Reset the system alarm to resume operation.

☐	Slowly close the system inlet isolation ball valve while observing the system vacuum gauge reading.
☐	When the system vacuum reaches the switch calibrated setpoint, the controller will alert the condition is active.
☐	The pump will turn off after the vacuum debounce period has elapsed and the system controller will indicate high vacuum preventing the pump from operating further.
☐	Fully open the inlet ball valve after the pump shuts down.
☐	Reset the system alarm to resume operation.
☐	Slowly close the system outlet isolation ball valve while observing the system pressure gauge reading.
☐	When the system pressure reaches the switch calibrated setpoint, the controller will alert that the condition is active.
☐	The pump will turn off after the pressure debounce period has elapsed and the system controller will indicate high pressure preventing the pump from operating further.
☐	Fully open the outlet ball valve after the pump shuts down.
☐	Reset the system alarm to resume operation.
☐	Jump the water detection sensor probes by placing a conductor, such as alligator clips or a screwdriver, across the two contacts.
☐	When the controller detects the water present, it will indicate the pending condition.
☐	The pump will turn off after the water debounce period has elapsed and the system controller will indicate high water preventing the pump from operating further.
☐	Remove the conductor to clear the condition.
☐	Reset the system alarm to resume operation.
☐	

AWD Testing – *If Applicable*

To test the Auto Water Drain (AWD) equipment, the system must have fuel in the water separator, the initial testing procedures above must be completed successfully, and the system must be set to HAND operation.

☐	Flip the water holding barrel over to trigger the high level float located in the head of the barrel.
☐	The system controller will indicate barrel full allowing the pump to continue operating.
☐	Return the barrel to its seated position to clear the condition.
☐	Jump the water detection sensor probes by placing a conductor, such as alligator clips or a screwdriver, across the two contacts.
☐	The pump will turn off after the water debounce period has elapsed and the system controller will indicate high water preventing the pump from operating further.
☐	After the configured settling period, the AWD pump will begin to run and the AWD solenoid will open allowing fluid to be transferred into the water holding barrel.
☐	Remove the conductor to clear the condition and resume pump operation.
☐	

Multi-Tank Testing – *If Applicable*

Multi-Tank testing does not require the system to have the pump moving fuel, but this will make the test easier to complete successfully. The following testing procedure will need to be repeated for each tank in the configuration.

☐	Trigger the CRH condition for the tank.
☐	The system controller will indicate “CRH Tank X” which prevents the pump from continuing to operate.
☐	Return the signal to its normal condition to clear.
☐	Using the system controller, activate each tank manually.
☐	Confirm that all other tanks valves are both returned to the full closed position.
☐	Confirm the valves both reach the full open position for the tank and the pump begins to run.

Multi-Point Testing – ***If Applicable***

Multi-Point testing does not require the system to have the pump moving fuel, but this will make the test easier to complete successfully.

☐	Deactivate the randomize feature of the system controller.
☐	Ensure the system pump is running.
☐	Select the supply valve SV01 for operation.
☐	Lift the wire for the control output to SV01.
☐	The system will shut down for valve failure.
☐	Reconnect the SV01 valve output wire.
☐	Reset the system alarms and the valve alarms using the system controller.
☐	Ensure the system pump is running.
☐	Select the supply valve RV01 for operation.
☐	Lift the wire for the control output to RV01.
☐	The system will shut down for valve failure.
☐	Reconnect the RV01 valve output wire.
☐	Reset the system alarms and the valve alarms using the system controller.

The following testing section will be repeated for each pair of valves in the configuration.

☐	Select the supply valve to be tested for operation.
☐	Ensure the system pump is running.
☐	Note the system vacuum reading.
☐	Select the return valve to be tested for operation.
☐	Ensure the system pump is running.
☐	Note the system pressure reading.

Once the testing is complete, the controller may have the randomize feature re-enabled per the instructions in the system controller manual.

Maintenance

Disposal of fuel, associated waste, and filters must be in accordance with all applicable federal, state, and local rules, laws, standards, and regulations.

Warning! Some fuels may have been treated with biocides. Biocides are extremely toxic and may enter the body through the skin. It is recommended to use adequate protection and proper precautions if the fuel at hand contains biocide-type products.

Preventative Maintenance Schedule

Maintenance Service	Monthly	Quarterly	Bi-Annually	Annually	AsNeeded	Additional Instruction
Check all bolts on the pump/motor and mounting hardware for tightness.	☑	☐	☐	☐	☐	Tighten as necessary.
Check the system and all parts for corrosion and rust.	☐	☐	☑	☐	☐	Treat as required.
Check the LG-X Fuel Conditioner for debris.	☐	☐	☐	☐	☑	See the Servicing the Fuel Conditioner section.
Check Primary Filter Lid for tightness.	☐	☑	☐	☐	☐	Tighten as necessary.
Clean or replace the Primary Filter Screen.	☐	☐	☑	☐	☑	See the Servicing the Primary Filter/Water Separator section.
Replace Secondary Spin-On Filter.	☐	☐	☑	☐	☑	See the Servicing the Secondary Filter section.
Verify Leak Detection Float Switch Functionality	☑	☐	☐	☐	☐	See the Initial Testing Procedures section.
Verify All Vacuum Switch Functionality	☐	☐	☐	☑	☐	See the Initial Testing Procedures section.
Verify All Pressure Switch Functionality	☐	☐	☐	☑	☐	See the Initial Testing Procedures section.
Verify Flow Switch Functionality	☐	☐	☐	☑	☐	See the Initial Testing Procedures section.
Verify Water Detection Sensor Functionality	☐	☐	☐	☑	☐	See the Initial Testing Procedures section.

Servicing the Primary Filter/Water Separator

ManuallyDrainingtheSeparator

1. Turn the system OFF.
2. Close the inlet and outlet ball valves.
3. Open the bleed screw at the top of the primary filter.
4. Connect a flexible line to the ½” hose barb fitting on the manual drain port of the water separator and direct it into a waste container.
5. Open the manual drain valve.
6. Observe the water level as it leaves the bowl and close the valve when adequate water has been removed.
7. Close the bleed screw.
8. Remove the flexible drain line.
9. Dispose of the collected wastewater properly.

Changing the Filter

1. Perform the steps in the Manually Draining the Separator section before continuing.
2. Loosen the four bolts on top of the primary filter and remove the cover plate.
3. Remove the filter spring and screen filter.
4. Refill the separator housing using clean fuel.
5. Inspect and either Cleaning (Backflushing) the Filter screen or replace it with a new one.
6. Re-install the filter spring.
7. Close the housing and carefully tighten the bolts by hand in an even cross-over pattern.

Warning! Do not overtighten the bolts as this may damage the filter housing, requiring replacement not covered under warranty.

8. Dispose of any waste properly.
9. Check for leaks when re-starting and re-pressurizing the system.

Cleaning (Backflushing) the Filter

1. Remove the filter, performing steps 1-4 in the Changing the Filter section.
2. Using clean fuel, pour through the filter backward to dislodge any particulate embedded in the filter.
3. Once clean, reinstall the filter by following the remaining steps in the Changing the Filter section.

Servicing the Fuel Conditioner

OpeningtheCoverPlate

1. Perform the steps in the Manually Draining the Separator section before continuing.
2. Open the JIC connection to the inlet of the system and drain any remaining fluid from the fuel conditioner.
3. Remove the retaining bolts in an even pressure loop around the faceplate of the conditioner.
4. Do not remove the magnet(s) unless deemed necessary.
5. Return the magnet(s) to the original install orientation if removed.

Cleaning the Conditioner

1. Perform all the steps in the Opening the Cover Plate section.
2. Use a cloth to clean the surface of the magnet as well as the housing of the conditioner.
3. If applicable, replace the magnet(s) as they were found.
4. Using a repair kit, replace the gasket seal.
5. Re-install the cover plate.
6. Replace all the retaining bolts in an even pressure application.

Warning! Do not overtighten the retaining bolts or damage to the conditioner may occur.

7. Reconnect the inlet side supply line.
8. Run the system to fully prime the supply side.
9. Check for leaks when re-starting and re-pressurizing the system.

Servicing the Secondary Filter

DrainingtheFilter(s)

1. Turn the system OFF.
2. Close the inlet and outlet ball valves.

3. Install a catch container under the filter housing.
4. Use a filter wrench to loosen the filter.
5. Carefully remove the filter by hand as fuel will likely drain from the plumbing and filter into the container below.
6. When removed, continue to drain the remaining fuel in the filter into the container below.
7. Properly dispose of the old filter.

Changing the filter(s)

1. Perform all the steps in the Draining the Filter(s) section before continuing.
2. Install the new o-ring gasket on the new filter. Never re-use the old gasket.
3. Apply a film of lubricating oil to the gasket of the new filter. Screw the new filter canister into the filter head until the gasket is tight and secure (rotate the element an additional 0.5-1.0 turn after the filter makes contact with the gasket).
4. Open the inlet and outlet ball valves.
5. Check for leaks when re-starting and re-pressurizing the system.

Switch Adjustments

Please contact AXI International before adjusting either the vacuum or the pressure switch to avoid voiding the system's warranty.

Vacuum and Pressure Switches

When the value exceeds the set point of the switches' rating, the switch will change state. Ensure you are working with a normally closed position (leads on opposite sides of the switch – across from one another are connected to the wire spades).

1. Remove the rubber plug between the spades on the back of the sensor.

Vacuum/Pressure Switch

Rubber Plug

2. Insert a 5/64" allen wrench into the slot for adjustment.
    a. Vacuum switch adjustment, turn ¼ - ½ turn at a time counter-clockwise to increase the vacuum set point.
    b. Pressure switch adjustment, turn ¼ - ½ turn at a time clockwise to increase the pressure set point.
3. Activate the system pump and observe the gauge for the switch to be adjusted.

4. Adjust the switch according to the newly desired setting.
5. Reset the system alarm if necessary and continue fine-tuning until the system runs without alarm. Do not exceed the maximum safe setting.
6. Add one additional ½ turn to the final set position to account for losses.
7. After adjusting the settings, perform the testing procedure(s) for the switch(es) as outlined in the Initial Testing Procedures section.
8. Replace the rubber plug.

Flow Switch

When the flow rate drops below the predetermined set point on the flow switch (i.e. 10 GPM), the switch will trigger a signal to shut down the pump. The switch will indicate that sufficient flow is being detected by illuminating the indicator light at the stem of the M12 cable.

Adjustable Flow Switch Device

Indicator Light

1. To adjust the flow switch set point, open both the supply and return isolation ball valves.
2. Activate the system pump.
3. Loosen the lock screw on the stem of the flow switch using the provided hex allen key.
4. Rotate the setting dial on the flow switch until the desired GPM flow range printed on the stem is reached.
    a. If the indicator light on the flow switch connector is not illuminated, a flow rate lower than the set point is being detected.
    b. Turn the black neck of the flow switch clockwise. Once the point is reached where the orange LED light turns on, turn the dial one more full turn clockwise.
5. Tighten the lock screw to secure the setting dial's placement.
9. After adjustment, ensure to perform the relevant testing procedure outlined in the Initial Testing Procedures section.

Internal Pressure Relief Adjustment

Please consult AXI International before performing any internal pressure relief adjustments to avoid warranty issues and potential damage to the system.

The pump used on the FPS systems comes from the factory with a pre-set internal pressure relief bypass. If the pressure on the discharge of the pump rises past this setpoint, the internal bypass will open and recirculate the fuel in the head of the pump to protect itself and any downstream components. When this happens, the discharge branch of the system will not see the proper fuel flow, most likely causing the system to fail on a low flow alarm.

By adjusting this internal pressure relief to a point past the set point on the pressure switch, the system will fail on a high pressure condition before the relief begins to open, allowing fuel to flow fully while within the acceptable pressure range.

Tightening the Bypass Spring

1. To tighten the spring in the pump head, remove the blue cover nut located on the left side of the pump head

2. Loosen the secondary nut to allow for screw adjustment
3. Using a flathead screwdriver adjust the screw for calibration.
    a. Turning clockwise will increase the setting.
    b. Turning counter-clockwise will decrease the setting.
4. Observe the system pressure gauge as the outlet isolation valve is slowly closed until the pressure stops rising. This is the setting of the bypass.
5. Restore the secondary nut and blue cover, tightening them down to their original positions.

MPFP Equipment Adjustment

All adjustments should be performed in a failure mode situation where the expected operating valve is disconnected to allow the pressure in the headers to build and trigger the conditions below.

Vacuum and Pressure Switches

1. Turn the system on and select SV01 or RV01 depending on which switch is to be adjusted.
2. Lift the output signal wire for the corresponding valve.
3. Remove the rubber plug between the spades on the back of the sensor.
4. Insert a 5/64” allen wrench into the slot for adjustment.

    a. Vacuum switch adjustment, turn ¼ - ½ turn at a time counter-clockwise to increase the vacuum set point.
    b. Pressure switch adjustment, turn ¼ - ½ turn at a time clockwise to increase the pressure set point.
5. Activate the system pump and observe the gauge for the switch to be adjusted.
6. Adjust the switch according to the newly desired setting.
7. Reset the system alarm if necessary and continue fine-tuning until the system runs without alarm. Do not exceed the maximum safe setting.
8. Add one additional ½ turn to the final set position to account for losses.
9. After adjusting the settings, perform the testing procedure(s) for the switch(es) as outlined in the Multi-Point Testing section.
10. Replace the rubber plug.

Pressure Relief

1. Turn the system on and select RV01.
2. Lift the output signal wire for the valve.
3. Observe the pressure reached before shutdown.
4. Adjust the relief nut on the head of the valve.
    a. Turn the nut clockwise to increase the pressure setting.
    b. Turn the nut counter-clockwise to decrease the pressure setting.
5. As required, repeat the process after clearing alarms, until the correct setting is achieved.
6. Reconnect the valve output.

Auto Water Drain (AWD) – *If Applicable*

ServicingAutoWaterDrainStrainer

1. Perform the steps in the Manually Draining the Separator section before continuing.
2. Remove and clean the AWD’s strainer.
3. Re-attach and secure the strainer to the AWD assembly.
4. Reset alarms.

Servicing Water Collection Drum

1. Turn the system OFF.
2. Remove the float switch from the water collection drum.

3. Properly dispose of the contents in the water collection drum.
4. Replace the float switch to its original state in the water collection drum.
5. Reset Alarms.

Troubleshooting

Diagnostic Table

To effectively identify and resolve problems associated with either the system or any of its upgrades, please consult the diagnostic table below:

Impact	Identified Problem	Possible Root Cause(s)
High Vacuum Alarm	Maintenance	• Primary filter needs to be serviced • Magnetic fuel conditioner requires service
	Plumbing	• Inlet ball valve not fully open • Suction line clogged • Excessive vacuum on inlet side too high • Inoperative foot valve
	Electrical/Sensor	• System vacuum switch needs calibration/adjustment • Defective vacuum switch • Controller wiring issue
High Water Alarm	Maintenance	• High water level present in the water separator sump • Heavy emulsified water contamination in fuel
	Electrical/Sensor	• Water holding tank full • Contaminated water detection probe • Defective water detection sensor probes • Defective water detection alarm module
	Other	• Controller wiring issue
High Pressure Alarm	Maintenance	• AWD drain failure
	Plumbing	• Secondary filter needs to be serviced
	Electrical/Sensor	• Outlet ball valve not fully open • Discharge line clogged • Excessive pressure on discharge side too high
No/Low Flow Alarm	Plumbing	• System pressure switch needs calibration/adjustment • Defective pressure switch • Controller wiring issue
	Electrical/Sensor	• Inlet/outlet valves not fully open • Supply plumbing leak pulling air into the fuel • Inoperative supply line foot valve
	Other	• Defective flow switch • Flow switch needs calibration/adjustment • Controller wiring issue • System needs to be primed

Impact	Identified Problem	Possible Root Cause(s)
Leak Detection Alarm	Pump Leak	• Leaking pump seal • Worn pump shaft seal • Pump pressure relief valve failure • Worn pump mechanical seals or O-rings
	Primary Filter Leak	• Cover plate not properly tightened • Vent screw not closed • Drain valve not closed • Loose unions due to vibration • Worn o-rings on inlet/outlet of the housing • Magnetic fuel conditioner not sealed
	Secondary Filter Leak	• Loose plumbing connection • Loose unions due to vibration • Damaged or incorrectly installed filter gasket
Pump/Motor Issue(s)	Loud Operation	• Vacuum level excessive causing cavitation • Pump relief improperly calibrated • Pump internal bypass calibrated incorrectly
	Rapid Pump Wear	• Pump coupler out of balance • Excessive vacuum or pressure conditions • Pump running dry or w/o insufficient fuel for extended periods • Worn pump/motor coupler
	Overload Alarm	• Pump and motor out of alignment • Fuel is outside operating ranges
	Motor Not Turning	• Misalignment of pump/motor coupler • Circuit breaker not ON • The supply voltage is too low and/or incorrect • Motor thermal overload condition
Auto Water Drain Issue(s)	Not Draining	• The motor is failed and/or seized possibly from excessive dry run • T-strainer requires service • Holding barrel full • Solenoid failed • Solenoid wired incorrectly
	Drain Too Short	• Pump wired incorrectly • Delay setting needs calibration • Drain setting needs calibration
Multi-Tank Issue(s)	Valve Not Traveling	• Valve not required to run/standby • Valve wiring disconnected • Valve wired improperly • Valve override switch in HAND position
	Valve Travel Alarm	• Travel time setting needs calibration • Valve limit switches need calibration
	Tank Overfilled	• Valve not completely closed, allowing fuel to transfer unexpectedly • Level sensor not wired correctly

SALES CONTACT

CONTACT

sales@rajkotmarinellc.ae

+971 6 7487580

www.rajkotmarine.com

RAJKOT MARINE LLC

Jerf Industrial Area 1,
P.O Box 5861
Ajman, UAE