

California Environmental Protection Agency



ARB Approved

Installation, Operation and Maintenance Manual

for

Executive Order

VR-204-K

VST Phase II EVR System Including Veeder-Root
In-Station Diagnostics (ISD)

NOTICE:

The **ARB Approved Installation, Operation and Maintenance Manual (IOM) for VR-204** describes the tools, methods, and skill levels required to install the **VST Phase II EVR System Including Veeder-Root ISD**.

Unless specified in this IOM, only skilled technicians that are trained, certified, and licensed by VST, Inc. (i.e. VST Authorized Service Contractors) are able to perform installation, maintenance, or repairs of components manufactured by VST Inc. or the warranty will be void. Unless specified otherwise, only skilled technicians that are trained, certified, and licensed by the Veeder-Root Company are able to perform installation, maintenance, or repairs of components manufactured by the Veeder-Root Company or the warranty will be void. Unless specified otherwise, only skilled technicians that are trained, certified and licensed by Franklin Fueling Systems (i.e. Healy or INCON Certified Technicians) are able to perform installation, maintenance or repairs of components manufactured by Franklin Fueling Systems or warranty will be void. Unless specified otherwise, only skilled technicians that are trained, certified and licensed by EMCO Wheaton Retail (i.e. EMCO Certified Technicians) are able to perform installation, maintenance or repairs of components manufactured by EMCO or Goodyear hoses manufactured by Veyance Technologies or warranty will be void.

NOTE: GDF Owner / Operator can remove and install hanging hardware (nozzle, curb hose, breakaway, flow limiter and whip hose).

It is the responsibility of each VST Authorized Service Contractor (ASC), Veeder-Root technician, Healy Certified Technician, and EMCO Certified Technician to be familiar with the current requirements of state, federal, and local codes for installation and repair of gasoline dispensing equipment.

It is also the responsibility of the VST ASC, Veeder-Root technician, Healy Certified Technician, and EMCO Certified Technician to be aware of all the manuals, necessary safety precautions, and site safety requirements to assure a safe and trouble-free installation.

To participate in a VST training class, a candidate will need to complete an enrollment form, which can be downloaded from the VST website at www.vsthose.com or requested by phone at 937-704-9333. Once the enrollment form is approved by VST, the candidate can enroll in a VST training class.

To confirm a VST Authorized Service Contractor status, a regulator can go to the VST website at www.vsthose.com. This list is updated periodically.

Vapor Systems Technologies, Inc.
650 Pleasant Valley Drive
Springboro, Ohio 45066

PH: 937-704-9333
FX: 937-704-9443
www.vsthose.com

To confirm Veeder-Root TLS or ISD training, a regulator should send an email to technicaltraining@gilbarco.com with the name (and company) of the ASC to obtain verification of the ASC TLS/ISD training status or call 800-997-7725 and press "*" to get to the Veeder-Root menu and "*" again to speak to a representative.

To confirm a Healy or INCON Certified Technician training status, a regulator can access a searchable database at the following web site: <http://www.franklinfueling.com/CertifiedInstallers/CertifiedInstallers.asp>

To confirm the status of an EMCO Certified Technician, please visit the EMCO Wheaton Retail's website at www.emcoretail.com or contact:

Jose E. Rodriguez
Manager of Technical Services & Support
EMCO Wheaton Retail
Phone: 619-421-1743
Email: JERodriguezSD@aol.com

EMCO Wheaton Retail
2300 Industrial Park Drive
Wilson, North Carolina 27893
Phone: 252-243-4394
Fax: 252-243-4759
Email: ewrc@emcoretail.com

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VST Contractor Requirements

Due to the highly volatile nature of gasoline and its handling and storage, VST requires the following certifications for its ASC's:

Level	Component	Authorized Tasks	Training Pre-Requisites
A Must be re-certified every two years	Hanging Hardware	Functional Testing Installation Maintenance Repair	No pre-requisite
A/B Must be re-certified every two years	Hanging Hardware	Functional Testing Installation Maintenance Repair	No pre-requisite
	Membrane Processor	Installation	Veeder-Root UST Monitoring Systems Level 1, 2/3, or 4
C Must be re-certified every two years	Membrane Processor	Annual Testing Component Replacement Maintenance Operation Post-Installation Power-Up Testing Start-Up Testing Troubleshooting	VST level "A/B" Veeder-Root UST Monitoring Systems Level 2/3, or 4 Veeder-Root ASC w/VST PMC/ISD certification
<u>NOTE:</u>			
Depending on local codes, in addition to the VST and Veeder-Root training, contractors may be required to take air-district training or ICC certification as an approved vapor-recovery installer.			

- ASC's must be able to show proof of certification if asked. Carry the wallet card or have a copy of your certification on file with the GDF.
- The ASC must record his or her certification number on the applicable paperwork for all warranties to be deemed valid.
- Contractors should **ALWAYS** verify the training and certification requirements with the air-district staff **BEFORE** beginning installation of EVR systems.

Veeder-Root Contractor Requirements

<p>Installer (Level 1) Certification</p>	<p>Contractors holding valid Installer Certification are approved to perform wiring and conduit routing; equipment mounting; probe, sensor and carbon canister vapor polisher installation; tank and line preparation; and line leak detector installation.</p>
<p>ATG Technician (Level 2/3 or 4) Certification</p>	<p>Contractors holding valid ATG Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.</p> <ul style="list-style-type: none"> • Wireless 2 • Tall Tank
<p>VR Vapor Products Certification</p>	<p>Contractors holding a certification with the following designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.</p> <ul style="list-style-type: none"> • ISD – In Station Diagnostics • PMC – Pressure Management Control • CCVP – Veeder-Root Vapor Polisher • Wireless – ISD/PMC Wireless <p>A current Veeder-Root Technician Certification is a prerequisite for the VR Vapor Products course.</p>
<p>Warranty Registrations may only be submitted by selected distributors.</p>	

EMCO Contractor Requirements

Level	Component	Authorized Tasks	Training Pre-Requisites
<p>A Must be re-certified every two-years</p>	<ul style="list-style-type: none"> • EMCO Hanging Hardware • Goodyear Maxxim Premier Plus Hose 	<ul style="list-style-type: none"> • Installation • Functional Testing • Preventive Maintenance • Repair 	<p>No pre-requisite</p>
<p><u>Note:</u></p> <p>Depending on local codes, in addition to EMCO training, contractors may be required to take air district training or ICC certification as an approved vapor recovery installer.</p>			

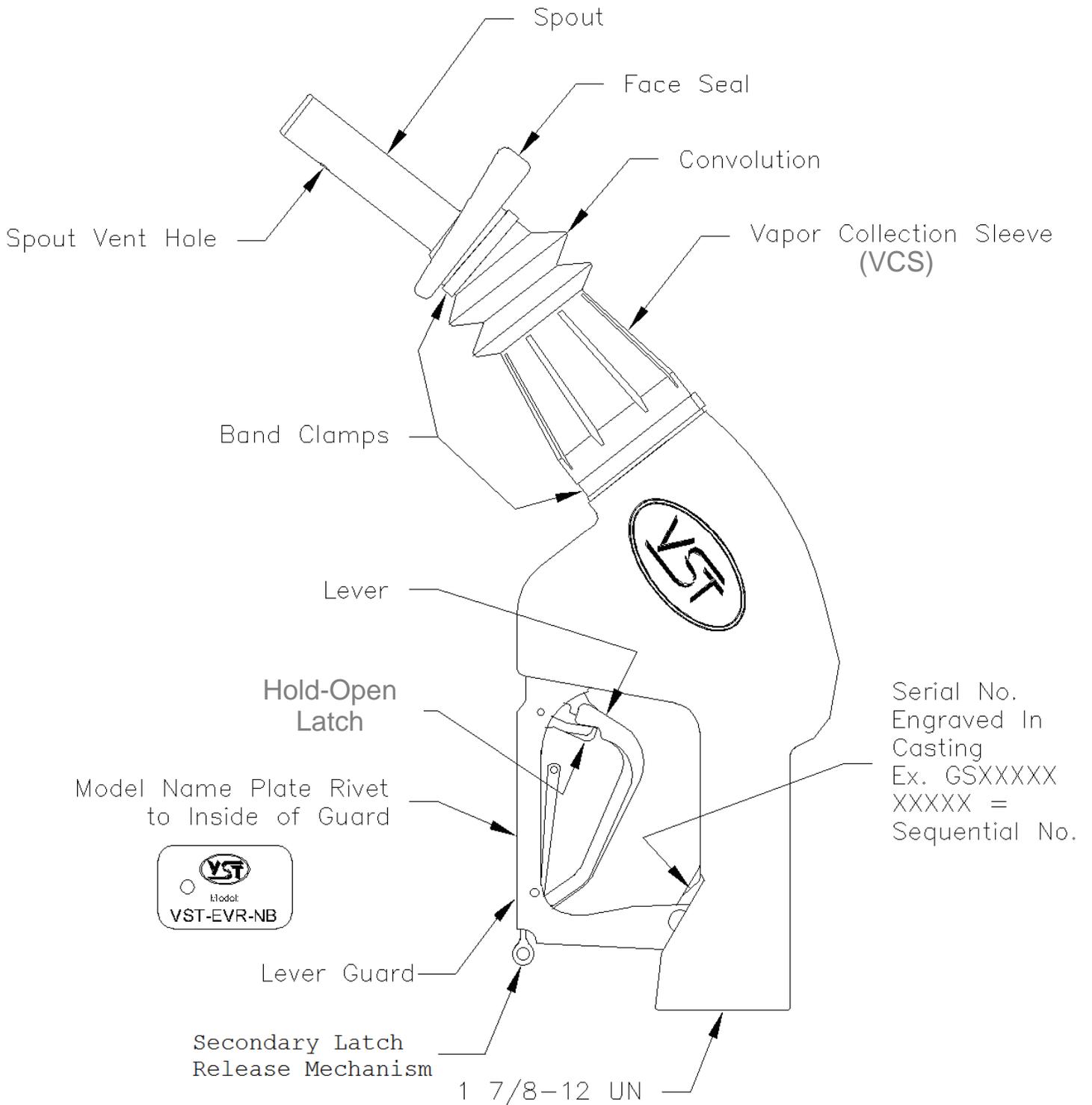
- EMCO Certified Technicians must be able to show proof of certification if asked. Carry the wallet card or have a copy of your certification on file with the gasoline dispensing facility.
- EMCO Certified Technicians must record his or her certification number on the applicable paperwork for all warranties to be deemed valid.

EMCO Certified Technician should **ALWAYS** verify training and certifications requirements with the air district staff **BEFORE** beginning installation of EVR systems or components.

FFS/Healy Contractor Requirements (for CAS)

- Unless specified otherwise, only skilled technicians that are trained, certified and licensed by Franklin Fueling Systems (i.e. Healy or INCON Certified Technicians) are able to perform installation, maintenance or repairs of components manufactured by Franklin Fueling Systems or warranty will be void.
- It is the responsibility of each Healy Certified Technician to be familiar with the current requirements of state, federal, local codes and air district rules and regulations for installation and repair of gasoline dispensing equipment.
- It is also the responsibility of the Healy Certified Technician to be aware of all the necessary safety precautions and site safety requirements to assure a safe and trouble free installation.
- To confirm a Healy or INCON Certified Technician training status, a regulator can access a searchable database at the following web site:
- <http://techlab.franklinfueling.com/mod/resource/view.php?id=64>

Figure 1
VST Nozzle



Weekly Inspections –Hanging Hardware

HANGING HARDWARE SYSTEM					
Component	Procedure	Fail Criteria	Corrective Action	Reference Manuals	Authorized Personnel
Nozzle Hose Breakaway	Inspect each hose, breakaway, and nozzle for loose connections or leaks	Presence of a leak	Tighten connections or replace with new product	IOM-6	Nozzle, hose, or breakaway replacement: GDF owner-operator or VST ASC Levels A, B, or C or EMCO Level A Component repair: VST ASC Levels A, B, or C or EMCO Level A
		Presence of residue from a leak	Tighten connections or replace with new product	IOM-8	
		Visible o-ring between any component connection	Tighten connections or replace with new product	IOM-9	
CO-AXIAL HOSES					
Component	Procedure	Fail Criteria	Corrective Action	Reference Manuals	Authorized Personnel
Coaxial Hose	Inspect hoses for wear, severe kinks, cracks, splitting, and functional swivels	Kinks, cracks, splitting, non-functional swivels, or any visible openings	Replace with new hose	IOM-8	Hose replacement: GDF owner-operator or VST ASC Levels A, B, or C or EMCO Level A
BREAKAWAY					
Component	Procedure	Fail Criteria	Corrective Action	Reference Manuals	Authorized Personnel
Breakaway	Inspect breakaway for leaks around the scuff	Presence of a leak around the scuff	Replace with new breakaway	IOM-9	Replace breakaway: Owner/Operator or VST ASC Levels A, B, or C or EMCO Level A

VST NOZZLE					
Nozzle Component	Procedure	Fail Criteria	Corrective Action	Reference Manuals	Authorized Personnel
Nozzle lever, lever guard, lever lock	Inspect for defects, cuts, or damage to the: Nozzle Lever Lever Guard Lever Lock Spout Spout Vent Hole Face Seal Interlock Rod Vapor Collection Sleeve.	Damaged or missing	Replace with new VST nozzle	IOM-6	GDF Owner/Operator or VST ASC Levels A, B, or C
Nozzle Spout		Sheared or bent	Replace nozzle spout assembly with new VST spout or replace with new VST nozzle	IOM-6 IOM-7	VST ASC Levels A, B, or C
Nozzle Vent Hole		Vent hole blocked	Clear blockage	IOM-6	GDF Owner/Operator or VST ASC Levels A, B, or C
Nozzle Collection Sleeve		If greater than 18 inches total length of cuts (if greater than .375 sq. inches of material missing)	Replace vapor collection kit	IOM-7	VST ASC Levels A, B, or C
			Replace nozzle with new VST nozzle	IOM-6	GDF Owner/Operator or VST ASC Levels A, B, or C
Nozzle Face Seal		Greater than 30% of the material is missing (if greater than 2.5 inches of the accumulated faceplate circumference is missing)	Replace vapor collection kit	IOM-7	VST ASC Levels A, B, or C
			Replace nozzle with new VST nozzle	IOM-6	GDF Owner/Operator or VST ASC Levels A, B, or C
Nozzle Front-End Kit (Collection sleeve and face seal)		Alignment lines are misaligned and/or the assembly is cockeyed	Replace vapor collection kit	IOM-7	VST ASC Levels A, B, or C
			Replace nozzle with new VST nozzle	IOM-6	GDF Owner/Operator or VST ASC Levels A, B, or C
Nozzle Interlock Rod		Daily Nozzle Inspection	Interlock rod sticks during engagement or disengagement	Replace vapor collection kit	IOM-7
	Replace nozzle with new VST nozzle			IOM-6	GDF Owner/Operator or VST ASC Levels A, B, or C

EMCO NOZZLE					
Nozzle Component	Procedure	Fail Criteria	Corrective Action	Reference Manuals	Authorized Personnel
Lever, Hold Open Latch, Lever Guard	Inspect for defects, cuts or damage to the: Lever Hold Open Latch Lever Guard Spout	Damaged or missing	Replace with new EMCO latch kit or nozzle	IOM – 6	Latch Kit Repair: EMCO Certified Technician Level A Nozzle Replacement: Station Operator or EMCO Certified Technician Level A
Spout		Sheared or bent	Replace with new EMCO Spout Kit or nozzle	IOM – 6 IOM - 7	Spout Kit Repair: EMCO Certified Technician Level A Nozzle Replacement: Station Operator or EMCO Certified Technician Level A
Spout Vent Hole	Inspect for defects, cuts or damage to the: Spout Vent Hole Boot Face Bellows	Vent hole blocked	Clear blockage	IOM – 6	Blockage Repair: Station Operator or EMCO Certified Technician Level A
Boot Face		> than 0.38 sq. inches of boot face material is missing (e.g. A triangular or similar shape in which greater than 7/16 inches of the boot face circumference is missing [accumulated])	Replace with new EMCO boot face kit or nozzle	IOM – 6 IOM - 7	Boot Face Kit Repair: EMCO Certified Technician Level A Nozzle Replacement: Station Operator or EMCO Certified Technician Level A
Bellows		A cut across 7 consecutive bellows convolutions	Replace with new EMCO bellows kit or nozzle	IOM – 6 IOM - 7	Bellows Kit Repair: EMCO Certified Technician Level A Nozzle Replacement: Station Operator or EMCO Certified Technician Level A

EMCO NOZZLE					
Insertion Interlock Rod	Inspect for defects, cuts or damage to the: Insertion Interlock Rod Band Clamps Serial Plate Security Rivet	Insertion interlock rod sticks during engagement or disengagement	Replace with new EMCO Spout Kit or nozzle	IOM – 6 IOM - 7	Spout Kit Repair: EMCO Certified Technician Level A Nozzle Replacement: Station Operator or EMCO Certified Technician Level A
Band Clamps		Damaged or missing	Replace with new EMCO band clamp kit or nozzle	IOM – 6 IOM - 7	Band Clamp Kit Repair: EMCO Certified Technician Level A Nozzle Replacement: Station Operator or EMCO Certified Technician Level A
Serial Plate, Security Rivet		Damaged or missing	Replace with new EMCO nozzle	IOM – 6	Nozzle Replacement: Station Operator or EMCO Certified Technician Level A

Weekly Inspection and Testing Checklist

Checklist results may be used to assist with filling out GDF maintenance log.

Date:

Page: _____ of _____

Dispenser Number	Unihose or Fuel Grade (circle one)	Nozzle Inspection (circle one)	Hose Inspection (circle one)	Breakaway (circle one)
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail
	Unihose 87 89 91 other _____	Pass Fail	Pass Fail	Pass Fail

Quarterly Inspections: Clean Air Separator Only

Inspect Clean Air Separator for proper operating configuration. See Executive Order VR-204-K, Exhibit 2, Figure 2B-16 or 2B-16H for guidance. Figure 2B-16 applies to vertical CAS installations. Figure 2B-16H applies to horizontal CAS installations.

Annual Inspections

Annual VST ECS Membrane Processor Inspections and Replacements					
Component	Procedure	Fail Criteria	Corrective Action	Reference Manuals	Authorized Personnel
Blower	Replace the blower every ten years or 15,000 hrs. (whichever comes first).			IOM - 11	VST ASC Level C
Vacuum pump	Replace pump every ten years or 15,000 hrs. (whichever comes first).				
Vacuum pump drive coupling - rubber insert	Visually inspect the drive coupling between the vacuum pump and the motor for wear	Rubber debris is found on or around the vacuum-pump base.	Replace the drive coupling rubber insert	IOM - 11	
Heat Trace Cable	Check the continuity of the heat trace cable.	If the heat trace cable circuit is open, the cable has failed.	Replace the heat- trace cable	IOM - 11	
HC Sensor	Test the HC sensor	The difference shall be within $\pm 1.0\%$ HC concentration from the calibration gas concentration for zero and mid-range gas and $\pm 2.0\%$ for the high-range gas.	Replace the HC Sensor	IOM - 11 and Exhibit 8	

Preventative Maintenance Checklist Form

Component	Frequency	Date Inspected	Completed	Required Action Items
VST ECS PROCESSOR	Yearly			
<ul style="list-style-type: none"> Inspect drive coupling on the vacuum pump. 			[]	
<ul style="list-style-type: none"> Check the continuity of the heat trace cable. 			[]	
RECIRCULATION BLOWER				
Replace every 10 years or 15,000 hours, whichever comes first.			[]	
VACUUM PUMP				
Replace every 10 years or 15,000 hours, whichever comes first.			[]	

ISD Alarm Troubleshooting Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting ¹
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	<ul style="list-style-type: none"> • Troubleshooting Guide found at http://www.vsthose.com/carbs_components.aspx • Exhibit 4 • Exhibit 14 (if FFS Healy CAS is installed) • TP201.3 (or equivalent test)
ISD VAPOR LEAKAGE FAIL ²	Containment	Red	8 th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95 th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	<ul style="list-style-type: none"> • Troubleshooting Guide found at http://www.vsthose.com/carbs_components.aspx • Exhibit 10 • Exhibit 9 • If installed, are ball valves for the clean air separator in the correct position?
ISD GROSS PRESSURE FAIL ²	Containment	Red	8 th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75 th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL ²	Containment	Red	31 st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	<ul style="list-style-type: none"> • Troubleshooting Guide found at http://www.vsthose.com/carbs_components.aspx • Exhibit 5 • Exhibit 6 • Exhibit 17
FLOW COLLECT FAIL ²	Collection	Red	2 nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
ISD VP STATUS WARN ^{4,5,6}	Processor	Yellow	Failure of Vapor Processor Effluent Emissions or Duty Cycle test.	<ul style="list-style-type: none"> • Troubleshooting Guide found at http://www.vsthose.com/carbs_components.aspx • VP Emission Test • VP Duty Cycle Test
ISD VP STATUS FAIL ^{2,4,5,6}	Processor	Red	2 nd Consecutive Failure of Vapor Processor Status test.	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting ¹
VP EMISSION WARN ^{3,4,5,6}	Processor	Yellow	Mass emission exceeded the certified threshold.	<ul style="list-style-type: none"> • Troubleshooting Guide found at http://www.vsthose.com/carbs_components.aspx. • Exhibit 8 • Exhibit 9 • Exhibit 11
VP EMISSION FAIL ^{3,4,5,6,7}	Processor	Red	2 nd Consecutive Mass emission test failure.	
VP DUTY CYCLE WARN ^{3,4}	Processor	Yellow	Duty cycle exceeds 18 hours per day or 75% of 24 hours.	<ul style="list-style-type: none"> • Troubleshooting Guide found at http://www.vsthose.com/carbs_components.aspx. • PMC Setup Procedure • Exhibit 10 • Exhibit 9 • Exhibit 4
VP DUTY CYCLE FAIL ^{4,7}	Processor	Red	2 nd Consecutive Duty Cycle Test Failure.	
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	<ul style="list-style-type: none"> • Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8 th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	<ul style="list-style-type: none"> • Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL ²	Self-Test	Red	8 th Consecutive Failure of Setup Test	
<p>¹See ISD Troubleshooting Manual P/N 577013-819 and the VST ISD Troubleshooting Guide 9513-003 found at www.vsthose.com for a complete list of suggestions.</p> <p>²ISD Shut Down Alarms – see “Site Re-Enable” on page 12-39</p> <p>³This warning will result in an ISD VP Status Warn</p> <p>⁴VST ECS Membrane Processor.</p> <p>⁵Veeder-Root Polisher</p> <p>⁶This failure will result in an ISD VP Status Fail.</p>				

Wireless Related Sensor Alarm (if wireless Veeder-Root Vapor Polisher or flow meter is installed)

Displayed Message	Device	Light Indicator	Description	Suggested Troubleshooting
Battery Warning	Vapor Valve, Vapor Flow Meter	Yellow	Device transmitter reports battery status as "Replace" for 24 hours.	Remove and replace battery.

Drive-Offs and Other Customer Abuse

If the hanging hardware components are involved in a drive-off or if they incur some customer abuse, and they are not replaced as new, each individual component of the hanging hardware **must be visually inspected and functionally tested** before the components can return to dispensing fuel.

- ▶ A visual assessment and functional tests are outlined in the following pages.

ANY COMPONENT THAT DOES NOT PASS A VISUAL INSPECTION OR FUNCTIONAL TEST MUST BE REPLACED.

IF THE BREAKAWAY IS INVOLVED IN A DRIVEOFF, IT MUST BE REPLACED.

THE BREAKAWAY IS NON-RECONNECTABLE.



Before beginning work, barricade the work area to block customer use.

1 Drive Offs & Other Customer Abuse: Perform a Visual Assessment

Visually inspect the hanging hardware system as follows to determine the extent of the damage:

Action	Test Procedure	Corrective Action	Reference Material	Authorized Personnel
Perform a thorough visual examination of the exterior of the whip hose and the curb hose for any obvious imperfections.	Obvious imperfections include, but are not limited to: Damage to the swivels Damage to the couplings Kinks / flat spots Tears to the outer hose	Replace with new hose(s).	IOM-8	Hose replacement: GDF Owner/Operator or VST ASC Levels A, B, or C or EMCO Level A for Goodyear Hose
	If there are no imperfections to the whip and curb hose, those hoses may be reused.	Reassemble hose(s).	IOM-8	GDF Owner/Operator or VST ASC Levels A, B, or C or EMCO Level A for Goodyear Hose
Perform a thorough visual inspection of the nozzle for any obvious imperfections.	Obvious imperfections include, but are not limited to: <u>VST Nozzle:</u> Damaged spout (broken, bent); Damage to the face seal, collection sleeve / interlock rod assembly; Broken face seal; Torn collection sleeve; Bent interlock rod; Nozzle alignment marks; Damage to the lever and lever guard.	Replace damaged components where applicable.	IOM-7	Nozzle repair: VST ASC Levels A, B, or C or EMCO Level A
	<u>EMCO Nozzle:</u> Damage spout, broken or bent; Damage to the insertion interlock rod; Torn boot face or bellows; Damage to the lever, hold open latch and lever guard; Missing band clamp, serial plate and security rivet.	Replace with new nozzle.	IOM-6	Nozzle replacement: GDF Owner/Operator or VST ASC Levels A, B, or C or EMCO Level A
If no imperfection or damage is visibly evident, proceed to functional testing.				

Function Testing Description

Perform the following functional tests prior to re-using a hose or a nozzle following a drive-off:

Test	Test Procedure	Corrective Action	Authorized Personnel
Leak Check	<p>Verify that there are no liquid leaks in all components.</p> <p>Dispense fuel and check each connection between the components.</p> <p>A visual inspection of the nozzle can determine any obvious liquid leaks.</p>	<p>Any component that does not pass the functional test must be replaced.</p> <p>Go to IOM 6, 8, and 9</p>	<p>GDF Owner/Operator or VST ASC Levels A, B, or C or EMCO Level A</p>
Meter Creep	<p>Checking for meter creep will verify the integrity of the connections.</p> <p>Dispense 1/10 to 2/10 of a gallon of fuel into an approved container then release lever and move components around and/or gently shake the hose and verify if the displace amount on the dispenser changes.</p>	<p>Any component that does not pass the functional test must be replaced.</p> <p>Go to IOMs 6, 8, and 9</p>	<p>GDF Owner/Operator or VST ASC Levels A, B, or C or EMCO Level A</p>
Automatic Shut-Off and Insertion Interlock	<p>The insertion interlock mechanism shall not allow dispensing when the bellows is uncompressed as determined by direct observation or GDF-09 (See Vapor Recovery Defects list).</p>	<p>Repair or replace the nozzle</p> <p>Go to IOM-6 or IOM-7</p>	<p>Nozzle replacement GDF Owner/Operator or VST ASC Levels A, B, or C or EMCO Level A</p> <p>Nozzle repair VST ASC Levels A, B, or C or EMCO Level A</p>
Resistance	IOM-6	<p>Any component that does not pass the functional test must be replaced.</p> <p>Go to IOM 6, 8, and 9</p>	<p>GDF Owner/Operator or VST ASC Levels A, B, or C or EMCO Level A</p>

VST Installation Procedure for Phase II Coaxial EVR Balance Dripless Nozzles

Part Number Series: VST-EVR-NBcc, VST-EVR-NBccR
 cc = Scuff Guard Color Code and R = rebuilt



Vapor Systems Technologies, Inc.

650 Pleasant Valley Drive
 Springboro, Ohio 45066 (USA)

Toll Free: 1-888-878-4673

Phone: 937-704-9333

Fax: 937-704-9443

www.vsthose.com

GENERAL INFORMATION

If hanging hardware components are involved in a drive-off or incur other customer abuse, each individual component must be functionally tested prior to customer dispensing activities.

INSTALLATION PREPARATION

This procedure must be followed to insure leak-proof installation and operation of these nozzles.

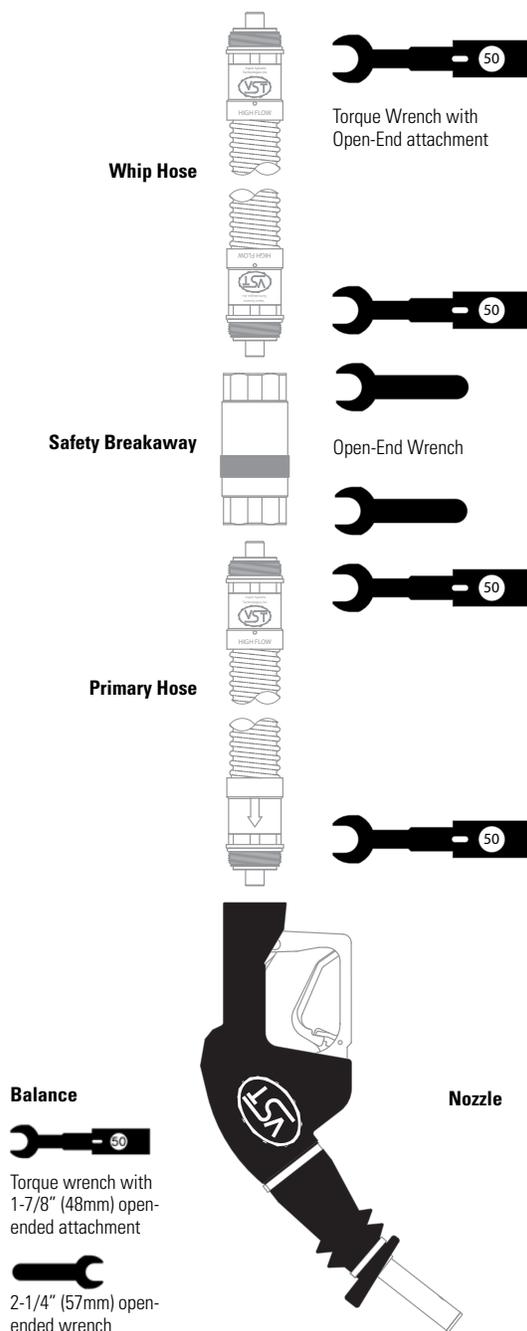
1. Turn off and tag the power to the dispenser. Dispenser must be de-energized prior to service to avoid personal injury.
2. Barricade work area to block vehicle access to the dispenser.
3. Close the dispenser shear valve prior to removing hanging hardware (hoses, safety breakaways, and nozzles).
4. Drain liquid product from the hanging hardware set into an approved container prior to replacing any hanging hardware components.
5. Remove hanging hardware from the dispenser prior to making replacement component assembly connections. VST recommends connecting the whip hose to the dispenser as the last connection during the hanging hardware assembly.

INSTALLATION AND FUNCTION TESTS

6. **STOP!** If this is a new facility installation, the fueling point must be flushed into an approved container before installing the nozzle. Using this nozzle to flush the system could result in foreign material becoming lodged in the nozzle's valve and cause it not to shut off.
7. Initial inspection and function tests:
 - a. Carefully unpack nozzle from shipping carton.
 - b. Inspect nozzle exterior for any damage.
 - c. Inspect threads, lever, lever lock, spout, collection sleeve, band clamps, and face seal to determine that they are present and undamaged.
 - d. Verify interlock rod alignment. Check interlock for engagement and release. Proper function of interlock rod requires the nozzle collection sleeve to be compressed ¼" to ½" and the lever to be engaged into the dispensing position. Nozzle will not function without interlock rod properly engaged.
 - e. Inspect spout vent hole. It should be clear of debris.

Figure 1.

EVR Hanging Hardware Assembly



VST Installation Procedure for Phase II Coaxial EVR Balance Dripless Nozzles

Part Number Series: VST-EVR-NBcc, VST-EVR-NBccR

cc = Scuff Guard Color Code and R = rebuilt

3. Lightly lubricate ALL O-Rings on mating connections with petroleum jelly or other suitable lubricant. DO NOT USE pipe dope or thread sealant.
4. Attach nozzle onto mating hose connection and tighten by hand.
5. Tighten the nozzle connection to 50 ft-lbs of torque. DO NOT OVER TIGHTEN. Use a torque wrench with an open-end attachment to fit the hose couplings and an open-end wrench to properly tighten coupling connections. DO NOT USE channel-locks or pliers to tighten hose joints. Proper ft./lb. torque may not be achieved with these tools.
6. Purge air from the system by pumping one-tenth (1/10) to two-tenths (2/10) of a gallon of fuel into an approved container. Inspect the nozzle connection for liquid leaks and make proper adjustments at hose connection if necessary.
7. Check the nozzle shut-off action by dispensing fuel into an approved container at least three times to assure the proper automatic operation of the interlock rod. According to U/L requirement 842, the fuel flow-rate must be greater than 3 gpm for the automatic shut-off mechanism to operate.

To test, operate the nozzle and submerge the spout tip in fuel until the fuel level covers the vent hole. The main valve of the nozzle automatically shuts off when the liquid covers the vent hole at the end of the spout. The nozzle is not designed to operate on gravity flow. The hold-open latch will disengage automatically when liquid covers the vent hole in the spout. Verify that the fuel flow stops when the nozzle collection sleeve is decompressed (e.g. interlock rod is disengaged). To test that the fuel flow stops, dispense some fuel into an approved container. Slowly remove the nozzle from the container while dispensing fuel. Fuel flow should stop when the nozzle collection sleeve is fully decompressed.

8. Measure the resistance between the dispenser outlet casting and the tip of the nozzle spout. Use an electronic multimeter set on the high range of the ohmmeter function. Resistance should not indicate more than 70,000 ohms per foot of hose. Example: The measured resistance for a 12-foot hose must not exceed 840,000 ohms (840 kilohms).

MAINTENANCE

Inspect nozzles daily for damaged component parts: vapor collection sleeve, face seal, interlock rod, spout, lever, lever lock, etc.

Damaged components must be replaced. Vent hole at the end of the spout should be clear of debris. The nozzle will not operate properly if vent hole becomes clogged. The nozzle will not function properly without the interlock rod properly engaged. Keep the hose connections tight.

Should there be a drive-off or incidence of customer abuse, follow the initial inspection instructions found in the INSTALLATION section. The nozzle should be replaced when damaged. The nozzle is designed and constructed to give lasting service if properly handled and maintained. If for any reason it should need attention, contact your VST distributor for proper disposition.

NOTE

Due to abuse, misuse, changing gasoline formulas, variation in maintenance practices, environmental conditions, and/or conditions beyond the manufacturer's control, dispensing equipment may need replacement before five (5) years. Inspections and proper maintenance procedures should be followed by the station manager to determine if replacement is required before five (5) years.

WARNING

Unauthorized rebuilding or modifying of nozzles voids ALL approvals and warranties.

VST products must be used in compliance with applicable federal, state, and local laws and regulations.

If local regulatory codes prohibit use of the nozzle's hold-open clip, it must be removed prior to nozzle installation. Remove the nozzle to a safe work area.

Place the nozzle on a flat surface.

Locate the alloy rivet securing the hold-open clip and spring in the nozzle's handle. Use a drill with a 3/16" (5mm) drill bit, drill out the rivet securing the hold-open clip, and discard the clip, spring, and all other rivet debris.



Vapor Systems Technologies, Inc.

650 Pleasant Valley Drive
Springboro, Ohio 45066 (USA)

Toll Free: 1-888-878-4673

Phone: 937-704-9333

Fax: 937-704-9443

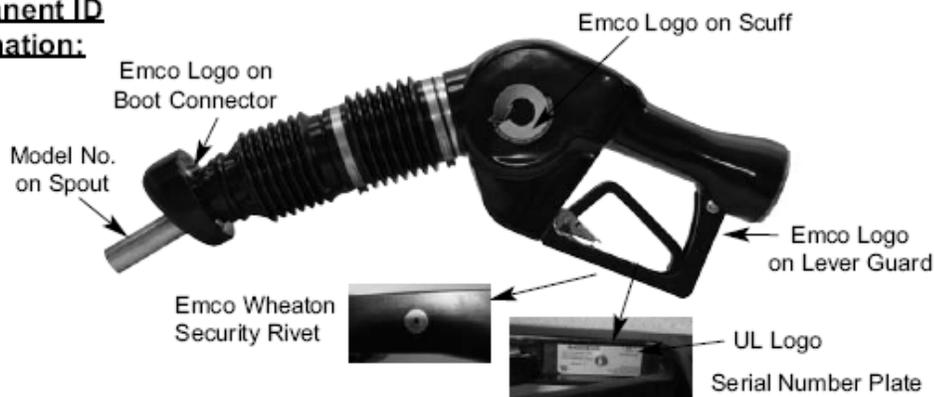
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EMCO[®]
WHEATON RETAIL

A4005EVR
Balance Vapor Recovery Nozzle
RA4005EVR = Rebuilt
XXX = Scuff Guard Color

For use with the Vapor
Systems Technologies VST
Coaxial Curb and Whip Hoses

**Permanent ID
Information:**



INSTALLATION INSTRUCTIONS

Service Tools Required:

- 1 7/8" Crows Foot
- Torque Wrench w/ 50 ft-lbs Setting
- Pipe Wrench w/ Flat Jaws
- Gasoline Approved Container
- Petroleum Jelly or Other Suitable Lubricant

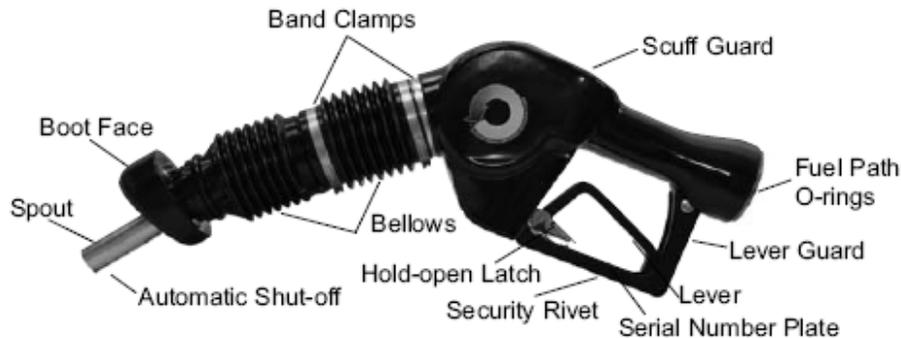
CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

1

Pre-Inspection:



1. Carefully unpack and remove the A4005EVR nozzle from the shipping container. Evaluate the following components for damage: scuff guard, lever guard, lever, hold open latch, serial number plate, security rivet, bellows, band clamps, boot face and spout.
2. Verify the automatic shutoff located at the end of the spout. The vent hole must be free and clear of all debris.
3. Verify the fuel path o-rings located at the hose end of the A4005EVR nozzle. Both o-rings must be properly secured inside the factory machined grooves.

Pre-Functional Test:



4. Functional test the insertion interlock of the A4005EVR nozzle by compressing the bellows and then squeezing the lever. The A4005EVR nozzle will not function unless the insertion interlock is properly engaged.

Pre-Installation:



5. Lightly lubricate both fuel path o-rings using petroleum jelly or other suitable lubricant.



6. Before attempting to install the A4005EVR nozzle onto the curb hose, verify the vapor path o-ring is properly secured onto the connector, and in good working condition. Lightly lubricate the o-ring using petroleum jelly or other suitable lubricant.

IMPORTANT: Do not use pipe thread sealant compound or Teflon tape when installing the A4005EVR nozzle. Failure to comply will void warranty.

Installation:

IMPORTANT: If this is a new facility installation, the fueling point must be flushed into a gasoline approved container before installing the A4005EVR nozzle. Failure to perform this procedure could result in foreign material becoming lodged inside the nozzle's fuel path causing it not to shut off or a reduction in fuel flow.



7. Attach the A4005EVR nozzle onto the curb hose connector. Tighten by hand to avoid cross threading. Take caution to avoid pinching the vapor path o-ring.



8. Using a 1 7/8" crows foot and torque wrench tighten the curb hose connector to 50 ft-lbs of torque.

Post Functional Tests:

9. Carefully purge the trapped air from the fueling point. Begin dispensing by compressing the bellows and then squeezing the lever. Dispense one gallon of fuel into a gasoline approved container.
10. Functional test the automatic shutoff of the A4005EVR nozzle. Begin dispensing by compressing the bellows and then squeezing the lever. Place the hold-open latch in "high" clip position to secure the lever. Dispense one gallon of fuel into a gasoline approved container. At the same time, lower the spout tip into the standing fuel until the vent hole is completely submersed. The main valve of the A4005EVR nozzle will automatically close causing fuel flow to stop.

IMPORTANT: Perform step 10 a minimum of three times to assure the insertion interlock, hold open latch and the automatic shutoff of the A4005EVR nozzle are operating properly.

According to UL requirement 842, the fuel flow rate must be greater than 3 gallons per minute for the automatic shutoff to operate properly. A common cause of low flow rates are dirty or clogged dispenser filters.

Post Inspection:

11. Before placing the A4005EVR nozzle onto the dispenser cradle, inspect all hanging hardware connections for potential fuel leaks. Make proper adjustments if necessary.

PREVENTIVE MAINTENANCE

1. Weekly inspect the A4005EVR nozzle, evaluate the following components for damage: scuff guard, lever guard, lever, hold open latch, serial number plate, security rivet, bellows, band clamps, boot face and spout. Damage components must be replaced with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
492775EVR	Bellows & Boot Face Kit
492776EVR	Boot Face Kit
492834EVR	Spout Kit
494150EVR	Latch Kit
494748EVR	Fuel Path O-ring Kit
494750EVR	Bellows Band Clamps Kit
A0557EVR-XXX	Scuff Guard Kit

IMPORTANT: Do not remove the serial number plate and security rivet from the A4005EVR nozzle. Failure to comply will void warranty.

2. Weekly inspect the automatic shutoff located at the end of the spout. The vent hole must be free and clear of all debris.
3. Weekly inspect all hanging hardware connections for potential fuel leaks.

IMPORTANT: Should a drive-off or incidence of customer abuse occur, follow the initial inspection and function instructions found in the installation section.

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.
2. Meets ARB Capable of Refueling Any Vehicle Standards as per Section 4.7.1 of CP-201.
3. Meets ARB Spout Dimension Standards as per Section 4.7.3 of CP-201.
4. Meets ARB Nozzle and Dispenser Compatibility Standards as per Section 4.9 of CP-201.
5. Meets ARB Balance Nozzle Criteria Standards as per Section 5.1 of CP-201.
6. TP-201.2B – Complies with the maximum allowable leak rate of 0.07 CFH @ 2.00 inches of water column pressure.
7. TP-201.2C – Complies with the maximum allowable spillage factor of 0.24 pounds/ 1,000 gallons.
8. TP-201.2D – Complies with the maximum allowable average of 3 post fuel drips.
9. TP-201.2E – Complies with the maximum allowable average of 100mL liquid retention and 1mL liquid spit-back.
10. TP-201.2J – Complies with the maximum allowable component pressure drop of 0.08 inches of water column @ 60 CFH.

IMPORTANT: Leave these installation instructions with the station owner and/or operator.

WARRANTY POLICY

Emco Wheaton Retail Corporation service station products are warranted to be free from defects in material and workmanship under normal use and service. Vapor recovery nozzles are warranted for a period of twelve (12) months from date of shipment from Emco Wheaton Retail Corporation or from installation date as specified by the returned warranty card, not to exceed fourteen (14) months from the date of shipment from Emco Wheaton Retail Corporation. This warranty excludes the spout and/or front end components of balance vapor recovery nozzles unless damage is obvious when the nozzle is removed from the shipping carton and the defective nozzle is returned to Emco Wheaton Retail Corporation prior to use and within two (2) months from the date of invoice. Other service station products are warranted for a period of twelve (12) months from the date of manufacture.

Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser and any subsequent purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

EMCO WHEATON RETAIL CORPORATION MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, (WHETHER WRITTEN OR ORAL), INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

In the event of failure within the warranty period, call the Customer Service Department at (800) 234-4394. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment PREPAID, to Emco Wheaton Retail Corporation for repair or replacement.

Emco Wheaton Retail Corporation products should be used in compliance with applicable federal, state and local laws and regulations. Product selection should be based on physical specifications and limitations and compatibility with the environment and material to be handled. All illustrations and specifications are based on the latest product information available at the time of publication. Emco Wheaton Retail Corporation reserves the right to make changes at any time in prices, materials, specifications and models and to discontinue models without notice or obligation.

Emco Wheaton Retail Corporation warrants the workmanship and materials to be free of defects and will comply with the performance standards of California ARB CP-201 for a period of one (1) year from the date of installation or fourteen months from the date of shipment from Emco Wheaton Retail Corporation.

Emco Wheaton Retail Corp.

2300 Industrial Park Dr. • Wilson, NC 27893
252-243-0150 • 252-243-4759 (fax)
619-421-1743 (Technical Services, California)

p/n 570435
Rev. A, 05/10

VST Installation Procedure for Phase II Coaxial EVR Balance Nozzle Repair Kits

Part Number Series:

VST-FEK-100 (Front End Kit includes VCK & Nozzle Spout Assembly)

VST-VCK-100 (Vapor Collection Kit: Boot Assembly Only)



Vapor Systems Technologies, Inc.

650 Pleasant Valley Drive
Springboro, Ohio 45066 (USA)

Toll Free: 1-888-878-4673

Phone: 937-704-9333

Fax: 937-704-9443

www.vsthose.com

TOOLS

Adjustable Wrench	Nozzle Band Clamp Pincers
Approved Fuel Container	Torque Wrench
Wide Mouth Funnel	Vaseline (or suitable lubricant)

GENERAL INFORMATION

If hanging hardware components are involved in a drive-off or incur other customer abuse, each individual component must be functionally tested prior to customer dispensing activities.

INSTALLATION PREPARATION

This procedure must be followed to insure leak-proof installation and operation of these nozzles.

1. Turn off and tag the power to the dispenser. Dispenser must be de-energized prior to service to avoid personal injury.
2. Barricade work area to block vehicle access to the dispenser.
3. Close the dispenser shear valve prior to removing hanging hardware (hoses, safety breakaways, and nozzles).
4. Visually inspect and assess the extent of the damage to all hanging hardware components. If there are no imperfections/damages, proceed to FUNCTIONAL TEST.
5. Drain liquid product from the hanging hardware set into an approved container prior to replacing any hanging hardware components.
6. Remove hanging hardware from the dispenser prior to making replacement component assembly connections. VST recommends connecting the whip hose to the dispenser as the last connection during the hanging hardware assembly.
7. To drain nozzle, engage nozzle interlock:
 - a. Push in face seal on nozzle boot assembly
 - b. Hold the backend of the nozzle over an approved container
 - c. Pull nozzle lever to fully drain the nozzle

VAPOR COLLECTION KIT (VST-VCK-100) REMOVAL

(See Figure 1)

1. Remove large band clamp from the Vapor Collection assembly with nozzle band clamp pincers. (VST-BPT-100)
2. Pull the Vapor Collection assembly (boot) off of the clamping groove of nozzle body.
3. Pull Vapor Collection assembly off of the spout by slightly twisting to go over the spout latch ring.
4. Properly discard the removed components.

VAPOR COLLECTION KIT (VCK) REPLACEMENT

1. Place the large band clamp on the collection sleeve. (See Figure 1)
2. Check proper orientation of the interlock rod. (See Figure 2)
3. Slide VCK over the spout.
4. Align and insert the interlock rod into the interlock port. (See Figure 2)
5. Align and center all alignment marks on top of the vapor collection kit and nozzle scuff. (See Figure 1)

6. Engage interlock a few times to check for correct alignment and functionality. (See Function Test 3)
7. Tighten collection band clamp until collection sleeve will not rotate. (See Figure 1)

NOZZLE SPOUT ASSEMBLY REMOVAL

1. Remove Vapor Collection Assembly.
2. Loosen spout nut with smooth-jaw wrench. (See Figure 3)
NOTE Do not use pipe wrench or locking-type pliers.
3. Once threads are completely disengaged, pull the spout straight out.

NOZZLE SPOUT ASSEMBLY (NSA) REPLACEMENT (See Figure 3)

1. Fuel chamber should remain in the nozzle casting with the vacuum sensing tube hole oriented at the top.
2. If the fuel chamber is pulled out of the nozzle casting:
 - a. Check O-ring for damage.
 - b. Replace O-ring if damaged (check for cuts, nicks, etc.).
 - c. Lubricate O-ring prior to re-assembly.
3. Insert fuel chamber into nozzle casting:
 - a. Poppet stem with spring goes through poppet hole in the fuel chamber (center hole).
 - b. Push fuel chamber until it is flush with casting.
 - c. Vacuum sensing tube in the fuel chamber should be oriented at the top.

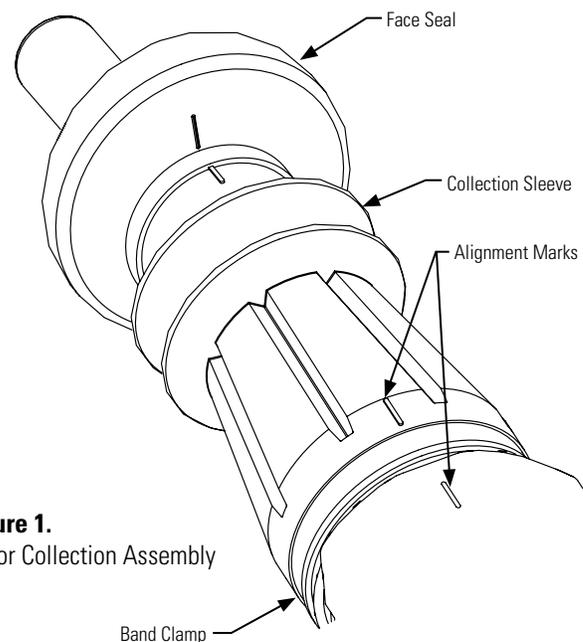


Figure 1.
Vapor Collection Assembly

VST Installation Procedure for Phase II Coaxial EVR Balance Nozzle Repair Kits

Part Number Series:
 VST-FEK-100 (Front End Kit includes VCK & Nozzle Spout Assembly)
 VST-VCK-100 (Vapor Collection Kit: Boot Assembly Only)

- Lightly lubricate **ALL** O-rings on the spout assembly.
NOTE Do not block vacuum sensing-tube hole with lubricant.
- Align vacuum sensing tube with mating hole in the fuel chamber.
- Align the anti-rotation bump on the spout with the casting notch. Be careful not to damage the spout O-rings.
- Firmly insert spout assembly into the nozzle casting.
- Apply a dab of Loctite® 565 (or equivalent thread sealant) to the male thread of the nozzle casting. Be careful not to apply the Loctite® so that it would enter into the casting notch. (See Figure 3)
- Thread spout nut onto the nozzle casting and tighten firmly. Torque to 30 foot-pounds. Spout should be tight and not able to rotate. Do not over-tighten the spout nut.
- After tightening the spout nut, place the Vapor Collection Kit onto the spout. Examine the location of the interlock rod to make sure it does not interfere or ride against the spout nut. If there is interference, tighten the spout nut a few degrees to allow the interlock rod to move freely.
- Re-install the Vapor Collection Kit assembly per the Vapor Collection Kit Replacement instructions.

FUNCTION TESTS

- Follow the VST Installation Procedure for each hanging hardware component. (Procedures: Section 10, 12, and 13)
- Purge air from the system by pumping one-tenth (1/10) to two-tenths (2/10) of a gallon of fuel into an approved container. Inspect the nozzle connection for liquid leaks and make proper adjustments at the hose connection if necessary.
- Check the nozzle shut-off action by dispensing fuel into an approved container at least three times to assure the proper automatic operation of the interlock rod. According to U/L requirement 842, the fuel flow-rate must be greater than 3 gpm for the automatic shut-off mechanism to operate.

To test, operate the nozzle and submerge the spout tip in fuel until the fuel level covers the vent hole. The main valve of the nozzle automatically shuts off when the liquid covers the vent hole at the end of the spout. The nozzle is not designed to operate on gravity flow. The hold-open latch will disengage automatically when liquid covers the vent hole in the spout. Verify that the fuel flow stops when the nozzle collection sleeve is decompressed. To test that the fuel flow stops, dispense some fuel into an approved container. Slowly remove the nozzle from the container while dispensing fuel. Fuel flow should stop when the nozzle collection sleeve is fully decompressed.

- Measure the resistance between the dispenser outlet casting and the tip of the nozzle spout. Use an electronic multimeter set on the high range of the ohmmeter function. Resistance should not indicate more than 70,000 ohms per foot of the hose. Example: The measured resistance of a 12-foot hose must not exceed 840,000 ohms (840 kilohms).

MAINTENANCE Inspect nozzles daily for damaged components parts: vapor collection sleeve, face seal, interlock rod, spout, lever, lever lock, etc. Damaged components must be replaced. Vent hole at the end of the spout should be clear of debris. The nozzle will not operate properly if vent hole

becomes clogged. The nozzle will not function properly without the interlock rod properly engaged. Keep the hose connections tight.

Should there be a drive-off or incidence of customer abuse, follow the initial inspection instructions found in the VST Installation Procedure Section 10. The nozzle should be replaced when damaged. The nozzle is designed and constructed to give lasting service if properly handled and maintained. If for any reason it should need attention, contact your VST distributor for proper disposition.

NOTE Due to abuse, misuse, changing gasoline formulas, variation in maintenance practices, environmental conditions, and/or conditions beyond the manufacturer's control, dispensing equipment may need replacement before five (5) years. Inspections and proper maintenance procedures should be followed by the station manager to determine if replacement is required before five (5) years.

WARNING Unauthorized rebuilding or modifying of nozzles voids ALL approvals and warranties. VST products must be used in compliance with applicable federal, state, and local laws and regulations. If local regulatory codes prohibit use of the nozzle's hold-open clip, it must be removed prior to nozzle installation. Remove the nozzle to a safe work area. Place the nozzle on a flat surface. Locate the alloy rivet securing the hold-open clip and spring in the nozzle's handle. Use a drill with a 3/16" (5mm) drill bit, drill out the rivet securing the hold-open clip, and discard the clip, spring, and all other rivet debris.

Figure 2.
Interlock Assembly

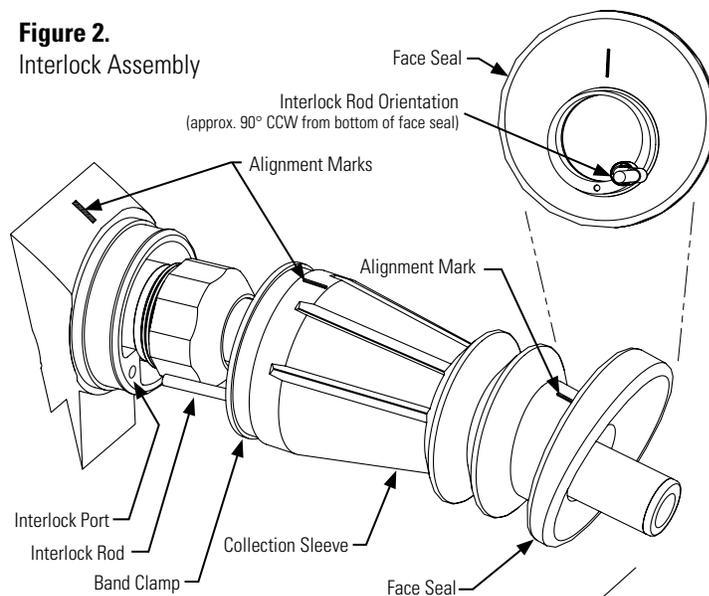
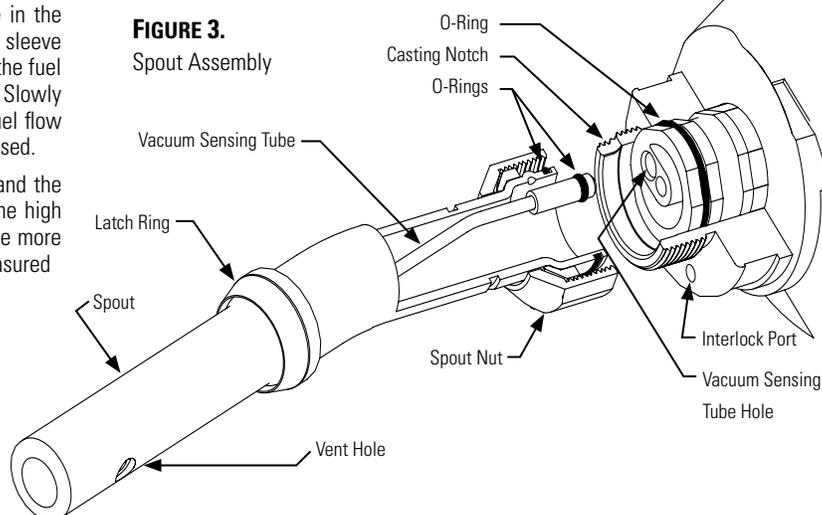


FIGURE 3.
Spout Assembly

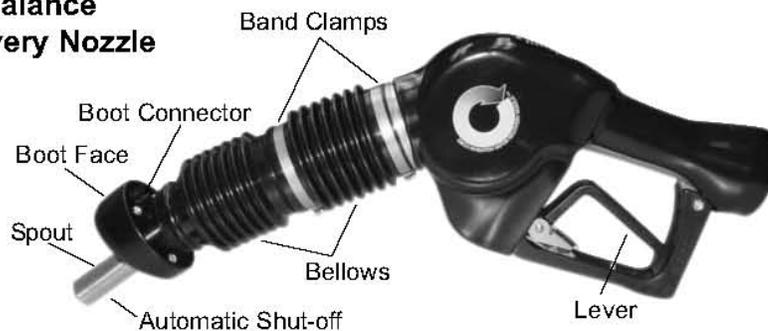


Packing List:

- (1) Bellows & Boot Face
- (1) Bellows O-ring
- (2) Bellows Band Clamps



**A4005EVR Balance
Vapor Recovery Nozzle**



INSTALLATION INSTRUCTIONS

Service Tools Required:

- Flat Head Screw Driver w/ Fine Tip
- Bench Vise w/ 5" Jaw Width
- Bellows Retainer Plate Tool p/n 494712EVR
- Bellows Band Clamp Crimp Tool p/n 494652EVR
- Scribe Tool w/ 90 degree tip
- Gasoline Approved Container

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

1. Carefully unpack and remove all kitted parts from the shipping container and evaluate for any kind of damage. Verify that no parts are missing from the packing list before proceeding with the installation.

Pre-Installation:

2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the bellows and boot face.



3. It is unnecessary to remove the A4005EVR nozzle from the fueling point during the removal and installation of the bellows and boot face. Use the bench vise to properly secure the A4005EVR nozzle during service.

Installation:

Removing the Existing Bellows & Boot Face



4. Locate the top bellows band clamp. Use the flat head screw driver to dislodge the locking mechanism and remove the band clamp from the bellows.



5. Locate the bottom bellows band clamp. Use the flat head screw driver to dislodge the locking mechanism and remove the band clamp from the bellows.



6. Remove the bellows and boot face from the A4005EVR nozzle. Grab the bellows and pull away from the nozzle body.



7. Use the scribe tool to remove the bellows o-ring.

IMPORTANT: Properly discard all removed components.

Installing the New Bellows & Boot Face



8. Before attempting to install the new bellows and boot face verify that the top of the interlock push rod is properly aligned with the bottom edge of the interlock guide.



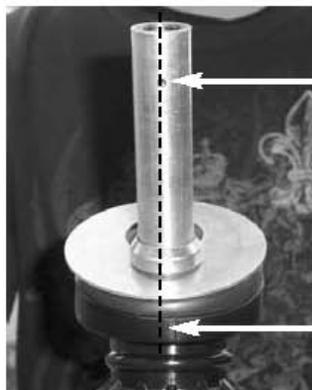
9. Install the new bellows o-ring. Verify that the o-ring seats properly into the machined groove.



10. Slide the new bellows over the spout until the end reaches the nozzle body. Push down over the bellows o-ring until properly seated.

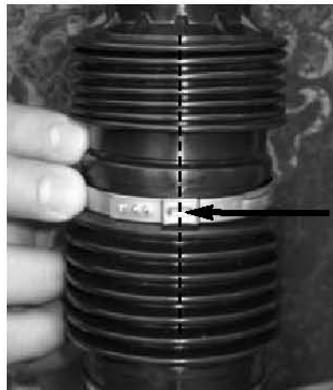


11. Use the bellows retainer plate tool p/n 494712EVR to secure and lock the bellows and boot face in place.



12. Slowly rotate the bellows until the parting line of the boot connector is aligned with the spout and automatic shut-off.

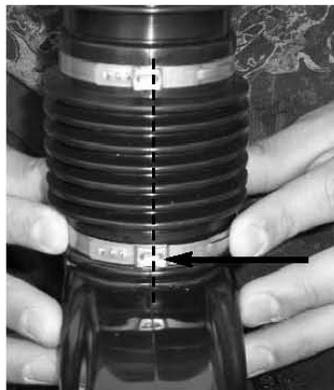
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13. Install the new top bellows band clamp into the groove of the bellows. Lock and align the crimp portion with the parting line of the bellows.



14. Use the bellows band clamp crimp tool p/n 494652EVR to crimp and secure into place.



15. Install the new bottom bellows band clamp into the groove of the bellows. Lock and align the crimp portion with the parting line of the bellows.

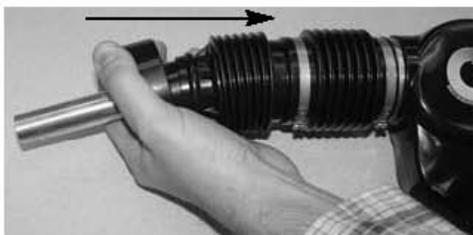


16. Use the bellows band clamp crimp tool p/n 494652EVR to crimp and secure into place.



17. Remove the bellows retainer plate tool p/n 494712EVR from bellows and spout.
18. Remove the A4005EVR nozzle from the bench vise.

Post-Functional Test:



19. Functional test the insertion interlock of the A4005EVR nozzle by compressing the bellows and then squeezing the lever. The A4005EVR nozzle will not function unless the insertion interlock is properly engaged.

Post-Installation:

20. Place the A4005EVR nozzle back onto the dispenser cradle.

PREVENTIVE MAINTENANCE

1. Weekly inspect the bellows & boot face for tears, cuts and slits.
Replace with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
492775EVR	Bellows & Boot Face Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.
2. Meets ARB Capable of Refueling Any Vehicle Standards as per Section 4.7.1 of CP-201.

IMPORTANT: Leave these installation instructions with the station owner and/ or operator.

WARRANTY POLICY

Emco Wheaton Retail Corporation service station products are warranted to be free from defects in material and workmanship under normal use and service. Vapor recovery nozzles are warranted for a period of twelve (12) months from date of shipment from Emco Wheaton Retail Corporation or from installation date as specified by the returned warranty card, not to exceed fifteen (15) months from the date of shipment from Emco Wheaton Retail Corporation. This warranty excludes the spout and/or front end components of balance vapor recovery nozzles unless damage is obvious when the nozzle is removed from the shipping carton and the defective nozzle is returned to Emco Wheaton Retail Corporation prior to use and within two (2) months from the date of invoice. Other service station products are warranted for a period of twelve (12) months from the date of manufacture.

Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

EMCO WHEATON RETAIL CORPORATION MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, (WHETHER WRITTEN OR ORAL), INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

In the event of failure within the warranty period, call the Customer Service Department at **(800) 234-4394**. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment **PREPAID**, to Emco Wheaton Retail Corporation for repair or replacement.

Emco Wheaton Retail Corporation products should be used in compliance with applicable federal, state and local laws and regulations. Product selection should be based on physical specifications and limitations and compatibility with the environment and material to be handled. All illustrations and specifications are based on the latest product information available at the time of publication. Emco Wheaton Retail Corporation reserves the right to make changes at any time in prices, materials, specifications and models and to discontinue models without notice or obligation.

Emco Wheaton Retail Corporation warrants the workmanship and materials to be free of defects and will comply with the performance standards of California ARB CP-201 for a period of one (1) year from the date of installation or fourteen months from the date of shipment from Emco Wheaton Retail Corporation.

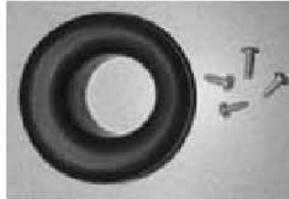
Emco Wheaton Retail Corp.

2300 Industrial Park Dr. • Wilson, NC 27893
252-243-0150 • 252-243-4759 (fax)
619-421-1743 (Technical Services, California)

p/n 569046
Rev. A, 06/09

Packing List:

- (1) Boot Face
- (4) Mounting Screws



A4005EVR
Balance Vapor Recovery Nozzle



INSTALLATION INSTRUCTIONS

Service Tools Required:

- Phillips Head Screw Driver w/ Fine Tip
- Bench Vise w/ 5" Jaw Width
- Gasoline Approved Container

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

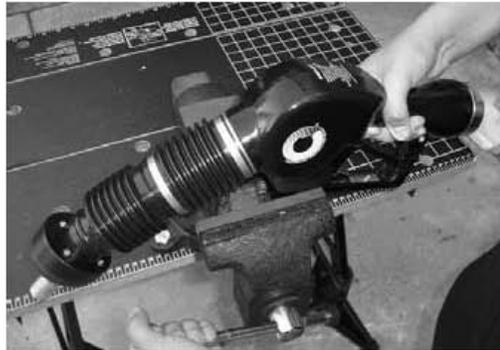
IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

1. Carefully unpack and remove all kitted parts from the shipping container and evaluate for any kind of damage. Verify that no parts are missing from the packing list before proceeding with the installation.

Pre-Installation:

2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the boot face.



3. It is unnecessary to remove the A4005EVR nozzle from the fueling point during the removal and installation of the boot face. Use the bench vise to properly secure the A4005EVR nozzle during service.

Installation:

Removing the Existing Boot Face



4. Use the philips screw driver to remove the four mounting screws located on the back of the boot connector.



5. Remove the existing boot face by pulling out of the boot connector.

2 **IMPORTANT: Properly discard all removed components.**

Installing the New Boot Face



6. Install the new boot face into the boot connector by pressing evenly. Align the four mounting holes of the boot face with those of the boot connector.



7. Use the philips screw driver to install and tighten the four new mounting screws.
8. Remove the A4005EVR nozzle from the bench vise.

Post-Installation:

9. Place the A4005EVR nozzle back onto the dispenser cradle.

PREVENTIVE MAINTENANCE

1. Weekly inspect the boot face for tears, cuts and slits. Replace with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
492776EVR	Boot Face Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.
2. Meets ARB Capable of Refueling Any Vehicle Standards as per Section 4.7.1 of CP-201.

IMPORTANT: Leave these installation instructions with the station owner and/ or operator.

WARRANTY POLICY

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Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

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In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

In the event of failure within the warranty period, call the Customer Service Department at **(800) 234-4394**. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment **PREPAID**, to Emco Wheaton Retail Corporation for repair or replacement.

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Emco Wheaton Retail Corporation warrants the workmanship and materials to be free of defects and will comply with the performance standards of California ARB CP-201 for a period of one (1) year from the date of installation or fourteen months from the date of shipment from Emco Wheaton Retail Corporation.

Emco Wheaton Retail Corp.

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619-421-1743 (Technical Services, California)

p/n 570184

Rev. A, 06/09

Packing List:

- | | |
|-------------------------|------------------------|
| (1) Spout | (1) Interlock Guide |
| (1) Bellows O-ring | (1) Interlock Push Rod |
| (2) Bellows Band Clamps | |



**A4005EVR Balance
Vapor Recovery Nozzle**



INSTALLATION INSTRUCTIONS

Service Tools Required:

- | | |
|---|--------------------------------|
| • Flat Head Screw Driver w/ Fine Tip | • Scribe Tool w/ 90 Degree Tip |
| • 15" Crescent Wrench | • Needle Nose Pliers |
| • Torque Wrench w/ 45-55 ft-lbs. Setting | • 40mm Crows Foot |
| • Bench Vise w/ 5" Jaw Width | • Snap Ring Pliers w/ Fine Tip |
| • Bellows Retainer Plate Tool p/n 494712EVR | |
| • Bellows Band Clamp Crimp Tool p/n 494652EVR | |
| • Gasoline Approved Container | |

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

1. Carefully unpack and remove all kitted parts from the shipping container and evaluate for any kind of damage. Verify that no parts are missing from the packing list before proceeding with the installation.

Pre-Installation:

2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the spout.



3. It is unnecessary to remove the A4005EVR nozzle from the fueling point during the removal and installation of the spout. Use the bench vise to properly secure the A4005EVR nozzle during service.

Installation:

Removing the Existing Bellows & Boot Face



4. Locate the top bellows band clamp. Use the flat head screw driver to dislodge the locking mechanism and remove the band clamp from the bellows.



5. Locate the bottom bellows band clamp. Use the flat head screw driver to dislodge the locking mechanism and remove the band clamp from the bellows.



6. Remove the bellows and boot face from the A4005EVR nozzle. Grab the bellows and pull away from the nozzle body.



7. Use the scribe tool to remove the bellows o-ring.

IMPORTANT: Properly discard bellows band clamps and bellows o-ring.

Removing the Existing Spout



8. Locate the snap ring on the spout. Use the snap ring and needle nose pliers to remove the snap ring from the machined groove. Slide the snap ring upward.



9. Disassemble the interlock guide. Remove the top piece by pulling upward and sliding over the spout. Remove the bottom piece by sliding over the spout.



10. Use the 15" crescent wrench to loosen the spout nut. Unfasten the spout nut by hand to avoid cross threading.



11. Remove the spout by slowly pulling upward.



12. Use the needle nose pliers to remove the interlock push rod.

IMPORTANT: Properly discard all removed components.

Installing the New Spout



13. Use the needle nose pliers to install the new interlock push rod.



14. Install the new spout by inserting the vent tube connector into the nozzle vent port. Slowly push downward on the spout and align the dimple on the spout with the notch on the nozzle body.



15. Fasten the new spout nut by hand onto the nozzle threads to avoid cross threading. Use the 40mm crows foot and torque wrench to tighten the spout nut between 45 to 55 ft-lbs of torque.



16. Install the new interlock guide by sliding the top and bottom pieces over the spout. Press the top piece into the bottom piece.



17. Use the snap ring and needle nose pliers to install the new snap ring into the machined groove located on the spout. Slide the snap ring downward until seated properly.

Installing the Existing Bellows & Boot Face



18. Before attempting to install the existing bellows & boot face verify that the top of the interlock push rod is properly aligned with the bottom edge of the interlock guide.



19. Install the new bellows o-ring. Verify that the o-ring seats properly into the machined groove.

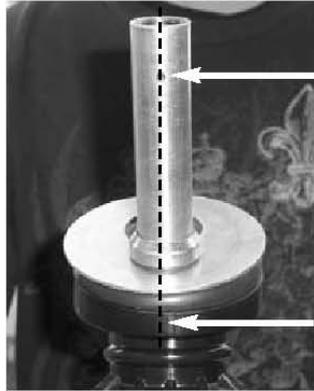


20. Slide the bellows over the spout until the end reaches the nozzle body. Push down over the bellows o-ring until properly seated.

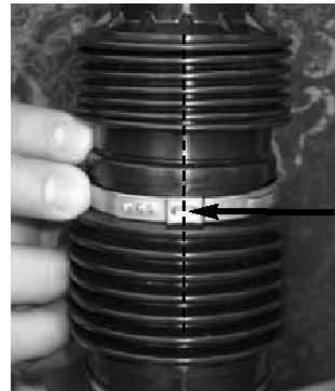
6



21. Use the bellows retainer plate tool p/n 494712EVR to secure and lock the bellows and boot face in place.



22. Slowly rotate the bellows until the parting line of the boot connector is aligned with the spout and automatic shut-off.



23. Install the new top bellows band clamp into the groove of the bellows. Lock and align the crimp portion with the parting line of the bellows.



24. Use the bellows band clamp crimp tool p/n 494652EVR to crimp and secure into place.



25. Install the new bottom bellows band clamp into the groove of the bellows. Lock and align the crimp portion with the parting line of the bellows.



26. Use the bellows band clamp crimp tool p/n 494652EVR to crimp and secure into place.



27. Remove the bellows retainer plate tool p/n 494712EVR from bellows and spout.

28. Remove the A4005EVR nozzle from the bench vise.

Post-Functional Test:



29. Functional test the insertion interlock of the A4005EVR nozzle by compressing the bellows and then squeezing the lever. The A4005EVR nozzle will not function unless the insertion interlock is properly engaged.
30. Functional test the automatic shutoff of the A4005EVR nozzle. Begin dispensing by compressing the bellows and then squeezing the lever. Place the hold-open latch in "high" clip position to secure the lever. Dispense one gallon of fuel into a gasoline approved container. At the same time, lower the spout tip into the standing fuel until the automatic shut is completely submersed. The main valve of the A4005EVR nozzle will automatically close causing fuel flow to stop.

IMPORTANT: Perform step 30 a minimum of three times to assure the insertion interlock , hold open latch and the automatic shutoff of the A4005EVR nozzle are operating properly.

According to UL requirement 842, the fuel flow rate must be greater than 3 gallons per minute for the automatic shutoff to operate properly. A common cause of low flow rates are dirty or clogged dispenser filters.

Post-Installation:

31. Place the A4005EVR nozzle back onto the dispenser cradle.

PREVENTIVE MAINTENANCE

1. Weekly inspect the spout for sheared, bent or blocked vent hole. Replace with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
492834EVR	Spout Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.
2. Meets ARB Capable of Refueling Any Vehicle Standards as per Section 4.7.1 of CP-201.
3. Meets ARB Spout Dimension Standards as per Section 4.7.3 of CP-201.

IMPORTANT: Leave these installation instructions with the station owner and/ or operator.

WARRANTY POLICY

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Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

EMCO WHEATON RETAIL CORPORATION MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, (WHETHER WRITTEN OR ORAL), INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

In the event of failure within the warranty period, call the Customer Service Department at **(800) 234-4394**. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment **PREPAID**, to Emco Wheaton Retail Corporation for repair or replacement.

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Emco Wheaton Retail Corp.

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p/n 570181
Rev. A, 06/09

For use with Vapor Systems
Technologies VST California Air
Resources Board Executive
Orders VR-203 and VR-204



Packing List:

(2) Fuel Path O-rings

**A4005EVR Balance
Vapor Recovery Nozzle**



**A4119EVR Coaxial
Safe Break Valve**



INSTALLATION INSTRUCTIONS

Service Tools Required:

- Pipe Wrench w/ Flat Jaws
- Bench Vise w/ 5" Jaw Width
- Petroleum Jelly or Other Suitable Lubricant
- Scribe Tool w/ 90 Degree Tip
- Gasoline Approved Container

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle and A4119EVR safe break valve, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle and A4119EVR safe break valve, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

1. Carefully unpack and remove all kitted parts from the shipping container and evaluate for any kind of damage. Verify that no parts are missing from the packing list before proceeding with the installation.

Pre-Installation:

2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the fuel path o-rings.



3. It is necessary to remove the A4005EVR nozzle and A4119EVR safe break valve from the curb hose during the removal and installation of the fuel path o-rings. Use the pipe wrench with flat jaws to loosen the curb hose connector. Unfasten the curb hose connector by hand from the A4005EVR nozzle to avoid cross threading.

IMPORTANT: Drain the fuel from the hanging hardware into a gasoline approved container when removing the A4005EVR nozzle from the curb hose.



A4005EVR Nozzle



**A4119EVR
Safe Break Valve**

4. Use the bench vise to properly secure the A4005EVR nozzle or A4119EVR safe break valve during service.

Installation:

Removing the Existing Fuel Path O-rings



A4005EVR Nozzle



**A4119EVR
Safe Break Valve**

5. Use the scribe tool to remove the existing fuel path o-rings.
6. Clean and remove all existing grease, fuel residue, debris, etc. from within the machined grooves.

IMPORTANT: Properly discard all removed components.

Installing the New Fuel Path O-rings



A4005EVR Nozzle



**A4119EVR
Safe Break Valve**

7. Use the scribe tool to install the new fuel path o-rings. Verify that both o-rings seat properly into the machined grooves.



A4005EVR Nozzle



**A4119EVR
Safe Break Valve**

8. Lightly lubricate the fuel path o-rings using petroleum jelly or other suitable lubricant.

Post-Installation:

9. Before attempting to reinstall the A4005EVR nozzle or A4119EVR safe break valve, please refer to the following installation instructions below.

- A4005EVR Balance Vapor Recovery Nozzle p/n 570435
- A4119EVR Coaxial Safe Break Valve p/n 569043

PREVENTIVE MAINTENANCE

1. Weekly inspect the A4005EVR nozzle and A4119EVR safe break valve connections for leaks or fuel residue. Replace with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
494748EVR	Fuel Path O-ring Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.

IMPORTANT: Leave these installation instructions with the station owner and/ or operator.

WARRANTY POLICY

Emco Wheaton Retail Corporation service station products are warranted to be free from defects in material and workmanship under normal use and service. Vapor recovery nozzles are warranted for a period of twelve (12) months from date of shipment from Emco Wheaton Retail Corporation or from installation date as specified by the returned warranty card, not to exceed fourteen (14) months from the date of shipment from Emco Wheaton Retail Corporation. This warranty excludes the spout and/or front end components of balance vapor recovery nozzles unless damage is obvious when the nozzle is removed from the shipping carton and the defective nozzle is returned to Emco Wheaton Retail Corporation prior to use and within two (2) months from the date of invoice. Other service station products are warranted for a period of twelve (12) months from the date of manufacture.

Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser and any subsequent purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

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In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

In the event of failure within the warranty period, call the Customer Service Department at (800) 234-4394. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment PREPAID, to Emco Wheaton Retail Corporation for repair or replacement.

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Emco Wheaton Retail Corp.

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619-421-1743 (Technical Services, California)

p/n 570541
Rev. C, 10/10

Packing List:

(6) Bellows Band Clamps



**A4005EVR Balance
Vapor Recovery Nozzle**



INSTALLATION INSTRUCTIONS

Service Tools Required:

- Flat Head Screw Driver w/ Fine Tip
- Bench Vise w/ 5" Jaw Width
- Bellows Retainer Plate Tool p/n 494712EVR
- Bellows Band Clamp Crimp Tool p/n 494652EVR
- Gasoline Approved Container

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

1. Carefully unpack and remove all kitted parts from the shipping container and evaluate for any kind of damage. Verify that no parts are missing from the packing list before proceeding with the installation.

Pre-Installation:

2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the bellows band clamps.



3. It is unnecessary to remove the A4005EVR nozzle from the fueling point during the removal and installation of the bellows band clamps. Use the bench vise to properly secure the A4005EVR nozzle during service.

Installation:

Removing the Existing Bellows Band Clamps



4. Locate the top bellows band clamp. Use the flat head screw driver to dislodge the locking mechanism and remove the band clamp from the bellows.



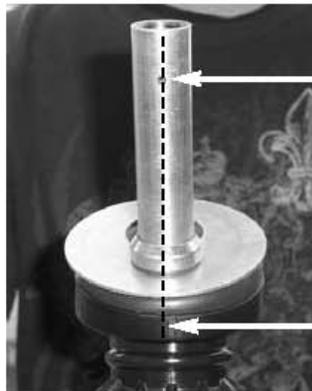
5. Locate the bottom bellows band clamp. Use the flat head screw driver to dislodge the locking mechanism and remove the band clamp from the bellows.

IMPORTANT: Properly discard all removed components.

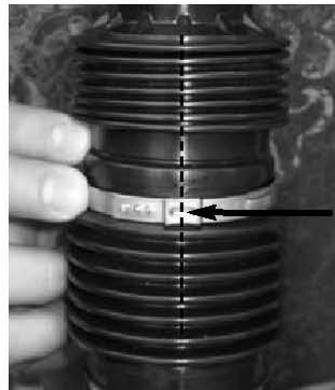
Installing the New Bellows Band Clamps



6. Use the bellows retainer plate tool p/n 494712EVR to secure and lock the bellows and boot face in place.



7. Slowly rotate the bellows until the parting line of the boot connector is aligned with the spout and automatic shut-off.



8. Install the new top bellows band clamp into the groove of the bellows. Lock and align the crimp portion with the parting line of the bellows.



9. Use the bellows band clamp crimp tool p/n 494652EVR to crimp and secure into place.



10. Install the new bottom bellows band clamp into the groove of the bellows. Lock and align the crimp portion with the parting line of the bellows.

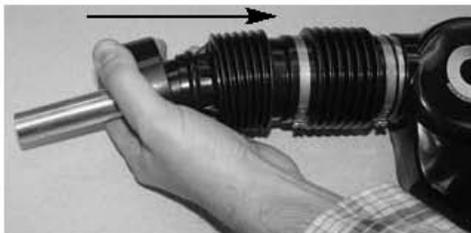


11. Use the bellows band clamp crimp tool p/n 494652EVR to crimp and secure into place.



12. Remove the bellows retainer plate tool p/n 494712EVR from bellows and spout.
13. Remove the A4005EVR nozzle from the bench vise.

Post-Functional Test:



14. Functional test the insertion interlock of the A4005EVR nozzle by compressing the bellows and then squeezing the lever. The A4005EVR nozzle will not function unless the insertion interlock is properly engaged.

Post-Installation:

15. Place the A4005EVR nozzle back onto the dispenser cradle.

PREVENTIVE MAINTENANCE

1. Weekly inspect the bellows band clamps for damage or if missing. Replace with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
494750EVR	Bellows Band Clamp Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.
2. Meets ARB Capable of Refueling Any Vehicle Standards as per Section 4.7.1 of CP-201.

IMPORTANT: Leave these installation instructions with the station owner and/ or operator.

WARRANTY POLICY

Emco Wheaton Retail Corporation service station products are warranted to be free from defects in material and workmanship under normal use and service. Vapor recovery nozzles are warranted for a period of twelve (12) months from date of shipment from Emco Wheaton Retail Corporation or from installation date as specified by the returned warranty card, not to exceed fifteen (15) months from the date of shipment from Emco Wheaton Retail Corporation. This warranty excludes the spout and/or front end components of balance vapor recovery nozzles unless damage is obvious when the nozzle is removed from the shipping carton and the defective nozzle is returned to Emco Wheaton Retail Corporation prior to use and within two (2) months from the date of invoice. Other service station products are warranted for a period of twelve (12) months from the date of manufacture.

Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

EMCO WHEATON RETAIL CORPORATION MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, (WHETHER WRITTEN OR ORAL), INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

In the event of failure within the warranty period, call the Customer Service Department at **(800) 234-4394**. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment **PREPAID**, to Emco Wheaton Retail Corporation for repair or replacement.

Emco Wheaton Retail Corporation products should be used in compliance with applicable federal, state and local laws and regulations. Product selection should be based on physical specifications and limitations and compatibility with the environment and material to be handled. All illustrations and specifications are based on the latest product information available at the time of publication. Emco Wheaton Retail Corporation reserves the right to make changes at any time in prices, materials, specifications and models and to discontinue models without notice or obligation.

Emco Wheaton Retail Corporation warrants the workmanship and materials to be free of defects and will comply with the performance standards of California ARB CP-201 for a period of one (1) year from the date of installation or fourteen months from the date of shipment from Emco Wheaton Retail Corporation.

Emco Wheaton Retail Corp.

2300 Industrial Park Dr. • Wilson, NC 27893
252-243-0150 • 252-243-4759 (fax)
619-421-1743 (Technical Services, California)

p/n 570180
Rev. A, 05/09

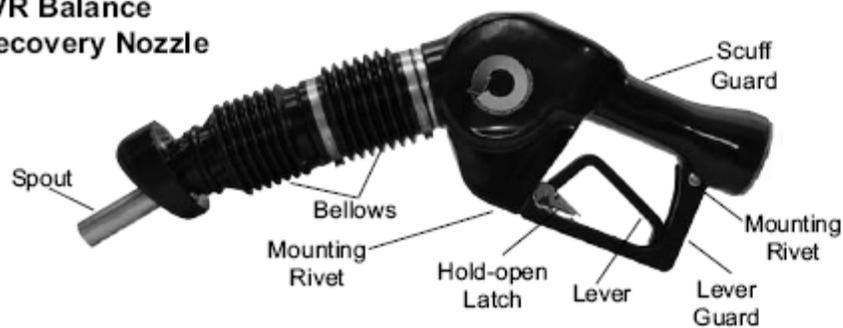
For use with Vapor Systems
Technologies VST California Air
Resources Board Executive
Orders VR-203 and VR-204

Packing List:

- (1) Latch Assembly
- (2) Mounting Rivets
- (1) Dust Plug



**A4005EVR Balance
Vapor Recovery Nozzle**



INSTALLATION INSTRUCTIONS

Service Tools Required:

- Pipe Wrench w/ Flat Jaws
- Flat Head Screw Driver w/ Wide Tip
- 1/8" Diameter Punch
- Bench Vise w/ 5" Jaw Width
- Lever Guard Rivet Installation Tool p/n 494653EVR
- Needle Nose Pliers
- Awl w/ 1/4" Tip
- Hammer
- 5/8" Diameter Punch
- Gasoline Approved Container

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

1. Carefully unpack and remove all kitted parts from the shipping container and evaluate for any kind of damage. Verify that no parts are missing from the packing list before proceeding with the installation.

Pre-Installation:

2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the latch.



3. It is necessary to remove the A4005EVR nozzle from the curb hose during the removal and installation of the latch. Use the pipe wrench with flat jaws to loosen the curb hose connector. Unfasten the curb hose connector by hand from the A4005EVR nozzle to avoid cross threading.

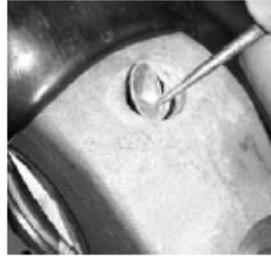
IMPORTANT: Drain the fuel from the hanging hardware into a gasoline approved container when removing the A4005EVR nozzle from the curb hose.

Installation:

Removing the Existing Latch



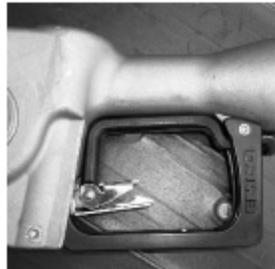
4. Pull the rear end of the scuff guard over the nozzle body until the dust plug is visible. Use the bench vise to properly secure the A4005EVR nozzle during service.
- 2



5. Use the awl and hammer to lightly tap and remove the dust plug.



6. Use the flat head screw driver to loosen the brass screw. Use the needle nose pliers to remove the brass screw and spring from the nozzle body.



7. Remove the A4005EVR nozzle from the bench vise and place on a flat surface. Use the 1/8" diameter punch and hammer to lightly tap and remove both mounting rivets located on the lever guard.



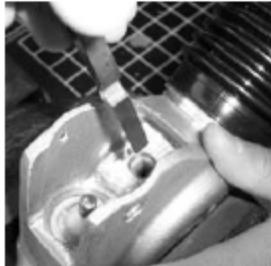
8. Remove the lever guard from the nozzle body.



9. Remove the existing latch by slowly pulling upward until the square stem clears the nozzle body.

IMPORTANT: Properly discard the dust plug and mounting rivets and latch.

Installing the New Latch



10. Locate the notch on the square stem and align to the right of the nozzle body. Install the new latch by pressing downward on the square stem.



11. Remove the A4005EVR nozzle from the bench vise and turn top side up. Install the existing spring around the square stem. Fasten the existing brass screw by hand onto the top of the square stem to avoid cross threading. Use the flat head screw driver to tighten.



12. Install the new dust plug. Use the 5/8 punch and hammer to light tap into place.



13. Remove the A4005EVR nozzle from the bench vise and place on flat surface. Install the existing lever guard onto the nozzle body using the new mounting rivets. Use the lever guard rivet installation tool p/n 494653EVR and hammer to properly flare the ends of the mounting rivets.



14. Install the existing scuff guard by pulling over the nozzle body.

Post-Installation:

15. Before attempting to reinstall the A4005EVR nozzle, please refer to the A4005EVR Balance Vapor Recovery Nozzle Installation Instructions p/n 570435.

PREVENTIVE MAINTENANCE

1. Weekly inspect the latch for damage or if missing. Replace with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
494150EVR	Latch Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.

IMPORTANT: Leave these installation instructions with the station owner and/ or operator.

WARRANTY POLICY

Emco Wheaton Retail Corporation service station products are warranted to be free from defects in material and workmanship under normal use and service. Vapor recovery nozzles are warranted for a period of twelve (12) months from date of shipment from Emco Wheaton Retail Corporation or from installation date as specified by the returned warranty card, not to exceed fourteen (14) months from the date of shipment from Emco Wheaton Retail Corporation. This warranty excludes the spout and/or front end components of balance vapor recovery nozzles unless damage is obvious when the nozzle is removed from the shipping carton and the defective nozzle is returned to Emco Wheaton Retail Corporation prior to use and within two (2) months from the date of invoice. Other service station products are warranted for a period of twelve (12) months from the date of manufacture.

Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser and any subsequent purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

EMCO WHEATON RETAIL CORPORATION MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, (WHETHER WRITTEN OR ORAL), INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

In the event of failure within the warranty period, call the Customer Service Department at (800) 234-4394. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment PREPAID, to Emco Wheaton Retail Corporation for repair or replacement.

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Emco Wheaton Retail Corporation warrants the workmanship and materials to be free of defects and will comply with the performance standards of California ARB CP-201 for a period of one (1) year from the date of installation or fourteen months from the date of shipment from Emco Wheaton Retail Corporation.

Emco Wheaton Retail Corp.

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619-421-1743 (Technical Services, California)

p/n 570543
Rev. C, 10/10

For use with Vapor Systems
Technologies VST California Air
Resources Board Executive
Orders VR-203 and VR-204



Packing List:

(1) Scuff Guard

A4005EVR
Balance Vapor Recovery Nozzle



INSTALLATION INSTRUCTIONS

Service Tools Required:

- Pipe Wrench w/ Flat Jaws
- Gasoline Approved Container
- Utility Knife

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

1. Carefully unpack and remove all kitted parts from the shipping container and evaluate for any kind of damage. Verify that no parts are missing from the packing list before proceeding with the installation.

Pre-Installation:

2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the scuff guard.

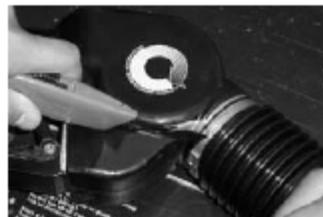


3. It is necessary to remove the A4005EVR nozzle from the curb hose during the removal and installation of the scuff guard. Use the pipe wrench with flat jaws to loosen the curb hose connector. Unfasten the curb hose connector by hand from the A4005EVR nozzle to avoid cross threading.

IMPORTANT: Drain the fuel from the hanging hardware into a gasoline approved container when removing the A4005EVR nozzle from the curb hose.

Installation:

Removing the Existing Scuff Guard



4. Place the A4005EVR nozzle on a flat surface. Use the utility knife to make the first cut along the front side of the scuff guard.



5. Use the utility knife to make the second cut along the rear side of the scuff guard.



6. Remove the scuff guard from the nozzle body.

IMPORTANT: Properly discard all removed components.

Installing the New Scuff Guard

7. Before attempting to install the new scuff guard. Soften the scuff guard by soaking in hot water and soap.



8. Install the new scuff guard by sliding over the spout and bellows. Pull the scuff guard completely over the nozzle body.

Post-Installation:

9. Before attempting to reinstall the A4005EVR nozzle, please refer to the A4005EVR Balance Vapor Recovery Nozzle Installation Instructions p/n 570435.

PREVENTIVE MAINTENANCE

1. Weekly inspect the scuff guard for the Emco Wheaton Retail manufacturer's logo. Replace with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
A0557EVR	Scuff Guard Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.

IMPORTANT: Leave these installation instructions with the station owner and/ or operator.

WARRANTY POLICY

Emco Wheaton Retail Corporation service station products are warranted to be free from defects in material and workmanship under normal use and service. Vapor recovery nozzles are warranted for a period of twelve (12) months from date of shipment from Emco Wheaton Retail Corporation or from installation date as specified by the returned warranty card, not to exceed fourteen (14) months from the date of shipment from Emco Wheaton Retail Corporation. This warranty excludes the spout and/or front end components of balance vapor recovery nozzles unless damage is obvious when the nozzle is removed from the shipping carton and the defective nozzle is returned to Emco Wheaton Retail Corporation prior to use and within two (2) months from the date of invoice. Other service station products are warranted for a period of twelve (12) months from the date of manufacture.

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The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

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In the event of failure within the warranty period, call the Customer Service Department at (800) 234-4394. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment PREPAID, to Emco Wheaton Retail Corporation for repair or replacement.

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Emco Wheaton Retail Corp.

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619-421-1743 (Technical Services, California)

p/n 570542
Rev. C, 10/10

4

VST Installation Procedure for Phase II Coaxial EVR Balance Fuel Hoses

Part Number Series: VSTA-EVR and VDV-EVR



Vapor Systems Technologies, Inc.

650 Pleasant Valley Drive
Springboro, Ohio 45066 (USA)

Toll Free: 1-888-878-4673

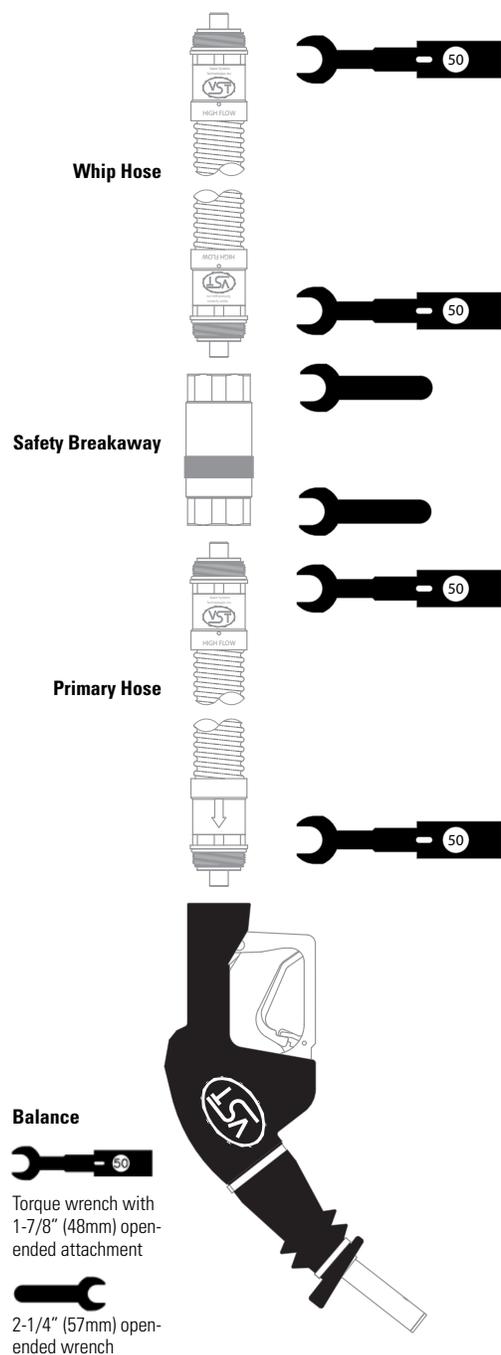
Phone: 937-704-9333

Fax: 937-704-9443

www.vsthose.com

Figure 1.

EVR Balance Hanging Hardware Assembly



GENERAL INFORMATION

If hanging hardware components are involved in a drive-off or incur other customer abuse, each individual component must be functionally tested prior to customer dispensing activities.

INSTALLATION PREPARATION

This procedure must be followed to insure leak-proof installation and operation of these hose products.

1. Turn off and tag the power to the dispenser. Dispenser must be de-energized prior to service to avoid personal injury.
2. Barricade work area to block vehicle access to the dispenser.
3. Close the dispenser shear valve prior to removing hanging hardware (hoses, safety breakaways, and nozzles).
4. Drain liquid product from the hanging hardware set into an approved container prior to replacing any hanging hardware components.
5. Remove hanging hardware from the dispenser prior to making replacement component assembly connections. VST recommends connecting the whip hose to the dispenser as the last connection during the hanging hardware assembly.

INSTALLATION AND FUNCTION TESTS

1. Initial inspection:
 - a. Carefully unpack hose from shipping carton.
 - b. Inspect ALL O-Rings on each end of the hose to determine that they are present and undamaged.
 - c. Inspect hose exterior for any damage.
 - d. Inspect coupling threads for any damage.
2. Lightly lubricate ALL O-Rings on mating connections with petroleum jelly or other suitable lubricant. DO NOT USE pipe dope or thread sealant.
3. Insert the hose coupling into the mating connection and hand-tighten.

NOTE Flow direction arrows on whip and primary hoses, where applicable, are indicated on hose coupling cuffs.
4. Tighten all the hose-joint connections to 50 foot-pounds of torque. DO NOT OVER TIGHTEN. Use a torque wrench with an open-end attachment to fit the hose couplings and an open-end wrench to properly tighten coupling connections. DO NOT USE channel-locks or pliers to tighten hose joints. Proper ft./lb. torque may not be achieved with these tools.
5. Purge air from the system by pumping one-tenth (1/10) to two-tenths (2/10) of a gallon of fuel into an approved container. Inspect each hose-joint connection for liquid leaks and make proper adjustments if necessary.

6. Check the nozzle shut-off action by dispensing fuel into an approved container at least three times to assure the proper automatic operation of the interlock rod. According to U/L requirement 842, the fuel flow-rate must be greater than 3 gpm for the automatic shut-off mechanism to operate.

To test, operate the nozzle and submerge the spout tip in fuel until the fuel level covers the vent hole. The main valve of the nozzle automatically shuts off when the liquid covers the vent hole at the end of the spout. The nozzle is not designed to operate on gravity flow. The hold-open latch will disengage automatically when liquid covers the vent hole in the spout. Verify that the fuel flow stops when the nozzle collection sleeve is decompressed (e.g. interlock rod is disengaged). To test that the fuel flow stops, dispense some fuel into an approved container. Slowly remove the nozzle from the container while dispensing fuel. Fuel flow should stop when the nozzle collection sleeve is fully decompressed.

7. Measure the resistance between the dispenser outlet casting and the tip of the nozzle spout. Use an electronic multimeter set on the high range of the ohmmeter function. Resistance should not indicate more than 70,000 ohms per foot of hose. Example: The measured resistance for a 12-foot hose must not exceed 840,000 ohms (840 kilohms)

PROCEDURE FOR POSITIONING THE LIQUID REMOVAL DEVICE

This procedure must be followed to insure proper positioning for the liquid-removal device in Part Number Series: VDV-EVR (See Figure 2).

1. After installing the VST hanging hardware, hold the nozzle straight out from the dispenser so that the compressed bellows is 48 inches away from the front face of the dispenser (simulate when the bellows is compressed in the filler neck of a vehicle) and the spout tip of the nozzle is 30 inches above the pavement. The nozzle spout is to be at a 30-degree angle above the horizontal plane.

2. When the hose and nozzle are held in position as shown in Figure 2, the factory installed liquid-removal device indicator-mark (striped line) on the vapor hose must be located:
 - In the bottom of the loop section within the tolerance range.
 - The allowable tolerance range is 3 inches left or right of the 6:00 o'clock position (lowest point of the loop) as measured along the center line of the hose

- In the bottom of the loop section within the tolerance range.
- The allowable tolerance range is 3 inches left or right of the 6:00 o'clock position (lowest point of the loop) as measured along the center line of the hose

If the liquid-removal device indicator-mark is not located within the tolerance range, the installer must choose one of the following options:

Adjust the hose retractor (if installed)

Use a different length whip hose

Use a different length primary hose

IMPORTANT

It is the installing technician's responsibility to insure that the properly sized and marked hanging hardware

is installed at the dispenser. Failure to properly install and locate the liquid removal device may reduce the effectiveness of the product in application resulting in outer hose liquid blockage and failure of the liquid removal test procedure.

MAINTENANCE

Inspect hoses daily for damage, loose connection, or leaks. Replace as necessary. Subject to customer abuse, hose should be replaced when damaged.

The hose is designed and constructed to give lasting service if properly handled and maintained. If for any reason it should need attention, contact your VST distributor for proper disposition.

NOTE Due to abuse, misuse, changing gasoline formulas, variation in maintenance practices, environmental conditions, and/or conditions beyond the manufacturer's control, dispensing equipment may need replacement before five (5) years. Inspections and proper maintenance procedures should be followed by the station manager to determine if replacement is required before five (5) years.

WARNING Unauthorized rebuilding or modifying of hoses voids **ALL** approvals and warranties. VST products must be used in compliance with applicable federal, state and local laws and regulations.

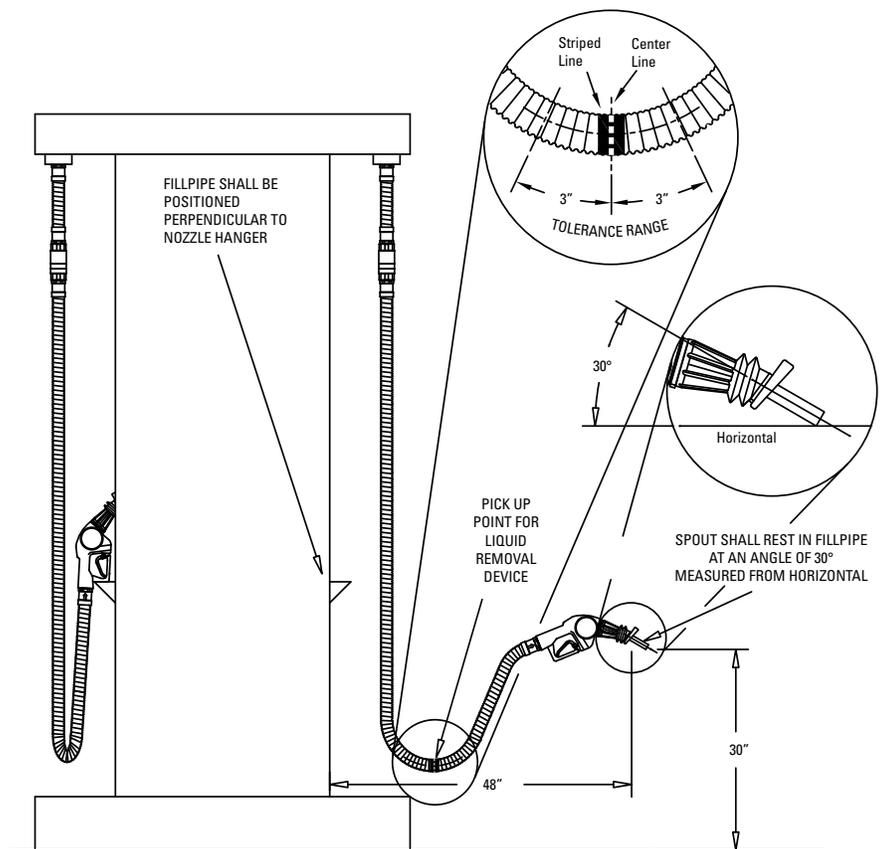


Figure 2. Procedure For Positioning the Liquid Removal Device



Maxxim Premier Installation Instructions

- 1 Install the correct hose length and other hanging hardware on the dispenser. This will include whip hose, breakaway, long hose, and nozzle.
 - a) When installing Maxxim Premier Plus, the end of the hose stamped “NOZZLE END” must be attached to the nozzle.
 - b) If a hose retractor is required, use the Goodyear Maxguard retractor clamp; part # 532-365-105-000-00.
 - c) Do not use high retractor tension. High tension is difficult for customers to handle and it reduces the life of the hose. Retractor tension above 12 pounds will void the warranty.
 - d) Do not mix Maxxim Premier Plus outer or inner hose with components from other manufacturer’s stage II hoses. The mixed assembly may not be grounded and could cause a serious fire hazard.
 - e) Make sure that the long hose does not touch the pavement or the top of the island when the nozzle hangs on the dispenser hook.
- 2 Tighten the swivel nut to 50 ft. lbs. torque using an open end torque wrench. Do not use a pipe wrench because the teeth on the wrench will damage the fitting. This connection is sealed by an o-ring. Do not apply thread sealant.

- Alternate method: If a torque wrench is not available, turn the swivel nut by hand until snug and the o-ring is seated. Then use a wrench to tighten the swivel nut ¼ turn past snug. This connection has straight threads and must be cinched tight to prevent the threads from unscrewing in service.

One source for an open end torque wrench is Belknap Tools, both part #'s are needed:

- VB-0608005 open end wrench head
- VB-100ST-I wrench handle preset at the factory to 50 ft lbs

After extended service, the swivel nut o-ring can be lubricated with front end bearing grease or Parker O-Lube

- 3 Function Test - Measure the resistance between the dispenser outlet casting and the tip of the nozzle spout. Use an electronic multimeter set on the high range of the ohmmeter function. Resistance should not indicate more than 70,000 ohms per foot of hose. Example: The measured resistance for a 12-foot hose must not exceed 840,000 ohms (840 kilohms)

Maxxim Premier Plus Venturi Pick-up Length Instructions

It is the responsibility of the installer to determine the optimum venturi pick-up length and verify that hoses installed on a dispenser have the optimum pick-up location. Failure to properly size the pick-up location will reduce the effectiveness of the venturi in removing liquid blockage from the outer vapor hose and may result in failure of the liquid removal test.

When the Maxxim Premier Plus hose is assembled in the factory, a mark is placed on the outer hose to locate the venturi pick-up location. This mark will help the installer determine whether the hose has the optimum pick-up location for the installation.

- 4 Hold the nozzle straight out from the dispenser so that the end of the compressed bellows (simulate when the bellows is compressed in the filler neck of a car) is 48 inches away from the front face of the dispenser (see Figure 1). Hold the nozzle so that the tip of the spout is 30 inches



above the pavement and the spout is at a 30° angle above the horizontal plane (see Figure 1). When the nozzle and hose are held in the position shown in Figure 1, the mark on the outer vapor hose should be within 3 inches of the bottom of the loop (see Figure 1).

- 5 If the mark on the hose is not within the tolerance shown in Figure 1, the installer may:
- Adjust the hose retractor (if installed);
 - Install a different length whip hose; or
 - Install a different long hose with the optimum venturi pick-up location. To determine the optimum venturi pick-up location (e.g., venturi pick-up tube length), conduct the following:
- a) Hold the nozzle and hose in the position shown in Figure 1;
 - b) Measure the length from the back end of the nozzle (where the hose screws into the nozzle) to the bottom of the loop in the hose. This length is the optimum “pick-up” length for the Maxxim Premier Plus balance venturi hose.
 - c) Contact your local Goodyear Engineered Products Authorized Distributor to obtain a Maxxim Premier Plus hose with the optimum venturi pick-up tube length.

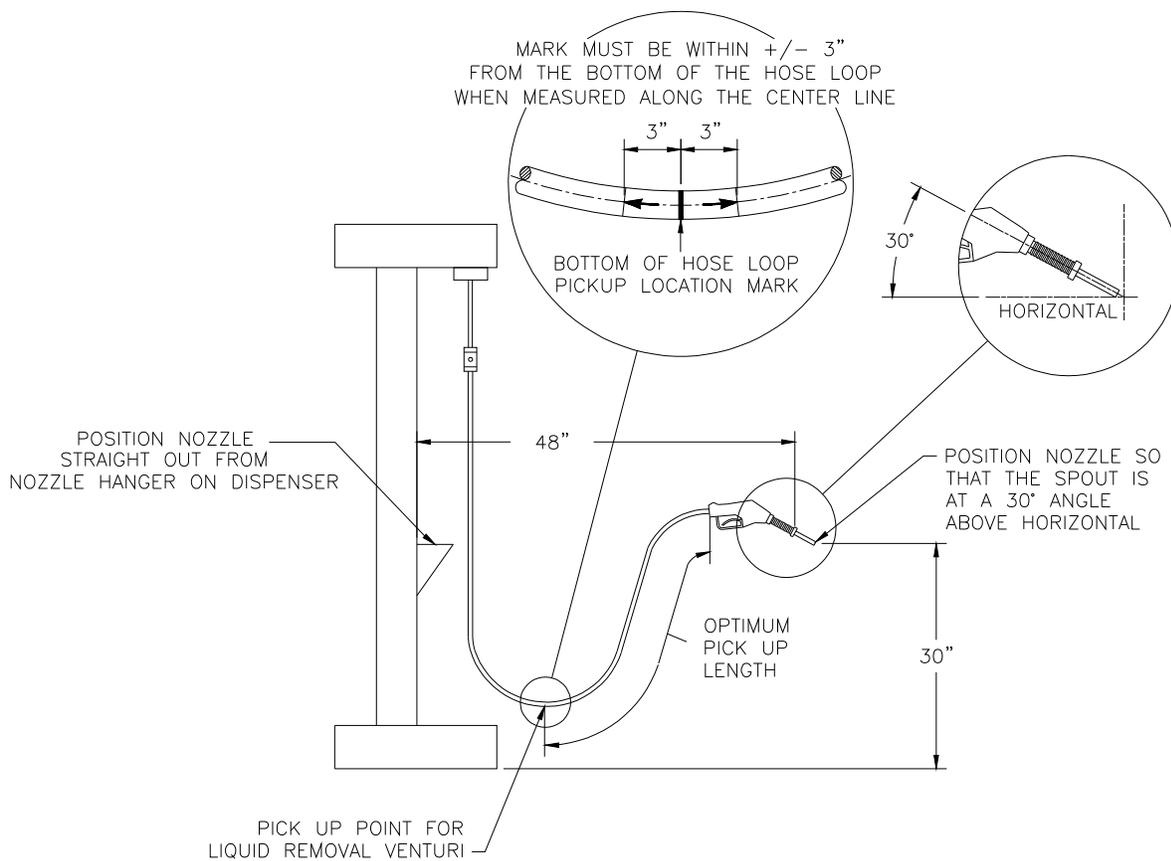


FIGURE 1

Questions on installation should be directed to your local Goodyear Engineered Products Authorized Distributor or Goodyear Engineered Products Customer Service, 1-800-235-4632.

VST Installation Procedure for Phase II Coaxial EVR Balance Safety Breakaway Devices

NON-Reattachable Breakaway Part Number Series: VSTA-EVR



Vapor Systems Technologies, Inc.

650 Pleasant Valley Drive
Springboro, Ohio 45066 (USA)

Toll Free: 1-888-878-4673

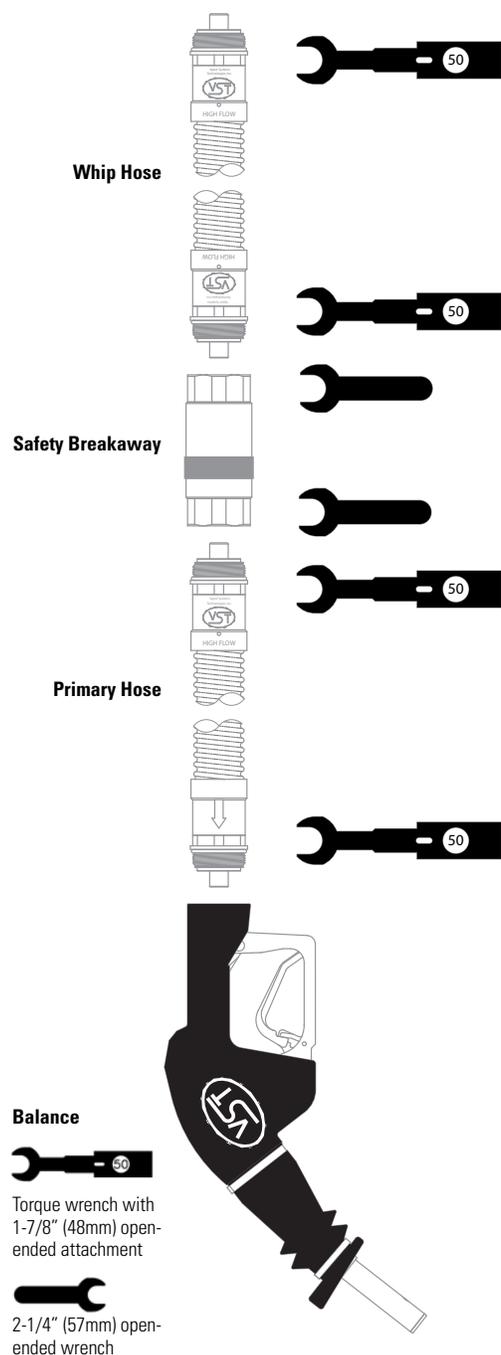
Phone: 937-704-9333

Fax: 937-704-9443

www.vsthose.com

Figure 1.

EVR Balance Hanging Hardware Assembly



APPLICATION

These VST Safety Breakaway devices are intended to prevent damage to the dispenser and hose in the event of a vehicle drive off. These devices separate at pull forces up to 350 lbs. Prior to installation (see Installation Preparation), you will need to determine that 350 lbs. of pull force will not damage the dispenser. After verifying that the dispenser is securely bolted to the island, it can be tested by using a spring scale and a length of rope. The rope must be connected at the dispenser outlet casting, which may require a threaded bushing with a hole for attaching the rope. Attach the scale to the rope and pull to 350 lbs. in several directions. Be sure to avoid damaging the dispenser.

NOTE

- The whip hose ALWAYS attaches to the dispenser. If a retractor is being used, the retractor clamp MUST be between the breakaway and the dispenser.
- VST hoses are made to withstand 350 pounds tensile pull without damage. If another brand of hose is present at the dispenser, VST recommends that you contact the hose manufacturer regarding the compatibility with this breakaway device.

GENERAL INFORMATION

If hanging hardware components are involved in a drive-off or incur other customer abuse, each individual component must be functionally tested prior to customer dispensing activities.

INSTALLATION PREPARATION

This procedure must be followed to insure leak-proof installation and operation of these safety breakaway products.

- Turn off and tag the power to the dispenser. Dispenser must be de-energized prior to service to avoid personal injury.
- Barricade work area to block vehicle access to the dispenser.
- Close the dispenser shear valve prior to removing hanging hardware (hoses, safety breakaways, and nozzles).
- Drain liquid product from the hanging hardware set into an approved container prior to replacing any hanging hardware components.
- Remove hanging hardware from the dispenser prior to making replacement component assembly connections. VST recommends connecting the whip hose to the dispenser as the last connection during the hanging hardware assembly

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INSTALLATION AND FUNCTION TESTS

1. Initial inspection:
 - a. Carefully unpack safety breakaway from shipping carton.
 - b. Inspect safety breakaway for any damage to threads, O-Rings, exterior, etc.
2. Lightly lubricate ALL O-Rings on mating connections with petroleum jelly or other suitable lubricant. DO NOT USE pipe dope or thread sealant.
3. Attach breakaway on mating connection and tighten by hand. NOTE THE FLOW DIRECTION ARROW (where applicable). Use the hex on the breakaway body to tighten. DO NOT USE the breakaway body to tighten the unit.
4. Tighten breakaway connection to 50 foot-pounds torque. DO NOT OVER TIGHTEN. Use the hex on the breakaway body to tighten. Use a torque wrench with an open-end attachment to fit the hose couplings and an open-end wrench to properly tighten breakaway connections. DO NOT USE channel-locks or pliers to tighten connections. Proper ft./lb. torque may not be achieved with these tools.
5. Purge air from the system by pumping one-tenth (1/10) to two-tenths (2/10) of a gallon of fuel into an approved container. Inspect each hose joint connection for liquid leaks and make proper adjustments if necessary.
6. Check the nozzle shut-off action by dispensing fuel into an approved container at least three times to assure the proper automatic operation of the interlock rod. According to U/L requirement 842, the fuel flow-rate must be greater than 3 gpm for the automatic shut-off mechanism to operate.

To test, operate the nozzle and submerge the spout tip in fuel until the fuel level covers the vent hole. The main valve of the nozzle automatically shuts off when liquid covers the vent hole at the end of the spout. The nozzle is not designed to operate on gravity flow. The hold-open latch will disengage automatically when liquid covers the vent hole in the spout. Verify that the fuel flow stops when the nozzle collection sleeve is decompressed (e.g. interlock rod is disengaged). To test that the fuel flow stops, dispense some fuel into an approved container. Slowly remove the nozzle from the container while dispensing fuel. Fuel flow should stop when the nozzle collection sleeve is fully decompressed.

7. Measure the resistance between the dispenser outlet casting and the tip of the nozzle spout. Use an electronic multimeter set on the high range of the ohmmeter function. Resistance should not indicate more than 70,000 ohms per foot of hose. Example: The measured resistance for a 12-foot hose must not exceed 840,000 ohms (840 kilohms).

MAINTENANCE

Inspect safety breakaways daily for damage, loose connections or leaks. Replace as necessary. Subject to customer abuse, safety breakaway should be replaced when damaged.

The safety breakaway is designed and constructed to give lasting service if properly handled and maintained. If for any reason it should need attention, contact your VST distributor for proper disposition.

NOTE

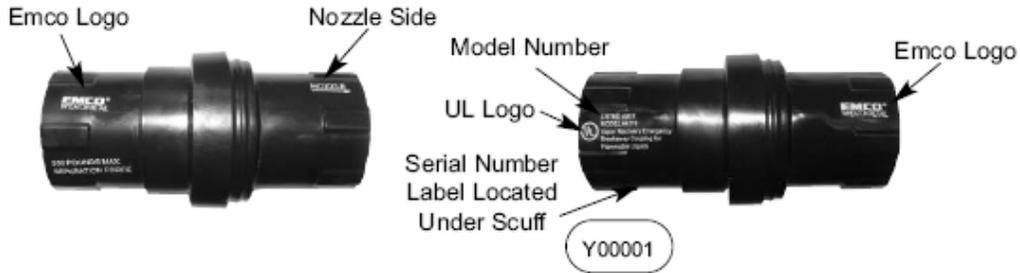
Due to abuse, misuse, changing gasoline formulas, variation in maintenance practices, environmental conditions and/or conditions beyond the manufacturer's control, dispensing equipment may need replacement before five (5) years. Inspections and proper maintenance procedures should be followed by the station manager to determine if replacement is required before five (5) years.

WARNING

Unauthorized rebuilding or modifying of safety breakaways voids **ALL** approvals and warranties.

VST products must be used in compliance with applicable federal, state, and local laws and regulations.

**Permanent ID
Information:**



INSTALLATION INSTRUCTIONS

Service Tools Required:

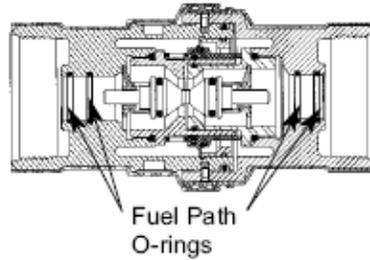
- 1 7/8" Crows Foot
- Gasoline Approved Container
- Petroleum Jelly or Other Suitable Lubricant
- Torque Wrench w/ 50ft-lbs Setting
- Pipe Wrench w/ Flat Jaws

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4119EVR safe break valve, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4119EVR safe break valve, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.
5. If a hose retractor is used, the A4119EVR safe break valve must be attached on the nozzle side of the retractor clamp.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/ or death.

Pre-Inspection:



1. Carefully unpack and remove the A4119EVR safe break valve from the shipping container and evaluate for any kind of damage.
2. Verify the fuel path o-rings located on both ends of the A4119EVR safe break valve. All o-rings must be properly secured inside the factory machined grooves.

Pre-Installation:



3. Lightly lubricate the fuel path o-rings using petroleum jelly or other suitable lubricant.



4. Before attempting to install the A4119EVR safe break valve onto the whip hose, verify the word "NOZZLE", which is printed on the scuff guard of the safe break valve, is on the opposite end. Verify the vapor path o-ring is properly secured onto the connector, and in good working condition. Lightly lubricate the o-ring using petroleum jelly or other suitable lubricant.



5. Before attempting to install the A4119EVR safe break valve onto the curb hose, verify the vapor path o-ring is properly secured onto the connector, and in good working condition. Lightly lubricate the o-ring using petroleum jelly or other suitable lubricant.

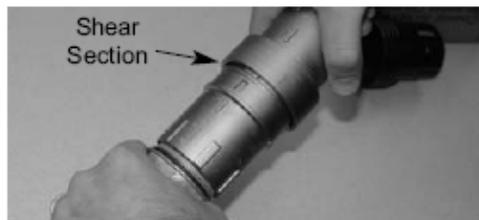
IMPORTANT: Do not use pipe thread sealant compound or Teflon tape when installing the A4119EVR safe break valve. Failure to comply will void warranty.

Installation:

IMPORTANT: If this is a new facility installation, the fueling point must be flushed into a gasoline approved container before installing the A4119EVR safe break valve. Failure to perform this procedure could result in foreign material becoming lodged inside the safe break valve's fuel path causing a reduction in fuel flow.



6. Remove the scuff guard by sliding on to the whip hose. Attach the A4119EVR safe break valve onto the whip hose connector. Tighten by hand to avoid cross threading. Take caution to avoid pinching the vapor path o-ring.



IMPORTANT: Never tighten across the shear section of the A4119EVR safe break valve. Failure to comply will result in damage to the safe break valve and void warranty.



7. Using a 1 7/8" crows foot and torque wrench, tighten the whip hose connector to 50 ft-lbs of torque.



8. Remove the scuff guard by sliding on to the curb hose. Attach the A4119EVR safe break valve onto the curb hose connector. Tighten by hand to avoid cross threading. Take caution to avoid pinching the vapor path o-ring.



9. Using a 1 7/8" crows foot and torque wrench, tighten the curb hose connector to 50 ft-lbs of torque.

Post Functional Tests:

10. Carefully purge the trapped air from the fueling point. Begin dispensing by compressing the bellows and then squeezing the lever. Dispense one gallon of fuel into a gasoline approved container.
11. Functional test the automatic shutoff of the A4005EVR nozzle. Begin dispensing by compressing the bellows and then squeezing the lever. Place the hold open latch in "high" clip position to secure the lever. Dispense one gallon of fuel into a gasoline approved container. At the same time, lower the spout tip into the standing fuel until the vent hole is completely submersed. The main valve of the A4005EVR nozzle will automatically close causing fuel flow to stop.

IMPORTANT: Perform step 11 a minimum of three times to assure the insertion interlock, hold open latch and the automatic shutoff of the A4005EVR nozzle are operating properly.

According to UL requirement 842, the fuel flow rate must be greater than 3 gallons per minute for the automatic shutoff to operate properly. A common problem cause of low flow rates are dirty or clogged dispenser filters.

Post Inspection:

12. Before placing the A4005EVR nozzle onto the dispenser cradle, inspect all hanging hardware connections for potential fuel leaks. Make proper adjustments if necessary.

PREVENTIVE MAINTENANCE

1. Weekly inspect the A4119EVR safe break valve, evaluate for any kind of damage. Damaged components must be replaced with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
494748EVR	Fuel Path O-ring Kit

2. Weekly inspect all hanging hardware connections for potential fuel leaks.

IMPORTANT: Should a drive-off or incidence of customer abuse occur, follow the initial inspection and function instructions found in the installation section.

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.
2. TP-201.2J – Complies with the maximum allowable component pressure drop of 0.04 inches of water column @ 60 CFH.

IMPORTANT: Leave these installation instructions with the station owner and/or operator.

WARRANTY POLICY

Emco Wheaton Retail Corporation service station products are warranted to be free from defects in material and workmanship under normal use and service. Vapor recovery nozzles are warranted for a period of twelve (12) months from date of shipment from Emco Wheaton Retail Corporation or from installation date as specified by the returned warranty card, not to exceed fifteen (15) months from the date of shipment from Emco Wheaton Retail Corporation. This warranty excludes the spout and/or front end components of balance vapor recovery nozzles unless damage is obvious when the nozzle is removed from the shipping carton and the defective nozzle is returned to Emco Wheaton Retail Corporation prior to use and within two (2) months from the date of invoice. Other service station products are warranted for a period of twelve (12) months from the date of manufacture.

Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

EMCO WHEATON RETAIL CORPORATION MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, (WHETHER WRITTEN OR ORAL), INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

In the event of failure within the warranty period, call the Customer Service Department at (800) 234-4394. Describe the problem and provide the product date stamp information to the customer service representative. In the case of a nozzle, provide the serial number. The customer service representative will provide a product complaint number, if applicable. Ship the defective equipment **PREPAID**, to Emco Wheaton Retail Corporation for repair or replacement.

Emco Wheaton Retail Corporation products should be used in compliance with applicable federal, state and local laws and regulations. Product selection should be based on physical specifications and limitations and compatibility with the environment and material to be handled. All illustrations and specifications are based on the latest product information available at the time of publication. Emco Wheaton Retail Corporation reserves the right to make changes at any time in prices, materials, specifications and models and to discontinue models without notice or obligation.

Emco Wheaton Retail Corporation warrants the workmanship and materials to be free of defects and will comply with the performance standards of California ARB CP-201 for a period of one (1) year from the date of installation or fourteen months from the date of shipment from Emco Wheaton Retail Corporation.

Emco Wheaton Retail Corp.

2300 Industrial Park Dr. • Wilson, NC 27893
252-243-0150 • 252-243-4759 (fax)
619-421-1743 (Technical Services, California)

p/n 569043
Rev. D, 06/09

For use with Vapor Systems
Technologies VST California Air
Resources Board Executive
Orders VR-203 and VR-204



Packing List:

(2) Fuel Path O-rings

**A4005EVR Balance
Vapor Recovery Nozzle**



**A4119EVR Coaxial
Safe Break Valve**



INSTALLATION INSTRUCTIONS

Service Tools Required:

- Pipe Wrench w/ Flat Jaws
- Bench Vise w/ 5" Jaw Width
- Petroleum Jelly or Other Suitable Lubricant
- Scribe Tool w/ 90 Degree Tip
- Gasoline Approved Container

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser.
2. Always use a gasoline approved container or test can when performing any type of preventive maintenance.
3. Before attempting to install, remove or service the A4005EVR nozzle and A4119EVR safe break valve, turn off and tag out power to the corresponding dispenser.
4. Before attempting to install, remove or service the A4005EVR nozzle and A4119EVR safe break valve, close the emergency impact valves located inside the base of the dispenser. Relieve the line pressure and standing fuel through the nozzle spout into a gasoline approved container by compressing the bellows and squeezing the lever.

IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

1. Carefully unpack and remove all kitted parts from the shipping container and evaluate for any kind of damage. Verify that no parts are missing from the packing list before proceeding with the installation.

Pre-Installation:

2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the fuel path o-rings.



3. It is necessary to remove the A4005EVR nozzle and A4119EVR safe break valve from the curb hose during the removal and installation of the fuel path o-rings. Use the pipe wrench with flat jaws to loosen the curb hose connector. Unfasten the curb hose connector by hand from the A4005EVR nozzle to avoid cross threading.

IMPORTANT: Drain the fuel from the hanging hardware into a gasoline approved container when removing the A4005EVR nozzle from the curb hose.



A4005EVR Nozzle



**A4119EVR
Safe Break Valve**

4. Use the bench vise to properly secure the A4005EVR nozzle or A4119EVR safe break valve during service.

Installation:

Removing the Existing Fuel Path O-rings



A4005EVR Nozzle



**A4119EVR
Safe Break Valve**

5. Use the scribe tool to remove the existing fuel path o-rings.
6. Clean and remove all existing grease, fuel residue, debris, etc. from within the machined grooves.

IMPORTANT: Properly discard all removed components.

Installing the New Fuel Path O-rings



A4005EVR Nozzle



**A4119EVR
Safe Break Valve**

7. Use the scribe tool to install the new fuel path o-rings. Verify that both o-rings seat properly into the machined grooves.



A4005EVR Nozzle



**A4119EVR
Safe Break Valve**

8. Lightly lubricate the fuel path o-rings using petroleum jelly or other suitable lubricant.

Post-Installation:

9. Before attempting to reinstall the A4005EVR nozzle or A4119EVR safe break valve, please refer to the following installation instructions below.

- A4005EVR Balance Vapor Recovery Nozzle p/n 570435
- A4119EVR Coaxial Safe Break Valve p/n 569043

PREVENTIVE MAINTENANCE

1. Weekly inspect the A4005EVR nozzle and A4119EVR safe break valve connections for leaks or fuel residue. Replace with factory authorized service kits.

<u>Part Number</u>	<u>Description</u>
494748EVR	Fuel Path O-ring Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

This component was factory tested to, and met the following specifications:

1. Meets ARB Material Compatibility with Fuel Blends as per Section 3.8 of CP-201.

IMPORTANT: Leave these installation instructions with the station owner and/ or operator.

WARRANTY POLICY

Emco Wheaton Retail Corporation service station products are warranted to be free from defects in material and workmanship under normal use and service. Vapor recovery nozzles are warranted for a period of twelve (12) months from date of shipment from Emco Wheaton Retail Corporation or from installation date as specified by the returned warranty card, not to exceed fourteen (14) months from the date of shipment from Emco Wheaton Retail Corporation. This warranty excludes the spout and/or front end components of balance vapor recovery nozzles unless damage is obvious when the nozzle is removed from the shipping carton and the defective nozzle is returned to Emco Wheaton Retail Corporation prior to use and within two (2) months from the date of invoice. Other service station products are warranted for a period of twelve (12) months from the date of manufacture.

Emco Wheaton Retail Corporation shall, at its option, repair or replace that part which proves to be defective. Repaired or replacement nozzles are warranted for the balance of the original warranty period. This warranty is void unless the original purchaser and any subsequent purchaser returns the claimed defective item to Emco Wheaton Retail Corporation for inspection to determine whether the claimed defect is covered by this warranty.

The exclusive and sole remedy under this warranty is repair or replacement of the defective part. Emco is not responsible for claims for damage caused by improper installation or maintenance; corrosive fluids; misuse of the product or use the product for other than its intended purpose; or accident, acts of God, or natural phenomena. Emco will not pay for labor or related expenses, nor shall Emco be liable for any incidental, consequential or exemplary damages. This warranty is void if the Emco Wheaton Retail Corporation product has been previously repaired with parts not approved by Emco Wheaton Retail Corporation, or if a nozzle bears the mark or imprint of a company other than Emco Wheaton Retail Corporation, indicating the nozzle has been rebuilt or repaired by a company other than Emco Wheaton Retail Corporation.

EMCO WHEATON RETAIL CORPORATION MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, (WHETHER WRITTEN OR ORAL), INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

In the event a nozzle is returned to Emco Wheaton Retail Corporation within the warranty period described above, and when tested is found to be functional and without defect, Emco Wheaton Retail Corporation reserves the right to return the nozzle to the customer or apply a Core Credit (see Nozzle Core Return Program), at Emco Wheaton Retail Corporation's discretion.

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619-421-1743 (Technical Services, California)

p/n 570541
Rev. C, 10/10

Installation Manual

ECS Membrane Processor: PMC and ISD

Part: VST ECS-CS3-310 – Three Phase
VST-ECS-CS3-110 – Single Phase

Executive Orders: VR-203-K
VR-204-K

Version: 3.0

Vapor Systems Technologies, Inc.
650 Pleasant Valley Drive
Springboro, Ohio 45066
937-704-9333 PH
937-704-9443 FX
www.vsthose.com

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UL Declaration Notice

- Acceptability of the installation of the Vapor *Processor* and all associated piping, fittings, controls, etc. is not covered under the UL Listing of the ECS Membrane *Processor*.

- NOTE: All peripheral equipment required to activate / control these units is not covered under the UL Listing of this ECS Membrane *Processor*.
 - ▶ They should be UL Listed, have the appropriate communications protocol, not installed over or in a hazardous location, and are determined to be acceptable to the authority having jurisdiction with regards to suitability and overall installation.



About VST

Vapor Systems Technologies, Inc. began in 1989 with the vision of One Company – One Integrated Solution.

Today, that philosophy is still in place and getting stronger. Recognizing that a healthier environment is a need and not an option, VST has dedicated its undivided attention to the ever-changing, stringent regulations that govern fugitive vapors at gasoline dispensing facilities (GDF). To this challenge, VST is committed to a continual R&D campaign of developing the most current, technologically advanced solutions to service not only the United States, but also the world.

VST specializes in the development, engineering, and manufacturing of products that are sold into the GDF segment of the petroleum industry. The VST focus provides our customers and users with exceptional products, services, and innovative solutions for improving the fueling-station experience as well as the world's air quality.

VST's product offering includes curb pump and vapor recovery hoses, safety breakaways, nozzles, and emission-control system *Processors*. The ENVIRO-LOC™ vapor-recovery product offering represents the most innovative concept in the industry for trapping fugitive vapors from the front end (vehicle refueling) to the back end (vent risers) of the GDF site.

Notice

Vapor Systems Technologies, Inc. shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this publication.

No part of this publication may be translated to another language without the prior written consent of Vapor Systems Technologies, Inc.

Warranty

- The warranty is conditional on whether the *Processor* was installed by a VST ASC Level B or a VST Level C.
- 12-month warranty becomes effective at the time of installation. If this card is not returned, the warranty becomes effective from the date of shipment from VST.
- VST cannot be held responsible for damage to the *Processor* or the *Processor* equipment (inclusive) due to acts of nature, vandalism, or neglect.
- Membranes exposed to gasoline (liquid) due to an overfill or any other reason voids the membrane warranty.
- VST products are warranted to be free of defects in material and workmanship.
- Liability under any expressed or implied warranty is limited to replacement of the product.
- Use of VST products on non-UL Listed systems, or use which falls outside intended field of use, voids any stated or implied warranty.
- VST is not responsible for misuse of, nor improperly installed, products.
- In the event of a warranty claim, the purchaser must obtain a copy of the Return Goods Authorization (RGA) prior to returning product to insure proper processing. Return shipping charges are the responsibility of the customer.
- Warranty status will be determined within 30 days of the return of suspected items.
- VST provides for a warranty program in conjunction with VST's exclusive serial number tracking system.
- Each VST product carries a unique serial number and warranty tracking card.
- Requests for warranty shall be through VST's Return Goods Authorization (RGA) procedure. Call VST at 937-704-9333.
- This warranty does not cover any components exposed to contact with fuels more than 5% menthanol, 10% ethanol, 15% MTBE by volume, or any exposure to M85 / E85 fuel.

Warranty Cards

 Vapor Systems Technologies, Inc. Phone: (937)-704-9333 • Fax: (937)-704-9443 www.vsthose.com	SERIAL NUMBER:
	INSTALLATION DATE:
	INSTALLATION SITE:
	CITY/STATE/ZIP:
	DISTRIBUTOR NAME:
	PRODUCT STYLE: <input type="checkbox"/> HOSE <input type="checkbox"/> SAFETY BREAKAWAY <input type="checkbox"/> NOZZLE <input type="checkbox"/> ECS PROCESSOR

IMPORTANT PRODUCT WARRANTY REGISTRATION CARD

12 MONTH WARRANTY BECOMES EFFECTIVE AT TIME OF INSTALLATION. IF THIS CARD IS NOT RETURNED, WARRANTY BECOMES EFFECTIVE FROM DATE OF SHIPMENT FROM VST.

THE MAXIMUM WARRANTY LIFE IS 18 MONTHS FROM DATE OF SHIPMENT.

PLEASE CALL VST IF THIS PRODUCT IS BEING USED AS A REPLACEMENT. REPLACEMENT WITH A NON VST PRODUCT VOIDS ANY WARRANTY.

Figure 1: VST Registration Card

	NOTICE: THIS TAG MUST NOT BE REMOVED FOR ANY REASON
ECS MEMBRANE PROCESSOR UNIT	
Serial Number:	_____
Date Installed:	_____
This device was factory tested and met all applicable performance standards and specifications to which it was certified.	
Manufactured By: Vapor Systems Technologies, Inc. 650 Pleasant Valley Dr., Springboro, Ohio 45066 Phone: (937) 704-9333, Fax: (937) 704-9443	

Figure 2: ECS Membrane Processor Sticker

Components and Warranties

PART #	DESCRIPTION	WARRANTY
5001-001	Vacuum Pump/Three-Phase Motor - Shipped with Three-Phase <i>Processor</i>	1 year
5001-002	Vacuum Pump/Single-Phase Motor - Shipped with Single-Phase <i>Processor</i>	1 year
5001-003	Vacuum Pump Drive Coupling Rubber Insert	1 year
5002-001	Circulating Blower / Three-Phase Motor - Shipped with Three-Phase <i>Processor</i>	1 year
5002-002	Circulating Blower / Single-Phase Motor - Shipped with Single-Phase <i>Processor</i>	1 year
5003-001	Check-Valve Assembly	1 year
5005-001	Membrane	1 year
5006-001	Membrane Housing, Complete	1 year
5006-011	O-Ring (2) Vertical Tube	1 year
5006-012	O-Ring (2) Base Insert	1 year
5006-013	O-Ring (2) Membrane	1 year
5007-004	Hydrocarbon Sensor	1 year
5008-001	Heat-Trace Cable	1 year
5008-002	Heat Trace Power Connection Kit	1 year
5008-003	Heat Trace End Seal Kit	1 year
5010-001	ECS Aluminum Cover	1 year
5012-100	Membrane Tubing	1 year
5012-101	Blower Inlet Tubing	1 year
5012-102	Blower Outlet Tubing	1 year
5012-103	Vacuum Pump Inlet Tubing	1 year
5012-104	Vacuum Pump Outlet Tubing	1 year
5012-105	HC Return Tubing	1 year
5012-106	HC Inlet Tubing	1 year
5012-107	Membrane Outlet Tubing	1 year
5013-001	Insulation	1 year
5015-001	HC Sentry Unit	1 year
5015-002	HC Sentry Interface Cable	1 year

Activating the Processor Warranty

Follow this process to activate the warranty on your *Processor*.

1. Make sure you have all the warranty paperwork. You should have:
 - ▶ A Warranty Card – See figure 1
 - ▶ A Post-Installation Checklist
 - ▶ A Post-Installation Power-Up Checklist.
2. Complete the Warranty Card
 - ▶ Completely fill out the card
 - ▶ Get the serial number of your *Processor* from the ECS Membrane Processor Sticker – See figure 2.
 - ▶ Make a copy of the card for your files.
 - ▶ Place the completed, original card in an envelope for return mailing to VST.
3. Be sure the contractor who installs the *Processor* fills out the Post Installation Checklist.
 - ▶ Go over the form to be sure the contractor has filled it out completely and signed the form.
 - ▶ Make 2 copies of the form:
 - Original goes to VST.
 - One copy stays with the GDF.
 - One copy goes to the contractor.
 - ▶ Place the completed, original form in an envelope for return mailing to VST.
 - ▶ Give one copy to the contractor.
 - ▶ Place a copy in your files.
4. Be sure the contractor who performs the *Processor's* initial Power-Up fills out the Post-Installation Power-Up Checklist
 - ▶ Go over the form to be sure the contractor has filled it out completely and signed the form.
 - ▶ Make 2 copies of the form:
 - Original goes to VST.
 - One copy stays with the GDF.
 - One copy goes to the contractor.
 - ▶ Place the completed, original form in an envelope for return mailing to VST.
 - ▶ Give one copy to the contractor.
 - ▶ Place a copy in your files.
5. Seal the envelope and mail the three forms to VST:
 - ▶ The completed Warranty Card.
 - ▶ The completed and signed Post-Installation Checklist.
 - ▶ The completed and signed Post-Installation Power-Up Checklist.
 - ▶ The VST mailing address is:
Vapor Systems Technologies, Inc.
650 Pleasant Valley Drive
Springboro, OH 45066

VST Contractor Requirements

Due to the highly volatile nature of gasoline and its handling and storage, VST requires the following certifications for its ASC's:

Level	Component	Authorized Tasks	Training Pre-Requisites
A Must be re-certified every two years	Hanging Hardware	Functional Testing Installation Maintenance Repair	No pre-requisite
A/B Must be re-certified every two years	Hanging Hardware	Functional Testing Installation Maintenance Repair	No pre-requisite
	Membrane Processor	Installation	Veeder-Root Level 1, 2/3, or 4 ASC certification
C Must be re-certified every two years	Membrane Processor	Annual Testing Component Replacement Maintenance Operation Post-Installation Power-Up Testing Start-Up Testing Troubleshooting	VST Level "A/B" Veeder-Root UST Monitoring Systems Level 2/3 or 4 Veeder-Root ASC w/VST PMC/ISD certification

NOTE:

Depending on local codes, in addition to the VST and Veeder-Root training, contractors may be required to take air-district training or ICC certification as an approved vapor-recovery installer.

- ASC's must be able to show proof of certification if asked. Carry the wallet card or have a copy of your certification on file with the GDF.
- The ASC must record his or her certification number on the applicable paperwork for all warranties to be deemed valid.
- Contractors should ALWAYS verify the training and certification requirements with the air-district staff BEFORE beginning installation of EVR systems.

Safety Icons

	<p>ELECTRICITY A potential shock hazard exists. High voltage is supplied to and exists in this device.</p>		<p>TURN POWER OFF Turn power off to the device and its accessories when installing and servicing the unit. Live power creates a potential spark hazard.</p>
	<p>EXPLOSIVE Gasoline and its vapors are extremely explosive if ignited.</p>		<p>NO POWER TOOLS Sparks from electric power tools can ignite gasoline and its vapors.</p>
	<p>FLAMMABLE Gasoline and its vapors are extremely flammable.</p>		<p>NO PEOPLE IN THE AREA Unauthorized people in the work area during installation and service of the device create a potential for personal injury.</p>
	<p>NO SMOKING Gasoline and its vapors can be ignited by sparks and embers of burning cigarettes.</p>		<p>READ ALL RELATED MATERIALS Read, understand, and follow all instructions, warnings, and requirements before you begin work.</p>
	<p>NO OPEN FLAMES Open flames from sources like lighters and matches can ignite gasoline and its vapors.</p>		<p>USE SAFETY BARRICADES Unauthorized people in the work area during installation and service of the device create a potential for personal injury. Therefore, always isolate your work area by using safety cones, barricades, etc.</p>
	<p>PINCH RISK Stay clear. Keeps hands and tools away from rotating machinery and moving parts.</p>		<p>ROTATING MACHINERY Stay clear. Keep hands and tools away from rotating machinery.</p>

Table of Terms & Abbreviations

ASC:	Authorized Service Contractor
AQMD:	Air Quality Management Districts
ATG:	Automatic Tank Gauge
CARB:	California Air Resources Board
CDFA:	California Department of Food & Agriculture
CVLD:	Continuous Vapor Leakage Detection, another name for Vapor Leak Detection
ECS:	Emissions Control System
EO:	Executive Order
EVR:	Enhanced Vapor Recovery
GDF:	Gasoline Dispensing Facility
HC:	Hydrocarbon
HC IR:	Hydrocarbon Infrared
ISD:	In-Station Diagnostics
MAG Probe:	A type (brand) of Tank Inventory Probe
NEC:	National Electric Code
NFPA:	National Fire Protection Association
ORVR:	On-Board Refueling Vapor Recovery
OSHA:	Occupational Safety Health Administration
Permeate:	Air return to atmosphere
PLC:	Programmable Logic Control
PMC:	Pressure Management Control
Retentate:	Vapor return to UST
RVP:	Reid Vapor Pressure
TLS:	Tank Level System
TLS Console:	Veeder-Root's line of environmental monitoring consoles.
TS:	Troubleshooting
Ullage:	Vapor space above liquid in a UST
UST:	Underground Storage Tank
VCK:	Vapor Collection Kit
Veeder Root:	Manufacturer of the TLS-350
VOC:	Volatile Organic Compounds
VST:	Vapor Systems Technologies, Inc. - manufacturer of the ECS Membrane <i>Processor</i>
WC:	Water Column

1 ECS Membrane Processor Overview

1.1 ECS Membrane Processor Theory of Operation

- The VST ECS membrane *Processor* does not interact directly with the other balance system hardware. It is in place to monitor and control the pressure in the UST to within limits specified by CARB.

Under conditions where the GDF is operational and the balance system hardware is functioning normally, the inherent ORVR compatibility of the balance system (when using VST's ENVIRO-LOC nozzle) will produce a predominately negative gauge pressure in the ullage space of the UST. Under these conditions the ECS membrane *Processor* will typically not need to operate.

During periods of less activity, the GDF being shut down overnight, winter fuels being present, or other conditions that promote the pressurization of the ullage space, the ECS membrane *Processor* will operate as needed to control the pressure in the ullage space to an accepted level. The ECS membrane *Processor* will turn on at an ullage pressure of +0.20 inches of water and turn it off at a pressure of -0.20 inches of water. Currently, the ECS membrane *Processor* unit is monitored and controlled through the PMC or ISD software.

- The ECS membrane *Processor* uses a type of membrane technology to enable it to selectively separate the components in the ullage vapor mixture.

Through a somewhat complex transport means, certain molecules will selectively travel in a stream from one side of the membrane to the other. This stream is referred to as the permeate stream.

In this case, predominate molecules transported across the membrane will be the primary constituents of air, which are oxygen, nitrogen, and water vapor. A small amount of the hydrocarbons present in the ullage mixture will also migrate across the membrane. Typically, permeate will contain less than 3.0% hydrocarbons. The result of this activity includes, fresh air vented to atmosphere, hydrocarbon vapors returned to the UST, and UST pressurization controlled to an acceptable level.

- The process of separation by the membrane is made possible by using two pumps, one low-pressure pump which circulates the ullage vapor mixture along one side of the membrane, and one high-vacuum pump, which creates the pressure differential needed to cause the permeate to transport across the membrane. These are the only moving parts in the system.

1.2 Overview of How the Processor Operates

- The Processor is a technology created for Gasoline Dispensing Facilities (GDF) to assist them in reducing the number of harmful emissions released to the atmosphere through the natural occurrence of gasoline vaporization.
- The table below lists the steps that the Veeder-Root TLS 350 and the software takes to control the Processor.

1.	<ul style="list-style-type: none"> • When the UST system pressure rises above +0.2"WC, the <i>Processor</i> turns ON.
2.	<ul style="list-style-type: none"> • Through the vapor inlet pipe connection at the <i>Processor</i>, the VOC vapor is drawn into the suction side of the blower.
3.	<ul style="list-style-type: none"> • The blower discharges the VOC vapor into the membrane housing.
4.	<ul style="list-style-type: none"> • Inside the membrane housing, the VOC vapor is separated in to two air streams: <ul style="list-style-type: none"> ▶ VOC depleted air (referred to as "air") ▶ Gasoline VOC vapor • The membrane is designed specifically for separating air from gasoline VOC vapor.
5.	<ul style="list-style-type: none"> • A vacuum pump draws the air from the membrane housing through a check valve.
6.	<ul style="list-style-type: none"> • A sample of the air flows through a hydrocarbon sensor to check the percent hydrocarbons.
7.	<ul style="list-style-type: none"> • From the vacuum pump, the air is vented to atmosphere via the air return.
8.	<ul style="list-style-type: none"> • The gasoline VOC vapor returns to the UST system via the vapor return.
9.	<ul style="list-style-type: none"> • When the UST system pressure drops below -0.2"WC, the <i>Processor</i> turns OFF.

1.3 Processor Dimensions and Weight

Part Number	Unit	Dimensions	Weight
VST-ECS-CS3-110	Single-Phase	L-39" x W-27" x H-43" Height includes 18" legs	385 lbs. Includes 24-lb. cover
VST-ECS-CS3-310	Three-Phase	L-39" x W-27" x H-43" Height includes 18" legs	350 lbs. Includes 24-lb. cover

1.4 Processor Components

PART #	DESCRIPTION
5001-001	Vacuum Pump/Three-Phase Motor - Shipped with Three-Phase <i>Processor</i>
5001-002	Vacuum Pump/Single-Phase Motor - Shipped with Single-Phase <i>Processor</i>
5001-003	Vacuum Pump Drive Coupling Rubber Insert
5002-001	Circulating Blower / Three-Phase Motor - Shipped with Three-Phase <i>Processor</i>
5002-002	Circulating Blower / Single-Phase Motor - Shipped with Single-Phase <i>Processor</i>
5003-001	Check-Valve Assembly
5005-001	Membrane
5006-001	Membrane Housing, Complete
5006-011	O-Ring (2) Vertical Tube
5006-012	O-Ring (2) Base Insert
5006-013	O-Ring (2) Membrane
5007-004	Hydrocarbon Sensor
5008-001	Heat-Trace Cable
5008-002	Heat Trace Power Connection Kit
5008-003	Heat Trace End Seal Kit
5010-001	ECS Aluminum Cover
5012-100	Membrane Tubing
5012-101	Blower Inlet Tubing
5012-102	Blower Outlet Tubing
5012-103	Vacuum Pump Inlet Tubing
5012-104	Vacuum Pump Outlet Tubing
5012-105	HC Return Tubing
5012-106	HC Inlet Tubing
5012-107	Membrane Outlet Tubing
5013-001	Insulation

1.5 Processor Auxiliary Components

PART #	DESCRIPTION
5015-001	HC Sentry Interface Module w/24VDC power supply
5015-002	HC Sentry Interface Cable

1.6 Explanation of VST Processor Model Numbers

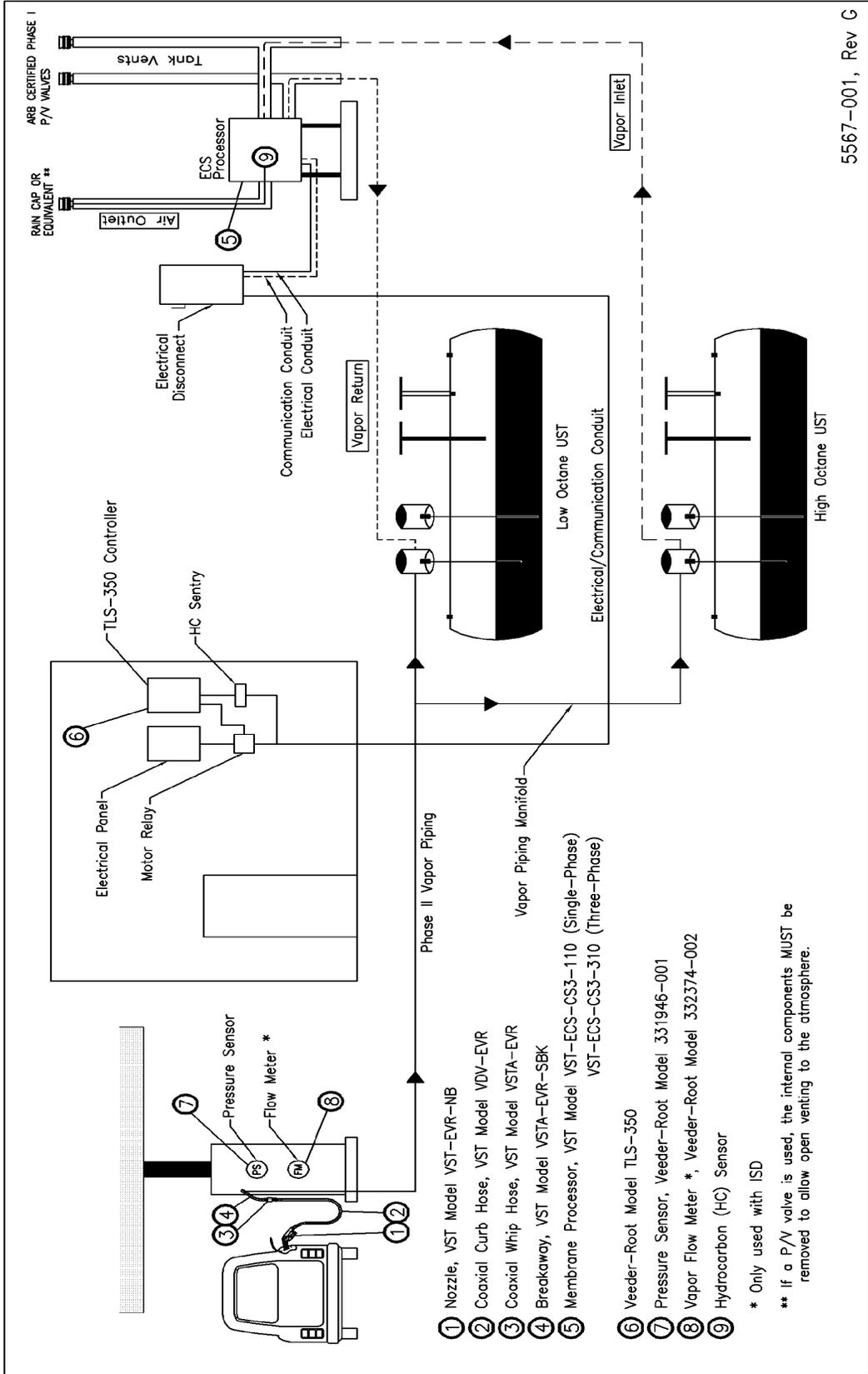
- The GDF owner can choose the model number of the *Processor* based on the electrical availability at the GDF.
 - ▶ All the electrical requirements are the same, except for the motors, where the choice is between single-phase and three-phase power.
- There are two choices of Processors:
 - ▶ VST-ECS-CS3-110: Single-Phase: The single-phase refers to the motor requirements.
 - ▶ VST-ECS-CS3-310: Three-Phase: The three-phase refers to the motor requirements.

1.7 Included with the Processor Package

- ECS Membrane Processor
- Bolted to a skid
- (4) 18” attached legs
- Attached aluminum cover
- Packaged with the processor in a separate, smaller box:
 - ▶ HC Sentry Module
 - ▶ 24-volt Power Supply
 - ▶ HC Sentry Interface Cable
- Owner package with warranty paperwork to be filled out and returned to VST in order to activate the warranty

1.8 Contractor-Supplied Components for the Processor

NOTE: This is not an exhaustive list. There may be more components the contractor will have to supply.	
<ul style="list-style-type: none"> • Motor Starters • Locking Ball Valves • Locks • Tees • Piping • Pipe Fittings • Electrical • Electrical Fittings • Conduit 	<ul style="list-style-type: none"> • Lockable Disconnect • Wires • Electrical Seal-Offs • Concrete • Veeder-Root TLS-350 • Veeder-Root PMC or ISD Software • Veeder-Root Pressure Sensor • Veeder-Root Flow Meters (ISD only)



5567-001, Rev G

Figure 3: How the Processor fits into the GDF layout

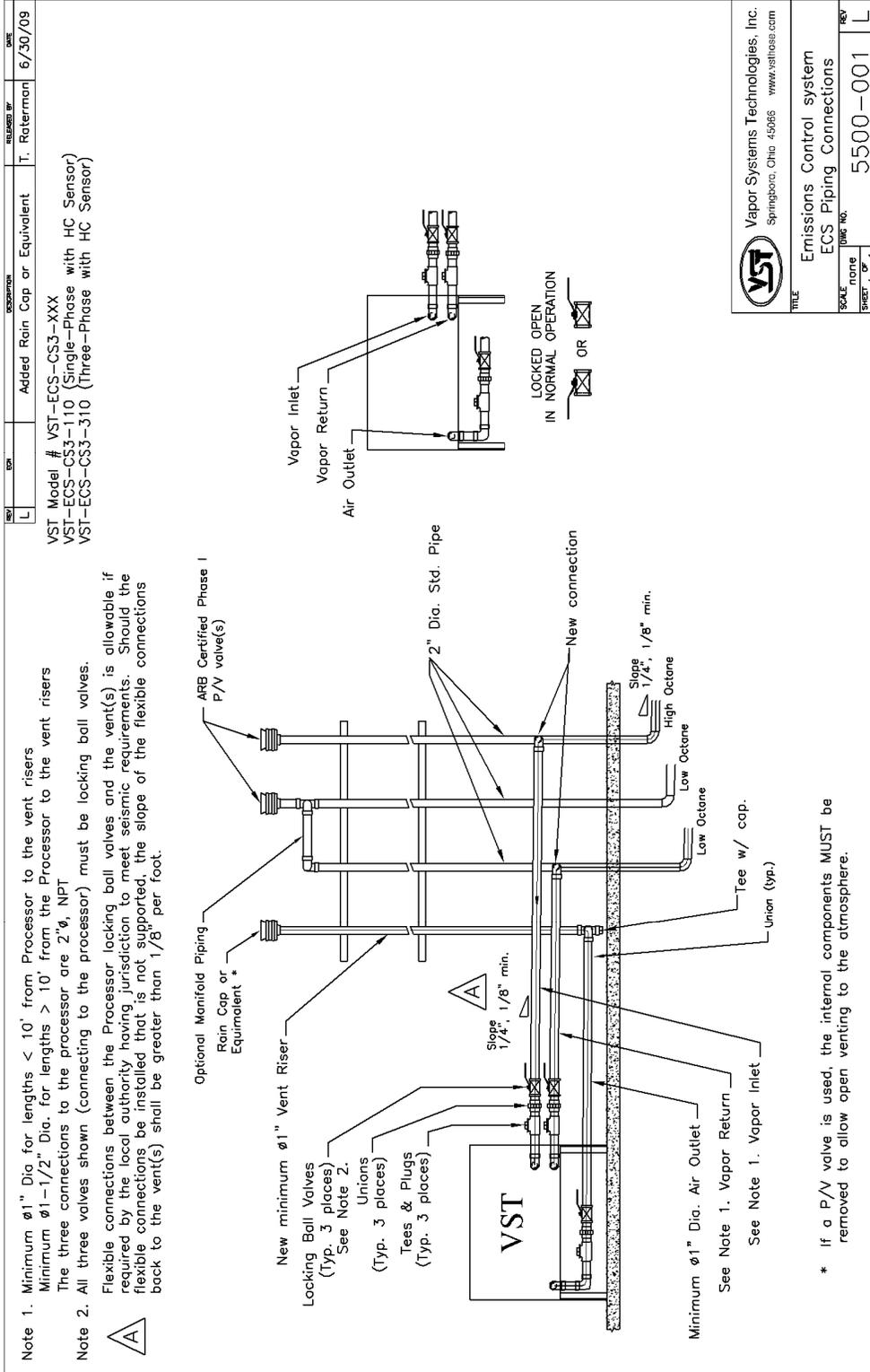
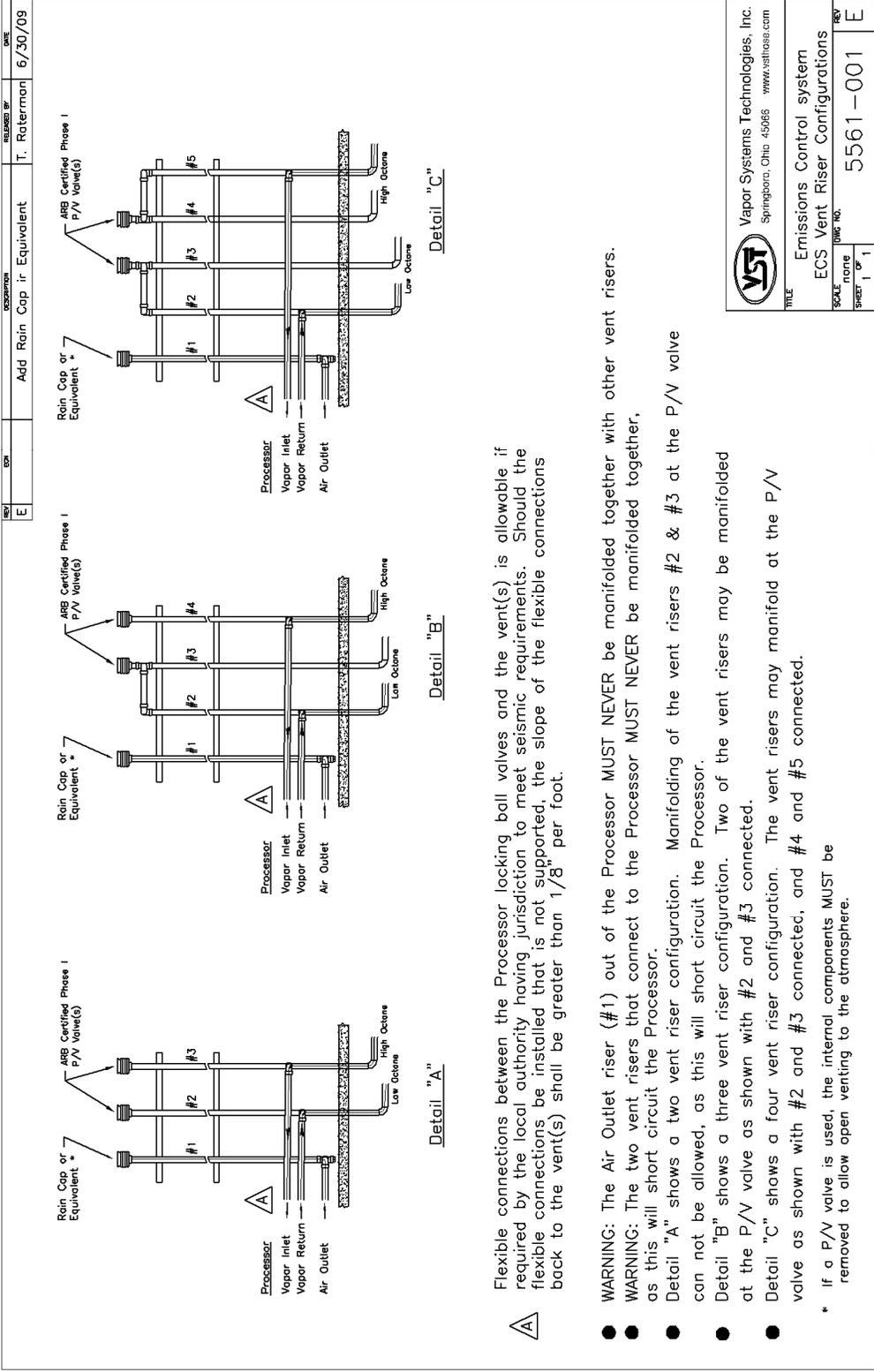


Figure 4: Processor Piping Diagram



Vapor Systems Technologies, Inc.
Springboro, Ohio 45985 - www.vstnss.com

TITLE
Emissions Control system
ECS Vent Riser Configurations

SCALE
NONE

FIG. NO.
5561-001

SHEET 1 OF 1

REV
E

Figure 5: ECS Vent Configurations

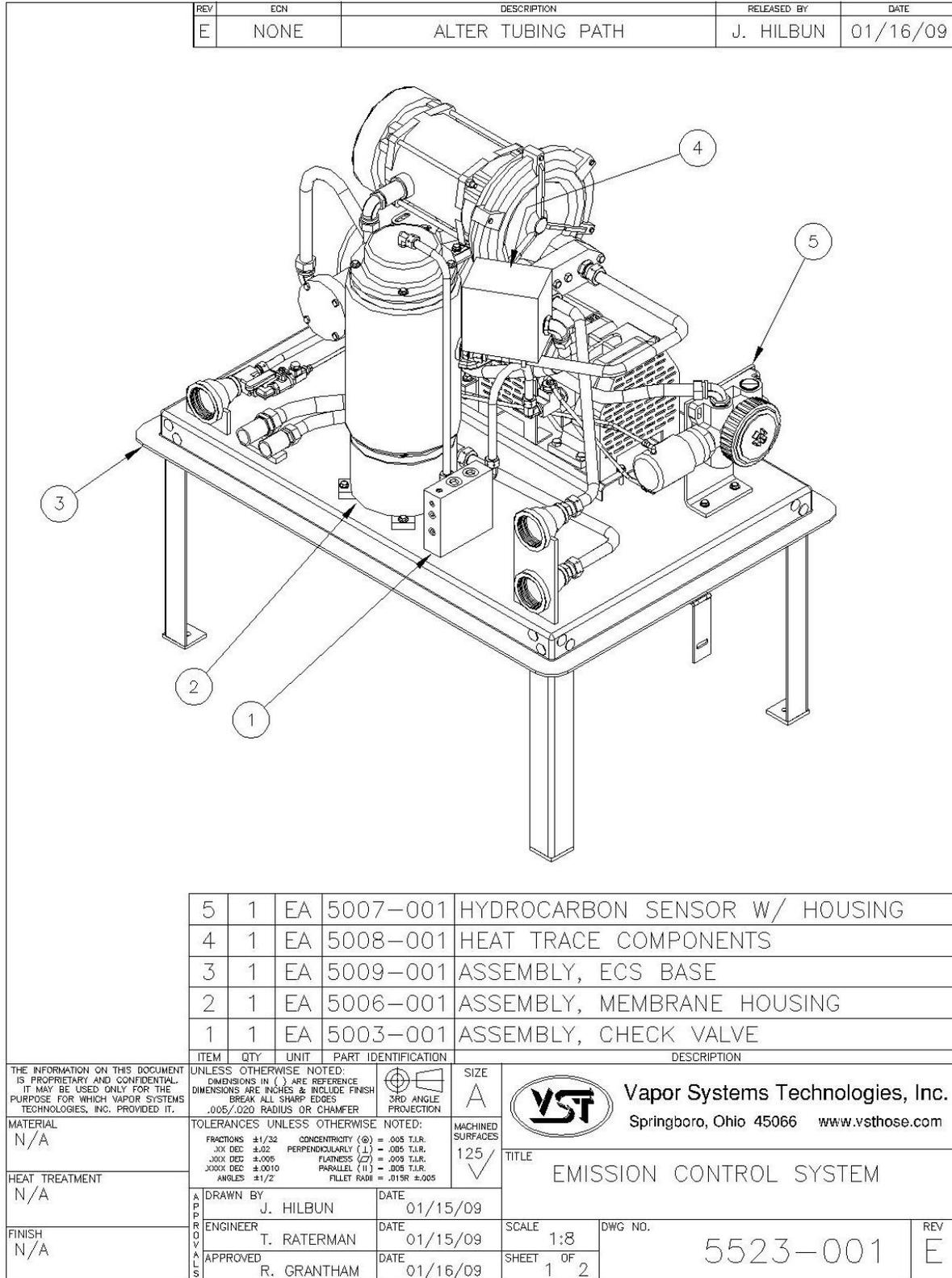


Figure 6: Processor Isometric Drawing (1 of 2)

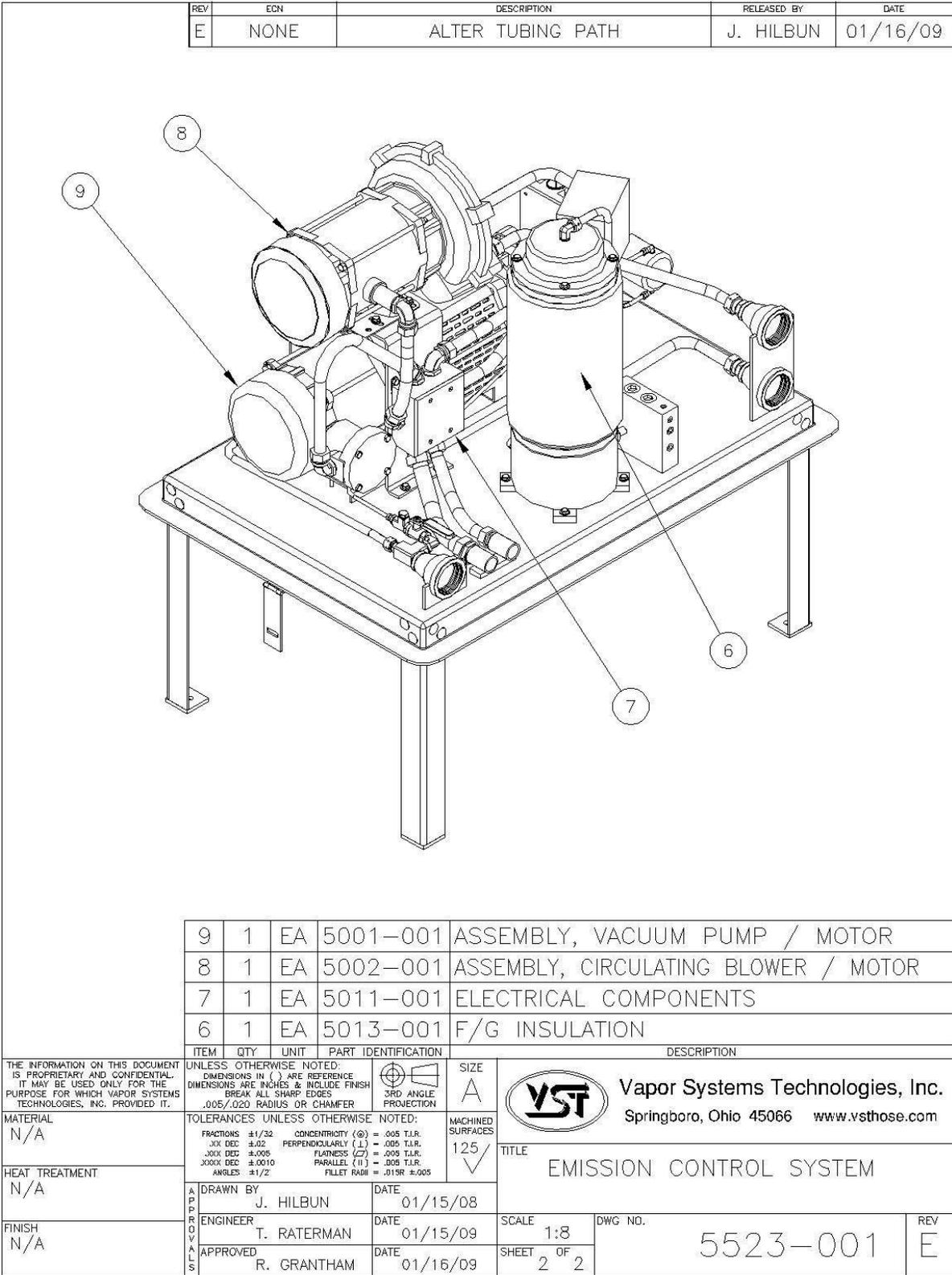


Figure 7: Processor Isometric Drawing (2 of 2)

2 Pre-Installation Site Survey

Vapor Systems Technologies, Inc. created a “Pre-Installation Site Survey,” as a guide to help certified installers and troubleshooters in the planning of an ECS Membrane *Processor* installation.

The “Pre-Installation Site Survey” is to be completely filled out in advance of an installation so that installation problems and delays are reduced or avoided.

You will find the “Pre-Installation Site Survey” on our website at www.vsthose.com.

3 How the Processor is Shipped

- The Processor is shipped with the following:
 - ▶ ECS Membrane Processor
 - ▶ Bolted to a skid
 - ▶ (4) 18” attached legs
 - ▶ Attached aluminum cover
 - ▶ HC Sentry Module
 - ▶ 24-volt power supply
 - ▶ HC Sentry Interface Cable
 - ▶ Owner package with warranty paperwork to be filled out and returned to VST in order to activate the warranty

4 Preparing the Processor for Installation

- Follow these steps to prepare the Processor for installation:
 1. Verify that all the items are in the shipping crate.
 2. Visually inspect all the items for any obvious damage.
 3. Before mounting the *Processor*, conduct the Pre-Installation *Processor* Leak Test.

Be sure to conduct a Pre-Installation *Processor* Leak Test before mounting the *Processor* to verify that the *Processor* is leak tight.

5 Pre-Installation *Processor* Leak Test

5.1 Purpose

- The purpose of the Pre-Installation Leak Test is to ensure that all of the tubing fittings and tubes located inside the ECS unit are leak-free prior to installation.

5.2 Preparation

- Follow these steps to prepare the ECS unit for the pre-installation leak test after the ECS unit is delivered to the GDF where it will be installed.
 1. Remove the packaging from the skid.
 2. Remove the cover from the ECS unit.

5.3 Functional Test Procedures

1. Place 2" NPT plugs in two of the pipe connection openings on the ECS unit. See Figure 8.
2. Install the Leak Test Fixture in the empty 2" pipe connection on the ECS unit. See Figure 9.
3. The leak check is conducted with 1.0 to 2.0 PSI nitrogen.
 - a. Make sure the isolation valve on the Leak Test Fixture is fully closed.
 - b. Make sure the Leak Test Fixture pressure regulator is fully closed.
 - c. Make sure the nitrogen regulator is set at a maximum of 10 PSI outlet pressure.
4. Slowly open the isolation valve on the test fixture to pressurize the ECS unit at 1.0 to 2.0 PSI compressed nitrogen.

CAUTION:

Pressurizing the ECS unit over a maximum of 5.0 PSI may cause damage to the ECS unit o-rings and/or pump seals, which will void all warranties of the ECS unit.

5. With the ECS unit pressurized between 1.0 to 2.0 PSI compressed nitrogen, spray a soapy solution on each fitting to check for bubbles:
 - a. If bubbles do not appear, the connection is tight.
 - b. If bubbles do appear, tighten the leaking fitting 1/8" turn (maximum) and re-check for leaks.
 - c. If the fitting cannot be tightened so that the connection is leak free, replace the 45° flare tube assembly that is leaking with a new tube assembly.
6. Continue this process until all the internal tube fittings have been checked and found leak free.
7. Once this test is complete and all the piping fittings are leak free, remove the compressed nitrogen connection to the Leak Test Fixture.
8. Remove the two 2" NPT plugs and the Leak Test Fixture.
9. The ECS Unit is now ready to install.



Figure 8: Processor Inlets & Outlets



Figure 9: Typical Leak Check Test Fixture

6 Site Requirements



Be sure to read and understand all site requirements before beginning an installation.

6.1 Regulations / Jurisdiction

- Under vapor recovery rules, air pollution control districts have primary authority for regulating GDF's.
 - ▶ Before modifying the facility, GDF operators should contact the local air district for specific information on local vapor-recovery requirements.
 - ▶ Contact information for local air pollution control districts is available on the air district permit to operate (PTO) and/or the California Air Pollution Control Officers Association (CAPCOA) website at <http://www.capcoa.org>.
- The area inside the *Processor* cover has been evaluated as a Class I, Division 2 hazardous area as defined by Underwriters Laboratory.
- The *Processor* must not be installed in a Class I, Division 1 or a Class I, Division 2 hazardous location as defined by the NEC (National Electric Code).
 - ▶ Because the area inside the *Processor* cover has been evaluated as a Class I, Division 2 hazardous location, be sure that all existing electrical seal-offs continue to meet NEC and NFPA requirements after installation of the *Processor*.

CAUTION

Always obtain approval from the local authority having jurisdiction.

Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

6.2 Snapshot of Site Requirements

<p><u>Local Air Pollution Control District</u></p> <ul style="list-style-type: none"> GDF must contact the local air pollution control district for specific local vapor-recovery requirements. <p><u>Ground-Mount Location</u></p> <ul style="list-style-type: none"> The local jurisdiction must allow the <i>Processor</i> to be placed on the ground. The <i>Processor</i> must be protected from damage. <i>Processor</i> must be located at least 10' from the property line. <i>Processor</i> must be within 100' of the vent risers. <p><u>Roof-Mount Location</u></p> <ul style="list-style-type: none"> The local jurisdiction must allow the <i>Processor</i> to be placed on the roof. Structure must be strong enough to hold the weight of the <i>Processor</i>: <ul style="list-style-type: none"> ▶ Three-phase 350 lbs. (Incl. alum. cover wt.). ▶ Single-phase 385 lbs. (Incl. alum. cover wt.). VST recommends a 18" perimeter around the <i>Processor</i> for maintenance and testing. The height of the <i>Processor</i> must be above the building parapet to allow for the proper vapor-piping slope. 	<p><u>Canopy-Mount Location</u></p> <ul style="list-style-type: none"> The local jurisdiction must allow the <i>Processor</i> to be placed on the canopy. Structure must be strong enough to hold the weight of the <i>Processor</i>: <ul style="list-style-type: none"> ▶ Three-phase 350 lbs. (Incl. alum. cover wt.). ▶ Single-phase 385 lbs. (Incl. alum. cover wt.). VST recommends a 18" perimeter around the <i>Processor</i> for maintenance and testing. All safety and code concerns have been addressed. <p><u>Three Phase Electric</u></p> <ul style="list-style-type: none"> 3 empty breaker spaces 208/230-460v panel for blower and vacuum pump motors. <ul style="list-style-type: none"> ▶ (1) 115v breaker for the heat-trace cable. ▶ (1) 115v outlet for the HC sentry. ▶ GFCI protected, weatherproof, 115v convenience outlet located at the <i>Processor</i> is optional. 2-hp vacuum pump / ½-hp blower. <p><u>Single Phase Electric</u></p> <ul style="list-style-type: none"> 2 empty 115v breaker spaces in the panel for the blower and vacuum pump motors. <ul style="list-style-type: none"> ▶ (1) 115v breaker for the heat-trace cable. ▶ (1) 115v outlet for the HC sentry. ▶ GFCI protected, weatherproof, 115v convenience outlet located at the <i>Processor</i> is optional. 2-hp vacuum pump / ½-hp blower. 	<p><u>Vent Risers</u></p> <ul style="list-style-type: none"> Recommended slope of ¼" per foot on all vapor-piping connecting the <i>Processor</i> to the vent risers or to any other UST connection. (VST requires a minimum of 1/8" per foot minimum slope for all vapor piping.) The maximum distance the <i>Processor</i> can be from the vent risers is 100-feet. Any type of trap, regardless of the <i>Processor</i> location, is not permitted in any vapor lines connected to the <i>Processor</i>. To install the <i>Processor</i>, there must be two vent risers connected at different locations to the UST's or to the underground vapor piping. If only one vent riser exists, another one must be added. Trenching to a UST or underground vapor piping is required in order to add the second vent riser. A 5' radius around the vent riser P/V valve is a Class I, Div. 2 hazardous area as defined in NFPA 70.
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Snapshot of Site Requirements, continued . . .

<p><u>UST Manifolding</u></p> <ul style="list-style-type: none"> • UST's must be manifolded below ground. • There must be at least two separate vent lines, which are not manifolded together. 	<p><u>Dispenser</u></p> <ul style="list-style-type: none"> • Must be a Balance dispenser. • The dispenser vapor piping must be sized adequately to meet the maximum pressure drop requirement, Item 1 of the Vapor Collection section. A minimum one inch (1") nominal internal diameter for the vapor down-pipe is recommended. <p><u>Veeder-Root Controls</u></p> <ul style="list-style-type: none"> • Must have TLS-350 with Veeder-Root software installed. 	<p><u>CARB Requirements</u></p> <ul style="list-style-type: none"> • VR-203 PMC • VR-204 ISD
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7 Ground Installation

7.1 Ground Installation Safety



- The *Processor* will be installed near locations where highly flammable and explosive gasoline vapors may be present.
- Installation of the ECS Membrane *Processor* must comply with the National Electric Code, federal, state and local codes, as well as other applicable safety codes.
- Use extreme caution due to the risk of fire or explosion, which could result in serious injury or even death.
- If you are working in an area where vehicle traffic may occur, always block off the work area during installation, testing, and service to protect yourself and others.
- Do not use power tools that can generate sparks if there is a risk of flammable or explosive vapors being present.
- Read and understand all materials related to installing, testing, and operating the *Processor* prior to installation.

7.2 Protecting the Processor

- Take measures to protect the *Processor* and external vapor piping from damage in areas near vehicle traffic with guards, such as concrete-filled bollards or guardrails.
 - ▶ Check local codes for protective-device guidelines before setting the bollards or guardrails.
- A fence should not be required since there is a lockable cover on the *Processor* with lockable hasps to prevent tampering. The contractor will provide the locks for the hasps.
- VST requires lockable ball valves be used at the inlet and outlet connections at the *Processor*.
 - ▶ VST does not include any locks or lockable valves for the *Processor*; therefore, the contractor must provide them.
 - ▶ Lockable ball valves used in this application must be compatible with gasoline and gasoline vapor. For further requirements, consult the lockable-valve installation instructions provided by the manufacturer.
- The *Processor* cover is designed and built to withstand snow accumulation, rain, and landscaping sprinklers.

7.3 Ground-Mount Location

- Location to property line: according to NFPA 30A, Section 10.1.7.1
“. . . in no case shall the vapor-processing equipment so protected be located within 3m (10-feet) of adjacent property lines that can be built upon.”
 - ▶ Local authorities may grant reduced distance depending on the specific circumstances
- To minimize the installation cost and to maximize operating efficiency, locate the *Processor* adjacent to the existing vent risers.
- All vapor-piping connecting to the *Processor* must be sloped away from the *Processor*. VST recommends 1/4" per foot slope. (VST requires a minimum of 1/8" per foot slope.)
- The *Processor* must be installed in accordance with the NEC and the NFPA standards.
- VST recommends a minimum clearance of 18" around the *Processor* for maintenance and testing.
- A new air outlet vent riser connected to the *Processor* must be installed to release air to the atmosphere.
- See Figure 5.

CAUTION

Always obtain approval from the local authority having jurisdiction. Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

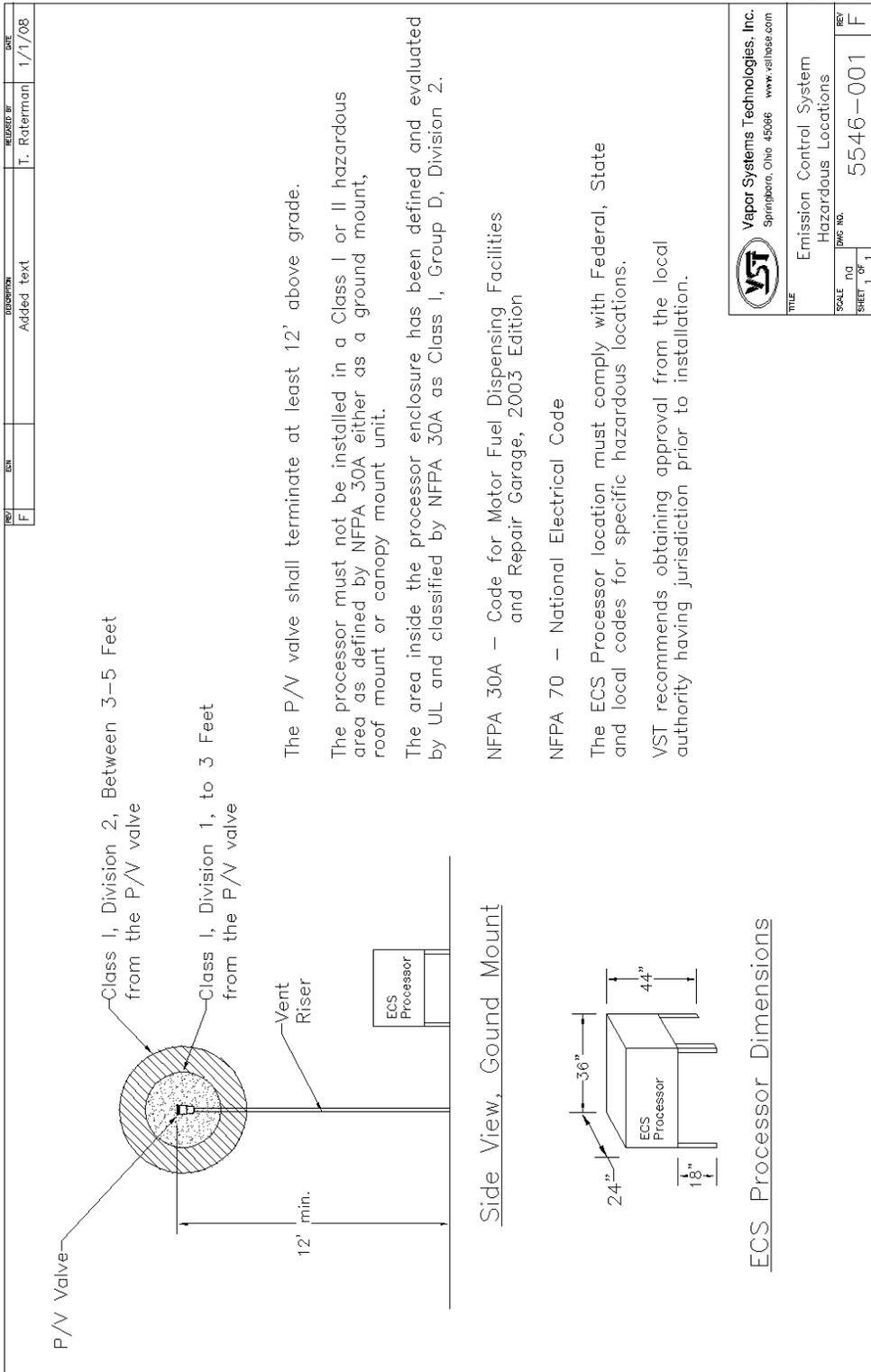


Figure 10: ECS Membrane Processor Hazardous Locations

7.4 Setting the Concrete Pad

- The *Processor* must be installed on a concrete pad, on grade, and permanently anchored to the concrete pad.
- The Processor CANNOT be installed directly on or anchored directly to asphalt. It must be installed and anchored directly to a concrete pad.
- The *Processor* can be installed on existing concrete, provided:
 - ▶ The existing concrete is of sufficient strength and thickness to support the *Processor*.
 - VST recommends a minimum of 6-inch thick concrete to accommodate 3 1/2" expansion-type anchor bolts.
 - Cracked concrete without re-bar may NOT be of sufficient strength to properly support the *Processor*.
 - ▶ The *Processor* is installed level.
- **NOTE: VST CANNOT BE HELD RESPONSIBLE FOR DAMAGE CAUSED BY IMPROPER PROCESSOR FOUNDATION SUPPORT.**
- VST does not provide any hardware to install the *Processor* on the pad.
- VST recommends using the minimum clearances listed below for maintenance and service:
 - ▶ Back: 18"
 - ▶ Front: 18"
 - ▶ Left: 18"
 - ▶ Right: 18"
- Concrete pad minimum dimensions:
 - ▶ 3'6" long x 2'6" wide
 - ▶ 6" thick (minimum)
 - ▶ See figure 11.
- Use steel re-enforced rebar in the pad for additional strength.
- Install the pad level.
- Install expansion-type bolts after completing the concrete pad. The bolts must be:
 - ▶ 3/8" diameter
 - ▶ Embedded 3 1/2" to 4" into the slab
 - ▶ Extend approx. 1 1/2" above the top of the slab

7.4.1 Processor Weight and Dimensions

Part Number	Unit	Dimensions	Weight
VST-ECS-CS3-110	Single-Phase	L-39" x W-27" x H-43" Height includes 18" legs	385 lbs. Includes 24-lb. cover
VST-ECS-CS3-310	Three-Phase	L-39" x W-27" x H-43" Height includes 18" legs	350 lbs. Includes 24-lb. cover

7.5 Installing the Processor on the Concrete Pad

7.5.1 Soil Conditions

- The soil must have the following capabilities:
 - ▶ Allowable bearing pressure: 1000 psf
 - ▶ Lateral bearing: 150 psf
 - ▶ Coefficient of sliding: 0.25

1	After the concrete has properly cured, install the expansion anchor bolts according to the manufacturer's recommendations.
2	For non-seismic applications, VST recommends using the HILTI KWIK BOLT, KB3 3/8" X 5" / item #00282524 as shown in Figure 12 or an approved equal.
3	<p>For applications that require expansion anchors that are especially suited to seismic and cracked concrete, VST recommends using the HILTI KWIK TZ (KB-TZ) BOLT, KB-TZ 3/8" X 5", (item number 00304583) or approved equal.</p> <ul style="list-style-type: none"> ▶ The contractor or design engineer is responsible for sizing the expansion anchors and the concrete pad to meet seismic and cracked concrete specifications required by local, state, and federal jurisdictions. ▶ Since seismic regulations may be different by location, VST has not included a specific drawing for this application. ▶ For seismic design reference, www.us.hilti.com.
4	After the appropriate anchor bolts have been installed, position the <i>Processor</i> onto the anchor bolts in the cement slab.
5	Bolt the <i>Processor</i> into place (according to the manufacturer recommended installation guidelines) with 3/8" galvanized lock washers and bolts that are included with the expansion bolt.

7.5.2 Following an Earthquake

- Insure the ECS unit is level.
- All piping fitting are leak free: conduct a leak check test as outlined in the ECS operations, maintenance, & startup manual.
- Check that all the electrical fitting and connections are tight.

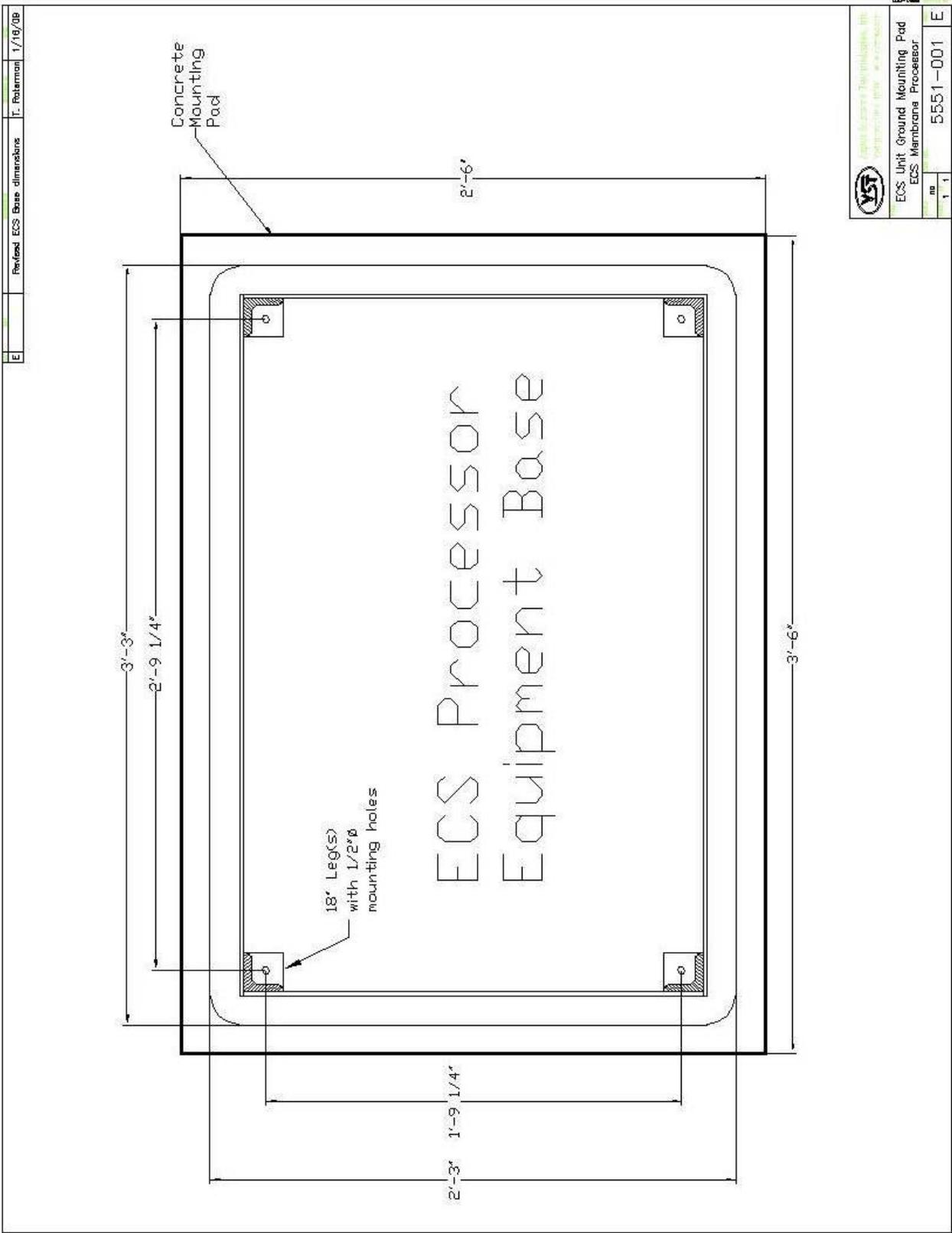


Figure 11: Concrete Mounting Pad Dimensions

8 Roof-Top Installation

8.1 Roof-Top Installation Safety



- The *Processor* will be installed near locations where highly flammable and explosive gasoline vapors may be present.
- Installation of the ECS Membrane *Processor* must comply with the National Electric Code, federal, state and local codes, as well as other applicable safety codes.
- Use extreme caution due to the risk of fire or explosion, which could result in serious injury or even death.
- If you are working in an area where vehicle traffic may occur, always block off the work area during installation, testing, and service to protect yourself and others.
- Do not use power tools that can generate sparks if there is a risk of flammable or explosive vapors being present.
- Read and understand all materials related to installing, testing, and operating the *Processor* prior to installation.

- The *Processor* may be installed on a station's roof provided the structure can support the weight of the *Processor*.

Part Number	Unit	Dimensions	Weight
VST-ECS-CS3-110	Single-Phase	L-39" x W-27" x D-43" Height includes 18" legs	385 lbs. Includes 24-lb. cover
VST-ECS-CS3-310	Three-Phase	L-39" x W-27" x D-43" Height includes 18" legs	350 lbs. Includes 24-lb. cover

- Location to property line: according to 2003 Edition of NFPA 30A, Section 10.1.6: Vapor-processing equipment shall be located "At least 3m (10 ft) from adjacent property lines that can be built upon."
 - ▶ Local authorities may grant reduced distance depending on the specific circumstances.
- The *Processor* must not be installed within 5' of a vent riser P/V valve.
- A 5' radius around the vent riser P/V valve is a Class I, Div. 2 hazardous area as defined in NFPA 70.
- All vapor-piping connecting to the *Processor* must be sloped away from the *Processor*. VST recommends 1/4" per foot slope. (VST requires a minimum of 1/8" per foot slope.)
- Any equipment located on the roof that is rated as Class I, Div. 2 cannot be located within 10' of the *Processor*, unless the equipment is at least 18" above the roof top.

CAUTION

Always obtain approval from the local authority having jurisdiction. Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

- The *Processor* must be installed in accordance with the NEC and the NFPA standards.
- VST recommends a minimum clearance of 18" around the *Processor* for maintenance and testing.
- Due to a variety of roof construction designs, VST cannot recommend how the *Processor* should be mounted on the roof; however, the *Processor* must be installed at a height allowing the piping inlet and outlets to be above or through the building parapet.
- The *Processor* is shipped on 18" legs bolted on the base, but the legs may be removed and the *Processor* secured to a steel structure attached to the roof.
- A new air outlet vent riser connected to the *Processor* must be installed to release air to the atmosphere.

9 Canopy Top Installation

9.1 Canopy Top Installation Safety



- The *Processor* will be installed near locations where highly flammable and explosive gasoline vapors may be present.
- Installation of the ECS Membrane *Processor* must comply with the National Electric Code, federal, state and local codes, as well as other applicable safety codes.
- Use extreme caution due to the risk of fire or explosion which could result in serious injury or even death.
- If you are working in an area where vehicle traffic may occur, always block off the work area during installation, testing, and service to protect yourself and others.
- Do not use power tools that can generate sparks if there is a risk of flammable or explosive vapors being present.
- Read and understand all materials related to installing, testing, and operating the *Processor* prior to installation.

- The *Processor* may be installed on a station’s canopy provided the structure can support the weight of the *Processor*.

Part Number	Unit	Dimensions	Weight
VST-ECS-CS3-110	Single-Phase	L-39" x W-27" x D-43" Height includes 18" legs	385 lbs. Includes 24-lb. cover
VST-ECS-CS3-310	Three-Phase	L-39" x W-27" x D-43" Height includes 18" legs	350 lbs. Includes 24-lb. cover

- Location to property line: according to 2003 Edition of NFPA 30A, Section 10.1.6: Vapor-processing equipment shall be located
 - ▶ “At least 3m (10 ft) from adjacent property lines that can be built upon.”
Local authorities may grant reduced distance depending on the specific circumstances.
- The *Processor* cannot be installed within 5’ of a vent riser P/V valve.
- A 5’ radius around the vent riser P/V valve is a Class I, Div. 2 hazardous area as defined in NFPA 70.
- All vapor-piping connecting to the *Processor* must be sloped away from the *Processor*. VST recommends ¼” per foot slope. (VST requires a minimum of 1/8” per foot slope).
- The *Processor* must be installed in accordance with the NEC and the NFPA standards.

CAUTION

Always obtain approval from the local authority having jurisdiction.

Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

- VST recommends a minimum clearance of 18" around the *Processor* for maintenance and testing.
- Due to a variety of canopy construction designs, VST cannot recommend how the *Processor* should be mounted on the canopy.
- All safety and code concerns should be taken into consideration prior to a canopy-top installation.
- The *Processor* is shipped on 18" legs bolted on the base, but the legs may be removed and the *Processor* secured to a steel structure attached to the canopy or to the roof top.

NOTE: THE MINIMUM PIPING SLOPE MUST ALWAYS BE MAINTAINED.

- A new air outlet vent riser connected to the *Processor* must be installed to release air to the atmosphere.

10 Vapor Piping

10.1 Vapor Piping Safety



- The *Processor* will be installed near locations where highly flammable and explosive gasoline vapors may be present.
- Installation of the ECS Membrane *Processor* must comply with the National Electric Code, federal, state and local codes, as well as other applicable safety codes.
- Use extreme caution due to the risk of fire or explosion which could result in serious injury or even death.
- If you are working in an area where vehicle traffic may occur, always block off the work area during installation, testing, and service to protect yourself and others.
- Do not use power tools that can generate sparks if there is a risk of flammable or explosive vapors being present.
- Read and understand all materials related to installing, testing, and operating the *Processor* prior to installation.

10.2 Piping Connection Material

- All connections to the *Processor* must be galvanized pipe.

10.3 Piping Connections to the Processor

- There are 3 piping connections to be made to the *Processor*:
 1. Vapor inlet from the UST vapor-piping system
 2. Vapor return back to the UST vapor-piping system
 3. Air outlet to atmosphere
- The typical installation will have:
 - ▶ The *Processor* vapor inlet connected to the high-grade UST vent.
 - ▶ The *Processor* vapor return connected to the low-grade UST vent.
 - ▶ The *Processor* vapor air outlet vent riser is to be added next to the existing UST vent risers if possible.

CAUTION

Always obtain approval from the local authority having jurisdiction.

Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

10.3.1 Flexible Connections

- Flexible connections between the *Processor* locking ball valves and the vent riser(s) are allowable if required by the local Authority Having Jurisdiction to meet seismic requirements.
- Should the flex connection be installed such that it is not supported, the slope of the flex connection from the *Processor* back to the vent riser(s) shall be greater than the 1/8" / foot slope required for the rest of the one-inch galvanized piping.
- The flexible connector must be UL approved for a service station above-ground application.
- The local contractor is responsible to provide all necessary galvanized piping, non-hardening UL-classified pipe joint compound and plumbing fittings.
- This requirement may apply for ground, rooftop, and canopy-mount locations.

10.4 Trenching

- The *Processor* may be installed without any trenching provided:
 - ▶ There are at least 2 vent risers connected to the UST's.
 - ▶ The vent-riser piping connecting to the UST's will not short circuit the *Processor*.
- Trenching will be required if only one vent riser exists at the GDF to connect the *Processor* to the UST's.
 - ▶ When one vent riser exists at a GDF, trenching is required to return the concentrated vapor from the *Processor* to the UST's.
 - ▶ The existing vent riser will be used as the "Vapor Inlet" connection to the *Processor*.
 - ▶ A new vent riser must be installed that connects the *Processor* to the UST's.
 - The connection pipe must be a minimum of 2" ID for all underground piping.
 - All new piping must be sloped back to the UST's.
 - VST recommends a 1/4" per foot slope away from the *Processor* for all vapor piping connecting the *Processor* to the UST vent risers or to any other UST connection points. A minimum of 1/8" slope is required by VST.
 - The connection location to the UST's must be configured to prevent short-circuit of the inlet vapor piping to the *Processor*.
 - The connection should be used as the "Vapor Return" piping returning the concentrated vapor from the *Processor* to the Low Octane UST.

10.5 Underground Vapor Piping Instructions

- From the dispenser to the UST:
 - ▶ A minimum of 2" ID is acceptable unless the dispenser lines are manifolded together.
 - ▶ Manifolded dispenser lines require a minimum 3" ID piping, including the float-vent valve, if applicable.
 - ▶ Check the "Vapor-Recovery Piping Configurations" section of Exhibit 2 for Underground Piping Requirements.

- From the UST to the vent riser
 - ▶ Stations that use only one vent riser require a minimum of 3" ID vapor piping and will require trenching as well.
 - ▶ Stations that use multiple risers require a minimum of 2" ID vapor piping.

- From the *Processor* vapor return to the UST
 - ▶ When new underground piping is required from the *Processor* vapor return to the low octane UST, VST requires a minimum of 2" ID piping.

CAUTION

Always obtain approval from the local authority having jurisdiction.

Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

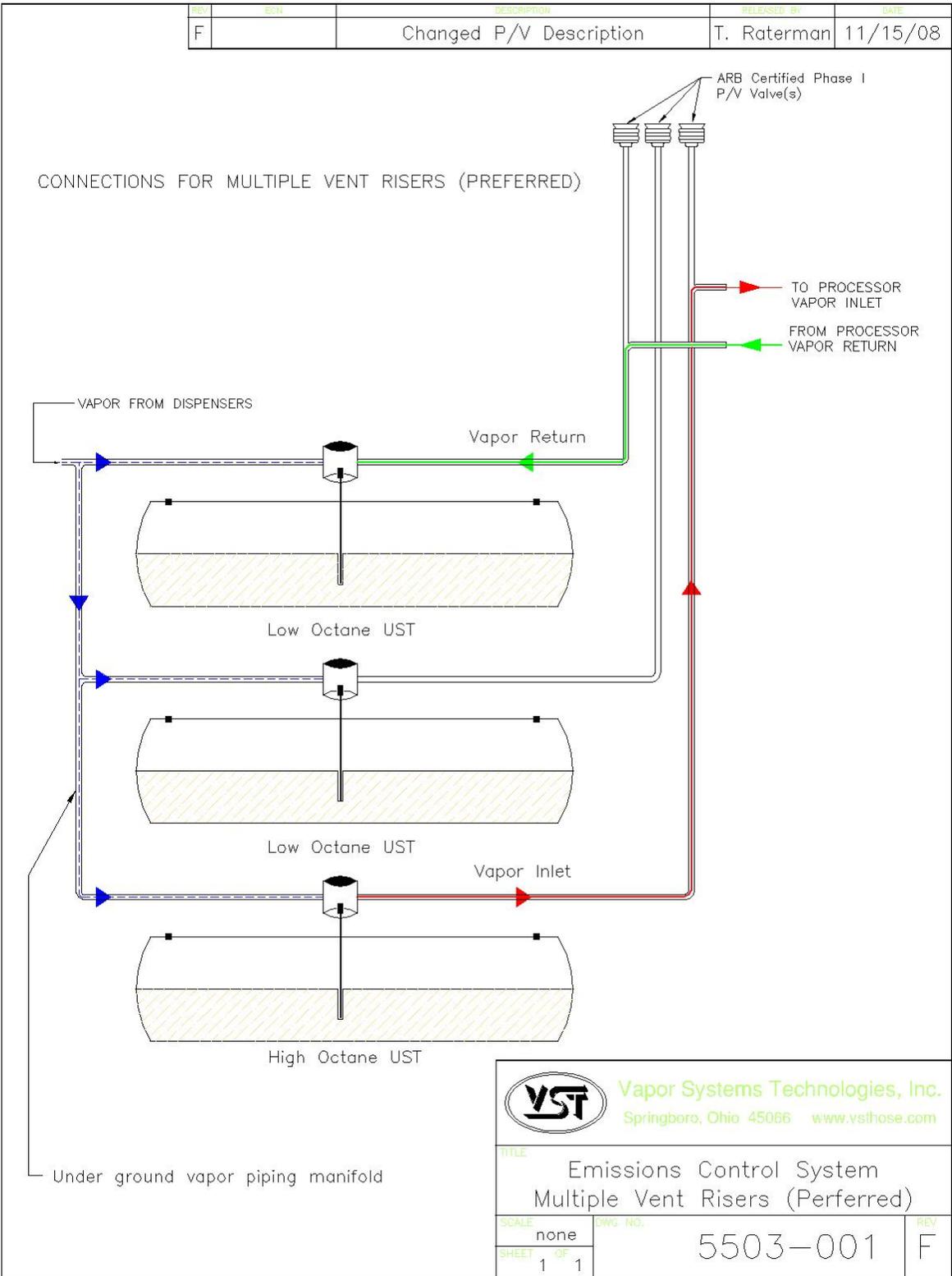


Figure 13: Processor Connections with Multiple Vent Risers

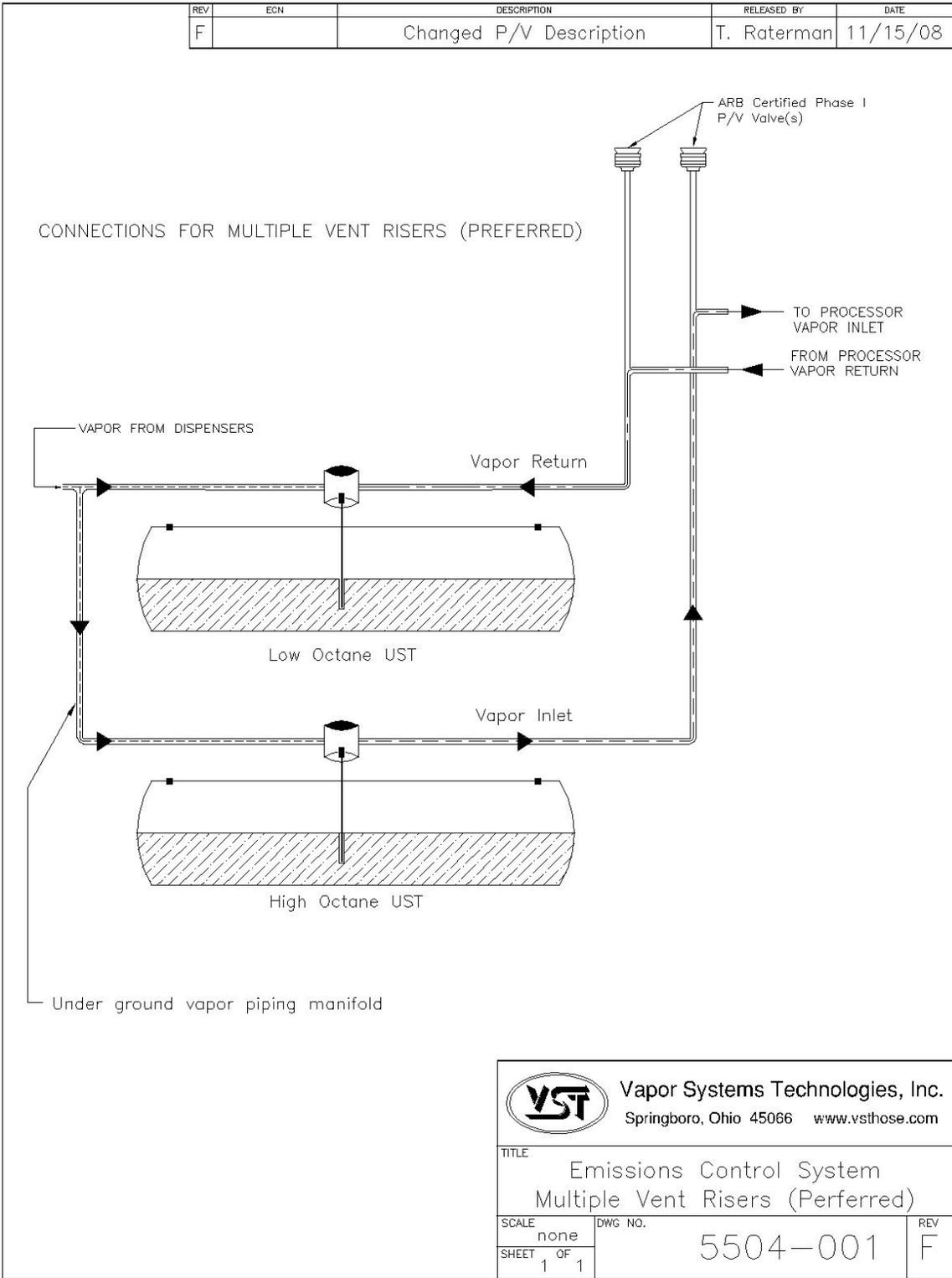


Figure 14: Processor Connections with 2 Vent Risers

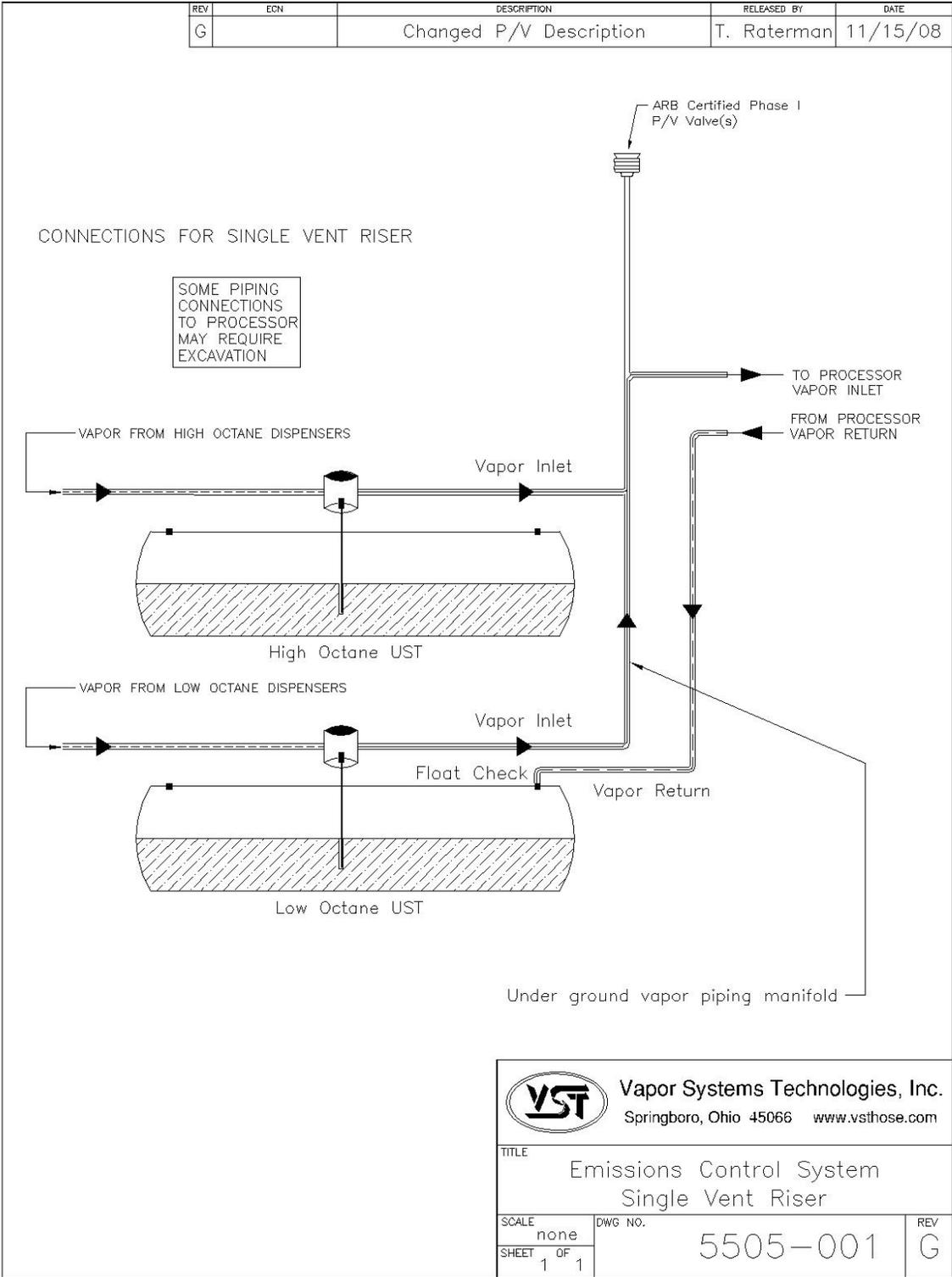
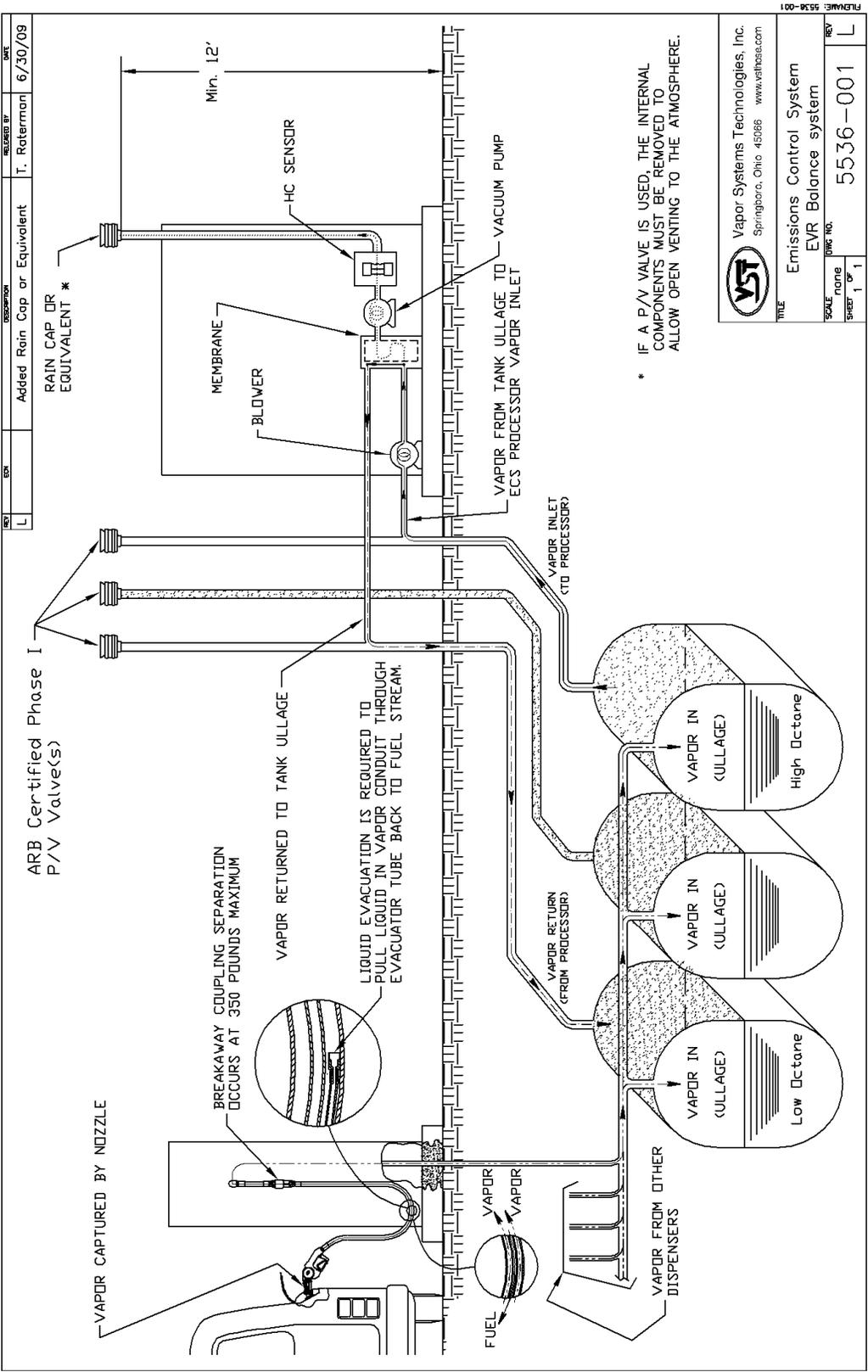


Figure 15: Processor Connections with Single Vent Riser



10.6 Vapor Inlet and Vapor Return Connections

- Install a minimum 1" galvanized pipe between the *Processor* and the vent riser(s) if the distance between the *Processor* and the vent riser is less than 10'.
 - If the distance between the *Processor* and vent risers is greater than 10', use a minimum 1 ½" diameter pipe.
 - See Figure 17 for pipe size requirements.
 - When new underground piping is required from the *Processor* to the low-octane UST, a minimum of 2" ID piping is required.
 - Order of installation:
 1. Processor
 2. Tee (sized for the pipe diameter)
 3. Ball Valve (sized for the pipe diameter)
 4. Union (sized for the pipe diameter)
 5. Vent Riser
- The tee and the ball valve allow for isolation of the *Processor* from the vapor-piping system for maintenance and testing. See Figure 17.
- Provide a slope for the piping from the *Processor* of at least ¼" per foot.
 - ▶ VST requires a minimum slope of 1/8" per foot.
 - Verify that all piping connections are leak tight.
 - Connect the vapor inlet and vapor return for the *Processor* to existing vent risers provided there are multiple vent risers connecting to individual USTs.
 - Install new tees in the existing vent risers for connection to the *Processor* vapor inlet & outlet.
 - Take note that pipe connecting vent risers to the *Processor* **MUST** slope away from the *Processor* towards the vent risers.

10.6.1 Flexible Connections

- Flexible connections between the Processor locking ball valves and the vent riser(s) are allowable if required by the local Authority Having Jurisdiction to meet seismic requirements.
- Should the flex connection be installed such that it is not supported, the slope of the flex connection from the Processor back to the vent riser(s) shall be greater than the 1/8" / foot slope required for the rest of the one-inch galvanized piping.
- The flexible connector must be UL approved for a service station above-ground application.
- The local contractor is responsible to provide all necessary galvanized piping, non-hardening UL-classified pipe joint compound, and plumbing fittings.
- This requirement may apply for ground, rooftop, and canopy-mount locations.

11 Air Outlet Connection

- Install a minimum 1" tee and 1" lockable ball valve between the *Processor* and the new vent riser in the order of:

1. Processor
2. Tee (sized for the pipe diameter)
3. Ball Valve (sized for the pipe diameter)
4. Union (sized for the pipe diameter)
5. Vent Riser



See Figure 17.

- Be sure to follow the same height and location criteria for the additional vent riser that has been used for the existing vent pipes.
 - ▶ The tee and the valve allow for isolation of the *Processor* from the vapor-piping system for maintenance and/or testing as needed.
 - ▶ Verify that all piping connections are leak tight.
- Install a new tee with a cap at the bottom of the new air outlet vent riser to provide for drainage.
- Install the new dedicated vent riser so that the discharge opening is a minimum of 12-feet above grade and a minimum of 1" diameter.
- Be sure to slope the air outlet vent-riser discharge pipe downward away from the *Processor*.
 - ▶ VST recommends a $\frac{1}{4}$ " per foot slope away from the *Processor* for all vapor piping connecting the *Processor* to the UST vent risers or to any other UST connection points. A minimum of $\frac{1}{8}$ " slope is required by VST.
- A rain cap or equivalent valve must be installed on the air outlet vent riser to shield against rain and reduce noise. If a PV vent valve is used, the internal components should be removed to allow open venting to the atmosphere.
- The air outlet discharge creates a hazardous location per the NFPA 30A, therefore:
 - ▶ Class I, Group D, Division 1 is within 3 feet in all directions of the vent opening.
 - ▶ Class I, Group D, Division 2 is within 3 to 5 feet in all directions of the vent opening.
- The new vent riser may be installed next to the existing vent risers.

11.1 Flexible Connections

- Flexible connections between the Processor locking ball and the vent riser(s) are allowable if required by the local Authority Having Jurisdiction to meet seismic requirements.
- Should the flex connection be installed such that it is not supported, the slope of the flex connection from the Processor back to the vent riser(s) shall be greater than the 1/8" / foot slope required for the rest of the one-inch galvanized piping.
- The flexible connector must be UL approved for a service station above-ground application.
- The local contractor is responsible to provide all necessary galvanized piping, non-hardening UL-classified pipe joint compound and plumbing fittings.
- This requirement may apply for ground, rooftop, and canopy-mount locations.

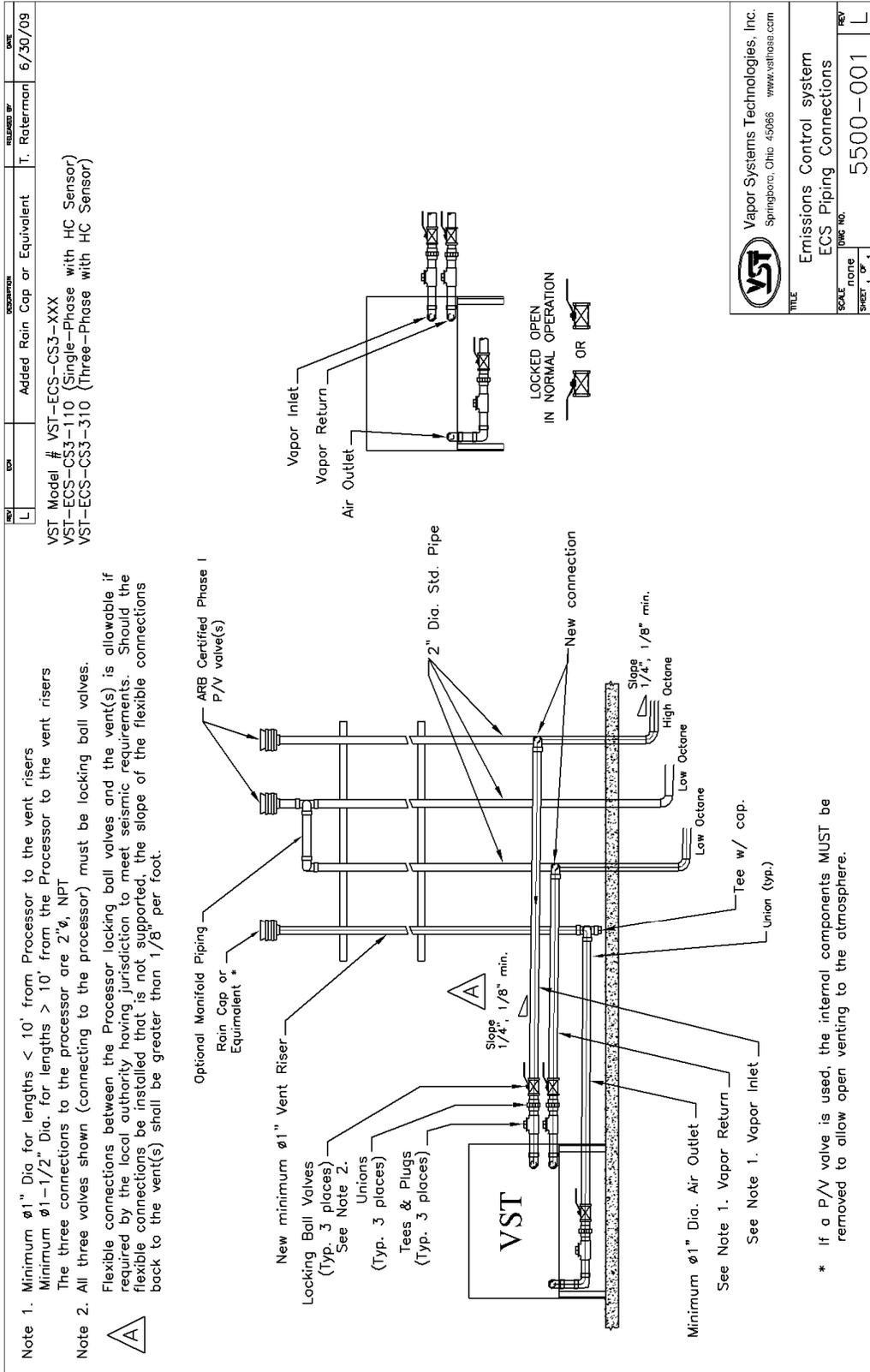
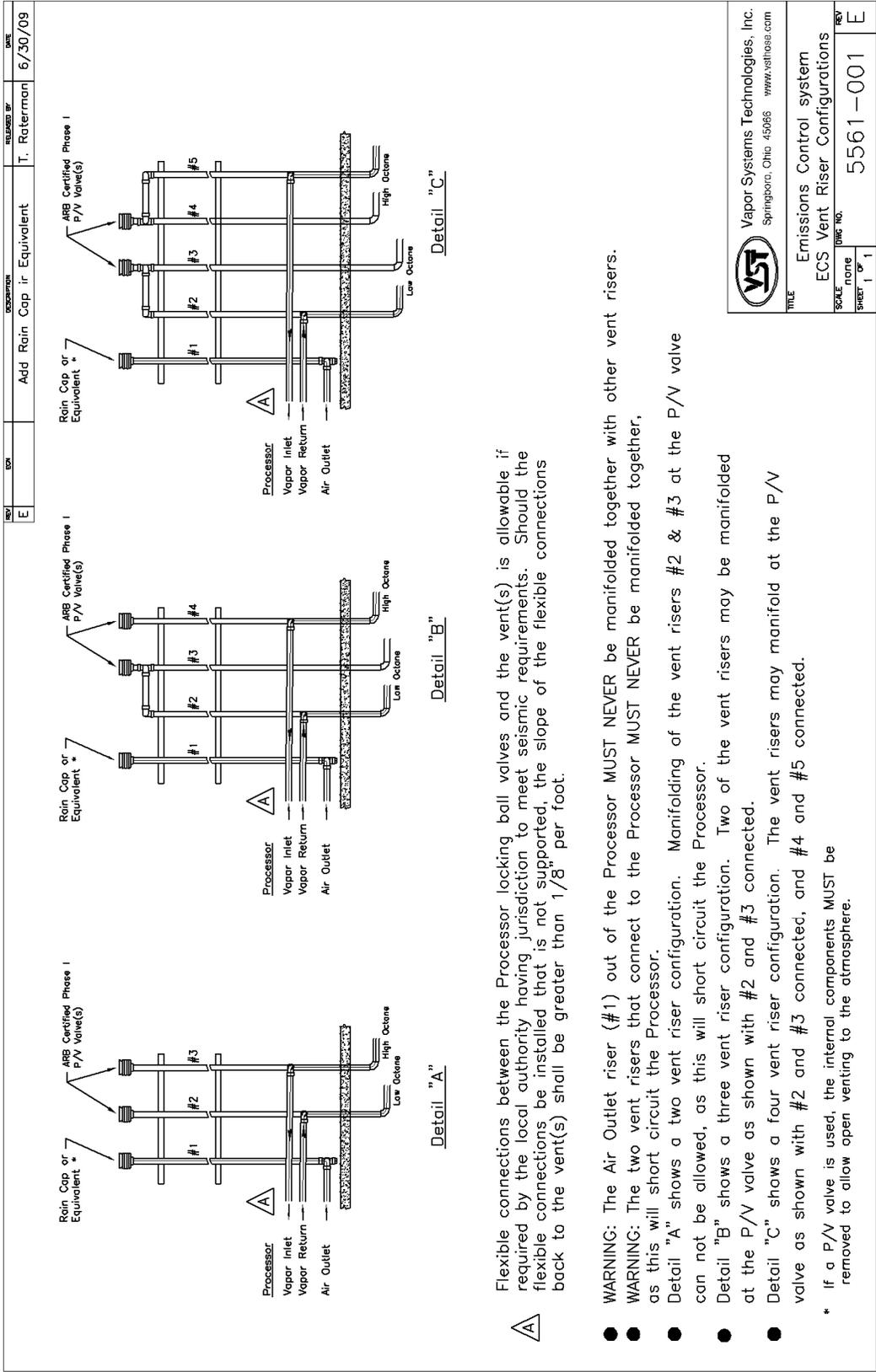


Figure 17: ECS Processor Piping Diagram



VST Vapor Systems Technologies, Inc. Springboro, Ohio 45066 www.vstohio.com	TITLE Emissions Control system ECS Vent Riser Configurations
SCALE 1" = 1'	DRAWING NO. 5561-001
SHEET 1 OF 1	REV E

Figure 18: ECS Vent Configuration

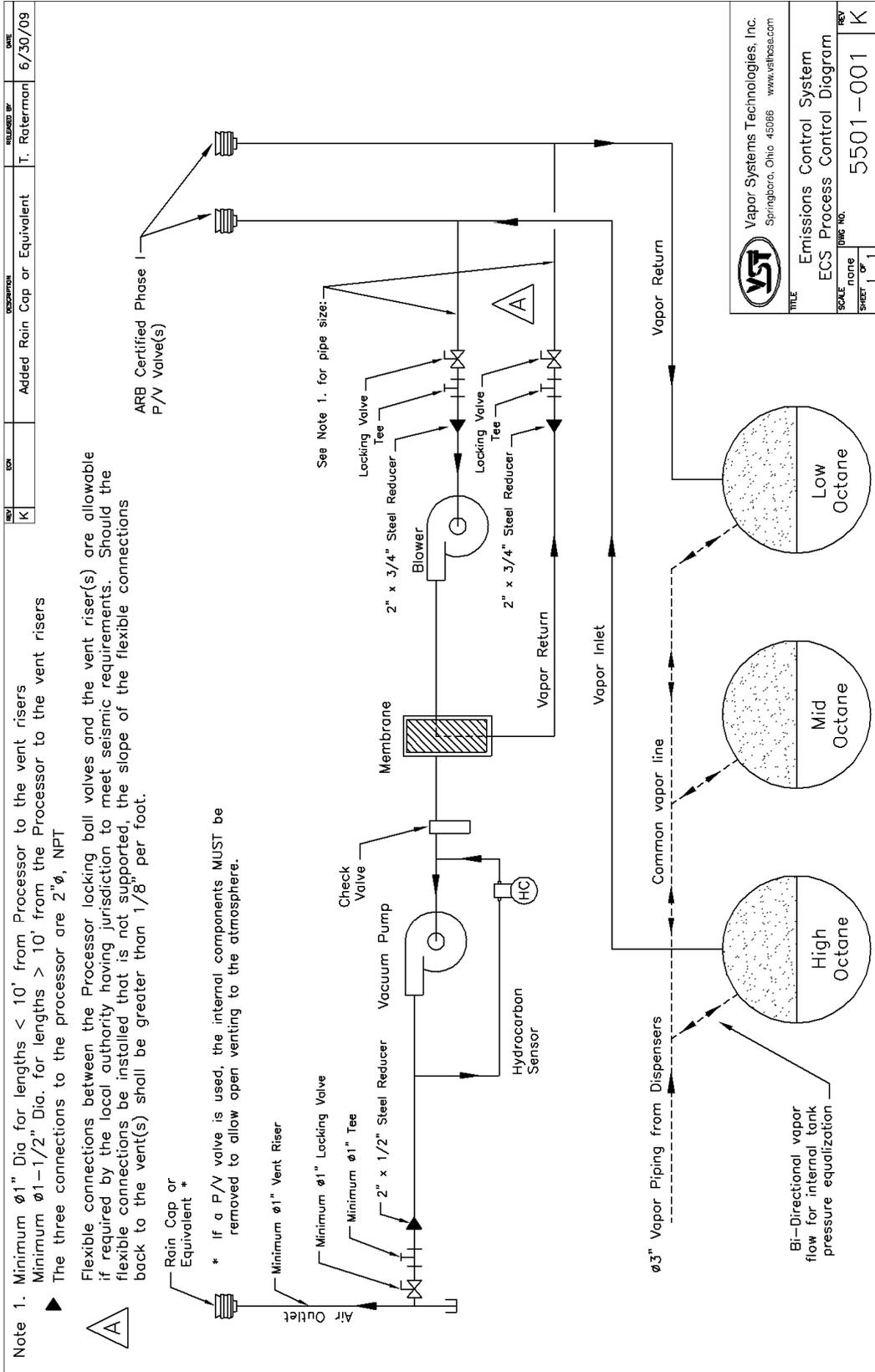


Figure 19: Processor Piping Connections

11.2 Underground Piping Connection

- Provide a slope for the vapor piping for drainage. VST recommends a ¼" per foot slope for all vapor piping. A minimum of 1/8" slope is required by VST.
- Meet all CP-201 size and slope requirements for all underground piping.
 - ▶ To avoid the possibility of an underground liquid trap, never use flexible vapor piping.
 - ▶ VST recommends a Wet Blockage Test on the vent piping to guarantee there are no unknown traps in the vapor piping. Methodology 6 of TP-201.4.
- All underground vapor piping must be a minimum of 2" NPT.
 - ▶ Always check with local authorities for applicable requirements; larger pipe size may be required.
- Refer to pipe-size requirements in Exhibit 2, Executive Orders VR/203 and VR/204.

11.3 Storage Tank Vapor Manifolds

- Storage tanks must be vapor manifolded below ground.

11.4 P/V Valves

- The P/V valve for each vent riser (not including the *Processor* air outlet) is part of the Phase I system, and therefore must be a CARB-certified component.
- A rain cap or equivalent must be installed on the air outlet vent riser to shield against rain and reduce noise. If a P/V vent valve is used, the internal components must be removed to allow open venting to the atmosphere. The air outlet rain cap or equivalent is not regulated by CARB and does not need to be tested by AQMD's.

CAUTION

Always obtain approval from the local authority having jurisdiction.

Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

12 Electrical

12.1 Electrical Safety



- The *Processor* uses lethal voltages and operates in areas where gasoline vapor may be present.
- Serious injury or death from electrical shock, fire, or explosion may result if the power is ON during installation, testing, or maintenance.
- Be sure to use Lockout/Tag-Out procedures when working on or installing the *Processor* or while working on electrical components.
- Always power OFF any electrical components connected to the *Processor*. The *Processor* can start automatically.
- Do not use tools that can generate sparks if there is risk of flammable or explosive vapors being present.
- Read and understand all materials related to installing, testing, and operating the *Processor* prior to installation.

12.2 Single-Phase Processor

- A lockable, safety disconnect-switch is not included with the *Processor*.
 - ▶ NEC code requires that a readily accessible lockable, safety disconnect-switch be installed within sight of the *Processor*.
 - ▶ VST recommends installing the lockable, safety disconnect-switch approximately 3-feet from the *Processor* for testing and inspection reasons.
- At the main breaker, size the motor panel breaker according to the table below. Make sure the total amperage includes both motors.

Single-Phase Power Requirements				
Motor	HP	Phase	Voltage	Amperage
Blower	.5	Single	115	9.8
			230	4.9
Vacuum Pump	2	Single	115	24
			230	12

Table 1: Single-Phase Motor Power Requirements

- The contractor is to supply a lockable circuit breaker in accordance with local, state, and national authorities.
- It is mandatory to follow standard lock-out/tag-out procedures when performing service on the *Processor*.

- Following such procedures may be required by local, state, and national authorities.
 - ▶ You must install the *Processor* in accordance with the National Electric Code (NEC), NFPA 70, and with the Automotive and Marine Service Station Code (NFPA30A).
 - ▶ According to NFPA 30A and the California Fire Code:

“Electrically energized vapor-recovery equipment shall be directly connected to and controlled by the emergency pump shut off in Section 5202.4.7.” See figure 22.
- The contractor shall supply 115v motor starter(s) with a 115v relay coil to start/stop the single-phase motors.

12.2.1 Power Requirements for Single-Phase Electrical Service

- 115v/230v, single-phase, 60Hz (blower and vacuum pump motors).
 - ▶ See Table 1 for the motor amperage.
- 115v breaker (heat-trace cable power).
 - ▶ 115v, 2-amp service to power the heat trace.
- 115v, 2-amp minimum service to power a dedicated outlet for the 24VDC power supply for the HC sensor and the HC sentry.
- The ECS motor-starter relay(s) connects to the TLS.
- The ECS motor-starter relay(s) can be located inside the GDF or at the *Processor*, depending on the electrical design.

12.3 Three-Phase Processor

- A circuit disconnect device is not included with the *Processor*.
 - ▶ NEC code requires that a readily accessible lockable, safety disconnect-switch be installed within sight of the *Processor*.
 - ▶ VST recommends installing the lockable, safety disconnect-switch approximately 3-feet from the *Processor* for testing and inspection reasons.
- At the main breaker use a 208/230-460v, 3-phase, 60Hz electric service.
 - ▶ See Table 2 for the motor amperage.
- The contractor is to supply a lockable circuit breaker in accordance with local, state, and national authorities.
 - ▶ It is mandatory practice to follow standard lock-out / tag-out procedures when performing service on the unit.
- Following such procedures may be required by local, state, and national authorities.
 - ▶ You must install the *Processor* in accordance with the National Electric Code (NEC), NFPA 70, and with the Automotive and Marine Service Station Code (NFPA30A).
 - ▶ According to NFPA 30A and the California Fire Code:

“Electrically energized vapor-recovery equipment shall be directly connected to and controlled by the emergency pump shut off in Section 5202.4.7.” See figure 27.

- The contractor shall supply a 208/230-460v motor starter(s) with a 115v relay coil to start / stop the three-phase motors.

12.3.1 Power Requirements for Three-Phase Electrical Service

- See Table 2 for the motor amperage.
 - ▶ 208/230-460v, 3-phase, 60Hz (blower and vacuum pump motors).
- Size the motor panel breaker according to the table below. Make sure the total amperage includes both motors.

Three-Phase Power Requirements				
Motor	HP	Phase	Voltage	Amperage
Blower	.5	Three	208	2.4
			230	2.2
			460	1.1
Vacuum Pump	2	Three	208	7.5
			230	6.8
			460	3.4

Table 2: Three Phase Motor Power Requirements

- 115v breaker (heat-trace cable power)
 - ▶ 115v, 2-amp minimum service to power the heat trace
- 115v, 2-amp service to power a dedicated outlet for the 24VDC power supply for the HC sensor and the HC sentry
- The ECS motor-starter relay(s) connects to the TLS.
 - ▶ 115V, 2 amp service to power the motor-starter relay coil.
- The ECS motor-starter relay(s) can be located inside the GDF or at the *Processor*, depending on the electrical design.

12.4 Reference Information for Processor Power Requirements

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

- The HC sentry must be installed indoors in the GDF's electrical room.
- All electrical/control components must be installed per the NEC, with clear access for personnel.
- The area inside the *Processor* cover is classified as a Class I, Division 2 hazardous area as defined by UL. All electrical components inside the *Processor* are rated for this hazardous area. The *Processor* must not be installed in a Class I, Division 1 or Class I, Division 2 hazardous location as defined by the NEC.
- Because the area inside the *Processor* cover is defined as a Class I, Division 2 hazardous location, be sure that all existing electrical seal-offs continue to meet NEC and NFPA requirements after installation of the *Processor*.
- NEC code requires a lockable, safety disconnect-switch be installed. VST does not provide an outside electrical disconnect for the *Processor*. The NEC requires an electrical lockable, safety disconnect-switch be connected to the *Processor* with respect to the panel location. Consult the NEC as to the correct location and type of disconnect.
- Install the *Processor* in accordance with the National Electrical Code (NFPA 70) and the Automotive and Marine Service Station Code (NFPA 30A).
- According to NFPA 30A and the California Fire Code:

“Electrically energized vapor-recovery equipment shall be directly connected to and controlled by the emergency pump shut off in Section 5202.4.7.”

See figure 22 and figure 27, which are the Processor ESO (Emergency Shut-Off) wiring diagrams.

- Because of multiple ways to install the electrical based on cost, the level of motor protection, electrical components used, placement of such electrical components, and local jurisdiction requirements, this manual presents just the basic electrical requirements for the ECS Membrane *Processor*.
- Internal motor automatic thermal re-sets or thermostat:

Phase	Included	
Single Phase	Blower	yes
	Vacuum Pump	yes
Three Phase	Blower	yes
	Vacuum Pump	yes

12.5 Power for the Motors

12.5.1 Single-Phase Processor

- Breakers rated at 115v, single-phase power the two electric motors in the *Processor*.
 - ▶ This breaker should be a delayed-trip motor starting type.
 - ▶ See Figure 20.
 - ▶ See Figure 21.
 - ▶ See Figure 22.

- Single-phase motors wiring diagrams:
 - ▶ See Figure 23 for the vacuum pump single-phase motor wiring diagram
 - ▶ See Figure 24 for the blower single-phase motor wiring diagram

12.5.2 Three-Phase Processor

- Breakers rated at 208/230-460v (three-phase), power the two electric motors in the *Processor*.
 - ▶ This breaker should be a delayed-trip motor starting type.
 - ▶ See Figure 25.
 - ▶ See Figure 26.
 - ▶ See Figure 27.

- Three-phase motors wiring diagrams:
 - ▶ See Figure 28 for the vacuum pump three-phase motor wiring diagram.
 - ▶ See Figure 29 for the blower three-phase motor wiring diagram.

12.5.3 Power for the HC Sensor in both the Single-Phase and the Three-Phase Processor

- 115v, 2-amp dedicated service to power the 24VDC power supply for the HC sensor and HC sentry.

CAUTION

Always obtain approval from the local authority having jurisdiction.

Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

12.6 Power for the Heat-Trace Cables in both Single-Phase and Three-Phase Processors

- 115v circuit powers the heat-trace cable.
 - ▶ The negative side of the circuit is off a common neutral with a common ground inside the electrical enclosure located inside the *Processor*.

12.7 Power for the Motor Starter Relay Coil

- 115v circuit provides power to the relay coil.

12.8 Optional Convenience Outlet at the **Processor**

- An optional convenience outlet located near the *Processor* may be installed for powering tools and test equipment.

CAUTION: The optional convenience outlet located near the Processor CANNOT be installed in a Class 1, Div. 2 hazardous area.

- ▶ The wires for the convenience outlet can go in the same conduit as the motor power wires.
- Seal-offs are required as per NFPA 70 for a conduit run leaving a Division 2 location to an unclassified location.
 - ▶ Install as required by the NEC and Local Authority having Jurisdiction.
- Other seal-offs may be necessary based on the installation and site specifics.

13 Electrical Installation

13.1 Electrical Safety



- The *Processor* uses lethal voltages and operates in areas where gasoline vapor may be present.
- Serious injury or death from electrical shock, fire, or explosion may result if the power is ON during installation, testing, or maintenance.
- Be sure to use Lockout/Tag-Out procedures when working on or installing the *Processor* or while working on electrical components.
- Always power OFF any electrical components connected to the *Processor*. The *Processor* can start automatically.
- Do not use tools that can generate sparks if there is risk of flammable or explosive vapors being present.
- Read and understand all materials related to installing, testing, and operating the *Processor* prior to installation.

13.2 Electrical Installation Code Requirements

- According to NFPA 30:
“Electrical wiring and electrical utilization equipment shall be a type specified by and be installed in accordance with NFPA 70. Electrical wiring and electrical utilization equipment shall be approved for the locations in which they are installed.”
- All electrical wiring and electrical utilization equipment must be installed to meet federal, state, and local codes.
- Flexible electrical conduit connections to the Processor may be required by local jurisdictions to meet seismic code requirements.

13.2.1 Single-Phase Processor Configuration

- The ECS motor-starter relay can be installed inside the GDF’s electrical room or at the *Processor*, depending on the electrical design.
- Install properly-sized conduit from the electrical room to a lockable, safety disconnect-switch (located near the *Processor*).
- From the disconnect switch to the *Processor*:
 - ▶ The first ¾” rigid conduit is for the 115v vacuum pump and blower motors. It is also for 115v power for the heat trace cable.
 - ▶ The second ¾” rigid conduit is for 24VDC and HC signal control wiring.

If you are using existing conduit, it is acceptable by VST to run the electrical and the communications through the same conduit, provided that the local jurisdiction authorizes doing so.

BE SURE TO CHECK WITH LOCAL AUTHORITIES.

13.2.2 Three-Phase Processor Configuration

- The ECS motor-starter relay can be installed inside the GDF's electrical room or at the *Processor*, depending on the electrical design.
- Install properly-sized conduit from the electrical room to a lockable, safety disconnect-switch (located near the *Processor*).
- From the disconnect switch to the *Processor*:
 - ▶ The first $\frac{3}{4}$ " rigid conduit is for 208/230-460v vacuum pump and blower motors. It is also for 115v power for the heat trace cable.
 - ▶ The second $\frac{3}{4}$ " rigid conduit is for 24VDC and HC signal control wiring.

If you are using existing conduit, it is acceptable by VST to run the electrical and the communications through the same conduit, provided that the local jurisdiction authorizes doing so.

BE SURE TO CHECK WITH LOCAL AUTHORITIES.

13.2.3 Single and Three-Phase Processors

- Install the electrical / communications conduit(s) sized to meet NEC and local code standards from the electrical room to a lockable, safety disconnect-switch.
 - ▶ THE NEC REQUIRES THAT A LOCKABLE, SAFETY DISCONNECT-SWITCH BE LOCATED NEAR THE PROCESSOR.
 - ▶ Flexible electrical conduit connections to the Processor may be required by local jurisdictions to meet seismic code requirements.

- Install either one or two $\frac{3}{4}$ " diameter conduit connections on the *Processor*.
 - ▶ There are two $\frac{3}{4}$ " diameter conduit connections on the *Processor*.
 - ▶ The contractor may decide to use either one or both of these conduits depending on:
 - The configuration of the electrical switch
 - Single phase or three phase *Processor*
 - Size of the wire used in the *Processor*

13.2.4 Wiring between the Processor and components:

- All wiring (208/203-460 VAC and 24 VDC) to be TFFN or THHN with 600 V insulation.
- All wiring must be gasoline and oil resistant.
- VST provides the 24VDC power supply for the HC Sentry module.
 - ▶ The 24VDC power-supply plugs into a dedicated 115v outlet.
 - ▶ The 115v outlet must be located within 3-feet of the HC sentry module.
- The HC sensor receives 24VDC power from the HC sentry module, and the HC sentry module receives 4-20 mA control signal from the HC sensor.
 - ▶ One cable contains the 24VDC power and 4-20 mA signals.
 - ▶ The cable must be a minimum 3 conductor, 18 AWG, twisted pair with a shielded ground.
 - ▶ The isolated ground is connected to the HC Sentry. The HC Sentry receives power from a separate 115V circuit.
- Run two ground wires from the electrical panel:
 - ▶ 1st ground wire is the equipment ground.
 - ▶ 2nd ground wire is an electrical ground.
 - ▶ Both grounds must be a minimum 12 AWG (follow all NEC requirements for equipment grounding).

- Wiring the 208/230-460v or 115/230V power for the motors is a minimum 14 AWG:
 - ▶ Sizing must comply with NEC requirements for motor load and wiring distance.
 - ▶ Larger gauge wire may be necessary based on conductor length and voltage supplied by the load center.
- NEC recommends a maximum conductor voltage drop of 3%, but notes that with a conductor voltage drop of 5%, most devices should operate with acceptable efficiency.

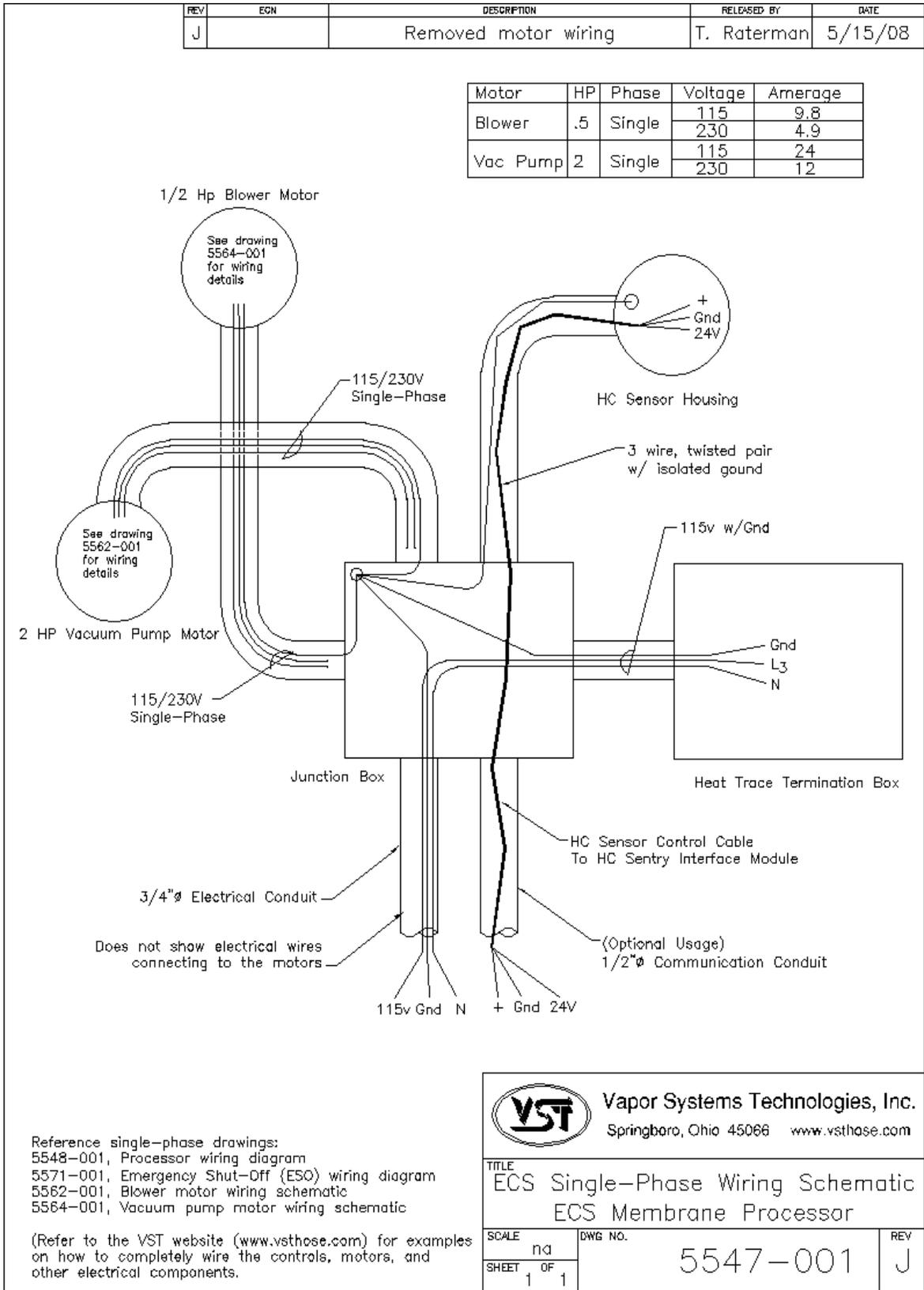


Figure 20: Single-Phase Wiring Schematic

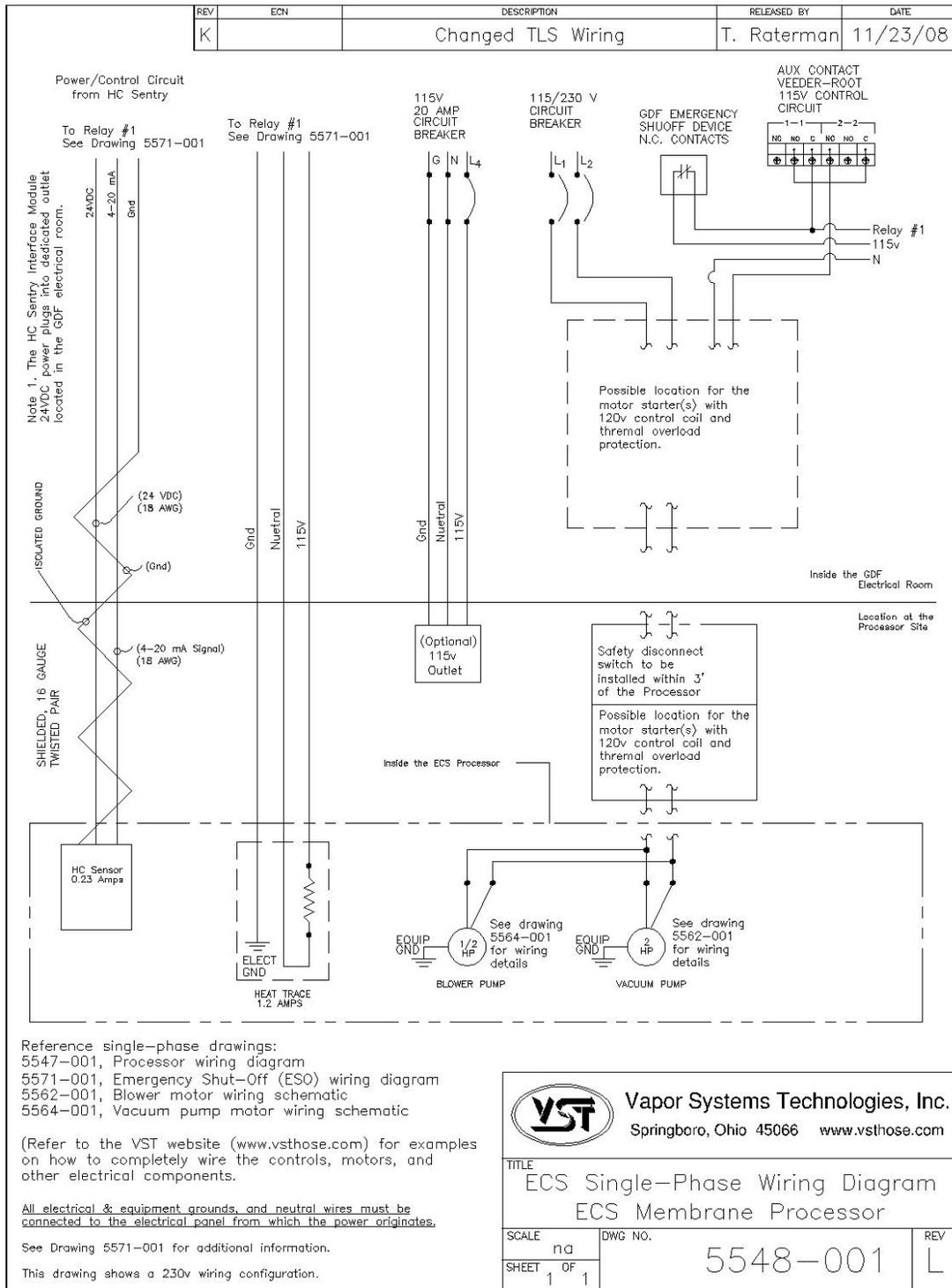


Figure 21: Processor Single-Phase Wiring Diagram

FILENAME: 5562-001

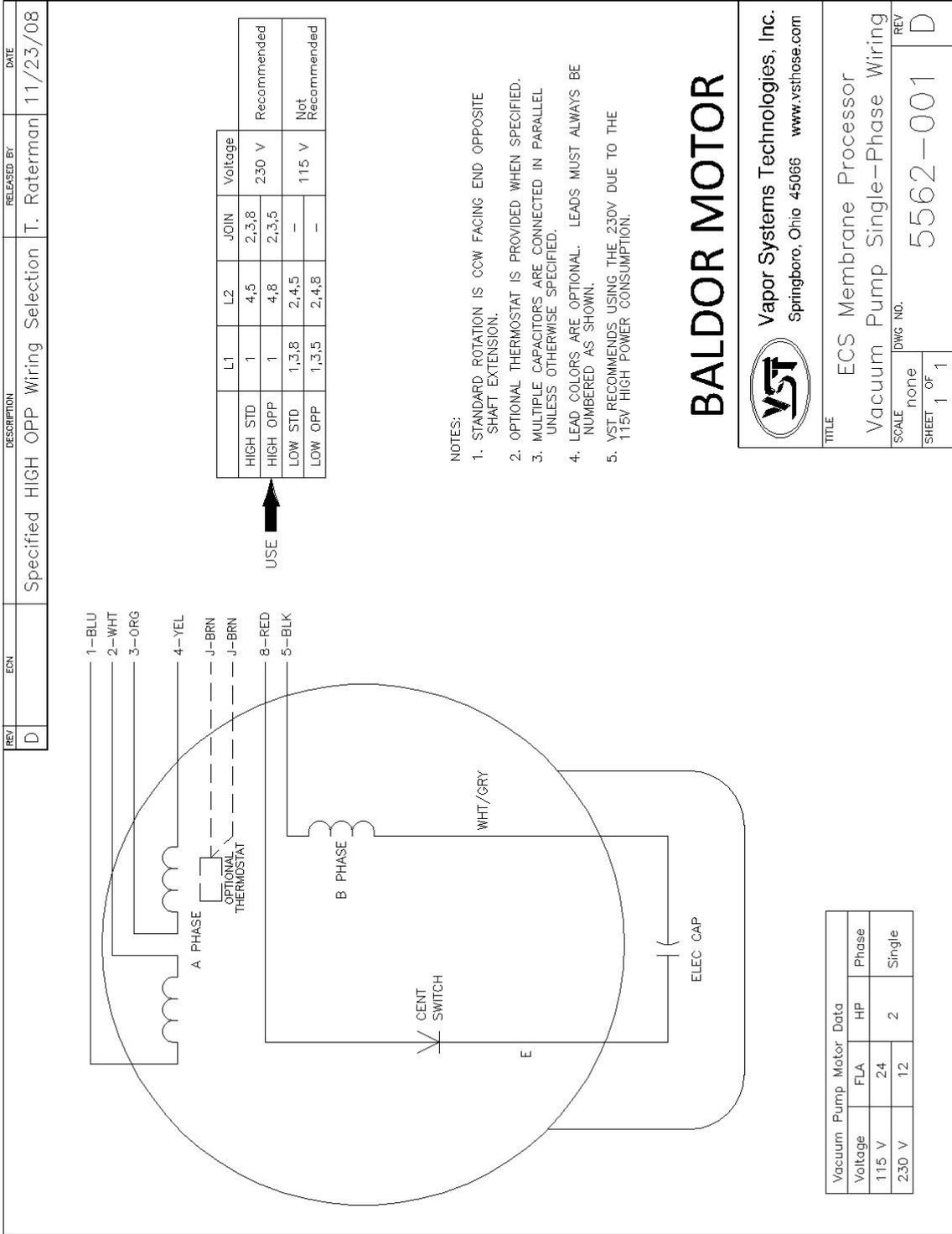


Figure 23: Vacuum Pump: Single-Phase Motor Wiring Diagram

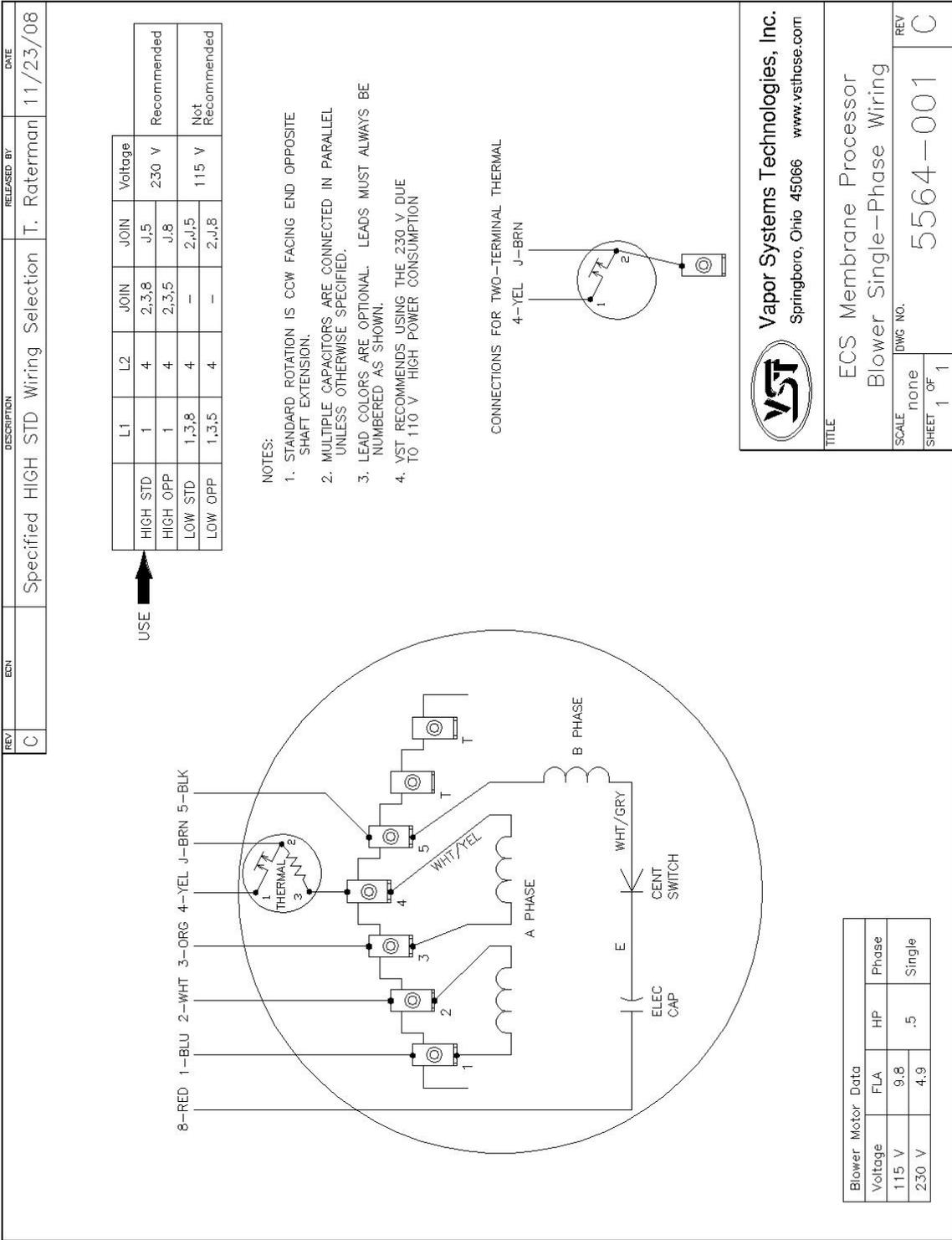


Figure 24: Blower: Single-Phase Motor Wiring Diagram

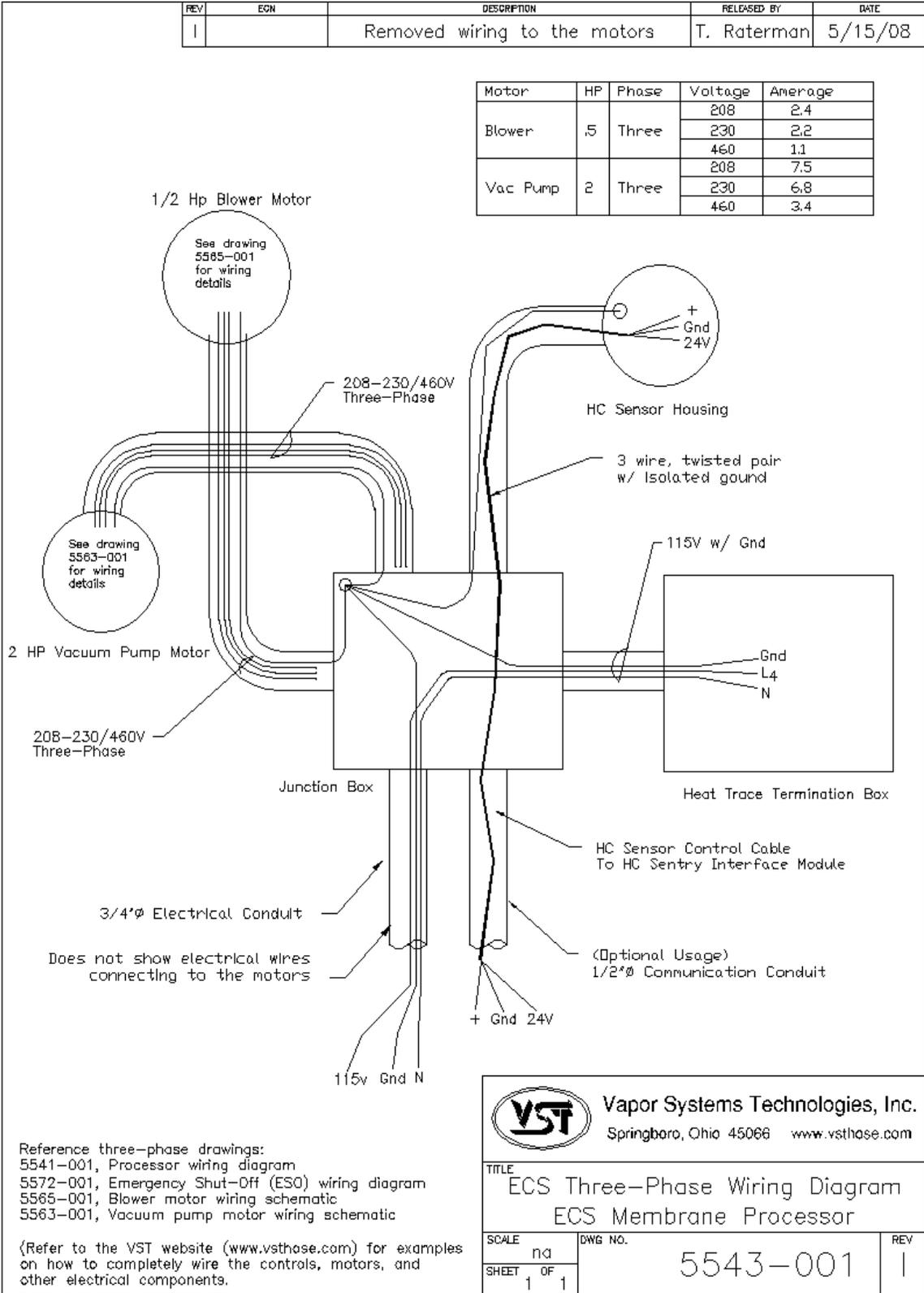


Figure 25: Processor Three-Phase Wiring Schematic

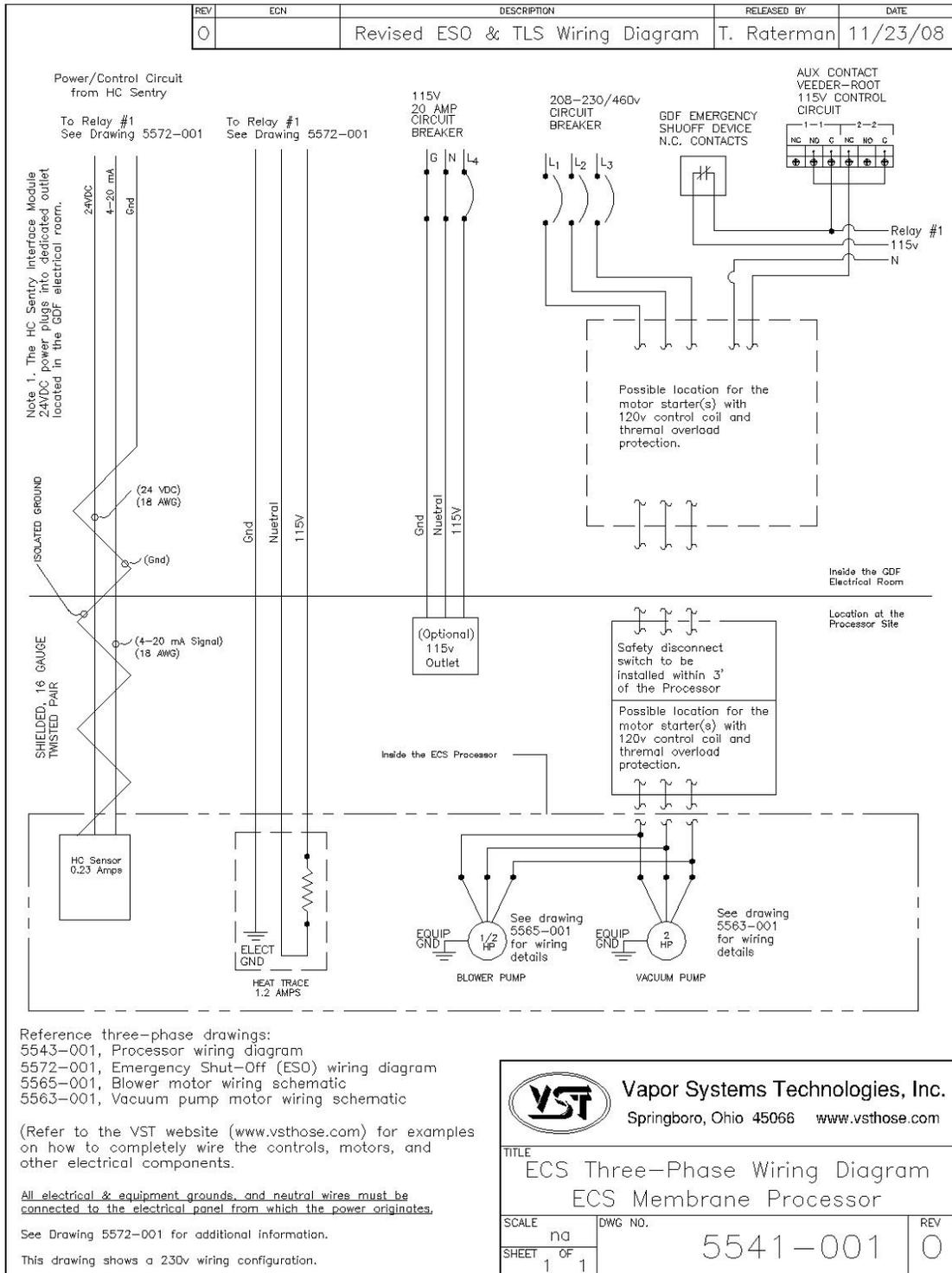


Figure 26: Processor Three-Phase Wiring Schematic

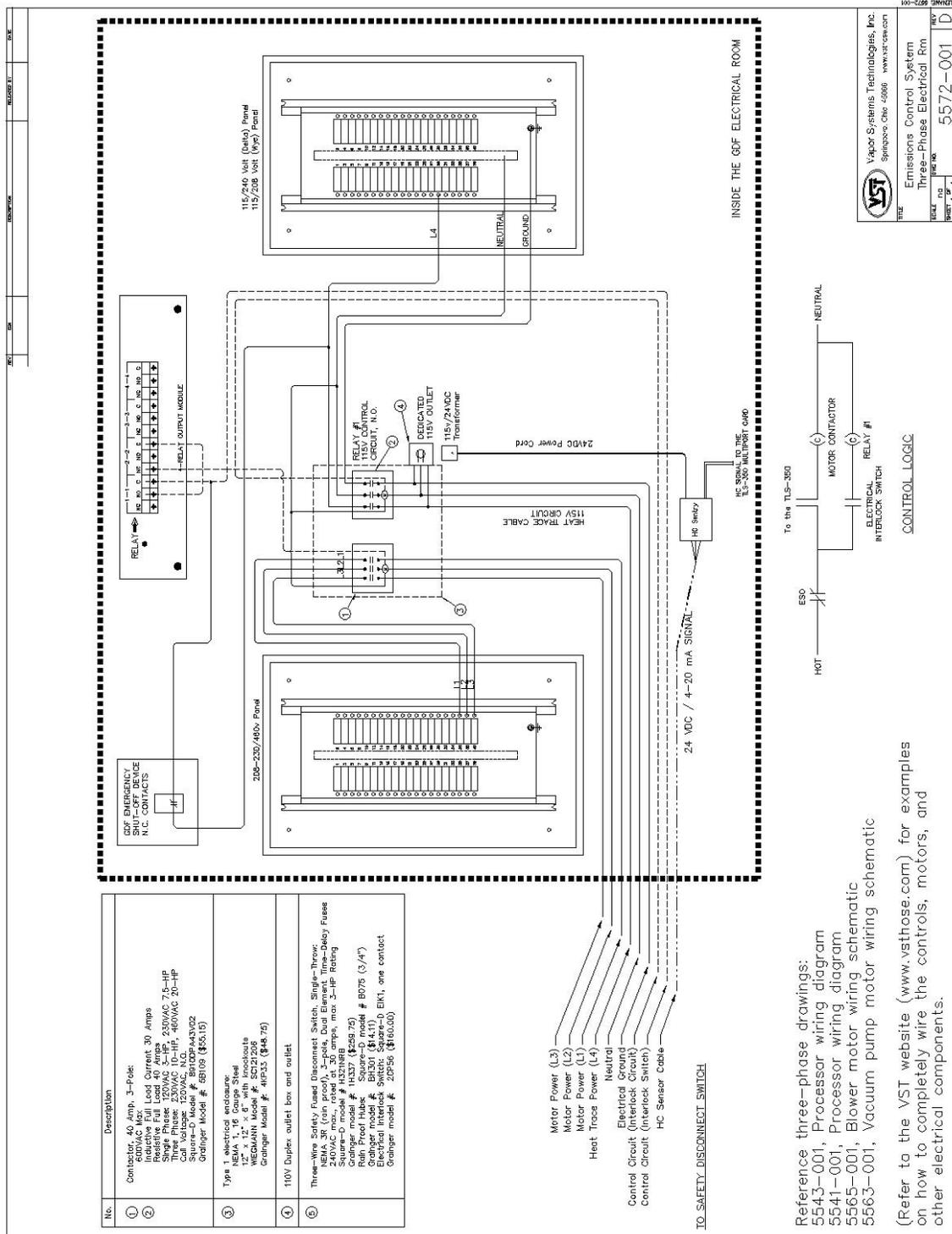


Figure 27: Processor Three-Phase ESO Wiring Diagram

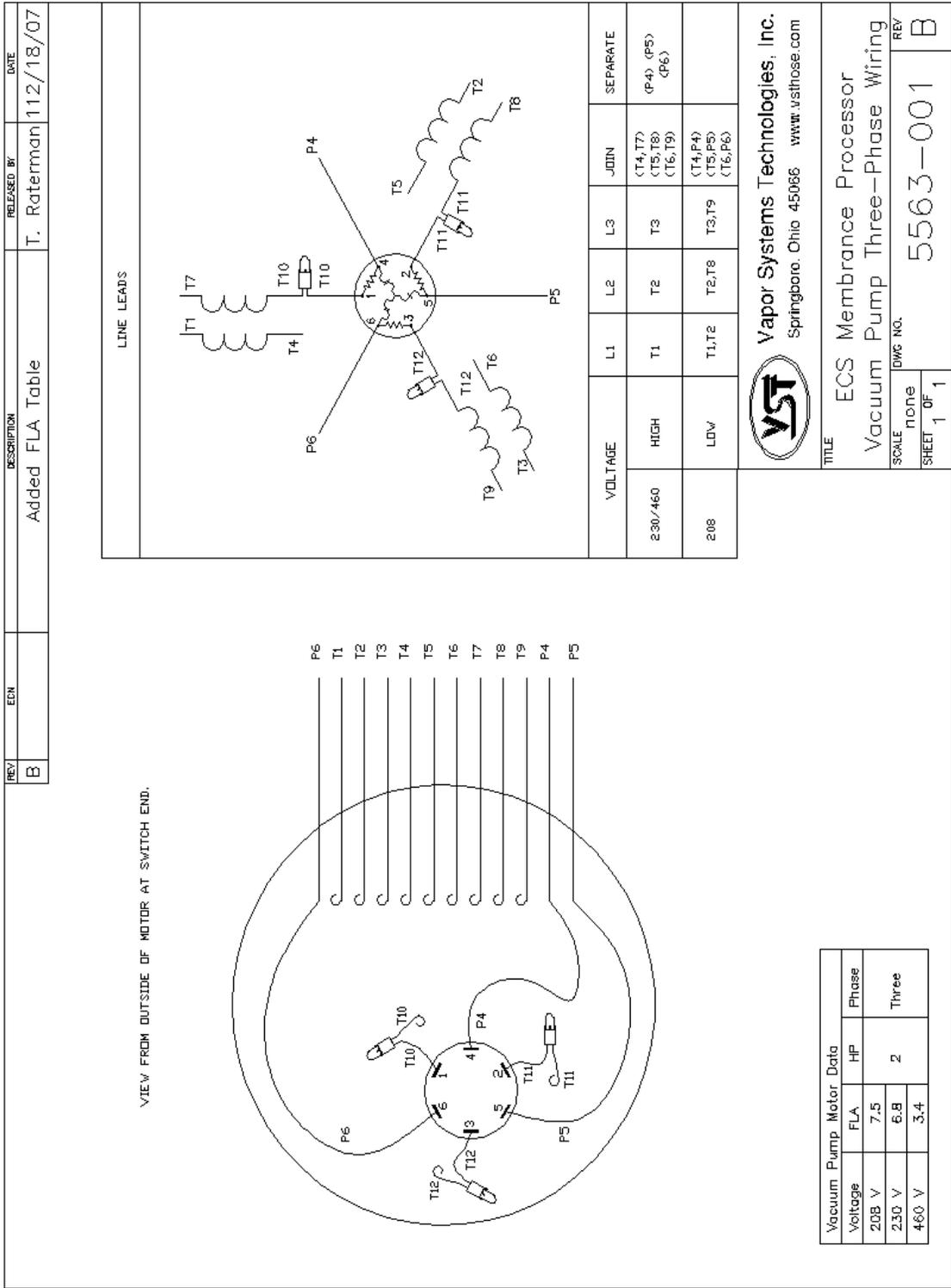


Figure 28: Vacuum Pump: Three-Phase Motor Wiring Diagram

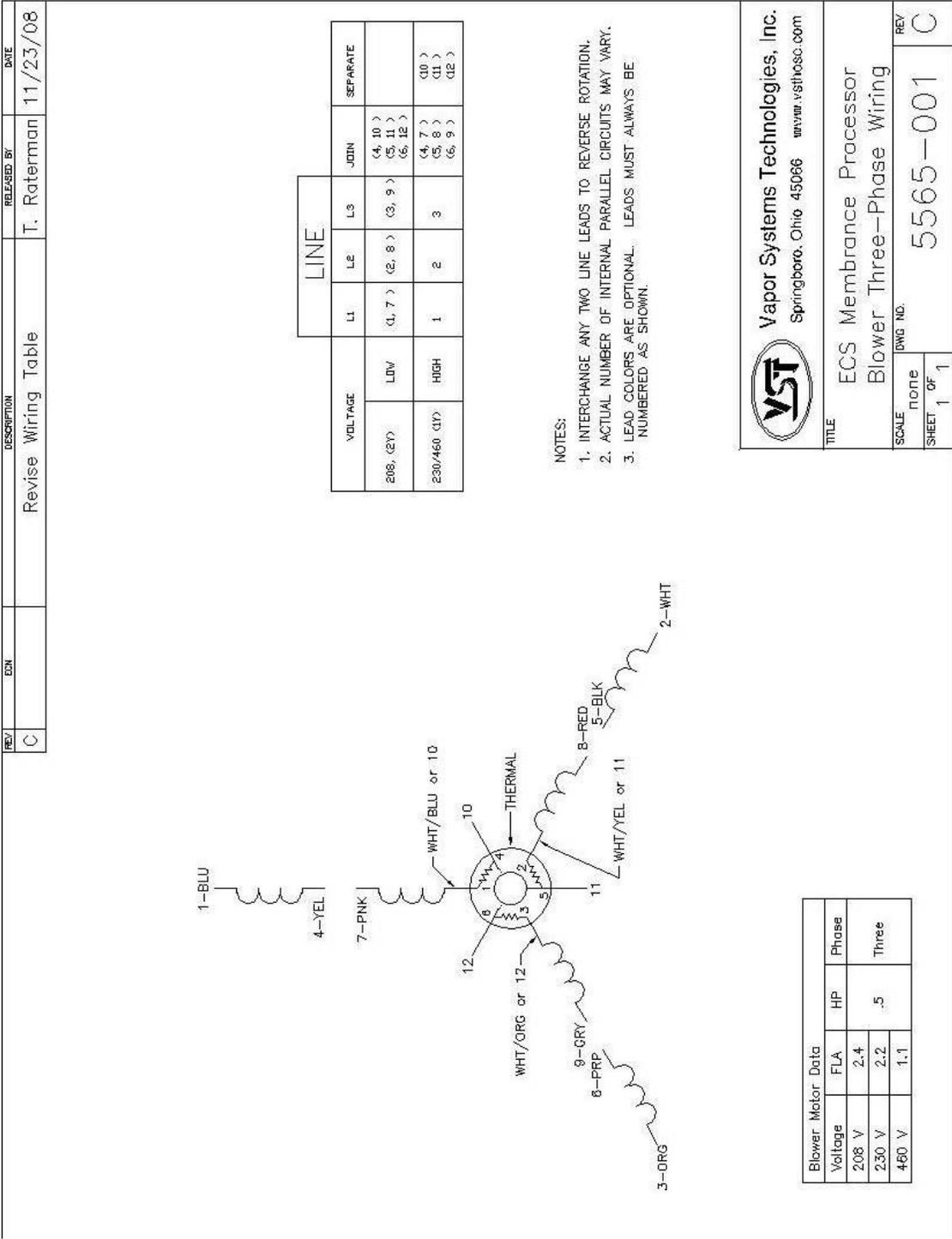


Figure 29: Blower: Three-Phase Motor Wiring Diagram

13.3 Auxiliary Output Relay

- Run two wires from motor relay contacts to the Veeder-Root TLS.

DO NOT MAKE THIS FINAL CONNECTION.

THIS FINAL CONNECTION IS TO BE MADE AT THE TIME OF START-UP.

THIS ACTION REQUIRES THAT THE VST ASC (LEVEL C) BE A VEEDER-ROOT CERTIFIED CONTRACTOR WITH A MINIMUM OF VEEDER-ROOT LEVEL 1, OR 2/3, OR 4 CERTIFICATION.

- ▶ The user interface is equipped with an Auxiliary Output Relay for external monitoring of the *Processor*.
- The 115V control voltage for the motor control contactor is from the 115V electrical panel.
- This relay will be used when the *Processor* is installed with a PMC or an ISD system as specified by CARB Enhanced Vapor Recovery Program.
- When the *Processor* is powered and operating normally, the auxiliary relay is energized (green LED on Auxiliary Relay is lit).
- In ISD, when the *Processor* is powered off (either manually or due to an alarm mode), or is in alarm mode, the auxiliary relay is de-energized.
- Auxiliary relay contact rating: 240V, 6A with 4000V isolation.
 - ▶ Connect the *Processor* motor control relay on either the 4-Relay Module or the I/O Combination Module.
 - ▶ DO NOT CONNECT TO POWER
 - ▶ See Figure 30.

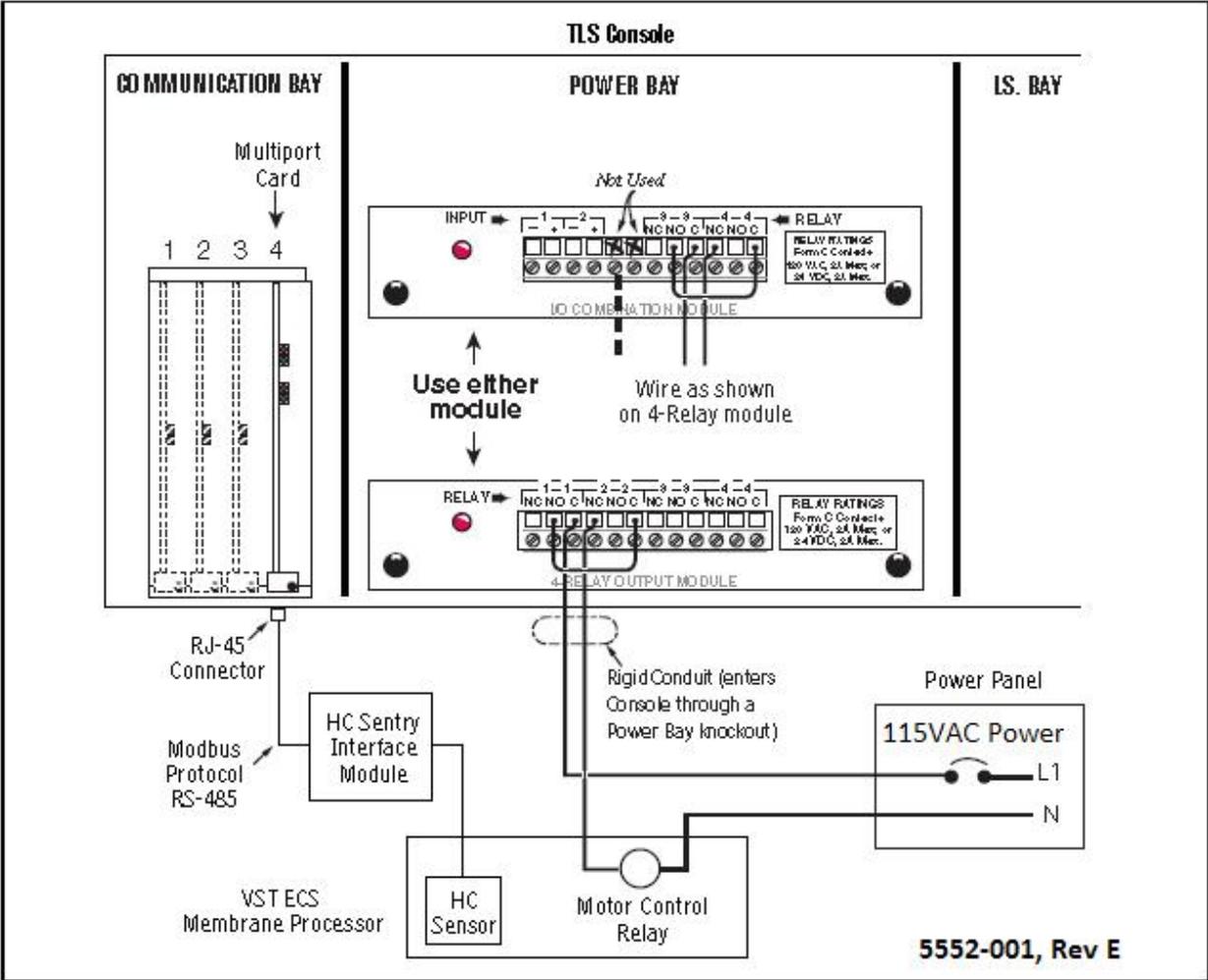
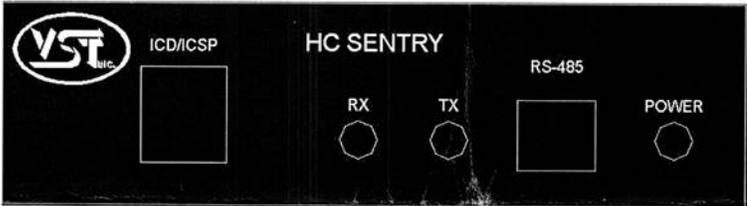


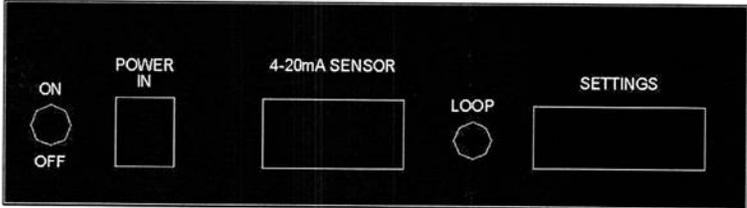
Figure 30: VR TLS Multi-Port Card Connection to HC Sentry Module

13.4 HC Sensor / HC Sentry

- Using 24 VDC, the HC sentry provides power to the HC sensor.
- A 115V / 24 VDC converter from a 115V outlet powers the HC sentry.
- A 3-wire, 18 AWG shielded twisted-pair cable connects the HC sensor to the HC sentry for the 24 VDC power, the 4-20mA signal, and an isolated ground.
- Install an equipment ground to the HC sensor housing.



- ICD/ICSP: This connector provides a means for performing in-circuit-debug and in-circuit-serial-programming utilizing the programming and debugging tools from the processor manufacturer. This connector will typically be used in production to perform initial programming, and could be used as a simple field method for updating a device.
- RX: This led flashes to indicate received data via the RS485 link.
- TX: This led flashes to indicate transmitted data via the RS485 link.
- RS-485: This two-pin connector provides the link to the TLS, RS-485 network.
- POWER: This led indicates that the HC Sentry device is powered up.



- ON/OFF: Switch for turning the device power on and off.

Figure 31: HC Sentry Front & Back Views

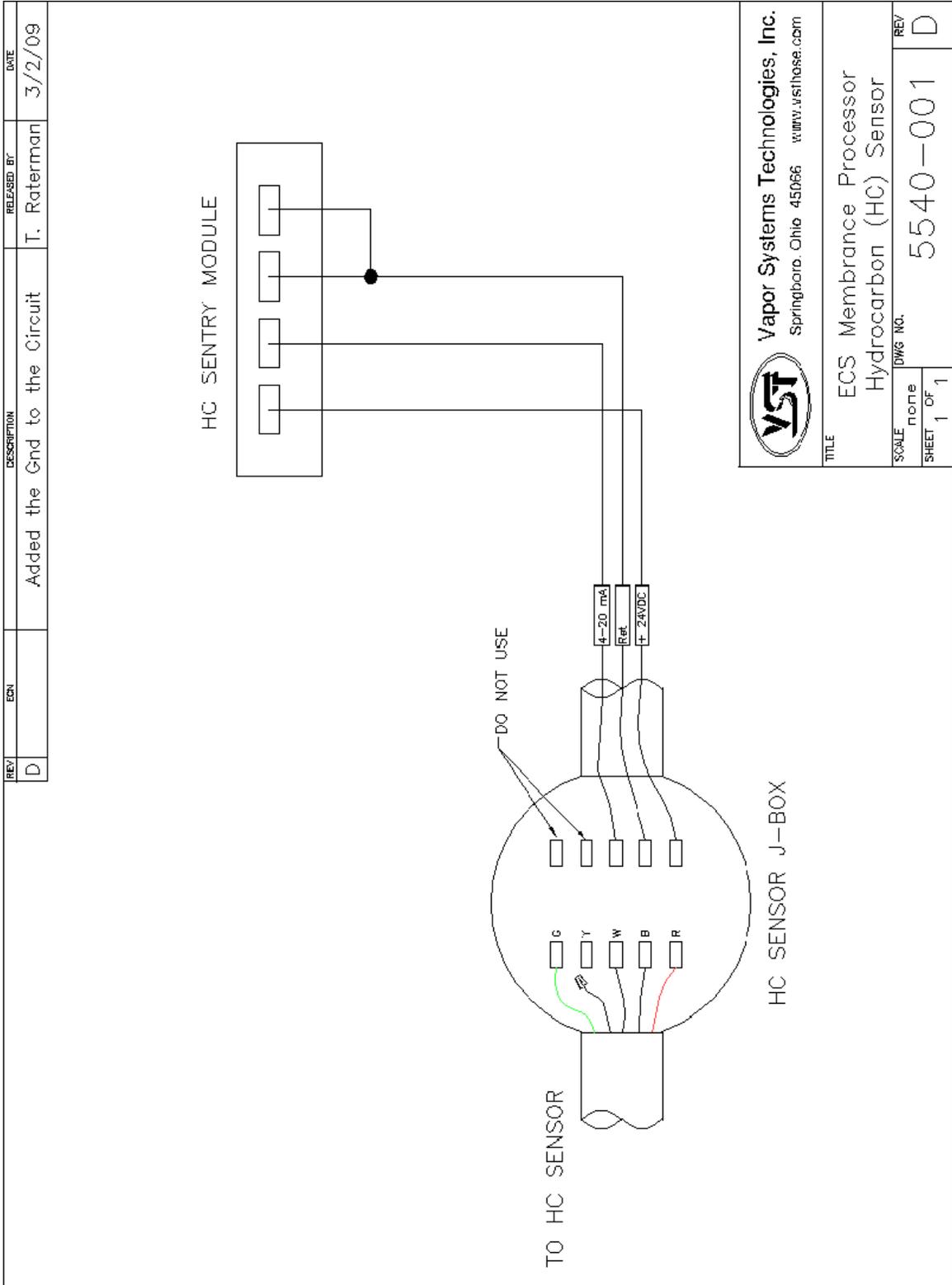


Figure 32: HC Sentry and HC Sensor Wiring Diagram

REV	ECN	DESCRIPTION	RELEASED BY	DATE
A			T. Raterman	4/23/07



Circuit board

HC Sensor Junction box



HC Sentry (Front)



HC Sentry (Back)

 Vapor Systems Technologies, Inc. Springboro, Ohio 45066 www.vstthose.com		
TITLE Emission Control System Hydrocarbon Sensor		
SCALE none	DWG No. 5538-001	REV A
SHEET 1 OF 1		

Figure 33: HC Sensor and HC Sentry Pictures

13.5 Multiport Card for Vapor Processor Communication

- Run wire from HC sentry to TLS
 - ▶ This action requires that the VST ASC (Level B) be a Veeder-Root Certified Contractor with Level 1, or 2/3, or 4 certification.
- The HC sensor is powered by the HC Sentry Interface Module using 24VDC power.
- Power required for the HC Sentry Interface Module is 24VDC power supply plugged into an 115VAC outlet.
- A three-wire, 18 AWG, shielded twisted-pair cable connects the HC sensor to the HC Sentry Interface Module for the 24VDC power, the 4-20mA signal, and an isolated ground.
- The wiring from the HC sensor is connected to the two twisted pair wires inside the HC electrical housing.
- See Figure 34 TLS / HC Sentry RS-485 Cable for the wiring diagram.
- ▶ VST provides the HC Sentry Interface Cable.

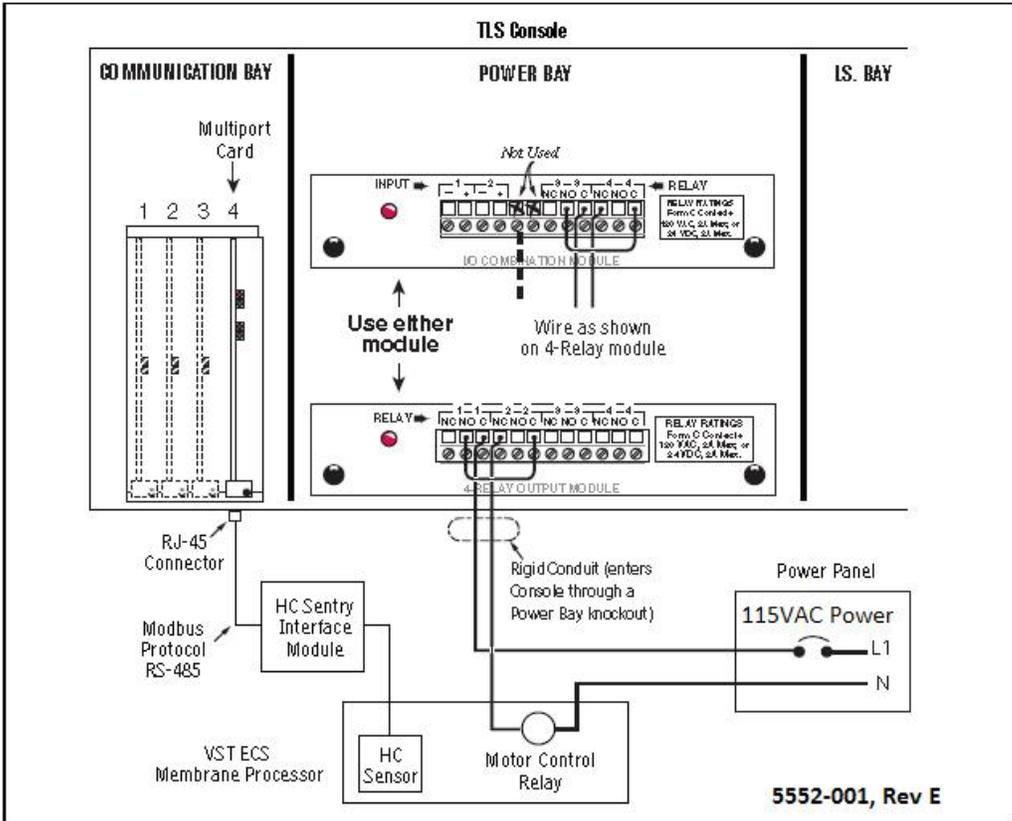


Figure 34: VR TLS Multi-Port Card Connection to the HC Sentry Module

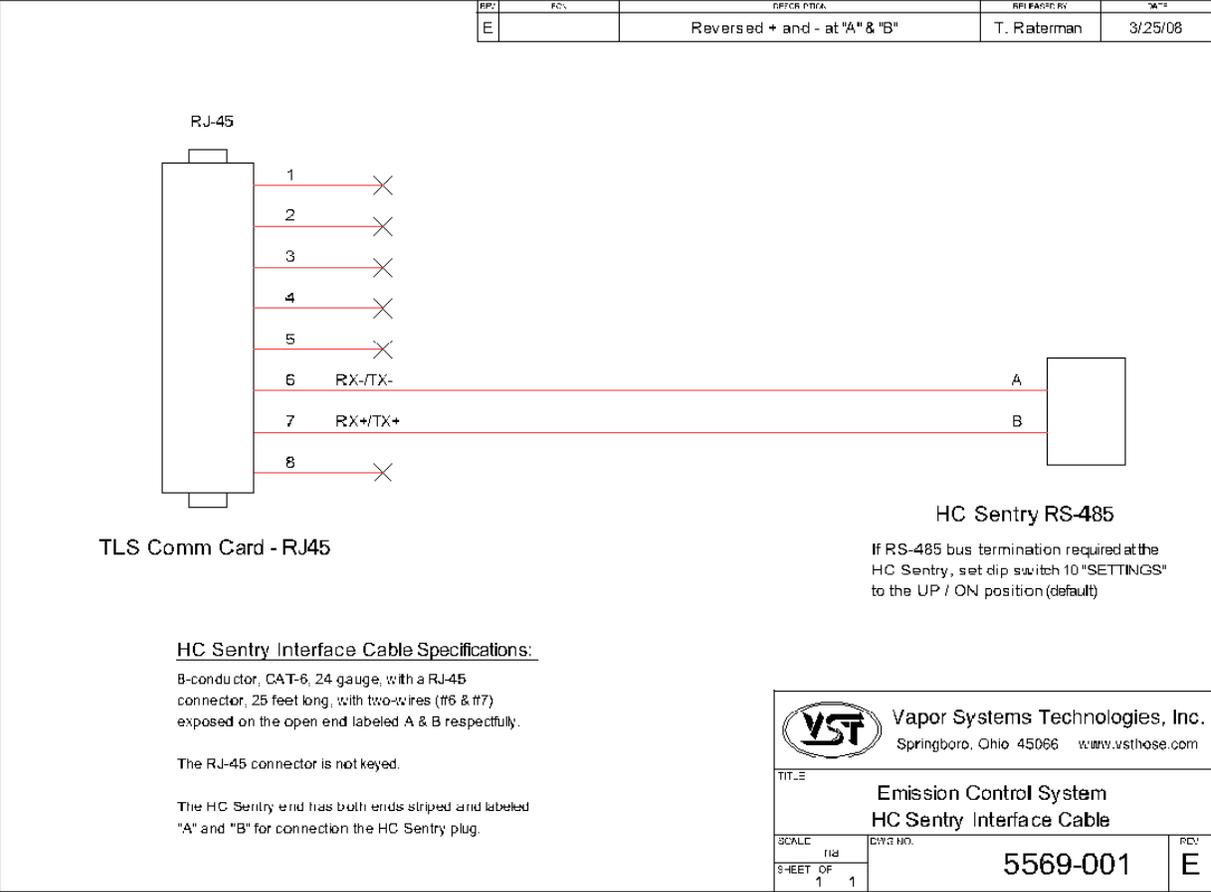


Figure 35: HC Sentry RS-485 Cable Wiring Diagram

13.6 Veeder-Root TLS 350 with PMC or ISD Controls

- The *Processor* is controlled by a Veeder-Root (VR) TLS-350 with a PMC or ISD software package.
- The pressure sensor is located in a dispenser closest to the UST's and is supplied by Veeder-Root as part of the Veeder-Root TLS-350 with an ISD control package.
- VST will supply the HC Sentry Interface Module with 115VAC/24VDC power supply as part of the *Processor*.
- The HC Sentry Interface Module converts the 4-20 mA signals from the HC sensor to a proprietary signal the TLS-350 will recognize.
- VST provides the HC Sentry Interface cable that connects the HC Sentry to the Multiport Card in the TLS Communication Bay.
- VST does not provide the TLS-350 controller or the software required by the TLS-350.



5554-001

Figure 36: VR TLS-350

14 Acceptable NEC Electrical Installation Examples

- The next 8 drawings show acceptable NEC electrical installation examples you may find helpful in the field.

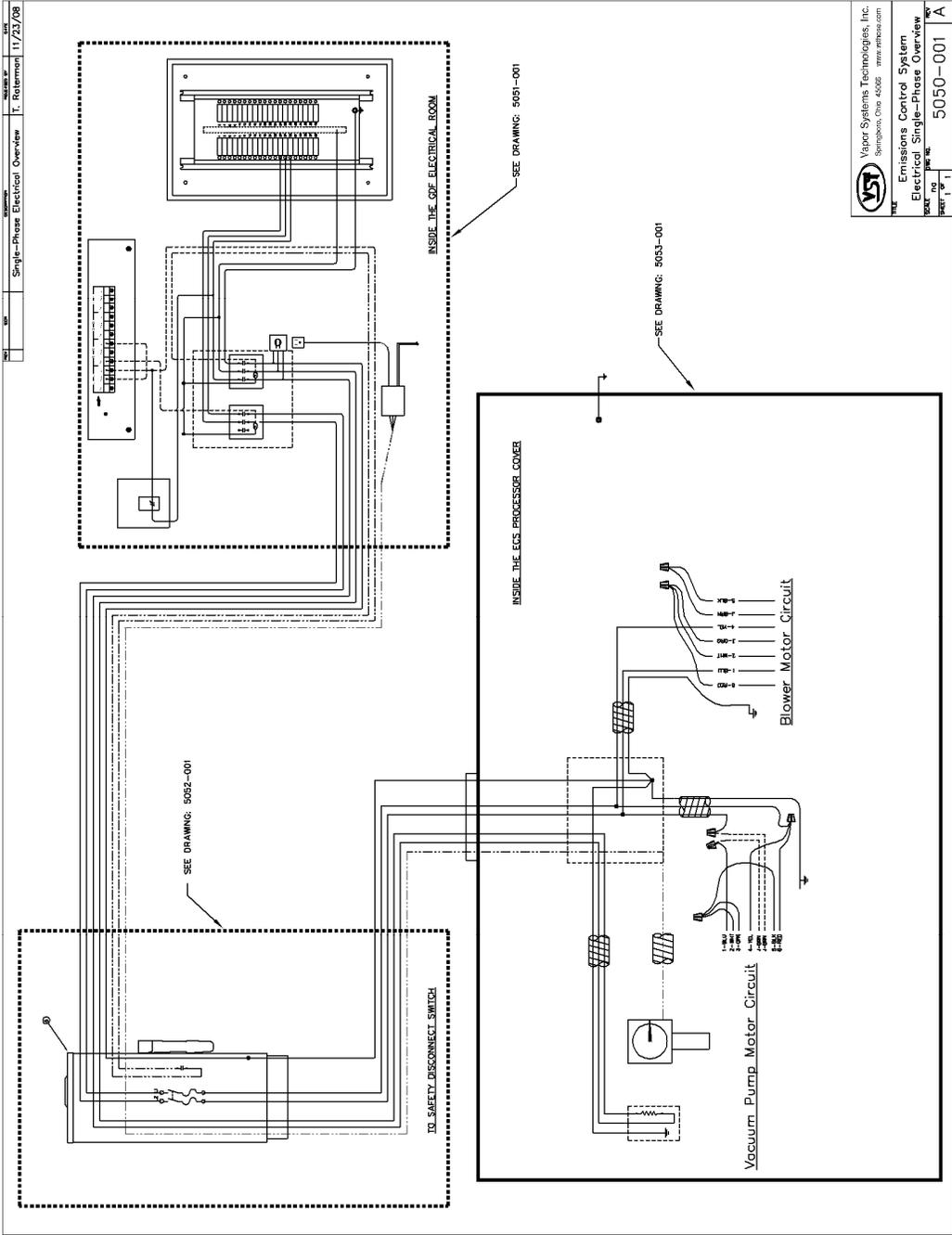


Figure 37: Single phase electrical overview

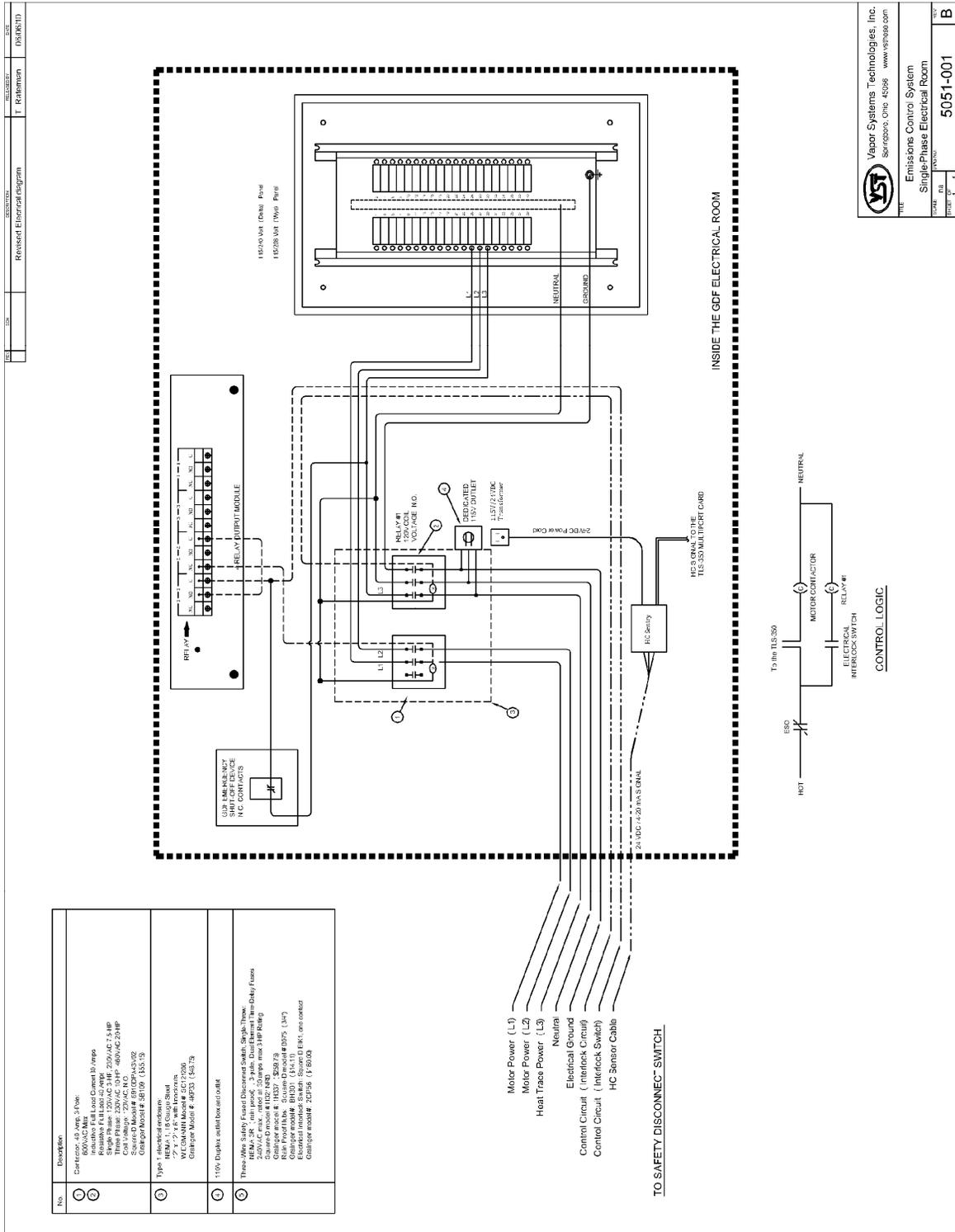
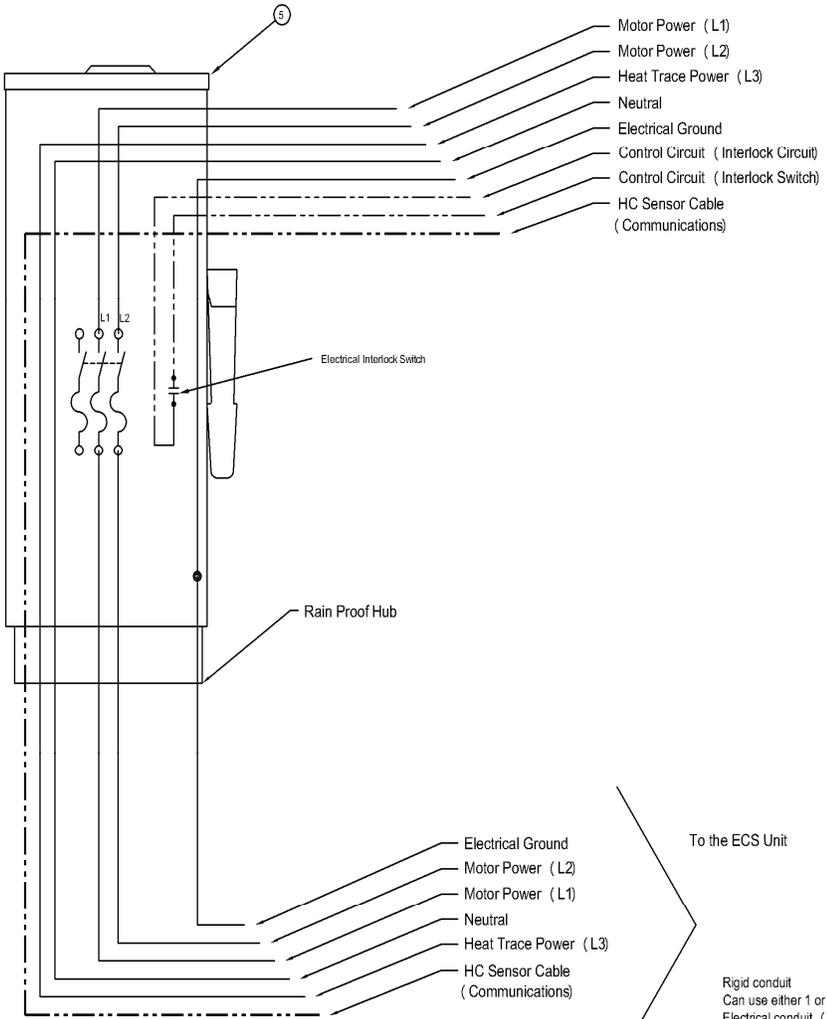


Figure 38: Single phase electrical room

NO.	REV.	DESCRIPTION	RELEASED BY	DATE
		Revised Electrical Diagram	T. Ratoman	7/6/10



UNDERGROUND ELECTRICAL TO ELECTRICAL ROOM

Rigid conduit
Can use either 1 or 2 conduits
Electrical conduit (3/4" Ø)
Communication conduit (3/4" Ø)

No.	Description
1	Contactor, 40 Amp, 3-Pole: 600VAC Max Inductive Full Load Current 30 Amps Resistive Full Load 40 Amps Single Phase: 120VAC 3-HP, 230VAC 7.5-HP Three Phase: 230VAC 10-HP, 460VAC 20-HP Coil Voltage: 120VAC, N.O. Square-D Model #: 8910DPM43V02 Grainger Model #: 5B109 (\$55.15)
3	Type 1 electrical enclosure: NEMA 1, 16 Gauge Steel 12" x 12" x 6" with knockouts WIEGMANN Model #: SC121206 Grainger Model #: 4KP33 (\$48.75)
4	110V Duplex outlet box and outlet
5	Three-Wire Safety Fused Disconnect Switch, Single-Throw: NEMA 3R (rain proof), 3-pole, Dual Element Time-Delay Fuses 240VAC max., rated at 30 amps, max 3-HP Rating Square-D model #: H321NRB Grainger model #: 1H337 (\$259.75) Rain Proof Hubs: Square-D model #: B075 (3/4") Grainger model #: B9301 (\$14.11) Electrical Interlock Switch: Square-D EIK1, one contact Grainger model #: 2CP56 (\$160.00)

To the ECS Unit

Rigid conduit
Can use either 1 or 2 conduits
Electrical conduit (3/4" Ø)
Communication conduit (3/4" Ø)

Vapor Systems Technologies, Inc. Springboro, Ohio 45068 www.vsthsos.com			
TITLE: Emissions Control System			
Electrical Single-Phase Disconnect			
SCALE: 1/8"	REVISED:	5052-001	REV: C
SHEET OF 1			

Figure 39: Single phase electrical disconnect

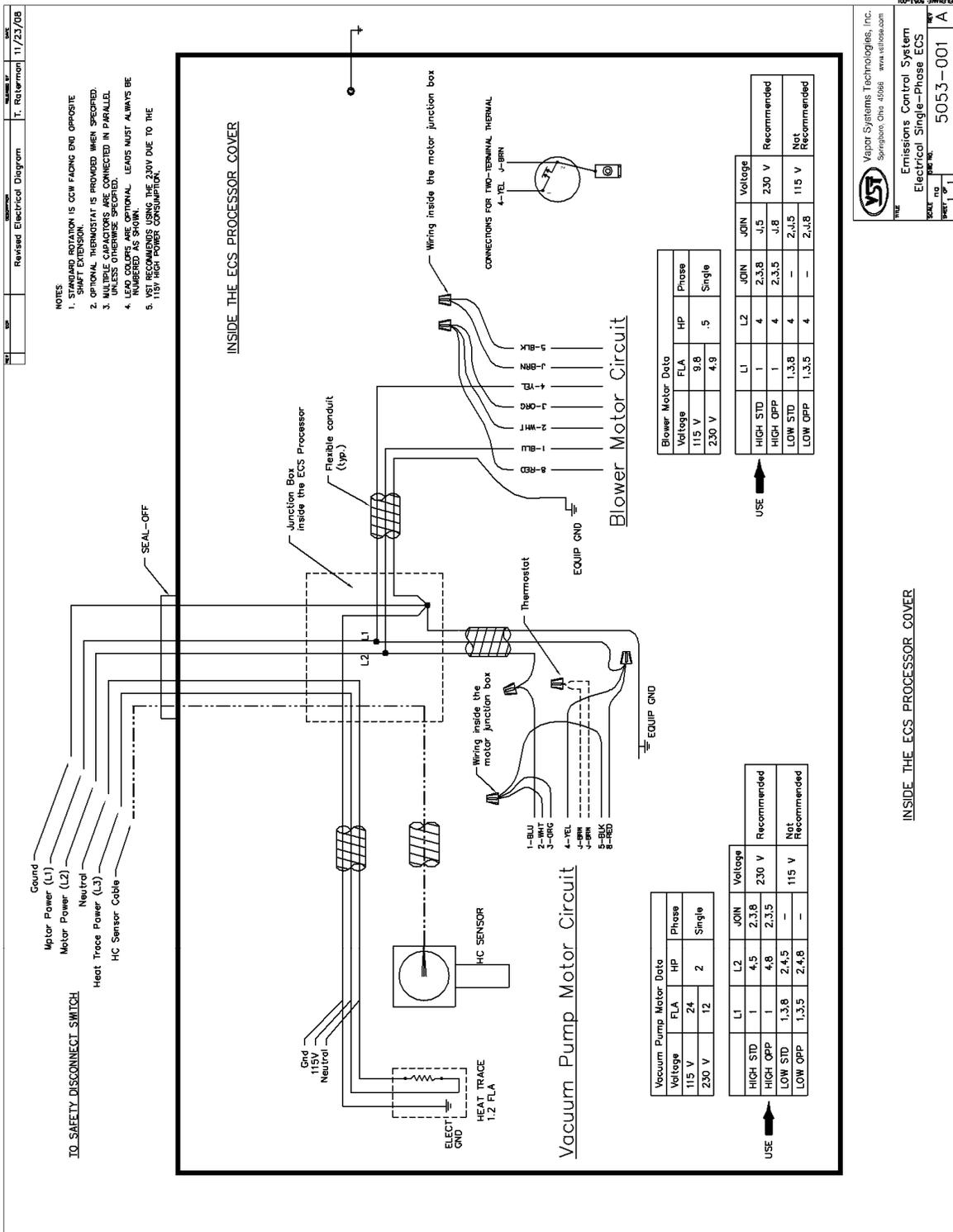


Figure 40: Single phase elec. inside the ECS

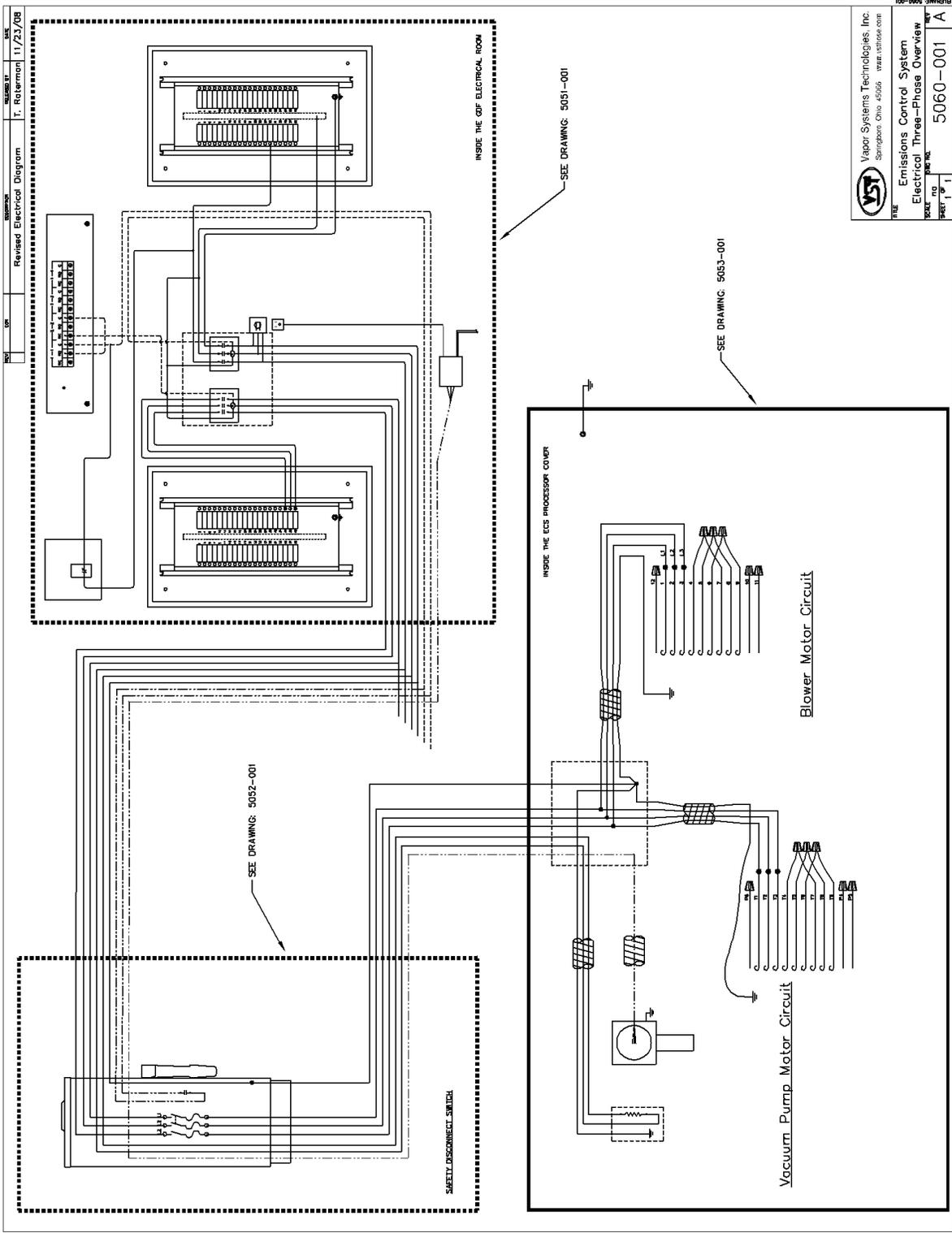


Figure 41: 3-phase electrical overview

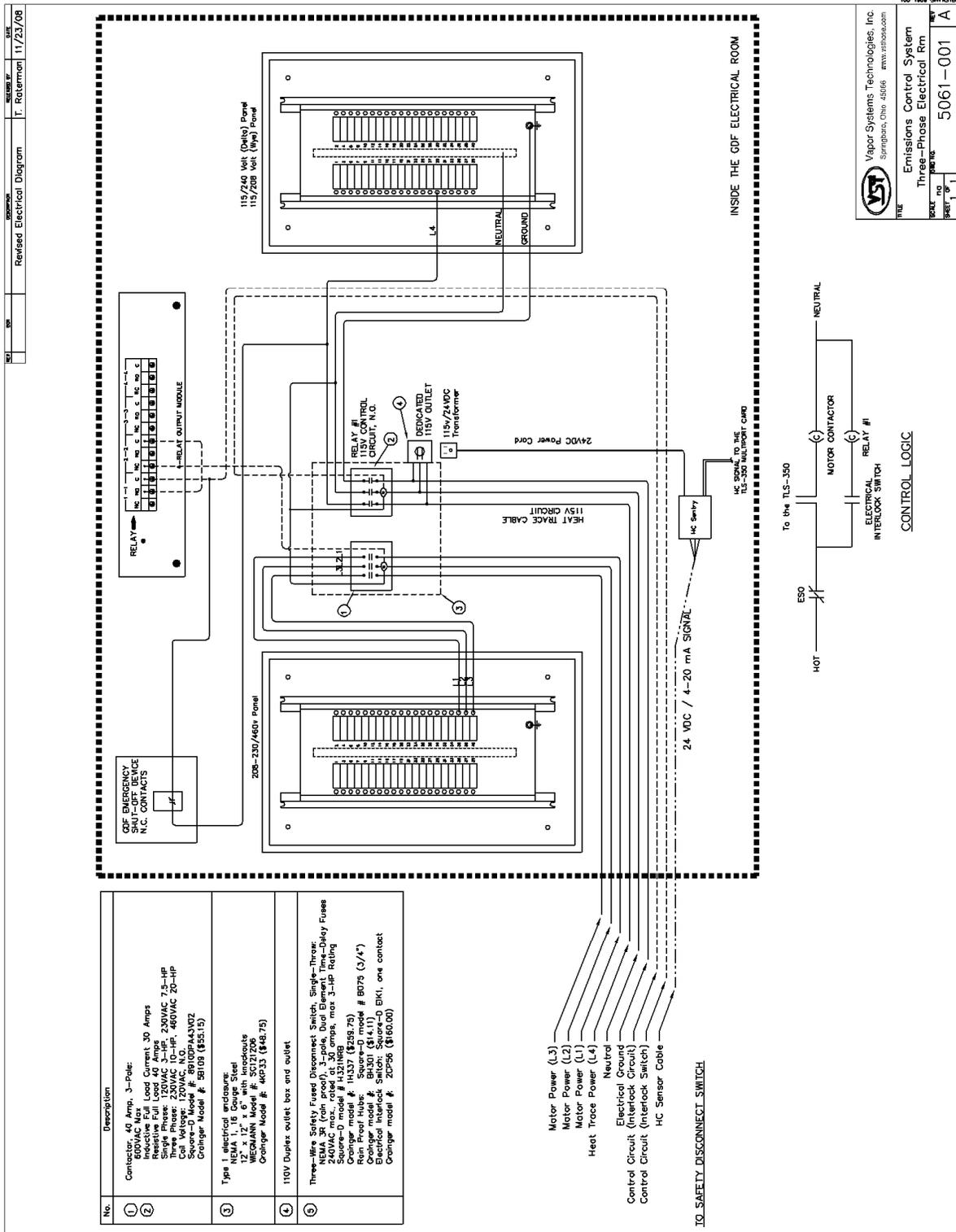


Figure 42: 3-phase electrical room

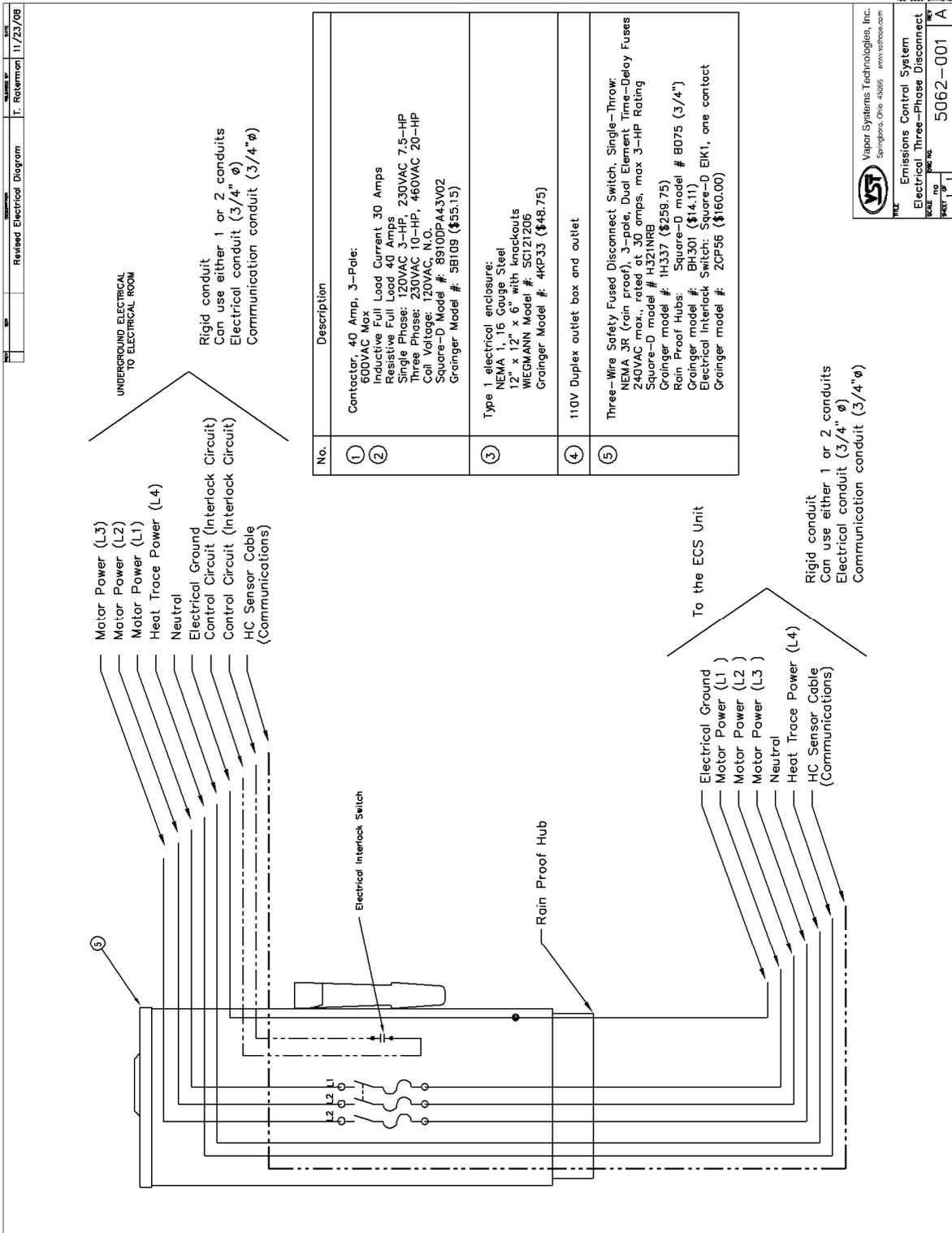


Figure 43: 3-phase electrical disconnect

15 Post-Installation Checklist

Post-Installation Checklist					
VST ASC #:	Date:				
ASC Name:					
VST-ASC Certification Level	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C				
ASC Company:					
GDF Name:					
Address:					
City:	State:	Zip Code:			
GDF Contact Person Name:					
GDF Contact Person Title:					
GDF Contact Person Phone:			E-mail:		
Notes: Use this form to note details of the post-installation tests					
Checkpoints	Site Components	Yes	No	Un-known	If No or Unknown, explain
Pressure sensor installed		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TLS-350 with ISD software installed		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HC sentry connected to the TLS		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Processor Leak Check		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
All vapor piping sloped away from the Processor		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
All vapor piping line size meets CP-201 requirements		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
All vapor piping slope meets CP-201 requirements		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Checkpoints	Site Components	Yes	No	Un-known	If No or Unknown, explain
All warranty information has been filled out and sent to VST		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
All connections from the Processor to the UST's are correct		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
The Processor has not been installed in a Class I, Div. 1 or Class I, Div. 2 area		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
The electrical installation meets NEC, federal, state, and local standards		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
The Processor installation meets CP-201 requirements		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
The ECS Processor has been installed per installation instructions		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Attach product sticker with bar code here

The above tests were performed in accordance with IOM found in the VST's Executive Orders.

ASC Signature

Operation, Maintenance & Set-Up Manual

ECS Membrane Processor: PMC and ISD

Part: VST ECS-CS3-310 – Three Phase
VST-ECS-CS3-110 – Single Phase

Executive Orders: VR-203-K
VR-204-K

Version: 3.0

Vapor Systems Technologies, Inc.
650 Pleasant Valley Drive
Springboro, Ohio 45066
937-704-9333 PH
937-704-9443 FX
www.vsthose.com

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About VST

Vapor Systems Technologies, Inc. began in 1989 with the vision of One Company – One Integrated Solution.

Today, that philosophy is still in place and getting stronger. Recognizing that a healthier environment is a need and not an option, VST has dedicated its undivided attention to the ever-changing, stringent regulations that govern fugitive vapors at gasoline dispensing facilities (GDF). To this challenge, VST is committed to a continual R&D campaign of developing the most current, technologically advanced solutions to service not only the United States, but also the world.

VST specializes in the development, engineering, and manufacturing of products that are sold into the GDF segment of the petroleum industry. The VST focus provides our customers and users with exceptional products, services, and innovative solutions for improving the fueling-station experience as well as the world's air quality.

VST's product offering includes curb pump and vapor recovery hoses, safety breakaways, nozzles, and emission-control system *Processors*. The ENVIRO-LOC™ vapor-recovery product offering represents the most innovative concept in the industry for trapping fugitive vapors from the front end (vehicle refueling) to the back end (vent risers) of the GDF site.

Notice

Vapor Systems Technologies, Inc. shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this publication.

No part of this publication may be translated to another language without the prior written consent of Vapor Systems Technologies, Inc.

Warranty

- The warranty is conditional on whether the *Processor* was installed by a VST ASC Level B or a VST Level C.
- 12-month warranty becomes effective at the time of installation. If this card is not returned, the warranty becomes effective from the date of shipment from VST.
- VST cannot be held responsible for damage to the *Processor* or the *Processor* equipment (inclusive) due to acts of nature, vandalism, or neglect.
- Membranes exposed to gasoline (liquid) due to an overfill or any other reason voids the membrane warranty.
- VST products are warranted to be free of defects in material and workmanship.
- Liability under any expressed or implied warranty is limited to replacement of the product.
- Use of VST products on non-UL Listed systems, or use which falls outside intended field of use, voids any stated or implied warranty.
- VST is not responsible for misuse of, nor improperly installed, products.
- In the event of a warranty claim, the purchaser must obtain a copy of the Return Goods Authorization (RGA) prior to returning product to insure proper processing. Return shipping charges are the responsibility of the customer.
- Warranty status will be determined within 30 days of the return of suspected items.
- VST provides for a warranty program in conjunction with VST's exclusive serial number tracking system.
- Each VST product carries a unique serial number and warranty tracking card.
- Requests for warranty shall be through VST's Return Goods Authorization (RGA) procedure. Call VST at 937-704-9333.
- This warranty does not cover any components exposed to contact with fuels more than 5% menthanol, 10% ethanol, 15% MTBE by volume or any exposure to M85 / E85 fuel.

Warranty Cards

 Vapor Systems Technologies, Inc. Phone: (937)-704-9333 • Fax: (937)-704-9443 www.vsthose.com	SERIAL NUMBER:
	INSTALLATION DATE:
	INSTALLATION SITE:
	CITY/STATE/ZIP:
	DISTRIBUTOR NAME:
	PRODUCT STYLE: <input type="checkbox"/> HOSE <input type="checkbox"/> SAFETY BREAKAWAY <input type="checkbox"/> NOZZLE <input type="checkbox"/> ECS PROCESSOR

IMPORTANT PRODUCT WARRANTY REGISTRATION CARD

12 MONTH WARRANTY BECOMES EFFECTIVE AT TIME OF INSTALLATION. IF THIS CARD IS NOT RETURNED, WARRANTY BECOMES EFFECTIVE FROM DATE OF SHIPMENT FROM VST.

THE MAXIMUM WARRANTY LIFE IS 18 MONTHS FROM DATE OF SHIPMENT.

PLEASE CALL VST IF THIS PRODUCT IS BEING USED AS A REPLACEMENT. REPLACEMENT WITH A NON VST PRODUCT VOIDS ANY WARRANTY.

Figure 1: VST Registration Card

	NOTICE: THIS TAG MUST NOT BE REMOVED FOR ANY REASON
ECS MEMBRANE PROCESSOR UNIT	
Serial Number:	_____
Date Installed:	_____
This device was factory tested and met all applicable performance standards and specifications to which it was certified.	
Manufactured By: Vapor Systems Technologies, Inc. 650 Pleasant Valley Dr., Springboro, Ohio 45066 Phone: (937) 704-9333, Fax: (937) 704-9443	

Figure 2: ECS Membrane Processor Sticker

Components and Warranties

PART #	DESCRIPTION	WARRANTY
5001-001	Vacuum Pump/Three-Phase Motor - Shipped with Three-Phase <i>Processor</i>	1 year
5001-002	Vacuum Pump/Single-Phase Motor - Shipped with Single-Phase <i>Processor</i>	1 year
5001-003	Vacuum Pump Drive Coupling Rubber Insert	1 year
5002-001	Circulating Blower / Three-Phase Motor - Shipped with Three-Phase <i>Processor</i>	1 year
5002-002	Circulating Blower / Single-Phase Motor - Shipped with Single-Phase <i>Processor</i>	1 year
5003-001	Check-Valve Assembly	1 year
5005-001	Membrane	1 year
5006-001	Membrane Housing, Complete	1 year
5006-011	O-Ring (2) Vertical Tube	1 year
5006-012	O-Ring (2) Base Insert	1 year
5006-013	O-Ring (2) Membrane	1 year
5007-004	Hydrocarbon Sensor	1 year
5008-001	Heat-Trace Cable	1 year
5008-002	Heat Trace Power Connection Kit	1 year
5008-003	Heat Trace End Seal Kit	1 year
5010-001	ECS Aluminum Cover	1 year
5012-100	Membrane Tubing	1 year
5012-101	Blower Inlet Tubing	1 year
5012-102	Blower Outlet Tubing	1 year
5012-103	Vacuum Pump Inlet Tubing	1 year
5012-104	Vacuum Pump Outlet Tubing	1 year
5012-105	HC Return Tubing	1 year
5012-106	HC Inlet Tubing	1 year
5012-107	Membrane Outlet Tubing	1 year
5013-001	Insulation	1 year
5015-001	HC Sentry Unit	1 year
5015-002	HC Sentry Interface Cable	1 year

Activating the Processor Warranty

Follow this process to activate the warranty on your *Processor*.

1. Make sure you have all the warranty paperwork. You should have:
 - ▶ A Warranty Card – See Figure 1.
 - ▶ A Post-Installation Checklist
 - ▶ A Post-Installation Power-Up Checklist.
2. Complete the Warranty Card
 - ▶ Completely fill out the card
 - ▶ Get the serial number of your *Processor* from the ECS Membrane Processor Sticker – See Figure 2.
 - ▶ Make a copy of the card for your files.
 - ▶ Place the completed, original card in an envelope for return mailing to VST.
3. Be sure the contractor who installs the *Processor* fills out the Post Installation Checklist.
 - ▶ Go over the form to be sure the contractor has filled it out completely and signed the form.
 - ▶ Make 2 copies of the form:
 - Original goes to VST.
 - One copy stays with the GDF.
 - One copy goes to the contractor.
 - ▶ Place the completed, original form in an envelope for return mailing to VST.
 - ▶ Give one copy to the contractor.
 - ▶ Place a copy in your files.
4. Be sure the contractor who performs the *Processor's* initial Power-Up fills out the Post-Installation Power-Up Checklist
 - ▶ Go over the form to be sure the contractor has filled it out completely and signed the form.
 - ▶ Make 2 copies of the form:
 - Original goes to VST.
 - One copy stays with the GDF.
 - One copy goes to the contractor.
 - ▶ Place the completed, original form in an envelope for return mailing to VST.
 - ▶ Give one copy to the contractor.
 - ▶ Place a copy in your files.
5. Seal the envelope and mail the three forms to VST:
 - ▶ The completed Warranty Card.
 - ▶ The completed and signed Post-Installation Checklist.
 - ▶ The completed and signed Post-Installation Power-Up Checklist.
 - ▶ The VST mailing address is:
Vapor Systems Technologies, Inc.
650 Pleasant Valley Drive
Springboro, OH 45066

VST Contractor Requirements

Due to the highly volatile nature of gasoline and its handling and storage, VST requires the following certifications for its ASC's:

	Level A Re-cert every 2 years	Level B Re-cert every 2 years	Level C Re-cert every 2 years	Level D Re-cert every 2 years
Component	<ul style="list-style-type: none"> Hanging Hardware 	<ul style="list-style-type: none"> Hanging Hardware ECS Membrane Processor 	<ul style="list-style-type: none"> Hanging Hardware ECS Membrane Processor 	<ul style="list-style-type: none"> Green Machine
Authorized Tasks	<ul style="list-style-type: none"> Functional Testing Installation Maintenance & Repair 	<ul style="list-style-type: none"> Installation 	<ul style="list-style-type: none"> Installation Functional Testing Start-Up Troubleshooting Maintenance & Repair 	<ul style="list-style-type: none"> Installation Functional Testing Start-Up Troubleshooting Maintenance & Repair
Training Pre-Requisites	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> VST Level A Veeder-Root UST Monitoring Systems Level 1, 2/3, or 4 	<ul style="list-style-type: none"> VST Level A/B Veeder-Root UST Monitoring Systems Level 2/3 or 4 Veeder-Root ASC w/VST PMC/ISD certification 	<ul style="list-style-type: none"> VST Level A/B Veeder-Root UST Monitoring Systems Level 2/3 or 4 Veeder-Root ASC w/VST PMC/ISD certification

NOTE:
Depending on local codes, in addition to the VST and Veeder-Root training, contractors may be required to take air-district training or ICC certification as an approved vapor-recovery installer.

- ASC's must be able to show proof of certification if asked. Carry the wallet card or have a copy of your certification on file with the GDF.
- The ASC must record his or her certification number on the applicable paperwork for all warranties to be deemed valid.
- Contractors should **ALWAYS** verify the training and certification requirements with the air-district staff **BEFORE** beginning installation of EVR systems.

Safety Icons

	<p>ELECTRICITY A potential shock hazard exists. High voltage is supplied to and exists in this device.</p>		<p>TURN POWER OFF Turn power off to the device and its accessories when installing and servicing the unit. Live power creates a potential spark hazard.</p>
	<p>EXPLOSIVE Gasoline and its vapors are extremely explosive if ignited.</p>		<p>NO POWER TOOLS Sparks from electric power tools can ignite gasoline and its vapors.</p>
	<p>FLAMMABLE Gasoline and its vapors are extremely flammable.</p>		<p>NO PEOPLE IN THE AREA Unauthorized people in the work area during installation and service of the device create a potential for personal injury.</p>
	<p>NO SMOKING Gasoline and its vapors can be ignited by sparks and embers of burning cigarettes.</p>		<p>READ ALL RELATED MATERIALS Read, understand, and follow all instructions, warnings, and requirements before you begin work.</p>
	<p>NO OPEN FLAMES Open flames from sources like lighters and matches can ignite gasoline and its vapors.</p>		<p>USE SAFETY BARRICADES Unauthorized people in the work area during installation and service of the device create a potential for personal injury. Therefore, always isolate your work area by using safety cones, barricades, etc.</p>
	<p>PINCH RISK Stay clear. Keeps hands and tools away from rotating machinery and moving parts.</p>		<p>ROTATING MACHINERY Stay clear. Keep hands and tools away from rotating machinery.</p>

Table of Terms & Abbreviations

ASC:	Authorized Service Contractor
AQMD:	Air Quality Management Districts
ATG:	Automatic Tank Gauge
CARB:	California Air Resources Board
CDFA:	California Department of Food & Agriculture
CVLD:	Continuous Vapor Leakage Detection, another name for Vapor Leak Detection
ECS:	Emissions Control System
EO:	Executive Order
EVR:	Enhanced Vapor Recovery
GDF:	Gasoline Dispensing Facility
HC:	Hydrocarbon
HC IR:	Hydrocarbon Infrared
ISD:	In-Station Diagnostics
MAG Probe:	A type (brand) of Tank Inventory Probe
NEC:	National Electric Code
NFPA:	National Fire Protection Association
ORVR:	On-Board Refueling Vapor Recovery
OSHA:	Occupational Safety Health Administration
Permeate:	Air return to atmosphere
PLC:	Programmable Logic Control
PMC:	Pressure Management Control
Retentate:	Vapor return to UST
RVP:	Reid Vapor Pressure
TLS:	Tank Level System
TLS Console:	Veeder-Root's line of environmental monitoring consoles.
TS:	Troubleshooting
Ullage:	Vapor space above liquid in a UST
UST:	Underground Storage Tank
VCK:	Vapor Collection Kit
Veeder Root:	Manufacturer of the TLS-350
VOC:	Volatile Organic Compounds
VST:	Vapor Systems Technologies, Inc. - manufacturer of the ECS Membrane <i>Processor</i>
WC:	Water Column

1 ECS Membrane Processor Overview

1.1 ECS Membrane Processor Theory of Operation

- The VST ECS membrane *Processor* does not interact directly with the other balance system hardware. It is in place to monitor and control the pressure in the UST to within limits specified by CARB.

Under conditions where the GDF is operational and the balance system hardware is functioning normally, the inherent ORVR compatibility of the balance system (when using VST's ENVIRO-LOC nozzle) will produce a predominately negative gauge pressure in the ullage space of the UST. Under these conditions the ECS membrane *Processor* will typically not need to operate.

During periods of less activity, the GDF being shut down overnight, winter fuels being present, or other conditions that promote the pressurization of the ullage space, the ECS membrane *Processor* will operate as needed to control the pressure in the ullage space to an accepted level. The ECS membrane *Processor* will turn on at an ullage pressure of +0.20 inches of water and turn it off at a pressure of -0.20 inches of water. Currently, the ECS membrane *Processor* unit is monitored and controlled through the PMC or ISD software.

- The ECS membrane *Processor* uses a type of membrane technology to enable it to selectively separate the components in the ullage vapor mixture.

Through a somewhat complex transport means, certain molecules will selectively travel in a stream from one side of the membrane to the other. This stream is referred to as the permeate stream.

In this case, predominate molecules transported across the membrane will be the primary constituents of air, which are oxygen, nitrogen, and water vapor. A small amount of the hydrocarbons present in the ullage mixture will also migrate across the membrane. Typically, permeate will contain less than 3.0% hydrocarbons. The result of this activity includes, fresh air vented to atmosphere, hydrocarbon vapors returned to the UST, and UST pressurization controlled to an acceptable level.

- The process of separation by the membrane is made possible by using two pumps, one low-pressure pump which circulates the ullage vapor mixture along one side of the membrane, and one high-vacuum pump, which creates the pressure differential needed to cause the permeate to transport across the membrane. These are the only moving parts in the system.

1.2 Overview of How the Processor Operates

- The Processor is a technology created for Gasoline Dispensing Facilities (GDF) to assist them in reducing the number of harmful emissions released to the atmosphere through the natural occurrence of gasoline vaporization.
- The table below lists the steps that the Veeder-Root TLS 350 and the software takes to control the Processor.

1.	<ul style="list-style-type: none"> • When the UST system pressure rises above +0.2"WC, the <i>Processor</i> turns ON.
2.	<ul style="list-style-type: none"> • Through the vapor inlet pipe connection at the <i>Processor</i>, the VOC vapor is drawn into the suction side of the blower.
3.	<ul style="list-style-type: none"> • The blower discharges the VOC vapor into the membrane housing.
4.	<ul style="list-style-type: none"> • Inside the membrane housing, the VOC vapor is separated in to two air streams: <ul style="list-style-type: none"> ▶ VOC depleted air (referred to as "air") ▶ Gasoline VOC vapor • The membrane is designed specifically for separating air from gasoline VOC vapor.
5.	<ul style="list-style-type: none"> • A vacuum pump draws the air from the membrane housing through a check valve.
6.	<ul style="list-style-type: none"> • A sample of the air flows through a hydrocarbon sensor to check the percent hydrocarbons.
7.	<ul style="list-style-type: none"> • From the vacuum pump, the air is vented to atmosphere via the air return.
8.	<ul style="list-style-type: none"> • The gasoline VOC vapor returns to the UST system via the vapor return.
9.	<ul style="list-style-type: none"> • When the UST system pressure drops below -0.2"WC, the <i>Processor</i> turns OFF.

1.3 Processor Dimensions and Weight

Part Number	Unit	Dimensions	Weight
VST-ECS-CS3-110	Single-Phase	L-39" x W-27" x H-43" Height includes 18" legs	385 lbs. Includes 24-lb. cover
VST-ECS-CS3-310	Three-Phase	L-39" x W-27" x H-43" Height includes 18" legs	350 lbs. Includes 24-lb. cover

1.4 Processor Components and Their Purpose

PART #	DESCRIPTION	PURPOSE
5001-001	Vacuum Pump / Three-Phase Motor Shipped with Three-Phase <i>Processor</i>	Draws air through the membrane housing to the atmosphere.
5001-002	Vacuum Pump / Single-Phase Motor Shipped with Single-Phase <i>Processor</i>	
5001-003	Vacuum Pump Drive Coupling Rubber Insert	Drive coupling rubber insert.
5002-001	Circulating Blower / Three-Phase Motor Shipped with Three-Phase <i>Processor</i>	The blower circulates the vapor from the UST system through the separation membrane located inside the <i>Processor</i> back to the UST system.
5002-002	Circulating Blower / Single-Phase Motor Shipped with Single-Phase <i>Processor</i>	
5003-001	Check-Valve Assembly	Eliminates outside air from entering the UST's.
5005-001	Membrane	<p>By means of the circulating blower, the vapor from the UST system continuously flows through the membrane housing, which holds the membrane cartridge. This happens only while the <i>Processor</i> is running.</p> <p>The membrane cartridge separates the air from the VOC inlet vapor, returning a concentrated VOC stream back into the storage tank while the air is vented to the atmosphere.</p> <p>The membrane and housing use UL approved o-rings.</p>
5006-001	Membrane Housing, Complete	Houses the membrane cartridge.
5006-011	O-Ring (2) Vertical Tube	Prevents hydrocarbons from leaking into the atmosphere.
5006-012	O-Ring (2) Base Insert	Prevents the separated air from mixing with concentrated hydrocarbons.
5006-013	O-Ring (2) Membrane	
5007-004	Hydrocarbon Sensor	<p>The HC Sensor continuously monitors the amount of hydrocarbons in the air stream being vented to the atmosphere. This happens only while the <i>Processor</i> is running.</p> <p>A 4-20mA signal is sent to the TLS-350 controller that monitors the hydrocarbon percentage by volume.</p> <p>24VDC power is required and is supplied from the HC sentry.</p>

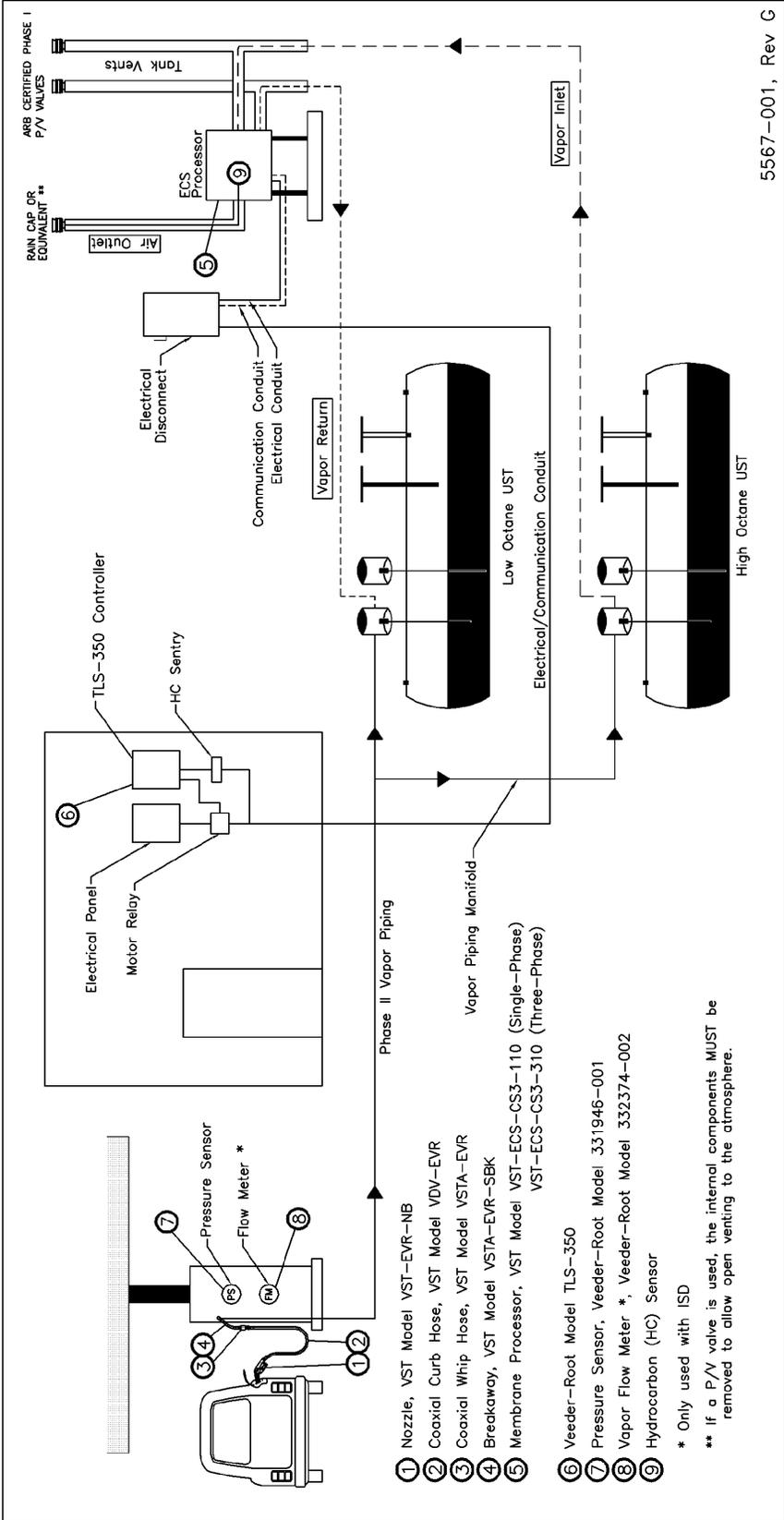
PART #	DESCRIPTION	PURPOSE
5008-001	Heat-Trace Cable	<p>A self-regulating heat trace cable wraps around the membrane housing and is designed to keep the membrane housing temperature between 100°-150° F.</p> <p>Power is continuously applied to the heat-trace cable 100% of the time whether the <i>Processor</i> is running or not.</p> <p>The power requirements are 115 VAC at 130 watts per foot, with a maximum of 2 amps draw.</p> <p>On the end of the heat-trace cable is an end-seal kit to terminate the cable.</p>
5008-002	Heat Trace Power Connection Kit	Connection for 115V power.
5008-003	Heat Trace End Seal Kit	End circuit connection.
5010-001	ECS Aluminum Cover	Protective Cover
5012-100	Membrane Tubing	Internal Vapor Tubing
5012-101	Blower Inlet Tubing	
5012-102	Blower Outlet Tubing	
5012-103	Vacuum Pump Inlet Tubing	
5012-104	Vacuum Pump Outlet Tubing	
5012-105	HC Return Tubing	
5012-106	HC Inlet Tubing	
5012-107	Membrane Outlet Tubing	
5013-001	Insulation	1" thick insulation encases the membrane housing and the heat trace cable to preventing unnecessary heat loss.

1.5 Processor Auxiliary Components

PART #	COMPONENT	DESCRIPTION
5015-001	HC Sentry Interface Module w/24VDC power supply	<p>The HC Sentry module acts as an interface between the TLS and the HC sensor.</p> <p>115v power is supplied to the HC sentry module, which supplies 24VDC power to the HC sensor.</p> <p>A 4-20 mA signal is sent from the HC sensor to the HC sentry module, which converts the signal to a proprietary code for the TLS-350.</p>
5015-002	HC Sentry Interface Cable	Connects the HC Sentry to the TLS-350.

1.6 Processor Manuals

Manual #	Manual Name	Section
9520-001	ECS Membrane Processor with PMC/ISD: Installation Manual	IOM-10
9520-002	ECS Membrane Processor with PMC/ISD: OM&S	IOM-11
9514-003	ECS Membrane Processor with PMC/ISD: Troubleshooting Guide	www.vsthose.com
9514-004	ECS Membrane Processor with PMC/ISD: Pre-Installation Site Survey	www.vsthose.com



5567-001, Rev C

Figure 3: How the Processor fits into the GDF layout

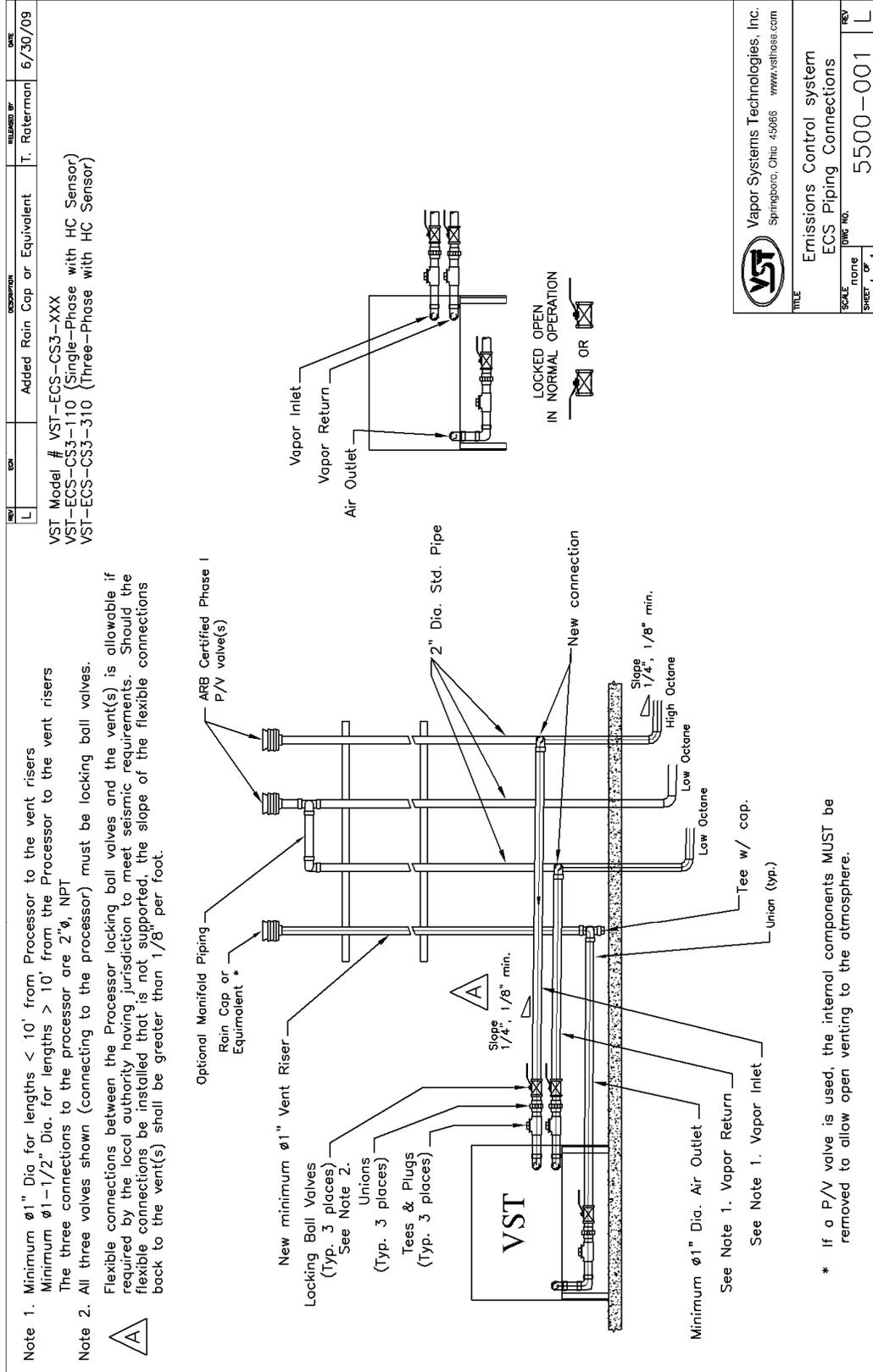


Figure 4: Processor Piping Diagram

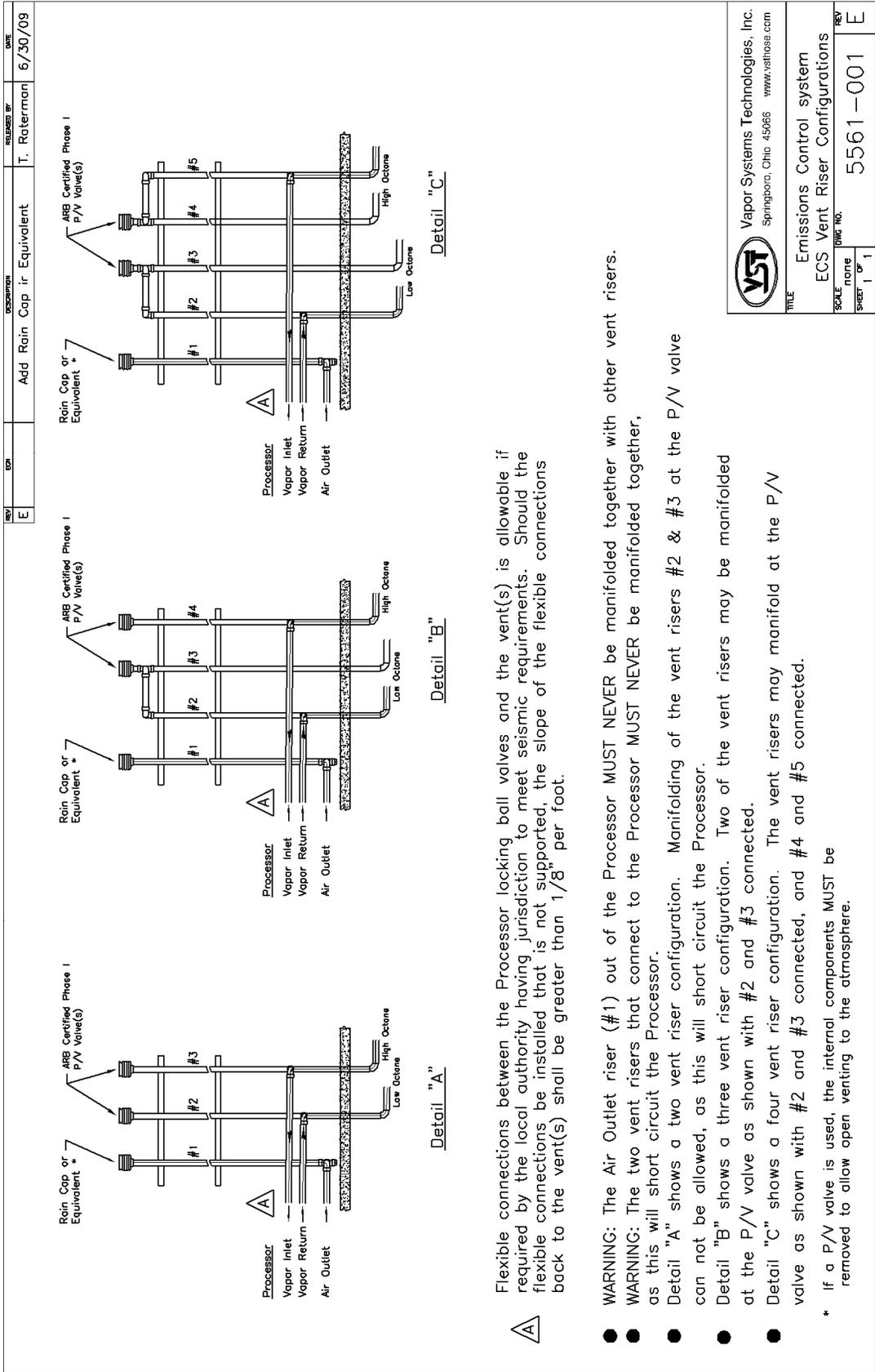


Figure 5: ECS Vent Configurations

VST	Vapor Systems Technologies, Inc. Springboro, Ohio 45066 www.vsthoas.com
Emissions Control system ECS Vent Riser Configurations	
SCALE	DWG. NO.
SHEET 1 OF 1	REV 5561-001 E

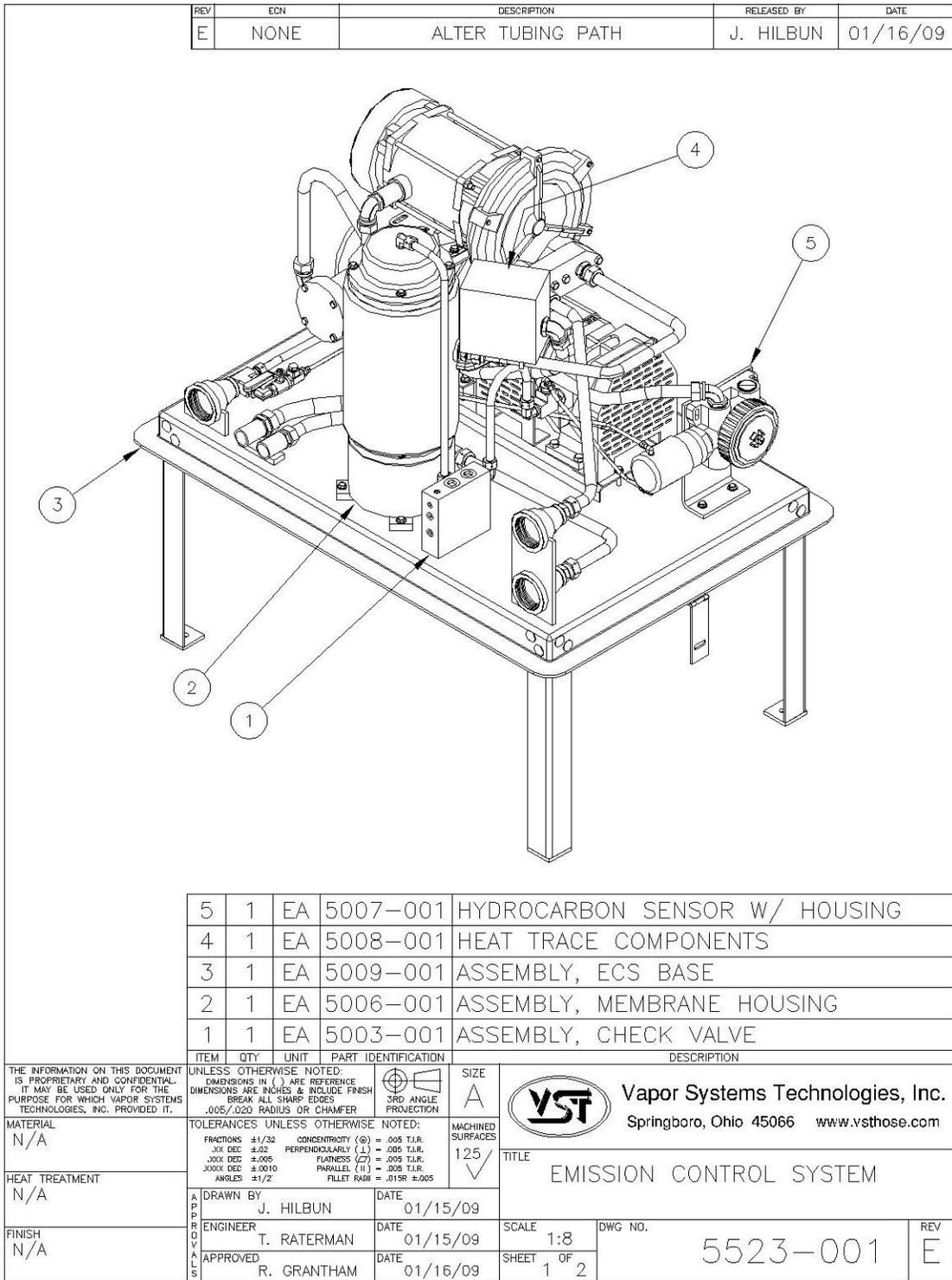


Figure 6: Processor Isometric Drawing (1 of 2)

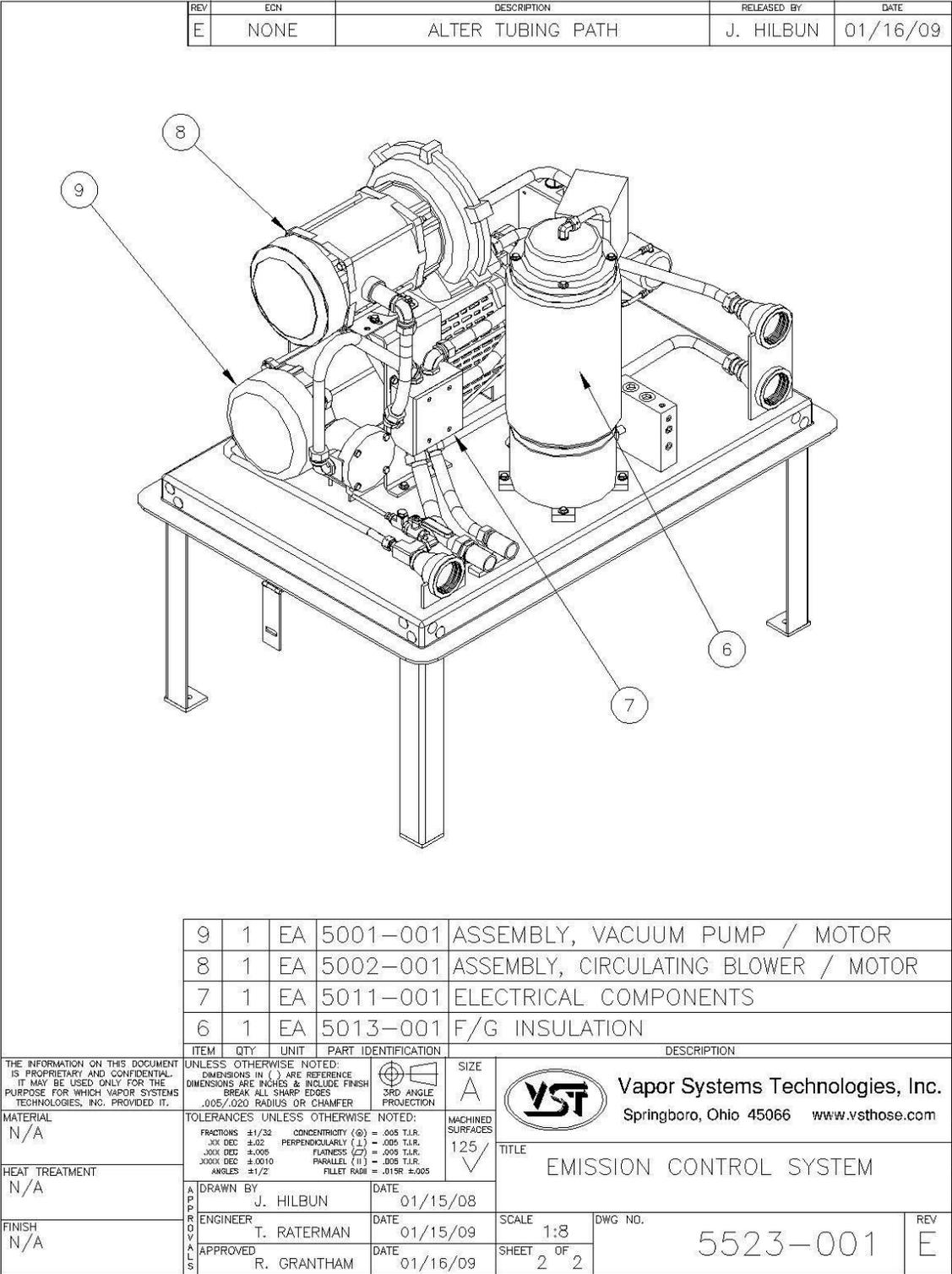


Figure 7: Processor Isometric Drawing (2 of 2)

2 Processor Operation

- The Veeder-Root Pressure software controls the *Processor* and is located within the TLS-350 console. The TLS-350 is an automatic tank gauging, compliance, and fuel-management system.
- The TLS-350 will be configured for either PMC or ISD control software.
- Warnings and alarms are announced through the various lights on the panel as well as through a paper print-out.

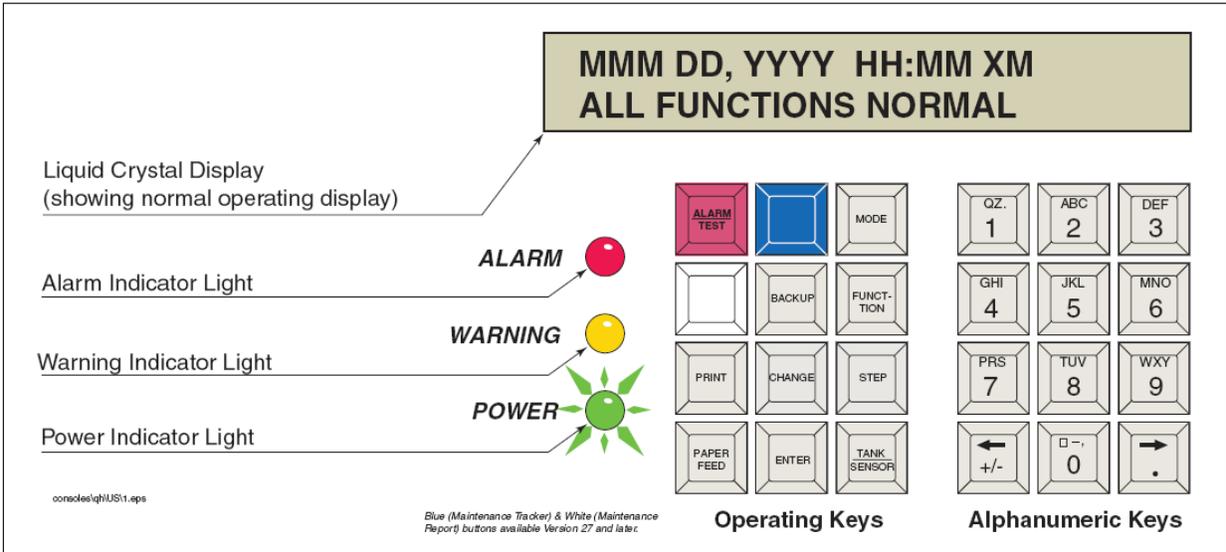


Figure 8: TLS-350 Face

2.1 TLS 350 Construction

- The *TLS Console* is constructed with fuel compatible materials and is approved for use in GDF's by UL (Underwriters Laboratories, Inc.) where wetted components and materials are tested for durability and resistance to corrosion.
- The *TLS Console* is designed to withstand power outages by storing critical system parameters in nonvolatile memory.
- The pressure sensor (supplied by Veeder-Root) is installed inside a dispenser.

2.2 Automatic Control

- Under automatic control, vapor pressure readings are compared to the programmed ON/OFF thresholds to determine the appropriate *Processor* state.
 - ▶ When the *Processor* is OFF and the UST pressure equals or exceeds the programmed ON vapor pressure threshold, the *Processor* is turned ON and remains so until the pressure equals or is less than the programmed OFF vapor pressure threshold.
 - ▶ During periods when there are no deliveries, if the *Processor* is ON continuously for longer than the programmed max 30 minutes runtime, the *Processor* is turned OFF.
 - ▶ It will remain OFF for the same number of minutes programmed as max runtime minutes before turning back ON.
 - ▶ It will continue to cycle on and off until the vapor pressure drops below the low/off threshold limit.
- During a delivery, if the *Processor* ON time exceeds the maximum run time, the *Processor* will be shut OFF.
 - ▶ After 3 seconds the *Processor* will be turned back ON if the pressure is above the high pressure threshold limit.
 - ▶ This cycle will continue until the delivery has ended or until the pressure goes below the low pressure threshold and the *Processor* is turned OFF.

2.3 Manual Control of the Processor

- From the PMC diagnostic menu, the *Processor* mode can be changed from **Automatic** to **Manual**.
- When the *Processor* control mode is **Manual**, the diagnostic menu allows the *Processor* to be directly turned **ON** and **OFF**.
 - ▶ This feature is to support the testing functionality of the *Processor* or compliance testing without needing the pressure to be at operational set points.
 - ▶ This is especially useful if the vapor space has been disturbed through the course of repair or testing.
- The current vapor pressure threshold settings are available through the diagnostic menu.
- Note: If the *Processor* is **ON** and the control mode is **Automatic**, changing the control mode to **Manual** mode will turn the *Processor* **OFF**.
- This feature is to support testing functionality of the *Processor* without needing the pressure to be at operational set-points.
- This function is also to be used for conducting testing or at any time compliant-testing involves opening of the vapor space.
- The current vapor pressure reading will also be available through the diagnostic menu.

At the conclusion of any testing or repairs, verify that the *Processor* has been set to "AUTOMATIC mode" at the TLS-350.

2.4 TLS Alarms

- During normal operation when the system is functioning properly and no warning or alarm conditions exist, the “ALL FUNCTIONS NORMAL” message will appear in the system status (bottom) line of the console display.
- If a warning or alarm condition occurs, the system displays the condition type and its location.
- If more than one warning or alarm condition exists, the display will alternately flash the appropriate messages.
- The system automatically prints an alarm report showing the warning or alarm type, its location, and the date and time the warning or alarm condition occurred.
- Warning and alarm posting causes the TLS 350 to activate:
 - ▶ Warning lights
 - ▶ Failure-Alarm indicator lights
 - ▶ Audible alarm
 - ▶ Automatic strip paper printout documenting the warning or alarm

2.5 Thresholds and Algorithms

- Two thresholds (high and low pressure) are used to activate and deactivate the *Processor* internal TLS-350 relay.
- Three thresholds can be set via the TLS keypad or serial RS232 commands. These thresholds include:
 - ▶ Vapor *Processor* **LOW PRESSURE THRESHOLD** set at -0.2" WC
 - Maximum negative UST pressure required in order to turn OFF the *Processor*
 - ▶ Vapor *Processor* **HIGH PRESSURE THRESHOLD** set at +0.2" WC
 - Minimum positive UST pressure required in order to turn ON the *Processor*
 - ▶ Vapor *Processor* runtime set at 30 minutes
 - Maximum allowable runtime
- The TLS 350 control algorithm checks the current UST pressure level and turns the *Processor* **ON** and **OFF** according to the high and low pressure thresholds.
- All **WARNINGS** and **ALARMS** should be resolved and then followed by **CLEAR TEST AFTER REPAIR** (found in the TLS menu) regardless of PMC and ISD software.

- The Veeder-Root Pressure Sensor (VRPS) reads every 20 seconds, and this reading is compared to the vapor-pressure thresholds to determine the *Processor* state, which will be either **ON** or **OFF**.
- DUE TO THE SAMPLE RATE OF 20 SECONDS, SOME DELAY OCCURS IN POSTING. THE ACTUAL VALUES DISPLAYED ON THE TLS MAY BE SLIGHTLY HIGHER THAN THE +.2"WC AND SLIGHTLY LOWER THAN THE -.2"WC SET POINTS.
- When the *Processor* is **OFF** and the high-vapor pressure threshold (+0.2"WC) is exceeded, the relay is enabled (which starts the *Processor*), and the relay remains enabled until the pressure drops below the low-vapor pressure (-0.2"WC) threshold.
- Automatic control is the default mode.
- The internal relay must be programmed as a **VST VAPOR PROCESSOR (VP)** through the TLS 350 relay setup menu.
- The *Processor* control algorithm will not be engaged until at least one relay of this type is detected by the TLS 350.
- Whenever the *Processor* runs more than 30 minutes, (whether you're using PMC or ISD software) the *Processor* is *automatically* turned OFF.
 - ▶ During this 30-minute period, the *Processor* will not be controlled by UST pressure and will remain OFF for 30 minutes.
- The *Processor* will then restart assuming the UST pressure is still above the lower threshold setting and the TLS is in the automatic controlled mode.
- Figure 9 shows the *Processor Run-Time* Algorithm.

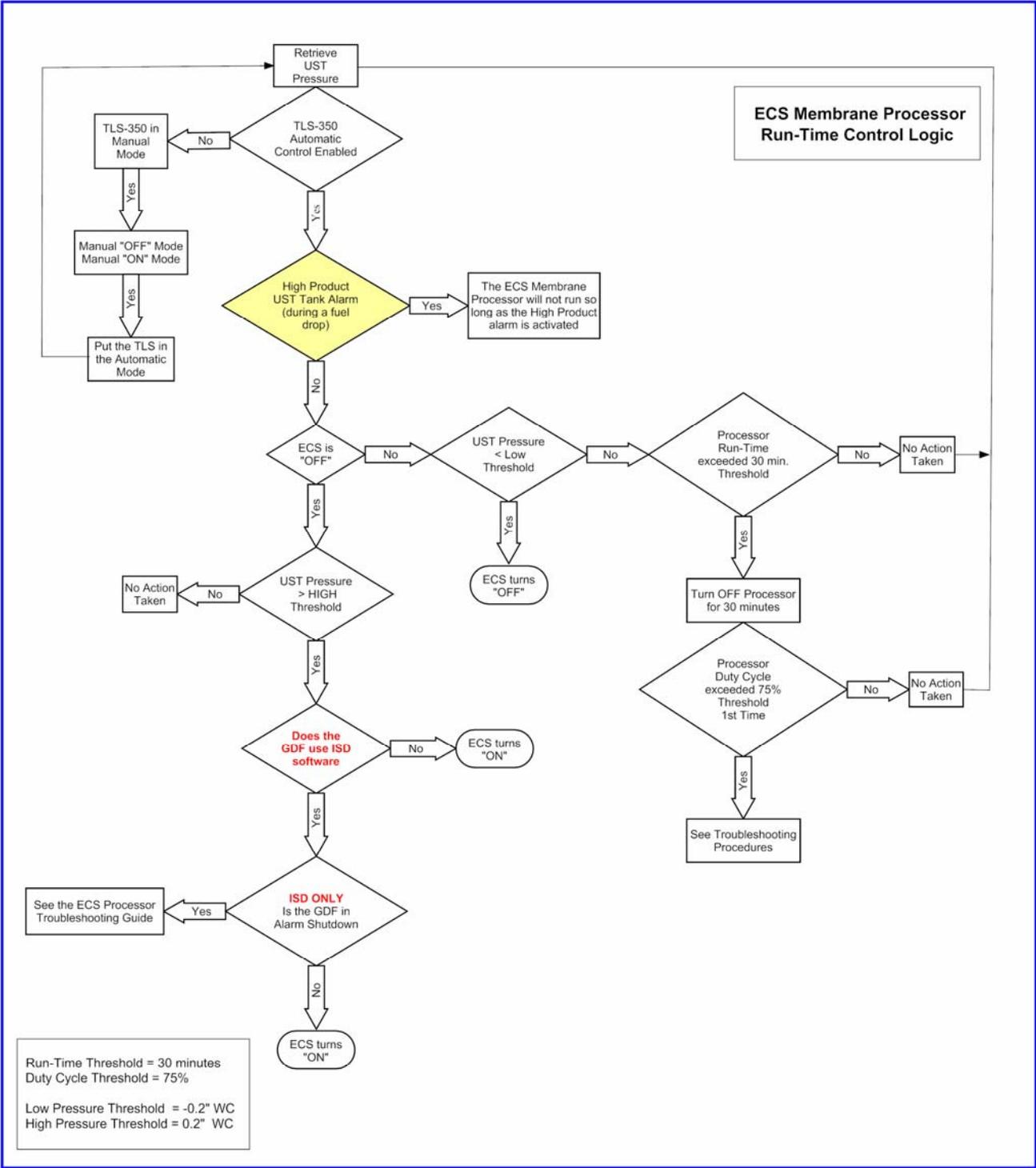


Figure 9: Processor Run-Time Algorithm

2.5.1 TLS-350 (PMC): Alarm Troubleshooting Summary

Displayed Message	Description	Light Indicator	Suggested Troubleshooting
VP EMISSION WARN	Mass emission exceeded the certified daily threshold.	Yellow	<ul style="list-style-type: none"> • Troubleshooting Guide www.vsthose.com. • Exhibit 8 • Exhibit 9
VP EMISSION FAIL	2 nd Consecutive mass emission failure.	Red	
PMC SETUP FAIL	PMC is not configured or missing components.	Red	<ul style="list-style-type: none"> • Troubleshooting Guide www.vsthose.com. • See ISD Troubleshooting Guide, P/N 577013-819. • Exhibit 8 • Exhibit 9
PMC SENSOR FAULT	Component used by PMC has failed or reported an error condition. See Troubleshooting section for complete description of sensors and associated conditions that can cause a sensor fault.	Red	<ul style="list-style-type: none"> • Check for Smart Sensor Device Alarm or Fault.
VP DUTY CYCLE WARN	Duty cycle exceeds 18 hours per day or 75% of 24 hours.	Yellow	<ul style="list-style-type: none"> • Troubleshooting Guide www.vsthose.com. • TLS 350 PMC Setup Procedure • Exhibit 10 • Exhibit 9 • Exhibit 4
VP DUTY CYCLE FAIL	2 nd Consecutive Duty Cycle Failure.	Red	

2.5.2 TLS-350 (ISD): Alarm Troubleshooting Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting ¹
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	<ul style="list-style-type: none"> • Troubleshooting Guide found at www.vsthose.com • Exhibit 4
ISD VAPOR LEAKAGE FAIL ²	Containment	Red	8 th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95 th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	<ul style="list-style-type: none"> • Troubleshooting Guide found at www.vsthose.com • Exhibit 10 • Exhibit 9
ISD GROSS PRESSURE FAIL ²	Containment	Red	8 th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75 th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL ²	Containment	Red	31 st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	<ul style="list-style-type: none"> • Troubleshooting Guide found at www.vsthose.com. • Exhibit 5 • Exhibit 6 • Exhibit 17
FLOW COLLECT FAIL ²	Collection	Red	2 nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
ISD VP STATUS WARN ^{4,5,6}	Processor	Yellow	Failure of Vapor Processor Effluent Emissions or Duty Cycle test.	<ul style="list-style-type: none"> • Troubleshooting Guide found at www.vsthose.com. • VP Emission Test • VP Duty Cycle Test
ISD VP STATUS FAIL ^{2,4,5,6}	Processor	Red	2 nd Consecutive Failure of Vapor Processor Status test.	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting ¹
VP EMISSION WARN ^{3,4,5,6}	Processor	Yellow	Mass emission exceeded the certified threshold.	<ul style="list-style-type: none"> • Troubleshooting Guide found at www.vsthose.com. • Exhibit 8 • Exhibit 9 • Exhibit 11
VP EMISSION FAIL ^{3,4,5,6,7}	Processor	Red	2 nd Consecutive Mass emission test failure.	
VP DUTY CYCLE WARN ^{3,4}	Processor	Yellow	Duty cycle exceeds 18 hours per day Or 75% of 24 hours.	<ul style="list-style-type: none"> • Troubleshooting Guide found at www.vsthose.com. • PMC Setup Procedure • Exhibit 10 • Exhibit 9 • Exhibit 4
VP DUTY CYCLE FAIL ^{4,7}	Processor	Red	2 nd Consecutive Duty Cycle Test Failure.	
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	<ul style="list-style-type: none"> • Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8 th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	<ul style="list-style-type: none"> • Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL ²	Self-Test	Red	8 th Consecutive Failure of Setup Test	

¹See ISD Troubleshooting Manual P/N 577013-819 and the VST ISD Troubleshooting Guide 9513-003 found at www.vsthose.com for a complete list of suggestions.
²ISD Shut Down Alarms – see “Site Re-Enable” on page 12-39
³**This warning will result in an ISD VP Status Warn**
⁴**VST ECS Membrane Processor.**
⁵**Veeder-Root Polisher**
⁶**VST Green Machine**
⁷**This failure will result in an ISD VP Status Fail.**

3 Post-Installation Power-Up Tests



During post-installation testing, the *Processor* will use outside air, not gasoline vapor from the USTs to conduct these tests.

- Close the 3 valves located on the inlet and the outlets of the *Processor*.
- Remove the plugs on the 3 tees located on the inlet and the outlets of the *Processor*.

3.1 Post-Installation Electrical Connections

- Prior to starting the *Processor*, the Motor Starter Relay Coil must be wired to the TLS-350 4-Relay Module. The *Processor* cannot start until this connection is made.

CAUTION: Make sure the TLS-350 is in the Manual OFF Mode prior to installing the wires. Make sure the power to the motors is OFF at the electrical panel.

- Install two 18 AWG wires that connect the Motor Starter Relay Coil to the TLS-350 4-Relay Module.
- See Figure 10 for connections to the TLS-350.
- Leaving the TLS-350 in the Manual OFF Mode, the power to the motors can be turned ON at the electrical panel.
- After the connection has been made, proceed to the Post-Installation Power-Up Tests.
- See Section 3.2.

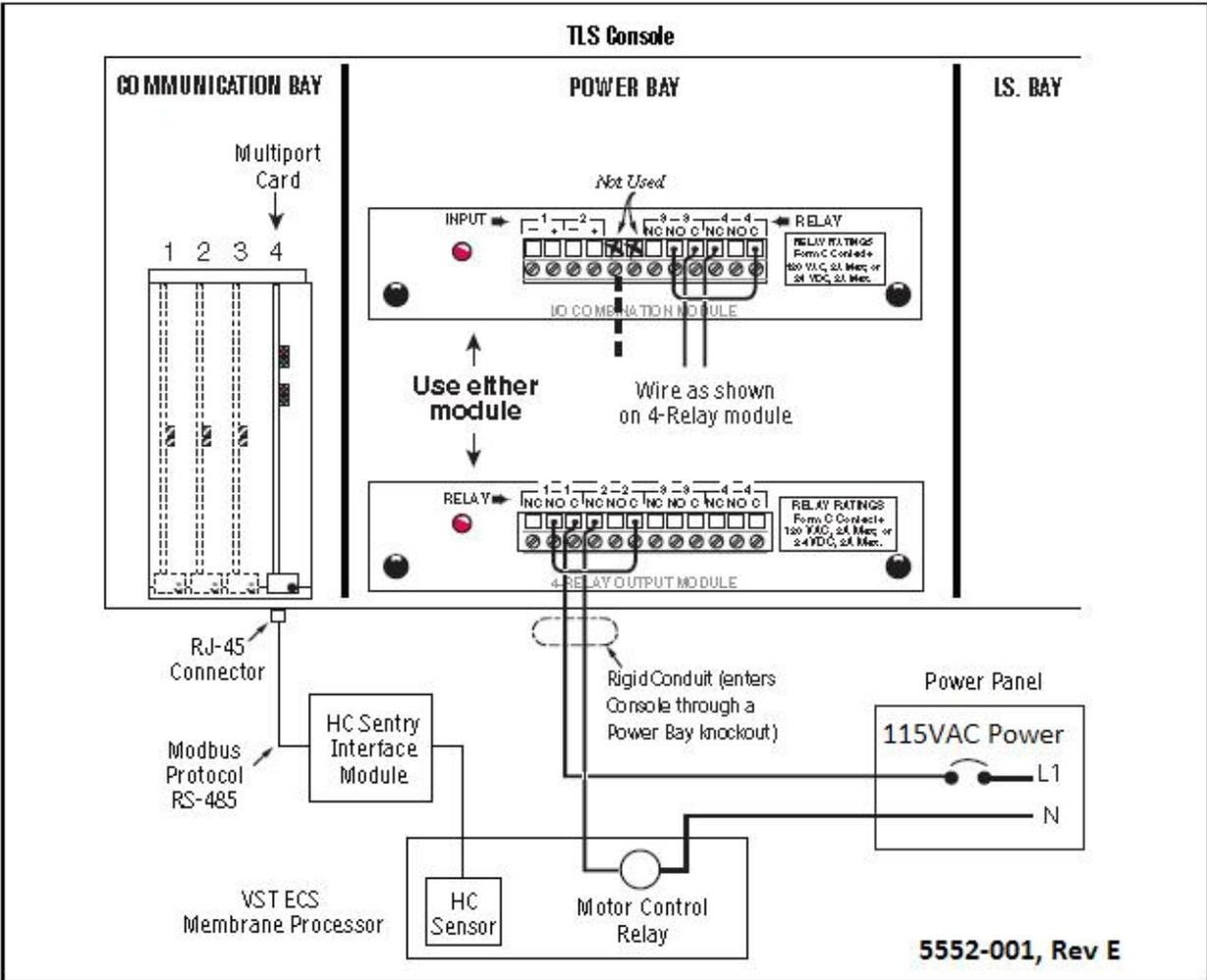


Figure 10: Wiring the Motor Starter Relay Coil

3.2 Required Post-Installation Power-Up Tests

- These tests are used for the Post-Installation Power-Up and Troubleshooting Test.
- Once you have properly prepared the Processor for testing, conduct tests 1 through 4 found in the table below.

	Test	Page
1.	Electrical Connection Check	11-41
2.	Motor Rotation Test	11-41
3.	Heat-Trace Continuity Test	11-47
4.	HC Sensor & HC Sentry 24 Power Test	11-48

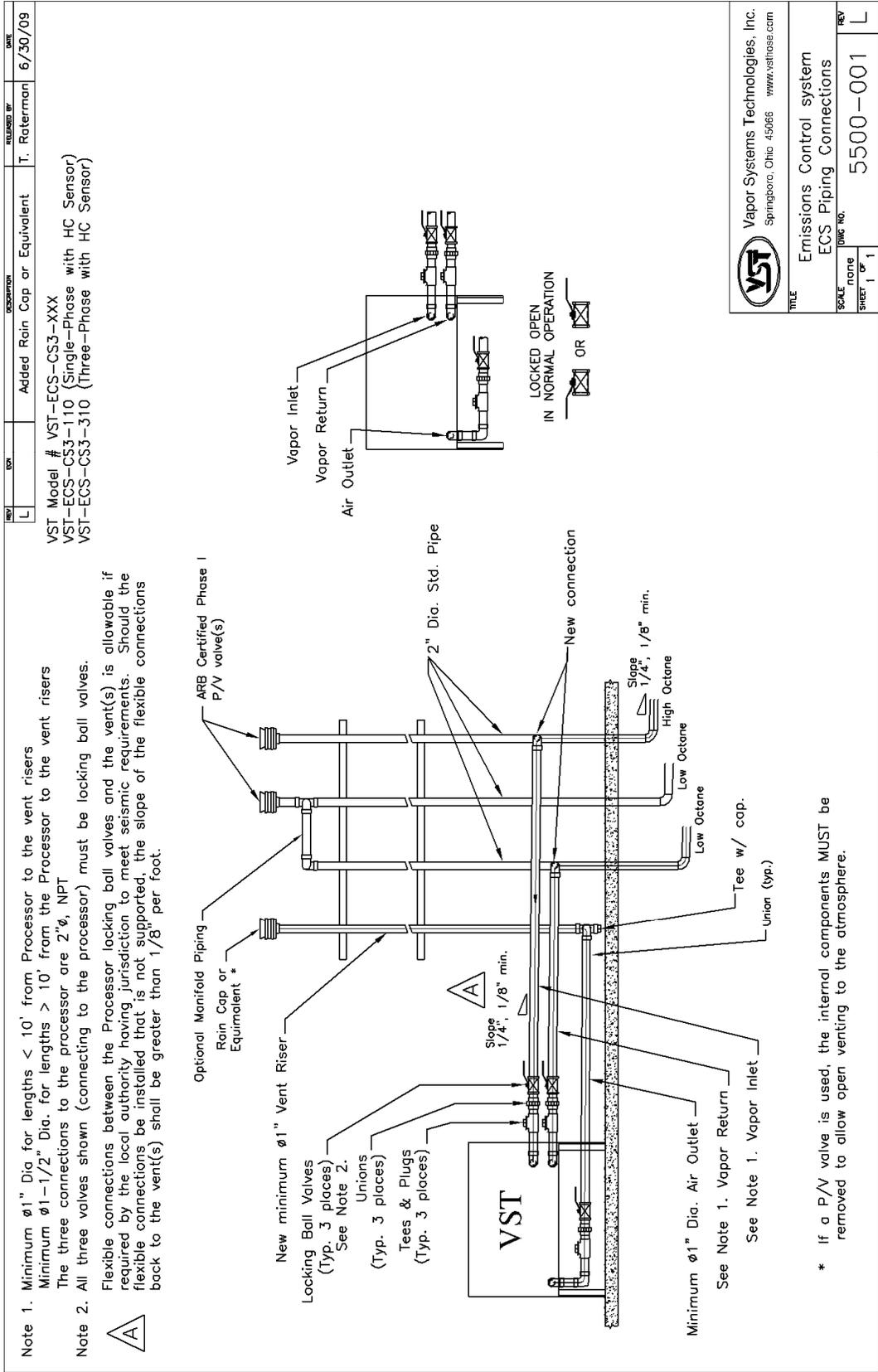


Figure 11: ECS Piping Configuration

Vapor Systems Technologies, Inc. Springboro, Ohio 45066 www.vsttosa.com	
Emissions Control system ECS Piping Connections	
SCALE	DRAWING NO.
1" = 1"	5500-001
SHEET	REV
1 OF 1	L

3.3 TLS Manual Mode

- Follow the steps at the TLS console to put the TLS-350 in the Manual “OFF” Mode, as shown in Figure 12 for the PMC Diagnostic Menu and Figure 13 for the ISD Diagnostic Menu.
- After the post-installation power-up tests are complete, put the *Processor* in the Manual “OFF” position.
- ALWAYS BE SURE TO REFER TO THE MOST RECENT VEEDER-ROOT PMC MANUAL (Manual #577013-801).

PMC Diagnostic Menu with PMC Software (VR Reference Manual #577013-801)

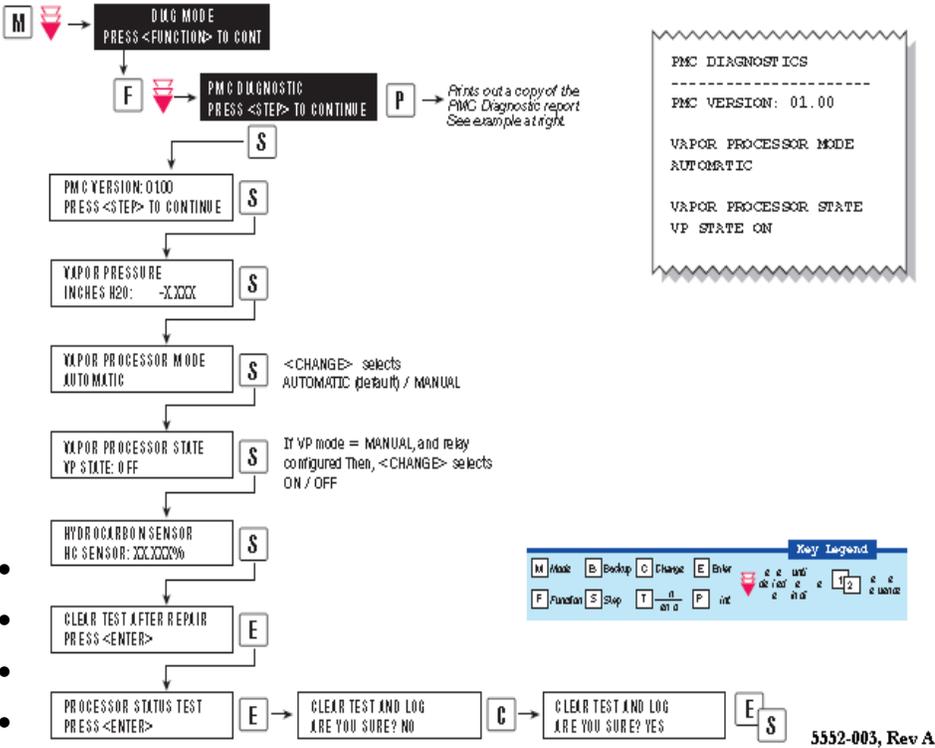


Figure 12: PMC Diagnostic Menu with PMC Software

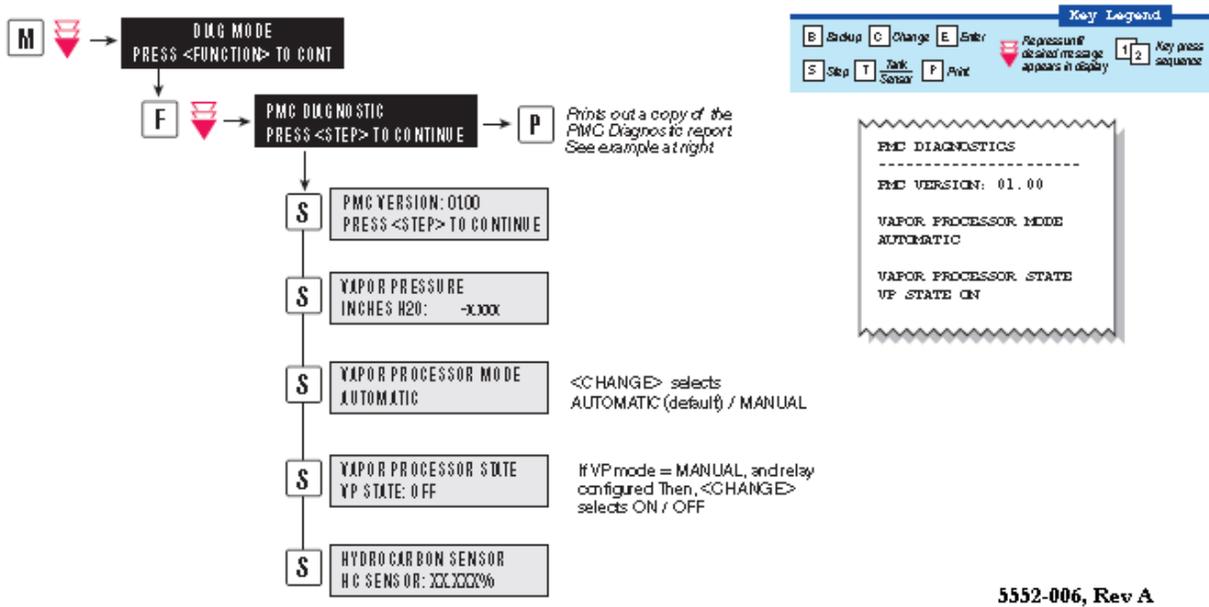


Figure 13: PMC Diagnostic with ISD Software

3.4 Electrical Connection Test

- Put the TLS-350 in the Manual OFF mode as shown in the Diagnostic Menus (See Figure 12 or Figure 13).
- Check all electrical and control connections prior to applying power to the *Processor*.
- Make sure that all connections have been made to the proper terminals and that all connections are tight.
 - ▶ In the electrical room:
 - HC Sentry 24VDC (output) / 115V power
 - Fused disconnects
 - Panel breaker wiring connections
 - Starter
 - TLS 4-relay module
 - HC Sentry Interface Cable
 - ▶ At the *Processor*:
 - Blower motor
 - Vacuum pump motor
 - Heat trace cable
 - HC sensor
 - All equipment grounds

3.5 Motor-Rotation Test

- The purpose of this test is to insure that the motors are rotating in the correct direction.
- Turn the power OFF at the disconnect switch located near the *Processor*.
- Put the *Processor* in the manual ON Mode at the TLS as shown in the diagnostic menu in Figure 12 or Figure 13.
 - ▶ Remove the cover from the *Processor*.
- Bump the power (briefly energize) the power at the disconnect switch.
 - ▶ Visually check the motor rotation for the vacuum pump and blower motors to be sure they are rotating according to the arrows that are shown on the equipment.
 - ▶ The rotation of the motors can be visually checked by looking at the rotation of the fan located on the end of each motor.

CAUTION

Always obtain approval from the local authority having jurisdiction.

Installation of the *Processor* must comply with (if applicable):

- CARB CP-201
- VST EVR E.O.
- Fire Marshal
- Water Board
- Local Air Pollution District
- ICC
- NEC
- NFPA 30 and 30A
- UL
- Any other applicable federal, state, and local codes

CAUTION: DO NOT RUN THE PUMP(S) FOR ANY EXTENDED PERIOD OF TIME UNTIL THE PROPER ROTATION IS VERIFIED OR YOU COULD CAUSE SERIOUS DAMAGE.

Motor Rotation Test, continued . . .

- If the motors are rotating in the proper direction, put the TLS in the manual OFF mode.
- If either of the motors are not rotating in the correct direction:
 - ▶ Put the *Processor* in the manual “OFF” Mode at the TLS.
 - ▶ Follow safety regulations regarding lock-out / tag-out procedures to insure power cannot be turned on to the *Processor*.
- Three-Phase Motors:
 - ▶ At the motor junction box at the ECS *Processor*, switch any two of the three power circuits for the motor that is not rotating in the correct direction.
 - ▶ See Figure 15 and Figure 17.
- Single-Phase Motors:
 - ▶ Check the wiring connection diagrams for the specific motor that is not rotating in the correct rotation and correct as required.
 - ▶ See Figure 14 and Figure 16.
- Remove the lock from the lock-out and apply power to the *Processor*.
- Return the *Processor* to the manual ON Mode at the TLS-350.
- Bump the power (briefly energize) power at the disconnect switch.
- Re-check the equipment for proper rotation.
- Return the *Processor* to the manual OFF mode at the TLS.

*If either motor will not run, refer to the ECS Troubleshooting Guide found on the VST website at:
www.vsthose.com.*

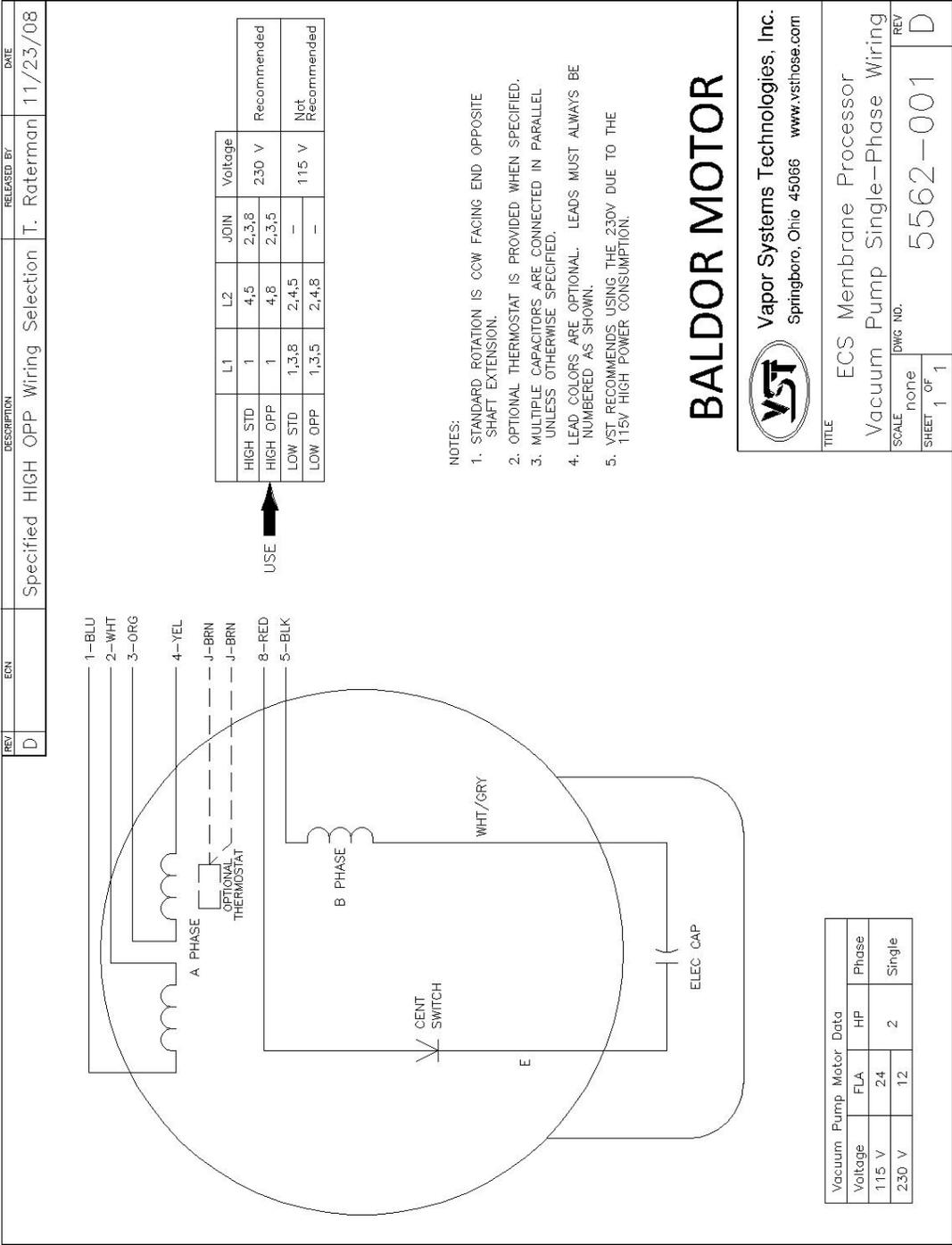


Figure 14: Vacuum Pump: Single-Phase Motor Wiring Diagram

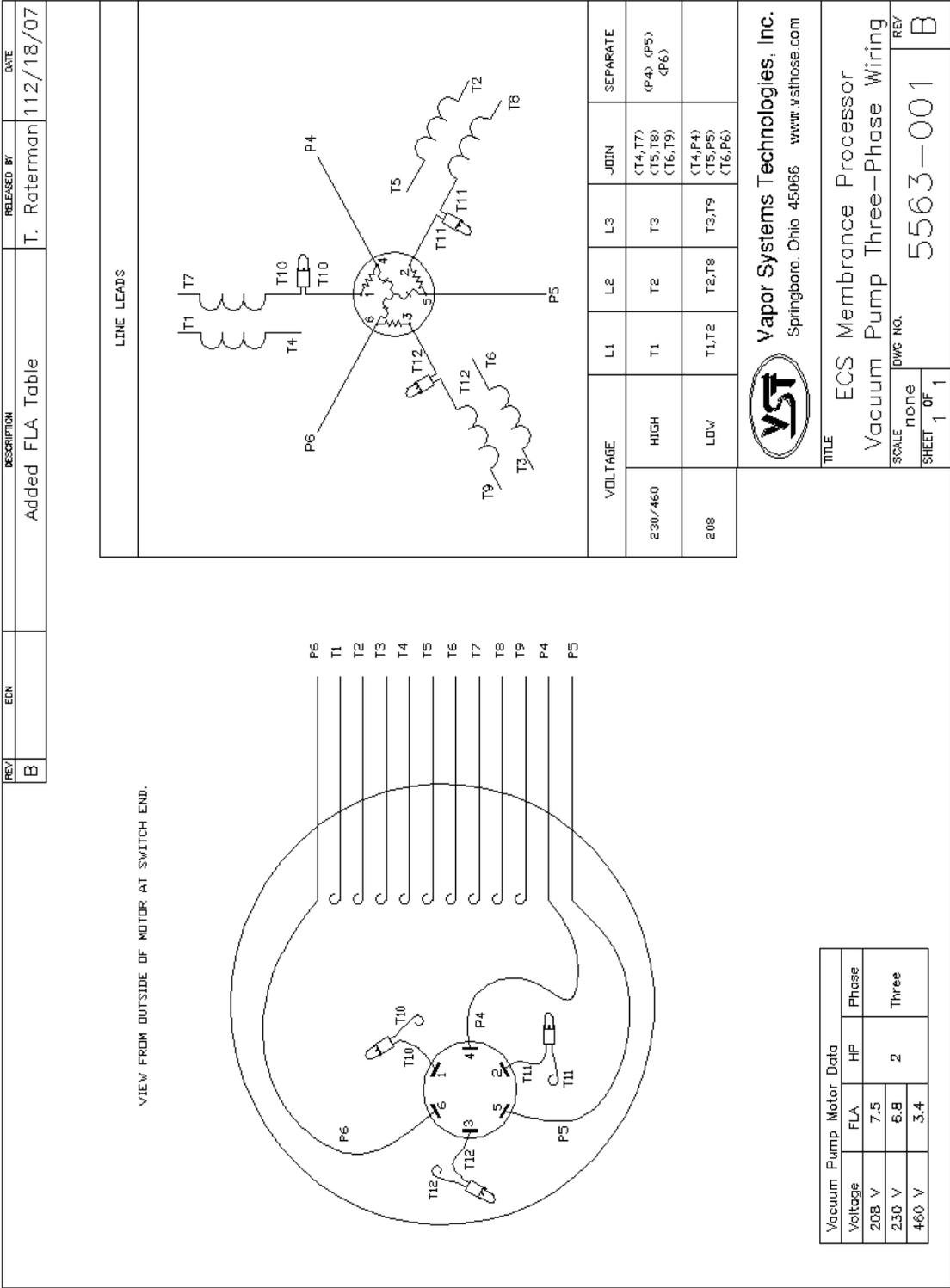
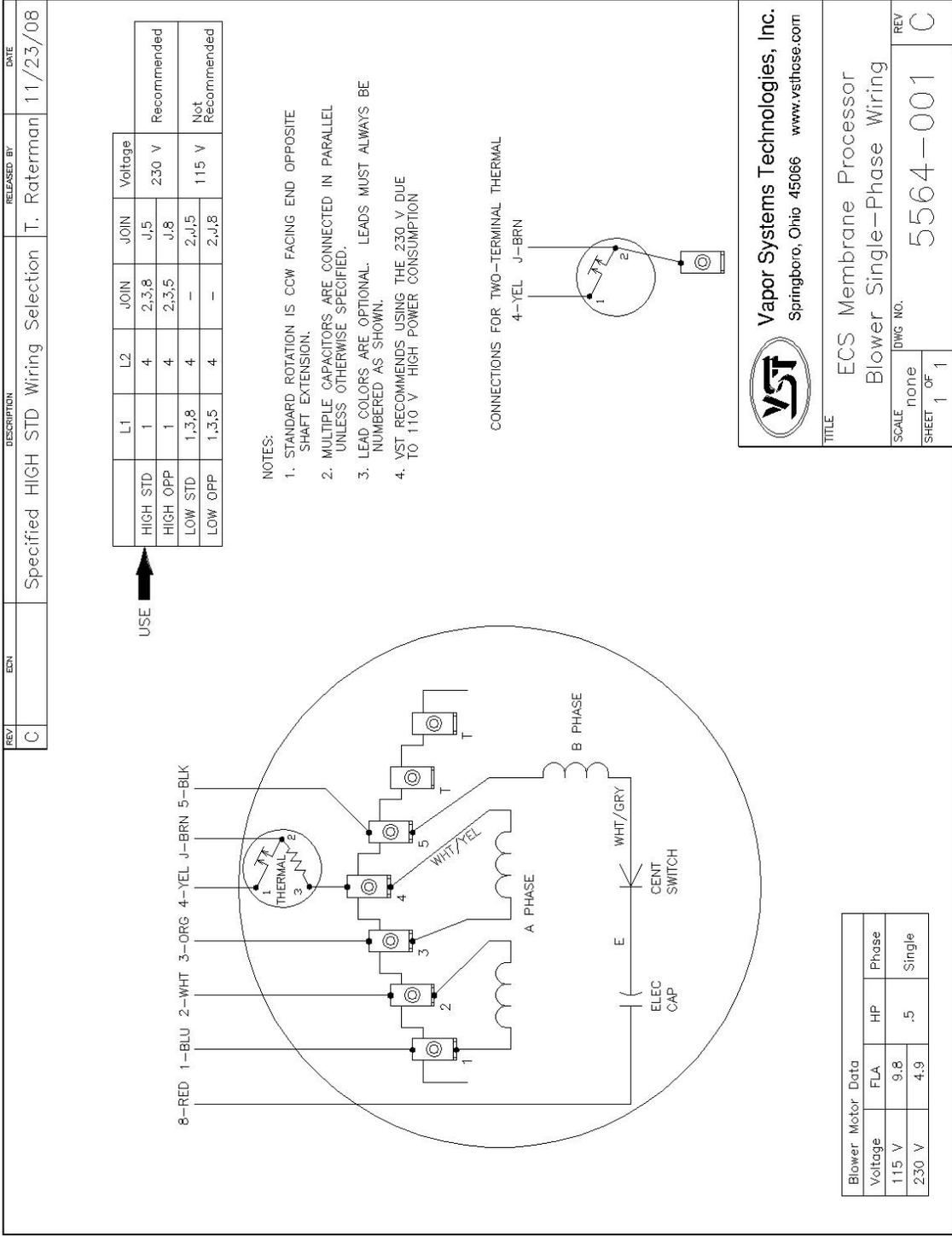


Figure 15: Vacuum Pump: Three-Phase Motor Wiring Diagram



FILENAME: 5564-001

Figure 16: Blower: Single-Phase Motor Wiring Diagram

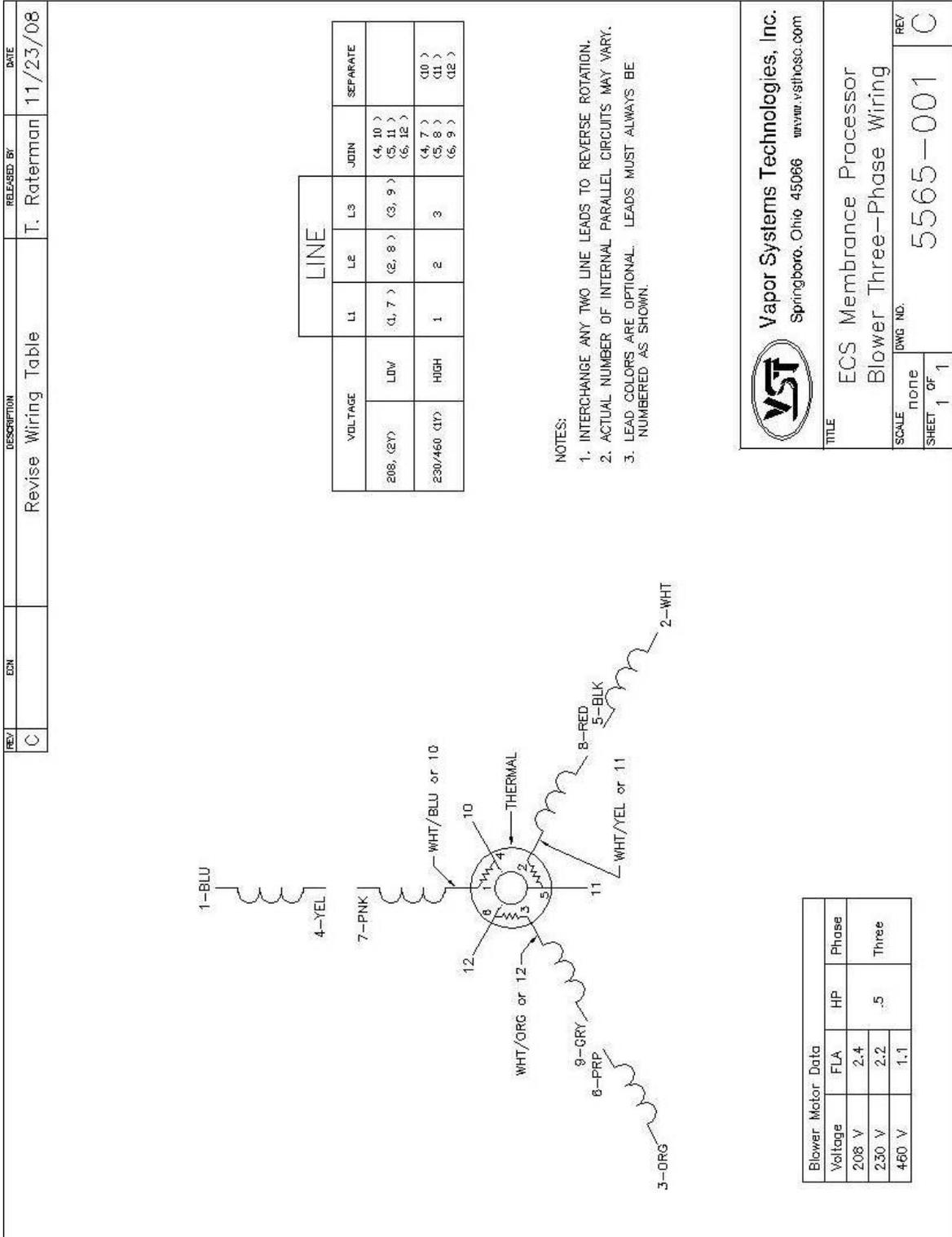


Figure 17: Blower: Three-Phase Motor Wiring Diagram

3.6 Heat-Trace Continuity Test

The purpose of the Heat Trace Continuity test is to insure there is not a short or damage to the Heat Trace cable. The self-regulating heating cable provides safe and reliable heat tracing for process temperature maintenance.

In electronics, a continuity test is the checking of an electric circuit to see if current flows (that it is in fact a complete circuit). A continuity test is performed by placing a small voltage (wired in series with an LED) across the chosen path. If the electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is "open." Devices that can be used to perform continuity tests include multimeters or specialized continuity testers.

3.6.1 Preparing the heat trace electrical junction box for the test:

- **CAUTION:** Be sure to use Lockout/Tag-Out procedures when performing work on the *Processor* or while working on electrical components.
1. Put the *Processor* in the manual OFF mode at the TLS-350.
 2. Trip the heat trace cable 115v circuit breaker in the electrical panel to remove the power from the heat trace cable.
 3. Remove the cover to the *Processor*.
 4. Remove the heat trace electrical junction box cover by removing the 4 hold-down screws and lifting the molded plastic cover off the base.

3.6.2 Testing the heat trace circuit

1. Using a multimeter or continuity tester, check the continuity (current flow) across the heat trace circuit as shown in Figure 18.
2. Verify the circuit is complete between the positive terminal and the neutral at the three-position terminal block.
3. If the red light does not come on, the heat trace circuit is open. (If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is "open.):
 - a) Check that all wiring connections are correct.
 - b) Repair/replace the heat trace cable as required to correct the problem.
4. Replace the cover on the heat trace electrical junction box using the 4 hold down screws.
5. Replace the cover on the *Processor*.
6. The *Processor* can now be put back in the Automatic Mode at the TLS-350 provided all work is completed.



Figure 18: Heat Trace Circuit Test

3.7 HC Sensor and HC Sentry Power Test

- The purpose of this test is to insure there is 24VDC power to the HC sensor and the HC Sentry module.

3.7.1 Checking 24 VDC Power to the HC Sensor

- The 24VDC power to the HC sensor is from the HC Sentry Module.
- Using the multimeter, check the + to Gnd connection on the HC Sentry.
- If there is no 24VDC power, check power to the HC Sentry module.
- If the unit does not function properly, see the ECS Troubleshooting Guide found on the VST website at www.vsthose.com.

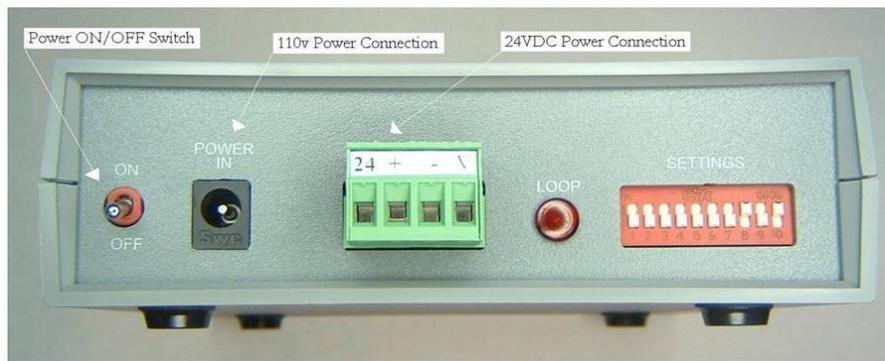


Figure 19: HC Sentry Interface Module Front View: Power and ON/OFF Switch

3.7.2 Checking 24VDC Power to the HC Sentry Module

- The HC Sentry is powered from a 115V outlet and uses a 115v/24VDC power converter, which is VST supplied.
- Check that the unit is ON.
- Check that the Power Light is ON.
- If the power light is not ON when the unit is ON:
 - ▶ Check to make sure there is 115v power to the outlet.
 - ▶ Check the ON switch on the HC Sentry module.
 - ▶ Check that the 115v/24VDC power converter is functioning.
 - ▶ If the unit does not function properly, see the ECS Troubleshooting Guide at www.vsthose.com.



Figure 20: HC Sentry Interface Module Back View: Power "ON" Light

3.8 Processor Leak Test: After Repair (Only) ECS Unit

3.8.1 Purpose of the Test

- The purpose of the After Repair Leak Test is to insure that all of the ECS unit tubing fittings and tubes located inside the ECS unit are leak-free after the tubing has been disrupted for ECS unit repair.

3.8.2 Preparation

- Follow these steps to prepare the ECS unit for the Leak Test after repairs have been made.
 1. Conduct this test with the Veeder-Root TLS-350 in the Manual "OFF" Mode.
 2. Turn OFF power to the ECS unit and motors

3.8.3 Functional Test Procedures

1. Close the three (3) valves at the ECS unit.
2. Remove a 2" plug from one of the pipe tees at the ECS unit. (See Figure 21)
3. Install the Leak Test Fixture (See Figure 22) in the empty 2" pipe tee on the ECS unit.
4. The leak check is conducted with 1.0 to 2.0 PSI nitrogen.
5. Make sure the isolation valve on the Leak Test Fixture is fully closed.
6. Make sure the Leak Test Fixture pressure regulator is fully closed.
7. Make sure the nitrogen regulator is set at a maximum of 20 PSI outlet pressure.
8. Slowly open the valve on the test fixture to pressurize the ECS unit at 1.0 to 2.0 PSI compressed nitrogen.

CAUTION: PRESSURIZING THE ECS UNIT OVER A MAXIMUM OF 5.0 PSI MAY CAUSE DAMAGE TO THE ECS UNIT O-RINGS AND/OR PUMP SEALS, WHICH WILL VOID ALL WARRANTIES OF THE ECS UNIT

9. With the ECS unit pressurized between 1.0 to 2.0 PSI compressed nitrogen, spray a soapy solution on each fitting to check for bubbles:
 - If bubbles do not appear, the connection is tight.
 - If bubbles do appear, tighten the leaking fitting 1/8" turn (maximum) and re-check for leaks.
 - If the fitting cannot be tightened so that the connection is leak free, replace the 45° flare tube assembly that is leaking with a new tube assembly.
10. Continue this process until all the internal tube fittings have been checked and found leak free.
11. Once this test is complete and all the piping fittings are leak free, remove the compressed nitrogen connection to the Leak Test Fixture.
12. Remove the Leak Test Fixture.
13. Re-install the 2" pipe plug.
14. After ALL repairs are complete:
 - Open the three (3) valves at the ECS unit.
 - Turn ON the power to the ECS unit and motors.
 - Return the Veeder-Root TLS-350 to the "AUTOMATIC" Mode.



Figure 21: Processor Inlets & Outlets



Figure 22: Typical Leak Check Test Fixture

3.9 Preparing the Processor for Field Operation

3.9.1 Setting the TLS-350 Threshold Values

- Although the threshold values are in the Veeder-Root posting reports, the Veeder-Root PMC and ISD manuals do not address changing the initial "Default" values to match the defaults that are prescribed in VST Executive Orders VR-203 and VR-204.
- In the PMC Set Up menu verify / set the TLS-350 to the following values:

	Software	Description	Default	Threshold Values
IN THE PMC SET UP MENU	PMC / ISD	Vapor Processor Max. Run-Time	60 minutes	30 minutes
	PMC / ISD	Over Pressure Limit	0.0"WC	1.0"WC
	PMC / ISD	Analysis time	0.0	11:59 PM.
	PMC / ISD	Turn off vapor processor threshold	-0.2"WC	NO CHANGE
	PMC / ISD	Turn on vapor processor threshold	+0.2"WC	NO CHANGE
	PMC Only	Duty cycle limit	75%	NO CHANGE
	PMC / ISD	All the other associated threshold values are pre-set from the factory.		

- **CAUTION:** These values MUST be set prior to putting the TLS-350 into the AUTOMATIC MODE.

3.9.2 Processor Configuration Prior to Start Up



- After all the post-installation power-up tests are complete:
- Replace the plugs on the 3 tees located on the inlet and the outlet of the *Processor* and tighten.
- Lock in the open position the 3 valves located on the inlet and the outlet of the *Processor*.
- Leave the *Processor* in the manual "OFF" mode at the TLS 350.
- See Figure 12 or Figure 13.
- Complete the Post-Installation Power-Up checklist form (found on the next page of this document).

3.10 Post-Installation Power-Up Checklist

Post-Installation Power-Up Checklist Form					
VST-ASC #:	Date:				
ASC Name:					
VST-ASC Certification Level	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C		
ASC Company:					
GDF Name:					
Address:					
City:			State:	Zip Code:	
GDF Contact Person Name:					
GDF Contact Person Title:					
GDF Contact Person Phone:				E-mail:	
Notes: Use this form to note details of the note details of the power-up process					
Checkpoints	Passed	Failed	Repaired	Replaced	Action Items if Required
ECS Processor Components					
All electrical connections checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Blower motor rotation checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Vacuum pump motor rotation checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Heat-trace continuity checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HC sentry power checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HC sensor power checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Set threshold values	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Attach product sticker with bar code here

The above post-installation power-up tests were performed in accordance with IOM found in the VST's Executive Orders.

ASC Signature

4 Processor Start-Up

- Use the following start-up procedure:
 - ▶ When initially starting the *Processor* or
 - ▶ When re-starting the *Processor* following maintenance or testing.

START-UP PROCEDURE	
1.	<ul style="list-style-type: none"> • Make sure the plugs are installed on the 3 tees at the <i>Processor</i>.
2.	<ul style="list-style-type: none"> • Make sure all 3 valves are locked in the OPEN position at the <i>Processor</i>.
3.	<ul style="list-style-type: none"> • Make sure power is on to the: <ul style="list-style-type: none"> ▪ Heat-trace cable ▪ HC sentry ▪ HC sensor ▪ ECS vacuum pump ▪ ECS recirculation blower
4.	<ul style="list-style-type: none"> • Make sure the pressure sensor is operational.
5.	<ul style="list-style-type: none"> • Make sure that the GDF is vapor tight. (TP 201.3 and Exhibit 4)
6.	<ul style="list-style-type: none"> • After the TLS is installed and configured and all EVR equipment has been installed, the <i>Processor</i> can become operational. • Put the TLS in the AUTOMATIC MODE. • If the pressure is above +0.2" WC, the <i>Processor</i> will start and the auxiliary relays will close. • If the pressure is below +0.2" WC, the <i>Processor</i> will not start because the UST system-pressure is below the high-pressure threshold.
<p>NOTE: All exhibits can be found in Executive Orders VR-203 and VR-204. VR-203 is for those systems using PMC. VR-204 is for those systems using ISD.</p>	

CAUTION:

Locking ball valve handles at the *Processor* inlet and outlet must not be removed.

4.1 Processor Shut-Down Procedure

CAUTION: POWER TO THE HC SENSOR AND THE HEAT TRACE CABLE MUST BE TURNED OFF INDIVIDUALLY FROM DIFFERENT POWER SOURCES. THEY DO NOT RECEIVE THEIR POWER FROM THE SAME SOURCE AS THE MOTORS.

4.1.1 Processor Shut-Down Procedure

- The *Processor* must be **SHUT DOWN** for all testing and maintenance.
- The only exception is for the “Determination of VST Processor Activation Pressure Test” (exhibit 9).
- To turn the *Processor* **OFF**:
 - a) Through the front panel of the TLC console, access the PMC menu.
 - b) Select *Processor* **MANUAL** mode.
 - c) Verify that the status is **OFF**.
 - d) Remove power to the *Processor* by either turning **OFF** the breaker or by disconnecting power at the *Processor*.
- To return the *Processor* to the **AUTOMATIC** mode:
 - a) Through the front panel of the TLS console, access the PMC menu.
 - a) Select *Processor* **AUTOMATIC** mode.
 - b) Turn the power **ON** to the *Processor*.

4.1.2 HC Sensor and HC Sentry Module

- The 115VAC/24 VDC power supply for the HC Sentry Module / HC sensor can be unplugged, which will remove power to the HC Sensor in the *Processor*.

4.1.3 Heat-Trace Cable

- The heat trace cable should not be turned **OFF** unless maintenance is performed in an area that could cause electrical shock.
- Turn **OFF** power to the heat-trace cable from the 115v electrical-panel breaker.

5 Processor Maintenance

- The VST Emissions Control System consists of only two components having moving parts: a blower and a vacuum pump, which do not have any scheduled maintenance for 10 years.
- The remaining components are tested, but they require maintenance only if they fail their tests:
 - ▶ Heat trace cable
 - ▶ HC sensor
 - ▶ HC Sentry module
- Because the system continually monitors itself and notifies you of any problems or situations, it requires very little attention.
- The table on the following page outlines the required annual inspections and tests.
 - ▶ Preventative Maintenance Checklist Form
 - ▶ GDF Maintenance Records

5.1 Annual System Compliance Testing

Annual System Compliance Testing	
Static Pressure Test:	TP-201.3 Exhibit 4
Dynamic Back Pressure Test:	TP-201.4
Liquid Removal Test Procedure:	Exhibit 5
Hydrocarbon Sensor Verification Test:	Exhibit 8
Vapor Pressure Sensor Verification Test:	Exhibit 10
VST <i>Processor</i> Activation Test:	Exhibit 9
Nozzle Bag Test Procedure:	Exhibit 7
ISD Operability Test: (Flow Meter Operability Test)	Exhibit 17 (Exec. Order VR-204 only)
<p>NOTE: All exhibits can be found in Executive Orders VR-203 and VR-204. VR-203 is for those systems using PMC. VR-204 is for those systems using ISD.</p>	

5.2 Annual Inspections and Replacements

Annual <i>Processor</i> Inspections and Replacements					
Component	Procedure	Fail Criteria	Corrective Action	Reference Manuals	Authorized Personnel
Blower	Replace the blower every ten years or 15,000 hrs. (whichever comes first).			IOM – 11 Found in Executive Orders VR-203 and VR-204	VST ASC Level C
Vacuum pump	Replace blower every ten years or 15,000 hrs. (whichever comes first).				
Vacuum pump drive coupling - rubber insert	Visually inspect the drive coupling between the vacuum pump and the motor for wear	Rubber debris is found on or around the vacuum-pump base.	Replace the drive coupling rubber insert	IOM – 11 Found in Executive Orders VR-203 and VR-204	
Heat Trace Cable	Check the continuity of the heat trace cable.	If the heat trace cable circuit is open, the cable has failed.	Replace the heat-trace cable	IOM – 11 Found in Executive Orders VR-203 and VR-204	
HC Sensor	Test the HC sensor	The difference shall be within $\pm 1.0\%$ HC concentration from the calibration gas concentration for zero and mid-range gas and $\pm 2.0\%$ for the high-range gas.	Replace the HC Sensor	IOM – 11 and Exhibit 8 Found in Executive Orders VR-203 and VR-204	

5.3 Preventative Maintenance Checklist Form

Component	Frequency	Date Inspected	Completed	Required Action Items
<i>PROCESSOR</i>				
<ul style="list-style-type: none"> Inspect drive coupling on the vacuum pump. 	Yearly		[]	
<ul style="list-style-type: none"> Check the continuity of the heat trace cable. 			[]	
RECIRCULATION BLOWER				
Replace every 10 years or 15,000 hours, whichever comes first.			[]	
VACUUM PUMP				
Replace every 10 years or 15,000 hours, whichever comes first.			[]	

5.4 GDF Maintenance Record

Date of Maintenance/ Test/Inspection/Failure (including date and time of maintenance call)	Repair date to correct test failure	Maintenance/Test/Inspection Performed and Outcome	Affiliation	Name and Technician ID Number of Individual Conducting Maintenance or Test	Telephone Number

Component Replacement

6 ECS Unit Purging Instructions Prior to Service or Maintenance

6.1 Purpose

- Prior to disassembly of the ECS unit, the ECS must be purged of gasoline vapor when internal components or internal tubing are removed for service or maintenance.

6.2 Tools Required

- The following tools are needed to purge the ECS unit of gasoline vapors:
 1. Large crescent wrench
 2. A Leak Check Test Fixture
 3. 1-bottle of nitrogen
 4. ¼" tubing (to connect the nitrogen bottle to the leak check test fixture)

6.3 Preparation

CAUTION: THE ECS UNIT IN THE TLS DIAGNOSTIC MENU MUST BE IN THE MANUAL "OFF" MODE AND THE POWER TO THE ECS MUST BE TURNED OFF BEFORE PURGING THE ECS UNIT. See Figure 12 or Figure 13.

1. Close the Vapor Inlet and Vapor Return isolation valves
 - The air outlet isolation does not have to be closed
 - See Figure 23.
2. Remove the caps from the Vapor Inlet and Vapor Return tees
 - The cap on the Air Outlet tee does not have to be removed
 - See Figure 23.
3. Install the Leak Check Test Fixture at the Vapor Inlet tee
 - Make sure the valve on the fixture is closed
 - Make sure the pressure regulator is set to zero flow
 - See Figure 24.
4. Connect the nitrogen bottle to the Leak Check Test fixture using ¼" tubing
 - **CAUTION: Make sure the nitrogen regulator is set to 20 psi.**

6.4 Procedures

1. Open the nitrogen valve.
2. Check to make sure the nitrogen supply pressure is 20 psi.
3. Slowly open the isolation valve on the leak check fixture.
4. Slowly open the pressure regulator so the supply pressure is at 1-2 psi.
5. Allow the nitrogen to purge the ECS unit for 2 -3 minutes.

PURGING OF THE ECS UNIT IS COMPLETE

6.5 Post Purging Procedures

- 1. Close the nitrogen valve
- 2. Remove the 1/4" tubing from the nitrogen bottle to the leak check fixture
- 3. Close the pressure regulator valve
- 4. Close the isolation valve
- 5. Remove the leak check fixture from the ECS unit

THE ECS UNIT IS NOW READY FOR SERVICE OR MAINTENANCE

6.6 Post Service or Maintenance

- 1. Make sure the caps have been replaced in the tees
- 2. Make sure the valves on the Vapor Inlet and the Vapor Return are open
- 3. Make sure the ECS is set at the TLS to the AUTOMATIC MODE

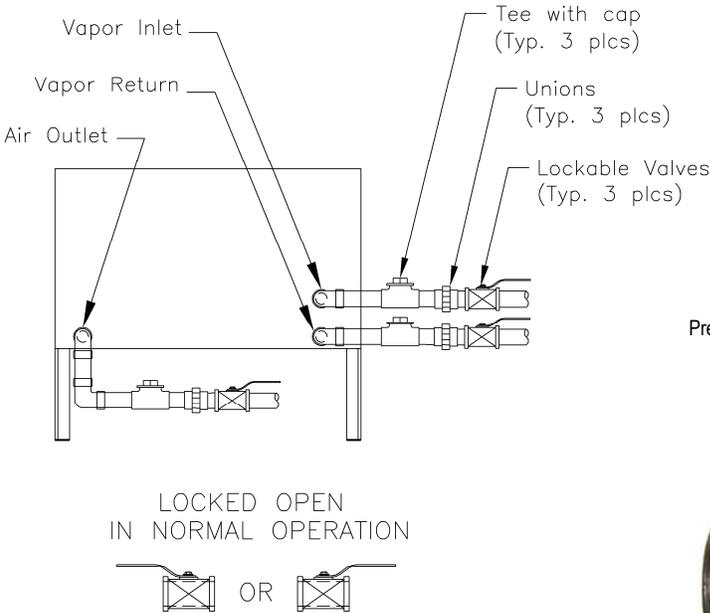


Figure 23: Processor Inlets & Outlets

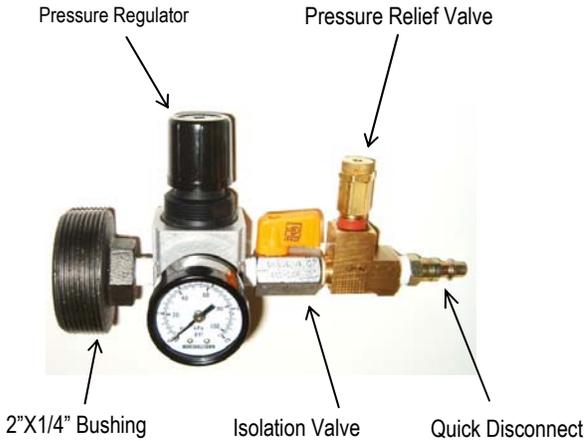


Figure 24: Typical leak-check fixture

7 Blower Replacement

7.1 Blower Replacement Safety



Use lockout / tagout procedures prior to starting work.

7.2 Removing the Blower

1. Put the TLS 350 in the manual "OFF" mode.
 - See Figure 12 or Figure 13.
2. Disconnect power to the blower and vacuum pump motors. Do this at both the breaker and at the disconnect switch. The disconnect switch is located near the *Processor*.
3. Close the ball valves between the *Processor* and the vents. See Figure 23.
4. Conduct ECS Unit Purge Procedure (See Section 6 of this document).
5. Completely remove the two blower $\frac{3}{4}$ " - 45° flare inlet and out tubes.
 - See Figure 26.
 - NOTE: The nuts on the tubing are $\frac{3}{4}$ " 45° flare, use caution not to damage the flared ends on the tubing or the threads on the nuts after removal.
6. Remove the two 45° flare inlet and outlet connection fittings from the blower.
7. Disconnect and remove the blower electrical from the motor.
 - See Figure 25.
8. Remove (4) $\frac{1}{4}$ " x $\frac{3}{4}$ " mounting bolts.
 - The 4 holes in the blower stand are tapped $\frac{1}{4}$ ".
 - Keep the (4) $\frac{1}{4}$ " bolts for reuse or replace them with new ones.
 - CAUTION: The blower end of the blower/motor assembly is heavier than the motor end, which may cause the blower to fall off the stand. USE CAUTION when removing the bolts.
9. Remove the blower from the stand.

7.3 Installing the New Blower

1. Place the new blower on the blower stand.
2. Install and hand tighten the (4) ¼" x ¾" blower mounting bolts.
3. Install the two 45° flare inlet and outlet connection fittings into the blower.
4. Install the ¾" inlet and outlet tubing.
 - Do not use any thread-sealing compound when assembling the 45° flare nuts.
 - NOTE: When tightening the 45° flare nuts: Clamp the tube flare between nut and nose body of the tube by screwing the nut on finger tight. Tighten with a wrench an additional ¼ turn for a metal-to-metal seal.
5. After the tubing is installed and the 45° flare nuts tightened, tighten the (4) mounting bolts.
6. Reconnect the electrical power wires to the blower motor.
7. Remove the lock(s) and tags from the lockout & tagout.
8. Conduct a *Processor* Leak Check – see Section 3.8 of this manual.
9. Open the ball valves between the Processor and the vent risers.
10. Turn ON power to the blower and vacuum pump at the breaker.
11. Put the TLS-350 in the manual ON mode.
12. Bump the power (briefly energize) the power at the disconnect switch.
13. Check the rotation of the blower motor.
14. Engage the disconnect switch.
15. After work is completed, put the TLS-350 in the AUTOMATIC mode.

See Figure 12 or Figure 13.



Figure 25: Blower electrical connection conduit



Figure 26: Blower inlet and outlet tubing connections and mounting bolts

8 Vacuum Pump Replacement

8.1 Safety



Use lockout / tagout procedures prior to starting work.

8.2 Removing the Vacuum Pump

1. Put the TLS 350 in the manual "OFF" mode.
 - See Figure 12 or Figure 13.
2. Disconnect power to the blower and vacuum pump motors. Do this at both the breaker and at the disconnect switch. The disconnect switch is located near the *Processor*.
3. Close the ball valves between the Processor and the vent risers.
 - NOTE: Before you begin disassembling; note that the vacuum pump and the motor are attached to a common base plate.
4. Conduct ECS Unit Purge Procedure (See Section 6 of this document).
5. Completely remove the vacuum pump ½" outlet tubing.
 - See Figure 27.
6. Completely remove the vacuum pump ½" and ¼" inlet 45° flare tubing and all pipe fittings connected to the vacuum pump.
 - See Figure 28.
7. Completely remove the ¼" HC sensor inlet tubing at the air outlet and the HC sensor.
 - See Figure 29 and Figure 30.
 - NOTE: The tube ends are a Parker 45° flare, use caution not to damage the flared ends on the tubing or the threads on the nuts after removal.
8. Disconnect and remove the vacuum pump electrical from the motor.
9. Remove (4) ¼" x 1-½" mounting bolts from the vacuum pump motor assembly base plate.
 - Note: The vacuum pump and motor will stay connected to the base plate.
 - Keep the (4) bolts for reuse or replace with new.
10. Slide the vacuum pump out from under the blower stand.

8.3 Installing the new Vacuum Pump and Vacuum Pump Motor Assembly

1. Slide the new vacuum pump under the blower stand and align the mounting holes.
2. Install the (4) 1/4" x 1-1/2" vacuum pump base mounting bolts.
3. Tighten the mounting bolts so that the bottom of the vacuum pump base is 1/8" from the ECS base.
4. Re-install the 1/2" and 1/4" inlet 45° flare tubing and all pipe fittings connected to the vacuum pump.
5. Re-install the 1/2" outlet tubing.
6. Re-install the 1/4" HC sensor inlet tubing.
Do not use any thread sealing compound when assembling the 45 ° flare nuts.

NOTE: When tightening the 45° flare nuts: Clamp the tube flare between nut and nose body of the tube by screwing the nut on finger tight. Tighten with a wrench an additional 1/4 turn for a metal-to-metal seal.

7. Reconnect the electrical power wires to the vacuum pump motor.
8. Conduct a Processor Leak Check – see Section 3.8 of this document.
9. Open the ball valves between the *Processor* and the vent risers.
10. Remove the lock(s) and tags from the lockout & tagout.
11. Turn ON power to the blower and vacuum pump at the breaker, but not at the disconnect switch.
12. Turn the Processor to the **MANUAL ON** mode.
13. Bump the power (briefly energize) the disconnect switch.
14. Check rotation of vacuum pump motor.
15. After work is completed, put the TLS-350 in the **AUTOMATIC** mode.

See Figure 12 or Figure 13.

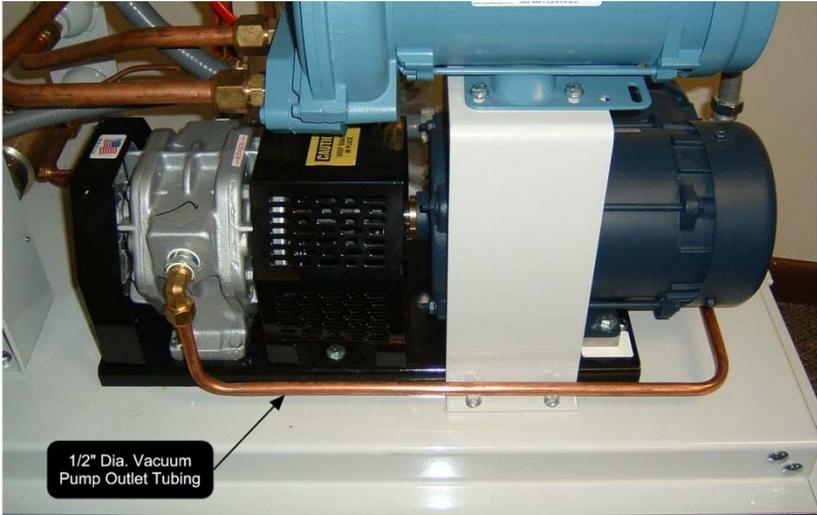


Figure 27: Vacuum pump outlet tubing connection

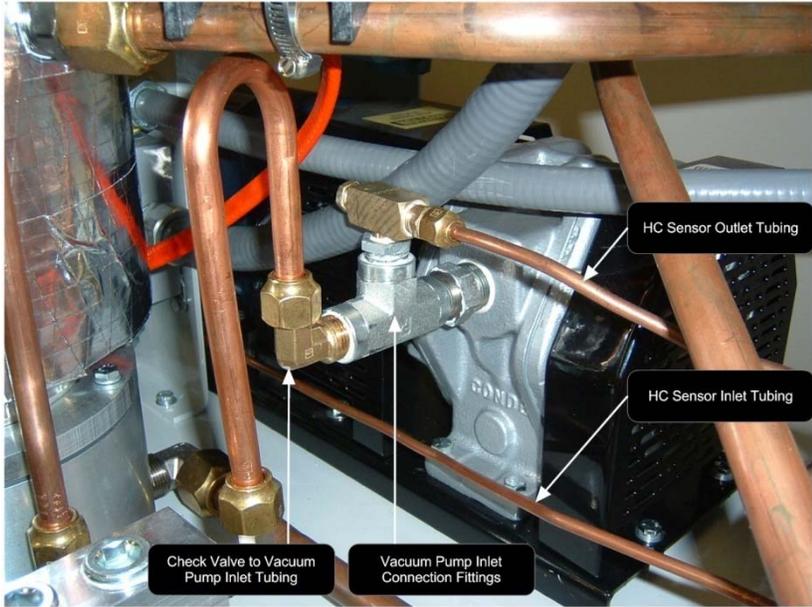


Figure 28: Vacuum pump inlet tubing and fittings

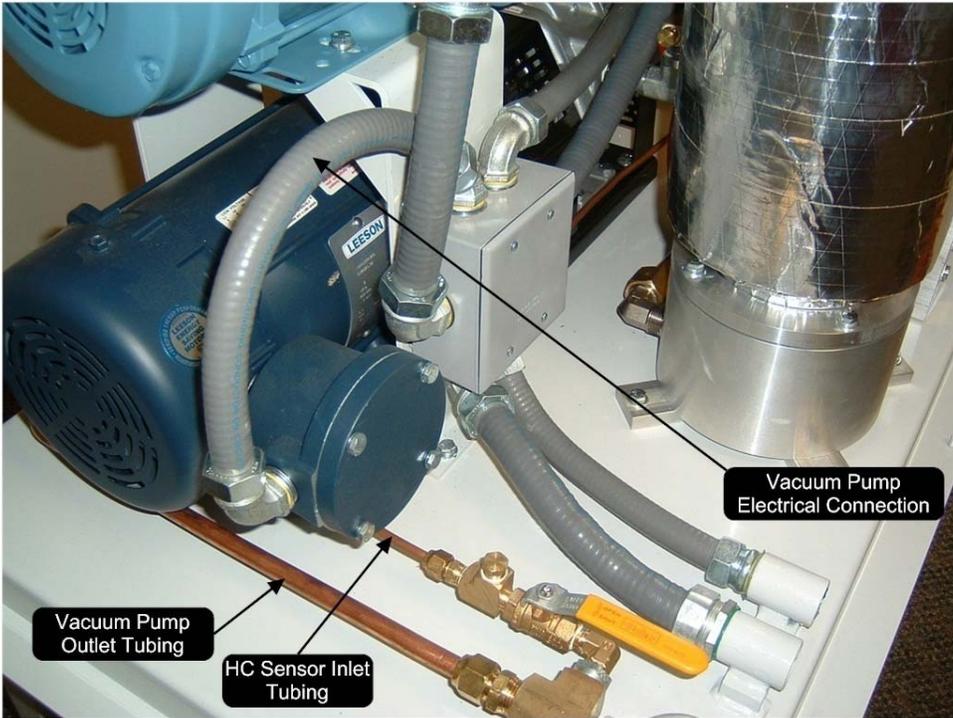


Figure 29: Vacuum pump electrical connection / vacuum pump outlet tubing / HC sensor inlet tubing

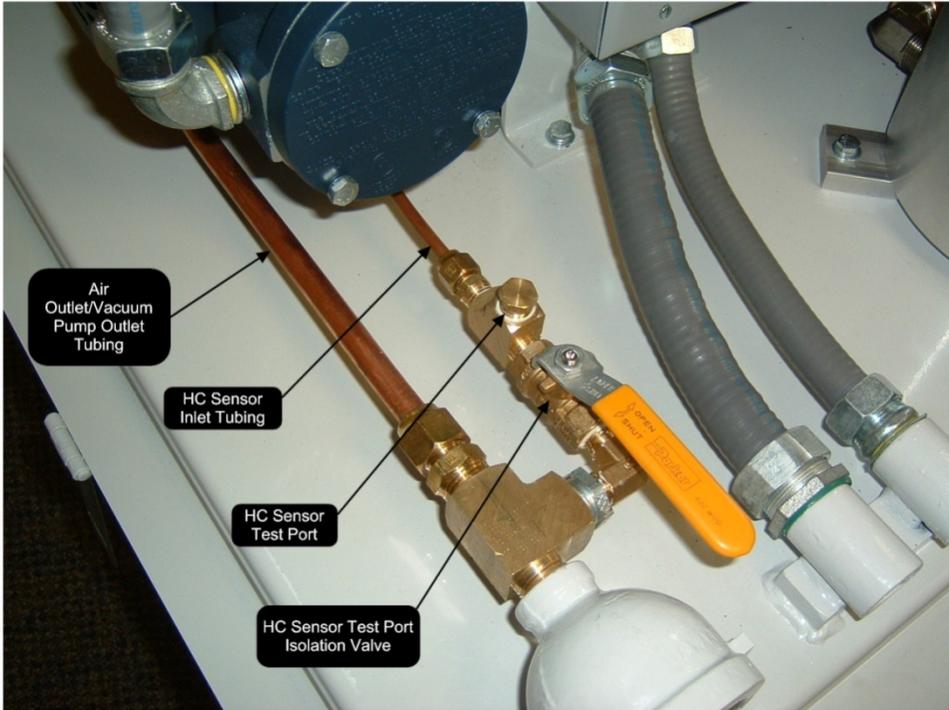


Figure 30: Air outlet / vacuum pump outlet / HC sensor inlet tubing

9 Membrane Replacement

9.1 Safety



Use lockout / tagout procedures prior to starting work.

9.2 Removing the Membrane from the Membrane Housing

1. Put the TLS 350 in the manual "OFF" mode. See Figure 12 or Figure 13.
2. At the breaker and at the disconnect switch, disconnect power to the heat trace cable, the vacuum pump, and the blower.
3. Close the ball valves between the *Processor* and the vent risers.
4. Conduct ECS Unit Purge Procedure (See Section 6 of this document).
5. Disconnect and remove the $\frac{1}{2}$ " 45° flare tubing from the top and side of the membrane housing:
See Figure 31.

NOTE: The nuts on the tubing are $\frac{3}{4}$ " 45° flare. Use caution not to damage the flared ends on the tubing or the threads on the nuts after removal.

6. Remove the (4) $\frac{1}{4}$ " bolts from the top plate (on top of the membrane housing).
7. Keep the (4) bolts/washers/lock washers for reuse.
8. Remove the top plate. A small lever may have to be used to gently pry the top plate off the membrane housing.

The top plate seals against the vertical tube with an o-ring. Use caution when removing the top plate. The membrane is now exposed.

See Figure 32.



Figure 31:
Membrane Housing



Figure 32: Exposed membrane with top plate removed.

Continued next page . . .

9. Gently screw the membrane extraction tool into the top of the membrane.
Screw the extraction tool into the membrane until the threads bottom out.
See Figure 33.

CAUTION: Do not over tighten the extraction tool when screwing into the membrane.

10. Gently move the extraction tool side-to-side while pulling up with moderate force until the membrane becomes loose.

CAUTION: Do not use excessive force or a twisting action to remove the membrane as these items may cause damage to the membrane epoxy potting.

There are two o-rings on the inside bottom of the vertical tube causing resistance in removing the membrane

An aluminum insert (Figure 34) may still be attached to the bottom of the membrane or will stay in the membrane-housing base.

DO NOT LOSE THE INSERT AS IT WILL BE NEEDED TO COMPLETE THE MEMBRANE INSTALLATION AND MAKE THE MEMBRANE OPERATION FUNCTIONAL.

11. Remove the extraction tool from the membrane.
12. Remove and discard the (4) o-rings:
 - (2) O-rings on the membrane
 - (2) O-rings on the base insert

Keep the vertical tube top o-ring for re-use.



*Figure 33:
Membrane extraction
tool*



Figure 34: Membrane base insert

9.3 Installing the New Membrane

1. Install (4) new O-rings:
(2) O-rings on the membrane (VST Part #5006-012).
(2) O-rings on the base insert (VST Part #5006-013).
2. Use only silicon grease (not hydrocarbon-based grease) on the o-rings prior to installation.

Hydrocarbon-based grease or lubricant will emit hydrocarbon vapors, which will be measured by the HC sensor and will cause inaccurate gas-level readings.
3. With (2) new o-rings on the “insert” installed, place the “insert” into the bottom of the base as orientated in Figure 34.
4. With the (2) membrane o-rings installed, place the membrane into the membrane housing. Apply a moderate downward force with a mild side-to-side action to seat the membrane in the membrane base.
5. Install the existing top vertical tube o-ring (re-lubricated). Install the top plate.
 - The top plate will seat on the vertical tube o-ring while bolting the top plate in place.
 - **DO NOT USE FORCE TO SEAT THE TOP PLATE.**
6. Install the (4) ¼” bolts/washers/lock washers in the top plate/retaining ring to secure the top plate.
7. Tighten the (4) bolts to 85 in-lbs in a cross-pattern using 20%, 40%, 60%, 80%, 90%, 100% of torque.
 - This cross-pattern torque procedure will evenly seat the top plate to the vertical tube.
8. Re-install the ½” 45° flare tubing from the top/side of the membrane housing.
 - Note: When tightening the 45° flare nuts: Clamp the tube flare between nut and nose body of the tube by screwing the nut on finger tight. Tighten with a wench an additional ¼ turn for a metal-to-metal seal.
9. Perform a *Processor* Leak Test. See Section 3.8.
10. Open the ball valves between the *Processor* and the vent risers.
11. Remove the lock(s) and tags from the lockout & tagout.
12. Turn ON power to the heat trace, blower, and vacuum pump.
13. After work is completed, put the TLS-350 in the AUTOMATIC mode. See Figure 12 or Figure 13.

10 Drive Coupling Rubber Insert Replacement

- NOTE: The drive coupling rubber insert replacement is done with the vacuum pump and motor assembly still attached to the ECS base.

10.1 Safety



Use lockout / tagout procedures prior to starting work.

10.2 Removing the Drive Coupling Insert

- Prior to starting work, put the TLS-350 in the Manual OFF mode.
 - See Figure 12 or Figure 13
- Close the ball valves between the *Processor* and the vent risers.
- At the disconnect switch and at the breaker, disconnect the power to the blower and vacuum pump motors.
- Conduct ECS Unit Purge Procedure (See Section 6 of this document).
- With the vacuum pump and motor assembly in-place on the ECS base, remove the drive coupling guard and the pump fan guard.
 - See Figures 36-37.
- Completely remove the vacuum pump ½" outlet tubing.
 - See Figure 27.
- Completely remove the vacuum pump ½" and ¼" inlet 45° flare tubing and all pipe fittings connected to the vacuum pump. See Figure 29.
- Completely remove the ¼" HC sensor inlet tubing at the air outlet and the HC sensor.
 - See Figure 52.
 - NOTE: The tube ends are a Parker 45° flare, use caution not to damage the flared ends on the tubing or the threads on the nuts after removal.



Figure 36: Vacuum and motor assembly

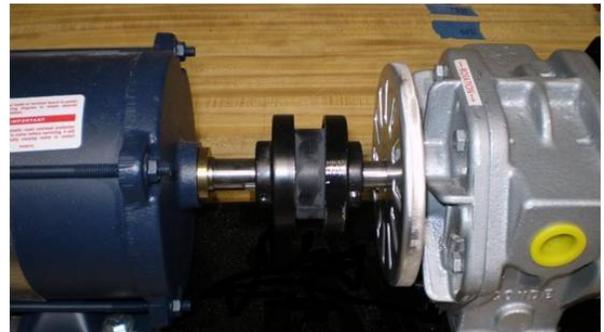


Figure 35: Vacuum pump with guard removed

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9. Un-bolt the vacuum pump from the base and move the vacuum pump away from the motor.
- Moving the vacuum pump away from the motor will separate the drive coupling for removal of the rubber insert.
 - Be sure to mark and keep any shims used under the vacuum pump for re-use (the shims are used for aligning the vacuum pump with the motor).
 - Keep the bolts for re-use.
 - See Figure 37.

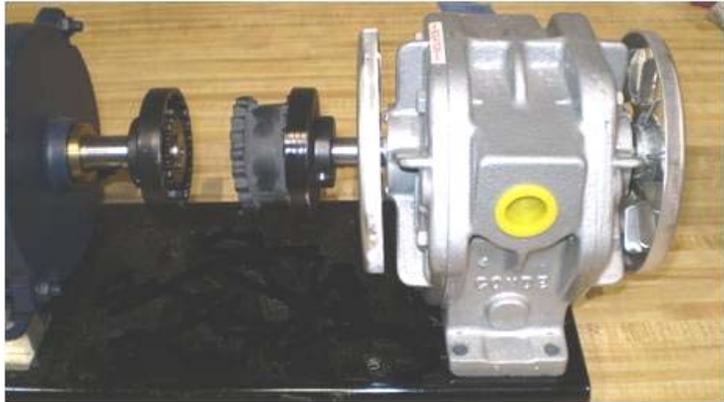


Figure 37: Vacuum pump unbolted and moved away from the motor

10.3 Installing the Drive Coupling Insert

1. Replace the rubber insert into the drive coupling.
See Figure 38.
2. Slide the vacuum pump towards the motor.
 - Place any shims under the vacuum pump in their original location.
3. Bolt the vacuum pump to the vacuum pump base.
4. Install the drive coupling and fan guards.
5. Re-install the ½" and ¼" inlet 45° flare tubing and all pipe fittings connected to the vacuum pump.
6. Re-install the ½" outlet tubing.
7. Re-install the ¼" HC sensor inlet tubing.
Do not use any thread sealing compound when assembling the 45 ° flare nuts.
NOTE: When tightening the 45° flare nuts: Clamp the tube flare between nut and nose body of the tube by screwing the nut on finger tight. Tighten with a wrench an additional ¼ turn for a metal-to-metal seal.
8. Perform a *Processor* leak test – see Section 3.8 of this document.
9. Remove the lock(s) and tags from the lockout & tagout.
10. Open the ball valves between the *Processor* and the vent risers.
11. At the breaker, but not at the disconnect switch, turn ON power to the blower and vacuum pump.
12. Return the TLS-350 to the manual ON mode.
13. Using the disconnect switch near the Processor, briefly cycle the power to verify that there is no excessive vibration at the coupling.
14. After work is completed, put the TLS-350 in the AUTOMATIC mode and engage the disconnect.
See Figures 12 or 13.



Figure 38: Drive coupling rubber insert

11 Heat Trace Cable Replacement

11.1 Safety



Use lockout / tagout procedures prior to starting work.
Disconnect electricity to the *Processor*.

11.2 Removing the Heat Trace Electrical Box

1. Prior to starting work, put the TLS-350 in the Manual “OFF” mode
 - See Figure 12 or 13.
 - Remove power to the *Processor* by either turning OFF the breaker or by disconnecting power at the *Processor*.
2. At the breaker, disconnect power to the heat trace cable.
3. Remove the entire heat trace electrical box from the $\frac{3}{4}$ ” tubing.
4. Disconnect and remove the heat trace cable from inside the electrical junction box.
 - Remove the top cover from the electrical junction box (be sure to keep the screws for reuse).
 - Remove the 115V and ground wires from the terminal block located inside the electrical junction box.
 - See Figure 39.
 - Remove the bottom plate (be sure to keep the screws for reuse).
 - Pull the heat trace cable out of the electrical box and bottom plate (be sure keep the rubber grommet for reuse).
5. Completely remove the 1” thick F/G insulation from the membrane housing.
 - Cutting on the insulation seam, remove the insulation (with the aluminum tape attached) in one piece and save for reuse.
 - See Figure 40.
6. Peel the aluminum tape off the heat trace cable and discard.
 - This will expose the heat trace cable and end seal kit.
7. Disassemble the seal kit and remove the heat trace cable.
 - Retain the end seal kit parts for re-use.

11.3 Overview for Installing the New Heat Trace Cable

1. VST has found that making both the end seal kit and electrical junction box connection first to the heat trace cable works the best.
2. After both connections are made to the heat trace cable, attach the electrical junction box to the $\frac{3}{4}$ " tube.
3. After the electrical junction box is attached to the $\frac{3}{4}$ " tube, wrap the heat trace cable around the vertical tube starting at the bottom and wrapping towards the top, applying aluminum tape on each revolution.
4. The last step is to secure the end seal kit to the vertical tube.

11.4 Steps for Installing the New Heat Trace Cable

1. Install the end seal kit on the heat trace cable:
 - Using a multimeter, check the heat trace cable electrical circuit continuity at the electrical junction box to insure the circuit is complete and is not in a ground fault condition.
 - See Figure 41. End Seal Kit Components
 - See the Figures 42-43. Chromalox End Seal Kit Installation Instruction (2-Pages -) to install the heat trace cable on the end seal kit
 - Figure 44. Prepare the New Heat Trace Cable for installation into the End Seal Kit
2. Install the heat trace cable to the electrical junction box.
 - See Figures 45-48. Electrical Junction Box Installation Instructions, (4-Pages).
3. Attach the electrical junction box to the $\frac{3}{4}$ " tube (attached to the membrane housing).
4. Wrap the heat trace cable around the vertical tube starting at the bottom and wrapping towards the top, applying aluminum tape on each revolution.
 - Be sure to install the heat trace cable flat against the membrane housing – free of twists.
 - Use nylon reinforced aluminum tape.
5. Secure the end seal kit/heat trace cable to the top section of the top section of the vertical tube.
 - See Figure 49 End Seal Kit Location and Heat Trace Cable Installation.
 - The heat trace cable on the vertical tube should be completely wrapped with aluminum tape. (Note: The nylon reinforced aluminum tape serves two purposes, it holds the heat trace cable in place while installing the heat trace cable on the vertical tube, and it insures the heat trace cable is held firmly in contact with the vertical tube).
6. The installation is now complete.
 - See Figure 50. Installed Electrical Junction Box with Electrical Connections.
7. Check all electrical connections for loose wires.

Continued next page . . .

- 8. Remove the lock(s) and tags from the lockout & tagout.
- 9. Turn ON power to the Heat Trace Cable and vacuum pump.
- 10. After work is completed, put the TLS-350 in the AUTOMATIC mode.
 - See Figure 12 or 13



Figure 39: Termination block inside the electrical junction box



Figure 40: Seam to cut to remove the insulation



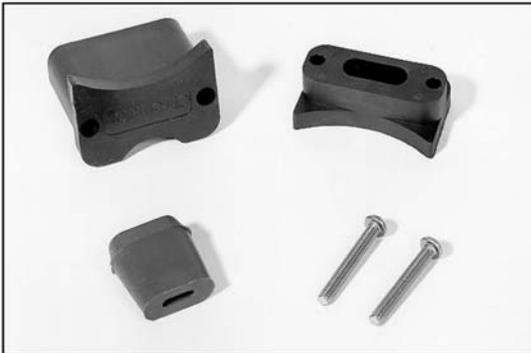
Figure 41: End seal kit components
Connection screws
End cap
Grommet
Pressure plate
Heat trace cable

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Installation Instructions

SERVICE REFERENCE	
DIVISION 4	SECTION RT
SALES REFERENCE (Supersedes PJ450-9)	PJ450-10
161-562761-001	
DATE	MARCH, 2004

Type RTES End Seal Kit for Self-Regulating and Constant Wattage Rapid-Trace Heating Cable



- RTES Kit Parts:**
 1 - End Cap 1 - Pressure Plate
 2 - Screws 1 - Grommet

GENERAL

The RTES kit is used for terminating braided (-C) and overcoated (-CR or -CT) versions of Self-Regulating and Fluoropolymer insulated Constant Wattage Rapid-Trace Heating Cable. The cable grommet is furnished with this kit such that the kit suffix number is the same as the grommet number (eg., an RTES-3 kit uses a GR3 grommet). Refer to the list below to insure you have the proper grommet for the cable you are installing.

- GR1 for SRL-C
- GR2 for SRL-CR or SRL-CT

- GR3 for CWM-C
- GR4 for CWM-CT
- GR5 for SRL-MC
- GR6 for SRL-MCR or SRL-MCT
- GR7 for SRM/E-C
- GR8 for SRM/E-CT

Each kit contains enough material to make one termination. Materials required include: standard electrical cutters, screwdriver and fiberglass tape.

INSTALLATION

WARNING

ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heating cable and accessories. A qualified person must perform installation and service of heating cable and accessories. Heating cable must be effectively grounded in accordance with the National Electrical Code. Failure to comply can result in personal injury or property damage.

Note: All electrical wiring, including GFCI (Ground Fault Circuit Interrupters), must be done in accordance with the National Electrical Code and local codes by a qualified person.

Note: These instructions are for all Self-Regulating and Constant Wattage heating cables in ordinary locations. Consult factory for

installation of braided cable in hazardous locations. Not all instructions, are for all cables. Each step has a boldface heading stating what type of cable that instruction is for.

- 1. FOR CONSTANT WATTAGE CABLE:**
Using standard electrical cutters, make a perpendicular cut across the cable four inches from the last module point.

Note: Cutting the cable between module points (indentions in cable) creates a non-heated cold lead. See Figure 1.

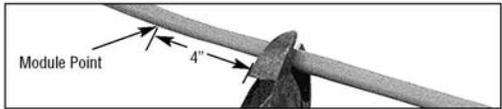


Figure 1

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Figure 42: End seal kit installation instructions, page 1 of 2

INSTALLATION

2. FOR CABLE WITH EXPOSED METAL BRAID (-C):
Push the braid back three inches to expose the base cable insulation. See Figure 2.



Figure 2

3. FOR ALL CABLE:
Slide the pressure plate and grommet over the end of the cable. **Note:** The pressure plate and end cap have different size curved surfaces on the top and bottom of each piece. These curved surfaces are designed to give a better fit on process equipment. The side with the smaller radius curve is for use on pipes with diameters up to three inches or on flat surfaces. The other side is for use on pipes with diameters of three inches or more. See Figure 3 and Figure 8.

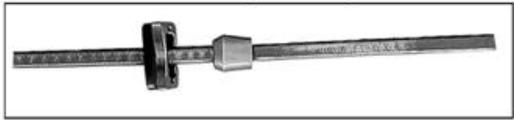


Figure 3

4. FOR OVERCOATED CABLES (-CR or -CT):
Score the outer jacket one inch from the end of the cable. Remove the jacket to expose the braid. Unravel and trim the braid flush with the outer jacket. Pull any strands of braid back towards the outer jacket. See Figure 4.



Figure 4

5. FOR ALL CABLE:
Using standard electrical cutters, cut a "VEE" notch between the buss wires. See Figure 5.

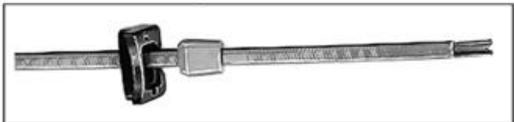


Figure 5

6. FOR ALL CABLE:
Slide the pressure plate and grommet towards the end of the cable leaving 5/8" of the cable extending past the end of the grommet. See Figure 6.

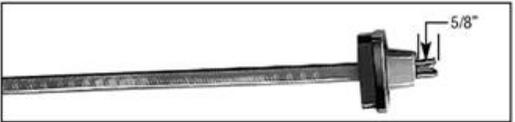


Figure 6

7. FOR ALL CABLE:
Slide the end cap over the grommet. Using a screwdriver, connect the pressure plate to the end cap. See Figure 7.

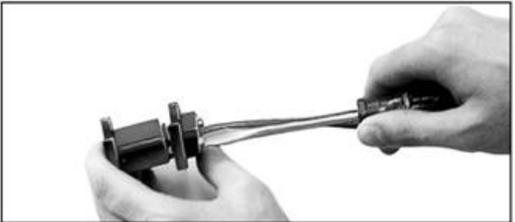


Figure 7

8. FOR ALL CABLE:
Using a fastening device, fiber re-inforced electrical tape (Chromalox FT-1 or equal), secure the assembly to the pipe. Wrap the tape around the assembly between the legs. See Figure 8.



Figure 8

WARRANTY AND LIMITATION OF REMEDY AND LIABILITY

Chromalox warrants only that the Products and parts manufactured by Chromalox, when shipped, and the work performed by Chromalox when performed, will meet all applicable specification and other specific product and work requirements (including those of performance), if any, and will be free from defects in material and workmanship under normal conditions of use. All claims for defective or nonconforming (both hereinafter called defective) Products, parts or work under this warranty must be made in writing immediately upon discovery, and in any event, within one (1) year from delivery, provided, however all claims for defective Products and parts must be made in writing no later than eighteen (18) months after shipment by Chromalox. Defective and nonconforming items must be held for Chromalox's inspections and returned to the original f.o.b. point upon request. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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Upon Buyer's submission of a claim as provided above and its substantiation, Chromalox shall at its option either (i) repair or replace its Products, parts or work at the original f.o.b. point of delivery or (ii) refund an equitable portion of the purchase price. THE FOREGOING IS CHROMALOX'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY, AND IS BUYER'S EXCLUSIVE REMEDY AGAINST CHROMALOX FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES. BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS. IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTAL OR CONSEQUENTIAL DAMAGES AND BUYER SHALL HOLD CHROMALOX HARMLESS THEREFROM. ANY ACTION BY BUYER ARISING HEREUNDER OR RELATING HERETO, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE DATE OF SHIPMENT OR IT SHALL BE BARRED.

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PRECISION HEAT AND CONTROL
1382 HEIL CLAKER BLVD., LAVERGNE, TN 37086
Phone: (615) 793-3900 www.chromalox.com

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Figure 43: End seal kit installation instructions, page 2 of 2

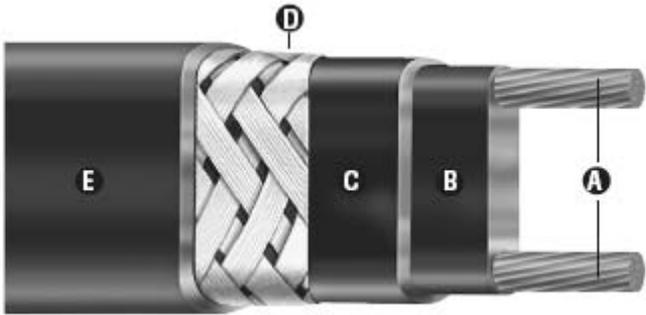


Figure 44: Prepare the new heat trace cable for installation into the end seal kit

- A. Twin 14 AWG copper buss wires
- B. Semi-conductive polymer core
- C. High temp. fluoropolymer jacket
- D. Metallic braid ground
- E. High temperature fluoropolymer jacket

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Installation Instructions

SERVICE REFERENCE	
DIVISION 4	SECTION RT
SALES REFERENCE (Supersedes PJ451-9)	PJ451-10
161-562762-001	
DATE	MARCH, 2004

RTPC Power Connection Kit for Self-Regulating and Constant Wattage Rapid-Trace Heating Cable



- RTPC Power Connection Kit Parts:**
- 1 - Molded Junction Box consisting of:
 - Base - Box - Lid - Hardware
 - 1 - Three Position Terminal Block
 - 1 - Mounting Screw for Terminal Block
 - 1 - Cable Grommet
 - 1 - Cover Gasket

GENERAL

⚠WARNING

ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heating cable and accessories. A qualified person must perform installation and service of heating cable and accessories. Heating cable must be effectively grounded in accordance with the National Electrical Code. Failure to comply can result in personal injury or property damage.

NOTE: All electrical wiring, including GFCI (Ground Fault Circuit Interrupters), must be done according to National Electrical or local codes by a qualified person.

The RTPC Kit is used to connect base, braided (-C) and over-coated (-CR or -CT) versions of Self-Regulating and Fluoropolymer insulated Constant Wattage Rapid-Trace Heating Cables to power. The cable grommet is furnished with this kit, such that the kit suffix number is the same as the grommet number (eg., an RTPC-3 kit uses a GR3 grommet). Refer to the list below to insure you have the proper grommet for the cable you are installing.

- GR1 for SRL-C
- GR2 for SRL-CR or SRL-CT
- GR3 for CWM-C
- GR4 for CWM-CT
- GR5 for SRL-MC
- GR6 for SRL-MCR or SRL-MCT
- GR7 for SRM/E-C
- GR8 for SRM/E-CT

Each kit contains enough material to make one power connection point. It is possible to connect up to three Self-Regulating or two Constant Wattage Cables in the same box. (One grommet required for each cable.)

Materials required for installation include: standard electrical cutters, screwdriver, sharp utility knife and a pipe strap (Chromalox PS or equal).

Wipe inside lip of cover with a clean cloth. Remove protective backing from the gasket and affix it to the cover lip. Press firmly all around for proper adhesion.

Figure 45: Electrical junction box installation instructions, page 1 of 4

INSTALLATION

NOTE: These instructions are for all Self-Regulating and Constant Wattage heating cables in ordinary locations. Consult factory for installation of braided cable in hazardous locations. Not all instructions are for all cables. Each step of the instructions will have a heading in boldface stating what type of cable each instruction is intended for.

- 1. FOR CONSTANT WATTAGE CABLES:**
Cut the cable 12 inches past the last module point (indentation in cable). **NOTE:** Cutting the cable between module points creates a non-heating cold lead. See Figure 1.

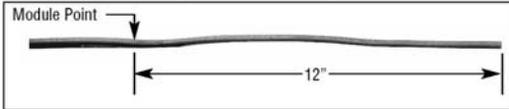


Figure 1

- 2. FOR CABLE WITH EXPOSED METAL BRAID (-C):**
Push the braid back 12 inches on the cable. See Figure 2.

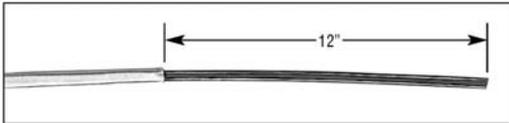


Figure 2

- 3. FOR ALL CABLES:**
Feed the ends of the cables through the appropriate hole in the base. Allow eight (8) inches of cable to extend above the top of the base. See Figure 3.

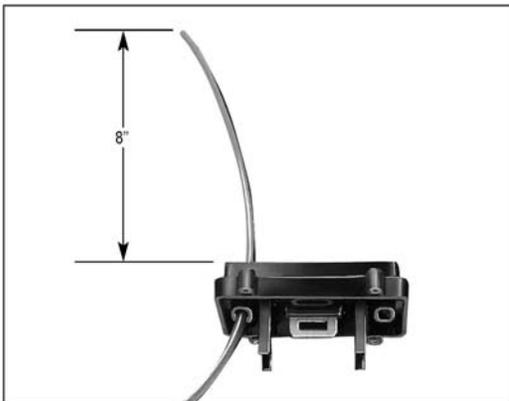


Figure 3

- 4. FOR ALL CABLES:**
Slide cable grommet over the end of the cable and insert it into the opening in the base. Secure the base to the pipe by threading the appropriate sized pipestrap through the slot in the mounting plate. Tighten the pipestrap until the base is securely attached to the pipe. See Figure 4.



Figure 4

- 5. FOR OVERCOATED CABLES (-CR or -CT):**
Score the outer insulation seven (7) inches from the end of cable. Remove the jacket to expose the metal braid. See Figure 5. **CAUTION: When removing the outer jacket, be careful not to damage the braid or the base cable insulation.**

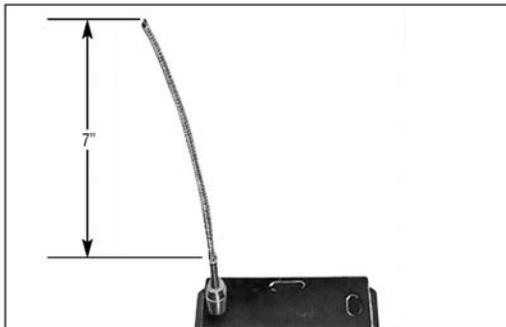


Figure 5

- 6. FOR ALL CABLES:**
Punch out the knockouts on the bottom of the box which correspond to the openings in the base through which the heating cable passes. Be careful to punch out only those knockouts to be used. If one is mistakenly punched, blank grommets can be ordered to re-establish the water tight seal. See Figure 6.



Figure 6

Figure 46: Electrical junction box installation instructions, page 2 of 4

INSTALLATION

7. FOR ALL CABLES:
Feed the cables through the corresponding holes in the box. Secure box to base using all four (8-32) screws. See Figure 7.

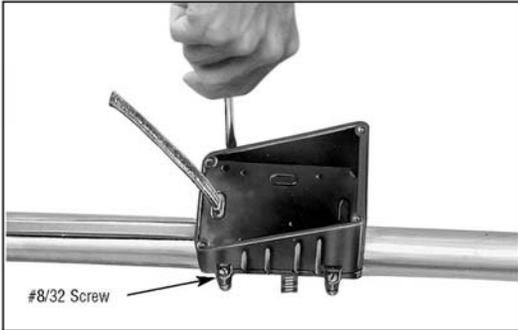


Figure 7

8. FOR OVERCOATED CABLES:
Starting from the end of the cable, unravel 2-1/2 inches of the braid. Twist the strands together to form a pigtail. See Figure 8.

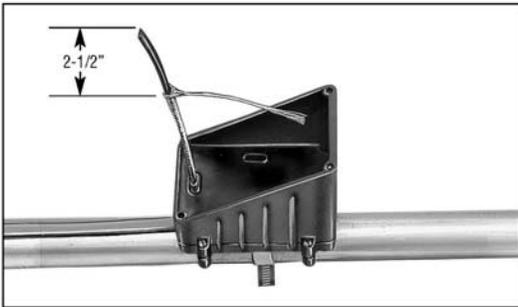


Figure 8

9. FOR SELF-REGULATING CABLES:
Using standard electrical cutters, cut a 3/4 inch long notch out of the cable between the conductor wires. Bare a 3/8 inch length of each conductor by stripping off the outside insulation and the inner black core material. See Figure 9.

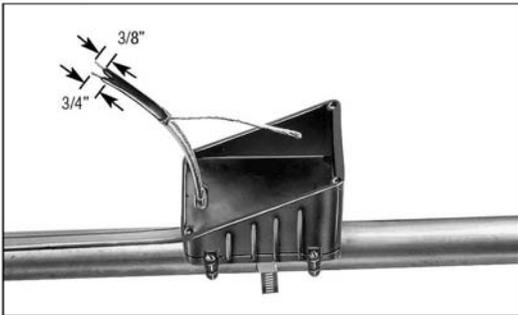


Figure 9

10. FOR CONSTANT WATTAGE CABLES:
Score the outer jacket 3/4 inch from the end of the cable and remove the jacket. Cut off the exposed nichrome wire, pushing any remainder back under the jacket. These cables have an inner layer of insulation which is also to be removed as

described above. Separate the buss wires and strip off the last 3/8 inch of insulation from both buss wires. See Figure 10.

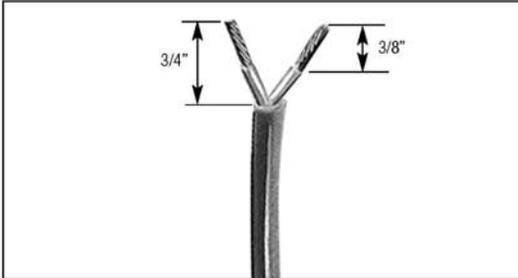


Figure 10

11. FOR ALL CABLES:
Insert the bared ends of the conductors into the openings in the terminal block. Tighten screws firmly to hold conductors in place. See Figure 11.



Figure 11

12. FOR OVERCOATED CABLES (-CR or -CT):
Insert the end of the braid pigtail into the remaining opening in the terminal block. Tighten screw firmly to hold the braid in place. See Figure 12.



Figure 12

13. FOR ALL CABLES:
Connect conduit hub (Chromalox CCH or equal) to the box. Attach conduit to hub and bring power leads into box. See Figure 13.

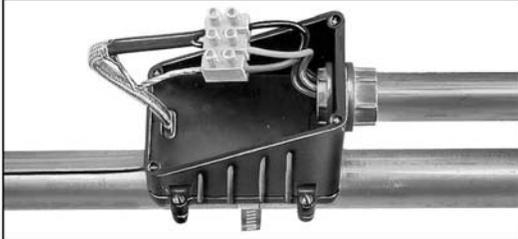


Figure 13

Figure 47: Electrical junction box installation instructions, page 3 of 4

INSTALLATION

14. FOR ALL CABLES:

Strip 3/8 inch length of each conductor of the power cord. Insert the bared ends of the conductors into the corresponding openings on the unused side of the terminal block. Remember, the green (ground) wire must be opposite of the opening of the terminal block which is either empty or contains the metal braid. See Figure 14.



Figure 14

15. FOR ALL CABLES:

Mount terminal block to bottom of the box by driving the 6/32 self-tapping screw into the mounting hole as shown. See Figure 15.

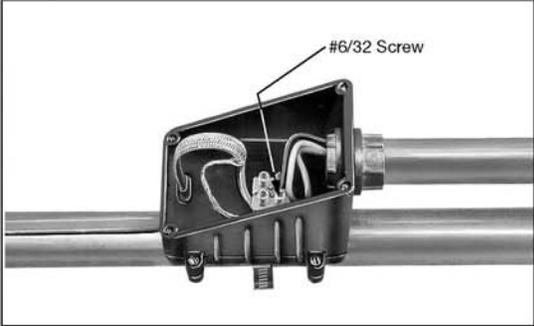


Figure 15

16. FOR ALL CABLES:

Carefully push the wires into the box. Secure the lid to box. See Figure 16.



Figure 16

17. FOR CABLE WITH EXPOSED METAL BRAID (-C):
Unravel four (4) inches of braid from the cable and twist into a pigtail.

⚠ WARNING

ELECTRIC SHOCK HAZARD. The twisted braid must be effectively grounded in accordance with the National Electrical Code to eliminate electric shock hazard.

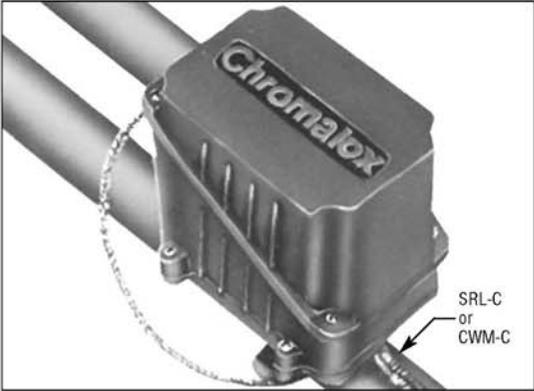


Figure 17

WARRANTY AND LIMITATION OF REMEDY AND LIABILITY

Chromalox warrants only that the Products and parts manufactured by Chromalox, when shipped, and the work performed by Chromalox when performed, will meet all applicable specification and other specific product and work requirements (including those of performance), if any, and will be free from defects in material and workmanship under normal conditions of use. All claims for defective or nonconforming (both hereinafter called defective) Products, parts or work under this warranty must be made in writing immediately upon discovery, and in any event, within one (1) year from delivery, provided, however all claims for defective Products and parts must be made in writing no later than eighteen (18) months after shipment by Chromalox. Defective and nonconforming items must be held for Chromalox's inspections and returned to the original f.o.b. point upon request. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Notwithstanding the provisions of this WARRANTY AND LIMITATION Clause, it is specifically understood that Products and parts not manufactured and work not performed by Chromalox are warranted only to the extent and in the manner that the same are warranted to Chromalox by Chromalox's vendors, and then only to the extent that Chromalox is reasonably able to enforce such warranty, it being understood Chromalox shall have no obligation to initiate litigation unless Buyer undertakes to pay all cost and expenses therefor, including but not limited to attorney's fees, and indemnifies Chromalox against any liability to Chromalox's vendors arising out of such litigation.

Upon Buyer's submission of a claim as provided above and its substantiation, Chromalox shall at its option either (i) repair or replace its Products, parts or work at the original f.o.b. point of delivery or (ii) refund an equitable portion of the purchase price.

THE FOREGOING IS CHROMALOX'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY, AND IS BUYER'S EXCLUSIVE REMEDY AGAINST CHROMALOX FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES. BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS. IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTAL OR CONSEQUENTIAL DAMAGES AND BUYER SHALL HOLD CHROMALOX HARMLESS THEREFROM. ANY ACTION BY BUYER ARISING HEREUNDER OR RELATING HERETO, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE DATE OF SHIPMENT OR IT SHALL BE BARRED.

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Chromalox®
PRECISION HEAT AND CONTROL
 1382 HEIL QUAKER BLVD., LAVERGNE, TN 37086
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Figure 48: Electrical junction box installation instructions, page 4 of 4



Figure 49: End seal kit location and heat trace cable installation



Figure 50: Installed electrical junction box with electrical connections

12 Hydrocarbon Infrared (HC IR) Sensor Module Replacement

12.1 Safety



Use lockout / tagout procedures prior to starting work.

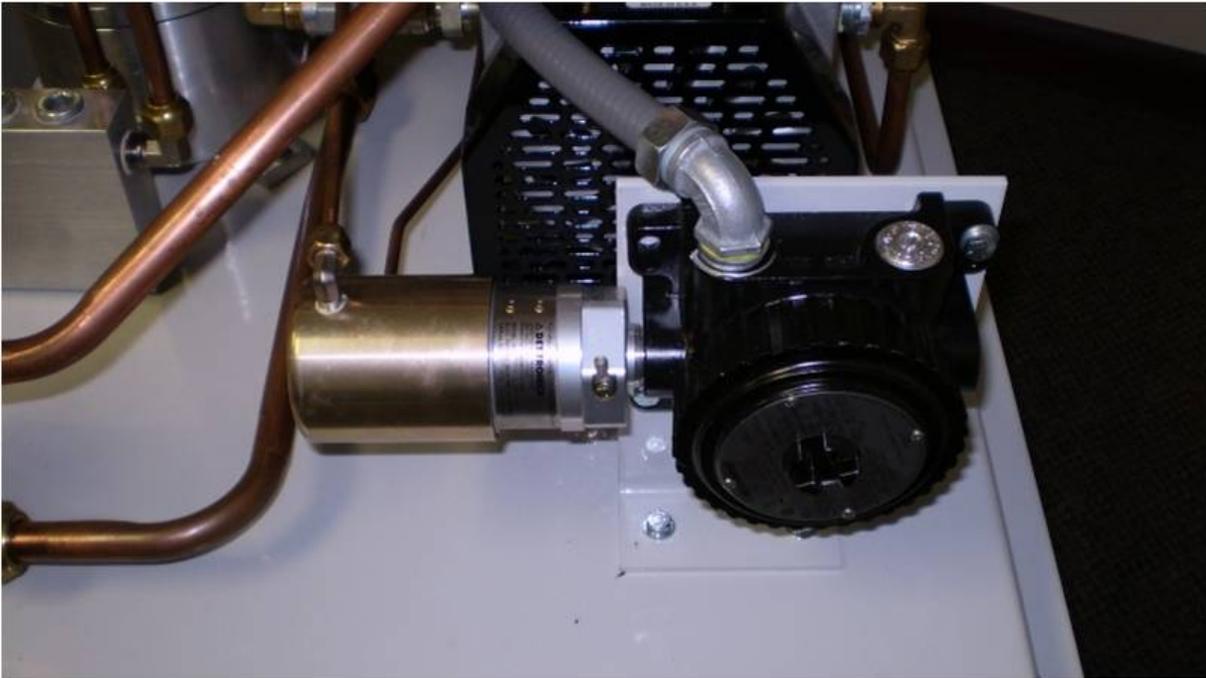


Figure 51: HC IR Sensor Module and Electrical Housing Assembly

12.2 Removing HC IR Sensor from the HC IR Sensor Module Electrical Housing

1. Prior to starting work, put the TLS-350 in the Manual "OFF" mode.
See Figure 12 or Figure 13.
2. At the disconnect switch or the breaker, disconnect power to the heat trace cable, the vacuum pump, and the blower motors.
3. Conduct ECS Unit Purge Procedure (See Section 6 of this document).
4. In the electrical room, turn off the HC Sensor power by disconnecting the 115V power to the HC Sentry Module.
5. Disconnect and completely remove the 1/4" 45° flare tubing from the top and bottom sides of the HC IR Sensor Module.
 - See Figure 52.
 - NOTE: The nuts on the tubing are 1/4" 45° flare. Use caution to avoid damaging the flared ends on the tubing or the threads on the nuts after removal.
5. Remove the cover on the electrical house and keep for re-use.
 - NOTE: Do not remove the HC sensor electrical housing.

Continued next page . . .



Figure 52: HC IR Sensor Module 1/4" 45° tubing and fittings

- 6. Disconnect the following HC IR sensor wires from the electrical housing circuit board:
 - White: 4-20 mA signal wire
 - Black: -(common) RET wire
 - Red: +24VDC power wire
 - NOTE: The yellow and green wires are not used in this application.
 - See Figures 53 and 54.

- 7. Unscrew and remove the HC IR Sensor Module from the electrical housing.
 - Package the used HC IR Sensor Module in the anti-static bag and box that came with the new / recalibrated HC IR Sensor Module unit.
 - The used HC IR Sensor Module can be sent back to VST for re-calibration.

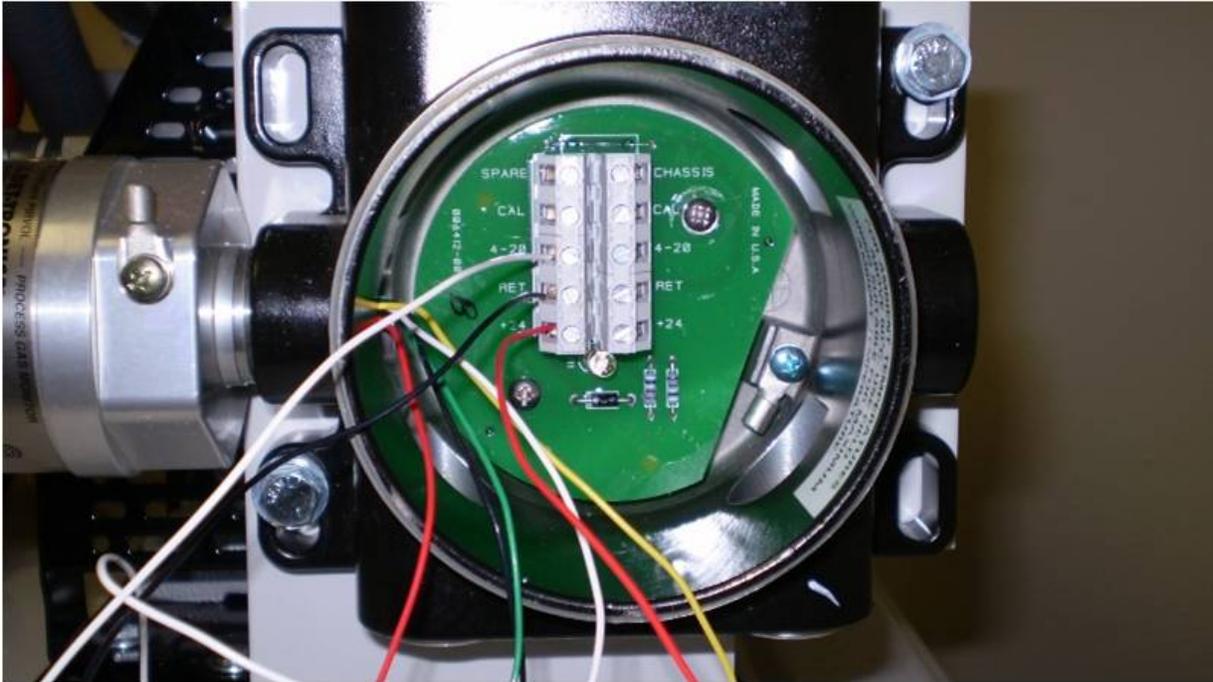


Figure 53: HC IR Sensor Electrical Housing Circuit Board

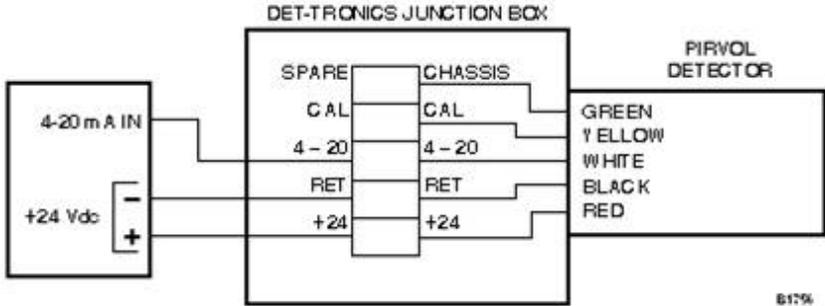


Figure 54: HC IR Sensor Electrical Housing Circuit Board Wiring Diagram

12.3 Installing a New or Re-calibrated HC IR Sensor Module to the HC IR Sensor Module Electrical Housing

1. Use only silicon grease (not hydrocarbon-based grease) to lubricate the HC IR sensor threads prior to installation.
 - Hydrocarbon-based grease or lubricant will emit hydrocarbon vapors, which will be measured by the HC sensor and will cause inaccurate gas-level readings.
2. Screw the new / re-calibrated HC IR sensor module to the electrical housing.
 - Remove the aluminum cover from the HC IR sensor.
 - While screwing on the sensor, orient the optics in the vertical position.
 - See Figure 55.
3. Replace the aluminum cover on the HC IR sensor.

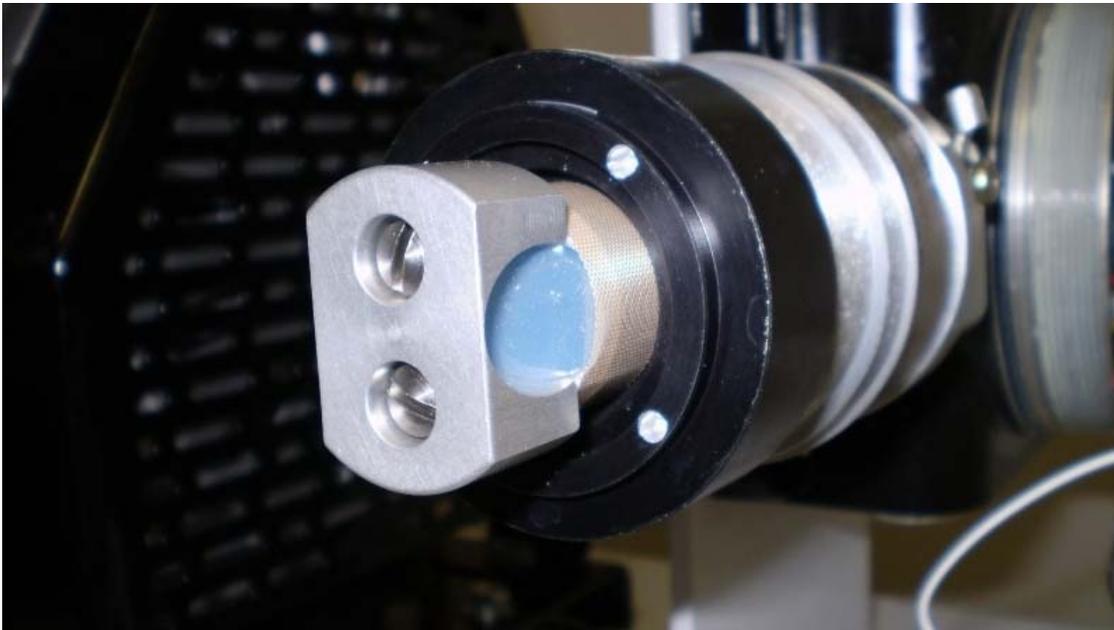


Figure 55: HC IR sensor installation orientation

4. Connect the following HC IR sensor wires to the electrical housing circuit board:
 - White: 4-20 mA signal wire
 - Black: -(common) RET wire
 - Red: +24VDC power wire
 - NOTE: the yellow and green wires are not used in this application.
 - See Figures 53 and 54.
5. Install the cover on the electrical housing.
 - Use only silicon grease (not hydrocarbon-based grease) to lubricate the cover threads prior to installation.
 - Hydrocarbon-based grease or lubricant will emit hydrocarbon vapors, which will be measured by the HC sensor and will cause inaccurate gas-level readings.
6. Re-install the (2) ¼" 45° flare tubing on the top and bottom sides of the HC IR sensor module.
 - NOTE: When tightening the 45° flare nuts, clamp the tube flare between the nut and the nose body of the tube by screwing the nut on finger-tight. Tighten with a wrench an additional ¼-turn for a metal-to-metal seal.
7. Remove the lock(s) and tags from the lockout/tagout.
8. At the breaker and at the disconnect switch, turn ON power to the heat trace, blower, and vacuum pump.
9. In the electrical room, turn ON power to the HC Sentry Module.
10. Perform a *Processor* Leak Test – see Section 3.8 of this document.
11. After the installation is complete, put the TLS-350 in the AUTOMATIC ON mode.
 - See Figure 12 or 13.

13 Forms

- The following pages contain forms for:
 - ▶ Scheduled preventative maintenance list
 - ▶ Scheduled preventative maintenance checklist

13.1 Preventative Maintenance

Preventative Maintenance		
ASC #:	Date:	
ASC Name:		
ASC Certification Level:		
ASC Company:		
GDF Name:		
Address:		
City:	State:	ZIP Code:
GDF Contact Person Name:		
GDF Contact Person Title:		
GDF Contact Person Phone:		
GDF Contact Person E-mail:		
Notes		
Use the form on the following page to note details of Preventative Maintenance activities.		

13.2 Preventative Maintenance Checklist Form

Component	Frequency	Date Inspected	Completed	Required Action Items
PROCESSOR				
<ul style="list-style-type: none"> Inspect drive coupling on vacuum pump. 	Yearly		☐	
<ul style="list-style-type: none"> Check the continuity of the heat trace cable. 			☐	
RECIRCULATION BLOWER				
<ul style="list-style-type: none"> Replace every 10 years or every 15,000 hours, whichever comes first. 			☐	
VACUUM PUMP				
<ul style="list-style-type: none"> Replace every 10 years or every 15,000 hours, whichever comes first. 			☐	

Veeder-Root In-Station Diagnostics (ISD)

Install, Setup, & Operation Manual

For VST ECS Membrane Processors, Veeder-Root Polisher, and Franklin Fueling System Clean Air Separator (CAS)



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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.

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

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.

CUSTOMER'S PREFERRED CARRIER

1. It is the customer's responsibility to file a claim with their carrier.
2. Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
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.
4. Veeder-Root will NOT be responsible for any compensation when a customer chooses their own carrier.

RETURN SHIPPING

For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

FCC INFORMATION

This equipment complies with the requirements in Part 15 of the FCC rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception requiring the operator to take whatever steps are necessary to correct the interference.

INSTALLATION IN THE STATE OF CALIFORNIA

Please refer to the California Air Resources Board Vapor Recover Certification Phase II EVR Executive Order web site (www.arb.ca.gov/vapor/leo-evrphaseII.htm) for the latest manual revisions pertaining to VR 204 (VST Phase II EVR System Including ISD System).

WARRANTY - Please see next page, iii.

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Warranty

This warranty applies only when the product is installed in accordance with Veeder-Root's specifications, and that a Warranty Registration and Checkout Form has been filed with Veeder-

Root by an authorized Veeder-Root Distributor. This warranty will not apply to any product which has been subjected to misuse, negligence, accidents, systems that are misapplied or are not installed per Veeder-Root specifications, modified or repaired by unauthorized persons, or damage related to acts of God. Veeder-Root is not liable for incidental, consequential, or indirect damages or loss, including, without limitation, personal injury, death, property damage, environmental damages, cost of labor, clean-up, downtime, installation and removal, product damages, loss of product, or loss of revenue or profits. **THE WARRANTY CONTAINED HEREIN IS EXCLUSIVE AND THERE ARE NO OTHER EXPRESS, IMPLIED, OR STATUTORY WARRANTIES. WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.**

TLS-350R, TLS-350 PLUS, TLS-350J AND TLS-300I/C, AND TLS2 MONITORING SYSTEMS

We warrant that this product shall be free from defects in material and workmanship for a period of one (1) year from the date of installation or twenty-four (24) months from the date of invoice, whichever occurs first. During the warranty period, we or our representative will repair or replace the product, if determined by us to be defective, at the location where the product is in use and at no charge to the purchaser. **LAMPS, FUSES, AND LITHIUM BATTERIES ARE NOT COVERED UNDER THIS WARRANTY.**

If "Warranty" is purchased as part of the Fuel Management Service, Veeder-Root will maintain the equipment for the life of the contract in accordance with the written warranty provided with the equipment. A Veeder-Root Fuel Management Services Contractor shall have free site access during Customer's regular working hours to work on the equipment. Veeder-Root has no obligation to monitor federal, state or local laws, or modify the equipment based on developments or changes in such laws.

MODULES, KITS, OTHER COMPONENTS (PARTS PURCHASED SEPARATE OF A COMPLETE CONSOLE)

We warrant that this product shall be free from defects in material and workmanship for a period of one (1) year from the date of installation or fifteen (15) months from the date of invoice, whichever occurs first. We warrant that the lithium batteries (excluding EVR BATTERY PACK) shall be free from defects in material and workmanship for a period of three (3) months from date of invoice. We will repair or replace the product if the product is returned to us; transportation prepaid by user, within the warranty period, and is determined by us to be defective. **LAMPS AND FUSES ARE NOT COVERED UNDER THIS WARRANTY.**

IN STATION DIAGNOSTICS (ISD)

For components used in ISD systems (Vapor Flow Sensor, Vapor Pressure Sensor, Software, TLS RF, Wireless Repeater, Wireless Transmitter & Wireless Receiver), excluding **LAMPS, FUSES, AND LITHIUM BATTERIES**, the following warranty applies:

We warrant that this product shall be free from defects in material and workmanship and will comply with the performance standards of California EPA CP-201 section 10 as amended July 22, 2004 for a period of one (1) year from the date of ISD start-up or twenty-four (24) months from the date of invoice, whichever occurs first. During the warranty period, we and or our representative will repair or replace the product, if determined by us to be defective, at the location where the product is in use, at no charge to the purchaser.

For ISD components installed after the initial ISD start-up, we warrant that these products shall be free from defects in material and workmanship for a period of one (1) year from the date of installation or fifteen (15) months from date of invoice. We will repair or replace the product if the product is returned to us; transportation prepaid by user, within the warranty period, and is determined by us to be defective.

EVR BATTERY PACK

We warrant that this product shall be free from defects in material and workmanship for a period of one (1) year from the date of installation or fifteen (15) months from the date of invoice, whichever occurs first. **The replacement EVR Battery Pack warranty period will be the REMAINING warranty period of the original EVR Battery Pack. LAMPS, FUSES, AND LITHIUM BATTERIES OTHER THAN THE EVR BATTERY PACK, ARE NOT COVERED UNDER THIS WARRANTY.**

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1 Introduction

In-Station Diagnostic (ISD) equipment is designed to monitor the collection and containment of vapors by vapor recovery equipment. The ISD software monitors the vapor recovery equipment using the Veeder-Root (V-R) TLS console platform, sensor inputs, and dispenser fuel events. ISD provides test reports, generates alarms following test/equipment failures, and finally, shuts down the site upon the occurrence of designated alarms.

This manual provides instructions to install, setup, and operate the special components of the Veeder-Root ISD system that are not covered in existing documentation shipped with other non-ISD specific V-R equipment (e.g., Mag probes, line leak detection, etc.). The ISD feature is an option for the TLS console platform, and as such, many of the installation/setup/operation instructions for non-ISD specific tasks (e.g., line leak detection) are covered in TLS-3XX supplied literature.

WARNING! Revision or reprogramming of the TLS may require notification of the local Certified Unified Program Agency (CUPA).

Site Requirements

Below are the requirements for all vapor recovery systems except where noted.

- V-R TLS-350R/EMC w/BIR, TLS-350 Plus/EMC Enhanced, TLS-350/EMC and Red Jacket ProMax consoles with ECPUII - install as per TLS-3XX Site Prep manual, setup following instructions in TLS-3XX System Setup Manual.
- A flash memory board (NVMEM203) for ISD software storage - installed on the ECPU2 board in place of the console's 1/2 Meg RAM board - install as per TLS-350 Series Board and Software Replacement Manual, no setup required.
- An available RS-232 module is required for RS-232 access to ISD reports - install as per instructions shipped with module, connect to the port using instructions in this manual.
- An output relay or dispenser relay board is required (either 4-Output Relay module, I/O Combination module) to shut down each Submersible Turbine Pump (STP) or dispenser upon activation of certain ISD alarms (these alarms can also be assigned in Line Leak Disable setup to shut down the STP or dispenser if Line Leak detection feature is installed) - install as per instructions shipped with module or line leak system, setup ISD shut down alarms either using output relays or line leak system following instructions in this manual. Two output relays on either of these two modules are also required for vapor processor motor control - install as per instructions in this manual.
- Dispenser Interface module (DIM) for the type of dispensers installed - install as per installation manual shipped with device, setup following instructions in DIM manual and TLS-3XX Setup Manual. Note: the DIM supplies flow meter event inputs needed for ISD analysis.
- One V-R Mag probe in each of the gasoline tanks being monitored - install as per installation manual shipped with device, setup following instructions in TLS-3XX Setup Manual.
- Smart Sensor module is required to monitor Air Flow Meters and Vapor Pressure Sensor (up to 8 devices per module, or 7 if customer is using SmartSensor module / embedded pressure). Install and connect following instructions in the Air Flow Meter and Vapor Pressure Sensor installation Guides.
- Air Flow Meters (one for each dispenser) - install as per ISD Flow Meter installation manual shipped with meter, setup following instructions in this manual. Also referred to as Vapor Flow Meters within this manual.
- Vapor Pressure Sensor (one per site) - install as per ISD Pressure Sensor installation manual shipped with sensor, setup following instructions in this manual.
- When monitoring a VST ECS membrane processor a Multi-port controller module is required.

Supported Vapor Recovery Systems

Table 1 lists V-R supported vapor recovery system.

Table 1. Vapor Recovery System

Name	CARB Executive Order
VST Phase II EVR System including ISD	VR-204

Contractor Certification Requirements

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

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

ATG Technician (Level 2/3 or 4) Certification: Contractors holding valid ATG Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- Wireless 2
- Tall Tank

VR Vapor Products Certification: Contractors holding a certification with the following designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- ISD – In Station Diagnostics
- PMC – Pressure Management Control
- CCVP - Veeder-Root Vapor Polisher
- Wireless – ISD/PMC Wireless

A current Veeder-Root Technician Certification is a prerequisite for the VR Vapor Products course.

Warranty Registrations may only be submitted by selected Distributors.

Related Manuals

The manuals in Table 2 below are shipped with the equipment on the V-R Tech Docs CD-ROM and will be needed to install related equipment.

Table 2. Related Manuals

V-R Manual	Part Number
TLS-3XX Site Prep Manual	576013-879
ISD Balance Flow Meter Installation Guide	VR-204 IOM/ Section 18
Pressure Sensor Installation Guide	VR-204 IOM/ Section 13
TLS-3XX Series Consoles System Setup Manual	576013-623

Table 2. Related Manuals

V-R Manual	Part Number
TLS-3XX Series Consoles Operator's Manual	576013-610
Serial Comm Modules Installation Guide	577013-528
ISD Troubleshooting Manual	577013-819
TLS-350 Series Board and Software Replacement Manual	576013-637
TLS-350R Point-of-Sale (POS) Application Guide	577013-401
Input/Output Modules Installation	576013-614
TLS RF Wireless 2 System (W2) Installation and Maintenance Guide	577013-964

Safety Precautions

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

	<p>ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>		<p>TURN POWER OFF Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>
	<p>READ ALL RELATED MANUALS Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>		<p>WARNING Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.</p>

 **WARNING**

 	<p>The console contains high voltages which can be lethal. It is also connected to low power devices that must be kept intrinsically safe.</p> <p>Turn power Off at the circuit breaker. Do not connect the console AC power supply until all devices are installed.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p>
---	--

Example Site Diagrams

Figure 1 shows an example site with a VST ECS membrane vapor processor. The diagram shows setups unique to ISD which are discussed in this manual (marked with a star), and those setups performed following instructions in the appropriate sections of the TLS-3XX System Setup manual, such as In-Tank setup (marked with a hexagon).

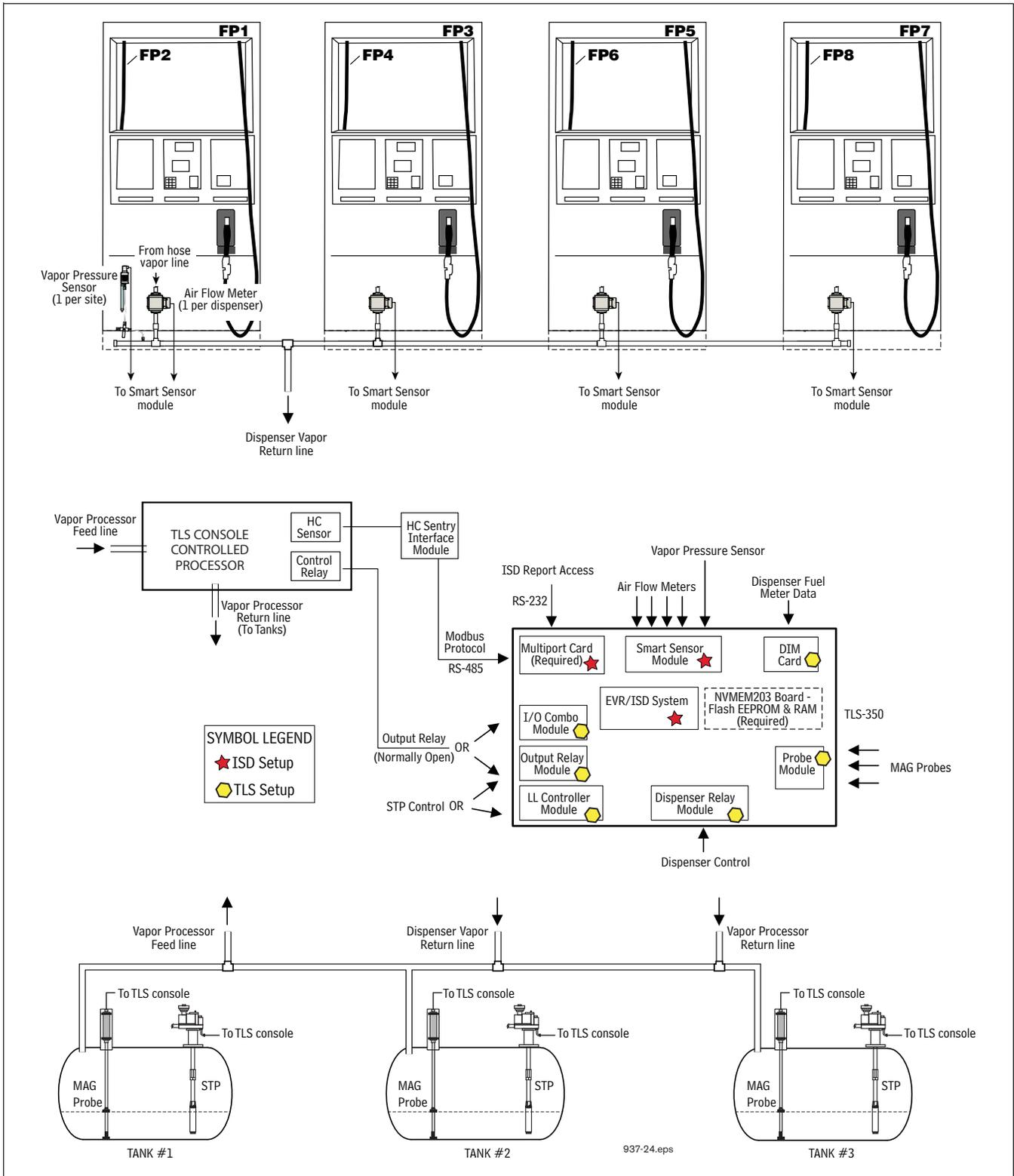


Figure 1. Example Site Diagram - TLS Console Controlled Vapor Processor

2 Installation

This section discusses the installation and wiring of the hardware required to enable the TLS console to perform ISD monitoring of the site's gasoline vapor recovery equipment (non-gas tanks are not monitored):

- Vapor Flow Meter
- Vapor Pressure Sensor
- Smart Sensor Interface Module (8 input and 7 input w/embedded pressure versions)
- NVMEM203 board - required
- 4-Relay Output Module or Dispenser Relay Module or I/O Combination Module
- Line Leak Detection
- Dispenser Interface Module
- Probe Interface Module
- Multi-port Card (for VST ECS Membrane Processor only)



All field wiring, its type, its length, etc., used for TLS console sensors must conform to the requirements outlined in the Veeder-Root TLS-3XX Site Prep manual (P/N 576013-879).

Vapor Flow Meter

Install one Vapor Flow Meter in the vapor return piping of each gasoline dispenser following the instructions in the ISD Balance Flow Meter Installation guide (VR-204 IOM / Section 18). Program the meter following instructions in this manual.

Vapor Pressure Sensor

Install one Vapor Pressure Sensor in the vapor return piping of the gasoline dispenser closest to the tanks following the instructions in the Pressure Sensor Installation guide (VR-204 IOM / Section 13). Program the meter following instructions in this manual.

Installing TLS Console Modules - General Notes

TLS consoles have three bays in which interface modules can be installed; Comm bay (left door) and Power and Intrinsically-Safe bays (right door). Smart Sensor modules are installed in the Intrinsically-Safe (I.S.) bay only (Figure 2).

Most consoles will be shipped with modules installed as ordered. If additional features are added at a later date, modules will be field installed.

In all cases, the position of the modules, their respective connectors and the devices wired to the connectors must be recorded to prevent improper replacement during installation or service. A circuit directory for Power and I.S. bay Interface Modules is adhered to the back of the right-hand door for this purpose.

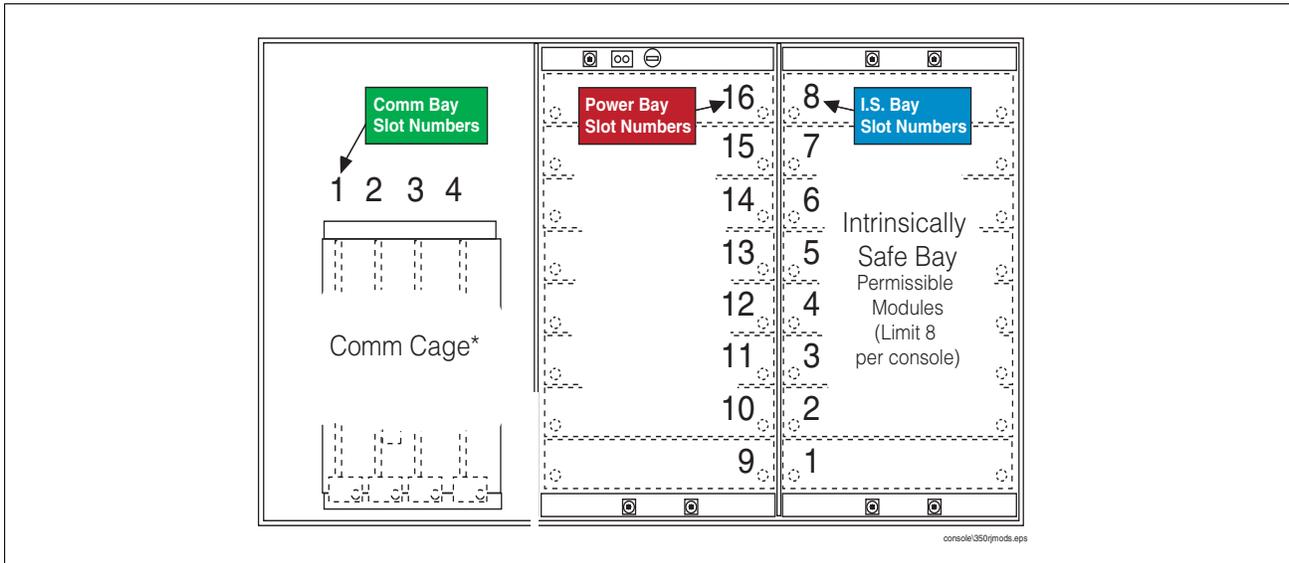


Figure 2. TLS console Interface Module Bays



CAUTION! During programming, module positions and the devices wired to each module are identified and stored in memory. If a connector is removed and reinstalled on a different module after programming, or if an entire module with its connector is removed and reinstalled in a different module slot, the system will not properly recognize the data being received.

Module Position

1. Record on the circuit directory the type of module in each slot location.
2. If a system contains multiple modules of a single type (i.e., two Smart Sensor Modules), they may be swapped between their respective slot locations, however, the connectors must remain with their original locations, not with the original modules.

Connector Position

1. Identify all connectors according to their slot location using the self-adhesive numbering labels furnished with each module. Accurately record on the circuit directory the location of each device wired to the connector as you attach wires to the module.
2. Once a device has been wired to certain terminals on a connector and the system has been programmed, the wires from that device may not be relocated to other terminals without reprogramming the system.

Grounding Probe and Sensor Shields

Connect probe and sensor cable shields to ground at the console only. Do not ground both ends of the shield.

CIRCUIT DIRECTORY

A circuit directory is adhered to the inside of the right-hand door. It should be filled out by the installer as the module's connectors are being wired.

The following information should be recorded for each slot:

- **Module Type:** record what type of module has been installed in the slot, e.g., Smart Sensor Module.
- **Position Record:** record the physical location and/or type of device wired to each terminal of the module connector in the slot, e.g., AFM1.

Smart Sensor Interface Module

The Smart Sensor Interface Module 8 input or 7 input w/embedded pressure versions monitor Air Flow Meter (AFM) and Vapor Pressure Sensor (VPS) inputs.



Switch off power to the TLS console while you install modules and connect sensor wiring.

Open the right door of the console and slide the necessary Smart Sensor modules into empty I.S. Bay slots. Connect the field wiring from each of the sensors following instructions in the Flow Meter and Pressure Sensor manuals. Setup the Smart Sensor module(s) following instructions in this manual.

NVMEM203 Board

Verify that a NVMEM203 board is installed in the TLS console (ref. Figure 2-7 in the V-R TLS-3XX Series Consoles Troubleshooting Manual P/N 576013-818, Rev Q or later). This board contains flash EEPROM and RAM needed to run ISD software and store ISD reports. No setup is required.

Site Shut Down Requirements

Normal ISD operation requires TLS console control of the STP in each of the gasoline tanks. If the site has Wireless Pressure Line Leak Detection (WPLLD), Pressure Line Leak Detection (PLLD) or Volumetric Line Leak Detection (VLLD) for each tank, you can use the line leak disable setup to control the vapor recovery tanks (diesel tanks do not require shutdown). If the site does not have line leak detection for all vapor recovery tanks, you can use output relay setup to control each tank. In lieu of line leak detection, install the necessary modules (output relay) to control each gasoline tank. Alternately, you can install Dispenser Relay Modules to control dispensing.

Dispenser Interface Module (DIM)

Verify that a dispenser interface module (DIM) is installed in the TLS console communication bay (ref. Figure 2) and that it is designed to communicate with the type of gasoline dispensers installed at the site. The ISD software requires dispenser fuel flow meter data inputs. Reference TLS-350R Point-of-Sale (POS) Application Guide to select correct DIM card. Refer to the manual shipped with the DIM for installation instructions, refer to the TLS-3XX System Setup manual to program the DIM.

Probe Interface Module

Verify that a Probe Interface Module(s) is installed (Intrinsically-Safe bay) and that a Mag probe is in each gasoline tank and is connected to the module(s). Program the Mag probes following instructions in the TLS-3XX System Setup manual.

I/O Combination or 4-Relay Module

Connect the vapor processor motor control relay to two relays on either the 4-Relay or I/O Combination module as shown in Figure 4.

Multi-port Card for Vapor Processor Communication



A Multi-port card is needed for RS-485 communication with the TLS console and is required with VST ECS membrane processor installations. Verify that a Multi-port card is installed in slot 4 of the card cage in the communications bay of the TLS console (ref. Figure 4). When installing this card, refer to the V-R Serial Comm Modules Installation Guide (577013-528) for instructions. Connect this card to the vapor processor as shown in Figure 4. Program the card as instructed in this manual.

TLS Console with V-R Vapor Polisher

Figure 4 shows the interconnection wiring between a TLS console and a V-R Vapor Polisher.

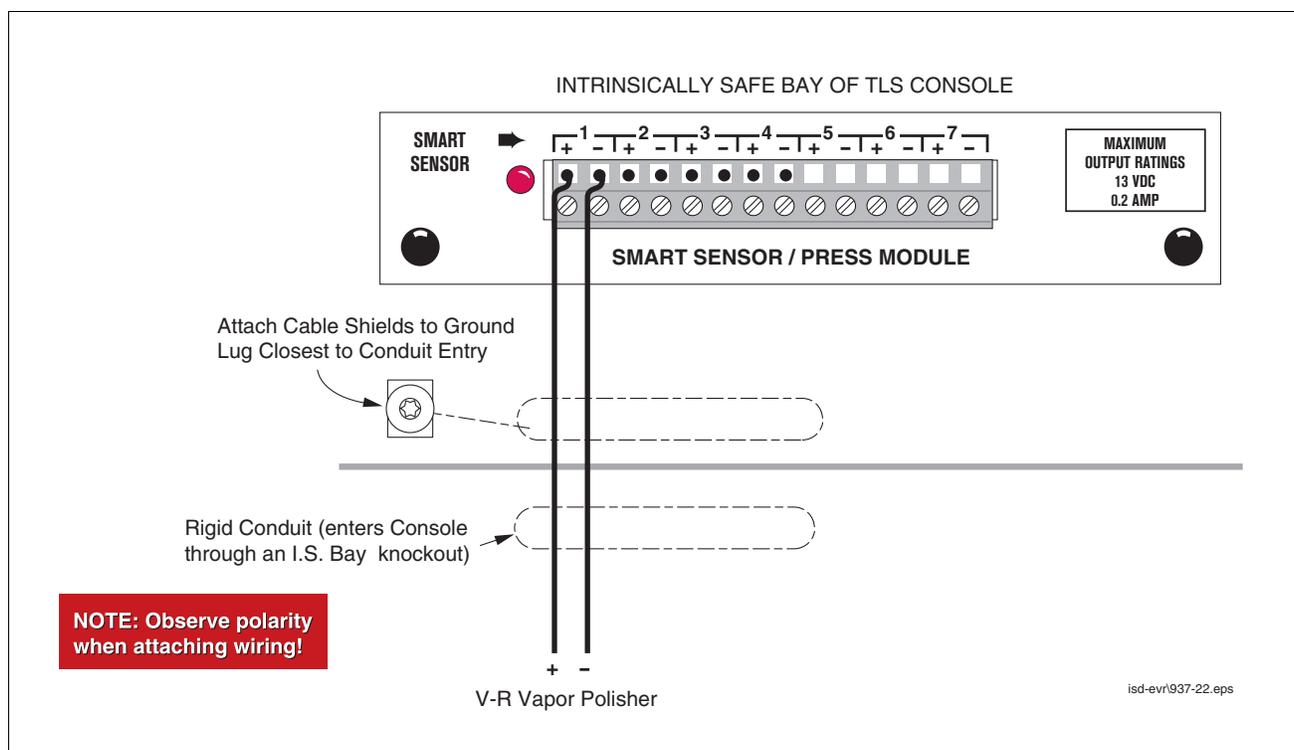


Figure 3. V-R Vapor Polisher Connections to TLS Console

TLS Console with VST ECS Membrane Processor & VST Green Machine

Figure 4 shows the interconnection wiring between a TLS console and a VST ECS Membrane Processor and VST Green Machine.

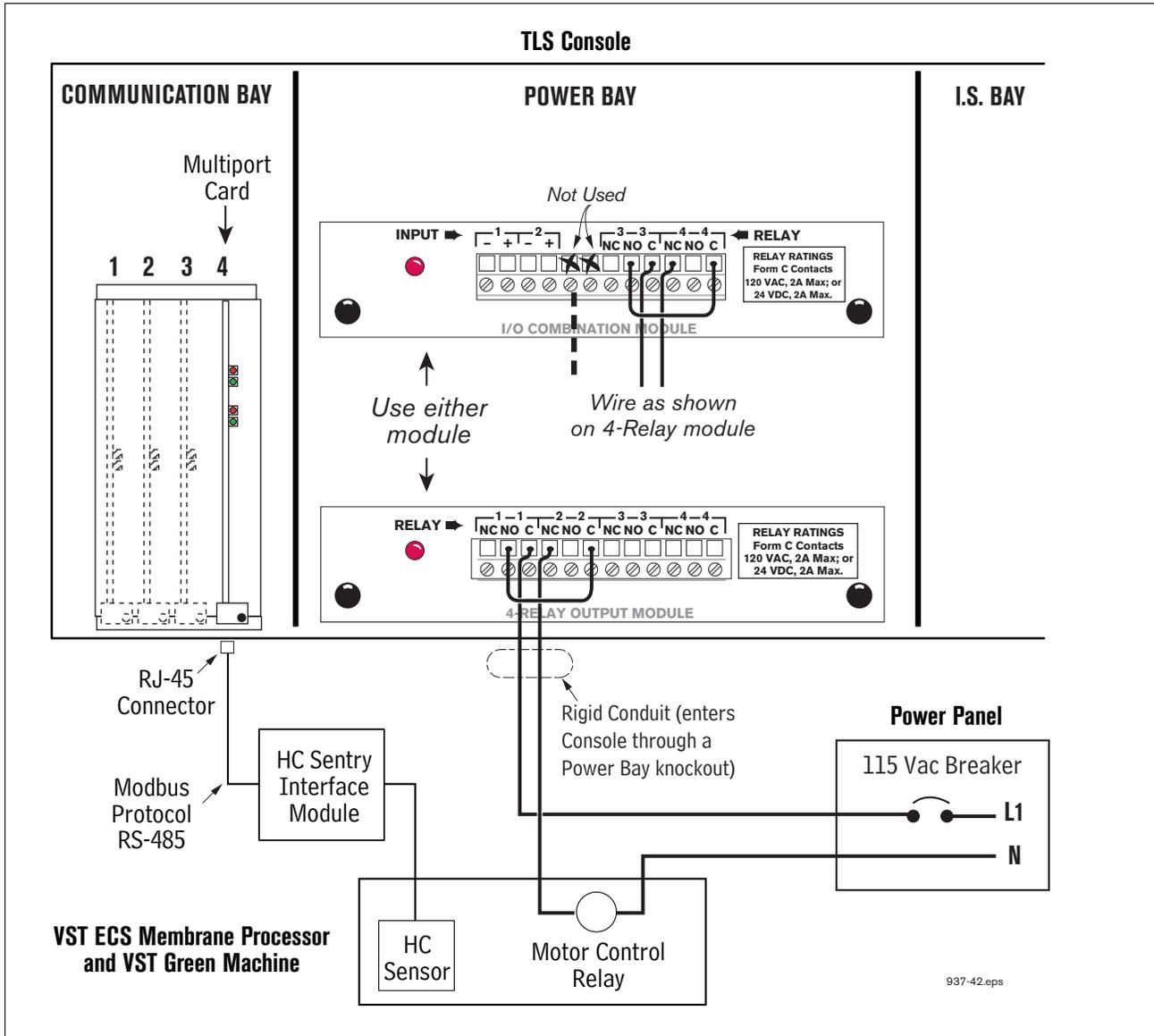


Figure 4. VST ECS Membrane Processor & VST Green Machine Connections to TLS Console

3 Setup

Introduction

This section describes how to program the ISD system using the TLS console's front panel buttons and display. The procedures in this manual follow standard TLS console setup programming input, i.e., keypad/display interaction. If necessary, refer to Section 2 of the TLS-3XX System Setup manual (P/N 576013-623) to review entering data via the front panel keypads.

All ISD-related equipment must be installed at the site and connected to the TLS console prior to beginning the setups covered in this section. As with all TLS connections, you cannot change sensor wiring or module slots after programming or the system will not recognize the correct data. Reference the section entitled "Connecting Probe/Sensor Wiring to Consoles" in the TLS-3XX Site Prep and Installation manual (P/N 576013-879) for rewiring precautions.

SYSTEM SETUPS

- Smart Sensor Setup - All ISD site (Figure 5)
This setup mode function programs the Smart Sensor Interface module to monitor the Air Flow Meters, ATM, Vapor Valve and the Pressure Sensor.
- EVR/ISD Setup - All ISD sites (Figure 7, Figure 8 and Figure 9)
This setup mode function programs the TLS console for EVR/ISD vapor recovery monitoring and reporting.
- Verify Console Date/Time
Check the console front panel to confirm display of current date and time. Reset if necessary (refer to current date/current time setups in TLS-3XX System Setup manual).

ALARM SETUPS

One or more TLS setups below must be performed to shut down the tank or the dispenser should certain ISD alarms occur:

- For ISD sites with line leak detection - XLLD Line Disable Setup (go to Figure 16)
This setup assigns ISD alarms to a line leak detector that will shut down the tank's STP.
- For ISD sites without line leak detection - Output Relay Setup (go to Figure 18)
This setup assigns ISD alarms to a relay that will shut down the tank's STP.
- For ISD sites with dispenser shutdown - Dispenser Relay Setup (go to Figure 20)
This setup assigns ISD alarms to a relay that will shut down the dispenser.

Smart Sensor Setup

The Smart Sensor Interface Module is installed in the Intrinsically-Safe bay of the TLS console. This module monitors Air Flow Meters, ATM, Vapor Valve and the Vapor Pressure Sensor. Figure 5 diagrams the Smart Sensor setup procedure. Figure 6 shows a printout of the Smart Sensor setup.

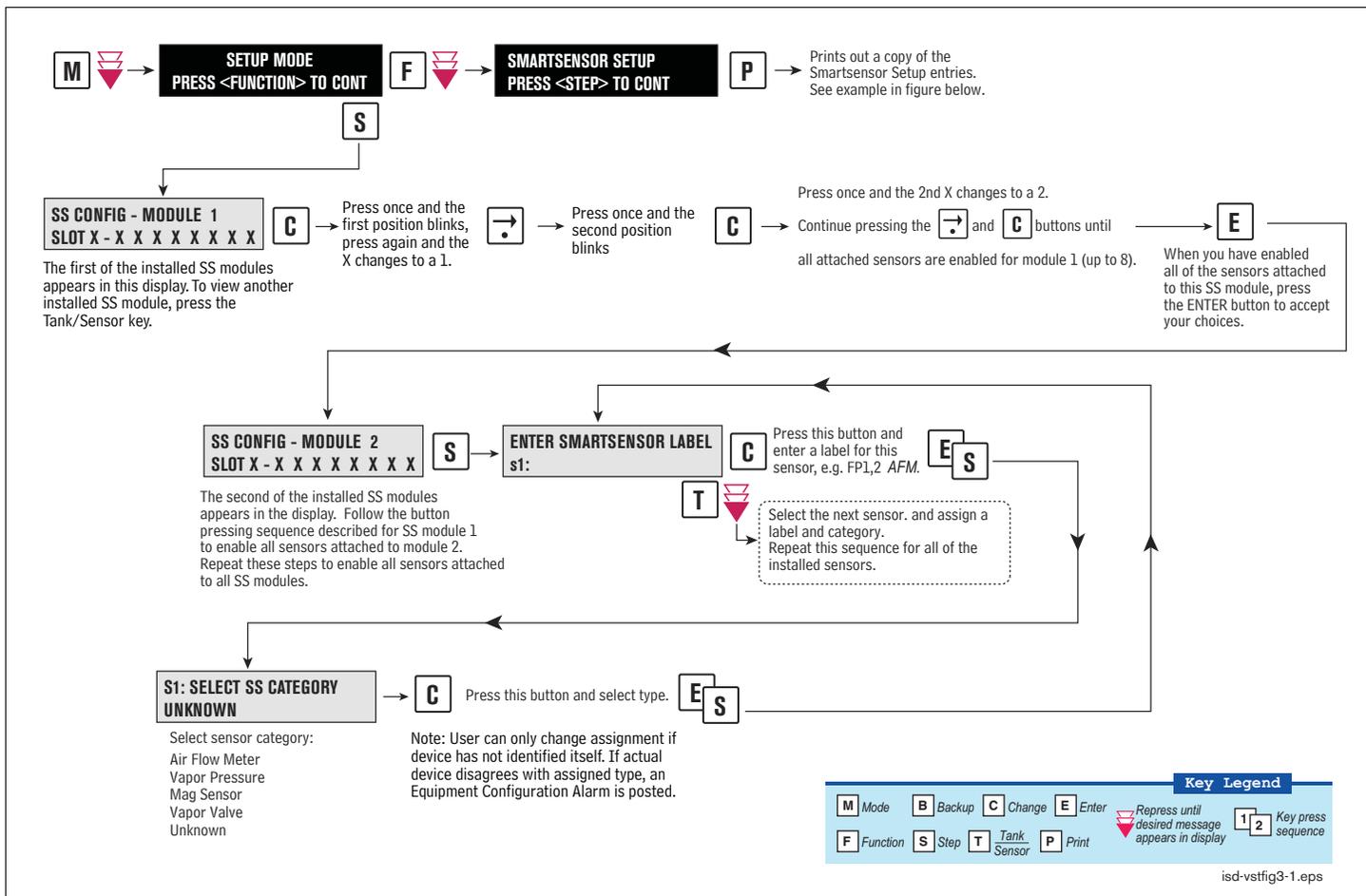


Figure 5. Smart Sensor Setup

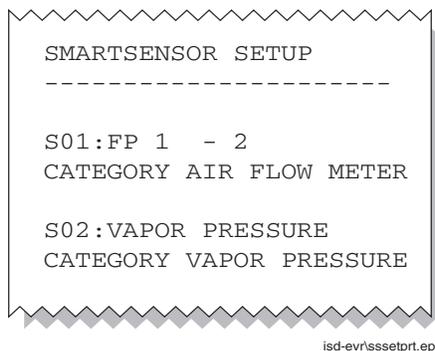


Figure 6. Smart Sensor Setup Printout Example

ATM Pressure Sensor Setup

The ATM Pressure Sensor is factory installed in the SmartSensor / Press module and preassigned to channel 8. At least one SmartSensor / Press module, which contains the ATM Pressure Sensor, must be installed in the console. You must configure at least one ATM Pressure Sensor for use by the Vapor Polisher or a PMC Set-up Fail will occur. NOTE: If more than one SmartSensor / Press module is installed, only one ATM Pressure Sensor needs to be configured.

Look in console and note the slot position of the SmartSensor / Press module. Enter the Setup Mode and press the FUNCTION key until you see the message:

```
SMARTSENSOR SETUP
PRESS <STEP> TO CONTINUE
```

Press STEP until you see the message:

```
SS CONFIG - MODULE n
SLOT x - X X X X X X X X
```

Where *x* is the slot number containing the SmartSensor / Press module. Press the → key to move the cursor to the last (8th) X. Press CHANGE and the message below should appear:

```
SLOT x - X X X X X X X 8
PRESS <STEP> TO CONTINUE
```

Press STEP:

```
ENTER SMARTSENSOR LABEL
s 8:
```

NOTE: In the example above, the ATM P sensor position is 8 but it could be 16, 32, or 40 depending on the SmartSensor's module number.

Press CHANGE and enter a label:

```
ENTER SMARTSENSOR LABEL
s 8: (ATMP Sensor Label)
```

Press ENTER to accept your label:

```
s 8: (ATMP Sensor Label)
PRESS <STEP> TO CONTINUE
```

Press STEP:

```
s 8: SELECT SS CATEGORY
UNKNOWN
```

Press CHANGE until you see the message:

```
s 8: SELECT SS CATEGORY
ATM P SENSOR
```

Press ENTER to accept the category. Press STEP, then BACKUP to return to the configuration display for Smart Sensor module 1:

SS CONFIG - MODULE 1
SLOT x - X X X X X X X X

This completes the ATM Pressure Sensor configuration.

EVR/ISD Setup

You must choose the appropriate data sheet from Appendix A for the vapor recovery system installed at your facility (e.g., Single or Multi-Hose Dispensers) and record in those sheets, all of the unique information from sensors/hose positions, prior to beginning the TLS EVR/ISD set up procedure below.

Figure 7 describes the first of the EVR/ISD setup programming diagrams.

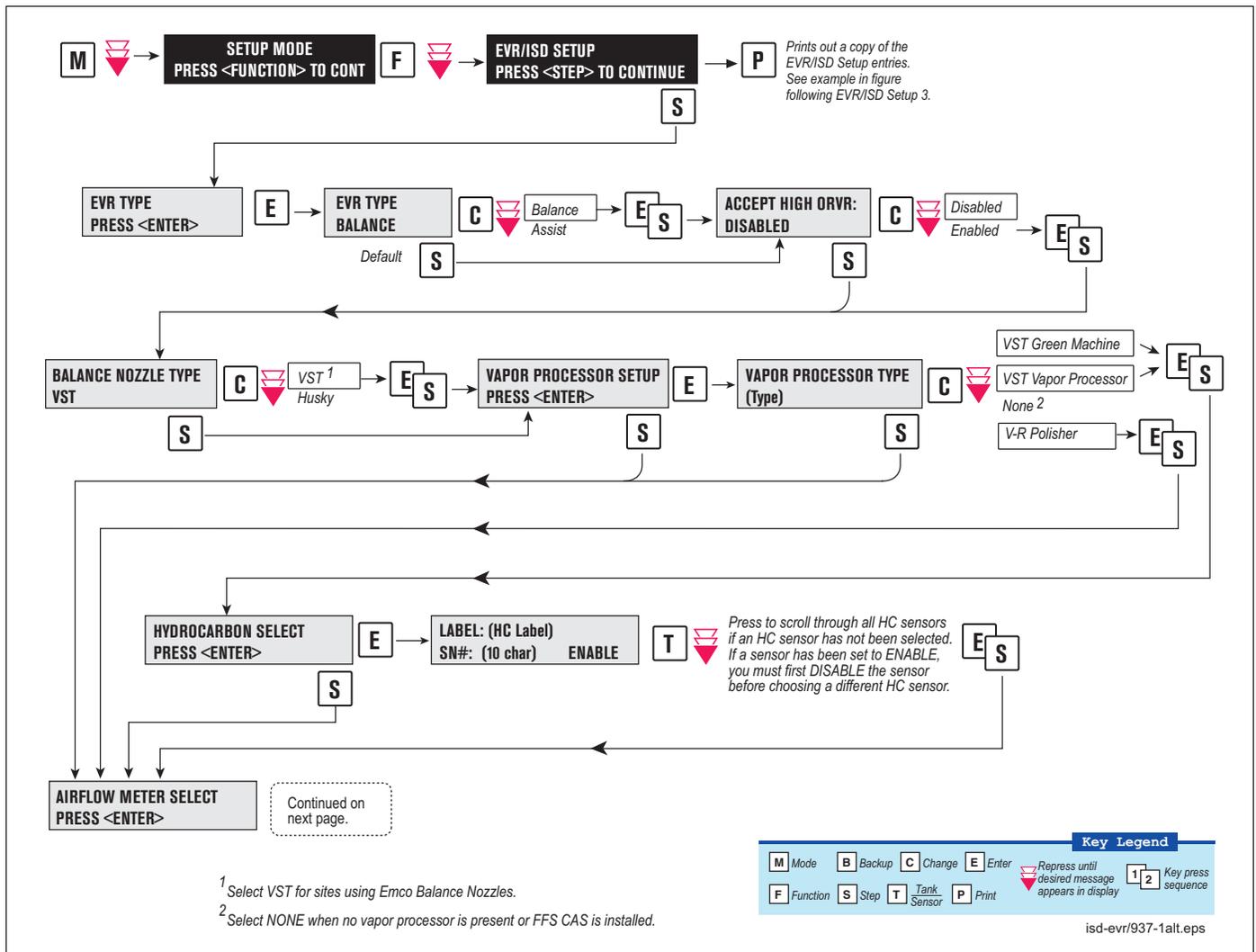


Figure 7. EVR/ISD Setup 1

Figure 8 describes the second of the EVR/ISD setup programming diagrams.

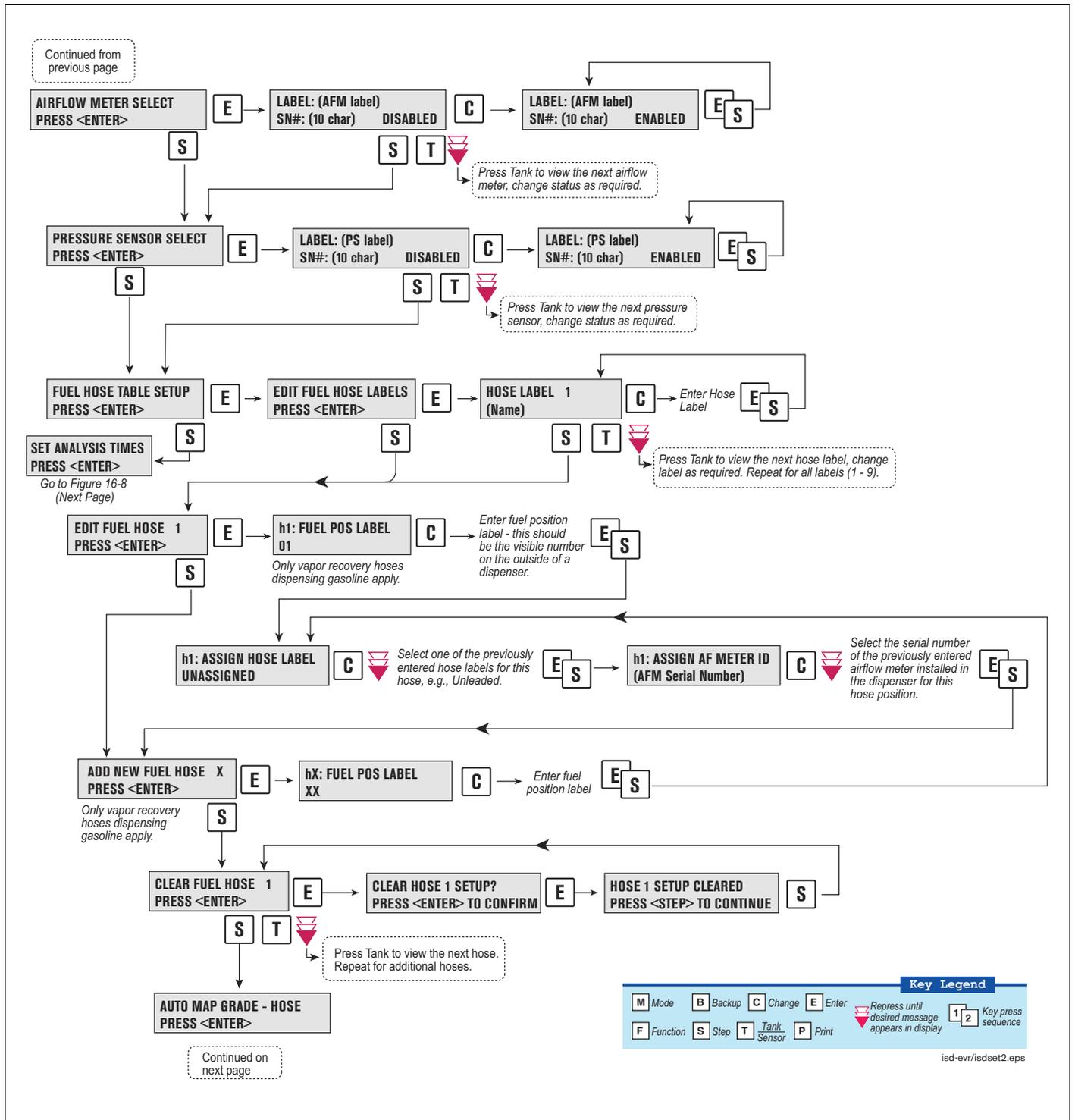


Figure 8. EVR/ISD Setup 2

Figure 9 describes the last of the EVR/ISD setup programming diagrams.

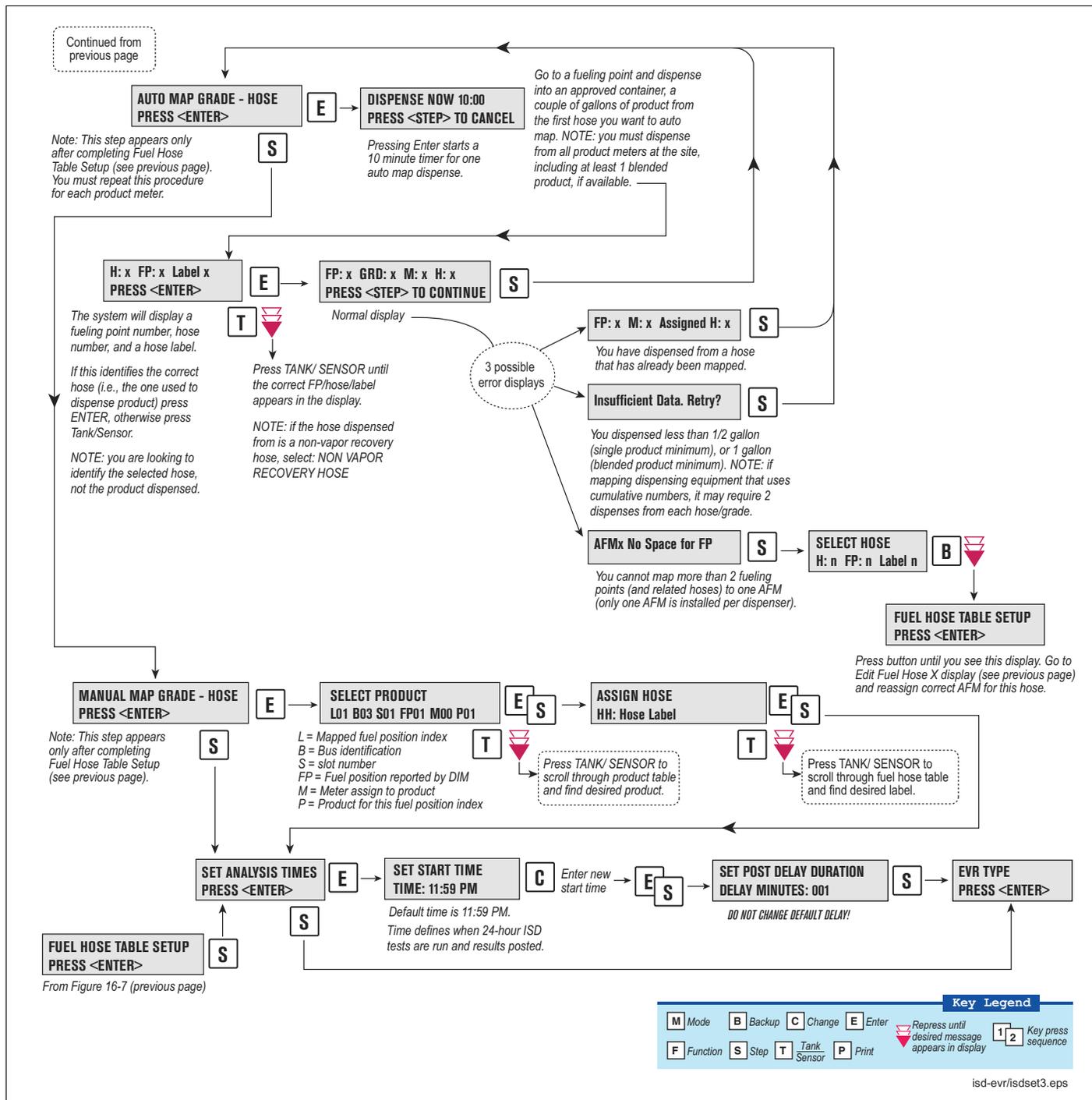


Figure 9. EVR/ISD Setup 3

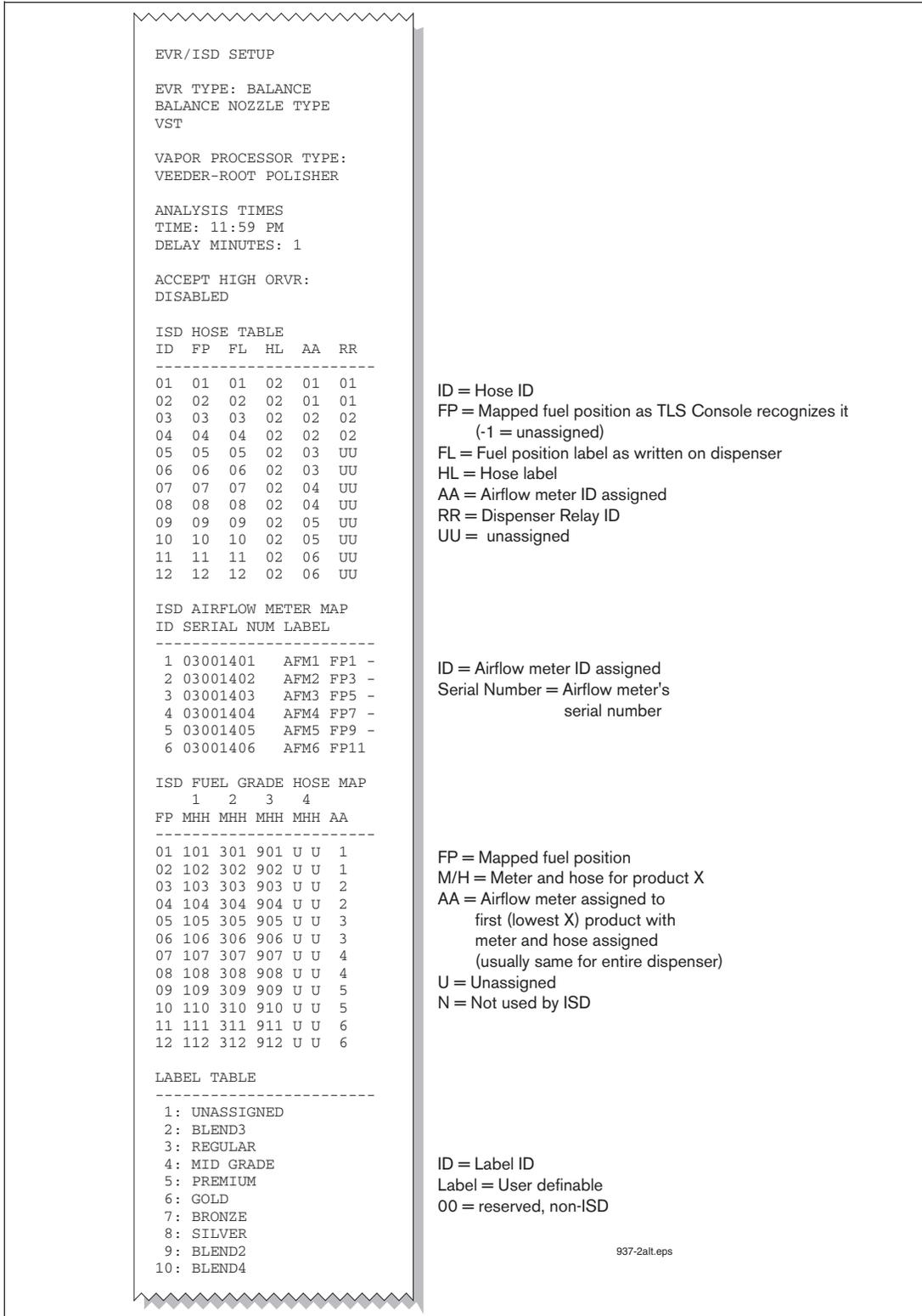


Figure 10. Example VST ECS Printout

Output Relay Setup - VST ECS Membrane Processor

The Output Relay setup programs an output relay so that the TLS console can switch a controlled vapor processor on and off as shown in Figure 11.

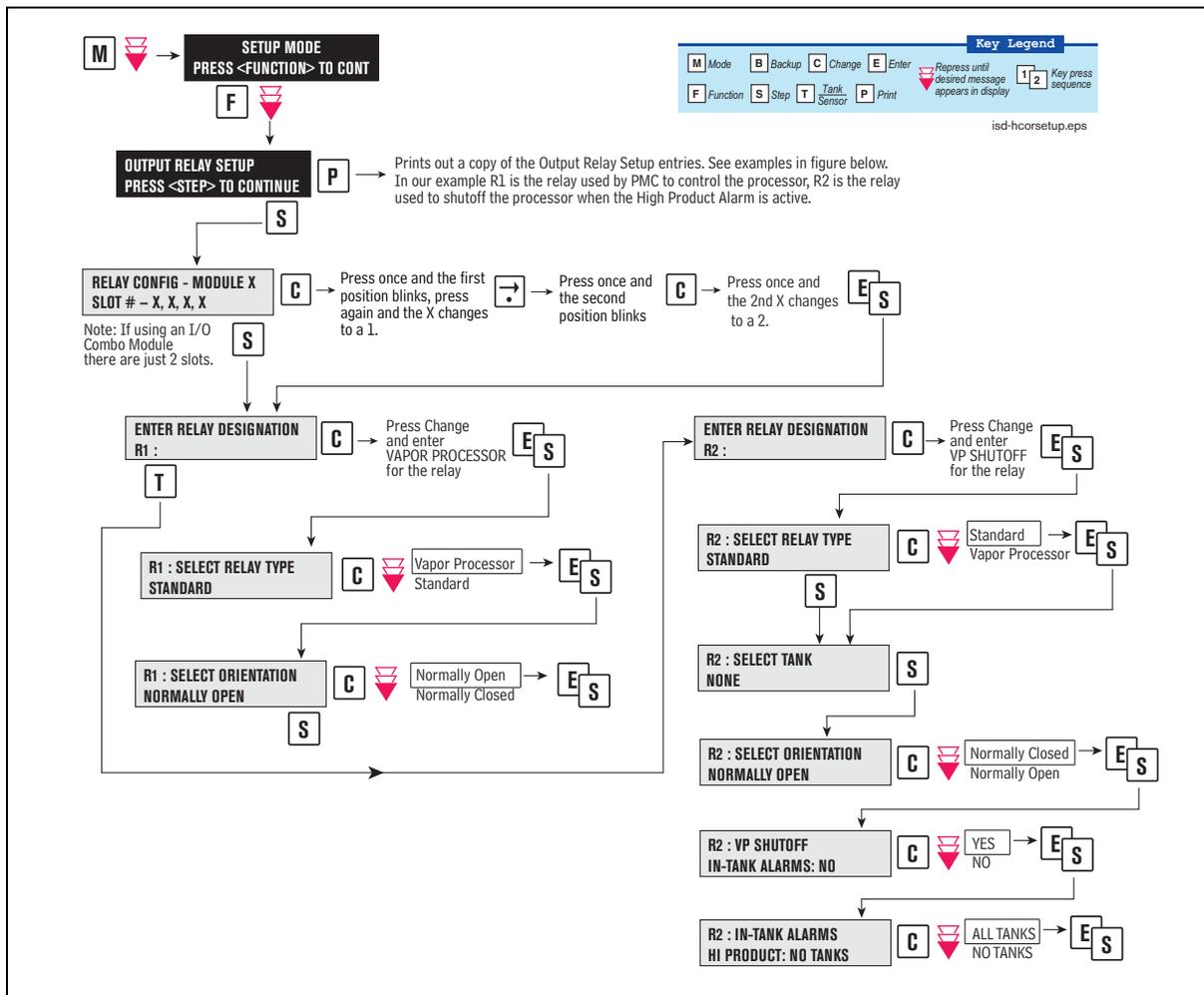


Figure 11. Output Relay Setup for VST ECS Membrane Processor

Figure 12 shows example setup printouts of the Output Relays setup.

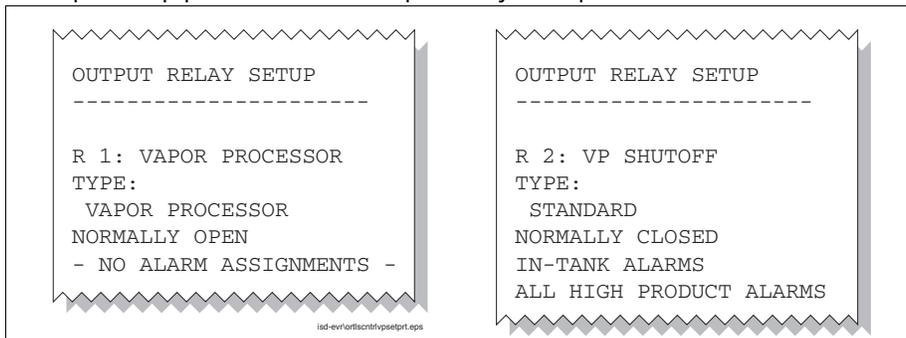


Figure 12. Output Relay Setup Printout Examples for TLS Console Controlled Processor

PMC Setup for VST ECS Membrane Processor

PMC setup allows you to select the maximum runtime and the start/stop pressure of TLS console controlled vapor processors (see Figure 13).

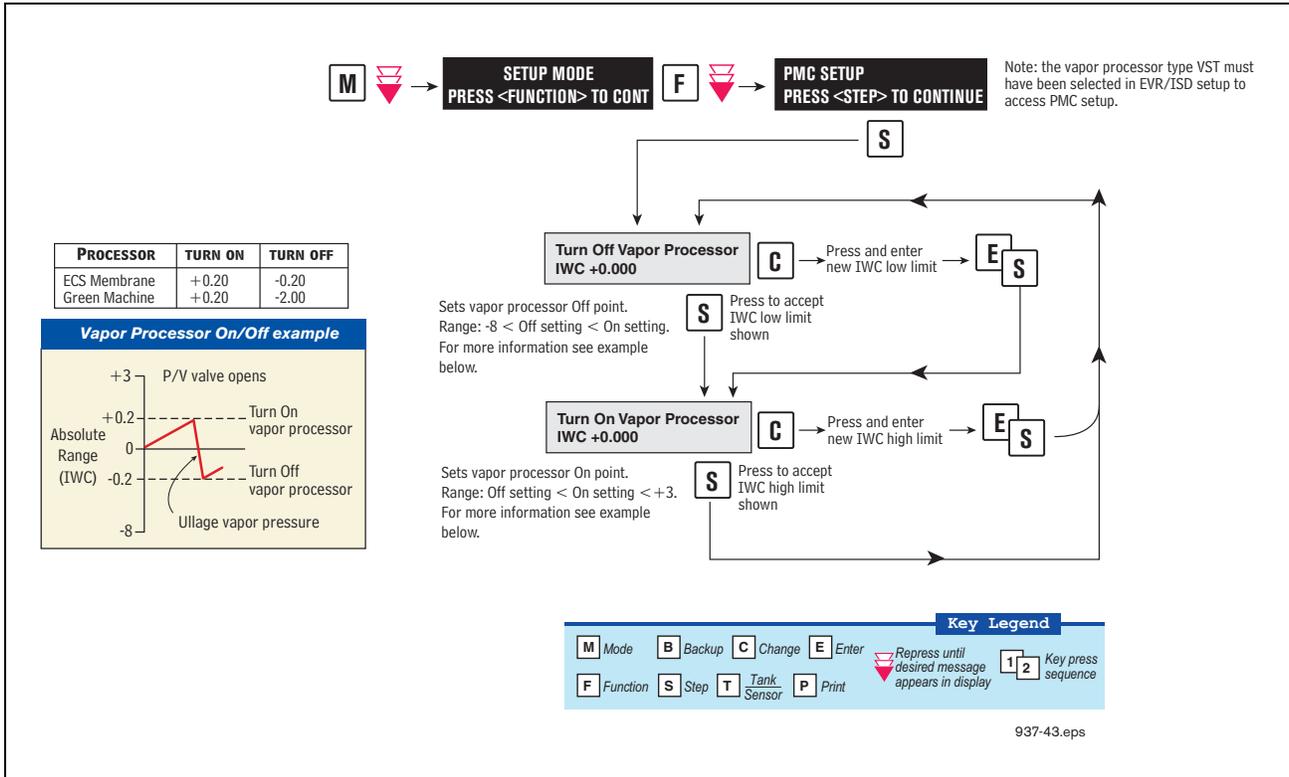


Figure 13. PMC Setup - VST ECS Membrane Processor

Alarm Setup

INTRODUCTION

California regulations (VAPOR RECOVERY CERTIFICATION PROCEDURE, CP-201, DATED MAY 25, 2006, CERTIFICATION PROCEDURE FOR VAPOR RECOVERY SYSTEMS AT GASOLINE DISPENSING FACILITIES, Sections 9.1.2) require shut down of dispensing systems that generate specific alarm conditions. To accomplish this, the TLS must be configured to control the gasoline tank's pump (diesel tanks are not monitored) or the gasoline dispensers in order to disable them when ISD shutdown alarm conditions occur. Prior to setting up ISD shut down alarms, you will need to determine how the site's tank pumps or dispensers are controlled. If the site has line leak detection, you can shut down the line (tank) by assigning the ISD alarms in Line Leak Disable setup. In the absence of line leak detection, you can assign the ISD alarms to Output Relays which in turn can be wired to shut down the tank or assign ISD alarms to Dispenser Relays which can be used to shut down the dispenser. Figure 14 illustrates two examples of tank pump control, one using a line leak/output relay combination and one using output relays.

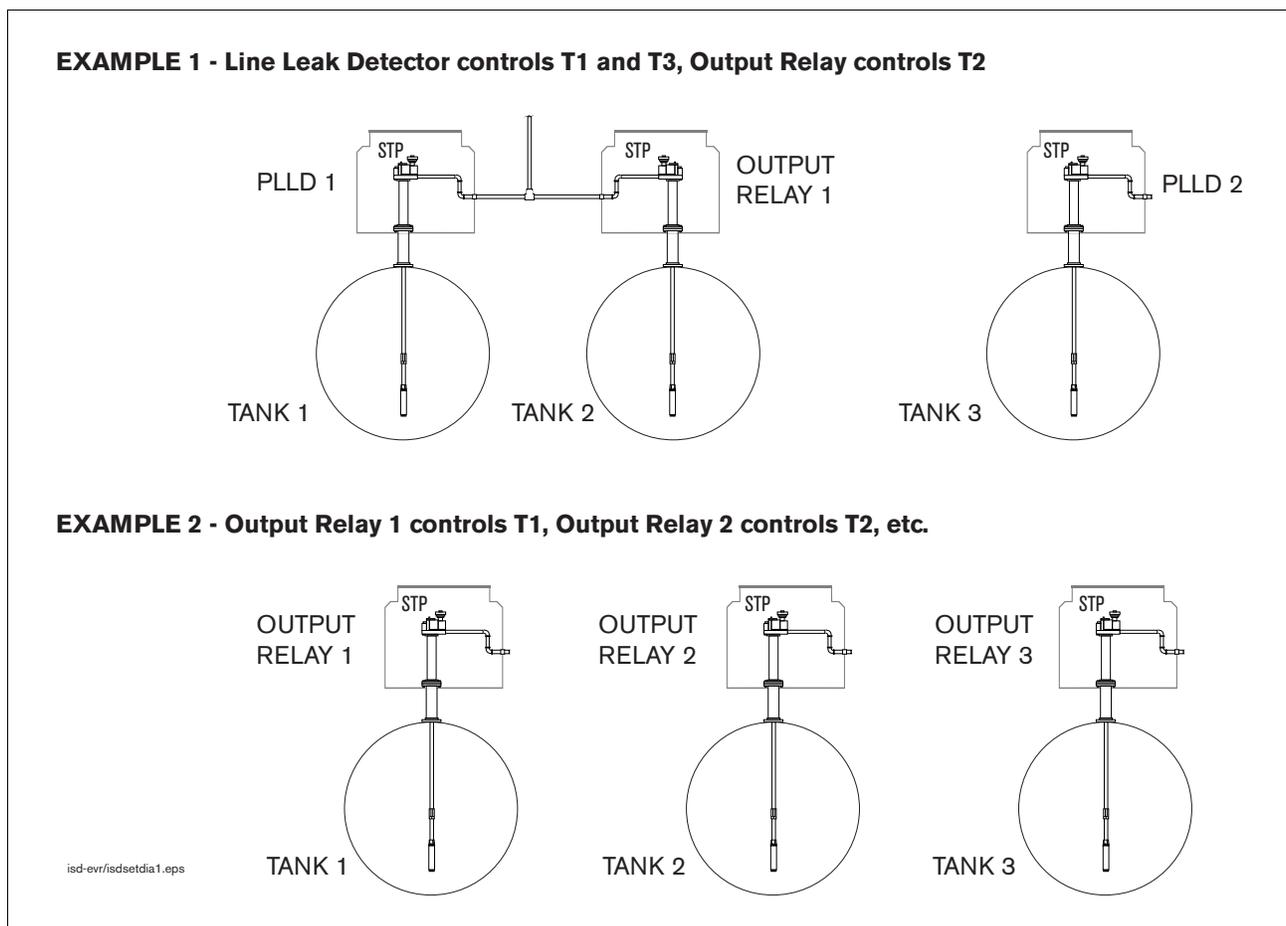


Figure 14. Site Tank Control Examples

Referencing the figure above, in example 1, you would assign the ISD shut down alarms for tank 1 to PLLD 1 in PLLD Line Leak Disable setup, for tank 2 to a relay in Output Relay Setup, and for tank 3 to PLLD 2 in PLLD Line Leak Disable setup. In example 2, you would assign the ISD shut down alarms for tank 1 to output relay 1, tank 2 to output relay 2, and tank 3 to output relay 3.

Figure 15 illustrates two examples of dispenser control using Dispenser Relay modules.

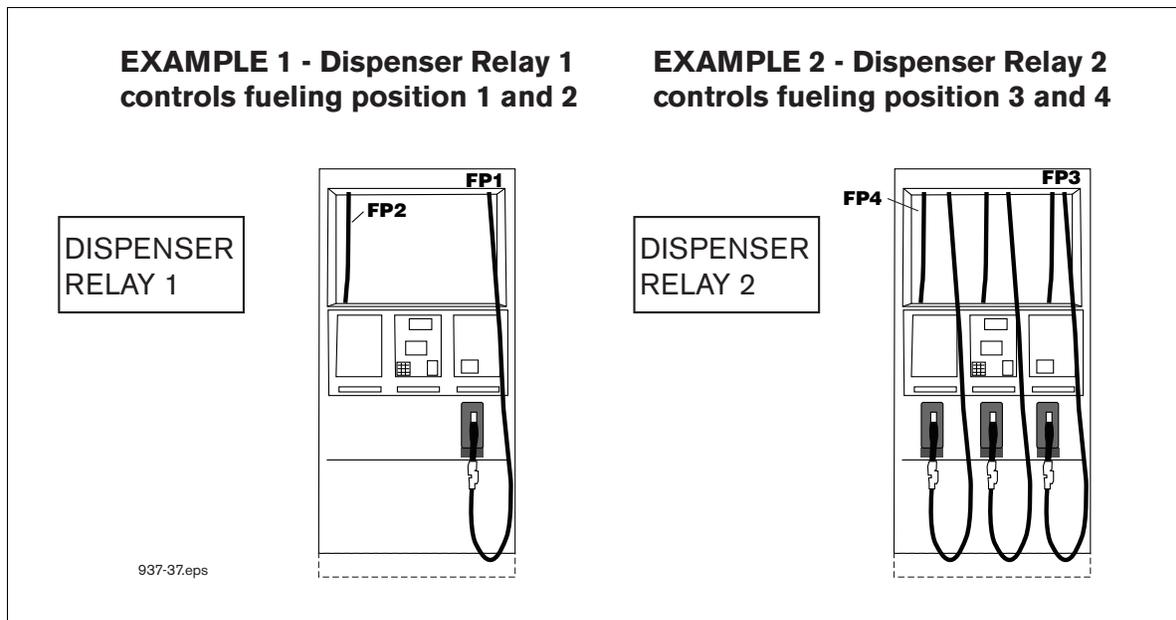


Figure 15. Dispenser Control Examples

You can assign ISD containment shut down alarms to the submersible pump output relays and assign ISD collection alarms to the dispenser relay as shown above.

ALARM SETUP FOR SITES WITH LINE LEAK DETECTION

Figure 16 illustrates the setup steps required to assign ISD Shut Down Alarms to a tank having a line leak detection system installed.

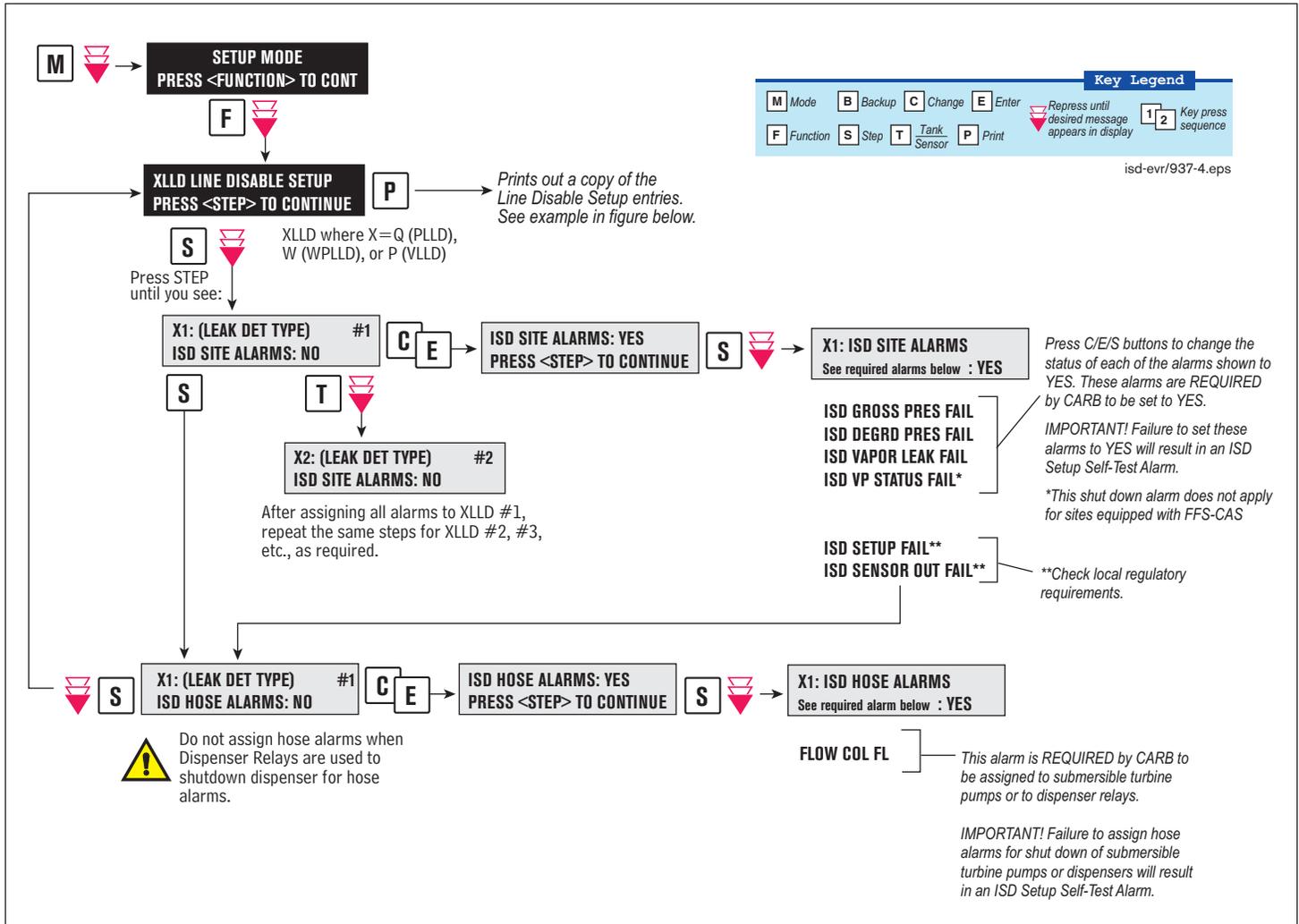


Figure 16. Assigning ISD Shut Down Alarms in Line Leak Disable Setup

Figure 17 shows a resulting printout of the Line Leak Disable setup with ISD alarms assigned when Dispenser Relay modules are not used.

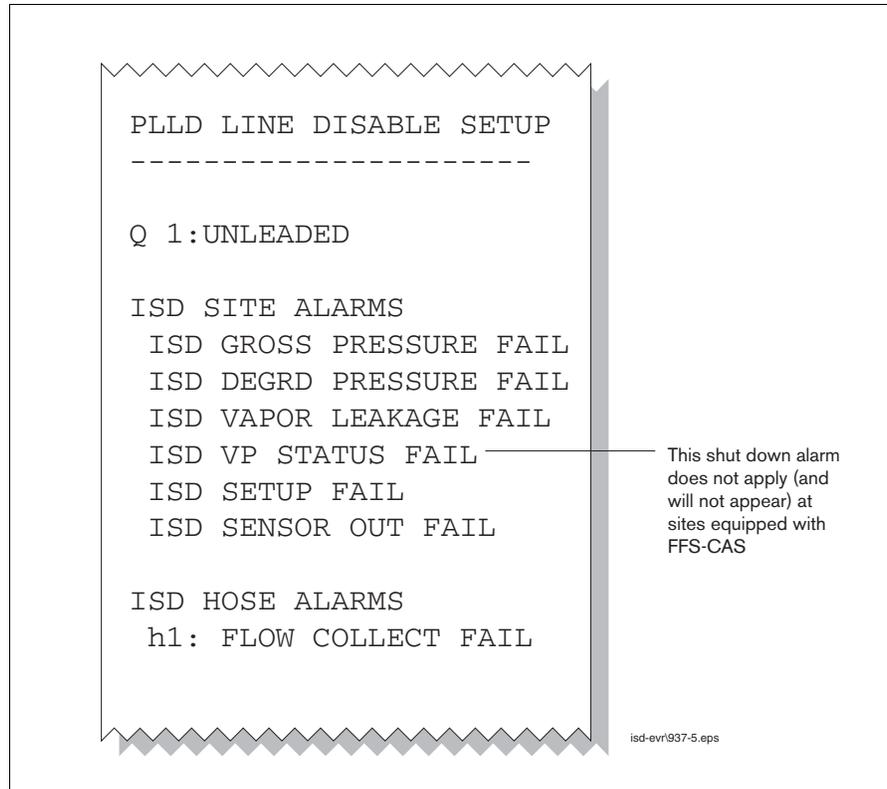


Figure 17. Example Line leak Disable Setup Printout

ALARM SETUP FOR SITES WITHOUT LINE LEAK DETECTION

Figure 18 illustrates the setup steps required to assign ISD Shut Down Alarms to a tank using either a Four Relay Output Module or an I/O Combination Module.

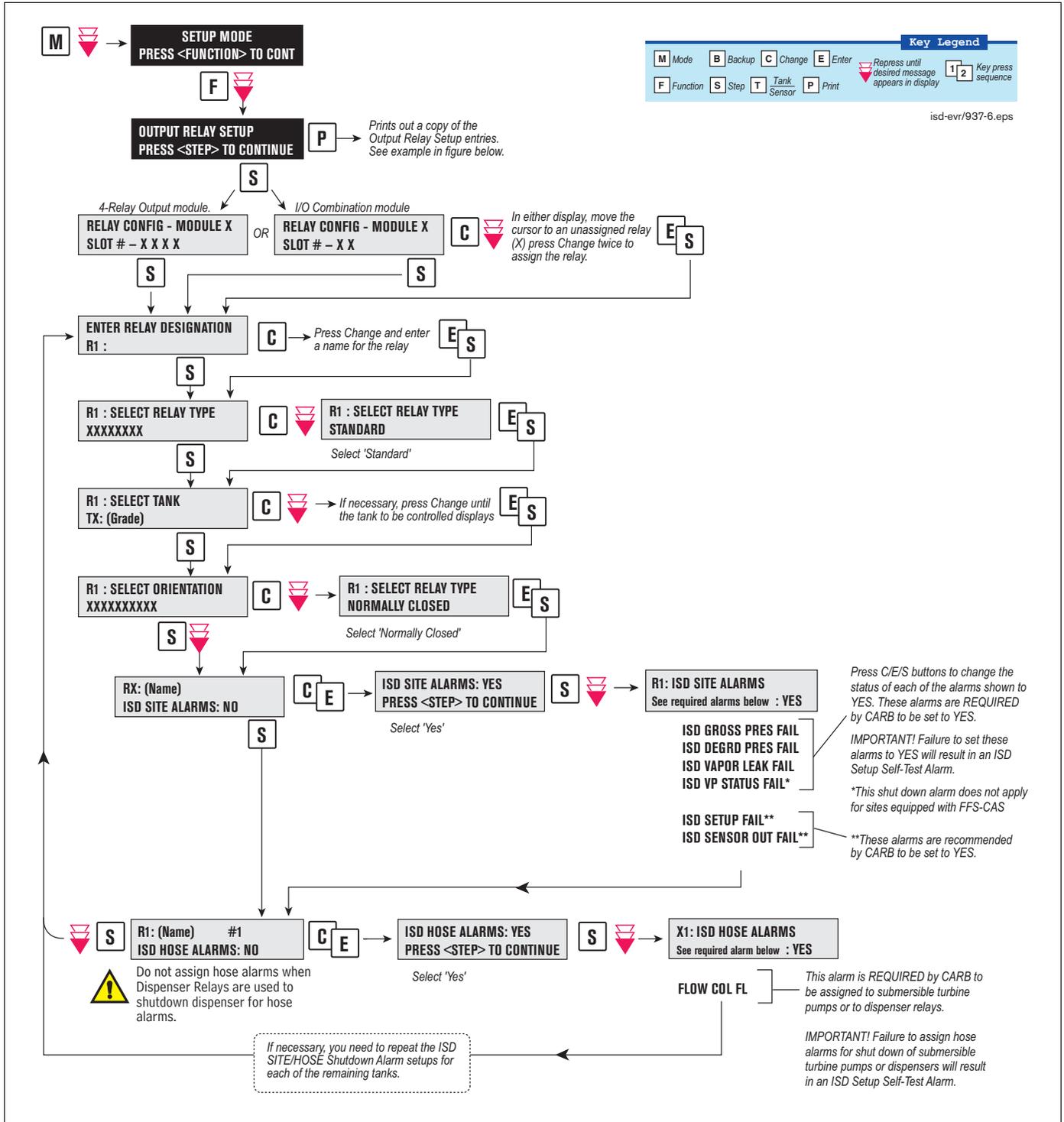


Figure 18. Assigning ISD Shut Down Alarms in Output Relay Setup

Figure 19 shows a resulting printout of the Output Relay setup with ISD alarms assigned when Dispenser Relay modules are not used.

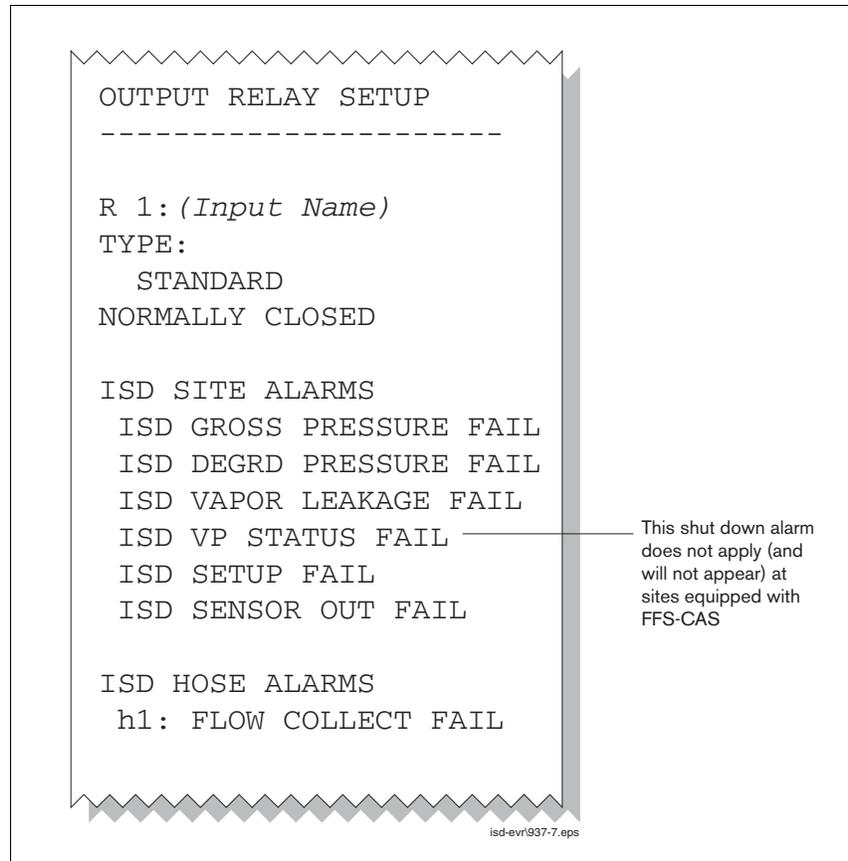


Figure 19. Example printout - ISD Alarms Assignments - Output Relay Setup

ALARM SETUP FOR SITES WITH DISPENSER RELAYS

Figure 20 illustrates the setup steps required to assign ISD Shut Down Alarms to a dispenser using a Dispenser Relay Module.

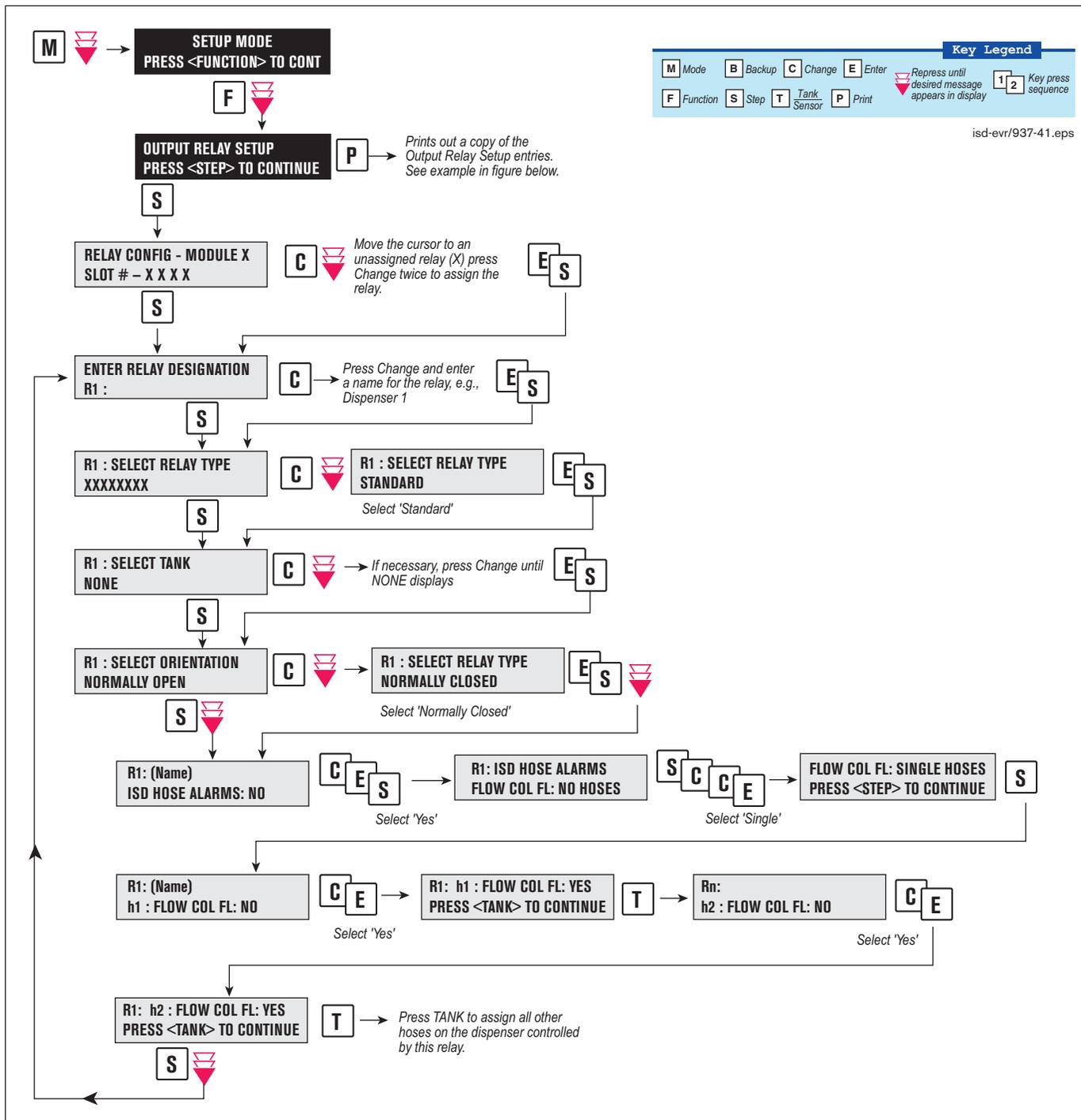


Figure 20. Assigning ISD Shut Down Alarms in Dispenser Relay Setup

Figure 21 shows a resulting printout of the Dispenser Relay setup with ISD hose alarms assigned.

```
OUTPUT RELAY SETUP
-----

R 1:DISPENSER 1
TYPE:
  STANDARD
  NORMALLY CLOSED

TANK #:  NONE

ISD HOSE ALARMS
h 1:FLOW COLLECT FAIL
h 2:FLOW COLLECT FAIL

937-39.eps
```

Figure 21. Example printout - ISD Hose Alarm Assignments - Dispenser Relay Setup

4 ISD Operability Test Procedure

The following procedures shall be used at field sites to determine the operability of the Veeder-Root ISD system to satisfy the requirements documented in VAPOR RECOVERY CERTIFICATION PROCEDURE, CP-201, DATED MAY 25, 2006 CERTIFICATION PROCEDURE FOR VAPOR RECOVERY SYSTEMS AT GASOLINE DISPENSING FACILITIES. Testing the ISD equipment in accordance with this procedure will verify the equipment's operability for Vapor Containment Monitoring and Vapor Collection Monitoring.

Veeder-Root's TLS console ISD System Self-Test Monitoring algorithms are designed to verify proper selection, setup and operation of the TLS console modules and sensors and will not complete and report passing test results in the event of a failure of components used in the system. Completed ISD monitoring tests are evidence that:

- The system was properly powered for data collection
- All necessary ISD sensors were setup and connected
- All necessary ISD sensors were operating within specification
- All internal components including TLS console modules were properly setup and operating within specification

Veeder-Root recommends printing a copy of the ISD ALARM STATUS and ISD DAILY report (REF. Section 5, Operation of the ISD Install, Setup & Operation Manual) periodically to determine that compliance tests are being completed in accordance with local and state regulations.

Vapor Pressure Sensor Verification Test

See EO VR 204 Exhibit 10 for the Pressure Sensor Verification Test.

Vapor Flow Meter Operability Test

See EO VR 204 Exhibit 17 for the ISD Vapor Flow Meter Operability Test Procedure.

Vapor Processor Operability Test

See EO VR 204 Exhibit 8 and 9 for the VST ECS Membrane Operability Test.

5 Operation

Alarms

OVERVIEW OF TLS CONSOLE INTERFACE

The TLS console is continuously monitoring the vapor recovery system, PMC and ISD sensors for alarm conditions such as excessively high or low vapor collection, containment system vapor leakage and equipment problems.

During normal operation when the TLS console and monitored EVR/ISD System is functioning properly and no alarm conditions exist, the "ALL FUNCTIONS NORMAL" message will appear in the system status (bottom) line of the console display, and the green Power light will be On (see Figure 22).

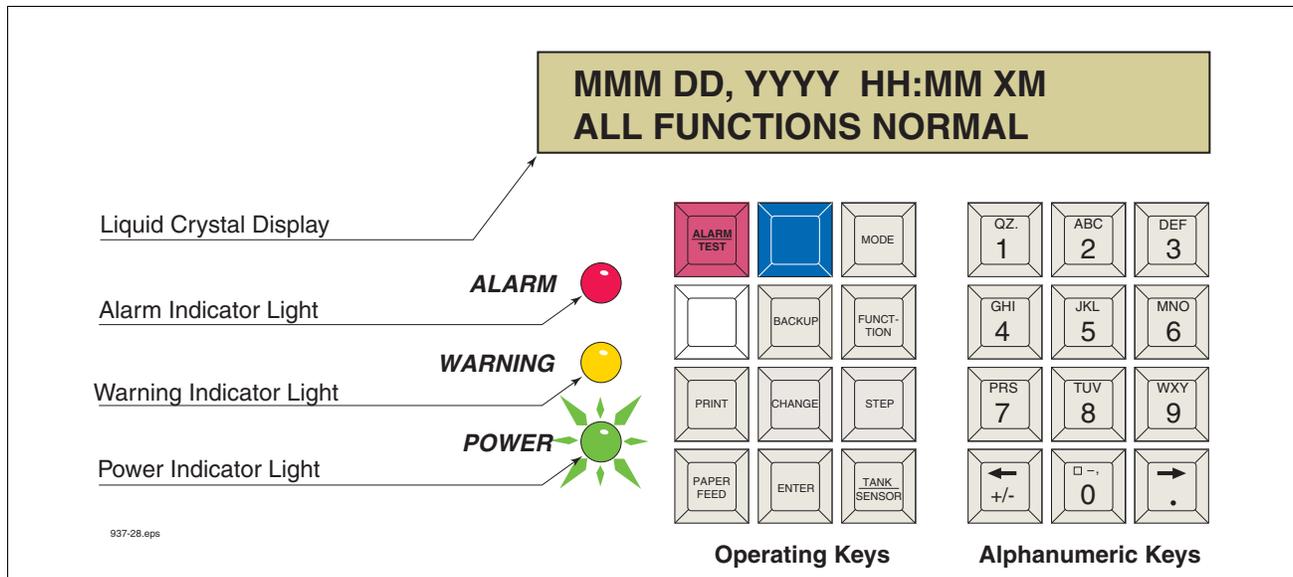


Figure 22. TLS console alarm interface

If an alarm condition occurs the system displays the condition type and its location. If more than one condition exists, the display will continuously cycle through the appropriate alarm messages. The system automatically prints an alarm report showing the alarm type, its location and the date and time the alarm condition occurred.

Warning and alarm posting causes the TLS console-based system to activate warning or failure indicator lights, an audible alarm, and an automatic strip paper printout documenting the warning or alarm. Historical reports of warning and alarm events are available for up to one year.

WARNING POSTING

Displayed messages alert you to the source and type of alarm. Printed messages show the type and location of the alarm. In the Warning example in Figure 23, the display's second line and printed message indicates that the containment system's vapor leak rate has increased above the allowed standard generating a warning.

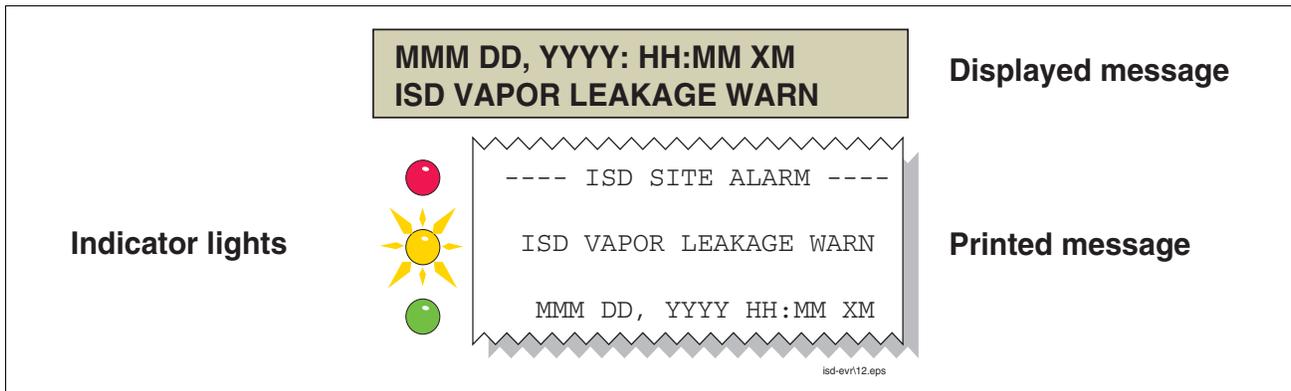


Figure 23. Example Warning posting

The TLS console also logs an entry to the Warning Log upon posting a warning.

ALARM POSTING

Displayed messages alert you to the source/number and type of alarm. Printed messages show the type and location of the alarm. In the alarm example in Figure 24 the display's second line and printed message indicates that vapor collection on hose 1, FP1 Super has dropped below the allowed standard resulting in a failure alarm. (By default, for unihose dispensers, FP1 BLEND3 will be displayed rather than FP1SUPER as shown below.)

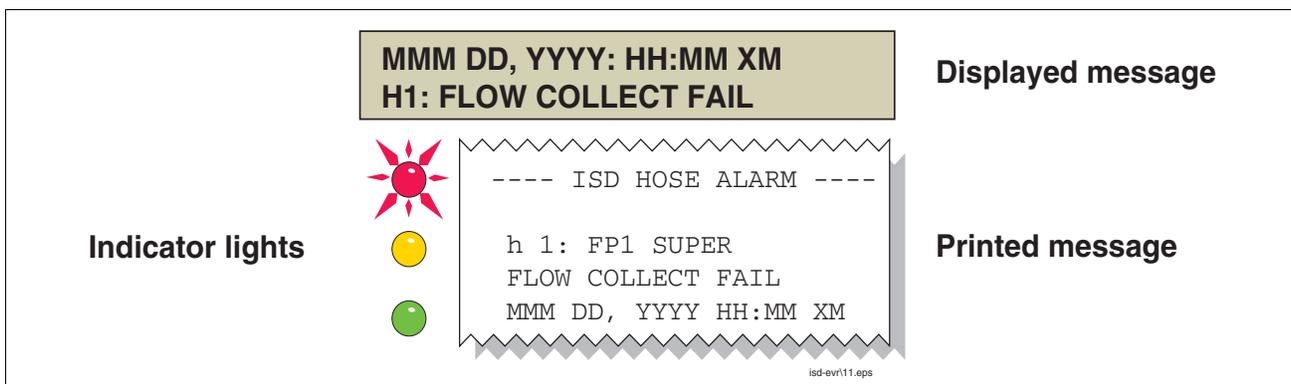


Figure 24. Example Alarm posting

Upon posting a failure alarm, the TLS console logs an entry to the Failure Log, prohibits fuel dispensing from all ISD gasoline fueling points or effected fueling points when dispenser shutdown is enabled and logs a shutdown event to the Shutdown & Misc. Event Log.

ISD can prohibit fuel dispensing from all gasoline fueling points by shutting down the submersible pumps in all gasoline tanks or individual fueling points using dispenser relays. The method of overriding an ISD Alarm shutdown is discussed in the "Site Re-enable" section.

SITE RE-ENABLE

The TLS console ALARM/TEST button allows you to perform a logged shutdown override and resume dispensing. Figure 25 illustrates the ISD alarm override procedure.

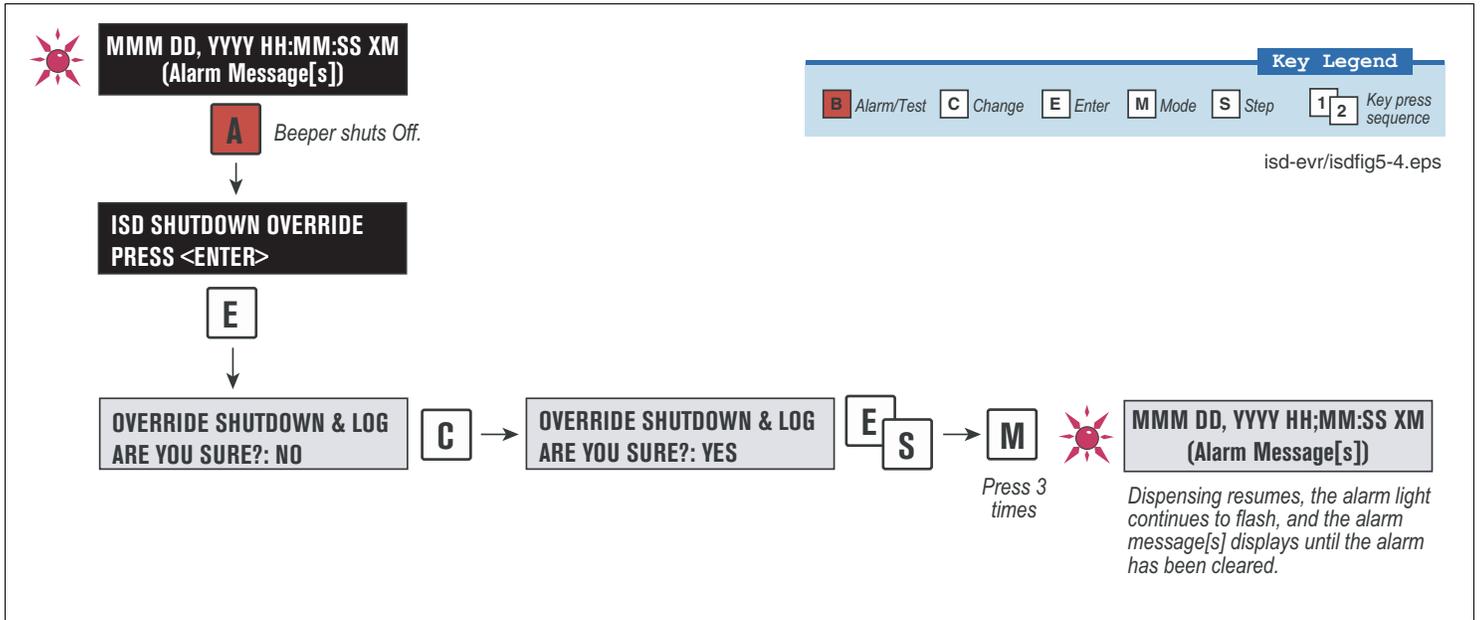


Figure 25. ISD Alarm Override Procedure

ALARM LOGS

Alarms will be recorded in the Warning Log or Failure Log of the monthly reports, which can be viewed electronically or via the integral printer (if queued in the most recent 10 events). The following example shows an excerpt from an electronically accessed monthly report.

Monthly Report Warning & Failure Log Examples:

WARNING ALARMS						
DATE	TIME	DESCRIPTION	READING	VALUE		
08-03-15	00:01:26	FLOW PERFORMANCE HOSE BLOCKAGE	FP12 BLEND4	BLKD		
08-02-17	00:00:49	FLOW PERFORMANCE HOSE BLOCKAGE	FP 1 BLEND4	0.59		
08-02-01	00:01:07	VAPOR CONTAINMENT LEAKAGE	CFH@2 INCHES WC	22.39		
FAILURE ALARMS						
DATE	TIME	DESCRIPTION	READING	VALUE		
08-03-14	00:01:26	FLOW PERFORMANCE HOSE BLOCKAGE	FP12 BLEND4	BLKD		
08-02-13	00:01:45	VAPOR CONTAINMENT LEAKAGE	CFH@2 INCHES WC	36.56		
08-02-12	00:01:46	VAPOR CONTAINMENT LEAKAGE	CFH@2 INCHES WC	37.74		
08-02-11	00:01:57	VAPOR CONTAINMENT LEAKAGE	CFH@2 INCHES WC	30.10		

937-21.eps

ALARM SEQUENCE

Each ISD monitoring test operates once each day on sensor data gathered over a fixed time interval and with a minimum required number of monitored events. The interval is a fixed number of calendar days depending on the test being run. As an example, the ISD Gross Pressure Containment Monitoring test requires seven calendar days of data. In this example, each daily test result represents a test based on the prior seven days' time period. When a test first fails, a warning is posted and a warning event is logged. If this condition persists for seven more consecutive days, an alarm is posted, a failure alarm event is logged and the site is shutdown. If the condition continues, additional failure events are logged and the site will continue to be shutdown each day.

ISD Alarm Summary

Table 3 summarizes the ISD Alarms - Alarms with a superscript 2 will result in a site shutdown.

Table 3. ISD Alarm Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting ¹
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard	<ul style="list-style-type: none"> • Troubleshooting Guide www.vsthose.com/carbs_components.aspx • Exhibit 4 • Exhibit 14 (when FFS-CAS is installed)
ISD VAPOR LEAKAGE FAIL ²	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC	<ul style="list-style-type: none"> • VST Processor <ul style="list-style-type: none"> - Troubleshooting Guide www.vsthose.com/carbs_components.aspx - Exhibit 9 - Exhibit 10 - Check pressure sensor ball valve for correct position. • FFS-CAS Troubleshooting <ul style="list-style-type: none"> - Check FFS-CAS ball valves for correct positions. • Veeder Root Polisher <ul style="list-style-type: none"> - Check vent statck ball valve for correct position. - Check pressure sensor ball valve for correct position
ISD GROSS PRESSURE FAIL ²	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC	
ISD DEGRD PRESSURE FAIL ²	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
hnn: FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%	
hnn: FLOW COLLECT FAIL ²	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	<ul style="list-style-type: none"> • Troubleshooting Guide www.vsthose.com/carbs_components.aspx • Exhibit 5 • Exhibit 6 • Exhibit 17

Table 3. ISD Alarm Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting ¹
ISD VP STATUS WARN ^{4, 5, 6, 8}	Processor	Yellow	Failure of Vapor Processor Effluent Emissions or Duty Cycle test	<ul style="list-style-type: none"> • Troubleshooting Guide www.vsthose.com/carbs_components.aspx
ISD VP STATUS FAIL ^{2, 4, 5, 6, 8}	Processor	Red	2nd Consecutive Failure of Vapor Processor Status test	<ul style="list-style-type: none"> • VP Emission Test • VP Duty Cycle Test
VP EMISSION WARN ^{3, 4, 5, 6, 8}	Processor	Yellow	Mass emission exceeded the certified threshold	<ul style="list-style-type: none"> • Troubleshooting Guide www.vsthose.com/carbs_components.aspx
VP EMISSION FAIL ^{3, 4, 5, 6, 8}	Processor	Red	2nd Consecutive Mass emission test failure	<ul style="list-style-type: none"> • Exhibit 8 • Exhibit 9 • Exhibit 11
VP DUTY CYCLE WARN ^{3, 4, 8}	Processor	Yellow	Duty cycle exceeds 18 hours per day Or 75% of 24 hours	<ul style="list-style-type: none"> • Troubleshooting Guide www.vsthose.com/carbs_components.aspx
VP DUTY CYCLE FAIL ^{3, 4, 7, 8}	Processor	Red	2nd Consecutive Duty Cycle Test Failure	<ul style="list-style-type: none"> • PMC Setup Procedure • Exhibit 4 • Exhibit 9 • Exhibit 10
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	<ul style="list-style-type: none"> • Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	<ul style="list-style-type: none"> • Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL	Self-Test	Red	8th Consecutive Failure of Setup Test	

¹See ISD Troubleshooting Manual, P/N 577013-819, and the VST ISD Troubleshooting Guide 9513-003 found at www.vsthose.com for a complete list of suggestions.

²ISD Shutdown Alarms - see "Site Re-enable" on page 29.

³This warning will result in an ISD VP Status Warn.

⁴VST ECS Membrane Processor.

⁵Veeder-Root Polisher

⁶VST Green Machine

⁷This failure will result in an ISD VP STATUS FAIL.

⁸Does not apply to FFS-CAS processor.

Other Alarms

Table 4 summarizes additional alarms that may be posted by ISD related equipment. These alarms are not critical to vapor recovery functionality, but could indicate erroneous setup or equipment malfunction. NOTE: Additional TLS console alarms listed in the TLS-3XX Operator's manual may be posted and may lead to an ISD shutdown alarm if persistent (see ISD Troubleshooting Manual for details). Table 5 lists wireless related sensor alarms.

Table 4. Other Alarms

Displayed Message	Light Indicator	Set Condition	Clear Condition
MISSING RELAY SETUP	Red	One or more required shutdown alarms have not been assigned to a relay.	Setup required shutdown alarms.
MISSING TANK SETUP	Red	There are no vapor recovery (gasoline) tanks defined or a gasoline pump has not been assigned to a control (shut down) device in at least one tank.	Complete gasoline tank setup.
MISSING HOSE SETUP	Red	There are no product meters assigned to a hose.	Assign at least 1 product meter to a hose.
hnn: VPRFLOW MTR SETUP	Red	Incoming transaction from a hose with an unavailable Vapor Flow Meter.	Configure Vapor Flow Meter (Smart Sensor) and enable it in ISD.
MISSING VAPOR PRES SEN	Red	There is no Vapor Pressure Sensor setup or detected.	Complete Vapor Pressure Sensor setup.
MISSING VAPOR FLOW MTR	Red	There is no Vapor Flow Meter setup or detected.	Complete Vapor Flow Meter setup.
fnn: CHK VAPOR FLOW MTR	Red	Failure of locked rotor test - possible locked vapor flow meter.	Locked rotor test passes or vapor flow meter deconfigured, or test cleared.

Table 5. Wireless Related Sensor Alarms

Displayed Message	Device	Light Indicator	Description	Suggested Troubleshooting
BATTERY WARNING	Vapor Valve, Vapor Flow Meter	Yellow	Device transmitter reports battery status as 'Replace' for 24 hours	Remove and replace battery pack

Reports

There are two main reports (CP-201 required) that are stored by the ISD system: the Monthly Status Report, stored for 12-months, and the Daily Status Report, stored for 365 days. A third report discussed in this section is the ISD Status Report. You can print out ISD reports from the TLS console front panel as shown in Figure 26.

- The monthly report includes:
 - ISD operational up-time (as a percentage)
 - EVR/ISD system pass time (as a percentage)
 - The Warning Log
 - The Failure Log
 - The Misc. Event Log
- The daily report includes:
 - Maximum and minimum ullage pressures
 - Results of the Vapor Containment Monitoring Gross (75th percentile), Degradation (95th percentile) ullage pressure test and Vapor Leakage Detection (CVLD) tests
 - Vapor Collection Monitoring test results for each fueling position
 - Vapor Processor Monitoring test results
- ISD Status Report
 - Last test report results

VIEWING ISD REPORTS

You can print out ISD reports from the TLS console front panel as shown in Figure 26.

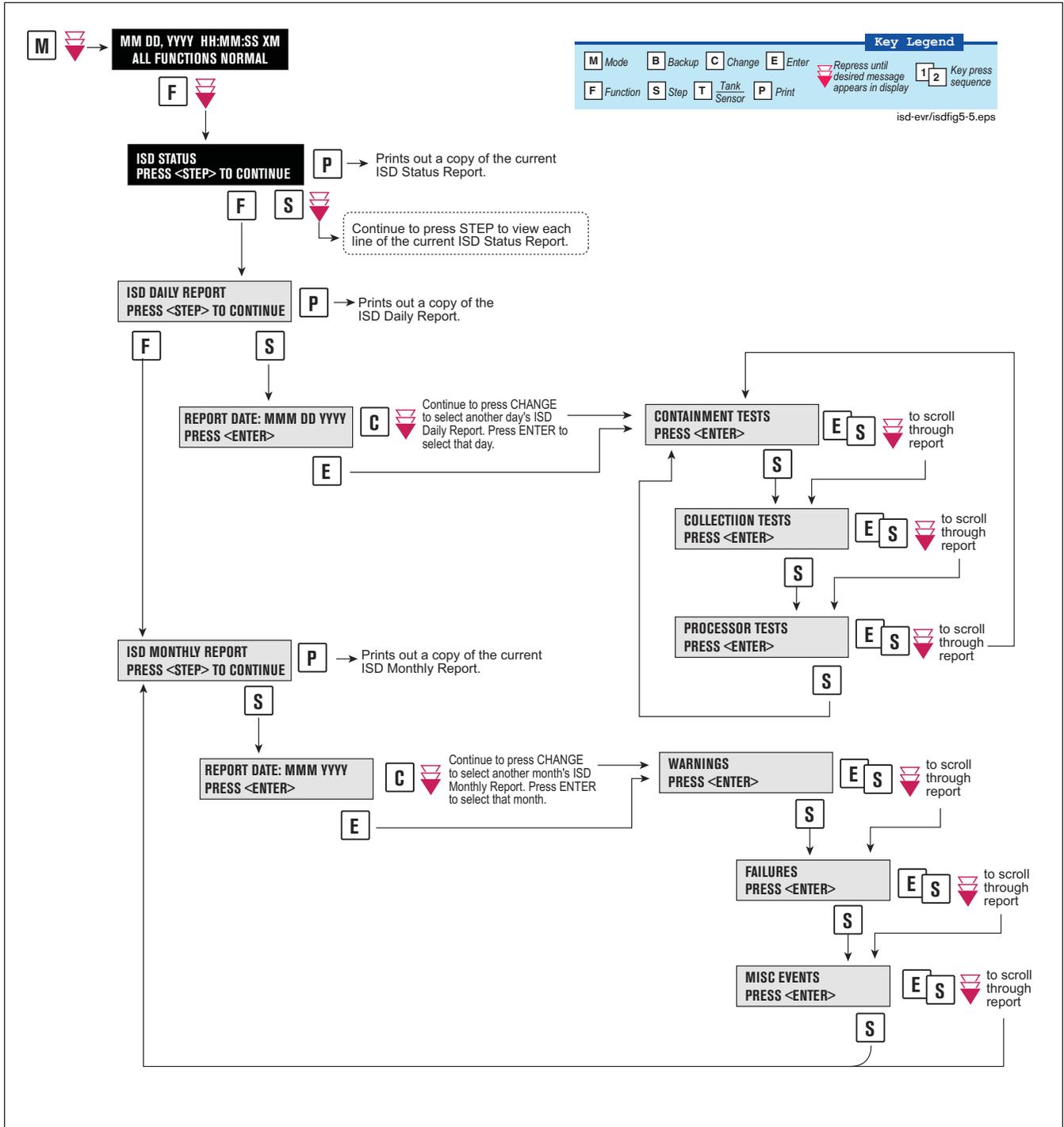


Figure 26. Printing ISD Reports on Console Printer

Figure 27 shows an example ISD Status Report.

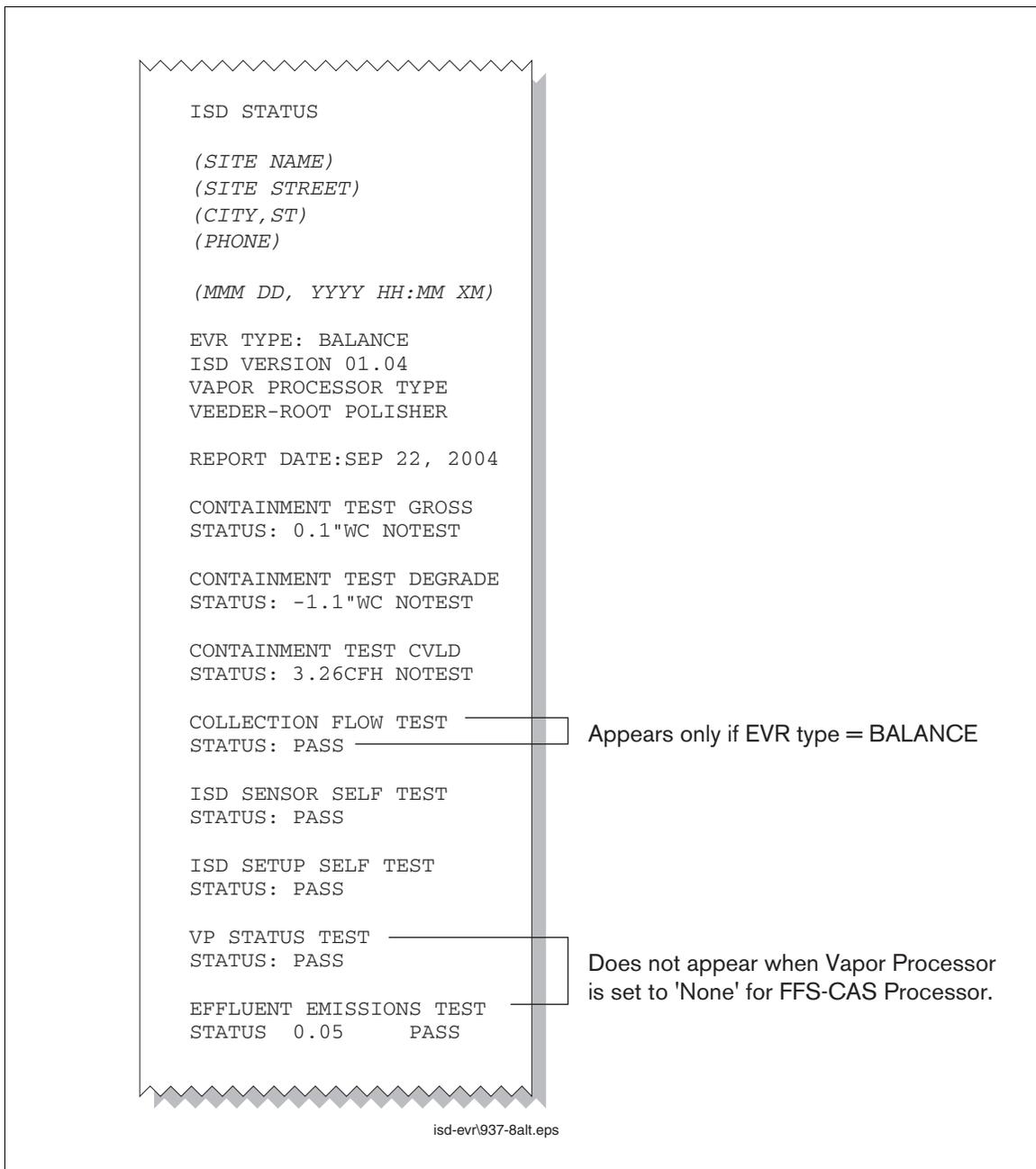


Figure 27. ISD Status Report Example - TLS console printout

Figure 28 shows an example ISD Daily Report.

```

ISD DAILY REPORT

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)
(MMM DD, YYYY HH:MM XM)

EVR TYPE: BALANCE
ISD VERSION 01.04
VAPOR PROCESSOR TYPE
VEEDER-ROOT POLISHER

REPORT DATE: MMM DD
ISD VERSION 01.04

OVERALL STATUS PASS
EVR CONTAINMENT NOTEST
EVR COLLECTION PASS
STAGE1 2 of 2 PASS
VAPOR PROCESSOR PASS
SELF TEST PASS
ISD MONITOR UP-TIME 100%

-----
CONTAINMENT TESTS

GROSS 95% -0.0N "WC
DGRD 75% -0.7N "WC
VAPOR LEAK 0N CFH
MAX 0.9 "WC
MIN -5.0 "WC

-----
COLLECTION TESTS
GROSS
V/L(#)

FP 1: BLEND4
V/L = 0.94 ( 32)
FP 2: BLEND4
V/L = 0.96 ( 66)
:::::
FP11: BLEND4
V/L = 1.08 ( 40)
FP12: BLEND4
V/L = 1.09 ( 56)

-----
PROCESSOR TESTS

VP STATUS TEST
STATUS : PASS

EPFLUENT EMISSIONS TEST
0.084 LB/1KG PASS

-----
SELF TEST

SETUP TEST PASS
SENSOR OUT TEST PASS

```

isd-evr\937-9alt.eps

PROCESSOR TESTS section does not appear when Vapor Processor is set to 'None' for FFS-CAS Processor.

Figure 28. ISD Daily Report Example - TLS console printout

Figure 29 shows an example ISD Monthly Report.

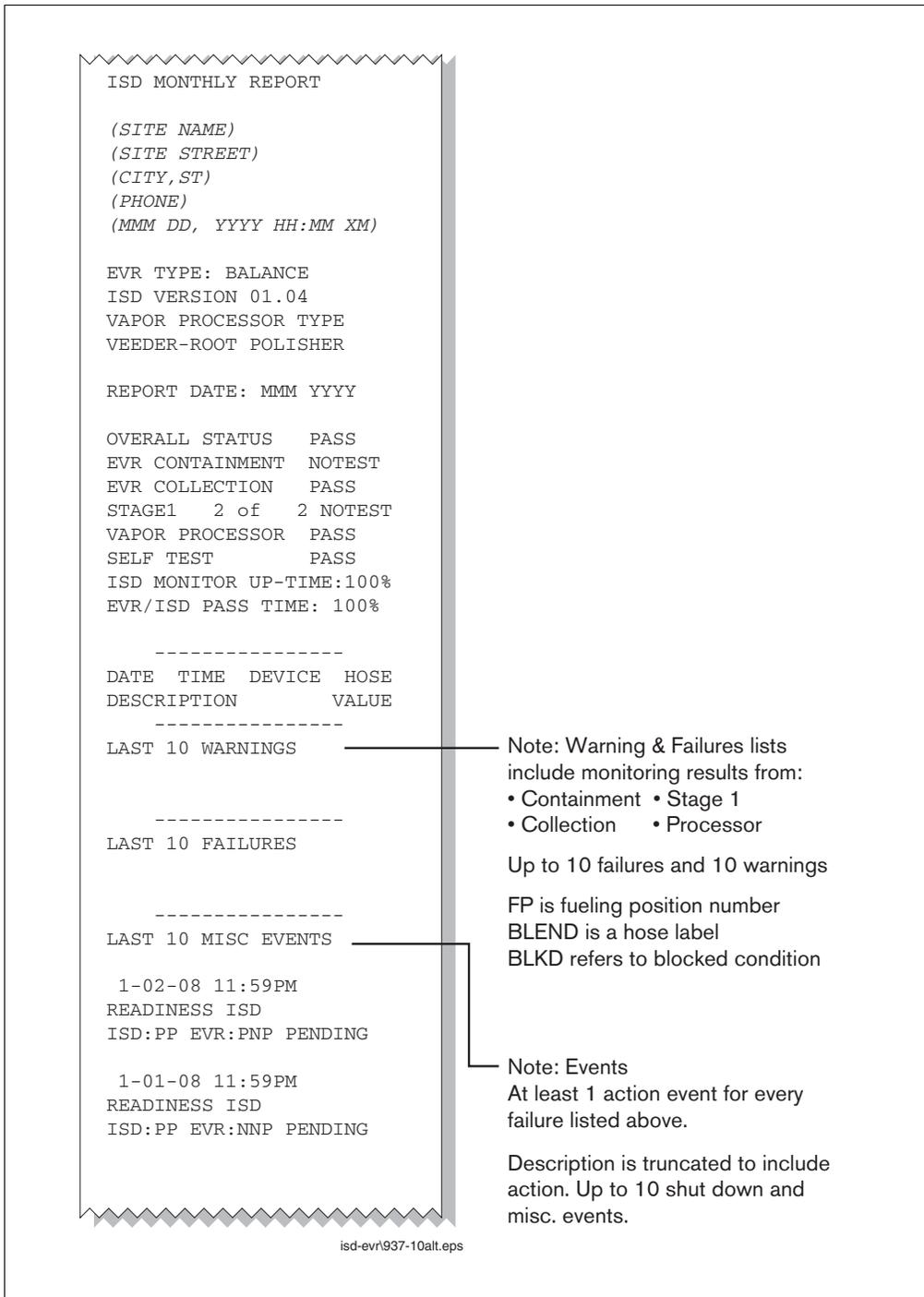


Figure 29. ISD Monthly Report Example - TLS console printout

Viewing ISD Reports via RS-232 Connection

CONNECTING LAPTOP TO CONSOLE

Connect your laptop to the TLS console's RS-232 or Multiport module using one of the methods shown in the examples in Figure 30 below.

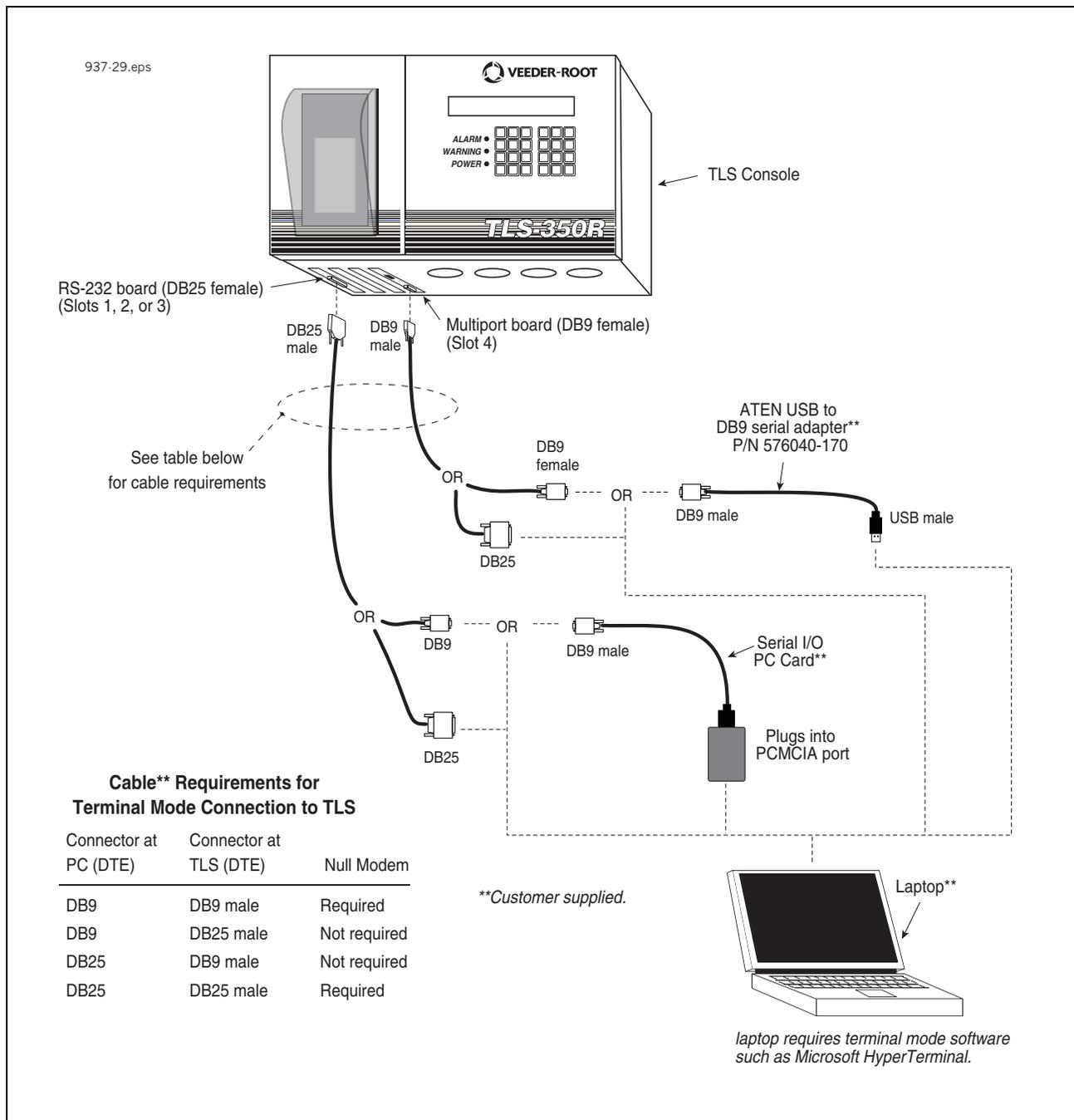


Figure 30. Connecting laptop to TLS console for serial communication

CONNECTING LAPTOP TO CONSOLE

1. Open your laptop's serial communication program, e.g., HyperTerminal. You can typically find HyperTerminal under: Start/Programs/Accessories/Communications.
2. After opening the terminal software program, ignore (cancel) any modem/dialing related request windows since you will be directly connecting to the console via serial communications. When the Connection Description window appears (Figure 31), enter a connection name, e.g., TLSDIRECT, and click the OK button.

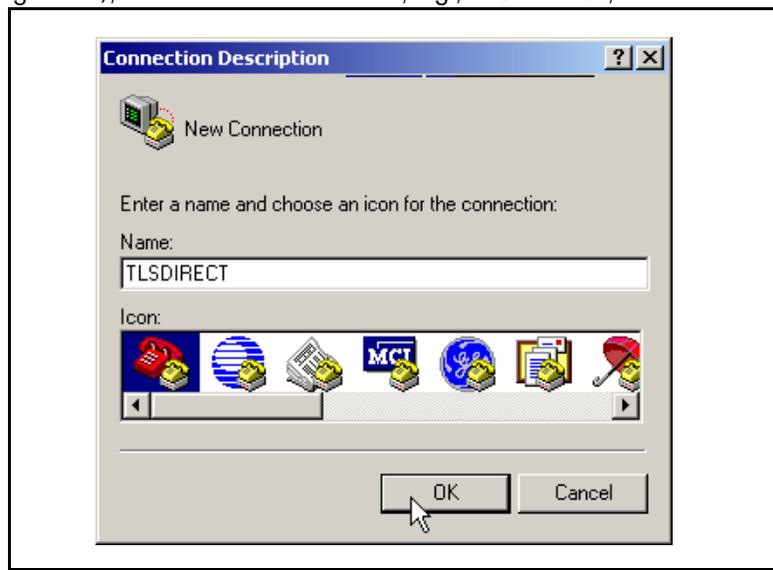


Figure 31. Connection Description window

3. After clicking the OK button, you may see a repeat of the modem/dialing windows, in which case ignore (cancel) them all.
4. When the Connect To window appears (Figure 32), depending on your connection method, select either COM1 (If RS-232 port on laptop), USB-Serial Controller (if using USB port on laptop), or Serial I/O PC Card (if using PCMCIA port on laptop) in the 'Connect using' drop down box, then click OK button.



Figure 32. Connect To window



5. Next you should see the 'Port Settings' window.

IMPORTANT! The settings of the laptop's com port must match those of the console's com port to which you are connected.

- a. Go to the console front panel press the MODE key until you see:

```

SETUP MODE
PRESS <FUNCTION> TO CONT

```

- b. Press the FUNCTION key until you see the message:

```

COMMUNICATIONS SETUP
PRESS <STEP> TO CONTINUE

```

- c. Press the STEP key until you see the message:

```

PORT SETTINGS
PRESS <ENTER>

```

- d. Press the PRINT key to printout the port settings for all communication modules installed in the console. Figure 33 shows an example port settings printout with the RS-232 module installed. Using the console port settings in the example below, your HyperTerminal 'Port Settings' window entries would be Bits per second - 2400, Data bits - 7, Parity - Odd, Stop Bits - 1. For the 'Flow Control' entry select None. Click OK.

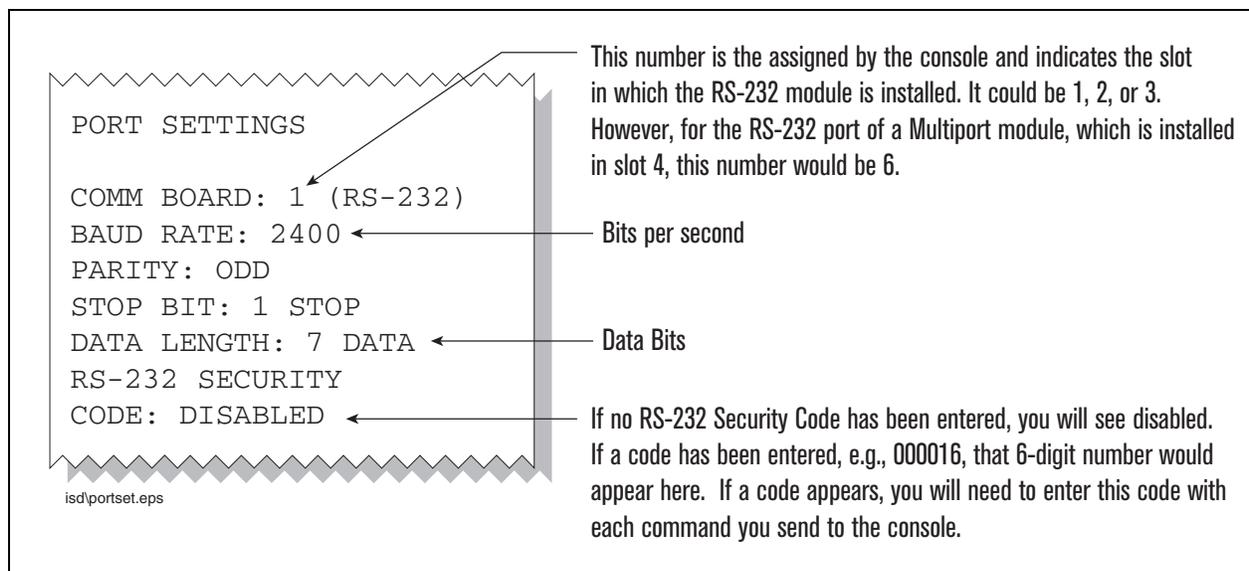


Figure 33. Console comm port settings printout example

In the example port settings printout above, the RS-232 Security Code is disabled. If the code was enabled you would see a 6-digit number which you will need to enter to access the console (refer to the 'Sending Console Commands' paragraph below for more information).

6. After entering your port settings, the program's main window appears (Figure 34).

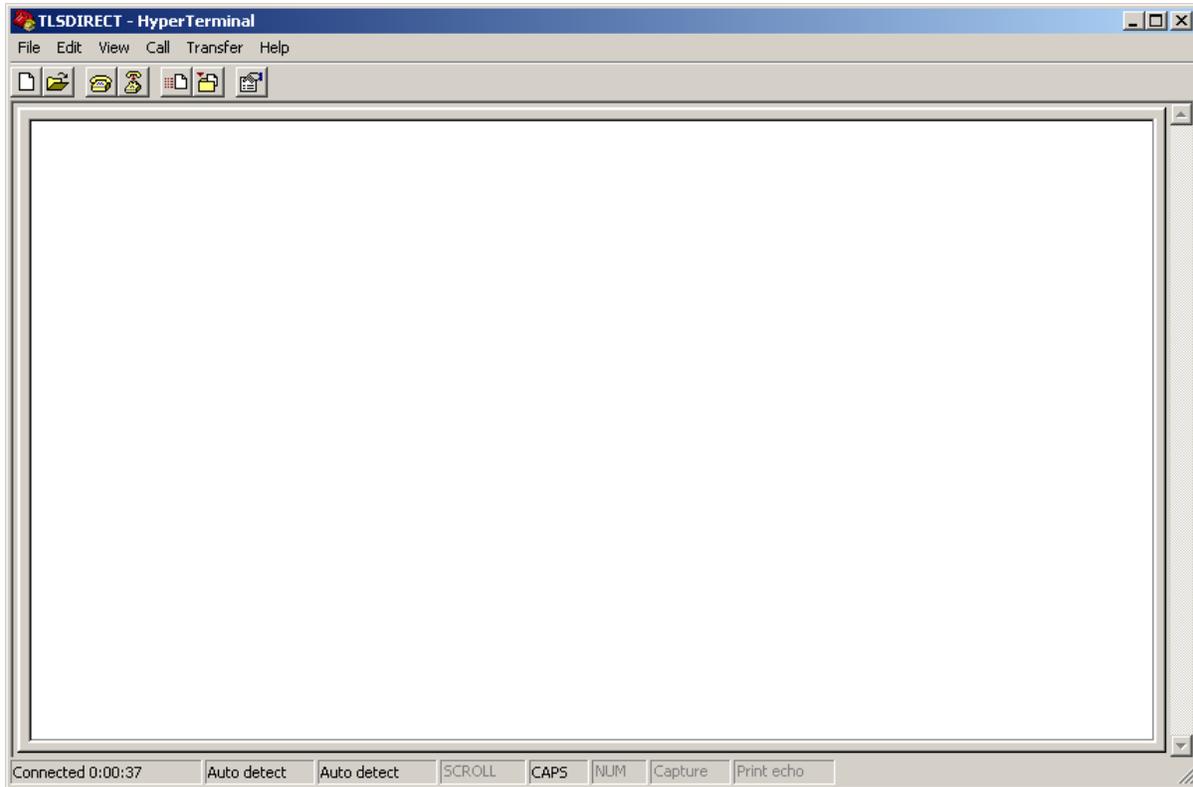


Figure 34. HyperTerminal main window

SENDING CONSOLE COMMANDS

Table 6 shows four important ISD console commands: IV0500, IV0200, IV0100, and IB6100. The <SOH> shown in the table means that you must press and hold the **Ctrl** key while you press the **A** key.

For example, let's say you want to see the Daily Report Details for the last 10 days.



Note: If you want to see the characters of the command as you type them in, click on File menu, then select Properties/Settings (tab)/ASCII Setup and click the check box for 'Echo typed characters locally', then click OK to close the window(s) and return to the main screen.

If the RS-232 Security Code is disabled - press and hold the Ctrl key while you press the A key, then type in IV0500010. If the RS-232 Security Code is enabled (e.g., 000016) you must enter the security code before the command - press and hold the Ctrl key while you press the A key, then type in 000016IV0500010.

You will see the typed command on the screen: ☺IV0500010 followed by the response (report) from the console. The ☺ symbol indicates CtrlA and the ♥ symbol indicates the end of the response.

If the console recognizes the command the response displays as soon as the command is typed in.

If the console does not recognize the command you would see something like ☺IV0500010☺9999FF1B♥ which indicates the console did not recognize the command.

All responses (Reports) can be printed or saved to a file. See the terminal program's help file for instructions.

Table 6. Serial Commands for ISD Alarm, Monthly, and Daily Reports

Report Type	Serial Command (PC to Console) ¹
Daily Report Details (See example Figure 35)	<SOH>IV0500ddd Where ddd = number of days, 001 = yesterday and today, 002 = two days ago, etc.
Monthly Status Report (See example Figure 36)	<SOH>IV0200yyyymm Where yyyy = year number, e.g. 2003, mm = month number, 01 = January, 02 = February, etc.
Alarm Status (See example Figure 37)	<SOH>IV0100
V80 Vapor Processor Runtime Diagnostic Report ² (See examples Figure 38 and Figure 39)	<SOH>IV8000
Vapor Processor Status Report ² (See example Figure 40)	<SOH>IV8200
Vapor Valve Status Report ² (See example Figure 43)	<SOH>IB6100
Non-Priority Alarm History Report (See example Figure 41)	<SOH>I11100
Priority Alarm History Report (See example Figure 42)	<SOH>I11200
Smart Sensor Sub Alarm History Report (See example Figure 44)	<SOH>IB6200
Daily Vapor Polisher Diagnostic Report (See example Figure 45)	<SOH>IV8800yyyymmddnnnn Where: yyyy = year number, e.g., 2003, mm = month number (01 = January, 02 = February, etc.), dd = day of the month, nnnn = number of records after the date entered (9999 = all).

¹<SOH> = Control A. For more information on TLS console serial commands, refer to the V-R Serial Interface Manual.

²Not available for FFS-CAS Processor.

```

IV0500
JAN  8, 2008  3:52 PM                               isd-evr937-11alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD DAILY REPORT DETAILS

EVR TYPE: BALANCE
ISD TYPE: 01.04
VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER

OVERALL STATUS           :WARN           EVR VAPOR COLLECTION :PASS
EVR VAPOR CONTAINMENT   :WARN
ISD MONITOR UP-TIME     :100%           STAGE I TRANSFERS: 10 of 10 PASS
EVR/ISD PASS TIME      : 81%           VAPOR PROCESSOR    :PASS

Status Codes: (W)Warn (F)Fail (D)Degradation Fail (G)Gross Fail
              (ISD-W)ISD Self-Test Warning (ISD-F)ISD Self-Test Fail (N)No Test

      ISD  ISD  ---CONTAINMENT TESTS---      STAGE      ---COLLECTION TESTS
      EVR  %UP  GROSS  DGRD  MAX  MIN  LEAK  I  VAPOR  FP1  FP2  FP3
DATE  STATUS TIME  95%   75%  "WC  "WC  CFH  XFR  PRCSR  BLEND BLEND BLEND
12/28  W    100%  0.2  -0.3  0.7 -2.5  18W PASS  PASS  0.94  1.07  1.10
12/29  W    100%  0.2  -0.3  0.7 -3.0  16W PASS  PASS  0.95  0.85  1.11
12/30  PASS 100%  0.2  -0.3  0.7 -4.1   0 PASS  PASS  0.95N 0.99  1.02
12/31  PASS 100%  0.2  -0.3  0.8 -3.0   0 PASS  PASS  0.97  0.96  1.17
01/01  PASS 100%  0.2  -0.3  -0.2 -3.3   0     PASS  0.86  1.02  0.99
01/02  PASS 100%  0.2  -0.3  0.9 -5.0   0 PASS  PASS  0.94  0.96  1.20
01/03  PASS 100%  0.2  -0.3  1.1 -4.3   0 PASS  PASS  0.82  1.10  1.13
01/04  PASS 100%  0.4  -0.3  1.9 -2.8   0     PASS  1.07  1.01  1.10
01/05  PASS 100%  0.2  -0.3  2.8 -5.0   0 PASS  PASS  0.97  1.12  0.84
01/06  PASS 100%  0.2  -0.3  0.4 -5.0   0 PASS  PASS  0.80  1.23  1.11
01/07  PASS 100%  0.2  -0.3  0.6 -5.0   0 PASS  PASS  0.93  0.96  1.07

---COLLECTION TESTS-DAILY AVERAGE HOSE FLOW PERFORMANCE-----
      FP4  FP5  FP6  FP7  FP8  FP9  FP10  FP11  FP12
DATE  BLEND BLEND BLEND BLEND BLEND BLEND BLEND BLEND BLEND
12/28 1.06 1.16 0.96 1.21 1.10 1.03 1.08 1.13 1.13
12/29 1.03 1.12 1.16 1.07 1.13 1.01 0.97 1.06 1.06
12/30 1.04 0.96 0.95 1.06 1.11 0.97 1.14 1.18 0.94
12/31 1.07 1.20 1.05 1.10 1.00 0.90 1.09 1.07 1.27
01/01 1.03 1.18 1.19 0.85 1.16 1.24 1.13 1.31 1.16
01/02 0.94 0.98 1.10 0.97 1.10 0.91 0.98 1.08 1.09
01/03 1.12 0.96 1.17 1.12 1.07 1.06 1.12 1.12 1.10
01/04 1.04 1.18 1.09 1.16 1.16 0.90 1.19 1.05 1.13
01/05 1.13 0.94 1.11 1.02 1.10 1.10 1.21 1.19 1.04
01/06 1.11 1.14 1.09 1.10 1.18 0.95 1.15 1.09 1.05
01/07 0.96 1.13 1.07 0.84 1.13 1.02 1.06 1.12 1.00

```

Figure 35. ISD Daily Report Details - Serial to PC Format (Example report with Veeder-Root Polisher)

```

IV0200
JAN  8, 2008  3:53 PM                                isd-evr937-12alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD MONTHLY STATUS REPORT

EVR TYPE: BALANCE
ISD TYPE: 01.04
VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER

OVERALL STATUS           :FAIL                EVR VAPOR COLLECTION :FAIL
EVR VAPOR CONTAINMENT    :WARN
ISD MONITOR UP-TIME      :100%                STAGE I TRANSFERS: 33 of 33 PASS
EVR/ISD PASS TIME       : 77%                VAPOR PROCESSOR      :WARN

CARB EVR CERTIFIED OPERATING REQUIREMENTS

ISD MONITORING TEST PASS/FAIL THRESHOLDS

                                PERIOD    BELOW  ABOVE
VAPOR COLLECTION BALANCE SYS FLOW PERFORMANCE    1DAYS    0.60  ----
VAPOR CONTAINMENT GROSS FAIL, 95th PERCENTILE    7DAYS    ----  1.30"wcg
VAPOR CONTAINMENT DEGRADATION, 75th PERCENTILE  30DAYS    ----  0.30"wcg
VAPOR CONTAINMENT LEAK DETECTION FAIL @2"WCG    7DAYS    ----  12.5cfh
STAGE I VAPOR TRANSFER FAIL, 50th PERCENTILE    20MINS    ----  2.50"wcg
VAPOR PROCESSOR MASS EMISSION FAIL (LB/1KG)     1DAYS    ----  0.32

WARNING ALARMS
DATE      TIME      DESCRIPTION                READING          VALUE
07-12-30  00:02:33  VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  15.51
07-12-29  00:02:07  VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  18.24
07-12-28  00:02:01  VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  17.34
07-12-27  00:01:36  VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  17.11
07-12-26  00:01:41  VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  18.66
07-12-10  00:02:05  FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4      BLKD

FAILURE ALARMS
DATE      TIME      DESCRIPTION                READING          VALUE
07-12-11  00:02:05  FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4      BLKD

SHUTDOWN & MISCELLANEOUS EVENTS
DATE      TIME      DESCRIPTION                ACTION/NAME
07-12-11  00:02:18  FLOW PERFORMANCE BLK       DISABLED FP 08

```

Figure 36. ISD Monthly Status Report - Serial to PC Format (Example report with Veeder-Root Polisher)

1

```

IV0100
JAN  8, 2008  3:53 PM
                                                    937-13alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD ALARM STATUS REPORT

EVR TYPE: BALANCE
ISD TYPE: 01.04
VAPOR PROCESSOR TYPE: VST VAPOR PROCESSOR

OVERALL STATUS           :PASS           EVR VAPOR COLLECTION :PASS
EVR VAPOR CONTAINMENT   :PASS
ISD MONITOR UP-TIME     :100%           STAGE I TRANSFERS:  2 of 2 PASS
EVR/ISD PASS TIME       :100%           VAPOR PROCESSOR      :PASS

WARNING ALARMS
DATE      TIME      DESCRIPTION           READING      VALUE
07-12-30 00:02:33 VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  15.51
07-12-29 00:02:07 VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  18.24
07-12-28 00:02:01 VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  17.34
07-12-27 00:01:36 VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  17.11
07-12-26 00:01:41 VAPOR CONTAINMENT LEAKAGE  CFH@2 INCHES WC  18.66
07-12-10 00:02:05 FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4      BLKD
07-11-16 00:02:17 FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4      BLKD
07-11-13 00:02:28 FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4      BLKD
07-11-11 00:03:19 FLOW PERFORMANCE HOSE BLOCKAGE  FP 6 BLEND4      BLKD

FAILURE ALARMS
DATE      TIME      DESCRIPTION           READING      VALUE
07-11-14 00:02:18 FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4      BLKD
07-11-12 00:02:38 FLOW PERFORMANCE HOSE BLOCKAGE  FP 6 BLEND4      BLKD
07-11-09 00:03:41 CONTAINMENT GROSS OVER PRESSURE WEEKLY 95%      4.60
07-10-31 00:02:45 VAPOR PROCESSOR STATUS
                VP EMISSIONS FAIL           LB/1KB           0.693
07-10-15 00:03:14 FLOW PERFORMANCE HOSE BLOCKAGE  FP 2 BLEND4      BLKD
07-10-15 00:03:13 FLOW PERFORMANCE HOSE BLOCKAGE  FP 1 BLEND4      BLKD
07-10-14 00:03:11 FLOW PERFORMANCE HOSE BLOCKAGE  FP 2 BLEND4      BLKD

SHUTDOWN & MISCELLANEOUS EVENTS
DATE      TIME      DESCRIPTION           ACTION/NAME
07-11-03 19:52:52 VAPOR PROCESSOR      TEST MANUALLY CLEARED
07-11-18 00:02:24 READINESS ISD:PP EVR:PPP      ISD & EVR READY
07-11-17 13:09:06 READINESS ISD:PP EVR:NNN      EVR READINESS PENDING
07-11-17 13:09:06 ISD STARTUP
07-11-17 13:03:24 ISD SHUTDOWN
07-11-14 00:02:18 FLOW PERFORMANCE BLK          DISABLED FP 08 BLEND4
07-11-12 00:02:38 FLOW PERFORMANCE BLK          DISABLED FP 06 BLEND4
07-11-09 00:03:41 CONTAINMENT GROSS          DISABLED DISPENSERS
07-11-04 01:00:00 TIME CHANGE DETECTED AT:      07-11-04 02:00:13
07-11-03 00:01:25 VAPOR PROCESSOR PROBLEM      DISABLED DISPENSERS

```

Figure 37. ISD Alarm Status Report - Serial to PC Format (Example report with Veeder-Root Polisher)

Figure 38 shows an example VST Vapor Processor Runtime Diagnostic Report (not available with FFS-CAS).

```

IV8000
SEP 30, 2007 12:27 AM

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)
(MMM DD, YYYY HH:MM XM)

VAPOR PROCESSOR

DATE-TIME ON      ELAPSED      PRESSURE INCHES H2O  RUNTIME
MINUTES          ON           OFF             FAULT
5-04-07  3:31PM    8.87           0.244    -0.202    NO
5-05-07  4:17AM    3.35           0.202    -0.212    NO
5-07-07  10:17PM   3.50           0.206    -0.221    NO
5-07-07  10:28PM  15.12          0.384    -0.356    NO
5-08-07  8:16PM    21.77          0.325    -0.211    NO
5-09-07  6:35PM    20.60          0.368    -0.276    NO
5-10-07  8:03PM    6.18           0.226    -0.398    NO
5-10-07  8:15PM    2.55           0.231    -0.227    NO
5-13-07  8:55PM    18.23          0.314    -0.205    NO
  
```

937-35.eps

Figure 38. VST Vapor Processor Runtime Diagnostics Report - Serial to PC Format

Figure 39 shows an example V-R Vapor Polisher Runtime Diagnostic Report and Table 7 explains the IV8000 report's event codes (not available with FFS-CAS).

```

IV8000
FEB 4, 2008 1:01 PM

TLS_350 UST
VEEDER-ROOT TEST LAB
125 POWDER FOREST DR
SIMSBURY, CT 06070

VAPOR POLISHER
VALVE EVENT          PRESSURE
DATE-TIME            "WC          EVENT CODE
1-31-08  3:44PM      -0.700      OPEN PURGE
1-31-08  3:47PM       0.038      CLOSE FORCE PURGE
1-31-08  3:51PM      -0.255      OPEN PURGE
1-31-08  8:08PM      -0.300      CLOSE PURGE Hi P
2-01-08  1:59PM      -0.300      OPEN PURGE
2-01-08  2:18PM      -0.263      OPEN PURGE
2-01-08  2:33PM      -0.289      OPEN PURGE
2-04-08  11:22AM     -0.560      NO EVENT
2-04-08  11:28AM     -0.560      OPEN PURGE
2-04-08  11:48AM     -0.300      OPEN PURGE
2-04-08  12:28PM     -0.263      OPEN PURGE
2-04-08  12:42PM     -0.299      OPEN PURGE
  
```

937-30.eps

Figure 39. V-R Vapor Polisher Runtime Diagnostics Report - Serial to PC Format

Table 7. Vapor Processor Runtime Diagnostic Report Event Codes

Event Code	Cause	Event Code	Cause
NO EVENT	The valve changed state outside of the carbon canister algorithm.	CLOSE NEAR FULL	Canister load is between 80 and 100% and pressure is <1.05.
CLOSE TEST	Manual operation of the valve	OPEN PURGE	Canister load is >0% and pressure <-0.25
OPEN TEST	Manual operation of the valve	OPEN EXCESS PURGE	Canister load is 0%, Excess purge is incomplete, pressure <-1.5, time is between 6AM and 4PM.
CLOSE PURGE HI P	The canister state is in excess purge and the pressure is above -0.5.	OPEN FILL	Canister valve is open for loading: <ul style="list-style-type: none"> • When pressure is greater than or equal to 0.75 IWC and Canister load is less than 80%. • Pressure is greater than or equal to 1.3 IWC and Canister load is greater than 80%.
CLOSE PURGE TIME	The canister state is in excess purge and the time is outside 6AM to 4PM.	CLOSE CVLD TEST	Valve was closed to collect data for ISD contamination leak test.
CLOSE FORCE PURGE	Canister is in startup period. Loading with pressures <+1.05 is not allowed until startup period is complete.	CLOSE LIMIT	Valve closed because canister has reached allowable extended capacity loading limit.
CANISTER EMPTY	Canister was loaded above 1% and purged to 0%. No valve state change.	CANISTER FULL	No valve state change. The canister load passed from below 95% to/thru the 100% point and not yet at day's emission limit.
CLOSE EMPTY	Excess purging has completed.		

Figure 40 shows an example Vapor Processor Status Report (not available with FFS-CAS).

```

IV8200
DEC 8, 2010 4:29 AM

<Site Name>
<Site Address>
<Site Address>
<Site Address>

VAPOR PROCESSOR STATUS REPORT

PMC VERSION: 01.04

ASSESSMENT TIME: DEC 7, 2010 11:59 PM

VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER

PMC MONITORING TEST PASS/FAIL THRESHOLDS
VAPOR PROCESSOR MASS EMISSION FAIL          PERIOD  BELOW  ABOVE
                                                1DAYS   ----   0.32 LBS/1KG

EFFLUENT EMISSIONS TEST : PASS      (0.00 LBS/1KG)

DAILY THROUGHPUT : 6989 GALS

```

Figure 40. Vapor Processor Status Report - Serial to PC Format

Figure 41 shows an example Non-Priority Alarm History Report.

```

I11200
DEC  9, 2010  4:20 AM

<Site Name>
<Site Address>
<Site Address>
<Site Address>

NON-PRIORITY ALARM HISTORY
ID  CATEGORY  DESCRIPTION              ALARM TYPE              STATE   DATE       TIME
T 3  TANK      DIESEL                  LOW TEMP WARNING        CLEAR  12-08-10   3:00PM
T 3  TANK      DIESEL                  LOW TEMP WARNING        ALARM  12-08-10   3:00PM
T 3  TANK      DIESEL                  HIGH PRODUCT ALARM      CLEAR  12-08-10   3:00PM
T 3  TANK      DIESEL                  HIGH PRODUCT ALARM      ALARM  12-08-10   2:56PM
      SYSTEM                PRINTER ERROR           CLEAR  11-17-10   10:51AM
      SYSTEM                PAPER OUT               CLEAR  11-17-10   10:51AM
      SYSTEM                PAPER OUT               ALARM  11-17-10   10:50AM
      SYSTEM                PRINTER ERROR           ALARM  11-17-10   10:50AM

```

Figure 41. Non-Priority Alarm History Report - Serial to PC Format

Figure 42 shows an example Priority Alarm History Report.

```

I11100
DEC  9, 2010  4:20 AM

<Site Name>
<Site Address>
<Site Address>
<Site Address>

PRIORITY ALARM HISTORY
ID  CATEGORY  DESCRIPTION              ALARM TYPE              STATE   DATE       TIME
T 2  TANK      91 OCTANE                PROBE OUT               CLEAR  12-08-10   7:55PM
T 2  TANK      91 OCTANE                PROBE OUT               ALARM  12-08-10   7:07PM
T 2  TANK      91 OCTANE                OVERFILL ALARM          CLEAR  11-17-10   11:46AM
T 2  TANK      91 OCTANE                OVERFILL ALARM          ALARM  11-17-10   11:45AM

```

Figure 42. Priority Alarm History Report - Serial to PC Format

Figure 43 shows an example Vapor Valve Status report.

```

IB6100
FEB 4, 2008 1:09 PM
s 2:Vapor valve

VAPOR VALVE
SERIAL NUMBER      123456
VALVE POSITION:     OPEN
OPEN CAP:          CHARGED
CLOSE CAP:         CHARGED
AMBNT TEMP:        65.08 F
OUTLET TMP:        75.05 F
SENSOR FAULTS:
  NONE

```

937-31.eps

Figure 43. Vapor Valve Status Report - Serial to PC Format

The IB6100 command reports the current state of the Vapor Valve Components. The current position of the valve is reported as Open or Closed. The Capacitors are used to move the valve and are reported as Charged or Discharged. Outlet Temperature is the Canister thermal probe temperature. Ambient Temperature is the temperature at the Vapor Valve ambient temperature sensor. Sensor Faults are the active faults reported by the Vapor Valve. The IB6100 (Figure 43) command only provides active Sensor Fault conditions. Use the IB6200 command to see archived fault conditions (Figure 44).

```

IB6200
SEP 19, 2008 1:05 PM

```

937-32.eps

```

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

SMART SENSOR SUB ALARM HISTORY

```

ID	TYPE	ALARM TYPE	SUB ALARM	STATE	DATE	TIME
9	14	SENSOR FAULT ALARM	TEMPERATURE RANGE FAULT	CLEAR	9-19-08	11:50AM
9	14	SENSOR FAULT ALARM	TEMPERATURE RANGE FAULT	ALARM	9-19-08	11:46AM

Figure 44. Smart Sensor Sub Alarm History Report - Serial to PC Format

Figure 45 shows an example PMC Daily Vapor Polisher Diagnostic Report.

```
IV8800
OCT 2, 2008  2:58 PM                               937-33.eps

PMC DAILY VAPOR POLISHER DIAGNOSTIC

DATE/TIME          LOAD   PRGE   MIN%   MAX%   SELF   EMISSION
                   HRS    HRS   LOAD   LOAD   TEST   TEST
08-10-02 14:58:58  3.1   2.5   15     69    WARN   FAIL
```

Figure 45. PMC Daily Vapor Polisher Diagnostic Report - Serial to PC Format

6 Maintenance

TLS Console

The TLS console, including interface modules, do not require scheduled maintenance, but the station operator is responsible to ensure printer paper is properly loaded and front panel indicator lights are operational. ISD System Self-Test Monitoring algorithms are designed to verify proper selection, setup and operation of the TLS console and sensors. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

Vapor Flow Meter

There is no recommended maintenance, inspection nor calibration for the Air Flow Meter. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

Vapor Pressure Sensor

There is no recommended maintenance, inspection nor calibration for the Vapor Pressure Sensor. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

7 Diagnostic Menus

The diagnostic menus below are accessed and viewed from the TLS console front panel.

Smart Sensor Diagnostic Menu

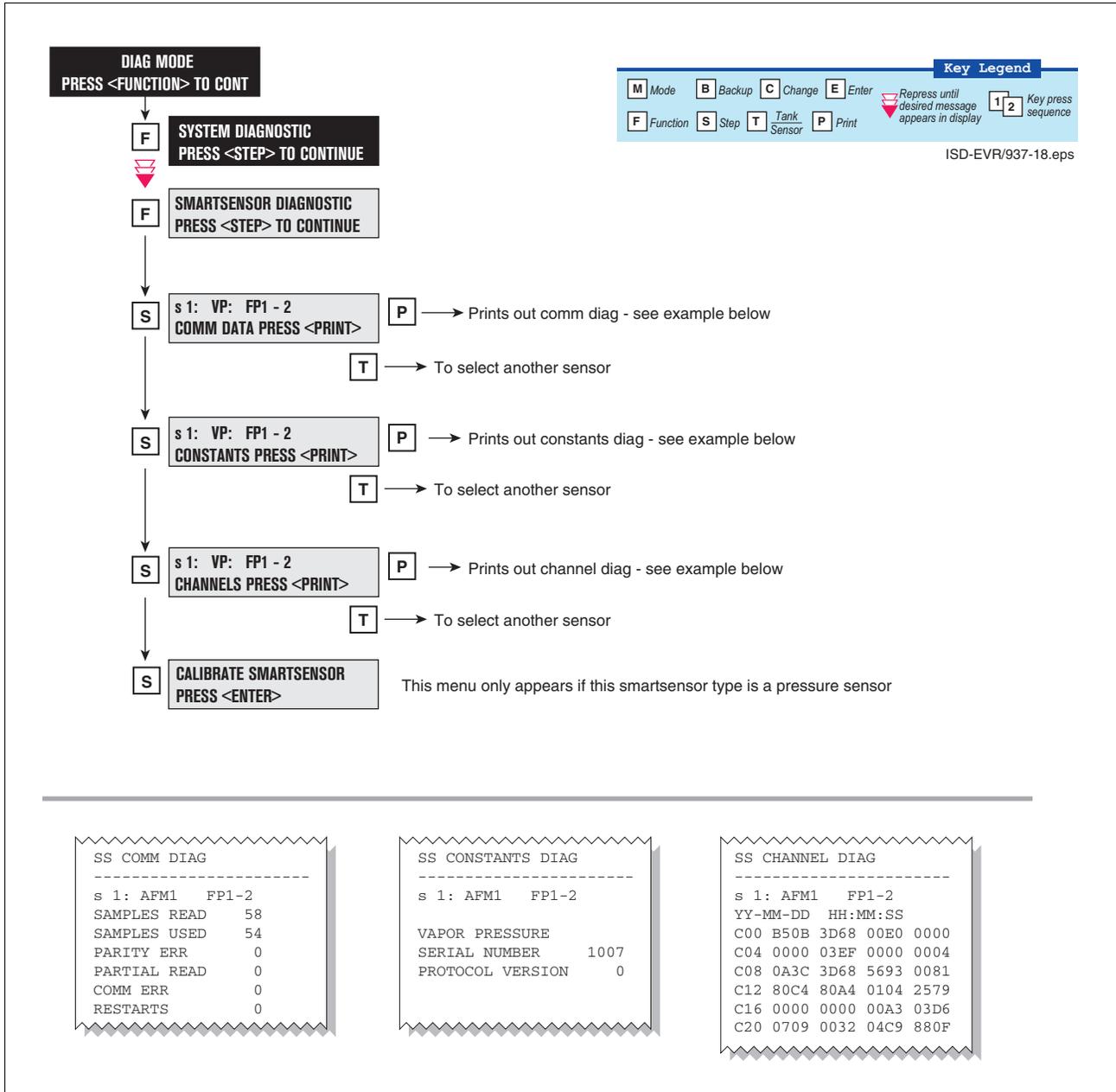


Figure 46. Smart Sensor Diagnostic Menu

Calibrate Smart Sensor Menu

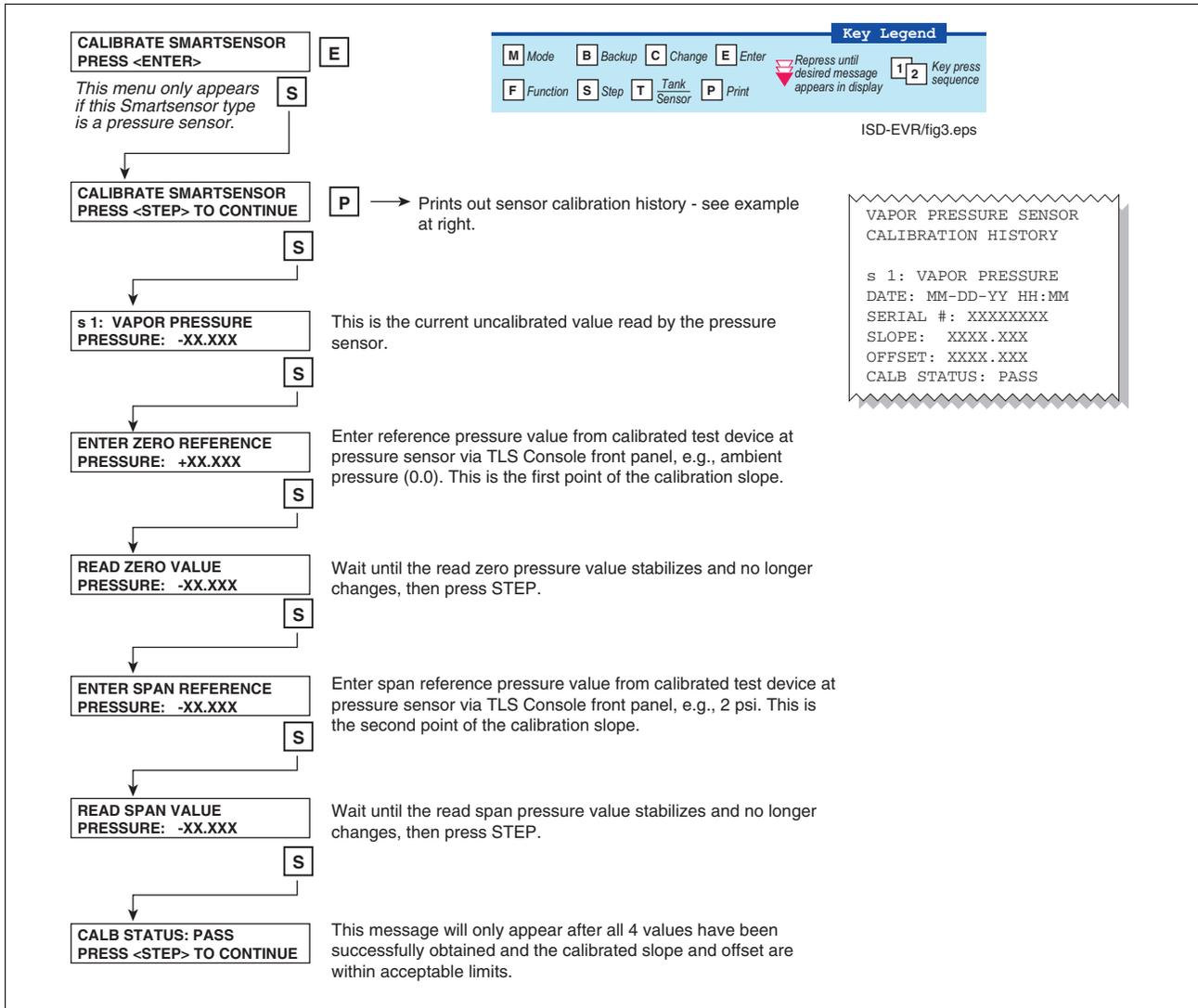


Figure 47. Smart Sensor Calibration Menu

ISD Diagnostic Menu

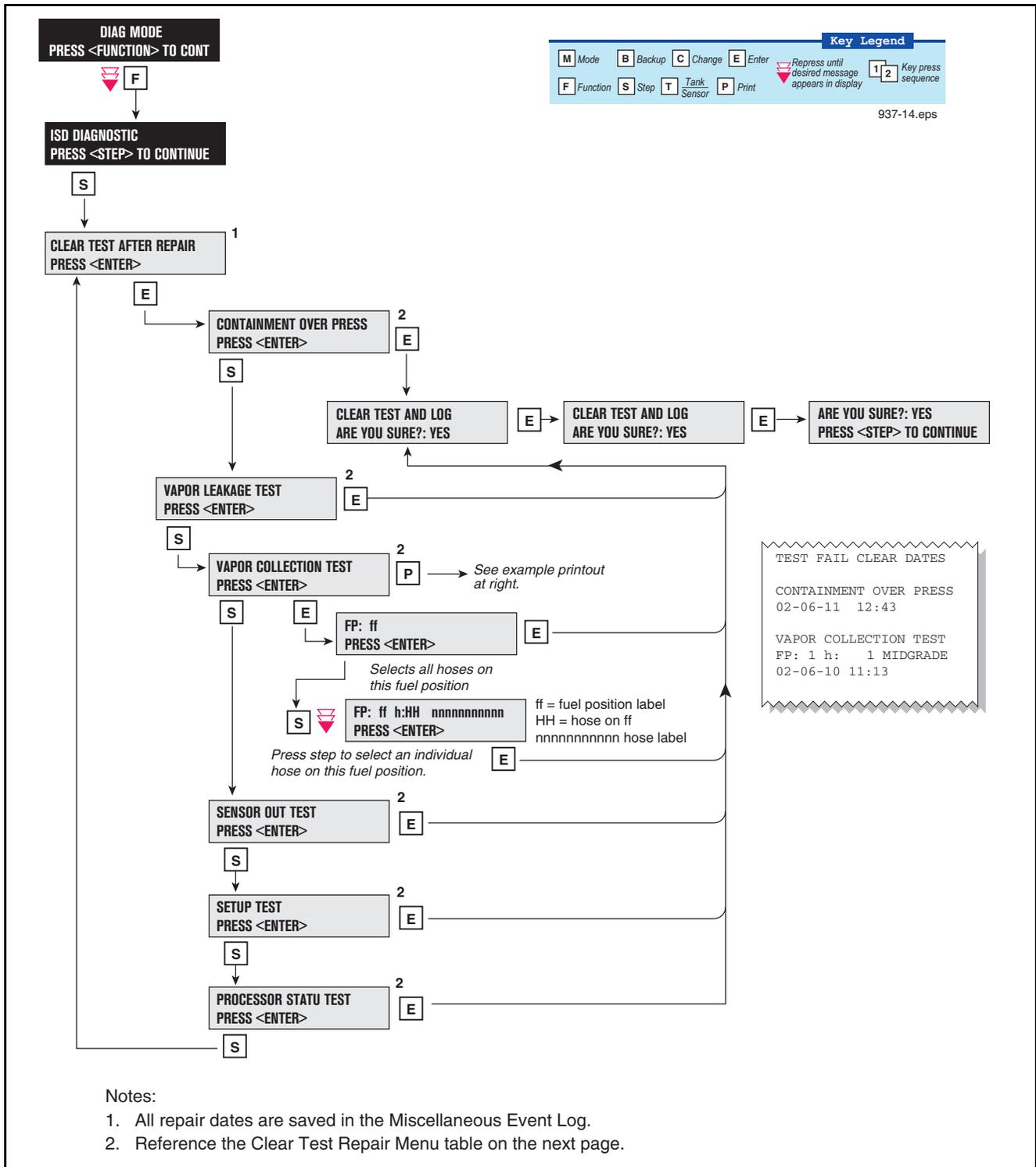


Figure 48. ISD Diagnostic Menu

Table 8. Clear Test Repair Menu

Menu Selection	Clears Alarms	Reset Dates
Containment Over Press	ISD GROSS PRESSURE WARN ISD GROSS PRESSURE FAIL ISD DEGRD PRESSURE WARN ISD DEGRD PRESSURE FAIL	Containment Test Time
Vapor Leakage Test	ISD VAPOR LEAKAGE WARN ISD VAPOR LEAKAGE FAIL	Vapor Leak Test Time
Vapor Collection Test	GROSS COLLECT WARN GROSS COLLECT FAIL DEGRD COLLECT WARN DEGRD COLLECT FAIL FLOW COLLECT WARN FLOW COLLECT FAIL AIRFLOW MTR SETUP	Hose Test Time
Sensor Out Test	ISD SENSOR OUT WARN ISD SENSOR OUT FAIL	Sensor Out Test Time
Setup Test	ISD SETUP WARN ISD SETUP FAIL	Setup Self Test Time
Processor Status Test ¹	ISD VP STATUS WARN ISD VP STATUS FAIL VP EMISSIONS WARN VP EMISSIONS FAIL VP DUTY CYCLE WARN VP DUTY CYCLE FAIL	Valid Vapor Processor Test Time

¹These tests and alarms are not available with FFS-CAS.

VST ECS Membrane Processor Diagnostic Menu

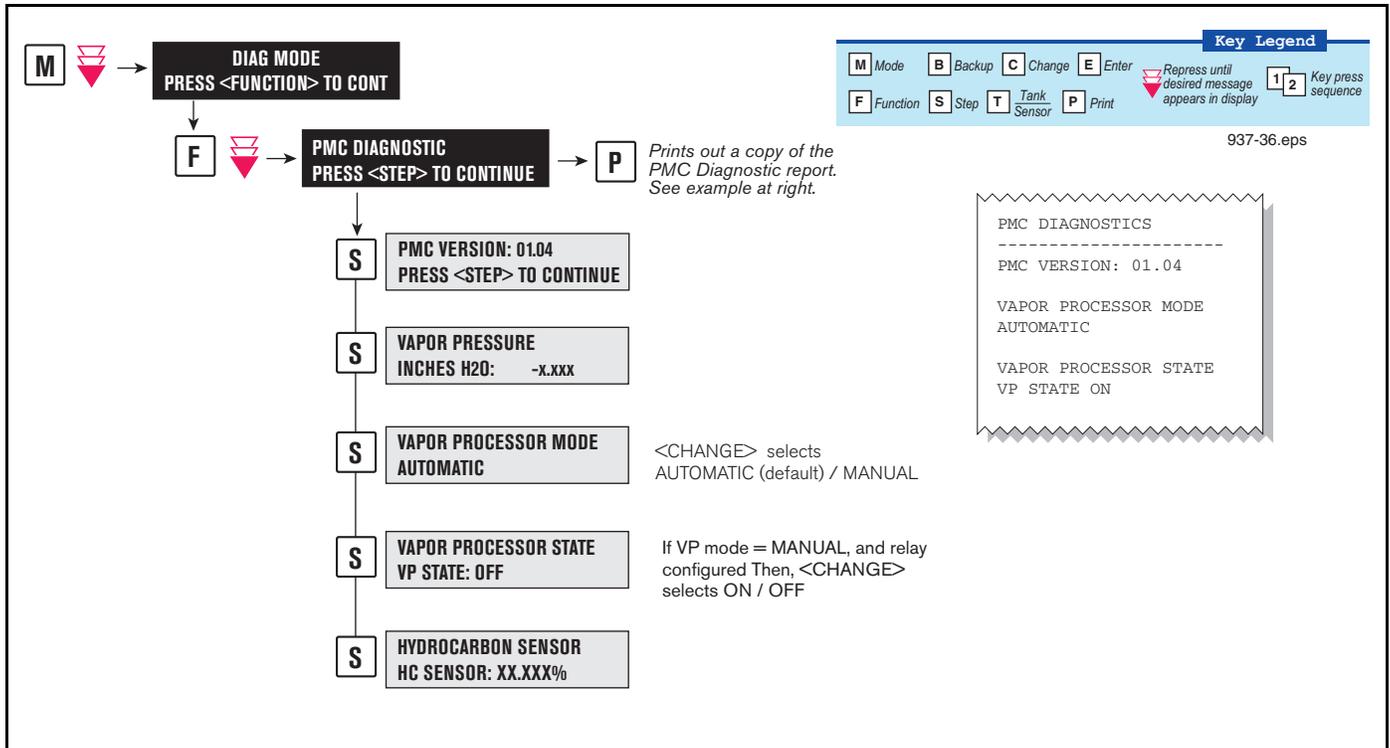


Figure 49. VST ECS Membrane Processor Diagnostic Menu

Veeder-Root Vapor Polisher Diagnostics

AUTOMATIC CONTROL

If PMC mode is in AUTOMATIC, PMC will control flow through the canister using a vapor control valve. The control algorithms will monitor tank pressure, vapor temperature and carbon temperature to monitor carbon canister loading. When the pressure is positive the valve is opened to relieve the pressure and begin loading the canister. When the UST pressure becomes negative the valve is opened and the purging process begins. The valve will close when the canister has either reached capacity or the canister is empty after purging.

MANUAL CONTROL

If PMC mode is in MANUAL, the diagnostic menu allows the valve to be opened (ON) or closed (OFF) manually. This feature is to support testing operation of the valve without waiting for canister to reach loading or purging thresholds. It also provides the necessary controls to perform 2" decay tests. The current UST ullage space vapor pressure will also be available through the diagnostic menu.

When set to Manual mode, the system will reset to Automatic mode after 4 hours.

Veeder-Root Vapor Polisher PMC Diagnostic Menu

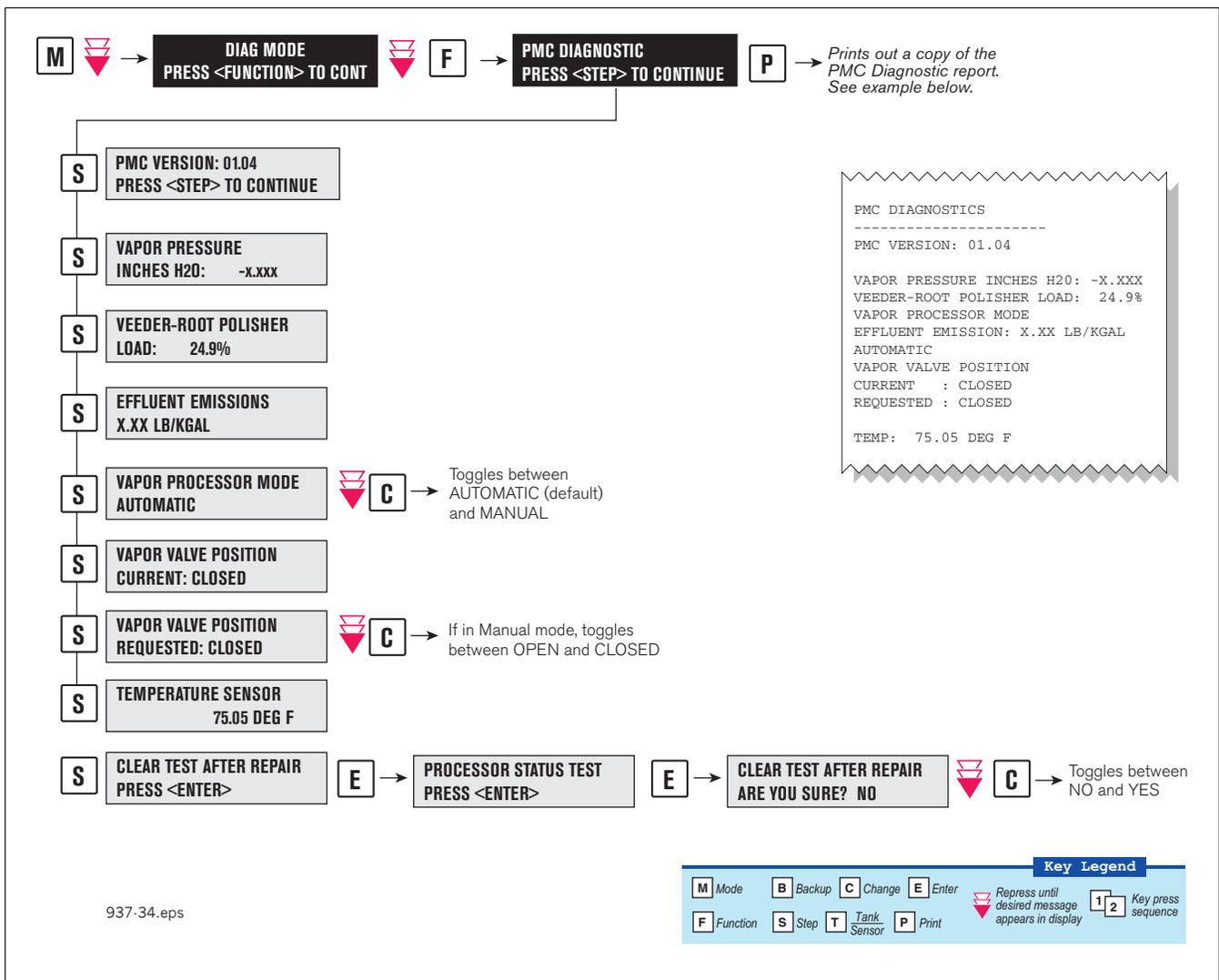


Figure 50. PMC Diagnostic Menus

Appendix A: Site EVR/ISD Equipment Location Worksheet

You should create a table listing each hose, fueling point, Air Flow Meter's serial number, etc.. This information will be required when you perform the EVR/ISD Setup hose/meter dispenses. This appendix contains blank worksheets for sites with single- and multi-hose dispensers. You are advised to fill in all of the appropriate information about your installed equipment, complete the TLS console's EVR/ISD setup, then perform the Product Meter ID dispensing procedure.

Single-Hose Fueling Position Dispensers

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST			
Hose ID ¹	FP ²	Hose Label ³	AFM Serial Number ⁴	AFM Label ⁵	Product Dispense(s) ⁶			
					1st	2nd	3rd	4th
1		Blend		AFM FP__&__				
2		Blend						
3		Blend		AFM FP__&__				
4		Blend						
5		Blend		AFM FP__&__				
6		Blend						
7		Blend		AFM FP__&__				
8		Blend						
9		Blend		AFM FP__&__				
10		Blend						
11		Blend		AFM FP__&__				
12		Blend						
13		Blend		AFM FP__&__				
14		Blend						
15		Blend		AFM FP__&__				
16		Blend						

¹Each hose must have a unique number (1 - 99).

²This is the Fuel Position Label which is the visible number on the outside of the dispenser (1 -2 digits).

³The hose label is always Blend for single-hose dispensers.

⁴This is the serial number on the Air Flow Meter (1 per dispenser).

⁵This is the AFM label entered in EVR/ISD setup (1 per dispenser and must be in the format shown, e.g., AFM FP1&2 - where 1 and 2 refer to the one [or two] numbers on the outside of the dispenser).

⁶After you have entered the contents of columns 1 - 5 into the TLS EVR/ISD hose table setup, you now must follow automap procedure and dispense from each gas meter AND one blend grade that feeds each hose. Enter a check beneath each product following a dispense from the hose.

FILL OUT - USE TO SETUP HOSE TABLE					AUTO MAP CHECK LIST			
Hose ID	FP	Hose Label	AFM Serial Number	AFM Label	Product Dispense(s)			
					1st	2nd	3rd	4th
17		Blend		AFM FP__&__				
18		Blend						
19		Blend		AFM FP__&__				
20		Blend						
21		Blend		AFM FP__&__				
22		Blend						
23		Blend		AFM FP__&__				
24		Blend						
25		Blend		AFM FP__&__				
26		Blend						
27		Blend		AFM FP__&__				
28		Blend						
29		Blend		AFM FP__&__				
30		Blend						
31		Blend		AFM FP__&__				
32		Blend						
33		Blend		AFM FP__&__				
34		Blend						
35		Blend		AFM FP__&__				
36		Blend						

FILL OUT - USE TO SETUP HOSE TABLE					AUTO MAP CHECK LIST			
Hose ID	FP	Hose Label	AFM Serial Number	AFM Label	Product Dispense(s)			
					1st	2nd	3rd	4th
		Blend		AFM FP __ & __				
		Blend						
		Blend		AFM FP __ & __				
		Blend						
		Blend		AFM FP __ & __				
		Blend						
		Blend		AFM FP __ & __				
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		Blend		AFM FP __ & __				
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		Blend		AFM FP __ & __				
		Blend						



Pressure Sensor

Installation Guide



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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.

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

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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For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

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Pressure Sensor Installation

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Pressure Sensor Installation

This manual contains instructions to install a Veeder-Root (In-Station Diagnostic) Pressure Sensor in a dispenser's vapor return line or in a vapor vent stack.

CAUTION: Installation of the pressure sensor on the vapor vent stack is only allowed at facilities equipped with a “Veeder-Root Vapor Polisher” or “Franklin Fueling System Healy Clean Air Separator.

This manual assumes all preliminary site preparation is completed, and that wiring from the console to the Pressure Sensor junction box is in place and meets the requirements set out in the console's Site Prep manual.

Contractor Certification Requirements

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

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

ATG Technician (Level 2/3 or 4) Certification: Contractors holding valid ATG Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- Wireless 2
- Tall Tank

VR Vapor Products Certification: Contractors holding a certification with the following designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- ISD – In Station Diagnostics
- PMC – Pressure Management Control
- CCVP - Veeder-Root Vapor Polisher
- Wireless – ISD/PMC Wireless
- A current Veeder-Root Technician Certification is a prerequisite for the VR Vapor Products course.

Warranty Registrations may only be submitted by selected Distributors.

Related Documents

576013-879	TLS-3XX Series Consoles Site Prep and Installation Manual
577013-800	ISD Setup and Operation Manual
577013-801	PMC Setup and Operation Manual
577013-937	In-Station Diagnostics (ISD) Install, Setup, & Operation Manual
331940-012	TLS-RF System Control Drawing
577013-964	TLS RF Wireless 2 System (W2) Installation and Maintenance Guide

Safety Precautions

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

 <p>EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.</p>	 <p>FLAMMABLE Fuels and their vapors are extremely flammable.</p>
 <p>ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p>TURN POWER OFF Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>
 <p>WARNING Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.</p>	 <p>USE SAFETY BARRICADES Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.</p>
 <p>READ ALL RELATED MANUALS Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>	

⚠ WARNING

     	<p>This product is to be installed and operated in the highly combustible environment of a gasoline dispenser where flammable liquids and explosive vapors may be present.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <p>The following hazards exist:</p> <ol style="list-style-type: none"> 1. Electrical shock resulting in serious injury or death may result if power is on during installation and the device is improperly installed. 2. Product leakage could cause severe environmental damage or explosion resulting in death, serious personal injury, property loss and equipment damage. <p>Observe the following precautions:</p> <ol style="list-style-type: none"> 1. Read and follow all instructions in this manual, including all safety warnings. 2. To be installed in accordance with the National Electrical Code (NFPA 70) and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A). 3. Before installing this device, turn Off, tag/lock out power to the system, including console and submersible pumps. 4. To protect yourself and others from being struck by vehicles, block off your work area during installation or service. 5. Substitution of components may impair intrinsic safety.
--	--

Before You Begin

- Comply with all recommended safety practices identified by OSHA (Occupational Safety and Health Administration) and your employer.
- Review and comply with all the safety warnings in the installation manuals and any other national, State or Local requirements.
- When direct wiring to a TLS console, a 2-conductor, 18 AWG shielded cable must be installed in intrinsically safe conduit from the dispenser or from the vapor vent stack to the TLS console.
- The Pressure Sensor must be installed in a VERTICAL position with the sensing port pointing down. Its connection in the base of the dispenser to the vapor return line must be made BELOW the vapor return line shear valve mechanism, AND BELOW the Vapor Flow Meter outlet (if a flow meter is installed).
- For all connections requiring sealant, use only UL classified yellow Gas/TFE Teflon tape.
- When installing on a vent stack, customer supplied pipe and pipe fittings shall be standard full-weight (ASTM Schedule 40) wrought iron or steel.
- Customer supplied copper tubing shall be soft tempered, 1/4-inch O.D., with a minimum wall thickness of 0.0265 inches.
- Pipe threads shall be in accordance with the Standard for Pipe Threads, General Purpose (Inch) ANSI/ASME B1.20.1-1983.

Veeder-Root Parts

Veeder-Root parts and kits required to install the Pressure Sensor are listed in Table 1 and Table 2.

Table 1. Under Dispenser - Pressure Sensor Installation Kit (P/N 330020-515)

Item	Qty.	Description	P/N
1	1	Pressure sensor	331946-001
2	4	Male connector 68CA-4-4, brass 1/4" tube to 1/4" pipe	514100-430
3	1	Union 62CA-4, brass 1/4" tube size	514100-431
4	1	Plug 59CA-4, brass 1/4" tube size	514100-432
5	1	Universal sensor mounting kit - miscellaneous assortment of U-bolts, brackets, clamps, and fasteners	330020-012
6	2	Wire nut	576008-461
7	1	Sealing pack	514100-304
8	1	Cord grip	331028-011
9	2	Tie wrap	510901-337
10	1	Shim	332061-001
11	1	Ball Valve, 3-way, 1/4"	576008-649
12	1	Copper tube, soft, 1/4" OD, 36" length	332151-001

Table 2. Vapor Vent Stack - Pressure Sensor Installation Kit (P/N 330020-630)

Item	Qty.	Description	P/N
1	1	Pressure sensor	331946-001
2	1	Enclosure, NEMA 4X- modified	333004-001
3	1	Panel, composite, modified	333005-001
4	2	Male elbow 169CA-4-4, brass 1/4" tube to 1/4" pipe	579066-001
5	2	Male connector 68CA-4-4, brass 1/4" tube to 1/4" pipe	514100-430
6	1	Plug 59CA-4, brass 1/4" tube size	514100-432
7	1	Bulkhead union 62CABH-4, brass 1/4" tube size	514100-476
8	2	Washer, 0.469 x 1.125 x 0.063", zinc	510904-573
9	1	Tube - copper, 1/4" OD, short S bend	333006-001
10	1	Tube - copper, 1/4" OD x 8" length	333018-001
11	1	Ball valve, 3-way, 1/4"	576008-649
12	1	Hub, conduit, liquid tight, 1/2", zinc	576010-715
13	3	Conduit clamp, 2", steel - std duty	514100-478
14	3	1/4-20 x 0.75" hex bolt - steel	026-620-1
15	3	Washer, flat, 1/4", zinc	514100-374
16	3	1/4-20, hex nut w/lock washer	511000-251
17	1	Vent, porous, flanged, 0.17 x 0.42"	514100-477
18	2	Wire nut	576008-461
19	1	Sealing pack	514100-304
20	1	Cord grip	331028-011
21	2	Tie wrap	510901-337
22	1	Shim	332061-001
23	1	Manual, Installation VR Pressure Sensor	577013-797
24	1	Manual, ISD Setup & Operation	577013-800
25	1	Manual, PMC Setup & Operation	577013-801
26	1	ISD Quick Reference Guide	577013-842
27	1	Warranty card, ISD system	577013-868
28	1	Manual, ISD Setup & Operation, VST	577013-937
29	2	Conduit clamp, 3", steel, std duty	514100-482
30	1	Label - eVRgreen	333041-001

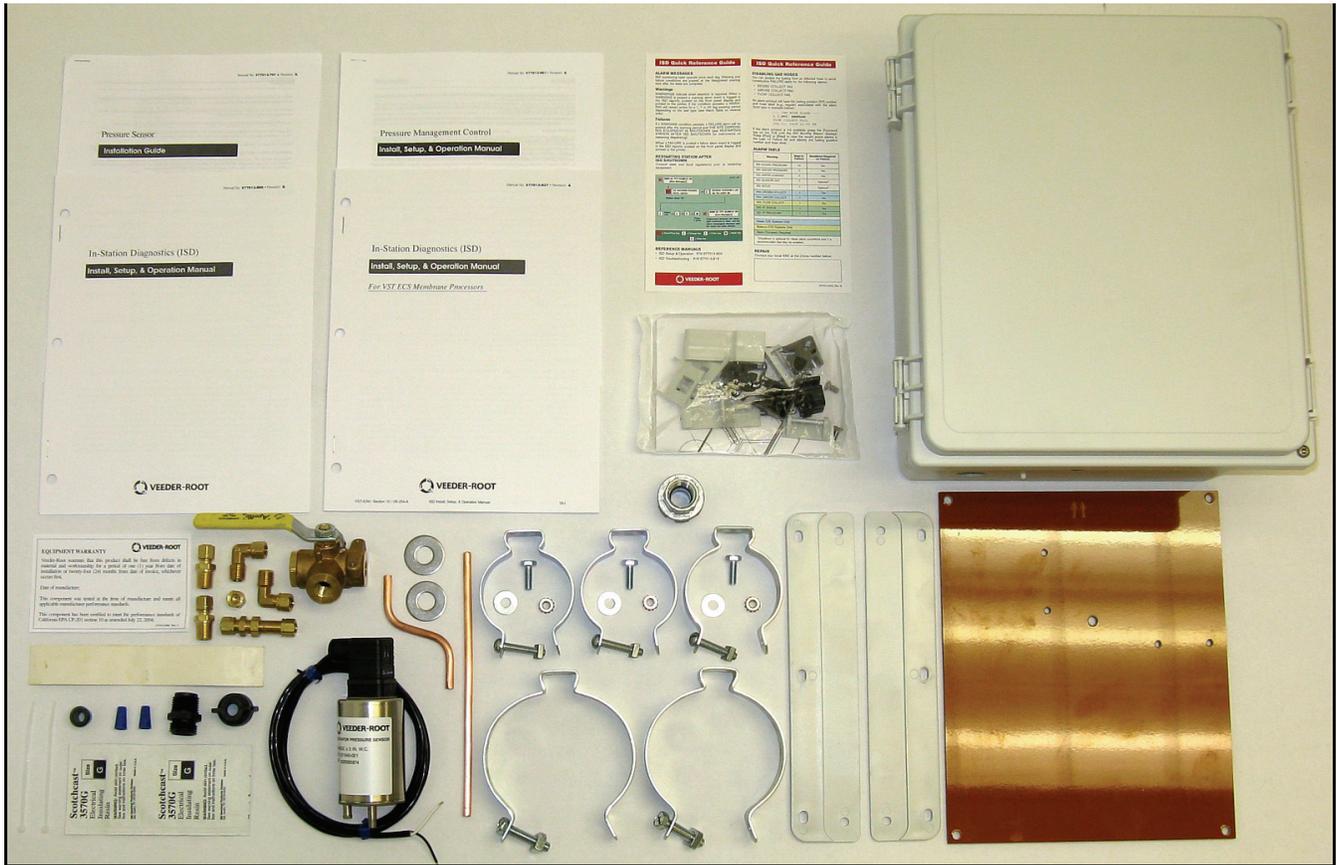


Figure 1. Table 2 Component Pictorial

Tools Required

1. Wrenches suitable for tightening tubing/pipe fittings.
2. Necessary pipe fitter’s equipment (including threading equipment as needed) and a non-hazardous work space suitable to modify the dispenser vapor line or the vapor vent stack for Pressure Sensor installation.
3. Torx bit for tamper-resistant screws (VR P/N 330020-635).

NOTE: this bit is required to open and close the enclosure door.

Under Dispenser Installation Steps



1. Before installing this device, turn Off, tag/lock out power to the system, including console and submersible pumps.
2. Determine which dispenser is closest to the tank being monitored. Remove that dispenser’s lower sheet metal doors to gain access to the vapor plumbing.
3. Refer to Pressure Sensor dispenser installation examples in Figure 2 through Figure 6 to locate a suitable port or plumb a suitable fitting for the Pressure Sensor tubing in either the vapor return shear valve or in the

vapor return line. **NOTE: In ISD installations, the pressure port used must be below the vapor flow meter outlet.**

4. Install one of the 68CA-4-4 male connectors (item 2 in Table 1) from the kit into the tapped hole.
5. Install Pressure Sensor (item 1 in Table 1) vertically to the dispenser frame or piping using the 2-inch conduit clamp, rubber shim, and necessary bolts, nuts, and washers from the included Universal Sensor Mounting kit. Wrap the rubber shim (item 10 in Table 1) around the sensor before inserting it into the clamp. Also make sure the sensor cable outlet is facing up and the pressure sensing port tube in the base of the sensor is facing down.
6. Attach one end of the 62CA-4 union (item 3 in Table 1) to the pressure sensing port in the base of the Pressure Sensor.
7. Install the remaining 68CA-4-4 male connectors (item 2 in Table 1) from the kit into each of the three ports in the 3-way calibration valve (item 13 in Table 1).
8. Measure, fabricate, and install a 1/4" OD copper tube (item 12 in Table 1) that runs between the 62CA-4 union in the base of the sensor and the center port of the 3-way calibration valve.
9. Measure, fabricate, and install a 1/4" OD copper tube that runs between the 1/4" tube end of the male connector fitting installed beneath the shear valve mechanism and the right port on the 3-way valve, being careful not to create any potential liquid traps (Note 3-way valve orientation in Figure 6).
10. Screw the 59CA-4 plug, item 4, from the kit onto the left port's male connector. Make sure the valve's handle is set to connect the sensor to the vapor return line and not to the capped (ambient) port.

Important! All plumbing's pitch to drain should be 1/4" vertical per 12" horizontal to eliminate liquid traps.

11. Route the cable from Pressure Sensor to the Pressure Sensor junction box in the dispenser. Observing polarity, connect the sensor wiring to the field wiring from console and cap with wire nuts (see Figure 7) - OR - terminate the wiring in the TLS RF transmitter (W2). In wireless installations, the wiring is not sealed and does not run back to the TLS console and Steps 12, 13 and 14 ARE NOT REQUIRED.
12. Seal wire nuts in epoxy sealant following the instructions in Figure 8.
13. Push the epoxy sealed bag into the junction box. Replace and tighten the junction box cover.
14. Terminate field wiring into TLS Console and connect to Smart Sensor Module (TLS-3XX - Figure 9). Note: observe polarity! The cable length between the console and sensor must not exceed the distance stated in the TLS-3XX Site Prep manual (P/N 576013-879).

Note: Intrinsically safe devices must be installed in accordance with Article 504 of the National Electrical Code, ANSI/NFPA 70, for installation in the United States, or Section 18 of the Canadian Electrical Code for installations in Canada.

This intrinsically safe Pressure Sensor P/N 331946-001, has only been evaluated for connection to a UL listed TLS-3XX Liquid Level Gauge / Leak Detector.

Conductors of different intrinsically safe circuits run in the same cable/conduit must have at least 0.01 inch (0.25 mm) of insulation.

15. After the Pressure Sensor is installed, pressurize the tank ullage space and vapor piping to at least 2 inches WC and test for leaks using leak detection solution.
16. Replace lower dispenser sheet metal doors onto dispensers.

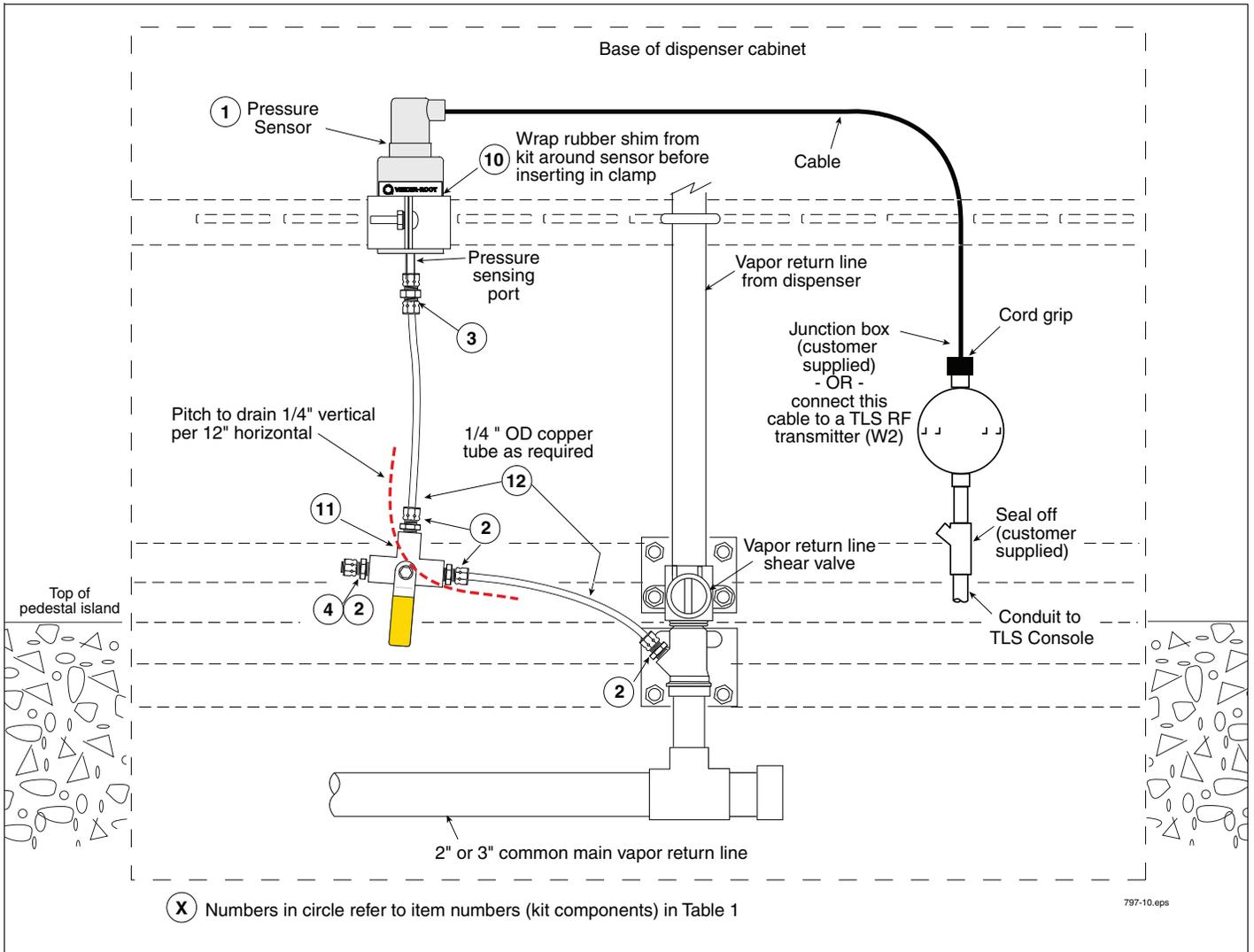


Figure 2. Example Pressure Sensor Install In Shear Valve Port - Preferred Non-ISD Installation (Without Vapor Flow Meter)

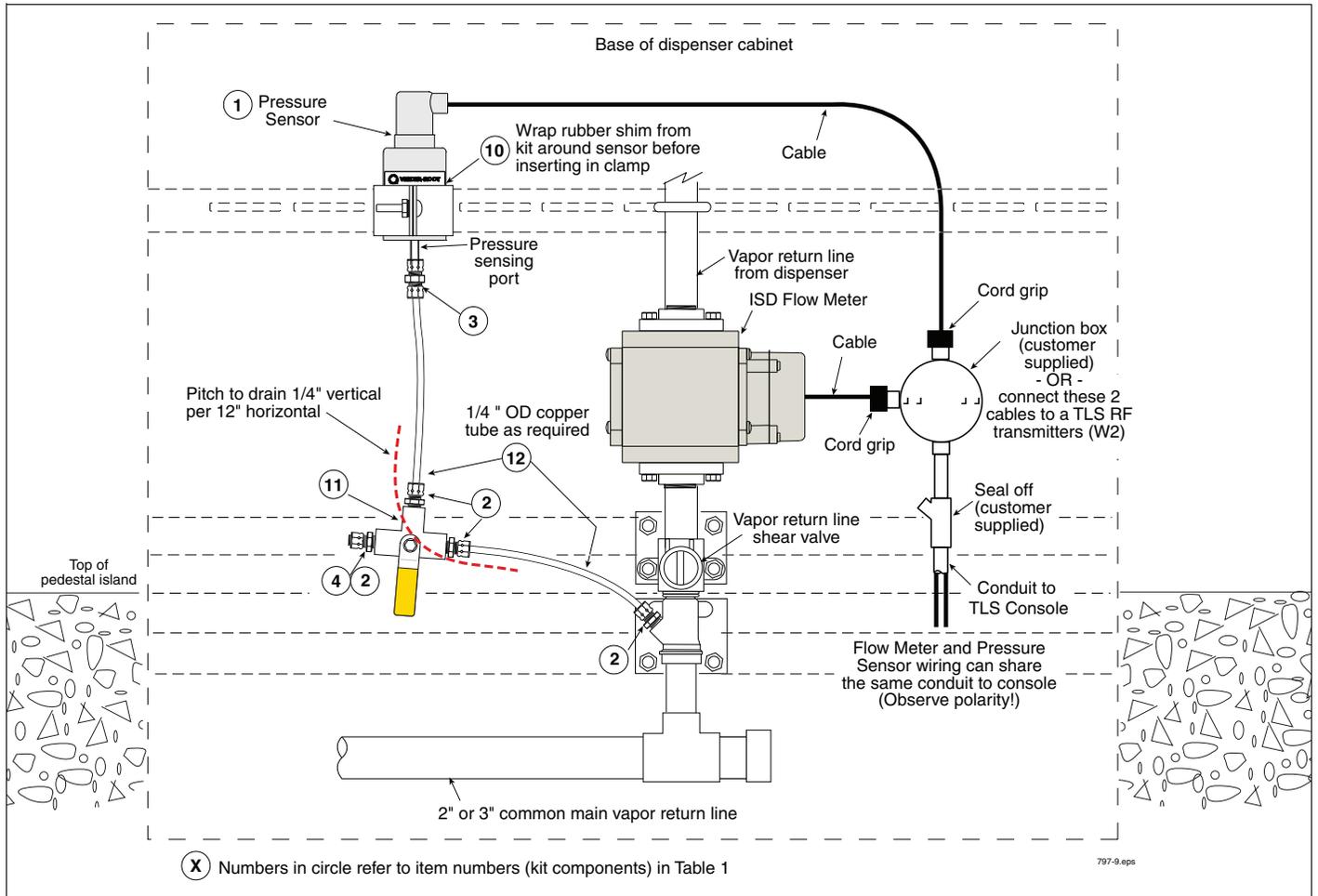


Figure 4. Example Pressure Sensor Install In Shear Valve Port - Preferred ISD Installation (With Vapor Flow Meter Above Shear Valve)

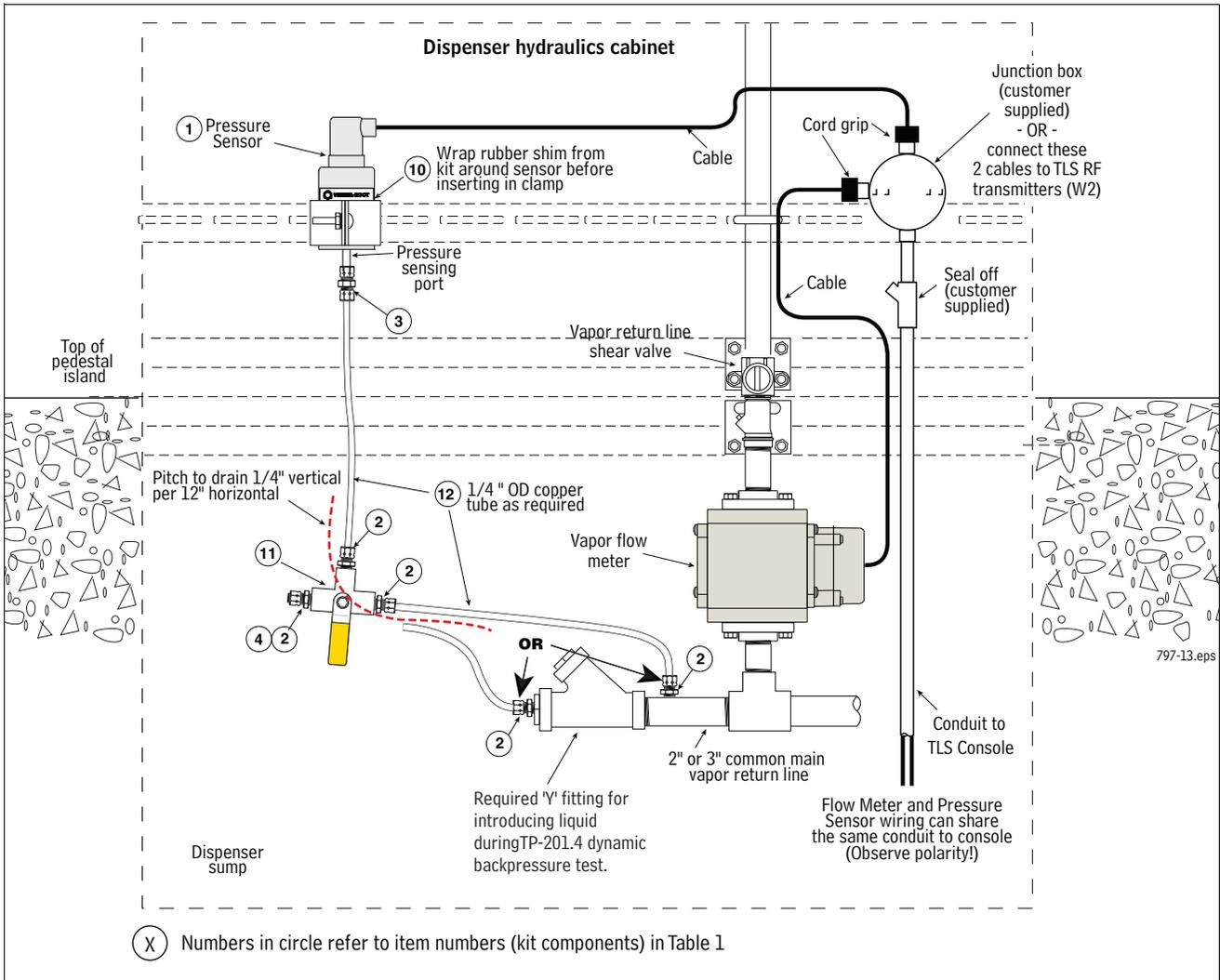


Figure 5. Example Pressure Sensor Install In Horizontal Access Fitting Or Vapor Return Line - ISD Installation (With Vapor Flow Meter Below Shear Valve)

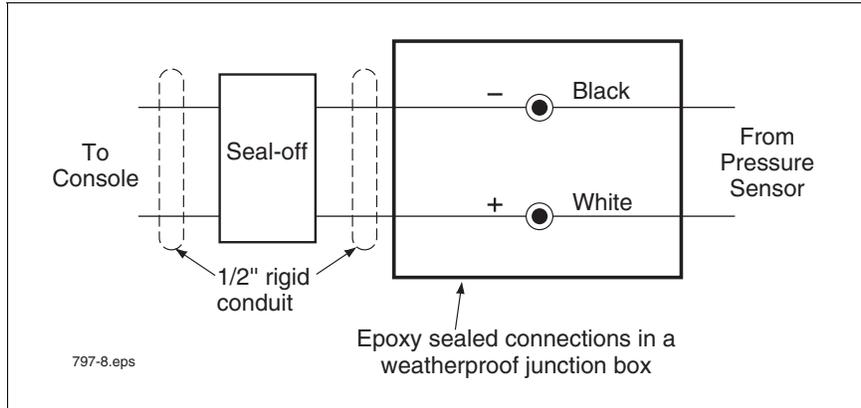


Figure 7. Field wiring Pressure Sensor - Observe Polarity

Instructions:

NOTE: When temperature is below 50°F (10°C), keep resin in a warm place prior to mixing (e.g., in an inside pocket next to body).

1. Open epoxy sealant package, and remove resin pak.
2. Holding resin pak as shown in A, bend pak along long length.
3. As shown in B, firmly squeeze the RED SIDE of the resin, forcing it through the center seal and into BLACK SIDE.
4. Mix thoroughly to a uniform color by squeezing contents back and forth 25-30 times.
5. Squeeze mixed, warm resin into one end of bag and cutoff other end.
6. Slowly insert wiring connections into sealing pack until they fit snugly against the opposite end as shown in C.
7. Twist open end of bag and use tie wrap to close it off and position the tie wrapped end up until the resin jells.

CAUTION: Epoxy sealant is irritating to eyes, respiratory system, and skin. Can cause allergic skin reaction. Contains: epoxy resin and Cycloaliphatic epoxy-carboxylate.

Precautions: Wear suitable protective clothing, gloves, eye, and face protection. Use only in well ventilated areas. Wash thoroughly before eating, drinking, or smoking.

NOTE: Not required for wireless installations!

Figure 8. Epoxy sealing field wiring

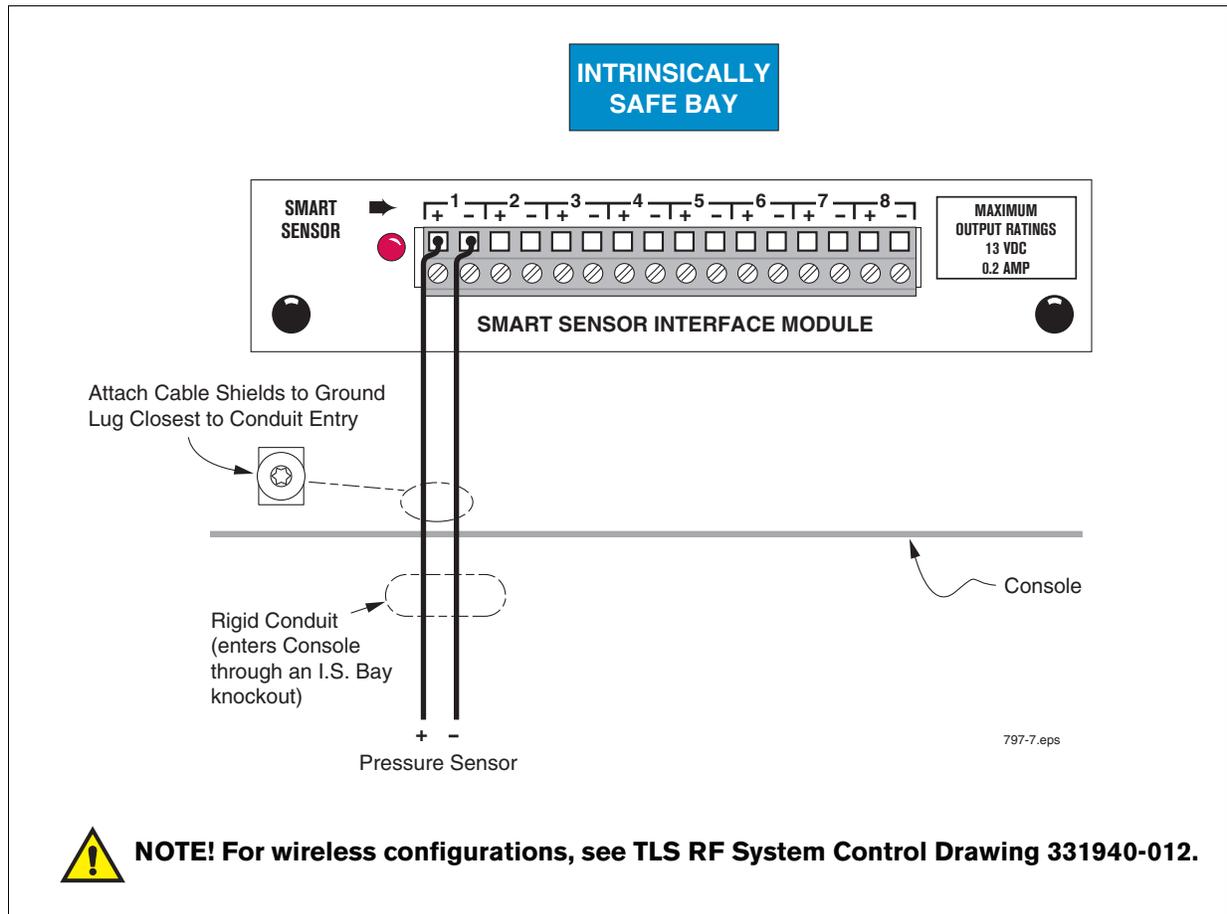


Figure 9. Connecting Pressure Sensor to TLS-3XX Smart Sensor Interface Module

Vapor Vent Stack Installation Step

1. Before installing this device, perform all required safety procedures to gain access inside the vapor vent stack.
2. Determine which vapor vent stack line is closest to the tank being monitored. Select this line for the addition of the pressure sensor.

CAUTION: Installation of the pressure sensor on the vapor vent stack is only allowed at facilities equipped with a “Veeder-Root Vapor Polisher” or “Franklin Fueling System Healy Clean Air Separator.”

3. Locate a suitable port in an existing Schedule 40 piping fitting (tee, cross, etc.) or plumb a suitable Schedule 40 pipe fitting (tee, cross, etc.) into the vapor vent stack line (maximum length of copper tubing limited by dimension in Figure 10).
4. Install the pressure sensor (item 1 in Table 2) vertically onto the center of the composite panel (item 3 in Table 2) using a 2-inch conduit clamp, rubber shim, and necessary bolts, nuts, and washers included in the kit. Be sure the top symbol on the panel is facing upwards (see Figure 11). Wrap the rubber shim (item 22 in Table 2) around the sensor before inserting it into the clamp. Also make sure the sensor cable outlet is facing up

and the pressure sensing port tube in the base of the sensor is facing down. Locate the pressure sensor in the clamp, but leave the conduit clamp screw somewhat loose for later sensor height adjustment.

5. Install two 169CA-4-4 male elbows (item 4 in Table 2) into each end of the 3-way calibration valve (item 11 in Table 2) as shown (see Figure 11).
6. Install one 68CA-4-4 male connector (item 5 in Table 2) into the center port of the 3-way calibration valve, and then directly attach it to the pressure sensor inlet port (see Figure 7).
7. Screw the 59CA-4 plug (item 6 in Table 2) onto the left port's male elbow (see Figure 11).
8. Install the two plastic enclosure mounting plates to the back of the enclosure. Use the four short flat-head screws included in the enclosure hardware bag.
9. Install the composite panel into the enclosure (item 2 in Table 2) such that the sensor cable outlet is facing up and the pressure sensing port tube in the base of the sensor is facing down. The top symbol on the panel should be facing upward. Use the four short screws included in the enclosure hardware bag.
10. Make sure that the white flanged porous vent (factory installed - item 17 in Table 2) is still securely installed into the hole in the bottom of the enclosure (see Figure 11).
11. Insert the S-bend 1/4" OD copper tube (item 9 in Table 2) into the right-side male elbow of the 3-way calibration valve, but do not fully tighten the compression nut (see Figure 11).
12. Locate the 62CABH-4 bulkhead union (item 7 in Table 2) and remove the compression nut and the adjustable nut then place a large washer (item 8 in Table 2) against the fixed, integral body nut. Slide the compression nut that was removed onto the bottom portion of the S-bend tube.
13. Partially insert the bulkhead union into the bottom center hole in the enclosure. Slide a large washer over the body, and thread the adjustable nut back onto the body.
14. Insert the bottom portion of the S-bend tube into the bulkhead union and fully tighten the bulkhead union adjustable nut against the large washer and enclosure wall. Adjust the pressure sensor vertically in the shim / conduit clamp to make sure the S-bend tube is fully inserted into the union and male elbow.
15. Fully tighten the compression nuts to connect the S-bend tube to the union and to the male elbow. Tighten the sensor conduit clamp screw to secure the sensor in its final vertical position (see Figure 11).
16. Mount the plastic enclosure onto the vapor vent stack or suitable rigid structure ABOVE the vapor vent stack port using two conduit clamps (for 2" or 3" pipe), bolts, nuts, and washers included, or use other customer supplied suitable mounting hardware (Example: Unistrut®). Leave the mounting hardware somewhat loose for later enclosure height adjustment (see Figure 10).
17. Measure, fabricate, and install customer supplied pipe and pipe fittings between the vapor vent stack port and within a few inches of the bulkhead union in the bottom of the enclosure.
18. Install one 68CA-4-4 male connector (item 5 in Table 2) onto the top of the new pipe (see View A-A, Figure 10).
19. Measure, fabricate, and install 1/4" OD copper tubing (item 10 in Table 2) between the bulkhead union and the male connector. Adjust the enclosure vertically on vent pipe to make sure the copper tube is fully inserted into the bulk head union and male connector.
20. Fully tighten the compression nuts to secure the fabricated tube to the bulkhead union and to the male connector. Tighten the enclosure mounting hardware to secure the enclosure in its final vertical position.

Note: **Important!** All plumbing's pitch to drain should be 1/4" vertical per 12" horizontal to eliminate any potential liquid traps.

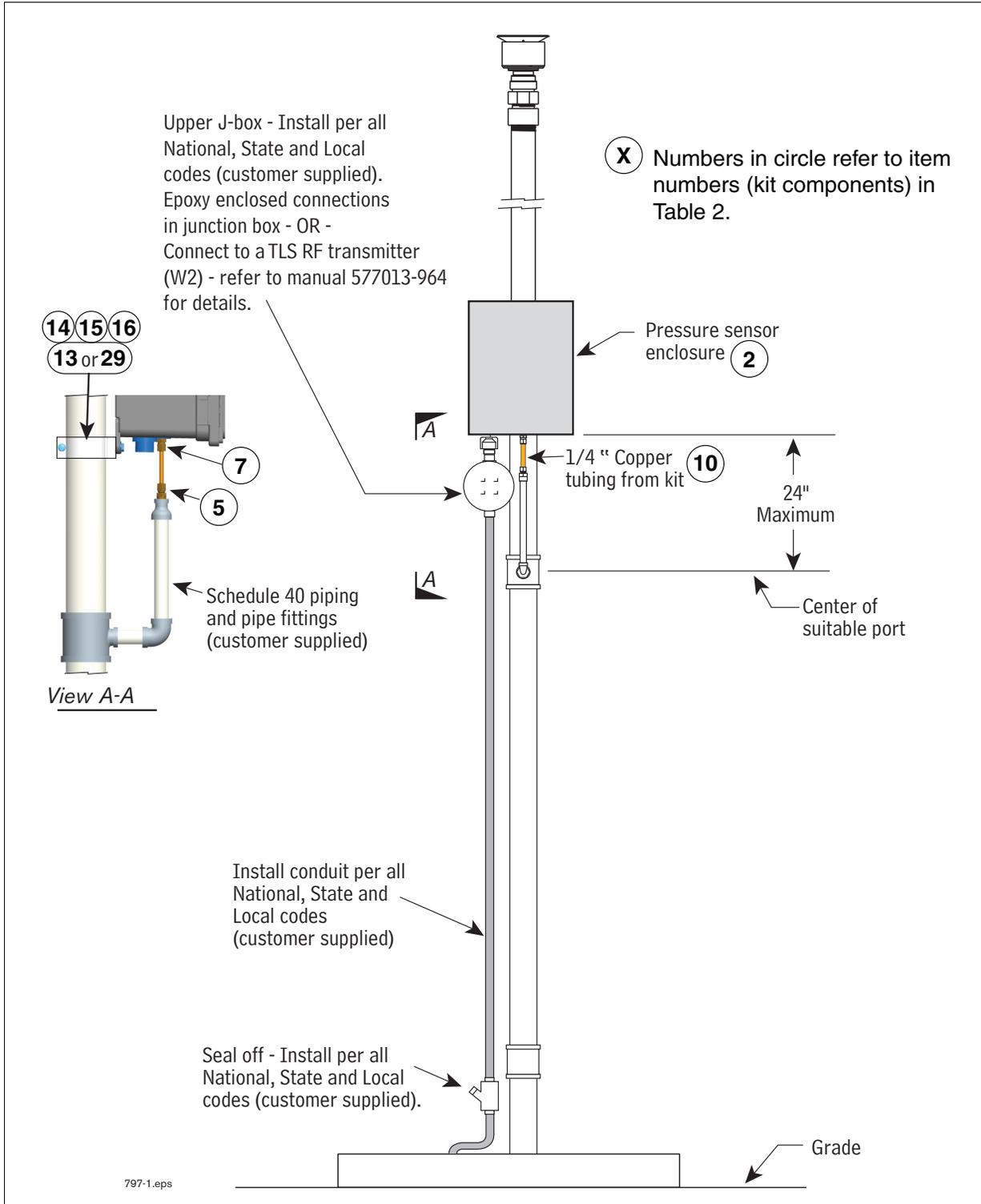


Figure 10. Locating Pressure Sensor Enclosure in Vapor Vent Stack

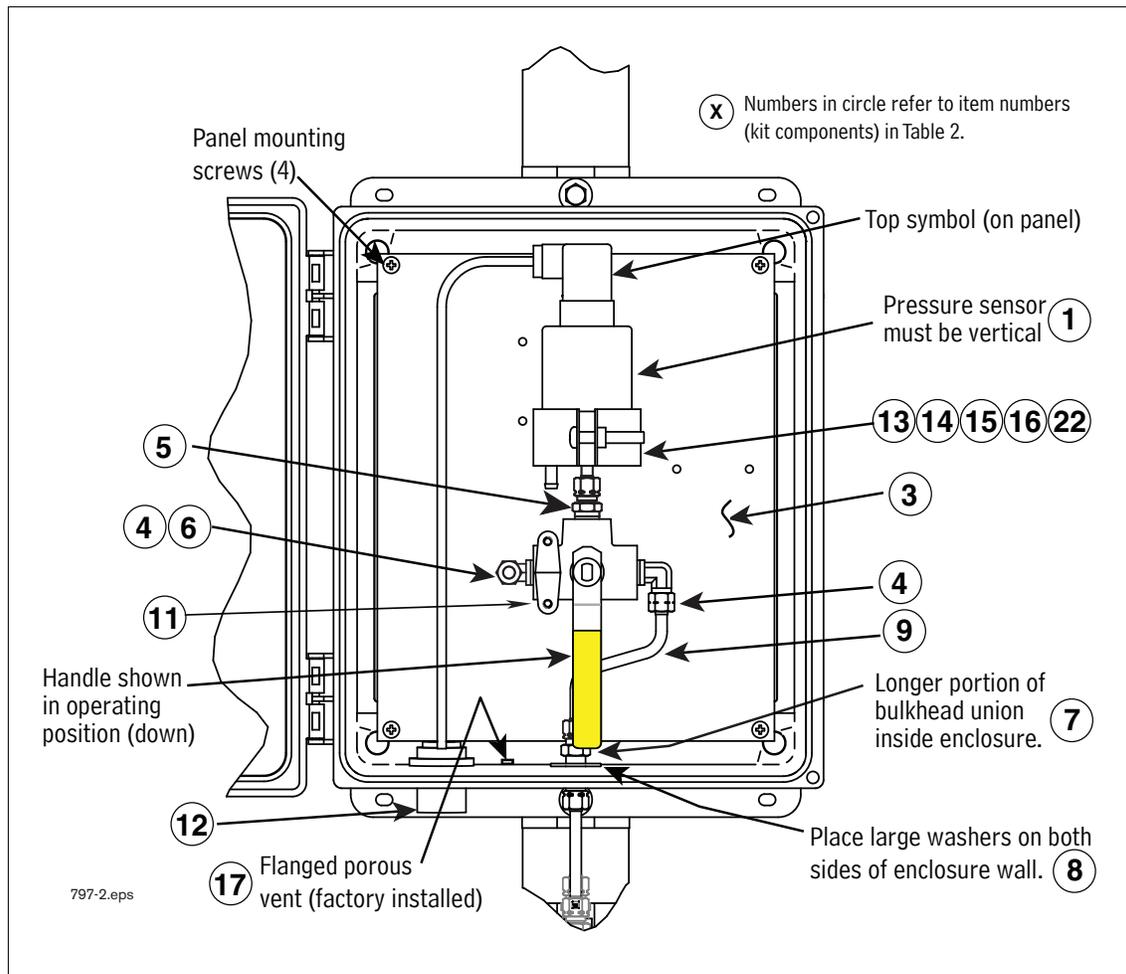


Figure 11. Mounting Pressure Sensor Assembly onto Composite Panel

21. Make sure the valve's handle is set to connect the sensor to the vapor vent stack and not to the capped (ambient) port.
22. Install two tamper-resistant screws from the enclosure hardware bag into the two holes on the enclosure door (if not already installed) using a Torx bit for tamper-resistant screws. Discard any remaining items in the enclosure hardware bag.
23. When direct wiring to a TLS console, install 1/2" electrical conduit from the conduit hub in the bottom of the enclosure to the customer supplied weather-proof junction box (see Figure 10). For wireless installations, using the TLS RF, Steps 23 - 27 are not required.
24. Route the cable from the pressure sensor to the junction box under the enclosure. Observing polarity, connect the sensor wiring to the field wiring from console and cap with wire nuts (see Figure 10).
25. Seal wire nuts in epoxy sealant following the instructions in Figure 8.
26. Push the epoxy sealed bag into the junction box. Replace and tighten the junction box cover.

27. Terminate field wiring into TLS Console and connect to Smart Sensor Module (TLS console - Figure 9). Note: observe polarity! The cable length between the console and sensor must not exceed the distance stated in the TLS-3XX Site Prep manual (P/N 576013-879).

Note: Intrinsically safe devices must be installed in accordance with Article 504 of the National Electrical Code, ANSI/NFPA 70, for installation in the United States, or Section 18 of the Canadian Electrical Code for installations in Canada.

This intrinsically safe Pressure Sensor (P/N 331946-001), has only been evaluated for connection to a UL listed TLS-3XX Liquid Level Gauge / Leak Detector.

Conductors of different intrinsically safe circuits run in the same cable/conduit must have at least 0.01 inch (0.25 mm) of insulation.

28. After the Pressure Sensor is installed, pressurize the tank ullage space and vapor piping to at least 2 inches WC and test for leaks using leak detection solution.
29. Close the enclosure door and secure by threading the tamper-resistant screws into the enclosure body using a Torx bit for tamper-resistant screws.
30. Affix the eVRgreen label (item 30 in Table 2) to the enclosure door as desired.



Carbon Canister Vapor Polisher

Installation and Maintenance Guide



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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.

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

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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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2. Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
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.
4. Veeder-Root will NOT be responsible for any compensation when a customer chooses their own carrier.

RETURN SHIPPING

For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

FOR INSTALLATIONS IN THE STATE OF CALIFORNIA

Please refer to the California Air Resources Board Vapor Recovery Certification Phase II EVR Executive Order web site (www.arb.ca.gov/vapor/eo-evrphaseII.htm) for the latest manual revisions pertaining to Executive Order VR 203 (VST Phase II EVR System) and VR 204 (VST Phase II EVR System Including ISD System).

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Introduction

This manual contains instructions to install a Veeder-Root Carbon Canister Vapor Polisher (CCVP) into a gasoline tank vent pipe.

Contractor Certification Requirements

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

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

ATG Technician (Level 2/3 or 4) Certification: Contractors holding valid ATG Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- Wireless 2
- Tall Tank

VR Vapor Products Certification: Contractors holding a certification with the following designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- ISD – In Station Diagnostics
- PMC – Pressure Management Control
- CCVP - Veeder-Root Vapor Polisher
- Wireless – ISD/PMC Wireless
- A current Veeder-Root Technician Certification is a prerequisite for the VR Vapor Products course.

Warranty Registrations may only be submitted by selected Distributors.

Related Documents

576013-879	TLS-3XX Series Consoles Site Prep Manual
577013-949	In-Station Diagnostics Install, Setup & Operation Manual
577013-948	Pressure Management Control Install, Setup and Operation Manual
576013-858	Direct Burial Cable Installation Guide
577013-964	TLS RF Wireless 2 System (W2) Installation Manual
331940-012	TLS RF System Control Drawing

Safety Precautions

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

 <p>EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.</p>	 <p>FLAMMABLE Fuels and their vapors are extremely flammable.</p>
 <p>ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p>TURN POWER OFF Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>
 <p>READ ALL RELATED MANUALS Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>	 <p>USE SAFETY BARRICADES Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.</p>
 <p>WARNING Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.</p>	 <p>WEAR EYE PROTECTION Wear eye protection when working with pressurized fuel lines or epoxy sealant to avoid possible eye injury.</p>
 <p>INJURY Careless or improper handling of materials can result in bodily injury.</p>	 <p>GLOVES Wear gloves to protect hands from irritation or injury.</p>

! WARNING

This product is to be installed and operated in the highly combustible environment of a gasoline station where flammable liquids and explosive vapors may be present.

ATTEMPTING TO SERVICE TANK MONITORS AND EQUIPMENT WITHOUT PROPER TRAINING CAN CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN PERSONAL INJURY OR DEATH.

The following hazards exist:

1. Electrical shock resulting in serious injury or death may result if power is on during installation and the device is improperly installed.
2. Product leakage could cause severe environmental damage or explosion resulting in death, serious personal injury, property loss and equipment damage.

Observe the following precautions:

1. Read and follow all instructions in this manual, including all safety warnings.
2. Comply with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes.
3. Before installing this device, turn Off, tag/lock out power to the system, including console and submersible pumps.
4. To protect yourself and others from being struck by vehicles, block off your work area during installation or service.
5. Substitution of components may impair intrinsic safety.

Before You Begin

- Comply with all recommended safety practices identified by OSHA (Occupational Safety and Health Administration) and your employer.
- The canister can only be installed in systems with a vapor recovery vent stack fitted with a UL Listed pressure/vacuum (P/V) valve that complies with California Air Resources Board (CARB) requirements and operates between -8 and +6 inches water column. The outlet of the carbon canister vapor valve has the same classified area requirements as the P/V valve per figure 3 and is subject to approval by the local authority having jurisdiction.
- Where separate intrinsically safe circuits are installed in the same raceway they must be segregated in accordance with Article 504 of the NEC.
- Review and comply with all the safety warnings in the installation manuals and any other national, state or local requirements.
- Consult figure 4 along with the National Electrical Code and the compliance section of 576013-879 TLS-3XX Series Consoles Site Prep Manual before installing the CCVP into the hazardous location. If the Carbon Canister is being wired directly to a TLS console, a 2-conductor, 18 AWG shielded cable must be installed in intrinsically safe conduit from the intrinsically safe wiring compartment of the TLS console to the carbon canister. Use of direct burial cable may be subject approval by the local authority having jurisdiction. See manual 576013-858 for a complete listing of required materials and an overview of direct burial installations.
- Use only UL certified Gas/TFE yellow Teflon tape on all fittings. Do not use pipe dope to seal pipe threads or fittings in and out of the CCVP.
- Customer supplied vent riser and vent riser fittings shall be standard full weight (ASTM Schedule 40) wrought iron or steel.
- Vapor polisher installation kit provides either 2" tee (Form Number 861290-002) or 3" reducing tee with busing (Form Number 861290-003) to reduce to 1/2" NPT. Customer supplied reducing tee must not reduce from 2" or 3" to less than 1/2" NPT. If tee reduces to larger than 1/2" use appropriate bushing to reduce the tee to 1/2" NPT.
- For new or rebuilt sites, it is recommended that the installation design specify a threaded fitting for joining the vent pipes to the underground piping system.
- Modification to plumbing in the inlet flow path (i.e., excessive bends) to the CCVP can result in non-compliance with local codes (ARB Exhibit 11 test) and may adversely affect performance if these installation guidelines are not followed. No liquid traps permitted.
- Vent riser threads shall be in accordance with the standard for pipe threads, general purpose (inch) ANSI/ASME B1.20.1-1983.
- The CCVP outlet shall be not less than 12 feet from grade.
- The CCVP outlet shall be located at least 15 feet from powered ventilation air intake devices.
- The CCVP must be mounted vertically.
- The structure to which the CCVP is mounted must be plumb and perpendicular to grade and independently supported and comply with all applicable codes.
- Offset piping and inlet piping to the CCVP shall be installed to avoid bends. No liquid traps permitted.
- Figures and illustrations in this manual represent typical installations and due to site variation, cannot represent all installation situations. Final installation must comply with instructions provided in this manual and all required codes per the jurisdiction having authority.

Veeder-Root Parts

- Veeder-Root Carbon Canister Vapor Polisher, Form No. 861290-002.

Table 1. CCVP 2" Installation Kit

Item	Qty.	Description	P/N
1	1	Carbon Canister	332761-002
2	1	Inlet Piping Kit	330020-638
3	1	2" Mounting Bracket Kit	330020-647
4	1	Group - 2" Pipe and Reducing Tee	332954-002
5	1	CCVP Installation Instructions	577013-920

- Veeder-Root Carbon Canister Vapor Polisher, Form No. 861290-003.

Table 2. CCVP 3" Installation Kit

Item	Qty.	Description	P/N
1	1	Carbon Canister	332761-002
2	1	Inlet Piping Kit	330020-638
3	1	3" Mounting Bracket Kit	330020-648
4	1	Group - 3" Pipe, Reducing Tee & Bushing	332954-003
5	1	CCVP Installation Instructions	577013-920

- Veeder-Root CCVP replacement parts kits. Note: Replacement part kits are not included with new canister assemblies and must be ordered separately, as needed. See the maintenance section of this manual for details.

Table 3. CCVP Replacement Parts Kits

Item	Qty.	Description	P/N
1	1	Valve Enclosure Assembly Kit	330020-643
2	1	Sensor Housing Kit	330020-644
3	1	Filter Kit	330020-645
4	1	Temperature Probe Kit	330020-653

Standard Vent Stack Installation Procedure

1. This procedure requires Veeder-Root installation kits and parts. When using customer provided parts refer also to the alternate vent stack installation procedures.
2. The TLS-3XX Site Prep Manual, P/N 576013-879, must be consulted for the proper installation of a direct-wired carbon canister into hazardous locations. The TLS RF Wireless 2 System (W2) Installation Manual (P/N 577013-964) and document 331940-012, must be consulted for the proper installation of a wireless carbon canister into hazardous locations.
3. During the installation, all required national, state and local safety codes must be followed.
4. The CCVP contains an integral vapor valve that operates in conjunction with the pressure/vacuum (P/V) vent. Location of the vapor valve outlet must conform to the same requirements as the P/V vent. Reference Article 514 of the National Electrical code (NEC) and NFPA 30/30A.
5. Do not install the CCVP on unsupported vent pipes. For all customer supplied supports or strut assemblies, wind loading must comply with all required local, state and national codes and shall be rated for 88 pounds (minimum) static load.
6.  **IMPORTANT! To ensure that the canister outlet is 12 feet (minimum) above grade, the CCVP mounting bracket must be positioned according to dimensions shown in Figure 1 and the U-bolts tightly clamped to the support structure before mounting the canister. The mounting bracket must be centered in line with the outlet of the tee before installing the CCVP.**
7. Following all required national, state, local and site safety precautions, carefully hang the CCVP's notched support tabs onto the top two side studs of its mounting bracket (Step 1 in Figure 2), swing the canister down until all of the slots in the canister's side mounting tabs seat against the studs in the bracket (Step 2 in Figure 2), then tighten the six side nuts to secure the canister onto its bracket (Step 3 in Figure 2).
8. Figure 3 shows important Class I Div 1, Group D and Class I Div 2, Group D radius spheres and operability test valve handle positions of the installed canister.
9. For installations using the TLS RF Wireless System, skip to Step 15. For installations using a direct-wired CCVP, go to Step 10.
10. Install weather tight junction box, seal off and conduit per all NEC, state and local codes (see example installation in Figure 1).
11. Connect the two-pin connector of the 6-foot cable provided in the installation kit to the CCVP vapor valve, observing plug polarities (see Figure 4). The other end of this cable is passed through a kit supplied cord grip in the upper junction box.
12. Connect the white wire of the two conductor cable from the vapor valve to the positive sensor wire from the TLS console smart sensor interface module (see Figure 5). Connect the black wire on the two conductor cable to the negative sensor wire from the TLS console smart sensor interface module.
13. Following the instructions in Figure 6, seal the wire nuts of each of the two cable connections in the epoxy pack provided.
14. Attach CCVP vapor valve field wiring to the smart sensor interface module in the TLS console as shown in Figure 7.
15. Connect all lower fittings, valve and tubing between the vent pipe and the lower manifold on the CCVP (see Figure 3).
16. See the Test Port Installation section to install a test port for the Exhibit 12 test.
17. Confirm ball valve is in the open, canister to vent stack position (per Figure 3), then insert the clevis pin and secure with the hitch pin.
18. A passing pressure decay test, in accordance with CARB TP-201.3, must be completed after the CCVP is installed (see Exhibit 4 of VR 203 / VR 204).
19. A passing operability test must be completed in accordance with the procedures defined in VR 203 / VR 204 Exhibit 11 & 12.

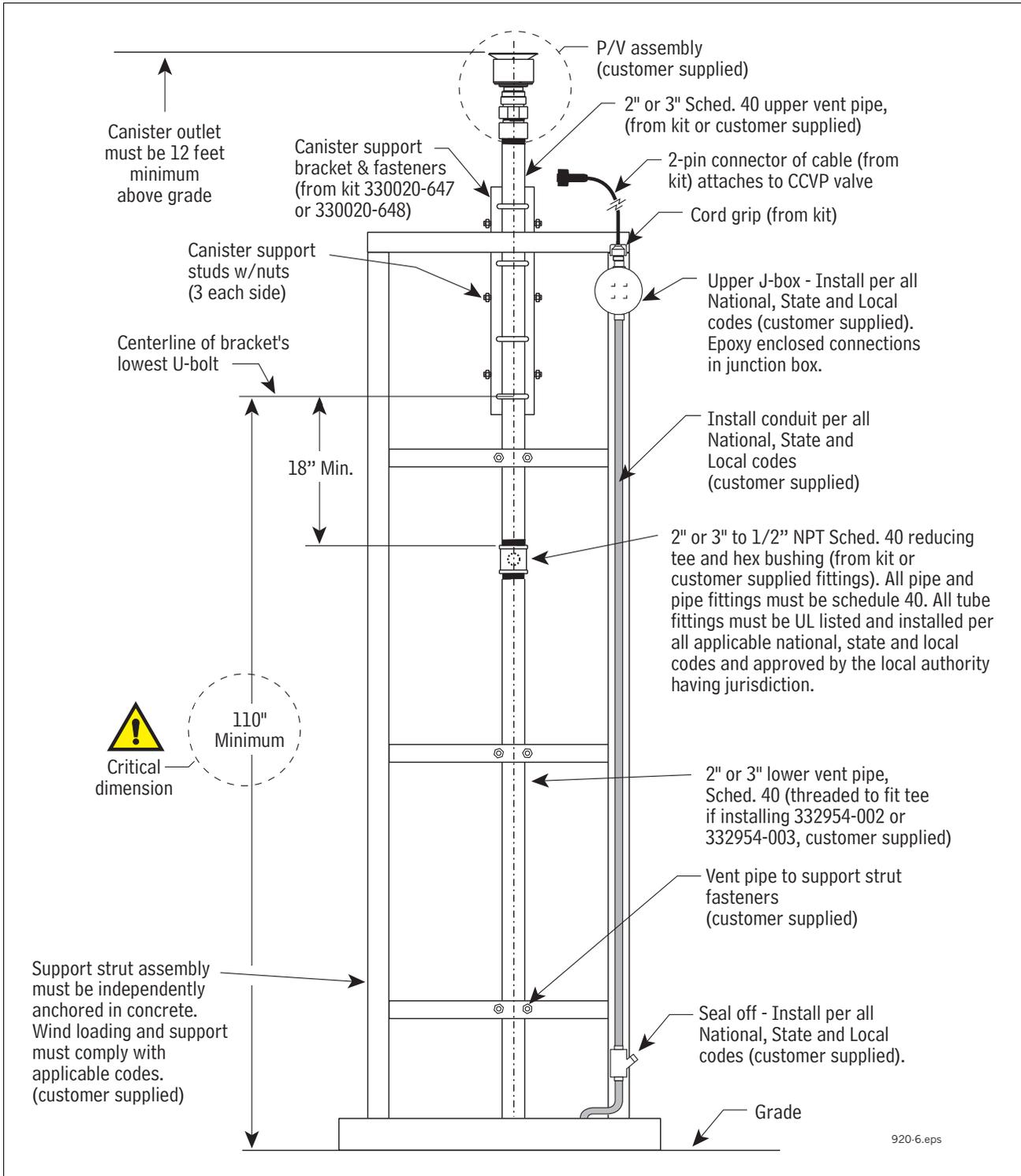


Figure 1. Typical direct wired installation example

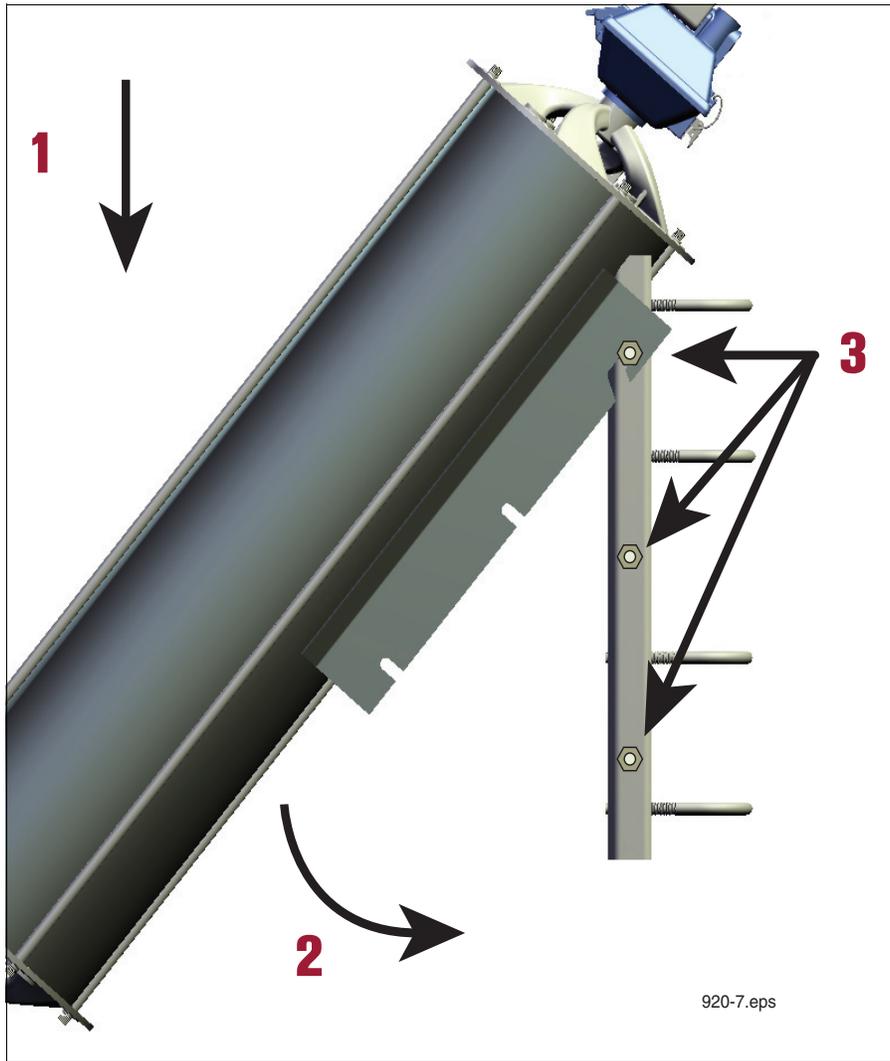


Figure 2. Installing CCVP onto bracket

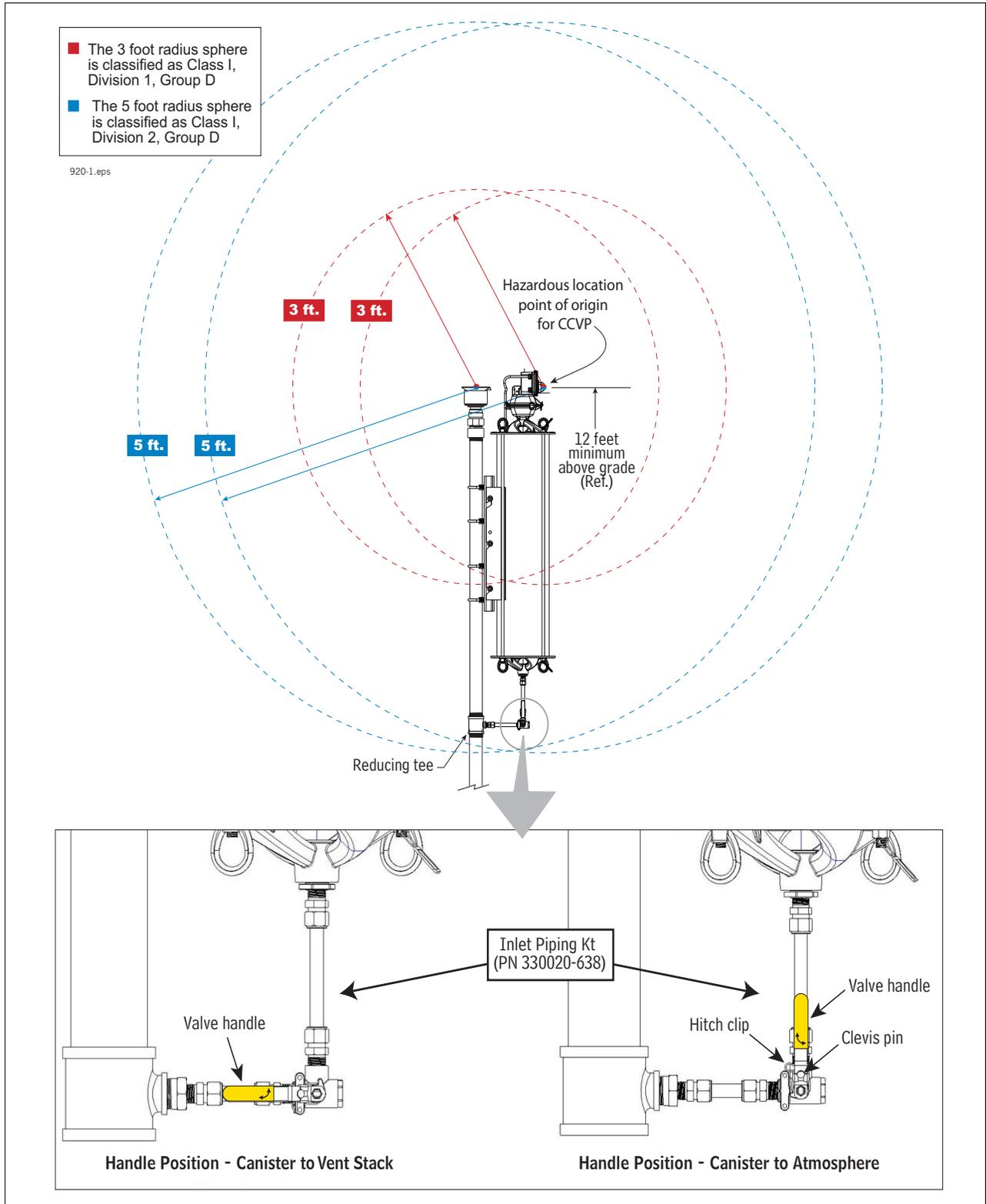


Figure 3. Inlet plumbing detail and classified area definition

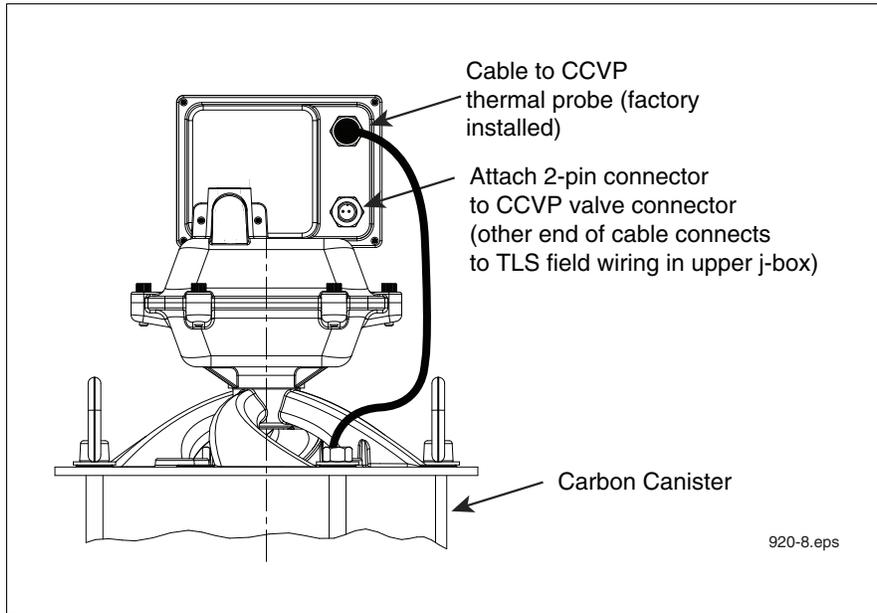


Figure 4. Locating the CCVP vapor valve connector

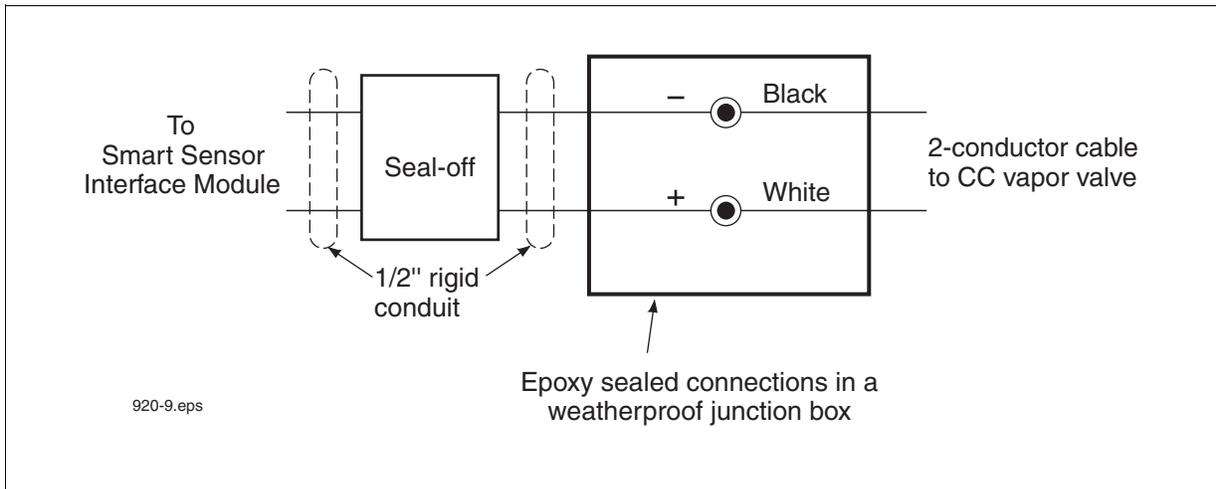


Figure 5. Field wiring CCVP vapor valve - direct-wired CCVP only

A

B

C

Make sure that the ends of the cable sheathing are submerged in sealant

Tie wrap

Wire nuts

INSTRUCTIONS:

NOTE: When temperature is below 50°F (10°C), keep resin in a warm place prior to mixing (e.g., in an inside pocket next to body).

1. Open epoxy sealant package, and remove resin pak.
2. Holding resin pak as shown in A, bend pak along long length.
3. As shown in B, firmly squeeze the RED SIDE of the resin, forcing it through the center seal and into BLACK SIDE.
4. Mix thoroughly to a uniform color by squeezing contents back and forth 25-30 times.
5. Squeeze mixed, warm resin into one end of bag and cutoff other end.
6. Slowly insert wiring connections into sealing pack until they fit snugly against the opposite end as shown in C.
7. Twist open end of bag and use tie wrap to close it off and position the tie wrapped end up until the resin jells.

CAUTION: Epoxy sealant is irritating to eyes, respiratory system, and skin. Can cause allergic skin reaction. Contains: epoxy resin and Cycloaliphatic epoxy-carboxylate.

Precautions: Wear suitable protective clothing, gloves, eye, and face protection. Use only in well ventilated areas. Wash thoroughly before eating, drinking, or smoking.

920-10.eps

Figure 6. Epoxy sealing CCVP vapor valve field wiring connections - direct-wired CCVP only

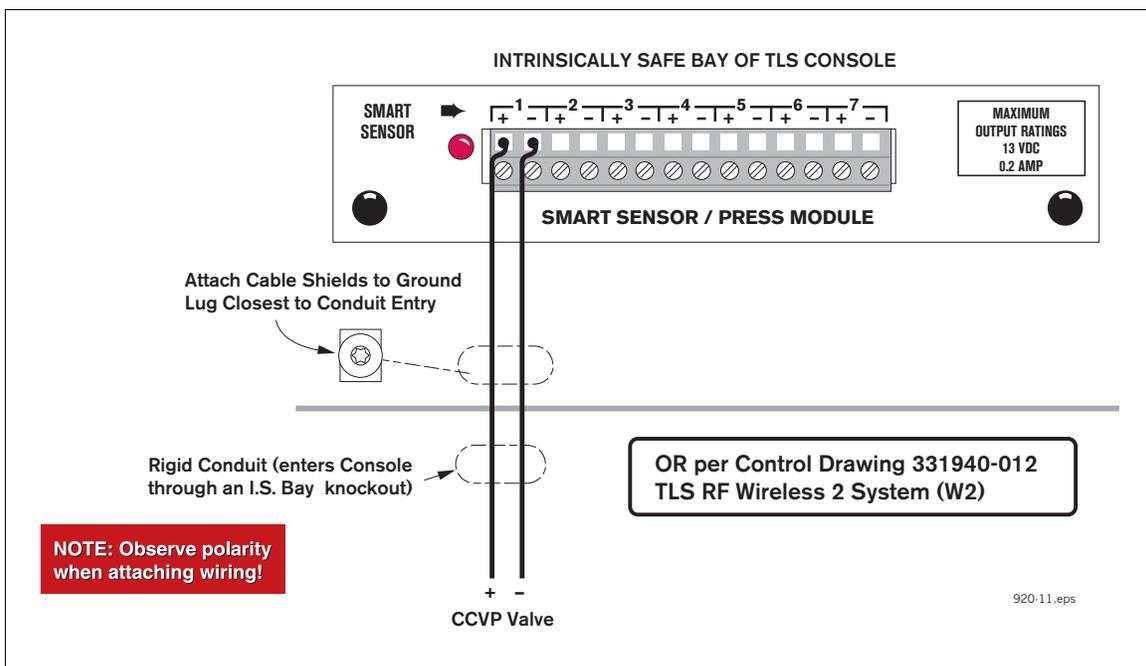


Figure 7. Attaching CCVP vapor valve wiring to TLS-350 console - direct-wired CCVP only

Alternate Vent Stack Installations



IMPORTANT!

When a canister is not installed directly to a vent pipe, it is the responsibility of the site owner(s) to:

1. Provide suitably rated mounting locations designed for 88 pounds (minimum) static load.
2. Provide adequate wind loading per all applicable local codes.
3. Follow all recommendations providing an unrestricted flow path into the canister that is free of liquid traps and minimizes the number of bends and turns in the piping. Any departure from the specified installation procedures, must conform to all local code requirements per the jurisdiction having authority.
4. All standard vent stack installation procedures and applicable codes, etc., apply.

Additional requirements are as follows:

- CCVP outlet shall be located not less than 5 feet above the canopy, see NFPA 30: 2008, clause 5.6.3.
- The total length of the tubing (installed horizontally and vertically) between the 3-way valve and the CCVP can not exceed 12 feet. Horizontal lengths shall have a minimum slope of 1/8-inch per foot back to the 3-way valve to drain.
- The horizontal length of tubing between the vent stack and the 3-way valve must not exceed 15 inches. If a horizontal length of more than 15 inches is required, follow the offset riser mounting installation procedures. No liquid traps permitted.
- Customer can supply the following inlet piping materials:
 - 5/8" O.D. x 0.065 wall thickness hard temper copper tubing. Alternatively, customer supplied standard full weight (ASTM Schedule 40) wrought iron or steel pipe (1/2" I.D. minimum) can be substituted subject to applicable codes.
 - ASTM Schedule 40 wrought iron or steel, 2" or 3" vent riser pipe and pipe fittings
- Vapor Polisher installation kit provides either 2" tee (Form Number 861290-002) or 3" reducing tee with bushing (Form Number 861290-003) to reduce to 1/2" NPT. Customer supplied reducing tee must not reduce from 2" or 3" to less than 1/2" NPT. If tee reduces to larger than 1/2" use appropriate bushing to reduce the tee to 1/2" NPT.
- 3-way valve from the inlet piping kit must be used.

Follow the standard installation procedures when installing vapor polishers in configurations similar those in Figure 8 and Figure 9. All installations of this type must comply with NFPA 30/30A and NFPA 70 and are subject to the approval of the local authority having jurisdiction.

Alternate Vent Stack Installations

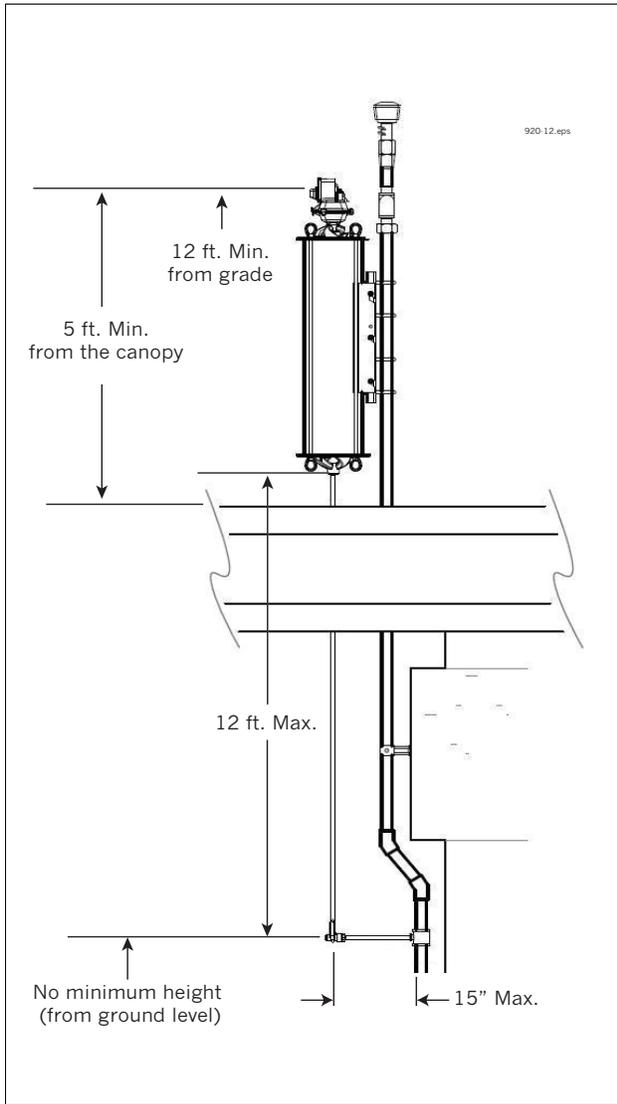


Figure 8. Through canopy w/extended plumbing

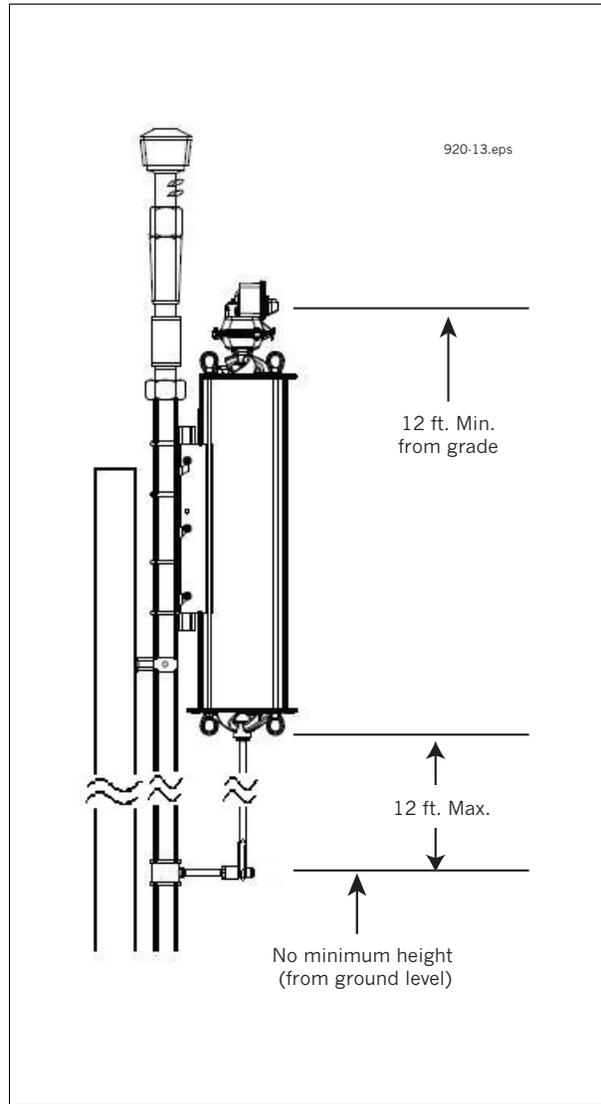


Figure 9. Vent stack mounting

Offset Mount Installations

An offset mount is any installation where the CCVP is not mounted on the P/V vent stack. The CCVP can be mounted to a flat surface, or installed on an offset riser, that is plumbed to the vent stack (see Figure 10 and Figure 11).

The horizontal length of standard inlet piping between the vent stack and the 3-way valve must not exceed 15 inches. If a horizontal length of more than 15 inches is required, use 2-inch minimum pipe. No liquid traps permitted.

The manifold pipe between the vent riser and canister must not exceed 100 feet in length and must be at least 2-inch schedule 40 pipe with no liquid traps present and slope 1/8-inch per foot back to the vent riser to drain. To prevent the CCVP inlet piping from supporting the offset piping weight, provide additional support as required. Offset piping must be capped and comply with applicable local codes.

Flexible connections may be required by local jurisdiction having authority when offset mounting.

Flexible connections between the CCVP's offset piping and the vent riser are allowable if required by the local authority having jurisdiction to meet seismic requirements.

- Should the flex connection be installed such that it is not supported, the slope of the flex connection from the CCVP back to the vent riser shall be greater than the 1/8-inch per foot slope required for the rest of the piping.
- The flexible connector must be UL approved for a service station above-ground application.
- The local contractor is responsible to provide all necessary schedule 40 piping, pipe fittings and pipe cap.
- The Hazardous Location Area Classification shown for the CCVP in Figure 3 must be considered from the point of origin for all offset mountings.

FLAT MOUNTING

1. The bracket in the installation kit must be used.
2. The mounting point must comply with all applicable codes.
3. The mounting method must be sufficiently rated for 88 pounds as per applicable building codes.
4. If bolting the mounting bracket to the mounting surface, use a minimum of 4 bolts.

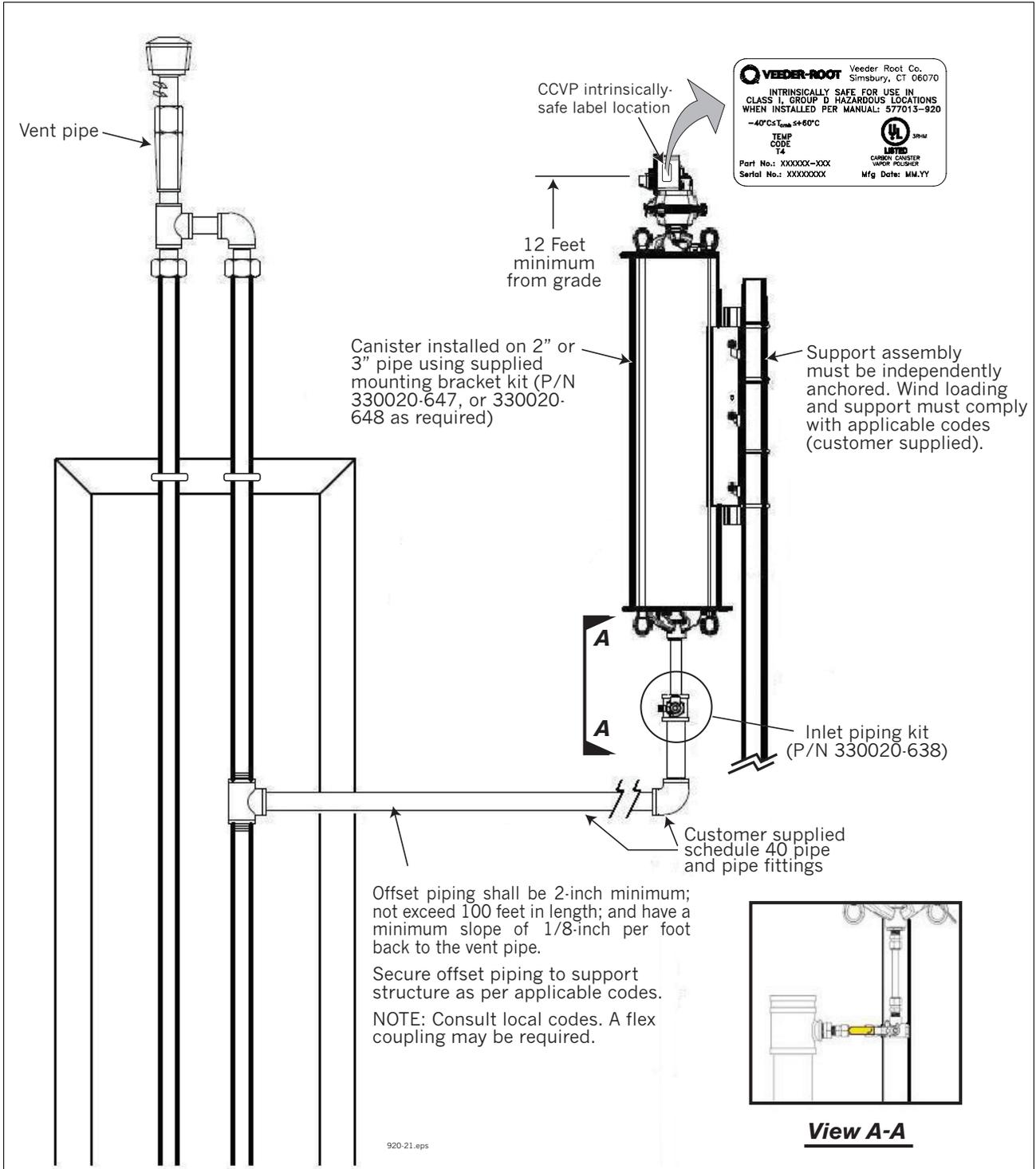


Figure 10. Offset mount on a 2" or 3" pipe

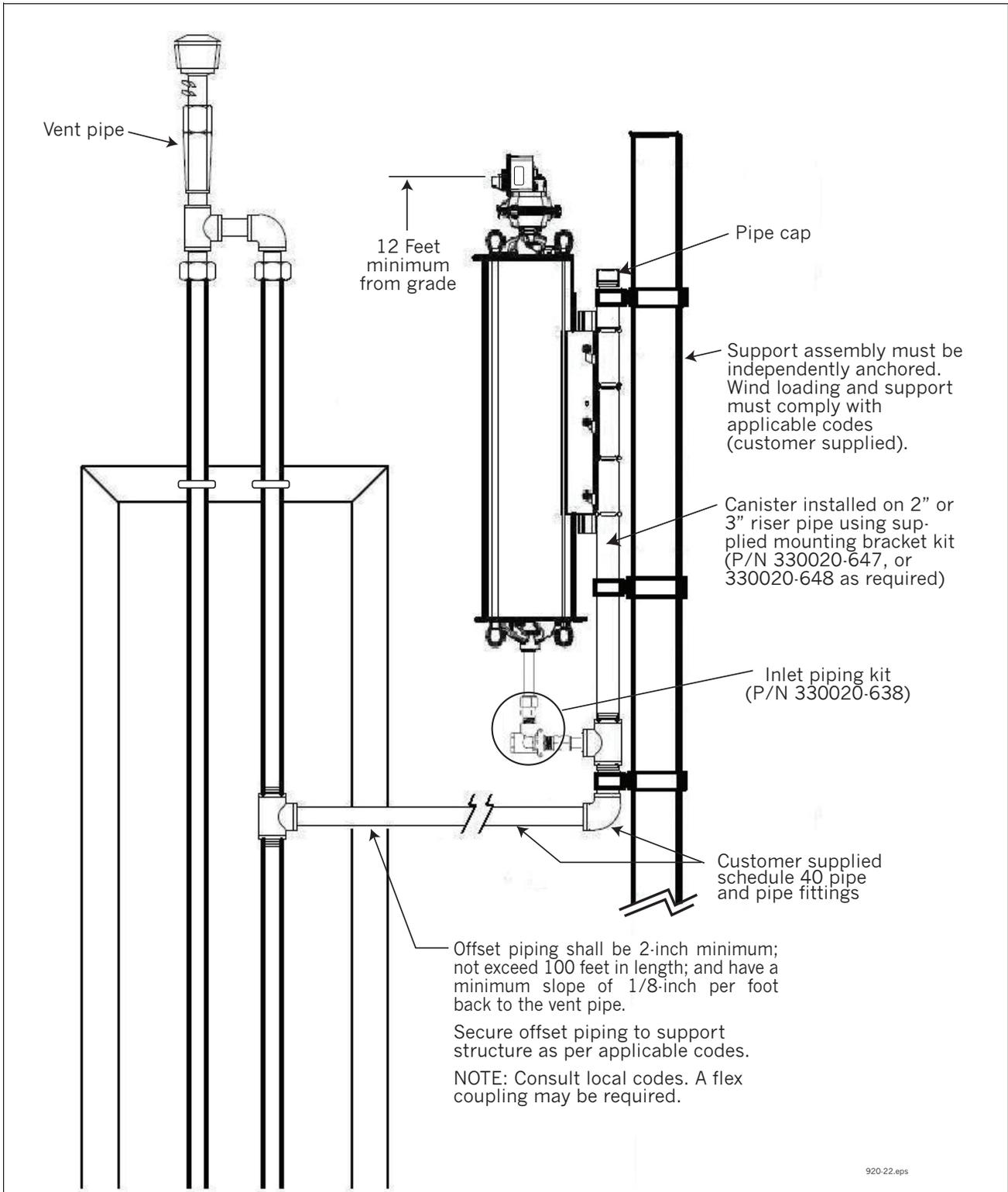


Figure 11. Offset mount on a supported riser

Test Port Installation

Standard Installation Procedure

1. Remove 1/4-inch plug from upper manifold.
2. Install customer supplied schedule 40, 1/4-inch male-to-male with 90 degree elbow NPT fitting by applying Teflon™ tape to the threads and tighten 1/4 turn past snug.
3. Install the outlet test port cap by applying Teflon™ tape to the threads and tighten the cap 1/4 turn past snug.
4. Perform the CCVP integrity test (VR-203 & VR-204 Exhibit 11).

Alternate Lowering of the Upper Test Port

In some installations it may be desirable to have the upper test port more accessible. The steps below describe this procedure.

1. Refer to Figure 12 to install optional piping necessary to lower the CCVP's operability (upper) test port.
2. Use schedule 40, 1/4-inch pipe and pipe fittings (customer supplied) - install per all applicable codes.
3. Perform the CCVP integrity test (VR-203 & VR-204 Exhibit 11).

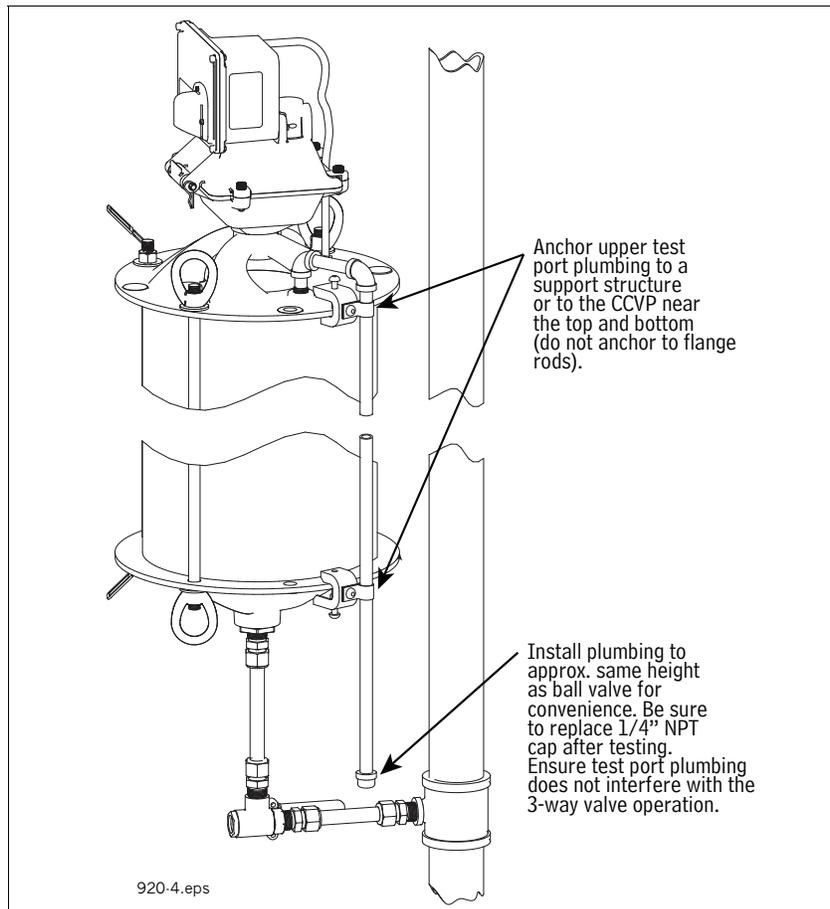


Figure 12. Optional lowering of upper test port

Maintenance

Sensor Housing Kit (P/N 330020-644)

1. Remove the three #25 torx screws holding the sensor housing assembly to the vapor valve assembly (see Figure 13).
2. Pull the sensor housing assembly straight out (unplugging it).
3. Align the replacement sensor housing assembly's connector with the connector in the vapor valve assembly and push in the assembly until it seats against the vapor valve assembly (see Figure 14).
4. Replace the three #25 torx screws in the sensor housing assembly cover until tight.

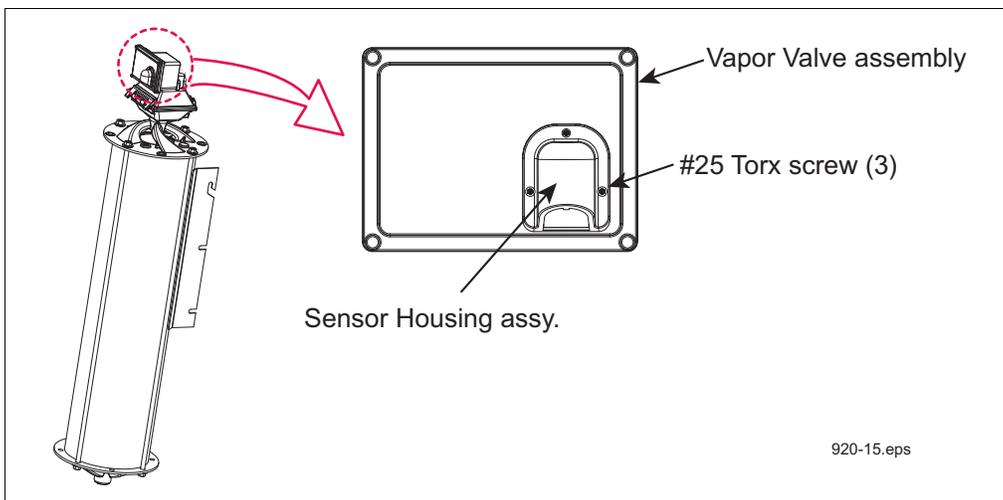


Figure 13. Removing sensor housing assembly

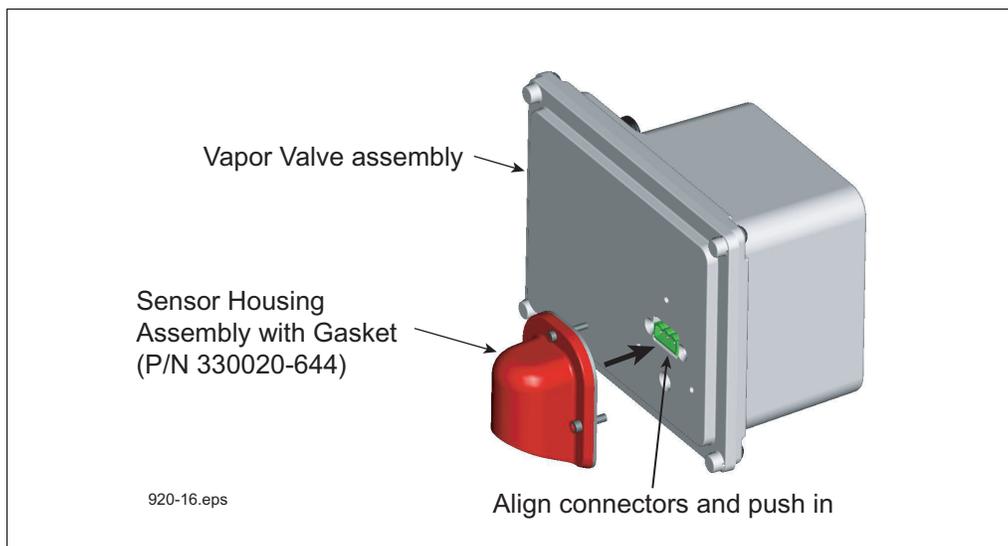


Figure 14. Replacing sensor housing assembly

Filter Kit (P/N 330020-645)

1. Remove the four 1/4-20 x 1 inch hex key bolts from the top of the vapor valve filter housing (see Figure 15).
2. Swing the housing top back and remove the filter plate from its seat and the o-ring from its groove in the vapor valve filter housing's lower half (see Figure 16).
3. Install a new o-ring in the groove and insert a new filter plate into its seat in the lower half of the housing, close the cover and screw in the four 1/4-20 hex key bolts until tight.
4. Perform the CCVP integrity and flow test (VR-203 & VR-204 Exhibit 11).

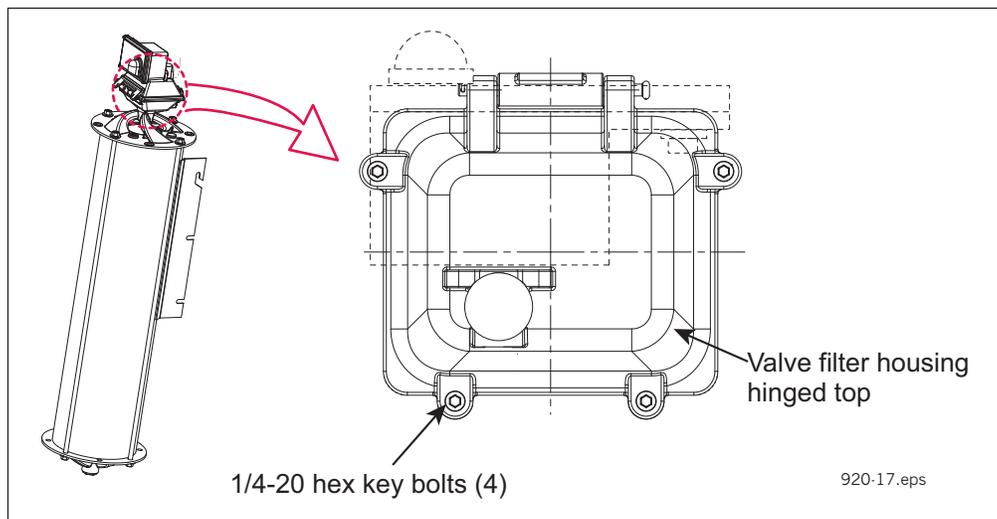


Figure 15. Accessing the valve filter and o-ring

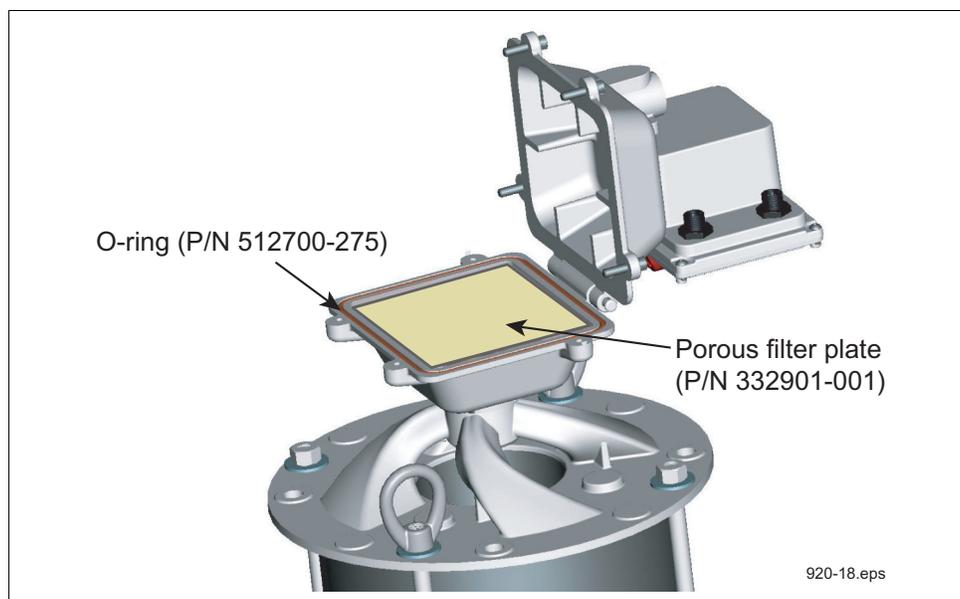
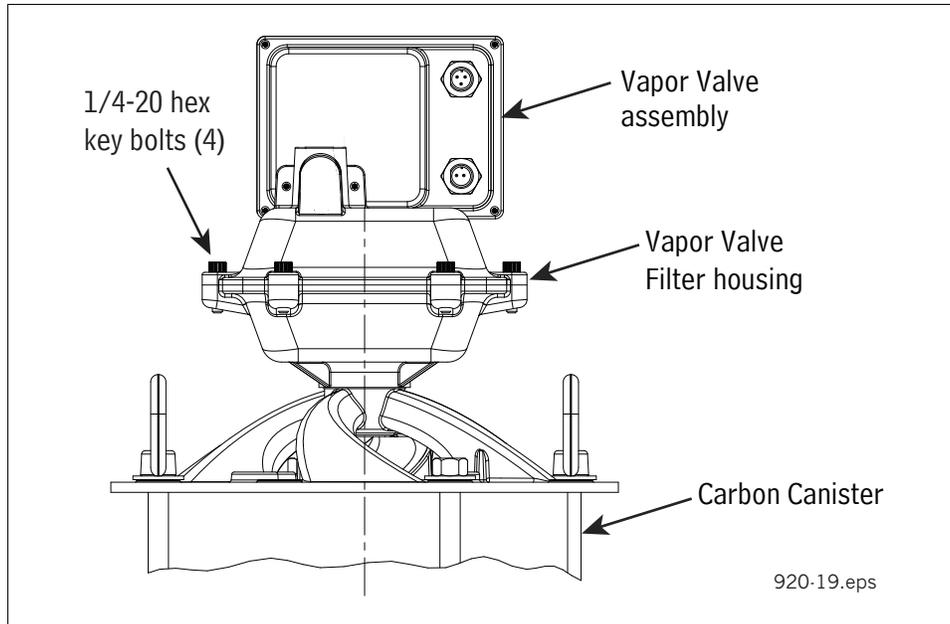


Figure 16. Replacing the valve filter and o-ring

Valve Enclosure Assembly Kit (P/N 330020-643)**Figure 17. Removing vapor valve assembly**

1. Remove the cables from the two connectors on the rear of the vapor valve assembly.
2. Remove the four 1/4-20 x 1 inch hex key bolts from the top of the vapor valve filter housing (see Figure 17).
3. Remove the hitch clip from the long clevis pin in the front hinge of the vapor valve assembly and vapor valve filter housing (see Figure 18).
4. Push the long clevis pin out and free of the hinge bores and lift up the vapor valve assembly. Be careful not to damage the filter in the vapor valve filter housing.
5. Place the new vapor valve assembly onto the vapor valve filter housing and push the long clevis pin through the hinge bores. Insert the hitch pin in the hole in the end of the clevis pin.
6. Screw in the four 1/4-20 hex key bolts until tight.
7. Reconnect the two cables to the two connectors on the vapor valve assembly.
8. Perform the CCVP integrity and flow test (VR-203 & VR-204 Exhibit 11).

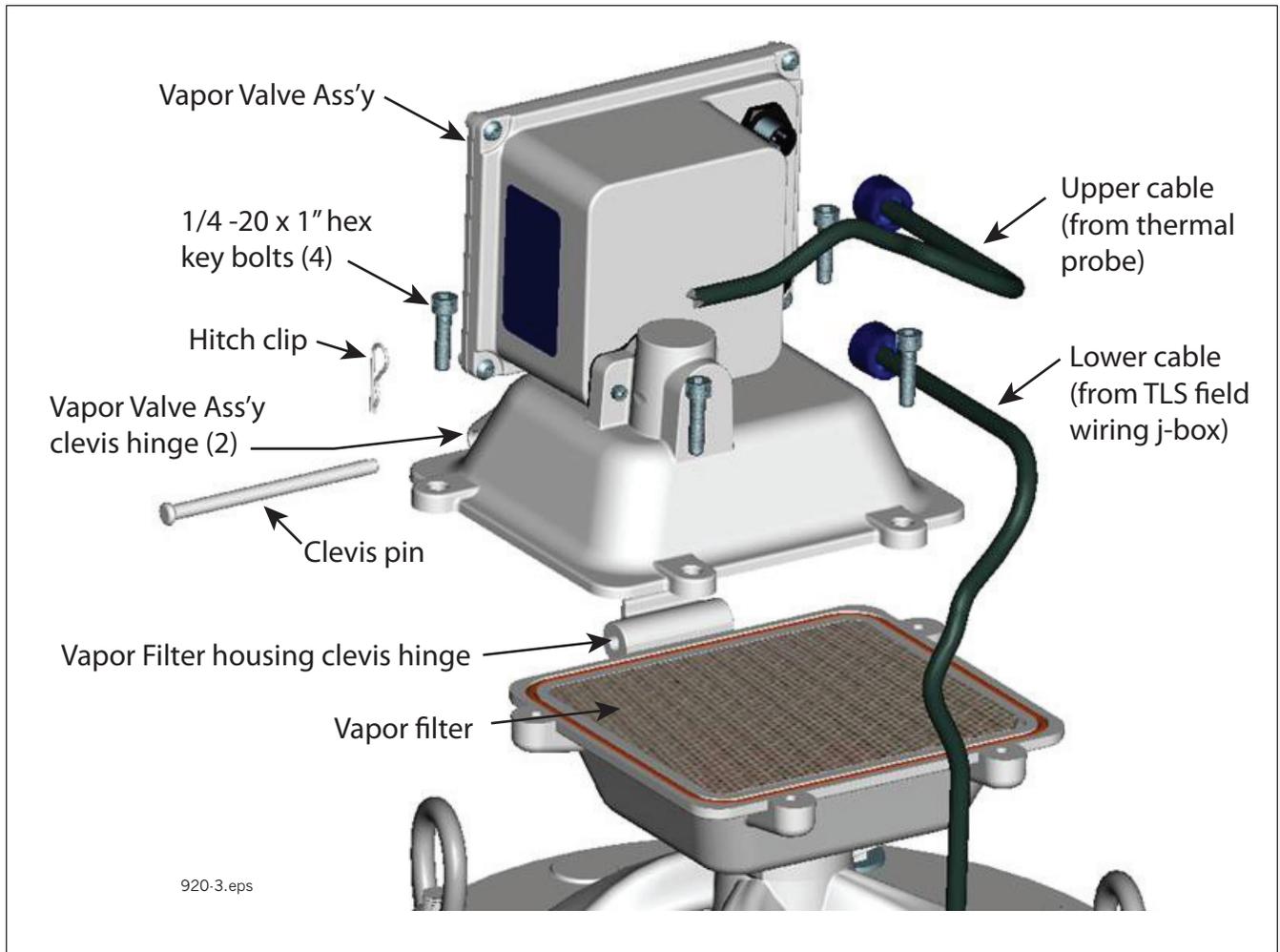


Figure 18. Replacing vapor valve assembly

Thermal Probe Kit (P/N 330020-653)

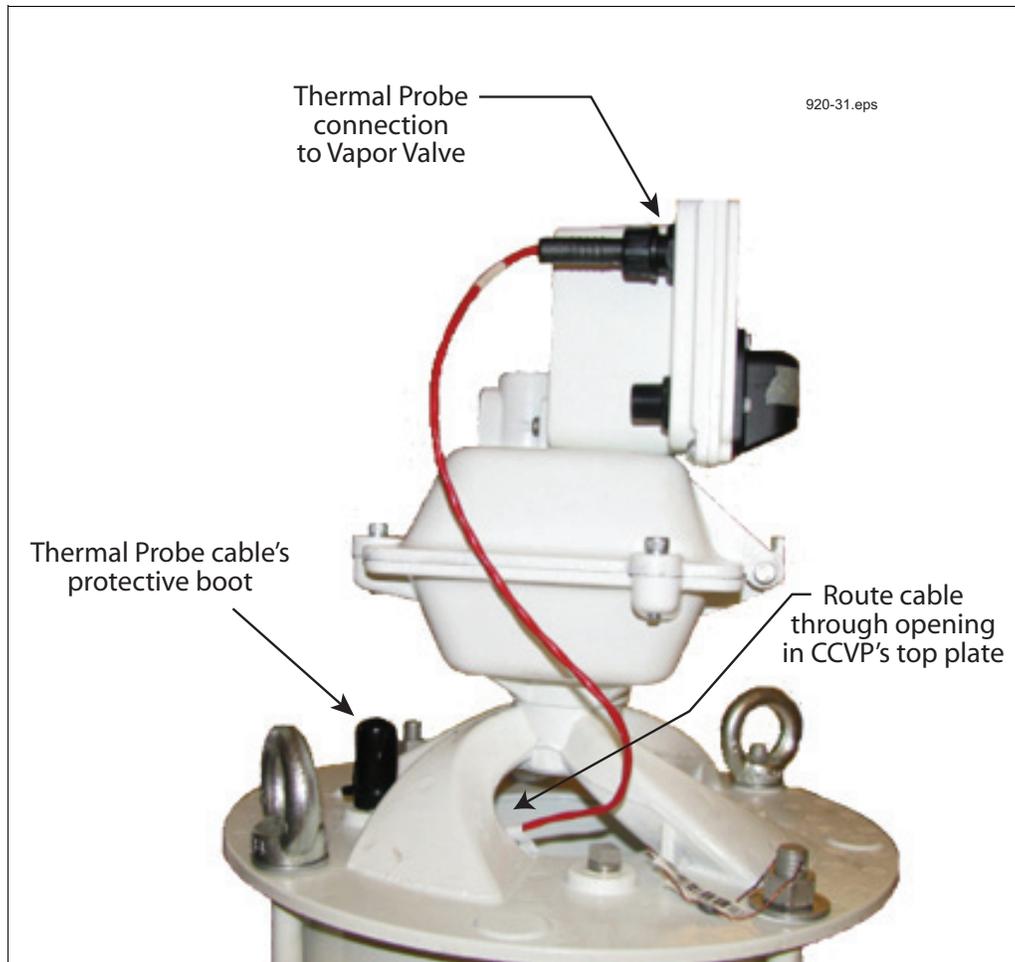


Figure 19. CCVP thermal probe

1. Cut the tie wrap around the thermal probe's protective boot and remove and set aside the boot. Remove the thermal probe cable connector from the back of the vapor valve assembly (see Figure 19).
2. Using a 9/16-inch open-end wrench, remove the thermal probe from the top of the CCVP.
3. Install and tighten the replacement thermal probe into its port in top of the CCVP.
4. Route the thermal probe connector cable through the opening in the top of the CCVP as shown in the above figure and attach the cable connector to the top port on the rear of the vapor valve assembly.
5. Make a small bend in the thermal probe cable no more than one inch above the probe hex nut (see Figure 20).
6. Slide the boot over the bend of the cable and push it down over the probe's hex nut until it rests on the top of the CCVP. Get a tie wrap from the kit and position it around the end of the boot just under the probe's hex nut and tighten it (see Figure 21).
7. Perform the CCVP integrity and flow test (VR-203 & VR-204 Exhibit 11).

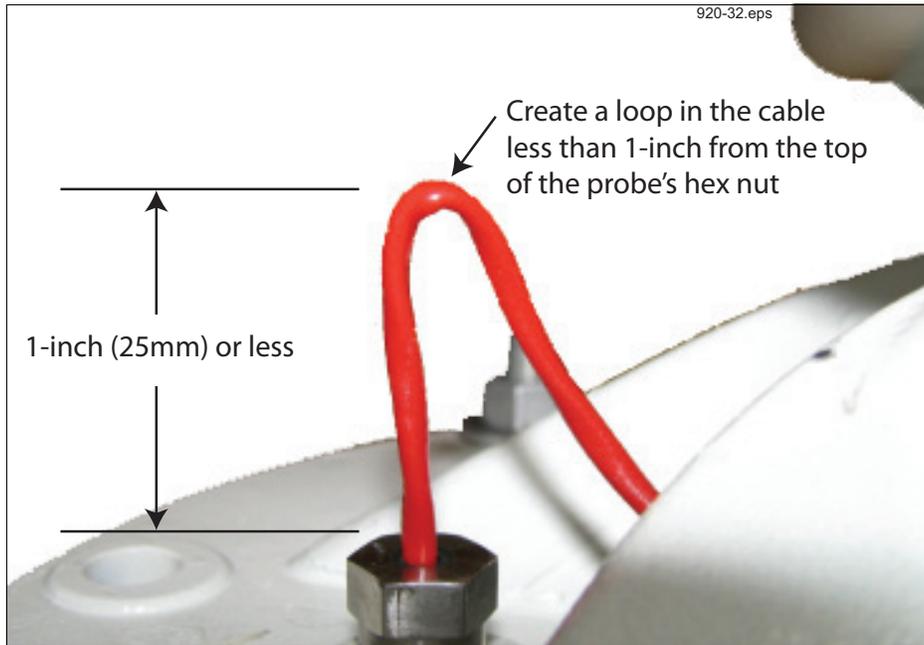


Figure 20. Preparing the thermal probe cable for the protective boot

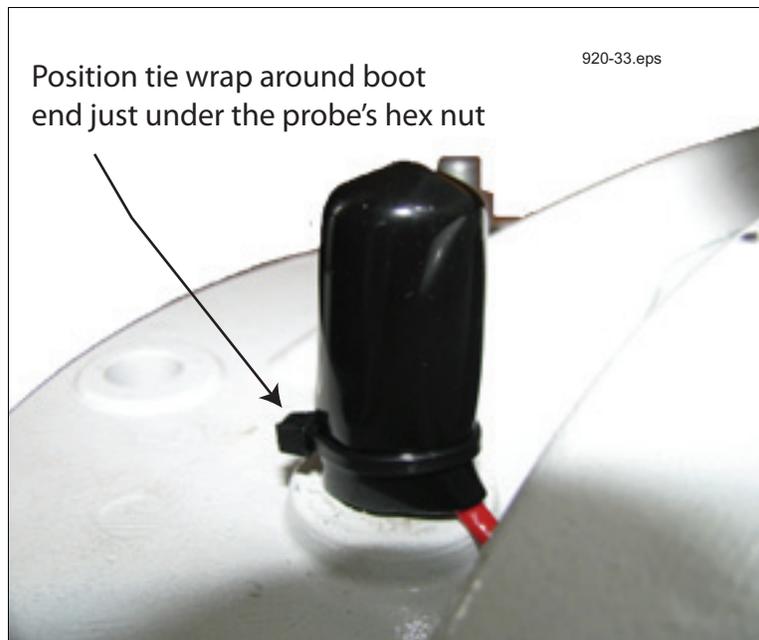


Figure 21. Positioning the tie wrap over the probe cable's protective boot



ISD Balance Vapor Flow Meter

Installation Guide



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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.

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

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2. Fax signed Bill of Lading (BOL) to Veeder-Root Customer Service at 800-234-5350.
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For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

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ISD Vapor Flow Meter Installation

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ISD Vapor Flow Meter Installation

This manual contains instructions to install a Veeder-Root ISD (In-Station Diagnostic) Vapor Flow Meter in a dispenser's vapor return line in balance systems.

This manual assumes all preliminary site preparation is completed, and that wiring from the console to the Vapor Flow Meter junction box is in place and meets the requirements set out in the TLS-3XX Series Site Prep and/or TLS RF Wireless 2 system (W2) installation manuals.

Contractor Certification Requirements

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

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

ATG Technician (Level 2/3 or 4) Certification: Contractors holding valid ATG Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- Wireless 2
- Tall Tank

VR Vapor Products Certification: Contractors holding a certification with the following designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- ISD – In Station Diagnostics
- PMC – Pressure Management Control
- CCVP - Veeder-Root Vapor Polisher
- Wireless – ISD/PMC Wireless
- A current Veeder-Root Technician Certification is a prerequisite for the VR Vapor Products course.

Warranty Registrations may only be submitted by selected Distributors.

Related Documents

576013-879 TLS-3XX Series Consoles Site Prep Manual

VST-IOM / Section 16 / VR-204 In-Station Diagnostics Install, Setup & Operation Manual

331940-012 TLS-RF System Control Drawing

577013-964 TLS RF Wireless 2 System (W2) Installation and Maintenance Guide

Safety Precautions

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

 <p>EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.</p>	 <p>FLAMMABLE Fuels and their vapors are extremely flammable.</p>
 <p>ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p>TURN POWER OFF Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>
 <p>READ ALL RELATED MANUALS Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>	 <p>USE SAFETY BARRICADES Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.</p>
 <p>WARNING Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.</p>	 <p>WEAR EYE PROTECTION Wear eye protection when working with pressurized fuel lines or epoxy sealant to avoid possible eye injury.</p>
 <p>INJURY Careless or improper handling of materials can result in bodily injury.</p>	 <p>GLOVES Wear gloves to protect hands from irritation or injury.</p>

⚠ WARNING

     	<p>This product is to be installed and operated in the highly combustible environment of a gasoline dispenser where flammable liquids and explosive vapors may be present. Improper installation could cause damage to property, environment, resulting in serious injury or death.</p> <p>The following hazards exist:</p> <ol style="list-style-type: none"> 1. Electrical shock resulting in serious injury or death may result if power is on during installation and the device is improperly installed. 2. Product leakage could cause severe environmental damage or explosion resulting in death, serious personal injury, property loss and equipment damage. <p>Observe the following precautions:</p> <ol style="list-style-type: none"> 1. Read and follow all instructions in this manual, including all safety warnings. 2. Comply with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes. 3. Before installing this device, turn Off, tag/lock out power to the system, including console and submersible pumps. 4. To protect yourself and others from being struck by vehicles, block off your work area during installation or service. 5. Substitution of components may impair intrinsic safety.
--	--

Before You Begin

- A level 1 or higher certified Veeder-Root Technician must be available (on site) to assist in this type of installation.
- Comply with all recommended safety practices identified by OSHA (Occupational Safety and Health Administration) and your employer.
- Follow all installation requirements as per NFPA (National Fire Protection Association) 30, 30A, and 70.
- Review and comply with all the safety warnings in the installation manuals and any other national, State or Local requirements.
- When direct wiring to a TLS console, a 2-conductor, 18 AWG shielded cable must be installed in intrinsically safe conduit from each dispenser to the intrinsically safe wiring compartment of the TLS console.
- Debris from plumbing modifications should be flushed through the piping system prior to installing the ISD Vapor Flow Meter.
- Use only UL recognized Gas/TFE yellow teflon tape on all fittings. Do not use pipe dope to seal pipe threads or fittings in and out of the ISD Vapor Flow Meter.

Veeder-Root Parts

- Sensor Installation Kit, see Table 1.

Table 1. Vapor Flow Meter Installation Kit (P/N 330020-585)

Item	Qty.	Description	P/N
1	1	ISD Vapor Flow Meter	332374-002
2	2	Flange with 1" NPT threaded hole	332091-001
3	4	5/16-18 UNC-2B x 3/4" hex head bolt	514100-426
4	2	1-11.5 NPT x 2 " male to male threaded steel nipple	576008-655
5	2	O-ring (Parker size # 2-218, Nitrile)	512700-258
6	1	Cord grip group	331028-001
7	1	Sealing pack	
8	2	Wire nut	576008-461
9	2	Tie wrap	510901-337
10	4	5/16" Lock washer	514100-436

Tools Required

- Pipe wrench suitable for tightening 1-inch NPT pipe.
- 1/2" socket wrench to install Vapor Flow Meter flange bolts.
- Necessary pipe fitter's equipment and a non-hazardous work space suitable to modify dispenser vapor line for Vapor Flow Meter installation, when necessary.

Installation Steps - Balance Systems Above Shear Valve



1. Before installing this device, turn off, tag/lock out power to the system, including console and submersible pumps.
2. Remove the dispenser's lower sheet metal doors to access the vapor plumbing.
3. Loosen any factory installed mounts and/or brackets in order to provide room to disconnect any factory installed vapor return plumbing from the shear valve.
4. Disconnect the factory installed vapor return plumbing from the vapor shear valve (see Figure 1).
5. Remove any unneeded field installed plumbing above the vapor shear valve. The Vapor Flow Meter with flanges attached can be used for sizing the required head space of approximately 8 inches. Approximately 3 inches of clearance is required on both sides of the piping to accommodate the width of the meter body.
6. Thread one of the flanges (two provided in installation kit) onto the dispenser vapor return piping.

Note: Prior to modifying any piping in the dispenser, consult the dispenser manufacturer to determine if ISD ready retrofit kits are available. Any factory installed plumbing that must be modified in order to install the vapor flow meter, must be removed to a non hazardous work area before any cutting or threading takes place. After modifications to any plumbing, it must be reinstalled in accordance with the dispenser manufacturers installation guidelines.

7. Install any necessary plumbing and the lower flange above the vapor shear valve.

Note: The use of 90° elbows should be kept to a minimum to minimize pressure drop, maximize vapor collection efficiency and to prevent liquid traps. All horizontal plumbing must pitch to drain.



IMPORTANT: Upper and lower flanges must align to within 1/16" center-to-center before installing flow meter. If piping is improperly aligned, torque could damage the flow meter and result in vapor leakage.

8. Clean all debris around the inlet and outlet plumbing prior to installing the Vapor Flow Meter. Do not blow compressed air through the Vapor Flow Meter to prevent damaging the internal screens.
9. Install the o-ring into the lower mounting flange.
10. Taking care that foreign material (chips, debris, sealant, etc.) does not enter the open piping or Vapor Flow Meter, carefully insert the o-ring and then connect the Vapor Flow Meter to the upper flange. Note that the flow arrow on the side of the meter body must point down.
11. Connect the lower flange to the Vapor Flow Meter.
12. Tighten any loose fittings and hardware
13. Route the wiring to the TLS RF transmitter (W2) or into the junction box via the supplied cord grip assembly when direct wiring to a TLS console.
14. Connect the wires from the Vapor Flow Meter to the field wiring from the console and cap with wire nuts (see Figure 2). Not required when connecting to the TLS RF transmitter (W2).
15. After all other ISD Vapor Flow Meters and the ISD Pressure Sensor are installed, pressurize the tank ullage space and vapor piping to at least 2 inches WC and test for leaks using leak detection solution.



IMPORTANT: Upper and lower flanges must align to within 1/16" center-to-center before installing flow meter. If piping is improperly aligned, torque could damage the flow meter and result in vapor leakage.

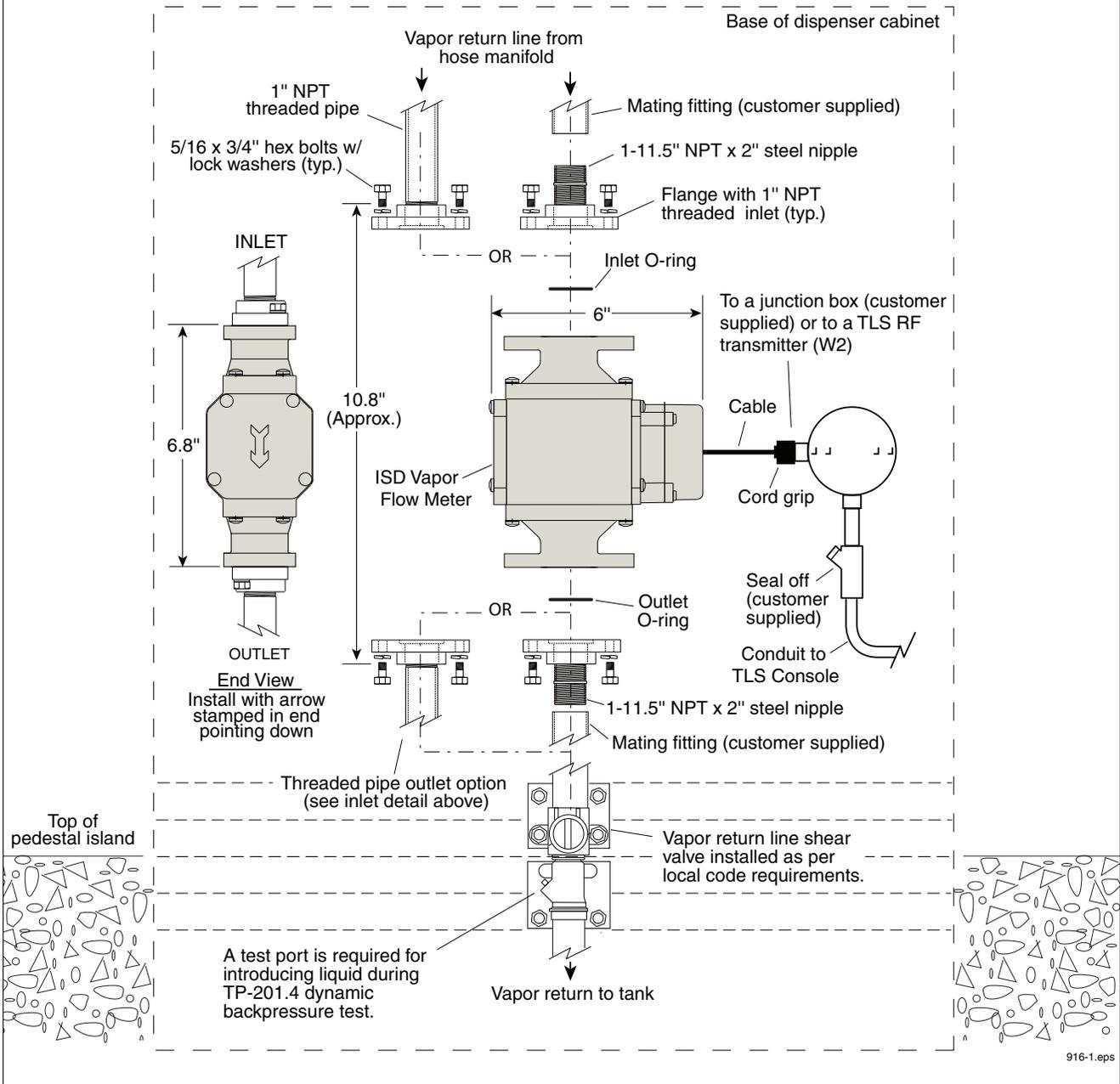


Figure 1. Example Vapor Flow Meter Installation Above Shear Valve

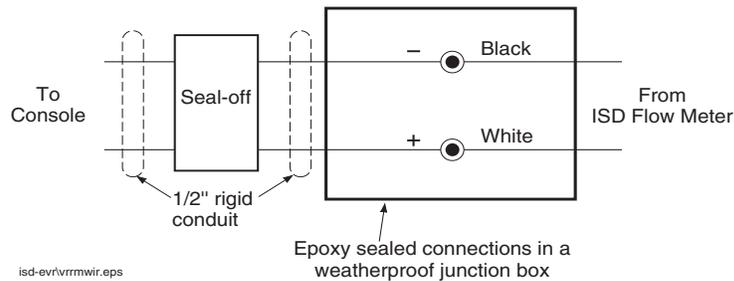


Figure 2. Field wiring Vapor Flow Meter - Observe Polarity

Installation Steps - Balance Systems Below Shear Valve

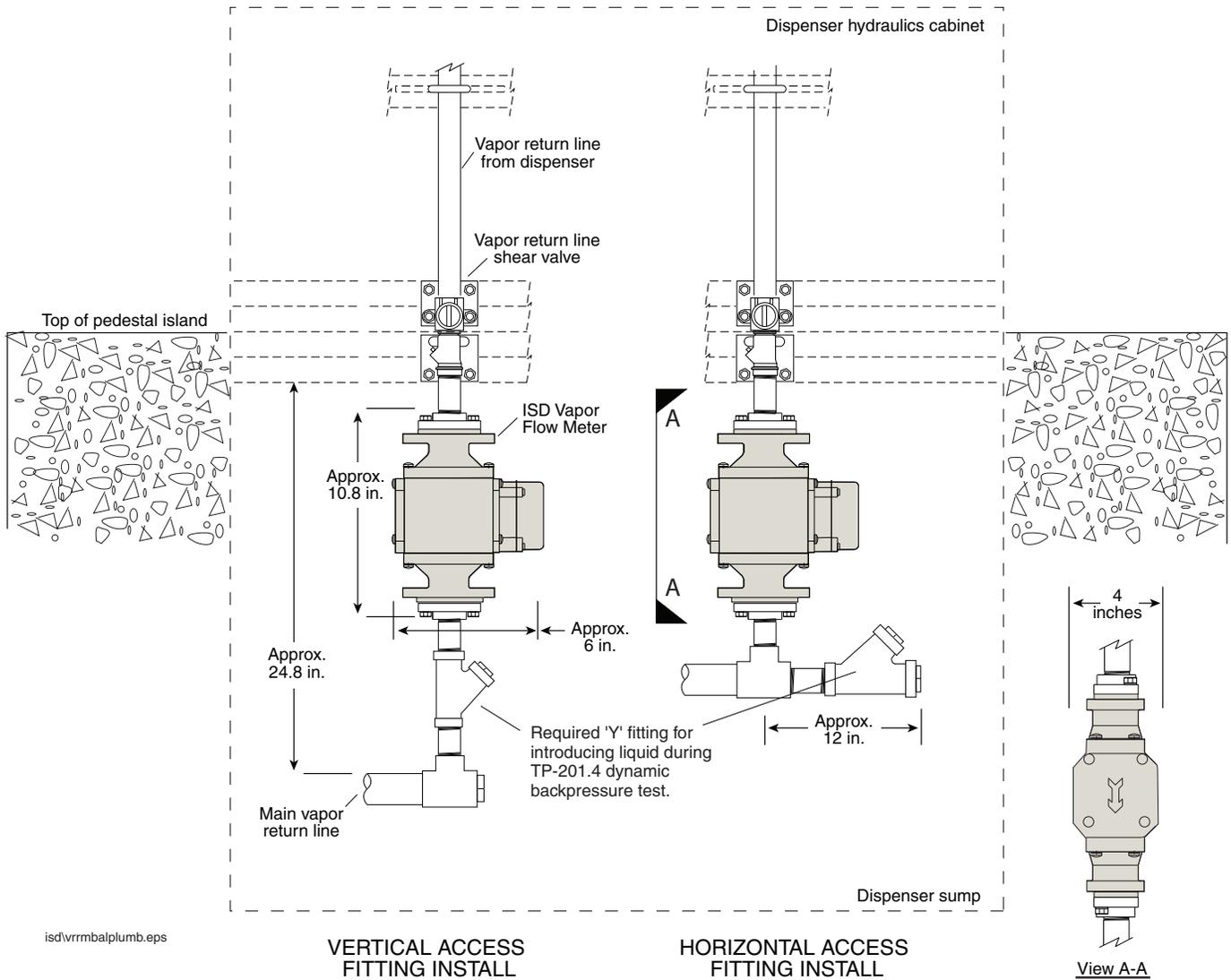


1. Before installing this device, turn Off, tag/lock out power to the system, including console and submersible pumps.
2. Remove the dispenser's lower sheet metal doors to access the vapor plumbing, if necessary.
3. Remove any unneeded field installed plumbing between the vapor shear valve and the vapor return line fitting. Figure 3 shows two example installations of the Vapor Flow Meter with the required lateral or wye fitting for running the TP-201.4 back-pressure test. Approximately 3 inches of clearance is required on both sides of the piping to accommodate the width of the meter body.



IMPORTANT: Upper and lower flanges must align to within 1/16" center-to-center before installing flow meter. If piping is improperly aligned, torque could damage the flow meter and result in vapor leakage.

4. Connect the lower flange to the pipe that is connected to the lateral or wye access fitting (see Figure 4).
5. Install the Vapor Flow Meter over the lower flange.
6. Connect the upper flange with o-ring above the Vapor Flow Meter.
7. Using a close nipple, thread the shear valve into the upper flange.
8. Using nipples, unions, and other plumbing as required, connect the plumbing outlet to the shear valve.
9. Route the wiring into the junction box via the supplied cord grip assembly. Connect the wires from the Vapor Flow Meter to the field wiring from the console and cap with wire nuts (see Figure 2) - OR - connect the wires to the TLS RF transmitter (W2).
10. After all other ISD Vapor Flow Meters and the ISD Pressure Sensor are installed, pressurize the tank ullage space and vapor piping to at least 2 inches WC and test for leaks using leak detection solution.



isd\vrmbalplumb.eps

Figure 3. Example flow meter installations with approximate clearances



IMPORTANT: Upper and lower flanges must align to within 1/16" center-to-center before installing flow meter. If piping is improperly aligned, torque could damage the flow meter and result in vapor leakage.

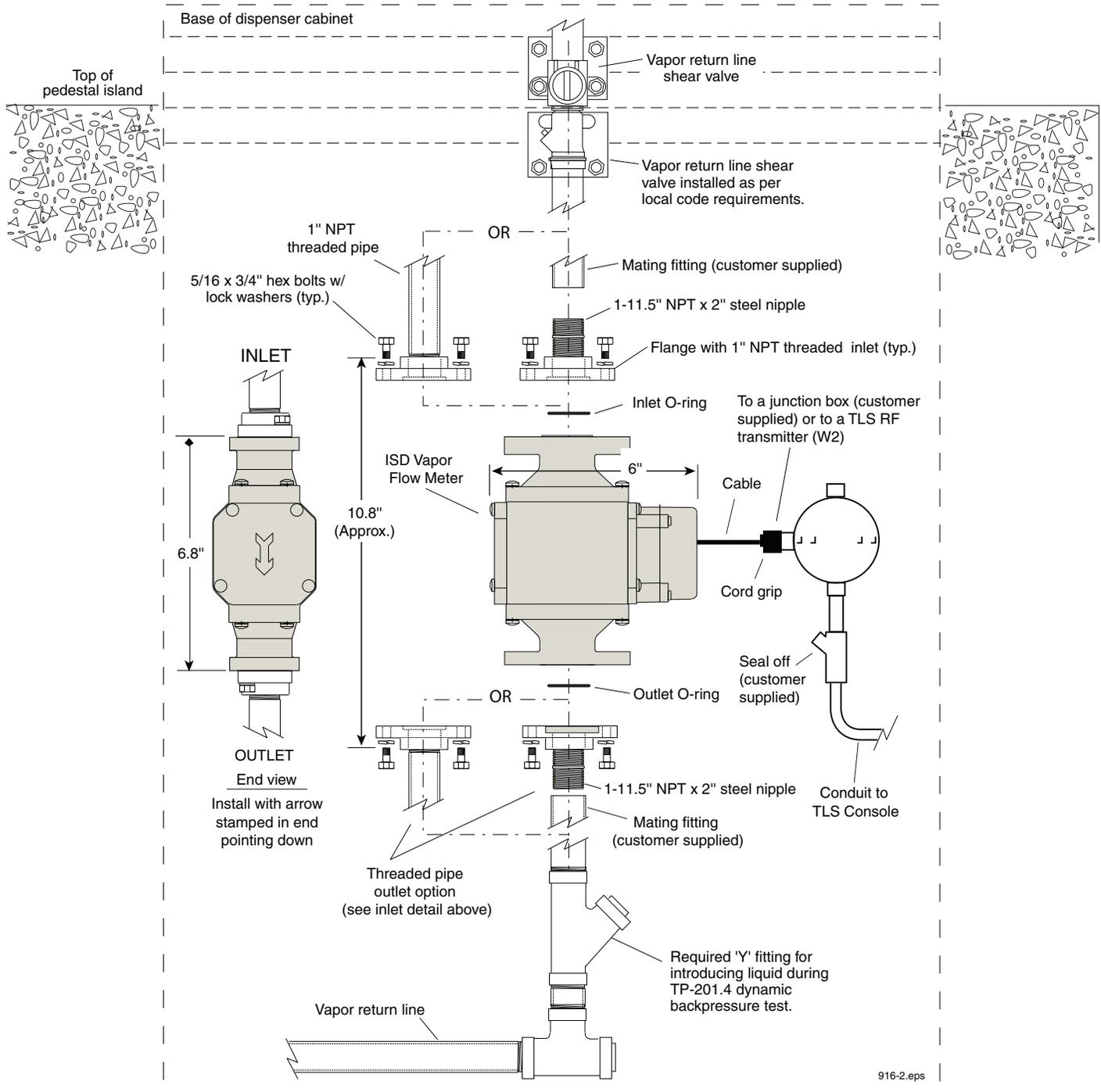


Figure 4. Example Vapor Flow Meter Installation Below Shear Valve

Seal and Connect Field Wiring

1. Seal wire nuts with epoxy sealant following the instructions in Figure 5. Note - wire sealing is not required for installations using a wireless interface.



CAUTION: Epoxy sealant is irritating to eyes, respiratory system, and skin. Can cause allergic skin reaction. Contains: epoxy resin and Cycloaliphatic epoxy-carboxylate. Precautions: Wear suitable protective clothing, gloves, eye, and face protection. Use only in well ventilated areas. Wash thoroughly before eating, drinking, or smoking.

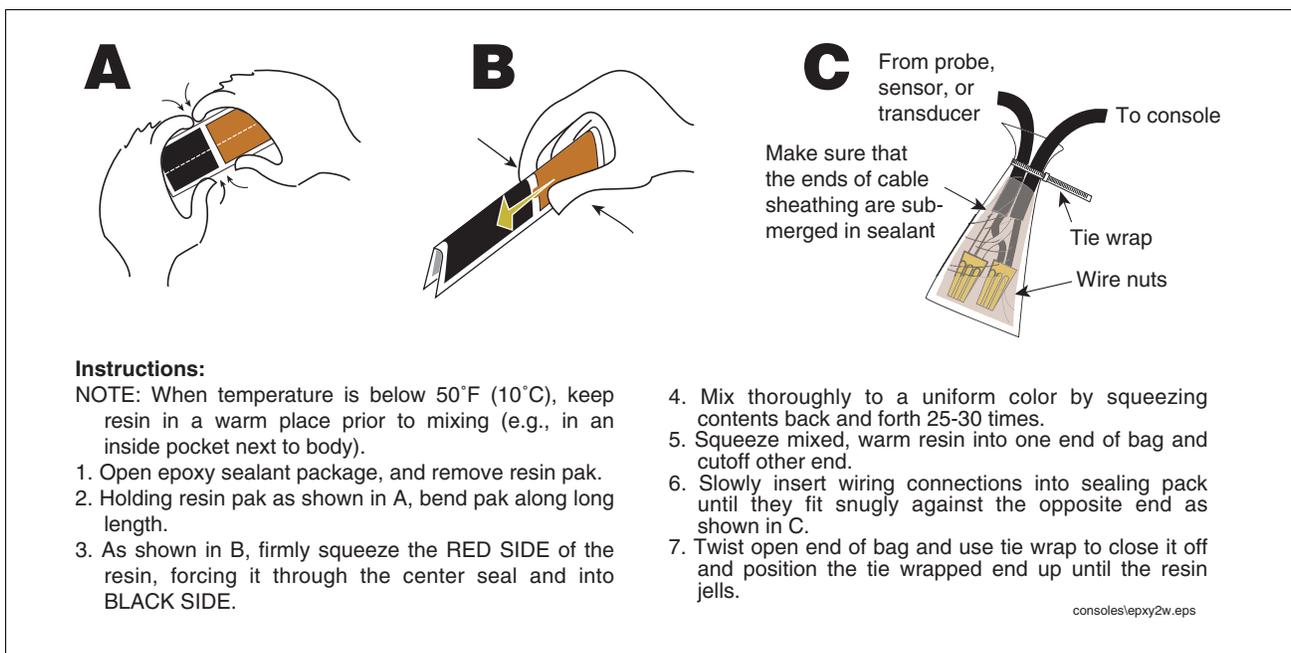


Figure 5. Epoxy sealing field wiring

2. Push the epoxy sealed bag into the junction box. Replace and tighten the junction box cover.
3. Terminate field wiring into TLS Console and connect to Smart Sensor Module located in the intrinsically safe wiring compartment of the TLS as shown in Figure 6. Note: you must observe polarity! Also, the cable length between the console and sensor must not exceed the distance stated in the TLS-3XX Site Prep manual (P/N 576013-879). For the wireless version, terminate the wires in the TLS RF transmitter (W2).
4. Replace the lower sheet metal doors in the dispenser.

Note: Intrinsically safe devices must be installed in accordance with Article 504 of the National Electrical Code, ANSI/NFPA 70, for installation in the United States, or Section 18 of the Canadian Electrical Code for installations in Canada.

This intrinsically safe vapor flow meter P/N 332374-002, has only been evaluated for connection to a UL listed TLS-350 Series Liquid Level Gauge / Leak Detector.

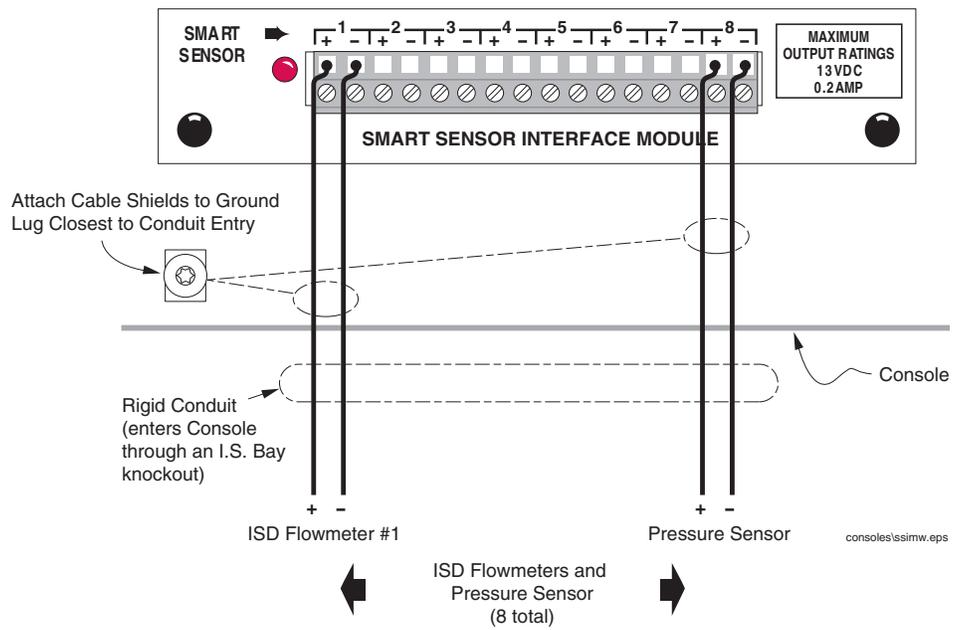


Figure 6. Direct Wiring Vapor Flow Meter to Smart Sensor Interface Module



NOTE! For wireless configurations, see TLS RF System Control Drawing 331940-012.



INSTALLATION INSTRUCTIONS for HEALY SYSTEMS, INC. CLEAN AIR SEPARATOR

The Model 9961 or 9961H, Healy Systems Clean Air Separator (CAS) consists of a 400 gallon steel vapor processor vessel that contains a fuel resistant bladder to hold excess gasoline vapors that may develop in gasoline storage tanks during idle periods of gasoline dispensing facility operation. Models and Drawings with a “H” suffix apply to horizontal CAS installations and those without a “H” suffix apply to vertical CAS installations. The CAS assembly weighs approximately 800 pounds which makes it necessary to have a power assisted lifting device available at the installation site to remove the CAS from the transportation vehicle and place it on the required concrete pad (see drawing 9900-9945 or 9900-9945H). The pad (level within 1/8”/foot) is located within 100 feet to the gasoline storage tank vent lines. The pad is a requirement of this installation. **DO NOT PLACE THE CLEAN AIR SEPARATOR DIRECTLY ON THE GROUND OR ASPHALT SURFACE.** NOTICE: The installer is responsible to ensure that the installation meets the latest edition requirements of NFPA 30A, Chapter 10. No electrical connections are required. The CAS securement method shown in drawing 9900-9945 or 9900-9945H shall be approved by the local authority having jurisdiction with respect to wind and seismic loading. Installer shall not loosen, rotate or remove factory installed fittings or flange as this may damage factory seals and void warranty.

In addition to the vapor processor vessel, there is a hardware kit that contains the following:

- 4 Locking 1” NPT Ball Valves
- 4 Pad locks (keyed alike)
- 1 Breather Assembly, Healy Model 9948
- 1 Float Check Valve Assembly, Model 9466G

Reference the appropriate Healy Systems installation drawing (9900-9942, 9900-9942H, 9900-9971, 9900-9971H, 9900-9972, 9900-9972H, 9900-9973 or 9900-9973H of this manual) for placement of the above parts for the vent stack configuration required by the local Authority Having Jurisdiction (AHJ) for the Underground Storage Tank (UST) system. **A flexible connection between the Clean Air Separator and the vent line(s) is allowable if required by the local Authority Having Jurisdiction (AHJ) to meet seismic requirements. Should the flex connection be installed such that it is not supported, the slope of the flex connection shall be greater than the 1/8”/foot slope required for the rest of the one inch galvanized piping.** The local contractor is responsible to provide all necessary, galvanized piping, non-hardening, UL classified pipe joint compound and plumbing fittings. Additional Pressure/Vacuum (P/V) vent valves to complete installation are not included in the hardware kit. Healy is not responsible for the warranty of any other P/V vent valve purchased to complete installation.

The CAS arrives at the site assembled and tested. All plumbing shall be done using 1” galvanized steel pipe (Schedule 40) and approved nipples, as called out in the installation drawing appropriate for the site installation. Mounting hardware shall be galvanized or stainless steel. Careful attention must be paid to the installation drawing appropriate for the site installation to assure proper operation of the bladder system. Do not inflate the bladder assembly after installation.

It is important that the CAS be secured to the concrete pad as shown in drawing 9900-9945 or 9900-9945H of this manual to prevent any unintentional repositioning of the CAS as the connecting plumbing to the vent system is accomplished.

Franklin Fueling Systems
3760 Marsh Road
Madison, Wisconsin 53718 USA
ARB Approved Installation, Operation and Maintenance Manual

Website: <http://www.franklinfueling.com>
Email: sales@franklinfueling.com
Telephone: 800-225-9787
Fax: 608-838-6433



OPERATION AND PURGING

NORMAL OPERATION:

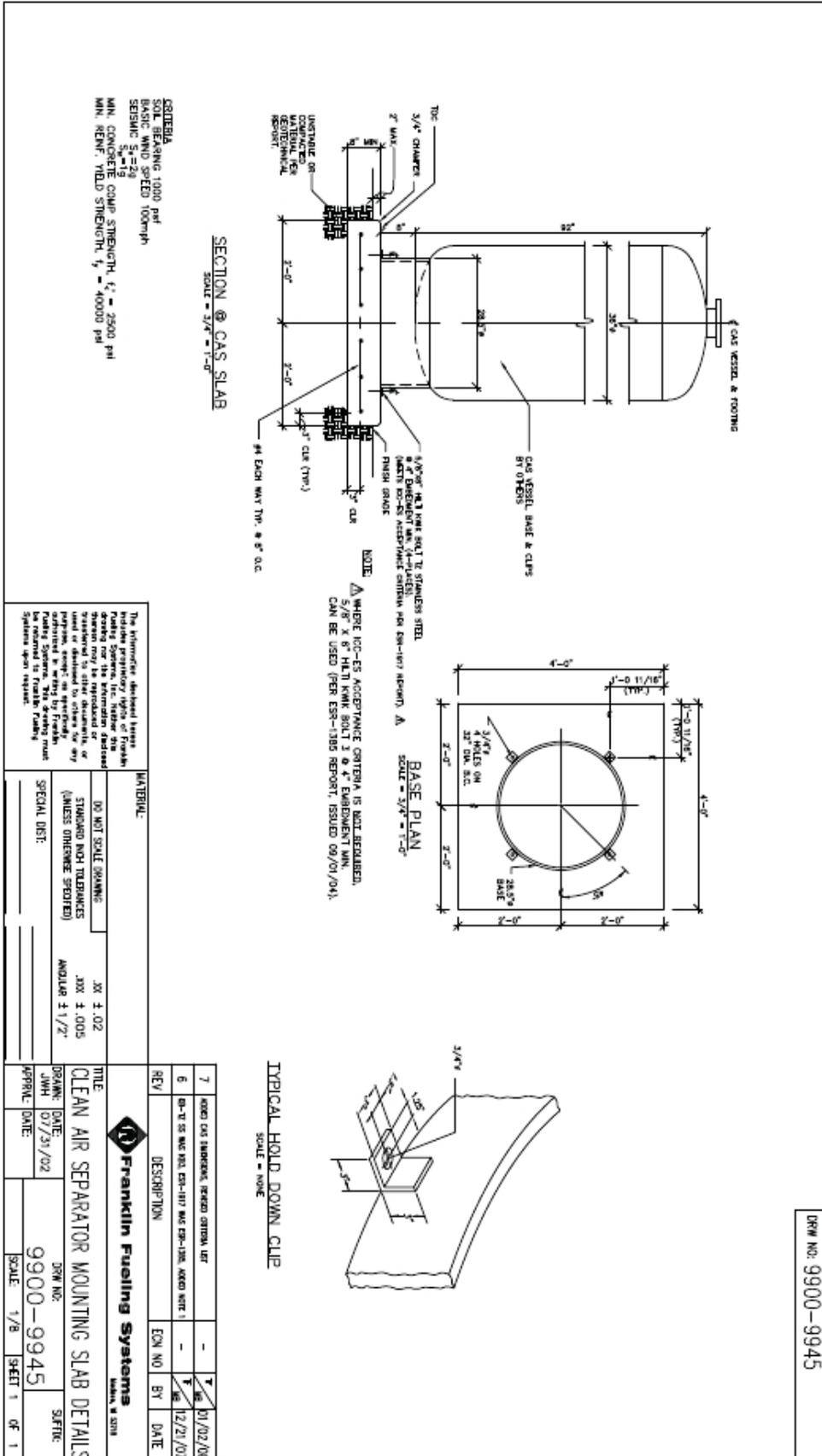
- There are four ball valves on the CAS. Each ball valve is to be installed so as to allow opening and closing with nothing obstructing the full range (90°) of movement. In normal operation, only the valve (A) at the top of the CAS shall be open – the other three valves (B, C and D) shall be closed. All four valves shall be locked in the above positions. The two plugs (E and F) should be installed using a non-hardening, UL classified pipe joint compound and tightened to 60 ft-lbs.

DRAINING THE BLADDER:

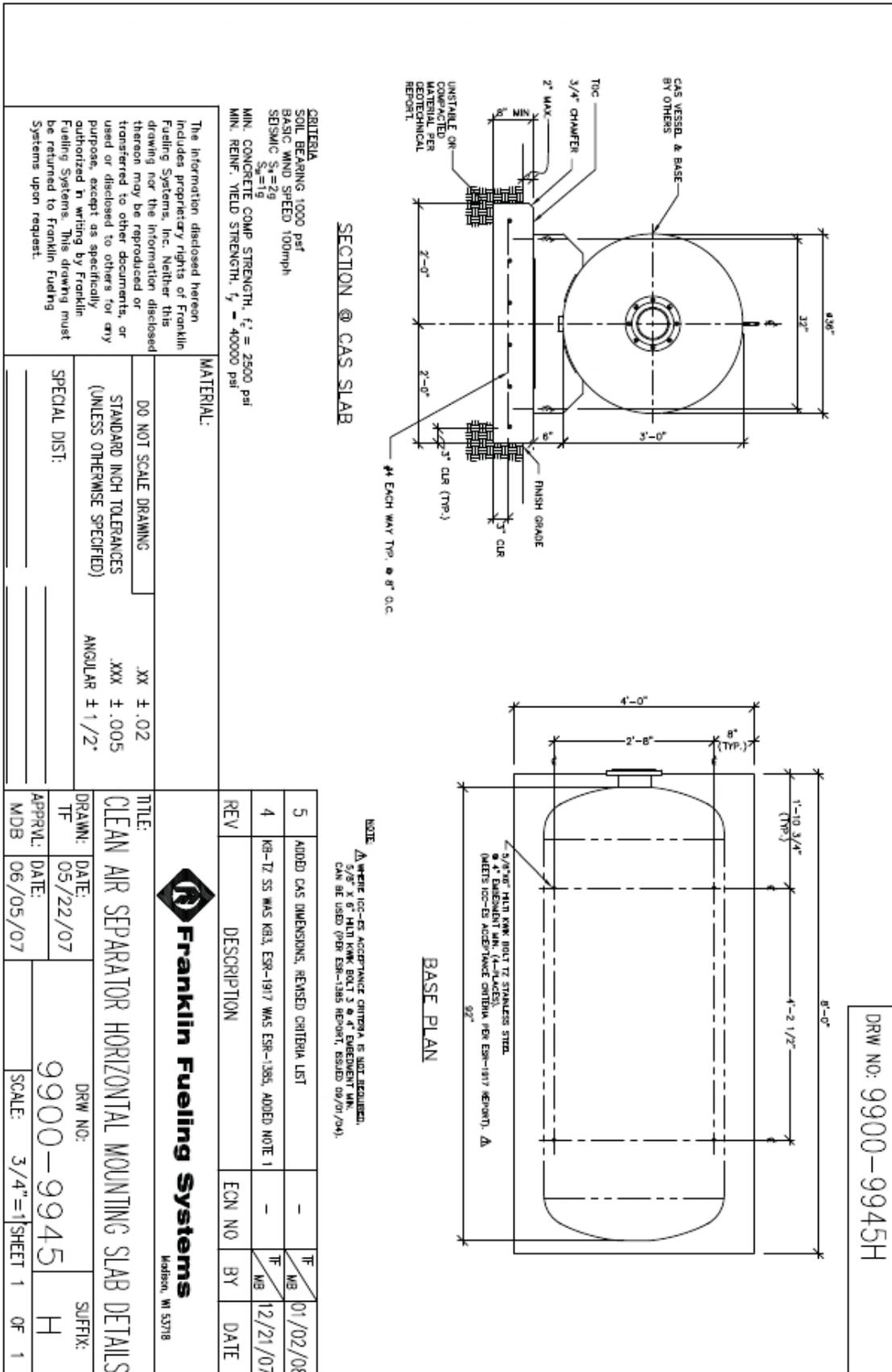
- Any liquid coming over from the vent system would have collected above the valve (A) in the riser pipe before going into the bladder. An inspection of the need to drain the bladder is easily made by removing the plug (E) at the tee on the bottom plumbing of the CAS. Before removing this plug, open the valve (B) above the tee to release any liquid into the piping below. Wait approximately 30 seconds and then close the valve (B). Now, remove the plug (E) at the tee on the bottom plumbing of the CAS – be sure to have a container suitable for gasoline available to catch fluid. If liquid in excess of 16 ounces (473 ml) drains out, the bladder should also be drained.
- Should it be necessary to drain the bladder:
 1. Close the upper ball valve (A) (usually open) leading to the gasoline storage tank vent lines.
 2. Open the valve (C) that goes to the internal syphon tube. Be sure the other three ball valves (A, B and D) that connect to the vent lines and CAS are closed.
 3. Remove the plug (E) from the bottom tee and connect an explosion proof evacuation pump capable of handling liquid. Have a liquid tight, container suitable for gasoline positioned to receive any fluid that may exit the system and start the pump. If no liquid returns within 30 seconds, the bladder is dry – discontinue pumping, remove the pump, replace the plug (E) and return the ball valves to their normal, locked, positions.

DRAINING THE CAS:

- Should it be necessary to drain the CAS (between the bladder and steel wall):
 1. Close the ball valve at the top (A) of the CAS and also the two valves (B and C) on the vertical risers.
 2. Remove the plug (E) in the bottom tee and place a metal container below the pipe opening.
- Carefully open the ball valve (D) at the bottom of the CAS – observe that the container that is being drained into does not overflow – empty container as required until fluid no longer comes from the pipe when the valve is open.
 1. Close the ball valve (D) and replace the plug (E) into the tee.
 2. Return all ball valves to their normal locked positions.



DRW NO: 9900-9945



CRITERIA
 SOIL BEARING 10000 psf
 BASIC WIND SPEED 100mph
 SEISMIC $S_a=2g$
 $S_b=1g$
 MIN. CONCRETE COMP STRENGTH, $f'_c = 2500$ psi
 MIN. REINF. YIELD STRENGTH, $f_y = 40000$ psi

SECTION @ CAS SLAB

BASE PLAN

NOTE:
 Δ WELDED IGC-ES ACCEPTANCE CRITERIA IS NOT REQUIRED.
 5/8" X 6" HLT KKK BOLT 3 @ 4" EMBEDMENT MIN. CAN BE USED (PER ESR-1385 REPORT, ISSUED 09/01/04).

REV	DESCRIPTION	ECN NO	BY	DATE
5	ADDED CAS DIMENSIONS, REVISED CRITERIA LIST	-	TF	01/02/08
4	K8-TZ SS WAS K8A, ESR-1917 WAS ESR-1385, ADDED NOTE 1	-	MB	12/21/07

MATERIAL:

DO NOT SCALE DRAWING

STANDARD INCH TOLERANCES (UNLESS OTHERWISE SPECIFIED)

ANGULAR ± 1/2°

SPECIAL DIST:

FRANKLIN FUELING SYSTEMS
 Madison, WI 53718

TITLE:
 CLEAN AIR SEPARATOR HORIZONTAL MOUNTING SLAB DETAILS

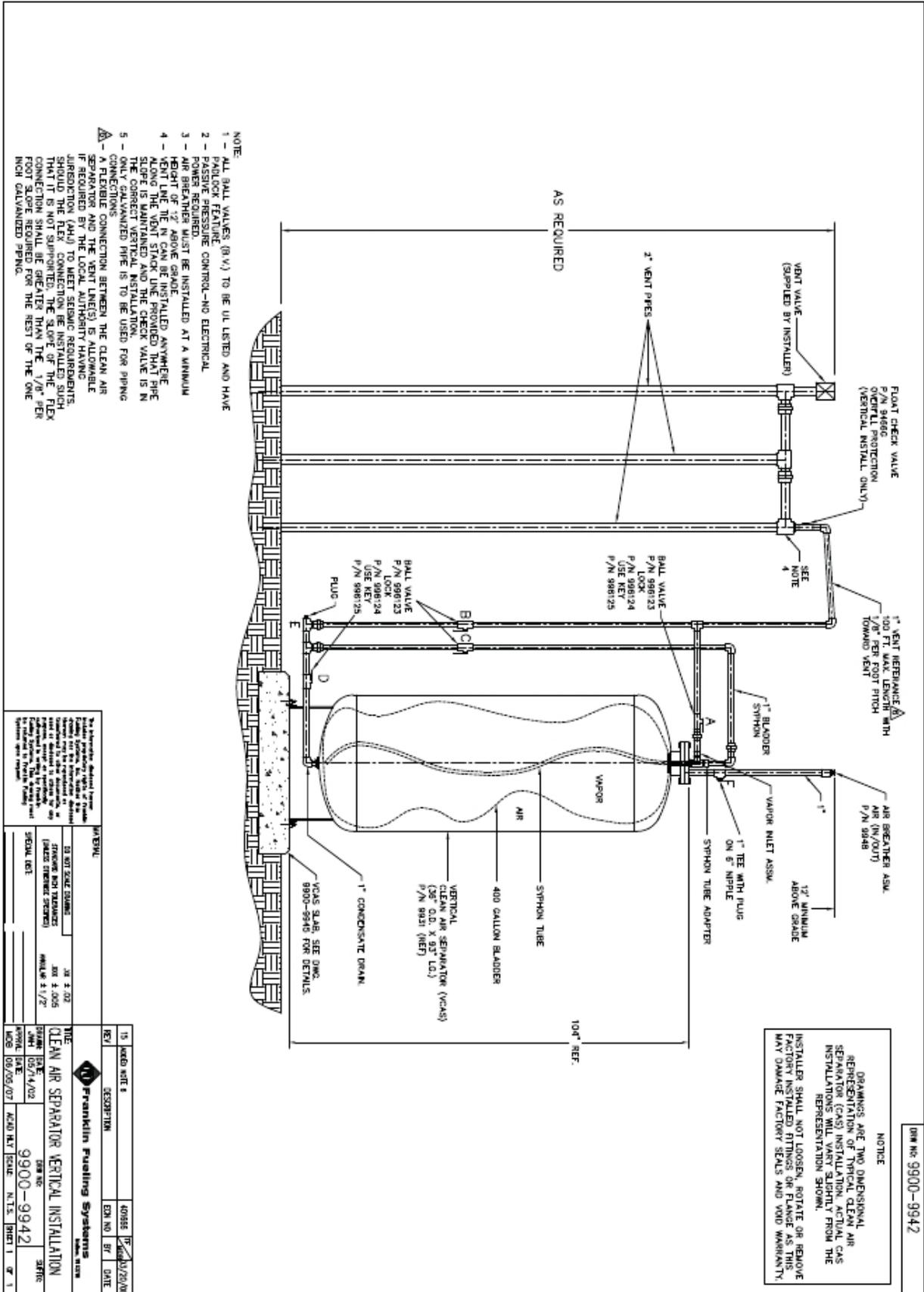
DRAWN: DATE: 05/22/07
APP'VD: DATE: 06/05/07

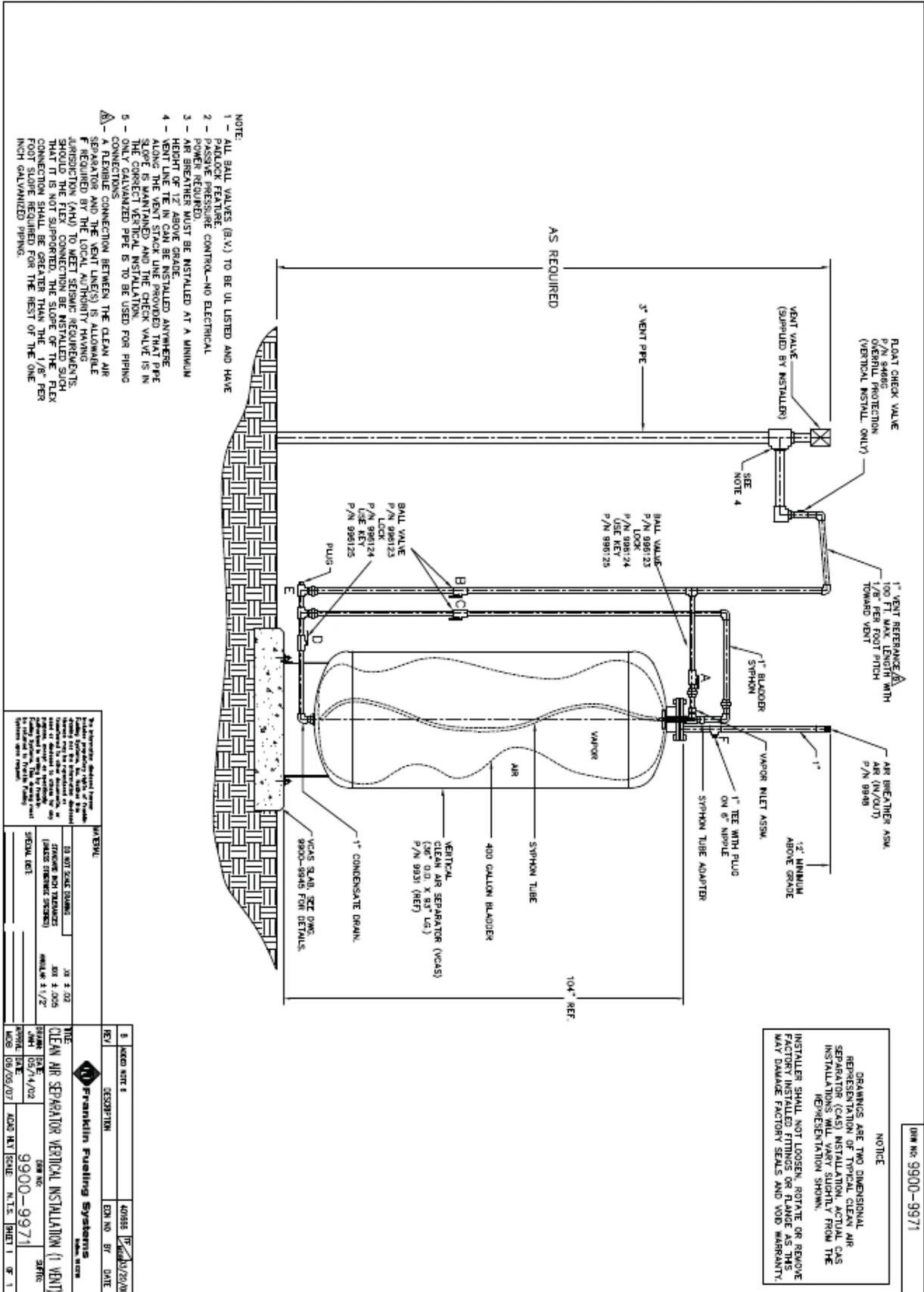
DRW NO: 9900-9945
 SUFFIX: H

SCALE: 3/4" = 1' SHEET 1 OF 1

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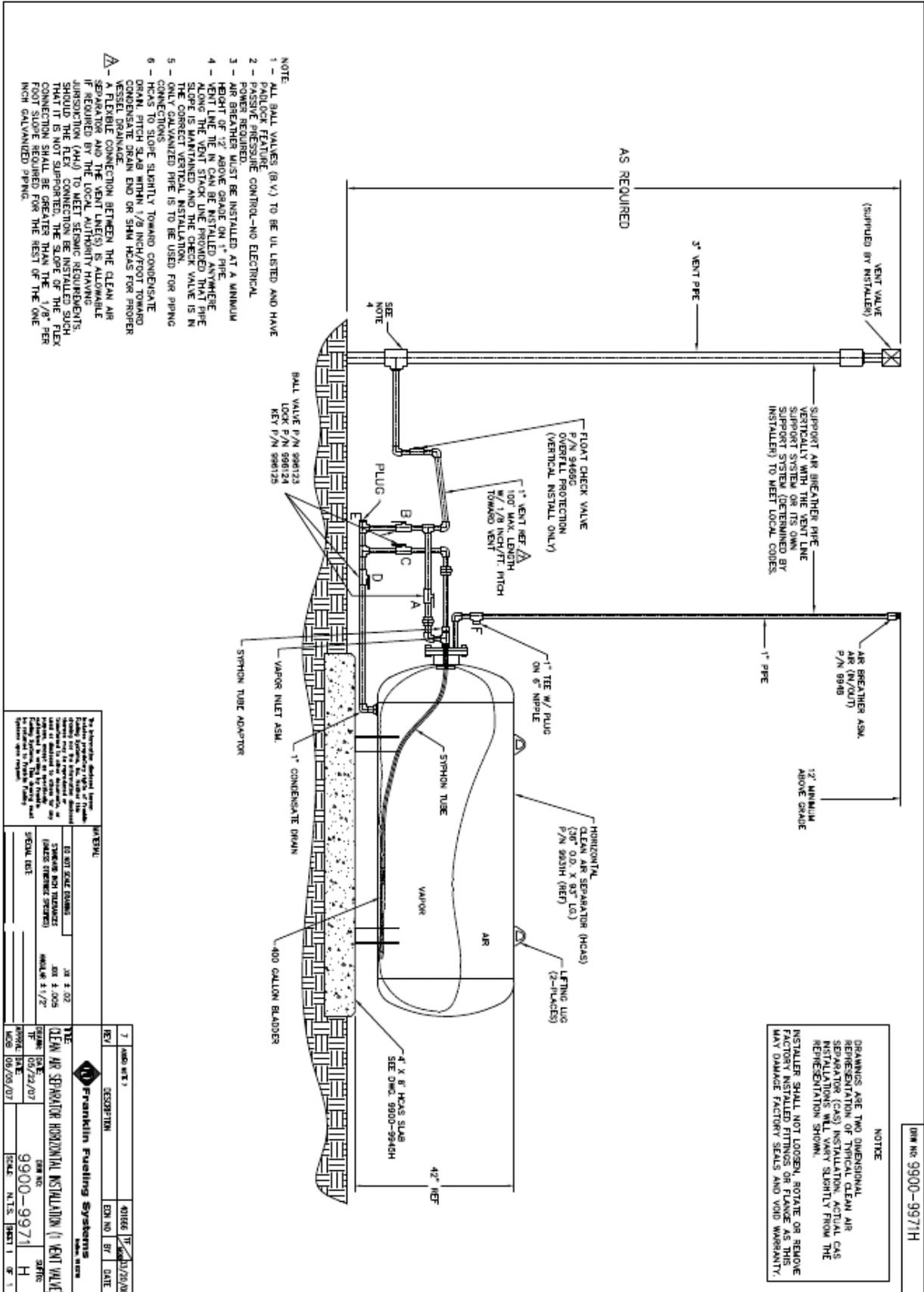
DRW NO: 9900-9945H





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DATE	REV	DESCRIPTION	BY
05/14/02	1	CLEAN AIR SEPARATOR VERTICAL INSTALLATION (1 VENT)	DAVID
09/05/07	2	ADD HAT SCALE	DAVID

9900-9971 SHEET 1 OF 1	104" REF
---------------------------	----------

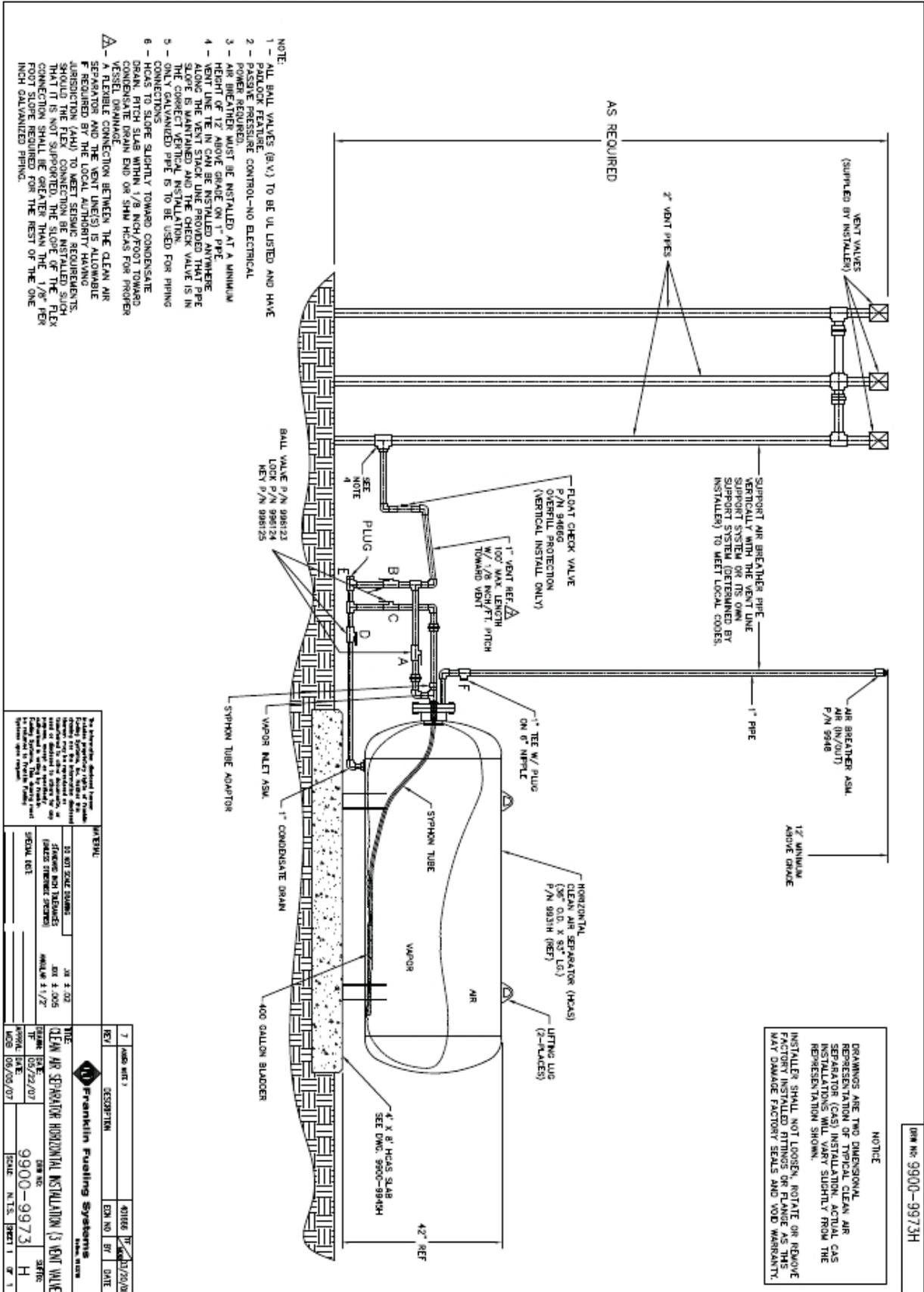


By a manufacturer, authorized licensee, or other person, the use of this drawing for any purpose other than that intended by the manufacturer is prohibited. The user of this drawing shall be responsible for obtaining all necessary permits and approvals for its use. The user of this drawing shall be responsible for obtaining all necessary permits and approvals for its use.

NO.	DATE	BY	DESCRIPTION
01	03/02/07	JM	ISSUE FOR CONSTRUCTION
02	05/22/07	JM	ISSUE FOR CONSTRUCTION
03	05/22/07	JM	ISSUE FOR CONSTRUCTION
04	05/22/07	JM	ISSUE FOR CONSTRUCTION
05	05/22/07	JM	ISSUE FOR CONSTRUCTION
06	05/22/07	JM	ISSUE FOR CONSTRUCTION
07	05/22/07	JM	ISSUE FOR CONSTRUCTION
08	05/22/07	JM	ISSUE FOR CONSTRUCTION

7	05/22/07	JM	ISSUE FOR CONSTRUCTION
8	05/22/07	JM	ISSUE FOR CONSTRUCTION
9	05/22/07	JM	ISSUE FOR CONSTRUCTION
10	05/22/07	JM	ISSUE FOR CONSTRUCTION
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17	05/22/07	JM	ISSUE FOR CONSTRUCTION
18	05/22/07	JM	ISSUE FOR CONSTRUCTION
19	05/22/07	JM	ISSUE FOR CONSTRUCTION
20	05/22/07	JM	ISSUE FOR CONSTRUCTION

Franklin Fueling Systems
 9900-9971
 H



- NOTE:
- 1 - ALL BALL VALVES (B.V.) TO BE UL LISTED AND HAVE PASSLOCK FEATURE.
 - 2 - POWER REQUIRED MUST BE INSTALLED AT A MINIMUM HEIGHT OF 12" ABOVE GRADE ON 1" PIPE.
 - 3 - VENT LINE TE IN CAN BE INSTALLED ANYWHERE ALONG THE VENT STACK LINE PROVIDED THAT PIPE SLOPE IS MAINTAINED AND THE CHECK VALVE IS IN THE CORRECT VERTICAL INSTALLATION.
 - 4 - ONLY GALVANIZED PIPE IS TO BE USED FOR PIPING CONNECTIONS.
 - 5 - HOCS TO SLOPE SLIGHTLY TOWARD CONDENSATE DRAIN. PITCH SLAB WITHIN 1/8" INCH/FOOT TOWARD VESSEL DRAINAGE.
 - 6 - A REMOVABLE CONNECTION BETWEEN THE CLEAN AIR SEPARATOR AND THE VENT LINE(S) IS ALLOWABLE PROVIDED THE VENT LINE(S) IS MAINTAINED AT A MINIMUM HEIGHT OF 12" ABOVE GRADE. THE VENT LINE(S) SHOULD BE INSTALLED SUCH THAT IT IS NOT SUPPORTED. THE SLOPE OF THE FLEX CONNECTION SHALL BE GREATER THAN THE 1/8" PER FOOT SLOPE REQUIRED FOR THE REST OF THE ONE INCH GALVANIZED PIPING.

NOTICE
 DRAWINGS ARE TWO DIMENSIONAL REPRESENTATION OF TYPICAL CLEAN AIR SEPARATOR (CAS) INSTALLATION. ACTUAL CAS INSTALLATIONS WILL VARY SLIGHTLY FROM THE REPRESENTATION SHOWN.
 INSTALLER SHALL NOT LOOSEN, ROTATE OR REMOVE FURNISHED FITTINGS OR FLANGES AS THIS MAY DAMAGE FACTORY SEALS AND VOID WARRANTY.

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PROJECT: 33 807 5022 50000 DRAWING NO: 9900-9973H DATE: 05/22/07 SCALE: N.T.S.	TITLE: CLEAN AIR SEPARATOR HORIZONTAL INSTALLATION (3) VENT VALVES DATE: 05/22/07 DRAWN BY: 9900-9973 CHECKED BY: H DATE: 05/22/07
REV: 1 (ISSUE 01) DATE: 05/22/07	REV: 2 (ISSUE 02) DATE: 05/22/07

TLS RF Wireless 2 System (W2)

Installation and Maintenance Guide



Notice

Veeder-Root makes no warranty of any kind with regard to this publication, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Veeder-Root shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this publication.

Veeder-Root reserves the right to change system options or features, or the information contained in this publication as approved by ARB.

This publication contains proprietary information which is protected by copyright. All rights reserved. No part of this publication may be modified or translated to another language without the prior written consent of Veeder-Root.

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.

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

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.

CUSTOMER'S PREFERRED CARRIER

1. It is the customer's responsibility to file a claim with their carrier.
2. Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
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.
4. Veeder-Root will NOT be responsible for any compensation when a customer chooses their own carrier.

FCC INFORMATION

This equipment complies with the requirements in Part 15 of the FCC rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception requiring the operator to take whatever steps are necessary to correct the interference.

RETURN SHIPPING

For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

FOR INSTALLATIONS IN THE STATE OF CALIFORNIA

Please refer to the California Air Resources Board Vapor Recovery Certification Phase II EVR Executive Order web site (www.arb.ca.gov/vapor/eo-evrphaseII.htm) for the latest manual revisions pertaining to Executive Order VR202 (Healy Phase II EVR System Including ISD System), VR 203 (VST Phase II EVR System) and VR 204 (VST Phase II EVR System Including ISD System).

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Introduction

This manual describes site preparation and installation procedures for the Veeder-Root TLS RF Wireless 2 System (W2) for Vapor Recovery monitoring. The TLS RF Wireless 2 System (W2) features two-way communication utilizing a client/server architecture resulting in improved data collection.

Veeder-Root strongly recommends the use of hard wiring for connecting Veeder-Root sensors to the TLS Console. Wired connections provide a robust communication link that is far superior to wireless networks.

A wide variety of devices can be integrated into the TLS RF Wireless 2 System (W2) network depending on the console(s) installed as shown in Table 1. Wireless component kit part numbers are shown in Table 2.

Table 1. Wireless 2 Devices Per TLS Console

Consoles	Wireless Device		Total Number of Wireless Devices per TLS console
	Vapor Flow Meter	Carbon Canister Vapor Polisher	
8470 TLS-350 Console			32
8482 TLS-350R Console	Up to 32	1	32

Table 2. Wireless Component Kit Numbers

V-R Kit Order Number	V-R Component Number					
	RF Console 332242-002	Transmitter 332235-016	Repeater 332440-030	Receiver 332440-029	Battery Pack 332425-011	Enclosure 330020-716
858090-203	X		X	X		
858090-204	X		X	X		
858090-205		X			X	
330020-716						X
330020-668	X					
330020-674		X				
330020-670			X			
330020-669				X		
330020-718					X	

Procedures Contained Within This Manual

- Mounting the TLS RF and connecting power wiring.
- Installing Receiver, Repeater and Transmitters.

- Connecting the TLS RF to the TLS console.

After installing the TLS RF Wireless System devices, you must configure the sensors in the console following instructions contained in the TLS console's System Setup Manual.

Contractor Certification Requirements

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

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

ATG Technician (Level 2/3 or 4) Certification: Contractors holding valid ATG Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- Wireless 2
- Tall Tank

VR Vapor Products Certification: Contractors holding a certification with the following designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- ISD – In Station Diagnostics
- PMC – Pressure Management Control
- CCVP - Veeder-Root Vapor Polisher
- Wireless – ISD/PMC Wireless
- A current Veeder-Root Technician Certification is a prerequisite for the VR Vapor Products course.

Warranty Registrations may only be submitted by selected Distributors.

RF Transmitter Considerations

Installation of this equipment in wet or below grade locations requires that the installer take steps to ensure that the equipment is mounted above the maximum water level.



CAUTION! – The Transmitter will not function properly in water. Also, submersion of the Transmitter in water can cause permanent damage to the internal electronics.

Wireless 2 devices will not function properly if certain conditions arise such as, but not limited to, the following:

- **Ambient Interference – Due to site layout or vehicles parked in the RF transmission path. For example, CSLD will not function if the transmission path is blocked for more than a few minutes.**
- **Improper equipment installation – Keep objects from improperly coming in contact with the antenna. Follow these installation instructions and mount the transmitter in a fixed position to ensure maximum RF connectivity. Antenna orientation is significant in achieving an optimal transmission path.**
- **Equipment Sump Parameters – Sumps intended for use with RF equipment must accommodate the worst case rainfall condition that could reasonably occur. The RF Transmitter and the antenna must not come in contact with liquids from any source.**

TLS System performance will be degraded should any of the above conditions occur and is not covered under the Veeder-Root Product Warranty. Corrective actions to such conditions are the responsibility of the station-site owner. Veeder-Root is not liable for any event that is a result of an improper installation or use of this equipment.

It is important that installers have knowledge of all relevant procedures before installing a wireless system. Read and understand all manuals thoroughly. If you do not understand a procedure, contact a certified contractor or contact Veeder-Root. Each TLS Console has its own setup and installation manuals.

Related Documents

577013-796	ISD Vapor Flow Meter Installation Guide
577013-916	ISD Balance Flow Meter Installation Guide
577013-920	Carbon Canister Vapor Polisher Installation and Maintenance Guide
576013-623	TLS-3XX System Setup Manual
331940-012	TLS RF System Control Drawing

Safety Precautions

Retain and follow all product safety and operating instructions. Observe all warnings on the product and in the operating instructions. To reduce the risk of bodily injury, electric shock, fire, or damage to the equipment, observe the following precautions.



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

GENERAL PRECAUTIONS

Heed service markings: Opening or removing the console cover may expose you to electric shock. Servicing of Veeder-Root equipment must be done by Veeder-Root authorized service contractors.

Use product with approved equipment: This product should be used only with Veeder-Root components identified as suitable for use with the TLS RF Wireless System.

Use the correct external power sources: This product should be operated only from the type of power sources indicated on the electrical ratings labels affixed to the components. If you are not sure of the type of power source required, consult your Veeder-Root authorized service contractor.

When not in use, a longer battery life can be achieved by keeping the battery pack in a cool, dry location where the temperature never exceeds 30°C or 86°F and does not go below 10° C or 50° F.

SPECIAL TOOLS REQUIRED

- #15 Torx screwdriver
- Small blade screwdriver (maximum blade width 3/32")
- Wire strippers

Safety Symbols

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



EXPLOSIVE

Fuels and their vapors are extremely explosive if ignited.



FLAMMABLE

Fuels and their vapors are extremely flammable.

 <p>ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p>TURN POWER OFF Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>
 <p>WARNING Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.</p>	 <p>READ ALL RELATED MANUALS Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>

National Electrical Code Compliance

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that electrical equipment and wiring located in Class I, Division 1 and 2 installations shall comply with the latest appropriate articles found in the National Electric Code (NFPA 70) and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A), or other local code such as the CEC, Canadian Electrical Code.

TLS RF-TO-TLS CONSOLE WIRING

Wire Type

To ensure the best operating systems available, Veeder-Root REQUIRES the use of shielded cable.

Wire Length

Improper system operation could result in undetected potential environmental and health hazards if the TLS RF-to-TLS Console wire runs exceed 1000 feet. Wire runs must be less than 1000 feet to meet intrinsic safety requirements.

Splices

Veeder-Root recommends that a minimum number of splices are used in the wire run between the TLS RF and the TLS Console. Each splice degrades signal strength and could result in poor system performance.

Wire Gauges - Color coded

Shielded cable must be used in all installations. TLS RF-to-TLS Console wires must be #14 to #18 AWG stranded copper wire and installed as a Class 1 circuit.

Alternate Method

When approved by the local authority having jurisdiction, 22 AWG wire such as Belden 88761 may be suitable in installations with the following provisions:

- Wire run is less than 750 feet
- Capacitance does not exceed 100 pF/foot
- Inductance does not exceed 0.2 μ H/foot

TLS RF AC POWER WIRING

Wires carrying 120 or 240 Vac from the power panel to the TLS RF must be at least #14 AWG copper wire for line, neutral and chassis ground (3); and #12 AWG copper wire for barrier ground (1).

NOTE: Note: See page 30 for details of Repeater Power Wiring.

TLS RF Wireless System Site Layout

Figure 1 illustrates an example TLS RF Wireless System installation. The Repeater component may be required if the system Receiver, mounted on building's outside wall, has difficulty receiving signals from any of the Transmitters. See page 30 for Repeater installation.

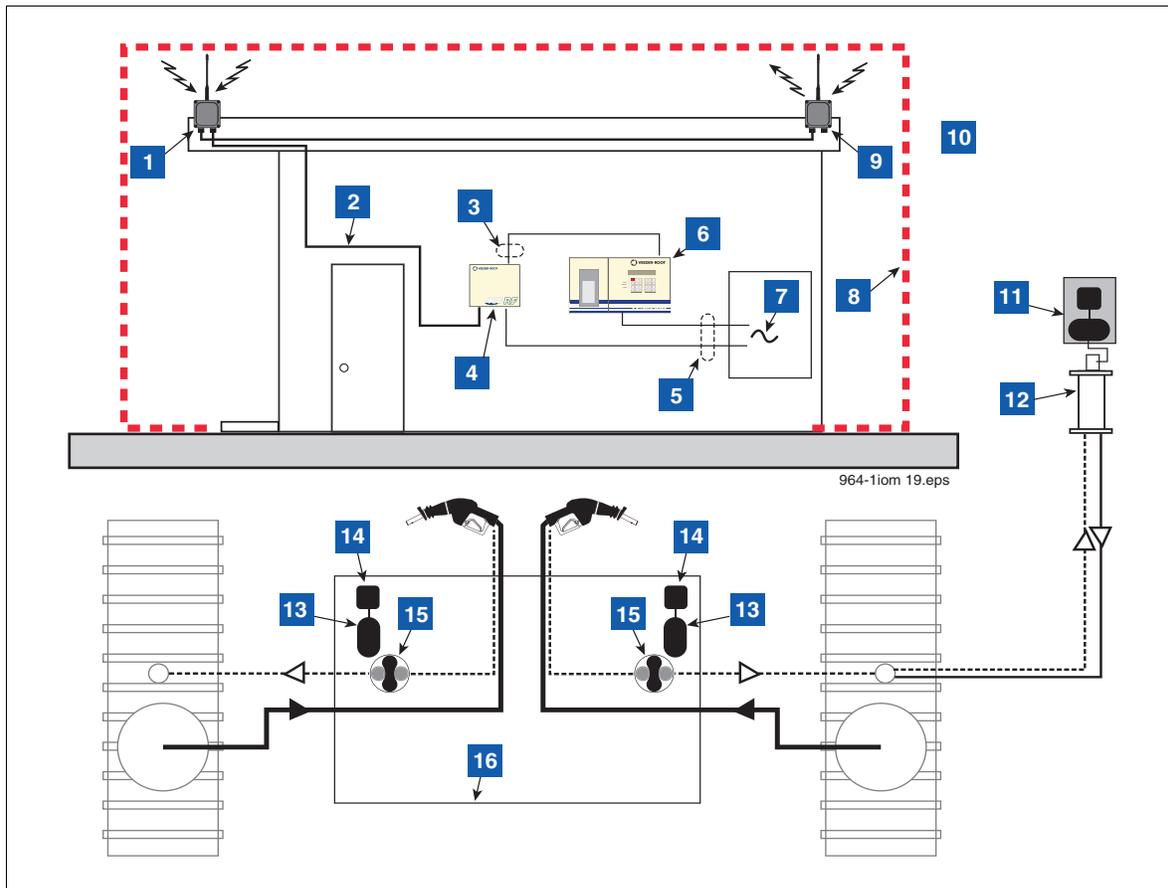


Figure 1. Example TLS RF Wireless System Site Layout

LEGEND FOR NUMBERED BOXES IN Figure 1

To be installed in accordance with the National Electrical Code, NFPA 70 and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A), or other local codes such as the CEC, Canadian Electrical Code.

WARNING! Substitution of components may impair intrinsic safety.

Circuitry within the console barrier forms an intrinsically safe, energy-limited system. This system is intrinsically safe for use in a Class I, Group D hazardous location.

1. Receiver (1 per RF System)
2. RS-485 Cable (Belden #3107A or equiv.)
3. NOTE: Intrinsically safe wiring shall be installed in accordance with Article 504-20 of the NEC, ANSI/ NFPA 70. Max cable length 1000 ft. (304 m). W2 Receiver (1 per RF System)
4. TLS-RF

5. Conduit that enters power wiring knockout.
6. TLS console (Vm = 250 V)
7. 120 or 230 Vac from power panel
8. Non-hazardous area
9. Repeater (1 per RF System)
10. Hazardous area (Class I, Div. 1, Group D)
11. CCVP transmitter/battery enclosure
12. Carbon Canister Vapor Polisher
13. Transmitter
14. Battery Pack
15. Vapor Flow meter
16. Dispenser sump



Equipment Dimensions

Dimensions of the TLS RF are shown in Figure 2.

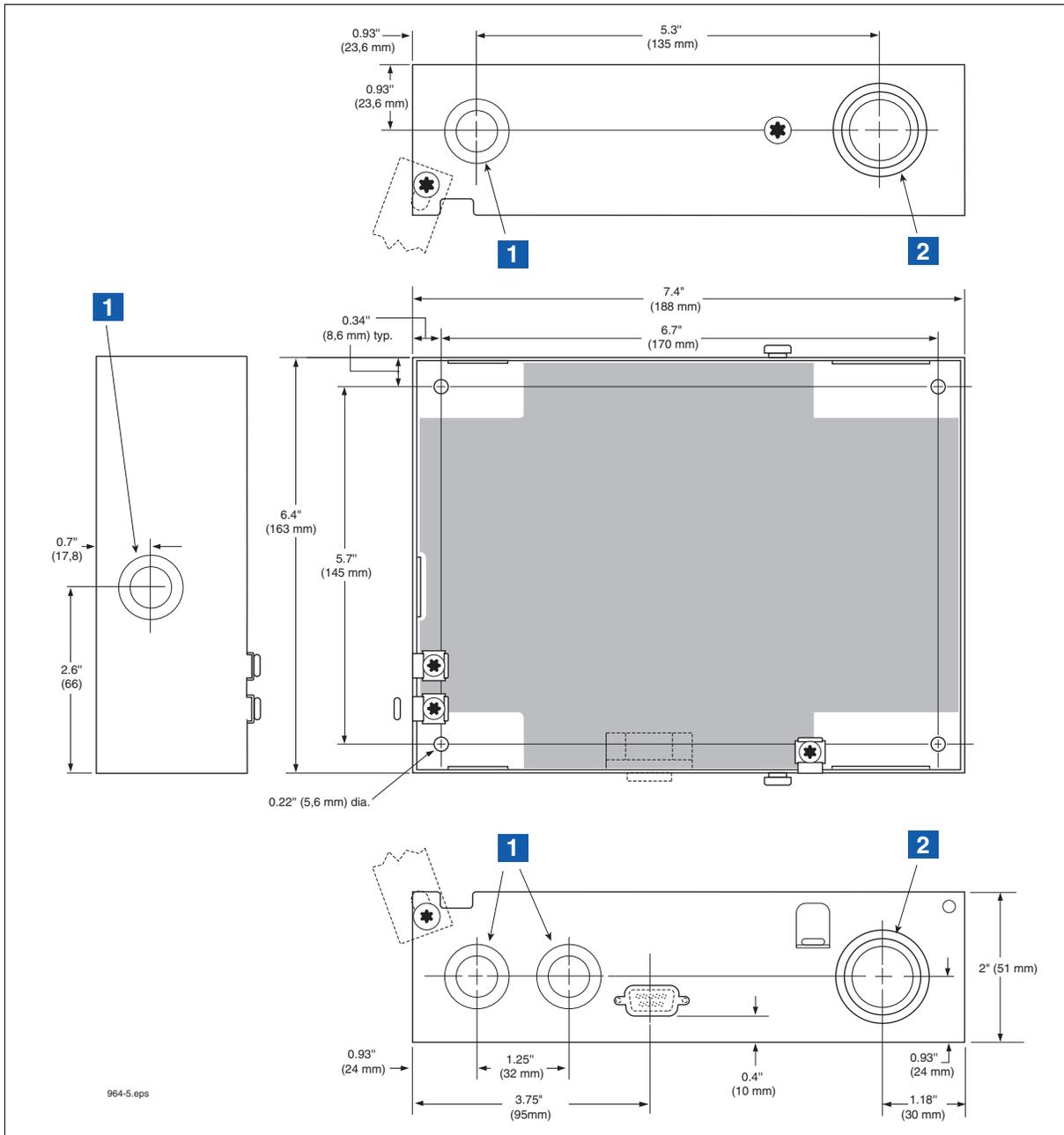


Figure 2. TLS RF dimensions and designated conduit knockouts

LEGEND FOR NUMBERED BOXES IN Figure 2

- | | |
|---------------------------------------|---|
| 1. Designated power wiring knockouts. | 2. Designated intrinsically-safe wiring knockouts.) |
|---------------------------------------|---|

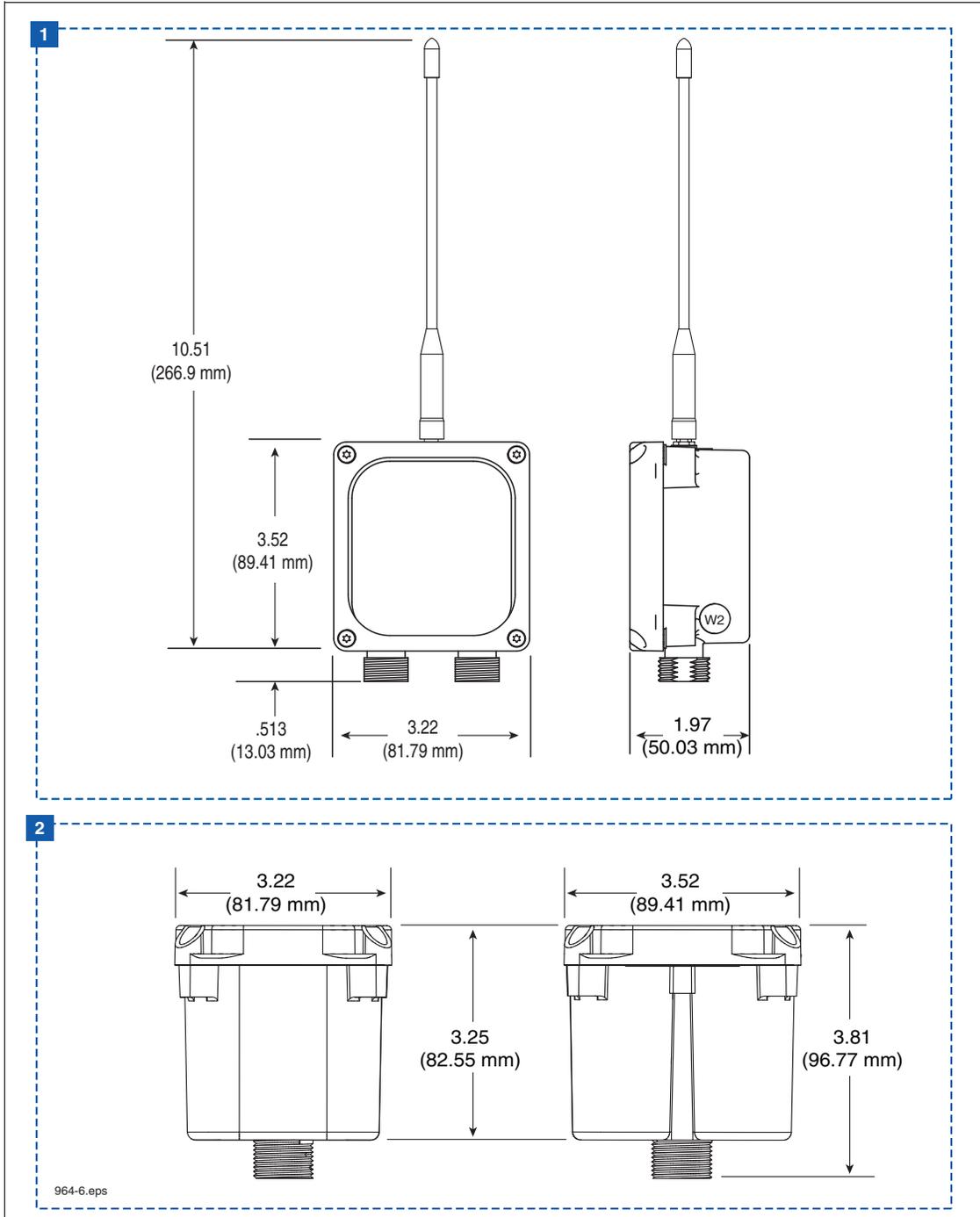


Figure 3. Wireless component dimensions

LEGEND FOR NUMBERED BOXES IN Figure 3

1. W2 Receiver, W2 Transmitter, and W2 Repeater dimensions

2. Battery housing dimensions

Pre-Installation Component Setup and Functional Check

The steps below describe the process of verifying the Wireless System component functionality; listed steps are only for one TLS RF. If there are more than 8 Sensors installed at the site, refer to Appendix B on how to setup the DIP Switches for auxiliary TLS RF(s).

1. Remove all the hardware from their boxes; lay the TLS RF, Receiver, Repeater, and all the Transmitters on a table.
2. Set Site ID for the Receiver, Repeater, and all the Transmitters (refer to Appendix B on how to set up the Site ID). Typically the Site ID is set to 0 (default). If there is a nearby wireless site, the Site ID's must be different.
3. Set all Transmitter's IDs and connect the battery cables to all the Transmitters. Label each Transmitter with its set ID.
 - a. Using a #15 torx driver, remove the cover of the Transmitter.
 - b. Remove the nut from the battery cable cord grip (right side cord grip) and slide it over the non-connector end of the battery cable.
 - c. Make sure the battery/dc power cable is not connected to the battery pack or dc power source at this time. Push the battery cable through the battery cable cord grip bushing and into the Transmitter.
 - d. Strip back the cable jacket and wires as shown in Figure 4.
 - e. Connect the battery pack/dc power cable to the BATTERY terminal block (white to +IN and black to -IN) as shown in Figure 5.
 - f. **Hand tighten both cable entry cord grip nuts to prevent water entry!**
 - g. Replace the cover of the Transmitter, but do not tighten down cover screws at this time.

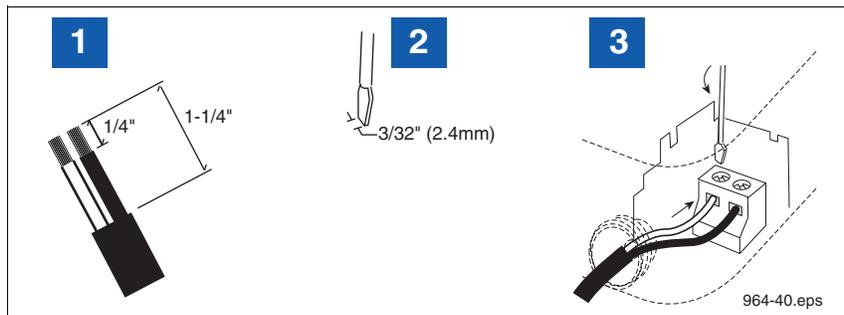


Figure 4. Connecting wiring to device terminal blocks

LEGEND FOR NUMBERED BOXES IN Figure 4

- | | |
|--|---|
| 1. Strip back cable and wire jackets the amount shown. | 3. Both wires must be tight in terminals! |
| 2. Use a screwdriver with the proper blade width. | |

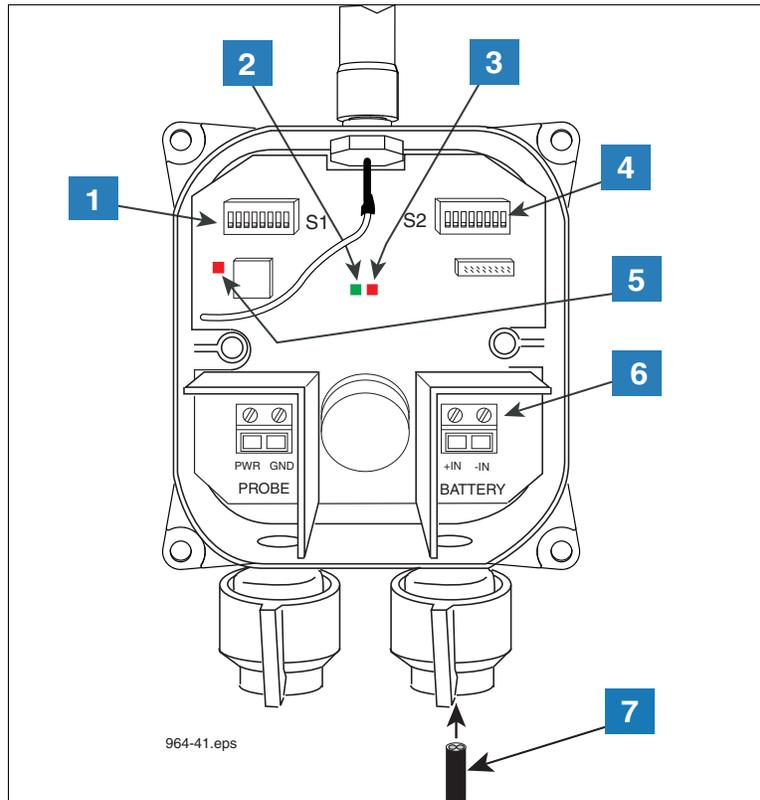


Figure 5. Wiring the Battery Cable to the Transmitter

LEGEND FOR NUMBERED BOXES IN Figure 5

- | | |
|---|--|
| <ul style="list-style-type: none"> 1. S1 DIP switch 2. Green LED – Unit status. 3. Red LED – Radio status. 4. S2 DIP switch 5. Red LED – Flashes only when radio is powered on in Diagnostic Mode. | <ul style="list-style-type: none"> 6. Battery power-in terminals (+IN and –IN). Observe polarity! <p style="text-align: center;"> Pay close attention to the polarity of the +15 Vdc. Reversing the connections can cause damage to the TLS RF.</p> <ul style="list-style-type: none"> 7. Cable from battery pack |
|---|--|

4. Using a #15 torx driver, open the covers of the TLS RF, Repeater and Receiver. Make a temporary ac power cord with a grounded plug on one end. Connect the ac power cord to the TLS RF's input power terminals and ground terminal (refer to Figure 6 and Figure 7). Connect a necessary length of RS-485 cable from the TLS RF's RS-485 terminals to the Receiver's RS-485 terminals (refer to Figure 21). Connect a necessary length of 2-conductor cable from the Receiver's Repeater terminals to the Repeater's Repeater terminals (refer to Figure 22).
5. The steps below are to verify the communication between the TLS RF Unit and the Receiver.
 - a. Plug the TLS RF's ac power cord into a 120 Vac outlet. Confirm the Green /Red LEDs (refer to item 2 in Figure 12), are flashing rapidly. This is an indication there is RS-485 network activity between the TLS RF and the Receiver.
 - b. If it is, continue to Step 6.
 - c. If it is not, check PWR LED (refer to item 3 in Figure 12), if not lit; check power wiring. If the wiring is correct, measure the voltage across the twisted pair power wires, it should read +15Vdc. If it is not, the TLS RF is bad.

- d. If the Red LED (refer to item 2 in Figure 12) is not flashing, confirm the TLS RF address is set to Master (refer to Appendix B, Figure B-1 on how to set the TLS RF Device ID). If it is, the TLS RF has failed.
 - e. If the Red LED is flashing and the Green LED is not flashing, the TLS RF is not receiving a response from the Receiver.
 - f. Confirm the Receiver PWR LED is lit (refer to item 1 in Figure 21). If not check the power wiring.
 - If the power wiring is correct, measure across the +15V and GND (refer to item 4 in Figure 21), it should be +15Vdc. If it is not, measure the voltage across the +15V and GND terminals in the TLS RF, it should read +15Vdc. If it does, replace the twisted pair power wires. If it does not, the Receiver is bad.
 - Check the RS-485 Green LED (refer to item 1 (PWR LED) in Figure 21), if it is flashing; it is receiving Data from the TLS RF. If it is not flashing, check the RS-485 cabling between the TLS RF and the Receiver.
 - Check the Red LED (XMIT LED), if it is flashing; check the cabling. If it is not flashing, the Receiver is at fault; replace the Receiver.
6. This step is to verify to make sure Data from the Transmitter is being received by the TLS RF. Make sure the power to the Repeater is off.
- a. Connect the first Transmitter's battery cable to a battery pack; noting the Red LED should be flashing momentarily then followed by the Green LED (refer to item 2 and 3 in Figure 5). Since there is no Sensor connected, the two LEDs should be flashing. This is an indication a Sensor communication error and is acceptable at this step.
TIP - Normal flashing is when an LED turns On for over 1 second and turns Off for over 1 second. Error flashing is when an LED turns On and Off every 1/2 second or less.
 - b. Go to the TLS RF, open its cover. One of the 8 Red received LEDs should be flashing (refer to item 5 in Figure 12). Observe which LED is lit and compare it against the Transmitter ID; they should match. For example, if the Transmitter ID is set to 1, the LED number 1 in the TLS RF should be flashing.
 - c. If the Transmitter ID and the LED in the TLS RF do not match, disconnect the Transmitter's battery cable from the battery pack. Move this DIP switches back and forth a few times to make sure they are set properly. Reset this DIP Switch to the correct setting; reconnect the battery cable; confirm that the correct LED is flashing.
 - d. If they still do not match, disconnect the Transmitter's battery cable from the battery pack; change the Transmitter ID to different setting and repeat Step 6.
 - e. If resetting the Transmitter to a different device ID and the LED position in the TLS RF matches; that DIP Switch position is bad, the Transmitter is at fault.
 - f. If resetting the Transmitter to a different device ID and the LEDs in the TLS RF and the Transmitter are not matched; remove the power from the Transmitter and put it aside.
 - g. Repeat Step 6 with the next Transmitter.
 - h. If both Transmitters have the same problems, it could be the Receiver or the TLS RF.
 - i. In the case where the LED in the TLS RF is not flashing, check the site ID in the Receiver and the Transmitter to make sure they are correct. If the site IDs are correct, the Transmitter or the Receiver is at fault. NOTE: Sometimes it is necessary to disconnect the battery cable from the battery pack and wait for 2 minutes and retry again to make sure the connection is established properly.
7. If all the Transmitters have been verified to be working properly, they are now ready to be installed.
8. Unplug the TLS RF, disconnect the temporary power cable and RS-485 cable to the Receiver and close the cover of the TLS RF, but do not tighten the cover screws at this time.
9. Disconnect the temporary RS-485 and 2-conductor cables from the Receiver and replace its cover, but do not tighten at this time. Disconnect the temporary 2-conductor cable from the Repeater and replace its cover, but do not tighten at this time.

TLS RF Installation

Selecting A Location

WARNING



Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed. The TLS RF is not explosion proof.

An explosion or fire resulting in serious injury or death, property loss and equipment damage could occur if the console is installed in a volatile, combustible or explosive atmosphere (Class I, Division 1 or 2).

Do not install this unit in a volatile, combustible, or explosive atmosphere.

The TLS RF must be mounted indoors, protected from severe vibration, extremes in temperature and humidity, and other conditions that could harm computerized electronic equipment.

Ensure that the TLS RF is located where neither it nor its associated cabling will be damaged by doors, furniture, etc. Consider the ease of routing wiring, and ducting to the TLS console. Check that the mounting surface is strong enough to support the unit's weight of about 4 pounds.

Mounting the TLS RF

Install the unit's fastening devices to the mounting surface using the hole pattern (6.7" x 5.7") shown in Figure 2. Mounting screws up to 3/16" diameter may be used.

Install metal conduit (1/2-inch I.P.S.) between the upper power side knockout on the unit and the power panel. Figure 2 shows the three designated knockouts (one each on top, left side, and bottom) through which power wiring can safely enter the unit.

Also install metal conduit (1/2-inch I.P.S.) between the lower intrinsically-safe wiring knockout on the TLS RF and an intrinsically-safe wiring knockout on the TLS console for device data wiring.

Wiring the TLS RF

WARNING



The unit contains voltages which can be lethal.

Connecting power wires to a live circuit can cause electrical shock that may result in serious injury or death.

Turn power off at the circuit breaker before connecting wiring to the TLS RF.

Attach conduit from the power panel to the unit's power wiring knockouts only (1 on top and 1 on bottom, ref. Figure 2)

To connect power wiring see Figure 6. To connect Receiver wiring see Figure 7. To daisy chain two TLS RFs, see Figure 9 and Figure 10. To connect TLS RF data output wiring to the TLS console see Figure 11.



WARNING! Do not apply power to the TLS RF Console until all device wiring is complete. This includes the wiring for the Receiver, Repeater, the probes and additional TLS RF Consoles.

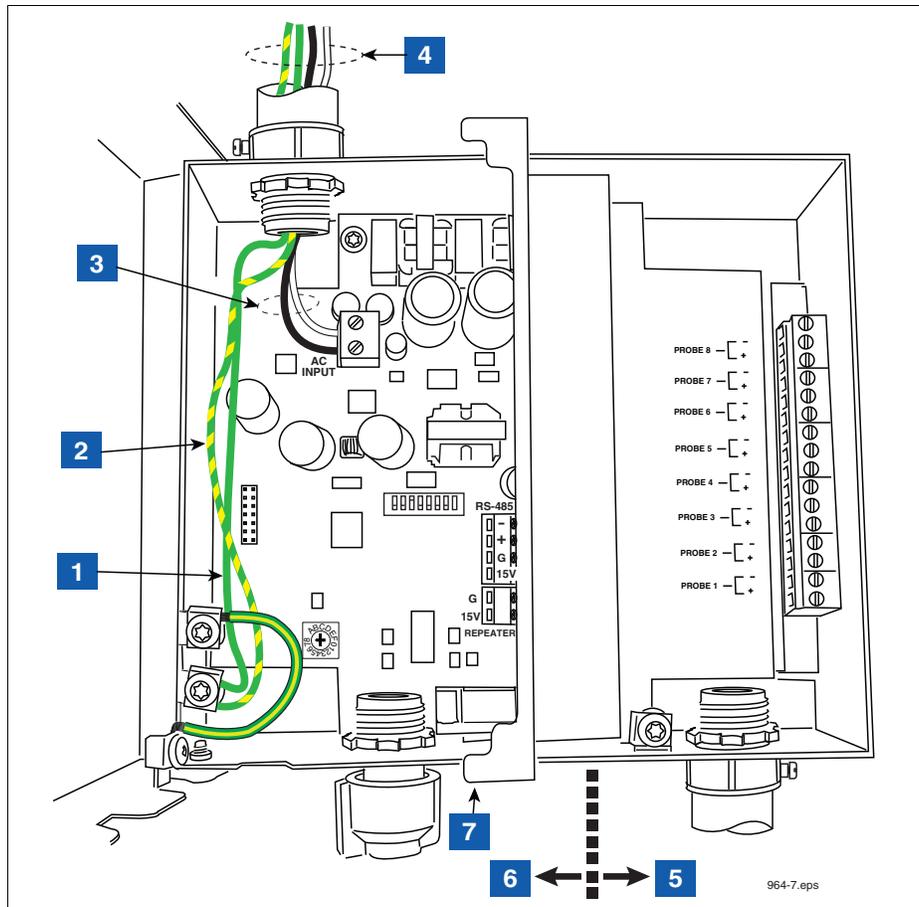


Figure 6. Wiring AC power to the TLS RF

LEGEND FOR NUMBERED BOXES IN Figure 6

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Attach chassis ground wire (#14 AWG) to ground lug. 2. Protective earthing conductor (green and yellow). Attach #12AWG barrier ground wire to ground lug. Ground must be the same as the supply and less than 1.0 ohms to ground. 3. AC power input wires (#14 AWG) to AC INPUT terminals. 4. POWER WIRING NOTES: <ul style="list-style-type: none"> • Barrier ground must be #12 AWG or larger diameter. • Check to be sure that the electrical resistance between the unit ground lug and a known good earth ground is less than 1 ohm. • Connect the power supply wires in the power panel to a separate dedicated circuit. • Electrical rating power input - 120 Vac or 240 Vac, 50/60 Hz, 2 A max. • See Figure 2 for actual locations of power conduit knockouts into the unit. Power wiring must enter only in one of these knockouts. | <ol style="list-style-type: none"> 5. Intrinsically-safe side 6. Power side 7. RS-232 diagnostic port: <ul style="list-style-type: none"> • Baud rate - 9600 • Data length - 8 • Parity - None • Stop bits - 1 |
|---|--|

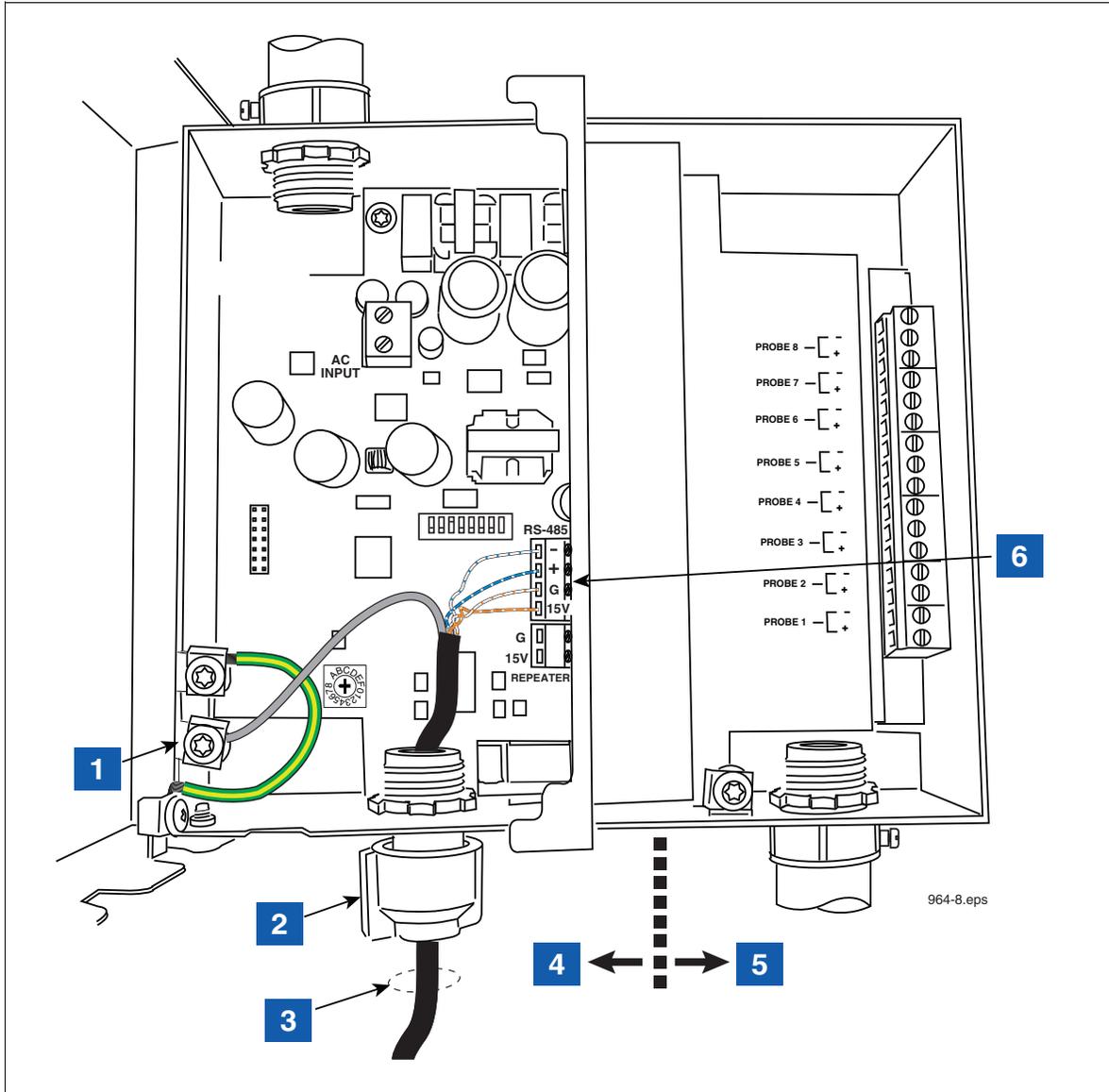


Figure 7. Wiring Receiver to the TLS RF

LEGEND FOR NUMBERED BOXES IN Figure 7

- 1. Connect the shield of the RS-485 cable to the ground lug.
- 2. Cord grip
- 3. RS-485 cable to Receiver
- 4. Power side
- 5. Intrinsically-safe side
- 6. NOTE: Attach one end of RS-485 cable to RS-485 terminals in the TLS RF and other end to RS-485 terminals in the Receiver. One twisted pair connects to terminals - and + (RS-485 signals) and the second twisted pair connects to terminals +15 and G (Receiver power).

6 (Cont'd).
 You must connect each wire of each pair to the same terminals in the Receiver (e.g., white w/blue stripes to "-“and white w/blue stripes to “+“). (ref. Figure 21).

NOTE: see Figure 4 for wire connection tips. NOTE: In sites with more than one TLS RF, the Receiver is only connected to the master TLS RF.

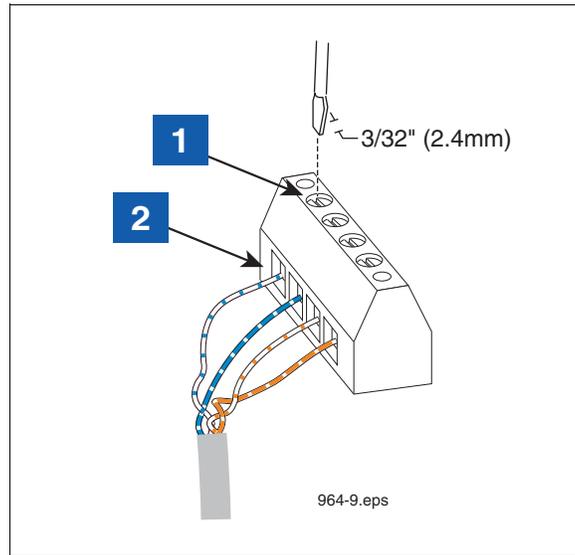


Figure 8. Connecting RS-485 Wiring

LEGEND FOR NUMBERED BOXES IN Figure 8

- | | |
|---|--|
| <p>1. Use small blade screwdriver and loosen terminal by turning top screw over desired terminal counter clockwise. DO NOT raise screw head above top of hole or it may disengage from clamp.</p> | <p>2. Insert 1/4" stripped wire into terminal clamp's side opening and tighten screw clockwise until wire cannot be moved in or out.</p> |
|---|--|

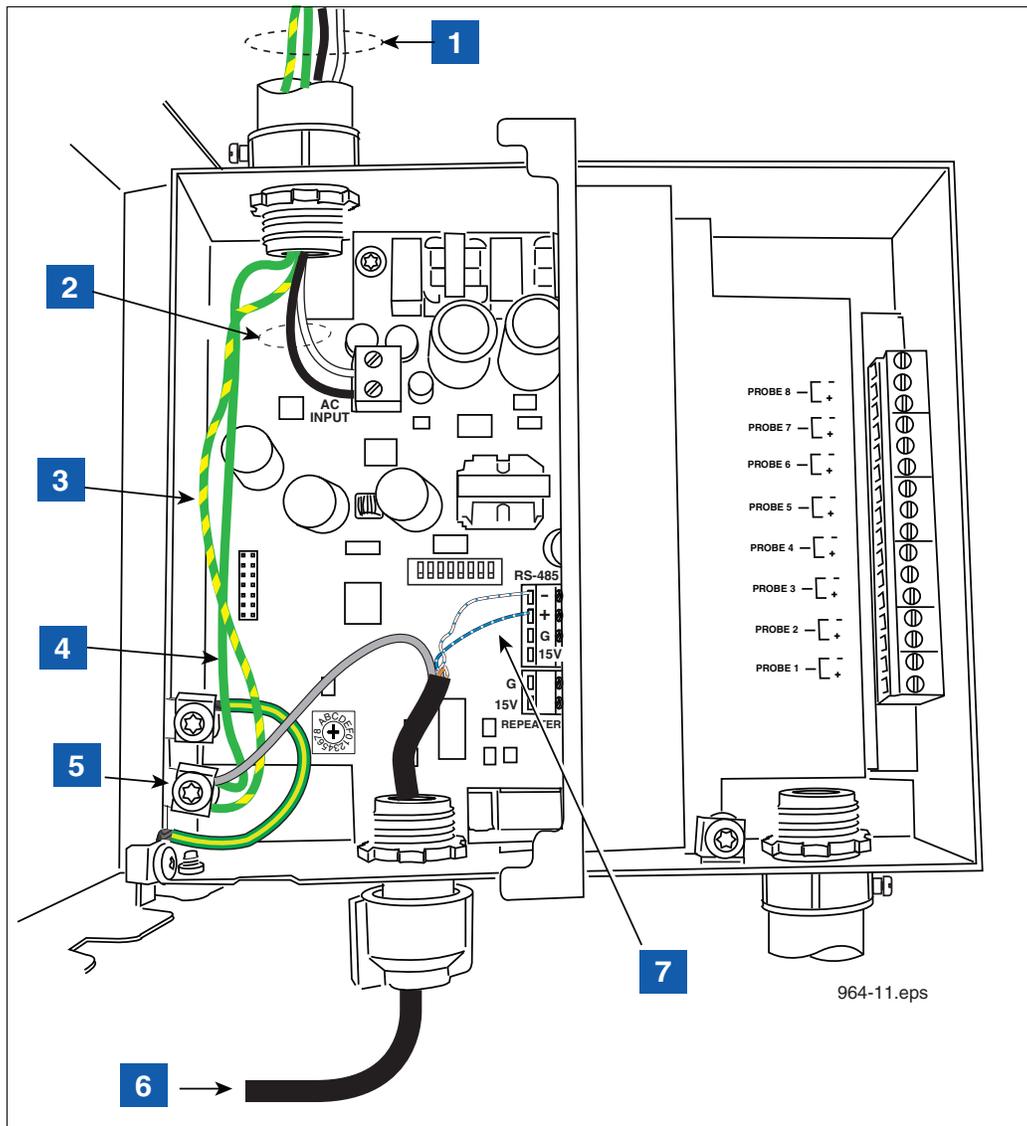


Figure 9. Power connections to a daisy chained TLS RFs

LEGEND FOR NUMBERED BOXES IN Figure 9

- | | |
|--|--|
| <p>1. POWER WIRING NOTES:</p> <ul style="list-style-type: none"> • Barrier ground must be #12 AWG or larger diameter. • Check to be sure that the electrical resistance - between the unit ground lug and a known good earth ground is less than 1 ohm. • Connect the power supply wires in the power panel to a separate dedicated circuit. • Electrical rating power input - 120 Vac or 240 Vac, 50/60 Hz, 2 A max. • See Figure 2 for actual locations of power conduit knockouts into the unit. Power wiring must enter only in one of these knockouts. <p>2. AC power input wires (#14 AWG) to AC input terminals.</p> | <p>3. Protective earthing conductor (green and yellow). Attach #12AWG barrier ground wire to ground lug. Ground must be the same as the supply and less than 1.0 ohms to ground.</p> <p>4. Attach chassis ground wire (#14 AWG) to ground lug.</p> <p>5. Connect the shield of the RS-485 cable to the ground lug.</p> <p>6. RS-485 cable from master TLS RF.</p> <p>7. See Figure 10 for connections.</p> |
|--|--|

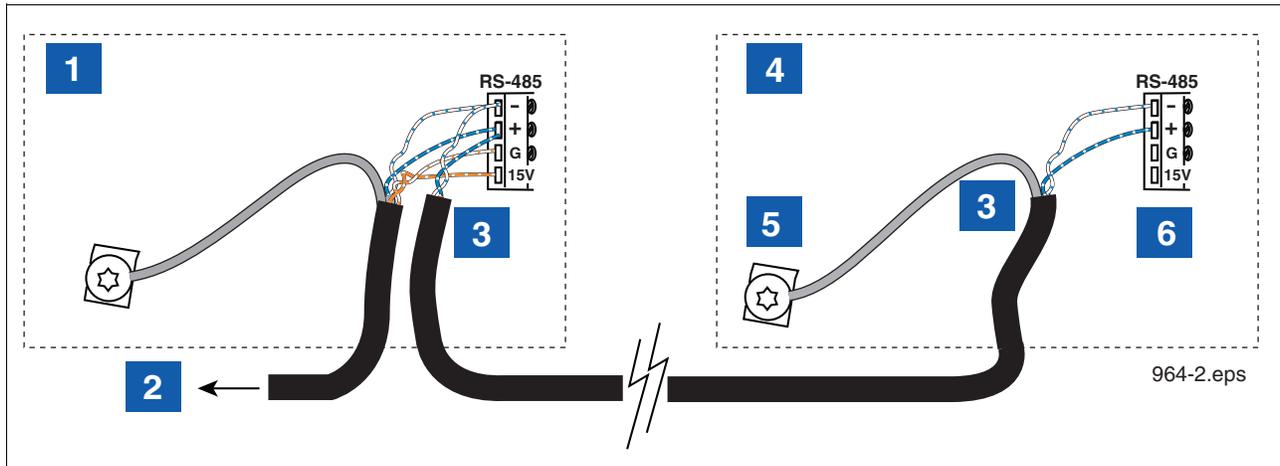


Figure 10. RS-485 cable connections when daisy chaining two TLS RFs

LEGEND FOR NUMBERED BOXES IN Figure 10

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Master TLS RF 2. RS-485 cable to Receiver. 3. RS-485 cable to auxiliary TLS RF. Cut the unused twisted pair back to the cable's jacket at each end of the cable. Maximum cable length is 500 feet if a communication grade cable is used. 4. Auxiliary TLS RF | <ol style="list-style-type: none"> 5. Connect the shield of the RS-485 cable to the ground lug. 6. Connect like colored wires of the twisted pair to like terminals in the auxiliary TLS RF. Each additional TLS RF connects in the same way to the last in the chain. |
|---|--|

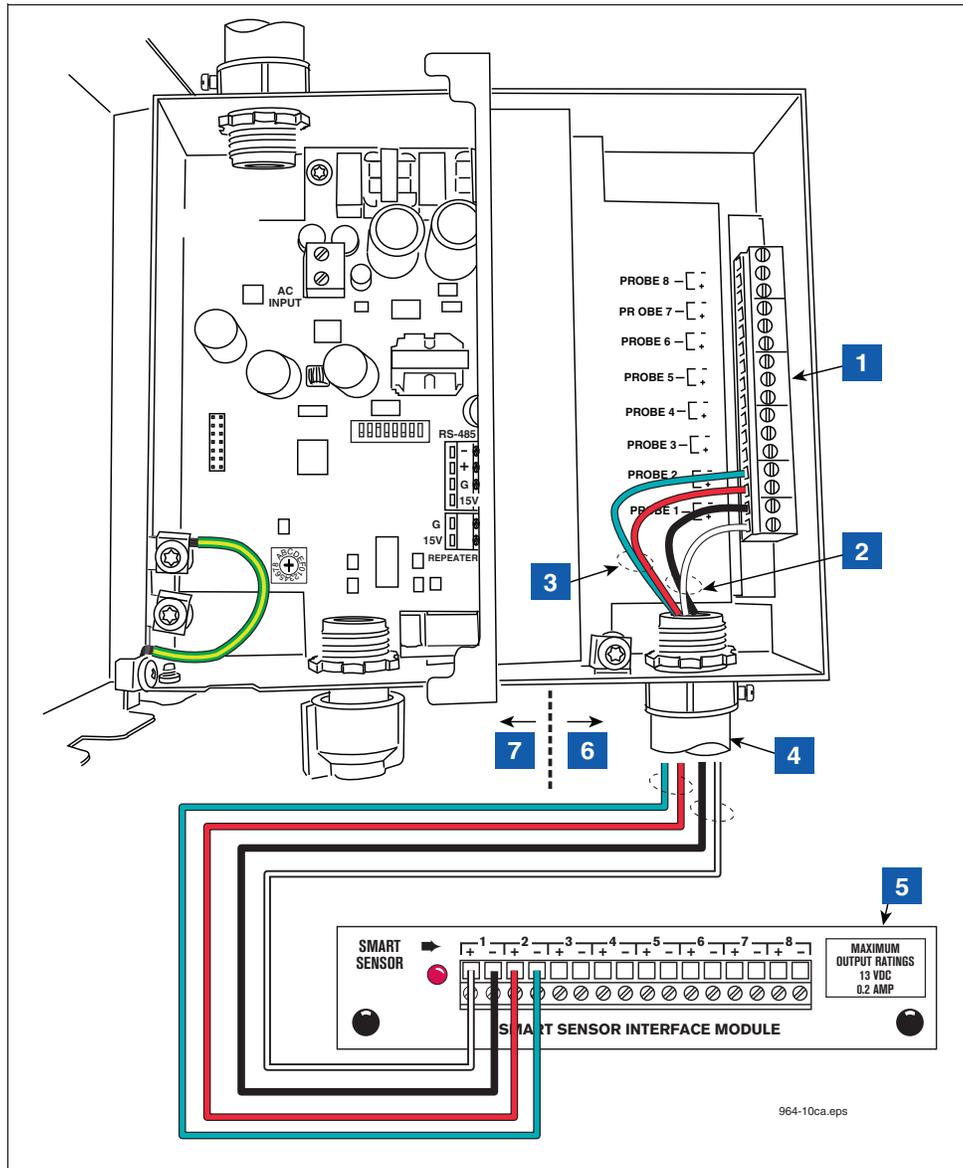


Figure 11. Wiring Data Outputs from TLS RF to TLS Console

LEGEND FOR NUMBERED BOXES IN Figure 11

Note: Output wiring from the TLS RF to the TLS console is an intrinsically safe circuit.

NOTE: Intrinsically safe wiring shall be installed in accordance with Article 504-20 of the NEC, ANSI/NFPA 70.

1. Received Transmitter data output terminals (1-8).
2. In this example, device output 1 is a CCVP transmitter - Observe polarity. Note: each time a transmission is received from this device, LED 1 (see item 5 in Figure 12) will flash.
3. In this example, device output 2 is a Flow Meter - Observe polarity. Note: each time a transmission is received from this device, LED 2 (see item 5 in Figure 12) will flash.

4. 1/2" i.p.s. conduit to TLS console
5. SmartSensor interface module in TLS console
6. Intrinsically-safe side
7. Power side



Figure 12 locates the diagnostic lights and setup switches in the TLS RF.

Each TLS RF in the site network must have a unique device set number (0,1,2 or 3). The factory default setting is '0'. You must select '0' for the master TLS RF. The site's Receiver must also be connected to the master TLS RF.

If a second TLS RF is required, enter '1' in the auxiliary TLS RF. For additional TLS RFs, enter '2' for the third and '3' for the fourth.

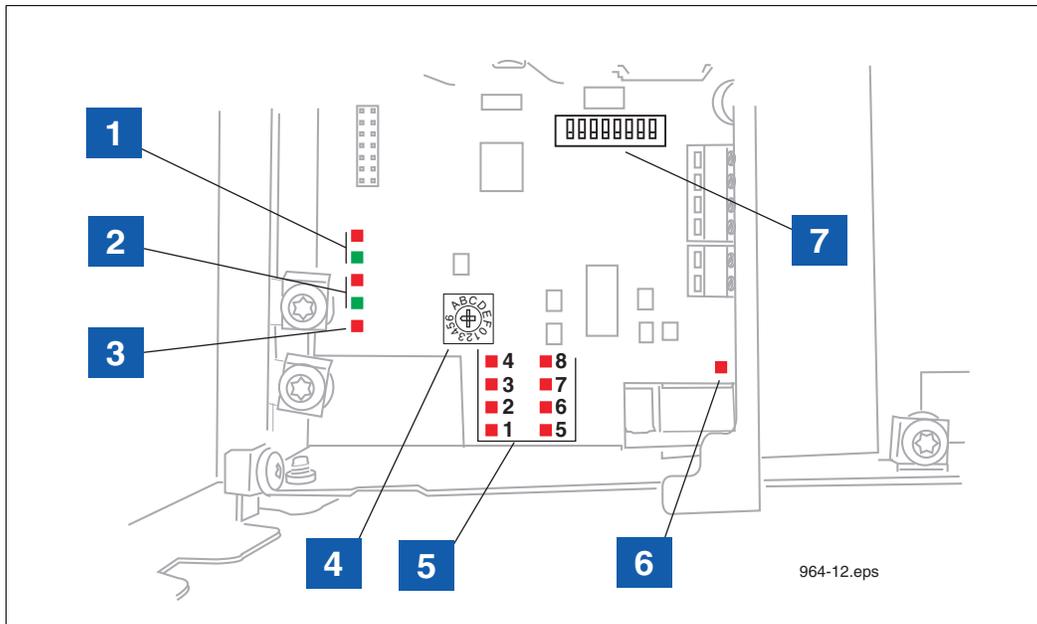


Figure 12. TLS RF diagnostic LEDs and switch locations

LEGEND FOR NUMBERED BOXES IN Figure 12

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. These LEDs flash when there is comm activity on RS-232 port (Red = TX, Green = RX). 2. These LEDs flash when there is comm activity on the RS-485 network (between TLS RF and Receiver). 3. Red LED is lit when TLS RF is powered on. 4. Device timeout rotary switch selects the maximum allowed time to wait for communication from Transmitter before an Comm alarm is posted by TLS console (see Appendix B for selections). Position 1 (10 minutes) is the factory default setting. | <ol style="list-style-type: none"> 5. These red LEDs flash when a message is received from a Transmitter in the monitored device set. LED 1 is the device wired to I.S. output terminal 1. LED 2 is the device wired to output terminal 2, etc. 6. Red LED flashes when TLS console is polling for device data. 7. S2 DIP switches 1-2 enter device set address (see Appendix B). |
|--|--|

ISD Component Installation

Vapor Flow Meter Installation - Dispenser

1. A Transmitter /battery pack pair must be installed with the Veeder-Root Vapor Flow Meter (VFM) in the dispenser cabinet.
2. Install the VFM in the dispenser following instructions accompanying the VFM.
3. Using two taptite screws from the kit, attach the Transmitter housing to the side of the battery support bracket that has the two circular slots (see Figure 13). Do not tighten screws at this time.
4. Remove the cover from the transmitter. Attach the non-connector end of the cable from the VFM to the transmitter as described in the section below entitled "Connecting Sensor Cables To The Transmitter" on page 24, then attach the transmitter/L bracket assembly to the back mounting surface using two #10 taptite screws from the kit.
5. Determine a support location within the dispenser cabinet that will allow you room for the transmitter/battery support bracket. Clamp the bracket to an available support structure (see Figure 14).
6. Rotate the Transmitter antenna as close as possible to a horizontal position then tighten two mounting screws in housing.
7. Insert the battery pack into its support bracket - do not connect the battery cable to the battery pack at this time.

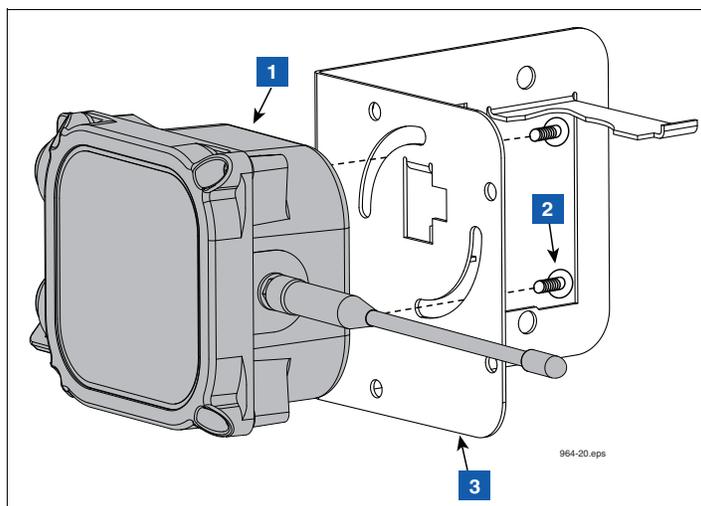


Figure 13. Attaching Transmitter to battery support bracket

LEGEND FOR NUMBERED BOXES IN Figure 13

1. Transmitter
2. #10 x 1/2" taptite screws (2)
3. Battery support bracket

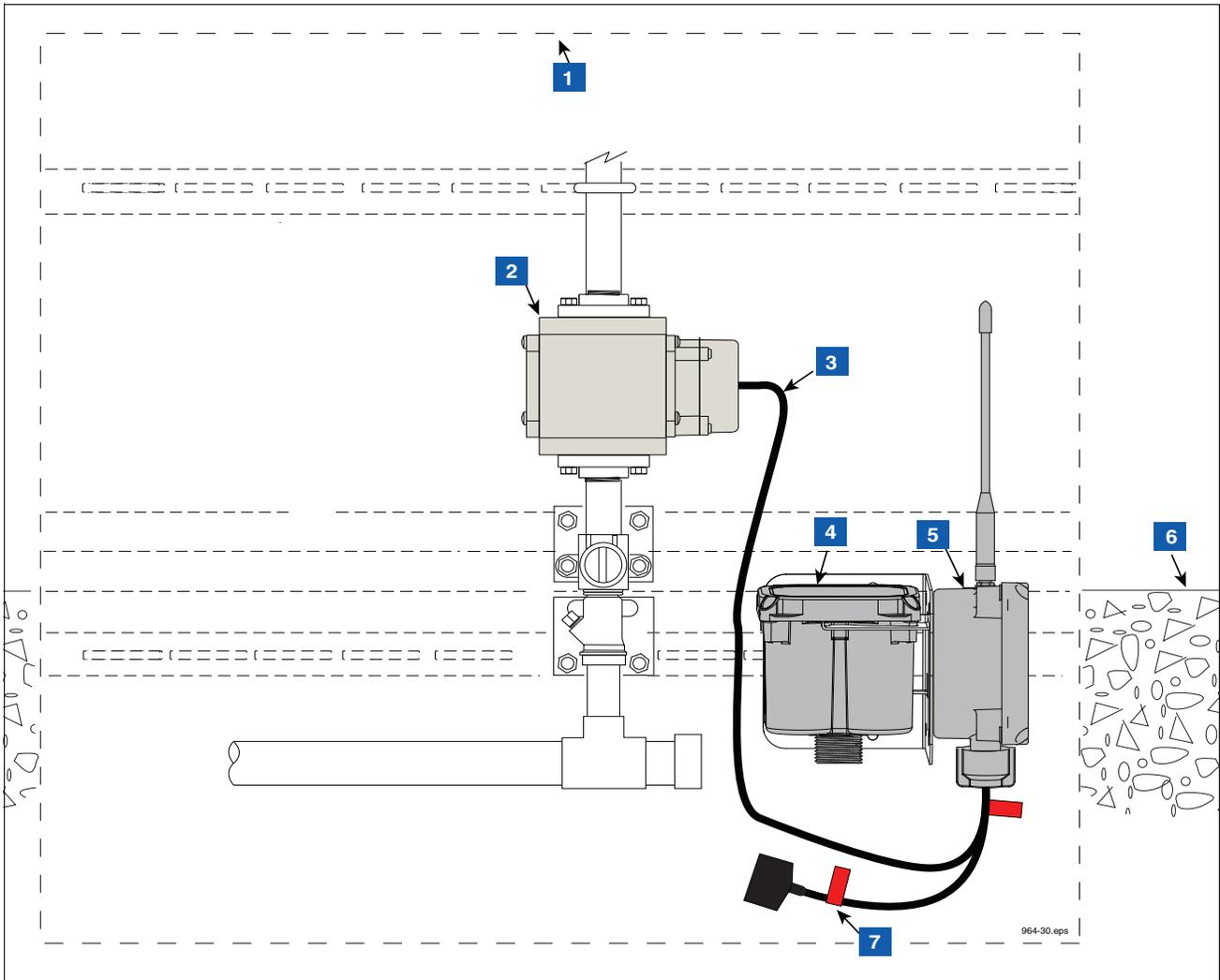


Figure 14. Example VFM Transmitter installation in dispenser

LEGEND FOR NUMBERED BOXES IN Figure 14

- | | |
|------------------------------|---|
| 1. Base of dispenser cabinet | 5. Transmitter |
| 2. VFM | 6. top of dispenser pedestal |
| 3. VFM cable | 7. Battery caution label attached to battery cable (2 places) |
| 4. Battery pack | |

Carbon Canister Vapor Polisher Installation

1. During the installation, all required National, State and local safety codes must be followed.
2. A Transmitter /battery pack pair must be installed with the Veeder-Root Carbon Canister Vapor Polisher (CCVP) in a weatherproof enclosure mounted on the vent stack (see Figure 15).
3. Install the CCVP sensor following instructions accompanying the sensor.
4. Using two #10 taptite screws from the kit, attach the Transmitter housing to the side of the L bracket from the wireless installation kit - do not attach L bracket/transmitter assembly to the back mounting surface at this time.
5. Get the battery pack mounting bracket from the wireless installation kit and put the threaded connector fitting of the battery housing through the large hole in the bracket.
6. Get the thin hex nut from the kit and screw it onto the battery housing cable connector threaded fitting until snug (see item 3 in Figure 16).
7. Attach the battery housing/bracket assembly to the back mounting surface of the enclosure using two #10 taptite screws from the kit (see item 4 in Figure 16).
8. Remove the cover of the transmitter. Connect the non-connector end of the cable that connects the CCVP to the transmitter as described in the section below entitled "Connecting Sensor Cables To The Transmitter" on page 24, then attach the transmitter/L bracket assembly to the back mounting surface using two #10 taptite screws from the kit.
9. Attach the connector end of the CCVP cable to the Carbon Canister's Vapor Valve connector (see Figure 17).
10. Insert the battery pack into its support bracket - do not connect the battery cable to the battery pack at this time.

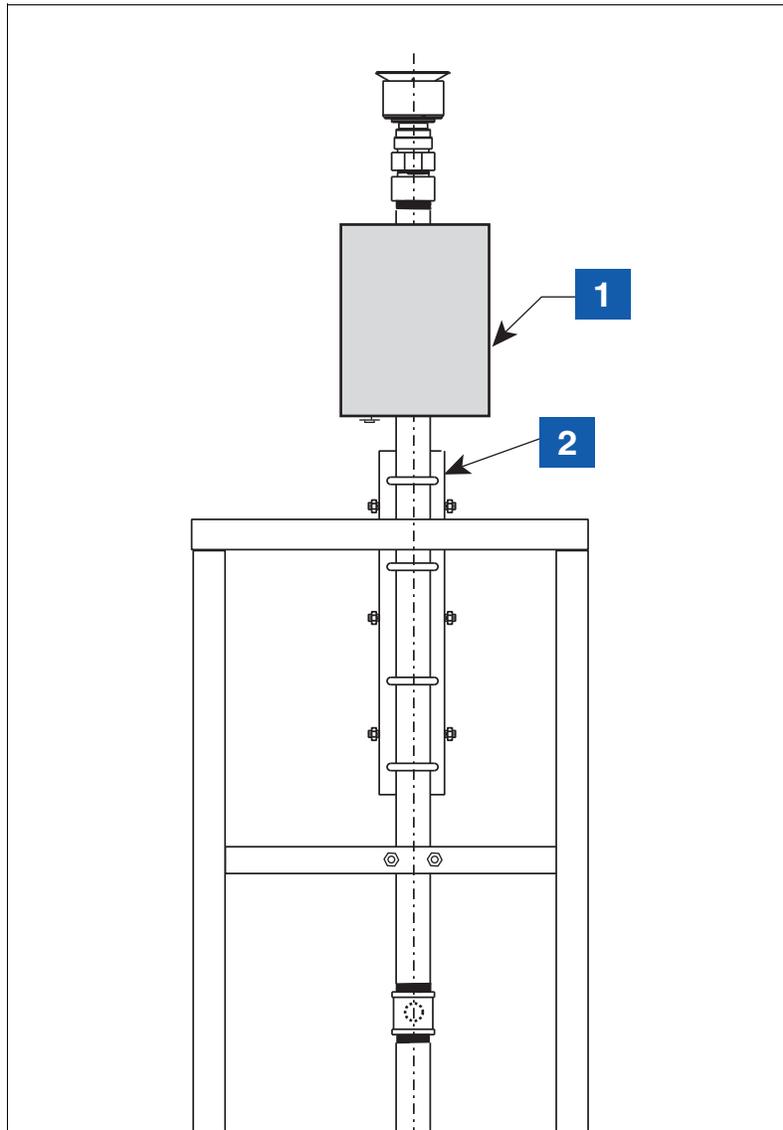


Figure 15. Example CCVP installation

LEGEND FOR NUMBERED BOXES IN Figure 15

1. CCVP transmitter/battery enclosure on vent stack

2. CCVP support bracket

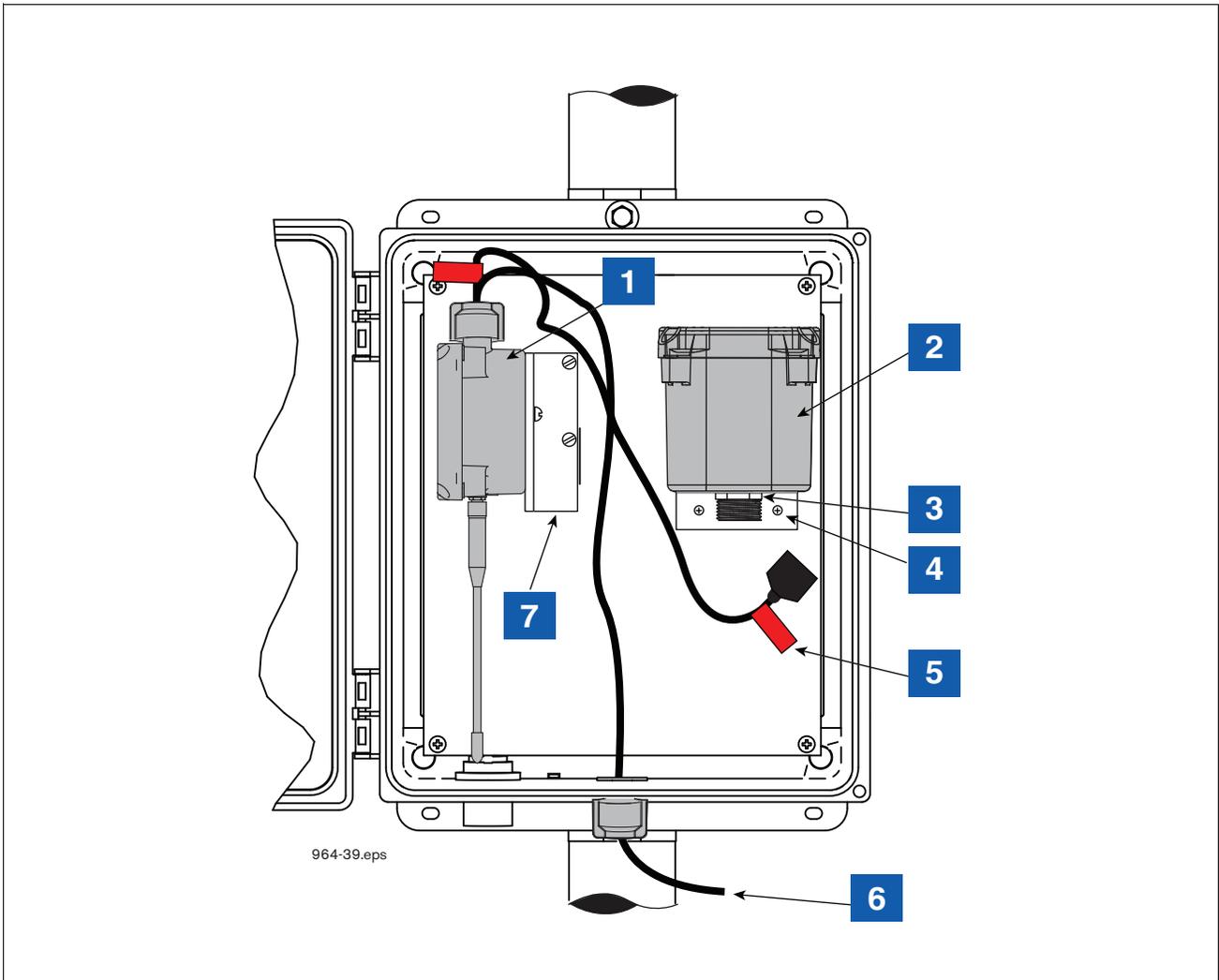


Figure 16. Example CCVP transmitter/battery pack installation in vent stack enclosure

LEGEND FOR NUMBERED BOXES IN Figure 16

- | | |
|--|---|
| 1. Transmitter | 5. Battery caution label attached to battery cable (2 places) |
| 2. Battery pack | 6. Cable from CCVP |
| 3. Thin hex nut | 7. Attach Transmitter L bracket using two #10 taptite screws |
| 4. Attach Battery L bracket using two #10 taptite screws | |

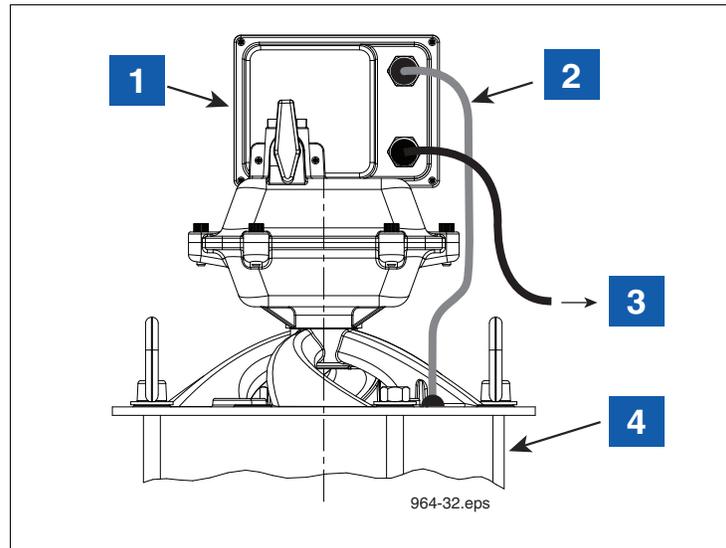


Figure 17. Attaching transmitter cable to CCVP vapor valve

LEGEND FOR NUMBERED BOXES IN Figure 17

- | | |
|--|------------------------------|
| 1. Vapor Valve assembly | 3. Cable to CCVP transmitter |
| 2. Cable to CCVP thermal probe (factory installed) | 4. CCVP |

Connecting Sensor Cables To The Transmitter

Note: The dip switches in each transmitter must be set to the proper dip switch settings listed in Appendix B. If the dip switches are set incorrectly, this device will fail to operate properly.

- Using a #15 torx driver, remove the cover of the Transmitter.
- Make sure the battery/dc power cable is not connected to the battery pack or dc power source at this time.



WARNING! To prevent ignition of flammable or combustible atmosphere disconnect power before servicing.

- Remove the nut from the sensor cable cord grip (left side cord grip) and slide it over the non-connector end of the sensor cable. Push the end of the cable into the Transmitter.
- Strip back cable jacket and wires as shown in Figure 18.
- All sensor cables connect to the PROBE terminal block the SAME WAY - the white wire to the PWR terminal and the black wire to the GND terminal as shown in Figure 19.



- Hand tighten both cable entry cord grip nuts to prevent water entry!**

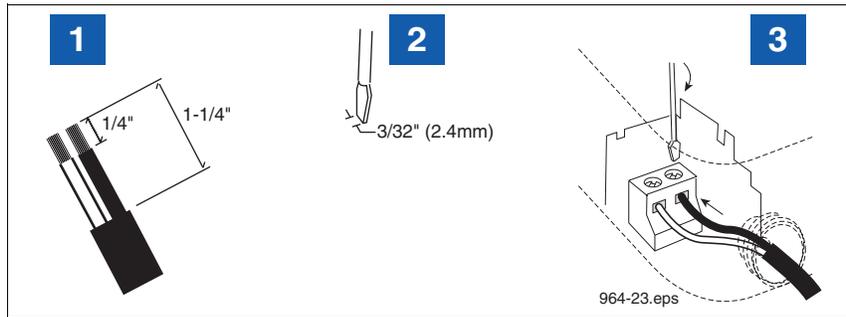


Figure 18. Connecting sensor wiring to sensor terminal block

LEGEND FOR NUMBERED BOXES IN Figure 18

- | | |
|--|---|
| 1. Strip back cable and wire jackets the amount shown. | 3. Both wires must be tight in terminals! |
| 2. Use a screwdriver with the proper blade width. | |

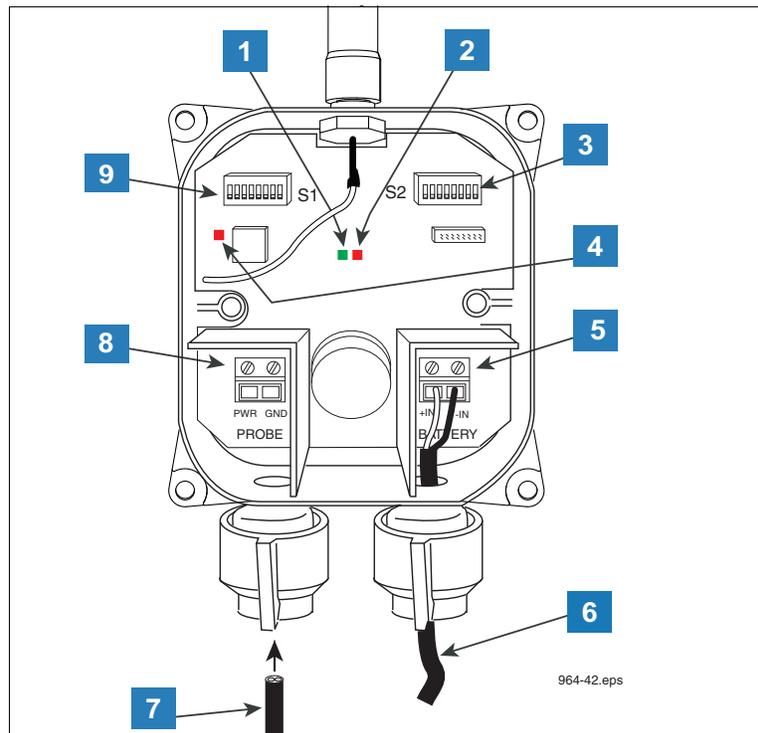


Figure 19. Wiring the Transmitter

LEGEND FOR NUMBERED BOXES IN Figure 19

- | | |
|--|---|
| 1. Green LED – Unit status. | 7. Cable from sensor. |
| 2. Red LED – Radio status. | 8. Sensor input terminals (PWR and GND). OBSERVE POLARITY! |
| 3. S2 DIP switch | 9. S1 DIP switch |
| 4. Red LED – Flashes only when radio is powered on in Diagnostic Mode. |  Pay close attention to the polarity of the +15 Vdc and sensor input connections. Reversing the connections can cause damage to the TLS RF. |
| 5. Battery power-in terminals (+IN and –IN). Observe polarity! | |
| 6. Cable from battery pack | |

7. To assure a water-tight seal between the cover and the enclosure, follow these steps:
 - a. Insert the four cover screws through the cover and then press on the retaining washers to hold the screws in place.
 - b. Make sure that the cover gasket is free of dirt and debris on both sides of the gasket and that the inside of the cover is clean in the gasket area.
 - c. Position the gasket into the cover groove, assuring that it is pressed fully into the groove and sitting completely flat.
 - d. Assemble the cover onto the enclosure, tightening the screws in a couple of turns each. Using an alternating 'X' pattern, continue to tighten the screws until they are all tight.
8. If you haven't done so already, attach the red battery ID labels from the installation kit to the battery cable at both ends.
9. Push the battery cable connector onto the battery housing threaded fitting and hand tighten.

Receiver Installation

1. One Receiver is required per site and it is mounted in the vertical position (antenna up) on the outer wall of the same building housing the TLS RF. The Receiver is attached to its mounting bracket with #10 x 1/2" taptite screws from its install kit (see Figure 20). The L-bracket is then mounted on the outer wall of the building using appropriate fasteners (customer supplied). If the Receiver will be exposed to the weather, attach the L-bracket to the mounting surface inside a weatherproof enclosure. This enclosure is not required when mounting the Receiver under a roof overhang and shielded from the weather.

NOTE: When locating the mounting position, keep in mind that the RS-485 cable connecting the Receiver to the TLS RF must be less than 250 feet in length. Avoid placing the Receiver near motors (e.g., power roof vents), fluorescent lighting (min. 1 foot separation), pumps, welders.

Locate the Receiver on the same side of the building as the underground transmitters. If there are additional tanks either too far away or on the opposite side of the building, the Repeater can be located either on a structure near the remote tanks or on the opposite side of the building facing those tanks - see Repeater installation.



The Receiver is only suitable for use in a non-hazardous location.

2. Run the RS-485 cable (Belden #3107A or equiv.) from the TLS RF through the building's wall to the Receiver. Caulk the cable where it passes through wall openings. Use cable clamps at appropriate intervals to secure the cable to the walls.
3. Note that the Receiver cover label indicates the cord grip to be used for the RS-485 cable from the TLS RF and the cable to the Repeater (if used). Remove the cover of the Receiver and set it aside.
4. Set S1 and S2 DIP settings as desired (ref. Appendix B, Figure B-2). NOTE: set all dip switches prior to attaching the TLS RF RS-485 cable as the dip switches are only read during power up.
5. Slide the nut over the cable. Choose the correct size bushing and slide it over the cable. Dress the cable jacket according to the dimensions in Figure 18. Insert the cable into the appropriate opening at the bottom of the housing. Insert each wire into the appropriate terminal and tighten. Leave a small amount of slack in each wire. Slide the bushing into the bottom of the housing. Hand tighten the nut.
6. Note that there are two twisted pair color-coded wires in the cable (e.g., a white with blue stripe and blue with white stripe pair and a white with orange strip and orange with white stripe pair). One of the pairs is for RS-485 communication (- & + terminals) and the other pair is for Receiver power (+15 Vdc & Gnd). Using Figure 21 as a guide, attach the wires of the two twisted pairs to the RS-485 terminals.

Record which wire attaches to each terminal to help you attach the other end of that wire to the identically marked terminal in the TLS RF.

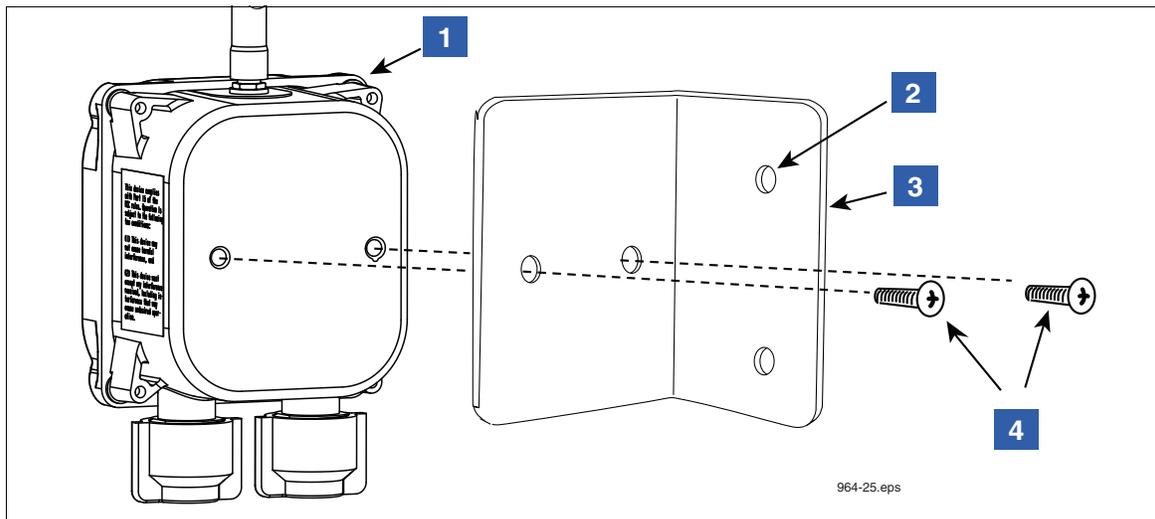


Figure 20. Attaching mounting bracket to Receiver or Repeater

LEGEND FOR NUMBERED BOXES IN Figure 20

- | | |
|---|------------------------------|
| 1. Receiver or Repeater | 4. #10 x 1/2" taptite screws |
| 2. 0.280" diameter hole (2) – mount this narrow side of bracket to wall or post | |
| 3. Mounting bracket. | |

7. Referring to your connection notes in step 5 above, connect the other end of the RS-485 cable to the RS-485 terminal block in the TLS RF (ref. Figure 7 on page 13).
8. If a Repeater is used and powered by the Receiver, push the two wire power cable (to Repeater) through the +15 Vdc cord grip of the Receiver (item 7 in Figure 21).
9. Slide the nut over the cable. Choose the correct size bushing and slide it over the cable. Dress the cable jacket according to the dimensions in Figure 18. Insert the cable into the appropriate opening at the bottom of the housing. Insert each wire into the appropriate terminal and tighten. Leave a small amount of slack in each wire. Slide the bushing into the bottom of the housing. Hand tighten the nut.
10. Attach the dc power cable (white to +15 Vdc and black to GND) to the Repeater terminal block (item 9 in Figure 21).



11. Hand tighten both cable entry cord grip nuts to prevent water entry!

12. To assure a water-tight seal between the cover and the enclosure, follow these steps:
 - a. Insert the four cover screws through the cover and then press on the retaining washers to hold the screws in place.
 - b. Make sure that the cover gasket is free of dirt and debris on both sides of the gasket and that the inside of the cover is clean in the gasket area.
 - c. Position the gasket into the cover groove, assuring that it is pressed fully into the groove and sitting completely flat.
 - d. Assemble the cover onto the enclosure, tightening the screws in a couple of turns each. Using an alternating 'X' pattern, continue to tighten the screws until they are all tight.

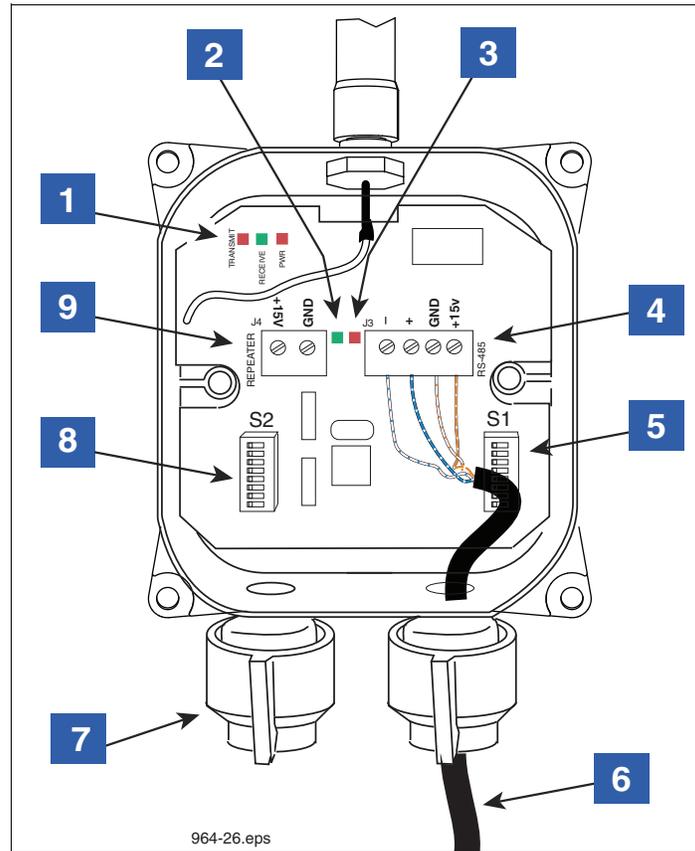


Figure 21. Wiring the Receiver

LEGEND FOR NUMBERED BOXES IN Figure 21

1. RS-485 Comm Activity:
 - XMIT (Red) LED – flashes when message transmitted to TLS-RF
 - RCV (Green) LED – flashes when message received from TLS-RF
 - PWR (Red) LED – Receiver power on indicator
2. Green LED – Unit status
3. Red LED – Radio status
4. Connect the color pairs of the RS-485/power cable to the same RS-485 terminals in both the Receiver and the master TLS RF (ref. “Connecting RS-485 Wiring” on page 14).
5. S1 DIP switch
6. RS-485 cable - Maximum cable length is 500 feet if a communication grade cable is used.

7. A solid bushing must be installed to seal the Receiver when this cord grip is unused. In sites where a Repeater is powered from the Receiver, the Repeater’s power cable enters through this cord grip and attaches to the Repeater terminal block (item 9).



HAND TIGHTEN BOTH CABLE ENTRY CORD GRIP NUTS TO PREVENT WATER ENTRY!

8. S2 DIP switch
9. +15 Vdc power source for the Repeater.



Pay close attention to the polarity of the +15 Vdc. Reversing the connections can cause damage to the TLS RF.

Repeater Installation

1. Use of a single repeater is optional but may improve system performance when installed correctly. The Repeater should be located closer to the device transmitters to rebroadcast messages to the Receiver. Use the 15 Vdc power source provided in the Receiver to power the Repeater, or use a customer supplied non-interruptible, Class 2, 15 Vdc power source. The most common method of powering the Repeater power is to use the Repeater power terminal block J4 in the Receiver (see item 9 in Figure 21).

When device transmitters are on the opposite side of the building from the Receiver, the Repeater should be mounted on the side of the building facing those transmitters. Mount the Repeater with its transmitter antenna in the up or vertical orientation.

2. The Repeater is attached to its mounting bracket with #10 x 1/2" taptite screws from its install kit (ref. Figure 20 on page 28). The L-bracket is then attached to the outer wall of the building using appropriate fasteners (customer supplied). If the Repeater will be exposed to the weather, attach the L-bracket to the mounting surface inside a weatherproof enclosure. This enclosure is not required when mounting the Repeater under a roof overhang and shielded from the weather.



The Repeater is only suitable for use in a non-hazardous location.

3. Set S1 and S2 as desired (refer to Appendix B). NOTE: set all dip switches prior to connecting the +15 Vdc power cable as the dip switches are only read during power up.
4. Note the cover of the Repeater indicates the cord grip to be used for the cable connecting the Repeater to its dc power source (item 5 in Figure 22). Remove the cover of the Repeater and set it aside.
5. Slide the nut over the cable. Choose the correct size bushing and slide it over the cable. Dress the cable jacket according to the dimensions in Figure 18. Insert the cable into the appropriate opening at the bottom of the housing. Insert each wire into the appropriate terminal and tighten. Leave a small amount of slack in each wire. Slide the bushing into the bottom of the housing. Hand tighten the nut.
6. Connect the 2-wire dc power cable to the Repeater terminal block, white to +15 Vdc and black to GND (see item 7 in Figure 22).



7. Hand tighten both cable entry cord grip nuts to prevent water entry!

8. To assure a water-tight seal between the cover and the enclosure, follow these steps:
 - a. Insert the four cover screws through the cover and then press on the retaining washers to hold the screws in place.
 - b. Make sure that the cover gasket is free of dirt and debris on both sides of the gasket and that the inside of the cover is clean in the gasket area.
 - c. Position the gasket into the cover groove, assuring that it is pressed fully into the groove and sitting completely flat.
 - d. Assemble the cover onto the enclosure, tightening the screws in a couple of turns each. Using an alternating 'X' pattern, continue to tighten the screws until they are all tight.
9. The other end of the Repeater's dc power cable connects to the Receiver's +15 Vdc output terminal (ref. item 9 in Figure 21), or to a non-interruptible, Class 2, 15 Vdc power source.

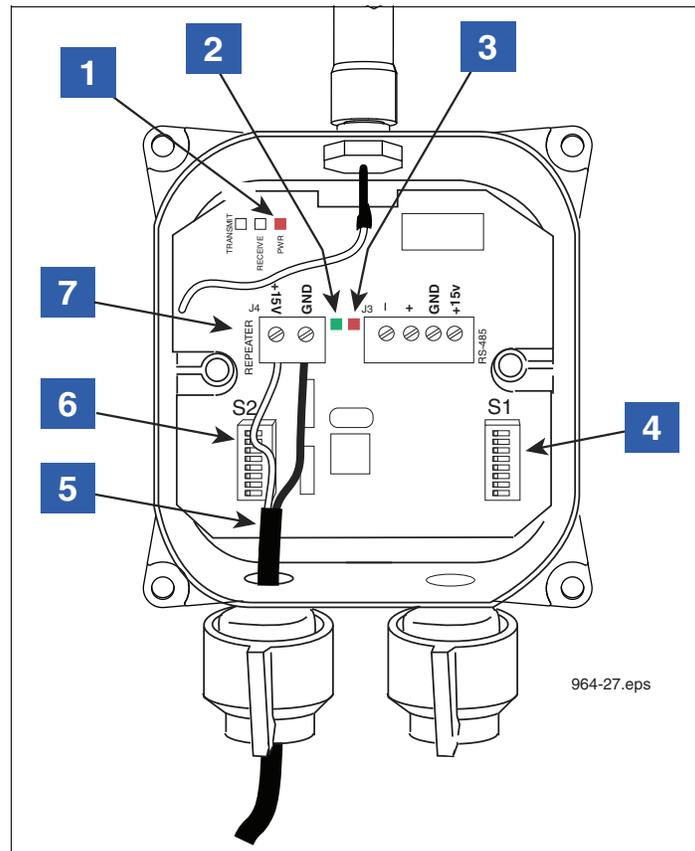


Figure 22. Wiring the Repeater

LEGEND FOR NUMBERED BOXES IN Figure 22

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Red LED – on when power is applied. 2. Green LED – Unit status 3. Red LED – Radio status 4. S1 DIP switch 5. DC Power input cable (from Receiver, or dc power source) | <ul style="list-style-type: none"> 6. S2 DIP switch 7. DC power input terminals - +15 Vdc and ground |
|--|--|



Pay close attention to the polarity of the +15 Vdc. Reversing the connections can cause damage to the TLS RF.

Network Setup

Hardware Overview

An example TLS RF Wireless System site network illustrating a 32 Transmitter configuration is shown in Figure 23. The maximum number of Transmitters permissible in a site is 32 (requires 4 TLS RFs).

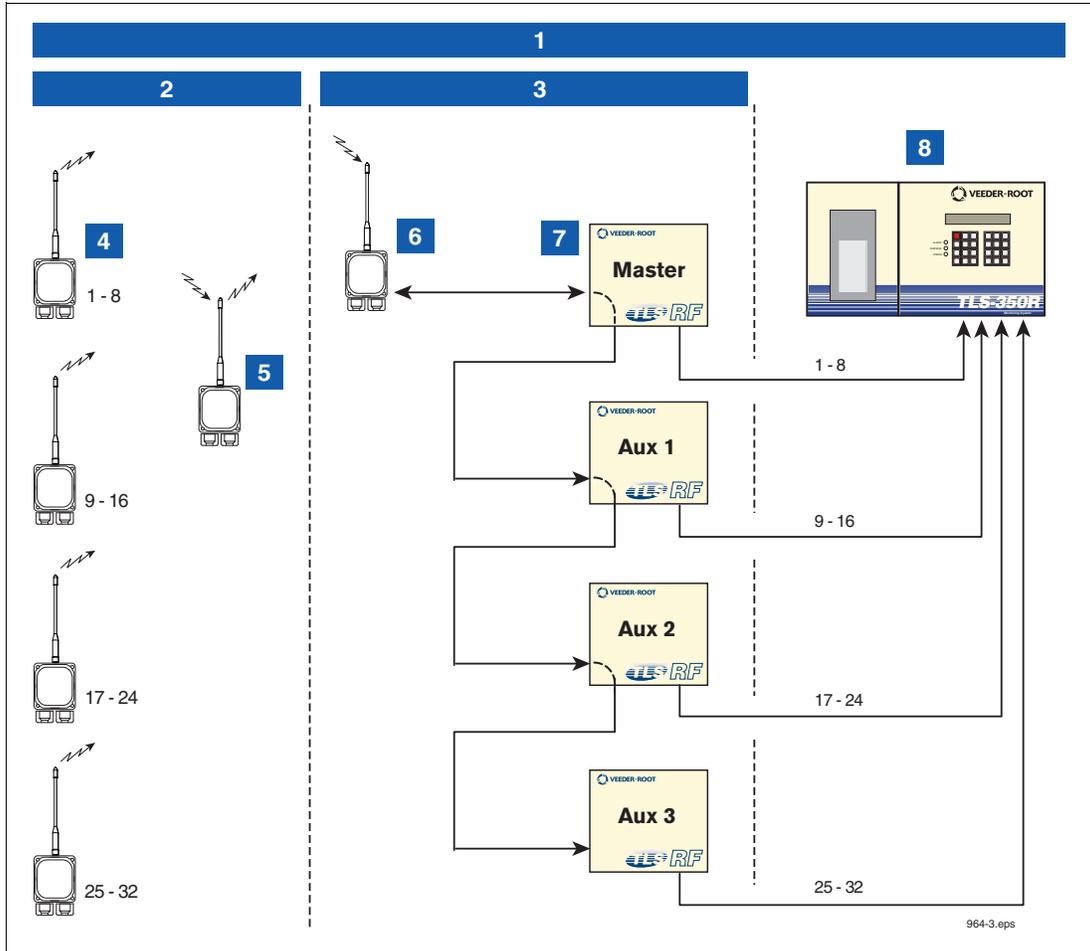


Figure 23. Example Site Network diagram

LEGEND FOR NUMBERED BOXES IN Figure 23

- | | |
|---------------------|--|
| 1. Site Network | 5. Repeater |
| 2. Wireless network | 6. Receiver |
| 3. VR bus | 7. TLS RF, one required per 8 Transmitters |
| 4. Transmitters | 8. TLS console |

Identifying Devices in the TLS RF Wireless Site Network

The Site ID must be identical for all Transmitters, the Repeater, and the Receiver in the site's wireless network. Each Transmitter in the site's wireless network must have a unique device ID number (from 1 – 32). Each TLS RF in the site's network must have a unique Device ID (Master at 0 and Auxiliaries at 1, 2, and/or 3).

All ID numbers are converted into binary form and entered using DIP switches located in each device.

You must enter the IDs in each device before it is installed.

Making up a site network worksheet before actually setting device DIP switches or connecting signal wires will help prevent mistakes when entering Site/Device IDs or making wiring connections between the TLS RF(s) and the TLS console.

Entering Device ID Numbers for the Site Network

TRANSMITTER ID NUMBER

Each of the transmitters must have a unique Device ID number (1 – 32). Enter this number by setting DIP switches 4 – 8 on S1 (see Figure 19 on page 26) in the 'off' position or 'on' position as shown below.

Device ID	S1 DIP Switch Settings					Device ID	S1 DIP Switch Settings				
	4	5	6	7	8		4	5	6	7	8
1	off	off	off	off	on	17	on	off	off	off	on
2	off	off	off	on	off	18	on	off	off	on	off
3	off	off	off	on	on	19	on	off	off	on	on
4	off	off	on	off	off	20	on	off	on	off	off
5	off	off	on	off	on	21	on	off	on	off	on
6	off	off	on	on	off	22	on	off	on	on	off
7	off	off	on	on	on	23	on	off	on	on	on
8	off	on	off	off	off	24	on	on	off	off	off
9	off	on	off	off	on	25	on	on	off	off	on
10	off	on	off	on	off	26	on	on	off	on	off
11	off	on	off	on	on	27	on	on	off	on	on
12	off	on	on	off	off	28	on	on	on	off	off
13	off	on	on	off	on	29	on	on	on	off	on
14	off	on	on	on	off	30	on	on	on	on	off
15	off	on	on	on	on	31	on	on	on	on	on
16	on	off	off	off	off	32	off	off	off	off	off

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TLS RF DEVICE SET NUMBER

Each TLS RF in the site network must have a unique Device Set number (0 – 3). You must select 0 if it is the only TLS RF in the site, or if it is the TLS RF in a site with multiple TLS RFs that is monitoring the first Device Set (transmitters 1 – 8). You would enter a 1 for the TLS RF monitoring the second Device Set (transmitters 9 – 16), etc. The site’s receiver must also be connected to the TLS RF having Device Set ‘0’. The factory default setting is ‘0’.

Enter this number by setting DIP switches 1 – 2 on S2 (see Figure 12 on page 18) in the ‘off’ position or ‘on’ position as shown below.

Transmitter ID Number	TLS RF Device Set Number	S2 DIP switch Settings		TLS RF
		1	2	
1-8	0	off	off	Master
9-16	1	off	on	AUX 1
17-24	2	on	off	AUX 2
25-32	3	on	on	AUX 3

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Entering the Site ID Number

All of the site’s Transmitters, Repeater and Receiver must have the same Site ID number (0 – 15) entered in S2 DIP switches 5 - 8 (see settings below). The TLS RF does not require a Site ID. The factory default Site ID number for all components is set to 0. You would only need to change the factory set Site ID when another site is nearby. Adjoining sites could experience data reception ‘crosstalk’ if both were left at the same number.

Site ID Number	S2 DIP switch Settings				Site ID Number	S2 DIP switch Settings			
	5	6	7	8		5	6	7	8
0	off	off	off	off	8	on	off	off	off
1	off	off	off	on	9	on	off	off	on
2	off	off	on	off	10	on	off	on	off
3	off	off	on	on	11	on	off	on	on
4	off	on	off	off	12	on	on	off	off
5	off	on	off	on	13	on	on	off	on
6	off	on	on	off	14	on	on	on	off
7	off	on	on	on	15	on	on	on	on

964-49.eps

Site Startup Procedure

Depending on the site layout, it is permissible to install RF devices in a variety of locations including dispensers and containment sumps. After all the wireless equipment has been installed, follow the steps below to verify the final setup. It is necessary not to close the dispenser's cover after installing the Transmitter in case the signal strength is a problem. Close the dispenser's cover only after the Transmitter went through the second verification process.

1. Go to the first Transmitter and connect the battery cable to the battery pack.
2. Return to the TLS RF, open its cover; you should see one of the 8 red LEDs flashing (item 5 in Figure 12). This is an indication the transmission from the Transmitter is being received. If it is, go to Step 2a. If one of the 8 LEDs is not flashing go to Step 2b.
 - a. Go back to the Transmitter, and if applicable, replace the dispenser's cover. Return to the TLS RF and verify that the same LED is still flashing.
 - i. If it is, disconnect the battery cable from the battery pack and repeat Step 1 on the next Transmitter.
 - ii. If it is not, the Receiver is not picking up the Transmitter's signal. Go back to the Transmitter; remove the dispenser's cover, reorient the antenna or lower the Transmitter, then go back to the TLS RF to verify that the same LED is flashing.
 - iii. If reorienting the antenna or moving the Transmitter doesn't help, disconnect the battery cable from the battery pack and make a note that the signal is not being received at this particular dispenser.
 - iv. Repeat Step 1 with the next Transmitter.
 - b. If applicable, go back to the dispenser, remove the Transmitter's cover; the green LED (item 2 in Figure 5) should be flashing indicating that the sensor is being read. If the green LED is not flashing, check the sensor cable's wiring connections. If the wiring is correct, check site ID. If it is correct, it means either the Transmitter is bad or there is a problem with the sensor, disconnect the battery cable from the battery pack and continue to Step 1 with the next Transmitter.
3. After verifying that each Transmitter is being received at the TLS RF(s), go around to each Transmitter; reconnect the Transmitters' battery cable to the battery pack. Replace dispenser's cover as appropriate. Go to the TLS console and configure all site sensors. Check for any comm alarms. If none are observed, the startup is complete.

NOTE: If some Transmitters are not being received at the TLS RF, relocating the Receiver and/or the Repeater may improve reception.

Diagnostics

Alarms

During normal operation when the TLS Console and monitored PMC and ISD System is functioning properly and no warning or alarm conditions exist, the “ALL FUNCTIONS NORMAL” message will appear in the system status (bottom) line of the console display. Regardless of the TLS Console in use at this site, record the software part number as well as the software revision.

There is an additional alarm, battery replacement, when wireless equipment is used in place of wires. ISD, PMC and Smart Sensor warnings and alarm are the same. If a warning or alarm condition occurs as a result of a failure in the wireless communication hardware the system displays the communication failure for the effected Smart Sensor. If more than one condition exists, the display will alternately flash the appropriate messages. The system automatically prints an alarm report showing the warning or alarm type, its location and the date and time the warning or alarm condition occurred.

Any break in link between transmitter and sensor, or between TLS and TLS RF results in Communication Alarm. All other alarms related to individual sensor types, such as sensor fault alarm, are supported as they are with a wired system. When the Sensor Transmitter has determined the communication with the RF box has failed it will command the Vapor Valve to close. The valve will remain closed until an open command is sent (from the TLS) after communication is reestablished.

Battery Diagnostics

You can get the battery status from the TLS-350 (with software Version 30A or higher). The battery status is displayed for the wireless sensors, from the Smart Sensor Diagnostics (see Figure 24). The wireless sensors's battery status can also be printed from this screen.

The battery status for the wireless sensors is reported as Full, Medium, Low or Replace.

- Full: greater than or equal to 3.4 Volts
- Medium Range: 3.2V to 3.4 Volts
- Low range: 3.0V to 3.2V
- Replace: Below 3.0V

When the Smart Sensor battery reports a status 'Replace' continuously for 24 hours, a Smart Sensor warning will be posted on the TLS to alert the operator that the battery requires replacement. The warning will persist in the TLS until the battery reports 'Medium' or 'Full'. The alarm will clear at that time. This is a low priority TLS warning which will sound the beeper, flash the yellow warning light, post on the two line display, print on the printer and be recorded in the non-priority alarm history. The warning can be accessed remotely and be reported remotely similar to all TLS warnings and alarms. This warning will not appear in the ISD or PMC reports (only sensor failures are recorded in the ISD and PMC reports).

WIRELESS SENSOR DIAGNOSTIC MENU (TLS-350 CONSOLES)

The Battery Status for all wireless Smart Sensors will be displayed in the menu after the Serial Number (see Figure 24).

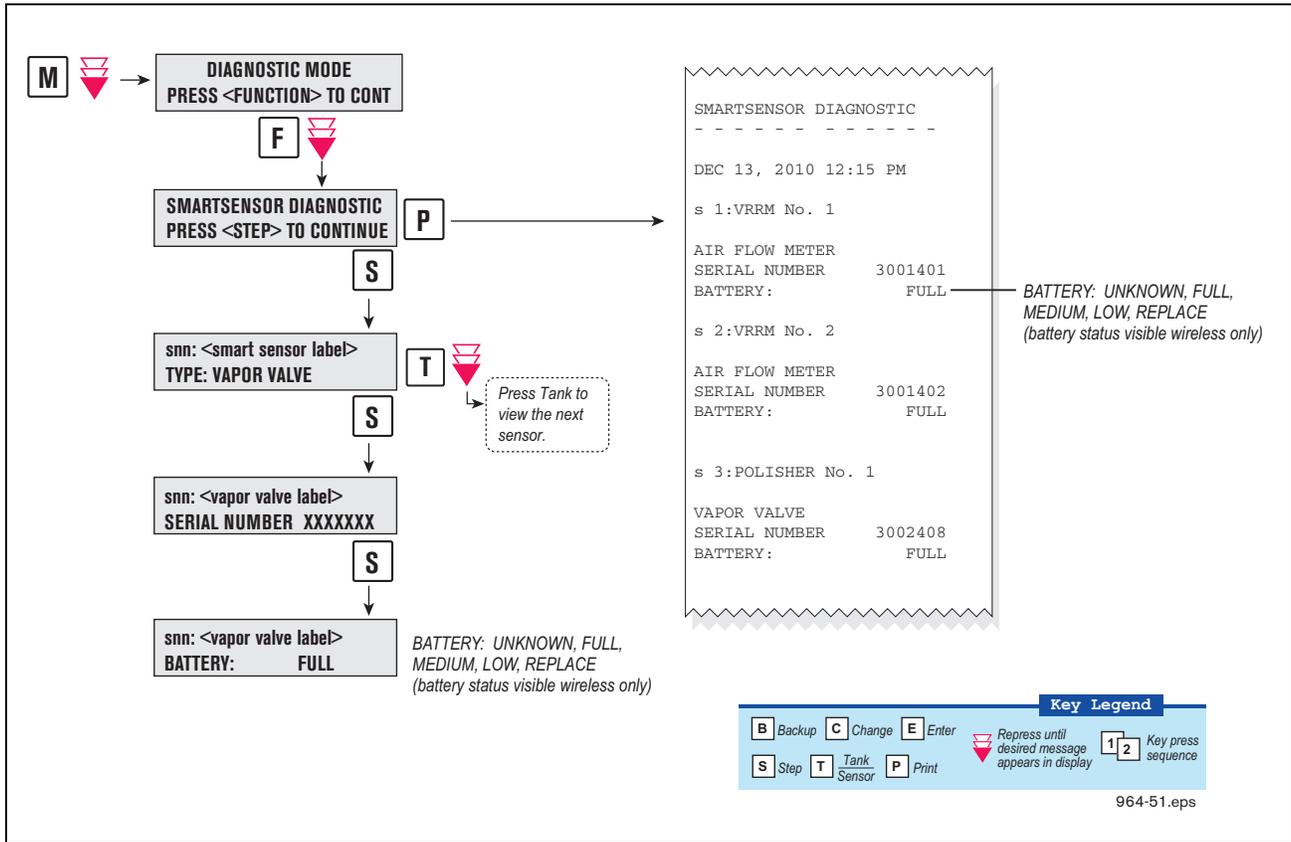


Figure 24. Device Battery Status in SmartSensor Diagnostic Menu

Appendix A: Regulatory Information

Federal Communications Commission Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio or television technician for help.

MODIFICATIONS

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Veeder-Root Company may void the authority to operate the equipment.

CABLES

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

DECLARATION OF CONFORMITY FOR PRODUCTS MARKED WITH THE FCC LOGO—UNITED STATES ONLY

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions regarding your product, contact:

Veeder-Root Company
125 Powder Forest Drive
Simsbury, CT 06070
Or, call 1-800-652-6672

For questions regarding this FCC declaration, contact:

Veeder-Root Company
125 Powder Forest Drive
Simsbury, CT 06070
Or, call 1-800-652-6672

To identify this product, refer to the Part, Series, or Model number found on the product.

Canadian Notice

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

AVIS CANADIEN

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Battery Warning



WARNING: The TLS RF Wireless System Battery Pack contains lithium batteries. To reduce the risk of fire or burns, do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.



Because of the type of batteries used in TLS RF Wireless System, follow local regulations regarding the safe disposal of the battery. Consult Appendix D of this manual for more information on battery disposal.

Wireless Notices

In some environments, the use of wireless devices may be restricted. Such restrictions may apply aboard airplanes, in hospitals, near explosives, in hazardous locations, etc. If you are uncertain of the policy that applies to the use of this device, please ask for authorization to use it prior to turning it on.

U.S. Regulatory Wireless Notice

WARNING: Exposure to Radio Frequency Radiation. The radiated output power of this device is below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. To avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna should be minimized.

Canadian Regulatory Wireless Notice

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. The term "IC:" before the certification/registration number only signifies that the Industry Canada technical specifications were met.

System Specifications

Note: Not all models described are available in all regions.

Appendix B: Device DIP Switch Settings

TLS RF Number Settings

The Dip Switch Locations to set the unique Device number for the TLS RF(s) are shown in the Figure B-1. The TLS RF that monitors the Receiver and Transmitter IDs 1 - 8 is considered the site's master TLS RF and must have its Device ID set to 0 (default).

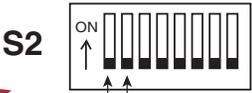
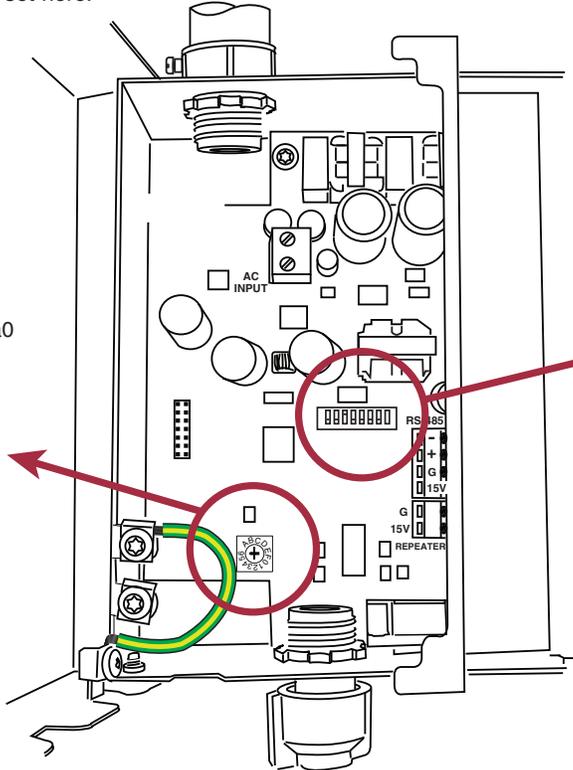


CAUTION: Setting the Device Timeout delay to less than 10 minutes may result in Device Out errors since the transmitter's transmit time intervals are programmable and may have been set to a value greater than the Device Timeout you set here.

TLS RF

Device Timeout
(Time to Comm alarm)

Sw Pos	Delay
0	5 m
1	10 m (default)
2	15 m
3	20 m
4	30 m
5	45 m
6	60 m
7	90 m
8	2 h
9	3 h
A	4 h
B	6 h
C	8 h
D	12 h
E	18 h
F	24 h



TLS RF Device ID
0 = Master

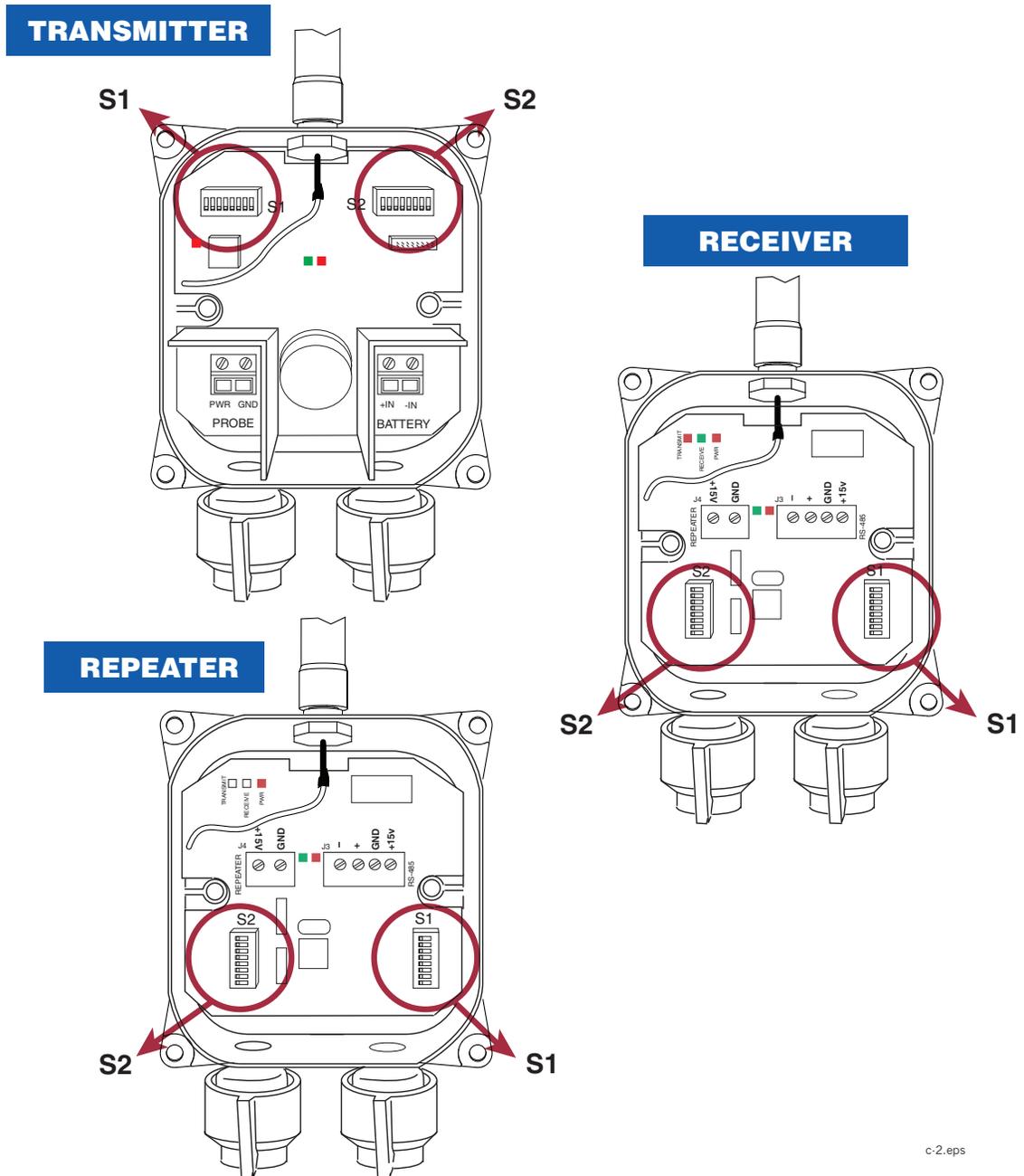
Device ID	Sw1	Sw2	Transmitter IDs
0 (Master)	off	off	1 - 8
1 (Aux 1)	off	on	9 - 16
2 (Aux 2)	on	off	17 - 24
3 (Aux 3)	on	on	25 - 32

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Figure B-1. TLS-RF switch settings

Transmitter/Receiver/Repeater DIP Switch Settings

DIP switch locations for the Transmitter, Receiver and Repeater are shown in Figure B-2. Device DIP switch settings for these devices are listed in Figure B-3 through Figure B-7 (use the appropriate settings for your software version 1 or 3).



c-2.eps

Figure B-2. DIP switch settings

Certified SLD (Static) & CSLD (Continuous) Leak Detection for single tanks and Mag Sump Sensor monitoring, where ambient interference is not a factor.

All Wireless 2 (W2) Devices						
S1: Positions			TRANSMITTER			
1	2	3	900 MHz Radio			
OFF	OFF	OFF	Always		Dip Switches are located inside each transmitter and they must be set up CORRECTLY	
OFF	OFF	ON	Do Not Set			
OFF	ON	OFF	Do Not Set			
OFF	ON	ON	Do Not Set			
ON	OFF	OFF	Do Not Set			
ON	OFF	ON	Do Not Set			
ON	ON	OFF	Do Not Set			
ON	ON	ON	Do Not Set			

c-3.eps

Figure B-3. S1: DIP switch positions 1-3 – (W2) All Devices

All Wireless 2 (W2) Devices							
S1: Positions					TRANSMITTER		
4	5	6	7	8	Device Number		
OFF	OFF	OFF	OFF	ON	1 (Master TLS-RF Device 1)		Each device is related to one unique transmitter with one unique device number
OFF	OFF	OFF	ON	OFF	2 (Master TLS-RF Device 2)		
OFF	OFF	OFF	ON	ON	3 (Master TLS-RF Device 3)		
OFF	OFF	ON	OFF	OFF	4 (Master TLS-RF Device 4)		
OFF	OFF	ON	OFF	ON	5 (Master TLS-RF Device 5)		
OFF	OFF	ON	ON	OFF	6 (Master TLS-RF Device 6)		
OFF	OFF	ON	ON	ON	7 (Master TLS-RF Device 7)		
OFF	ON	OFF	OFF	OFF	8 (Master TLS-RF Device 8)		
OFF	ON	OFF	OFF	ON	9 (Aux 1 TLS-RF Device 1)		Aux 1 is the second TLS RF Console
OFF	ON	OFF	ON	OFF	10 (Aux 1 TLS-RF Device 2)		
OFF	ON	OFF	ON	ON	11 (Aux 1 TLS-RF Device 3)		
OFF	ON	ON	OFF	OFF	12 (Aux 1 TLS-RF Device 4)		
OFF	ON	ON	OFF	ON	13 (Aux 1 TLS-RF Device 5)		
OFF	ON	ON	ON	OFF	14 (Aux 1 TLS-RF Device 6)		
OFF	ON	ON	ON	ON	15 (Aux 1 TLS-RF Device 7)		
ON	OFF	OFF	OFF	OFF	16 (Aux 1 TLS-RF Device 8)		
ON	OFF	OFF	OFF	ON	17 (Aux 2 TLS-RF Device 1)		
ON	OFF	OFF	ON	OFF	18 (Aux 2 TLS-RF Device 2)		
ON	OFF	OFF	ON	ON	19 (Aux 2 TLS-RF Device 3)		
ON	OFF	ON	OFF	OFF	20 (Aux 2 TLS-RF Device 4)		
ON	OFF	ON	OFF	ON	21 (Aux 2 TLS-RF Device 5)		
ON	OFF	ON	ON	OFF	22 (Aux 2 TLS-RF Device 6)		
ON	OFF	ON	ON	ON	23 (Aux 2 TLS-RF Device 7)		
ON	ON	OFF	OFF	OFF	24 (Aux 2 TLS-RF Device 8)		
ON	ON	OFF	OFF	ON	25 (Aux 3 TLS-RF Device 1)		
ON	ON	OFF	ON	OFF	26 (Aux 3 TLS-RF Device 2)		
ON	ON	OFF	ON	ON	27 (Aux 3 TLS-RF Device 3)		
ON	ON	ON	OFF	OFF	28 (Aux 3 TLS-RF Device 4)		
ON	ON	ON	OFF	ON	29 (Aux 3 TLS-RF Device 5)		
ON	ON	ON	ON	OFF	30 (Aux 3 TLS-RF Device 6)		
ON	ON	ON	ON	ON	31 (Aux 3 TLS-RF Device 7)		
OFF	OFF	OFF	OFF	OFF	32 (Aux 3 TLS-RF Device 8)		

c-4.eps

Figure B-4. S1: DIP switch positions 4-8 – (W2) All Devices

Wireless 2 (W2) CCVP-Carbon Can Vapor Processor							
	S2: Positions				Transmitter Interval in Seconds		
	1	2	3	4	Read	TX	
	OFF	OFF	OFF	OFF	32	16	default setting
	OFF	OFF	OFF	ON	Do Not Set	Do Not Set	
	OFF	OFF	ON	OFF	Do Not Set	Do Not Set	
	OFF	OFF	ON	ON	Do Not Set	Do Not Set	
	OFF	ON	OFF	OFF	Do Not Set	Do Not Set	
	OFF	ON	OFF	ON	Do Not Set	Do Not Set	
	OFF	ON	ON	OFF	Do Not Set	Do Not Set	
	OFF	ON	ON	ON	Do Not Set	Do Not Set	
	ON	OFF	OFF	OFF	Do Not Set	Do Not Set	
	ON	OFF	OFF	ON	Do Not Set	Do Not Set	
	ON	OFF	ON	OFF	Do Not Set	Do Not Set	
	ON	OFF	ON	ON	Do Not Set	Do Not Set	
	ON	ON	OFF	OFF	Do Not Set	Do Not Set	
	ON	ON	OFF	ON	Do Not Set	Do Not Set	
	ON	ON	ON	OFF	Do Not Set	Do Not Set	
	ON	ON	ON	ON	Do Not Set	Do Not Set	

c-7.eps

Figure B-5. S2: DIP switch positions 1-4 – (W2) CCVP

Wireless 2 (W2) Vapor Flowmeter							
	S2: Positions				Transmitter Interval in Seconds		
	1	2	3	4	Read	TX	
	OFF	OFF	OFF	OFF	Do Not Set	Do Not Set	
	OFF	OFF	OFF	ON	Do Not Set	Do Not Set	
	OFF	OFF	ON	OFF	Do Not Set	Do Not Set	
	OFF	OFF	ON	ON	Do Not Set	Do Not Set	
	OFF	ON	OFF	OFF	32	32	default setting
	OFF	ON	OFF	ON	Do Not Set	Do Not Set	S2: Position 2
	OFF	ON	ON	OFF	Do Not Set	Do Not Set	Must Be Set
	OFF	ON	ON	ON	Do Not Set	Do Not Set	to ON
	ON	OFF	OFF	OFF	Do Not Set	Do Not Set	
	ON	OFF	OFF	ON	Do Not Set	Do Not Set	
	ON	OFF	ON	OFF	Do Not Set	Do Not Set	
	ON	OFF	ON	ON	Do Not Set	Do Not Set	
	ON	ON	OFF	OFF	Do Not Set	Do Not Set	
	ON	ON	OFF	ON	Do Not Set	Do Not Set	
	ON	ON	ON	OFF	Do Not Set	Do Not Set	
	ON	ON	ON	ON	Do Not Set	Do Not Set	

c-9.eps

Figure B-6. S2: DIP switch positions 1-4 – (W2) Vapor Flow Meter

All Wireless 2 (W2) Devices								
All 3 Site ID Settings must be the same for each RF System								
	S2: Positions				TRANSMITTER	REPEATER ¹	RECEIVER ¹	
	5	6	7	8	Site ID	Site ID	Site ID	
	OFF	OFF	OFF	OFF	0	0	0	
	OFF	OFF	OFF	ON	1	1	1	
	OFF	OFF	ON	OFF	2	2	2	
	OFF	OFF	ON	ON	3	3	3	
	OFF	ON	OFF	OFF	4	4	4	
	OFF	ON	OFF	ON	5	5	5	
	OFF	ON	ON	OFF	6	6	6	
	OFF	ON	ON	ON	7	7	7	
	ON	OFF	OFF	OFF	8	8	8	
	ON	OFF	OFF	ON	9	9	9	
	ON	OFF	ON	OFF	10	10	10	
	ON	OFF	ON	ON	11	11	11	
	ON	ON	OFF	OFF	12	12	12	
	ON	ON	OFF	ON	13	13	13	
	ON	ON	ON	OFF	14	14	14	
	ON	ON	ON	ON	15	15	15	
								c-10.eps
¹ Set all remaining dip switches to OFF for both the Repeater and Receiver								

Figure B-7. S2: DIP switch positions 5-8 – (W2) All Devices

Appendix C: Lithium Battery Safety Data

This appendix contains the manufacturer supplied Transportation Certificate and Material Safety Data Sheet for the lithium batteries used in the TLS RF Wireless 2 (W2) System.

Lithium Battery Disposal Considerations

1. Waste disposal must be in accordance with the applicable regulations.
2. Disposal of the Lithium batteries should be performed by permitted, professional disposal firms knowledgeable in Federal, State or Local requirements of hazardous waste treatment and hazardous waste transportation.
3. Incineration should never be performed by battery users, but by trained professionals in an authorized facility with proper gas and fume containment.
4. Recycling of battery can be done in authorized facility, through licensed waste carrier.



TRANSPORTATION CERTIFICATE

Ref. TC-LS 33600 11/2008- 87

This is to certify that the Saft cell type, **LS 33600**, has been subjected and has met the requirements of the UN Recommendations on the Transport of Dangerous Goods, Part III, sub-section 38.3, Manual of Tests and Criteria, 4th Revised edition - 2003 - Ref. ST/SG/AC.10/11/Rev. 4), as detailed in Saft-Poitiers internal reports P 0256/03, dated 06/2003.

Concerned Part Numbers

All the part numbers relative to single LS 33600 cells, whatever their finish mode (with and without end-tabs or wiring and connector assemblies, etc.)

Product Description

Primary (non-rechargeable), Lithium-Thionyl Chloride (Li-SOCl₂) D-sized single cell

Nominal Voltage	3.6 Volts
Nominal Capacity	17.0 Ah
Lithium metal content	4.5 grams
Nominal energy	17.0 x 3.6 = 61.2 Wh
Maximum recommended continuous discharge current	250 mA

Product Classification

Worldwide, besides the United States of America

Since it passes the UN-defined transport tests but because its lithium content is above the 1 gram limit, the **LS 33600 individual cell, in all of its finish versions, according to the current UN Recommendations on the Transport of Dangerous Goods - Model regulations, is declared non-exempt from the Dangerous Goods Regulations. It is restricted to transport/ assigned to Class 9**, and must be packed in accordance with the relevant packing instructions of the applicable Handbooks and Codes issued by the bodies (IATA-ICAO, IMO, ADR, US-DOT, etc.) in charge of regulating the transportation of dangerous goods.

Within the United States of America

The U.S. DOT CFR 49 Regulations, Parts 171, 172, 173 and 175, are governing the transportation of lithium cells and batteries. Special Provision 188 (in Part 172.102) **defines the LS 33600 single lithium metal cell, in all of its finished versions, as belonging to the "medium primary lithium cell" category**, and details the requirements to be met for the different transportation conditions.

Signed on Behalf of Saft, Specialty Battery Group

Pascal Hans SBG Quality Manager

dated 23/11/08

Alain Kerouanton SBG Lithium Product Manager

dated 23/11/2008

Specialty Battery Group – Rue Georges Leclanché BP 1039 – 86060 Poitiers Cedex 09 – France



Material/Product Safety Data Sheet (MSDS-PSDS)

LS/LSG/LSH/LST/LSX products	Lithium/Thionyl chloride single cells and multi-cell battery packs
Revision 8 Date 10/2008	

1. Identification of the Substance or Preparation and Company				
Product	Primary Lithium/Thionyl chloride unit cells and multi-cell battery packs (Li-SOCl₂)			
Production sites	Saft Ltd. River Drive Tyne & Wear South Shields NE33 2TR – UK Ph. :+44 191 456 1451 Fax :+44 191 456 6383	Saft Rue Georges Leclanché BP 1039 86060 Poitiers cedex 9 France Ph. :+33 (0)5 49 55 48 48 Fax :+33 (0)5 49 55 48 50	Saft America Inc 313 Crescent Street Valdese NC 28690 – USA Ph. :+1 828 874 4111 Fax :+1 828 874 2431	Saft Batteries Co., Ltd Zhuhai Free Trade Zone Lianfeng Road Zhuhai 519030 Guangdong Province China Ph. : +86 756 881 9318 Fax : +86 756 881 9328
www.saftbatteries.com (section « Contact »)				
Emergency contact Within the USA	+1 (703) 527 3887 +1 (800) 494 9300	(CHEMTREC US Service Center)		

2. Hazards Identification
<p>Do not short circuit, recharge puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of product. Risk of fire or explosion.</p> <p>The Lithium-Thionyl chloride batteries described in this Safety Data Sheet are sealed units which are not hazardous when used according to the recommendations of the manufacturer.</p> <p>Under normal conditions of use, the electrode materials and liquid electrolyte they contain are not exposed to the outside, provided the battery integrity is maintained and seals remain intact. Risk of exposure only in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. Electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow, depending upon the circumstances.</p>

3. Composition & Information on Ingredients					
Ingredient	Content	CAS No.	CHIP Classification		
Lithium (Li)	3,5-5%	7439-93-2			F ; R14/15 C ; R34 R14/15, R21, R22, R35, R41, R43 S2, S8, S45
Thionyl chloride (SOCl ₂)	40-46%	7719-09-7			C ; R14, R21, R22, R35, R37, R41, R42/43 S2, S8, S24, S26, S36, S37, S45
					

MSDS Li-SOCl₂
Rev. 8 October 2008



Aluminum chloride anhydrous (AlCl ₃)	1-5%	7446-70-0			R14, R22, R37, R41, R43. S2, S8, S22, S24, S26, S36, S45
Carbon (C _n)	3-4%	1333-86-4			NONE KNOWN
<i>Amount varies depending on cell size.</i>					

4. First Aid Measures	
Inhalation	Remove from exposure, rest and keep warm. In severe cases obtain medical attention.
Skin contact	Wash off skin thoroughly with water. Remove contaminated clothing and wash before reuse. In severe cases obtain medical attention.
Eye contact	Irrigate thoroughly with water for at least 15 minutes. Obtain medical attention.
Ingestion	Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.
Further treatment	All cases of eye contamination, persistent skin irritation and casualties who have swallowed this substance or been affected by breathing its vapours should be seen by a doctor.

5. Fire Fighting Measures	
<p>CO₂ extinguishers or, even preferably, copious quantities of water or water-based foam, can be used to cool down burning Li-SOCl₂ cells and batteries, as long as the extent of the fire has not progressed to the point that the lithium metal they contain is exposed (marked by deep red flames). Do not use for this purpose sand, dry powder or soda ash, graphite powder or fire blankets.</p> <p>Use only metal (Class D) extinguishers on raw lithium.</p>	
Extinguishing media	Use water or CO ₂ on burning Li-SOCl ₂ cells or batteries and class D fire extinguishing agent only on raw lithium.

6. Accidental Release Measures	
<p>Remove personnel from area until fumes dissipate. Do not breathe vapours or touch liquid with bare hands. If the skin has come into contact with the electrolyte, it should be washed thoroughly with water.</p> <p>Sand or earth should be used to absorb any exuded material. Seal leaking battery and contaminated absorbent material in plastic bag and dispose of as Special Waste in accordance with local regulations.</p>	



7. Handling and Storage	
Handling	Do not crush, pierce, short (+) and (-) battery terminals with conductive (i.e. metal) goods. Do not directly heat or solder. Do not throw into fire. Do not mix batteries of different types and brands. Do not mix new and used batteries. Keep batteries in non conductive (i.e. plastic) trays.
Storage	Store in a cool (preferably below 30°C) and ventilated area, away from moisture, sources of heat, open flames, food and drink. Keep adequate clearance between walls and batteries. Temperature above 100°C may result in battery leakage and rupture. Since short circuit can cause burn, leakage and rupture hazard, keep batteries in original packaging until use and do not jumble them.
Other	Lithium-Thionyl chloride batteries are not rechargeable and should not be tentatively charged. Follow Manufacturers recommendations regarding maximum recommended currents and operating temperature range. Applying pressure on deforming the battery may lead to disassembly followed by eye, skin and throat irritation.

8. Exposure Controls & Personal Protection				
Occupational exposure standard	Compound	8hr TWA	15min TWA	SK
	Sulfur dioxide	1 ppm	1 ppm	-
	Hydrogen chloride	1 ppm	5 ppm	-
	Respiratory protection	In all fire situations, use self-contained breathing apparatus.		
	Hand protection	In the event of leakage wear gloves.		
	Eye protection	Safety glasses are recommended during handling.		
	Other	In the event of leakage, wear chemical apron.		

9. Physical and Chemical Properties	
Appearance	Cylindrical or prismatic shape
Odour	If leaking, gives off a pungent corrosive odour.
pH	Not Applicable
Flash point	Not applicable unless individual components exposed
Flammability	Not applicable unless individual components exposed
Relative density	Not applicable unless individual components exposed
Solubility (water)	Not applicable unless individual components exposed
Solubility (other)	Not applicable unless individual components exposed



10. Stability and Reactivity	
Product is stable under conditions described in Section 7.	
Conditions to avoid.	Heat above 100°C (150°C for the LSH 20-150 cells and the battery packs assembled from them) or incinerate. Deform. Mutilate. Crush. Pierce. Disassemble Recharge. Short circuit. Expose over a long period to humid conditions.
Materials to avoid	Oxidising agents, alkalis, water. Avoid electrolyte contact with aluminum or zinc.
Hazardous decomposition Products	Hydrogen (H ₂) as well as Lithium oxide (Li ₂ O) and Lithium hydroxide (LiOH) dust is produced in case of reaction of <i>lithium metal</i> with water. Chlorine (Cl ₂), Sulfur dioxide (SO ₂) and Disulfur dichloride (S ₂ Cl ₂) are produced in case of thermal decomposition of <i>thionyl chloride</i> above 140°C. Hydrochloric acid (HCl) and Sulfur dioxide (SO ₂) are produced in case of reaction of <i>Thionyl chloride</i> with water at room temperature. Hydrochloric acid (HCl) fumes, Lithium oxide, (Li ₂ O), Lithium hydroxide (LiOH) and Aluminum hydroxide (Al(OH) ₃) dust are produced in case of reaction of <i>Lithium tetrachloroaluminate (LiAlCl₄)</i> with water.

11. Toxicological Information	
Signs & symptoms	None, unless battery ruptures. In the event of exposure to internal contents, corrosive fumes will be very irritating to skin, eyes and mucous membranes. Overexposure can cause symptoms of non-fibrotic lung injury and membrane irritation.
Inhalation	Lung irritant.
Skin contact	Skin irritant
Eye contact	Eye irritant.
Ingestion	Tissue damage to throat and gastro-respiratory tract if swallowed.
Medical conditions generally aggravated by exposure	In the event of exposure to internal contents, eczema, skin allergies, lung injuries, asthma and other respiratory disorders may occur.

12. Ecological Information	
Mammalian effects	None known if used/disposed of correctly.
Eco-toxicity	None known if used/disposed of correctly.
Bioaccumulation potential	None known if used/disposed of correctly.
Environmental fate	None known if used/disposed of correctly.

13. Disposal Considerations	
Do not incinerate, or subject cells to temperatures in excess of 100°C. Such abuse can result in loss of seal, leakage, and/or cell explosion. Dispose of in accordance with appropriate local regulations.	



14. Transport Information	
Label for conveyance	For the single cell batteries and multi-cell battery packs that are non-restricted to transport (non-assigned to the Miscellaneous Class 9), use lithium batteries inside label. For the single cell batteries and multi-cell battery packs which are restricted to transport (assigned to Class 9), use Class 9 Miscellaneous Dangerous Goods and UN Identification Number labels. In all cases, refer to the product transport certificate issued by the Manufacturer.
UN numbers	UN3090 (shipment of cells and batteries <i>in bulk</i>) UN 3091 (cells and batteries <i>contained in equipment or packed with it</i>)
Shipping names	Lithium Metal Batteries
Hazard classification	Depending on their lithium metal content, some single cells and small multi-cell battery packs may be non- assigned to Class 9 (Refer to Transport Certificate)
Packing group	II
Specific dispositions	IATA: A45, A88, A99, P968, P969, P970 IMDG: 188, 230, 310, P903 ADR/RID: 188, 230, 310, 636, P903, P903a
IMDG Code	3090 (Li Batteries) 3091 (Li Batteries contained in equipment or packed with it)
CAS	
EmS No.	F-A, S-I
Marine pollutant	No
ADR Class	Class9

15. Regulatory Information			
Risk phrases	Lithium (Li)	R14/15 R21 R22 R35 R41 R42/43	Reacts violently with water, liberating extremely flammable gases. Harmful in contact with skin. Harmful if swallowed. Causes burns. Risk of serious damage to eye. May cause sensitization by inhalation and skin contact.
	Thionyl chloride (SOCl ₂)	R14 R22 R35 R37 R41 R42/43	Reacts with water. Harmful if swallowed. Causes burns. Irritating to respiratory system. Risk of serious damage to eye. May cause sensitization by inhalation and skin contact.
	Aluminum chloride anhydrous (AlCl ₃)	R14 R22 R37 R41 R43	Reacts with water. Harmful if swallowed. Irritating to respiratory system. Risk of serious damage to eye. May cause sensitization by skin contact.
Safety phrases	Lithium (Li)	S2 S8 S45	Keep out of reach of children Keep away from moisture In case of incident, seek medical attention.
	Thionyl chloride (SOCl ₂)	S2 S8 S24 S26 S36 S37 S45	Keep out of reach of children. Keep away from moisture. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable protective clothing. Wear suitable gloves. In case of incident, seek medical attention.



	Aluminum chloride anhydrous ($AlCl_3$)	S2 S8 S22 S24 S26 S36	Keep out of reach of children. Keep away from moisture. Do not breathe dust. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable protective clothing.
UK regulatory references	Classified under CHIP		

16. Other Information

This information has been compiled from sources considered to be dependable and is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty (either expressed or implied) or guarantee is made to the accuracy, reliability or completeness of the information contained herein.

This information relates to the specific materials designated and may not be valid for such material used in combination with any other materials or in any process. It is the user's responsibility to satisfy himself as to the suitability and completeness of this information for his particular use.

Saft does not accept liability for any loss or damage that may occur, whether direct, indirect, incidental or consequential, from the use of this information. Saft does not offer warranty against patent infringement.

Signature 

Alain Kerouanton
Lithium Product Manager



Executive Orders VR-203-K and VR-204-K

Air Resources Board Approved Liquid Condensate Trap Installation, Operations, and Maintenance Manual

1. PRE-INSTALLATION NOTES:

State Water Resources Control Board (SWRCB) Requirements are listed in California Health and Safety Code, Chapter 6.7 and California Code of Regulations Title 23 Div. 3 Chapter 16. SWRCB Local Guidance Letters LG-113 and LG-169 address in detail these regulatory requirements that apply to Liquid Condensate Traps. Installers should familiarize themselves with these requirements to ensure compliance.

Some of the highlights of the SWRCB requirements are: Vapor condensate traps are permitted as part of the Underground Storage Tank (UST) System and are regulated like any other UST System. Requirements will vary depending on the date of installation, but secondary containment, interstitial monitoring, periodic secondary containment testing, cathodic protection, periodic integrity testing, and overfill prevention may be required. Automatic evacuation of vapor condensate traps are equipped with a suction line (typically connected to a siphon port on the turbine) that can automatically evacuate liquid and return it to the UST. Because the suction line contains liquid product, it is subject to the same regulatory requirements as any other product suction piping on the UST system. Depending on the installation date of the UST and the presence or absence of check valves, secondary containment, interstitial monitoring, or periodic integrity testing of the suction line may be required.

CAUTION: Always obtain approval from the local authorities having jurisdiction before beginning any work. Installation of the Liquid Condensate Trap must comply with (if applicable):

- Air Resources Board Certification Procedure CP-201;
- VST Phase II EVR Executive Orders (EO) VR-203 and 204;
- Veeder-Root Level 1 certification required when installing and wiring LCT liquid sensor to a Veeder-Root tank monitoring system.
- INCON Level 1 certification required when installing and wiring LCT liquid sensor to an INCON tank monitoring system.
- Certified Unified Program Agency (CUPA) – List of CUPAs can be found at (www.calepa.ca.gov/CUPA/Directory/default.aspx);
- Fire Marshall;
- SWRCB;
- Local Air Pollution District;
- International Code Council (ICC) Note: Anyone working on an LCT system must have an ICC certification for UST Service Technician, or UST Installation and Retrofitter;
- NEC;
- NFPA 30 and 30A;
- UL;
- Any other applicable Federal, State and local codes.

2 LIQUID CONDENSATE TRAP PHASE II EVR COMPONENTS

Exhibit 1 of VR-203 and 204 lists components required for a Phase II EVR System with a Liquid Condensate Trap. Existing Liquid Condensate Traps may already have some of these components installed. Some of these required components are (reference all Figures):

Riser Adaptor — INCON Model TSP-K2A

This riser adaptor is to be installed on all risers that are connected to the Liquid Condensate Trap, except for the Liquid Condensate Trap suction tube riser.

In-Line Filter — Swagelok B-4F2-140 or SS-4F2-140 (or equivalent)

The purpose of the in-line filter is to trap debris and rust particles that are traveling inside the suction line to prevent them from blocking the syphon jet valve at the turbine pump. This in-line filter is installed at the syphon inlet of the turbine pump.

Stainless Steel Wired Braided Hose or 1/4" Copper Tubing (rated for use with gasoline)

Connects the suction tube to the turbine pump.

Aluminum or Stainless Steel Insect Screen with Stainless Steel Hose Clamp

This screen can be purchased from almost any hardware store. The specifications are: 18 X 14 mesh for aluminum insect screen and 18 X 18 for stainless steel insect screen. A small section of this screen material is installed over the end of the suction tube inside the Liquid Condensate Trap and secured with a SS hose clamp.

Liquid Sensor Connection to the UST Monitoring System

Many sites already have existing liquid sensors installed inside the Liquid Condensate Trap. If a liquid sensor does not exist inside the Liquid Condensate Trap then one must be installed.

Any Liquid sensor installed inside the Liquid Condensate Trap must meet the following minimal requirements:

- Provides a visual and audible alarm in case of failure of the evacuation system;
- The audible and visual alarm monitoring system must be installed at a location that is most likely to be heard by the station attendant during normal station operation;
- Set the liquid sensor to the height shown in Figure 5.
-

Various Pipe Fittings in 1/4" and 2" Sizes

For adapting the suction line as required, and to add a fuel entry point with a plug or cap to the Liquid Condensate Trap riser.

Optional Equipment:

Secondary Syphon Kit — Franklin Fueling Systems Part Number 402507930

For use when two syphon primers are required for one Submersible Turbine Pump (STP). One to syphon the Liquid Condensate Trap, and one for siphoning two or more tanks of like product grade.

3. PRIOR TO INSTALLING THE EQUIPMENT LISTED IN EXHIBIT 1 OF THE EO

WARNING Highly flammable vapors or liquids may be present in the environment in which this equipment is installed or serviced. Installing or working on this equipment means working in an environment that presents risks of severe injury or death if instructions and standard industry practices are not followed. Follow all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment. Refer to the *Installation and Owner's Manual* of this equipment and any related equipment for complete installation and safety information.

Prior to installing the Liquid Condensate Trap Equipment listed in Exhibit 1 of the EO VR-203 or VR-204, you must flush out the Liquid Condensate Trap to remove any dirt or debris that may have accumulated inside the Liquid Condensate Trap.

Installer will need to document the capacity, in gallons, of the Liquid Condensate Trap on an aluminum 'tag' and attach this tag to the suction riser above the Fuel Entry Port. The capacity could be documented using a metal stamp or metal engraving pen, or a waterproof ink marker on the aluminum tag. A vinyl covered steel cable or a 'zip tie' could be used to attach to the riser. Strips of aluminum can be purchased at most hardware stores.

Example LCT Capacity Tag

LCT Capacity - 9.9 Gallons

Flushing the Liquid Condensate Trap and attached Piping:

Flushing out the Liquid Condensate Trap of any debris is very important to avoid blocking the suction tube, suction line, the in-line filter, and the syphon jet at the turbine pump during liquid evacuation. This process must be performed before installing the required Liquid Condensate Trap Equipment listed in Exhibit 1 of the EO VR-203 or VR-204.

- Use appropriate equipment to flush out the Liquid Condensate Trap of any debris. One method used is:
 - a) Disconnect the suction line from the suction tube at the suction riser to prevent the turbine pump syphon from sucking any debris into the suction line and syphon jet during the flushing process.
 - b) Using a hand pump, pump approximately 5 gallons of fresh gasoline into the Liquid Condensate Trap. Using the same hand pump, reverse the hoses and pump out the gasoline you just added. Repeat this procedure using fresh clean gasoline each time until the gasoline you are removing is clean and clear. This process may require a number of flushes (may be as many as 20 or more) before the gasoline being removed is clean and clear.

Note: Handle gasoline in a safe manner, following industry safety practices and all applicable State regulations and local codes.

- c) With the suction line disconnected from the Liquid Condensate Trap and disconnected at the turbine syphon port, blow compressed air through the suction line to remove any debris and check for any blockages.

4. INSTALLATION OF THE PHASE II EVR EQUIPMENT LISTED IN EXHIBIT 1 OF EO VR-203 AND 204

Figures 1 through 3 show a typical layout of a Phase II EVR Liquid Condensate Trap after completion of installing the equipment listed in Exhibit 1 of EO VR-203 and VR-204.

**Figure 1
Typical Liquid Condensate Trap Installed Below the Transition Sump**

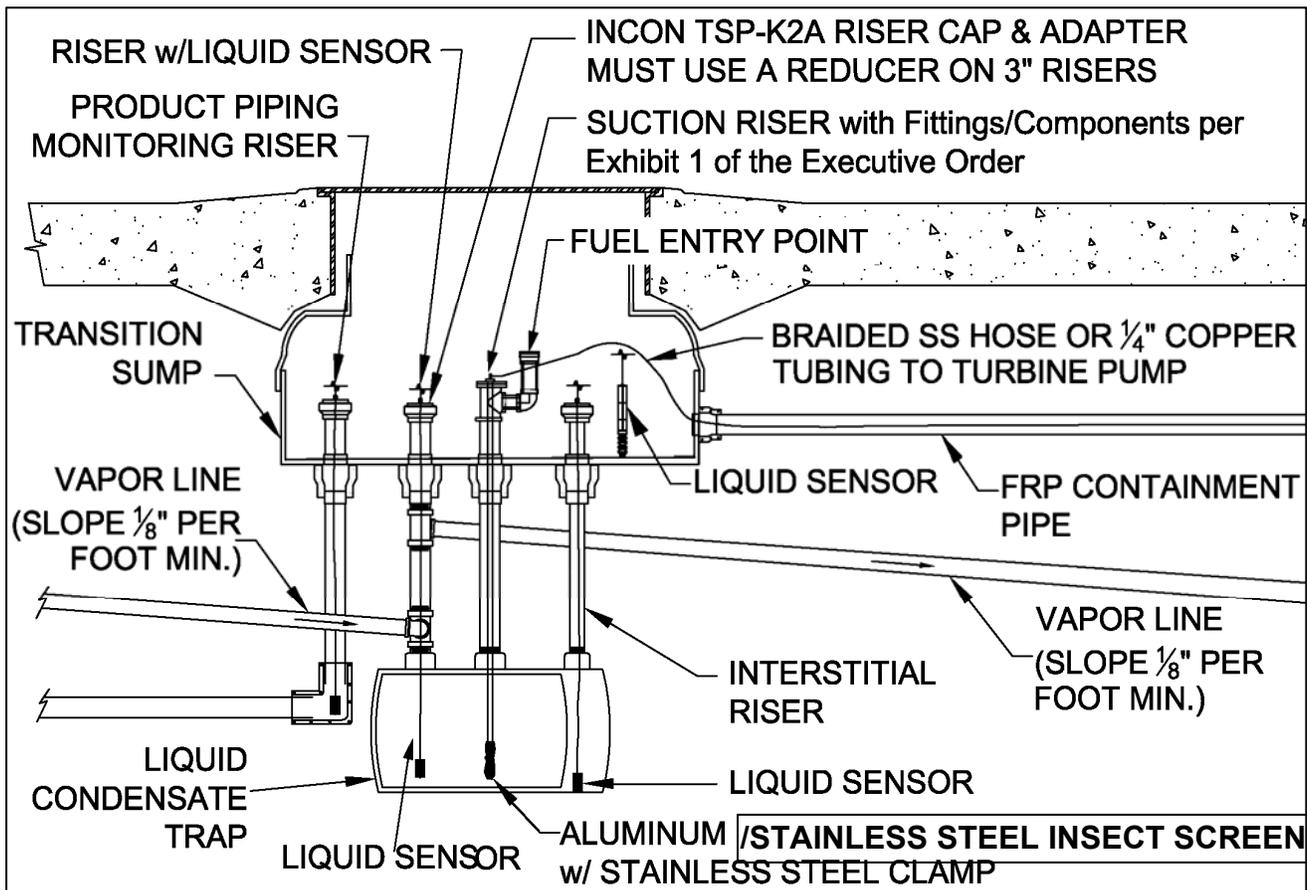


Figure 2
Typical Liquid Condensate Trap Installed Inside the Transition Sump

Note: A Liquid Condensate Trap installed inside a liquid AND vapor tight transition sump that is monitored with a liquid sensor can be single walled (if installed before July 1, 2004).

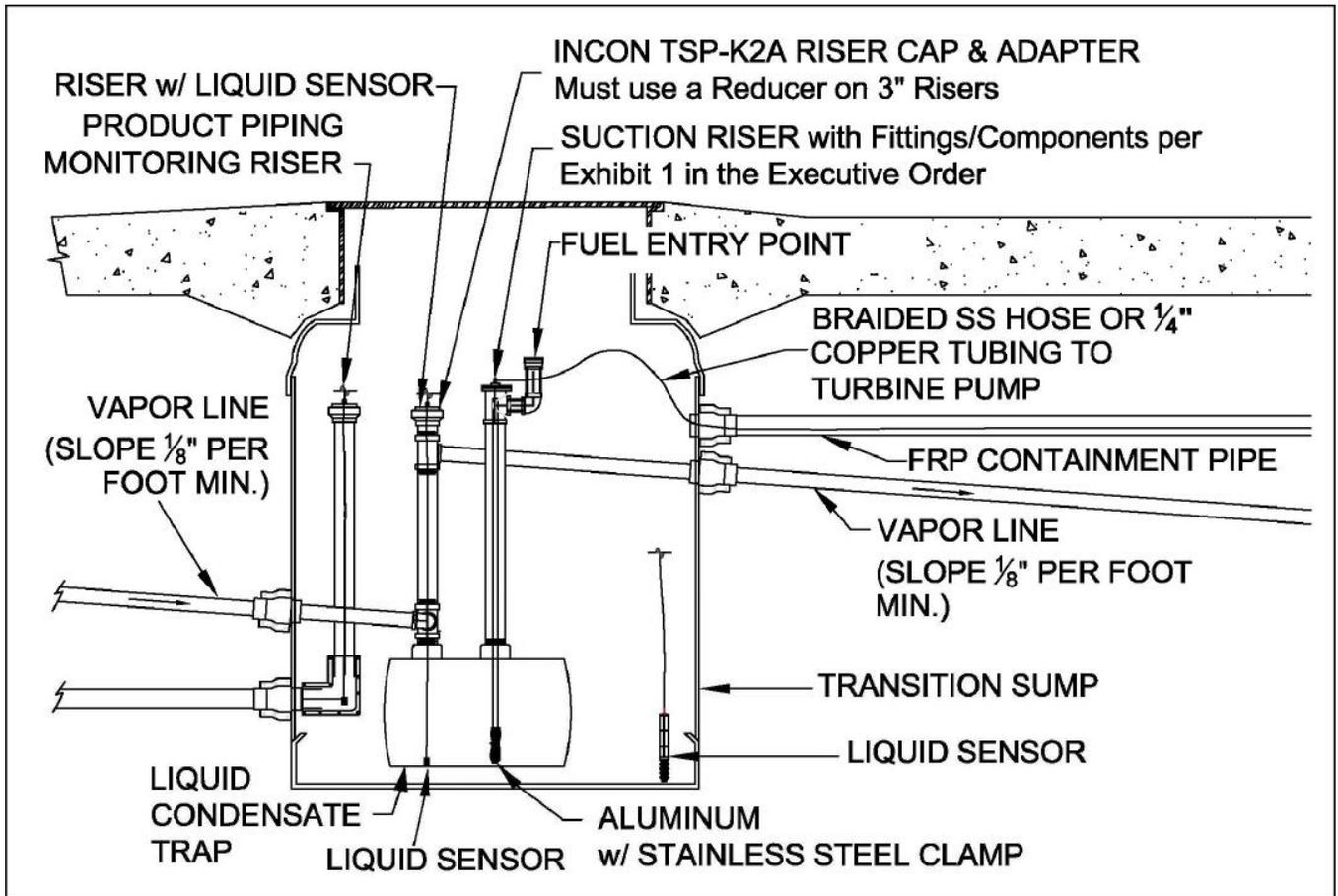
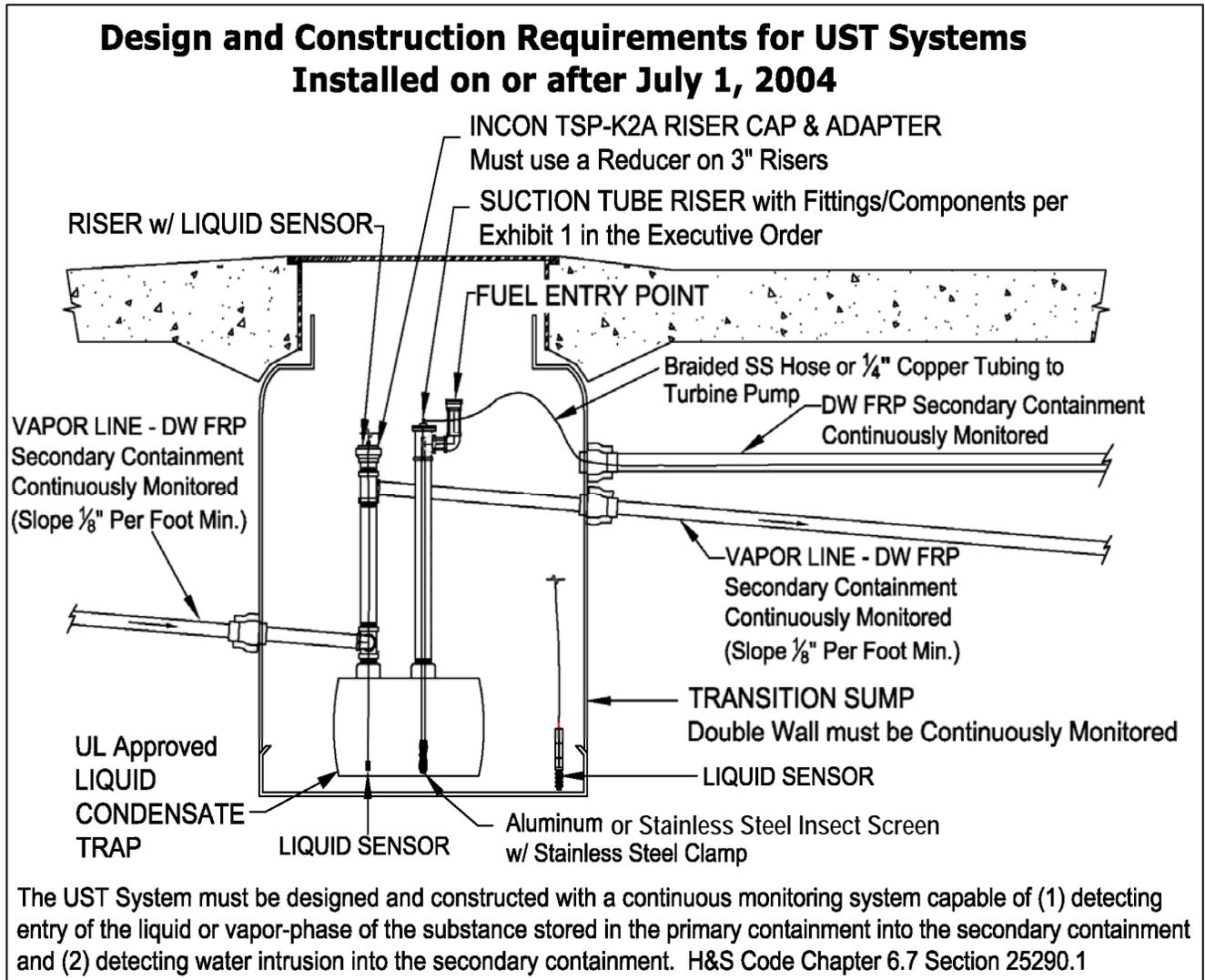


Figure 3
Typical Layout of a Liquid Condensate Trap Installed Inside in a UST System
That Was Installed On or After July 1, 2004 and
After the Installation of the Equipment Listed in Exhibit 1 of
Executive Orders VR-203 and VR-204



4.1 Installation of Swagelok 140 Micron In-Line Filter (or equivalent).

Swagelok instructions are used for guidance purposes. Individual manufacturer's installation instructions must be followed.

Swagelok In-Line filter B-4F2-140 Specifications

Body———Brass
Connection———1/4" Male NPT
Pore Size ———140 Micron

Apply Teflon tape to the male NPT threads on both ends of the in-line filter. Install the in-line filter with the direction of the arrow pointing towards the syphon jet port on the Submersible Turbine Pump (STP).

Figure 4
Top View of STP Sump

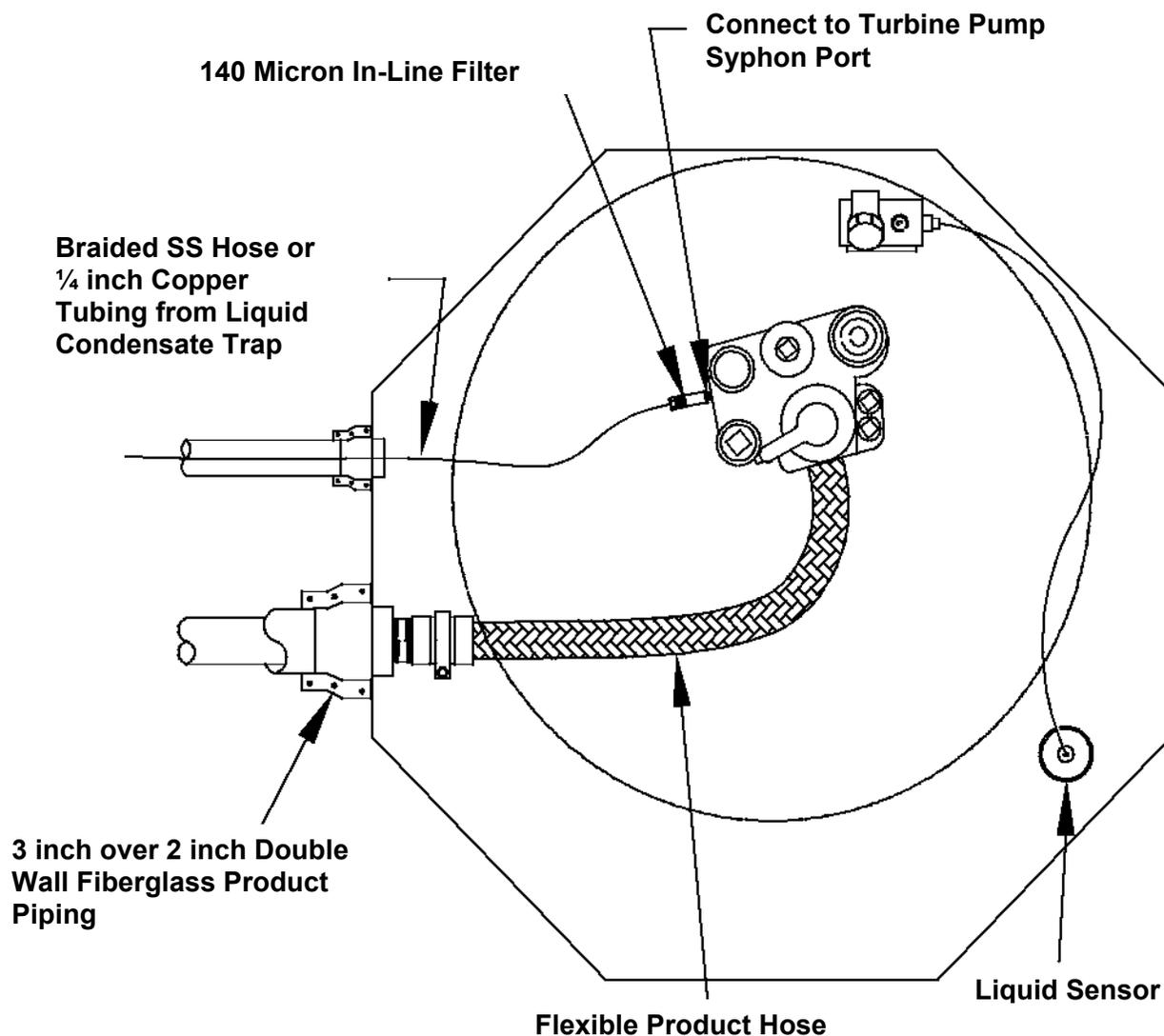


Figure 4a
Cut Away side view of an STP

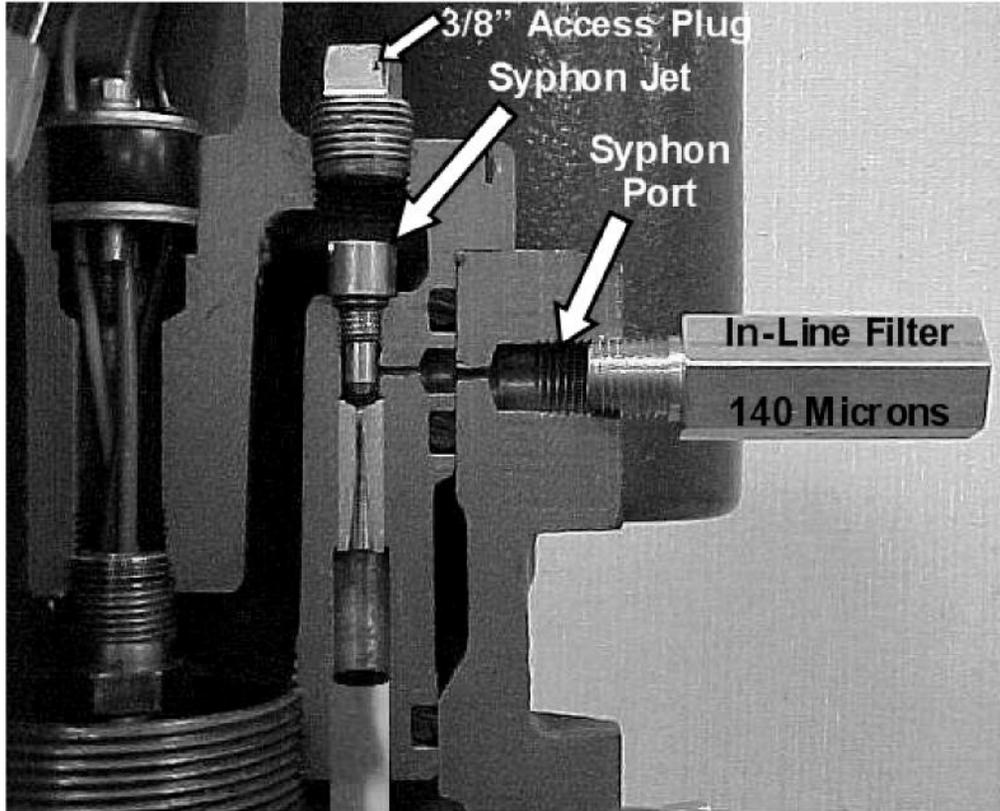
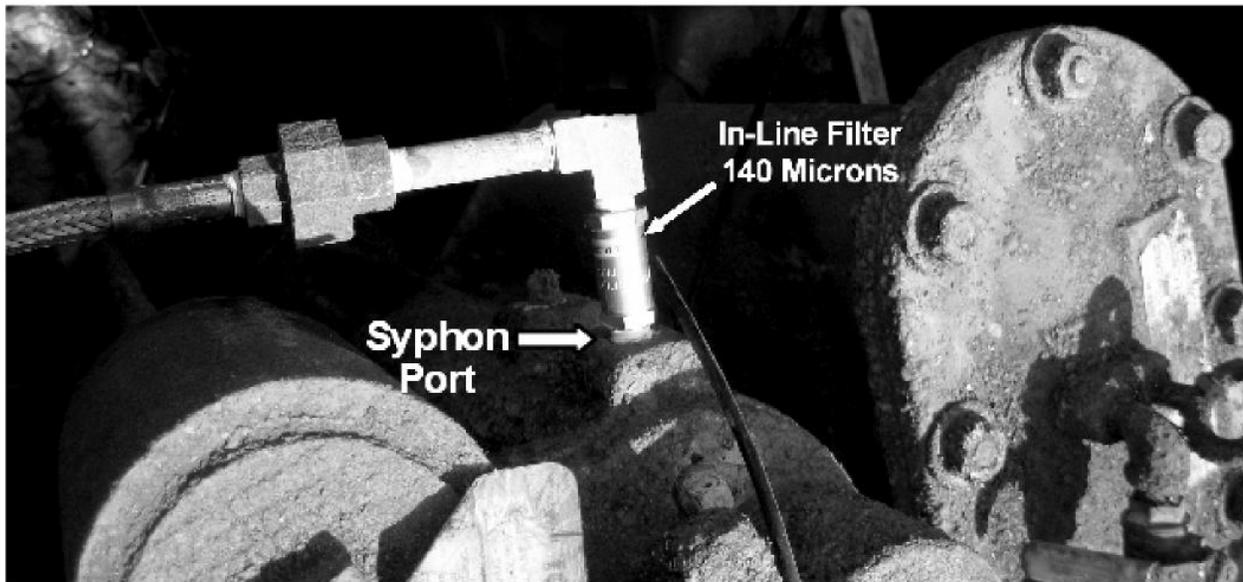


Figure 4b
In-Line Filter connection to syphon port



4.1.1 Replacing Micron Filter Element Inside the In-Line Filter Swagelok (or equivalent) instructions are used for guidance purposes. Individual manufacturer's installation instructions must be followed.

If the filter element becomes blocked from debris clean or replace the filter element – Swagelok P/N SS-4F-K4-140. See replacement instructions in Appendix B.

4.2 Installation of INCON TSP-K2A Riser Adaptor

WARNING Follow all federal, state and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30, 30A and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage and/or environmental contamination.

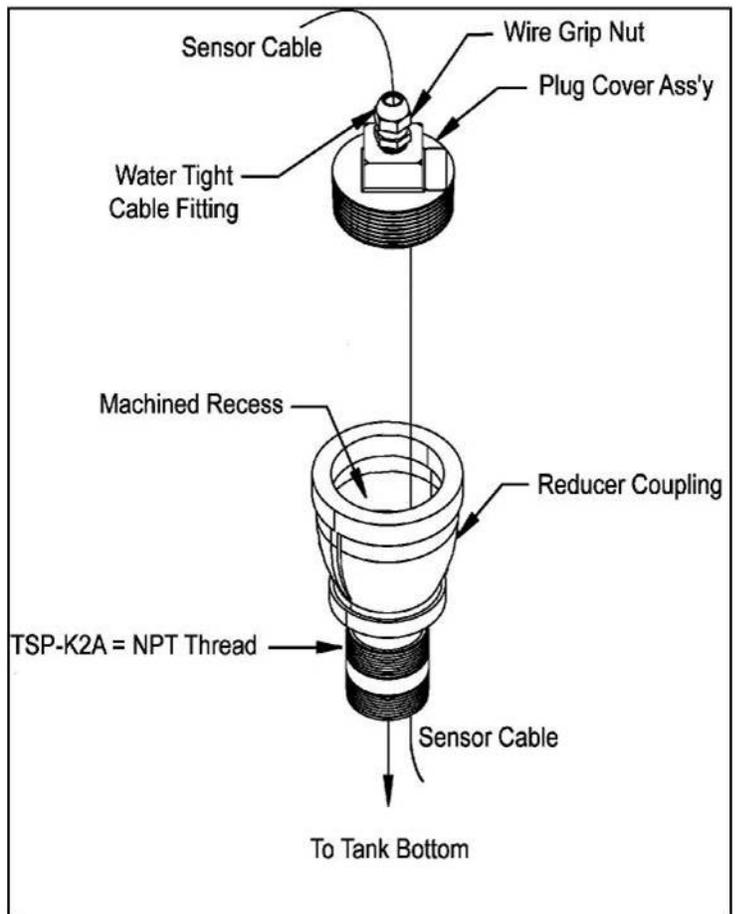
WARNING Always secure the work area from moving vehicles. The equipment in this guide is usually mounted underground, so reduced visibility puts service personnel working on this equipment in danger from moving vehicles entering the work area. To help eliminate these unsafe conditions, secure the area by using a service truck to block access to the work environment, or by using any other reasonable means available to ensure the safety of service personnel.

Procedure

1. Install a close fit 2" threaded nipple (field supplied) into the existing pipe.
2. Install the Reducer Coupling onto the threaded nipple.

Note: Use BOTH Teflon® Tape and a brushed-on thread sealant on all threaded connections to form a vapor-tight seal.

3. Insert the Sensor Cable through the wire grip nut so that the end of the sensor is on the inside of the Reducer Coupling.
4. Make all of the connections and test the sensor.
5. Tape and seal the Plug Cover Assembly into the Reducer Coupling. Make sure that the wire leads through the Wire Grip are loose and do not rotate when tightening the Plug Cover Assembly.
6. Tighten the Wire Grip Nut to 75-100 in. lbs. of torque to secure the cable. Use a torque wrench with McMaster Carr # 5347A148, 1-1/16 inch Open End Head, for Interchangeable-Head Torque Wrench or equivalent.



7. Retest the sensor functionality.

Figure 5
INCON TSP-K2A Riser Adaptor

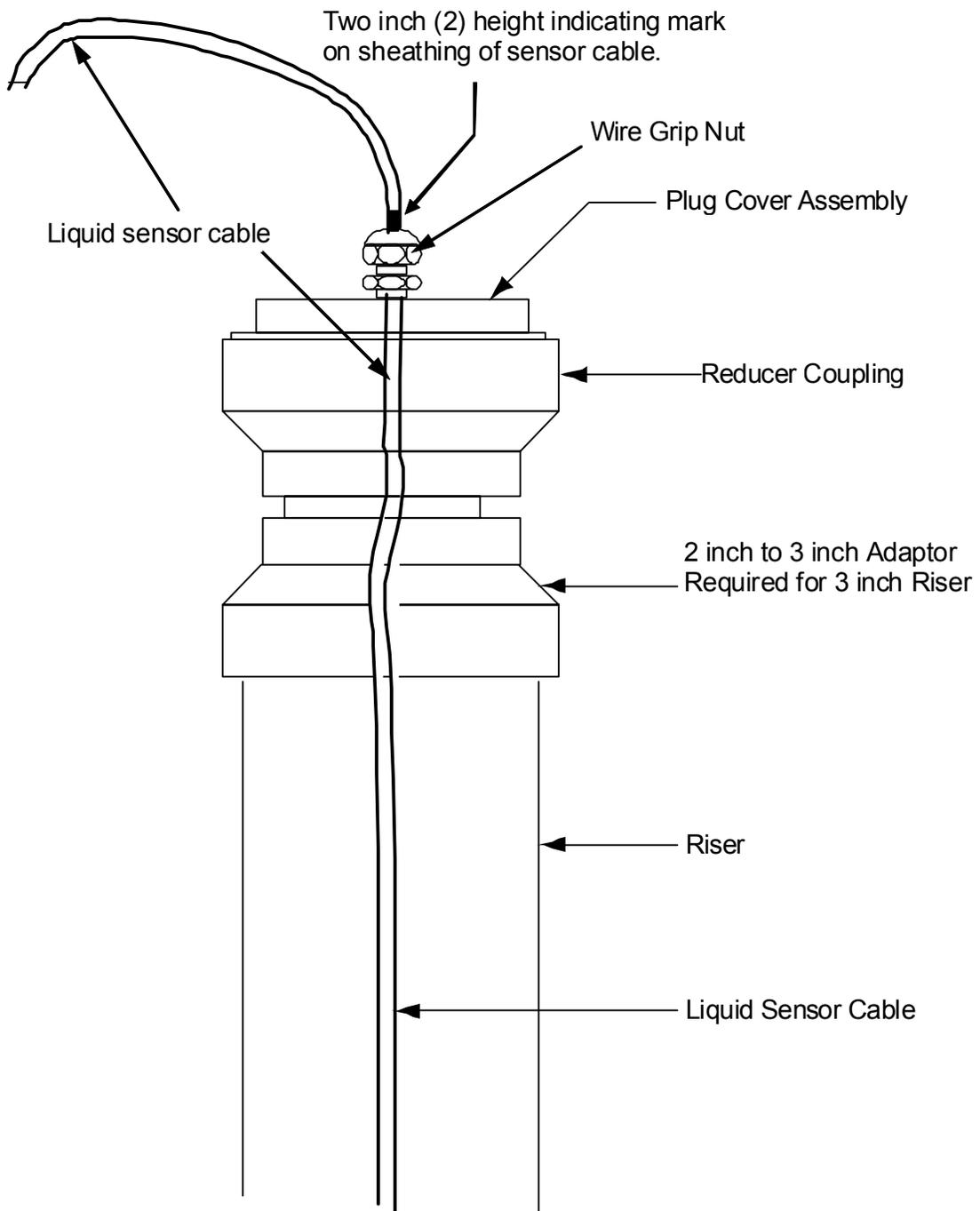
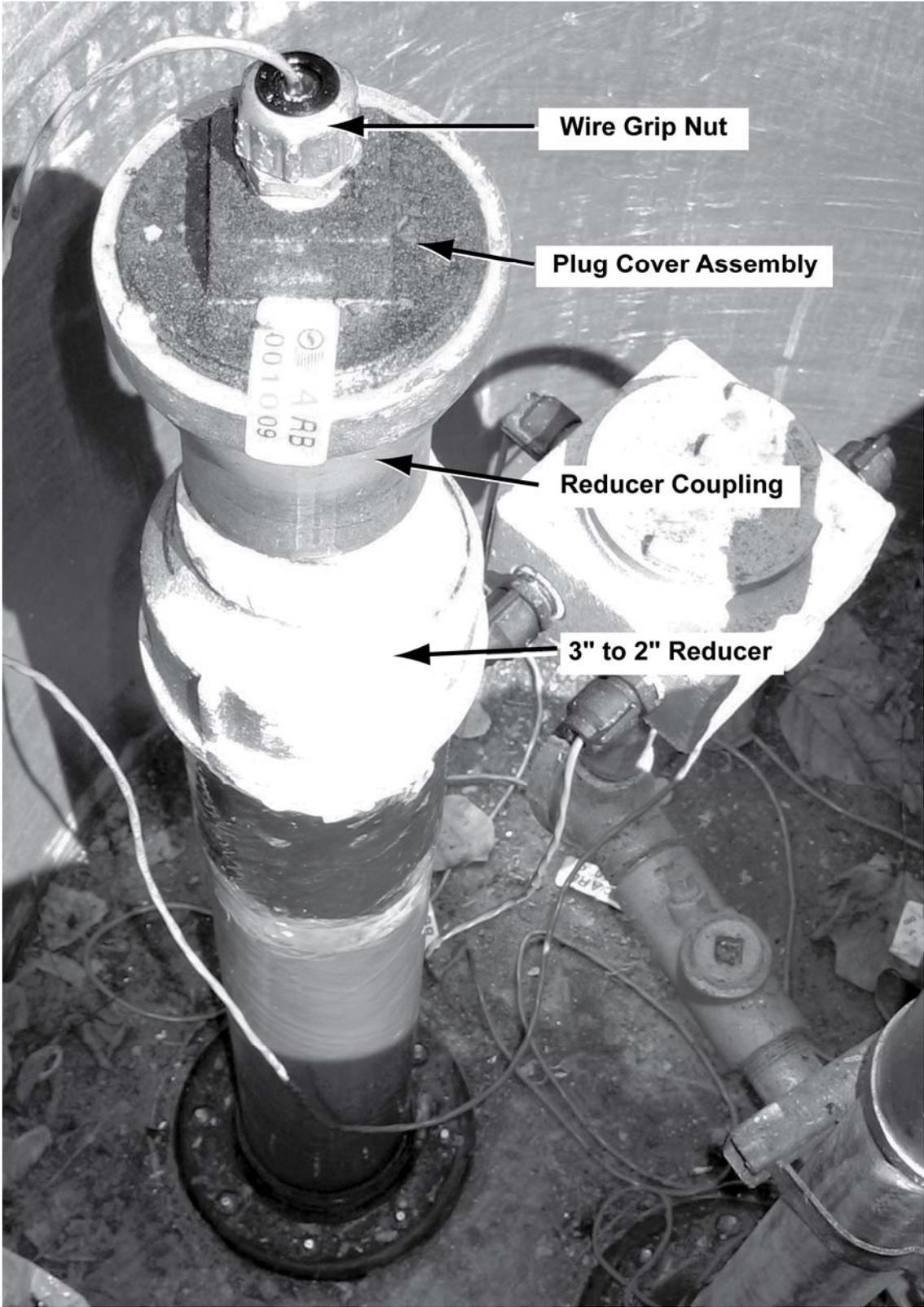


Figure 5a
INCON TSP-K2A Riser Adaptor



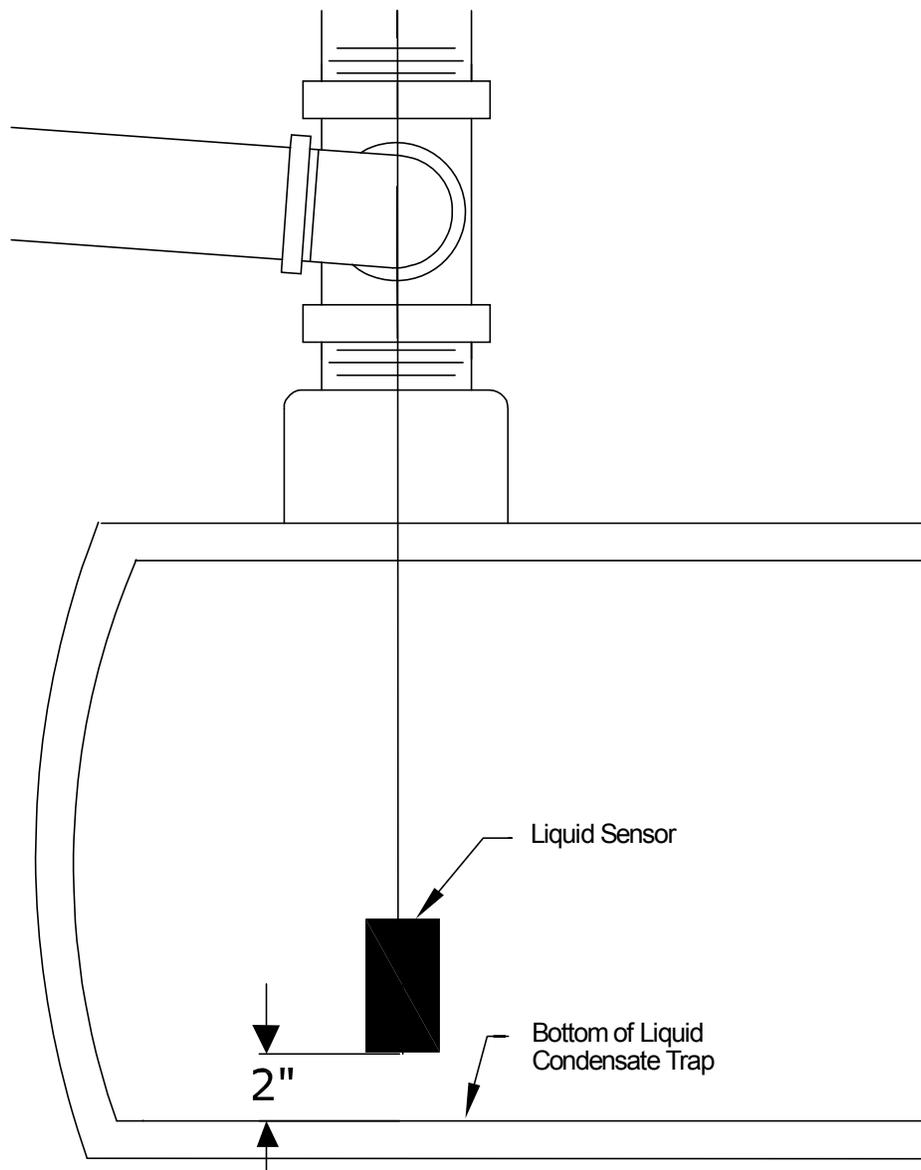
4.3 Liquid Sensor - Installation of a liquid sensor requires technician to meet applicable requirements as specified in the SWRCB Local Guidance Letter 167 (LG 167).

If not already present, install a liquid sensor following the manufacture's installation instructions. Set the liquid sensor two (2) inches from the bottom of the Liquid Condensate Trap. See Figure 6. Then tighten the wire grip nut (of the TSP-K2A) around sensor cable.

At the point where the cable exits the top of the wire grip, place a permanent indicating mark on the sheathing of the cable (e.g. using a waterproof marker such as a Sharpie™) which indicates the sensor is placed two (2) inches above the bottom of the Liquid Condensate Trap (see Figure 5).

When programming the LCT liquid sensor at the UST tank monitoring console, label the sensor with "LCT" in the title, e.g. L10 would be labeled "LCT High Liquid".

Figure 6
Liquid Sensor Height Setting



4.4 Installation of Suction Tube Riser, Suction Tube and Screen

For all installations you must use fuel rated pipe sealant on all threaded connections.

For new installations cut to size and thread a 2 inch galvanized steel riser for the suction tube and install it into a 2 inch bung at the top of the Liquid Condensate Trap.

For all installations install a 2 inch Tee fitting for the Fuel Entry Point on top of the 2 inch galvanized steel riser.

Measure the length of the suction tube to ensure it can meet the distance requirement in Figure 7. Cut the suction tube to length. When installing the suction tube, ensure the bottom of the suction tube is no more than 1 inch to 1 1/2 inches from the bottom of the Liquid Condensate Trap.

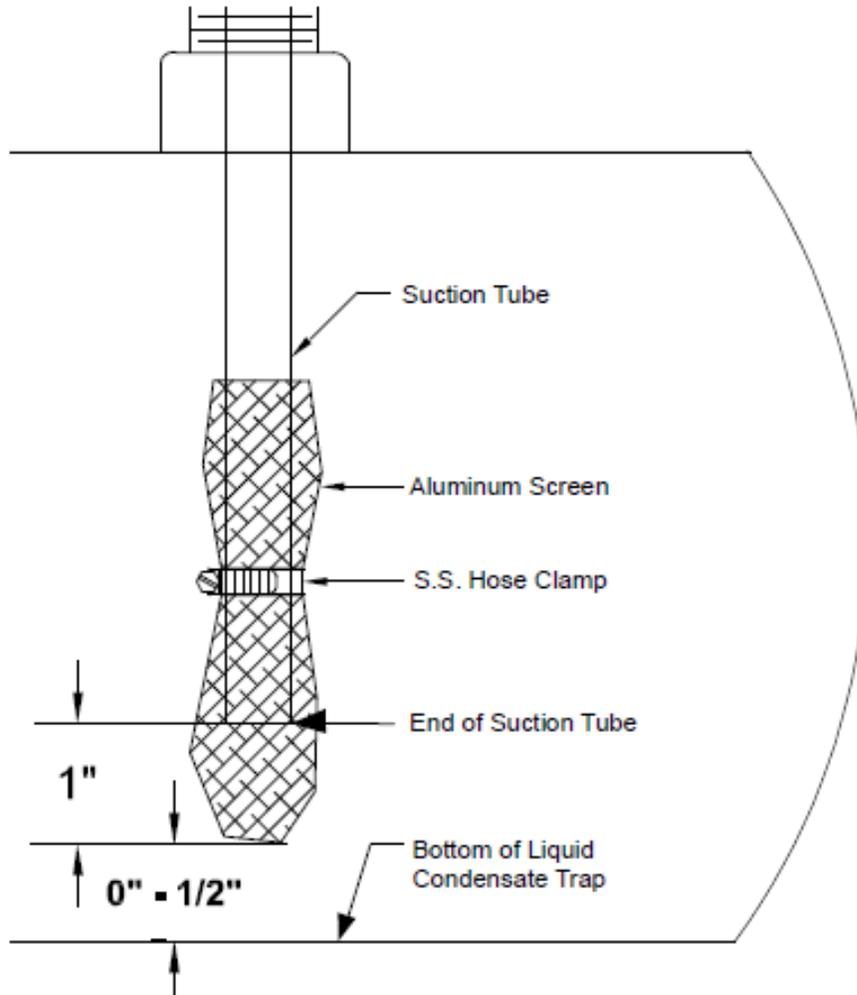
Cut a piece of 4 inch by 4 inch piece of screen material, either 18 x 14 aluminum mesh or 18 x 18 stainless steel mesh. Wrap it around the end of the suction tube as shown in Figure 7, leaving approximately 1 inch of screen below the end of the suction tube. Tighten the stainless steel hose clamp around the screen securing it approximately 3/8 inch or more from the bottom of the suction tube.

Once the aluminum screen is installed, the suction tube is ready to screw into the bottom of a double-tap bushing.

This double tap bushing, with the suction tube, is then installed into the top of the tee fitting.

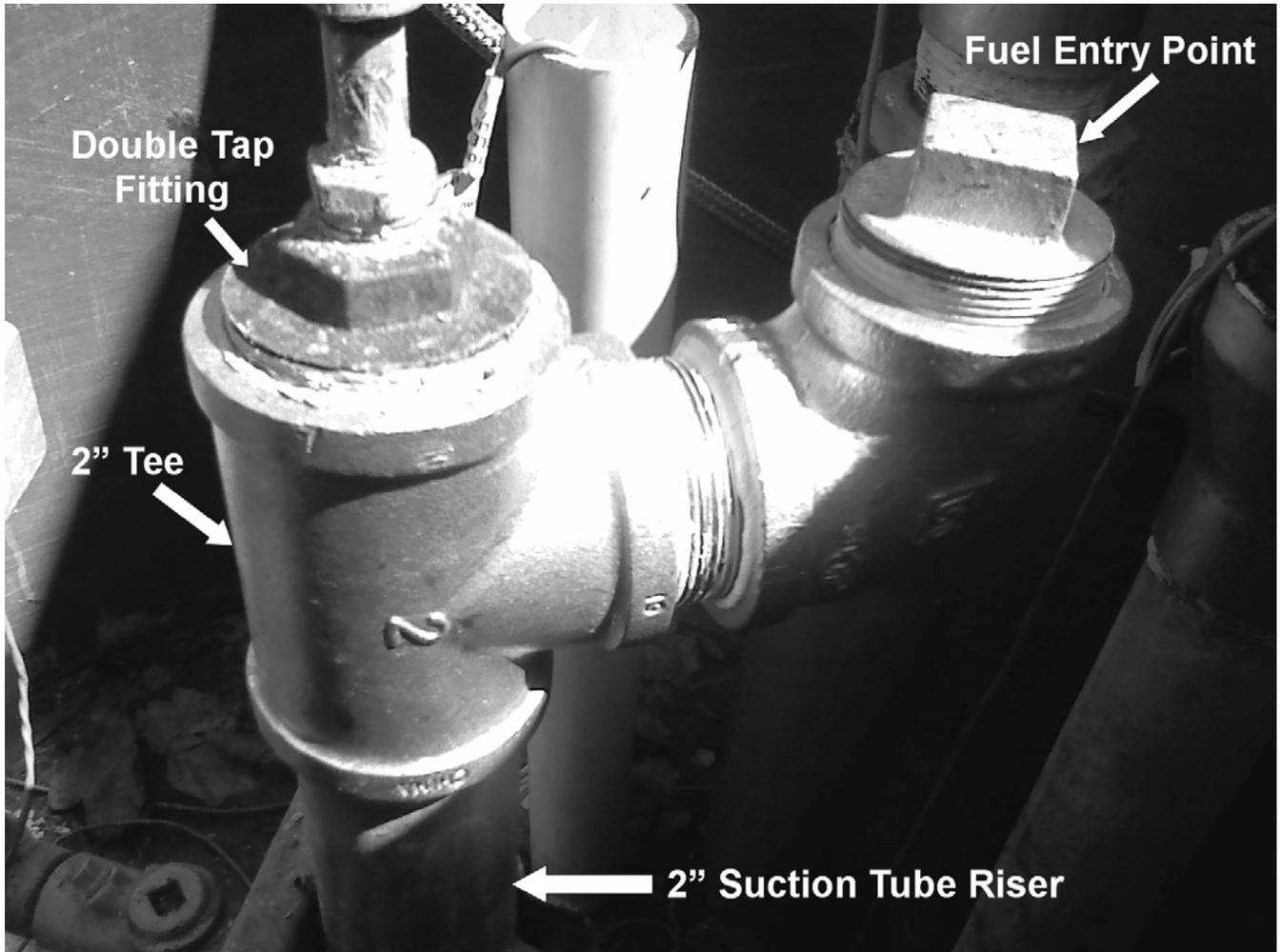
Connect the suction line to the top of the double tap bushing using appropriate fittings (Figures 8 thru 8c) and the other end of the suction line connects to the 140 micron in-line filter installed at the turbine syphon port per section 4.1 (Figures 4a and 4b).

Figure 7
Aluminum Screen and Suction Tube Installation



- 4.5 Fuel Entry Point** – On top of the 2 inch galvanized steel pipe install a 2 inch tee, 2 inch nipple, 2 inch elbow, additional 2 to 4 inch nipple (if using cap). Prior to installing cap or plug, conduct Exhibit 16 (VR-203 or VR-204). Install 2 inch cap or plug using pipe thread sealant (all pipe fittings must be galvanized steel.) See figures 8 & 8a, 8b, 8c and 8d.
- 4.6** Conduct TP-201.3, Determination of 2 Inch WC Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities, and Exhibit 4.

**Figure 8
Assembly of Fuel Entry Point**



- 5.** In the event that the turbine connected to the Liquid Condensate Trap is replaced, Exhibit 16 of Executive Orders VR-203 or VR-204 shall be conducted following replacement of the turbine.

Figure 8a
Assembly of Fuel Entry Point

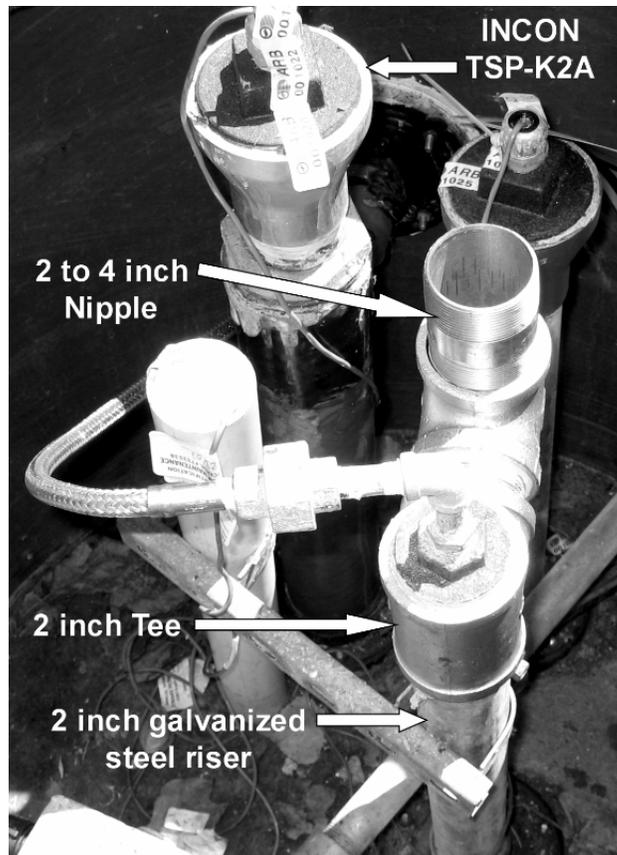


Figure 8b
Assembly of Fuel Entry Point

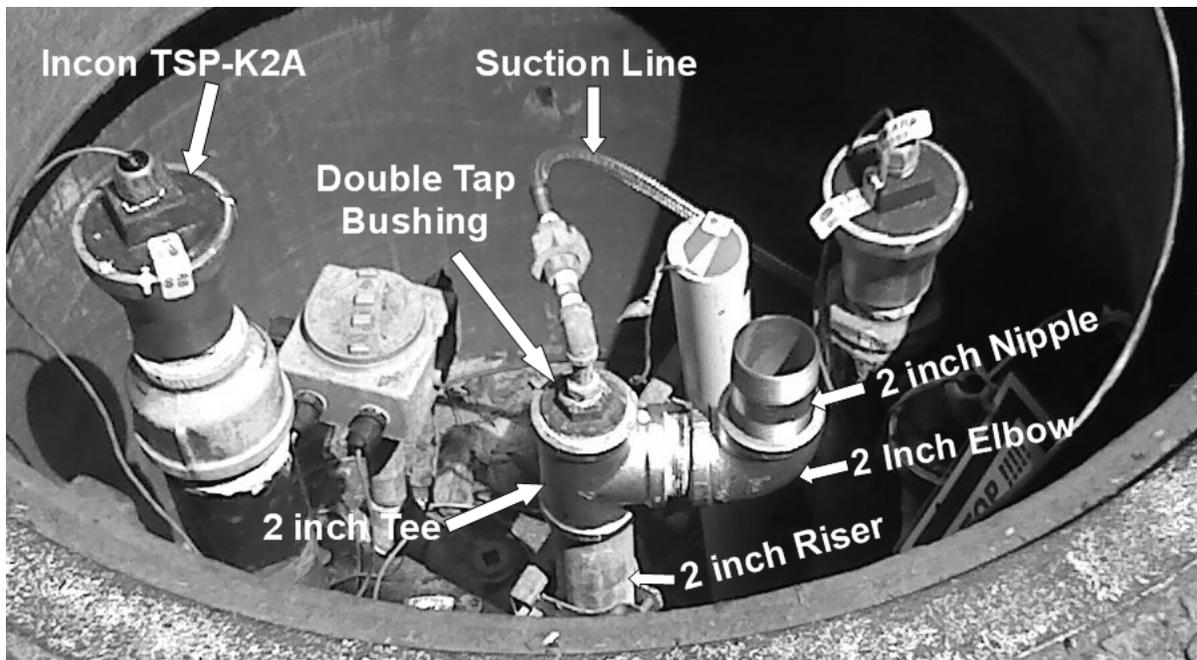


Figure 8c
Additional View Assembly of Fuel Entry Point

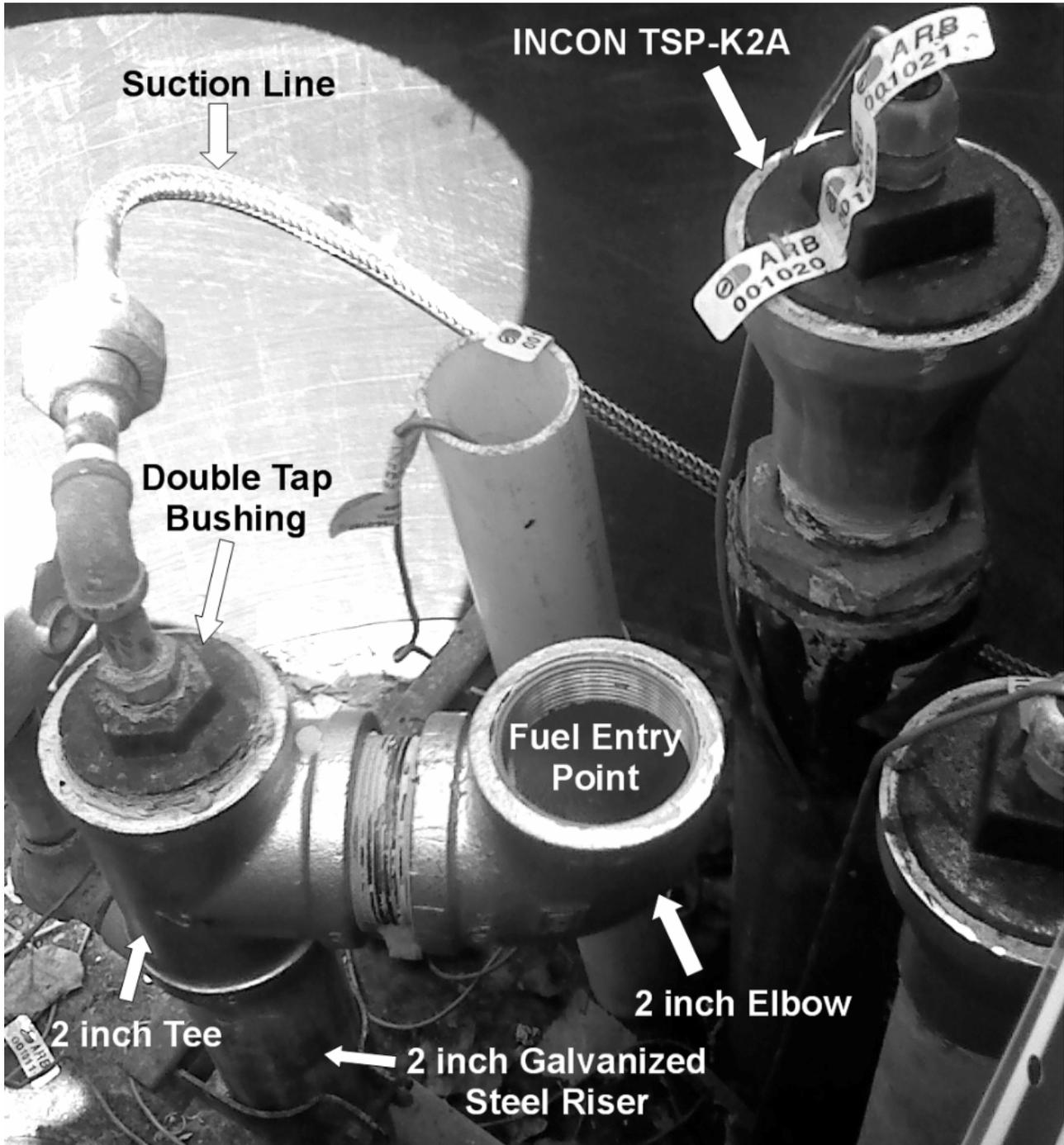


Figure 8d
Various Pipe Fittings



TROUBLESHOOTING PROCEDURES FOR LIQUID CONDENSATE TRAP

WARNING Installing or working on this equipment means working in an environment that presents risks of severe injury or death if instructions and standard industry practices are not followed. Obey all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment.

1. Test The Turbine Pump For Normal Vacuum Readings:

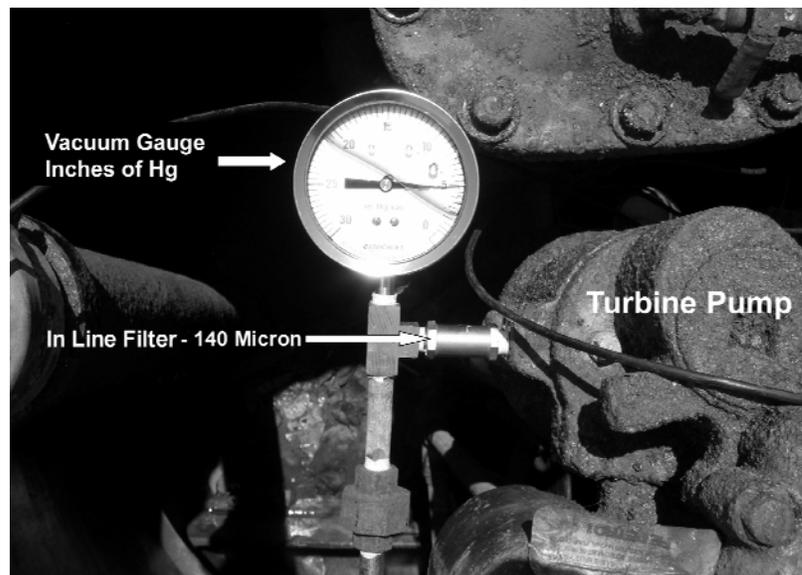
- Follow FE Petro syphon jet test procedures. See Appendix A, FFS FE Petro Service Bulletin SB005 “Syphon System Testing” (SB005). When using this test procedure for testing the turbine pump connected to the Liquid Condensate Trap only, perform Steps 1– 4. Do not use a syphon check valve and skip the syphon check valve test (for other turbine pump manufacturers, refer to their test procedure.)
- This will ensure the turbine pump is operating correctly and producing the correct amount of vacuum at the syphon port (minimum vacuum is 16 to 28 inches Hg). Make any necessary repairs to the turbine pump to meet the syphon port minimum vacuum levels.
- If the turbine pump is creating the appropriate amount of vacuum (16 to 28 inches Hg) at the syphon port, remove the test fixture called out in SB005 and install the 140 micron in-line filter.
- Check the vacuum level again with the in-line filter installed using the vacuum gauge in Figure 9. The amount of vacuum should be between 16 to 28 inches Hg.

2. Required Troubleshooting Test Equipment

Install the following Liquid Condensate Trap evacuation troubleshooting equipment:

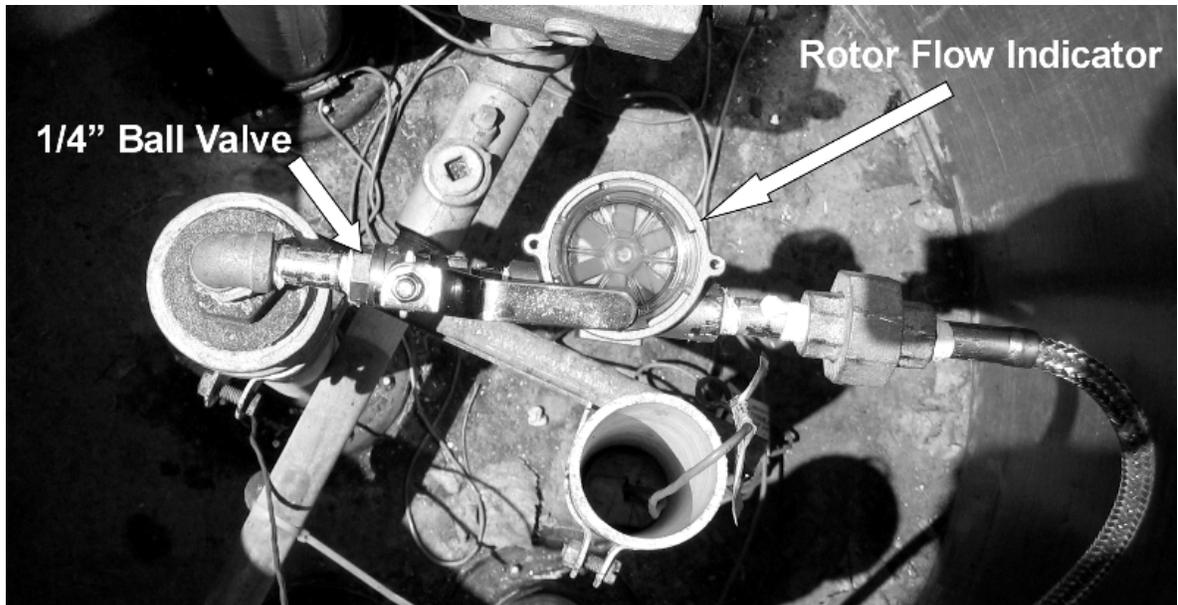
- 2.1** Ashcroft liquid-filled stainless steel, inches of Hg vacuum gauge, Grainger #2C879, 2C927 or equivalent. Install this gauge before the 140 micron in-line filter so that it is visible from outside the sump. See Figure 9.

Figure 9



- 2.2** Install a ¼ inch **full port** ball valve (ball valve) and rotor flow indicator Grainger Model 1AMD7 (or equivalent). The rotor flow indicator provides a visual indication of fuel flow when evacuating the Liquid Condensate Trap. Install this equipment so that it can be viewed from outside the sump. See Figure 10.

Figure 10



- 3. With the troubleshooting equipment installed perform the following procedures:**
- a. With the ball valve in the CLOSED position, fill the Liquid Condensate Trap with gasoline using the same method used in the Liquid Condensate Trap Compliance Test Procedure. The liquid sensor should be approximately 2 inches from the bottom of the Liquid Condensate Trap. Start the turbine pump connected to the Liquid Condensate Trap if it is not already running.
 - b. With the ball valve CLOSED, check the vacuum gauge and verify it is reading between 16 to 28 inches Hg of vacuum. If you do not have the correct amount of vacuum then look for a vacuum leak in the system. Check for a blocked in-line filter or syphon jet. See the table titled "If You Experience the Following Conditions".
 - c. OPEN the ball valve and watch for rotation of the rotor flow indicator. Rotation of the rotor flow indicator will indicate the flow of gasoline. The rotor flow indicator will not rotate at a high speed and will not rotate at all if no liquid is flowing through the indicator. The rotor flow indicator provides a visual indication that liquid is being evacuated from the Liquid Condensate Trap. If any air is getting into the syphon system during evacuation the liquid flow rate will change or stop.
 - d. When first opening the ball valve, the vacuum pressure may drop to zero inches of Hg (0" Hg) during priming of the suction line; however the vacuum should rise up to approximately 4 to 5 inches Hg during evacuation. Monitor the rotor flow indicator for steady rotation.

- e. When the Liquid Condensate Trap is almost empty and/or the liquid is below the end of the suction tube the rotor flow indicator will stop then start a few times and then completely stop. This is an indication that air is getting into the system. If the liquid sensor is out of alarm and the Liquid Condensate Trap is empty or almost empty (liquid level is at or below the bottom of the suction tube) you have successfully evacuated the Liquid Condensate Trap.

Note: At this time the vacuum gauge will read near zero inches of Hg (0" Hg) because the suction tube is sucking in air and not liquid.

4. When you have successfully passed this **Troubleshooting** section, remove the troubleshooting equipment and retest the system again using the "Liquid Condensate Trap Compliance Test Procedure" (Exhibit 16 of VR-203 or VR-204).

IF YOU EXPERIENCE THE FOLLOWING CONDITIONS:

Symptom:	Troubleshooting steps:
<p>The ball valve is open, no rotation of the rotor flow indicator, and high vacuum (16" Hg to 28" Hg)</p>	<ul style="list-style-type: none"> ○ There is a blockage in the piping before the vacuum gauge. ○ Check the suction tube and suction line from the bottom of the suction tube to the vacuum gauge. ○ Check for kinks or pinches in the suction line.
<p>The ball valve is open and the rotor flow indicator stops and starts intermittently. This indicates a small vacuum leak or an intermitting blockage</p>	<ul style="list-style-type: none"> ○ Check the screen at the bottom of the suction tube for debris, dirt, rocks, etc. ○ Check the in-line filter and/or syphon jet for debris and blockage. ○ Check the fittings and connections from the suction tube to the syphon jet for any vacuum leaks.
<p><u>With the ball valve open,</u> no rotation of the rotor flow indicator, zero vacuum (0" Hg), <u>and the liquid condensate trap still has liquid above the bottom of the suction tube.</u></p>	<ul style="list-style-type: none"> ○ Check the in-line filter and/or syphon jet for debris and blockage. Small particle of debris (rust particles) can block the in-line filter and/or syphon jet causing the vacuum level to drop to zero. ○ Check the in-line filter and/or syphon jet for debris and clean or replace the filter element and/or syphon jet as necessary. ○ There may be a vacuum leak somewhere in the system. If you had the correct amount of vacuum before you opened the ball valve, then the vacuum leak is between the ball valve and the end of the suction tube; or the liquid level inside the Liquid Condensate Trap is below the bottom of the suction tube and you are sucking in air.
<p><u>The ball valve is closed</u> and there is zero inches (0" Hg) of vacuum on the gauge</p>	<ul style="list-style-type: none"> ○ Check the in-line filter and/or syphon jet for debris and blockage. Small particles of debris (rust particles) can block the in-line filter and/or the syphon jet causing the vacuum level to drop to zero. ○ Check the in-line filter and/or syphon jet for debris and clean or replace the filter element and/or syphon jet as necessary. ○ Check for a vacuum leak between the vacuum gauge and the ball valve.

Appendix A



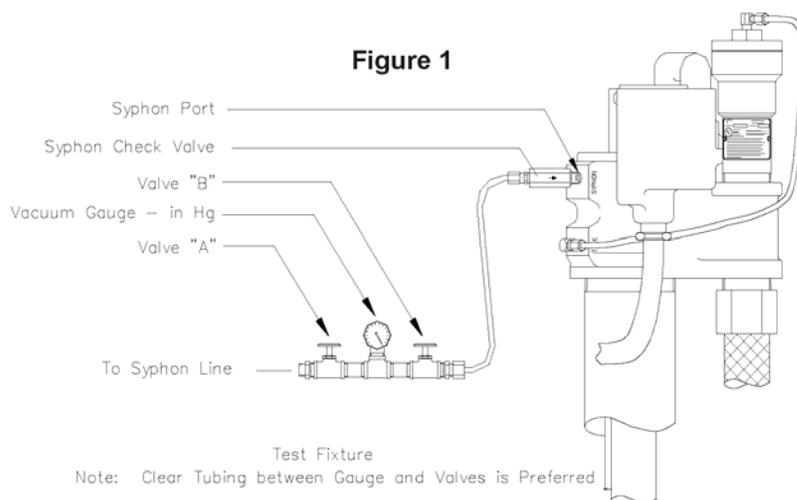
SERVICE BULLETIN

SB005 Rev 2

January 20, 2009

Syphon System Testing

The following procedure illustrates syphon system testing techniques on 4" pumps.



When manifolded tanks are not maintaining equal product levels (i.e., loss of syphon prime) there are several possible causes: the Submersible Turbine Pump (STP) is not generating a vacuum, the syphon check valve is not holding prime when the STP is off, there is a leak in the syphon loop (i.e., tube, fittings, or pipe), there is foreign material blocking the syphon pipe, and/or the syphon system was not properly installed (i.e., the syphon bar is not sloped, the syphon pipes are too short, the tanks are different diameters, the tanks are on different planes, etc.).

Warning  Highly flammable vapors or liquids may be present in the environment in which this equipment is installed or serviced. Installing or working on this equipment means working in an environment that presents risks of severe injury or death if instructions and standard industry practices are not followed. Follow all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment. Refer to the *Installation and Owner's Manual* of this equipment and any related equipment for complete installation and safety information.

Vacuum Testing Procedure

1. Turn off the power at the load center, then lock out and tag the circuit breaker.
2. Install a test fixture into the syphon line as shown in Figure 1.
3. Run the STP with the dispenser nozzles and valve "A" closed, and with valve "B" open. The normal vacuum reading should be 20-28" Hg. If the vacuum is normal, continue with Step 4. If there isn't any vacuum or it is somewhat less than 20" Hg, there is the possibility of blockage in the STP syphon passages.

Note: Vacuum readings should be taken without any product delivery. Also, check if the Pump Motor Assembly is producing correct pressures.

4. To remedy abnormal vacuum conditions, remove the 3/8" plug from the manifold discharge head (see Figure 3) and unscrew the brass Syphon Jet using a large standard screwdriver. Pull the Syphon Jet out and clean it, making sure that the Syphon Jet only allows for downward flow when installed. Before reinstalling the Syphon Jet, ensure that the Syphon Port and the Vapor Return Tube have open passages by using a stiff wire or other similar device to check. Replace or reinstall the Syphon Jet and 3/8" plug. Check for normal vacuum. If the passages are clear and the vacuum is still abnormal, check the STP Extractable O-rings for damage and make sure that the Vapor Return Tube is not pinched. To check the Vapor Return Tube, remove the STP Extractable and repair as necessary (see Figure 2). If the condition has been corrected, continue with the next step to test the remaining syphon system. If abnormal vacuum conditions continue, contact FFS Petro Technical Support.

- Run the submersible with dispenser nozzles and valve "A" closed, but leave valve "B" open. When the vacuum reading reaches 20-28" Hg, shut the submersible off. The vacuum should hold for at least 15 minutes. If this worked, continue with the next step. If the vacuum does not hold, the Syphon Check Valve is not holding or the Test Fixture fittings may be loose. Providing the Test Fixture fittings are tight, remove the Syphon Check Valve and clean or replace it. Repeat this step until the problem has been corrected, then continue with the next step.

Note: Syphon Check Valves may hold at high vacuum, but may fail under low vacuum. Test the Syphon Check Valve at a lower vacuum by bleeding off the vacuum and re-testing at 5" Hg.

- Run the STP with valves "A" and "B" both open and the dispenser nozzles closed. Normal priming should take approximately 5-10 minutes. When first priming with both valves open, the vacuum gage will indicate 0" Hg. After awhile, vacuum will begin to show. For every inch of mercury vacuum shown, the product level in the syphon pipes is about 1-½ feet above the tank fluid level. When air is being removed from the syphon system, the vacuum gauge needle will bounce. This bouncing should stabilize as more air is removed. If not, this would be a good indication that there is a leak in the syphon system. This air may also be visible if using a Test Fixture with clear tubing. The air would indicate that there is a leak in the syphon line between the tanks or the possibility of foreign material blocking the syphon pipe. Repair any leaks or blockage and repeat this step. If there is no evidence of air, then continue with the next step.

- Close valve "B" and then shut off the STP. The gauge should hold constant for 30-40 minutes after the submersible is turned off. The vacuum may increase if the syphon system wasn't fully primed before closing the valve. If the vacuum drops, there is a leak in the syphon line between the tanks or the possibility of foreign material blocking the syphon pipe. Repair any leaks or blockages and then repeat this step.

Note: If there is a leak in the syphon line, product will drain out of the horizontal pipes before vacuum gauge readings indicate a leak.

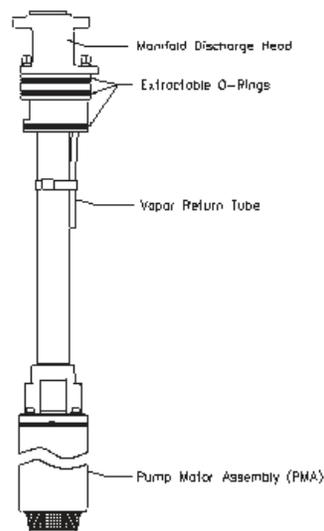


Figure 2
(STP Extractable)

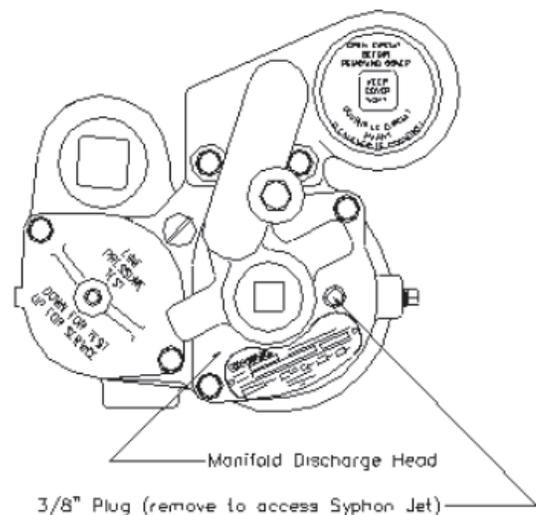


Figure 3
(Top View of STP)

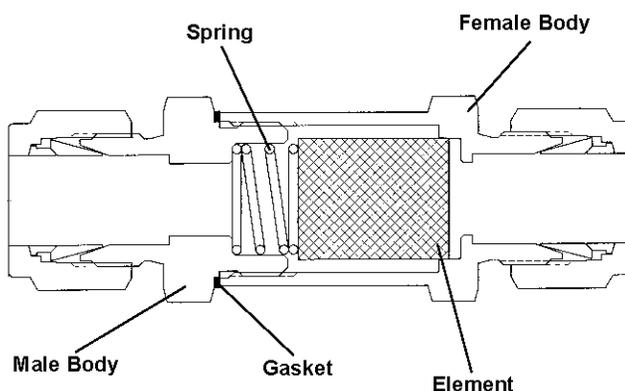
Contact FFS Technical Support for any assistance

Franklin Fueling Systems • 3760 Marsh Rd. • Madison, WI 53718 USA
Tel: +1 608 838 8786 • 800 225 9787 • Fax: +1 608 838 6433 • www.franklinfueling.com

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APPENDIX B

Swagelok F-Series In-Line Filter Service Instructions



Disassembly

1. Loosen male and female bodies and disassemble.
2. If replacing the filter element, remove and discard used element.

Reassembly

3. Before reassembling the filter, be certain that all components are clean.
4. Align the new filter element parallel to the filter bore of the female body. Position the open end of the element towards the body and press in place.
5. Lubricate the gasket with a thin film of system-compatible lubricant. Place gasket on male body seal surface.
6. Place the spring in to the male body.
7. Thread the male and female bodies together, and tighten finger-tight.
8. Tighten the bodies to the proper torque as shown in the table below.
9. Test the filter for proper operation and leak-tight sealing.

Size and Series	Torque, in.-lb. (N-m)		
	Standard Assembly		Unplated Gasket Stainless Steel
	Stainless Steel	Brass	
1F, 2F, 3F-MM	135 (15)	125 (14)	—
4F, 6F-MM	350 (40)	325 (36)	500 (56)
6F, 8F, 10F-MM, 12F-MM	500 (56)	450 (50)	800 (90)