

PLLD & WPLLD

Troubleshooting Guide

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Introduction

This manual contains theory of operation, alarm analysis, and diagnostic analysis for PLLD and WPLLD Line Leak Systems compatible with system software versions 19 and later. This manual does not address selection, installation, or setup of PLLD and WPLLD Line Leak components.

Related Manuals

| | |
|------------|---|
| 577013-465 | Line Leak Detection Systems Application Guide |
| 576013-902 | PLLD Site Prep and Installation Guide |
| 576013-923 | WPLLD Site Prep and Installation Guide |
| 576013-623 | TLS-3XX Series Consoles System Setup Manual |

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 or 4** Contractors holding valid Level 2,3, or 4 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.

Safety Precautions

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

| | |
|---|---|
|  EXPLOSIVE Fuels and their vapors are extremely explosive if ignited. |  FLAMMABLE Fuels and their vapors are extremely flammable. |
|  ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists. |  TURN POWER OFF Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit. |
|  WARNING Heed the adjacent instructions to avoid equipment damage or personal injury. |  READ ALL RELATED MANUALS Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does. |

⚠ WARNING

This product is installed in systems operating near locations where highly combustible fuels or vapors may be present.

Fire or explosion resulting in serious injury or death could result if the equipment is improperly installed or modified. Serious contamination of the environment may also occur.

1. Read and follow all instructions in this manual, including all safety warnings.
2. Comply with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes.

Theory of Operation

Line Leak Detection Schematic

Figure 1 is a simplified diagram of the piping being monitored by a line leak detection system. In the example below, a line check valve is needed to regulate the relief pressure. A line check valve isn't required with pumps that have a Veeder-Root approved internal precision check valve.

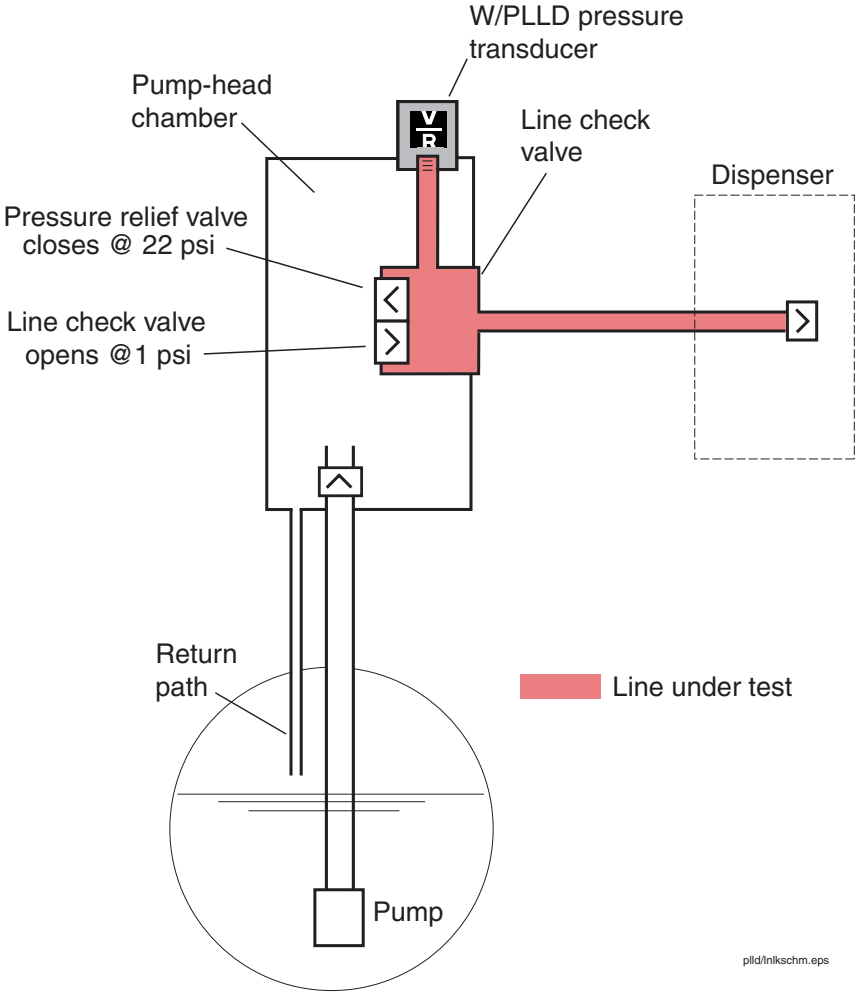


Figure 1. Line Leak Detection Schematic

The Line Pressure Graph

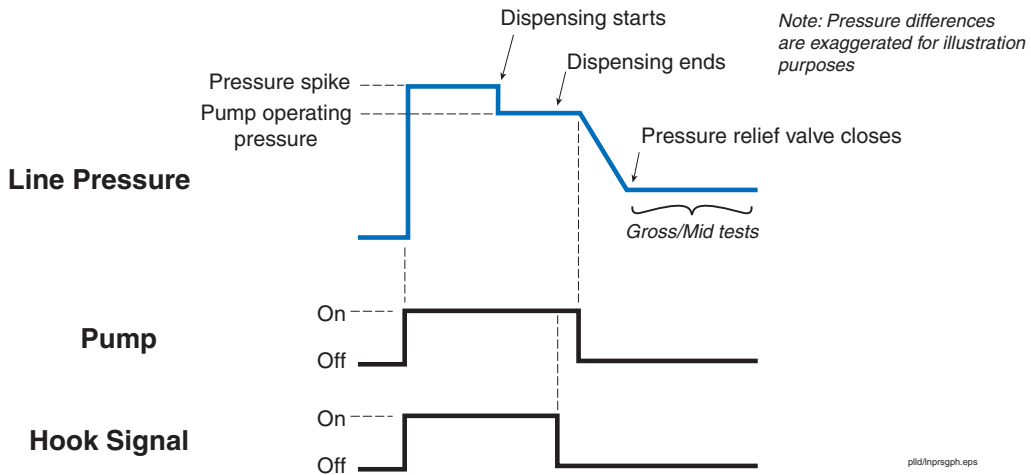


Figure 2. Line Pressure Graph - Gross/Mid Tests

LINE PRESSURE GRAPH - GROSS/MID TESTING

When the pump is turned On the line check valve opens and fuel is pumped into the line (Figure 2). When dispensing starts the line pressure drops to the pump’s operating pressure. When dispensing ends the pump remains On for 10 more seconds. The pump shuts Off and the line pressure drops as the fuel in the line returns to the pump head chamber through the pressure relief valve. When the line pressure drops to the pressure relief valve’s setpoint, the valve closes. **Gross and Mid test measurements are made after the pressure relief valve closes.**

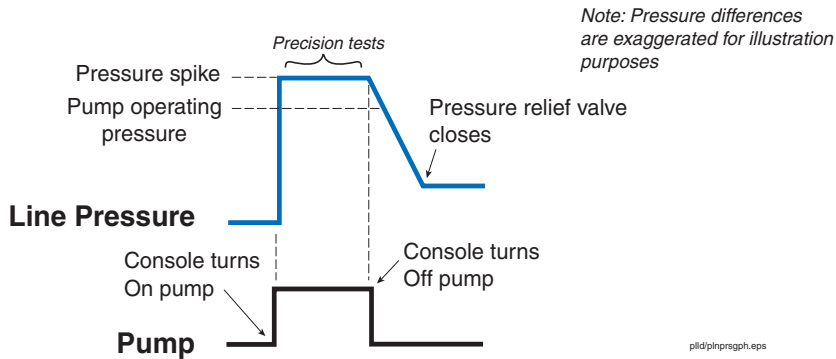


Figure 3. Line Pressure Graph - Precision Tests

LINE PRESSURE GRAPH - PRECISION TESTS (0.2 AND 0.1 GPH)

The console turns the pump On opening the line check valve and pumping fuel into the line (Figure 3). The line check valve closes trapping a pressure spike in the line. **Precision test measurements are made in the spike section of the line pressure graph.** After the measurements are made the console shuts the pump Off. The line pressure drops as the fuel in the line returns to the pump head chamber through the pressure relief valve. When the line pressure drops to the pressure relief valve’s setpoint, the valve closes.

Line Test Sequence



Figure 4. Precision Test Sequence

The line leak tests are performed in the following sequence: gross, periodic (includes mid test) and annual, dependent on software, line type, and console programming

A gross test always follows the completion of a dispense. At the conclusion of the gross test a periodic test will be performed if either a periodic or annual test is scheduled. At the conclusion of the periodic test the annual test will run if scheduled. This sequence is also followed when a test is started manually.

If a dispense request occurs during any test, the test is aborted and the pump is turned On to commence dispensing. The testing will restart from the beginning once dispensing stops.

Gross Leak Test

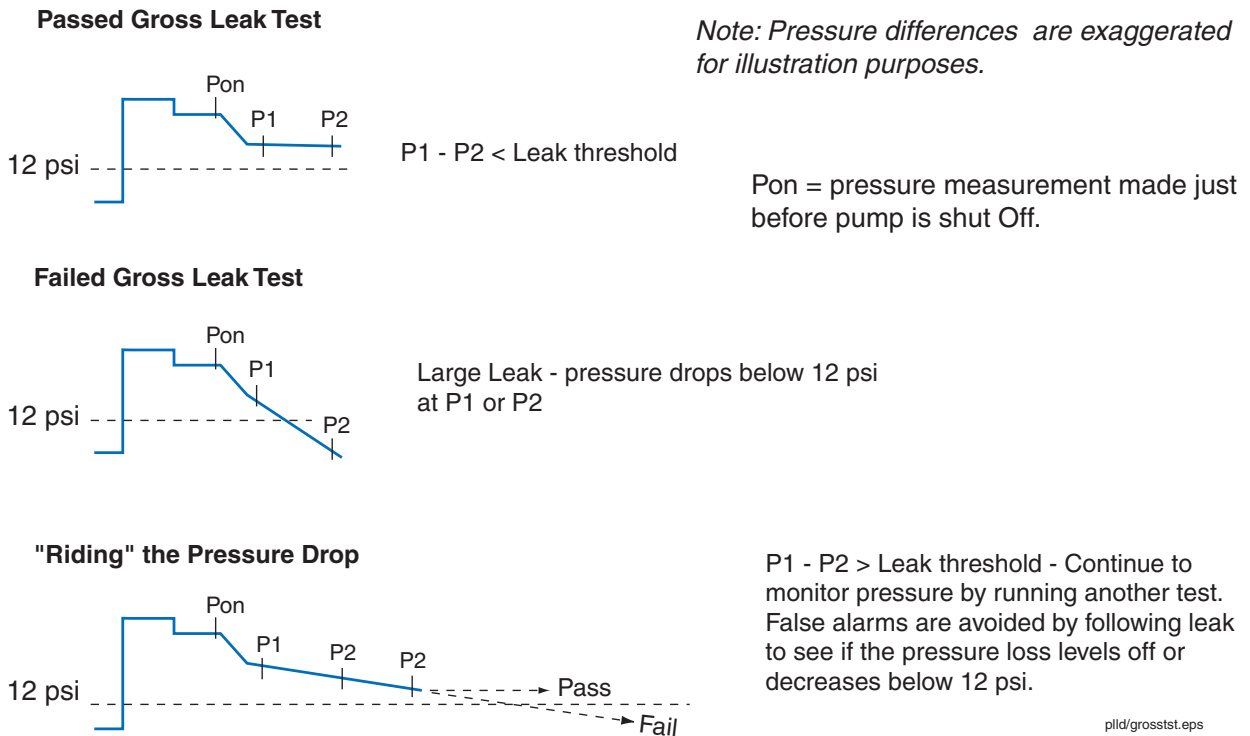


Figure 5. Gross Leak Test Diagram

The Gross Leak test (3 gph) is a pump-Off test that immediately follows the end of dispensing (indicated when the Pump In [handle] signal goes inactive):

1. After the pump is turned Off, the test waits time T1 for the line pressure to vent down to the relief valve pressure of approximately 22 psi. At this time the reference pressure, P1, is measured (see Figure 5). If P1 is below 12 psi it is assumed there is a large leak and a retest is run to confirm the leak. If it fails yet again, a "Gross Test Fail" alarm is posted.
2. If P1 is above 12 psi the test then waits time T2 to allow the line to lose pressure should there be a leak. At time T2 a second pressure measurement is made, P2. If P2 is less than 12 psi the test fails. If P2 is greater than 12 psi and a drop in pressure from P1 to P2 indicates there is a leak, the line pressure will continue to be monitored by taking additional pressure measurements.
3. This monitoring process continues until P2 drops below 12 psi (a failure) or the P1-P2 comparison does not indicate a leak (a pass).

The wait times (T1 and T2) are based upon the line type and line length. Incorrectly programming the line type and line length can impact test results (false failures/passes) - see "Troubleshooting Field Leak Testing Problems" on page 21. In the case where a stiff line (steel or fiberglass) is programmed as a flex line the wait time will be excessively long and will subject the line to false alarms, particularly when there are thermals causing the line to contract. When a soft flex line is programmed as a steel or fiberglass line the wait times will be too short and will not give the line enough time to lose the required amount of pressure that would permit identification of a leak near the fail threshold.

Precision Testing

LEAK RATE MEASUREMENT (0.2 AND 0.1 GPH TESTS)

The precision leak tests (Periodic, 0.2 gph and Annual, 0.1 gph) are pump-On tests. The main component of the precision tests is the leak rate (LR) value.

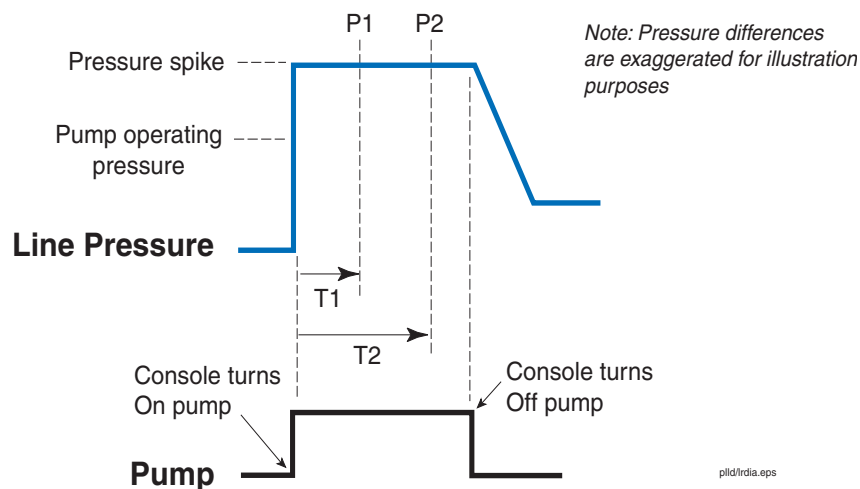


Figure 6. Leak Rate Calculation

When the pump is turned On a pressure spike is trapped in the line (Figure 6). After a waiting time T1, the reference pressure P1 is measured. After waiting time T2, pressure P2 is measured. A leak rate (LR) is calculated using the values T1, T2, P1, and P2.

PRECISION TEST PROCEDURE

Figure 7 diagrams the precision test sequence assuming no thermal instability. Whether scheduled or manually initiated, Precision leak tests (Periodic and Annual) always follow a passing Gross test.

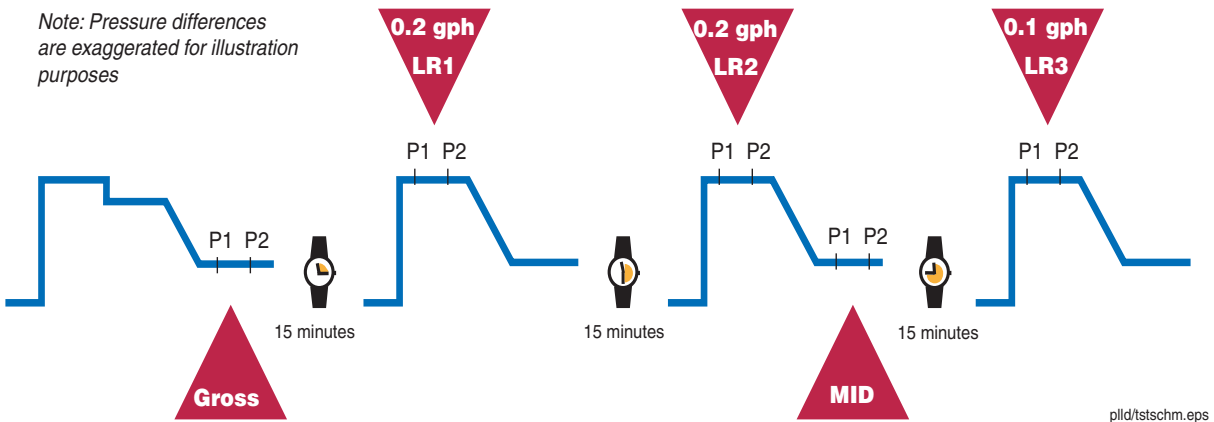


Figure 7. Precision Test Diagram

Periodic Test

Fifteen minutes after a Gross test has completed the Periodic test starts with the measurement of leak rate LR1. After another 15 minute waiting period LR2 is measured. At this point the Mid test is performed. If the Mid test passes the leak rates LR1 and LR2 are checked for thermal stability. If the leak rates do not indicate the line is thermally stable the 15-minute readings will continue until thermal stability has been declared. The final leak rate, LRn is used to determine the state of the test, pass or fail. A failure will post a Periodic Test Fail alarm. The minimum amount of time it takes to complete a Periodic test is 30 minutes; 15 minutes to measure LR1 and another 15 minutes to measure LR2. The "LR" cycles will continue until thermal stability in the line has been achieved.

Mid Test

The Mid test is a pump-Off test that is a part of the Periodic test. At the end of the second leak rate measurement the pump is turned Off and a pump-Off test is performed. This test is similar to the Gross Leak test in which two pressures are measured. If the Mid test fails, the Periodic Test Fail alarm is posted and precision testing is complete. So for troubleshooting purposes, follow the same guidelines as for 3 gph failures.

Annual Test

If the Periodic test result is a pass, the Annual test will follow. The Annual test procedure is the same as the Periodic test but it has tighter thresholds. The Annual test uses the last Periodic test rate, LR2, as it's starting test rate LR1. After a fifteen-minute wait LR2 is measured and a test for thermal stability is performed. A line may be thermally stable for a Periodic test but not for an Annual test because the requirements are stricter. When thermal stability is reached LR2 is used to determine the Annual test result. The minimum test duration for an Annual test is 45 minutes (30 minutes for the Periodic test and another 15 minutes for LR2).

HOW THERMAL INSTABILITY AFFECTS PRECISION TESTS

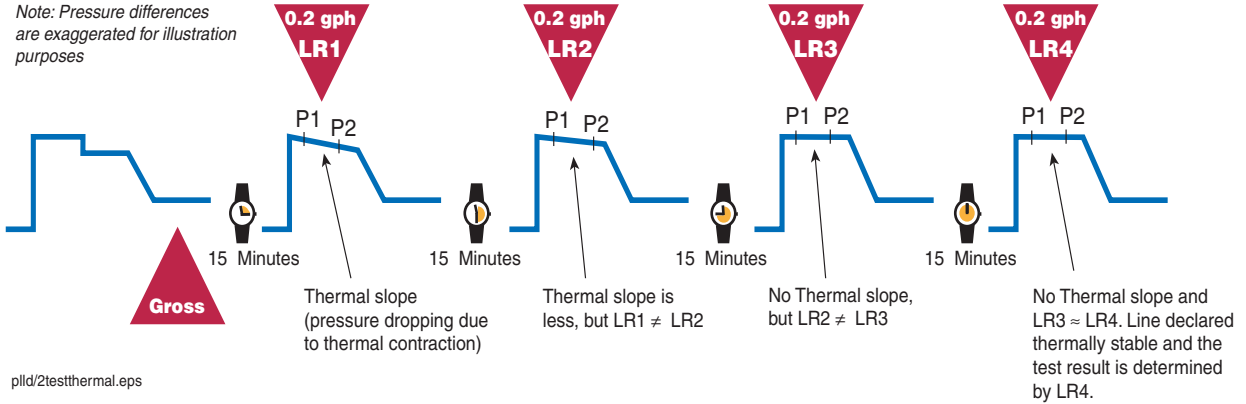


Figure 8. Thermal Instability Lengthens Precision Test Times

Due to the sensitivity of the precision tests, thermal instability results in longer 0.2 and 0.1 gph test times. Thermally-induced pressure change occurs when the ground temperature at the depth of the tank is different from the ground temperature at the line which is closer to the surface. When a temperature differential exists, the pressure of the fluid in the line may increase or decrease rapidly after dispensing before tapering off as its temperature approaches that of the line.

The precision tests are designed to wait out thermal-induced pressure changes (Figure 8). If the pressure is changing due to thermals, the leak rates will be different when measured 15 minutes apart. If the rates are different, the system continues to take measurements until two sequential leak rate calculations are equal (or within a certain tolerance). At this point the line is declared thermally stable and the state of the test determined by the last measured leak rate. There is no limit on the number of 15-minute test cycles in a precision test because the test will continue until thermal stability has been declared, or a dispense request (Pump-In signal active) causes the test to abort.

Troubleshooting Guidelines

How A Line Loses Pressure

- External Leaks

Fuel is leaking from the line into the environment.

- Internal Leaks

Fuel is leaking from the line into a section of the pumping system that is not being tested. An example of an internal leak at the pump head would be a leaking check valve allowing fuel to leak back into the tank. An example of an internal leak at the dispenser would be a leaking blend valve where the fuel is leaking into another line. The W/PLLD line leak detection system cannot distinguish between an external and internal leak.

- Thermal Contraction

The temperature of the fuel in the line is decreasing causing it to contract.

Gross Test Fail Alarm

The Gross Test Fail alarm occurs when the gross line leak algorithm determines that the line is leaking at a rate exceeding 3.0 gph.

DIAGNOSTIC

Enter Diagnostic Mode, press FUNCTION until the Pressure (or WPLLD) Line Leak Diag screen appears, press Step until the 3.0 Diag screen appears, and press Print:

```
~~~~~
PRESSURE LINE LEAK DIAG
JUN 29, 2000 04:09 PM
Q1:
3.0 TEST PASSES
-----
PON      P1      P2
JUN 29, 2000 01:30 PM
30.2    21.3    20.0
JUN 29, 2000 01:09 PM
32.7    21.0    20.6
JUN 29, 2000 12:02 PM
30.9    21.1    21.0

3.0 TEST FAILS
-----
PON      P1      P2
JUN 29, 2000 02:23 PM
30.3    6.1     3.5
~~~~~
pild/gdiag.eps
```

Figure 9. Gross Test Diag Printout

PROBABLE CAUSES

1. The line is leaking externally, inspect all visible areas of pipeline, dispenser piping, and STP for leakage. If available, review reconciliation data for the last 30 days. If losses are indicated, the probability of a leak is high.

2. The tank is empty. When the tank runs dry the pump is unable to pressurize the line. The low line pressure may result in a failure of the gross test. If the line has a tank assigned to it, the fuel level in the tank is checked before the alarm is posted. If the tank's level is less than 10 inches a Fuel Out alarm will be posted in place of the Gross Test Fail alarm. When there is an active Fuel Out alarm the pump will not turn On. The Fuel Out alarm will clear when a delivery raises the fuel level above 10 inches.
3. Power to the STP is switched Off - PLLD ONLY. Pon = P1 = P2 <12 psi.
4. Faulty check valve (FE Petro or SwiftCheck Valve). Pon = normal and P2 <12 psi.
5. Line length or type programmed incorrectly in the console.
6. Bad transducer - install gauge in line.
7. Packer-discharge seal leaking (Red Jacket STP) - replace with the correct seal for your application.
8. Dispenser is leaking internally. At the dispenser inspect the solenoid valve (leaking into nozzle hose), blend valve (leaking into another line), and the stage II vapor recovery system (leaking into the vapor recovery return path). Pon = normal and P2 <12 psi.
9. Low or no STP pressure (bad STP, starting capacitor). Pon < normal and P2 <12 psi.
10. Incorrect wiring. If the pressure transducers are wired to the incorrect lines the gross test algorithms will be evaluating the wrong pressures. - PLLD ONLY.

TROUBLESHOOTING GUIDELINES

1. Verify that the tank is not out of fuel.
2. Inspect system for external leakage.
3. Verify that the pump is receiving power and is producing normal pump-On pressures.
4. If there is no evidence of an external leak then the leak is most likely an internal leak - fuel is leaking into the dispensers or the tank. Close all dispenser emergency shut-off ('shear') valves and retest. If the test passes, the leak is probably in the dispenser(s). If the test fails, fuel is most likely leaking back into the tank. Check the line check valve and the seals in the pump head.

Mid Test Fail

This alarm occurs when the Periodic Line Leak algorithm determines that the line is leaking at a rate exceeding 0.2 gph.

DIAGNOSTIC

Enter Diagnostic Mode, press FUNCTION until the Pressure (or WPLLD) Line Leak Diag screen appears, press STEP until the Mid Diag screen appears, and press Print:

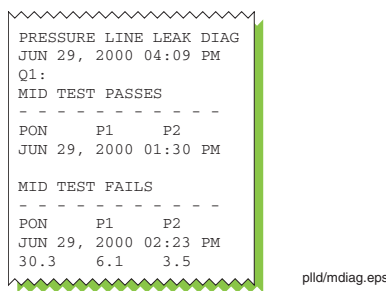


Figure 10. Mid Diag Printout

PROBABLE CAUSES

See Gross Test Fail Probable Causes paragraph above.

Periodic/Annual Test Fail

This alarm occurs when the line leak algorithm determines that the line is leaking at a rate exceeding 0.2 gph (Periodic Test) or 0.1 gph (Annual Test).

DIAGNOSTICS

Periodic Test Diag

Enter Diagnostic Mode, press Function until the PRESSURE (or WPLLD) LINE LEAK DIAG screen appears, press STEP until the 0.20 DIAG screen appears, and press PRINT (see example Figure 11).

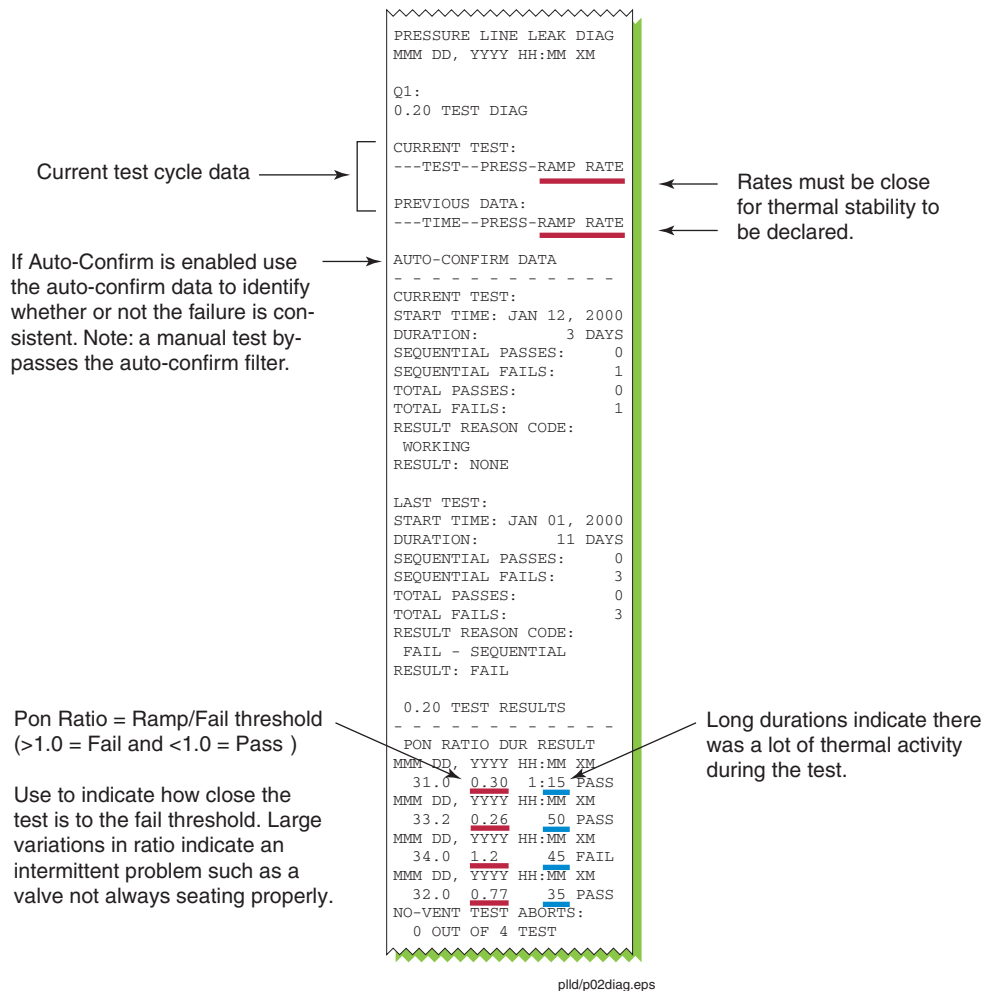


Figure 11. Periodic Test Diag Printout

Annual Test Diag

Enter Diagnostic Mode, press FUNCTION until the PRESSURE (or WPLLD) LINE LEAK DIAG screen appears, press STEP until the 0.10 DIAG screen appears, and press PRINT (see example Figure 12).

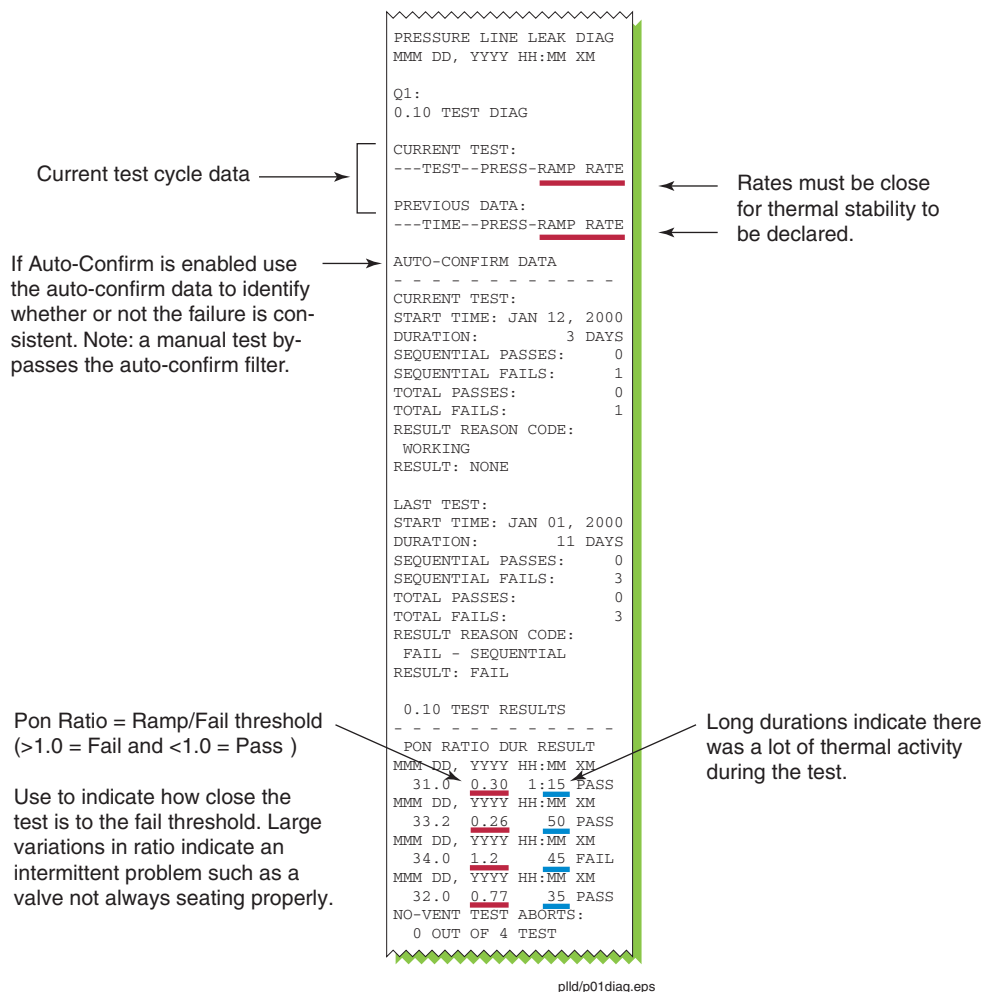


Figure 12. Annual Test Diag Printout

PROBABLE CAUSES

1. The line is leaking.
2. Line check valve is leaking.
3. Dispenser is leaking. External leaks (connections, filters, etc.), or internal leaks (solenoid valves in dispensers leaking into nozzle hose, blender valve leaking, etc.)
4. The console is not programmed for the correct line length / type.
5. Packer-discharge seal is faulty (Red Jacket STP) - replace with the correct seal for your application.

TROUBLESHOOTING GUIDELINES

1. Switch STP On and inspect all visible areas of pipeline, dispenser piping, and STP for leakage. The line must be pressurized in order to observe a precision leak.
2. Check for dispenser solenoid valve leakage by squeezing each nozzle with STP On and dispenser switched Off.
3. If dispensers are blenders, check for blend valve leakage by looking for meter movement (no dispensing and STP On).
4. After making any necessary repairs to correct problems identified in items 1 - 3, retest line to confirm failure. If it passes, but no repairs were made, the problem is intermittent. The most common intermittent causes are Probable Cause items 2 and 3. If it fails proceed to the next step.
5. Close all dispenser emergency shut-off (shear) valves, and retest. If it fails, the most common possible causes are 1, 2, and 5. If it passes, the problem is in one of the dispensers. Open the shut-off valves, one at a time, or to save time, in groups, and continue testing until leakage recurs to identify suspect dispenser.

Line Equipment Fault Alarm

Two monitors are used to identify a problem with the pressure measurement equipment. The dispensing pressure monitor watches the line pressure when the pump is On and fuel is being dispensed. The venting pressure monitor keeps track of the line pressure after the pump is Off and the pressure relief valve closes.

DISPENSING PRESSURE MONITOR

The dispensing pressure monitor compares the dispensing pressure, Pd, with the previously measured reference dispensing pressure, Pd_ref. If the current Pd value exceeds the Pd_ref value by 5 psi for a continuous period of one month, the Line Equipment Fault alarm will be posted.

$$Pd > Pd_ref + 5 \text{ psi for 1 month} \rightarrow \text{Line Equipment Fault alarm}$$

Initial Setting of PD_REF

At system startup the Pd_ref value is unknown. When the dispense pressure, Pd, is calculated for the first time this value is recorded as Pd_ref. Any subsequent growth in pressure measurement offset can now be identified when the current Pd value is compared to this reference value.

Important! It is important that the pressure transducers do not have an offset at system startup because the offset value will be locked into the Pd_ref value.

Resetting Pd_ref

Automatically

In most pressurized line systems the line pressure will drop to zero due to thermal contraction. When the line pressure has been measured at pressures less than 5 psi, it is known that pressure transducer has little or no offset. At this time Pd_ref will be updated to the current Pd value.

Manually

Under the W/PLLD LINE LEAK DIAG Function, the step P OFFSET RESET allows the user to reset the Pd_ref value. After a pressure offset reset the Pd_ref value is set to the unknown state (value of 99). It is updated when the next Pd value is calculated. A manual reset should be performed after a transducer or pump has been replaced. It is important that the user has confirmed that there is no transducer offset prior to resetting the pressure offset monitors.

VENT PRESSURE MONITOR

The vent pressure monitor identifies gross errors in the pressure measurement system. This monitor runs after a passing Gross Line Test. The Gross Test values Pon (pump on) and P2 (pump Off vent pressure - Pv) are used to determine if there is a fault condition. If Pd is available, the Pd value will be used in place of the Pon value.

If $P_v > 40$ psi and $P_d > 50$ psi → Line Equipment Fault alarm is posted.

The vent pressure is nominally 22 psi. If the pressure relief path is restricted the vent pressure could be as high as the pump pressure. The inclusion of the Pd value in the formula prevents the alarm from firing when the reason for the high Pv value is a restricted relief path.

PRESSURE OFFSET TEST

Perform the pressure offset test steps below to determine the offset status of the transducer.



1. Turn Off, lock out, tag power to the STP.
2. Vent the line to zero.
3. Reseal the line.
4. Turn On power to the STP.
5. In the W/PLLD diagnostic menu, run the Pressure Measurement Offset test.



WARNING! WPLLD turns On the STP to take a pressure measurement. Are you sure that you reconnected the line after venting?

6. If the test result is greater than 5 psi, check the transducer wiring. If the wiring is correct replace the transducer.
7. Following all repairs repeat the Pressure Measurement Offset test.
8. If the Line Equipment Fault alarm is still active run a Gross Line Leak test.

W/PLLD Pressure Offset Diagnostic Printout

From the Diagnostic Mode, press FUNCTION until you see the WPLLD LINE LEAK DIAG or PRESSURE OFFSET DIAG. Press PRINT to printout the pressure offset diagnostic (Figure 13).

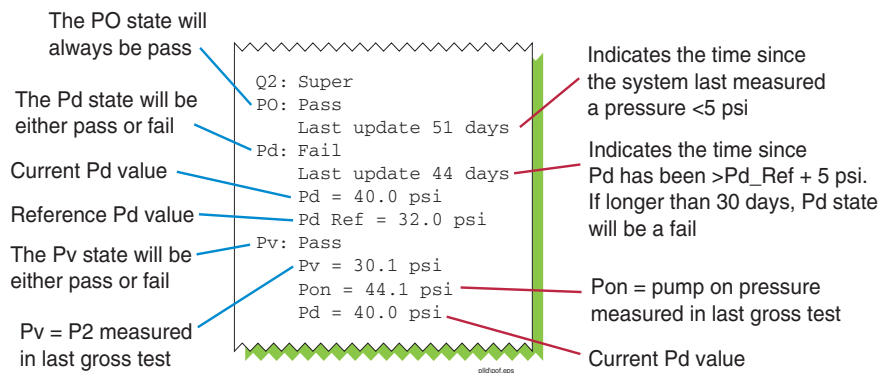


Figure 13. Example Pressure Offset Diagnostic Printout

Possible Causes

1. Pressure transducer has excessive offset.

2. PLLD pressure interface board is bad.
3. Incorrect Pd_ref value.

Troubleshooting Guidelines

1. Perform the Pressure Offset test to measure the offset value. If the offset is greater than 5 psi determine if the problem is the transducer or the PLLD interface board. Typically when the PLLD interface board is bad all lines will have high-pressure problems. After replacing the faulty component, repeat the Pressure Offset test if the failure was caused by Pd. If the failure was caused by Pv, run a Gross test. The alarm should clear after these tests are run.
2. If the problem was caused by an incorrect Pd_ref value the problem will be fixed when a passing Pressure Offset test has completed. The most likely cause for an incorrect Pd_ref value would be that in which a pump was replaced with a higher pressure pump and the pressure monitors were not reset. This condition would automatically correct itself when the line pressure dropped below 5 psi (thermal contraction). However, automatic correction does not always occur in hot climates or with flex lines.

Comm Alarm (WPLLD Only)

A WPLLD Comm Alarm is posted when the transmission is not received or when noise interferes with the reception.

PROBABLE CAUSES

Transmission Not Received

1. No Power to the STP (circuit breaker Off).
2. STP contactor permanently stuck On.
3. Controller Module has blown fuse.
4. Controller Module faulty.
5. AC Interface Module faulty.
6. Bad connection from the 220 Vac line to the AC Interface Module.
7. WPLLD transducer faulty.
8. Field wiring to STP faulty.
9. Comm Module faulty.
10. Bad connection between the AC Interface Module and the Comm Module.

Noise Interference

1. External device generating noise on the AC line (common sources are neon signs, variable speed motors, and STP contactors).
2. Signal strength adjustment incorrect (refer to manual 576013-923).
3. A sticking STP contactor on one of the lines.
4. STP is wired to legs of 3-phase power different than those to which the AC Interface Module is wired (results in Comm alarms).

TROUBLESHOOTING GUIDELINES

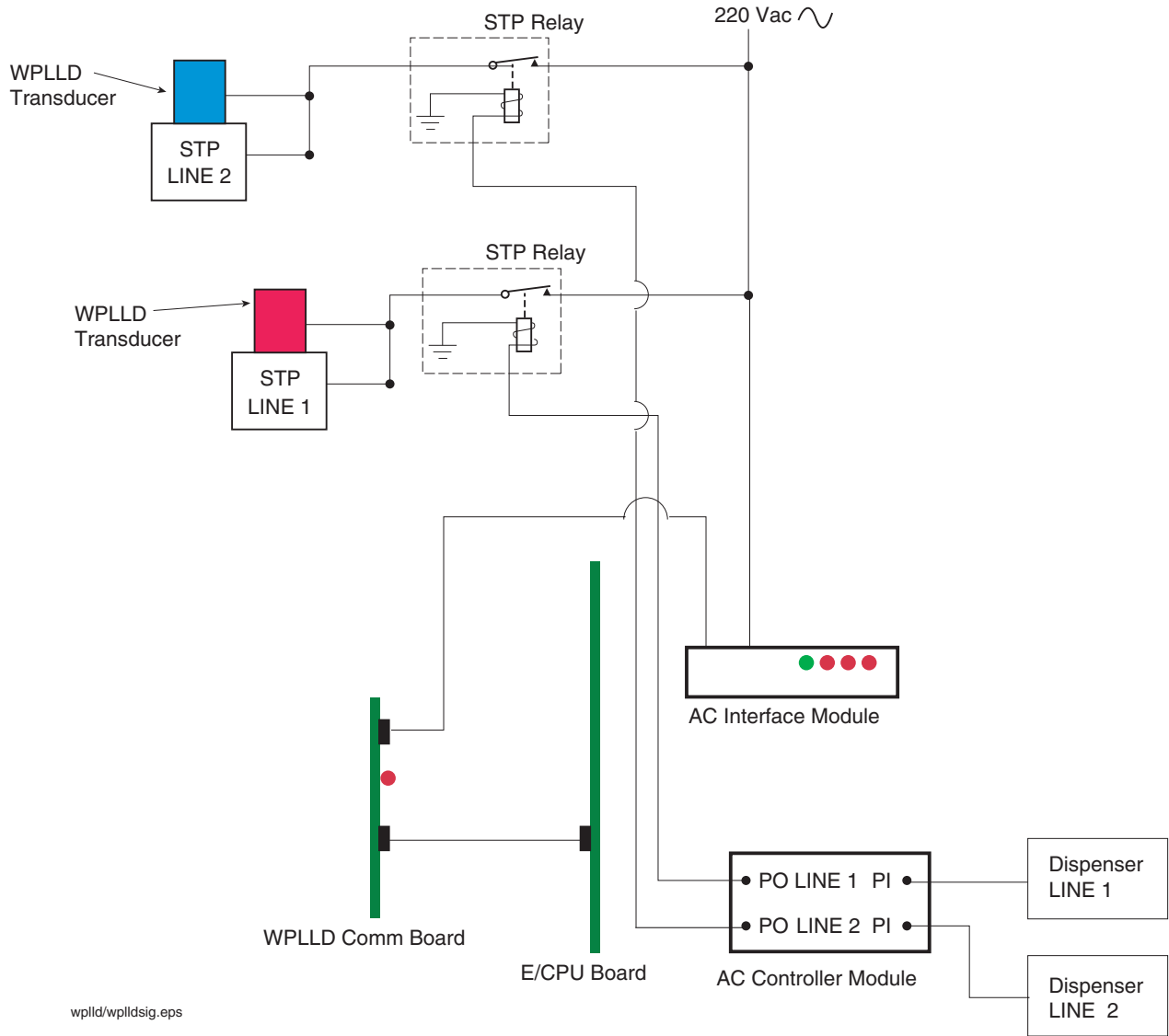


Figure 14. WPLLD Leak Detection Example Diagram for Two Lines

Figure 14 is an example of a two-line WPLLD wiring diagram. Figure 15 through Figure 18 illustrate how pump in signals from the dispensers result in the line pressure data's being properly recorded by the E/CPU board for use in determining Leak Rate values.

AC Controller Module staggers turning On STPs for each line to ensure that the data packets don't arrive at the AC Interface Module at the same time.

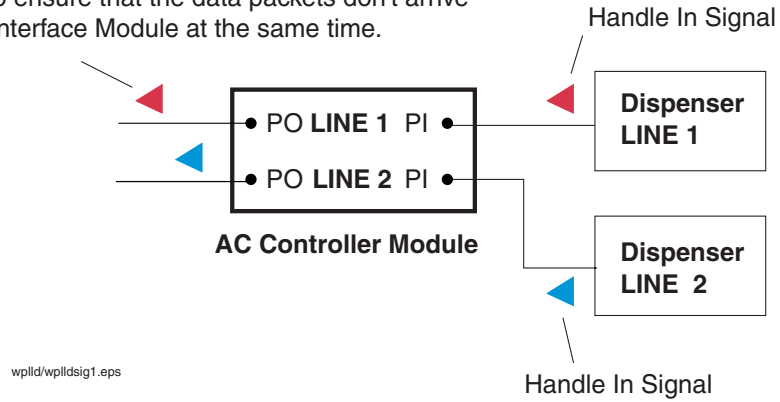


Figure 15. Dispense Requests Received - WPLLD

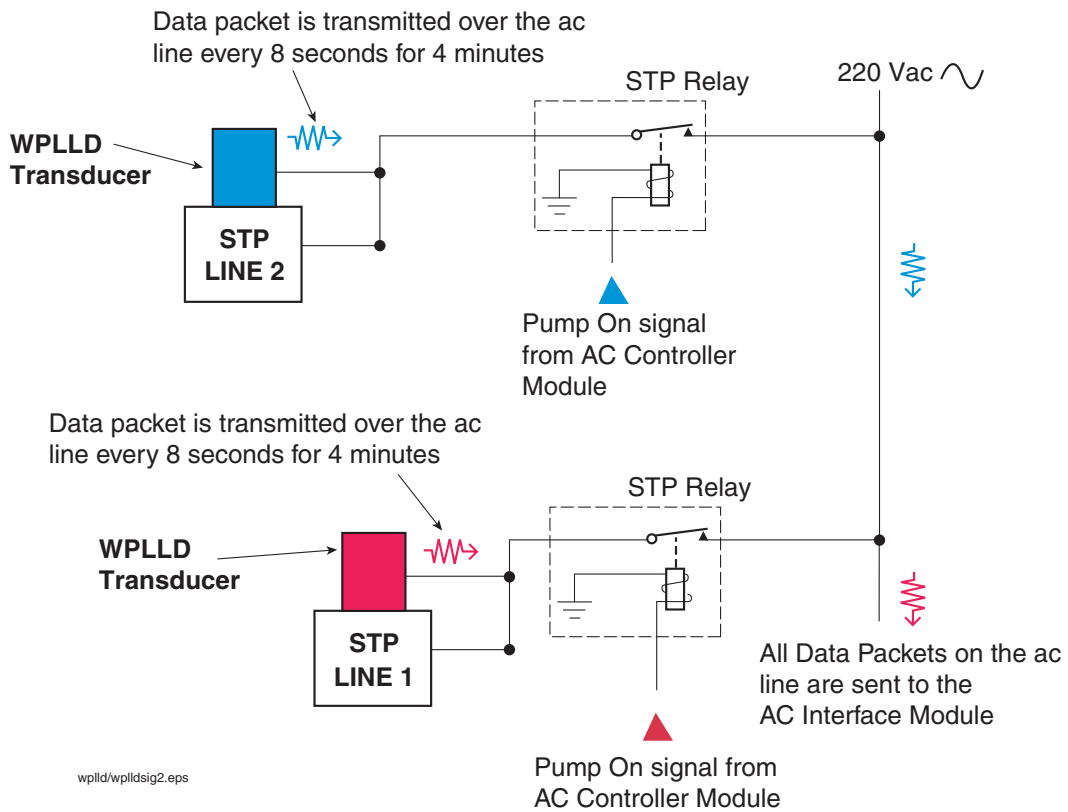
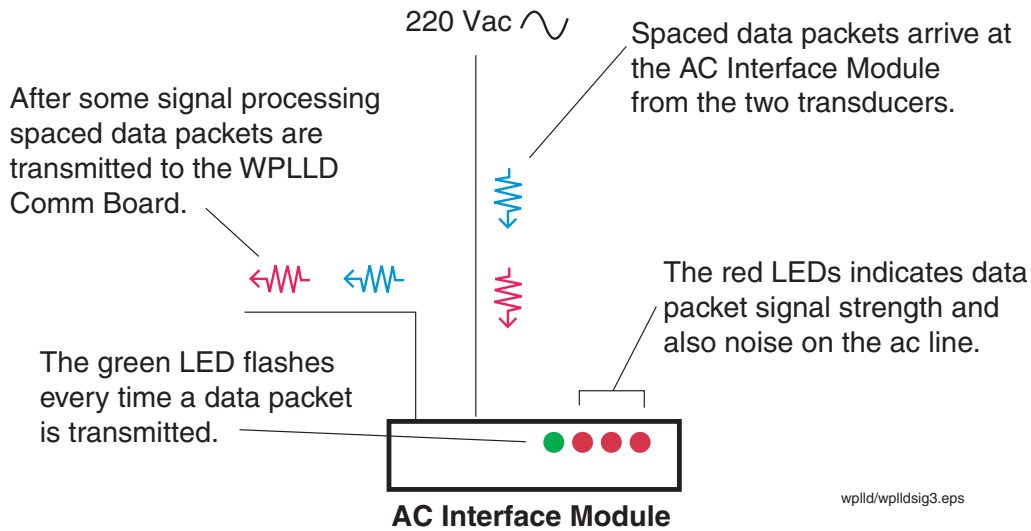
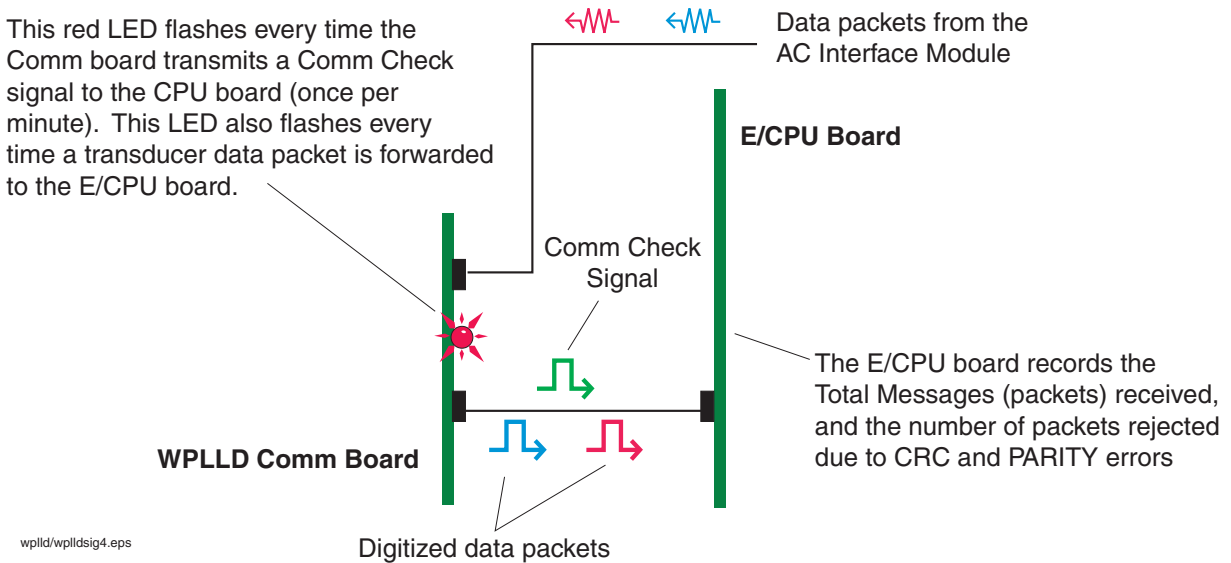


Figure 16. WPLLD Transducer Data Transmission



wplld/wplldsig3.eps

Figure 17. WPLLD Data Transmissions Removed from AC Line



wplld/wplldsig4.eps

Figure 18. WPLLD Data Transmissions Processed and Recorded

Determining if the problem is noise related

1. At the console enter the Diagnostic Mode, press FUNCTION until you see the WPLLD LINE LEAK DIAG screen, and then press STEP until you see the TOTAL MESSAGE screen (ref. Figure 20 on page 26). The Total Messages value is a count of the number of data packets from a transducer that are received by the E/CPU board. Press STEP to the next screen and check the CRC and PARITY values. They should be very low

when compared to the Total Messages value (high values mean the transducer's transmissions were received but were rejected because they had data errors. This condition indicates noise interference.

2. With all the STPs Off, examine the lights on the AC Interface Module.
3. If more than one light is lit, the problem is an external device generating noise.
4. Isolate the circuit that is generating the noise by turning the station's electrical breakers Off one at a time until no lights are lit on the module.
5. Determine which device on the circuit is generating the noise and remove or correct.

NOTE: Noise interference caused by 120 Vac devices drawing less than 5 amperes can be reduced/eliminated by using a plug-in noise filter, part number AF100, manufactured by Advanced Controls Technologies (telephone 800-886-2281 or website <http://www.act-solutions.com/PCCInst.htm>).

Determining if the problem is transmission related

Are data packets being received by the ac interface module?

1. Switch all STPs Off.
2. Start test on the line under repair. Pump will turn On for 10 seconds. Eight seconds after pump turns On, transducer should transmit. If lights on AC Interface Module do not flash, data packets from the transducer are not being received. Check causes 1 - 8 in "PROBABLE CAUSES" on page 15.

If lights on ac interface module are flashing, check comm board.

1. Switch all STPs Off. Comm board LED should flash once every minute, if not, replace board.
2. Run Gross Leak test. After 8 seconds, Comm board LED should flash. If it does transmission is being received from the AC Interface Module. If the LED does not flash, the problem is either the cable between Comm board and AC Interface Module, or the Comm board itself.

Continuous Handle Alarm

A continuous Pump-in signal will activate a Continuous Handle alarm after 16 hours.

PROBABLE CAUSES:

1. Dispenser switch is continuously On - verify that all dispenser switches are Off - dispenser internal board is faulty, or possibly a bad dispenser switch.
2. Excessive dispenser leakage voltage - measure Pump-in voltage with all dispensers switched Off; a reading >30 Vac indicates excessive leakage. Install an isolation relay between the dispenser and the W/PLLD Controller Module.

Fuel Out Alarm

When a Gross Leak test fails and the fuel level is below 10 inches, a Fuel Out alarm is posted. While this alarm is active the pump WILL NOT turn On. The Fuel Out alarm will clear only after a delivery raises the fuel level above 10 inches.

NOTE: The fuel level used to determine the fuel out condition does not include the programmable tilt value and may therefore be different from the height reading displayed.

Low Pressure Alarm

Line leak detection systems do not test the line while the line is dispensing. The purpose of the Low Pressure alarm is to identify a catastrophic leak that occurs when the line is dispensing. The low pressure threshold is programmable from 0 - 25 psi (a low pressure threshold of 0 disables the low pressure monitor). If the pressure drops below the programmed threshold while dispensing, the Low Pressure alarm will be posted and the pump will be shut Off. The pump will remain Off until the next handle signal. At that time the pump will be turned On. If the dispensing pressure is still below the threshold the pump will be turned Off again. If it is above the threshold the Low Pressure alarm will be cleared and the pump will remain On.

PROBABLE CAUSES

1. Large line leak (inspect visible areas of piping, dispensers, and STP).
2. Tank is empty - not if tank height is <10 inches.
3. Low or no STP pressure (bad STP, starting capacitor).
4. Failed STP contactor relay.
5. Power to the STP is switched Off.

Open Alarm - PLLD Only

When the pressure transducer is not connected to the PLLD Interface Module the pressure reading is negative. Note: Diagnostic screen will display 0 when pressures are negative.

PROBABLE CAUSES

1. Open condition in the field wiring.
2. Incorrect field wiring.
3. Reversed wiring on transducer.
4. Bad transducer.
5. Bad PLLD Interface Module.

Periodic or Annual Test Needed Warning

The system failed to complete or pass a Periodic (0.20 gph) or Annual (0.10 gph) test in the programmed number of days.

PROBABLE CAUSES

1. There are Periodic or Annual test failures [check test history to determine if tests are failing; if they are, follow procedures in Periodic or Annual Test Fail alarms (page 11)].
2. Pump-On pressure readings <22 psi.
3. The line is not venting when the pump is shut Off. There should be at least a 2 psi difference between P_{on} and P_{off}. Print out the 0.2 or 0.1 Test Diag. The Number of Vent Test Aborts message indicates how many tests have been aborted due to a non-venting problem. Check for stuck relay, Functional Element not disabled (Red Jacket), incorrect Check Valve (FE Petro), or incorrectly adjusted Check Valve (FE Petro).

4. Active Continuous Pump warning/alarm or Continuous Handle alarm.
5. If the site is extremely busy, especially if blenders are present, there may not be sufficient idle time to complete a Periodic or Annual test unless the station is shut down.
6. Dispenser programmed to turn On all pumps when only one product is to be used.
7. Test was not scheduled.

Setup Data Warning

This alarm occurs if an error was made in programming. This alarm will also occur if the line length has not been programmed. The line length default is 501 feet and will cause a SETUP DATA WARNING if the Service Contractor does not enter the line length.

IMPORTANT! The default line type is set to FLEX A (white Enviroflex PP1501). If the actual line type is not FLEX A, and the Service Contractor does not select the correct line type, the result may be a line test failure.

Troubleshooting Field Leak Testing Problems

This procedure is for sites, which when tested per Veeder-Root documents, fail to produce shutdowns when a calibrated leak is applied to the line.

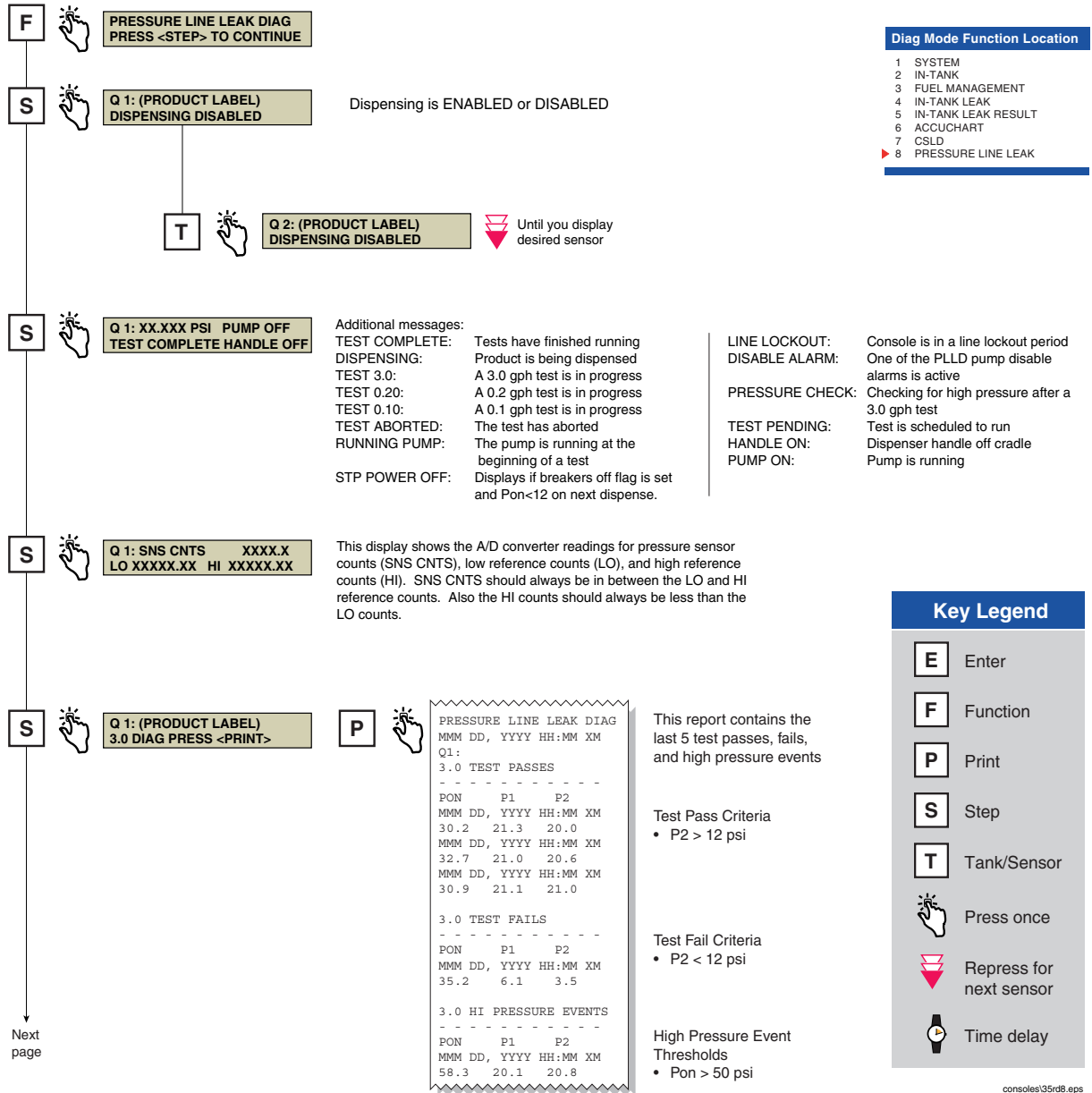
The following steps are necessary to identify the cause of the failure. It is necessary to retest after each step.

1. Verify that the console has been programmed to shut down on 3 gph line test failures.
2. Verify that the pump relay is not sticking, causing the STP to stay On when the console is trying to shut it down.
3. Verify that the PLLD/WPLLD transducer is measuring within 5 psi of actual line pressure. Replace transducer if necessary, purge the line of air, and perform 3 gph test.
4. Verify that the seating pressure of the check valve is between 17 - 25 psi. If the check valve seating pressure is outside of this range, replace it and purge the line of air.
5. Remove and replace the siphon jet assembly from the FE Petro pump (P/N 400562901). This device eliminates air from getting into the piping system. If air enters the piping system, it affects the bulk modulus of the line and will shift leak thresholds. If a defective jet assembly is found, it is necessary to fully purge the line.
6. If the console has software version 16/116/316 or lower, upgrade the software to the current version.
7. In the console line leak setup, increase the piping length by 10 percent and retest the line. If the line passes, the length of piping had been underestimated and should remain at the new length.
8. If the console has software version 23 or higher and is in the "User Defined" mode, verify that the Bulk Modulus value for the line being tested is programmed correctly. Refer to the Line Leak Application Guide (P/N 577013-465) for approved Bulk Modulus values.
9. If the line fails to produce shutdowns after these steps have been followed, contact Veeder-Root Technical Support for further assistance.

Line Leak Diagnostic Menus

PLLD Line Leak Diagnostics

In the Diag Mode press FUNCTION until you see PRESSURE LINE LEAK DIAG screen (Figure 19).



Key Legend

- E** Enter
- F** Function
- P** Print
- S** Step
- T** Tank/Sensor
- Press once
- Repress for next sensor
- Time delay

consoles\35rd8.eps

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Figure 19. PLLD Line Leak Diag

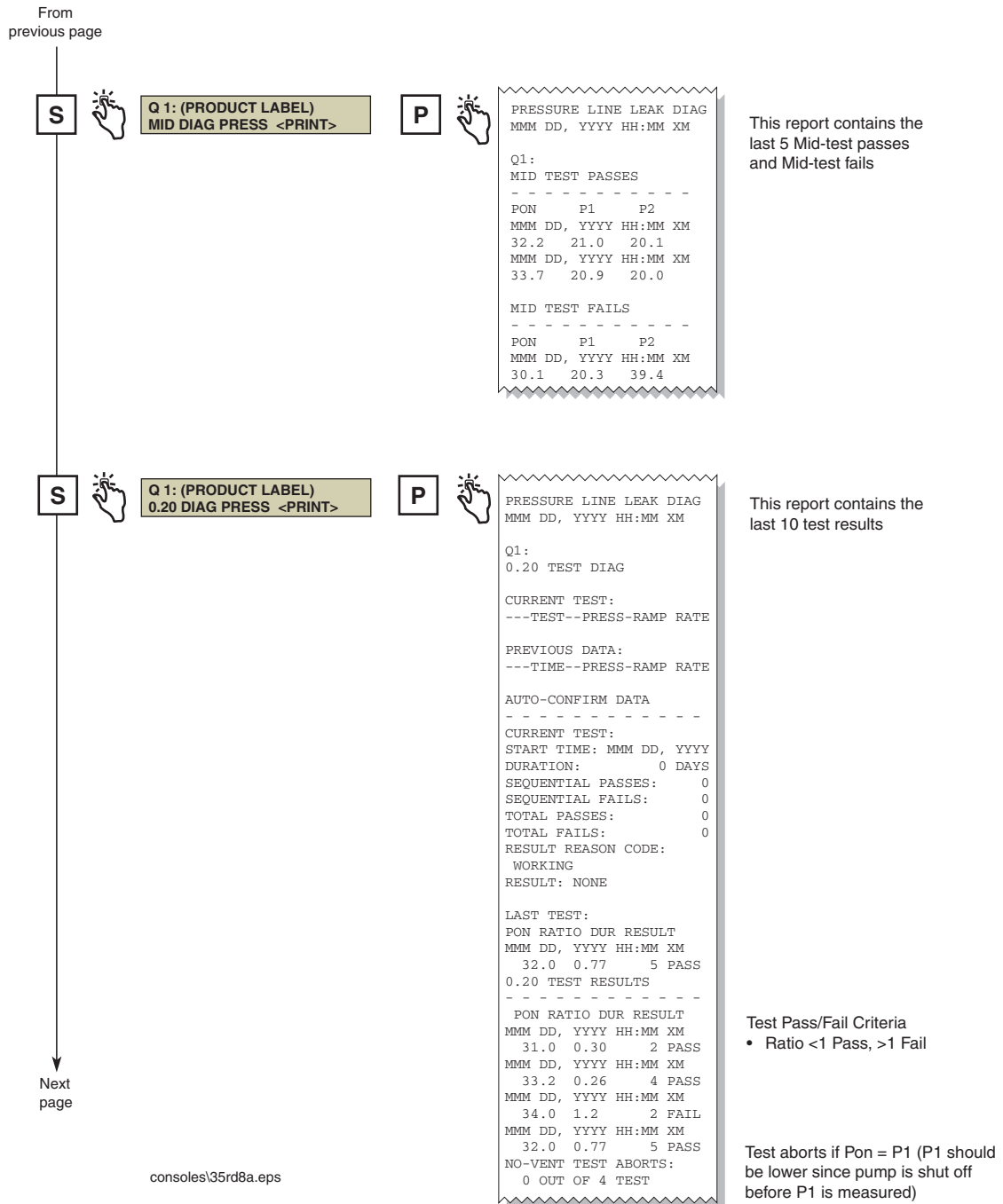


Figure 19. PLLD Line Leak Diag - Continued

From previous page



Q 1: (PRODUCT LABEL)
0.10 DIAG PRESS <PRINT>



```

PRESSURE LINE LEAK DIAG
MMM DD, YYYY HH:MM XM

Q1:
0.10 TEST DIAG

CURRENT TEST:
---TEST--PRESS-RAMP RATE

PREVIOUS DATA:
---TIME--PRESS-RAMP RATE

AUTO-CONFIRM DATA
- - - - -
CURRENT TEST:
START TIME: MMM DD, YYYY
DURATION: 0 DAYS
SEQUENTIAL PASSES: 0
SEQUENTIAL FAILS: 0
TOTAL PASSES: 0
TOTAL FAILS: 0
RESULT REASON CODE:
WORKING
RESULT: NONE

LAST TEST:
PON RATIO DUR RESULT
MMM DD, YYYY HH:MM XM
44.0 0.46 7 FAIL
0.10 TEST RESULTS
- - - - -
PON RATIO DUR RESULT
MMM DD, YYYY HH:MM XM
31.0 0.30 4 PASS
MMM DD, YYYY HH:MM XM
33.2 0.26 4 PASS
MMM DD, YYYY HH:MM XM
32.3 0.17 6 PASS
MMM DD, YYYY HH:MM XM
44.0 0.46 7 FAIL
NO-VENT TEST ABORTS:
0 OUT OF 4 TEST
    
```

This report contains the last 10 test results

Test Pass/Fail Criteria
• Ratio <1 Pass, >1 Fail

Test aborts if Pon = P1 (P1 should be lower since pump is shut off before P1 is measured)



Q 1: (PRODUCT LABEL)
P OFFSET DIAG <PRINT>



```

PRESSURE OFFSET MONITORS
MMM DD, YYYY HH:MM XM

Q1:
P0: PASS
LAST UPDATE: 51 DAYS
Pd: FAIL
LAST UPDATE: 44 DAYS
Pd = 40.0 PSI
Pd REF= 32.3 PSI
Pv: PASS
Pv = 28.1 PSI
Pon = 44.1 PSI
Pd = 40.1 PSI
    
```

Terms:
P0 = Line pressure w/pump off (< 5 psi)
Pd = Pump pressure during dispense
Pv = Pump vent pressure

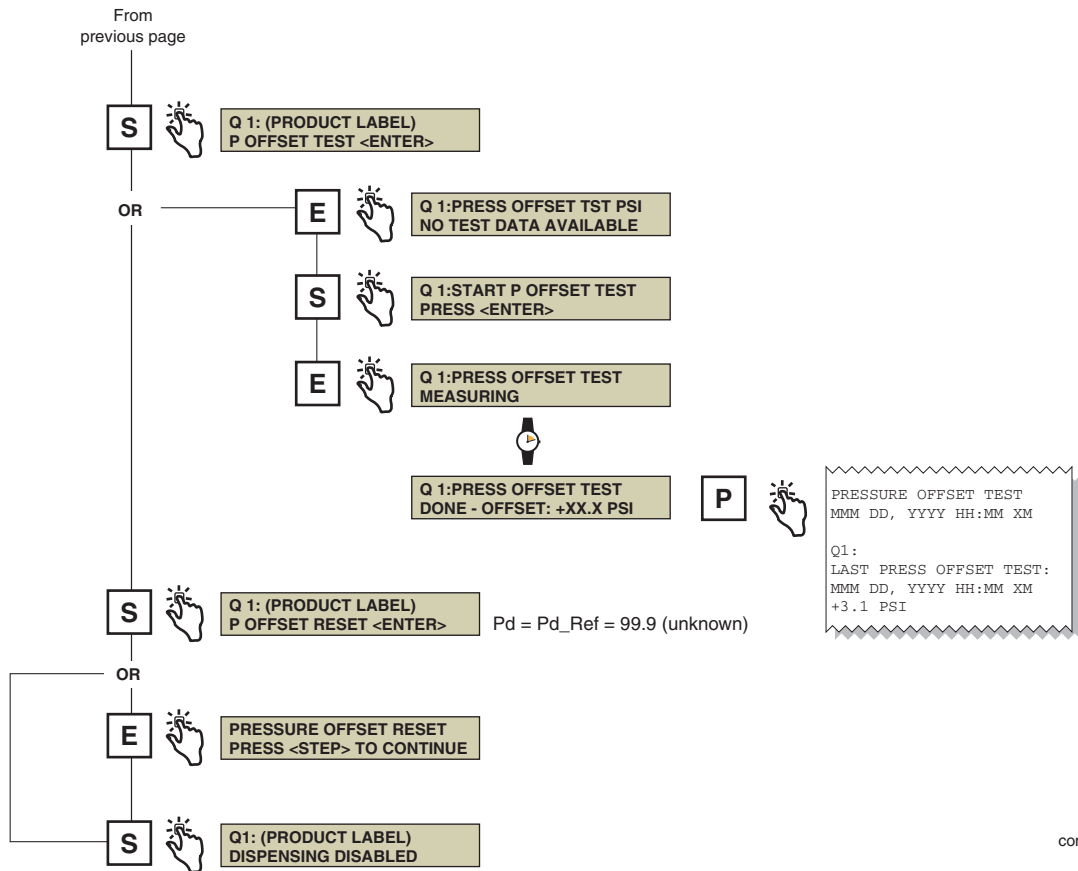
If Pd > Pd ref by more than 5 psi for 30 days LN EQ FAULT alarm posted. If Pd = 99.9 then Pd has not been calculated (requires = 24 hours)

If Pv > 40 psi AND Pd > 50 psi for 10 3 gph tests LN EQ FAULT alarm posted. Also, Pv > 40 psi AND Pd > 50 a HI PRESS EVENT is recorded

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Figure 19. PLLD Line Leak Diag - Continued



consoles\35rd8c.eps

Figure 19. PLLD Line Leak Diag - Concluded

WPLLD Line Leak Diagnostics

In the Diag Mode press FUNCTION until you see WPLLD LINE LEAK DIAG screen (Figure 20).

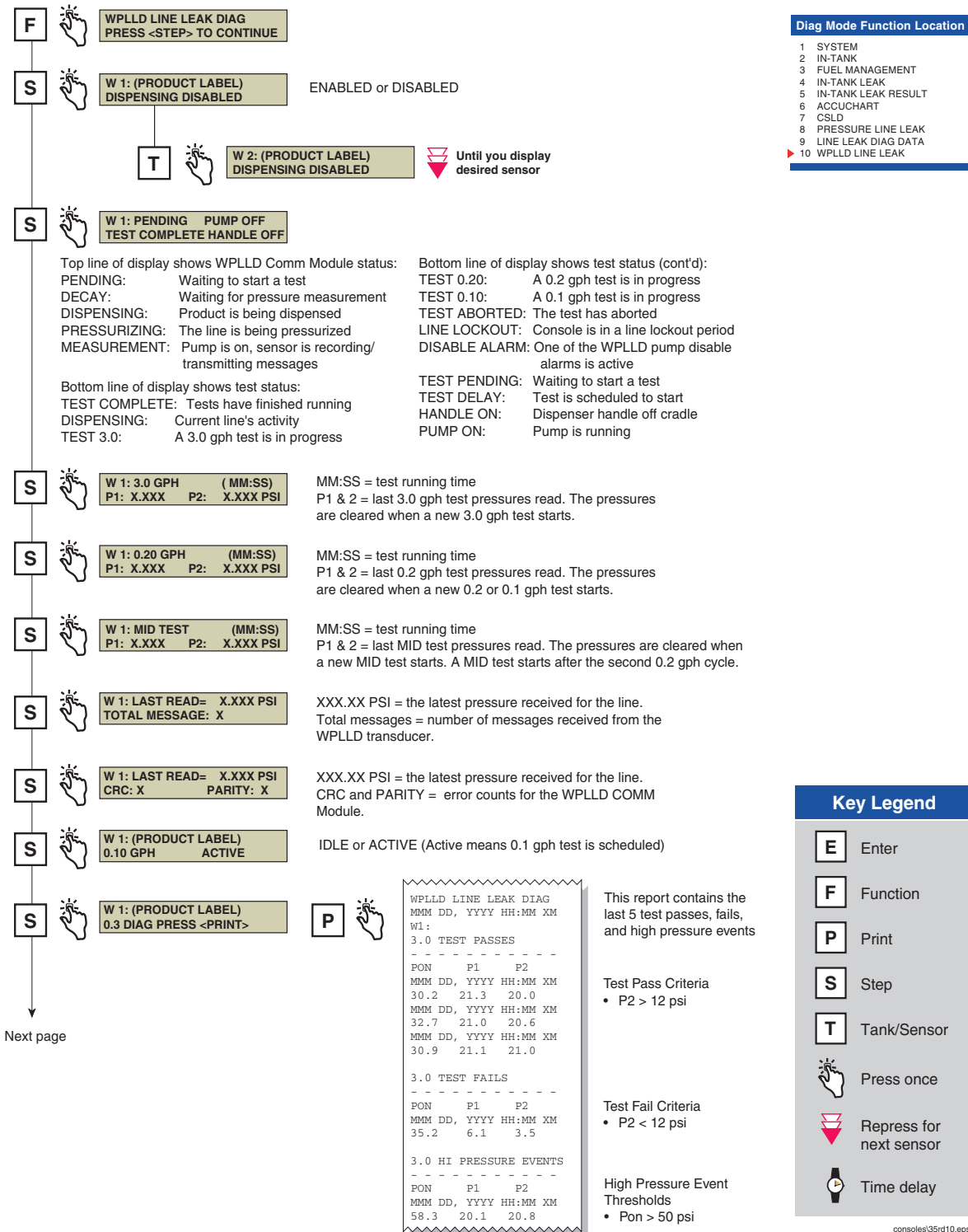


Figure 20. WPLLD Line Leak Diag

From previous page

S  **W 1: (PRODUCT LABEL)**
MID DIAG PRESS <PRINT> **P** 

```

WPLLD LINE LEAK DIAG
MMM DD, YYYY HH:MM XM

W1:
MID TEST PASSES
-----
PON      P1      P2
MMM DD, YYYY HH:MM XM
32.2    21.0    20.1
MMM DD, YYYY HH:MM XM
33.7    20.9    20.0

MID TEST FAILS
-----
PON      P1      P2
MMM DD, YYYY HH:MM XM
30.1    20.3    39.4
    
```

This report contains the last 5 Mid-test passes and Mid-test fails

S  **W 1: (PRODUCT LABEL)**
0.20 DIAG PRESS <PRINT> **P** 

```

WPLLD LINE LEAK DIAG
MMM DD, YYYY HH:MM XM

W1:
0.20 GPH TEST DIAG
CURRENT TEST:
---TIME--PRESS
PREVIOUS DATA:
---TIME--PRESS
MMM DD
HH:MM XM  0.0 0.0
AUTO-CONFIRM DATA
-----
CURRENT TEST:
START TIME: MMM DD, YYYY
DURATION:          X DAYS
SEQUENTIAL PASSES: 0
SEQUENTIAL FAILS:  0
TOTAL PASSES:      0
TOTAL FAILS:       0
RESULT REASON CODE:
WORKING
RESULT: NONE

LAST TEST:
NO TEST DATA AVAILABLE
0.20 TEST RESULTS
-----
PON  RATIO  DUR  RESULT
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS
MMM DD, YYYY HH:MM XM
0.0  0.00  33826  PASS

NO-VENT TEST ABORTS:
0 OUT OF 0 TEST
    
```

This report contains the last 10 test results

Test Pass/Fail Criteria
 • Ratio <1 Pass, >1 Fail

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Figure 20. WPLLD Line Leak Diag - Continued

From previous page

S  **W 1: (PRODUCT LABEL)
0.10 DIAG PRESS <PRINT>**

P 

```

WPLLD LINE LEAK DIAG
MMM DD, YYYY HH:MM XM

W1:
0.10 GPH TEST DIAG
CURRENT TEST:
---TIME---PRESS
PREVIOUS DATA:
---TIME---PRESS
MMM DD
HH:MM XM 0.0 0.0
AUTO-CONFIRM DATA
-----
CURRENT TEST:
START TIME: MMM DD, YYYY
DURATION: X DAYS
SEQUENTIAL PASSES: 0
SEQUENTIAL FAILS: 0
TOTAL PASSES: 0
TOTAL FAILS: 0
RESULT REASON CODE:
WORKING
RESULT: NONE
LAST TEST:
NO TEST DATA AVAILABLE

0.10 TEST RESULTS
-----
PON RATIO DUR RESULT
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
MMM DD, YYYY HH:MM XM
0.0 0.00 33826 PASS
NO-VENT TEST ABORTS:
0 OUT OF 0 TEST
    
```

This report contains the last 10 test results

Test Pass/Fail Criteria
 • Ratio <1 Pass, >1 Fail

S  **W 1: (PRODUCT LABEL)
P OFFSET DIAG <PRINT>**

P 

```

PRESSURE OFFSET MONITORS
MMM DD, YYYY HH:MM XM

W1:
P0: PASS
LAST UPDATE: 0 DAYS
Pd: PASS
LAST UPDATE: 0 DAYS
Pd = 99.9 PSI
Pd REF = 99.9 PSI
Pv: PASS
Pv = 0.0 PSI
Pon = 0.0 PSI
Pd = 0.0 PSI
    
```

Terms:
 P0 = Line pressure w/pump off (< 5 psi)
 Pd = Pump pressure during dispense
 Pv = Pump vent pressure

If Pd > Pd ref by more than 5 psi for 30 days LN EQ FAULT alarm posted. If Pd = 99.9 then Pd has not been calculated (requires ≈ 24 hours)

If Pv > 40 psi AND Pd > 50 psi for 10 3 gph tests LN EQ FAULT alarm posted. Also, if Pv > 40 psi AND Pd > 50 a HI PRESS EVENT is recorded

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consoles\35rd10B.eps

Figure 20. WPLLD Line Leak Diag - Continued

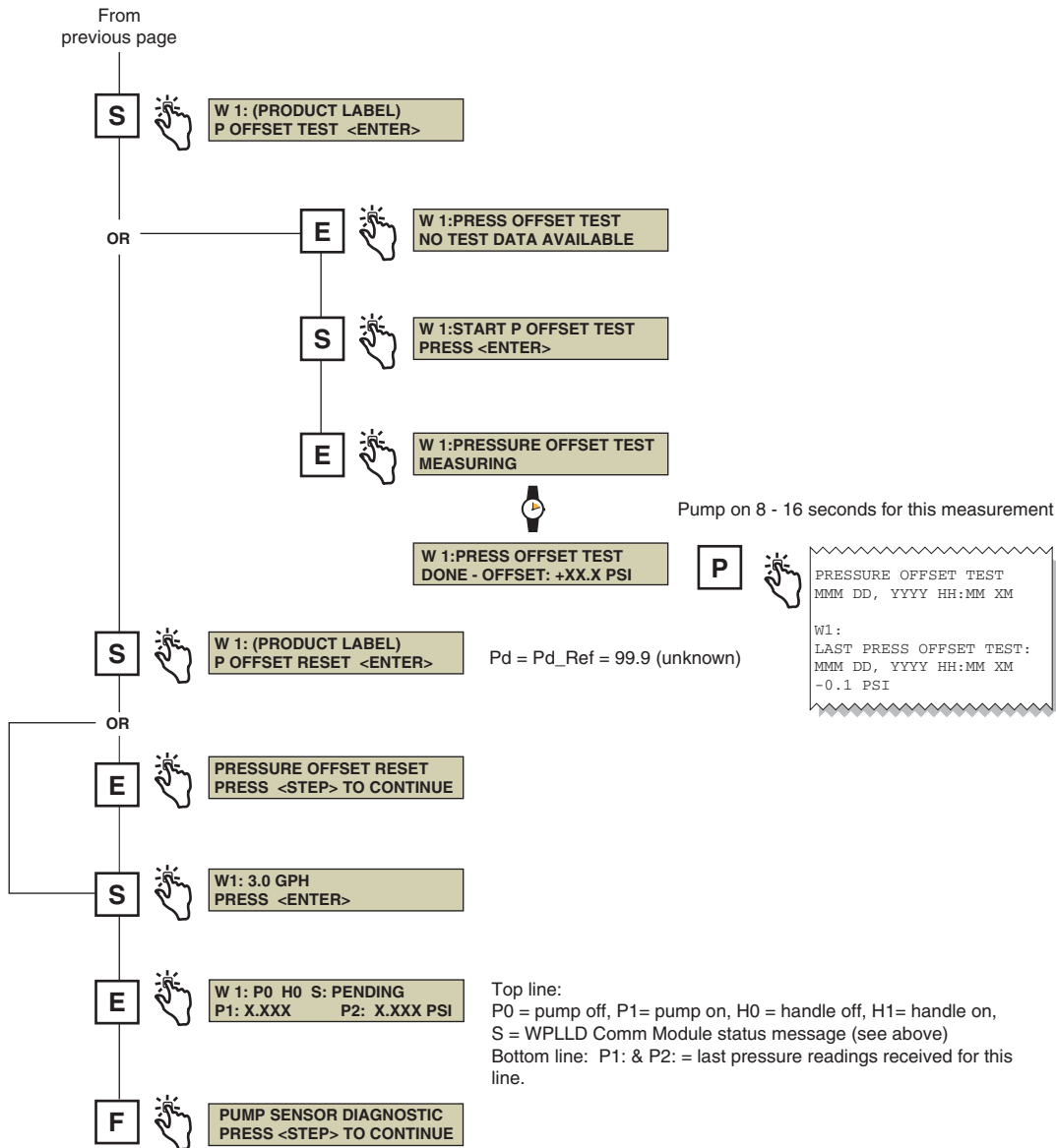


Figure 20. WPLLD Line Leak Diag - Concluded

**Veeder-Root has
sales offices
around the world
to serve you**



Headquarters

125 Powder Forest Drive
Simsbury, CT 06070-7684
Tel: (860) 651-2700
Fax: (860) 651-2719
Email: marketing@veeder.com

Australia

21 Highgate Street
Auburn 2144
NSW Australia
Tel: +61 2 8737 7777
Email: rxdupuy@veeder-australia.com

Brazil

Rua ado Benatti, 92
Sao Paulo - SP 05037-904
Tel: +55 (0) 11 3611 2155
Fax: +55 (0) 11 3611 1982
Email: clopez@veeder.com

Canada

Eastern Canada
Tel: (519) 925-9899
Western Canada
Tel: (604) 576-4469
Email: marketing@veeder.com

China

Room 2202, Scitech Tower
No. 22 Jian Guomen
Wai DaJie
Beijing 100004
Tel: +86 10 6512 8081
Fax: +86 10 6522 0887
Email: lu ying@veeder.com

England

Hydrex House, Garden Road
Richmond, Surrey TW9 4NR
Tel: +44 (0) 20 8392 1355
Fax: +44 (0) 20 8878 6642
Email: sales@veeder.co.uk

France

94, rue Blaise Pascal, ZI des Mardelles
93600 Aulnay-Sous-Bois
Tel: +33 (0) 1 48 79 55 90
Fax: +33 (0) 1 48 68 39 00
Email: sales@veeder.co.uk

Germany

Ferdinand-Henze-Straße 9, D-33154 Salzkotten
Tel: +49 (0)52 58 130
Fax: +49 (0)52 58 131 07
Email: sales@veeder.co.uk

Italy

Via de'Cattani, 220/G, 50145 Firenze
Tel: +39 (0)55 30941
Fax: +39 (0)55 318603
Email: sales@veeder.co.uk

Mexico

Sagitario #4529-3
Col. La Calma C.P. 45070
Zapopan, Jalisco
Tel: (523) 632 3482
Fax: (523) 133 3219
Email: jmartinez@veeder.com

Poland

01-517 Warszawa ul. Mickiewicza 18/12
Tel/Fax: +48 (0)22 839 0847
Email: sales@veeder.co.uk

Singapore

246 MacPherson Road
#08-01 Betime Building
348578
Tel: +65 (0) 6745 9265
Fax: +65 (0) 6745 1791
Email: francis.yap@veeder.com