

WPLLD

Site Prep and Installation Guide

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1 Introduction

This manual contains instructions on how to install the Veeder-Root Wireless Pressurized Line Leak Detection (WPLLD) System for use with TLS-350 Series Consoles. WPLLD sensors can be used with FE Petro™ or Red Jacket™ Pumps that have up to a 2-inch discharge.

Contractor Certification Requirements

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

Level 1 Contractors holding valid Level 1 Certification are approved to perform wiring and conduit routing, equipment mounting, probe and sensor installation, tank and line preparation, and line leak detector installation.

Level 2/3 Contractors holding valid Level 2 or 3 Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root Tank Monitoring Systems, including Line Leak Detection and associated accessories.

Warranty Registrations may only be submitted by selected Distributors.

Related Manuals

576013-879 TLS-3XX Series Site Prep and Installation Manual








577013-465 Line Leak Application Guide

577013-481 WPLLD Modules- Installation Manual

577013-727 WPLLD Alarm Quick Help Guide

Safety Precautions

The following safety symbols are used throughout this manual to alert you to important safety hazards and precautions. Know what these symbols mean before using this manual to install the WPLLD system.

 <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>CLEAN WORK AREA Dispose of fuel soaked materials properly and not into trash barrels that may be used by customers.</p>	 <p>APPROVED CONTAINERS Use nonbreakable, clearly marked containers, suitable for collecting and transporting hazardous fuels during service.</p>
 <p>WARNING Heed the adjacent instructions to avoid equipment damage or personal injury.</p>	

Before You Begin

1. Install the three WPLLD modules below in the TLS-350 Series Console following instructions shipped with each module. If these modules are not installed, the console will not be able to accept inputs from the WPLLD system.

- Wireless PLLD Communication Module (Part no. 847490-309)
- Wireless PLLD AC Interface Module (Part no. 847490-209)
- Wireless PLLD Controller Module (Part no. 847490-208)

IMPORTANT! WPLLD modules are not interchangeable with PLLD modules.

2. A 1-1/2" socket is recommended for installing the SwiftCheck™ valve in small manways (24").
3. If you are running 0.1 gph or 0.2 gph tests, be sure you have purchased the Software Enhancement Module which provides this capability. **IMPORTANT! If the correct hardware for precision line leak testing is also not installed, the system will not detect leaks less than 3.0 gph. In this situation, the system will always pass 0.2 and 0.1 gph tests, but the results will not be valid.**
4. Ensure that the submersible pump is properly grounded per the manufacturer's instructions.
5. Ensure that there is at least 4 inches clearance above the submersible pump capacitor housing to allow room to install the WPLLD components.
6. Ensure that you have UL-classified, non-toxic pipe sealant suitable for the fuel(s) involved.

System Description

The WPLLD System performs 3.0 gph leak tests following each dispense. If the appropriate software enhancement module is installed, the WPLLD System also allows line tests at full pump pressure for highly accurate 0.2 and 0.1 gph tests. Since WPLLD executes these tests automatically, there is no need for separate annual line leak testing.

Table 1-1 shows required kits and check valves for WPLLD operation, by pump type. Table 1-2 through Table 1-5 list the contents of the five WPLLD system kits and Table 1-7 lists the contents of the Non-Vented SwiftCheck Valve kit.

Table 1-1.- WPLLD Requirements for Gross and Precision Testing

Required Console Modules	Pump Type	3.0 GPH Only Testing Check Valve & Kit Requirements		3.0, 0.2 & 0.1 GPH Testing Check Valve & Kit Requirements		Additional Kit Required for Manifolded Lines	
		Check Valve Required	WPLLD Kit Required	Check Valve Required	WPLLD Kit Required	Single Tank w/ 2 STPs	Two Tanks w/ STP in Each
1, 2, or 3 WPLLD Controller Modules (each controls up to 3 STPs) and 1 WPLLD AC Interface Module and 1 WPLLD Comm Module	Red Jacket Standard ¹	V/R SwiftCheck (in WPLLD kit)	849490-002	V/R SwiftCheck (in WPLLD kit)	849490-002	Non-Vented Swift-Check Valve for Slave Pump V/R Kit P/N 330020-416 And Interlock Relay	Non-Vented Swift-Check Valve for Slave pump V/R Kit P/N 330020-416
		Red Jacket Pressurstat™ Assy. P/Ns 323-006-5, 323-001-5, 323-007-5 (AG), or 323-002-5 (AG)	849490-003	Not Supported	Not Supported		
	Red Jacket Quantum ¹	Red Jacket Pressurstat Assy. P/Ns 323-006-5, 323-001-5, 323-007-5 (AG), or 323-002-5 (AG)	849490-005	Not Supported	Not Supported		
		Red Jacket SpikeCheck™ Assy. P/N 388-080-5		Red Jacket SpikeCheck Assy. P/N 388-080-5	849490-005		
	The Red Jacket	None Required	849490-006	None Required	849490-006		
	FE Petro	FE Petro Model R P/N 400988932 (see Figure 4-12 below), and replacement O-ring for the valve housing	849490-001	FE Petro Model R P/N 400988932, and replacement O-ring for the valve housing	849490-001		

¹IMPORTANT! If using WPLLD with this submersible pump equipped with a Healy Mini-Jet System, also order one Flexible Fuel Line (P/N 329607-002) per system.

Table 1-2.- WPLLD System 849490-001

Quantity	Description	Part Number
1	WPLLD transducer	330786-001
1	Sensing Line*	330770-001
1	Pump Fitting*	514100-338
1	Shield*	330804-001
1	Capacitor Cover Bracket*	330805-001
2	Screws*	510500-457
1	Connector*	576008-056
1 sht.	WARNING Tags	329801-001
1	Site Preparation and Installation Guide	576013-923

Table 1-2.- WPLLD System 849490-001

Quantity	Description	Part Number
1	O-ring (Line Leak Sensor)*	512700-228
1	Label	331058-001

*Contained in FE Petro Install Kit: 330020-096

Table 1-3.- WPLLD Systems 849490-002 and 849490-004

Quantity	Description	Part Number
1	Wireless Line Leak Sensor	330786-001
1	SwiftCheck Valve ¹	330773-001
1	Sensing Line*	330772-001
1	Shield*	330804-001
1	Capacitor Cover Bracket*	330805-001
2	Screws*	510500-457
1	Connector*	576008-056
1 sht.	WARNING Tags	329801-001
1	Site Preparation and Installation Guide	576013-923
1	O-ring (Line Leak Sensor)*	512700-225
1	Label	331058-001

¹The 849490-004 systems require that a SwiftCheck Valve be purchased separately.

*Contained in Red Jacket Install Kit: 330020-099

Table 1-4.- WPLLD System 849490-003

Quantity	Description	Part Number
1	Wireless Line Leak Sensor	330786-001
1	Sensing Line*	331069-001
1	Pump Fitting*	514100-338
1	Shield*	330804-001
1	Capacitor Cover Bracket*	330805-001
2	Screws*	510500-457
1	Connector*	576008-056
1 sht.	WARNING Tags	329801-001
1	Site Preparation and Installation Guide	576013-923
1	O-ring (Line Leak Sensor)*	512700-225
1	Label	331058-001

*Contained in Install Kit: 330020-279

Table 1-5.- WPLLD System 849490-005

Quantity	Description	Part Number
1	Wireless Line Leak Sensor	331474-015
1	Sensing Line*	331654-003
1	Pump Fitting*	514100-338
1	Adaptor*	331642-001
10	Tie Wrap	510901-337
1	Connector*	576008-056
1 sht.	WARNING Tags	329801-001
1	Site Preparation and Installation Guide	576013-923
1	O-ring (Line Leak Sensor)*	512700-225
1	Shield*	330804-001
1	Capacitor Cover Bracket*	330805-001
2	Screws*	510500-457
1	Label*	331058-001

* Contained in Install Kit 330020-412

Table 1-6.- WPLLD System 849490-006

Quantity	Description	Part Number
1	Wireless Line Leak Sensor	331474-015
1	Sensing Line*	410138-001
1	Pump Fitting*	514100-338
1	Adaptor*	331642-001
10	Tie Wrap	510901-337
1	Connector*	576008-056
1 sht.	WARNING Tags	329801-001
1	Site Preparation and Installation Guide	576013-923
1	O-ring (Line Leak Sensor)*	512700-225
1	Shield*	330804-001
1	Capacitor Cover Bracket*	330805-001
2	Screws*	510500-457
1	Label*	331058-001

* Contained in Install Kit 330020-477

Table 1-7.- Non-Vented SwiftCheck Valve Kit 330020-416

Quantity	Valve Type
1	Non-Vented SwiftCheck Valve
1	Warning note

2 Site Considerations

As you prepare the site, you need to consider:

- Stage II Vapor Recovery system
- Submersible pump compatibility
- Piping runs
- Manifolded product lines

Stage II Vapor Recovery

If there is a Stage II Vapor Recovery system installed that includes a device in the pressurized piping, such as a Healy Mini-Jet™, see “WPLLD Installation with Stage II Vapor Recovery Systems” on page 4-14 for installation guidelines.

Submersible Pumps (STPs)

For proper WPLLD operation, the STP must be approved for use with our line leak detection system. Refer to the latest version of the Veeder-Root Line Leak Application Guide (P/N 577013-465) for approved submersible pumps.

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 cause inaccurate leak test results.

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 WPLLD System) can prevent the WPLLD System from detecting line leaks in the area of the pipeline downstream from the check valve.

Manifolded Product Lines

If the WPLLD system will be used on manifolded product lines, see “Manifolded Product Line WPLLD Installation” on page 4-12 for installation instructions.

Wire Length

Improper system operation could result in potential environmental and health hazards if the WPLLD transmitter-to-console wire runs exceed 1000 feet.

Pump Power

In order for WPLLD to function reliably, each submersible pump must use the **same** phase of 240 Vac power. If pumps are using different phases, they **MUST** be rewired to use the **same** phase.

3 Running Conduit/Wiring for WPLLD System

WARNING



TURN OFF, TAG, AND LOCKOUT POWER TO THE CONSOLE AND SUBMERSIBLE PUMPS WHILE INSTALLING THE WPLLD SYSTEM.

Use only supplied service parts to avoid compromising safety.

Do not allow WPLLD pump control wires to share conduit with wires from intrinsically safe devices such as probes and sensors.

Ensure that any assembled conduit only enters the console through the properly designated knockouts.

Wiring must comply with all applicable requirements of the National Electrical Code; federal, state, and local codes; and any other safety codes.

WPLLD Controller Module

PUMP POWER WIRING



1. Turn Off, tag, and lockout all AC power to the console, dispensers and submersible pumps.
2. Run conduit from the Power Bay of the console to the main power panel.
3. For each line to be monitored, pull two #14 AWG wires (one black and one white wire are recommended) between the 15 A circuit breaker on the main power panel and the Power bay of the console. Or you may pull two #14 AWG wires (one black and one white) from the 15 A circuit breaker on the main power panel to the Power bay of the console, and jumper to these wires using approved wire nuts for each WPLLD Controller Module.

PUMP CONTROL WIRING

1. Run conduit from the Power Bay of the console to the submersible pump relay control box. The conduit must be large enough to fit two #14 AWG wires for *each* pump control leg you are installing.

IMPORTANT! There are knockouts for ¾-inch, 1-inch or 1¼-inch conduit in the console. When deciding on the size and number of conduits required, consider the number of wires entering the console and code requirements.

2. Pull two #14 AWG color-coded or marked wires for each Wireless PLLD Module between the Power bay of the console and the submersible pump relay control box.

IMPORTANT! Since wiring for multiple pump controls may be entering the console through the same conduit opening, **be sure to color code or mark each wire to identify its source!**

WPLLD AC Interface Module



1. Turn Off, tag, and lockout all AC power to the console, dispensers and submersible pumps.
2. Run conduit from the Power bay of the console to the 240 Vac source supplying the STPs. Verify submersible pumps are using the **same** phase of 240 Vac power. If necessary, rewire them to the **same** phase.
3. Connect two non-isolated (i.e. not separated from main power by a transformer or other device) 240 Vac lines to the “L1” and “L2” terminals on the “AC” plug on the Wireless PLLD AC Interface Module in the Power bay of the console as shown in Figure 3-1. Note that the unlabeled terminal on the far right is not used. (Affix the warning label provided in the Installation Kit onto the circuit breaker panel to indicate that WPLLD is using this circuit.)

IMPORTANT! We strongly recommend that you use a separate dedicated 2-pole circuit breaker for the 240 Vac source (size in accordance to NEC requirements) because if you use a circuit breaker which is also supplying power to a submersible pump, any time the power to this pump is disabled it will result in a shutdown of all pumps which have WPLLD sensors installed.

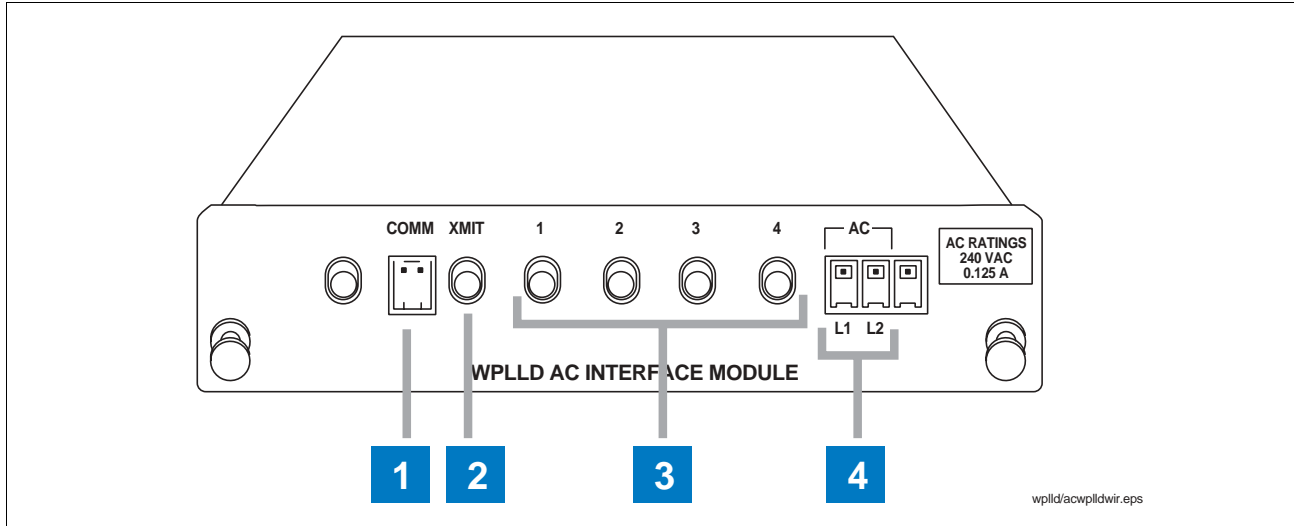


Figure 3-1. WPLLD AC Interface Module

Legend for numbered boxes in Figure 3-1:

- 1 Outputs communications from WPLLD transducers to WPLLD Comm Module in console.
- 2 XMT LED flashes when information is received from a WPLLD transducer.
- 3 Number of LEDs lit indicate signal strength received from WPLLD transducers. At least 3 LEDs should be lit, when receiving transducer communications, indicating good signal strength.
- 4 Receives WPLLD transducer communications over pump 240 Vac wiring.

Verifying WPLLD Communications Capability

IMPORTANT! This procedure must be performed prior to installation of the WPLLD Sensors and valves.

Because the AC Interface Module receives data from the WPLLD Sensors on the AC power lines, you **MUST** verify that there is not an excessive noise level present on the lines prior to completing the system installation. Excessive noise will cause WPLLD Comm alarms, resulting in line shutdowns.

Verification is done as follows:

1. Turn On **all** electrical equipment at the site and leave it on during this entire procedure to ensure an accurate test. Your electrical equipment may include car washes, fluorescent, neon, or high-intensity discharge (HID) lights, and other wireless devices.

IMPORTANT! Failure to turn on **all** equipment could result in a WPLLD COMM ALARM, which will disable your submersible pumps.



2. After the 240 Vac lines are connected to the AC Interface Module, observe the 4 signal strength LEDs on the front of the module (see Figure 3-1). With no transducers installed, these LEDs provide an indication of the noise level present on the AC lines. Ideally, no LEDs should be lit at this point; typically, communications will be successful if no more than the first LED is lit.
3. If more than the first LED is lit, there is noise at the site which could interfere with WPLLD communications. The source of this noise should be identified and eliminated. Even if only the first LED is lit, it is still desirable to eliminate the noise. To do this, check the site for the presence of other wireless devices which transmit using the AC power lines, such as wireless intercoms, light switches, dimmers, and phone extension jacks. If unplugging one of these devices causes the LED to go off, that device is not compatible with WPLLD and should not be used.

IMPORTANT! Do not unplug equipment required for site operation without permission of the site operator. Completion of this procedure may require the station to be taken out of service.

4. Non-wireless devices can also be noise sources. Motor speed controllers, neon, fluorescent, or HID lights, light dimmers, computers, or other electronic devices can cause noise. Unplug any of these devices, one at a time, to determine if the noise is eliminated. Once the device is identified, it may be possible to reduce the line noise by using a line filter or an isolation transformer on input power to the device instead of removing it completely.
5. Any device having an intermittent or faulty wiring connection, or an electric motor which is not running properly, can cause noise. Again, any powered device should be unplugged to determine if it is causing noise. Faulty connections or bad motors must be repaired or replaced prior to installing the WPLLD system.

4 WPLLD System Installation

IMPORTANT! If there is a Stage II Vapor Recovery System installed in the site that includes a device in the pressurized piping, see “WPLLD Installation with Stage II Vapor Recovery Systems” on page 4-14 for installation guidelines. For both non-manifolded and manifolded installations, ball valves are recommended to minimize spillage during service and to aid in verification of system leaks.

 WARNING	
	<p>TURN POWER OFF TO THE CONSOLE AND SUBMERSIBLE PUMP WHEN INSTALLING THE WPLLD TRANSDUCER AND/OR SWIFTCHECK VALVE.</p> <p>This equipment uses lethal voltages and attaches to accessory components which operate in areas where flammable liquids and vapors may be present. When installing this product:</p> <ol style="list-style-type: none">1. Use only supplied service parts to avoid compromising safety.2. Do not allow WPLLD pump control wires to share conduit with wires from intrinsically safe devices such as probes and sensors.3. Wiring must comply with all applicable requirements of the National Electrical Code; federal, state, and local codes; and any other safety codes.

Red Jacket Pumps (Except Quantum and The Red Jacket)

SWIFTCHECK VALVE INSTALLATION

The SwiftCheck valve mounts directly into the Mechanical Line Leak Detector (LLD) pump port. It eliminates the need to break product lines for installation and service. It also provides a means of precision testing on the packer discharge O-ring and threaded discharge.

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

Follow these steps to install a SwiftCheck valve in the pump for non-manifolded installations:



1. Turn Off, tag, and lockout power to pump.
2. If the pump is equipped with a Mechanical Line Leak Detector (LLD), remove the mechanical unit and any related tubing and fittings. Plug any tubing openings using appropriate fittings and seal using a UL-classified thread sealant suitable for the fuel involved.
3. If the pump is *not* equipped with a mechanical LLD, remove the 2-inch mechanical LLD port plug.
4. Ensure that the sealing surface for the valve’s external O-ring is smooth and free from corrosion, pitting, and any material build-up [Figure 4-1].

IMPORTANT! Failure to ensure a smooth sealing surface may result in false line leak alarms.



5. Catch all fuel drainage in an approved container and return to the tank. Do not contaminate the environment.

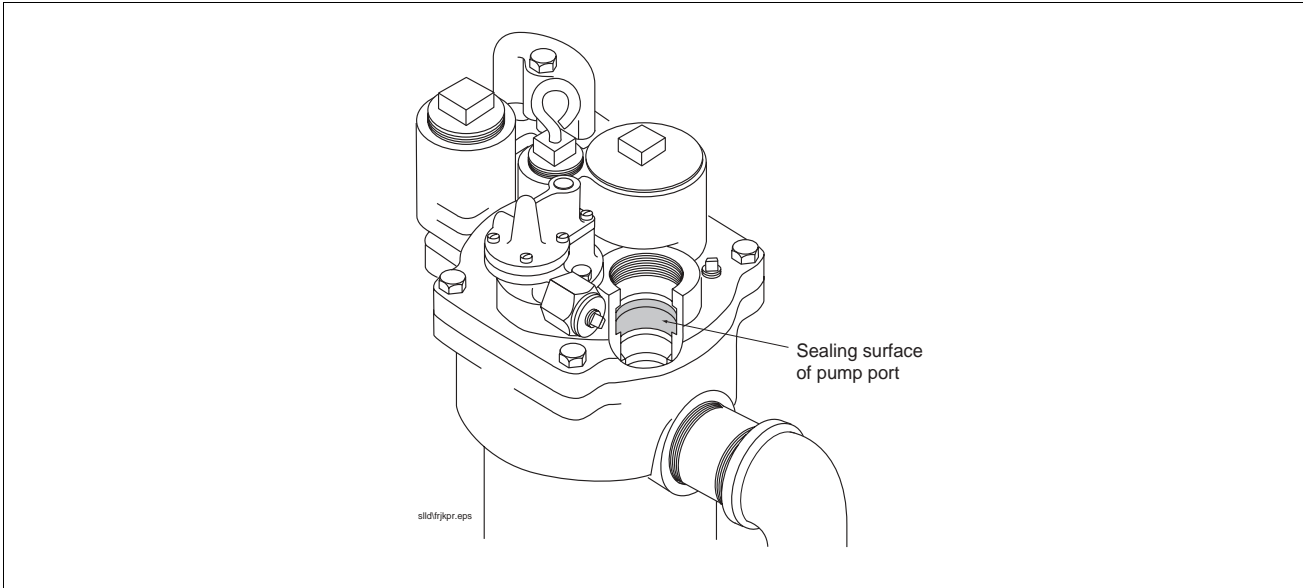


Figure 4-1. Sealing Surface for WPLLD Valve's External O-ring

6. Lubricate the external O-ring on the valve using mineral oil or other suitable lubricant.
7. Install the WPLLD valve [Figure 4-2] in the Mechanical LLD pump port.

IMPORTANT! Do not overtighten the valve when installing into the pump. Overtightening the valve can cause it to stick resulting in a flow restriction in the line! Seal the NPT threads only with a UL-classified non-toxic thread sealant suitable for the fuel involved.

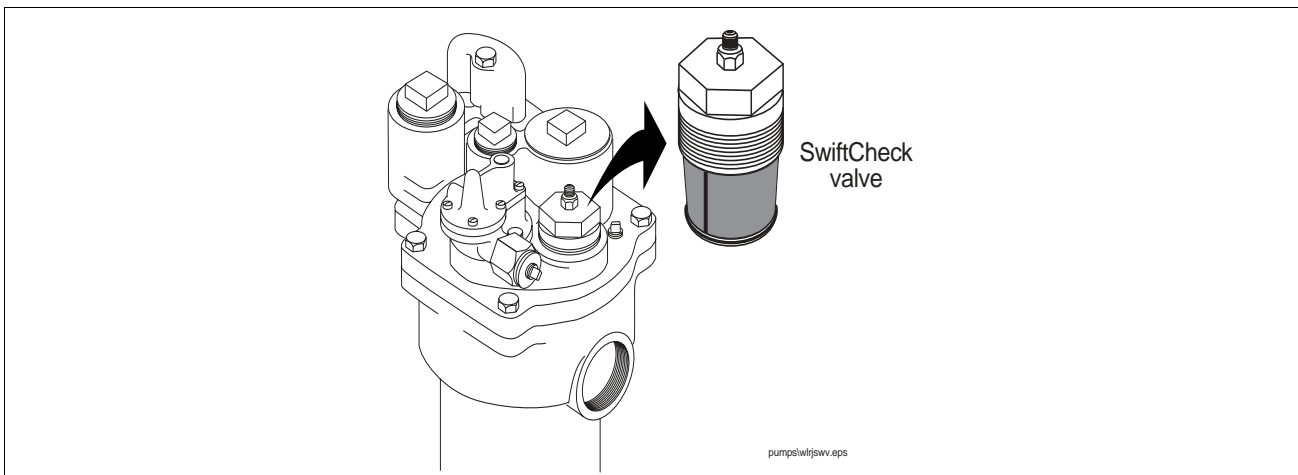


Figure 4-2. SwiftCheck Valve Installation

ADJUSTING THE PRESSURSTAT RELIEF PRESSURE (FOR 3.0 GPH TESTING ONLY)

Read this section if you have purchased a Pressurstat valve to run 3.0 gph tests only.

To adjust the relief pressure:

1. Remove the brass cap [Figure 4-3] by unscrewing it.
2. Turn down the adjustment screw. Tightening the screw clockwise increases the pressure. When the adjustment screw is fully down, the relief pressure is approximately 40 psi. Set the relief pressure to 20 - 25 psi; measure pressure by installing a pressure gauge on the line. Verify the relief pressure by using the console; refer to “Enable the Line for Dispensing” on page 6-3 for the procedure to obtain pressure readings.
3. Replace the brass cap - you only have to hand tighten it because the O-ring completes the seal.

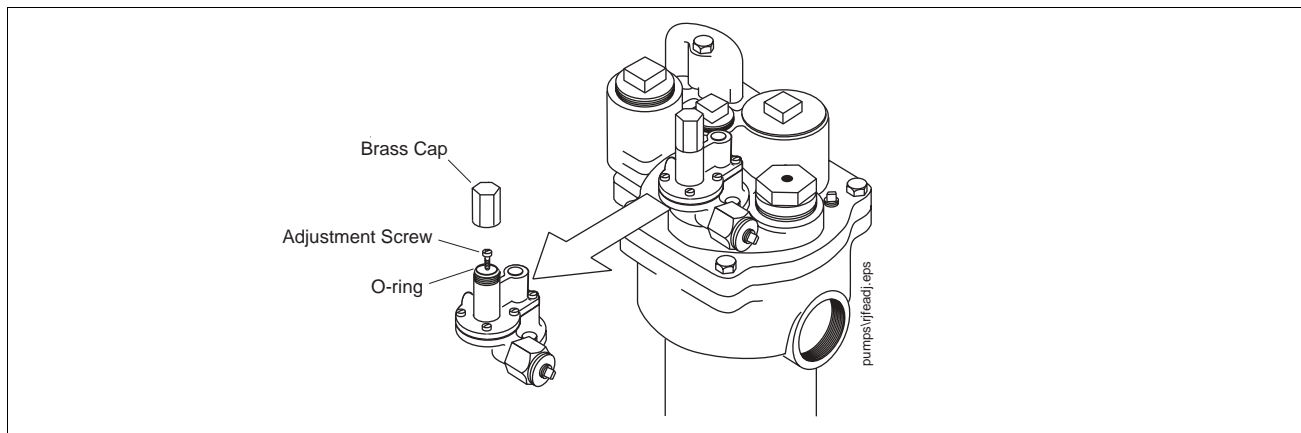


Figure 4-3. Pressurstat Adjustable Check Valve

DISABLING THE FUNCTIONAL ELEMENT (REQUIRED FOR 0.2 & 0.1 GPH TESTING)

The WPLLD valve eliminates the need for the pump’s functional element. You *must* modify the functional element as part of the WPLLD system installation on Red Jacket pumps.

⚠ WARNING	
	<p>CAREFULLY REASSEMBLE AND RESEAL THE FUNCTIONAL ELEMENT, FOLLOWING THE PROCEDURES DESCRIBED IN THIS MANUAL OR FIRE, EXPLOSION, OR GROUND CONTAMINATION COULD OCCUR.</p>

1. Remove the six slot-head screws from the functional element [Figure 4-4].
2. Remove the functional element’s spring and piston.
3. Carefully reassemble the functional element using a new diaphragm suitable for the fuel involved. Be sure that all gasketed surfaces are free from debris when reinstalling.
4. Torque the six slot-head screws to 40-65 in-lbs.

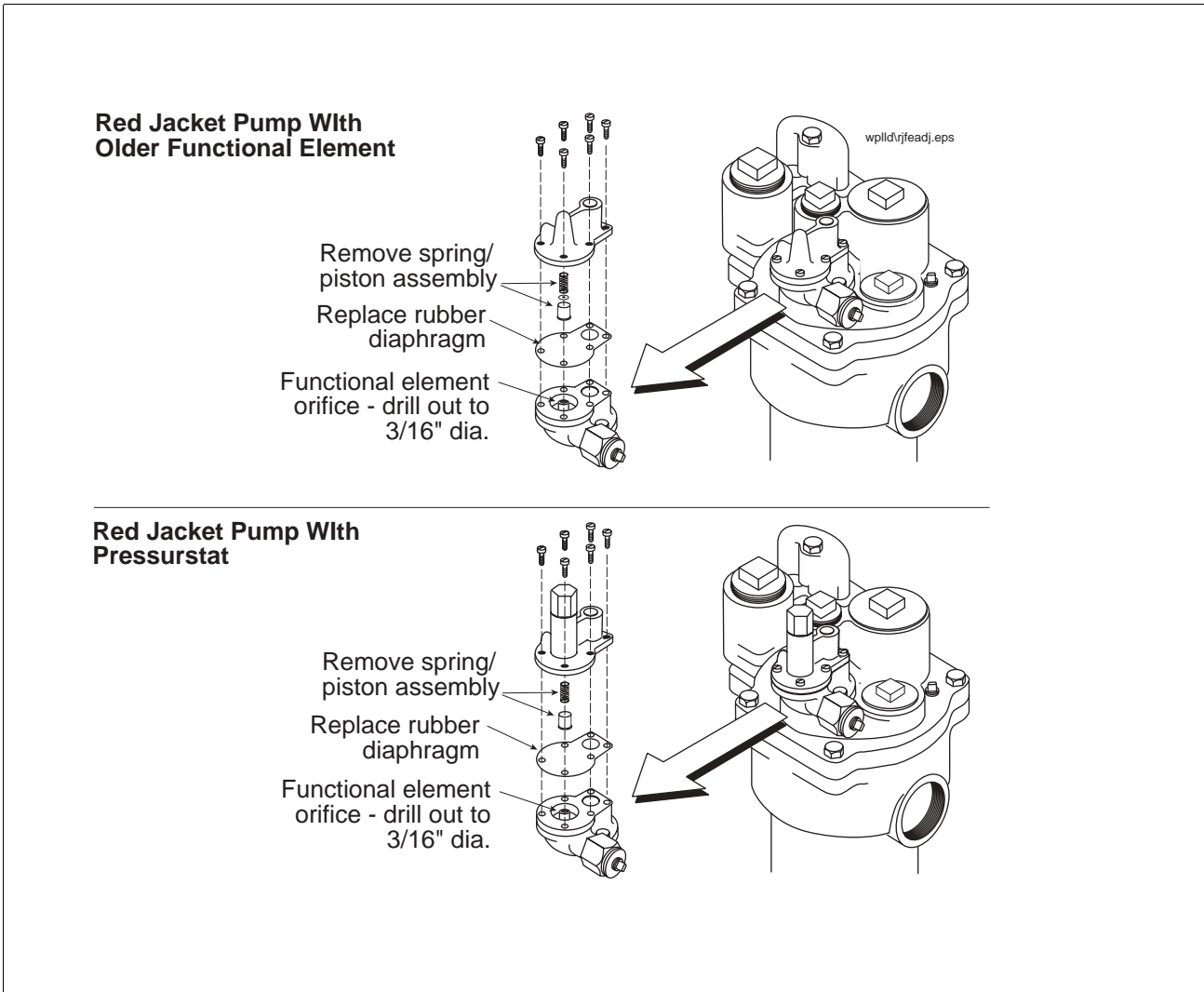


Figure 4-4. Functional element modifications

TRANSDUCER INSTALLATION





Red Jacket Pumps with Pressurstat -- start with Step 1. Red Jacket Pumps with SwiftCheck valve--start with Step 3.

Refer to Figure 4-8 on page 4-7 as you install the WPLLD transducer.

1. Remove the plug from the top of the line pressure test port (Red Jacket Pumps with Pressurstat only).
2. Install the pump fitting in the port (Red Jacket Pumps with Pressurstat only).

IMPORTANT! Seal the NPT pipe threads on the fitting with a UL-classified nontoxic thread sealant suitable for the fuel involved. Do not apply sealant to the threads adjacent to the flare fitting.

3. Remove the O-ring from the installation kit and lightly lubricate it with mineral oil or other suitable lubricant. Install the O-ring onto WPLLD transducer by carefully pushing it over the external threads and into the groove above the threads. Remove the protective plastic cap from the WPLLD transducer (do not discard cap).

 WARNING	
  	<p>DO NOT APPLY ANY THREAD SEALANT OR PIPE DOPE TO THE THREADS OF THE WPLLD TRANSDUCER OR TO THE THREADS OF THE STP'S MOTOR CAPACITOR WELL INTO WHICH IT IS SCREWED.</p> <p>The metal-to-metal joint created by threads of the WPLLD transducer in the STP's capacitor well ensures a restricted flame path to prevent propagation of a spark or flame to a hazardous area. If any thread sealant or pipe dope is applied to the threads of the WPLLD transducer or to the threads of the capacitor well, the flame path may not be restricted, potentially resulting in serious injury or death from explosion.</p>

Remove the capacitor cover from the pump head and place the protective plastic cap (removed from the WPLLD transducer) over its threads. Put the cover aside for now.

Also, some older Red Jacket pumps may have oval-style capacitors which are too tall for WPLLD transducer installations. An oval capacitor should be replaced with Red Jacket nos. 111-661-5 (1-1/2 HP pumps) or 111-092-5 (1/3 or 3/4 HP pumps).

IMPORTANT! If fuel is present in the STP's capacitor well, you must identify and correct the source of the leak before proceeding.

4. Cut the black wire (originating from the 240 Vac power source) in the capacitor housing (see Figure 4-5). Using the electrical connector provided, connect the 2 cut black leads to either one of the wires on the WPLLD transducer.
5. Cut the yellow or orange wire (Figure 4-5) in the capacitor housing. Using the electrical connector provided, connect the two cut yellow or orange leads to one of the wires in the WPLLD transducer.

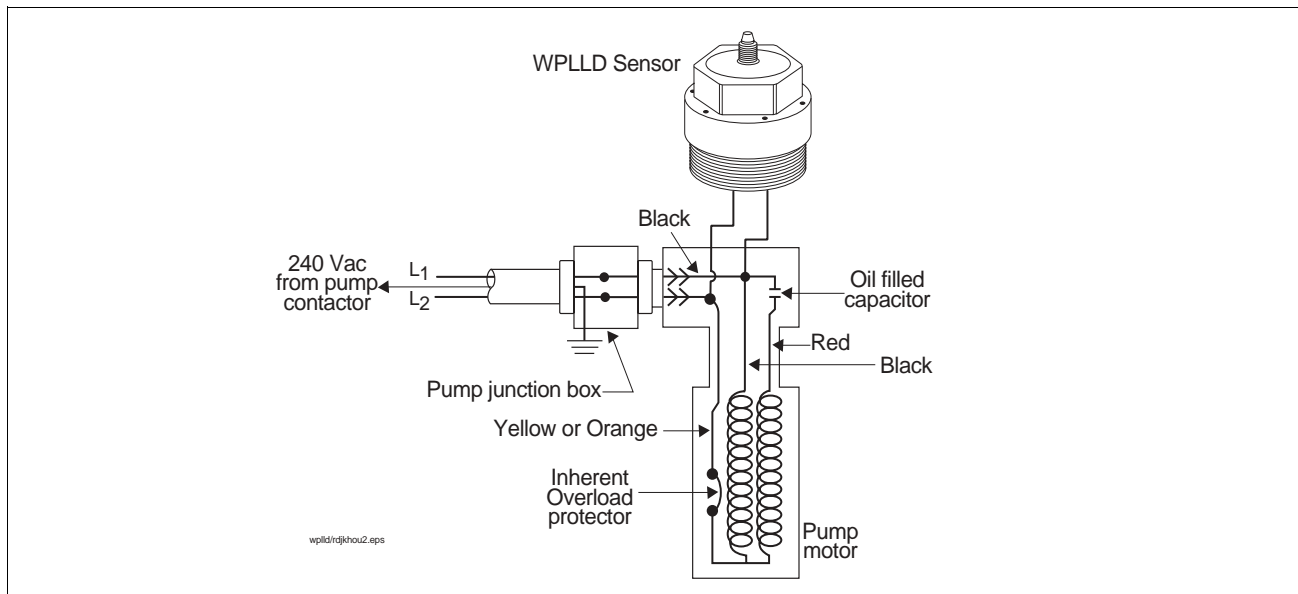


Figure 4-5. Wiring the WPLLD Transducer to the Pump

6. Place the shield (from the installation kit) into the capacitor housing with open side up. Hold the shield at an angle and place notched tab into the compartment first. Guide the two wires from the WPLLD transducer into the notch on the shield [Figure 4-6], leaving as much slack in the wires as possible above the shield (this will prevent stressing them when the transducer is threaded into the pump).

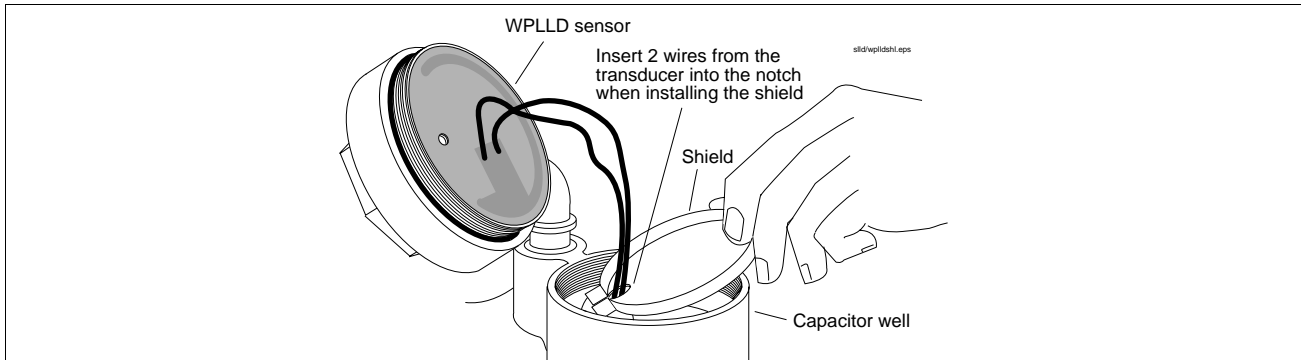


Figure 4-6. Placing Shield Into Capacitor Housing

7. Rotate the transducer about three turns counterclockwise, then screw it into the pump compartment and tighten it securely.

8. For 3.0 Gph-Only Testing (w/o SwiftCheck valve) -

Connect one end of the Sensing Line to the fitting in the Line Test port and the other end to the WPLLD transducer (Figure 4-8). Tighten connections and attach one of the “WARNING” tags to the Sensing Line. With the two 6-32 x 0.375” screws provided, attach the capacitor cover bracket to the top of the transducer. Snap the capacitor cover into the storage bracket.

For 0.2 Gph And 0.1 Gph Testing (w/ SwiftCheck valve) -

Install one end of the Sensing Line from the installation kit to the WPLLD transducer and the other end to the Swift-Check valve (Figure 4-7). Tighten connections and attach one of the “WARNING” tags to the Sensing Line. With the two 6-32 x 0.375” screws provided, attach the capacitor cover bracket to the top of the transducer. Snap the capacitor cover into the storage bracket.

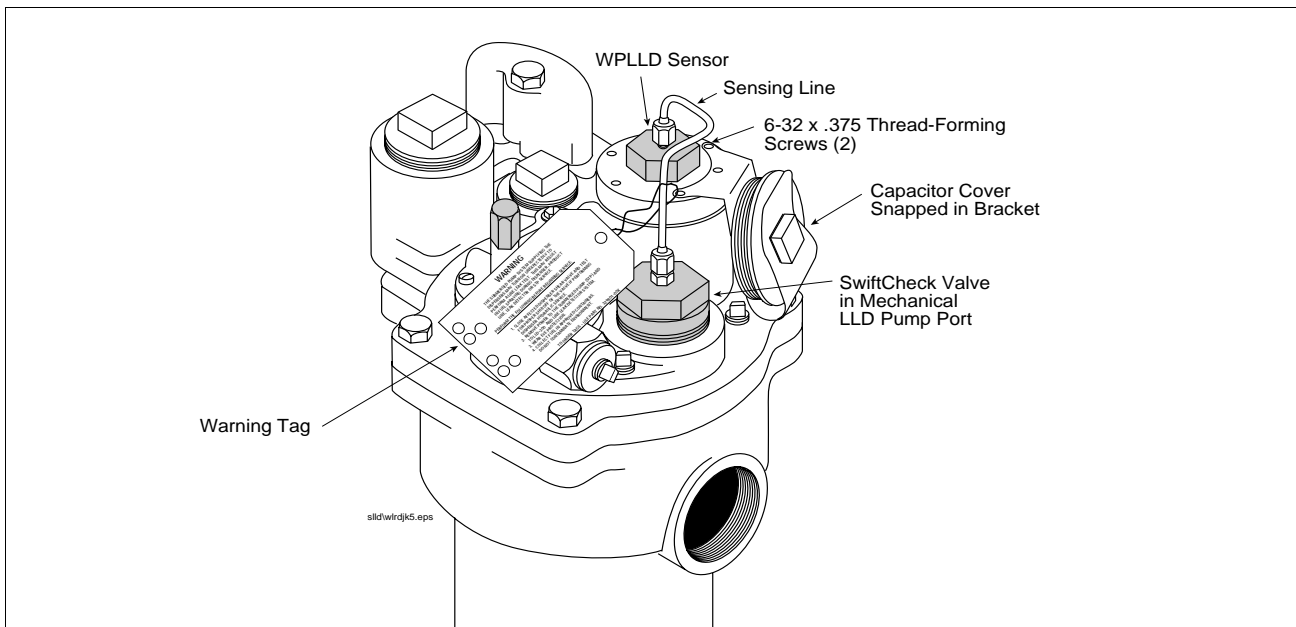


Figure 4-7. WPLLD Transducer Installation--Red Jacket Pump w/SwiftCheck

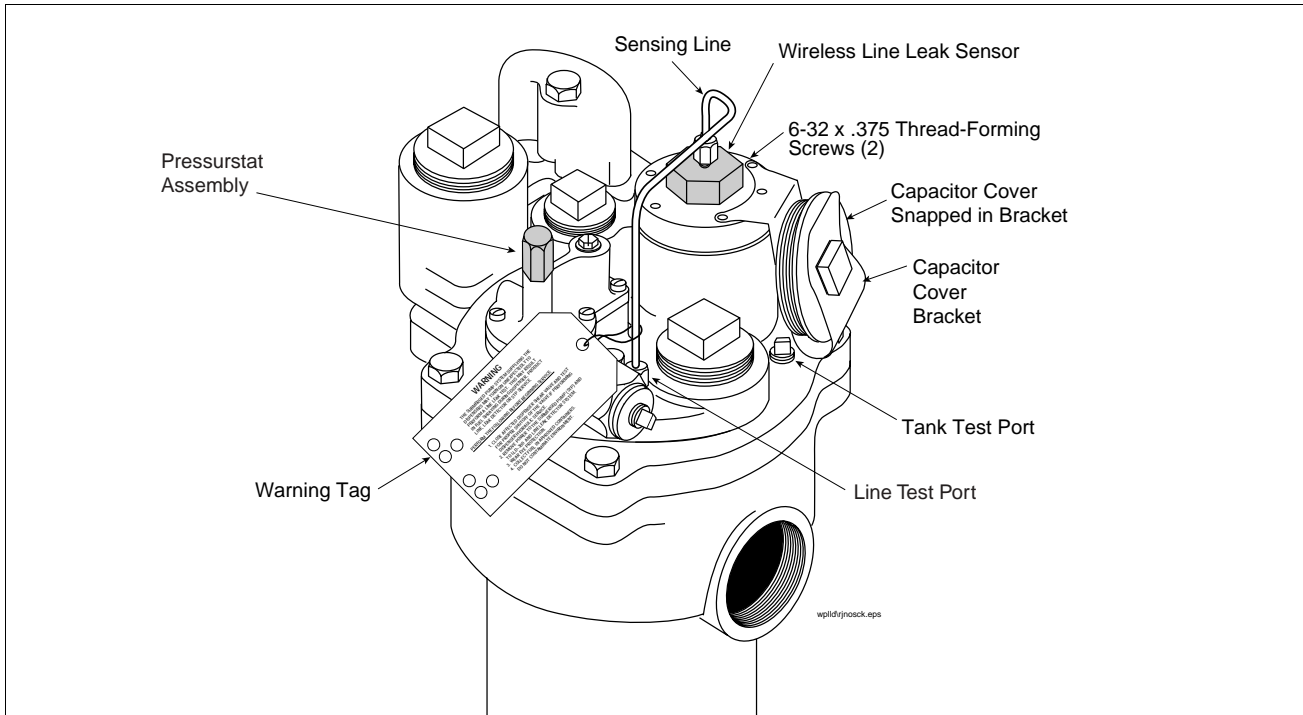


Figure 4-8. WPLLD Transducer Installation--Red Jacket Pump w/o SwiftCheck

Red Jacket Quantum Pump (w/ and w/o SpikeCheck Valve Assy.)



1. Turn Off, tag, and lockout power to pump.
2. After referring to Figure 4-9 remove the Line Test Port plug, the Pressurstat (if installing a SpikeCheck), and the cover from the pump's capacitor housing (do not discard cover).

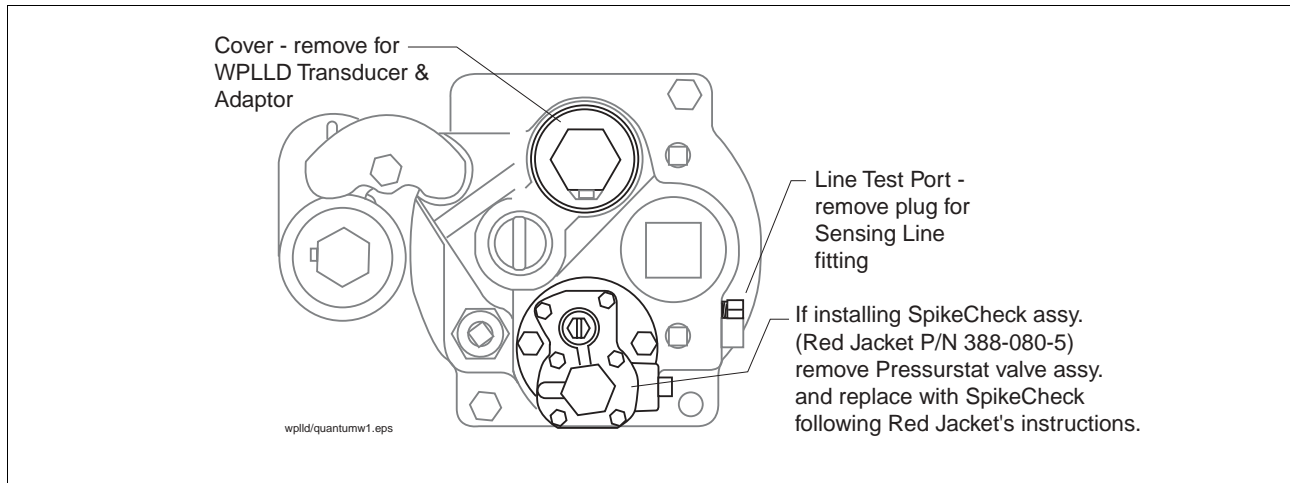



Figure 4-9. Red Jacket Quantum Pump

⚠ WARNING	
	<p>DO NOT APPLY ANY THREAD SEALANT OR PIPE DOPE TO THE THREADS OF THE WPLLD TRANSDUCER OR TO THE THREADS OF THE STP'S MOTOR CAPACITOR WELL INTO WHICH IT IS SCREWED.</p> <p>The metal-to-metal joint created by threads of the WPLLD transducer in the STP's capacitor well ensures a restricted flame path to prevent propagation of a spark or flame to a hazardous area. If any thread sealant or pipe dope is applied to the threads of the WPLLD transducer or to the threads of the capacitor well, the flame path may not be restricted, potentially resulting in serious injury or death from explosion.</p>

3. Remove the O-ring from the installation kit and lubricate it lightly with mineral oil or other suitable lubricant. Install the O-ring onto WPLLD transducer by carefully pushing it over the external threads and into the groove above the threads. Remove the protective plastic cap from the WPLLD transducer.
4. Holding the transducer over the adaptor, feed the WPLLD transducer wires down through the adaptor and screw the WPLLD transducer into the adaptor.
5. Cut the black wire (originating from the 240 Vac power source) in the capacitor housing (see Figure 4-5). Using the electrical connector provided, connect the 2 cut black leads to either one of the wires from the WPLLD transducer.
6. Cut the yellow or orange wire in the capacitor housing. Using the electrical connector provided, connect the two cut yellow or orange leads to the other wire from the WPLLD transducer.
7. Twist the WPLLD/Adaptor assembly a couple of turns counterclockwise and then screw it into the capacitor housing port.
8. Connect one end of the Sensing Line to the Line Test Port fitting and the other end to the WPLLD transducer (Figure 4-10). Tighten connections and attach one of the "WARNING" tags to the Sensing Line. With the two 6-32 x 0.375" screws provided, attach the conduit box cover bracket to the top of the transducer. Snap the removed capacitor housing cover into the storage bracket.

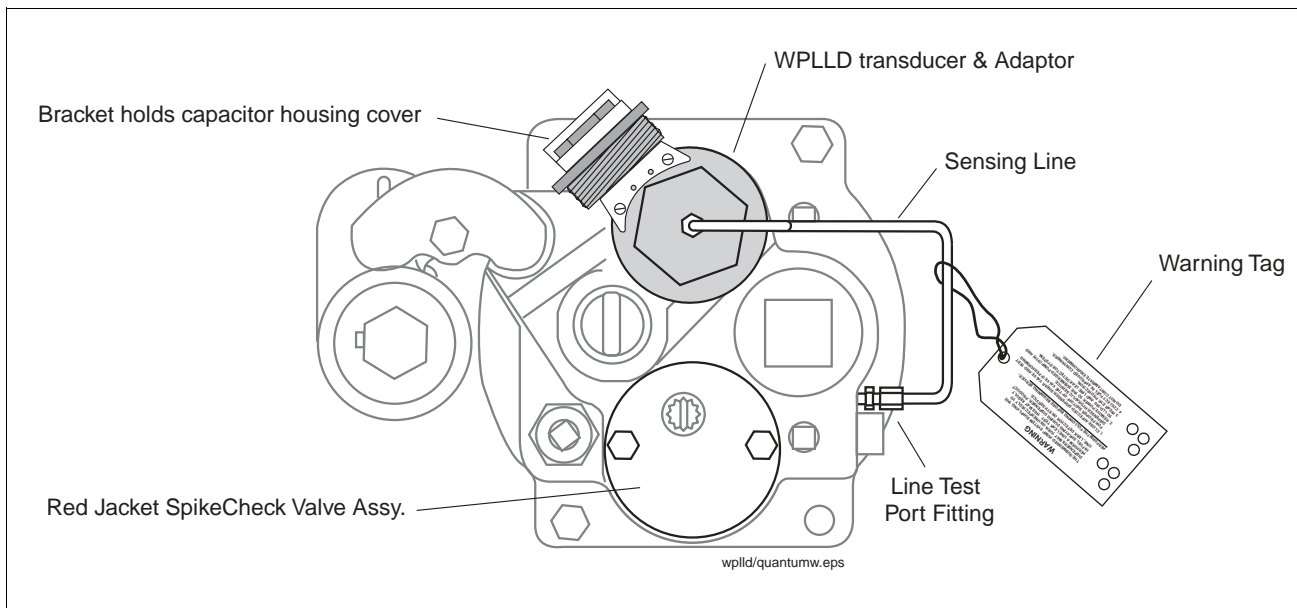


Figure 4-10. WPLLD Installation in Red Jacket Quantum Pump

The Red Jacket Pump



1. Turn Off, tag, and lockout power to pump.
2. After referring to Figure 4-11 remove the cover from the pump’s capacitor housing (do not discard cover).
IMPORTANT! Do not use any thread sealant on the adaptor’s threads.

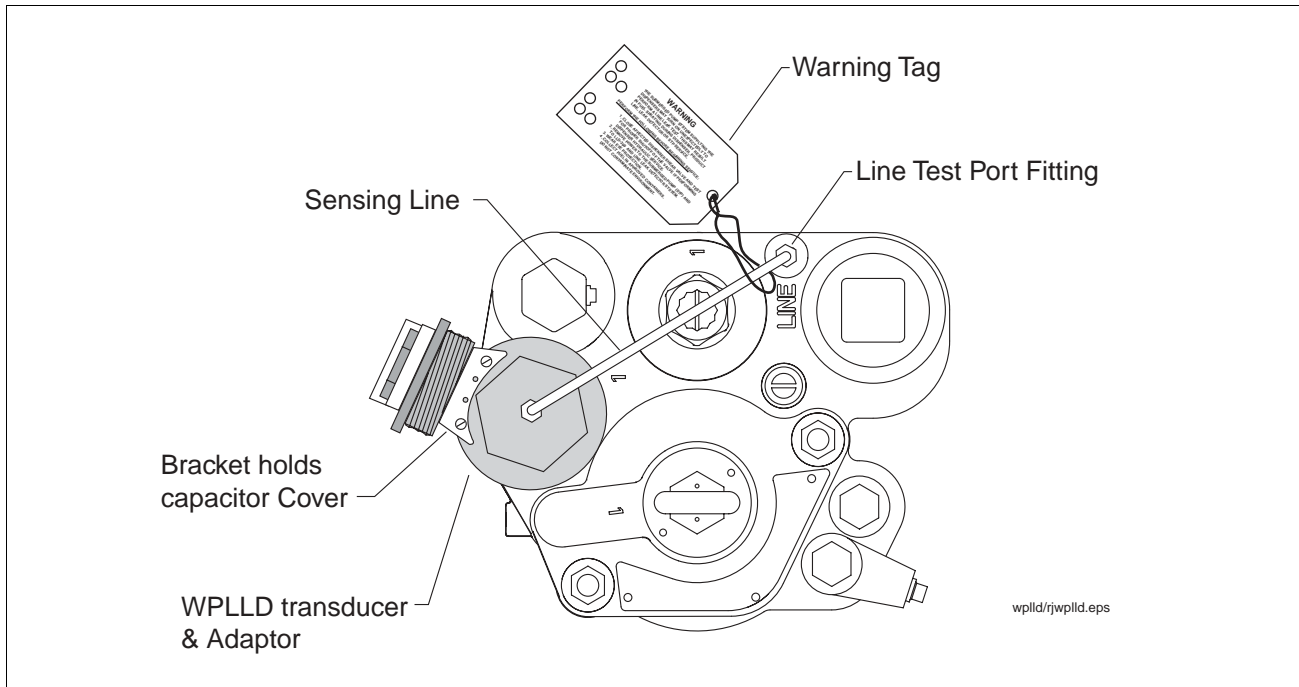


Figure 4-11. The Red Jacket Pump

WARNING	
	<p>DO NOT APPLY ANY THREAD SEALANT OR PIPE DOPE TO THE THREADS OF THE WPLLD TRANSDUCER OR TO THE THREADS OF THE STP'S MOTOR CAPACITOR WELL INTO WHICH IT IS SCREWED.</p> <p>The metal-to-metal joint created by threads of the WPLLD transducer in the STP's capacitor well ensures a restricted flame path to prevent propagation of a spark or flame to a hazardous area. If any thread sealant or pipe dope is applied to the threads of the WPLLD transducer or to the threads of the capacitor well, the flame path may not be restricted, potentially resulting in serious injury or death from explosion.</p>

3. Remove the O-ring from the installation kit and lubricate it lightly with mineral oil or other suitable lubricant. Install the O-ring onto WPLLD transducer by carefully pushing it over the external threads and into the groove above the threads. Remove the protective plastic cap from the WPLLD transducer.
4. Holding the transducer over the adaptor, feed the WPLLD transducer wires down through the adaptor and screw the WPLLD transducer into the adaptor.
5. Remove the wire nut connecting the two black wires (one from the compression bushing [240 Vac power source] and one from the capacitor) in the capacitor housing (see Figure 4-5). Using the electrical connector provided, connect the two black leads to either one of the wires from the WPLLD transducer. Remove the wire nut attaching the two orange

wires (one from the compression bushing [240 Vac power source] and one from the ump) in the capacitor housing. Using the electrical connector provided, connect the two orange leads to the other wire from the WPLLD transducer.

6. Twist the WPLLD/Adaptor assembly a couple of turns counterclockwise and then screw it into the capacitor housing port.
7. Remove the plug from the Line Test port and install the port fitting in its place (see Figure 4-11).
8. Connect one end of the Sensing Line to the Line Test port fitting and the other end to the WPLLD transducer (Figure 4-11). Tighten connections and attach one of the "WARNING" tags to the Sensing Line. With the two 6-32 x 0.375" screws provided, attach the conduit box cover bracket to the top of the transducer. Snap the removed capacitor housing cover into the storage bracket.

FE Petro Pumps

TRANSDUCER INSTALLATION



1. Turn Off, tag, and lockout power to pump.
2. Remove the plug from the top of the Pressure Test Port and adjust Valve Clamp if necessary (Figure 4-14).
3. For precision testing, install the FE Petro Model "R" precision check valve as shown in Figure 4-12.

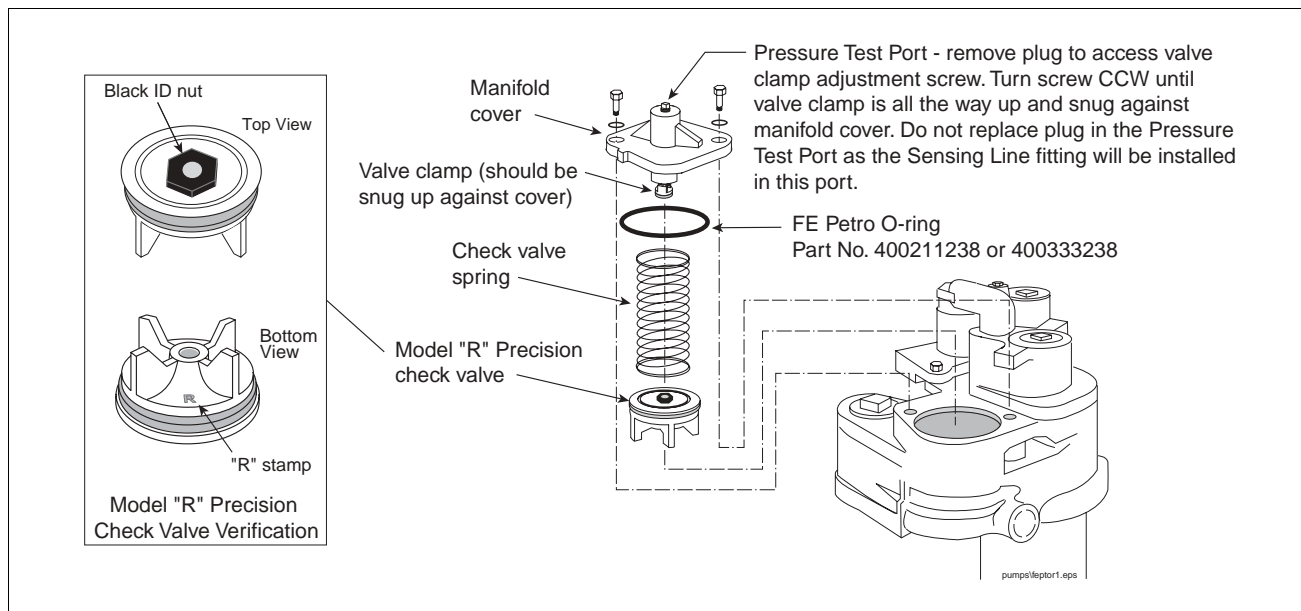



Figure 4-12. Location of Precision Check Valve in FE Petro Pump

4. Install the pump fitting from the kit in the Pressure Test Port. **IMPORTANT!** Seal the NPT pipe threads on the fitting with a UL-classified nontoxic thread sealant suitable for the fuel involved. Do not apply sealant to the threads adjacent to the flare fitting.

⚠ WARNING	
	<p>DO NOT APPLY ANY THREAD SEALANT OR PIPE DOPE TO THE THREADS OF THE WPLLD TRANSDUCER OR TO THE THREADS OF THE STP'S MOTOR CAPACITOR WELL INTO WHICH IT IS SCREWED.</p> <p>The metal-to-metal joint created by threads of the WPLLD transducer in the STP's capacitor well ensures a restricted flame path to prevent propagation of a spark or flame to a hazardous area. If any thread sealant or pipe dope is applied to the threads of the WPLLD transducer or to the threads of the capacitor well, the flame path may not be restricted, potentially resulting in serious injury or death from explosion.</p>

- Remove the O-ring from the installation kit and lubricate it lightly with mineral oil or other suitable lubricant. Install the O-ring onto WPLLD transducer by carefully pushing it over the external threads and into the groove above the threads. Remove the protective plastic cap from the WPLLD transducer (do not discard cap).
- Remove the capacitor cover from the pump head and place the protective plastic cap (removed from the WPLLD transducer) over its threads. The capacitor cover must remain with the pump because it contains important safety and manufacturers information. Snap the capacitor cover in the bracket.

IMPORTANT! If fuel is present in the STP's capacitor well, you must identify and correct the source of the leak before proceeding.

- Cut the black wire (originating from the 240 Vac power source) in the capacitor housing (see Figure 4-13). Using the electrical connector provided, connect the 2 cut black leads to either one of the wires from the WPLLD transducer.

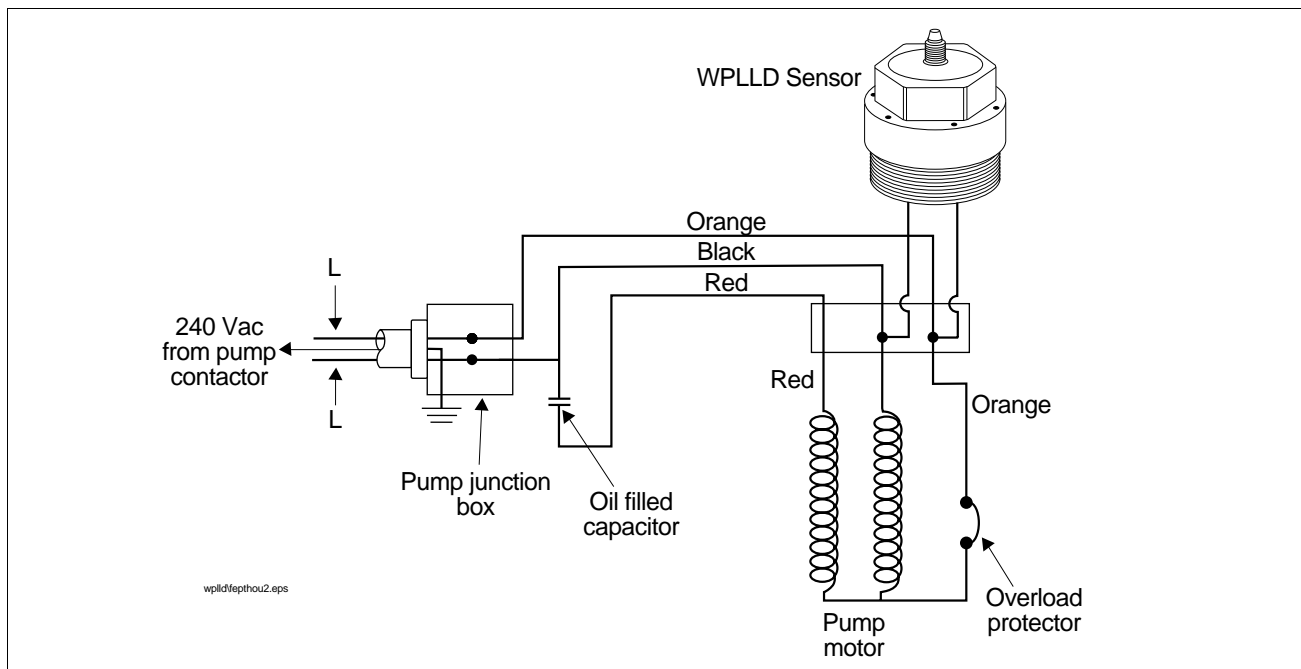


Figure 4-13. Wiring the WPLLD Transducer to the FE Petro Pump

- Cut the orange wire in the capacitor housing. Using the electrical connector provided, connect the two cut orange leads to the other wire from the WPLLD transducer.

9. Place the shield (from the installation kit) into the capacitor housing with open side up. Hold the shield at an angle and place notched tab into the compartment first. Guide the two wires from the WPLLD transducer into the notch on the shield [Figure 4-6 on page 4-6], leaving as much slack in the wires as possible above the shield (this will prevent stressing them when the transducer is threaded into the pump).
10. Rotate the transducer about three turns counterclockwise, then screw it into the pump compartment and tighten it securely.
11. Connect one end of the Sensing Line to the WPLLD transducer. Attach the other end of the Sensing Line to the Pressure Test Port. Tighten connections and attach one of the “WARNING” tags to the Sensing Line. With the two 6-32 x 0.375” screws provided, attach the capacitor cover bracket to the top of the transducer. Snap the capacitor cover into the storage bracket (Figure 4-14).

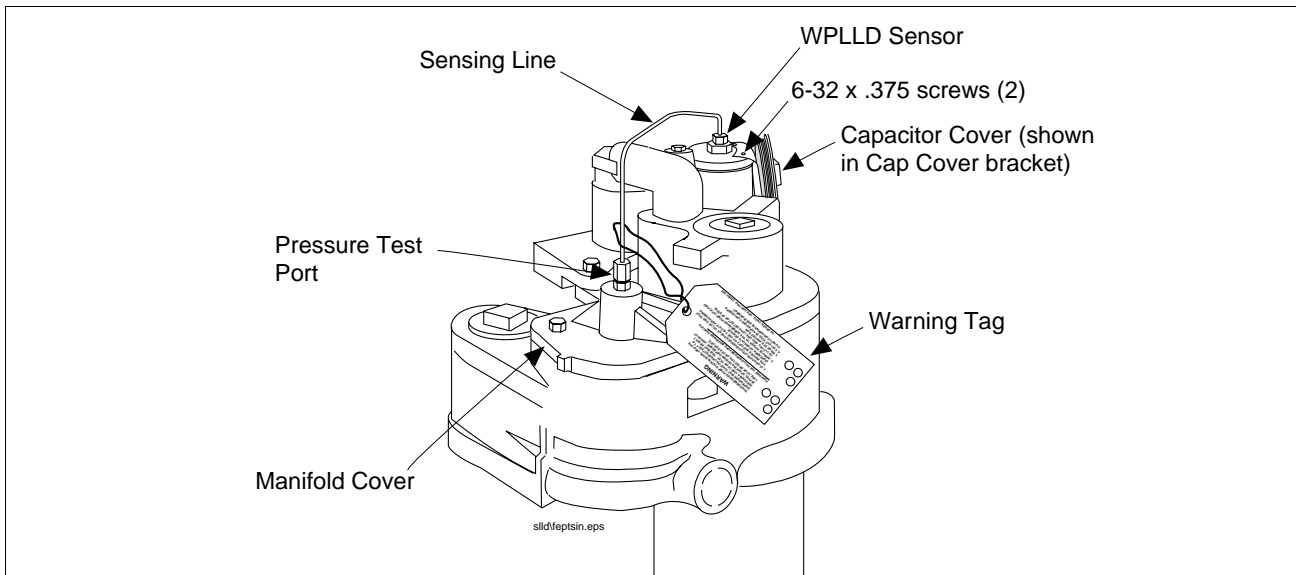


Figure 4-14. WPLLD Transducer Installation--FE Petro Pump

Manifolded Product Line WPLLD Installation

DUAL PUMPS IN SINGLE TANK

Follow these guidelines as you install a manifolded WPLLD system with dual pumps in a single tank:

- 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.
- An Interlock Relay must be installed so that the slave pump is energized only when dispensing (but is turned Off when performing line tests). Refer to page 5-1 for specific installation instructions.
- A non-vented SwiftCheck valve must be installed in the slave pump.



1. Turn Off, tag, and lockout AC power to the submersible pumps and console before beginning the installation.
2. If the system is equipped with an in-line shutoff valve, close the valve to reduce the amount of drainage from the product lines. Collect drained fuel in an approved container.
3. Install the non-vented SwiftCheck in the slave pump’s mechanical LLD pump port.
4. Install the Non-Vented Check Valve in the pump discharge port of the slave pump [Figure 4-15].

5. Install the WPLLD transducer and valve (not required for FE Petro pumps or Red Jacket Quantum pumps) in the master pump.
6. Wire the system as shown in Figure 5-3 on page 5-4. Follow the procedure described in “Pump Control Wiring for Red Jacket and Other Pumps” on page 5-1.

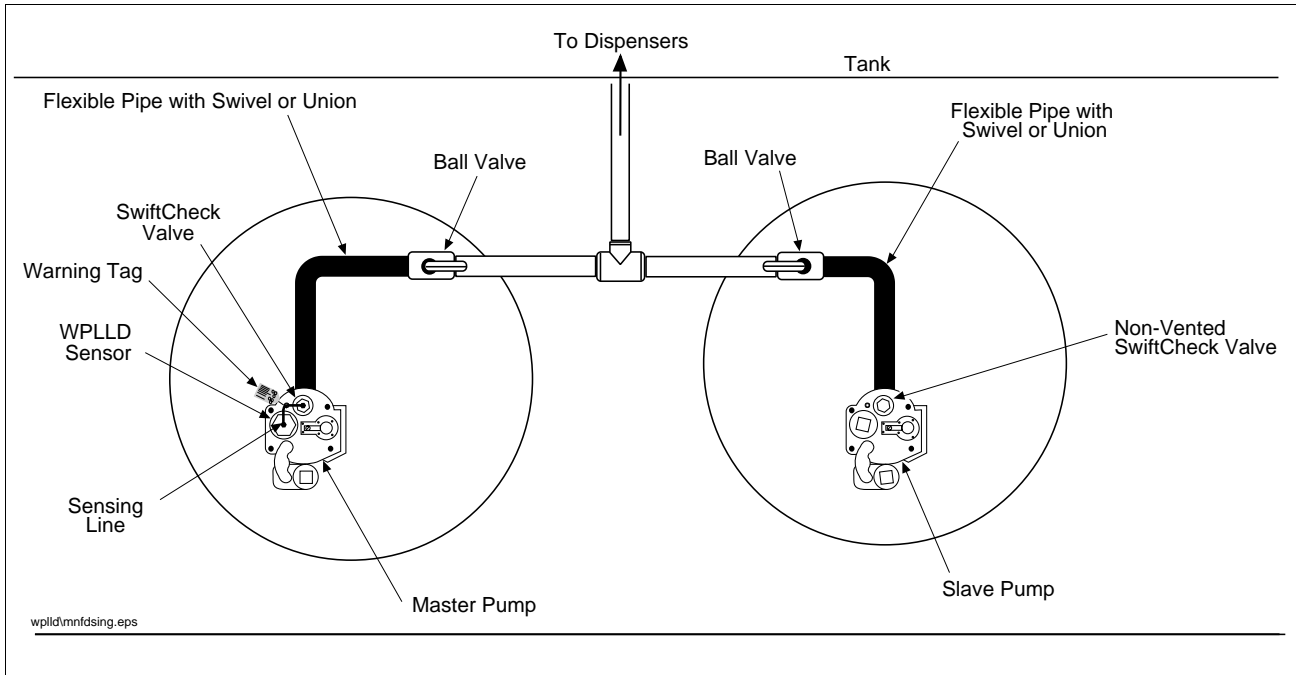


Figure 4-15. Manifolded Product Lines WPLLD Installation - Dual Pumps, Single Tank

MULTIPLE TANKS WITH MANIFOLDED PRODUCT LINES

Version 12/112 or later software provides a feature that permits the use of WPLLD on product lines supplied by multiple tanks with submersible pumps, up to a combined maximum of eight tanks and pumps. Please refer to the Setup Manual for detailed instructions when selecting this option.

Follow these guidelines as you install a manifolded WPLLD system with multiple tanks:

- A non-vented SwiftCheck valve must be installed in the slave pump(s).
- 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 WPLLD Module will provide pump control output for the primary tank and the “Pump In” (Dispenser ON) signal for the set.

WPLLD System Installation Procedure

1. Install the Non-Vented valve in the mechanical LLD port of the slave pump [Figure 4-16].

If the manifolded set has more than one slave tank, install a Non-Vented valve in each of the additional slave pumps the same way.

IMPORTANT! Seal any NPT threads using a UL-classified, non-toxic thread sealant suitable for the fuel involved.

2. Install the WPLLD transducer and valve (not required for FE Petro pumps or Red Jacket Quantum pumps) in the master tank's pump [Figure 4-16].
3. Wire the system as shown in Figure 5-4 on page 5-5. Follow the procedure described in "Pump Control Wiring for Red Jacket and Other Pumps" on page 5-1.

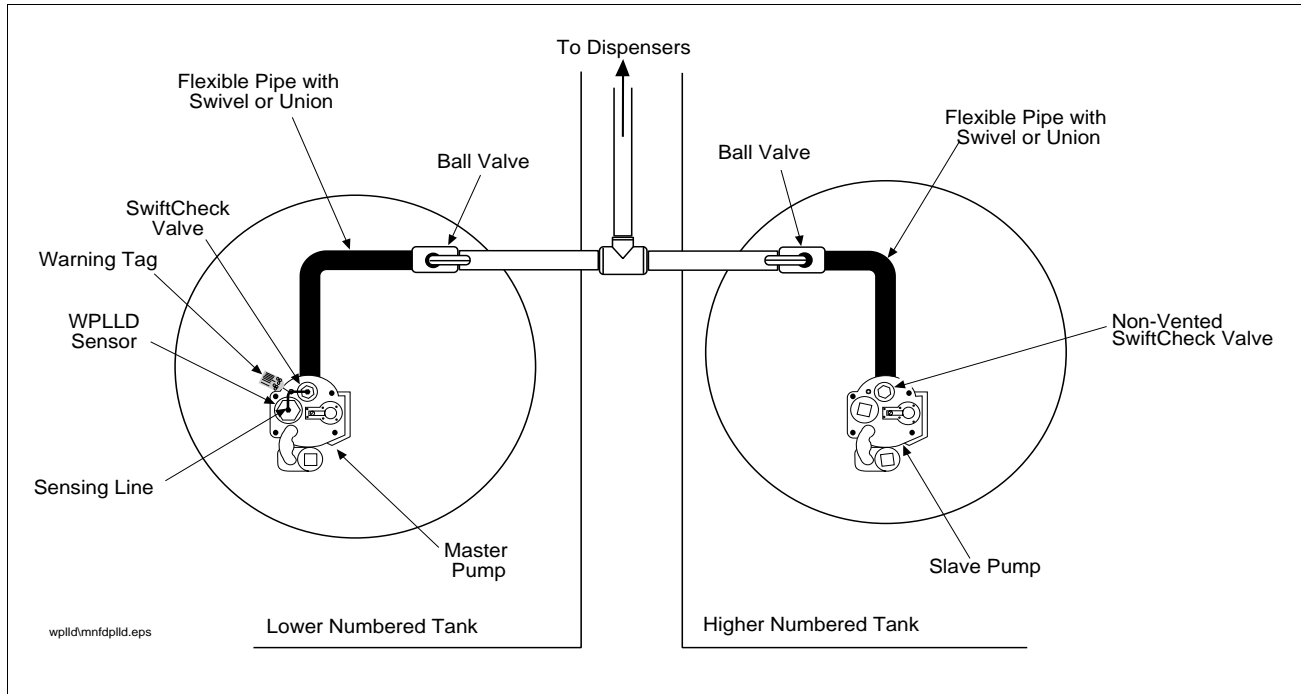


Figure 4-16. Manifolded Product Lines WPLLD Installation - Multiple Tanks

WPLLD Installation with Stage II Vapor Recovery Systems

Systems that have a Stage II Vapor Recovery Device installed in the pressurized piping require special installation procedures. Because the WPLLD must be installed downstream from these devices, a monitored containment sump or mechanical leak detector is required. The WPLLD will not detect leaks upstream from the valve (i.e. between the valve and the Submersible Pump).

Also, there *must not* be a check valve installed between the WPLLD valve and the Submersible Pump for WPLLD to function properly.

Refer to Figure 4-17 for WPLLD installation in Red Jacket Standard or Red Jacket Quantum without Spikecheck pumps with a Healy Mini-Jet system. Follow the applicable guidelines in "SwiftCheck Valve Installation" on page 4-1.

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

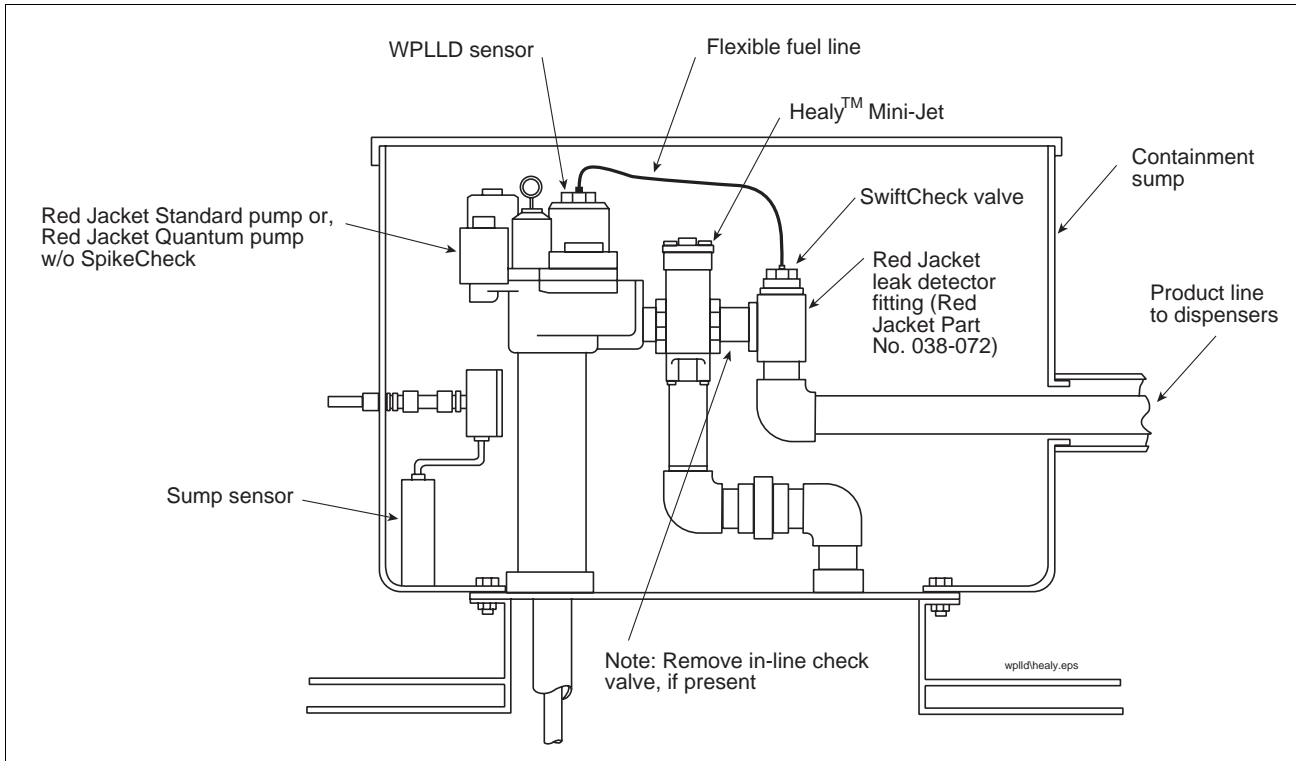


Figure 4-17. Example WPLLD Installation in pump w/Healy Mini-Jet System (req'd. dielectric union & shutoff valve not shown)

Warning Tags

WARNING tags [Figure 4-18] are provided with the WPLLD System. For your safety and the safety of others who may service dispensers, submersible pumps, or WPLLD Systems, you must attach a tag to the console, submersible pump, and dispenser filter where they can be seen clearly by a serviceman performing work on the system.

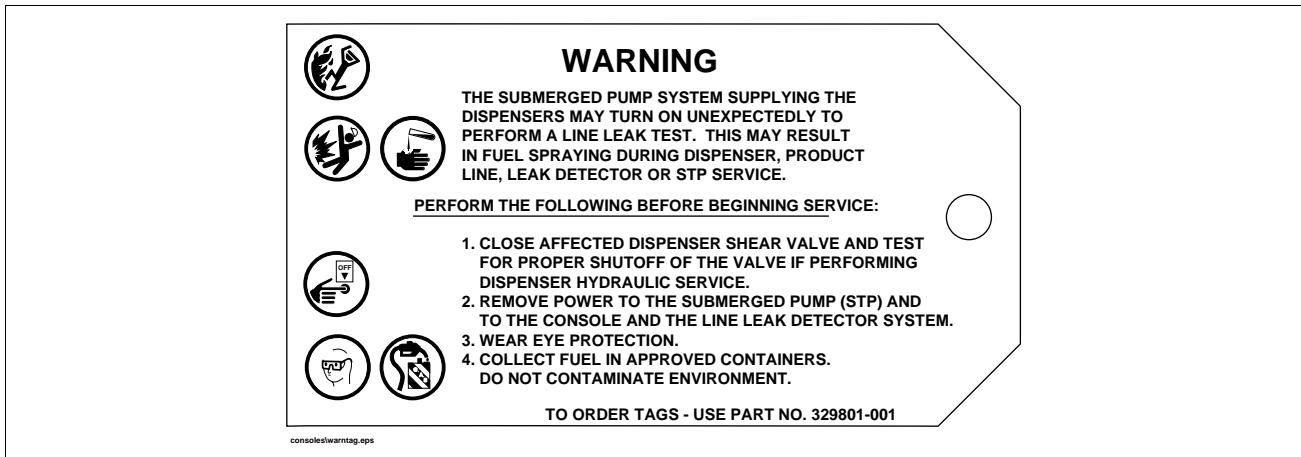


Figure 4-18. WARNING Tag

5 Connecting Console to Pump Wiring

WARNING



TURN OFF, TAG, AND LOCKOUT POWER TO THE CONSOLE, DISPENSERS, AND SUBMERSIBLE PUMPS WHILE CONNECTING CONSOLE TO PUMP WIRING.

This equipment uses lethal voltages and attaches to accessory components which operate in areas where flammable liquids and vapors may be present, THEREFORE:

Use only supplied service parts to avoid compromising safety.

Do not allow WPLLD pump control wires to share conduit with wires from intrinsically safe devices such as probes and sensors.

Ensure that any assembled conduit only enters the console through the properly designated knockouts.

Wiring must comply with all applicable requirements of the National Electrical Code; federal, state, and local codes; and any other safety codes.

General Wiring Practices

1. Be sure all wires are color-coded or carefully marked to identify their source.
2. The Wireless PLLD Controller 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.
3. Label all connectors using the self-adhesive labels supplied according to the slot in which the modules are installed.
IMPORTANT! Once a connector has been wired on a module and the Console has been programmed, the connector and module cannot be moved to another slot without reprogramming the system. For consistency in programming, we recommend labeling the lines with the same product descriptions as those used for the tanks.
4. Record the location (i.e., Line #1 (regular), Line #2 (super), etc.) of each submersible pump wired to a module on the circuit directory inside the Console door.

Pump Control Wiring for Red Jacket and Other Pumps

IMPORTANT! Line Leak Detector wiring for Red Jacket submersible pumps is different than wiring for other pumps. See Figure 5-1 on page 5-2 or Figure 5-2 on page 5-3 for the appropriate wiring diagram.

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

To enable this feature, interrupt the AC Line between the “Dispenser ON Switch” and the pump contactor. You can usually break the AC Line from the “Dispenser ON Switch” in the submersible pump relay control box.

The “Dispenser ON” signal may come from a Point-of-Sale terminal, self-serve console or switch or relay inside the dispenser, from which the AC Line will enter the pump relay control box.

IMPORTANT! 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 that the Console’s pump control circuitry CANNOT turn On 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.

1. Turn OFF, tag, and lockout all AC power to the Console, dispensers and submersible pumps.
2. Connect the AC Line from the “Dispenser STP Control Relay or Switch” to the wire leading to the PI (PUMP IN) terminal on the WPLLD Controller Module.
3. Connect the wire from the PO (PUMP OUT) terminal on the module to the AC Line side of the pump contactor.
4. Connect the PR (PUMP RETURN) wire from the module to AC Neutral [Figure 5-1 or Figure 5-2].
5. Connect the AC Line from the main power panel to the L1 terminal on the module.
6. If installing a system with manifolded product lines on Multiple Tanks, perform the following additional steps:
 - 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 (Refer to Figure 5-4 on page 5-5).
 - 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 WPLLD Controller Module to 120 volt AC line.
7. If installing a system with Dual Pumps on a Single Tank, install an Interlock Relay as shown in Figure 5-3 on page 5-4. This relay should energize the “slave” pump only when dispensing; the slave pump MUST NOT be energized when performing line leak tests.
8. Verify that the Emergency Stop circuit has not been circumvented by initiating a 3 gph test on each line. To do this, confirm that the pump relay is NOT energized at any time during the test.

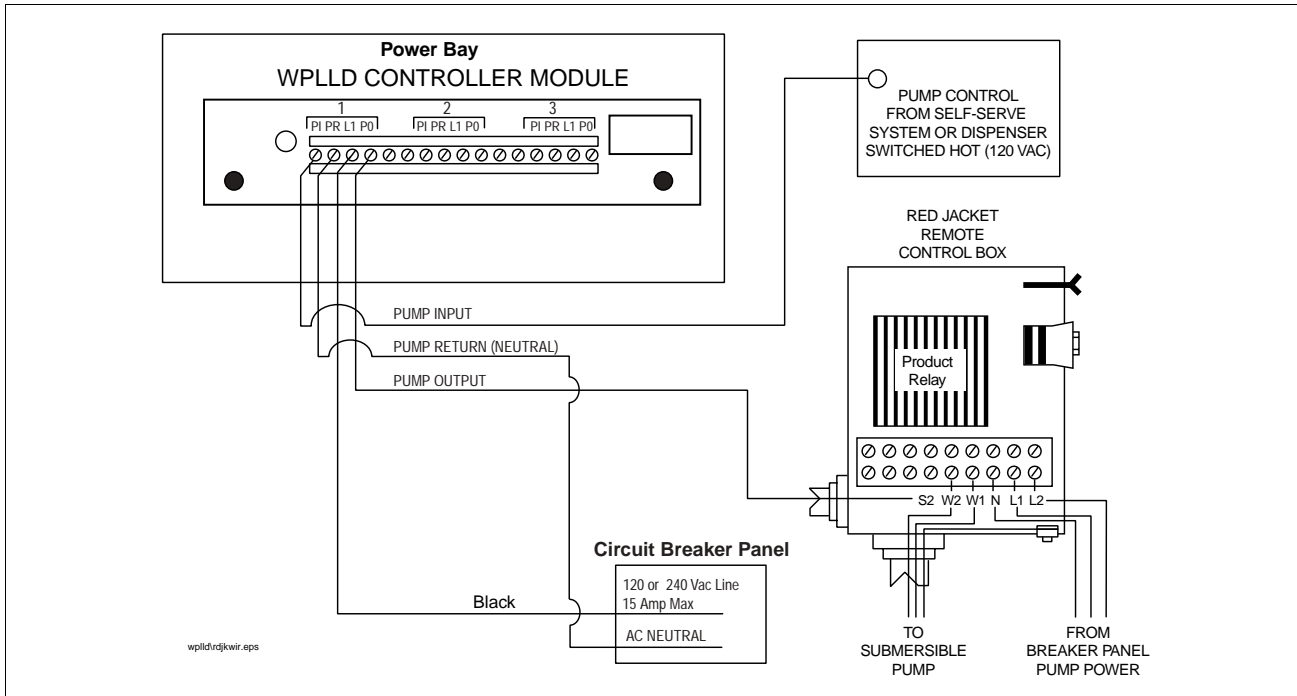


Figure 5-1. WPLLD System and Pump Control Diagram for Red Jacket Relay Control Box

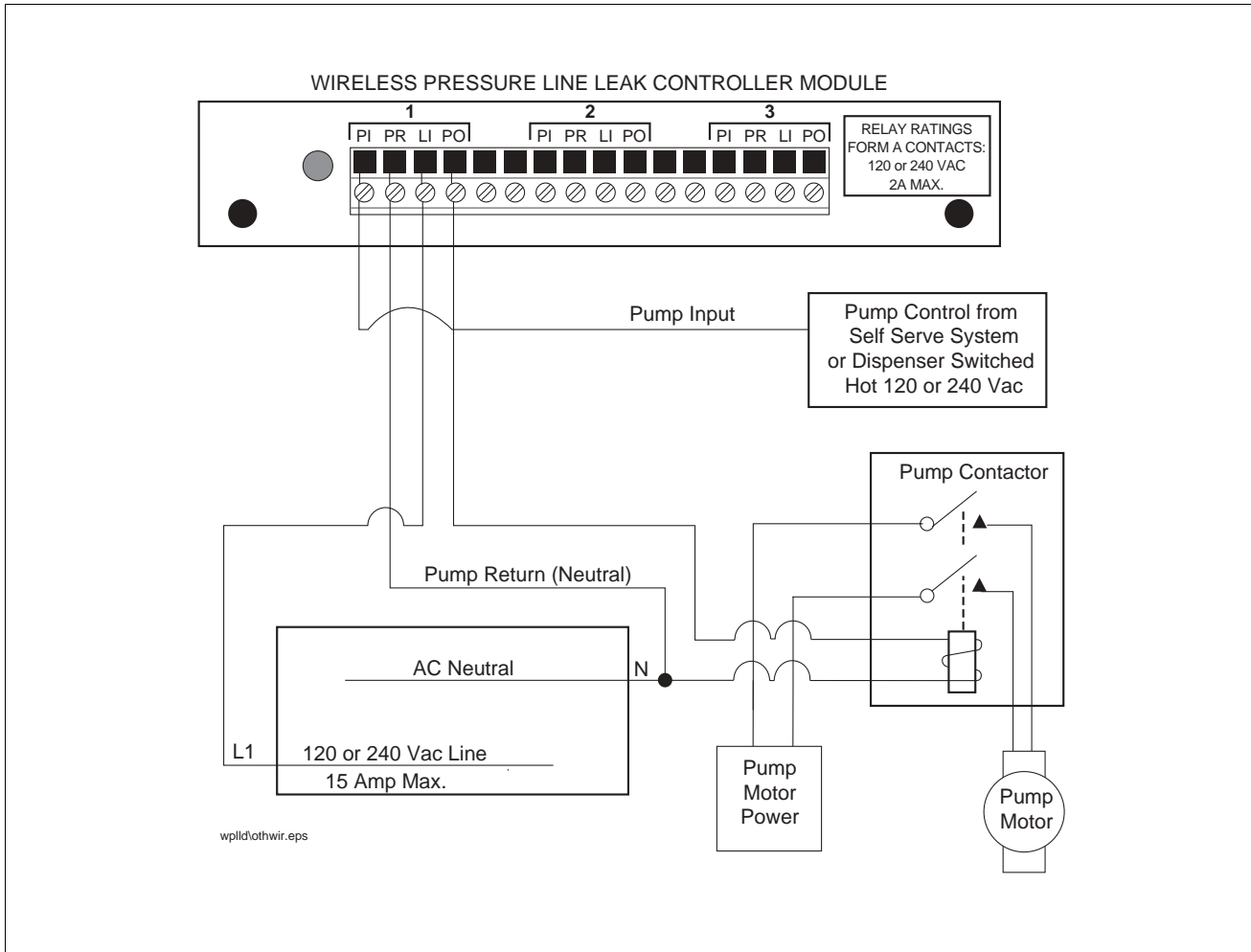


Figure 5-2. WPLLD System and Pump Control Diagram for Non-Red Jacket Relay Control Box

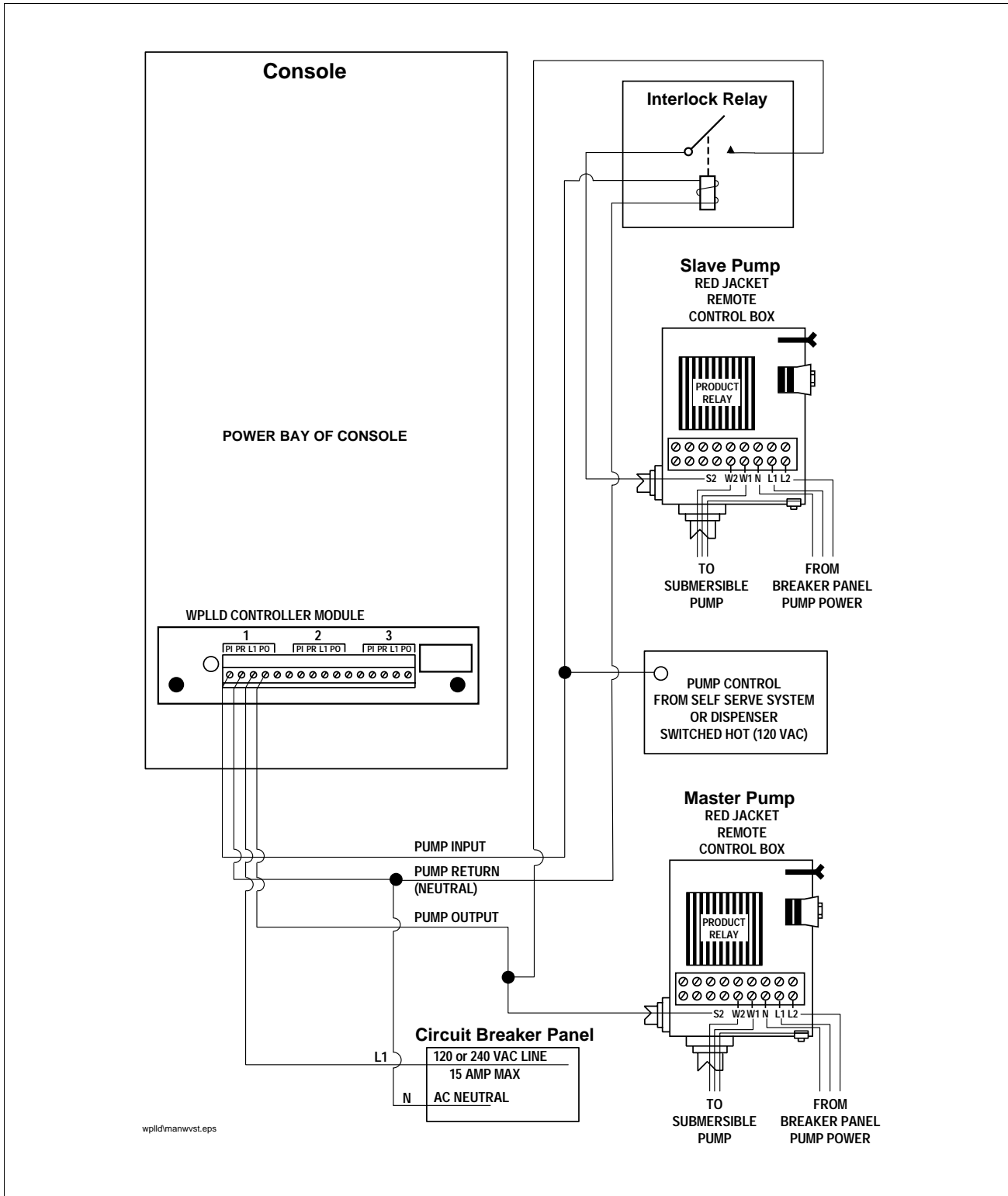


Figure 5-3. Wiring Diagram - Manifolded Product Lines WPLLD - Dual Pumps, Single Tank (Red Jacket relay box shown in this example)

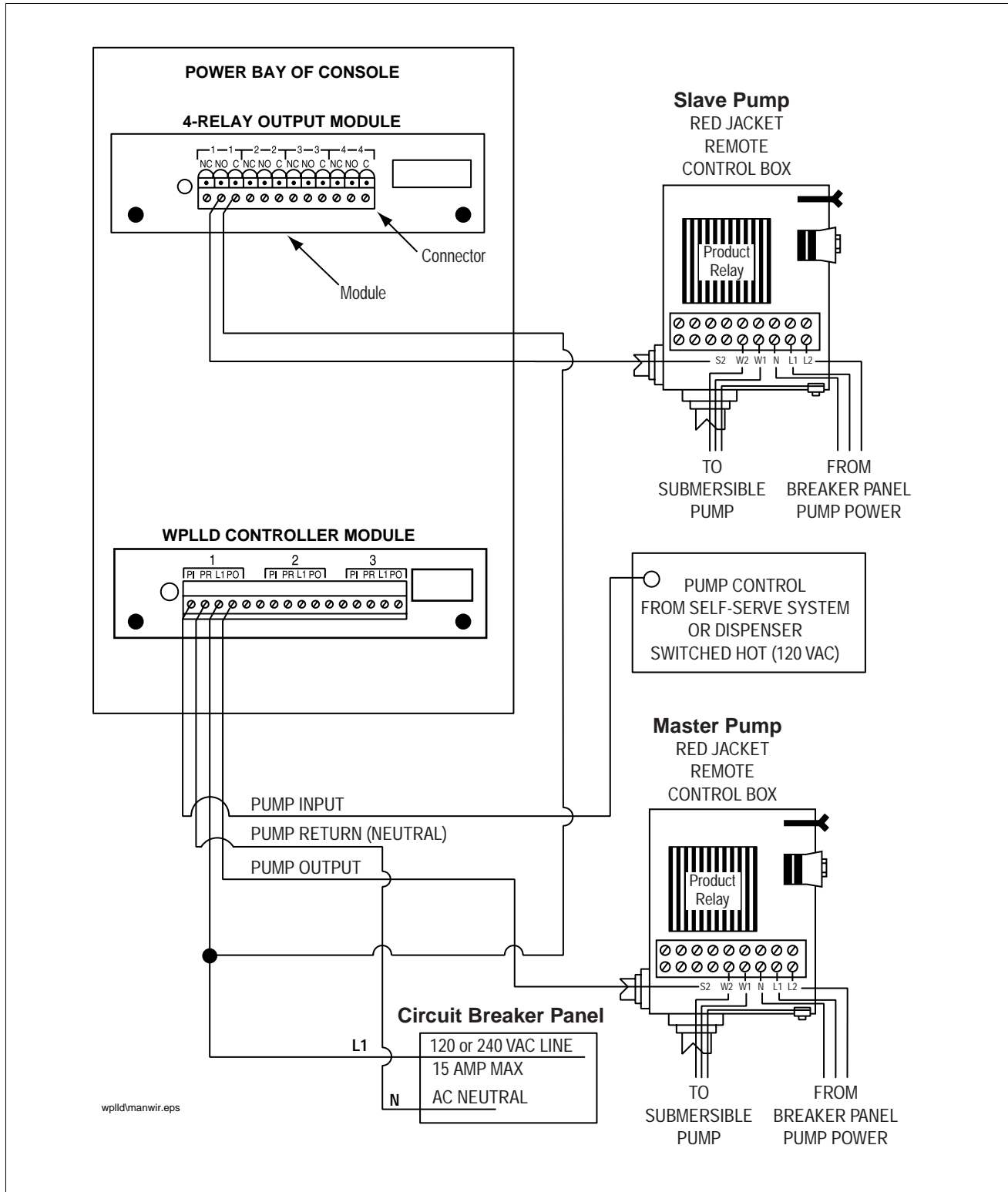


Figure 5-4. Wiring Diagram - Manifolded Product Lines WPLLD - Multiple Tanks (Red Jacket relay box shown in this example)

6 Checking the System

Setting the Signal Strength Jumper

IMPORTANT! You must install the WPLLD transducer prior to performing this procedure.

To obtain optimum signal reception from the transducer, it may be necessary to change the noise/signal strength jumper position (see Figure 6-1). The default position is R98.

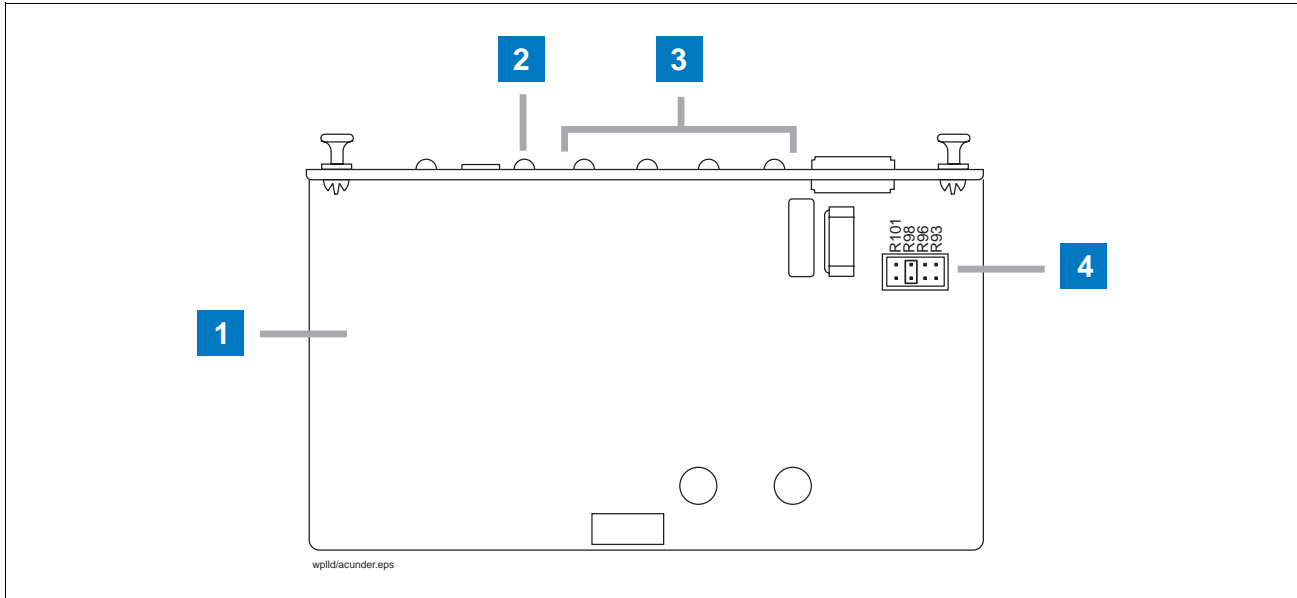


Figure 6-1. Noise/Signal Strength Jumper Settings

Legend for numbered boxes in Figure 6-1:

- 1 Underside of WPLLD AC Interface Module.
- 2 Green XMIT LED - flashes when information is received from a WPLLD transducer.
- 3 Number of LEDs lit indicate signal strength received from WPLLD transducers. At least 3 LEDs should be lit, when receiving transducer communications, indicating good signal strength.
- 4 Noise/signal strength jumper settings. R98 is default setting.

GUIDELINES

1. For optimum data reception, the LEDs on the front of the WPLLD AC Interface Module should turn On as follows.

- a. When a WPLLD transducer is not transmitting:

None of the 4 red LEDs should be lit (indicating no noise on the line). One dimly flashing red LED is acceptable; however, if more than 1 of the red LEDs are flashing, you have excessive noise on the ac line and it should be removed before continuing. Start turning off electrical signs, motors, etc., one item at a time, until the noise is eliminated. Replace the device causing the noisy condition.

- b. When a WPLLD transducer is transmitting*:

At least 2 of the red LEDs are flashing and the green (data) LED is flashing.

*8 seconds after power to the STP is turned On, the WPLLD transducer will transmit its first message. Every 8 seconds thereafter for up to 4 minutes, the transducer will transmit an additional message.

- 2. The R101 jumper position is the highest gain position and R93 is the lowest gain position.
- 3. Remember that as you increase the gain, you increase the signal strength as well as any noise on the line.
- 4. IMPORTANT! Some sites may use different phases of 240 Vac power for each submersible pump power source. Although this situation does not always prevent the WPLLD transducer from communicating, it can cause intermittent Comm Alarms. Therefore, it is required that each submersible pump use the SAME phase of 240 Vac power.

WPLLD System Checkout Procedure

Do not turn on power to the console. This must be done by an authorized Veeder-Root Authorized Service the warranty checkout and Start-Up Procedure!

A Veeder-Root Authorized Service Contractor must program the WPLLD set-up information into the console before beginning this procedure.

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 section **must** be performed when using new WPLLD 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 immediately after installing the transducer, before energizing the STP.

VENTING THE LINE



- 1. Turn Off, lock out, tag power to the STP.
- 2. Vent the line to zero.
- 3. Reseal the line.



WARNING! - The STP is actually turned On in this procedure. To prevent accidental discharge of product from the line, be sure to reseal the lines after venting.

- 4. Turn On power to the STP.

DETERMINE WPLLD TRANSDUCER PRESSURE OFFSET

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

WPLLD LINE LEAK DIAG
PRESS <STEP> TO CONTINUE

From the WPLLD Diag message, press STEP until you see the display below

W 1: WPLLD 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):

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

Press STEP:

```
W 1: START P OFFSET TEST
PRESS <ENTER>
```

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

```
W 1: PRESSURE OFFSET TEST
MEASURING
```

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

```
W 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. Press TANK/SENSOR and repeat the above procedure for the each of the other WPLLD transducers.

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. Refer to WPLLD troubleshooting procedures for further instructions.

Entering the Pressure Offset Value for each Transducer

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

```
WPLLD LINE LEAK SETUP
PRESS <STEP> TO CONTINUE
```

Press STEP until you see the message:

```
W 1: WPLLD NUMBER 1
PRESSURE OFFSET: +XX.X
```

Press CHANGE and enter the Pressure Offset value for transducer W1. If necessary, press the left arrow key to change the sign (+ or -). Note: enter the Offset value **exactly** as displayed in the Offset test result message (including + or - sign). Press TANK/SENSOR, to display another transducer. Press CHANGE to enter its Pressure Offset value, then ENTER to confirm the change. Repeat this procedure until you have entered Offsets for all transducers.

PURGE AIR FROM THE LINE

Follow accepted procedures to purge all air from the product line being enabled for dispensing.

ENABLE THE LINE FOR DISPENSING

After installing the WPLLD system, the TLS 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.

IMPORTANT! Verify that the functional element and SwiftCheck valve threads into the pump are not leaking. The WPLLD system will not detect leaks upstream from the SwiftCheck valve, including a leaking functional element.

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:

WPLLD 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:

W X: Product Label
DISPENSING DISABLED

In the display shown, W = device code for WPLLD, 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:

W XX.XXX PSI PUMP OFF
TEST COMPLETE HANDLE OFF

If there is not at least a 2 psi difference between the Pump On pressure and the Pump Off pressure, a no-venting condition exists that will interfere with precision line testing. Please consult the WPLLD Alarm Quick Help guide’s “Periodic or Annual Test Needed Warning” discussion for troubleshooting information.

Check for STP leaks as follows:

- a. Turn On the STP and carefully check all fittings and the functional element for leaks.
- b. Verify that the functional element, strainer, and check valve threads into the pump are not leaking.
 IMPORTANT! The WPLLD does not perform any leak test on the functional element or any other components upstream from the check valve and will not detect leaks there.
- c. Tighten any leaking fittings until the leak is stopped. **Be careful** not to overtighten and strip the threads.
- d. If the leak cannot be stopped, turn Off, tag, and lock out power to the submersible and check the fitting for thread damage or improper sealing. Replace or reseal the fitting as required.

Checking the Site's Emergency Stop Switch

After the WPLLD system is installed and all lines are enabled for dispensing, test the site to ensure that the Emergency Stop switch will shut down the pumps for all lines.

1. Turn On power to the TLS Console.
2. Engage the Emergency Stop switch. Dispensing from all lines should stop immediately. If the pumps do not stop, rewire the Emergency Stop switch circuit.

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