VEEDER-ROOT

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FXV Leak Detectors

Installation Instructions

REDJACKET®

Notice

Veeder-Root makes no warranty of any kind with regard to this publication, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Veeder-Root shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this publication.

Veeder-Root reserves the right to change system options or features, or the information contained in this publication.

Contact Red Jacket Technical Support for additional troubleshooting information at 800-323-1799.

DAMAGE GOODS/LOST EQUIPMENT

Thoroughly examine all components and units as soon as they are received. If any cartons are damaged or missing, write a complete and detailed description of the damage or shortage on the face of the freight bill. The carrier's agent must verify the inspection and sign the description. Refuse only the damaged product, not the entire shipment.

VR must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

1. Fax Bill of Lading to V/R Customer Service at 800-234-5350.
2. Call V/R Customer Service at 800-873-3313 with the specific part numbers and quantities that were received damaged or lost.
3. VR will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

CUSTOMER'S PREFERRED CARRIER

1. Customer files claim with carrier.
2. Customer may submit a replacement purchase order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
3. If "lost" equipment is delivered at a later date and is not needed, VR will allow a Return to Stock without a restocking fee.
4. VR will NOT be responsible for any compensation when a customer chooses their own carrier.

RETURN SHIPPING

For the parts return procedure, please follow the instructions in the "General Returned Goods Policy" pages of the "Policies and Literature" section of the Veeder-Root North American Red Jacket Mechanical Products Price Book. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

RESPONSIBILITIES OF THE INSTALLER AND STATION OWNER

This installation, operation and service instruction manual shall be left with the owner of the service station at which this equipment is installed. Retain these instructions for future use and provide them to persons servicing or removing this equipment.

Introduction

Installation Procedure

Testing

Third Party Certification

Figures

Tables

Introduction

FX1V Part No. 116-056-5, BFX1V Part No. 410981-001

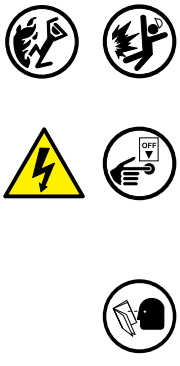
FX1DV Part No. 116-058-5, BFX1DV Part No. 410983-001

Safety Precautions

The following safety symbols are used throughout this manual to alert you to important safety hazards and precautions.

	**EXPLOSIVE** Fuels and their vapors are extremely explosive if ignited.		**FLAMMABLE** Fuels and their vapors are extremely flammable.
	**ELECTRICITY** High voltage exists in, and is supplied to, the device. A potential shock hazard exists.		**TURN POWER OFF** Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.
NOTICE	**WARNING** Heed the adjacent instructions to avoid equipment damage or personal injury.	⚠CAUTION	**CAUTION** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
⚠WARNING	**NOTICE** is used to address practices not related to physical injury.		**READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.
	**WEAR EYE PROTECTION** Wear eye protection when working with pressurized fuel lines to avoid possible eye injury.		

⚠ WARNING



This product operates in the highly combustible atmosphere of a gasoline storage tank.

FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.

1. **All installation work must comply with the latest issue of the National Electrical Code (NFPA 70), the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A), and any European, national, state, and local code requirements that apply.**
2. **Turn off, tag, and lockout power to the STP before connecting or servicing the STP.**
3. **Before installing pipe threads apply an adequate amount of an appropriate fresh, UL classified for petroleum, non-setting thread sealant.**
4. **When servicing unit, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.**
5. **To protect yourself and others from serious injury, death, or substantial property damage, carefully read and follow all warnings and instructions in this manual.**

Warnings and Instructions

IMPORTANT SAFETY INFORMATION

This section introduces the hazards and safety precautions associated with installing, inspecting, maintaining or servicing this product. Before performing any task on this product, read this safety information and the applicable sections in this manual, where additional hazards and safety precautions for your task will be found. Fire, explosion, electrical shock or pressure release could occur and cause death or serious injury, if these safe service procedures are not followed.

PRELIMINARY PRECAUTIONS

You are working in a potentially dangerous environment of flammable fuels, vapors, and high voltage or pressures. Only trained or authorized individuals knowledgeable in the related procedures should install, inspect, maintain or service this equipment.

Read the Manual

Read, understand and follow this manual and any other labels or related materials supplied with this equipment. If you do not understand a procedure, call 1-800-323-1719 to locate a qualified technician. It is imperative to your safety and the safety of others to understand the procedures before beginning work. **Make sure your employees and any service contractors read and follow the instructions.**

Follow the Regulations

Applicable information is available in National Fire Protection Association (NFPA) 30A; *Code for Motor Field Dispensing Facilities and Repair Garages*, NFPA 70; *National Electrical Code* (NEC), Occupational Safety and Hazard Association (OSHA) regulations and federal, state, and local codes. All these regulations must be followed. Failure to install, inspect, maintain or service this equipment in accordance with these codes, regulations and standards may lead to legal citations with penalties or affect the safe use and operation of the equipment.

Prevent Explosions and Fires

Fuels and their vapors will explode or burn, if ignited. Spilled or leaking fuels cause vapors. Even filling customer tanks will cause potentially dangerous vapors in the vicinity of the dispenser or island.

Working Alone

It is highly recommended that someone who is capable of rendering first aid be present during servicing. Familiarize yourself with Cardiopulmonary Resuscitation (CPR) methods, if you work with or around high voltages. This information is available from the American Red Cross. Always advise the station personnel about where you will be working, and caution them not to activate power while you are working on the equipment. Use the OSHA Lockout/Tagout procedures. If you are not familiar with this requirement, refer to OSHA documentation.

Working With Electricity Safely

Ensure that you use safe and established practices in working with electrical devices. Poorly wired devices may cause a fire, explosion or electrical shock. Ensure that grounding connections are properly made. Ensure that you do not pinch wires when replacing covers. Follow OSHA Lockout/Tagout requirements. Station employees and service contractors need to understand and comply with this program completely to ensure safety while the equipment is down. Before you start work, know the location of the Emergency Power Cutoff Switch (the E-STOP). This switch cuts off power to all fueling equipment and submerged turbine pumps and is to be used in the event of an emergency. The buttons on the console at the cashier's station WILL NOT shut off electrical power to the pump/dispenser. This means that even if you press a button on the console labeled EMERGENCY STOP, ALL STOP, PUMP STOP, or something similar, fuel may continue to flow uncontrolled.

Hazardous Materials

Some materials may present a health hazard if not handled correctly. Ensure that you clean hands after handling equipment. Do not place any equipment in the mouth.

WARNING! FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD RESULT IN PROPERTY DAMAGE, INJURY OR DEATH.

FIRE HAZARD! Do **NOT** use **power tools** (Class I Division I and Class I Division II) during the installation or maintenance of equipment. Sparking could ignite fuel or vapors, resulting in fire.

CHEMICAL EXPOSURE HAZARD! Wear appropriate **safety equipment** during installation or maintenance of equipment. Avoid exposure to fuel and vapors. Prolonged exposure to fuel may cause severe skin irritations and possible burns.

REQUIREMENTS FOR USE

- The Red Jacket is designed for use only at facilities dispensing motor fuels.
- Application of The Red Jacket must be consistent with NFPA Code 30A, OSHA regulations, and federal, state and local fire codes, and other applicable local regulations.
- The selection of any Veeder-Root product must be based upon physical specifications and limitations and the product's compatibility with the materials to be handled. Veeder-Root makes no warranty of fitness for a particular purpose.
- All Veeder-Root products should be used in accordance with applicable federal, state and local laws, ordinances and regulations.
- In addition to the specified torque values noted in this manual, when properly tightened, all flanged fittings should have metal-to-metal contact.

OPERATING PRECAUTIONS

- **NO SMOKING.** Extinguish all open flames and pilot lights, such as on RV appliances.
- **TURN OFF** cell phones and other electronic devices to avoid distractions while fueling.
- **GASOLINE CAN BE HARMFUL OR FATAL IF SWALLOWED.** Long-term exposure may cause cancer. Keep eyes and skin away from liquid gasoline and gasoline vapors. Avoid prolonged breathing of gasoline vapors.

⚠WARNING **Before installing leak detector, review the application section in this leak detector manual for limitations or restrictions on usage.**

NOTICE **This instruction sheet should be kept with the end user of the leak detector for reference.**

When using 117-182 Big-Flo Diaphragm Valve, refer to installation instructions #042-108-1 included with the valve. When using an FXV model leak detector with adapter housing #038-072-5, refer to installation instructions #041-415-1 included with the housing. FXV Leak Detectors are for use with all UL-listed 4-inch Red Jacket models containing a "P" or "AG" prefix; FE Petro UL-listed 4-inch "STP" models; Tokheim UL-listed 4-inch models – 585A-34 and 585A-150.

⚠WARNING **Tampering with the screws or seals on this leak detector may inhibit operation and will void warranty.**

⚠WARNING **DO NOT wire submersible pumps to run continuously. Red Jacket line leak detectors will not perform leak tests on pumping systems that run continuously.**

NOTICE **ALL AIR MUST BE OUT OF THE SYSTEM FOR THE LEAK DETECTOR TO WORK PROPERLY. Before installing leak detector in the pump, fill the system with product by running the pump and delivering product from each dispenser (starting with the farthest from the pump and working to the pump) until all air is removed from system.**

Certain regulatory bodies require that leak detectors remain in the system after the lines have been installed. The lines may be purged of air by back-pressuring the lines with an inert gas, such as helium or nitrogen, to a pressure of 25 psi (172 kPa). This may be done at the impact valve under the dispenser. When this pressure has been reached, the leak detector will be in the open position, By turning on the pump and gradually bleeding the gas from the line through a valve at the impact valve of the farthest dispenser, the line may be purged of air.

Applications

Limitations

Red Jacket leak detectors are mechanical, pressure operated valves. Like most mechanical devices, they have their limitations as to where and under what conditions they may be applied. The purpose of this section is to explain the circumstances surrounding the applications of Red Jacket mechanical leak detectors that allow them to operate in their intended fashion and those situations that are detrimental to their performance. Since mechanical leak detectors and their performance are affected by their system surroundings, **it is imperative that each leak detector be tested according to the test section in this manual after installation and before putting the system into operation**. This will dispel any question as to whether or not the leak detector is operating properly in a given application.

Where can leaks be detected?

As described in the operation section of this manual, Red Jacket mechanical leak detectors can only detect leaks that are downstream of the valve. Therefore, leaks can only be found from the location of the leak detector down the piping run to a vertical height that exerts enough fluid static head to keep the leak detector from entering the trip or leak sensing position. This generally will not include the area inside or beyond the dispenser. This section describes the effect of static head on the performance of mechanical leak detectors. In addition to fluid static head, valves installed in the system may also affect the performance of mechanical leak detectors. Check valves with an appropriate cracking pressure can exert the equivalent of static head on a leak detector.

Certain installations may contain valves such as solenoid valves that are closed during the leak check period. If these valves are installed downstream of a mechanical leak detector and are closed during the normal leak check time, the piping downstream of this valve cannot be checked for leakage. This may be the case for some satellite dispenser applications. In order for this piping to be checked, these valves must open immediately with the submersible pump being turned on. Extra solenoid valves at the inlet of the hose may be added to keep the system closed until the leak detector has performed it leak check.

Certain fueling systems feature dispensers that blend gasoline inside the dispenser using a blending valve. It is important to check the operation and integrity of these valves to keep fluids from one product piping system infiltrating another product piping system. It may be possible for product A to pressurize product line B if the blending valve does not offer isolation between these two systems. This pressurization may keep the leak detector in line B from entering the leak detection position in the event there is a breach in the mixing valve. This effect can be observed by dropping the pressure in product B with a pressure gauge on that system. When pump A is turned on with pump B turned off and no leak in the system, the pressure in system B must remain at 0. This effect should be verified in both directions.

Continuous Run

Mechanical leak detectors perform their leak check when the system pressure has dropped to less than 1 PSI. The leak check occurs when the submersible pump is turned on. Both of these events must occur for a mechanical leak detector to go into the restricted flow mode. In installations where the pump is running continuously due to situations such as improper wiring, faulty contactors, or continuous usage, leak checks will not be made because the leak detectors are not allowed an opportunity to enter the leak check position because the pressure is not allowed to decrease. Periodic observation of the pump run pilot lights on Red Jacket pump control boxes can assure that the pump is indeed turning off after dispensing is complete.

Fluid media

Because Red Jacket leak detectors are precision mechanical devices, the cleanliness of fluid media that they operate in will have bearing on the operational life span and performance of these valves. Storage tanks with leak detectors installed on their product piping systems must be kept clean. Abrasives such as rust, fine fiberglass or resin particles can affect the minimum leak rate detectable by a mechanical leak detector and its usable life span by causing excessive wear on internal seals and in the metering circuit of these valves.

Red Jacket model FX1V leak detectors and FX1DV leak detectors are intended for use in general fueling applications such as gasoline, diesel and kerosene. They will withstand methanol concentrations up to 10%,

ethanol concentrations to 10% and MTBE up to 15%. Red Jacket model BFX1V will withstand E85 and model BFX1DV is good for up to B100 biodiesel.

Pumping Systems

Red Jacket mechanical leak detectors are designed to operate on submersible pumping systems with maximum pumping pressures of 50 psi (5 HP Big Flo pump on diesel). They are applicable to all Red Jacket 4 inch and 6 inch Big Flo pumps and most competitive pumps with similar ratings. Maximum piping system test pressures allowable on the leak detector is 50 psi. Leak detectors require a vent port from their cap to the tank. This may not be present on competitive pumps. Diaphragm leak detectors require a minimum pressure of 15 psi. Red Jacket does not recommend the use of mechanical leak detectors with centrifugal suction pumps. Due to the wide variety of operating characteristics of these pumps, Red Jacket cannot guarantee the performance of the leak detector in this application.

Booster systems, where a submersible pump boosts pressure to a suction pump dispenser may present problems to the proper operation of a mechanical leak detector due to the interaction of the two pumps and regulating valves that may be used in the system. Leak detector performance should be verified upon start up and at least annually using the test procedure in this manual.

Multiple Pumps on Same Discharge Line

Two Pumps on Same Line – Periodically, direction is sought concerning application of leak detectors, when two pumps are used to supply the same discharge line. This becomes a matter of logic and judgment on the part of the individual designing the system, utilizing the following information.

There are basically two approaches to the situation, as follows:

1. When installing a leak detector at each pump (diagram A, Figure 1) the main considerations are:
   a. Considering that two leak detectors are involved, the flow rates referred to in Position 2, diagrams A, Figure 1 (leak sensing position) would double, i.e.
      1. The metering rate being allowed to the discharge line would double to approximately 6 gph versus 3 gph. Therefore, it would require a loss from the discharge system of this amount (approximately 6 gph versus 3 gph) or greater to prevent the leak detector from opening to Position 3 and allowing full flow. See notice below.
      2. The restrictive flow rate allowed by the leak detector when in Position 1 would double to approximately 3 to 6 gpm versus 1-1/2 to 3 gpm.
   c. The test time, however, would decrease for the same reason as stated in a.1) above.
   d. Assuming that the leak detectors were mounted directly in Red Jacket pumps, or in 038-072 housing as close to the discharge of the pumps as possible (see Figure 1), most of the discharge line would be monitored by the leak detector as the leak detector monitors the discharge line downstream from itself.
2. When installing one leak detector in the main discharge line at a point beyond where the discharge lines from each of the two pumps manifold to it (diagram B, Figure 1), main considerations are:
   a. The leak detector is dependent upon the total flow rate exposed to the main discharge line (≈70 gpm max.).
   b. With one leak detector being used, as illustrated in diagram B, Figure 1, the leak detector would operate as described in Figures 1 and 2 with stated flow rates and time being applicable.
   c. Considering that the leak detector monitors the discharge line downstream from itself, the manifold portion and any piping previous to the leak detector would not be protected by the leak detector (diagram B, Figure 1,)

More than Two Pumps on Discharge Line –When applying the leak detector to a system that would utilize more than two pumps to supply the same discharge line, it is important to note that the size of the leak rate which can be detected, using a leak detector in each pump, begins to reach an unacceptable level. For example, three pumps

using a leak detector in each as shown in diagram D, Figure 1 will only detect a leak of approximately 9 gph or larger (3 x 3 gph = 9 gph). Also, in the event that an adequate leak rate did occur to activate the leak detector, the restricted flow rate would be 1-1/ 2 to 3 gpm for each leak detector and pump in service (3 x 3 = 9 gpm). It is possible that a flow rate of this size would not be recognized as a restricted flow rate or as abnormal. Each additional leak detector and pump used will increase the minimum detectable leak rate by approximately 3 gph and the restricted flow rate by 1-1/2 to 3 gpm. Due to the above factors, we do not recommend this system.

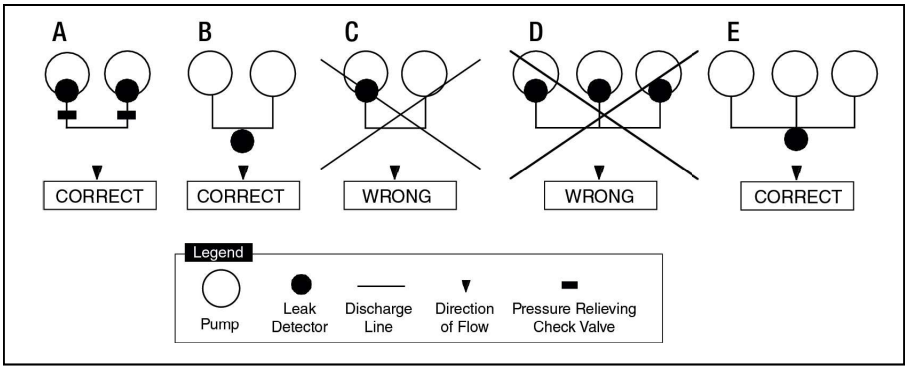


Figure 1. Leak Detector Installations

NOTICE **To retain the protection provided by any safety equipment, periodic examination and testing is mandatory. An annual testing of Red Jacket leak detectors is required.**

Static Head Pressure on Mechanical Leak Detector

The FX Leak Detector is designed to operate when installed into systems which impose a static head on 11 (eleven) feet or less.

When installing a mechanical leak detector in an underground submersible pumping system, the installer must be aware of the static head that will be placed on the leak detector when in operation (see 'A' in Figure 2). The static discharge head is the vertical elevation from the leak detector body to the point of free discharge.

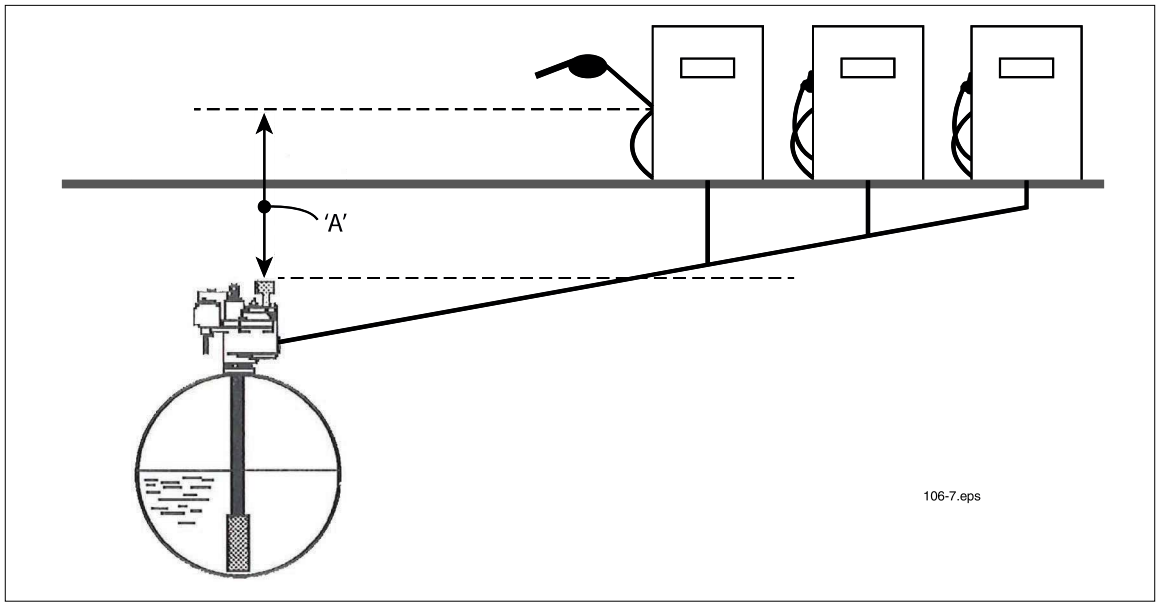


Figure 2. Static head

The term 'head' is usually expressed in feet whereas pressure is usually expressed in pounds-per-square-inch. The formula for converting these factors follows (A rough equation is 3 feet of gasoline head equals 1 psi):

$$\text{Pressure (Lbs./Sq. In.)} = \frac{\text{Head (feet)} \times \text{Specific Gravity}}{2.31}$$

$$\text{Head (feet)} = \frac{\text{Pressure (psi)} \times 2.31}{\text{Specific Gravity}}$$

The history of industry practice concerning location of the submersible pump in relation to the dispenser indicates that static head is not normally a problem. The general operating parameters for the leak detector dictate that it will trip or reset at approximately 3.5 to 4 psi or below, and the approximate 11 feet of liquid head or excess of 3.5 to 4 psi is not usually experienced by the leak detector. Typically, FX model leak detectors will overcome static heads of 3.5 to 4 psi.

However, if the static head and subsequent pressure experienced by the leak detector is in excess of the threshold, the leak detector may not operate. (see the three-step test).

Important Points to Remember:

1. Leaks occurring at a height above the leak detector that exert more fluid pressure than the threshold value will keep the leak detector from entering the leak sensing position. Such leaks will not be detected.
2. The threshold value for the reset pressure is a result of varying mechanical characteristics in the leak detector and may vary. Our experience shows that it is possible to encounter leak detectors that will work in a given situation when others won't because they have a slightly higher threshold.

The effect of excessive static pressure can be observed when a simulated leak is placed into the line above the threshold height and then closed before the pump is turned on. Under normal operations, the leak detector will hesitate at the metering pressure for several seconds before opening up to full pump pressure. With excessive static head present, the pressure will increase immediately to full pump pressure. If under these conditions a leak is present, the pump is turned on and full pump pressure is realized immediately, the leak detector is not operating properly.

The amount of pressure experienced by the leak detector can be determined by installing a pressure gauge on the line test port of the pump. The gauge must remain at the level of the line test port and should have a low pressure range (i.e., 0 to 30 psi) to get accurate readings.

After the pump is turned off, use the valve on the test apparatus to bleed the pressure from the highest vertical point in the system, typically located at the dispenser shear valve. The gauge on the line test port will read the static head present on the leak detector.

Possible solutions to the problem of excessive static head are:

1. Test the operation of leak detectors. Replace the leak detector with a low threshold attempting to find one with a higher threshold by observing test results.
2. Modify the system by raising the leak detector to decrease its static head. This can be done by installing a longer riser pipe between the pump and the tank. Note that this will raise the pump inlet further from the bottom of the tank by the distance added to the riser.
3. Modify the piping system to include a pressure relieving check valve. The pressure relieving check valve will isolate the excessive static head pressure in the line from the FX Leak Detector. The leak detector will now only experience the static head from its level to that of the check valve. This allows the leak detector to return to the leak sensing position when the pressure has fallen in the system.

⚠WARNING **The leak detecting capability of the system is functional only as long as the check valve does not leak. If the check valve leaks, the full static head is again transferred to the leak detector potentially rendering it inoperable. The leak detector functionality test must be performed with the check valve in line to assure functionality.**

In all cases, operation of the mechanical leak detector must be verified by inducing a leak and confirming correct operation of the unit after it is installed at the site.

⚠WARNING **Red Jacket mechanical leak detectors and their performance can be adversely affected by certain operating conditions. Conditions/ factors that will affect the leak detector's performance (leak detecting capability and life) include those following.**

Installation of In-line Check Valves in Submersible Pumping Systems with Mechanical Leak Detectors

Please refer to the previous section in this manual which addressed the effect of static head on mechanical leak detector performance. It states, static head on the leak detector in excess of its threshold value may keep the leak detector from going into the trip position and keep it from performing a line test. When the check valves with pressure relief are installed on the product line, they will contribute additional head that the leak detector senses, in that these valves have a "cracking pressure" (the minimum pressure required to cause a flow of fluid through the valve). See Figure 3 below. When a leak occurs in the system, the leak detector must "push" product through the check valve and uphill to the leak as it returns to the trip position. The cracking pressure of these valves in feet must be added to the feet of static head due to elevation to determine the total head on the leak detector. It can easily be seen that if the cracking pressure of the check valve is 1 psi or 3 feet of gasoline and the elevation is 3 feet, the total head of 6 feet or about 2 psi can keep the leak detector from going into the trip position. Consequently, a leak may go undetected. The following drawing illustrates the static head and cracking pressure effects.

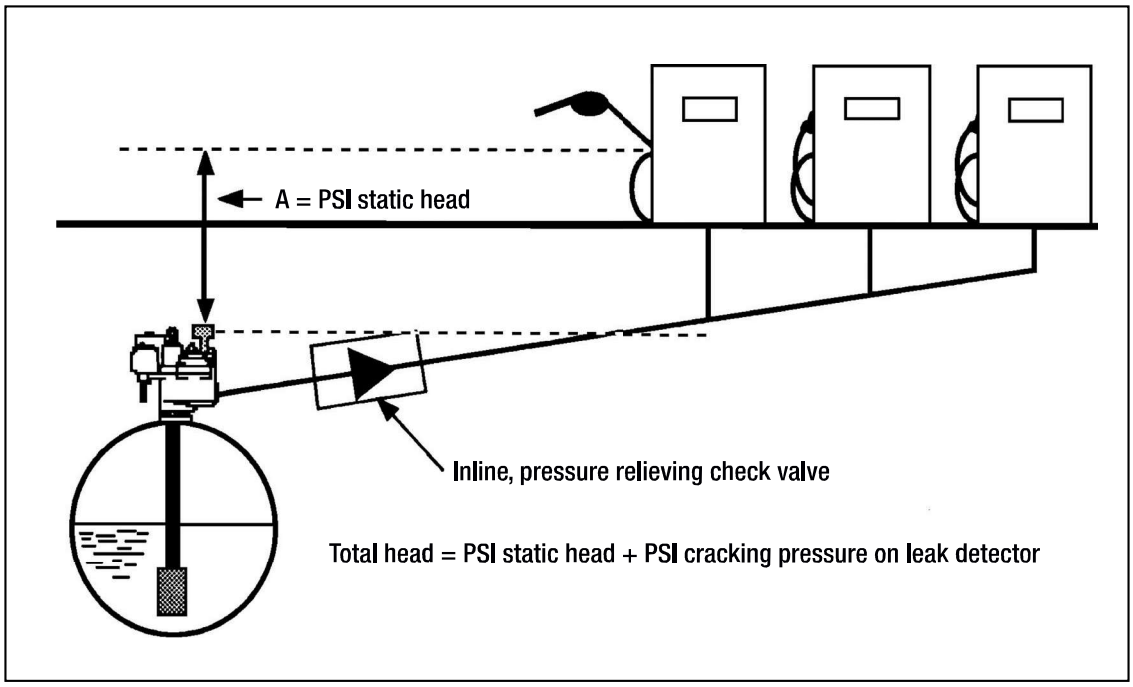


Figure 3. App. 2

Leak detectors in this type of installation must be tested according to the test section in this manual. The stated procedure is that the leak detector after a pressure drop should pause for approximately two seconds in the metering position prior to allowing full pump pressure. The leak detector is not operating properly if fuel pump pressure is realized with a leak in the line via the test fixture. This condition may lead to the failure of the leak detector to find a leak.

Possible remedies to this problem are:

1. Remove the check valve.
2. Test the operation of leak detectors in the test section of this manual.
3. Modify the system to handle the leak detector so that the leak detector does not experience head pressure greater than its threshold. Providing that clearance below manhole cover allows, install longer riser to submersible pump to raise the leak detector without lengthening the pump. This raises the pump further from the bottom of the tank by the distance added by the riser.

A solution that may come to mind in this case is to use appropriate piping to come from the pump discharge upward to desired height and install the leak detector in the Red Jacket adapter, #038-072, then bring down to original level forming an inverted “U”. We do not recommend using this solution as this forms a high spot in the line in which air will accumulate. This air will result in slowing down the leak detector operation. However, if in 1) or 2) above, the additional height of the leak detector over the manifold of the pump causes height problems, the adapter #038-072 can be used and the leak detector mounted on its side. As stated in the literature, the leak detector can be installed in any position.

Installation of Mechanical Leak Detector in a Marina Application

When installing a mechanical leak detector in a typical marina application (or the like) where there is a severe slope downward toward the dispensers (see illustration below). NFPA Code 30A (2021), Section 11.2.5.1 states: "Where a tank is at an elevation that produces a gravity head on the dispensing device, the tank outlet shall be equipped with a device, such as a normally closed solenoid valve, that will prevent gravity flow from the tank to the dispenser".

Please check the latest edition of these NFPA codes and proper authorities to meet all specifications in your area. To provide adequate leak detection in marina applications (per the design parameters of the Red Jacket mechanical leak detectors), we suggest utilizing a solenoid valve (or the like) before the leak detector and a Red Jacket Part #038-072 leak detector adapter to enable the leak detector to detect a leak downstream if a leak does occur (see Figure 4, App. 3).

⚠CAUTION **CAUTION! Be sure to utilize the Red Jacket adapter when installing a mechanical leak detector this way. A regular “T” does not have the special lip to allow the leak detector to go through its three-step test for a leak downstream.**

A pressure relief valve must be installed as shown to avoid excess pressure build up in the line due to product expansion. The discharge of the pressure relief valve must be vented to the tank through the “Tank Test” port on the packer of the pump.

If a leak did occur, after the submersible pump turned off, the solenoid valve would shut tight, preventing any siphoning effect from the tank through the submersible pump and, yet, allowing the leak detector to detect a leak. We suggest the electrical power to subject solenoid valve must begin and end simultaneously to that of the submersible pump. The solenoid valve in the dispenser should be delayed, if necessary, for approximately four seconds after the submersible pump starts up to help prevent nuisance tripping by the leak detector due to thermal contraction.

NOTICE **If a Leak Detector is used, the vent tubing must still be vented to the tank test port of the submersible pump. Extra tubing might be needed to reach this port.**

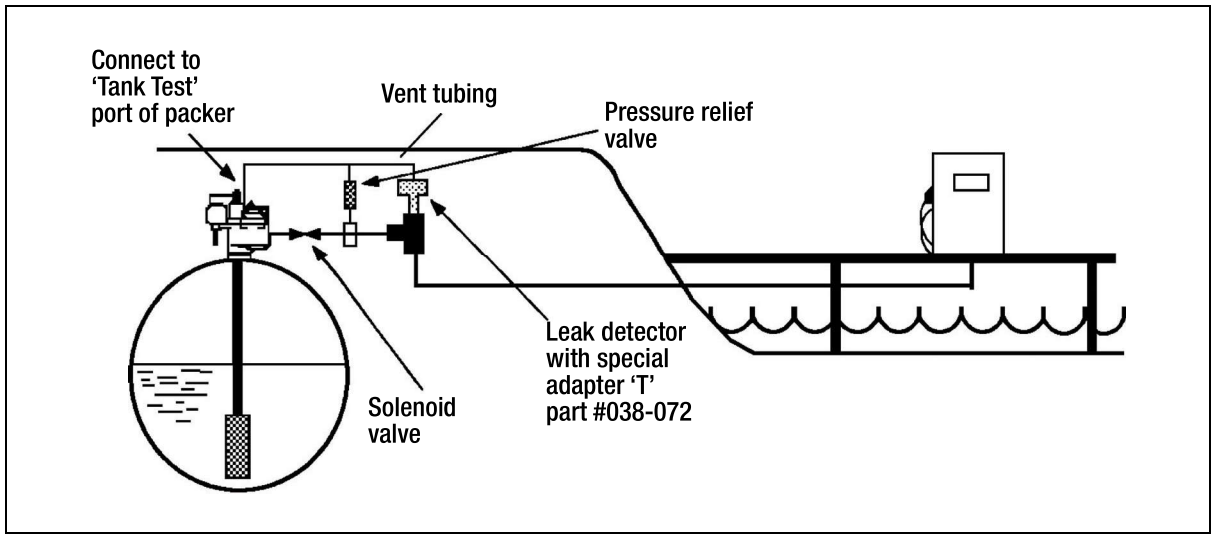


Figure 4. App. 3

Leak Detectors in Above Ground Tank Installations

Vertical Tanks

In an above ground vertical tank system, the biggest concern is dealing with static pressure that is being exerted on the system at all times due to the level of the fluid in the tank.

Figure 5 shows the ideal system when using a vertical tank. Notice that the Red Jacket submersible pump is mounted in a day tank and not directly into the storage tank. In this position the pump is not affected by the static pressure the storage tank would exert on the pump. A solenoid valve is used between the storage tank and the day tank. This valve is controlled by the level sensing device in the day tank; opening the valve when product drops to a refill level and closing the valve when the product raises to a full level. Filling the day tank occurs by gravity flow. The day tank is vented exposing the internal parts of the manifold to atmospheric pressure. This configuration allows easy removal of the pump when required and does not pressurize the packer manifold seal.

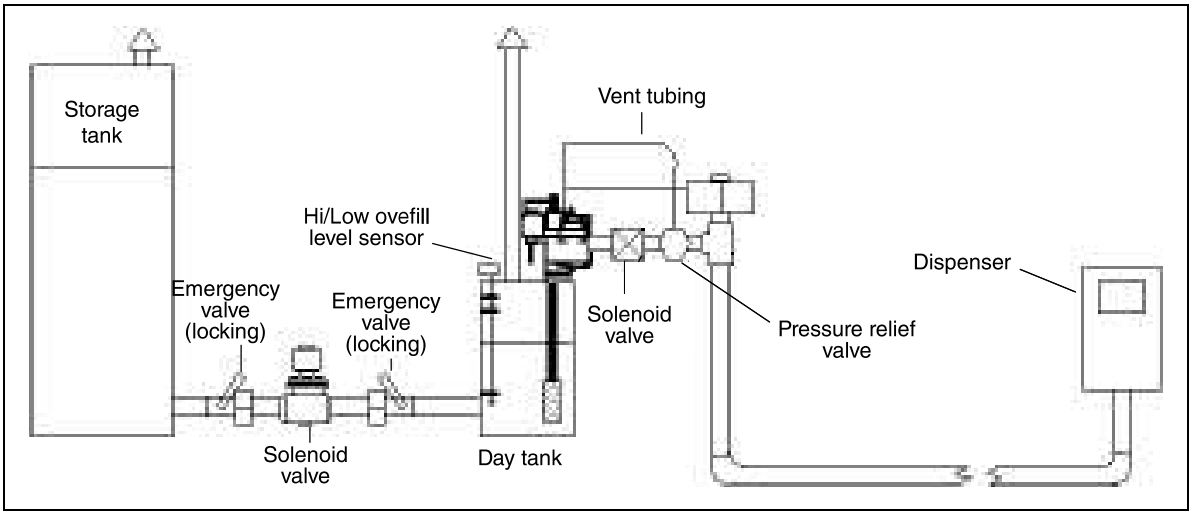


Figure 5. App. 4

It also must be noted that the top of the vent tube in the day tank must be equal in height to the top of the vent tube in the storage tanks. This will prevent overflowing the day tank in case of a failure in the level sensing device or a sealing problem with the solenoid valve.

The piping on the discharge of the pump must follow the regulations of NFPA Code 30 since the discharge of the pump will be higher than the dispensing of the product.

Horizontal Tanks

Figure 6 shows an installation having a horizontal above ground tank. This installation is similar to those described involving Marinas. The dispensers in these cases are at a lower level than the product in the tanks. Protection must be provided in the way of a solenoid valve to avoid siphoning product in the event there is a leak.

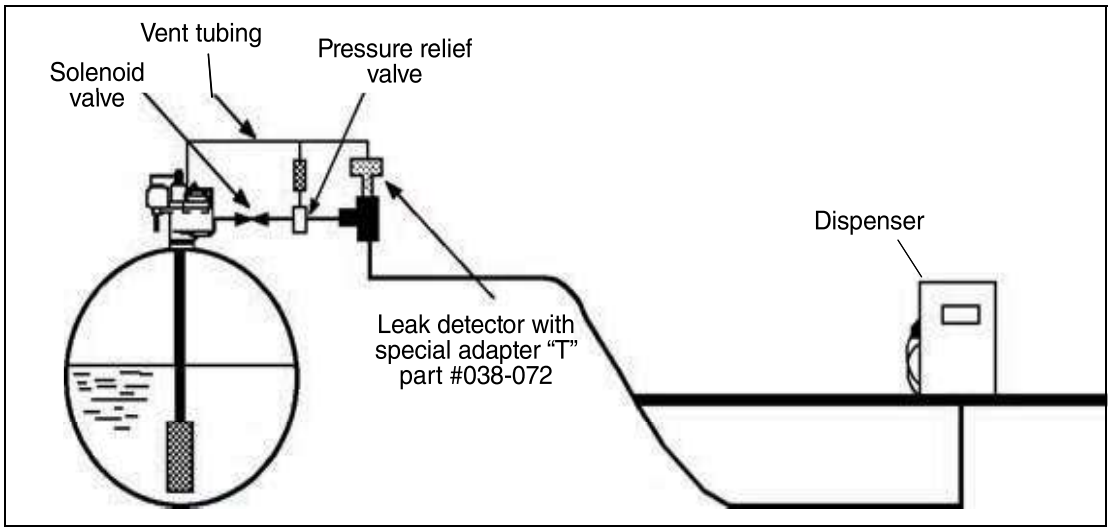


Figure 6. App. 5

Installation Procedure

⚠WARNING **Always disconnect, lock out, and tag the power at the panel before starting to service the pump. Relieve pressure before installing or removing petroleum equipment.**

1. Remove the two-inch plug from the top of the Standard pump (see Figure 7 for The Red Jacket leak detector installation ports and see Figure 9 for the Standard pump). If the two-inch plug is found to be so tight that cannot be removed, the submersible should be removed from the tank and placed in a vise. Remove the Functional Element assembly next to the pipe plug. The plug should then come out readily if a large pipe wrench is used. Replace the Functional Element assembly securely and replace the pump in the tank. (See Step 3 before replacing pump).

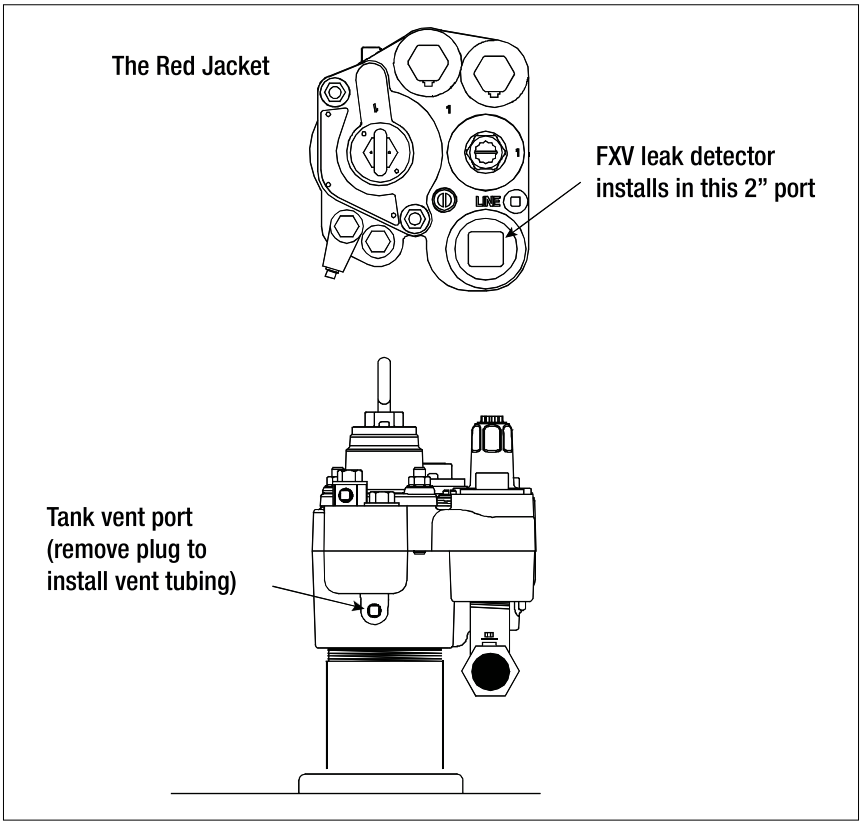


Figure 7. FXV Installation ports in The Red Jacket

2. Examine straight bore below two-inch thread for corrosion roughness. If found to be rough, smooth with fine emery paper.
3. Apply an appropriate UL-classified non-toxic pipe thread sealant to the two-inch threads on the detector. Lubricate o-ring on the leak detector.

NOTICE **If installing BFX1V or BFX1DV biofuel models, ensure pipe sealant is compatible.**

4. Screw the leak detector into the pump. Tighten with a wrench (top hex is 1-1/4 inch).
5. Installation of vent tube.

For FX1V and FX1DV Models (Copper Vent Tube Installation)

a. Remove ¼-inch pipe plug from tank test port (on 6-inch Big-Flo applications, remove the ¼-inch pipe plug from the riser/flange assembly, for The Red Jacket pumps, see Figure 7 and for the Standard pump see Figure 9).

b. Apply an appropriate UL-classified non-toxic pipe thread sealant to the threads of the ¼-inch NPT straight vent tube fitting and install in tank test port. On 6-inch Big-Flo applications, the ¼-inch NPT straight vent tube fitting may be installed into the riser/flange assembly.

c. Apply an appropriate UL-classified non-toxic pipe thread sealant to the threads of the ¼-inch NPT 90-degree vent tube fitting and install in the leak detector vent opening in the cap of the leak detector.

d. Install the vent tubing into both fittings and tighten per instructions on package.

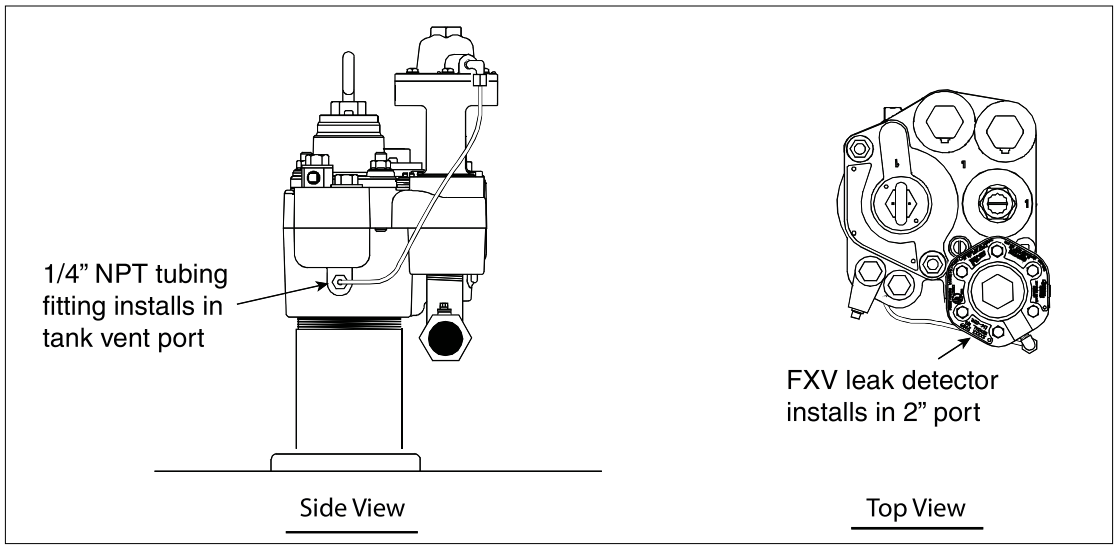


Figure 8. Installing FXV in The Red Jacket pump

For FX1V and FX1DV Models (STAINLESS STEEL [SST] Flexible Vent Hose Installation - Optional)

Requires kit 410985-001 containing hose assembly and stainless steel fittings. This needs to be ordered for new installation or replacement of copper tubing to flexible Stainless Steel hose.

a. Remove ¼ inch pipe plug from tank test port, see Figure 7 for The Red Jacket pump and Figure 9 for the Standard pump.

b. Apply an appropriate UL –classified non-toxic pipe thread sealant to the threads of the ¼-inch NPT Straight SST fitting and install in tank test port.

c. Apply an appropriate UL –classified non-toxic pipe thread sealant to the threads of the ¼-inch NPT swivel SST fitting and install in the leak detector vent opening in the cap of the leak detector.

d. Install the vent tubing into both fittings and tighten per instructions on package.

For BFX1V/BFX1DV Models

a. Remove ¼ inch pipe plug from tank test port, see Figure 7 for The Red Jacket pump and Figure 9 for the Standard pump.

b. Apply an appropriate UL –classified non-toxic pipe thread sealant to the threads of the ¼-inch NPT Straight SST fitting and install in tank test port.

c. Apply an appropriate UL –classified non-toxic pipe thread sealant to the threads of the ¼-inch NPT swivel SST fitting and install in the leak detector vent opening in the cap of the leak detector.

d. Tighten both fittings.

6. Connect power to pump at the load center.

7. Clear remaining air from system as follows:

   a. Turn on dispenser that is farthest from the leak detector but do not open nozzle. Wait 4 or 5 minutes or more. Look for leaks on parts worked on.

   b. Shut off the pump and allow it to stand four or five minutes. Then start the pump again and open the nozzle farthest from the leak detector.

   c. Continue to dispense enough gasoline, about 20 to 30 gallons (76 to 114 liters), to pump ALL air from the system.

NOTICE **If flow is restricted to about 3 gpm (11 lpm) or less with the nozzle open, the leak detector has not opened. Repeat Step 7 with increased running time of pump to insure the purging of all air. All air must be purged from the system or the leak detector will restrict flow to about 3 gpm.**

8. Affix the enclosed decals to the dispenser dial glass on grade of gasoline upon which the leak detector is being installed. Additional decals are available; call customer service at 1-800-873-3313 and request P/N 046-200-1.

9. Inspect all threaded joints to assure they are tight and not leaking.

Special Installation Instructions

To minimize the chance of experiencing any disruption in the dispensing operation and maximize the benefits of this Red Jacket leak detector, please read this section.

It is very important that all of the dispenser solenoid valves in the system in which this leak detector will operate remain closed for approximately four seconds every time the submersible pump is activated. The leak detector can only perform a line test during this four-second window.

This test requires approximately two to four seconds, depending upon conditions present in the system. The dispenser solenoid valve must stay closed until the test is completed. This may be accomplished by utilizing delays integral to electronic dispensing equipment or by installing a retrofit delay in the junction box.

Past experience has shown that without this delay the leak detector has insufficient time to complete its line test and provide uninterrupted service.

Contact Red Jacket technical service at 1-800-323-1799 with any questions concerning this procedure.

Testing

U.S. Environmental Protection Agency (EPA) regulations require annual verification of operation of leak detector. To assure maintenance of leak detection capability. Red Jacket requires that operation of the mechanical leak detector be verified by testing upon start-up and that testing of the leak detector be performed routinely, at least annually.

NOTICE **There are multiple ways to properly induce a leak by authorized technicians. Third party services and devices are also available for this purpose.**

The top cover on the Red Jacket leak detector is designed to accommodate a sealing wire which can be used to discourage tampering of the unauthorized removal of leak detector. (see Figure 9).

If the dispensing system (the solenoid valve and the nozzle) is opened previous to the completion of the line test, the FXV Series will detect this opening as a leak and restricted flow will result. Closing of the nozzle(s) for a period of time adequate to allow completion of the line test will allow the leak detector to open. Once opened, full pump flow can be provided.

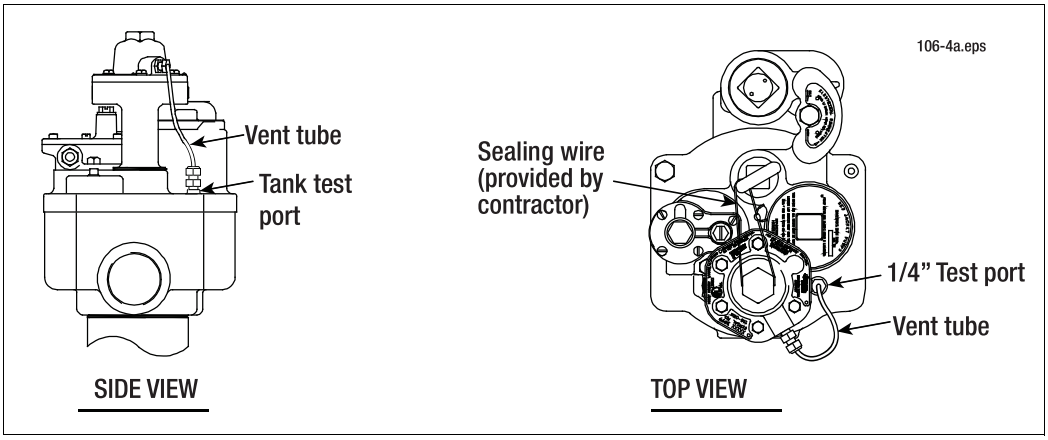


Figure 9. Installing FXV in the Standard pump

FX Leak Detector 3-Step Test

The V-R FX Series LLD is a pressure-sensing, diaphragm-operated valve designed to indicate a leak in the piping between the leak detector and the dispenser.

When the submerged pump is turned on, a controlled amount of product, 3 gph (11 lph) is metered through the LLD into the piping system. If a leak is present which equals or exceeds this amount, as much product escapes from the system as is metered in through the LLD. Under this condition pressure cannot build up in the piping system. When a nozzle is opened and the LLD poppet is in position one (ref. Figure 10), flow is restricted to approximately 1-1/2 to 3 gpm (5 - 11 lpm). If the poppet of the LLD is in position two when a nozzle is opened, flow is restricted to approximately 1-1/2 to 3 gph (5 - 11 lph). This is the indication to the operator that the leak is present.

If there are no leaks, pressure rapidly builds in the system forcing the LLD to open to the full-flow position. In a system with no leaks, it takes approximately 2 - 3 seconds for the complete test. No further line testing takes place until the line pressure drops below 3 to 5 psi (21 - 35 kPa) depending on which LLD is installed.

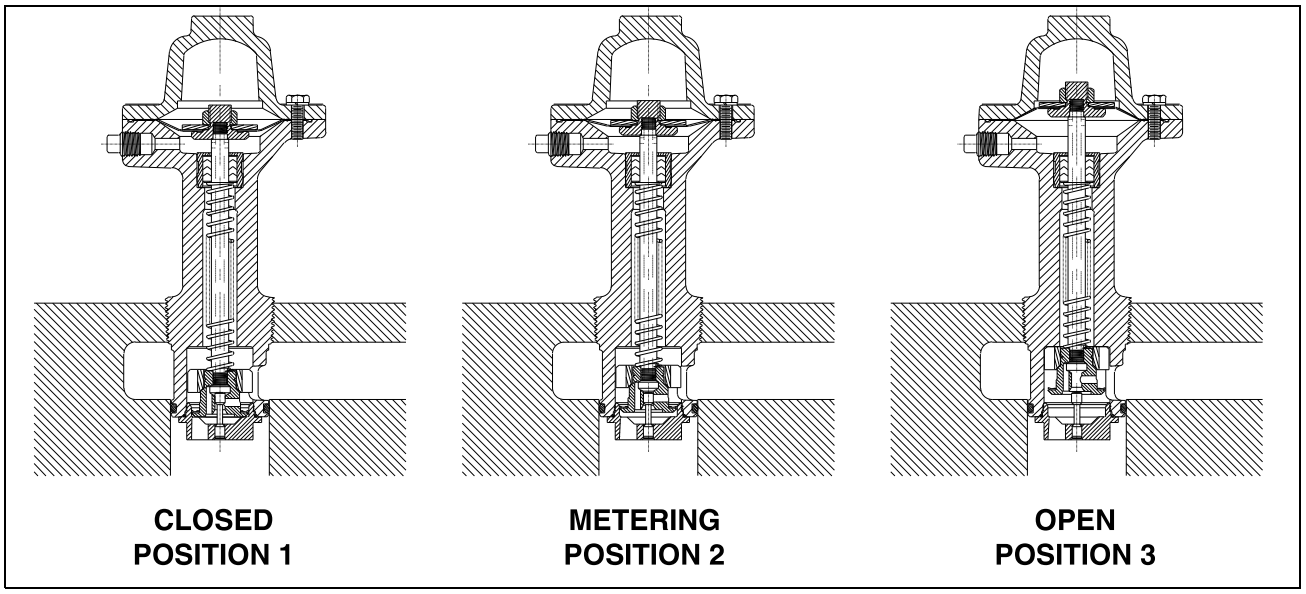


Figure 10. Leak detector operating positions

The Trip or Relaxed Position (Closed)

Under normal operating conditions, it is assumed that the lines are filled with gasoline. When the system pressure is less than 3 to 5 psi (21 - 35 kPa), the diaphragm and poppet are in their 'down' or 'tripped' position. The position of the valve 'poppet' is such as to allow approximately 1-1/2 to 3 gpm (5 - 11 lpm) flow into the delivery line through a bypass opening in the LLD valve poppet when the submersible pump starts. Since the system is full, pressure builds rapidly and the poppet moves to the leak sensing position assuming there is no leak present.

Leak Sensing Position (Metering)

As the pressure builds to approximately 8 to 16 psi (55 - 110 kPa) (rapidly) the diaphragm has moved the poppet to such a position as to almost stop the flow into the piping through the LLD valve poppet. In this position, all the flow must then travel around the metering pin which limits it to approximately 3 gph (11 lph) rate. If a simultaneous loss from the system equals or exceeds this amount, the line pressure will not build beyond this point and the valve will remain in the leak sensing position with the main flow blocked. If there is an attempt to dispense while the valve is in this position, the line pressure will drop, the diaphragm will respond, and the poppet will return to Position 1 where the 1-1/2 to 3 gpm (5-11 lpm) will flow to the dispensers. Leaks smaller than 3 gph will be indicated by the LLD taking longer than 2 - 3 seconds to open completely. If there is no leakage in the system, the small flow around the metering pin increases the line pressure to 12 - 16 psi (83 - 110 kPa) in approximately two seconds at which point the diaphragm will snap the poppet to Position 3. This all takes place in less time than it takes to reset the dispenser, walk to the car, remove the gas tank cap, insert and open the nozzle.

Non-Leak Position (Open)

This position allows full flow. The poppet will remain in this position as long as the system pressure remains above 3 to 5 psi (21-35 kPa). At less than 3 to 5 psi, the poppet will return to Position 1 and the next time the pump is activated, the LLD will perform a line test.

NOTICE **Per the above process, this product is designed and sold to detect leaks of 3gph (11 lph) or greater only. For leaks of less than 3 gph, please consult with your V-R Company Representative.**

Third Party Certification

Statement of Third Party Certification

The following listed Red Jacket equipment has been Third Party tested and certified per the appropriate EPA test protocols.

NOTICE

To assist owners and operators with the maintenance of records in accordance with EPA regulation 280.45, Red Jacket has copies of the below listed Third Party Evaluations available.

To obtain copies of a particular report, just call 1-800-873-3313 and request the Evaluation No. associated with the evaluation you require.

Table 1. Red Jacket Equipment Certifications

Red Jacket Equipment	Evaluation No.	Description of Evaluation
FX1V and FX2V	577013-872	Evaluation of the Red Jacket FX1V and FX2V line leak detectors for hourly monitoring on rigid and flexible pipelines
FX1D, FX2D, FX1DV and FX2DV	E14	Evaluation of the Red Jacket FX1D, FX2D, FX1DV and FX2DV line leak detectors (installed in the Big-Flo) for hourly testing on bulk lines containing diesel fuel
BFX1V and BFX1DV	577013-872	Evaluations of the Red Jacket BFX1V and BFX1DV line leak detectors for hourly monitoring on rigid and flexible pipelines

National Workgroup Listing

See website https://neiwpcc.org/nwglde/ for details.

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www.veeder.com