# Vacuum Sensor System

## Troubleshooting Guide

**VEEDER-ROOT**

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Contact TLS Systems Technical Support for additional troubleshooting information at 800-323-1799.

## DAMAGE CLAIMS / LOST EQUIPMENT

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

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1.  Contact Veeder-Root Customer Service at 800-873-3313 with the specific part numbers and quantities that were missing or received damaged.

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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3.  If "lost" equipment is delivered at a later date and is not needed, Veeder-Root will allow a Return to Stock without a restocking fee.

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# Figures

# *1* Introduction

This guide contains suggested corrective actions for troubleshooting Vacuum Sensor System problems. Refer to the Vacuum Sensor Installation Guide (P/N 577013-836) for all Vac Sensor component installation and setup procedures. Also refer to the V-R Sensor Operability Testing Guide (P/N 577013-814) for manual test procedures.

## Related Manuals

| | |
|---|---|
| TLS-3XX Setup Manual | 576013-623 |
| V-R Sensor Operability Testing Guide | 577013-814 |
| Vacuum Sensor Installation Guide | 577013-836 |
| TLS-450PLUS/TLS4 Operator's Manual | 577014-110 |

## Safety Warnings

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

| | | | |
|---|---|---|---|
| | **EXPLOSIVE** Fuels and their vapors are extremely explosive if ignited. | | **FLAMMABLE** Fuels and their vapors are extremely flammable. |
| | **ELECTRICITY** High voltage exists in, and is supplied to, the device. A potential shock hazard exists. | | **TURN POWER OFF** Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit. |
| | **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. | | **INJURY** Careless or improper handling of materials can result in bodily injury. |
| | **NO POWER TOOLS** Sparks from power tools (such as drills) can ignite fuels and their vapors. | | **NO OPEN FLAMES** Open flames from matches, lighters, welding torches, etc. can ignite fuels and their vapors. |
| | **NO SMOKING** Sparks and embers from burning cigarettes or pipes can ignite fuels and their vapors. | | **TURN OFF CELL PHONES/PAGERS** Sparks from electronic devices in the vicinity of gasoline storage tanks could cause an explosion or fire resulting in bodily injury or death. |
| | **WEAR EYE PROTECTION** Wear eye protection when working with pressurized fuel lines or epoxy sealant to avoid possible eye injury. | | **GLOVES** Wear gloves to protect hands from irritation or injury. |

| ⚠WARNING | **WARNING**<br>WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. | ⚠CAUTION | **CAUTION**<br>CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. |
|---|---|---|---|
| NOTICE | **NOTICE**<br>NOTICE is used to address practices not related to physical injury. | | **USE SAFETY BARRICADES**<br>Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area. |

## ⚠ WARNING

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

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

1. Read and follow all instructions in this manual, including all safety warnings to protect yourself and others from serious injury, explosion, or electrical shock.
2. Comply with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes.
3. To protect yourself and others from being struck by vehicles, block off your work area during installation or service.
4. Turn off, tag, and lockout power to the STP/Self-Serv System/Dispenser before connecting or servicing wiring to the STP.
5. Do not alter or modify any component or substitute components in this kit.
6. Substitution of components may impair intrinsic safety.
7. Field wiring to the Sensor must not share a conduit with any non-intrinsically safe device's wiring.
8. Before installing or taking the unit into a hazardous area, earth the unit in a safe area to remove any static charge. Then immediately transport the unit to the installation site. Do not rub or clean the unit prior to installation. Cleaning is not required under normal service conditions. Do not rub or clean the unit after installation. If the unit is not fixed to a known earth point when installed, ensure that a separate earth connection is made to prevent the potential of a static discharge. When fitting or removing the unit, use of anti-static footwear or clothing is required.
9. Materials used in the construction of this device do not contain, by mass, more than 10% in total of aluminum, magnesium, zirconium and titanium or 7.5% in total of magnesium, titanium and zirconium.

## How To Use This Manual

The sections to follow in this manual when troubleshooting the Vac Sensor System depend on the console being used.

| Console | Applicable Sections |
|---|---|
| TLS-350/350R | Sections 1, 2, 3 and 4 |
| TLS450PLUS | Sections 1, 2, 5 and 6 |

# 2 Vac System Overview

A simplified Veeder-Root Vacuum Sensor system installation in an STP sump is shown in Figure 2-1.



Seal off

To console ◄

Dual weatherproof junction boxes w/cord grip wiring entries containing epoxy sealed connections

Double wall sump vacuum fitting*

*If multiple ports are provided in the sump wall, install vacuum fitting in lowest one.*

Double wall tank

Wiring from sensor in tank interstice connects to vac sensor in J box

Tank interstitial vacuum fittings

Four Vac Sensor Housing Assembly bracketed to riser

STP

Barbed fitting in siphon port for vacuum source

Product line vacuum fitting

Vapor return line vacuum fitting

**Figure 2-1.-  Installation Example Of Four Vac Sensor W/Tank Interstitial Monitoring**

Figure 2-2 illustrates the components of a Vac Sensor/Float assembly.



Front of housing

Vac Sensor

Cable connector (TLS port)

Cable pair to junction box

Barbed elbow

Tapered bushing/nut

Barbed tee (STP SIPHON port)

Tapered bushing/nut

Barbed elbow (VAC TEST port)

Vent port

3-way ball valve - Valve handle shown in operating position (down).  To vent monitored interstice rotate handle up.

Tubing connects to interstitial space being monitored

Vac float
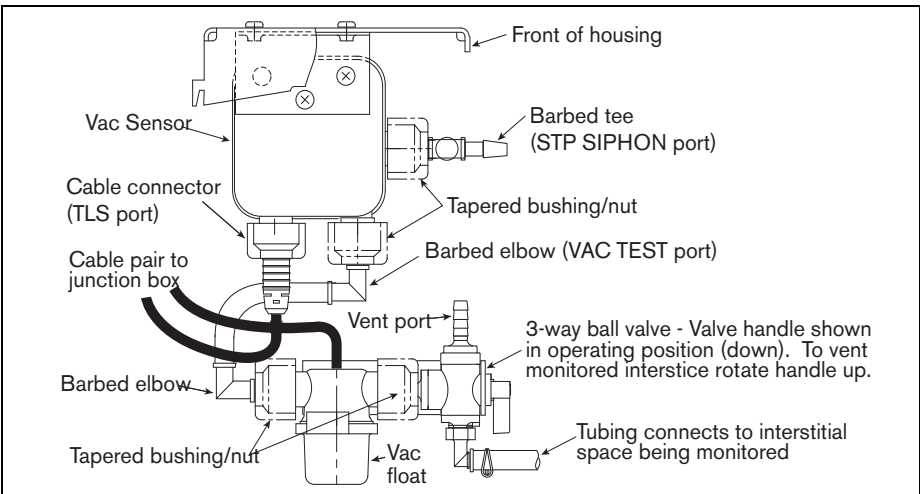
**Figure 2-2.-  Example Vac Sensor And Float Component Assembly**

Figure 2-3 is an example diagram of the vacuum connection to the STP.



vacsensor/fig12.eps

1/4" NPT male to 1/4" barbed adapter

Spring clamp

1/4"ID tubing connects to open tee fitting in Vac Sensor vacuum manifold

STP siphon cartridge

Siphon cartridge ID mark*

*NOTE: For STP siphon cartridges which have the ID Mark circle, an external siphon check valve is not required.
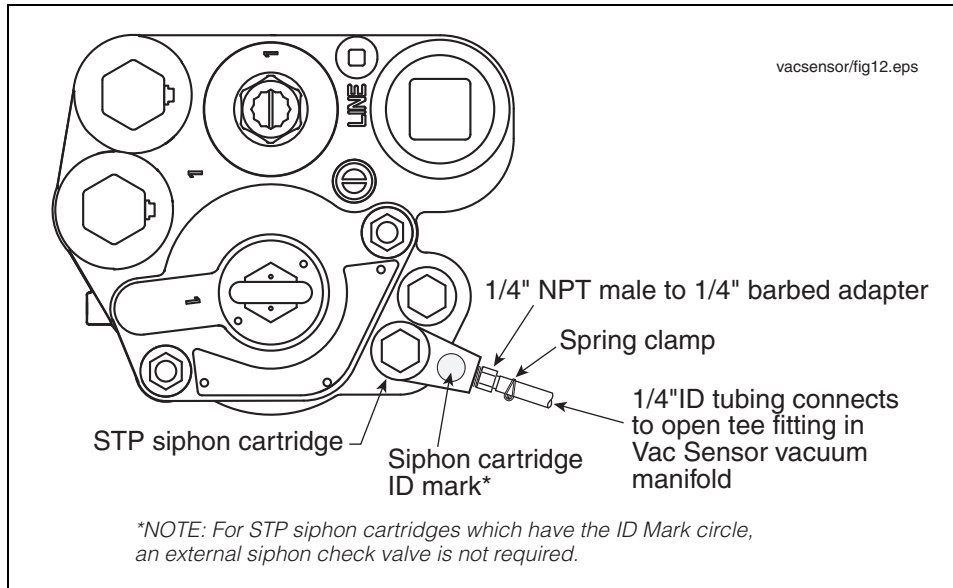
**Figure 2-3.-  Example Vacuum Source Connection At Pump**

A simplified functional diagram of the Vac Sensor system is shown in Figure 2-4. The TLS Console turns the pump on, opens the vacuum control valve (in Vac Sensor), and then monitors the pressure sensor (in Vac Sensor). Under normal operation, when the vacuum reaches either 1 psi above the entered relief valve pressure (relief valve installed), or -8 psi (no relief valve installed), unless the rate of evacuation decreases to less than 0.1 gpm, the console closes the vacuum control valve and turns off the pump. Thereafter, the console continues to monitor the pressure sensor for signs of a decrease in vacuum (leak) and the liquid float for the presence of a liquid in the vacuum line. In the event of a decrease in vacuum the console turns on the pump in an attempt to restore the vacuum. Small leaks will be maintained by these periodic evacuations. If the system calculated leak rate exceeds approximately 25 gph a Vac Warning will be posted. The console also monitors the liquid float in the Vac Float module or tank interstice and will post a High Liquid Alarm if enough liquid accumulates in the vacuum line liquid reservoir to lift the float.



To Pump Control Relay (TLS)

Intrinsically Safe Sensor Wiring To TLS

Field wiring junction box

Vacuum control valve

Liquid float

Vac line (1/4" ID tubing -Typ.)

Siphon port

Pressure sensor

Reservoir

Pump (Vac Source)

Vac Sensor Module

Vac Float Module (or tank interstice sensor)

Monitored Interstitial Space
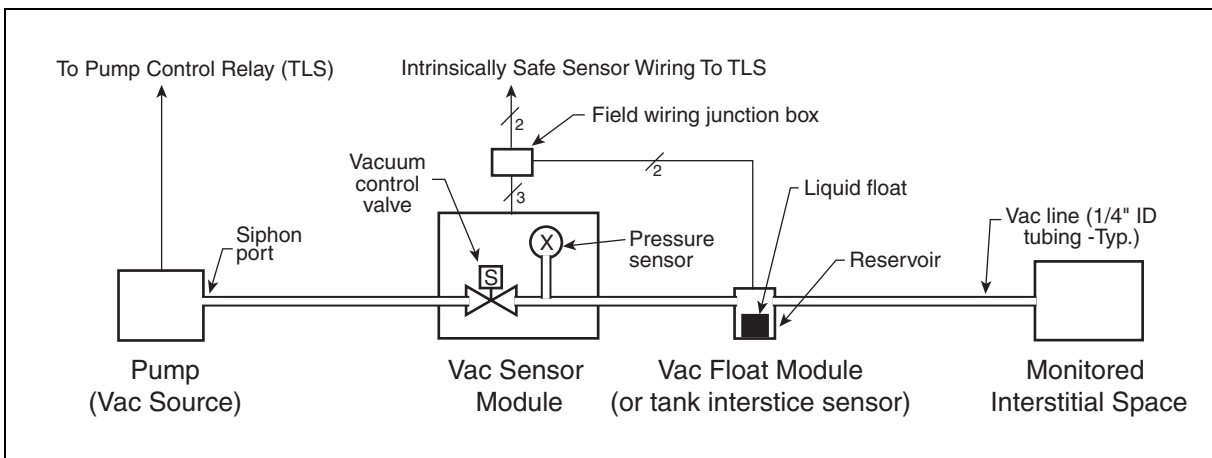
**Figure 2-4.-  Vacuum Sensor System Functional Diagram**

An example field wiring diagram of a Vac Sensor/Float assembly is shown in Figure 2-5.
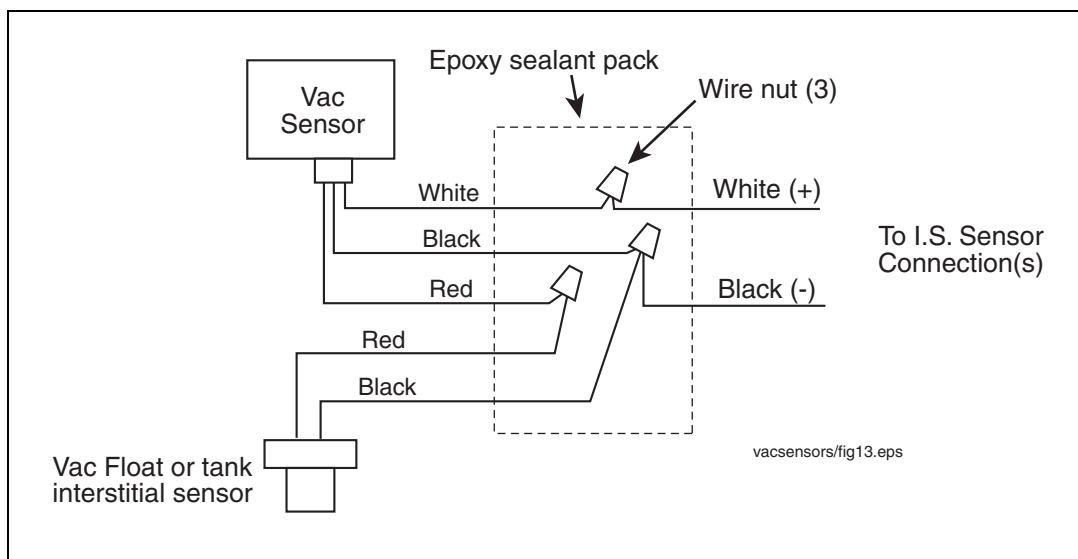


**Figure 2-5.-  Example Vac Sensor Field Wiring Connections**

## *3* Vac System Field Wiring - TLS-350/350R Consoles

### Connecting Vac Sensor to TLS-350/350R Console

1. Connect each Vac Sensor/Vac Float pair and the Vac Sensor/ Tank Interstitial Float pair cables to either a Smart Sensor with Pressure Sensor module or a Smart Sensor Interface module as shown in Figure 3-1. Note: at least one Smart Sensor with Pressure Sensor module must be installed in the console for proper Vac Sensor operation.

2. System programming of the Vacuum Sensors is performed following instructions in the TLS-3XX Setup Manual.
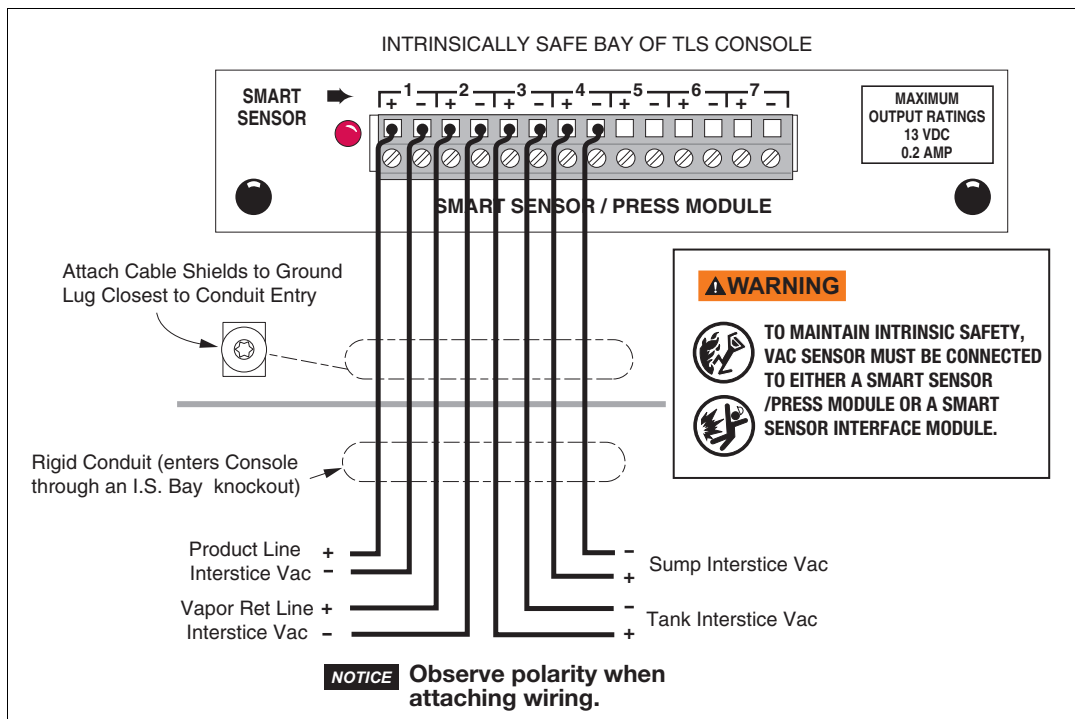


**Figure 3-1.- Attaching Vac Sensors To Smart Sensor With Pressure Sensor Module**

### Connecting Pump Control to TLS-350/350R Console

#### FOR SITES WITH PLLD OR WPLLD LEAK DETECTION

Pump control for Vac Sensors is shared with PLLD or WPLLD line leak detection. Connecting PLLD/WPLLD leak detection as per the instructions provided with that equipment is all that is required.

#### FOR SITES WITHOUT PLLD OR WPLLD LEAK DETECTION

A Pump Sense module and a 4-Relay module are required in the TLS Console for Vac Sensor pump control.

**Field Wiring:**

• For module connections with Red Jacket pumps see Figure 3-2. For module connections with non-Red Jacket pumps see Figure 3-3.

**Console Setup:**

• Pump Sense setup - assign each tank to Pump Sense device

• Output Relay setup - select 'Pump Control Output'
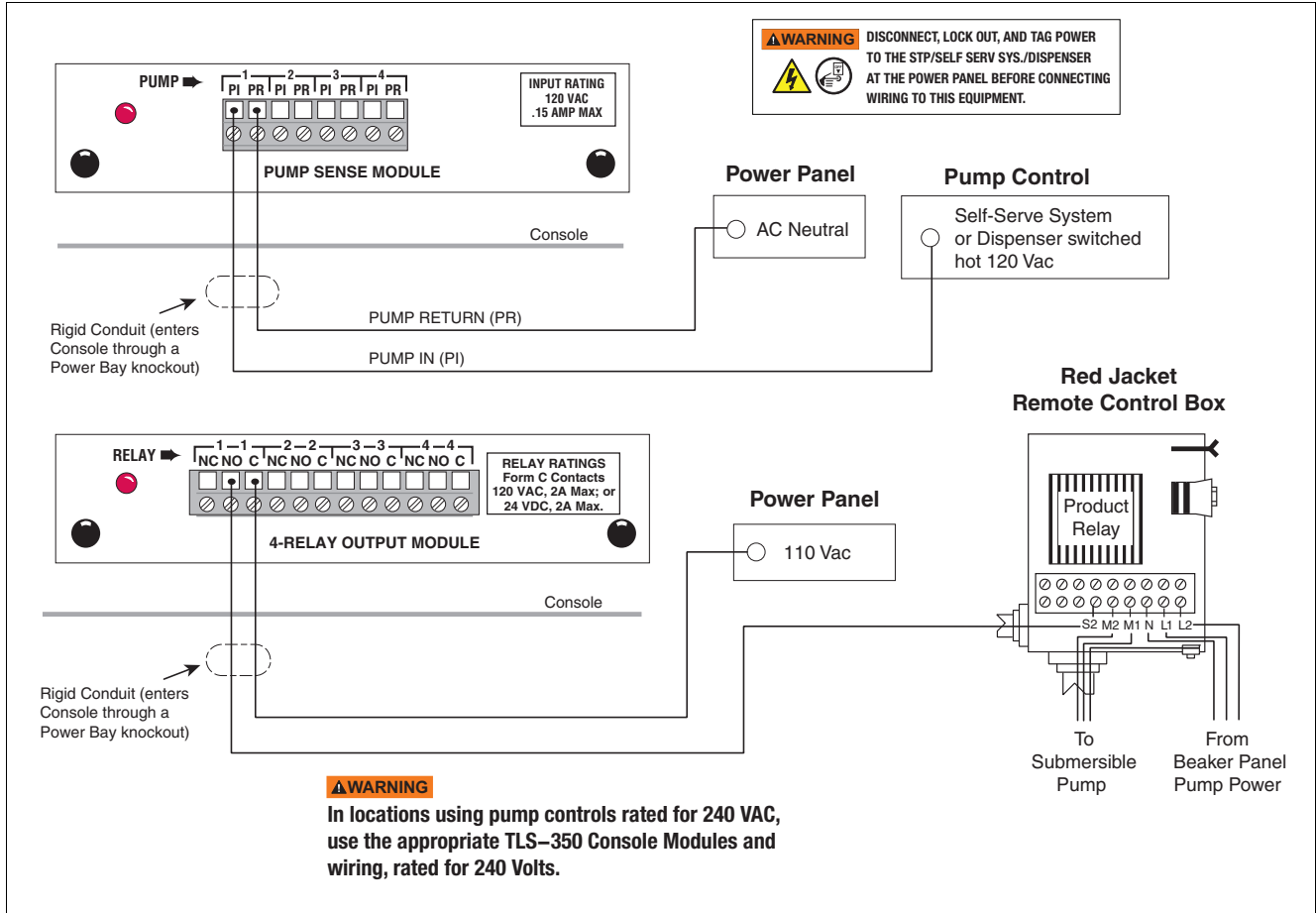


**Figure 3-2.-  Connecting Pump Sense And 4-Relay Modules - Red Jacket Pumps**
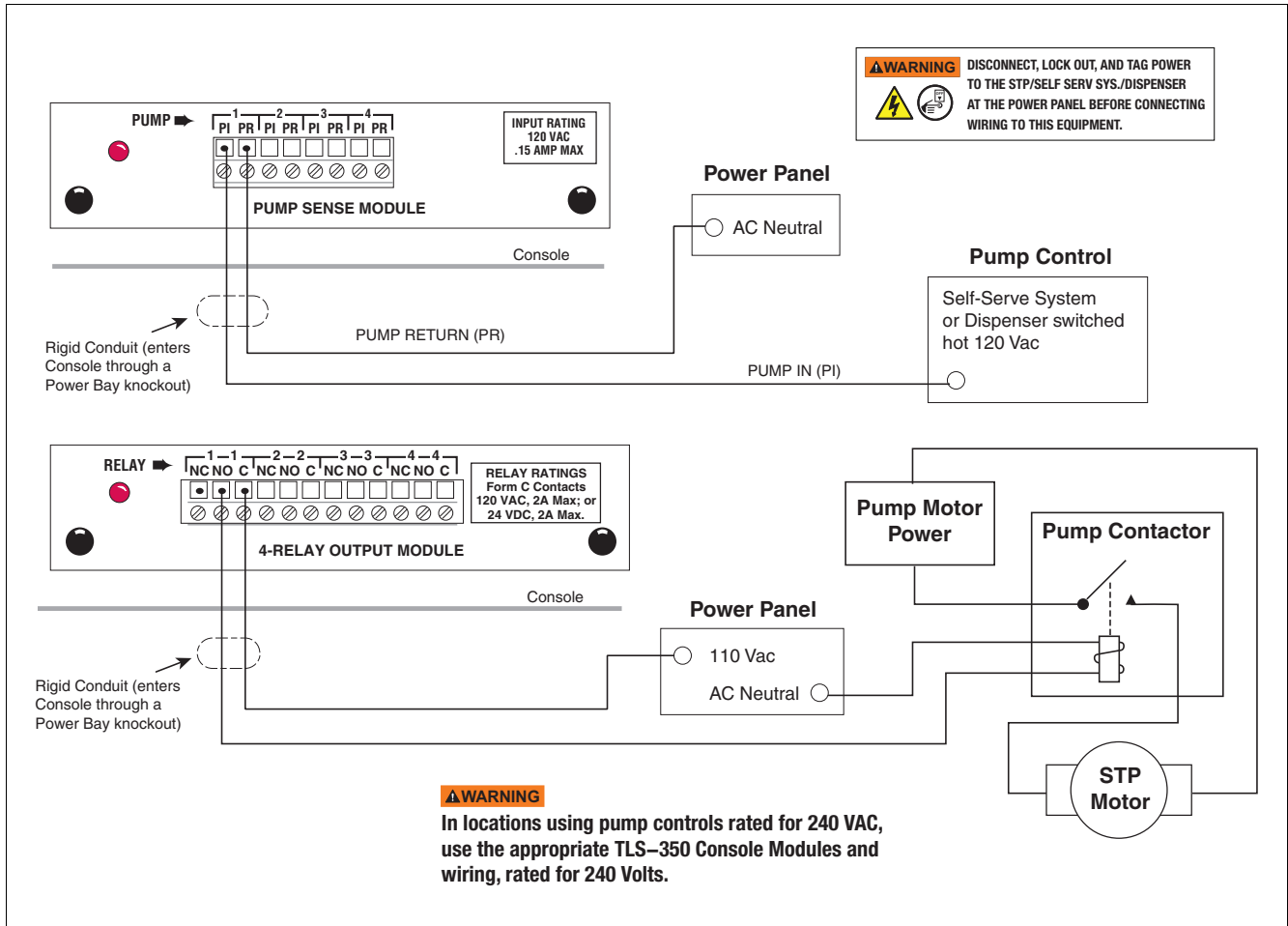
**Figure 3-3.-  Connecting Pump Sense And 4-Relay Modules - Non-Red Jacket Pumps**

## Disable Extended Run Feature in the Pump Controller

NOTICE   **Certain pump controllers may be programmed to turn off the pump after an extended run period and post an ER (Extended Run) error in the controller. Because the Vac Sensors may require the pumps to run for several hours and possibly triggering this error, disable this ER feature in the pump controller. Refer to the Pump Controller's documentation for instructions on how to disable the Extended Run feature.**

## 4 Vac Sensor Troubleshooting - TLS-350/350R Consoles

## High Liquid Alarm

TLS DISPLAY: Snn: High Liquid Alarm

RS-232 Description: HI LIQ ALM

### ALARM DESCRIPTION(S)

Alarm is posted for Vac Sensor when there is liquid present for two consecutive samples. Liquid is detected at the Vac Sensor liquid sensor or interstitial double wall sensors.

### TROUBLESHOOTING PROCESS

If there is a High Liquid Alarm all evacuation attempts are stopped. No evacuation attempts will be allowed until alarm is cleared.

1. Check the following:

    • Priority (I11100) and Non–priority alarm history (I11200).

    • Current Alarms, check for related alarms to Smart Sensors, STP disable shut down alarms. Troubleshoot and repair any related Sensor Fault alarms first.

2. Verify alarm condition for Vac Sensor that is in alarm:

    • Unscrew the lower float bowl (about a ¼ turn) on sensor that is in alarm.

    • Check to see if there is liquid in bowl. If liquid is found determine the source of liquid and have necessary repairs performed.

    • After repairs are made, empty bowl and clean and alarm will clear. Push alarm reset button to acknowledge alarm.

3. If they don't have Vac Float Sensors and they are using interstitial sensors on double wall tanks as float sensors:

    • Verify wire connections to Vacuum sensor as per Vacuum Sensor Installation Manual P/N 577013-836.

    • Then check interstitial space and verify if liquid is present.

    • If liquid is detected, troubleshoot for source and perform necessary repairs. Once repairs are done alarm will clear. Push alarm reset button to acknowledge alarm.

    • If no liquid detected, perform necessary troubleshooting procedures to verify interstitial sensor, field wiring, Smart Sensor module, channel for possible faults.

4. Perform a Manual Test ("Running a Manual Test" on page 4-10) to restore interstice vacuum and clear 'No Vacuum Alarm'.

## Setup Data Warning

TLS DISPLAY: SETUP WARN

RS-232 Description: SETUP DATA WARNING

### ALARM DESCRIPTION(S)

A set up parameter is not correct or is missing.

### ADDITIONAL ALARM DESCRIPTION

There will be a Setup Data Warning if:

• The volume is not in the correct range. The volume will default to 501. The user must program the volume between 0.1 to 500 gallons.

• A pump # is not assigned to the Vac Sensor or if a Pump Output Relay, that is assigned as a pump # and is not assigned to a pump sense device.

• There is not a configured Atmospheric pressure sensor. In this case, a Setup Data Warning will be posted for each configured Vacuum Sensor.

1. Check the following:

    • Priority (I11100) and Non–priority alarm history (I11200).

    • Current Alarms, check for related alarms to Smart Sensors, STP disable shut down alarms. Troubleshoot and repair any related Fault alarms first.

    • Verify Smart Sensor setup; Check what may be the cause of the Setup Data Warning. If you are connected via serial port, use the following RS-232 commands as applicable:

       - I721ss - Configuration Smart Sensor ('ss' is the SmartSensor number, such as 01, 02, etc.)

       - I80800 - Relay Alarm Assignments.

       - I78700 - PLLD Alarm Assignments.

       - I7A700 - WPLLD Alarm Assignments

       - I72A00 - Volume of Interstitial Zones

2. Once the Setup Data Warning has been cleared, it is recommended that you perform the Vacuum Sensor Operability Test (Testing Procedure K in the V-R Sensor Operability Guide #577013-814).

# Communication Alarm

TLS DISPLAY: Snn: Communication Alarm

RS-232 Description: COMM ALARM

## ALARM DESCRIPTION(S)

Communication to the Smart Sensor has been lost with the TLS.

**Possible causes:**
• Faulty Smart Sensor
• Faulty Smart Sensor Module/Channel/ Slot
• Faulty field wiring
• Faulty wiring connections

## TROUBLESHOOTING PROCESS

1. Check priority (I11100) and non-priority (I11200) Alarm History

2. "Jump Start" Procedure:

   First de-configure the Smart Sensor, then re-configure Smart Sensor, either using the Front Panel, or remotely via R-S 232 Command, S721. This will "Jump Start" the Smart Sensor. Wait for 2 minutes then either print out the Smart Sensor Diagnostics, or use R-S 232 Command, IB35ss. If you get data, then communication has been re-established with the Smart Sensor. Verify if alarm has cleared. Push alarm reset button to acknowledge alarm.

3. If Alarm still Active, perform the following:

   a. If Smart Sensor Module was not installed with a "Cold Start", do so at this time.

   b. Perform troubleshooting procedures to determine which of the following may be contributing to this alarm.
      - Faulty Smart Sensor Module/Slot
      - Faulty Smart Sensor Channel
      - Faulty wiring connections
      - Faulty field wiring
      - Faulty Smart Sensor

   c. Use similar process as troubleshooting sensors or probes. Connect the sensor directly to the console to troubleshoot field wiring, noisy line issues. If unit is OK, check wiring connections, wire conductivity, etc., to isolate the problem.

4. If you are connected via serial port: use the following commands only if communication is restored or intermittent. These commands may help determine how severe the communications loss may be occurring.

   • I10200 – System Configuration: Ensure that Smart Sensor Module was installed with a "Cold Start".

   • IB35ss – Smart Sensor Data, Serial Number, Type, Date Code, and Protocol Version. This command may be useful in referencing Smart Sensor variations, (Date Code).

## Vacuum Warning

TLS DISPLAY: Snn: Vacuum Warn

RS-232 Description: VACUUM WARN

### ALARM DESCRIPTION(S)

A Vacuum Warning will be posted under the following conditions:

• Leak Rate > 22.4 GPH for 40 minutes

• Evacuation ratio of less than 1.0 during a manual evacuation when vacuum level has not reached -4.0.

### ADDITIONAL DESCRIPTION(S)

Possible Causes:

• Faulty Vacuum sensor

• A vacuum leak, including tubing and fittings – see "Procedures for isolating source of a Vacuum leak" on page 4-7 below.

• STP Shut down, malfunction or no power

• STP Siphon System not working properly

• Incorrect Programming

| NOTICE | **Be aware that Vacuum Sensors are arranged in zones, and up to 4 Vacuum Sensors may share a common STP as their vacuum source. These Vacuum Sensors may go into a "VACU- UM WARN" or a "NO VAC ALM" if the STP supplying the vacuum is shut down due to an alarm condition or if power to the STP is down.** |

### TROUBLESHOOTING PROCESS

Refer to the Vacuum Sensor System Installation Guide (P/N 577013-836) as needed.

1. Check the following:

   • Current Alarms, check for related alarms to Smart Sensors, STP disable shut down alarms. Troubleshoot  and repair any related "Snn: Setup Warn" or "Snn: SENSOR FAULT" alarms first.

   • Assigned STP to Smart Sensor is enabled and has power.

   If connected via serial port, check:

   • Smart Sensor Diagnostic RS-232 commands

   • IB38ss – Vac Sensor Diagnostic Report

2. Start a Manual Test ("Running a Manual Test" on page 4-10) to attempt to increase vacuum level if the current pressure is less than -3 psi (if you already have sufficient vacuum, proceed directly to Step 'a'). Let the test run for a few minutes. If it stops the evacuation process because it is not 'making headway' (the vacuum level is not increasing or it is increasing very slowly as indicated by an 'Evac Ratio' less than 1.0), then start Vac sensor evacuation hold. This closes the VCV valve. Watch vacuum reading to see if it drops.

| NOTICE | **During a Manual Test the TLS may go into 'Evac Pending' to provide a short idle period (up to 10 minutes duration) for line testing.** |

   a. If vacuum holds, verify if alarm clears or remains. If it does, the alarm could have been caused by the STP having lost power.

b. If losing vacuum go to next step below.

3.  Verify the following possible causes:

   • Incorrect Programming (if the volume is programmed significantly larger than the actual volume, a small leak will be calculated as being much larger by the TLS).

   • STP Shut down, malfunction or no power

   • STP Siphon System not working properly

   • A vacuum leak – see "Procedures for isolating source of a Vacuum leak" on page 4-7.

   • Faulty Vacuum sensor - To test Vacuum Sensor, turn 3-way ball valve connected to this sensor to the 'Test' position to see if vacuum sensor indicates atmospheric pressure (should be within 0.5 psi of zero). If Vacuum sensor does not indicate atmospheric pressure, troubleshoot further by swapping to another position. If the issue persists replace Vac Sensor.

4.  Start a Manual Test. Let the test run for a few minutes; if vacuum is 'making headway' then start Vac sensor evacuation hold. This closes the VCV valve. Watch vacuum level to see if it drops.

> `NOTICE`  **During a Manual Test the TLS may go into 'Evac Pending' to provide a short idle period for line testing.**

   • If vacuum level is still dropping, did you verify all possible causes listed above?

   • If vacuum holds, wait at least 30 minutes to ensure alarm does not return.

## No Vac Alarm

TLS DISPLAY: Snn: NO VAC ALM

RS-232 Description: NO VACUUM ALARM

### ALARM DESCRIPTION(S)

Alarm is posted when compensated pressure is greater than -1.0 psi. This alarm may or may not shut down the STP depending on the disable alarm assignments. A Manual Test must be performed to clear the alarm ("Running a Manual Test" on page 4-10).

### ADDITIONAL DESCRIPTION(S)

The alarm will clear when vacuum pressure is less than -1.1 psi. Possible causes are:

• Faulty Vacuum sensor

• A vacuum leak, including tubing and fittings – see "Procedures for isolating source of a Vacuum leak" on page 4-7.

• STP Shut down, malfunction or no power

• STP Siphon System not working properly

• Incorrect Programming

> NOTICE **Be aware that Vacuum Sensors are arranged in zones, and up to 4 Vac Sensors may share a common STP as their vacuum source. These Vac Sensors may go into a "VACUUM WARN" or a "NO VAC ALM" if the STP supplying the vacuum is shut down due to an alarm condition or if power to the STP is down.**

### TROUBLESHOOTING PROCESS

1. Check the following:

    • Priority (I11100) and Non–priority alarm history (I11200).

    • Current Alarms, check for related alarms to Smart Sensors, STP disable shut down alarms. Troubleshoot  and repair any related "Snn: Setup Warn" or "Snn: SENSOR FAULT" alarms first.

    • Assigned STP to Vac Sensor is enabled and has power.

    • If connected via serial port, check: Smart Sensor Diagnostic RS-232 commands; IB38ss – Vac Sensor Diagnostic Report

2. Verify the following possible causes:

    • Incorrect Programming

    • STP Shut down, malfunction or no power

    • STP Siphon System not working properly

    • A vacuum leak – see "Procedures for isolating source of a Vacuum leak" on page 4-7.

    • Faulty Vac Sensor - To test Vac Sensor, turn the 3-way ball valve connected to this sensor to the 'Test' position to see if Vac Sensor indicates atmospheric pressure. If Vac Sensor does not indicate atmospheric pressure, troubleshoot  further by swapping to another position. If the issue persists replace Vac Sensor.

3. Start a Manual Test to attempt to increase vacuum level. Let it run for few minutes; when vacuum level stops increasing, then start Vac Sensor Evacuation Hold. This closes the VCV valve. Watch vacuum level to see if it drops.

> `NOTICE` **During a Manual Test the TLS may go into 'Evac Pending' to provide a short idle period (up to 10 minutes duration) for line testing.**

- If losing vacuum, see "Procedures for isolating source of a Vacuum leak" below.

- If vacuum level is increasing and passes the 'Vacuum OK' threshold, -1.1 psi, the alarm will clear.

> `NOTICE` **When the vacuum level increases past -1.1 psi, the 'NO VAC' alarm will clear and a 'VACUUM WARN' will be posted. The 'Vacuum Warn' will be cleared when the level reaches between -3 to -5 psi, depending upon the zone's relief valve setting.**

## PROCEDURES FOR ISOLATING SOURCE OF A VACUUM LEAK

Common leak points are entry boots, Schrader fittings (especially if uncapped – these fittings will hold pressure, but will vent vacuum, usually at some point after it exceeds -3 psi), ball valves (make sure handle is all the way down), etc.

1.  Cut a one-foot piece of tubing and attach its ends to two ends of a barbed tee (see Figure 4-4).

2.  On early model Vac Sensor Systems there is a piece of tubing connecting the Vac Float to the 3-way valve. On later model Vac Sensor Systems the Vac Float is directly connected to the 3-way valve. If your setup is a tubing-connected type go Step 3. If your setup is a direct-connected type skip to Step 7.

3.  Loosen the bushing on the Vac Float that secures the fitting/tubing connecting to the 3-way valve and remove the fitting.
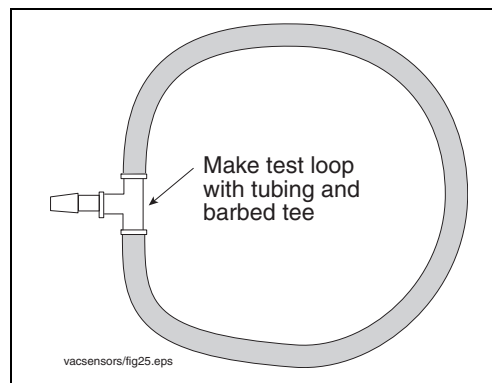


**Figure 4-4.- Making a Vac Zone Test Loop**

4.  Insert the open end of the test loop's tee into the Vac Float bushing and then tighten the bushing (see Figure 4-5).

> `NOTICE` **When attaching the test loop to Vac Sensor system components during leak isolation tests, remove the tubing fitting from the bushing instead of trying to remove the tubing from the barbed fitting.**

5.  Perform a Manual Test to evacuate to at least -4 psi (it is not necessary to pull a complete vacuum). Place the sensor into "Evac Hold" and observe if the amount of vacuum decreases.

6.  If vacuum drops by more than 0.5 psi over 15 minutes, the Vac Float is leaking and must be replaced. If there is no leak, remove the test loop tee and reconnect the fitting in the tubing going to the 3-way valve.
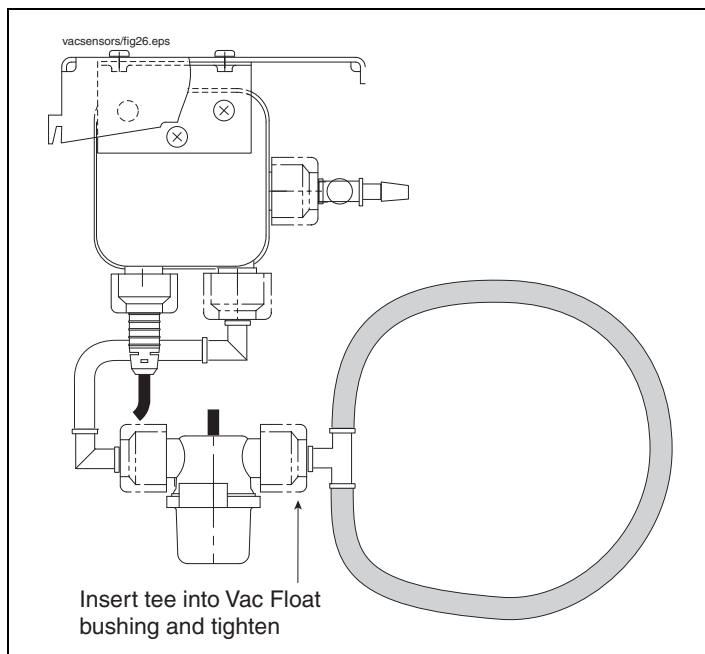
**Figure 4-5.- Isolating Vac Float for Leak Test**

7.  Cut a 2-inch piece of tubing and attach one end to the open fitting on the test loop's tee and the other end to the 3-way valve's input port (see Figure 4-6).
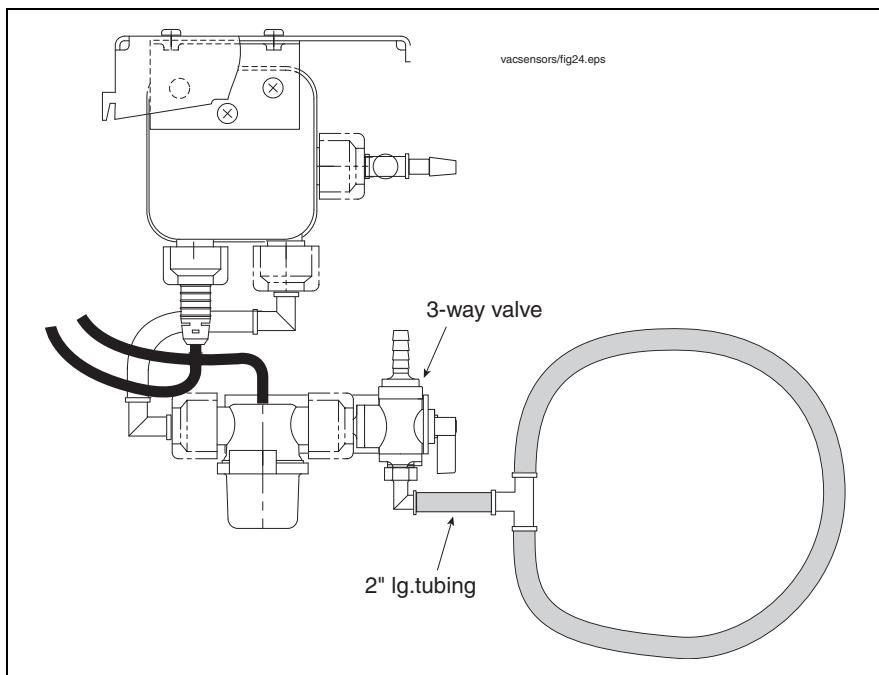


**Figure 4-6.- Isolating Vac Float for Leak Test**

8.  Perform a Manual Test to evacuate to at least -4 psi (it is not necessary to pull a complete vacuum). Place the sensor into "Evac Hold" and observe if the amount of vacuum decreases. Note: Since the volume connected is very small, even a tiny leak will cause a large change in vacuum.

9.  If vacuum drops by more than 0.5 psi over 15 minutes, the 3-way valve (or the direct-connect Vac Float/3-way valve on later models) is leaking and must be replaced. If there is no leak, replace the interstice tubing to the input port of the 3-way valve.

10. Repeat the basic process described above after reconnecting sections of the zone being monitored, adding small sections (as much as possible) until the leak returns.

## Sensor Fault Alarm

TLS DISPLAY: Sensor Fault Alarm

RS-232 Description: SENSR FAULT

### ALARM DESCRIPTION(S)

Alarm will be posted under the following conditions:

• Fluid Status Fault: The Vacuum Sensor has detected an open or short for the liquid sensor. Check the 'Fluid Status' in the Diagnostic Mode to determine if this is the case.

• Vacuum Pressure Sensor Stuck Reading (Pressure Sensor Fault): The system will attempt to detect the following two conditions:

• Over a 24-hour period, if the TLS detects no change at all in the readings, a Sensor Fault Alarm will be posted.

• Over a 90-day period if the pressure has not changed by 0.1 PSI a Sensor Fault alarm will be posted.

• Vacuum Pressure Sensor Out of Bounds Reading (Pressure Sensor Fault): If pressure is less than −14.7 psi (complete vacuum) the reading is out of bounds and sensor fault is posted.

• Relief Valve Fails Closed (Relief valve fault): There may be a relief valve in the interstitial space that the vacuum sensor is monitoring. If there is and the pressure of the interstitial space goes more than 2 psi below the relief pressure for 30 minutes a sensor fault alarm is posted.

NOTICE | **A diagnostic will show the condition(s) that made the Sensor Fault Alarm. RS-232 Command, IB38ss.**

### TROUBLESHOOTING PROCESS

1.  Check the following:

    • Priority (I11100) and Non−priority alarm history (I11200).

    • Current Alarms, check for related alarms to Smart Sensors, STP disable shut down alarms. Troubleshoot and repair any related Smart Sensor Setup Warning or Fault alarms first.

2.  If connected via serial port, check:

    • Smart Sensor Diagnostic RS-232 commands

    • IB38ss – Vac Sensor Diagnostic Report. This report will describe what Fault has occurred.

    • Verify Fault type.

• Print Vacuum Sensor Diagnostics to assist in troubleshooting - If remote communications is not available, use front panel procedure:

- Push Mode key until you see Diag Mode,

- Push Function key until you see Smart Sensor Diag,

- Push Step key until you see Vac sensor Diag,

- Press Print key.

3.  See above Alarm Description(s) for Fault Type. Troubleshoot fault as follows,

a. For Fluid Sensor Fault - Verify proper wiring installation as per Vacuum Sensor Installation manual #577013-836. Troubleshoot for possible faulty wiring, connections, interstitial sensor, and Vac Float related to Vacuum sensor.

b. For Vacuum Pressure Sensor Stuck Reading & Vacuum Pressure Sensor Out of Bounds Reading (Pressure Sensor Fault): Using the procedures below, see if Vacuum pressure will change.

•Verify proper wiring installation as per Vacuum Sensor Installation manual #577013-836. Troubleshoot for possible faulty wiring, and connections.

•Troubleshoot for possible faulty Smart Sensor channels and/or vacuum sensors by swapping channels and/or Vacuum Sensor.

•If swapping out vacuum sensor, or switching channels, de-configure channels that you are swapping. Reconfigure after swapping.

•Turn the 3-way ball valve on the vacuum fitting from the "Normal" position to the "Test" position. This will vent the sensor to atmospheric pressure, which should produce a reading within 0.5 psi of zero. Remember to turn it back to normal for "normal" operation later.

c. For Relief valve fails - In the programming for the Relief valve setup, the setup must be changed to yes for fiberglass tanks and any other zone using a relief valve. If this is correct, check and/or replace relief valve. After performing the Vacuum Sensor Operability Test, verify vacuum pressure does not go more than 2 psi below the relief pressure.

4.  After you find and repairs possible cause of fault, the Vacuum Sensor Operability Test should be run - See Vacuum Sensor Installation manual #577013-836.

## Running a Manual Test

A Manual Test is typically used when a zone has a low vacuum level or is in a 'No Vacuum' condition after a leak has been repaired. The Manual Test allows you to evacuate the zone to a desired level, then stop the evacuation to determine if the repair has corrected the leak.

NOTICE **This test is required for each sensor.**

You enter the DIAG MODE of the TLS Console by pressing the MODE key until its display appears. Press the FUNCTION key to select SmartSensor Diagnostic (Vac Sensors are considered Smart Sensors). Figure 4-7 displays the Vac Sensor Manual Test procedure steps and Figure 4-8 displays the Vac Sensor Evac Hold procedure steps.

DIAG MODE
PRESS <FUNCTION> TO CONT | F |

SMART SENSOR DIAGNOSTIC
PRESS <STEP> TO CONTINUE

| S |

sensors\vacsensor\fig21.eps

s X: (Label)
TYPE: XXX SENSOR | T |

s X: (Vac Sensor Label)
TYPE: VAC SENSOR | S |

s X: (Vac Sensor Label)
SERIAL NUMBER XXXXXXXXX | S |

| S | VAC SENSOR DIAGS
PRESS <ENTER> | P |

See example printout at right.

COMM DATA
PRESS <PRINT>
| S |

CONSTANTS
PRESS <PRINT>
| S |

CHANNELS
PRESS <PRINT>
| S |

| S | SMART SENSOR INSTALL LOG
PRESS <PRINT>

| E |

VAC SENSOR MANUAL TEST
PRESS <ENTER>

| S | | E |

```
SMARTSENSOR DIAGNOSTIC
MMM DD, YYYY  HH:MM XM
SX: (Vac Sensor Label)

VAC SENSOR
SERIAL NUMBER XXXXXXXX
COMPENSATED PRESSURE:
              -0.155 PSI
UNCOMPENSATED PRESSURE:
              -0.094 PSI
EVACUATION STATE:
  NO VACUUM
FLUID STATUS:   NORMAL
VCV: CLOSED

MM-DD-YYYY  HH:MM XM
LEAK RATE:    0.123 GPH
TIME TO NO VAC:
          100:00   HHH:MM

MM-DD-YYYY  HH:MM XM
EVAC RATIO:5.2 @-4.1PSI
SENSOR FAULTS:
  NONE
```

— Pressure sensor value minus ATM P sensor value

— Measured by pressure sensor (in Vac Sensor)

— Liquid float (in Vac Float)

— Vacuum control valve (in Vac Sensor)

— Rate in gph at which air is entering the interstitial space. A Vac Warning may be posted if this rate is >22.4 gph.

— Predicted time (in hours : minutes) it would take for the interstitial pressure to equal -1 psi. A Vac Warning Alarm will be posted if this rate is <8 hours.

— A Evac Ratio >1.0 is required or evacuation will abort. Pressure value (-4.1) is the pressure recorded at the time this ratio was calculated.

START MANUAL TEST
PRESS <ENTER>

| S | | E |

**TO SELECT ALL VAC SENSORS**

SELECT VAC SENSOR
ALL VAC SENSORS | C |

**TO SELECT INDIVIDUAL VAC SENSORS**

SELECT VAC SENSOR
sX (Vac Sensor Label)

| E |

START MANUAL TEST: ALL
PRESS <ENTER>

| E |

START MANUAL TEST: sX
PRESS <ENTER>

| E |

ALL: MANUAL TEST STARTED
PRESS <STEP> TO CONTINUE

| E |

sX: MANUAL TEST STARTED
PRESS <STEP> TO CONTINUE | S |

| S |

STOP MANUAL TEST
PRESS <ENTER> | S |

| E |

**TO SELECT ALL VAC SENSORS**

SELECT VAC SENSOR
ALL VAC SENSORS | C |

**TO SELECT INDIVIDUAL VAC SENSORS**

SELECT VAC SENSOR
sX (Vac Sensor Label)

| E |

STOP MANUAL TEST: ALL
PRESS <ENTER>

| E |

STOP MANUAL TEST: sX
PRESS <ENTER>

| E |

ALL: MANUAL TEST ABORTED
PRESS <STEP> TO CONTINUE

| E |

sX: MANUAL TEST ABORTED
PRESS <STEP> TO CONTINUE | S |

| S |

VAC SENSOR EVAC HOLD
PRESS <ENTER>

Go to Figure on next page.

**Key Legend**

| C | Change | E | Enter | F | Function | M | Mode | P | Print | S | Step | T | Tank/Sensor | ▽▼ Repress for next Tank/Sensor

**Figure 4-7.- TLS-350/350R Console Vac Sensor Manual Test**

Continued from previous page.

VAC SENSOR EVAC HOLD
PRESS <ENTER>

[S]  [E]

'Evac Hold' can be used to pause a manual test to see if the interstitial space is leaking without waiting to obtain the 'Vac OK' state.

START EVAC HOLD
PRESS <ENTER>

[S]  [E]

*TO SELECT ALL VAC SENSORS*

SELECT VAC SENSOR
ALL VAC SENSORS

[C]

*TO SELECT INDIVIDUAL VAC SENSORS*

SELECT VAC SENSOR
s X (Vac Sensor Label)

[E]

START EVAC HOLD: ALL
PRESS <ENTER>

[E]

ALL: EVAC HOLD STARTED
PRESS <STEP> TO CONTINUE

[S]

[E]

START EVAC HOLD: s X
PRESS <ENTER>

[E]

s X: EVAC HOLD STARTED
PRESS <STEP> TO CONTINUE

[S]

STOP EVAC HOLD
PRESS <ENTER>

[S]

[E]

*TO SELECT ALL VAC SENSORS*

SELECT VAC SENSOR
ALL VAC SENSORS

[C]

*TO SELECT INDIVIDUAL VAC SENSORS*

SELECT VAC SENSOR
s X (Vac Sensor Label)

[E]

STOP EVAC HOLD: ALL
PRESS <ENTER>

[E]

ALL: EVAC HOLD ABORTED
PRESS <STEP> TO CONTINUE

[S]

[E]

STOP EVAC HOLD: s X
PRESS <ENTER>

[E]

s X: EVAC HOLD ABORTED
PRESS <STEP> TO CONTINUE

[S]

s 1: VACUUM OK
-7.14 PSI     VCV: CLOSED

'VCV' shows if the Vacuum Control Valve in the Vac Sensor is open (to increase the vacuum) or closed.

[S]

s 1: (Vac Sensor Label)
FLUID STATUS: NORMAL

[S]

s 1: DD-HH-YY  HH:MM XM
LEAK RATE:        0.123 GPH

[S]

s 1: DD-HH-YY  HH:MM XM
NO VAC TIME:        50:20

'100:00' (100 hours) shows is the maximum displayed value.

[S]

s 1: DD-HH-YY  HH:MM XM
EVAC RATIO: 5.2  @  -4.1 PSI

[S]

VAC SENSOR DIAGS
PRESS <ENTER>

sensors\vacsensors\fig22.eps

**Figure 4-8.- TLS-350/350R Console Vac Sensor Evac Hold Procedure**

# *5* Vac System Field Wiring - TLS-450PLUS Console

## Connecting Vac Sensors To The TLS-450PLUS Console

1.  Connect each Vac Sensor/Vac Float pair and the Vac Sensor/ Tank Interstitial Float pair cables to the Universal Sensor Module (USM) as shown in Figure 5-1.

    NOTICE **At least one USM with attached ATM Pressure Sensor must be installed in the console for proper Vac Sensor operation.**

2.  System programming of the Vacuum Sensors is performed following instructions in the TLS-450PLUS/TLS4 Operator's Manual (P/N 577014-110).
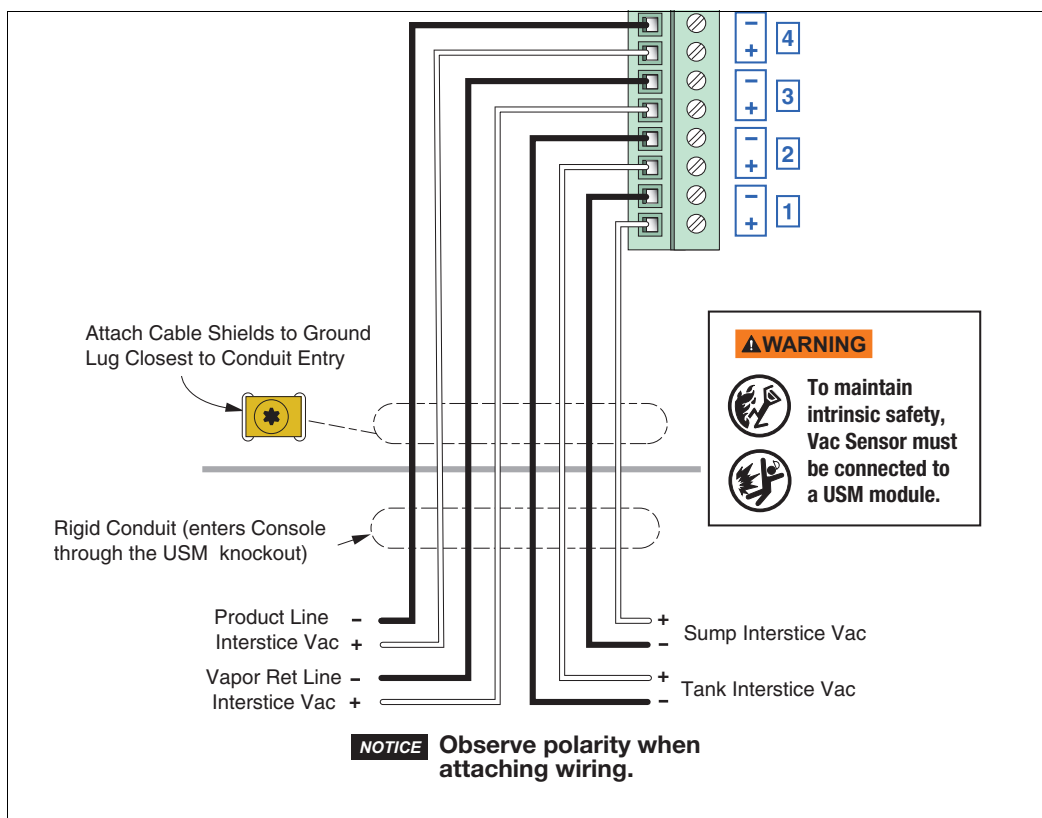


**Figure 5-1.- Vac Sensor Inputs**

## Connecting Pump Control to TLS-450PLUS Console

### FOR SITES WITH PLLD LEAK DETECTION

Pump control for Vac Sensors is accomplished with PLLD line leak detection. Connecting PLLD leak detection as per the instructions provided with that equipment is all that is required.

## FOR SITES WITHOUT PLLD LEAK DETECTION

An IOM module is required in the TLS Console for Vac Sensor pump control if there is no PLLD. Refer to Figure 5-2 for Red Jacket pump control wiring and to Figure 5-3 for non-Red Jacket pump control wiring.
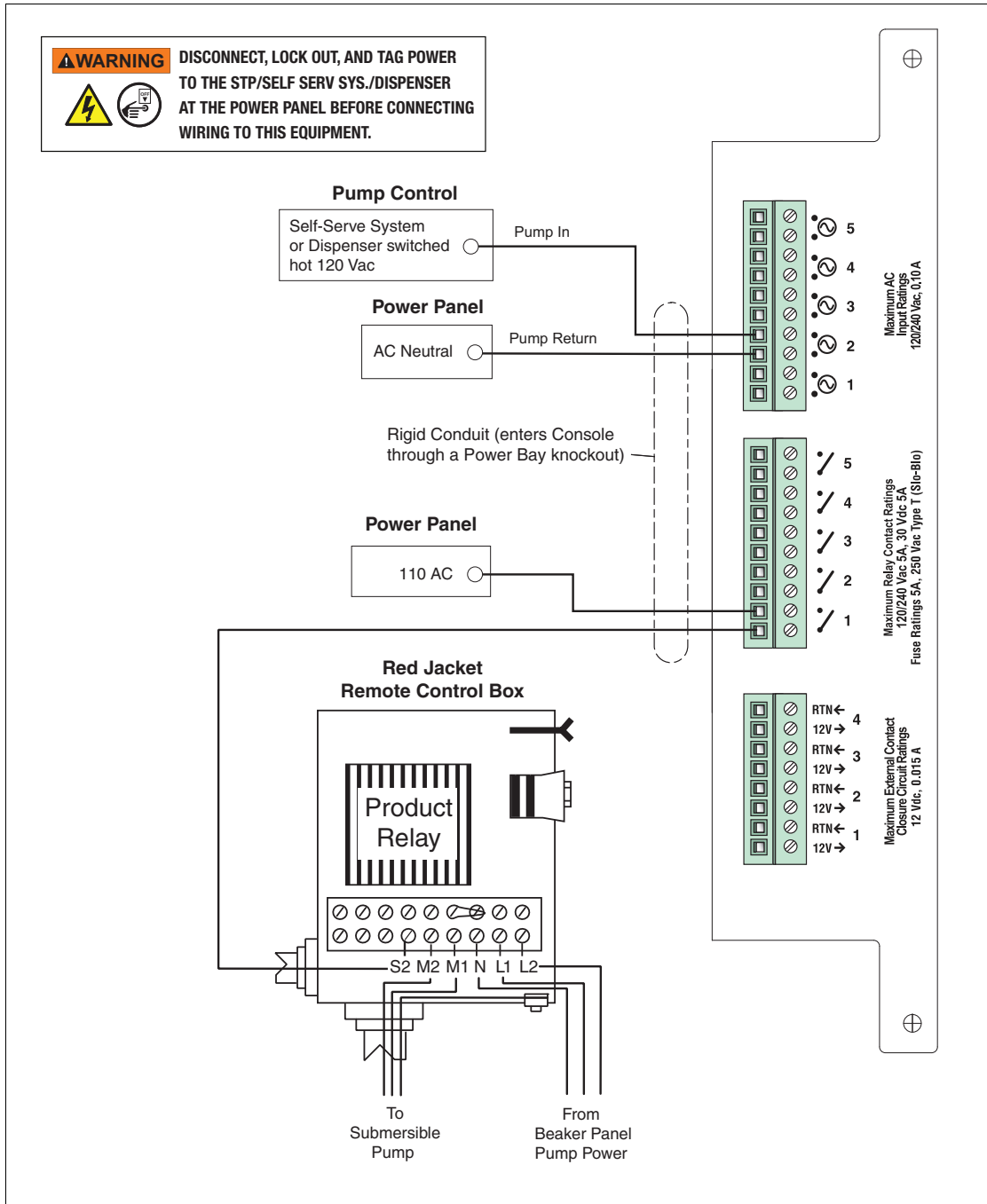


**Figure 5-2.- Red Jacket STP Control And Pump Sense Inputs**
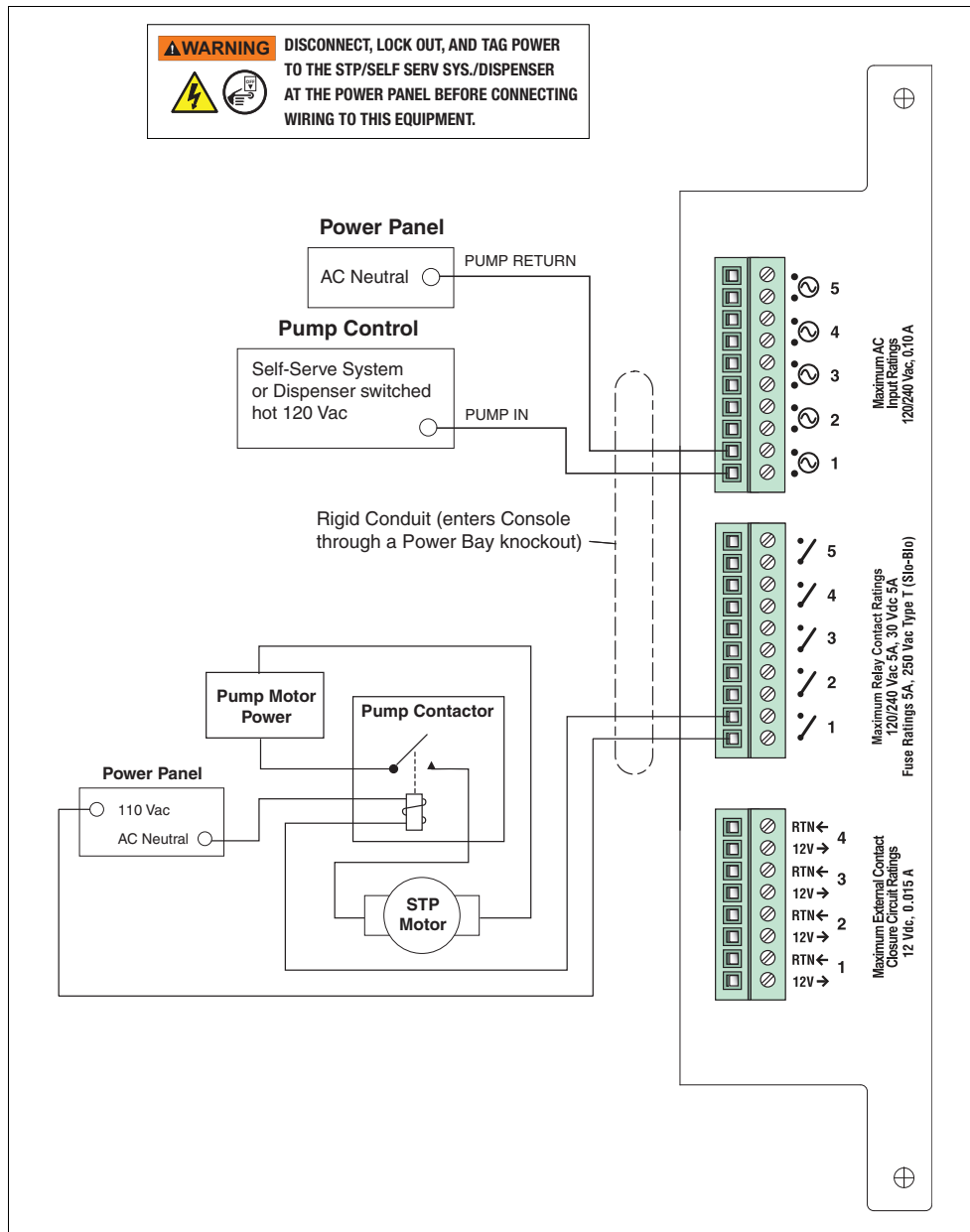
**Figure 5-3.- Non-Red Jacket STP Control And Pump Sense Inputs**

## Disable Extended Run Feature in the Pump Controller

**NOTICE**   **Certain pump controllers may be programmed to turn off the pump after an extended run period and post an ER (Extended Run) error in the controller. Because the Vac Sensors may require the pumps to run for several hours and possibly triggering this error, you must disable this ER feature in the pump controller. Refer to the Pump Controller's documentation for instructions on how to disable the Extended Run feature.**

## *6* Vac Sensor Troubleshooting - TLS-450PLUS Console

### High Liquid Alarm

TLS DISPLAY: Vsnn: HIGH LIQUID ALARM

### ALARM DESCRIPTION(S)

Alarm is posted for Vacuum Sensor when there is liquid present. Liquid is detected at the Vac sensor liquid sensor or interstitial double wall sensors.

### TROUBLESHOOTING PROCESS

This may happen when the VCV is open during an evacuation, any liquid in the interstice may be drawn into the liquid sensor or (in a tank interstice) a remote sensor detects liquid. If there is a High Liquid Alarm all evacuation attempts are stopped. No evacuation attempts will be allowed until alarm is cleared.

1. Check the following:

   • Priority (I11100) and Non–priority alarm history (I11200).

   • Current Alarms, check for related alarms to Vac Sensors, Automatic Event disable shut down alarms. Troubleshoot and repair any related Sensor Fault alarms first.

2. Verify alarm condition for Vacuum Sensor that is in alarm:

   • Unscrew the lower float bowl (about a ¼ turn) on sensor that is in alarm.

   • Check to see if there is liquid in bowl. If liquid is found determine the source of liquid and have necessary repairs performed.

   • After repairs are made, empty bowl and clean and alarm will clear. Press Alarm Status bar twice to acknowledge alarm.

3. If they don't have Vac Float Sensors and they are using interstitial sensors on double wall tanks as float sensors:

   • Verify wire connections to Vacuum sensor as per Vacuum Sensor Installation Manual 577013-836.

   • Then check interstitial space and verify if liquid is present.

   • If liquid is detected, troubleshoot for source and perform necessary repairs. Once repairs are done alarm will clear. Press Alarm Status bar twice to acknowledge alarm.

   • If no liquid detected, perform necessary troubleshooting procedures to verify interstitial sensor, field wiring, USM module, channel for possible faults.

4. Perform a Manual Test to restore interstice vacuum (see "Running a Manual Test" on page 6-13).

## Setup Data Warning

TLS DISPLAY: Vsnn: SETUP DATA WARNING

### ALARM DESCRIPTION

There will be a Setup Data Warning if:

- **Vac Sensor Address not set:** Address is not assigned in **Setup>Devices> Vac Sensor**

- **Volume Out of Range:** The volume is not in the correct range. The volume will default to 0. The user must program the volume between 0.1 to 500 gallons.

- **Pump Not Set:** A pump # is not assigned to the Vac Sensor.

- **ATMP Sensor not active:** There is not a configured Atmospheric Pressure Sensor or Atmospheric Pressure Sensor board is not installed. In this case, a Setup Data Warning will be posted for each configured Vac Sensor.

- **Pump Invalid:** The pump assigned to the Vac Sensor is not configured or is not set up correctly.

- **Pump Not TLS Pump Control:** The pump assigned to the Vac Sensor does not have a mode of TLS Pump Control.

- **Line Invalid:** The line assigned to the pump that is assigned to the Vac Sensor is not configured or is not set up correctly.

- I**PC Enabled/Vac Sensor Unsupported:** If the Intelligent Pump Control feature is active, you cannot configure a Vac Sensor for the Secondary Containment Vacuum Sensing feature.

### TROUBLESHOOTING PROCESS

1. Check the following:
   - Priority (I11100) and Non–priority alarm history (I11200).
   - Current Alarms, check for alarms related to Vac Sensors, Automatic Event shut down alarms. Troubleshoot and repair any related Fault alarms first.
   - Verify Vac Sensor setup; Check what may be the cause of the Setup Data Warning. If you are connected via serial port, use the appropriate RS-232 commands to check the setup programming based on the alarm descriptions listed above.

2. Once the Setup Data Warning has been cleared, it is recommended that you perform the Vacuum Sensor Operability Test (Testing Procedure K in the V-R Sensor Operability Guide P/N 577013-814).

# Communication Alarm

TLS DISPLAY: Vsnn: COMMUNICATION ALARM

## ALARM DESCRIPTION(S)

Communication to the Vac Sensor has been lost with the TLS.

**Possible causes:**
- Faulty Vac Sensor
- Faulty USM
- Faulty field wiring
- Faulty wiring connections
- Address is not assigned in **Setup>Devices**

## TROUBLESHOOTING PROCESS

1. Check priority (I11100) and non-priority (I11200) Alarm History

2. Reconfigure:

   First de-configure the Vac Sensor, then re-configure Vac Sensor, either using the GUI, or remotely via Web or RS-232 Command S72G. Wait for 2 minutes then either print out the Vac Sensor Diagnostics, or use RS-232 Command IB3Kss. If you get data, then communication has been re-established with the Vac Sensor. Verify if alarm has cleared. Press Alarm Status bar twice to acknowledge alarm.

3. If Alarm still Active, perform the following:

   a. Perform troubleshooting procedures to determine which of the following may be contributing to this alarm.
      - Faulty USM
      - Faulty wiring connections
      - Faulty field wiring
      - Faulty Vac Sensor
      - Address not assigned in **Setup>Devices>Vac Sensor**

   b. Use similar process as troubleshooting sensors or probes. Connect the sensor directly to the console to troubleshoot field wiring, noisy line issues. If unit is OK, check wiring connections, wire conductivity, etc., to isolate the problem.

4. If you are connected via serial port: use the following commands only if communication is restored or intermittent. These commands may help determine how severe the communications loss may be occurring.
   - IB3Kss – Vac Sensor Data, Serial Number, Type, Date Code, and Protocol Version. This command may be useful in referencing Vac Sensor variations (Date Code).

## Vacuum Warning

TLS DISPLAY: Vsnn: VACUUM WARNING

### ALARM DESCRIPTION(S)

A Vacuum Warning will be posted under the following conditions:

• Leak Rate greater than 22.4 gph for 40 minutes

• Evacuation ratio of less than 1.0 during a manual evacuation when vacuum level has not reached -4.0 psi.

### ADDITIONAL DESCRIPTION(S)

Possible Causes:

• Faulty Vacuum sensor

• A vacuum leak, including tubing and fittings – see "vacuum leak isolation procedures" below

• STP shut down, malfunction or no power

• STP Siphon System not working properly

• Incorrect Programming, e.g., wrong volume

| NOTICE | **Be aware that Vacuum Sensors are mounted in groups, and multiple Vac Sensors may share a common STP as their vacuum source. These Vacuum Sensors may go into a "VACUUM WARNING" or a "NO VACUUM ALARM" if the STP supplying the group is shut down due to an alarm condition or if power to the STP is down.** |

### TROUBLESHOOTING PROCESS

Refer to the Vacuum Sensor System Installation Guide (P/N 577013-836) as needed.

1. Check the following:
    • Current Alarms, check for alarms related to Vac Sensors, Automatic Events shut down alarms. Troubleshoot and repair any related Vsnn: SETUP DATA WARNING or FAULT alarms first.
    • If connected via serial port, check: Vacuum Sensor Diagnostic Report IB38ss – Vacuum Sensor Diagnostic Report
    • STP assigned to Vac Sensor is enabled and has power.

2. Start a Manual Test (see "Running a Manual Test" on page 6-13) to attempt to increase vacuum level if the current pressure is greater than -3 psi (if you already have sufficient vacuum, proceed directly to Step 'a'). Let the test run for up to 25 minutes. If it stops the evacuation process because the vacuum level is not increasing or it is increasing very slowly as indicated by an 'Evac Ratio' less than 1.0, then start Vac sensor evacuation hold. This closes the VCV valve. Watch vacuum reading to see if it drops.

| NOTICE | **During a Manual Test the TLS may go into 'Evac Pending' to provide a short idle period for line testing (up to 10 minutes duration).** |

  a. If vacuum holds, verify if alarm clears or remains. If it clears, the alarm could have been caused by the STP having lost power.

  b. If losing vacuum go to next step below.

3.  Verify the following possible causes:

    • Incorrect Programming (if the volume is programmed significantly larger than the actual volume, a small leak will be calculated as being much larger by the TLS).

    • STP Shut down, malfunction or no power

    • STP Siphon System not working properly

    • A vacuum leak – see "Procedures for isolating source of a Vacuum leak" on page 6-7.

    • Faulty Vacuum sensor - To test Vacuum Sensor, turn 3-way ball valve connected to this sensor to the 'Test' position to see if vacuum sensor indicates atmospheric pressure (should be within 0.5 psi of zero). If Vacuum sensor does not indicate atmospheric pressure, troubleshoot further by swapping to another position. If the issue persists replace Vac Sensor.

4.  Start a Manual Test. Let the test run for a few minutes; if Evac Ratio is recalculated and greater than 1.0 then start Vac Sensor evacuation hold. This closes the VCV valve. Watch vacuum level to see if it drops.

    NOTICE  **During a Manual Test the TLS may go into 'Evac Pending' to provide a short idle period for line testing.**

    • If vacuum level is still dropping, did you verify all possible causes listed above?

## No Vacuum Alarm

TLS DISPLAY: Vsnn: NO VACUUM ALARM

### ALARM DESCRIPTION(S)

Alarm is posted when compensated pressure is greater than -1.0 psi. This alarm may or may not shut down the STP depending on the Automatic Events alarm assignments. A Manual Test (see "Running a Manual Test" on page 6-13) should be performed to clear the alarm.

### ADDITIONAL DESCRIPTION(S)

The alarm will clear when vacuum pressure is less than -1.1 psi. Possible Causes:

* Faulty Vacuum sensor

* A vacuum leak, including tubing and fittings – see "Procedures for isolating source of a Vacuum leak" on page 6-7.

* STP Shut down, malfunction or no power

* STP Siphon System not working properly

* Incorrect Programming

NOTICE **Be aware that Vacuum Sensors are mounted in groups, and multiple Vac Sensors may share a common STP as their vacuum source. These Vacuum Sensors may go into a "VACUUM WARNING" or a "NO VACUUM ALARM" if the STP supplying the group is shut down due to an alarm condition or if power to the STP is down.**

### TROUBLESHOOTING PROCESS

1. Check the following:
   * Priority (I11100) and Non–priority alarm history (I11200).
   * Current Alarms, check for alarms related to Vac Sensors, Automatic Events shut down alarms. Troubleshoot and repair any related Vsnn: SETUP DATA WARNING or FAULT alarms first.
   * If connected via serial port, check: Vac Sensor Diagnostic Report IB38ss – Vacuum Sensor Diagnostic Report
   * STP assigned to Vac Sensor is enabled and has power.

2. Verify the following possible causes:
   * Incorrect Programming
   * STP Shut down, malfunction or no power
   * STP Siphon System not working properly
   * A vacuum leak – see "Procedures for isolating source of a Vacuum leak" below.
   * Faulty Vacuum sensor - To test Vacuum Sensor, turn the 3-way ball valve connected to this sensor to the 'Test' position to see if vacuum sensor indicates atmospheric pressure. If Vacuum sensor does not indicate atmospheric pressure, troubleshoot further by swapping to another position. If the issue persists replace Vac Sensor.

3. Start a Manual Test to attempt to increase vacuum level. Let it run for few minutes; when vacuum level stops increasing, then start Vac Sensor Evacuation Hold. This closes the VCV valve. Watch vacuum level to see if it drops.

| NOTICE | **During a Manual Test the TLS may go into 'Evac Pending' to provide a short idle period (up to 10 minutes duration-) for line testing.** |
|---|---|

- If losing vacuum, see "Procedures for isolating source of a Vacuum leak".

- If vacuum level is increasing and passes -1.1 psi, the alarm will clear.

| NOTICE | **When the vacuum level increases past -1.1 psi, the 'No Vacuum Alarm' will clear. A 'Vacuum Warning' may re-post at this time if it was active when the 'No Vacuum Alarm' started. In this case, refer to the 'Vacuum Warning' troubleshooting section (page 6-4) after the cause of the 'No Vacuum Alarm' is corrected.** |
|---|---|

## PROCEDURES FOR ISOLATING SOURCE OF A VACUUM LEAK

Common leak points are entry boots, Schrader fittings (especially if uncapped – these fittings will hold pressure, but will vent vacuum, usually at some point after it exceeds -3 psi), ball valves (make sure handle is all the way down), etc.

1.  Cut a one-foot piece of tubing and attach its ends to two ends of a barbed tee (see Figure 6-1).

2.  On early model Vac Sensor Systems there is a piece of tubing connecting the Vac Float to the 3-way valve. On later model Vac Sensor Systems the Vac Float is directly connected to the 3-way valve. If your setup is a tubing-connected type go Step 3. If your setup is a direct-connected type skip to Step 7.

3.  Loosen the bushing on the Vac Float that secures the fitting/tubing connecting to the 3-way valve and remove the fitting.

Make test loop
with tubing and
barbed tee

vacsensors/fig25.eps
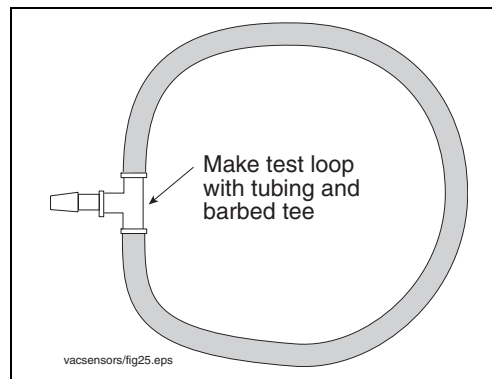
**Figure 6-1.- Making a Vac Zone Test Loop**

4.  Insert the open end of the test loop's tee into the Vac Float bushing and then tighten the bushing (see Figure 6-2).

| NOTICE | **When attaching the test loop to Vac Sensor system components during leak isolation tests, remove the tubing fitting from the bushing instead of trying to remove the tubing from the barbed fitting.** |
|---|---|

5.  Perform a Manual Test to evacuate to at least -4 psi (it is not necessary to pull a complete vacuum). Place the sensor into "Evac Hold" and observe if the amount of vacuum decreases.

6.  If vacuum drops by more than 0.5 psi over 15 minutes, the Vac Float is leaking and must be replaced. If there is no leak, remove the test loop tee and reconnect the fitting in the tubing going to the 3-way valve.
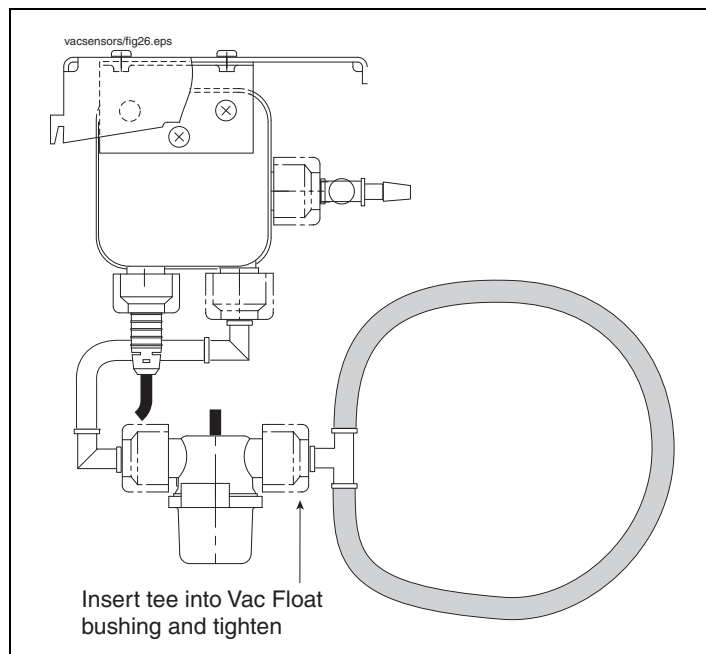
**Figure 6-2.- Isolating Vac Float for Leak Test**

7. Cut a 2-inch piece of tubing and attach one end to the open fitting on the test loop's tee and the other end to the 3-way valve's input port (see Figure 6-3).
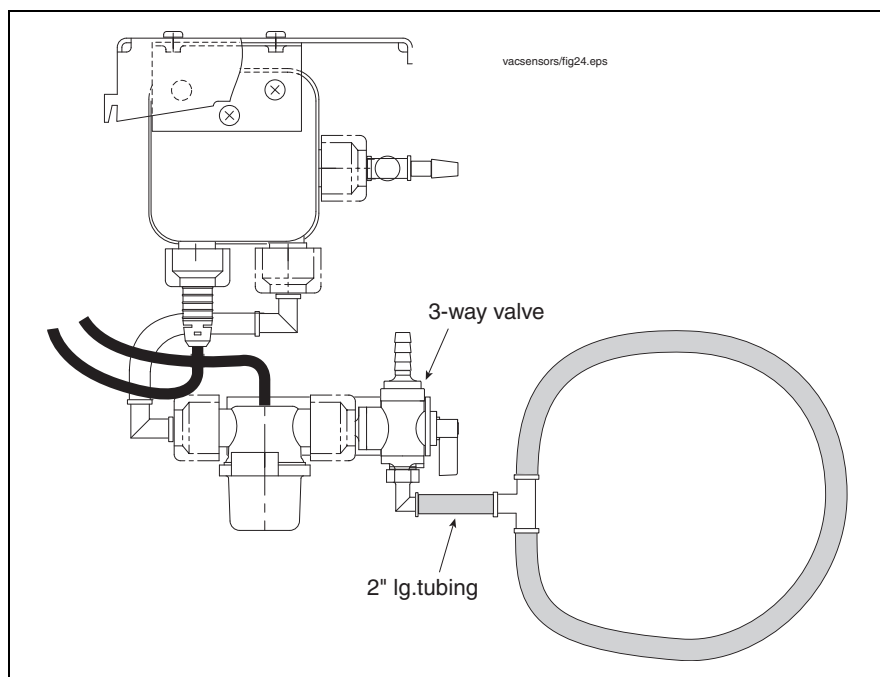


**Figure 6-3.- Isolating Vac Float for Leak Test**

8.   Perform a Manual Test to evacuate to at least -4 psi (it is not necessary to pull a complete vacuum). Place the sensor into "Evac Hold" and observe if the amount of vacuum decreases. Note: Since the volume connected is very small, even a tiny leak will cause a large change in vacuum.

9.   If vacuum drops by more than 0.5 psi over 15 minutes, the 3-way valve (or the direct-connect Vac Float/3-way valve on later models) is leaking and must be replaced. If there is no leak, replace the interstice tubing to the input port of the 3-way valve.

10.   Repeat the basic process described above after reconnecting sections of the zone being monitored, adding small sections (as much as possible) until the leak returns.

## Liquid Fault Alarm

TLS DISPLAY: Vsnn LIQUID FAULT ALARM

### ALARM DESCRIPTION

Alarm will be posted under the following conditions:

• The Liquid Sensor has a fault (open circuit)

NOTICE  **A Vac Sensor diagnostic will show the condition(s) that made the Liquid Fault Alarm. RS-232 Command, IB38ss.**

### TROUBLESHOOTING PROCESS

1.  Check the following:

    • Priority (I11100) and Non–priority alarm history (I11200).

    • Current Alarms, check for alarms related to Vac Sensors, Automatic Events shut down alarms. Troubleshoot and repair any related Vsnn: SETUP DATA WARNING or FAULT alarms first.

    • If connected via serial port, check: Vac Sensor Diagnostic Report; IB38ss – Vacuum Sensor Diagnostic Report

    • Verify Fault type.

    • Print Vac Sensor Diagnostics to assist in troubleshooting - If remote communication is not available, use the GUI:

        a.  Go to **Diagnostics>Vac Sensor>Status**

2.  Verify proper wiring installation as per Vacuum Sensor Installation manual, P/N 577013-836. Troubleshoot for possible faulty wiring, connections, interstitial sensor, and the Vac Float connected to the Vac Sensor.

3.  After you find and repair cause of fault, the Vacuum Sensor Operability Test (Testing Procedure K) should be run - See V-R Sensor Operability Guide, P/N 577013-814.

## Pressure Fault Alarm

TLS DISPLAY: Vsnn PRESSURE FAULT ALM

### ALARM DESCRIPTION

Alarm will be posted under the following conditions:

• The pressure readings are invalid.

### ADDITIONAL DESCRIPTION(S)

• Frozen counts (24 1h min/max)
• Frozen pressure (30 3day min/max)
• Pressure out of range

### TROUBLESHOOTING PROCESS

1. Check the following:
   • Priority (I11100) and non-priority alarm history (I11200).
   • Current Alarms, check for alarms related to Vac Sensors, Automatic Events shut down alarms. Troubleshoot and repair any related Vsnn: SETUP DATA WARNING or FAULT alarms first.
   • If connected via serial port, check: Vac Sensor Diagnostic Report; IB38ss – Vacuum Sensor Diagnostic Report
   • Verify Fault type.
   • Print Vac Sensor Diagnostics to assist in troubleshooting - If remote communication is not available, use the GUI:
      a. Go to **Diagnostics>Vac Sensor>Overview**
2. Using the procedures below, see if vacuum pressure will change:
   • Verify proper wiring installation as per Vac Sensor Installation Manual (P/N 577013-836). Troubleshoot for possible faulty wiring and connections.
   • Troubleshoot for possible faulty Vac Sensors by swapping inputs on USM and/or Vac Sensor. If swapping out Vac Sensor or changing input location on USM, de-configure inputs that you are swapping. Re-configure after swapping.
   • Turn the 3-way ball valve on the vacuum fitting from the 'Normal' position to the 'Test' position. This will vent the sensor to atmospheric pressure, which should result in a reading of within 0.5 psi of zero. Remember to turn it back to the 'Normal' position after verifying pressure change.
3. After you find and repair cause of fault, the Vacuum Sensor Operability Test (Testing Procedure K) should be run - See V-R Sensor Operability Guide, P/N 577013-814.

# Relief Valve Fault Alarm

TLS DISPLAY: Vsnn RELIEF VALV FLT ALM

## ALARM DESCRIPTION

Alarm will be posted under the following conditions:

• The relief valve failed to open.

## ADDITIONAL DESCRIPTION(S)

• Incorrect programming

• Relief valve stuck or failed to operate at the expected pressure.

## TROUBLESHOOTING PROCESS

1.  Check the following:
    - Priority (I11100) and non-priority alarm history (I11200).
    - Current Alarms, check for alarms related to Vac Sensors, Automatic Events shut down alarms. troubleshoot and repair any related Vsnn: SETUP DATA WARNING or FAULT alarms first.
    - If connected via serial port, check: Vac Sensor Diagnostic Report; IB38ss – Vacuum Sensor Diagnostic Report
    - Verify Fault type.
    - Print Vac Sensor Diagnostics to assist in troubleshooting - If remote communication is not available, use the GUI:

        a.  Go to **Diagnostics>Vac Sensor>Status**

2.  In programming the relief valve, Yes must be selected for fiberglass tanks and any other zone using a relief valve. With Yes selected, confirm that the relief pressure setting is correct. If the settings are correct, check and/or replace relief valve.

3.  After you find and repair cause of fault, the Vacuum Sensor Operability Test (Testing Procedure K) should be run - See V-R Sensor Operability Guide, P/N 577013-814. After running the Testing Procedure K test, verify vacuum pressure does not go more than 2 psi below the relief pressure.

## Running a Manual Test

A Manual Test is typically used when a zone has a low vacuum level or is in a 'No Vacuum' condition after a leak has been repaired. The Manual Test allows you to evacuate the zone to a desired level, then stop the evacuation to determine if the repair has corrected the leak.

> **NOTICE**   **Perform the Manual Test for Each Vac Sensor**

1.  Go to **Menu>Diagnostics>Vac Sensor>Status** screen. Select the box at the beginning of each row to select an individual Vac Sensor.



**Figure 6-4.- Vac Sensor Diagnostic Status Screen**

Touch the Down arrow in the Status button to view the Vac Sensor Diagnostic Overview screen (Figure 6-5). Changing entries in the Communication Samples Read column indicates the sensor is operative. Touch the Down arrow in the Overview button to return to the Status screen.



**Figure 6-5.- Vac Sensor Diagnostic Overview Screen**

2.  From the Vac Sensor Diagnostics Status screen select the box at the beginning of each row to select an individual Vac Sensor. Touch the Actions button to select the desired test.
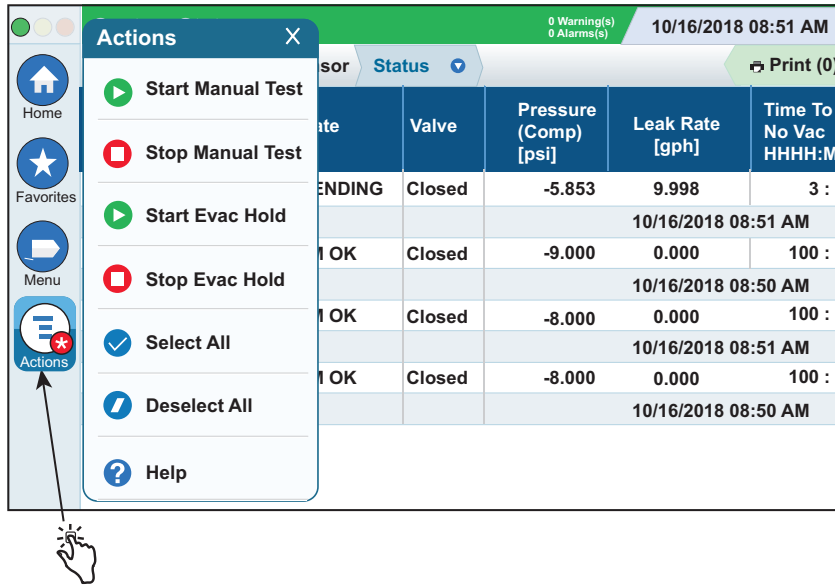


**Figure 6-6.- Accessing Vac Sensor Diagnostics Menu**

3.  Select Start Manual Test or Start Evac Hold. Use an Evac Hold to pause a manual test to see if the interstitial space is leaking without waiting to obtain the 'Vac OK' state. Once an Evac Hold procedure has begun, touch the  🖶 Print (0)  button to print out the Vac Sensor Diagnostic status.
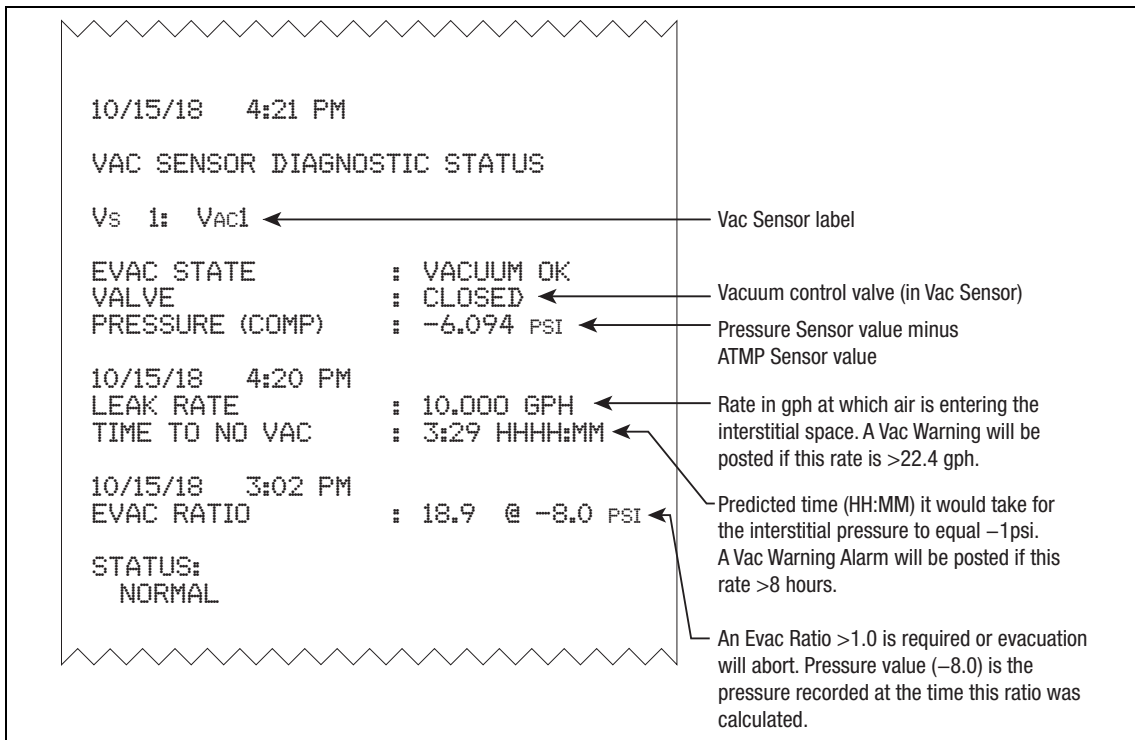


**Figure 6-7.- Vac Sensor Diagnostic Status Printout**

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