

PLLD

Site Prep and Installation Guide

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Introduction

This manual contains instructions for installing the components of a Veeder-Root Pressurized Line Leak Detection (PLLD) system. The PLLD system performs 3.0 gph line leak tests following each dispense. Depending on the software enhancement module installed, the PLLD system will also allow, with certain pump types, 0.2 and/or 0.1 gph line tests at full pump pressure. The PLLD system executes leak tests automatically to eliminate the need for separate annual line leak testing.

NOTICE You must consult the **Veeder-Root Line Leak Detection Systems Application Guide (P/N 577013-465)** for all information relating to PLLD applicable pipe types, equipment requirements, installation kits, and pump compatibilities.

Contractor Certification Requirements

Veeder-Root requires the following minimum training certifications for contractors who will install and setup the equipment discussed in this manual:

Installer Certification (Level 1): Contractors holding valid Installer Certification are approved to perform wiring and conduit routing; equipment mounting; probe, sensor and carbon canister vapor polisher installation; wireless equipment installation; tank and line preparation; and line leak detector installation.

Technician Certification (Level 2/3): Contractors holding valid Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- Wireless 2
- Tall Tank

Warranty Registrations may only be submitted by selected Distributors.

Related Manuals

577013-465	Line Leak Application Guide
577013-578	TLS Monitoring Systems Contractor's Site Preparation Guide
576013-879	TLS-3XX Series Site Prep and Installation Manual
576013-498	Pressurized Line Leak Interface Module - Installation Manual
576013-499	Pressurized Line Leak Controller Module - Installation Manual
577013-727	PLLD Alarm Quick Help Guide
577013-815	Variable Speed Controller Installation Guide
577013-932	SpikeCheck for Standard Pump - Installation Instructions

Red Jacket Variable Speed Flow Controller (VSFC) Applications













NOTICE For Red Jacket VSFC installations that include a TLS-350 Console with PLLD line leak detection, a separate PLLD transducer is not necessary because the VSFC unit and PLLD system will share the same transducer.

Red Jacket VSFC installations REQUIRE that the installer refer to this manual to install the PLLD transducer (beginning on page 8) AND to perform the PLLD System Checkout proce-

sure (beginning on page 35). For PLLD/STP wiring instructions and all other VSFC installation instructions, the installer **MUST** follow the Red Jacket VSFC Installation Guide (P/N 577013-815).

Safety Precautions

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

 <p>EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.</p>	 <p>FLAMMABLE Fuels and their vapors are extremely flammable.</p>
 <p>ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p>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.</p>
 <p>WEAR EYE PROTECTION Fuel spray from residual pressure in the lines can cause serious eye injuries. Always wear eye protection.</p>	 <p>INJURY Careless or improper handling of materials can result in bodily injury.</p>
 <p>GLOVES Wear gloves to protect hands from irritation or injury.</p>	 <p>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.</p>
 <p>WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p>	 <p>CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p>
 <p>USE SAFETY BARRICADES Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.</p>	 <p>NOTICE is used to address practices not related to physical injury.</p>

Before You Begin

1. Ensure that the submersible turbine pump (STP) is properly grounded as per the manufacturer's instructions.
2. A shutoff valve installed between the PLLD transducer and the product pipeline is recommended. Although not required for the PLLD system to work, the valve will aid in troubleshooting the system and in reducing any product spillage when performing service work in the sump.
3. The SwiftCheck valve requires a 3" hex socket (or wrench) for tightening it in the pump's leak detector port. The non-vented SwiftCheck valve requires a 1-1/2" hex socket (or wrench) for tightening it in the pump's leak detector port.
4. PLLD can only be installed in systems using approved pumps and piping types. Refer to the Line Leak Application Guide (P/N 577013-465) for updates on PLLD approved pumps, piping lengths, and piping types.

Warning Tags

⚠ WARNING Turn off, tag (using the warning tags provided), and lockout power to the console and submersible pumps while installing the PLLD system. This will prevent either a dispense attempt or the PLLD system from automatically starting up the pump.

Warning tags [Figure 1] are provided with the PLLD system. For your safety and the safety of others who may service dispensers, submersible pumps, or PLLD systems, you must attach a tag to each of the following devices where it can clearly be seen by a serviceman performing work on the system:

- Console
- Submersible pump
- Dispenser filter

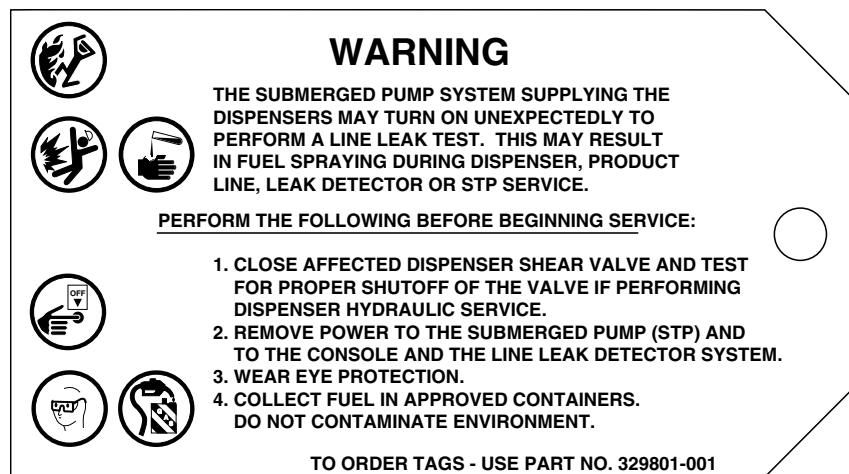


Figure 1. Warning Tag

Site Considerations

Manholes

When using a SwiftCheck Valve, the manhole must provide at least 8 inches of clearance above the pump head to install the PLLD components.

Unused Piping Runs

Where piping runs have been installed for future use, but are connected to the active piping system, isolate the inactive lines from the active lines using a shutoff valve. Failure to do so may harm system performance.

Existing Check Valves

You must ensure that there are no existing check valves already installed in the pipeline. The presence of any check valve (other than the one used with the PLLD system) can prevent the PLLD system from detecting line leaks in the area of pipeline downstream from the check valve.

Manifolded Product Lines

Follow these guidelines as you install a PLLD system into multiple manifolded tanks:

- Dielectric unions and flexible piping elements should be used as required by federal, state, and local requirements for the specific piping application. Location of unions may vary with configuration.
- A relay must be available on either a Four Relay module or I/O Combination module to control the pump on the higher-numbered tank. The PLLD Controller module will provide pump control output for the primary tank and the "Pump In" (Dispenser ON) signal for the set.
- A PLLD transducer is only required in the master pump.
- Remove any other check valve or leak detect device in the line that is not shown.
- Refer to the Line Leak Application Guide for check valve requirements.

PLLD System Overview

PLLD System Components:

- TLS-350 Series Console with PLLD feature
- PLLD pressure transducer (one for each product line monitored) - vented or non-vented check valves may be required depending on pump type and application
- PLLD Interface module - installs in TLS console intrinsically-safe bay (1 module monitors up to 6 transducers)
- PLLD Controller module - installs in TLS console power bay (1 module controls up to 3 STPs)
- Relay or I/O module - installs in TLS console power bay (required to control slave STP in manifolded set)

PLLD Installation Example

Figure 2 shows an example PLLD installation for a single tank and a manifolded tank set having Red Jacket Standard pumps.

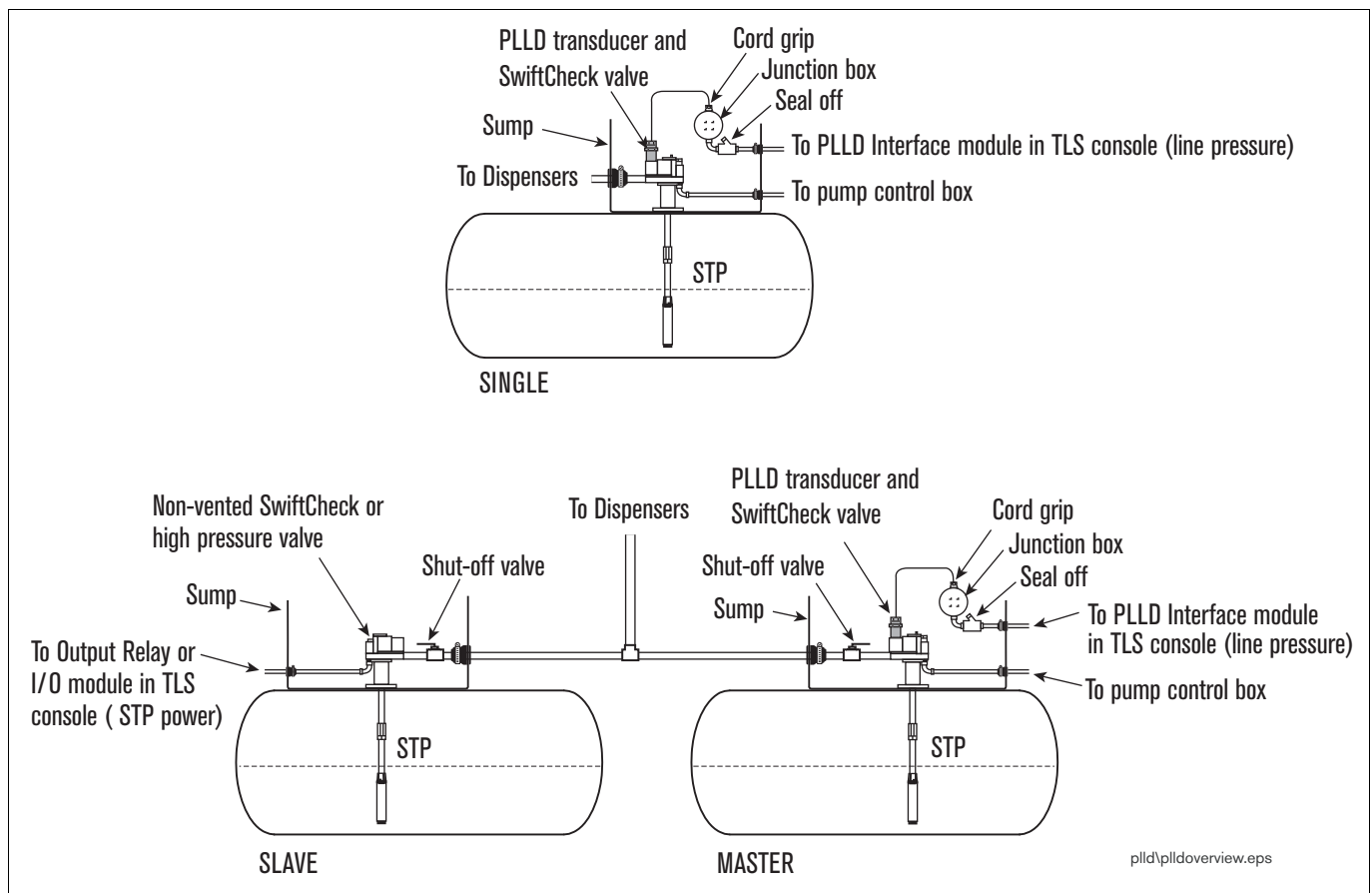


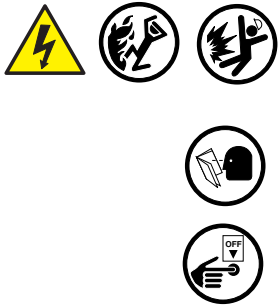
Figure 2. Example PLLD System Installation

PLLD System Field Wiring

⚠ WARNING Refer to the TLS-3XX Site Prep manual (P/N 576013-879) for required wiring types/lengths for pressure transducer and pump control field wiring.

Circuitry within the pressure transducer (sensor) and TLS console barrier form an intrinsically safe, energy limited system. This system makes the sensor intrinsically safe for use in a Class I, Group D hazardous location. The sensor wiring is intrinsically safe only when connected to TLS-350 Series consoles.

NOTICE For PLLD installations with Red Jacket Variable Speed Flow Controller (VSFC) pumps, you must refer to the VSFC Installation Guide (P/N 577013-815) for PLLD transducer wiring instructions.

⚠ WARNING	
	<p>This device is installed in equipment where potentially lethal voltages may exist. This device attaches to accessory components which operate in areas where flammable liquids and vapors may be present. FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <p>When installing this product:</p> <ol style="list-style-type: none">1. Read and understand all instructions.2. Turn off, tag, and lockout power to the console and submersible pumps while installing the PLLD system.3. Do not allow PLLD pump control wires to share conduit with wires from intrinsically safe devices such as probes and sensors.4. Insure that any assembled conduit only enters the console through the properly designated knockouts.5. To be installed in accordance with the National Electrical Code, NFPA 70 and the Automotive And Marine Service Station Code, NFPA 30; federal, state, and local codes; and any other safety codes.6. Intrinsically safe wiring shall be installed in accordance with article 504-20 of the NEC ANSI/NFPA 70.7. Substitution of components may impair intrinsic safety.

Field Wiring Requirements

NATIONAL ELECTRICAL CODE COMPLIANCE

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that electrical equipment and wiring located in Class I, Division 1 and 2 installations shall comply with the latest appropriate Articles found in the National Electric Code (NFPA 70) and the Automotive and Marine Service Station Code (NFPA 30A).

PLLD TRANSDUCER-TO-CONSOLE WIRING

Preferred Wiring Type

Use #14 - #18 AWG stranded copper, shielded cable (REQUIRED) and manufactured with a material suitable for the environment, such as Carol C2534, Belden 88760, or Belden 8760. Wiring to be installed as a Class 1 circuit with the following provisions:

- Wire run must not exceed 1000 feet to meet intrinsic safety requirements,
- Capacitance does not exceed 100 pF/ft,
- Inductance does not exceed 0.2 μ H/ft.

Note: Throughout this manual, when mentioning any cable or wire being used for PLLD transducer-to-console wiring, it will be referring to shielded cable.

Alternate Wiring Type - When Approved by the Local Authority Having Jurisdiction!

Use #22 AWG stranded copper, shielded cable (REQUIRED) and manufactured with a material suitable for the environment, such as Belden 88761. Wiring to be installed as a Class 1 circuit with the following provisions:

- Wire run must not exceed 750 feet to meet intrinsic safety requirements,
- Capacitance does not exceed 100 pF/ft,
- Inductance does not exceed 0.2 μ H/ft.

Splices

Veeder-Root recommends that no splices be made in the wire run between the PLLD transducer junction box and the console. Each splice degrades signal strength and could result in poor system performance

Field Wiring Procedure

1. Pull a shielded, 2-conductor cable from each PLLD transducer junction box to the intrinsically-safe bay of the TLS console.



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.

2. Referring to the appropriate wiring diagram in the PLLD Line Leak Controller module section, pull the necessary number of #14 AWG color-coded or marked copper wires from STPs, STP control boxes, self-serve system/dispenser, and power panel to the power bay of the TLS console. Since wiring for multiple pump controls may be entering the console through the same conduit opening, **color code or mark each wire to identify its source!**










The dispensers and TLS console must be wired to the same leg of incoming power at the main electrical panel; otherwise damage may result to dispensers and console.

PLLD Transducer Installation

This section discusses PLLD transducer installation for the following PLLD approved pumps:

- Red Jacket Standard and Quantum pumps - PLLD transducer/SwiftCheck valve (page 9)
- Red Jacket Standard and Quantum pumps - PLLD transducer/Pressurstat (page 12)
- Red Jacket Quantum with SpikeCheck Valve (page 13)
- The Red Jacket (page 15)
- Red Jacket VSFC pump (page 16)
- Red Jacket Maxxum Big-Flo (page 17)
- FE-Petro (page 18)
- Red Jacket Standard Pump with SpikeCheck (Not Shown). Refer to the SpikeCheck for Standard Pump Installation Instructions, P/N 577013-932.

Safety Warnings

 WARNING	
     	<p>This device is installed in equipment where potentially lethal voltages may exist. This device attaches to accessory components which operate in areas where flammable liquids and vapors may be present. FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <p>When installing this product:</p> <ol style="list-style-type: none">1. Read and understand all instructions.2. Turn off, tag, and lockout power to the console and submersible pumps while installing the PLLD system.3. Substitution of components may impair intrinsic safety.4. Do not allow PLLD pump control wires to share conduit with wires from intrinsically safe devices such as probes and sensors.5. Insure that any assembled conduit only enters the console through the properly designated knockouts.6. To be installed in accordance with the National Electrical Code, NFPA 70 and the Automotive And Marine Service Station Code, NFPA 30A.7. Intrinsically safe wiring shall be installed in accordance with article 504-20 of the NEC ANSI/NFPA 70.8. To protect yourself and others from being struck by vehicles, block off your work area during installation or service.

Red Jacket Standard and Quantum Pumps (PLLD w/SwiftCheck)

Use this installation procedure to install a PLLD transducer with a SwiftCheck valve in a Red Jacket Standard or Quantum pump.

WARNING



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.



When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

1. If a ball valve is installed down line from the pump, close it.
2. Do *one* of the following:
 - a. If the submersible turbine pump is equipped with a mechanical LLD, remove the mechanical unit and any related tubing and fittings, or
 - b. If the submersible turbine pump is **not** equipped with a mechanical LLD, remove the 2-inch mechanical LLD port plug.
3. Ensure that the sealing surface for the SwiftCheck valve's external o-ring is smooth and free from corrosion, pitting, and any material build-up [Figure 3].

WARNING

Failure to ensure a smooth seal surface can result in false line leak alarms.

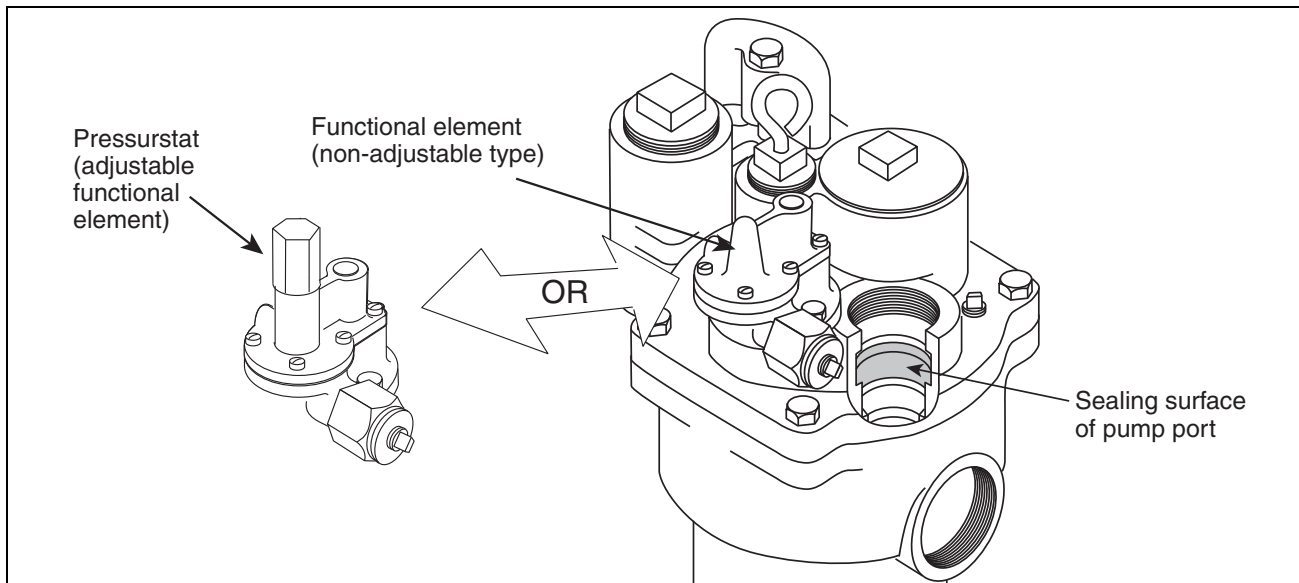


Figure 3. Sealing Surface For SwiftCheck Valve's External O-ring (With Both Functional Element Types Identified)

4. Lubricate the external o-ring on the SwiftCheck valve using mineral oil or other suitable lubricant.
5. If there is no Stage II vapor recovery, install the SwiftCheck valve [Figure 4] in the mechanical LLD pump port. Thread the PLLD transducer into the SwiftCheck Valve.

WARNING

Do not overtighten the SwiftCheck valve when installing it into the pump. Overtightening the valve can cause a flow restriction in the line!

⚠️ WARNING Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

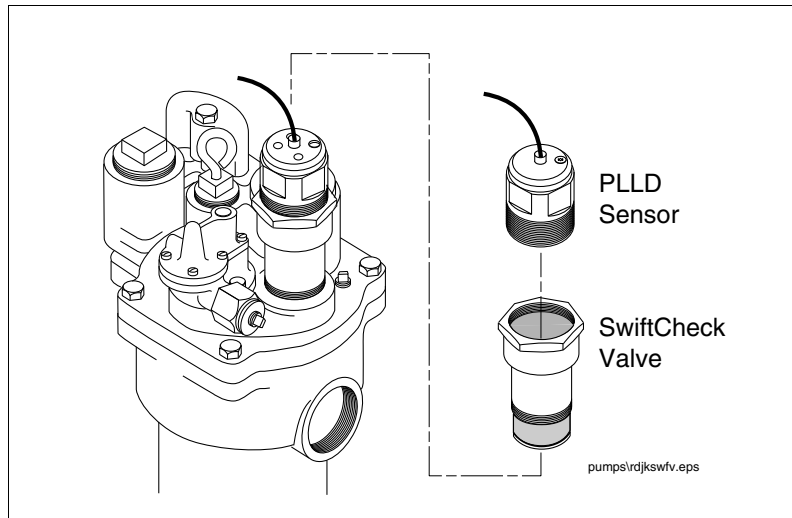


Figure 4. PLLD Transducer Installation

6. If there is a Stage II vapor recovery device installed in the pressurized piping you must install the SwiftCheck valve into a Red Jacket leak detector fitting (P/N 038-072) as shown in Figure 5 instead of in the pump's leak detector port. Because the PLLD transducer must be installed downstream from these devices, a monitored containment sump is required.

⚠️ WARNING There *must not* be a check valve installed between the SwiftCheck valve and the pump for PLLD to function properly.

Ensure that the Healy pump is wired according to the manufacturer's instructions and utilizes isolation relays.

Lubricate the external o-ring on the SwiftCheck valve using mineral oil or other suitable lubricant and thread the valve into the Red Jacket fitting.

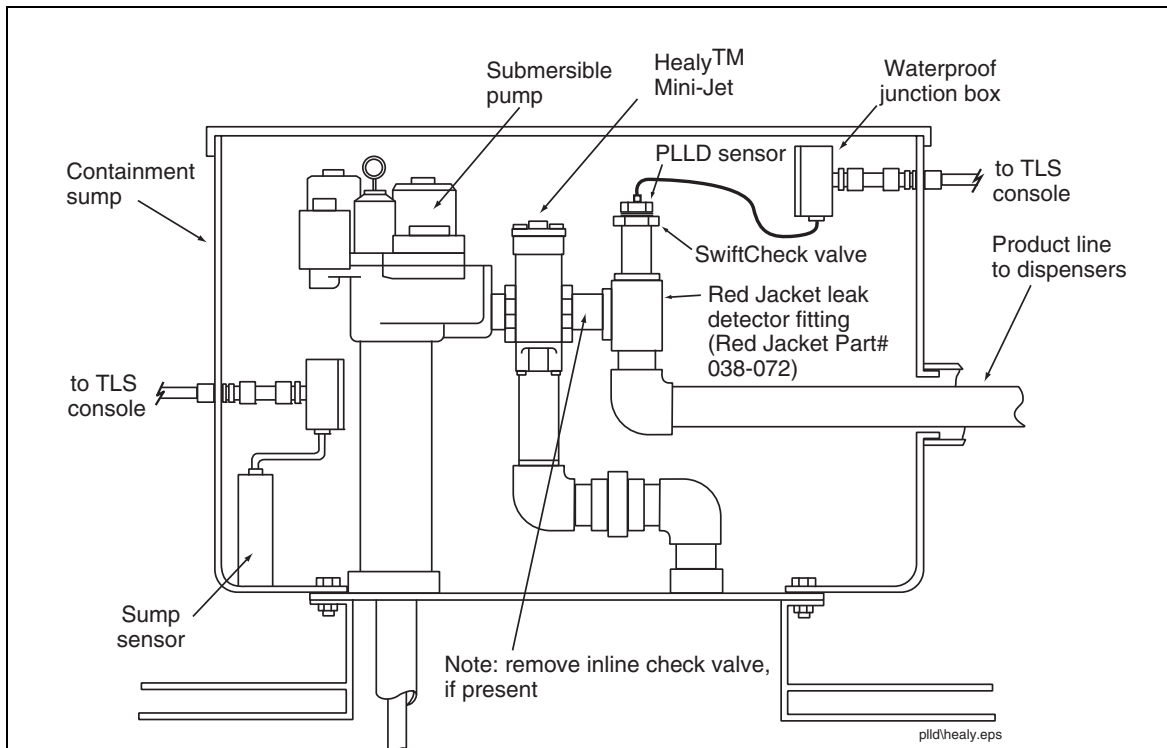



Figure 5. PLLD Install W/Healy Mini-Jet System (Required Dielectric Union And Shutoff Valve Not Shown)

7. Thread the PLLD transducer into the SwiftCheck valve (ref. Figure 4 or Figure 5 as appropriate).

⚠ WARNING

Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

8. Get a watertight cord grip from the transducer installation kit and coat its 1/2" NPT threaded end with UL-Classified, nontoxic pipe sealant suitable for the fuel involved. Screw the cord grip into one of the openings in the weatherproof junction box. Feed the end of the PLLD transducer cable through the cord grip and then tighten the nut to ensure a watertight seal. Connect and seal the pressure transducer wires to the wires from the TLS console as described in 'Epoxy Sealing PLLD Transducer Field Wiring Connections' on page 22.
9. The PLLD SwiftCheck valve eliminates the need for the pump's Pressurstat or functional element relief valve so it must be modified as part of the PLLD system installation. Remove the six 1/4-28 slot-head screws from the Pressurstat or functional element [Figure 6].
10. Remove the spring, piston and diaphragm.
11. Carefully reassemble the Pressurstat or functional element using a new diaphragm suitable for the fuel involved. Be sure that all mating surfaces are free from debris when reinstalling.
12. Torque the six slot-head screws to 40-65 in-lbs.
13. Open the ball valve down line from the pump.

⚠ WARNING	
	<p>Failure to properly reseal the Pressurstat or Functional Element may result in product leakage, which could create serious environmental and safety hazards.</p> <p>Fire, explosion, or ground contamination could occur.</p> <p>Carefully reassemble and reseal the Pressurstat or Functional Element, following the procedures described in this manual.</p>

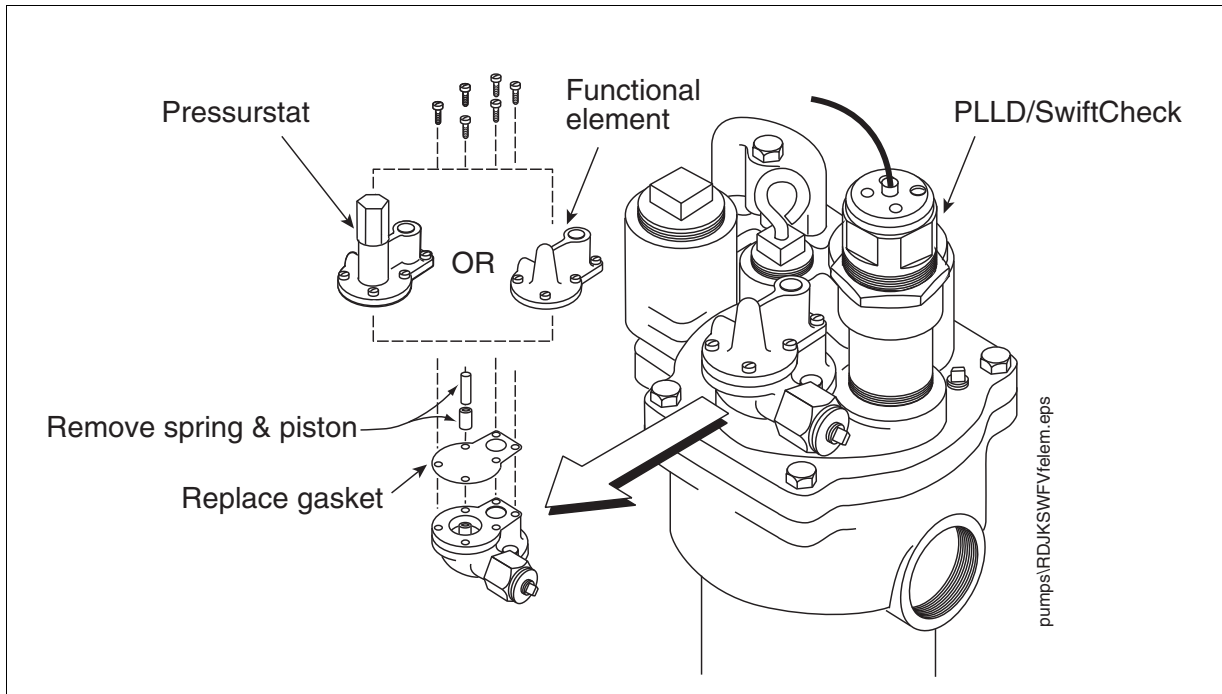


Figure 6. Modifying The Pressurstat/Functional Element In Red Jacket Pumps

Red Jacket Standard and Quantum Pumps (PLLD w/Pressurstat)

Use this installation procedure to install a PLLD transducer in a Red Jacket Standard or Quantum pump that has a Pressurstat that will be used for leak detection. NOTE: This installation method cannot be used if there is a Stage II vapor recovery device installed in the pressurized piping.



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.



When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

1. If a ball valve is installed down line from the pump, close it.

2. Do *one* of the following:
 - a. If the submersible turbine pump is equipped with a mechanical LLD, remove the mechanical unit and any related tubing and fittings, or
 - b. If the submersible turbine pump is **not** equipped with a mechanical LLD, remove the 2-inch mechanical LLD port plug.
3. Thread the PLLD transducer into the LLD port (Figure 5).

⚠ WARNING Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

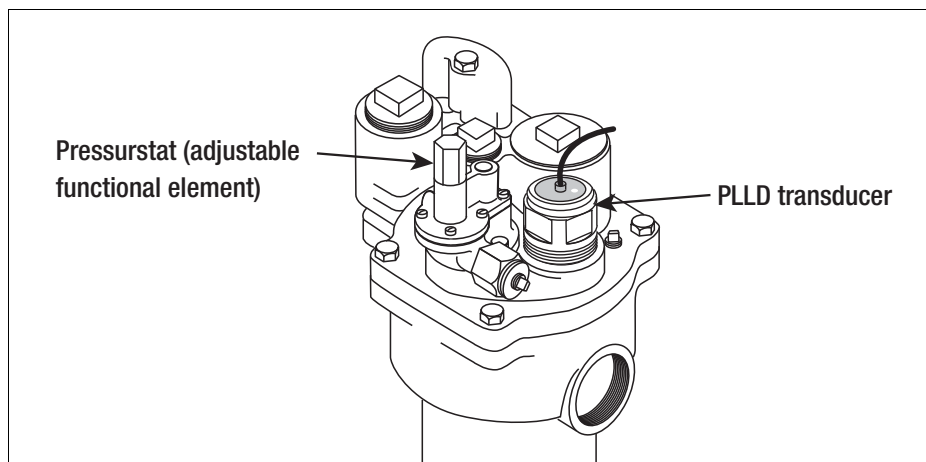


Figure 7. PLLD/Pressurstat Installation

4. Get a watertight cord grip from the transducer installation kit and coat its 1/2" NPT threaded end with UL-Classified, nontoxic pipe sealant suitable for the fuel involved. Screw the cord grip into one of the openings in the weatherproof junction box. Feed the end of the PLLD transducer cable through the cord grip and then tighten the nut to ensure a watertight seal. Connect and seal the pressure transducer wires to the wires from the TLS console as described in 'Epoxy Sealing PLLD Transducer Field Wiring Connections' on page 22.
5. Open the ball valve down line from the pump.

Red Jacket Quantum Pumps with SpikeCheck Valve

⚠ WARNING



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.



When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

1. If a ball valve is installed down line from the pump, close it.
2. If the pump does not have a Stage II vapor recovery device installed in the pressurized piping, do *one* of the following:

- a. If the submersible turbine pump is equipped with a mechanical LLD, remove the mechanical unit and any related tubing and fittings, or
- b. If the submersible turbine pump is **not** equipped with a mechanical LLD, remove the 2-inch mechanical LLD port plug.

Thread the PLLD transducer directly into the mechanical LLD port on the pump (see Figure 8).

⚠ WARNING Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

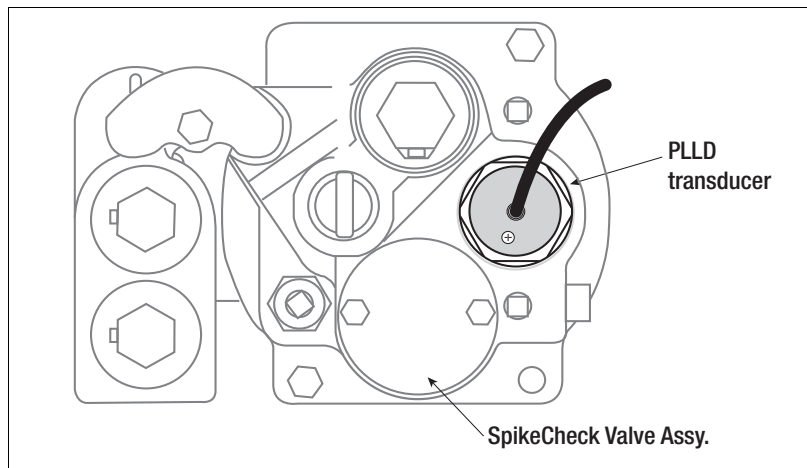


Figure 8. PLLD Installation In Red Jacket Quantum Pumps (W/SpikeCheck Valve Assy.)

3. If the pump does have a Stage II vapor recovery device installed in the pressurized piping remove the mechanical LLD unit and any related tubing and fittings if present and plug the ports.
Lubricate the external o-ring on the SwiftCheck valve using mineral oil or other suitable lubricant and thread the valve into the Red Jacket leak detector fitting (P/N 038-072) as shown in Figure 5 on page 11 instead of in the pump's leak detector port. Next thread the PLLD transducer into the SwiftCheck valve.

⚠ WARNING Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

Because the PLLD transducer must be installed downstream from these devices, a monitored containment sump is required.

⚠ WARNING There *must not* be a check valve installed between the SwiftCheck valve and the pump for PLLD to function properly.

Ensure that the Healy pump is wired according to the manufacturer's instructions and utilizes isolation relays.

4. Get a watertight cord grip from the transducer installation kit and coat its 1/2" NPT threaded end with UL-Classified, nontoxic pipe sealant suitable for the fuel involved. Screw the cord grip into one of the openings in the weatherproof junction box. Feed the end of the PLLD transducer cable through the cord grip and then tighten the nut to ensure a watertight seal. Connect and seal the pressure transducer wires to the wires from the TLS console as described in 'Epoxy Sealing PLLD Transducer Field Wiring Connections' on page 22.
5. Open the ball valve down line from the pump.

The Red Jacket Pump

The PLLD transducer mounts directly into the line leak detector pump port. It eliminates the need to break product lines for installation and service.

Since the PLLD transducer replaces the existing mechanical device, it is suitable in applications where there is no sump.



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.



When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

1. If a ball valve is installed down line from the pump, close it.
2. If the pump does not have a Stage II vapor recovery device installed in the pressurized piping, remove the 2" NPT plug from line leak detector port. Install the PLLD transducer into the 2" NPT port (see Figure 9).



Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

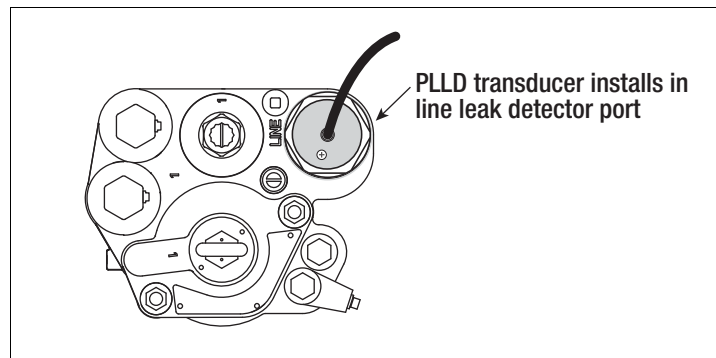


Figure 9. Locating Discharge Port Plug For Line Leak Transducer

3. If the pump does have a Stage II vapor recovery device installed in the pressurized piping, lubricate the external o-ring on the SwiftCheck valve using mineral oil or other suitable lubricant and thread the valve into the Red Jacket leak detector fitting (P/N 038-072) as shown in Figure 5 on page 11 instead of in the pump's leak detector port. Next thread the PLLD transducer into the SwiftCheck valve.



Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

Because the PLLD transducer must be installed downstream from these devices, a monitored containment sump is required.

⚠️WARNING There *must not* be a check valve installed between the SwiftCheck valve and the pump for PLLD to function properly.

Ensure that the Healy pump is wired according to the manufacturer's instructions and utilizes isolation relays.

4. Get a watertight cord grip from the transducer installation kit and coat its 1/2" NPT threaded end with UL-Classified, nontoxic pipe sealant suitable for the fuel involved. Screw the cord grip into one of the openings in the weatherproof junction box. Feed the end of the PLLD transducer cable through the cord grip and then tighten the nut to ensure a watertight seal. Connect and seal the pressure transducer wires to the wires from the TLS console as described in 'Epoxy Sealing PLLD Transducer Field Wiring Connections' on page 22.
5. Open the ball valve down line from the pump.

The Red Jacket VSFC Pump

The PLLD transducer mounts directly into the line leak detector pump port. It eliminates the need to break product lines for installation and service.

Since the PLLD transducer replaces the existing mechanical device, it is suitable in applications where there is no sump.

⚠️WARNING



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.



When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

1. If a ball valve is installed down line from the pump, close it.
2. If the pump does not have a Stage II vapor recovery device installed in the pressurized piping, remove the 2" NPT plug from line leak detector port. Install the PLLD transducer into the 2" NPT port (see Figure 10).

⚠️WARNING

Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

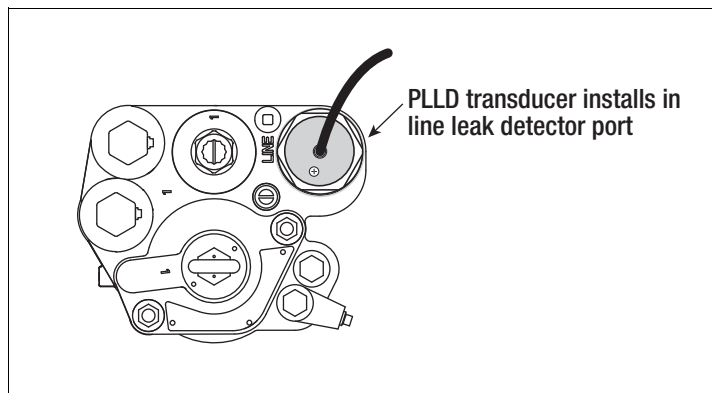


Figure 10. Locating Line Leak Detector Port In Red Jacket VSFC Pump For PLLD Transducer

3. If the pump does have a Stage II vapor recovery device installed in the pressurized piping, lubricate the external o-ring on the SwiftCheck valve using mineral oil or other suitable lubricant and thread the valve into the Red Jacket leak detector fitting (P/N 038-072) as shown in Figure 5 on page 11 instead of in the pump's leak detector port. Next thread the PLLD transducer into the SwiftCheck valve.

▲WARNING Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.



Because the PLLD transducer must be installed downstream from these devices, a monitored containment sump is required.

▲WARNING There *must not* be a check valve installed between the SwiftCheck valve and the pump for PLLD to function properly.

Ensure that the Healy pump is wired according to the manufacturer's instructions and utilizes isolation relays.

4. Open the ball valve down line from the pump.
5. Follow the PLLD/STP wiring connection procedures outlined in the VSFC Installation Guide (P/N 577013-815).

Red Jacket Maxxum Big-Flo

▲WARNING   Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.

 When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

1. If a ball valve is installed down line from the pump, close it.
2. If any in-line check valves or Big-Flo Diaphragm Valve are installed in the line, they must be removed.
3. Remove the cap from the 2-inch Transducer port next to the 3-inch discharge port. Thread the PLLD transducer into the transducer port (see Figure 11).

▲WARNING Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

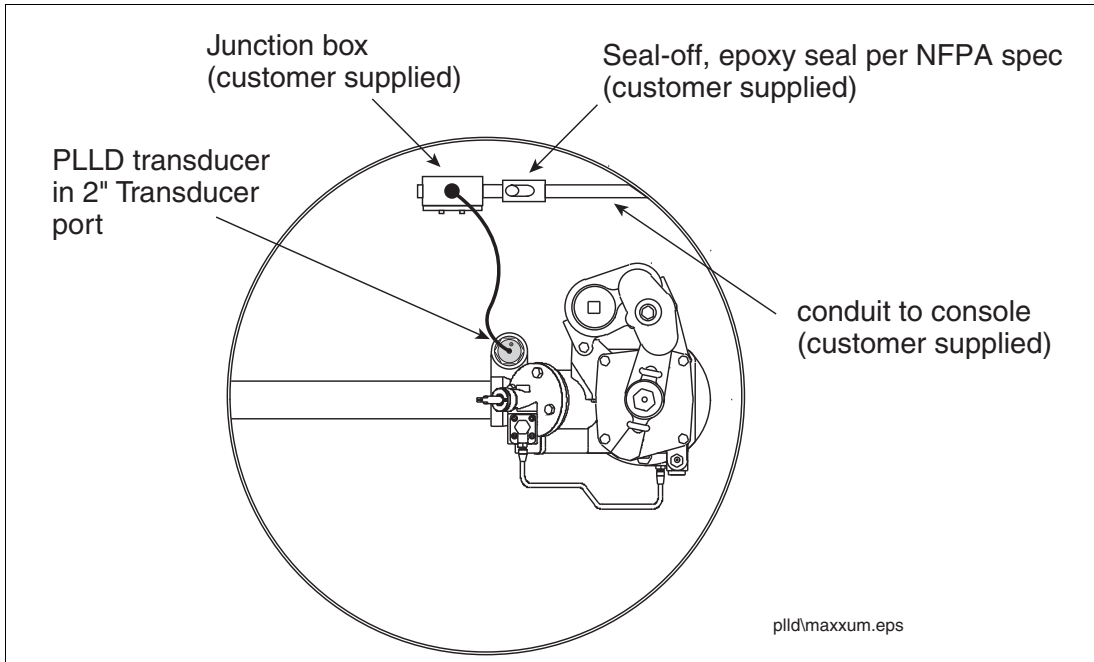


Figure 11. Example PLLD Installation In A Red Jacket Maxxum Big-Flo Pump

4. Get a watertight cord grip from the transducer installation kit and coat its 1/2" NPT threaded end with UL-Classified, nontoxic pipe sealant suitable for the fuel involved. Screw the cord grip into one of the openings in the weatherproof junction box. Feed the end of the PLLD transducer cable through the cord grip and then tighten the nut to ensure a watertight seal. Connect and seal the pressure transducer wires to the wires from the TLS console as described in 'Epoxy Sealing PLLD Transducer Field Wiring Connections' on page 22.
5. Open the ball valve down line from the pump.

FE Petro Pumps



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.



When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

1. If a ball valve is installed down line from the pump, close it.
2. If the pump does not have a Stage II vapor recovery device installed in the pressurized piping, remove the 2" NPT plug from line leak detector port. Install the PLLD transducer into the 2" NPT port as shown in Figure 12.



Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

3. If the pump does have a Stage II vapor recovery device installed in the pressurized piping, lubricate the external o-ring on the SwiftCheck valve using mineral oil or other suitable lubricant and thread the valve into

the Red Jacket leak detector fitting (P/N 038-072) as shown in Figure 5 on page 11 instead of in the pump's leak detector port. Next thread the PLLD transducer into the SwiftCheck valve.

⚠ WARNING Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

Because the PLLD transducer must be installed downstream from these devices, a monitored containment sump is required.

There *must* not be a check valve installed between the SwiftCheck valve and the pump for PLLD to function properly.

Ensure that the Healy pump is wired according to the manufacturer's instructions and utilizes isolation relays.

4. For PLLD operation there must be a FE Petro model R precision check valve in the pump, If necessary, replace the current check valve with a model R precision check valve (ref. Figure 12).

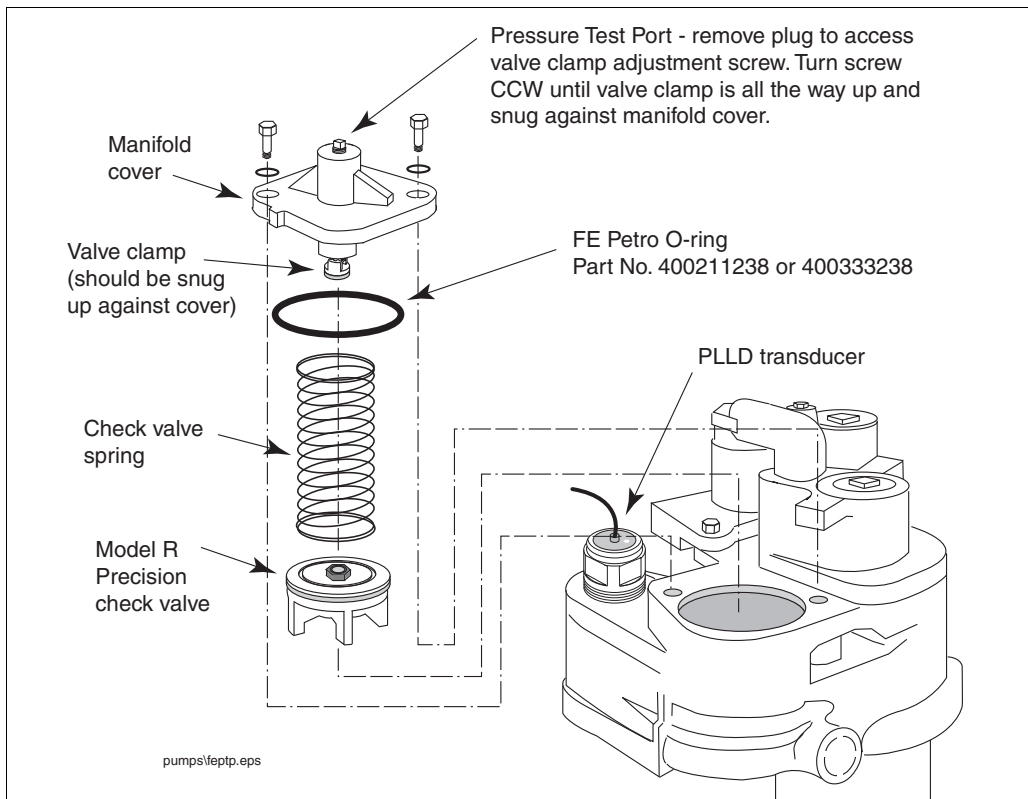


Figure 12. Location Of PLLD Transducer And Model R Precision Check Valve In FE Petro Pump

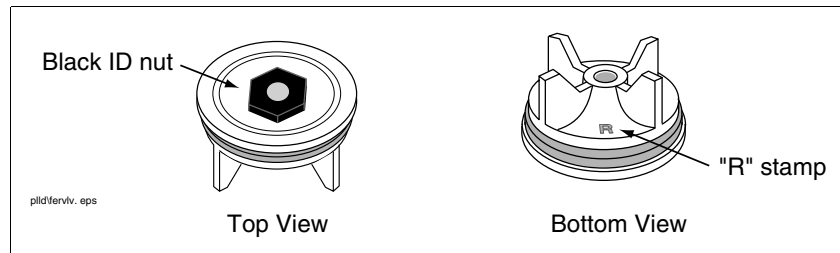


Figure 13. Identifying A FE Petro "R" Style Precision Check Valve

5. Get a watertight cord grip from the transducer installation kit and coat its 1/2" NPT threaded end with UL-Classified, nontoxic pipe sealant suitable for the fuel involved. Screw the cord grip into one of the openings in the weatherproof junction box. Feed the end of the PLLD transducer cable through the cord grip and then tighten the nut to ensure a watertight seal. Connect and seal the pressure transducer wires to the wires from the TLS console as described in 'Epoxy Sealing PLLD Transducer Field Wiring Connections' on page 22.
6. Open the ball valve down line from the pump.

FE PETRO HIGH CAPACITY PUMPS

When installing PLLD in a FE Petro High Capacity pump, a FE Petro Model 'R' Relief Valve (P/N 401330902) must be installed in the pump. Refer to the manufacturer's documentation to verify that this relief valve is present. If the 'R' relief valve is not present install as per manufacturer's instructions.

You will also need to install a reducing tee (customer supplied) in the 3-inch discharge port of the pump with the 2-inch opening facing up. Thread the PLLD transducer into the 2-inch opening of the tee.

⚠️WARNING Seal the NPT threads only with a UL-Classified, nontoxic pipe sealant suitable for the fuel involved (for high-alcohol fuel blend applications, Loctite 564 is recommended). Apply sealant in a manner that prevents it from entering and contaminating hydraulic cavities.

FE PETRO VARIABLE SPEED PUMP SYSTEM MODIFICATIONS

The FE Petro variable speed pump system contains a submersible pump and adjustable frequency drive. For satisfactory operation with the PLLD System, you need to change the following in the adjustable frequency drive as described below:

- Dip switch (SW2) settings
- Rotary switch positions

⚠️WARNING The correct hardware and switch settings must be used for the system to detect leaks less than 3.0 gph. If the correct hardware and switch settings are not used, the system will always pass 0.1 gph tests, but the passing results will be invalid.

IST-VFC Software Versions 1.1 and 1.2

The settings and positions depend on the software version of the FE Petro IST-VFC (Intelligent Submersible Turbine-Variable Speed Controller). To determine the software version of the IST-VFC, remove its cover and check the label on the FE Petro chip, which is on the printed circuit board. The instructions below are for Version 1.1 and 1.2 of the IST-VFC.

Dip Switch SW2

Pole 1 on dip switch SW2 (Figure 14) controls the pump start up time. Set this switch to OFF so that the submersible pump will run at 34 psi for 6 seconds each time it is started. Pole 2 does not affect PLLD operation; it sets the product type for the IST-VFC (ref. Table 1).

Table 1. FE-IST-VFC Product Type Dip Switch (SW2) Settings

Pole 1	Pole 2
OFF (required)	ON-gasoline, OFF-diesel

Rotary Switch

The rotary switch (Figure 14) controls the pump pressure of the submersible pump. As shown in Table 2, use positions 1, 2, 3, or 4 to run the pump at a pressure range compatible with PLLD operation.

NOTICE Do not use positions 0, 5, 6, 7, 8, or 9 with versions 1.1 or 1.2 software.

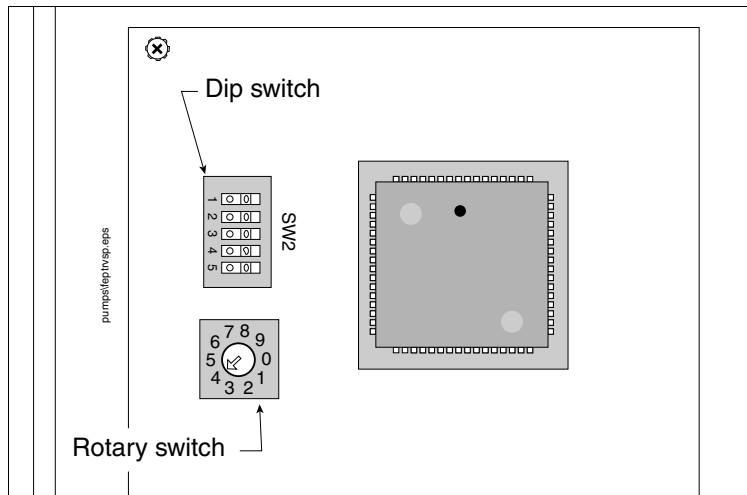


Figure 14. Dip Switch SW2 And Rotary Switch Locations In The FE-Petro IST-VFC Unit

Table 2. FE-IST-VFC Rotary Switch Positions W/V1.1/1.2 Software



Position	Pressure (psi)
1	26
2	28
3	30
4	32

IST-VFC Software Version 1.3

The settings for software version 1.3 are the same as versions 1.1 and 1.2, except that the rotary switch can be set to any position from 1 to 9.

PLLD Transducer Field Wiring Connections

⚠ WARNING For all Red Jacket VSFC applications, you must follow the PLLD/STP wiring procedures outlined in the VSFC Installation Guide (P/N 577013-815).

⚠ WARNING   Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.

 When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

1. Using wire nuts, connect the white and black wires from the PLLD transducer to field wires in the weatherproof junction box (ref. Figure 15). **Be sure to maintain correct polarity between the color-coded or marked field wires and PLLD transducer wires when making all connections. Cut off the transducer shielded ground wire (if present) flush with the cable jacket. Do the same for the cable shield.**

NOTICE Connect the shielded cable drain wire to the ground lug in the intrinsically safe area of the console, not to the transducer!

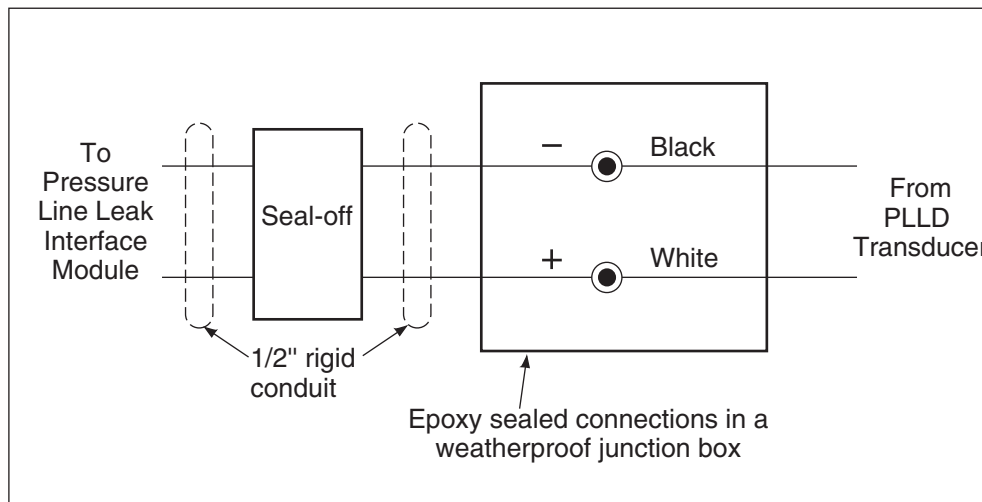


Figure 15. Field Connections Of PLLD Transducer

2. Seal wire nut connections using the epoxy sealant furnished with each PLLD. Use one packet for no more than two wire nut connections. **Ensure the end of the cable jacket is submerged in the epoxy.** Refer to Figure 16 as you prepare epoxy and seal connections.

⚠ WARNING Do not put more than two wire nut connections in one epoxy sealant bag or the connections will not be properly sealed. Improper sealing of the connections will result in inaccurate system readings and possibly false alarms.

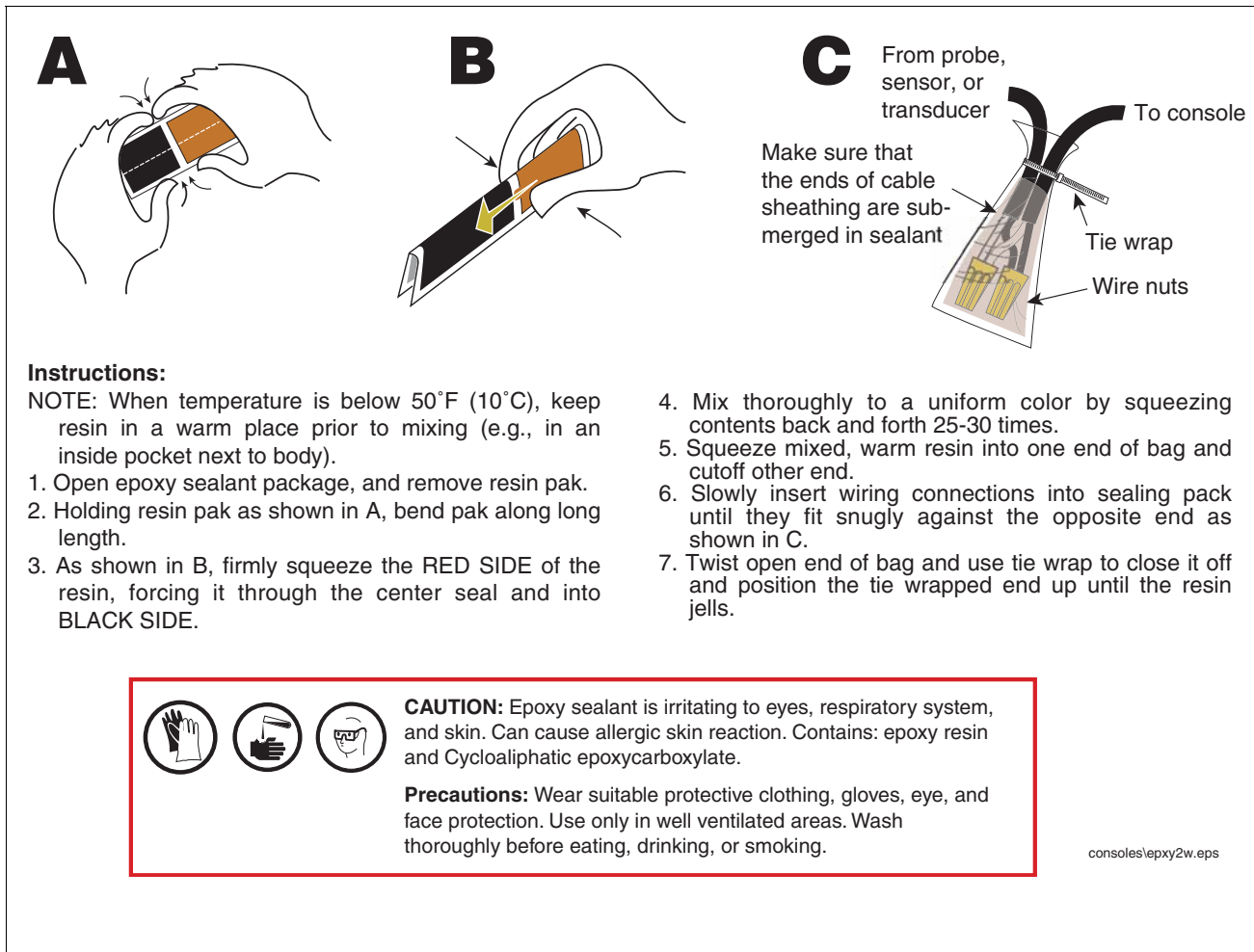


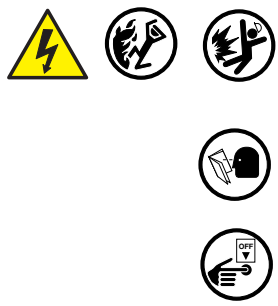
Figure 16. Epoxy Sealing Pressure Transducer Field Connections

PLLD Interface Module Wiring Connections

⚠ WARNING For all Red Jacket VSFC applications, you must follow the PLLD/STP wiring procedures outlined in the VSFC Installation Guide (P/N 577013-815).

Intrinsic Safety Warnings

Circuitry within the PLLD transducer and console barrier form an intrinsically safe, energy-limited system. This system makes the transducer intrinsically safe for use in a Class I, Group D hazardous location. The transducer wiring is intrinsically safe only when connected to TLS consoles.

⚠ WARNING	
	<p>This equipment uses lethal voltages and attaches to accessory components which operate in areas where flammable liquids and vapors may be present.</p> <p>Serious injury or death from shock, explosion, or fire may result if power is on during installation and the device is improperly installed.</p> <p>When installing this product:</p> <ol style="list-style-type: none">1. Read and understand all instructions.2. Turn off, tag, and lockout power to the console, dispensers, and submersible pumps while installing the PLLD system.3. Substitution of components may impair intrinsic safety.4. Do not allow PLLD pump control wires to share conduit with wires from intrinsically safe devices such as probes and sensors.5. Insure that any assembled conduit only enters the console through the properly designated knockouts.6. Intrinsically safe wiring shall be installed in accordance with Article 504-20 of the NEC, ANSI/NFPA 70.

Wiring Tips.

- Be sure all wires are color-coded or carefully marked to identify their source.
- The PLLD Interface module in the console comes with a connector in place. **Do not remove the connector from the module or remove the module from its slot in the console during wiring.** Terminal identifications appear only on the module bracket. Removing the connector from the module increases the risk of wiring errors.
- Label all connectors, using the supplied self-adhesive labels, according to the slot in which the modules are installed.

NOTICE Once a connector has been wired to a module and the console has been programmed, the connector and module cannot be moved to another slot without reprogramming the system.

- Record the location (e.g., Line #1 (regular), Line #2 (super), etc.) of each PLLD wired to a module on the circuit directory inside the console door.

PLLD Interface Module Wiring Connections

WARNING



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.

1. Connect the color-coded or marked wires from each PLLD transducer to the proper terminals on the PLLD Interface module connector starting with position 1 (see Figure 17). Wire each position on the module(s) in order without skipping a position, e.g., 1, 2, 3, 4, etc., not 1,3,4.

NOTICE

The console software will identify PLLD Controller module positions 1-3 (one module) and 4-6 (optional second module, highest in Power bay) with PLLD Interface module positions 1-6. Therefore you must wire the PLLD system so that the STP connected to position 1 on the PLLD Controller module has the PLLD transducer installed that is connected to the position 1 on the PLLD Interface module. The same relationship holds for the remaining 5 positions.

2. Connect the bare wire (shield) to one of the ground lugs in the TLS console only.
3. Maintain correct circuit orientation between the color-coded or marked field wires and connector terminals during wiring.

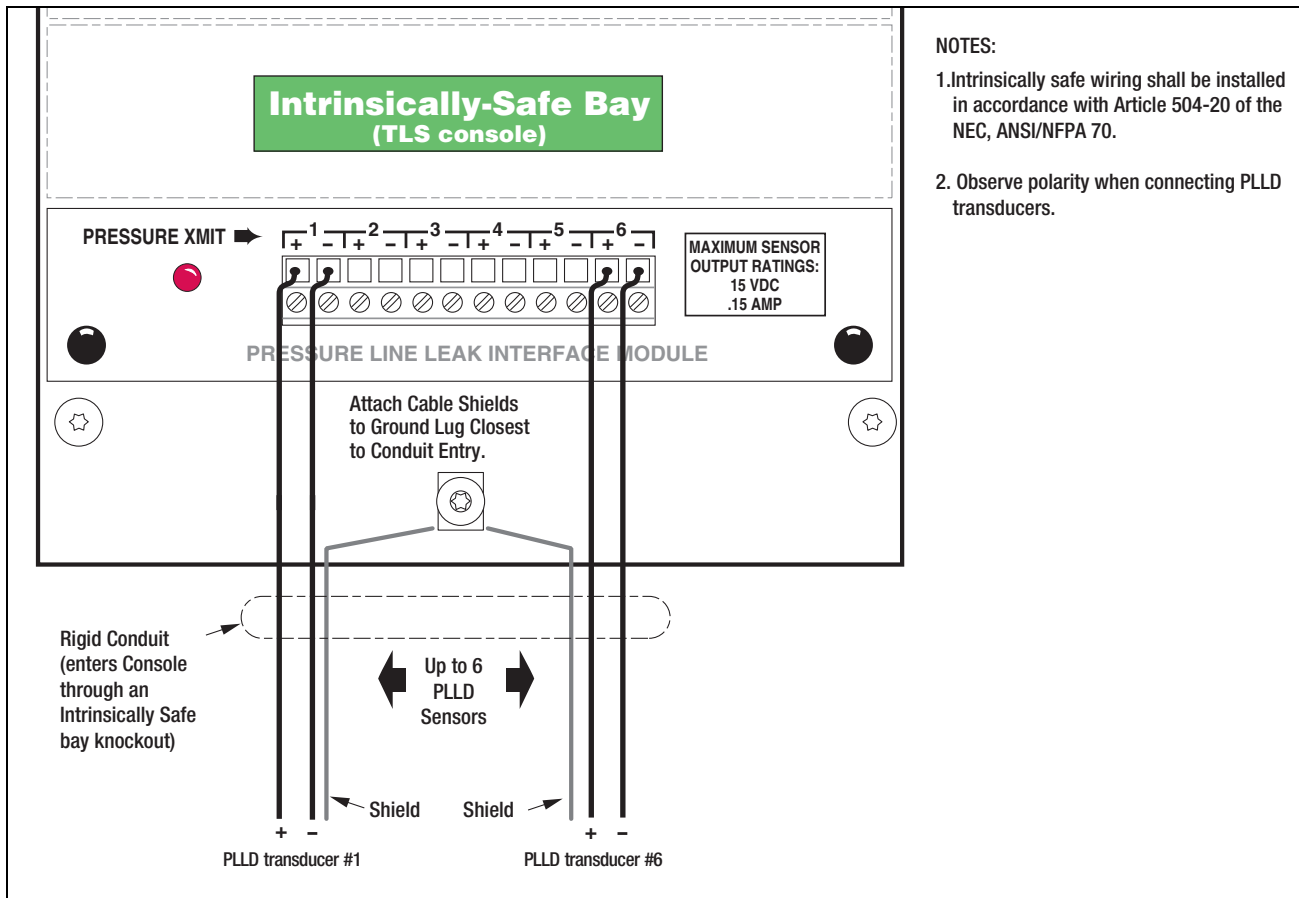


Figure 17. PLLD Interface Module Wiring Connections

PLLD Controller Module Wiring Connections

⚠ WARNING For all Red Jacket VSFC applications, you must follow the PLLD/STP wiring procedures outlined in the VSFC Installation Guide (P/N 577013-815).5).

Wiring Tips

The console must be able to detect when dispensers are switched On or Off so it only initiates line leak tests when the dispenser is switched Off. The console must also be able to start the submersible pump to perform a line leak test, and shut off the pump if a leak is detected.

⚠ WARNING Dispensers and TLS console must be wired to the same leg of incoming power at the main electrical panel; otherwise damage may result to both.

The console, when wired correctly, will control the pump independent of the dispenser control circuits. It is imperative that when the emergency stop switch is wired and tested the console's pump control circuitry **CANNOT** start up the pump. To ensure that the pumps are unable to be activated in an emergency situation, it is best to have the emergency stop switch interrupt pump power at the circuit breaker panel via shunt breakers.

NOTICE For consoles powered by a 240 Vac source, use a 240 Vac Pressure Line Leak Controller Module (P/N 847490-507) with relay contacts rated at 240 Vac, 2 A maximum and a 240 Vac, and if necessary, a 4 Relay Output Module (P/N 847490-500).

Example Wiring Diagrams

PLLD pump control wiring varies depending on the pump manufacturer's relay control box. Refer to the appropriate wiring diagram example below (circuit diagrams are for switched 'hot' dispensers):

- Red Jacket (ref. Figure 18, Figure 19, and Figure 20)
- Non-Red Jacket (ref. Figure 21)
- Manifolded tanks (ref. Figure 22, Figure 24, and Figure 25)
- Gilbarco dispenser isolation box (ref. Figure 23)

Wiring Connections

⚠ WARNING



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.

1. If you have two PLLD Controller modules, Position 1 is the first position on the module that is physically lower in the console's Power bay and Position 4 is the first position in the module that is physically higher in the Power bay.

The console software will identify PLLD Controller module positions 1-3 (one module) and 4-6 (optional second module, highest in Power bay) with PLLD Interface module positions 1-6. Therefore you must wire the PLLD system so that the STP connected to position 1 on the PLLD Controller module has the PLLD transduc-

- er installed that is connected to the position 1 on the PLLD Interface module. The same relationship holds for the remaining 5 positions.
2. Connect the AC line from the “Dispenser ON Switch” to the wire leading to the PI (PUMP IN) terminal on the PLLD Controller module.
 3. Connect the wire from the PO (PUMP OUT) terminal on the Controller module to the hot side of the STP control box relay (or S2 relay connection if a Red Jacket relay control box) side of the pump contactor.
 4. Connect the PR (PUMP RETURN/AC NEUTRAL) wire from the Controller module to the AC neutral line (ref. Figure 18, Figure 22). For other systems, PR is connected to the neutral side of the pump contactor relay and to the AC neutral line (ref. Figure 21).
 5. Connect the AC line (115 VAC) from the main power panel to the L1 terminal on the Controller module.
 6. If installing a system with manifolded product lines and multiple tanks, perform the following additional steps (ref. Figure 22):
 - a. Connect a wire from a “NO” terminal on the 4-Relay output or I/O Combination module to the AC line side of the pump contactor for the “slave” pump.
 - b. Connect a wire from the “C” terminal on the 4-Relay output or I/O Combination module into the wire connecting the “L1” terminal on the PLLD Controller module to 120 volt AC line.

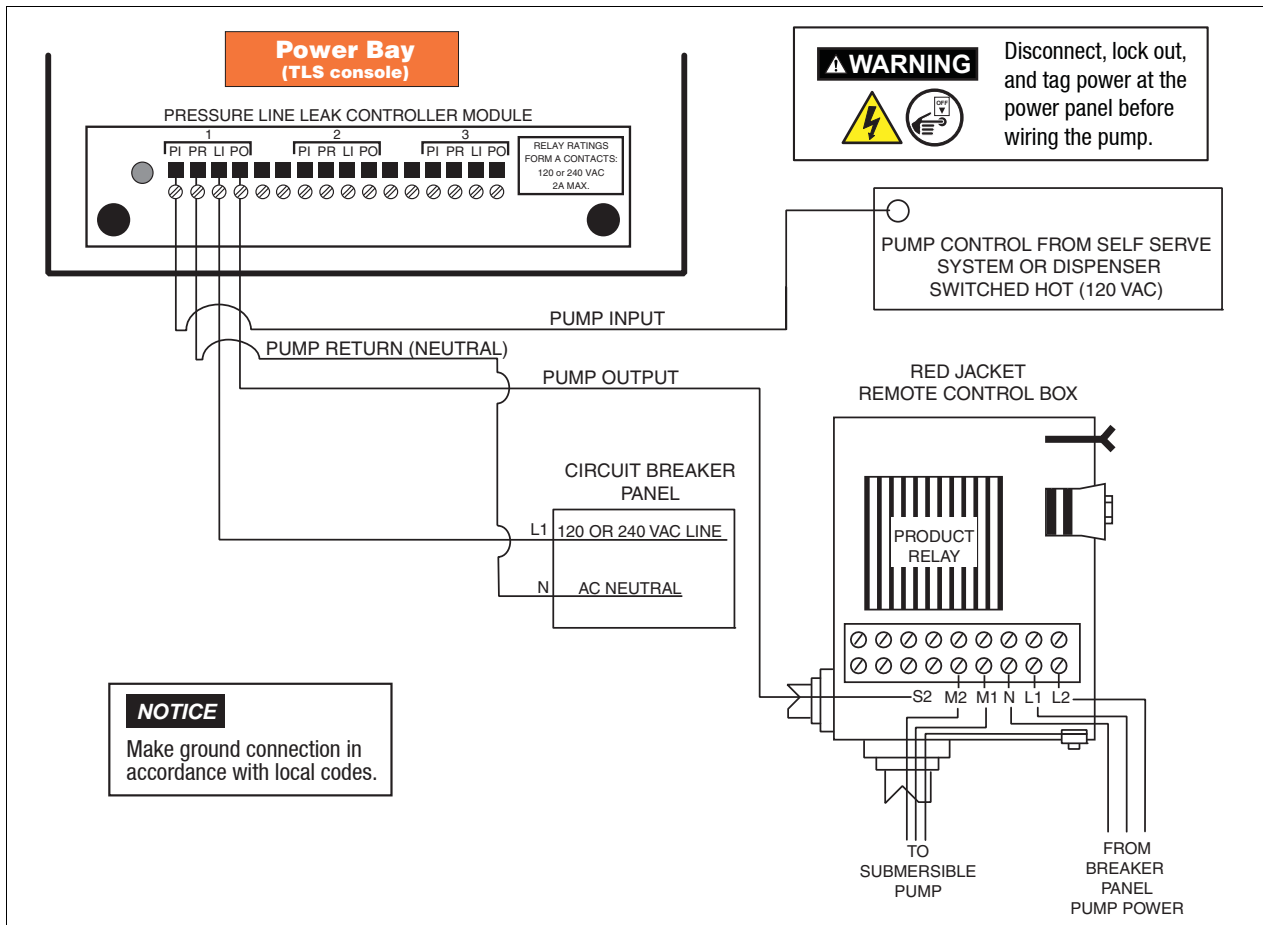


Figure 18. PLLD System And Pump Control Diagram For Red Jacket Relay Control Box

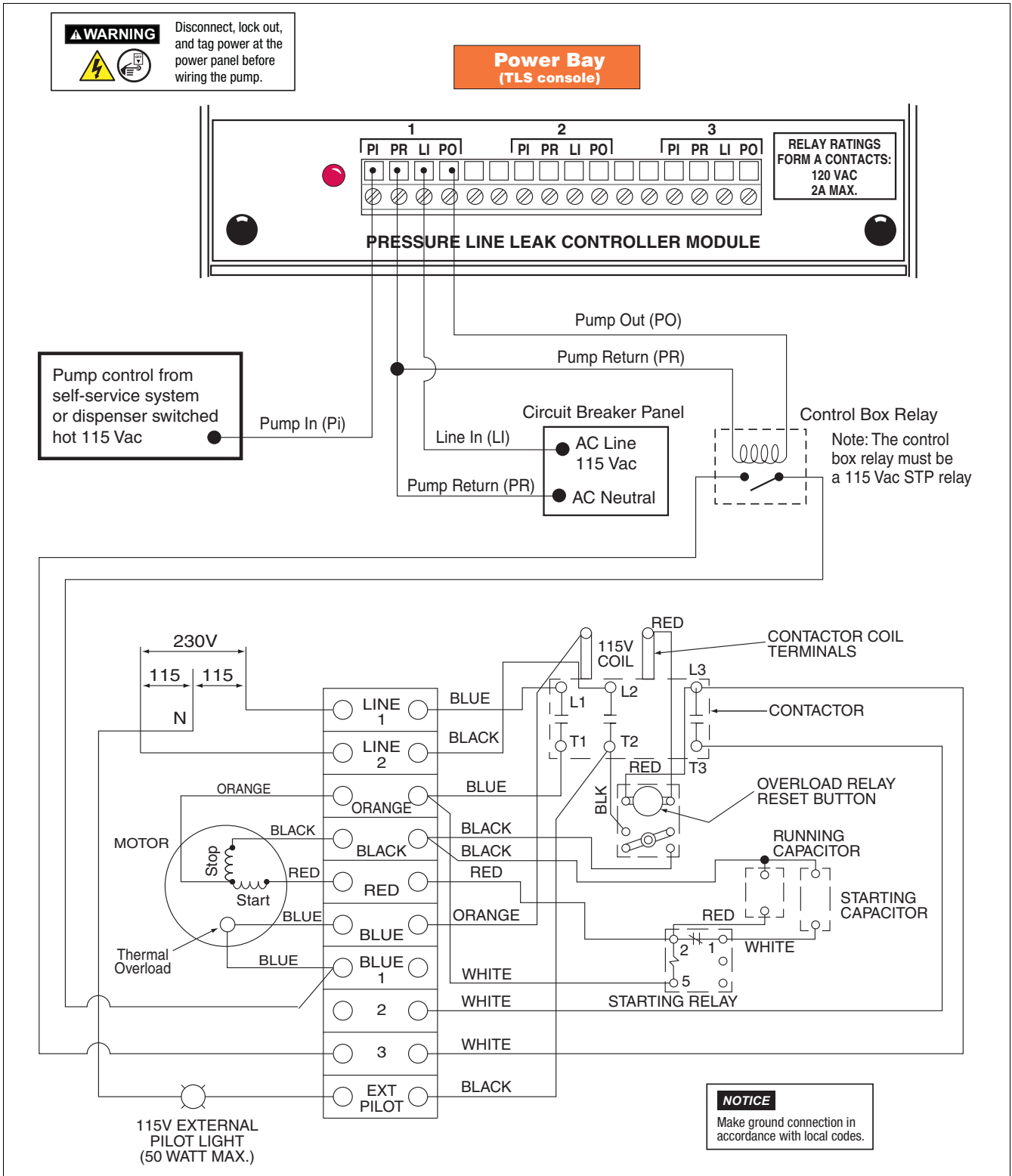


Figure 19. Red Jacket Maxxum Big-Flo Single-phase Wiring

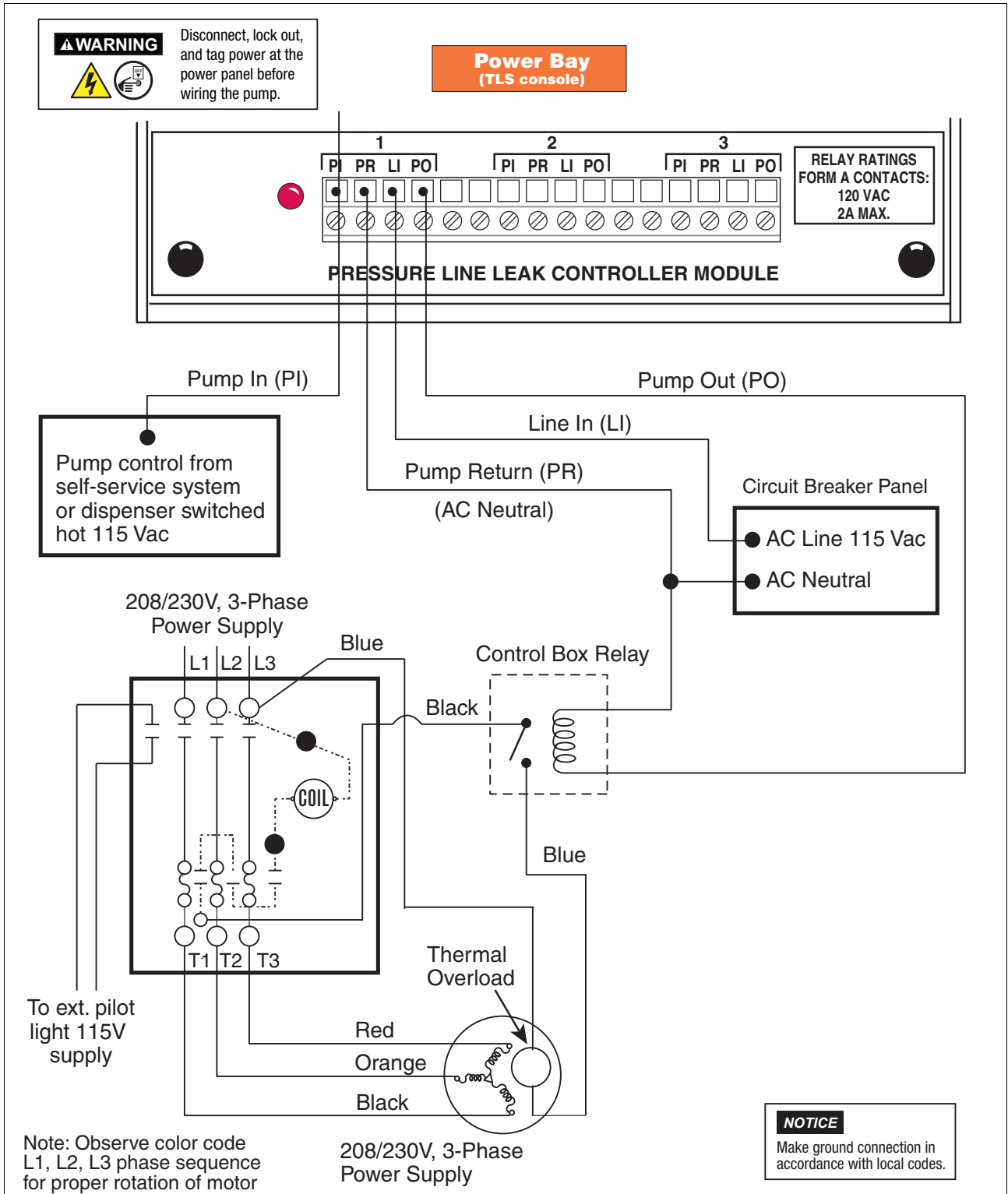


Figure 20. Red Jacket Maxxum Big-Flo 3-Phase Wiring

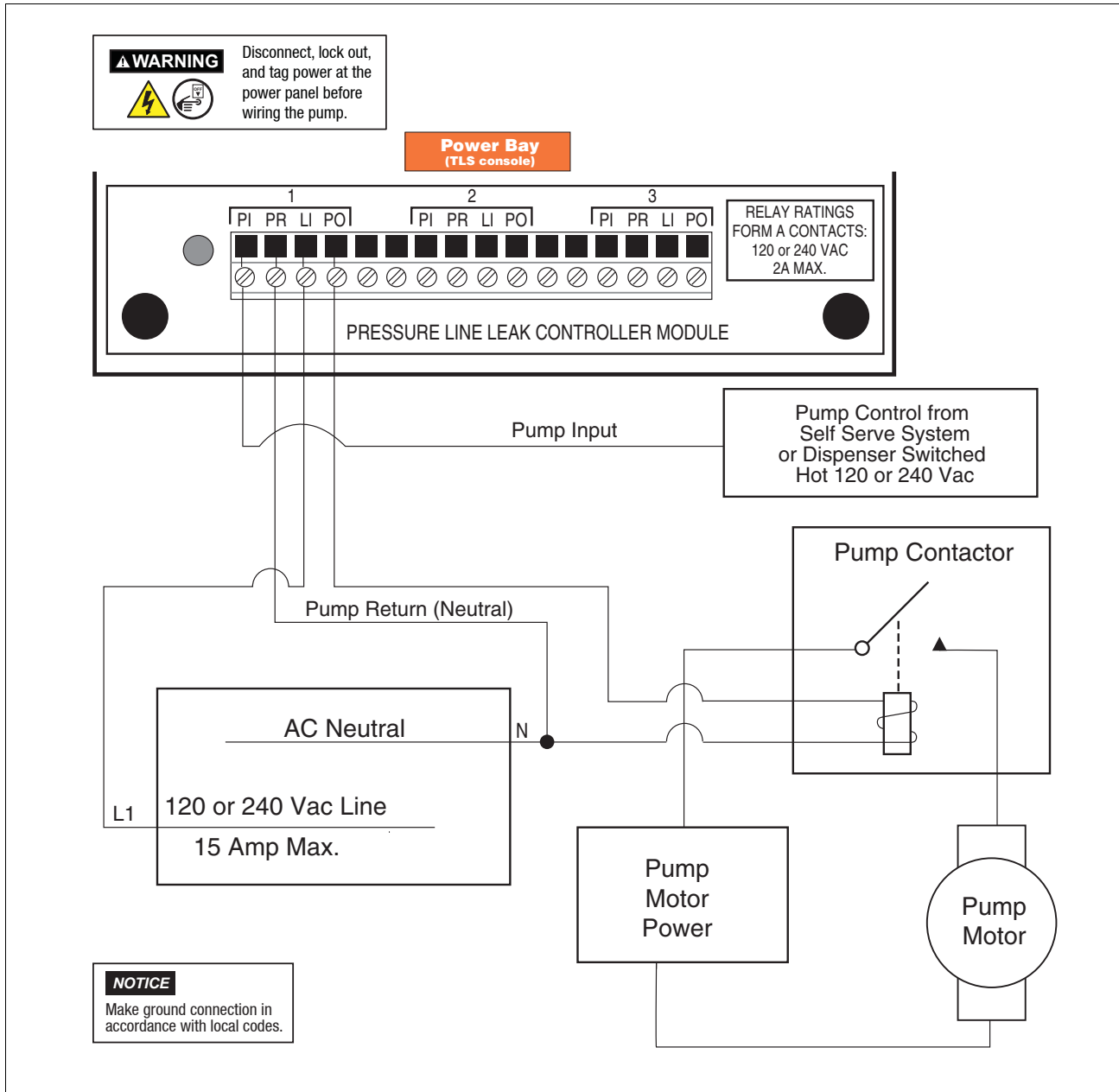


Figure 21. PLLD System And Pump Control Diagram For Non-Red Jacket Relay Control Box

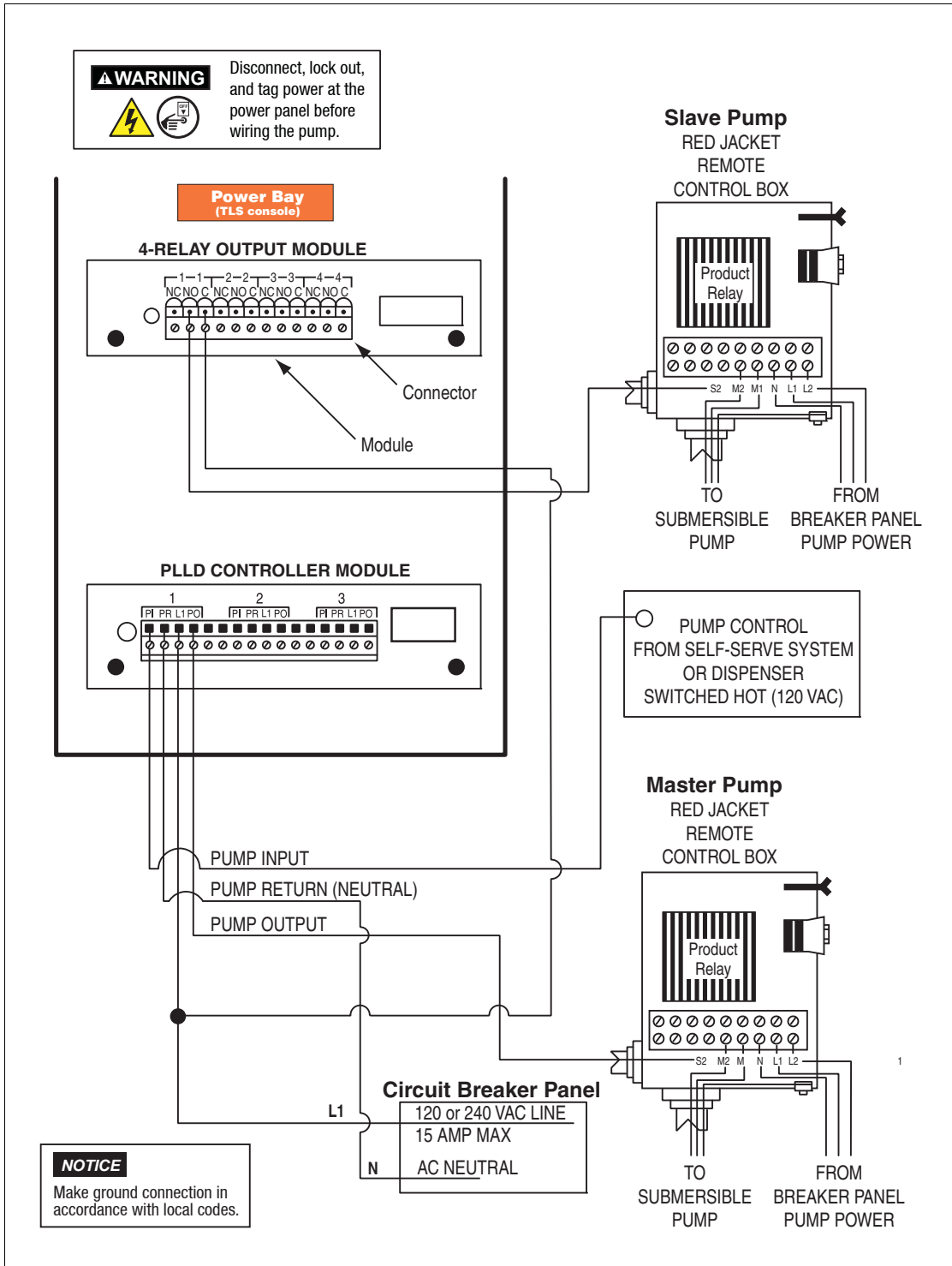
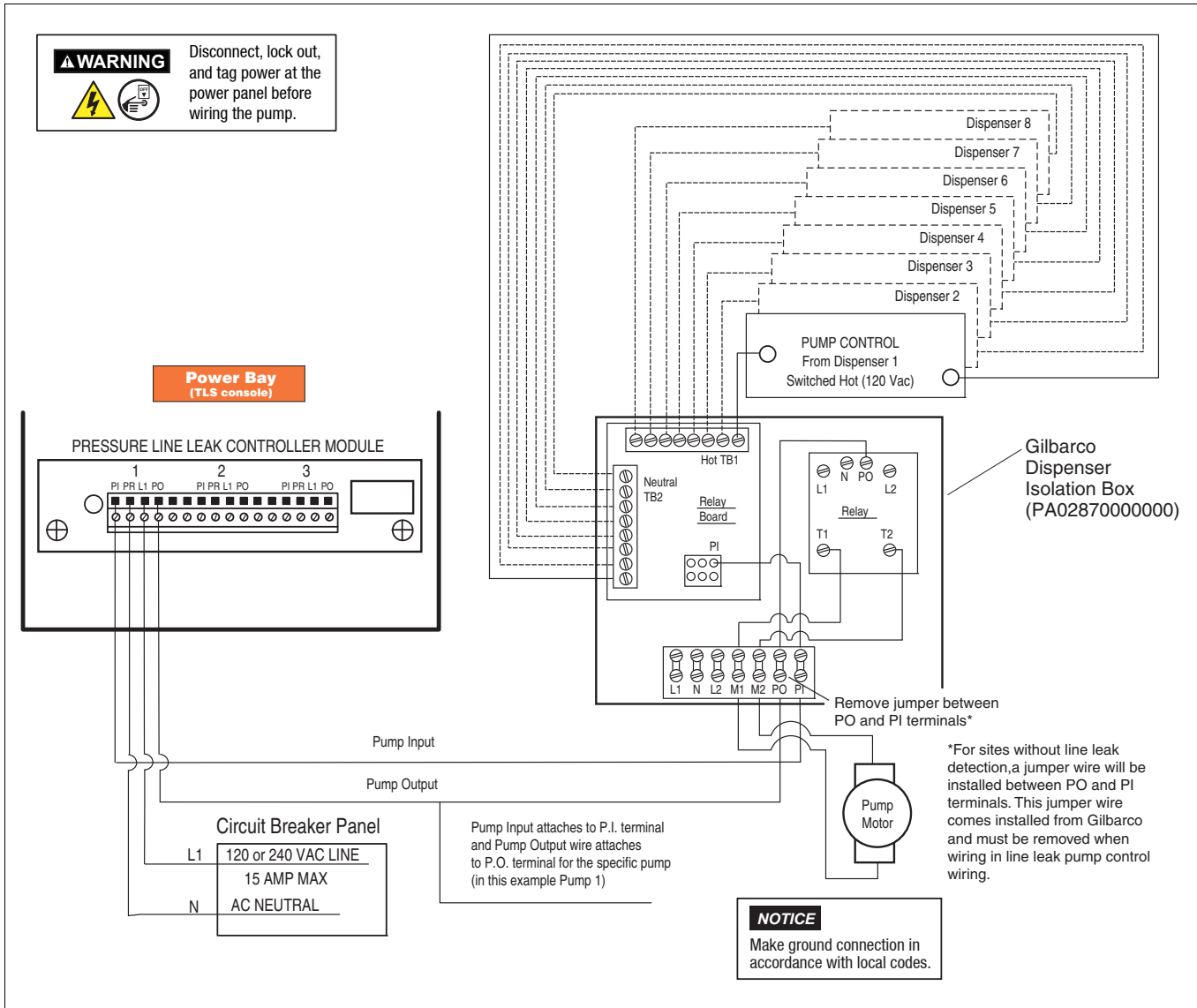


Figure 22. Wiring diagram - Manifolded Product Lines PLLD - Multiple Tanks (Red Jacket Relay Control Box Shown In This Example)



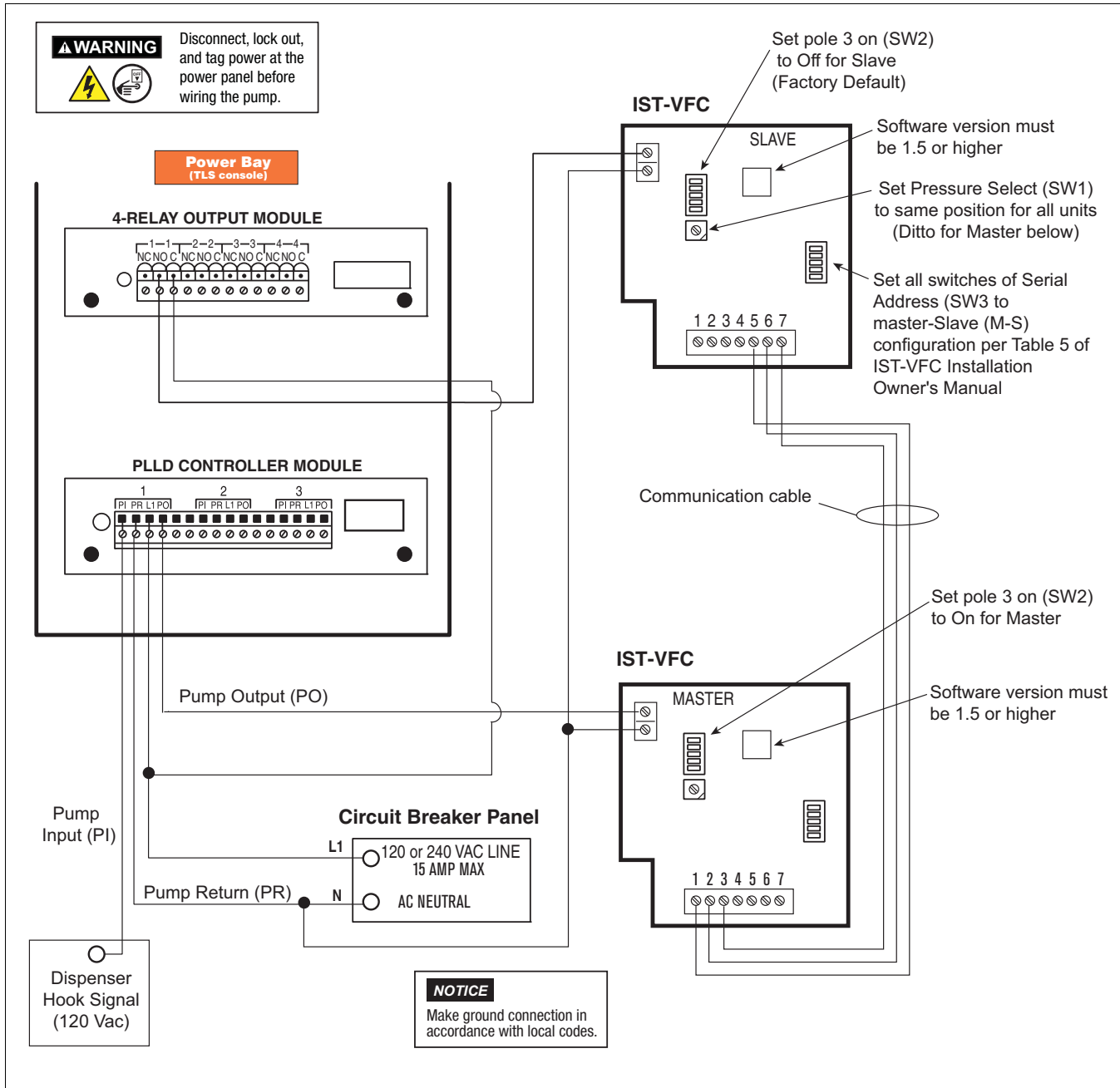


Figure 24. Manifolder Product Lines - Dual FE Petro IST-VFC Controllers (Requires TLS Software Version 22 Or Higher)

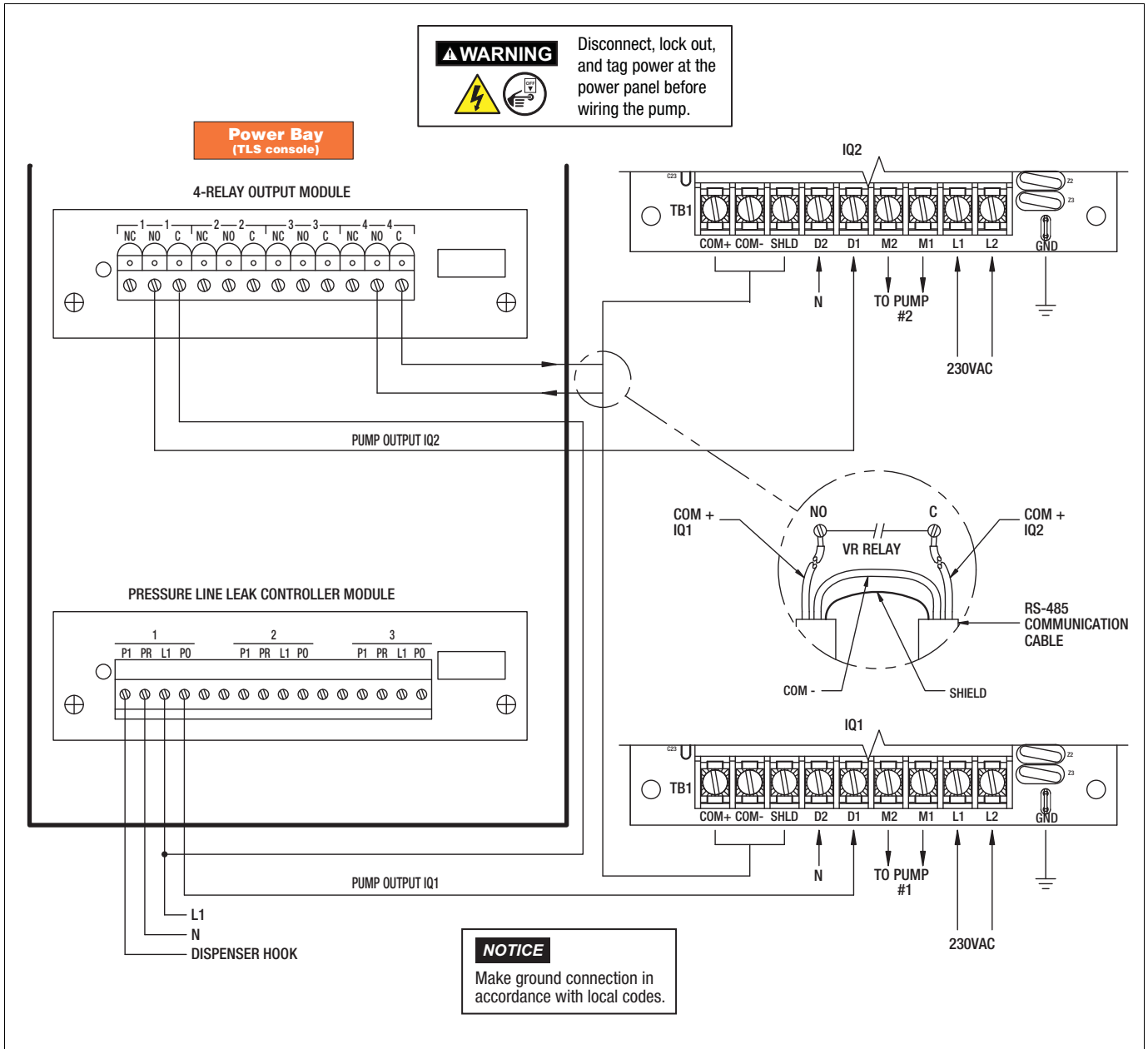


Figure 25. Manifolded Product Lines - Dual Red Jacket IQ Controllers

PLLD System Checkout

⚠ WARNING Do not switch On power to the console. This must be done by an Authorized Service Contractor during the warranty checkout and start-up procedure! An Authorized Service Contractor must program the PLLD set-up information into the console before beginning these PLLD system checks.

PLLD System Checkout Procedure

Repeat the four steps below for each PLLD monitored line.

1. VENT THE LINE



Disconnect, lock out, and tag all AC power to the TLS console, dispensers and submersible pumps.



When servicing equipment, use non-sparking tools and use caution when removing or installing equipment to avoid generating a spark.

- a. Vent the line to zero.
- b. Reseal the line.
- c. Turn On power to the STP.

⚠ WARNING If the pump has a functional element or PressurStat, verify that it is not leaking!

2. RED JACKET STANDARD, QUANTUM, AND MAXXUM PUMPS WITH PLLD TRANSDUCER AND PRESSURSTAT ONLY

⚠ WARNING You *must* reset the Pressurstat's relief pressure as part of the PLLD system installation.

1. Unscrew the protective brass cap from the adjustment screw (Figure 26).
2. When the adjustment screw is fully down, the relief pressure is approximately 40 psi.
3. Install a pressure gauge in the line.
4. Set the relief pressure to 20 - 25 psi (verify the relief pressure by using the console - [refer to "5. Enable the Line for Dispensing" on page 37 for the procedure to obtain pressure readings]).
5. Check the sealing surface for the cap's o-ring and the condition of the o-ring. Clean or replace as required.
6. Replace the brass cap and hand tighten (the o-ring completes the seal between the body and cap).

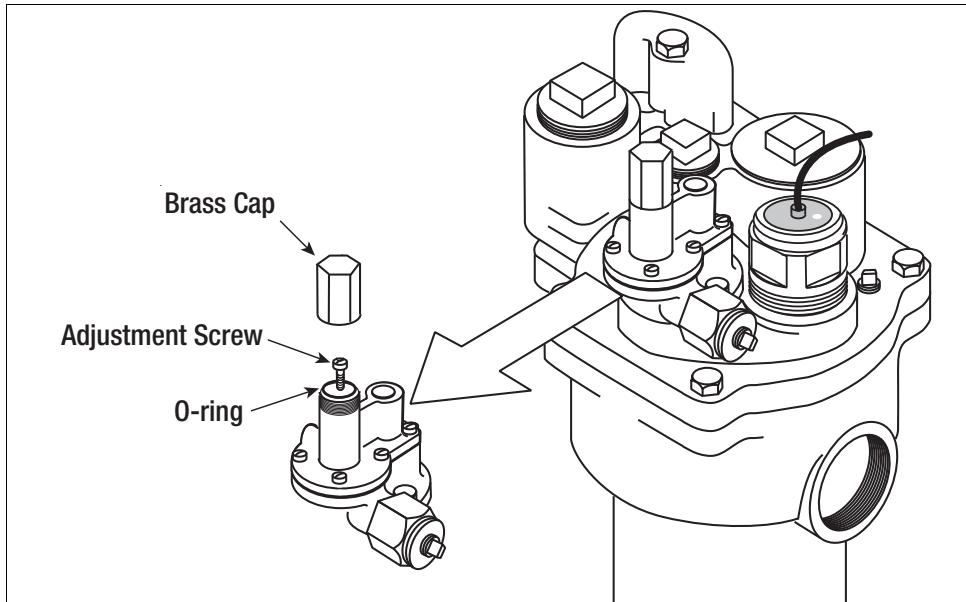


Figure 26. Pressurstat Adjustable Valve Assembly (Red Jacket Standard Pump Shown)

3. DETERMINE PLLD TRANSDUCER PRESSURE OFFSET

New transducers are now factory sealed and their internal chamber cannot be equalized to atmospheric pressure by opening a vent screw as in the past. The Pressure Offset test procedure described in this step **must** be performed when using new PLLD transducers with serial numbers of 100,000 or above, in sites located at altitudes above 2,000 feet. Note: this procedure can also be used with transducers having serial numbers below 100,000 instead of using the vent screw to equalize pressure.

Before this procedure is performed, the pressure in the line **MUST** be vented to zero. It is recommended that this procedure be performed after installing the transducer, before energizing the STP.

Run Pressure Offset Test

Press MODE to display DIAGNOSTIC MODE, then FUNCTION until you see the message:

```

PRESSURE LINE LEAK DIAG
PRESS <STEP> TO CONTINUE
    
```

Press STEP until you see the display below

```

Q 1: PLLD NUMBER 1
P OFFSET TEST <ENTER>
    
```

Press ENTER and the results of the last test displays ('No Test Data Available' message appears if this is the first test):

```

Q 1: PRESS OFFSET TST PSI
NO TEST DATA AVAILABLE
    
```


Press STEP:

**Q 1: START P OFFSET TEST
PRESS <ENTER>**

To start the test, press ENTER. During the test this message appears:

**Q 1: PRESSURE OFFSET TEST
MEASURING**

The Pressure Offset test results message appears when the test ends:

**Q 1: PRESSURE OFFSET TEST
DONE - OFFSET: +XX.X PSI**

You can print out the test result if you have an optional printer. If you do not have a printer, record the offset value for the transducer.

The maximum offset pressure range is ± 5 psi. If the Pressure Offset is greater than ± 5 psi, repeat the test. If the Pressure Offset is again out of range, either the line pressure is not completely vented or there is a hardware problem. Please consult the PLLD Alarm Quick Help guide's "Line Equipment Fault Alarm" discussion for troubleshooting information.

Entering the Pressure Offset Value for the PLLD Transducer

Press MODE to return to the SETUP MODE, then FUNCTION until you see the message:

**PRESSURE LINE LEAK SETUP
PRESS <STEP> TO CONTINUE**

Press STEP until you see the message:

**Q 1: PLLD NUMBER 1
PRESSURE OFFSET: +XX.X**

Press CHANGE and enter the Pressure Offset value for transducer Q1. If necessary, press the left arrow key to change the sign (+ or -). Press ENTER to confirm the entry. Note: enter the Offset value **exactly** as displayed in the Offset test result message (including + or - sign).

4. PURGE AIR FROM THE LINE

Follow accepted procedures, or appropriate pump manual, to purge all air from the product line being enabled for dispensing.

5. ENABLE THE LINE FOR DISPENSING

After installing the PLLD system, the console will not enable dispensing from a line until a 3.0 gph test on the line has been passed. In this step, as you run the required 3.0 gph test, you will also verify that the Pump On and Pump Off pressures are within their proper operating ranges.

Return to the Diagnostic Mode, by pressing the MODE key until this message appears:

**DIAG MODE
PRESS <FUNCTION> TO CONT**

Press the FUNCTION key until this message appears:

**PRESSURE LINE LEAK DIAG
PRESS <STEP> TO CONTINUE**

Press the STEP key to view the pump status. Because a passing line test has not been run, the line status will be disabled and you should see the message:

**Q X: Product Label
DISPENSING DISABLED**

In the display shown, Q = device code for PLLD, X = line number, Product Label = name assigned to product in tank setup, and Dispensing Disabled = current line status.

Press ENTER to run a 3.0 gph line test. During the "Running Pump" state, verify that the Pump On pressure is within the range 22 - 60 psi then drops to within the range 18 - 26 psi during the "Test 3.0" and "Test Complete" states:

**QX: XX.XX PSI PUMP OFF
TEST COMPLETE HANDLE OFF**



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