

# Line Leak Detection Systems, UST Leak Detection Equipment, Mag Sump Sensor, and Other Sensors

## Operability Testing Guide

# Notice

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2. Fax signed Bill of Lading (BOL) to Veeder-Root Customer Service at 800-234-5350.
3. Veeder-Root will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

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## Introduction

This manual contains instructions to verify operability for Veeder-Root WPLLD and PLLD Line Leak Systems, UST Leak Detection Equipment, Mag Sump Sensor, and other sensors to satisfy requirements of state or local regulations, as applicable.

*Veeder-Root environmental monitoring systems installed in accordance with installation manual requirements are designed to detect and report conditions that inhibit proper operation. Veeder-Root systems self-diagnose essential components, and if a component failure is detected, will not complete and report tank and line tests. The system will issue an audible and visual alarm when a failed or disconnected sensor is detected.*

Veeder-Root recommends periodic operability testing on its leak detections systems at a minimum annually.

### General Testing Requirements

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- The certified Veeder-Root Technicians below must be available (on site) to assist in these types of testing.
  - **Technician Certification (Level 2/3):** Contractors holding valid Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection.
- Comply with all recommended safety practices identified by OSHA and your employer.
- Follow all installation requirements per NFPA 30A.
- Review and comply with all the safety warnings in the manuals listed above and any other Federal, State or Local requirements.

### Reference Documents

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The following reference documents may be helpful when performing the operability tests outlined in this manual.

#### WPLLD & PLLD Systems

- Veeder-Root TLS-450 Setup and Operation Screens Manual (577013-940) - WPLLD is not supported
- Veeder-Root TLS-3XX Operators Manual (576013-610)
- Veeder-Root TLS-3XX Setup Manual (576013-623)
- Veeder-Root W/PLLD Troubleshooting Guide (577013-344)
- Veeder-Root Performance results Certification Reports (576013-308)
- Veeder-Root Line Leak Application Guide (577013-465)

- Red Jacket Test Procedures for Electronic Leak Detectors (RJP-2018 Rev. A 2/01)
- Red Jacket Engineering Report Test Procedures for Mechanical Leak Detectors (Red Jacket document RJ-20)
- Red Jacket Engineering Report Testing Mechanical Leak Detectors with the FX Tester (Red Jacket document 051-272)

### UST Leak Detection Equipment








- Veeder-Root TLS-3XX Operators Manual (576013-610)
- Veeder-Root TLS-450 Setup, Operation and Diagnostics Screens Manual (577013-940)

### Sensors

- Veeder-Root TLS-3XX Operators Manual (576013-610)
- Veeder-Root TLS-3XX Setup Manual (576013-623)
- Veeder-Root TLS-450 Setup, Operation and Diagnostics Screens Manual (577013-940)

## Safety Precautions

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

 <p><b>EXPLOSIVE</b> Fuels and their vapors are extremely explosive if ignited.</p>	 <p><b>FLAMMABLE</b> Fuels and their vapors are extremely flammable.</p>
 <p><b>ELECTRICITY</b> High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p><b>TURN POWER OFF</b> 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><b>APPROVED CONTAINERS</b> Use nonbreakable, clearly marked containers, suitable for collecting and transporting hazardous fuels during service.</p>	 <p><b>READ ALL RELATED MANUALS</b> Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>
 <p><b>WARNING</b> Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.</p>	

**⚠ WARNING**

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

**SWITCHING ON THE PUMP WHILE FITTING TEST EQUIPMENT TO DISPENSER SHEAR VALVES OR MAKING WIRING CHANGES FOR TESTING CAN CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.**

Product spillage could create serious environmental and safety hazards.



1. Read and follow all instructions in this manual, including all safety warnings.
2. Turn off, tag, and lockout power to pumps before removing dispenser shear valve fittings and when disconnecting pump wiring.
3. Dispose of drained fuel properly. Use an approved container suitable for moving fuel. Dispose of fuel soaked materials properly and not into trash barrels that may be used by customers.
4. Comply with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes.

# Verifying Operability of WPLLD & PLLD Systems

## Scope:

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These procedures can be used at field sites to determine the operability of Veeder-Root line leak detection systems. Testing line leak detection equipment in accordance with this procedure will verify the equipment's operability for leak detection at 3 gph (gallons per hour), 0.2 gph (if equipped and programmed for this capability), and 0.1 gph (if equipped and programmed for this capability).

## Reference Documents:

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- Veeder-Root TLS-450 Setup, Operation and Diagnostics Screens Manual (577013-940)
- Veeder-Root TLS-3XX Operators Manual (576013-610)
- Veeder-Root TLS-3XX Setup Manual (576013-623)
- Veeder-Root W/PLLD Troubleshooting Guide (577013-344)
- Veeder-Root Performance results Certification Reports (576013-308)
- Veeder-Root Line Leak Application Guide (577013-465)
- Red Jacket Test Procedures for Electronic Leak Detectors (RJP-2018 Rev. A 2/01)
- Red Jacket Engineering Report Test Procedures for Mechanical Leak Detectors (Red Jacket document RJ-20)
- Red Jacket Engineering Report Testing Mechanical Leak Detectors with the FX Tester (Red Jacket document 051-272)

## Before You Begin:

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- Verify that the TLS Console is programmed correctly for the Site and the application.
- Identify all breakers for disconnecting power to the pumps (STP).
- Identify and lock all dispenser nozzle handles which could interrupt this test. It is recommended that the entire station be shut down during this procedure to prevent a test from being interrupted.

## 3 GPH testing utilizing the Red Jacket FTA

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### Hardware Necessary:

Reference Red Jacket RJ-20, page 8

### Testing Procedure:



1. Shut off, lock out, and tag the circuit breakers that provide pump power to the STP. Disconnect the electrical power yoke at the STP for the product being tested.
2. Install the Red Jacket FTA leak simulating apparatus in the impact valve following the procedures defined in the RJ-20 document (pages 2-4, Section I, steps 1 - 10).



3. Calibrate the leak rate corresponding to 3.0 gph at 10 psi (pounds per square inch) per Section V (page 5, steps 22 - 26) of the RJ-20 document.



4. Rotate V1 to the vertical position to remove the pressure regulator from the fluid circuit and to place the simulated leak on the product line. Place the discharge hose into a suitable test container.
5. Re-connect the STP yoke, turn on the circuit breaker, and authorize the fueling position. Verify that no product is leaking from the connections to the FTA. Dispense approximately 5 gallons from the dispenser to ensure the line is purged of air.
6. When a steady stream of product is observed flowing from the hose, hang up the nozzle (this will initiate a 3 gph leak test).
7. If you are at a TLS-350 console go to step 7a. If you are at a TLS-450 console go to Step 7b.

- a. Enter the TLS-350 DIAGNOSTIC mode and monitor the front panel display. When the test is complete, the front panel display will read "Test Complete Handle Off", the system will alarm, and will shut down the line. Press the "Alarm/Test" key on the TLS-350 to silence the alarm.

Note: During the 3 gph test, the STP will turn On and Off intermittently. Do NOT assume the test has completed until the TLS Console has alarmed.

Note: If the test does NOT fail, the leak rate needs to be confirmed. Confirm the leak rate at pump pressure by referring to the procedure on page 2 of the RJP-2018 document (note that 3.0 gph at 10 psi with a pump-on pressure of 28 psi = 317 ml/minute). If the leak rate is correct, refer to the W/PLLD Troubleshooting Guide for instructions. Proceed to Step 8.

- b. At the TLS-450, touch the Home button, touch the Diagnostic button, touch the PLLD button to display the PLLD Diagnostics - Manual Test tab screen. When the test is complete, the Manual Test Status column will read "Test Complete", the system will alarm, and will shut down the line. Touch the "Alarm" button once to view the Active Alarm report and a second time to silence the alarm.

Note: During the 3 gph test, the STP will turn On and Off intermittently. Do NOT assume the test has completed until the TLS Console has alarmed.

Note: If the test does NOT fail, the leak rate needs to be confirmed. Confirm the leak rate at pump pressure by referring to the procedure on page 2 of the RJP-2018 document (note that 3.0 gph at 10 psi with a pump-on pressure of 28 psi = 317 ml/minute). If the leak rate is correct, refer to the W/PLLD Troubleshooting Guide for instructions. Proceed to Step 8.



8. Close the ball valve to stop the leak, shut off, lock out and tag the STP's circuit breaker, and disconnect the electrical power yoke at the STP for the product being tested.
9. Remove the leak testing hardware and replace the plug on the shear valve using the appropriate sealant on the threads and torque per the manufacturer's specification. **WARNING:** Over tightening the shear valve plug may result in damage to the shear valve.
10. Print the leak test history report for your records.
11. Re-connect the STP yoke and turn on the circuit breaker.
12. If you are at a TLS-350 console go to step 12a. If you are at a TLS-450 console go to Step 12b.
  - a. At the front panel of the TLS-350 press Function until you see 'Start Line Pressure Test, Press <Step> To Continue'. Select the line, select 3.0 test and at the prompt 'Start Line Leak Test Press <Enter>', press 'Enter' to start the test.
  - b. At the TLS-450's PLLD Diagnostics - Manual Test tab screen, select '3.0' test and touch the 'Start' button to begin the test.

13. Visually verify that product is not leaking from the shear valve port during the test, and confirm that the line now passes the 3 gph leak test.

### 3 GPH testing utilizing the Red Jacket FX tester

#### Hardware Necessary:

Reference Red Jacket 051-272, page 9

#### Testing Procedure:



1.  Shut off, lock out and tag the circuit breakers that provide power to the STP. Disconnect the electrical power yoke at the STP for the product being tested.
2. Install the Red Jacket FX Tester leak simulating apparatus in the impact valve following the procedures defined in the 051-272 document (page 6-7, Section II - J, steps 1 - 4).
3.  Re-connect the STP yoke, turn on the circuit breaker, and authorize the fueling position. Verify that no product is leaking (except into the test can). Dispense approximately 5 gallons from the dispenser into a suitable test container to ensure the line is purged of air.
4. Calibrate the leak rate corresponding to 3.0 gph at 10 psi per Table 1 below.

Table 1

Pump Operating Pressure (psi)	Flow rate to set at Pump Pressure (gph)
20	4.5
22	4.7
24	4.9
26	5.1
28	5.3
30	5.5
32	5.7
34	5.8
36	6.0
38	6.2
40	6.3

5. Set the FX Tester to the leak test position per Section II - B (page 3, step 2a-c) of the 051-272 document.
6. When a steady stream of product is observed flowing from the hose, hang up the nozzle (this will initiate a 3.0 gph leak test).
7. If you are at a TLS-350 console go to step 7a. If you are at a TLS-450 console go to Step 7b.

- a. Enter the TLS-350 DIAGNOSTIC mode and monitor the front panel display. When the test is complete, the front panel display will read "Test Complete Handle Off", the system will alarm, and will shut down the line. Press the "Alarm/Test" key on the TLS-350 to silence the alarm.

Note: During the 3 gph test, the STP will turn On and Off intermittently. Do NOT assume the test has completed until the TLS Console has alarmed.

Note: If the test does NOT fail, the leak rate needs to be confirmed. Confirm the leak rate at pump pressure by referring to the procedure on page 2 of the RJP-2018 document (note that 3.0 gph at 10 psi with a pump-on pressure of 28 psi = 317 ml/minute). If the leak rate is correct, refer to the W/PLLD Troubleshooting Guide for instructions. Proceed to Step 8.

- b. At the TLS-450, touch the Home button, touch the Diagnostic button, touch the PLLD button to display the PLLD Diagnostics - Manual Test tab screen. When the test is complete, the Manual Test Status column will read "Test Complete", the system will alarm, and will shut down the line. Touch the "Alarm" button once to view the Active Alarm report and a second time to silence the alarm.

Note: During the 3 gph test, the STP will turn On and Off intermittently. Do NOT assume the test has completed until the TLS Console has alarmed.

Note: If the test does NOT fail, the leak rate needs to be confirmed. Confirm the leak rate at pump pressure by referring to the procedure on page 2 of the RJP-2018 document (note that 3.0 gph at 10 psi with a pump-on pressure of 28 psi = 317 ml/minute). If the leak rate is correct, refer to the W/PLLD Troubleshooting Guide for instructions. Proceed to Step 8.




8. Close the ball valve to stop the leak, turn-off, lock out and tag the circuit breaker of the STP for the product being tested, then disconnect the electrical power yoke at that STP.
9. Remove the leak testing hardware and replace the plug on the shear valve using the appropriate sealant on the threads and torque per the manufacturer's specification NOTE: Over tightening the shear valve plug may result in damage to the shear valve.
10. Print the leak test history report for your records.
11. Re-connect the STP yoke and turn on the circuit breaker.
12. If you are at a TLS-350 console go to step 12a. If you are at a TLS-450 console go to Step 12b.
  - a. At the front panel of the TLS-350 press Function until you see 'Start Line Pressure Test, Press <Step> To Continue'. Select the line, select 3.0 test and at the prompt 'Start Line Leak Test Press <Enter>', press 'Enter' to start the test.
  - b. At the TLS-450's PLLD Diagnostics - Manual Test tab screen, select '3.0' test and touch the 'Start' button to begin the test.
13. Visually verify that product is not leaking from the shear valve port during the test, and confirm that the line now passes the 3 gph leak test.
14. Print out the applicable line leak setup and line leak test history for your records.

### 3 GPH testing utilizing the KWA LS 2003 Leak Detector Tester



1. All fuel accumulated during the testing should be collected in an approved container and returned to the tank at the conclusion of the testing.
2. Shut off, lock out and tag the circuit breakers that provide power to the STP(s) for the product line being tested. Install the quick-connect fittings in the shear valves for the tested pipeline beneath the dispensers or other convenient location.



3. Turn On the power to the turbines.
  4. Authorize a dispenser to pressurize the line. Dispense approximately 5 gallons into a suitable container to ensure that the line is purged of air.
  5. Connect the blue hose to the quick connect in the shear valve on one end and the KWA (Ken Wilcox Associates) LS 2003 on the other end. The selector should be in the "Off" position when connecting the hose.
  6. Turn the selector valve to the "Calibrate" position.
  7. Set the outlet pressure on the LS 2003 to 10 psi on the pressure gauge using the built-in regulator provided with the system.
  8. Set the leak rate to 3.0 gph, ( $189 \pm 10$  ml/min) at 10 psi using a stopwatch and the 500 ml graduated cylinder. The position of the float on the flow meter may vary slightly from site to site.
  9. Switch the selector valve to the "Test" position on the LS 2003.
  10. Hang up the nozzle to shut Off the dispenser. The leak detector should automatically perform a 3 gph leak test.
- 
11. Turn Off, lock out and tag the turbines at the breaker panel and on the pump controllers.
  12. Remove the quick-connect fittings from the shear valves beneath the dispensers. Check to make sure the safety valve on the shear valve has not been accidentally tripped.
  13. Print the leak test history report for your records.
  14. Re-connect the STP yoke and turn-on the circuit breaker.
  15. If you are at a TLS-350 console go to step 15a. If you are at a TLS-450 console go to Step 15b.
    - a. At the front panel of the TLS-350 press Function until you see 'Start Line Pressure Test, Press <Step> To Continue'?. Select the line, select 3.0 test and at the prompt 'Start Line Leak Test Press <Enter>', press 'Enter' to start the test.
    - b. At the TLS-450's PLLD Diagnostics - Manual Test tab screen, select '3.0' test and touch the 'Start' button to begin the test.
  16. Visually verify that product is not leaking from the shear valve port during the test, and confirm that the line now passes the 3 gph leak test.

## **Verification of 0.2 and 0.1 GPH Performance (if present)**

This procedure verifies that the system is performing 0.2 and 0.1 gph testing, if desired, and if the system is programmed to perform these tests.

Note: Since the hardware and system set-up parameters used for 0.2 and 0.1 gph testing are the same as those used for 3 gph testing, this test procedure can be used to verify system operability for all levels of line leak detection.

1. If you are at a TLS-350 console go to step 1a. If you are at a TLS-450 console go to Step 1b.
  - a. Press the <Function> key on the TLS -350 until the display reads "Pressure Line Results". Then press <Step> to obtain the most recent line leak test results. Pressing <Step> once provides the 3 gph results; pressing it again provides 0.2 gph results, and pressing it a third time provides 0.1 gph results. If a printout is desired and a printer is present, pressing the <Print> button will print out the test results.
  - b. Touch the 'Home' button, touch the 'Environmental' button and touch the 'Line Leak' tab. to view the line leak test results.

# Verifying Operability of UST Leak Detection Equipment

## Scope:

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These procedures can be used at field sites to determine the operability of Veeder-Root's underground storage tank leak detection systems. Testing underground tank leak detection equipment in accordance with this procedure will verify the equipment's operability for leak detection at 0.2 gph static, 0.1 gph static, and Continuous Statistical Leak Detection (CSLD).

## Compliance Inspection Recommendations:

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Veeder-Root TLS systems self-diagnose essential components, and will not complete and report passing tank tests in the event of failure of components used in the test. Completed tank tests, whether 0.2 gph static, 0.1 gph static, or using CSLD, are evidence that the system was powered as needed for the duration of the test, and that its components are in working order.

The unit provides audible and visual alarms on tank test failures. This feature is standard and not programmable.

In-tank probes do not require periodic calibration.

Completed compliance tests are evidence that, during the test,

- The system was properly powered for the data collection periods.
- All necessary tank probes were connected.
- All tank probes were operating within specification.
- All internal components were operating within specification.

Veeder-Root recommends that TLS tank testing systems be inspected periodically to determine that compliance tests, which can be 0.2 gph static tests, 0.1 gph static tests, or CSLD are being completed in accordance with local regulations. Since the leak detection system is required to compensate for changes in product level due to temperature changes in the tank in order to pass a leak test, a review of completed and successful periodic tank tests provides sufficient verification of system operability and should satisfy local agency requirements.

## Reference Documents:

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- Veeder-Root TLS-3XX Operators Manual (576013-610)
- Veeder-Root TLS-450 Setup and Operation Screens Manual (577013-940)

## Test Results

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1. If you are at a TLS-350 console go to step 1a. If you are at a TLS-450 console go to Step 1b.
  - a. Press the <Function> key on the TLS 350 until the display reads "In-Tank Test Results". Then press <Step> to obtain the latest test result. Pressing the <Tank/Sensor> button will scroll through the results for each tank. If a printout is desired and the console is equipped with a printer, pressing the <Print> button will print out the results.
  - b. Touch the 'Environmental' button to view the test results for each tank.

## Testing of 'Probe Out' and 'Sensor Out' Condition

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1. Disconnect probe or sensor cable from the top of the probe or sensor.
2. Wait for up to 2 minutes for a 'Probe Out' or 'Sensor Out' alarm.
3. Re-connect the probe or sensor and confirm that the console alarm has cleared.

### Alternate Procedure



1. Remove power from the TLS console.
2. Open the right console door to access the modules and disconnect one of the probe or sensor wires from the appropriate module.
3. Close the console door and restore power to the console.
4. Wait for up to 2 minutes for a 'Probe Out' or 'Sensor Out' alarm.
5. Remove power to the TLS console.
6. Open console door and re-connect the probe or sensor wire. Close the console door.
7. Restore power to the console and confirm that the alarm has cleared.

# Verifying Operability of Mag Sump Sensor

## Scope:

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This procedure shall be used to determine the operability of the Mag Sump sensor, Form number 875080-1xx.

## Reference Documents:

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- Veeder-Root TLS-3XX Operators Manual (576013-610)
- Veeder-Root TLS-3XX Setup Manual (576013-623)
- Veeder-Root TLS-450 Setup and Operation Screens Manual (577013-940)

## Before You Begin:

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This testing (which is not required by Veeder-Root) can be dangerous and any safety precautions as required by your organization, customer's requirements and all state/local safety mandates should be followed.

Review and comply with all the safety warnings in the manuals listed above and any other federal, state, or local requirements.

Verify that the TLS Console is programmed correctly for the site and the application. Document any programming changes you have made from the original configuration.

If the site console is a TLS-350 console in Simplicity mode, it must be switched out of this mode for this test.

## Required Hardware:

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Safety equipment to perform this testing as required by your organization, customer's requirements, and all state/local safety mandates.

## Testing Procedure:

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1. Remove the Mag sensor carefully from its containment area. This should produce an 'Installation Alarm' on the TLS console. Visually inspect the sensor for any damage as defined by in the Periodic Maintenance Checklist in the console Operator's manual, such as damage to the cable or to the sensor housing.
2. If you are at a TLS-350 console go to step 2a. If you are at a TLS-450 console go to Step 2b.
  - a. In Setup mode, press Function until you see Smart Sensor Setup Press <Step> To Continue. Select the Mag sensor your are testing and press Print to print out its water warning and height settings.
  - b. Touch the 'Home' button, touch the 'Setup' button, touch the 'Devices' button, touch the 'Mag Sensor' tab to display the Mag Sensor setup screen. Touch the 'Down' arrow to view page 2 of the Mag Sensor setup and record the water warning and alarm height settings.
3. Fill one of the test containers with water to just above the recorded Mag Sensor's Water Warning Height setting to test the 'Water Warning' alarm.

4. While holding the sensor vertically, place the sensor into the container until it is resting on the bottom; this should clear the Installation Alarm. Test only one sensor per test container (multiple test containers may be used). Wait up to 1 minute for the console to alarm. If it does not alarm after 1 minute, the sensor has failed the test. Document the alarm and proceed to the next step.
5. Remove the sensor from the test vessel after observing a response. Allow the water to drain out of the sensor to clear the alarm.
6. Fill the test container with water to just above the recorded Mag Sensor's Water Alarm Height setting to test the 'Water Alarm' alarm. Then repeat steps 5 and 6.
7. Fill a second test container with a minimum of 2 inches of product (fuel). Then insert the sensor being tested in the second container and wait for up to 1 minute for the console to alarm. If it does not alarm after 1 minute, the sensor has failed the test.
8. Remove the sensor from the test container after observing a response and allow the test fuel to completely dry off the unit. Document the alarm and proceed to the next step.
9. Press the Alarm/Test key on the TLS-350 or touch the Alarm button on the TLS-450 twice to clear the alarm before moving on to the next sensor.
10. Reinstall the sensor(s) upon verification of proper operation.
11. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.



## Verifying Operability of Other Sensors

Table 2 lists Veeder-Root sensors by part number and test procedure.

**Table 2**

Part No.	Sensor	Test Procedure
794380-320	Solid State Discriminating Pan Sensor	Ref Procedure A
794380-350	Solid State Discriminating Sump Sensor	Ref Procedure A
794380-322	Discriminating Pan Sensor	Ref Procedure A
794380-352	Discriminating Sump Sensor	Ref Procedure A
794380-36X series	Fiber Trench Sensor	Ref Procedure A
794380-341, -343	Discriminating Interstitial Sensor	Ref Procedure B or D
794380-208, -209	Piping Sump Sensor	Ref. Procedure C
794380-321	Solid State Pan Sensor	Ref. Procedure C
794380-351	Solid State Sump Sensor	Ref. Procedure C
794390-420, -460	Interstitial Liquid Sensor for Steel Tanks	Ref. Procedure C
794380-341, -343	Discriminating Interstitial Sensor (Used in the non-discriminating mode)	Ref. Procedure D
794380-345	Interstitial Sensor for High-Alcohol	Ref. Procedure D
794380-340, -344	MicroSensor	Ref. Procedure D
794390-40X series	Interstitial Sensor for Fiberglass Tanks	Ref. Procedure E
794380-301, -302, -303, -304	Hydrostatic Sensor	Ref. Procedure F
794380-62X	Groundwater Sensor	Ref. Procedure G
794390-700	Vapor Sensor	Ref. Procedure H
847990-001, -002	Standalone Dispenser Pan Sensor with Dispenser Control Interface	Ref. Procedure I
794380-323	Position Sensitive Sensor	Ref. Procedure J
857280-100, -200, -30X	Vacuum Sensor (TLS-350 only)	Ref. Procedure K
794380-333	Position Sensitive Interstitial Liquid Sensor for Steel Tanks	Ref. Procedure L

### Reference Documents:

- 
- TLS-3XX Operators Manual (576013-610)
  - TLS-3XX Setup Manual (576013-623)
  - TLS-450 Setup, Operation and Diagnostics Screens Manual (577013-940)

## Before You Begin:

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- Verify that the TLS Console is programmed correctly for the site and the application. Document any programming changes you have made from the original configuration.
- If the site console is a TLS-350 console in Simplicity mode, it must be switched out of this mode for these tests.

## Required Hardware:

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- Safety equipment to perform this testing as required by your Organization, Customer's requirements, and all state and local safety mandates.
- Two Test containers that are suitable to be used for fuel. Containers used in Procedure A must be able to support a liquid depth of 30 inches and should be marked to indicate the liquid heights specified in the test procedures. Containers used in Procedure B for testing the 794380-341 sensor must be non-metallic containers which are approved for use with gasoline and must be properly grounded when filling them with gasoline. Containers used in Procedures H and I must be able to support a liquid depth of 4 inches and should be marked to indicate this liquid height. Procedures C, E, and J require a vessel which can support a liquid depth of 2 inches and have a mark to indicate this liquid height. Procedures D and F require a depth that will cover the sensor.

## Alarm Filtering

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Veeder-Root has worked with many customers in an effort to reduce false and nuisance alarms which cause unneeded service calls and expense. In Software Version 32, Veeder-Root added filters to reduce nuisance alarms and to consolidate multiple alarms into a single alarm.

The following alarms were selected for filtering: The DIM Communication alarm, Tank Probe Out alarm, MAG Sensor Alarms, and various other Sensor Alarms. These filters do not alter the ATG's ability to respond to potential fuel loss events.

Keep in mind that when performing annual testing, maintenance, or troubleshooting, the alarm filter will increase the time needed to post and clear the above alarms. However if your TLS-350 system has version 32C or later software. or if your TLS-450 system has version V4A or later software, you can enable/disable this feature. (Default is Enabled.)

Note: In the TLS-350 consoles this feature is called **Alarm Reduction** and the path to it is as follows: press the MODE key, then press the FUNCTION key until you see the SYSTEM SETUP Function, then press the STEP key until you see the ALARM REDUCTION Step. In TLS-450 Consoles this feature is called **Alarm Filter** and the path to it is found from the Home screen by touching the SETUP button, then the ALARMS button and then selecting the Enable tab screen.

Refer to Appendix A for a list of the alarms that will be filtered and their resulting delay times.

## Testing Procedure A:

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Discriminating Pan/Sump Sensors 794380-320, 794380-350, 794380-322, 794380-352; Fiber trench Sensors 794380-360, 794380-361, 794380-362

1. Fill one of the test containers to obtain the level of water specified in Table 3 below in order to test the Low Liquid alarm:

**Table 3**

Sensor	Water Level (Inches)
794380-320	2
794380-350	2
794380-360	23
794380-361	13
794380-362	3
794380-322	2
794380-352	2

2. Remove the sensor carefully from tank or containment area. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable or to the sensor housing.
3. While holding the sensor vertically, place the sensor into the container until it is submerged. Test only one sensor per test container (multiple test containers may be used). Wait up to 5 minutes for the console to alarm. If it does not alarm after 5 minutes, the sensor has failed the test.
4. Remove the sensor from the test vessel after observing a response. Allow the sensor to completely dry off in order to clear the alarm. Document the alarm and proceed to the next step.
5. In order to test the High Level Alarm, add Water to the test container until the top of the sensor is submerged. Then repeat steps 4 and 5.
6. Fill the second test container with a minimum of one inch of product (fuel). Then insert the sensor being tested in the second container and wait for up to 20 minutes for gasoline and 60 minutes for diesel fuel for the console to alarm (in most cases, the sensor will alarm more quickly). If it does not alarm after the wait time, the sensor has failed the test.

**Optional procedure for faster recovery times (applicable to testing in gasoline only):**

Instead of keeping the sensor immersed in the product until it registers a Fuel alarm, remove it after 3 - 4 minutes of exposure. If it does not alarm after 8 minutes from the start of the immersion, the sensor will need to be immersed again until it alarms.

Note: If it is required by National, State, or Local requirements to test the sensor in fuels other than gasoline, the sensor response time may be significantly longer than 20 minutes. Also, it will be necessary to soak the sensor in Coleman Fuel for half an hour after testing before beginning the recovery period.

7. Remove the sensor from the test container after observing a response and allow the test fuel to completely dry off the unit. Document the alarm and proceed to the next step. Due to the time sensors take to recover when immersed in fuel, it may take up to one hour after testing in Gasoline (in most cases the sensor should recover within 30 minutes) and up to three hours after testing in Diesel or Kerosene for the sensor to return to a Normal state

8. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
9. Reinstall the sensor(s) upon verification of proper operation.
10. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

## Testing Procedure B:

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### Discriminating Interstitial Sensors 794380-341, 794380-343

1. Print out system status, sensor configurations and alarm history
2. Fill one of the test containers with enough Water to completely cover the sensor.
3. Remove sensor carefully from tank or containment area. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable or to the sensor housing.
4. While holding the sensor vertically, place the sensor into the container until it is submerged. Test only one sensor per test container (multiple test containers may be used). Test times may run as long as 10 minutes depending upon console type and configuration. If it does not alarm after 10 minutes, the sensor has failed the test.

Note: The 794380-343 sensor must be tested in a dark container. If there is too much ambient light, this may prevent the sensor from going into alarm.

5. Remove the sensor from the test container after observing a response. Allow the sensor to completely dry off in order to clear the alarm. Document the alarm and proceed to the next step. For the 794380-341 sensor, it is important that the sensor be tilted at an angle after removal because the sensor may trigger a false fuel alarm if small amounts of water are trapped in the window of the sensor.
6. Fill the test container with enough Fuel to completely cover the sensor.
7. Insert sensor to be tested in the container and wait up to 10 minutes for the console to alarm. Ensure that the sensor is completely submerged for the duration of the test. If it does not alarm after 10 minutes, the sensor has failed the test.

When testing, the sensor must be completely submerged. Also, the P/N 794380-341 sensor must be tilted at an angle after removal from the test container so that liquid does not become trapped in the window of the sensor.

8. Remove the sensor from the test container after observing a response. For the P/N 794380-343 sensor, dip the sensor into a small container of alcohol and briefly swirl it around to rinse off the unit.
9. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
10. Print the test history report for your records.
11. Reinstall the sensor (s) upon verification of proper operation.
12. This completes the testing. Report any performance concerns to Veeder-Root while on site.

## Testing Procedure C:

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Piping Sump Sensors 794380-208, 794380-209, Interstitial Sensors 794390-420, 794380-430, 794390-460, Solid-State Pan Sensor 794380-321, and Solid State Sump Sensor 794380-351

1. Fill one of the test containers with a minimum of 2 inches of water.
2. Remove sensor carefully from tank or containment area. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable or to the sensor housing.
3. While holding the sensor vertically, place the sensor into the container until it is submerged. Test only one sensor per test container (multiple test containers may be used). Test times may run as long as 5 minutes depending upon console type and configuration. If the sensor does not issue a "Fuel" alarm after 5 minutes, the sensor has failed the test.
4. Remove the sensor from the test vessel after observing a response. Allow the sensor to completely dry off in order to clear the alarm. Document the alarm and proceed to the next step.
5. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
6. Reinstall the sensor(s) upon verification of proper operation.
7. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

## Testing Procedure D:

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MicroSensor 794380-340, -344; Interstitial Sensor for High-Alcohol 794380-345, Discriminating Interstitial Sensors 794380-341, 794380-343 used in the Non-discriminating mode

1. Remove sensor carefully from the interstice containment area. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable or to the sensor housing.
2. Fill the test container with enough fuel to completely cover the sensor.
3. Insert sensor to be tested in the container and wait up to 10 minutes for the console to alarm. Ensure that the sensor is completely submerged for the duration of the test. If it does not alarm after 10 minutes, the sensor has failed the test.

Note: When testing, the sensor must be completely submerged.

Note: The 794380-344 and 794380-343 sensors must be tested in a dark container. If there is too much ambient light, this may prevent the sensor from going into alarm.

4. Remove the sensor from the test container after observing a response. For the P/N 794380-343 sensor, dip the sensor into a small container of alcohol and briefly swirl it around to rinse off the unit.
5. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
6. Print the test history report for your records.
7. Reinstall the sensor(s) upon verification of proper operation.
8. This completes the testing. Report any performance concerns to Veeder-Root while on site.

## Testing Procedure E:

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Interstitial Sensors for Fiberglass tanks 794380-401, -404, -407, and -409

1. Print out system status, sensor configurations, and alarm histories and save for your records.
2. Fill one of the test containers with a minimum of 2 inches of water.
3. Remove sensor carefully from the interstice containment area. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable or to the sensor housing.
4. While holding the sensor flat and with the side with the Red dot facing upwards, place the sensor into the container until it is submerged. Test only one sensor per test container (multiple test containers may be used). Test times may run as long as 5 minutes depending upon console type and configuration. If the sensor does not issue a "Fuel" alarm after 5 minutes, the sensor has failed the test.
5. Remove the sensor from the test vessel after observing a response. Allow the sensor to completely dry off in order to clear the alarm. Document the alarm and proceed to the next step.
6. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
7. Reinstall the sensor(s) upon verification of proper operation.
8. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

## Testing Procedure F:

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Hydrostatic Sensors 794380-301, 794380-302, 794380-303, 794380-304

1. Remove sensor carefully from tank reservoir. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable or to the sensor housing.
2. For Hydrostatic sensors, removal of the sensor from the tank reservoir represents the "Low Liquid" Alarm condition for a Dual Point sensor and a "Fuel" Alarm condition for a Single Point sensor. Time to alarm may run as long as 5 minutes depending upon console type and configuration. If the sensor does not alarm after 5 minutes, the sensor has failed the test.
3. For Dual Point Hydrostatic sensors, a second alarm condition representing a "High Liquid" alarm is present. To test this alarm, completely submerge the sensor in water. Time to alarm may run as long as 5 minutes depending upon console type and configuration. If the sensor does not alarm after 5 minutes, the sensor has failed the test.
4. In order to clear the alarm, re-install the sensor in the reservoir. Document the alarm and proceed to the next step.
5. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
6. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

**Testing Procedure G:**

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Groundwater Sensor 794380-621, 794380-622, 794380-624

1. Print out system status, sensor configurations, and alarm histories and save for your records.
2. Remove sensor carefully from monitoring well. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable.
3. For Groundwater sensors, removal of the sensor from the monitoring well represents the "Water Out" Alarm condition. Test times may run as long as 5 minutes depending upon console type and configuration. If the sensor does not alarm after 5 minutes, the sensor has failed the test.
4. In order to clear the alarm, re-install the sensor in the monitoring well. Document the alarm and proceed to the next step.
5. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
6. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

**Testing Procedure H:**

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Vapor Sensor 794390-700

1. Fill one of the test containers with a minimum of 4 inches of water.
2. Remove sensor carefully from monitoring well. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable.
3. Submerge the sensor in the water to produce a "Water Alarm" condition. Test times may run as long as 5 minutes depending upon console type and configuration. If the sensor does not alarm after 5 minutes, the sensor has failed the test.
4. In order to clear the alarm, remove the sensor from the container. Document the alarm and proceed to the next step.
5. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
6. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

**Testing Procedure I:**

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Standalone Dispenser Pan Sensor with Dispenser Control Interface 847990-001, 847990-002

1. Fill one of the test containers with a minimum of 4 inches of Water.

2. Remove sensor carefully from dispenser pan. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable or the sensor housing.
3. While holding the sensor vertically, place the sensor into the container until it is submerged. Test only one sensor per test container (multiple test containers may be used). The Alarm state is indicated by the dispenser power being turned off (i.e., there is no other visible or audible alarm).
4. Remove the sensor from the test vessel after observing a response and allow the sensor to completely dry off. Document the alarm and proceed to the next step.
5. Reinstall the sensor(s) upon verification of proper operation.
6. Turn Off power to the dispenser for at least 5 seconds in order to re-enable dispensing.



## Testing Procedure J:

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Position Sensitive Sensor 794380-323

1. Fill one of the test containers with a minimum of 2 inches of Water.
2. Remove sensor carefully from the pan or containment area - this should result in a "Sensor Out" alarm. Visually inspect the sensor for any damage as defined by sensor category in the Periodic Maintenance Checklist in the console's Operators manual, such as damage to the cable or the sensor housing.
3. While holding the sensor vertically, place the sensor into the container until it is resting securely on the bottom of the container (this should clear the "Sensor Out" alarm). Test only one sensor per test container (multiple test containers may be used). Test times may run as long as 5 minutes depending upon console type and configuration. If the sensor does not issue a "Fuel" alarm after 5 minutes, the sensor has failed the test.
4. Remove the sensor from the test vessel after observing a response. Allow the sensor to completely dry off in order to clear the alarm. Document the alarm and proceed to the next step.
5. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
6. Reinstall the sensor(s) upon verification of proper operation.
7. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

## Testing Procedure K (TLS-350 Consoles Only):

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Vacuum Sensors 857280-100, -200, -30x

1. Vacuum leak test: rotate the manual shut-off valve (which should be connected to the containment space being monitored) from the 'normal' position to the 'test' position. This should vent the vacuum sensor to atmosphere while maintaining vacuum in the test space.
2. Wait at least 1 minute at the console for the system to produce a 'No Vacuum' alarm. Press the Alarm/Test key to silence the beeper and acknowledge the alarm.
3. Rotate the manual shut-off valve back to the 'normal' position.
4. At the console go to DIAG MODE  $\downarrow$  VAC SENSOR DIAG  $\downarrow$  VAC SENSOR MANUAL TEST  $\downarrow$  START MANUAL TEST to initiate a manual test that will clear the No Vacuum alarm (Refer to the TLS-3XX Operator's manual for instructions).



5. Vac Float Liquid Sensor (in sump) test: This test is performed using water, gasoline, or other appropriate test liquid for systems with the float housing in the sump. Rotate the manual shut-off valve from the 'normal' to the 'test' position. Remove the lower float bowl and fill it with the test liquid. Upon re-installation, a Liquid Alarm will be generated. At the console press the Alarm/Test key to silence the beeper and acknowledge the alarm.

NOTE: in some instances, it may be impossible to fill the float bowl enough to produce an alarm. If this occurs, follow this alternate procedure.

- a. Loosen the nut on the side of the liquid sensor housing that connects to the 3-way ball valve and remove the barbed fitting.
  - b. Connect a 1 - 2 foot (30 - 60 cm) piece of tubing to another 1/4" barbed fitting and insert this barbed fitting into the liquid sensor housing. Insert a funnel into the other end of the piece of tubing.
  - c. Completely loosen the nut on the opposite side of the liquid sensor and remove the hose and bushing together.
  - d. Pour 22 - 25 ml of water, gasoline, or other appropriate test liquid into the funnel. A liquid alarm should be produced. At the console press the Alarm/Test key to silence the beeper and acknowledge the alarm.
  - e. Remove the short piece of tubing/funnel and re-install the original barbed fitting (with tubing connected to 3-way valve) and tighten the nut. Replace the hose and bushing in the other side of the liquid sensor and tighten the nut.
6. To remove the test liquid and clear the alarm, remove the lower float bowl of the liquid sensor, and ensure that all liquid is removed.
  7. Replace the lower float bowl and rotate the manual shut off valve back to the 'normal' position.
  8. Repeat Step 5 above.
  9. For double-walled tanks, the interstitial sensor must be removed from the tank to perform a functional test. Follow "Testing Procedure C:" (Interstitial Sensor for Steel Tanks) or "Testing Procedure E:" (Interstitial Sensor for Fiberglass Tanks) as applicable. NOTE: first you must vent the vacuum in the interstice and restore it per Step 5 above to clear the 'No Vacuum' alarm.
  10. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

## Testing Procedure L:

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### Position Sensitive Interstitial Sensor for Steel Tanks 794380-333

1. Fill one of the test containers with a minimum of 2 inches of water.
2. Remove sensor from tank and visually inspect the sensor for any damage as defined in the sensor category in the Periodic Maintenance Checklist in the consoles Operator manual, such as damage to the cable or to the sensor housing.
3. While holding the sensor vertically over the test container, suspend the sensor so it rests above the bottom of the test container a minimum of 2 inches.
4. Verify on the TLS system that the sensor is in a "FUEL ALARM". When the sensor is not positioned properly (Resting on the bottom of tank) it will generate a fuel alarm.
5. After verifying the sensor alarmed properly, holding the sensor vertically to the container lower the sensor until it's submerged. Test only one sensor at a time. Test time may take up to 5 minutes. The sensor should go into a "Fuel Alarm".
6. Remove the sensor from the test vessel after observing a response. Allow the sensor to completely dry off in order to clear the alarm. Document the alarm and proceed to the next step.
7. Press the Alarm/Test key on TLS-350 consoles, or touch the Alarm button twice on TLS-450 consoles to clear the alarm before moving on to the next sensor.
8. Reinstall the sensor(s) upon verification of proper operation.
9. Print the test history and console status for your records. This completes the test procedure. Report any performance concerns to Veeder-Root while on site.

# TLS-RF Wireless 2 (W2) Testing Procedure

## Testing Sensor Out Alarm

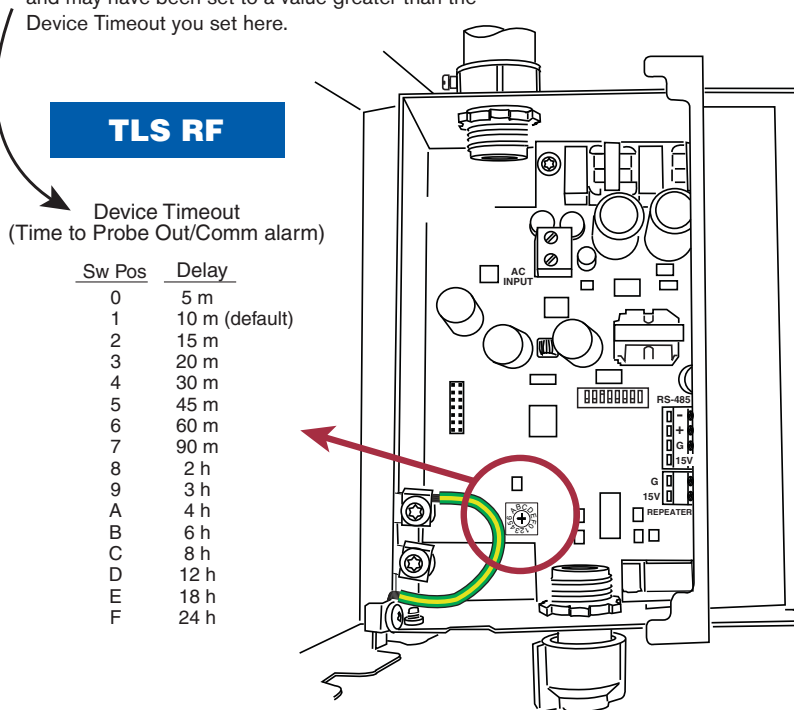
1. Disconnect sensor wiring from top of sensor.
2. Wait for up to 2 minutes for "Sensor Out" alarm.
3. Re-connect sensor wiring and confirm that console alarm has cleared.

## Testing Communication Alarm

1. Visually determine Device Timeout delay via Dip Switch setting inside TLS RF (see illustration below).
2. Disconnect battery cable from wireless transmitter.
3. Wait the Device Timeout delay time for a "Communication Alarm".
4. Re-connect battery cable to wireless transmitter and confirm that console alarm has cleared.

### NOTICE

Setting the Device Timeout delay to less than 10 minutes may result in Device Out errors since the transmitter's transmit time intervals are programmable and may have been set to a value greater than the Device Timeout you set here.



# Overfill Protection Testing

## Scope

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This procedure will provide a Veeder-Root ATG certified technician a procedure to safely test tank overfill protection.

## Reference Documents

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- Veeder-Root TLS-3XX Operators Manual (576013-610)
- Veeder-Root TLS-3XX Setup Manual (576013-623)
- Veeder-Root TLS-450 Setup and Operation Screens Manual (577013-940)
- Veeder-Root TLS-450PLUS/TLS4 Operator's Manual (577014-110)
- Veeder-Root TLS4 Quick Start (577014-034)
- Veeder-Root Overfill Alarm Installation Guide (576013-589)

## Consoles

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TLS-450PLUS, TLS4c, TLS4i, TLS-450 and TLS3XX

## Requirements

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TLS-450PLUS, TLS4c, TLS4i, TLS-450: Automatic Event: Device Task programmed to trigger on Tank Overfill and close a relay feeding voltage to the Overfill alarm device.

TLS-3XX: Output relay programmed to close a relay on a Tank Overfill alarm feeding voltage to the Overfill alarm device.

## Testing Procedure

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1. Inspection
  - a. Verify the levels in the tank to make sure there is product in the tank and that the tank is enabled.
  - b. If the site is currently receiving a delivery, wait until the delivery is complete.
  - c. If the tank is performing a SLD tank test, stop the test.
2. Preparation
  - a. Turn Alarm filtering off, as this will allow you to clear alarms quicker. Refer to TLS-3XX Setup manual (576013-623) or TLS4XX on-line help.
  - b. Program Delivery delay to 1 minute, this will allow the delivery to be completed quicker.
    1. Note the customers original value, so you can restore it after the test.

- c. Print the Tank Inventory Report.
- d. Test the relay assigned to the external Overfill alarm (if present) to insure the Overfill alarm works.
  - 1. If the Overfill alarm does not sound, repair the device before continuing testing.

### 3. Testing

- a. Turn off power to the console.
- b. Disconnect the probe from the field wiring and remove it from the riser.
  - 1. If you are testing more than one tank remove all the probes from their risers.
- c. Lay the probe safely on the ground and reattach the field wiring.
- d. Position the water float at the bottom of the probe and the product float 25% up from the bottom of the probe.
- e. Power the console back on.
- f. Simulate a delivery as follows:
  - 1. Move the float towards the top of the probe at a rate of 1-2" per ten seconds.
  - 2. Continue moving the float to the top of the probe at a rate of 1-2" per ten seconds for the next 50 seconds, the probe is now in delivery mode.
  - 3. Slide the float at a moderate speed to the top of the probe. Note to not slam the float against the head of the probe, this can damage the float.
- g. Once the float reaches the overfill level the Overfill alarm, including external Overfill alarm (if present), will sound.
- h. Silence the Overfill alarm on the TLS and external Overfill alarm (if present) by acknowledging it.
- i. Move the float down to the bottom of the probe. The TLS will clear the Overfill alarm once the delivery delay time is complete.
- j. Repeat 3f - 3i for the other probes.

### 4. Test Completion

- a. Print out the delivery report for all tanks tested.
- b. Power off the console.
- c. Replace the probes back into the tank; before inserting into riser, ensure that the floats are positioned at the bottom of the probe.
- d. Power on the console.
- e. If the console is running BIR enter a manual adjustment for the amount of the delivery.
- f. If the site is not running BIR give the delivery report to the store manager so they can log the delivery as part of the overfill testing.

## Appendix A - Filtered Alarms

Alarm	Detection Response Time	Clear Response Time
DIM Communication Alarm	6-minute delay	10-minute delay
Probe Out Alarm	2-minute delay	3-minute delay
Liquid <ul style="list-style-type: none"> <li>• Fuel</li> <li>• Water</li> <li>• Water Out</li> <li>• High Liquid</li> <li>• Low Liquid</li> <li>• Liquid Warning</li> </ul>	Immediate	3-minute delay
Liquid <ul style="list-style-type: none"> <li>• Open</li> </ul>	2-minute delay	3-minute delay
Liquid <ul style="list-style-type: none"> <li>* when caused by open circuit and no open alarms within the last 24-hours</li> </ul>	Immediate	3-minute delay
Liquid <ul style="list-style-type: none"> <li>• Short</li> </ul>	2-minute delay	15-minute delay
Vapor <ul style="list-style-type: none"> <li>• Fuel</li> <li>• Water Out</li> </ul>	Immediate	3-minute delay
Vapor <ul style="list-style-type: none"> <li>• Open</li> </ul>	2-minute delay	3-minute delay
Vapor <ul style="list-style-type: none"> <li>* when caused by open circuit and no open alarms within the last 24-hours</li> </ul>	Immediate	3-minute delay
Vapor <ul style="list-style-type: none"> <li>• Short</li> </ul>	2-minute delay	15-minute delay
Ground Water <ul style="list-style-type: none"> <li>• Fuel</li> <li>• Water Out</li> <li>• Liquid Warning</li> </ul>	Immediate	3-minute delay
Ground Water <ul style="list-style-type: none"> <li>• Open</li> </ul>	2-minute delay	3-minute delay
Ground Water <ul style="list-style-type: none"> <li>* when caused by open circuit and no open alarms within the last 24-hours</li> </ul>	Immediate	3-minute delay

**Appendix A - Filtered Alarms**

<b>Alarm</b>	<b>Detection Response Time</b>	<b>Clear Response Time</b>
Ground Water • Short	2-minute delay	15-minute delay
2-wire current loop • Fuel • Water Out • Liquid Warning	Immediate	3-minute delay
2-wire current loop • Open	2-minute delay	3-minute delay
2-wire current loop * when caused by open circuit and no open alarms within the last 24-hours	Immediate	3-minute delay
2-wire current loop • Short	2-minute delay	15-minute delay
3-wire current loop • Fuel • High Liquid • Liquid Warning	Immediate	3-minute delay
3-wire current loop • Open– caused by noise • Open – open circuit	2-minute delay	3-minute delay
3-wire current loop * when caused by open circuit and no open alarms within the last 24-hours	Immediate	3-minute delay
3-wire current loop • Open – open circuit *one or more open alarms within the last 24-hours	2-minute delay	3-minute delay
3-wire current loop • Short	2-minute delay	15-minute delay
Mag Sump Sensor • Fault • Communication	2-minute delay	15-minute delay
Mag Sump Sensor • Install	2-minute delay	3-minute delay

