

California Environmental Protection Agency

---



**ARB Approved**

**Installation, Operation and Maintenance Manual**

for

Executive Order

VR-203-H

VST Phase II EVR System

Not Including In-Station Diagnostics (ISD)

## **NOTICE:**

The **ARB Approved Installation, Operation and Maintenance Manual (IOM) for VR-203** describes the tools, methods, and skill levels required to install the **VST Phase II EVR System**.

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 Hirt Combustion Engineers, Inc. (HCE or Hirt) are able to perform installation, maintenance, or repairs of components manufactured by HCE or the 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 the 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, Hirt 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, Hirt 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](http://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](http://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](http://www.vsthose.com)

To confirm Veeder-Root TLS or ISD training, a regulator should send an email to [technicaltraining@gilbarco.com](mailto: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 Hirt training, a regulator should contact Hirt below with the name (and company) of the technician.

*Contact Information:*  
Customer Service Department  
Hirt Combustion Engineers, Inc.  
Phone: (562) 692-6970  
email: [HirtVCS@aol.com](mailto:HirtVCS@aol.com)

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

Jose E. Rodriguez  
Manager of Technical Services & Support  
EMCO Wheaton Retail  
Phone: 619-421-1743  
Email: [JERodriguezSD@aol.com](mailto: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](mailto:ewrc@emcoretail.com)

## *Table of Contents*

---

<b>Section 1:</b>	Contractor Requirements
<b>Section 2:</b>	Daily and Weekly Inspections
<b>Section 3:</b>	Quarterly and Annual Inspections
<b>Section 4:</b>	Alarm Troubleshooting Summary
<b>Section 5:</b>	Drive-offs and Other Customer Abuse
<b>Section 6:</b>	Phase II Coaxial Balance EVR Dripless Nozzles
<b>Section 7:</b>	Phase II Coaxial EVR Nozzle Front-End Kits
<b>Section 8:</b>	Phase II Coaxial EVR Balance Fuel Hose
<b>Section 9:</b>	Phase II Coaxial EVR Balance Safety Breakaway Device
<b>Section 10:</b>	VST ECS Membrane Processor: Installation
<b>Section 11:</b>	VST ECS Membrane Processor: Operation, Maintenance, & Start-Up
<b>Section 12:</b>	VST ECS Membrane Processor : Veeder-Root Pressure Management Control
<b>Section 13:</b>	VST ECS Membrane Processor /Veeder-Root Vapor Polisher: Pressure Sensor Installation Guide
<b>Section 14:</b>	Veeder-Root Vapor Polisher: Installation
<b>Section 15:</b>	Veeder-Root Vapor Polisher: Pressure Management Control
<b>Section 16:</b>	Hirt VCS 100: Vapor Processor and Indicator Panel
<b>Section 17:</b>	Healy Clean Air Separator: Installation

## 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
<b>A</b> Must be re-certified every two years	Hanging Hardware	Functional Testing Installation Maintenance Repair	No pre-requisite
<b>A/B</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
<b>C</b> 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.

*Veeder-Root Contractor Requirements*

<p><b>Installer (Level 1) Certification</b></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><b>TLS-350 Technician (Level 2/3 or 4) Certification</b></p>	<p>Contractors holding valid TLS-350 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-300 or TLS-350 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.</p>
<p><b>In-Station Diagnostics (ISD-PMC) Technician Certification</b></p>	<p>ISD PMC Contractors holding a valid ISD/PMC Certification are approved to perform (ISD/PMC) installation checkout, startup, programming, and operations training. This training also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current Veeder-Root Technician Certification is a prerequisite for the ISD/PMC course.</p>
<p><b>Veeder-Root ISD/PMC Including Carbon Canister Vapor Polisher Contractor Certification</b></p>	<p>This Certification includes Executive Orders 203, 204 and the Veeder-Root Vapor Polisher. This certification is required for setup and service of the Veeder-Root Vapor Polisher.</p>
<p><b>Warranty Registrations may only be submitted by selected distributors.</b></p>	

Veyance Technologies, Inc. Contractor Requirements

Level	Component	Authorized Tasks	Training Pre-Requisites
<p><b>EMCO Wheaton Retail Level A</b> Must be re-certified every two-years</p>	<p>Goodyear Maxxim Premier Plus Hose</p>	<ul style="list-style-type: none"> <li>• Installation</li> <li>• Functional Testing</li> </ul>	<p>No pre-requisite</p>
<p style="text-align: center;"><b><u>Note:</u></b></p> <p><b>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.</b></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 Technician should **ALWAYS** verify training and certifications requirements with the air district staff **BEFORE** beginning installation of EVR systems or components.

## Hirt Contractor Requirements

---

<b>Technician Certification</b>	Contractors holding valid Installer Certification are approved to perform VCS 100 processor and indicator panel installation; wiring and conduit routing; start-up; maintenance; troubleshooting; and parts replacement.
<p style="text-align: center;"><b><u>NOTE:</u></b></p> <p><b>Depending on local codes, in addition to the Hirt training, contractors may be required to take air-district training or ICC certification as an approved vapor-recovery installer.</b></p>	

## *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.

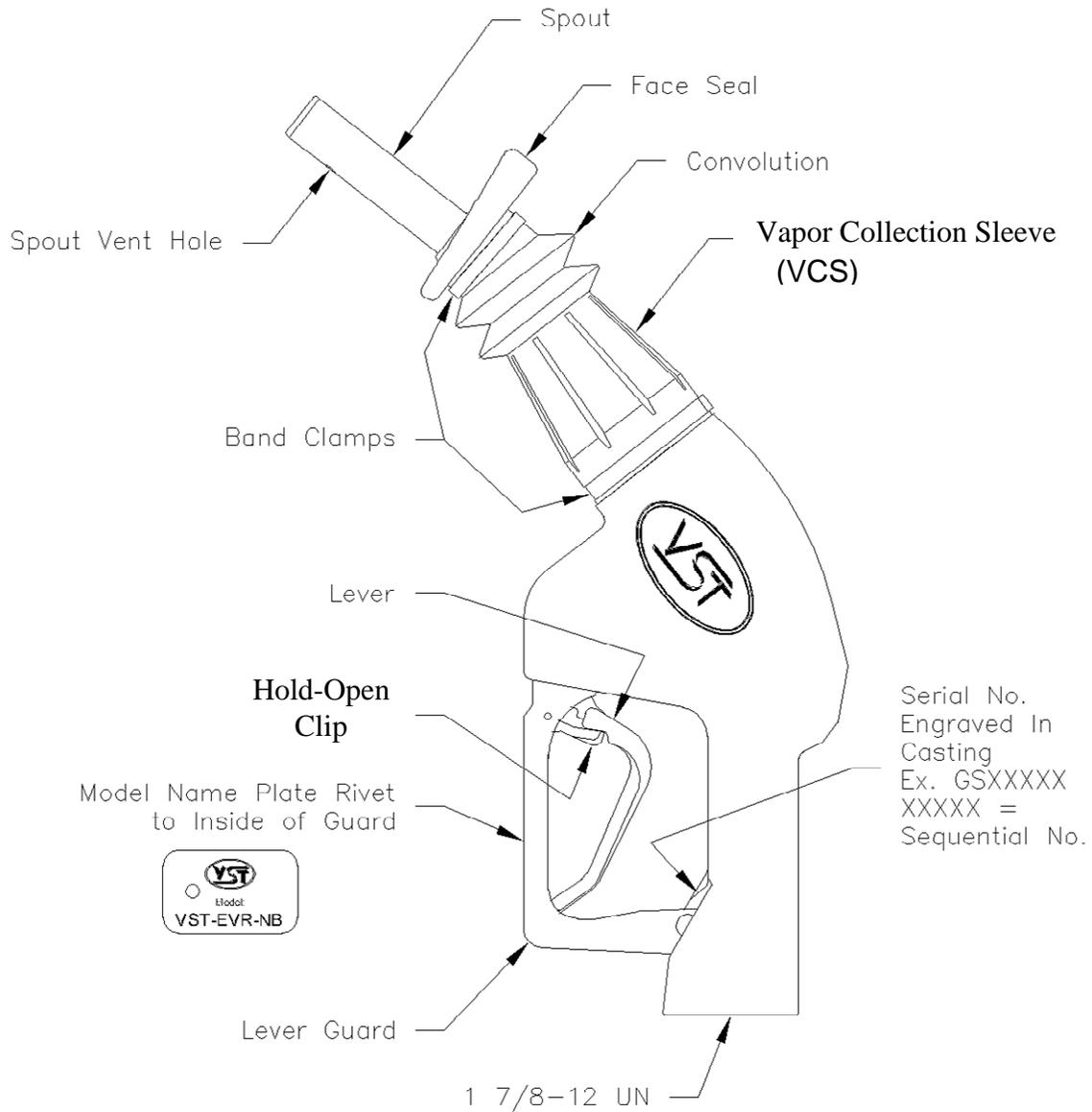
It is also the responsibility of the Healy Certified Technician to be aware of all the necessary safety precautions and site safety requirements to assure a safe and trouble free installation.

To confirm a Healy or INCON Certified Technician training status, a regulator can access a searchable database at the following web site:

<http://www.franklinfueling.com/CertifiedInstallers/CertifiedInstallers.asp>



Figure 1  
VST Nozzle



## Weekly Inspections – VST Hanging Hardware

<b>HANGING HARDWARE SYSTEM</b>					
<b>Component</b>	<b>Procedure</b>	<b>Fail Criteria</b>	<b>Corrective Action</b>	<b>Reference Manuals</b>	<b>Authorized Personnel</b>
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	<b>Nozzle, hose, or breakaway replacement:</b> GDF owner-operator or VST ASC Levels A, B, or C or EMCO Level A for Goodyear Hose <b>Component repair:</b> VST ASC Levels A, B, or C
		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	
<b>CO-AXIAL HOSES</b>					
<b>Component</b>	<b>Procedure</b>	<b>Fail Criteria</b>	<b>Corrective Action</b>	<b>Reference Manuals</b>	<b>Authorized Personnel</b>
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	<b>Hose replacement:</b> GDF owner-operator or VST ASC Levels A, B, or C or EMCO Level A for Goodyear Hose
<b>BREAKAWAY</b>					
<b>Component</b>	<b>Procedure</b>	<b>Fail Criteria</b>	<b>Corrective Action</b>	<b>Reference Manuals</b>	<b>Authorized Personnel</b>
Breakaway	Inspect breakaway for leaks around the scuff	Presence of a leak around the scuff	Replace with new breakaway	IOM-9	<b>Replace breakaway:</b> Owner/Operator or VST ASC Levels A, B, or C

<b>NOZZLE</b>					
<b>Nozzle Component</b>	<b>Procedure</b>	<b>Fail Criteria</b>	<b>Corrective Action</b>	<b>Reference Manuals</b>	<b>Authorized Personnel</b>
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

## 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

## Quarterly Inspections: Clean Air Separator Only

Inspect Clean Air Separator for proper operating configuration. See EO VR-203-H, Exhibit 2, Figure 2B-6 or 2B-6H for guidance. Figure 2B-6 applies to vertical CAS installations. Figure 2B-6H applies to horizontal CAS installations.

## Annual Inspections

<b>Annual VST ECS Membrane Processor Inspections and Replacements</b>					
<b>Component</b>	<b>Procedure</b>	<b>Fail Criteria</b>	<b>Corrective Action</b>	<b>Reference Manuals</b>	<b>Authorized Personnel</b>
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
<b>VST ECS PROCESSOR</b>				
	Yearly			
<ul style="list-style-type: none"> <li>Inspect drive coupling on the vacuum pump.</li> </ul>			[ ]	
<ul style="list-style-type: none"> <li>Check the continuity of the heat trace cable.</li> </ul>			[ ]	
<b>RECIRCULATION BLOWER</b>				
Replace every 10 years or 15,000 hours, whichever comes first.			[ ]	
<b>VACUUM PUMP</b>				
Replace every 10 years or 15,000 hours, whichever comes first.			[ ]	

## Hirt VCS 100 Processor Annual Inspection Checklist

**DATE OF TEST:**

SERVICE COMPANY NAME	SERVICE COMPANY'S TELEPHONE
SERVICE TECHNICIAN	HIRT TECHNICIAN CERTIFICATION # (as applicable) ICC or DISTRICT TRAINING CERTIFICATION (as applicable)
STATION NAME	DISTRICT PERMIT #
STATION ADDRESS	CITY STATE ZIP
<p>Instructions: Perform each step and check each box after step is completed. File completed checklist with station's Maintenance Records.</p>	
<b>1.</b>	Turn OFF electrical power to processor.  <b>CAUTION:</b> The processor can be hot from operation. Use caution when removing Weather Cover, Shell, and raising Inner Stack; they are HOT! <span style="float: right;"><input type="checkbox"/></span>
<b>2.</b>	Remove Weather Cover. Look inside stack and burner chamber to check for debris. Remove any debris. <span style="float: right;"><input type="checkbox"/></span>
<b>3.</b>	Remove padlocks, if any, and remove Shell from processor. <span style="float: right;"><input type="checkbox"/></span>
<b>4.</b>	Loosen stack bolt and raise Inner Stack. The pilot and igniter/sensor are now exposed. The internals should be checked for foreign material. Remove any foreign material. <span style="float: right;"><input type="checkbox"/></span>
<b>5.</b>	Check igniter/sensor for carbon buildup. Replace Pilot Tip assembly if Excessive buildup. See instructions that come with replacement Pilot Tip for Installation details. <span style="float: right;"><input type="checkbox"/></span>
<b>6.</b>	Visually check all processor piping and tubing for leaks (this is checked when conducting TP-201.3 and Exhibit 4 of Executive Order VR-203). Check metal tubing and piping for kinks, worn areas, and cracks, or deterioration. Check piping and metal tubing fittings to insure that they are strong and tight sealing. Replace any questionable components. <span style="float: right;"><input type="checkbox"/></span>

<b>7.</b>	Conduct Exhibit 13 of Executive Order VR-203 "Hirt VCS 100 Processor With Indicator Panel Operability Test Procedure"	<input type="checkbox"/>
<b>8.</b>	Check setting of Pilot Needle Valve adjustmet (section 8.8 of Hirt VCS 100 IOM).	<input type="checkbox"/>
<b>9.</b>	Lower Inner Stack and Tighten bolt. Replace Shell, Weather Cover, and padlocks removed for visual inspection.	<input type="checkbox"/>
<b>10.</b>	Verify handle on 3-way valve is in down position – Processor to UST Ullage.	<input type="checkbox"/>
<b>11.</b>	Turn ON electrical power to processor.	<input type="checkbox"/>

## PMC Alarm Troubleshooting Summary for VST ECS Membrane Processor

PMC Alarm Troubleshooting Summary				
Message	PMC Category	Light	Cause	Suggested Troubleshooting
VP EMISSION WARN	Processor	Yellow	Mass emission exceeded the certified threshold.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found out <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• Exhibit 8</li> <li>• Exhibit 9</li> </ul>
VP EMISSION FAIL	Processor	Red	2 <sup>nd</sup> Consecutive Mass emission test failure.	
PMC SETUP WARN	Processor	Red	PMC is not configured or missing components.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• See ISD Troubleshooting Guide, P/N 577013-819.</li> <li>• Exhibit 8</li> <li>• Exhibit 9</li> </ul>
VP DUTY CYCLE WARN	Processor	Yellow	Duty cycle exceeds 18 hours per day Or 75% of 24 hours.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• TLS 350 PMC Setup Procedure</li> <li>• Exhibit 10</li> <li>• Exhibit 9</li> <li>• Exhibit 4</li> </ul>
VP DUTY CYCLE FAIL	Processor	Red	2 <sup>nd</sup> Consecutive Duty Cycle Test Failure.	

## PMC Alarm Troubleshooting Summary for Veeder-Root Vapor Polisher

Warning Type	Description	Light Indicator	Suggested Troubleshooting <sup>1</sup>
PMC Sensor Fault	Component used by PMC has failed or reported an error condition. See Troubleshooting section of complete description of sensors and associated conditions that can cause a sensor fault.	Yellow	Check for Smart Sensor Device Alarm or Fault.
PMC Setup	A sensor used by PMC is missing or not configured.	Red	Ensure that all required components are installed and operational.

<sup>1</sup>Refer to ISD/PMC Troubleshooting Guide 577013-819

## Alarm Troubleshooting Summary For Hirt VCS 100 Processor

Hirt VCS 100 Troubleshooting Summary				
VCS 100 Indicator Panel	Category	Light	Cause	Recommended Troubleshooting
OVERPRESSURE LIGHT	VCS 100 Processor or System	Red	UST ullage pressure is positive for at least 1 continuous hour.	<p>GDF Owner/Operator Responsibilities:</p> <ul style="list-style-type: none"> <li>• “Weekly Inspections” of Hanging Hardware as specified in section 2 of Installation, Operation, and Maintenance Manual.</li> <li>• “Drive-Offs and Other Customer Abuse” as specified in section 5 of Installation, Operation, and Maintenance Manual.</li> <li>• Exhibit 7 of Executive Order VR-203</li> <li>• Record findings in GDF Owner/Operator Maintenance Log.</li> </ul> <p>Certified Contractor Responsibilities:</p> <ul style="list-style-type: none"> <li>• Follow VCS 100 Troubleshooting Guide (Contact Hirt by either Phone: (562) 692-6970 or by email: <a href="mailto:HirtVCS@aol.com">HirtVCS@aol.com</a> to get Guide)</li> <li>• TP-201.3 and Exhibit 4 of Executive Order VR-203</li> <li>• Exhibit 7 of Executive Order VR-203</li> <li>• Exhibit 13 of Executive Order VR-203</li> <li>• Record findings in GDF Owner/Operator Maintenance Log.</li> </ul>

## 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	<b>Hose replacement:</b> 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: 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	<b>Nozzle repair:</b> VST ASC Levels A, B, or C
		Replace with new VST nozzle.	IOM-6	<b>Nozzle replacement:</b> GDF Owner/Operator or VST ASC Levels A, B, or C
<b>If no imperfection or damage is visibly evident, proceed to functional testing.</b>				

## 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 for Goodyear Hose</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 for Goodyear Hose</p>
Automatic Shut-Off and Insertion Interlock	<p>IOM-6</p> <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><b>Nozzle replacement</b></p> <p>GDF Owner/Operator or VST ASC Levels A, B, or C</p>
			<p><b>Nozzle repair</b></p> <p>VST ASC Levels A, B, or C</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 for Goodyear Hose</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.

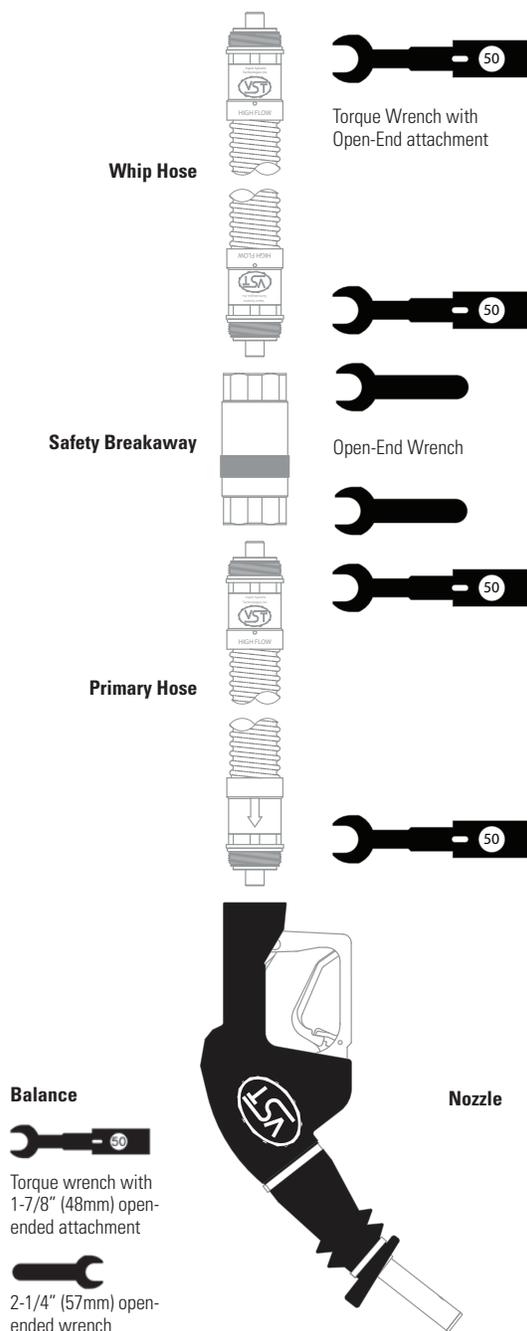
1. Turn off and tag the power to the dispenser. Dispenser must be de-energized prior to service to avoid personal injury.
2. Barricade work area to block vehicle access to the dispenser.
3. Close the dispenser shear valve prior to removing hanging hardware (hoses, safety breakaways, and nozzles).
4. 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  $\frac{1}{4}$ " to  $\frac{1}{2}$ " 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

www.vsthose.com

# 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)

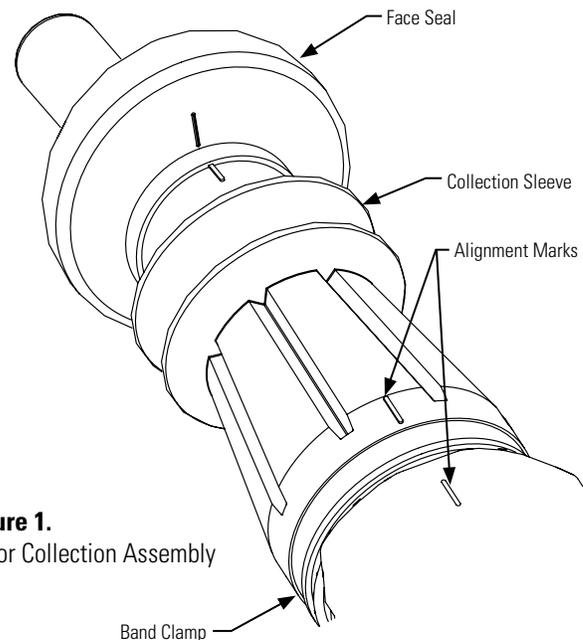
6. Engage interlock a few times to check for correct alignment and functionality. (See Function Test 3)
7. Tighten collection band clamp until collection sleeve will not rotate. (See Figure 1)

## 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)

4. Lightly lubricate **ALL** O-rings on the spout assembly.  
**NOTE** Do not block vacuum sensing-tube hole with lubricant.
5. Align vacuum sensing tube with mating hole in the fuel chamber.
6. Align the anti-rotation bump on the spout with the casting notch. Be careful not to damage the spout O-rings.
7. Firmly insert spout assembly into the nozzle casting.
8. 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)
9. 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.
10. 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.
11. Re-install the Vapor Collection Kit assembly per the Vapor Collection Kit Replacement instructions.

### FUNCTION TESTS

1. Follow the VST Installation Procedure for each hanging hardware component. (Procedures: Section 10, 12, and 13)
2. 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.
3. 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.

4. 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

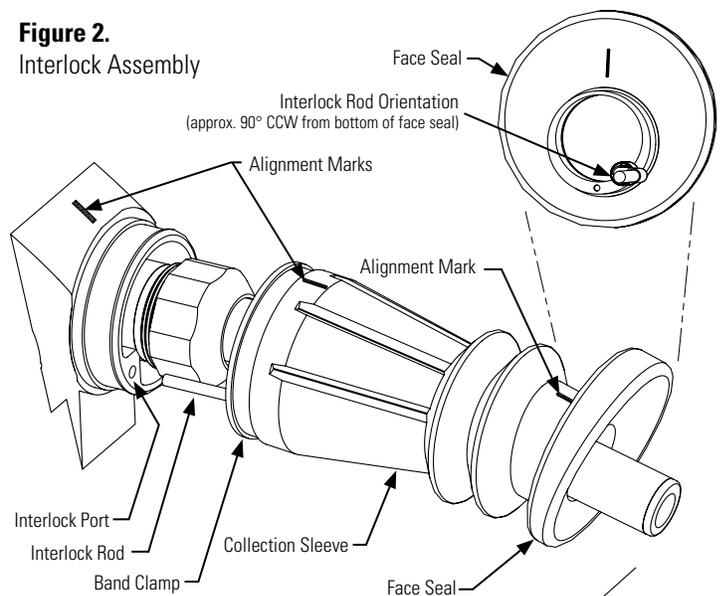
becomes clogged. The nozzle will not function properly without the interlock rod properly engaged. Keep the hose connections tight.

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.

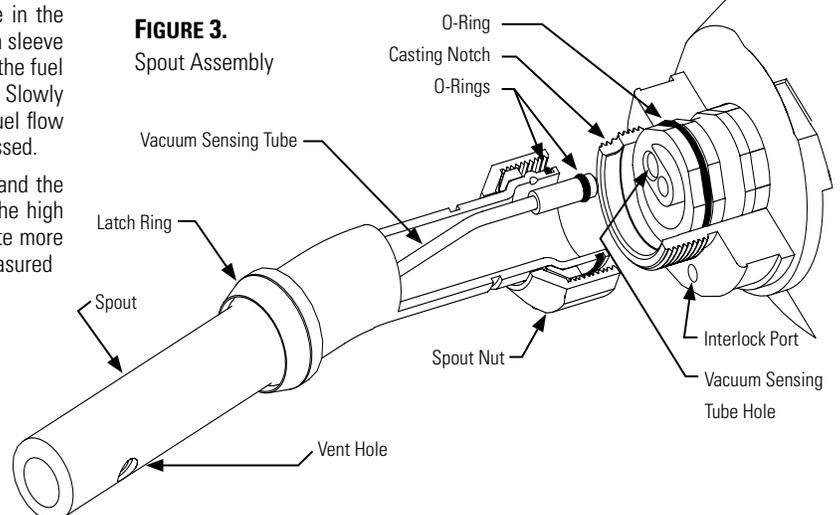
**NOTE** Due to abuse, misuse, changing gasoline formulas, variation in maintenance practices, environmental conditions, and/or conditions beyond the manufacturer's control, dispensing equipment may need replacement before five (5) years. Inspections and proper maintenance procedures should be followed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



# 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

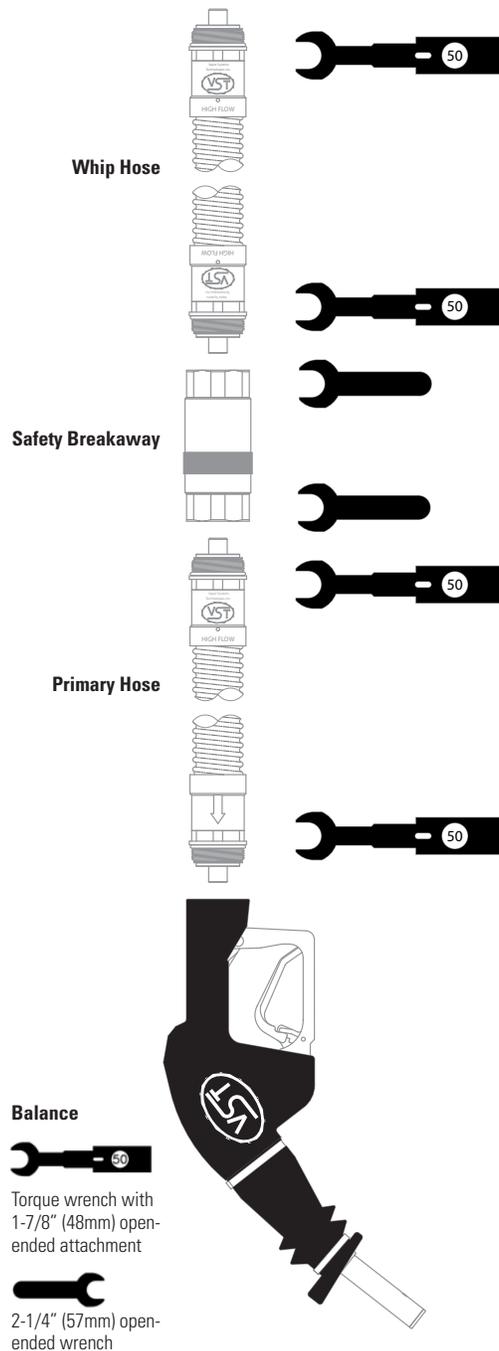
Phone: 937-704-9333

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.

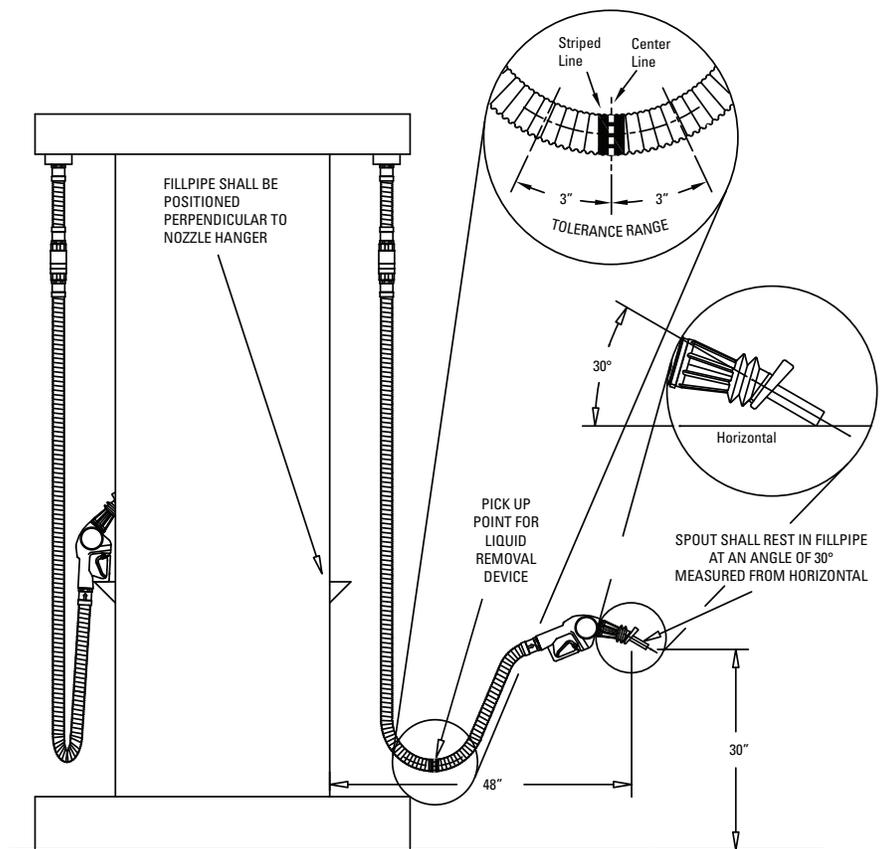
### MAINTENANCE

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

# 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

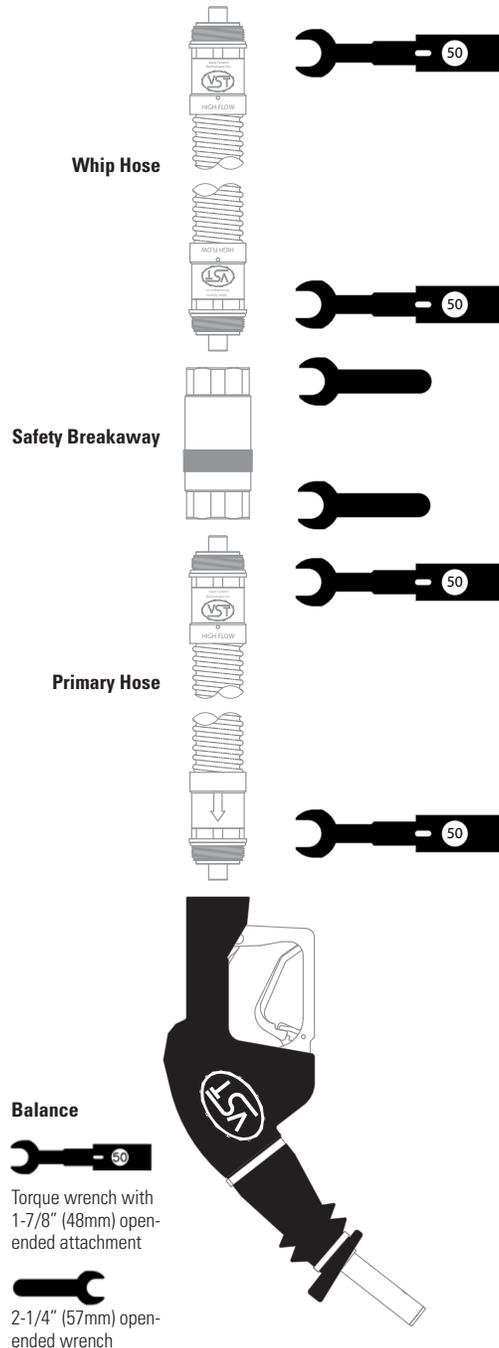
Phone: 937-704-9333

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

# 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

---

## 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.

# 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-H  
VR-204-H

Version: 2.0

*Vapor Systems Technologies, Inc.*  
650 Pleasant Valley Drive  
Springboro, Ohio 45066  
937-704-9333 PH  
937-704-9443 FX  
[www.vsthose.com](http://www.vsthose.com)

# Table of Contents

Table of Figures .....	5
UL Declaration Notice.....	7
About VST.....	8
Notice .....	8
Warranty .....	9
Warranty Cards .....	10
Components and Warranties .....	11
Activating the Processor Warranty .....	12
VST Contractor Requirements.....	13
Veeder-Root Contractor Requirements.....	14
Safety Icons.....	15
Table of Terms & Abbreviations .....	16
1 ECS Membrane Processor Overview.....	17
1.1 ECS Membrane Processor Theory of Operation .....	17
1.2 Overview of How the Processor Operates.....	18
1.3 Processor Dimensions and Weight.....	18
1.4 Processor Components .....	19
1.5 Processor Auxiliary Components.....	20
1.6 Explanation of VST Processor Model Numbers .....	20
1.7 Included with the Processor Package.....	20
1.8 Contractor-Supplied Components for the Processor .....	20
2 Pre-Installation Site Survey .....	26
3 How the Processor is Shipped.....	26
4 Preparing the Processor for Installation .....	26
5 Pre-Installation <i>Processor</i> Leak Test.....	27
5.1 Purpose .....	27
5.2 Preparation .....	27
5.3 Functional Test Procedures.....	27
6 Site Requirements .....	29
6.1 Regulations / Jurisdiction.....	29
6.2 Snapshot of Site Requirements .....	30
7 Ground Installation.....	32

---

7.1	Ground Installation Safety .....	32
7.2	Protecting the Processor .....	32
7.3	Ground-Mount Location .....	33
7.4	Setting the Concrete Pad .....	35
7.4.1	Processor Weight and Dimensions .....	35
7.5	Installing the Processor on the Concrete Pad .....	36
7.5.1	Soil Conditions .....	36
7.5.2	Following an Earthquake .....	36
8	Roof-Top Installation .....	39
8.1	Roof-Top Installation Safety .....	39
9	Canopy Top Installation .....	41
9.1	Canopy Top Installation Safety .....	41
10	Vapor Piping .....	43
10.1	Vapor Piping Safety .....	43
10.2	Piping Connection Material .....	43
10.3	Piping Connections to the Processor .....	43
10.3.1	Flexible Connections .....	44
10.4	Trenching .....	44
10.5	Underground Vapor Piping Instructions .....	45
10.6	Vapor Inlet and Vapor Return Connections .....	50
10.6.1	Flexible Connections .....	50
11	Air Outlet Connection .....	51
11.1	Flexible Connections .....	52
11.2	Underground Piping Connection .....	56
11.3	Storage Tank Vapor Manifolds .....	56
11.4	P/V Valves .....	56
12	Electrical .....	57
12.1	Electrical Safety .....	57
12.2	Single-Phase Processor .....	57
12.2.1	Power Requirements for Single-Phase Electrical Service .....	58
12.3	Three-Phase Processor .....	58
12.3.1	Power Requirements for Three-Phase Electrical Service .....	59
12.4	Reference Information for Processor Power Requirements .....	60
12.5	Power for the Motors .....	61
12.5.1	Single-Phase Processor .....	61
12.5.2	Three-Phase Processor .....	61

12.5.3	Power for the HC Sensor in both the Single-Phase and the Three-Phase Processor .....	61
12.6	Power for the Heat-Trace Cables in both Single-Phase and Three-Phase Processors.....	62
12.7	Power for the Motor Starter Relay Coil .....	62
12.8	Optional Convenience Outlet at the Processor .....	62
<b>13</b>	<b>Electrical Installation.....</b>	<b>63</b>
13.1	Electical Safety .....	63
13.2	Electrical Installation Code Requirements .....	63
13.2.1	Single-Phase Processor Configuration .....	63
13.2.2	Three-Phase Processor Configuration.....	64
13.2.3	Single and Three-Phase Processors .....	65
13.2.4	Wiring between the Processor and components: .....	65
13.3	Auxiliary Output Relay .....	76
13.4	HC Sensor / HC Sentry .....	78
13.5	Multiport Card for Vapor Processor Communication .....	81
13.6	Veeder-Root TLS 350 with PMC or ISD Controls.....	83
<b>14</b>	<b>Acceptable NEC Electrical Installation Examples .....</b>	<b>84</b>
<b>15</b>	<b>Post-Installation Checklist.....</b>	<b>92</b>

# Table of Figures

---

Figure 1: VST Registration Card.....	10
Figure 2: ECS Membrane Processor Sticker.....	10
Figure 3: How the Processor fits into the GDF layout.....	21
Figure 4: Processor Piping Diagram.....	22
Figure 5: ECS Vent Configurations.....	23
Figure 6: Processor Isometric Drawing (1 of 2).....	24
Figure 7: Processor Isometric Drawing (2 of 2).....	25
Figure 8: Processor Inlets & Outlets.....	28
Figure 9: Typical Leak Check Test Fixture.....	28
Figure 10: ECS Membrane Processor Hazardous Locations.....	34
Figure 11: Concrete Mounting Pad Dimensions.....	37
Figure 12: Processor Ground Mounting Pad.....	38
Figure 13: Processor Connections with Multiple Vent Risers.....	46
Figure 14: Processor Connections with 2 Vent Risers.....	47
Figure 15: Processor Connections with Single Vent Riser.....	48
Figure 16: Typical GDF Vapor Piping Diagram for Processor.....	49
Figure 17: ECS Processor Piping Diagram.....	53
Figure 18: ECS Vent Configuration.....	54
Figure 19: Processor Piping Connections.....	55
Figure 20: Single-Phase Wiring Schematic.....	66
Figure 21: Processor Single-Phase Wiring Diagram.....	67
Figure 22: Processor Single-Phase ESO Wiring Diagram.....	68
Figure 23: Vacuum Pump: Single-Phase Motor Wiring Diagram.....	69
Figure 24: Blower: Single-Phase Motor Wiring Diagram.....	70
Figure 25: Processor Three-Phase Wiring Schematic.....	71
Figure 26: Processor Three-Phase Wiring Schematic.....	72
Figure 27: Processor Three-Phase ESO Wiring Diagram.....	73
Figure 28: Vacuum Pump: Three-Phase Motor Wiring Diagram.....	74
Figure 29: Blower: Three-Phase Motor Wiring Diagram.....	75
Figure 30: VR TLS Multi-Port Card Connection to HC Sentry Module.....	77
Figure 31: HC Sentry Front & Back Views.....	78
Figure 32: HC Sentry and HC Sensor Wiring Diagram.....	79
Figure 33: HC Sensor and HC Sentry Pictures.....	80
Figure 34: VR TLS Multi-Port Card Connection to the HC Sentry Module.....	81
Figure 35: HC Sentry RS-485 Cable Wiring Diagram.....	82
Figure 36: VR TLS-350.....	83
Figure 37: Single phase electrical overview.....	84
Figure 38: Single phase electrical room.....	85

Figure 39: Single phase electrical disconnect ..... 86  
Figure 40: Single phase elec. inside the ECS ..... 87  
Figure 41: 3-phase electrical overview ..... 88  
Figure 42: 3-phase electrical room..... 89  
Figure 43: 3-phase electrical disconnect..... 90  
Figure 44: 3-phase elec. inside ECS ..... 91

## *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

 <b>Vapor Systems Technologies, Inc.</b> 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

	<b>NOTICE: THIS TAG MUST NOT BE REMOVED FOR ANY REASON</b>
<b>ECS MEMBRANE PROCESSOR UNIT</b>	
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.

## *Veeder-Root Contractor Requirements*

<p>Veeder-Root Level 1</p>	<p>Contractors holding valid Level 1 Certification are approved to perform wiring and conduit routing, equipment mounting, probe and sensor installation, tank and line preparation, and line leak detector installation.</p>
<p>Veeder-Root Level 2/3 or 4</p>	<p>Contractors holding valid Level 2, 3, or 4 certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root Tank Monitoring Systems, including Line Leak Detection and associated accessories.</p>
<p>PMC / ISD</p>	<p>This course of training includes In-Stations Diagnostics/Pressure Management Control (ISD/PMC) installation checkout, startup, programming, and operations training. It also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current level 2/3 or 4 certification is a prerequisite for the ISD/PMC course. After successful completion of this course the contractor will receive a certificate as well as a Veeder-Root ISD/PMC contractor certification card.</p>
<p>Warranty Registrations may only be submitted by selected distributors.</p>	

## Safety Icons

	<p><b>ELECTRICITY</b> A potential shock hazard exists. High voltage is supplied to and exists in this device.</p>		<p><b>TURN POWER OFF</b> Turn power off to the device and its accessories when installing and servicing the unit. Live power creates a potential spark hazard.</p>
	<p><b>EXPLOSIVE</b> Gasoline and its vapors are extremely explosive if ignited.</p>		<p><b>NO POWER TOOLS</b> Sparks from electric power tools can ignite gasoline and its vapors.</p>
	<p><b>FLAMMABLE</b> Gasoline and its vapors are extremely flammable.</p>		<p><b>NO PEOPLE IN THE AREA</b> Unauthorized people in the work area during installation and service of the device create a potential for personal injury.</p>
	<p><b>NO SMOKING</b> Gasoline and its vapors can be ignited by sparks and embers of burning cigarettes.</p>		<p><b>READ ALL RELATED MATERIALS</b> Read, understand, and follow all instructions, warnings, and requirements before you begin work.</p>
	<p><b>NO OPEN FLAMES</b> Open flames from sources like lighters and matches can ignite gasoline and its vapors.</p>		<p><b>USE SAFETY BARRICADES</b> 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><b>PINCH RISK</b> Stay clear. Keeps hands and tools away from rotating machinery and moving parts.</p>		<p><b>ROTATING MACHINERY</b> 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 Processor
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"> <li>• When the UST system pressure rises above +0.2"WC, the <i>Processor</i> turns ON.</li> </ul>
2.	<ul style="list-style-type: none"> <li>• Through the vapor inlet pipe connection at the <i>Processor</i>, the VOC vapor is drawn into the suction side of the blower.</li> </ul>
3.	<ul style="list-style-type: none"> <li>• The blower discharges the VOC vapor into the membrane housing.</li> </ul>
4.	<ul style="list-style-type: none"> <li>• Inside the membrane housing, the VOC vapor is separated in to two air streams:                             <ul style="list-style-type: none"> <li>▶ VOC depleted air (referred to as "air")</li> <li>▶ Gasoline VOC vapor</li> </ul> </li> <li>• The membrane is designed specifically for separating air from gasoline VOC vapor.</li> </ul>
5.	<ul style="list-style-type: none"> <li>• A vacuum pump draws the air from the membrane housing through a check valve.</li> </ul>
6.	<ul style="list-style-type: none"> <li>• A sample of the air flows through a hydrocarbon sensor to check the percent hydrocarbons.</li> </ul>
7.	<ul style="list-style-type: none"> <li>• From the vacuum pump, the air is vented to atmosphere via the air return.</li> </ul>
8.	<ul style="list-style-type: none"> <li>• The gasoline VOC vapor returns to the UST system via the vapor return.</li> </ul>
9.	<ul style="list-style-type: none"> <li>• When the UST system pressure drops below -0.2"WC, the <i>Processor</i> turns OFF.</li> </ul>

## 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

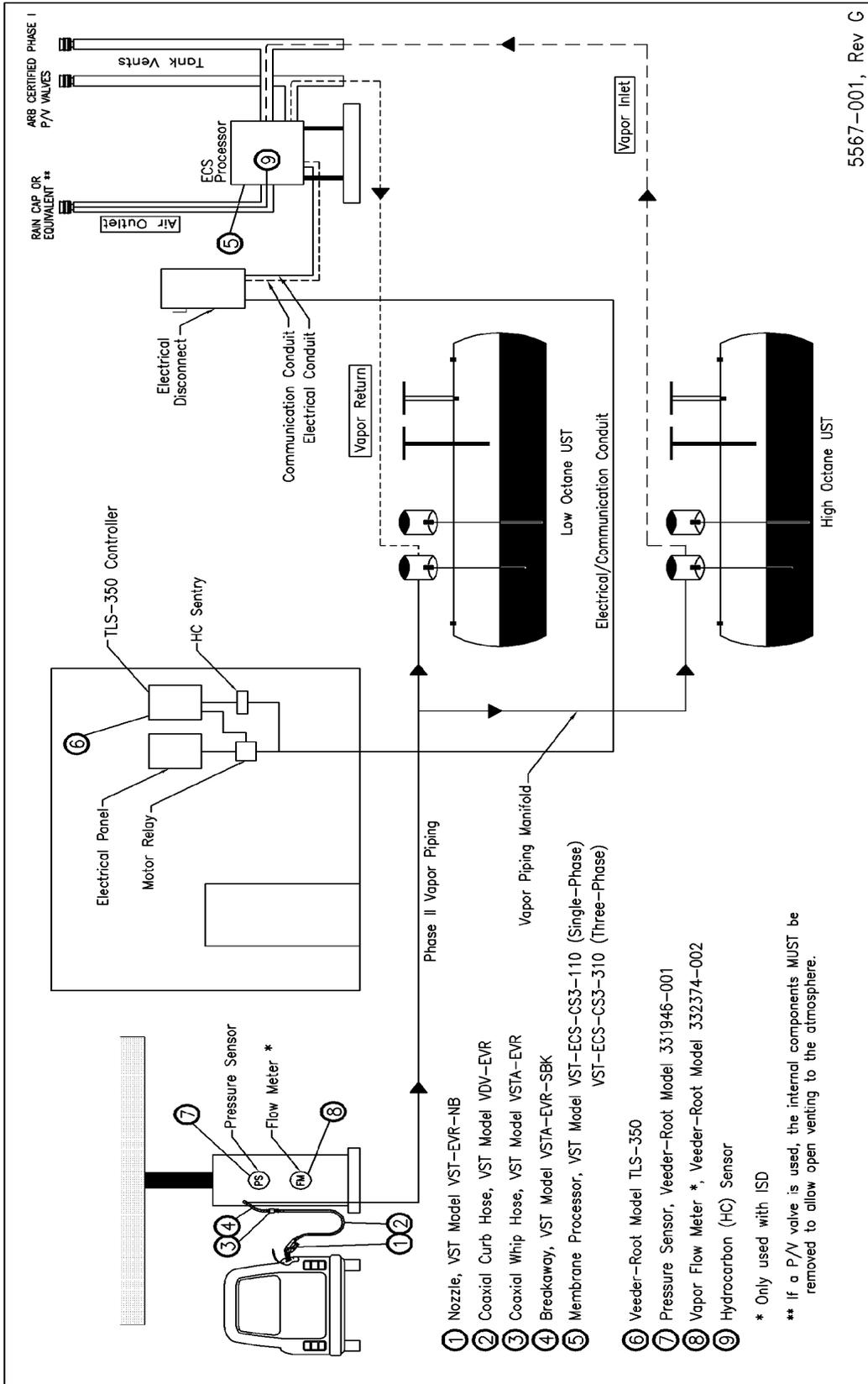
- The GDF owner can choose the model number of the *Processor* based on the electrical availability at the GDF.
  - ▶ All the electrical requirements are the same, except for the motors, where the choice is between single-phase and three-phase power.
- There are two choices of Processors:
  - ▶ VST-ECS-CS3-110: 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"> <li>• Motor Starters</li> <li>• Locking Ball Valves</li> <li>• Locks</li> <li>• Tees</li> <li>• Piping</li> <li>• Pipe Fittings</li> <li>• Electrical</li> <li>• Electrical Fittings</li> <li>• Conduit</li> </ul>	<ul style="list-style-type: none"> <li>• Lockable Disconnect</li> <li>• Wires</li> <li>• Electrical Seal-Offs</li> <li>• Concrete</li> <li>• Veeder-Root TLS-350</li> <li>• Veeder-Root PMC or ISD Software</li> <li>• Veeder-Root Pressure Sensor</li> <li>• Veeder-Root Flow Meters (ISD only)</li> </ul>



5567-001, Rev G

Figure 3: How the Processor fits into the GDF layout

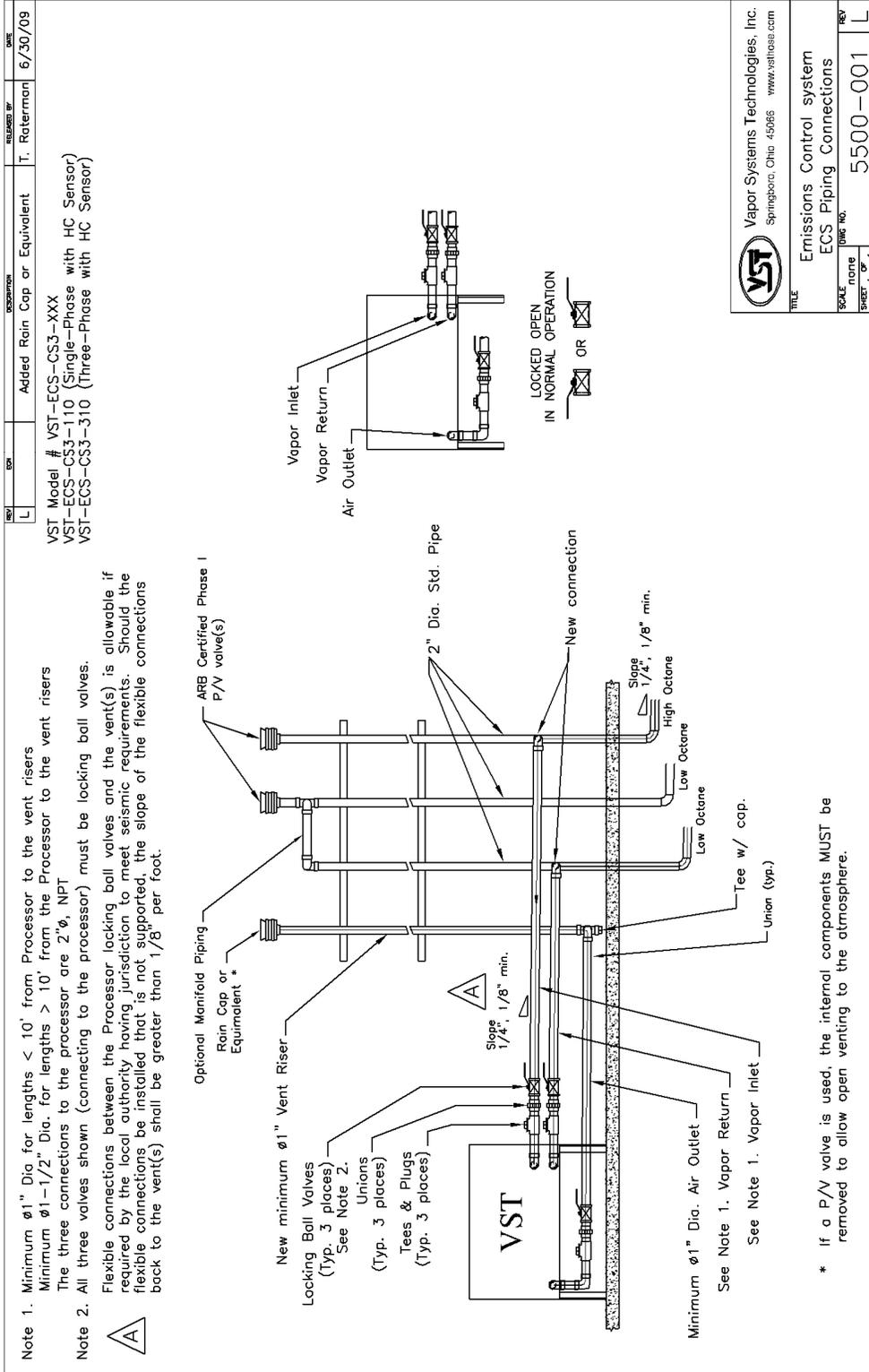


Figure 4: Processor Piping Diagram

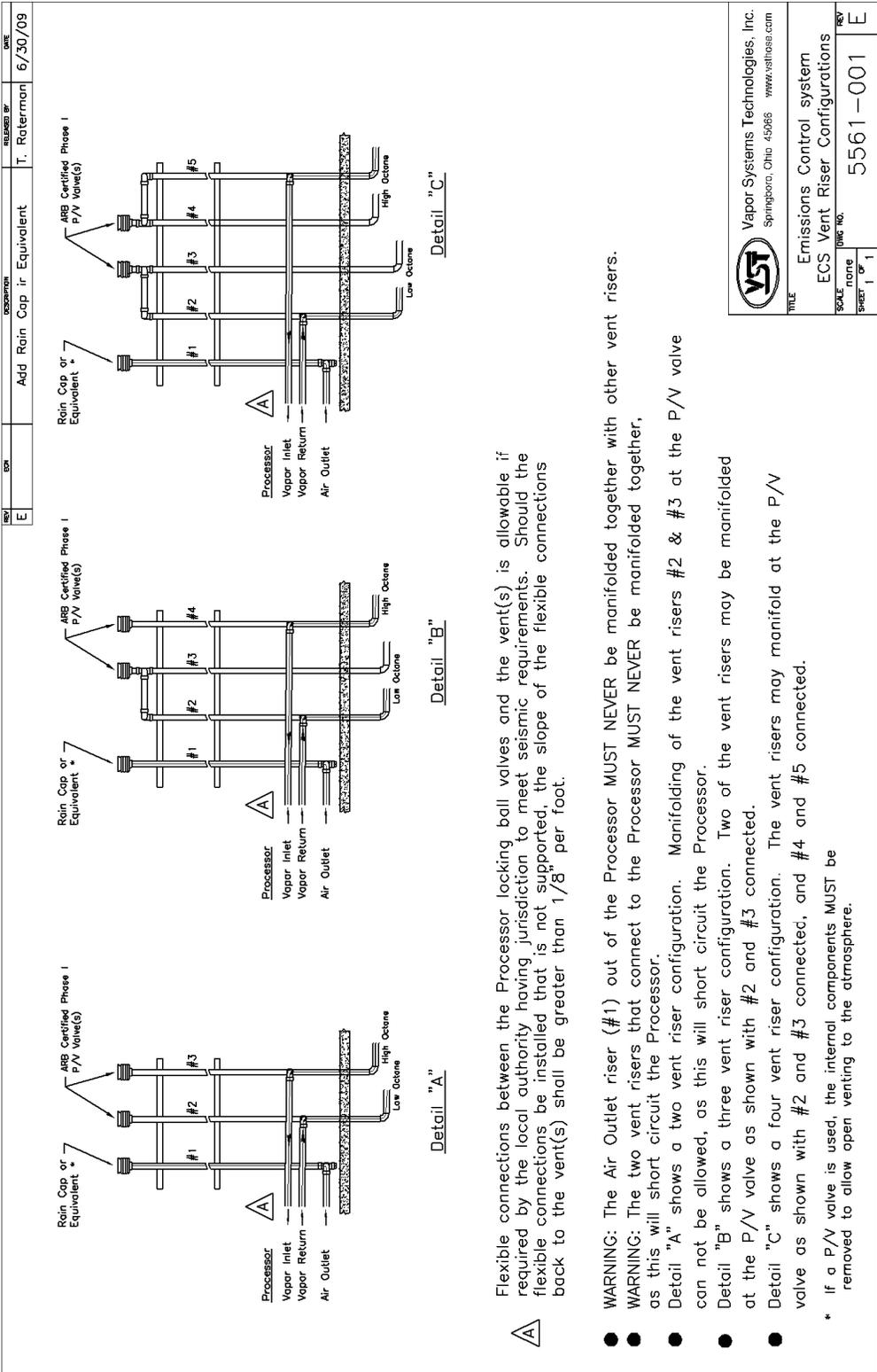


Figure 5: ECS Vent Configurations

Flexible connections between the Processor locking ball valves and the vent(s) is allowable if required by the local authority having jurisdiction to meet seismic requirements. Should the flexible connections be installed that is not supported, the slope of the flexible connections back to the vent(s) shall be greater than 1/8" per foot.

- **WARNING:** The Air Outlet riser (#1) out of the Processor MUST NEVER be manifolded together with other vent risers.
  - **WARNING:** The two vent risers that connect to the Processor MUST NEVER be manifolded together, as this will short circuit the Processor.
  - Detail "A" shows a two vent riser configuration. Manifolding of the vent risers #2 & #3 at the P/V valve can not be allowed, as this will short circuit the Processor.
  - Detail "B" shows a three vent riser configuration. Two of the vent risers may be manifolded at the P/V valve as shown with #2 and #3 connected.
  - Detail "C" shows a four vent riser configuration. The vent risers may manifold at the P/V valve as shown with #2 and #3 connected, and #4 and #5 connected.
- \* If a P/V valve is used, the internal components MUST be removed to allow open venting to the atmosphere.

	Vapor Systems Technologies, Inc. Springboro, Ohio 45365 www.vstnss.com
Emissions Control system	
ECS Vent Riser Configurations	
SCALE: none	DRAWING NO. 5561-001
SHEET 1 OF 1	REV E

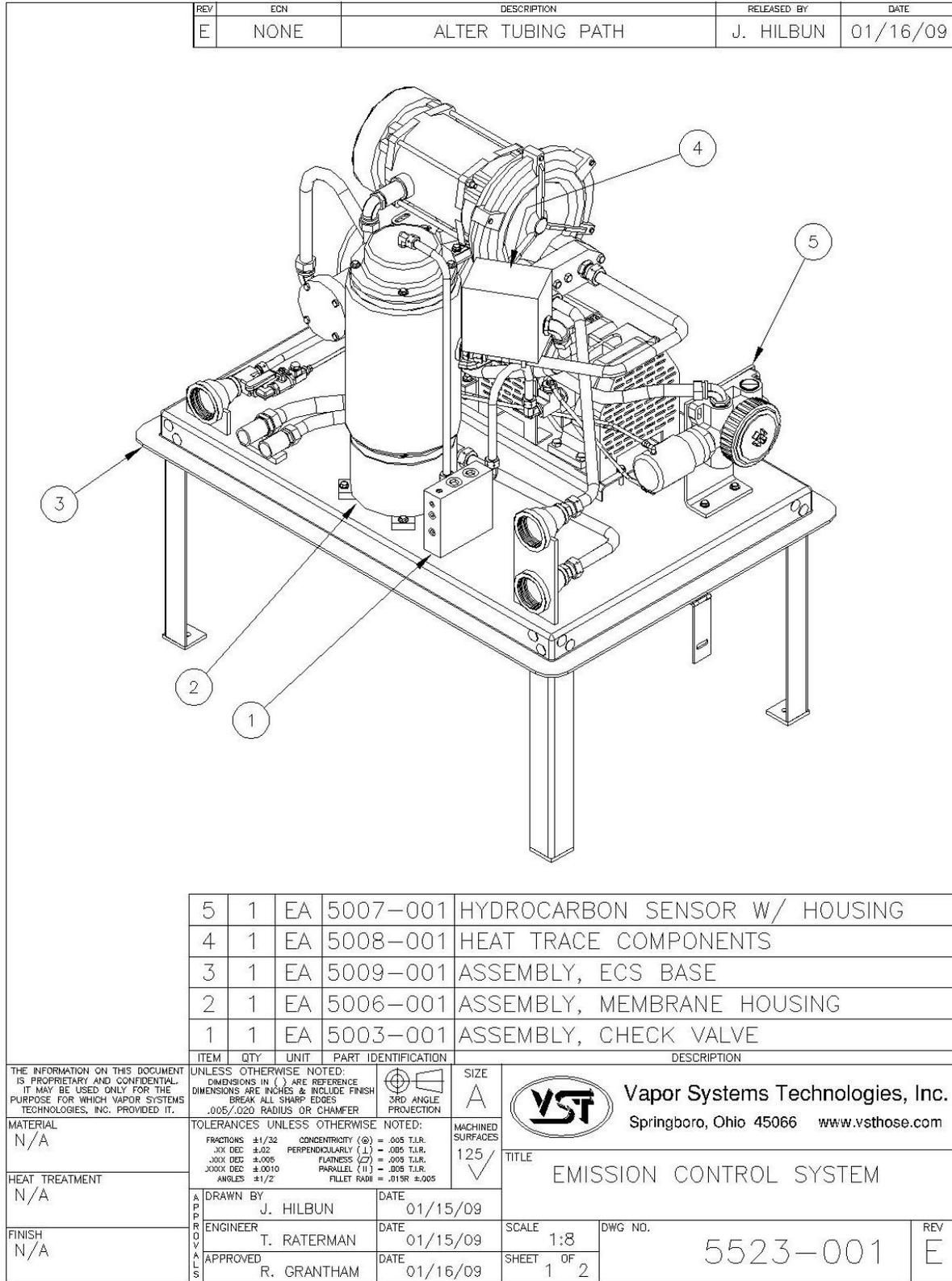


Figure 6: Processor Isometric Drawing (1 of 2)

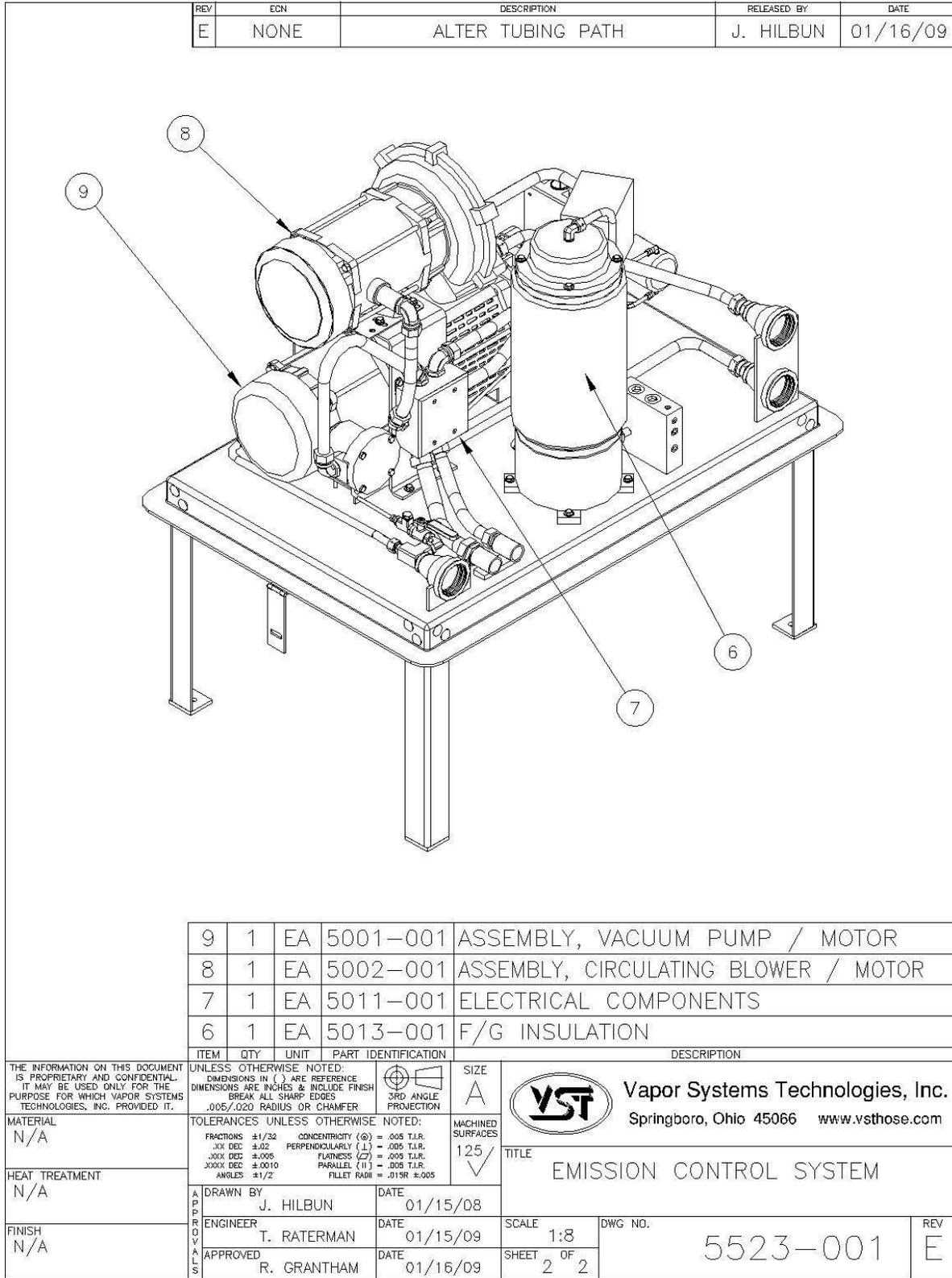


Figure 7: Processor Isometric Drawing (2 of 2)

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

Snapshot of Site Requirements, continued . . .

<p><b><u>UST Manifolding</u></b></p> <ul style="list-style-type: none"> <li>• UST's must be manifolded below ground.</li> <li>• There must be at least two separate vent lines, which are not manifolded together.</li> </ul>	<p><b><u>Dispenser</u></b></p> <ul style="list-style-type: none"> <li>• Must be a Balance dispenser.</li> <li>• 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.</li> </ul> <p><b><u>Veeder-Root Controls</u></b></p> <ul style="list-style-type: none"> <li>• Must have TLS-350 with Veeder-Root software installed.</li> </ul>	<p><b><u>CARB Requirements</u></b></p> <ul style="list-style-type: none"> <li>• VR-203 PMC</li> <li>• VR-204 ISD</li> </ul>
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------

## 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

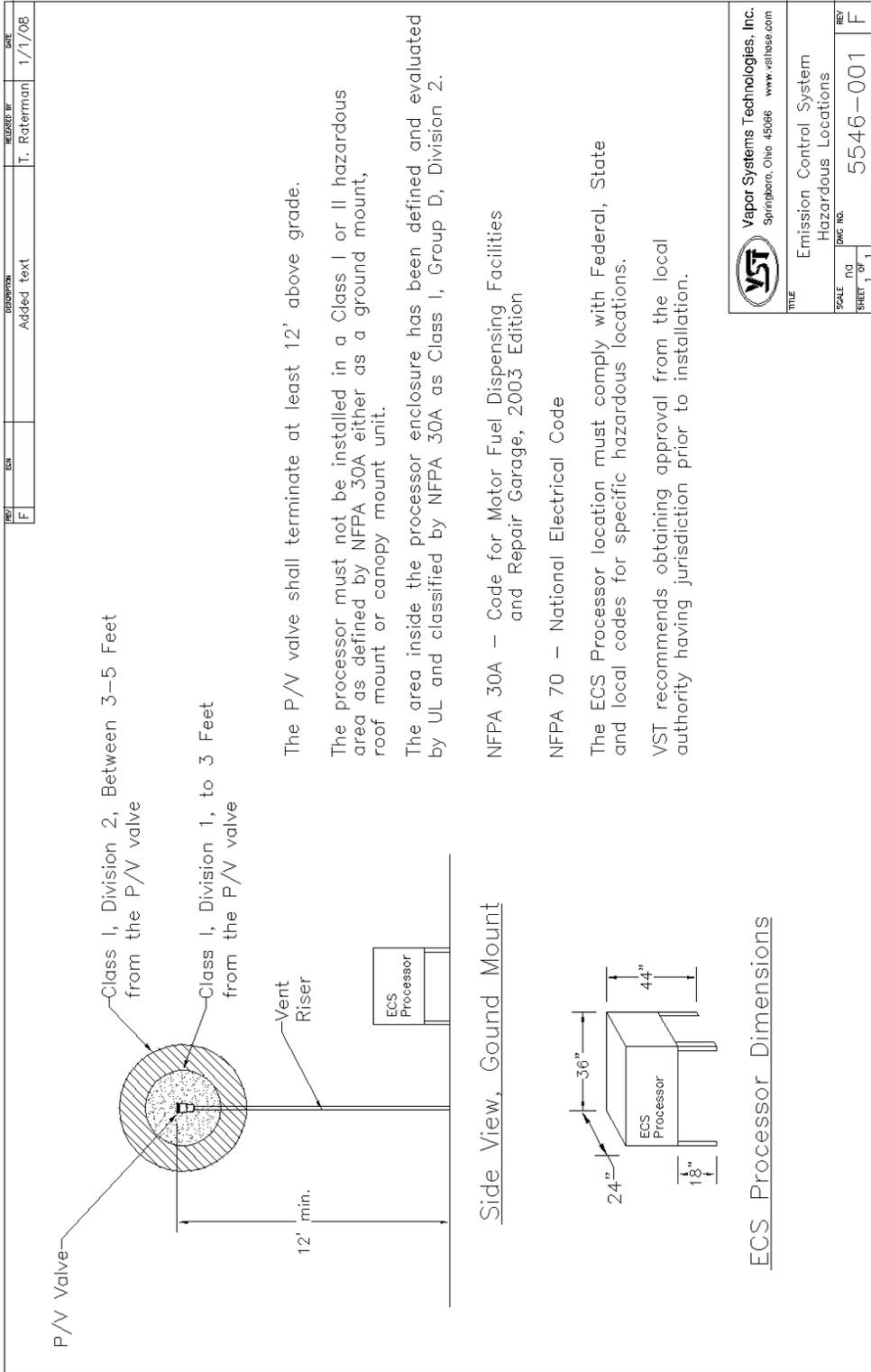


Figure 10: ECS Membrane Processor Hazardous Locations

## 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"> <li>▶ 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.</li> <li>▶ Since seismic regulations may be different by location, VST has not included a specific drawing for this application.</li> <li>▶ For seismic design reference, <a href="http://www.us.hilti.com">www.us.hilti.com</a>.</li> </ul>
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.

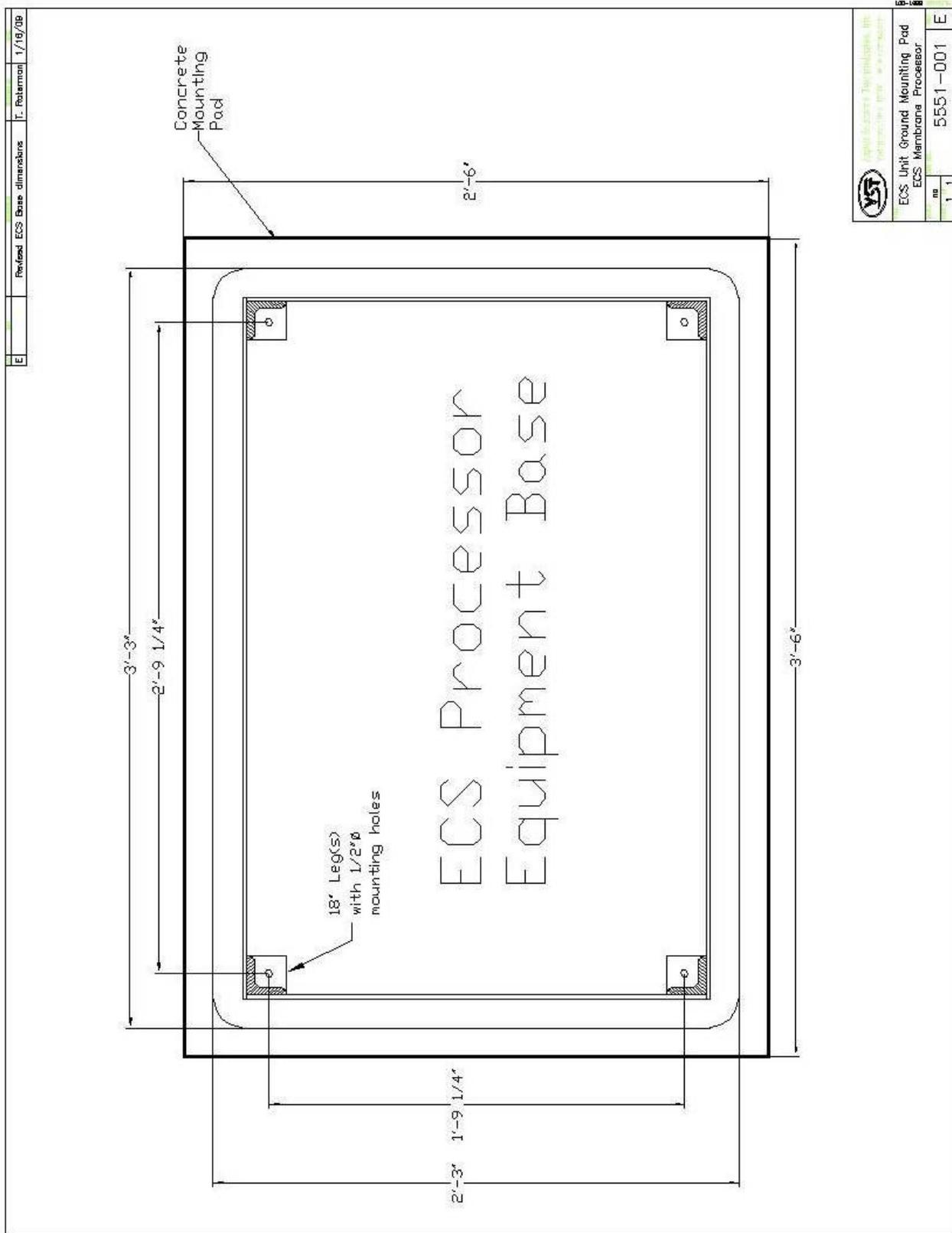


Figure 11: Concrete Mounting Pad Dimensions

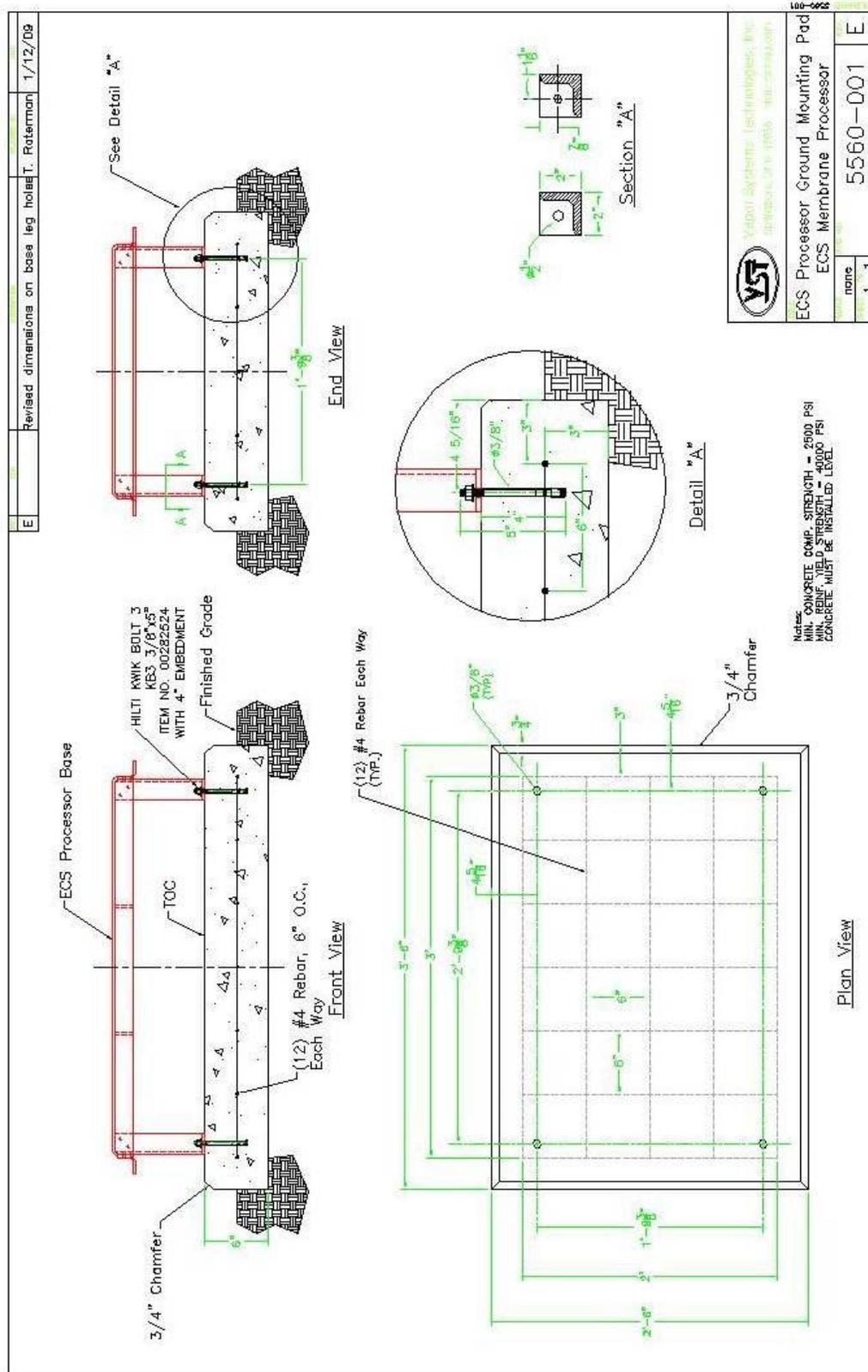


Figure 12: Processor Ground Mounting Pad

## 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 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.

### 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

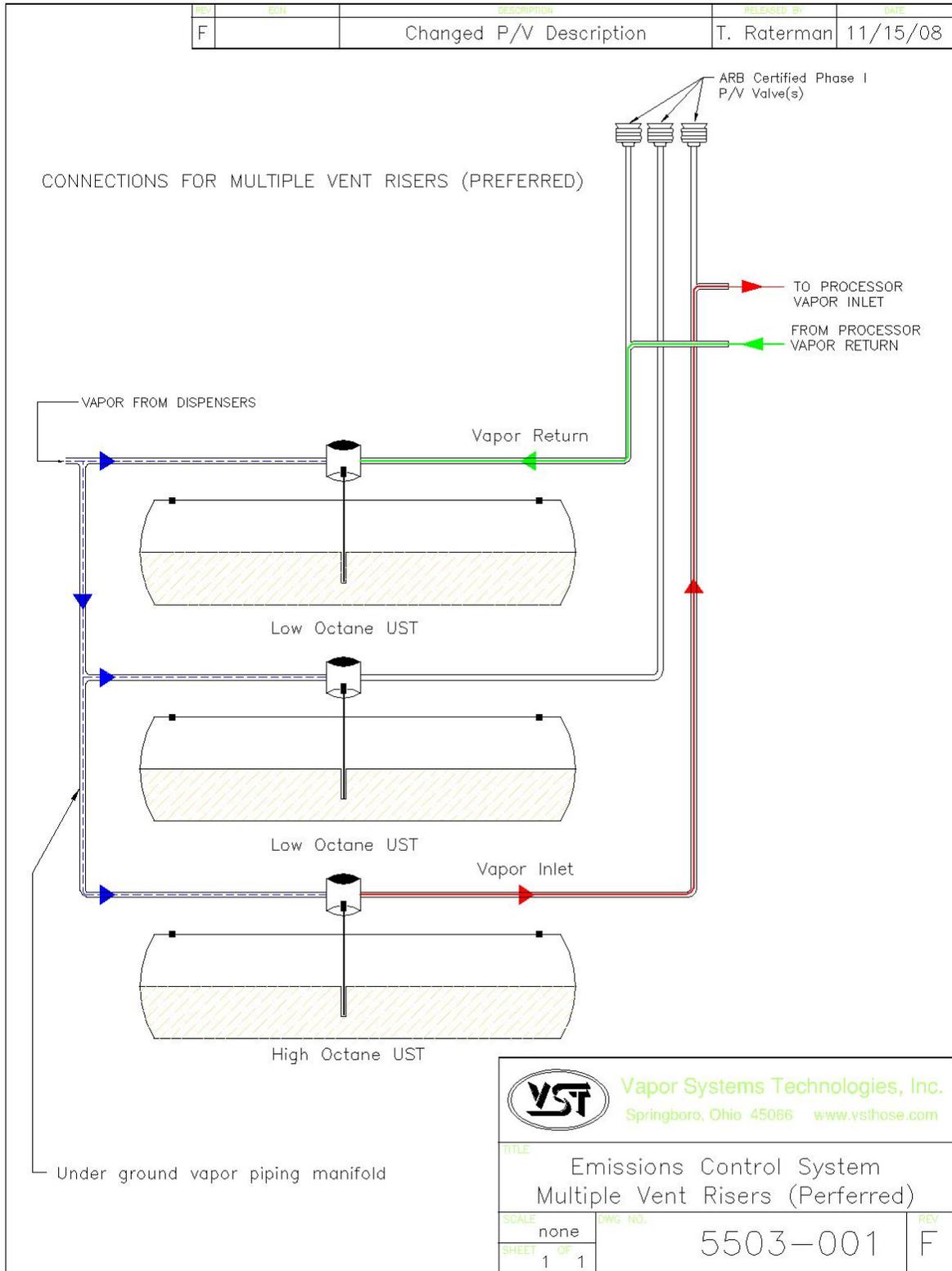


Figure 13: Processor Connections with Multiple Vent Risers

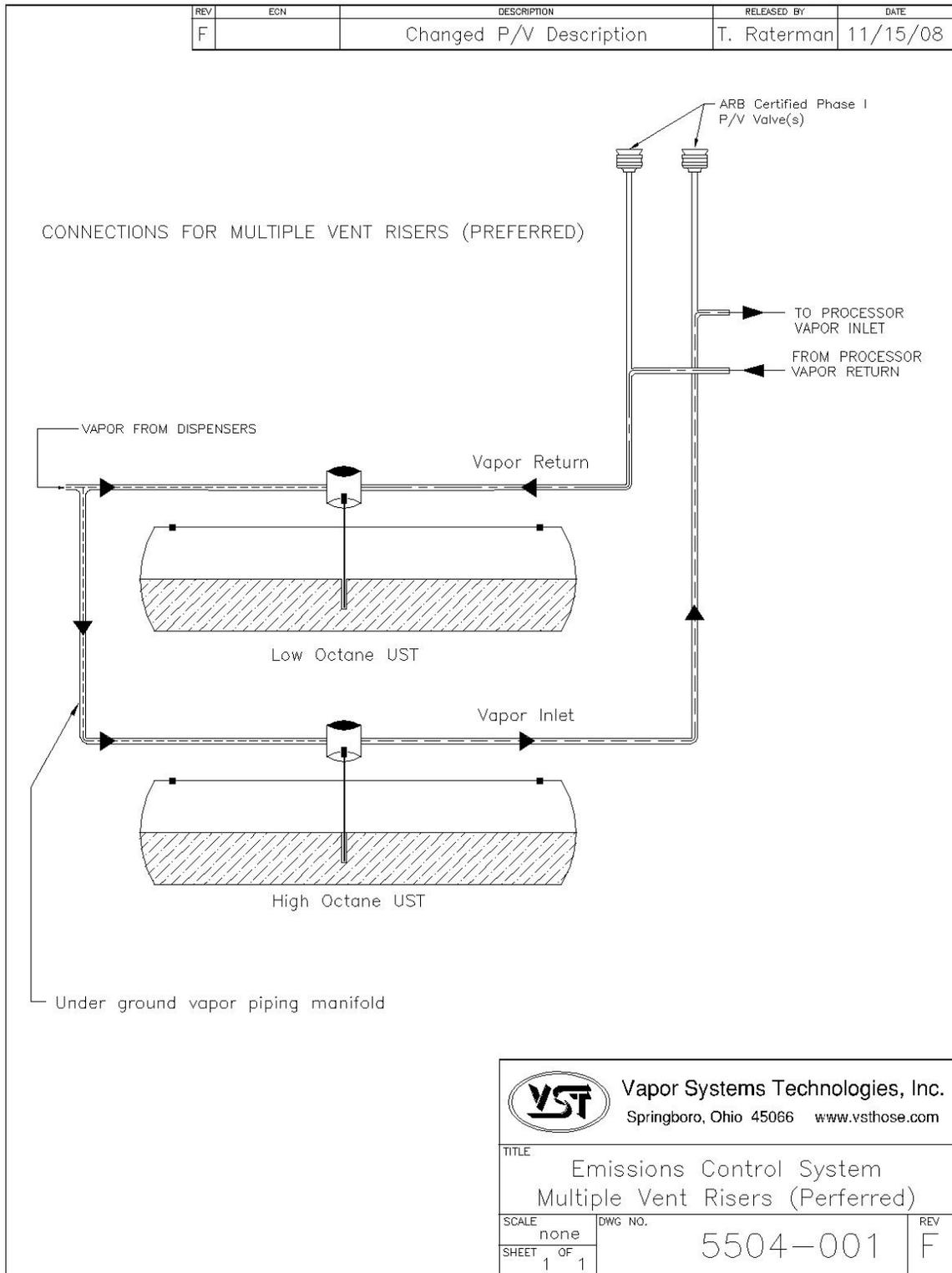


Figure 14: Processor Connections with 2 Vent Risers

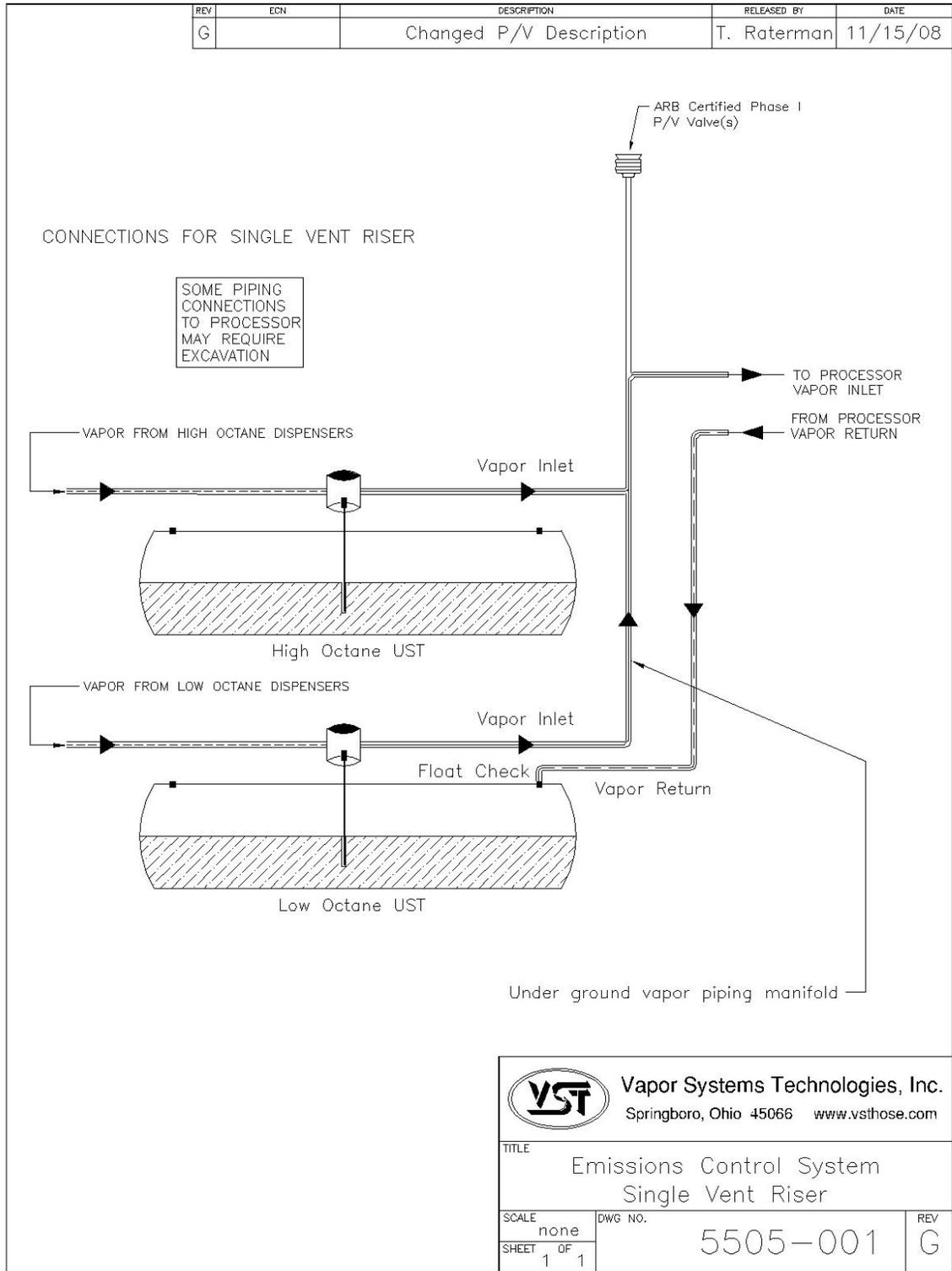
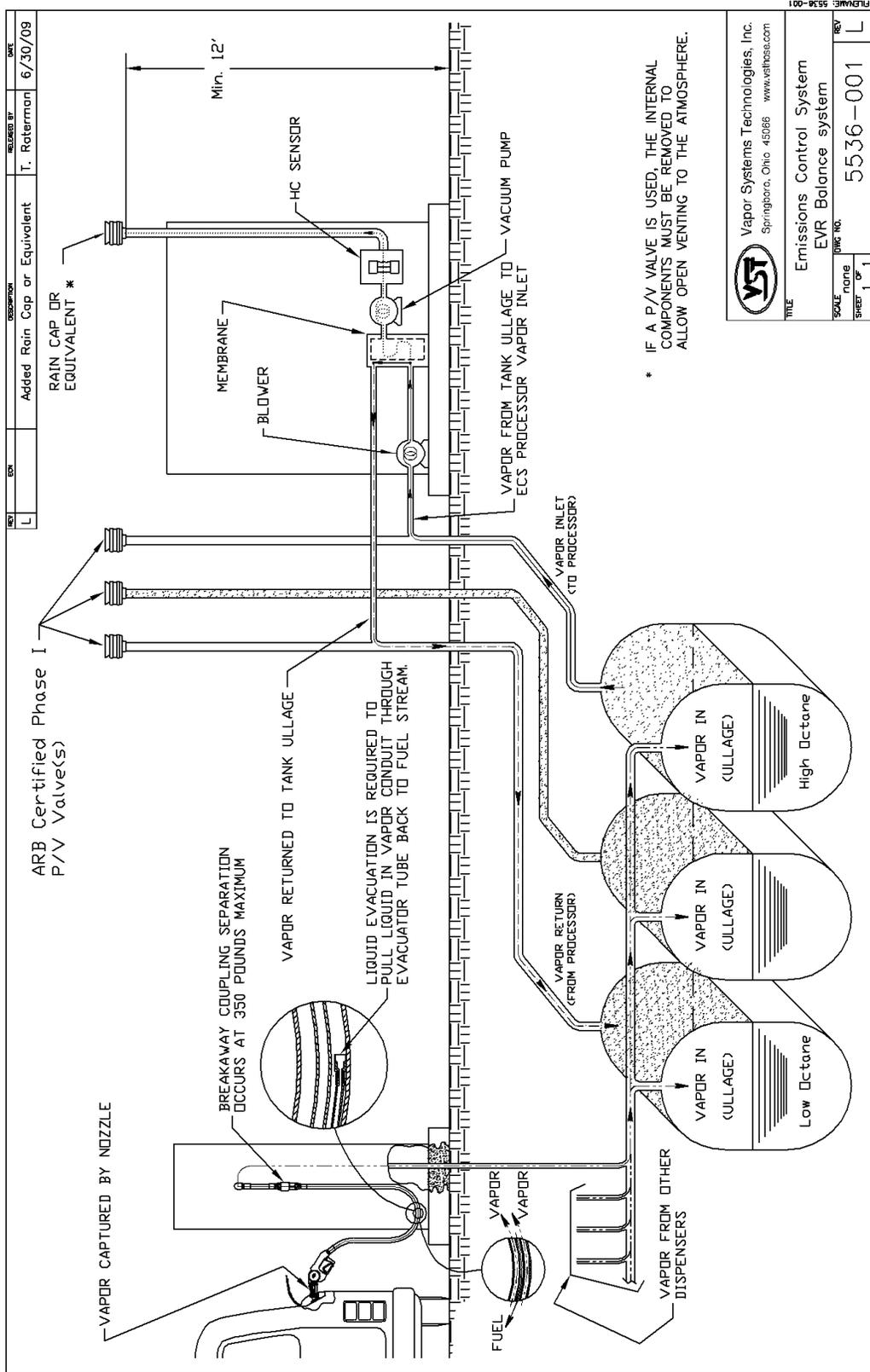


Figure 15: Processor Connections with Single Vent Riser



<b>VST</b>	Vapor Systems Technologies, Inc. Springboro, Ohio 45066 www.vstessa.com
TITLE Emissions Control System EVR Balance system	
SCALE	None
SHEET	OF 1
REV	5536-001
	L

Figure 16: Typical GDF Vapor Piping Diagram for Processor

## 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.

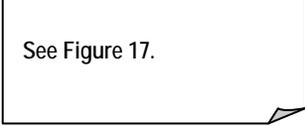
### 10.6.1 Flexible Connections

- 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 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.
- 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.

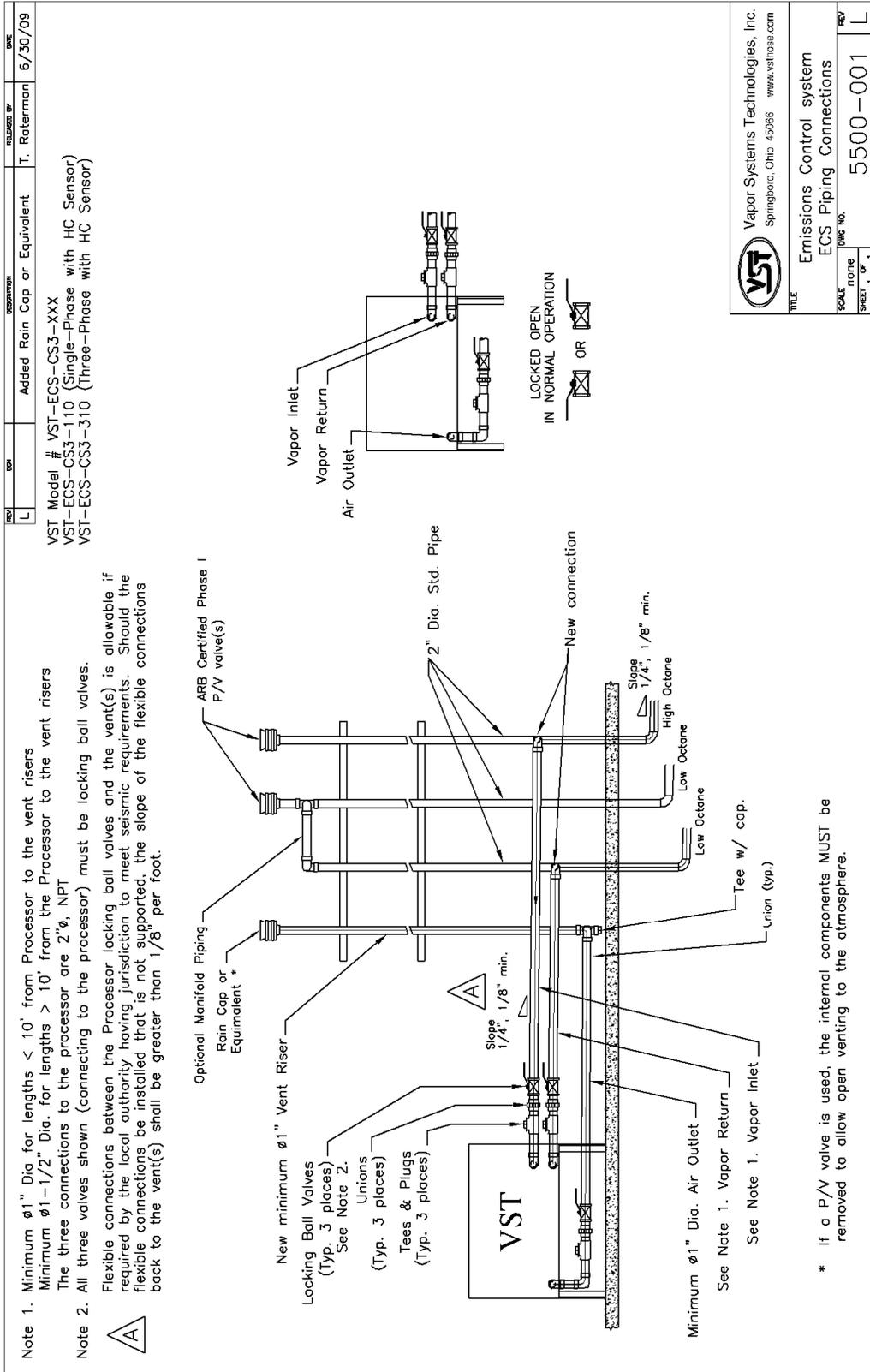


Figure 17: ECS Processor Piping Diagram

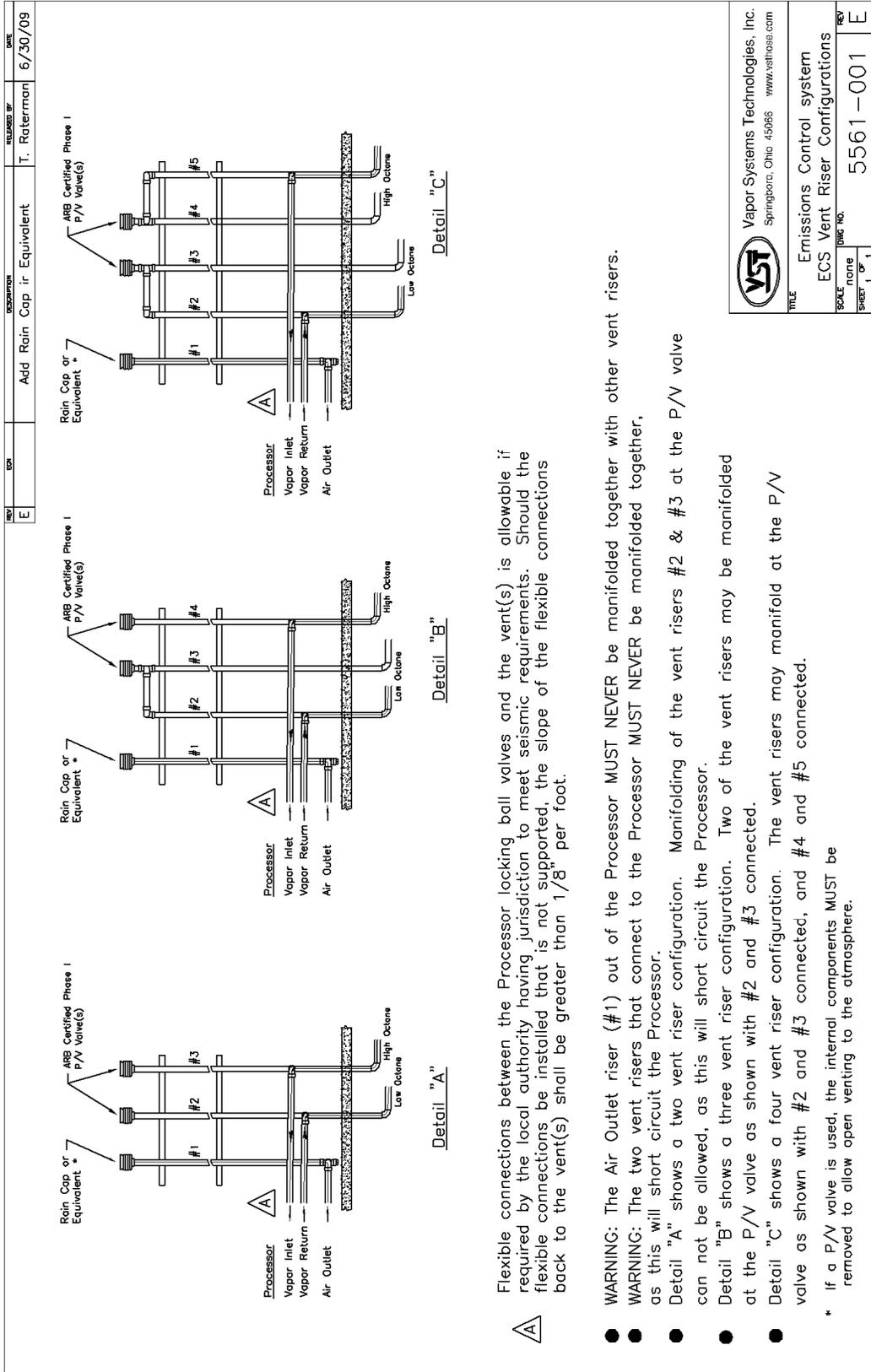


Figure 18: ECS Vent Configuration

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

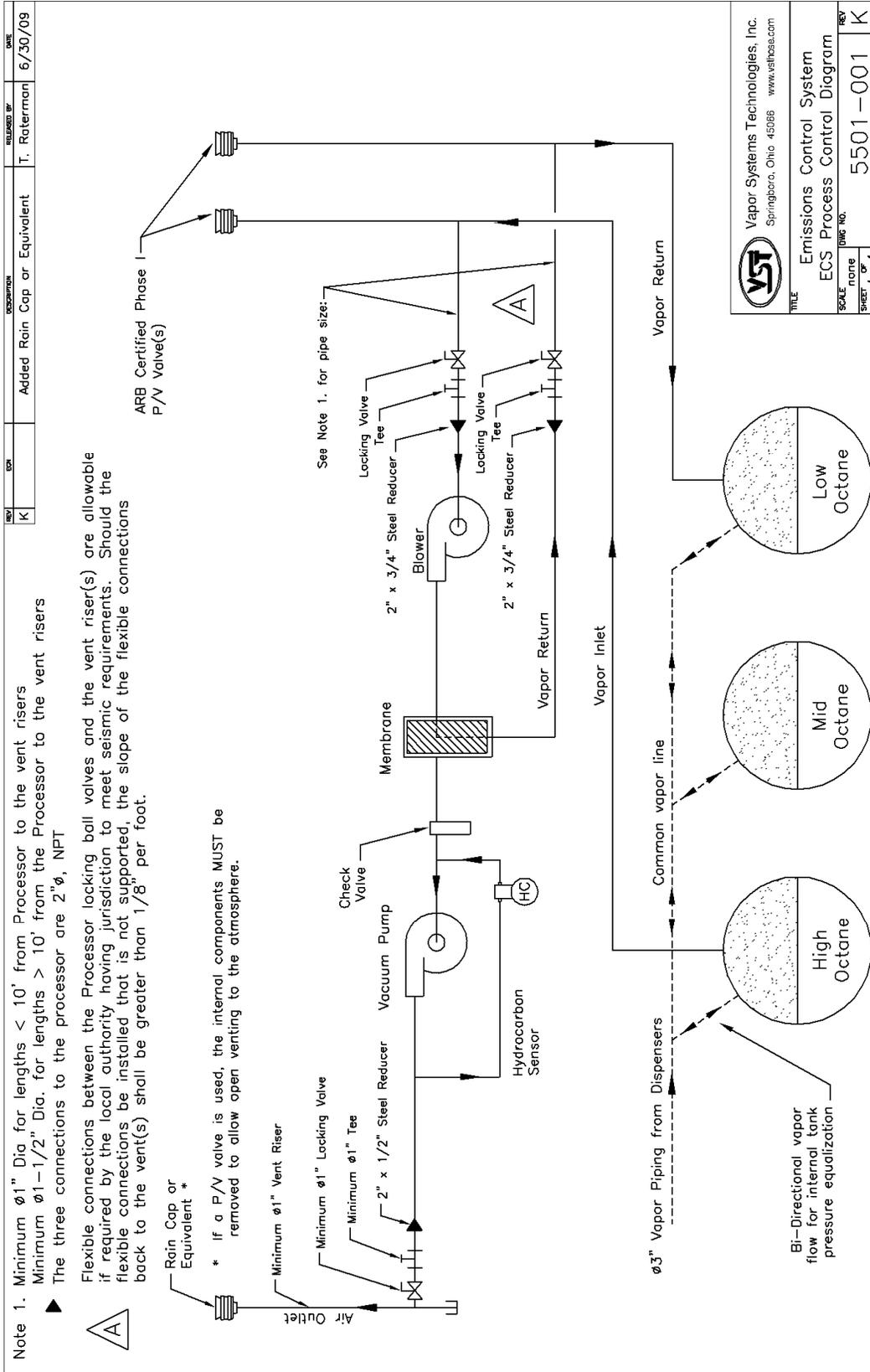


Figure 19: Processor Piping Connections

## 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:
  - ▶ 1<sup>st</sup> ground wire is the equipment ground.
  - ▶ 2<sup>nd</sup> 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.

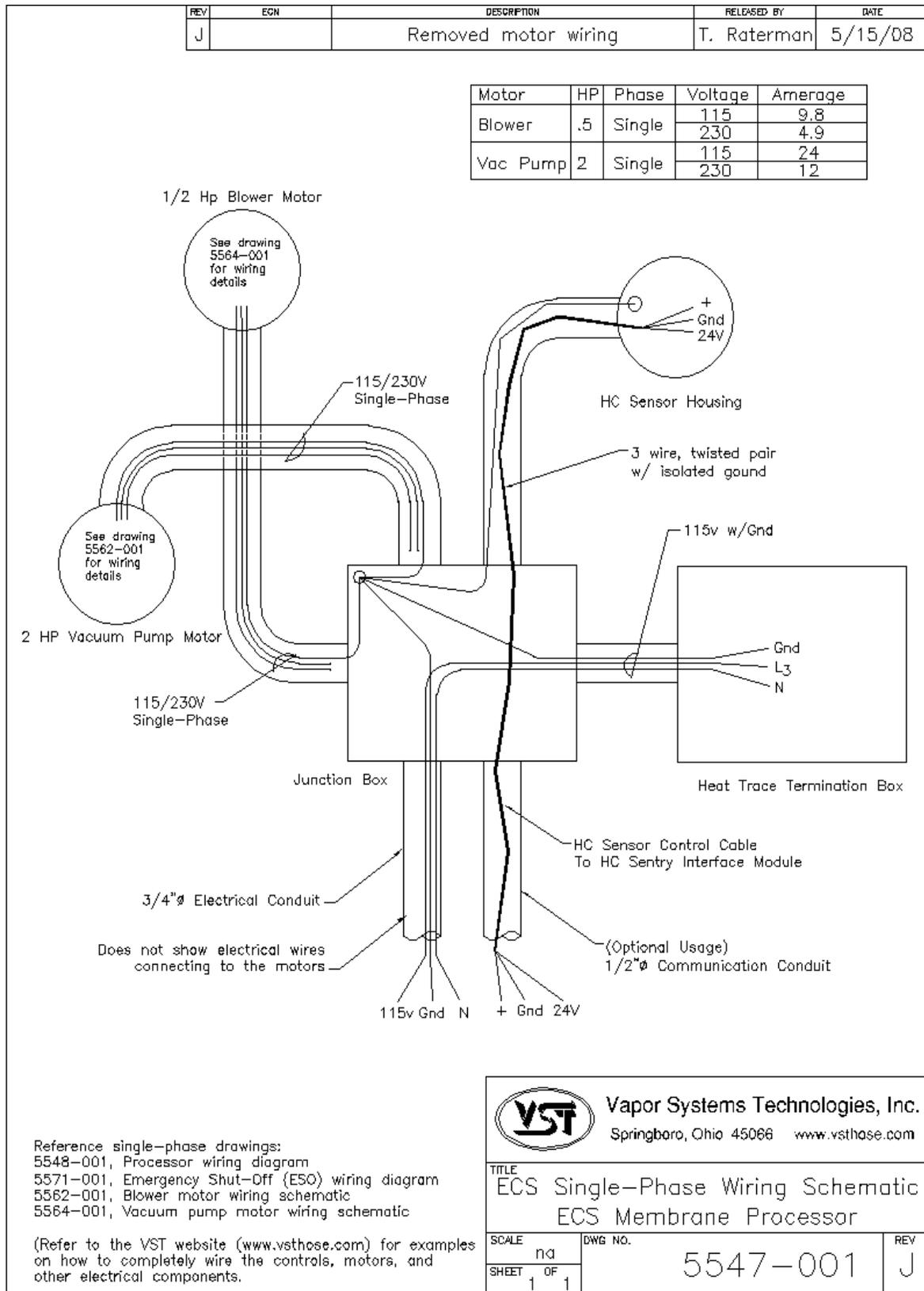


Figure 20: Single-Phase Wiring Schematic

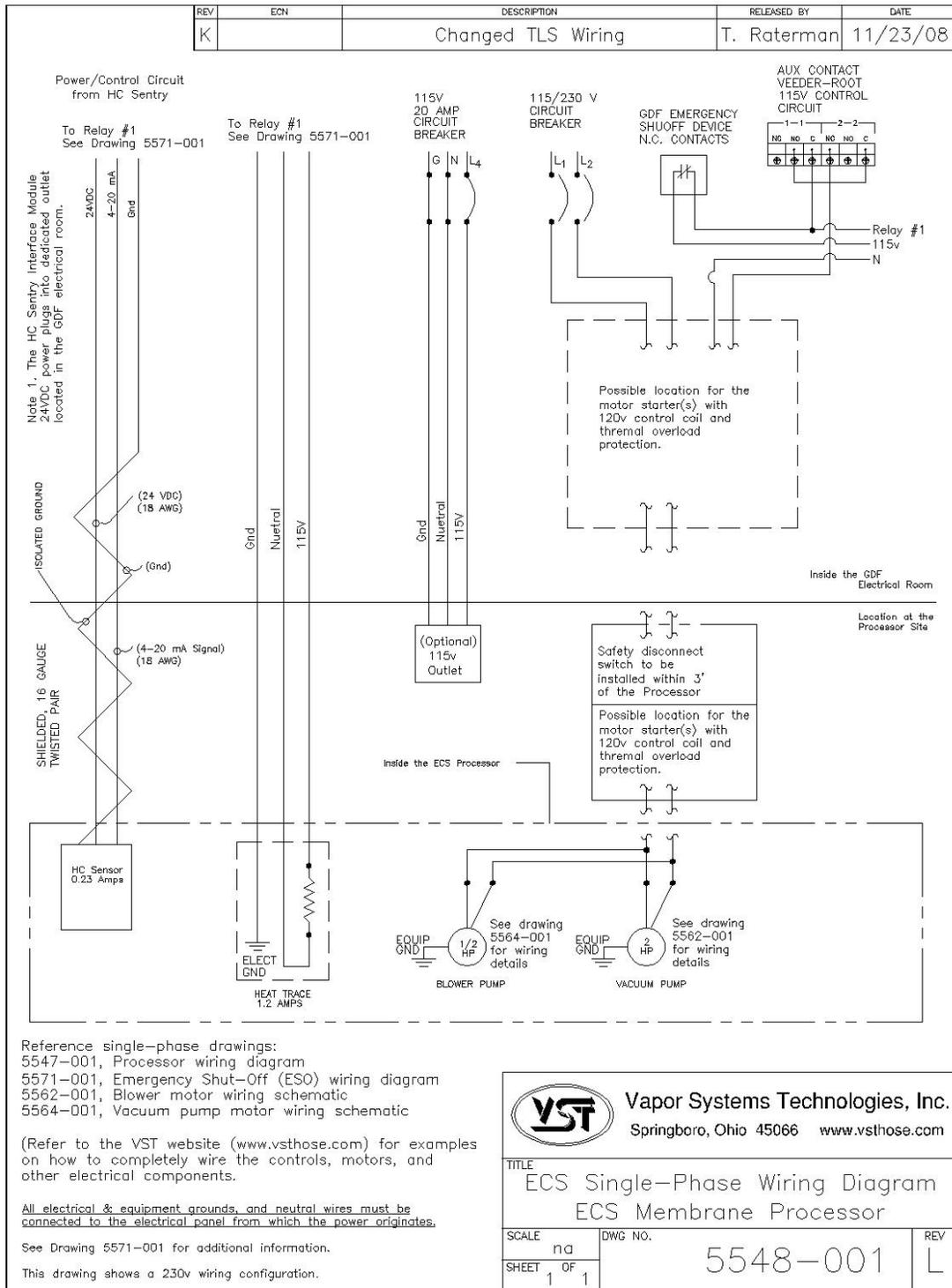


Figure 21: Processor Single-Phase Wiring Diagram



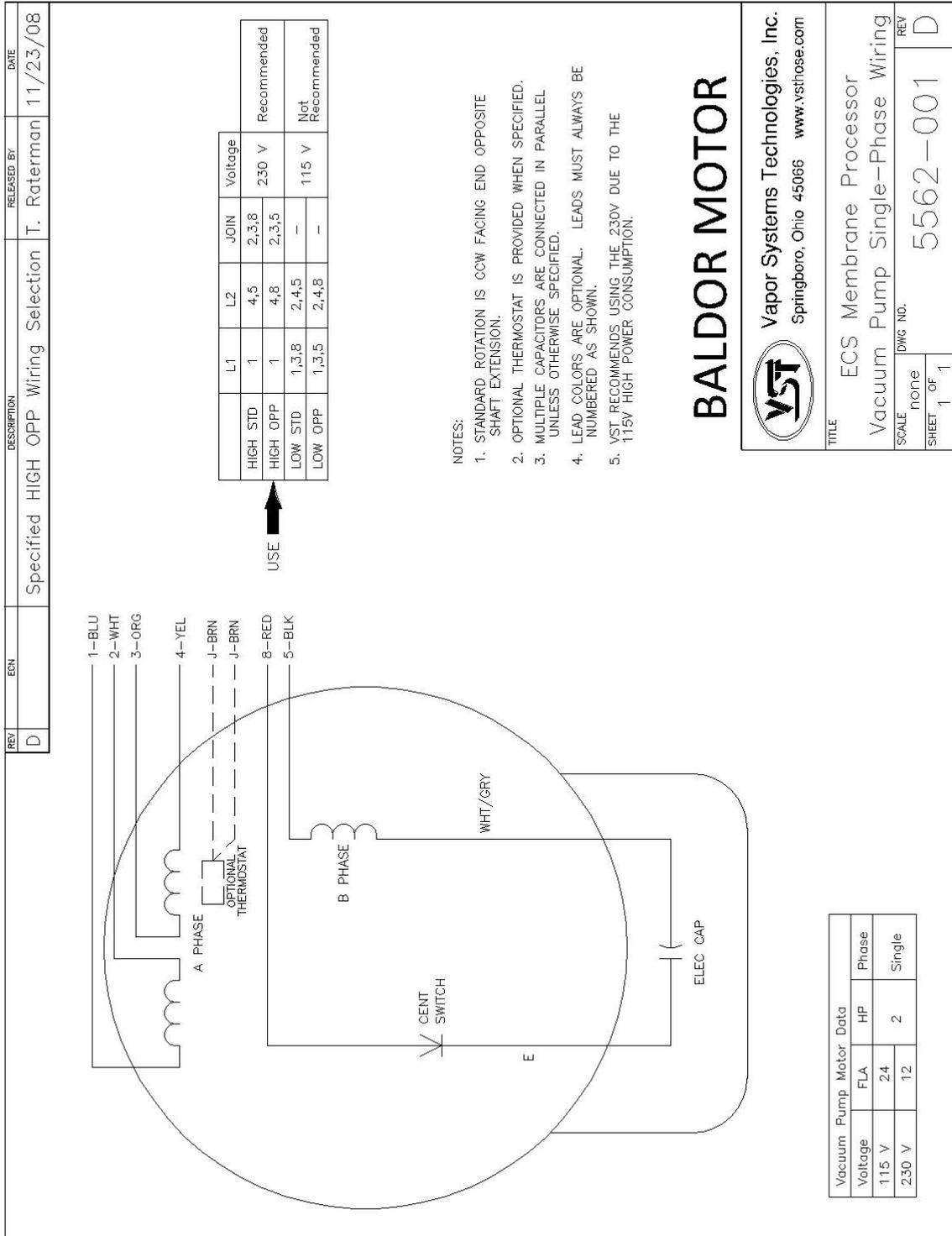


Figure 23: Vacuum Pump: Single-Phase Motor Wiring Diagram

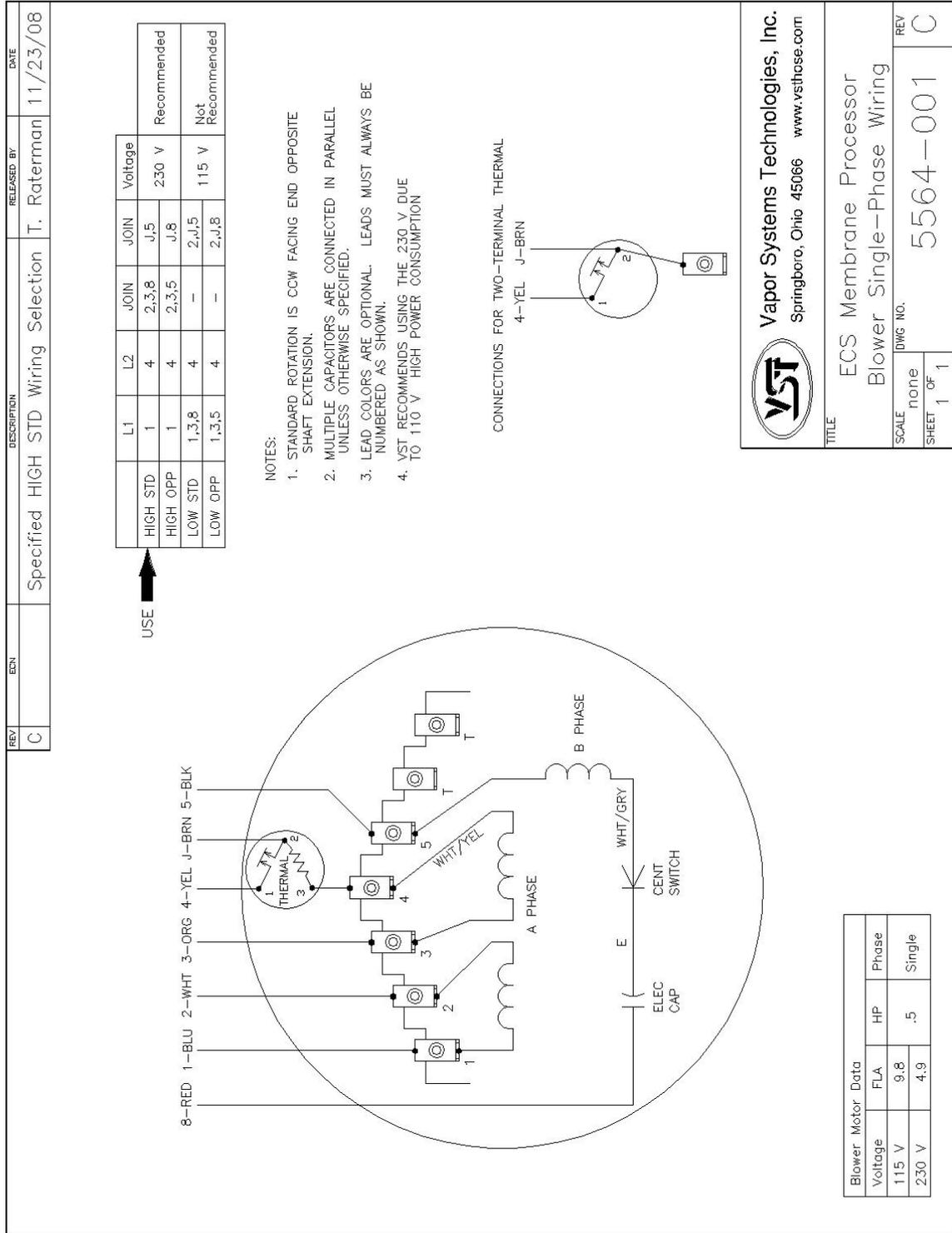


Figure 24: Blower: Single-Phase Motor Wiring Diagram

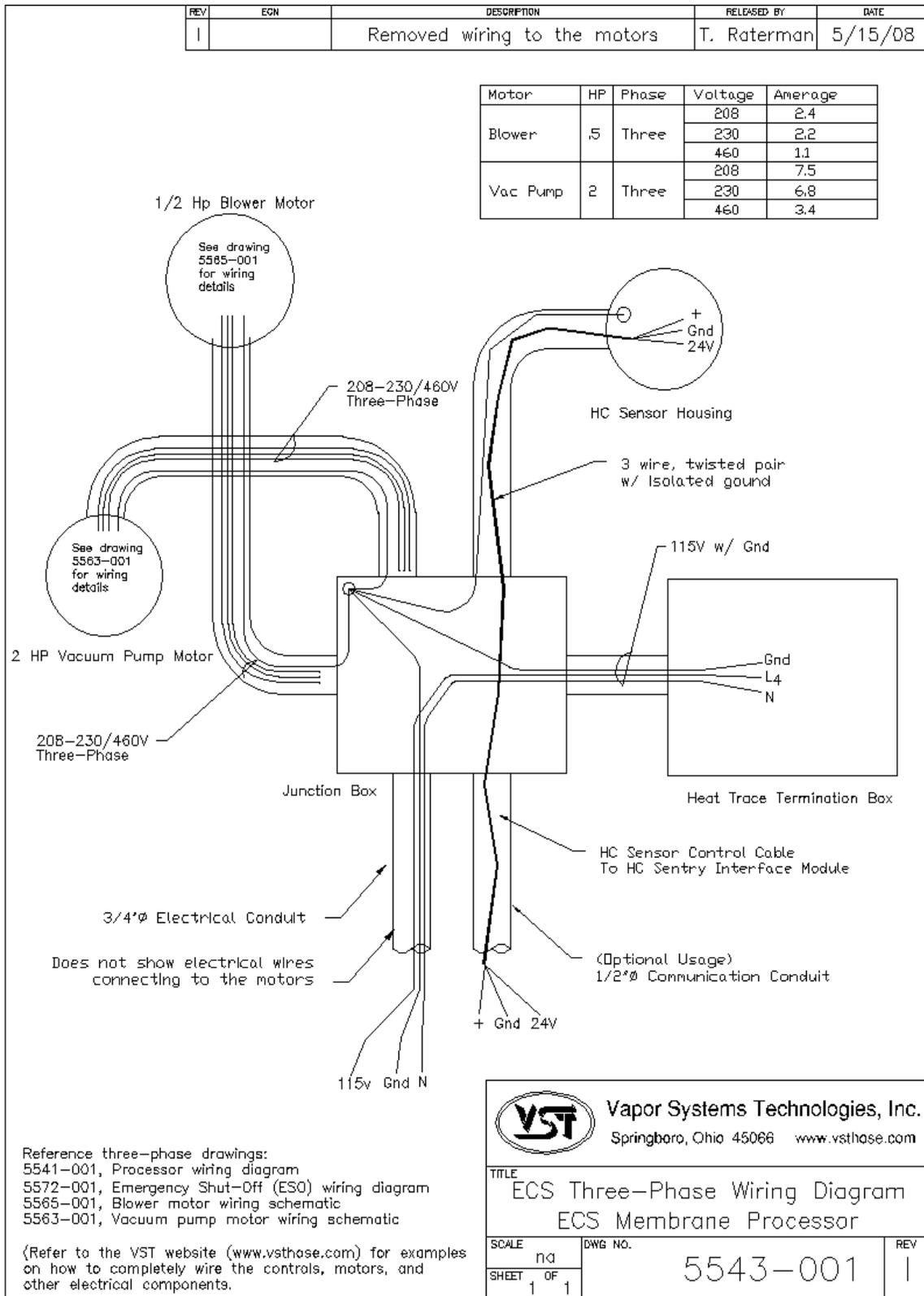


Figure 25: Processor Three-Phase Wiring Schematic

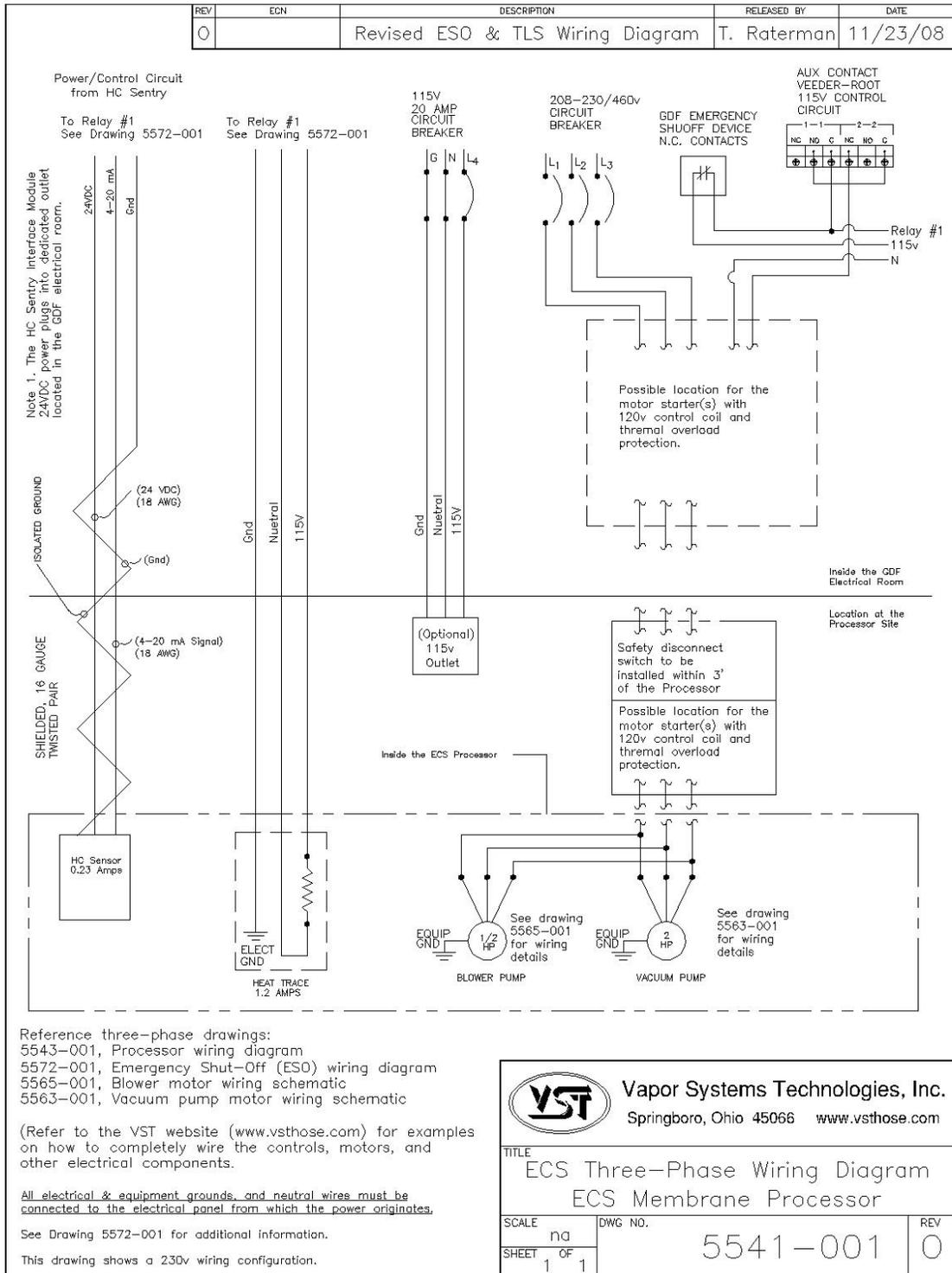


Figure 26: Processor Three-Phase Wiring Schematic

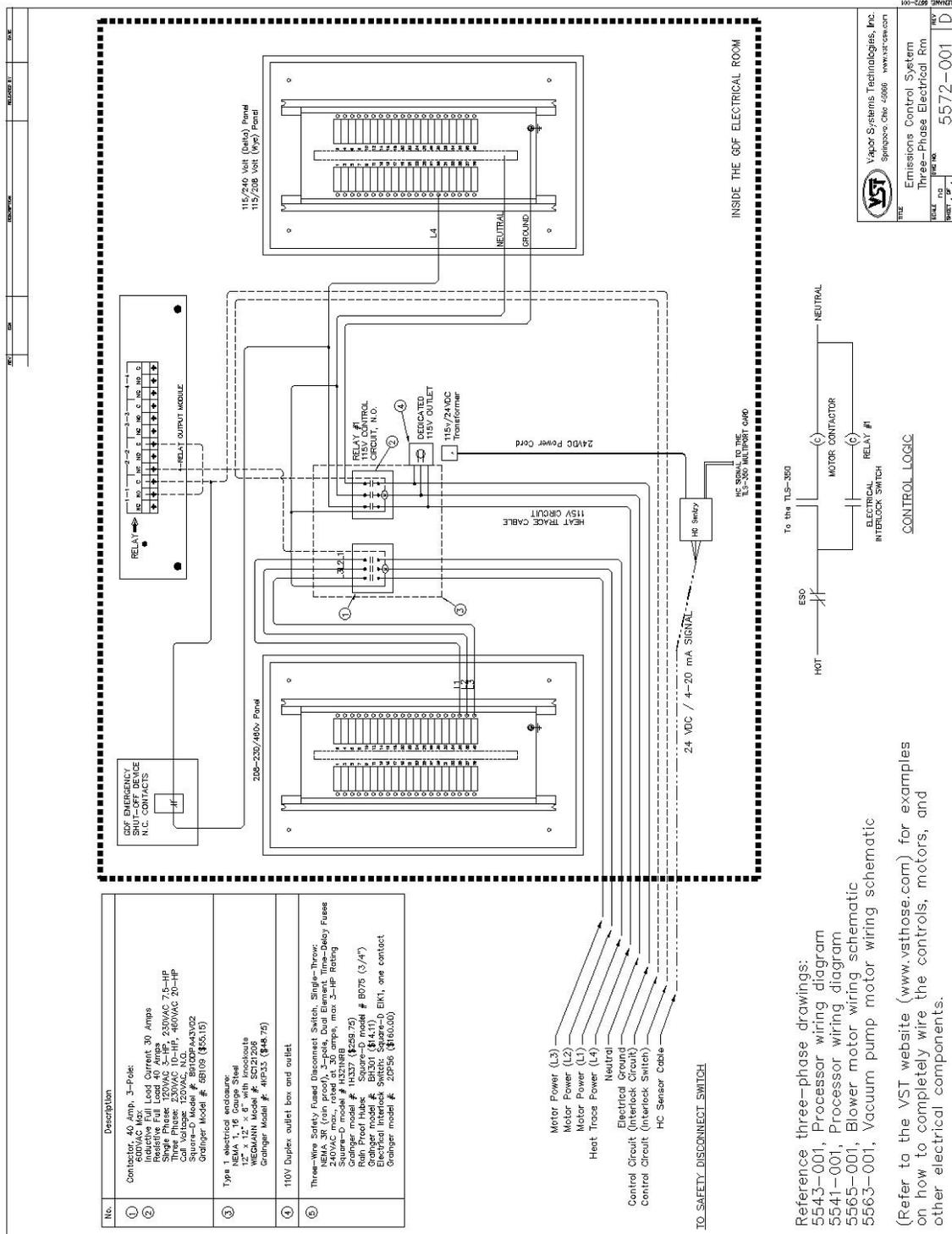


Figure 27: Processor Three-Phase ESO Wiring Diagram

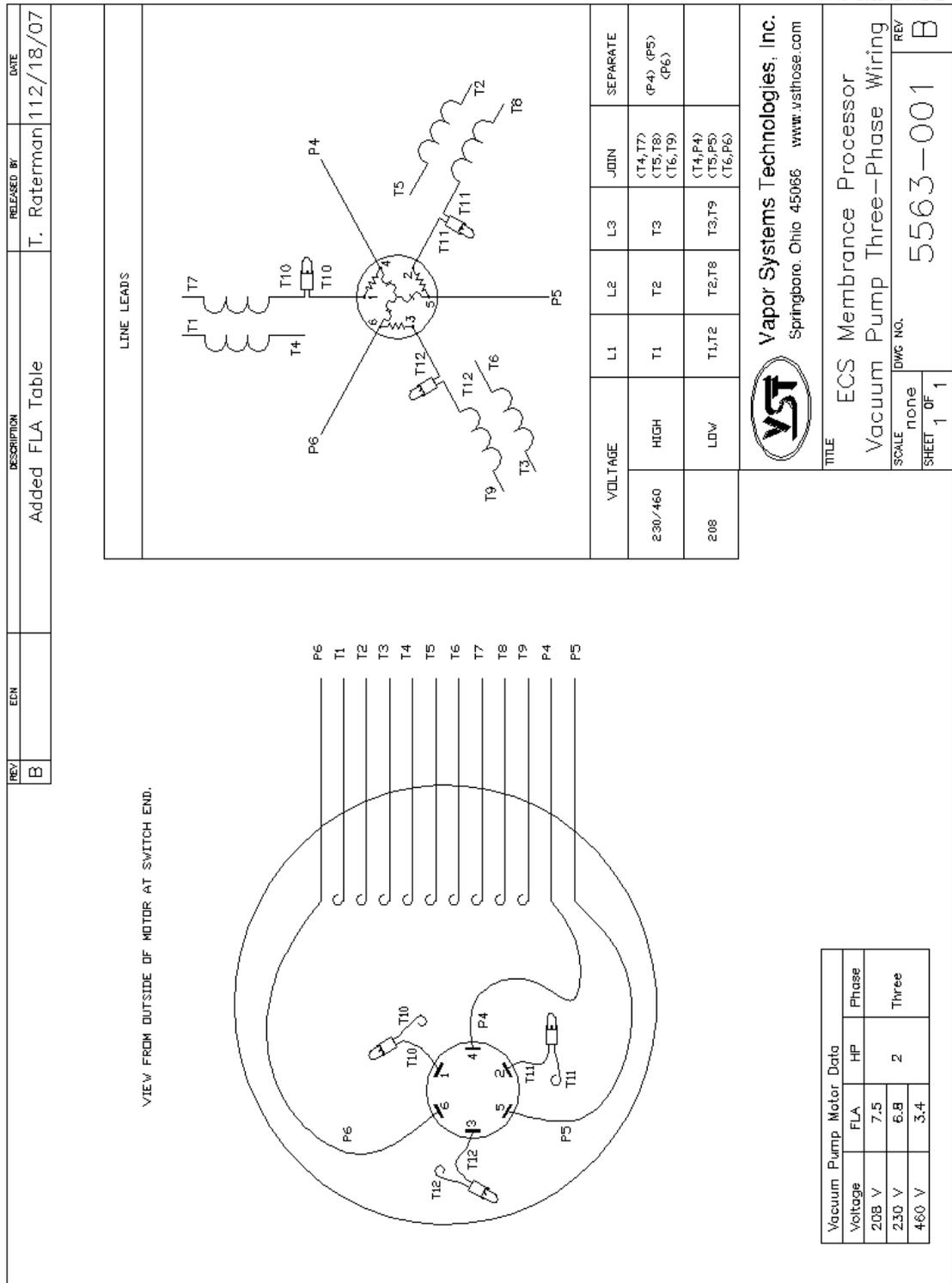


Figure 28: Vacuum Pump: Three-Phase Motor Wiring Diagram

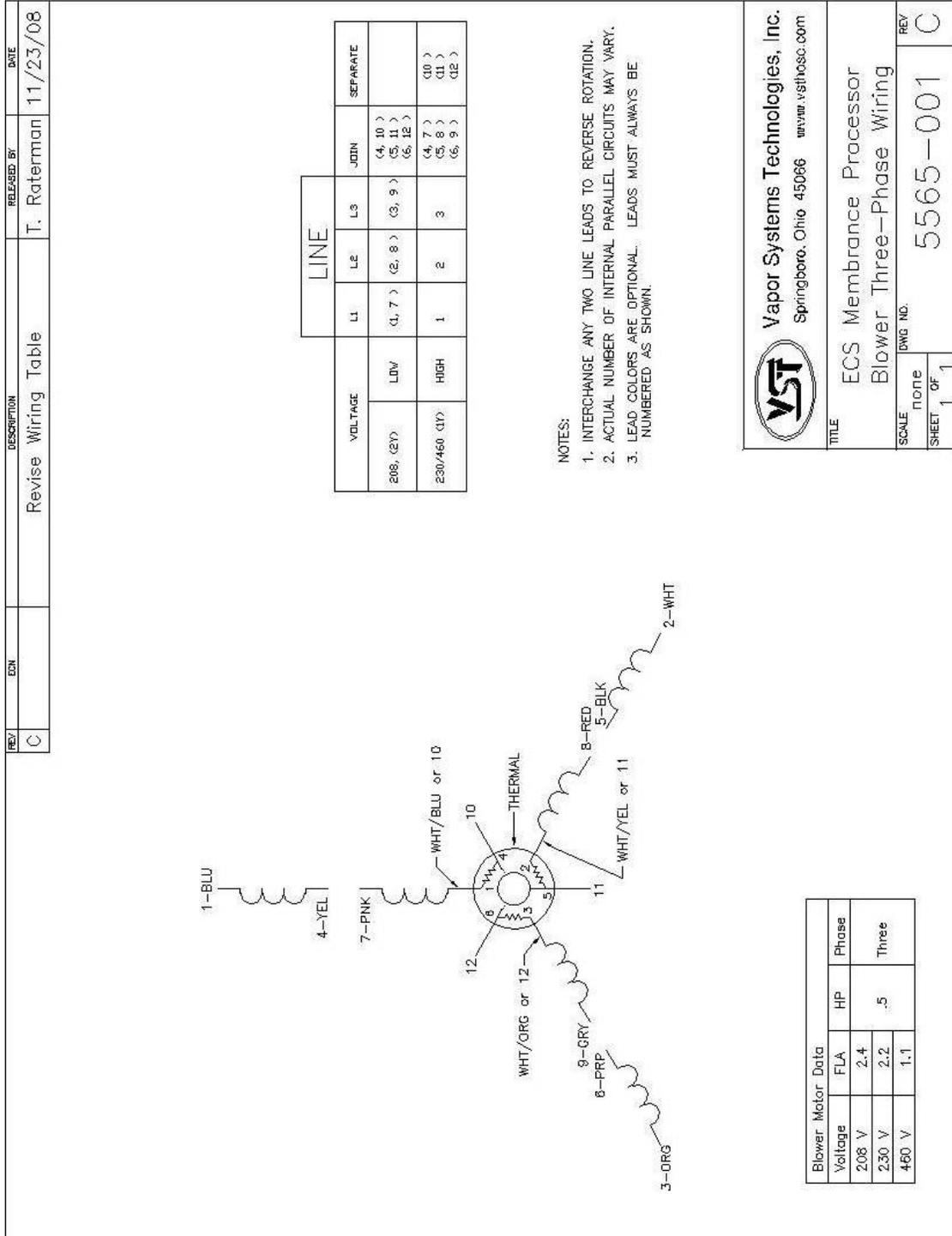


Figure 29: Blower: Three-Phase Motor Wiring Diagram

### 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.

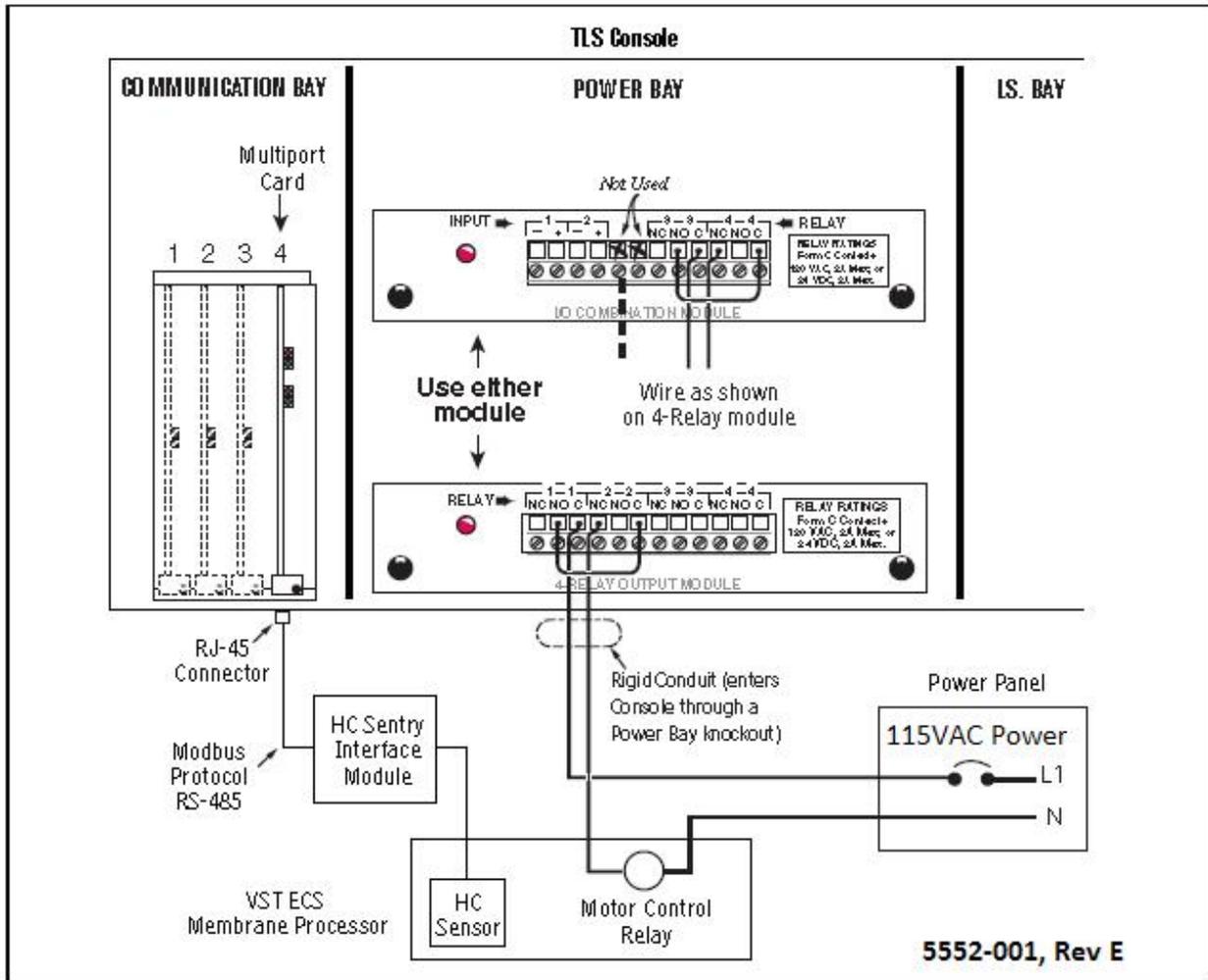
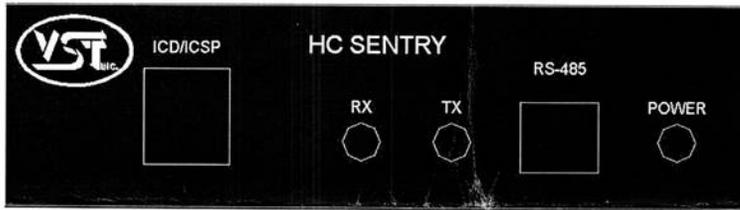


Figure 30: VR TLS Multi-Port Card Connection to HC Sentry Module

### 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.



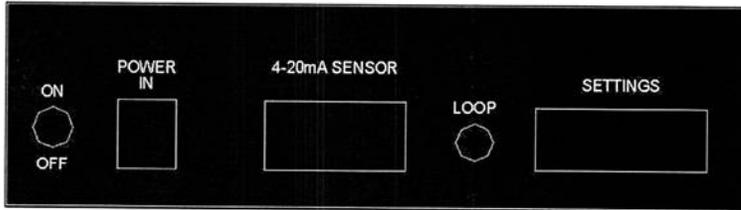
**ICD/ICSP:** This connector provides a means for performing in-circuit-debug and in-circuit-serial-programming utilizing the programming and debugging tools from the processor manufacturer. This connector will typically be used in production to perform initial programming, and could be used as a simple 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

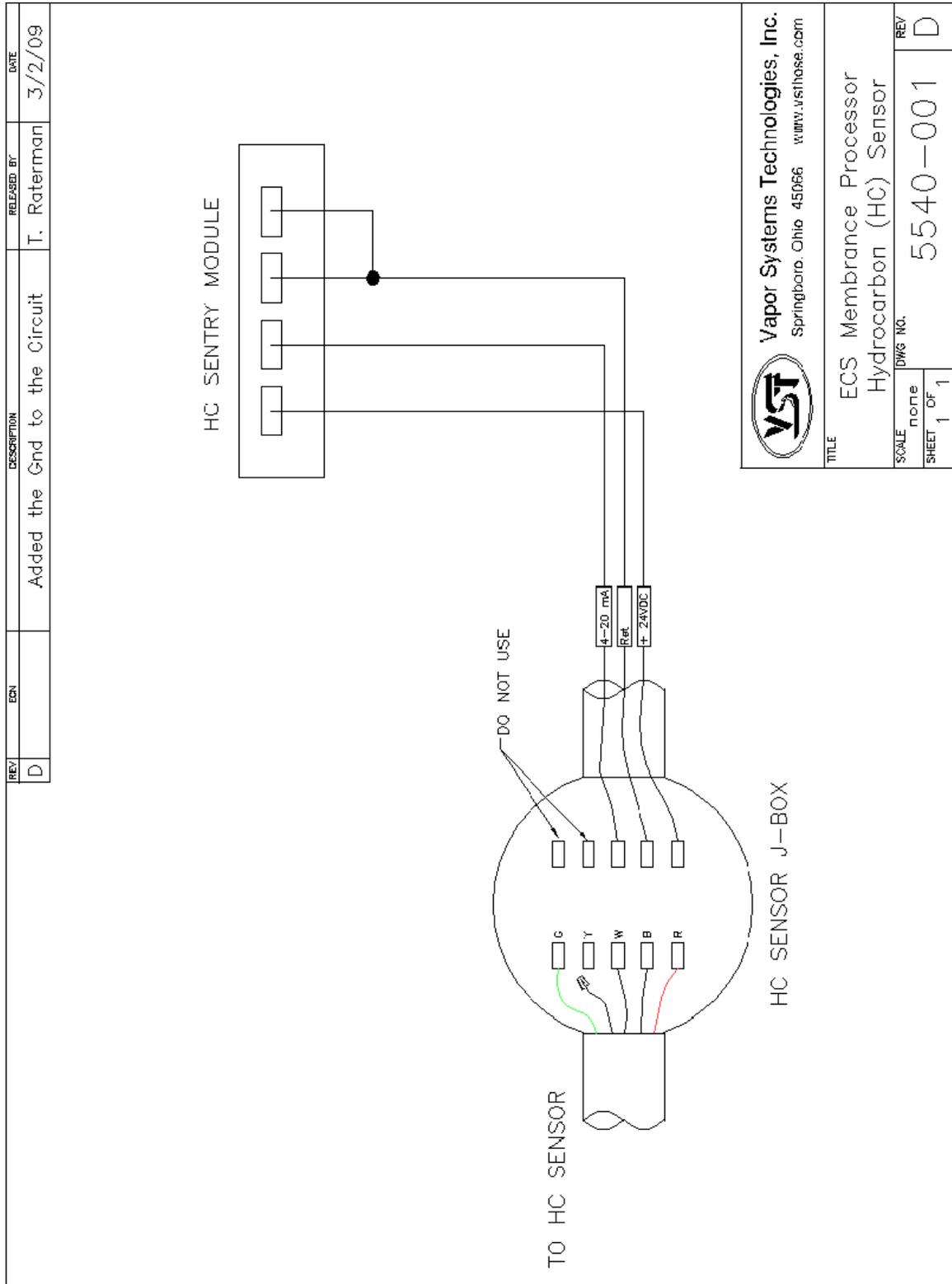


Figure 32: HC Sentry and HC Sensor Wiring Diagram

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



Circuit board

HC Sensor Junction box



HC Sentry (Front)



HC Sentry (Back)

 <b>Vapor Systems Technologies, Inc.</b> 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.

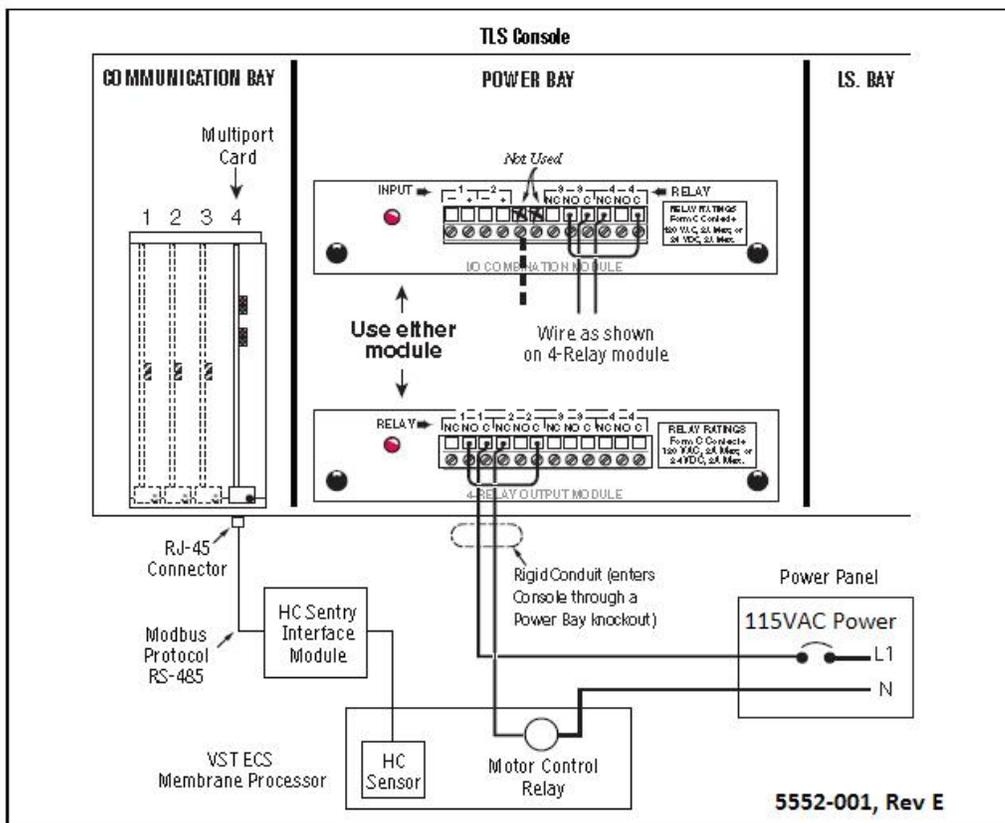


Figure 34: VR TLS Multi-Port Card Connection to the HC Sentry Module

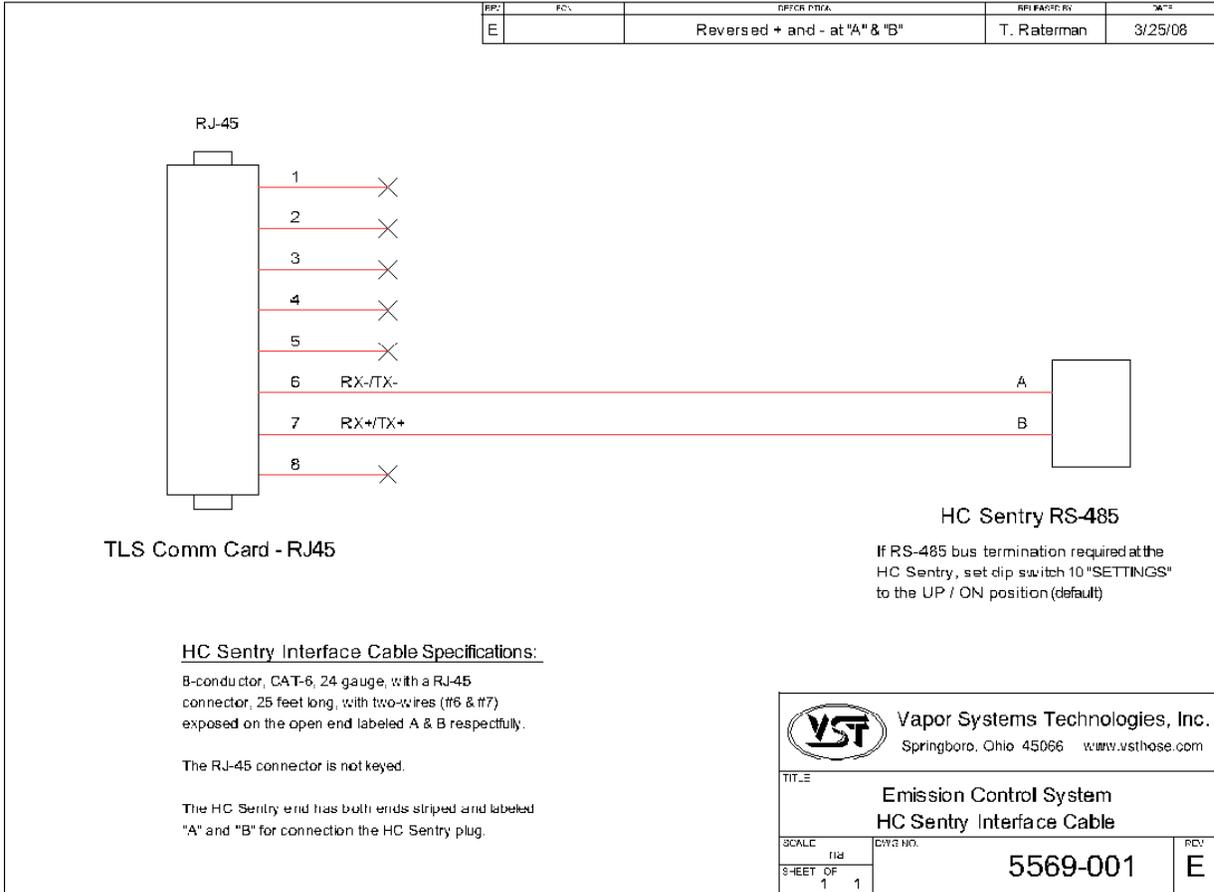
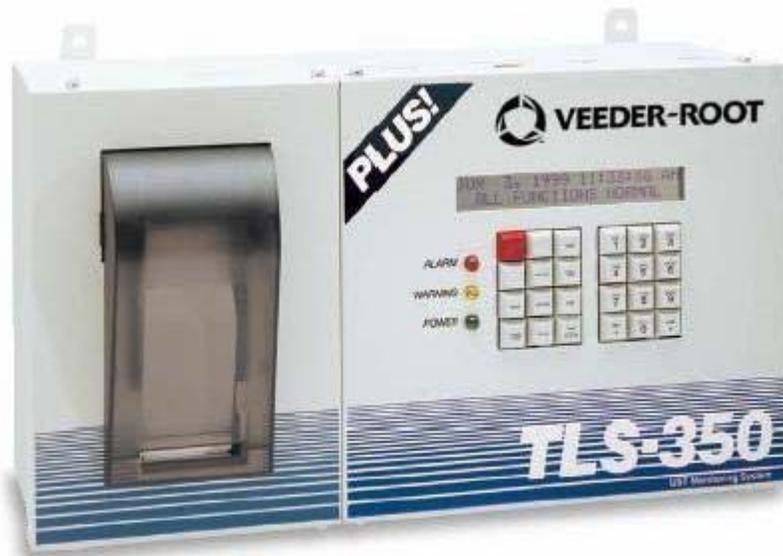


Figure 35: HC Sentry RS-485 Cable Wiring Diagram

### 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.

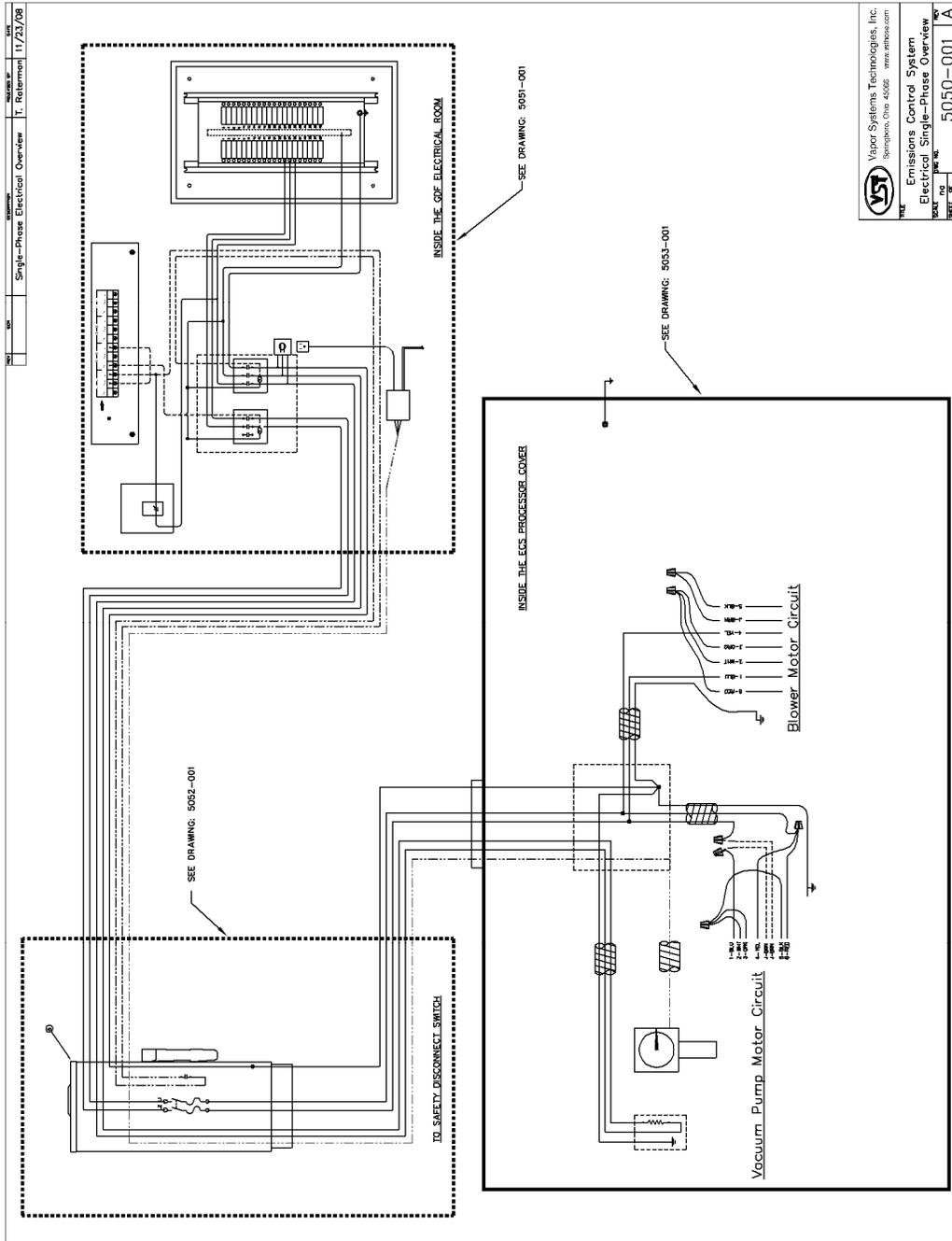
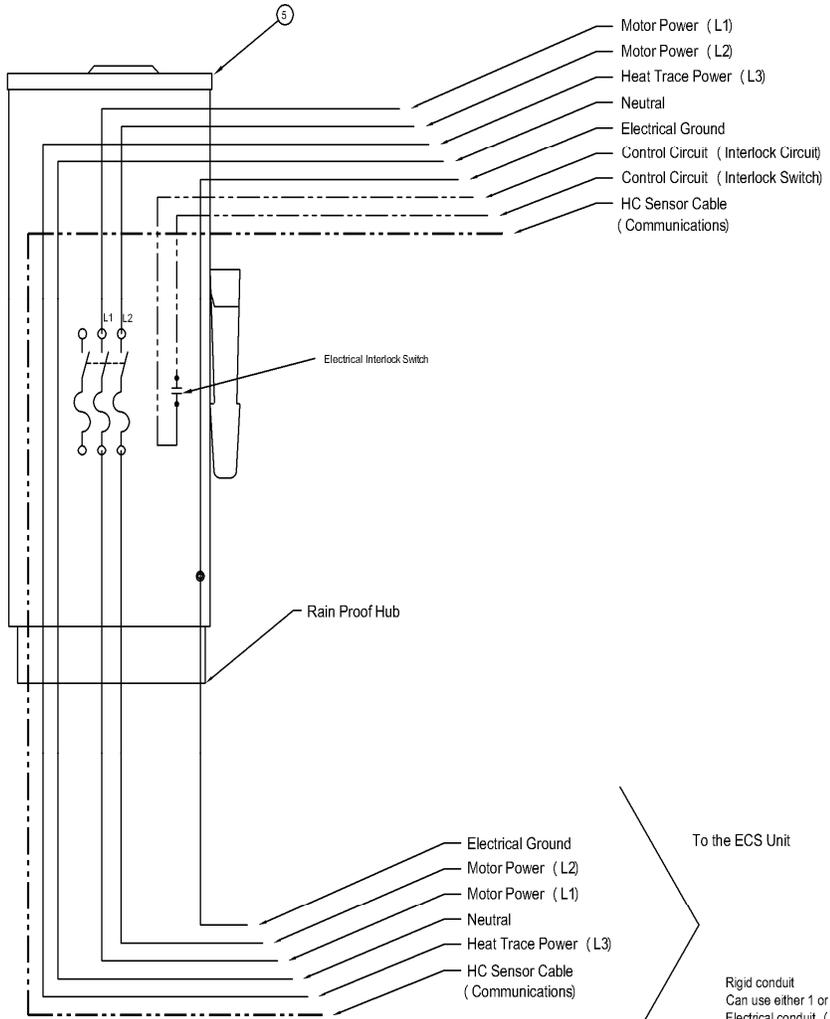


Figure 37: Single phase electrical overview



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 45066 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

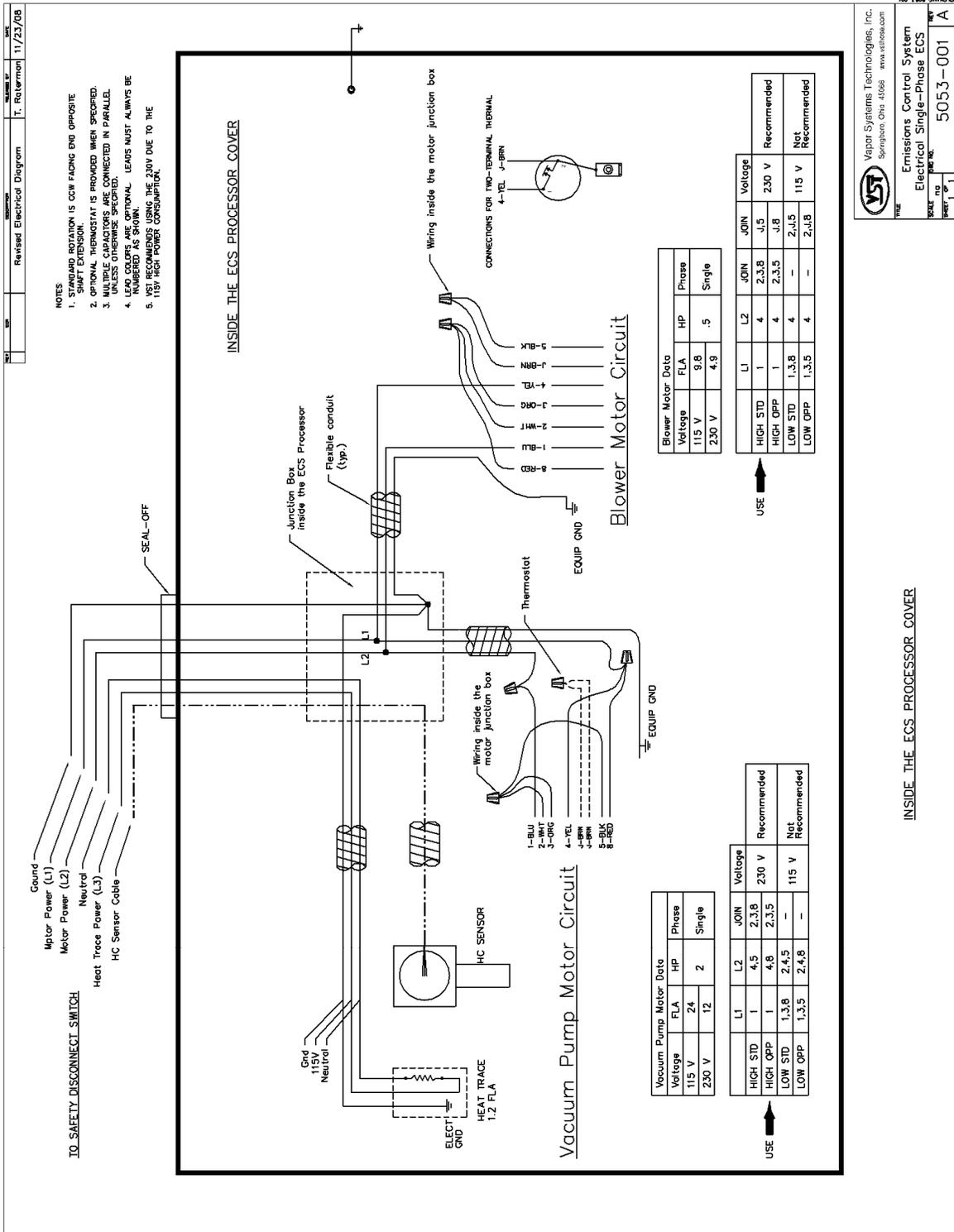


Figure 40: Single phase elec. inside the ECS

VST Vapor Systems Technologies, Inc.  
 Springfield, Ohio 45508 www.vstphase.com

**THE** Emissions Control System  
 Electrical Single-Phase ECS

SCALE: 1"=1'  
 SHEET NO. 5053-001  
 REV. A

INSIDE THE ECS PROCESSOR COVER

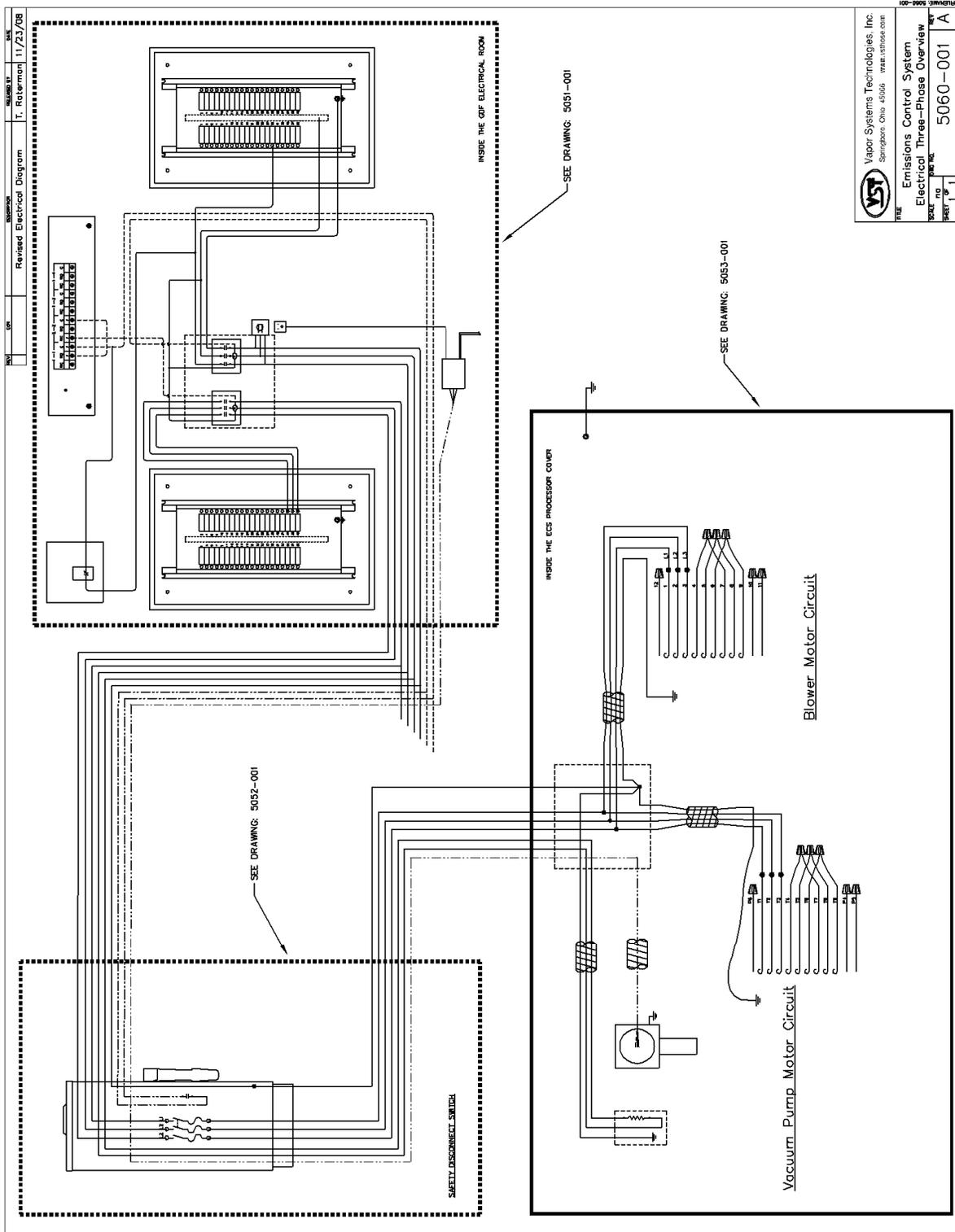


Figure 41: 3-phase electrical overview

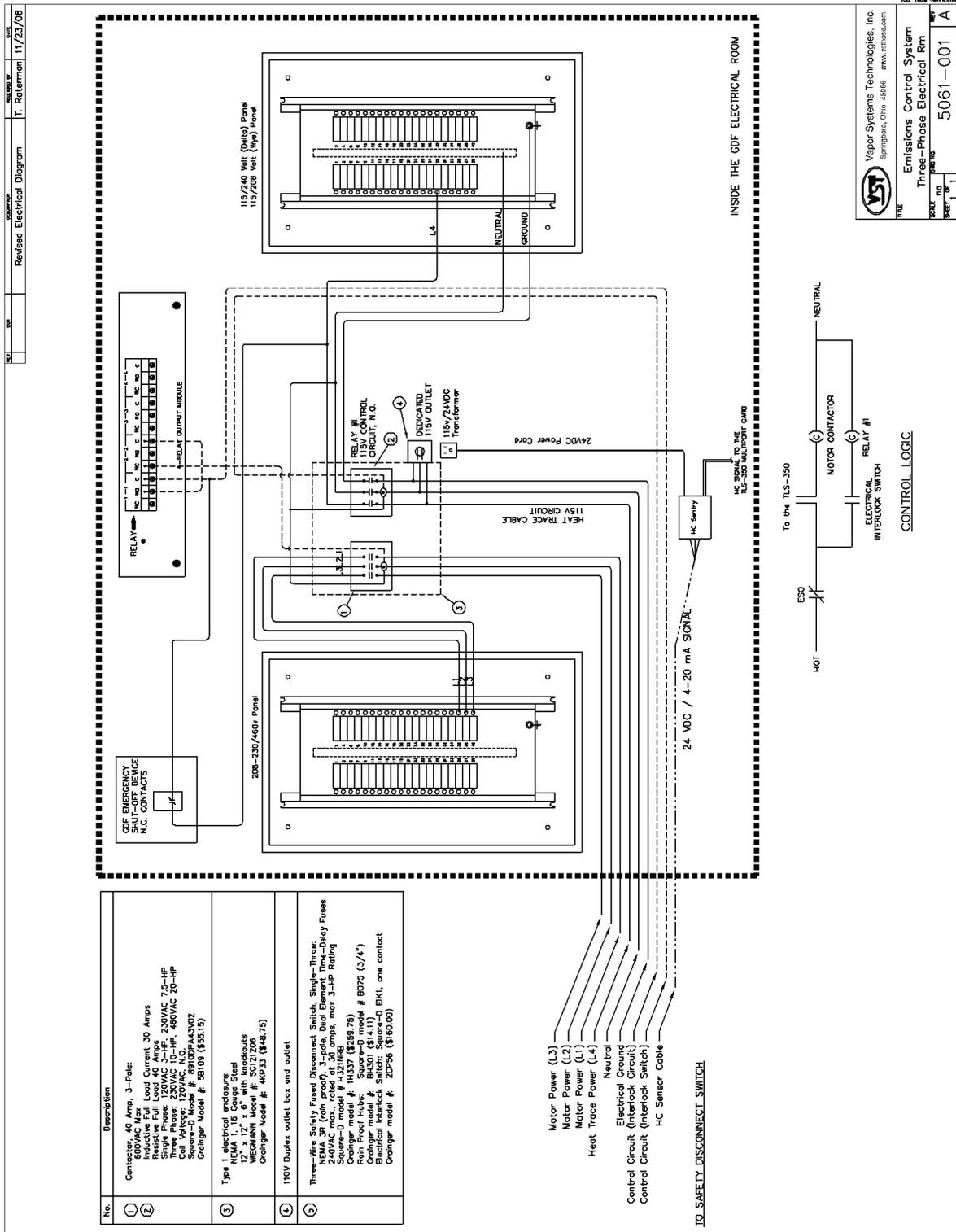


Figure 42: 3-phase electrical room

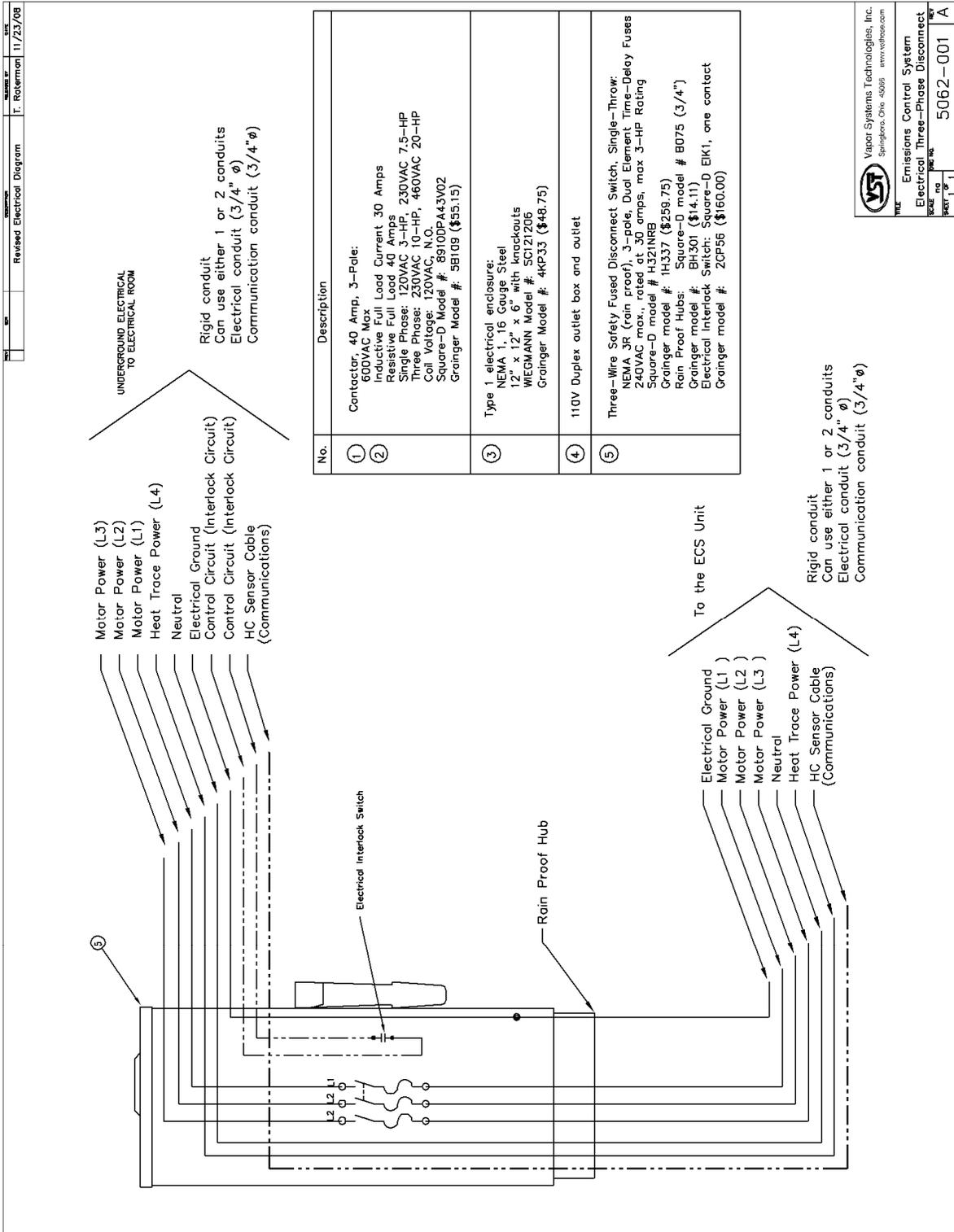


Figure 43: 3-phase electrical disconnect

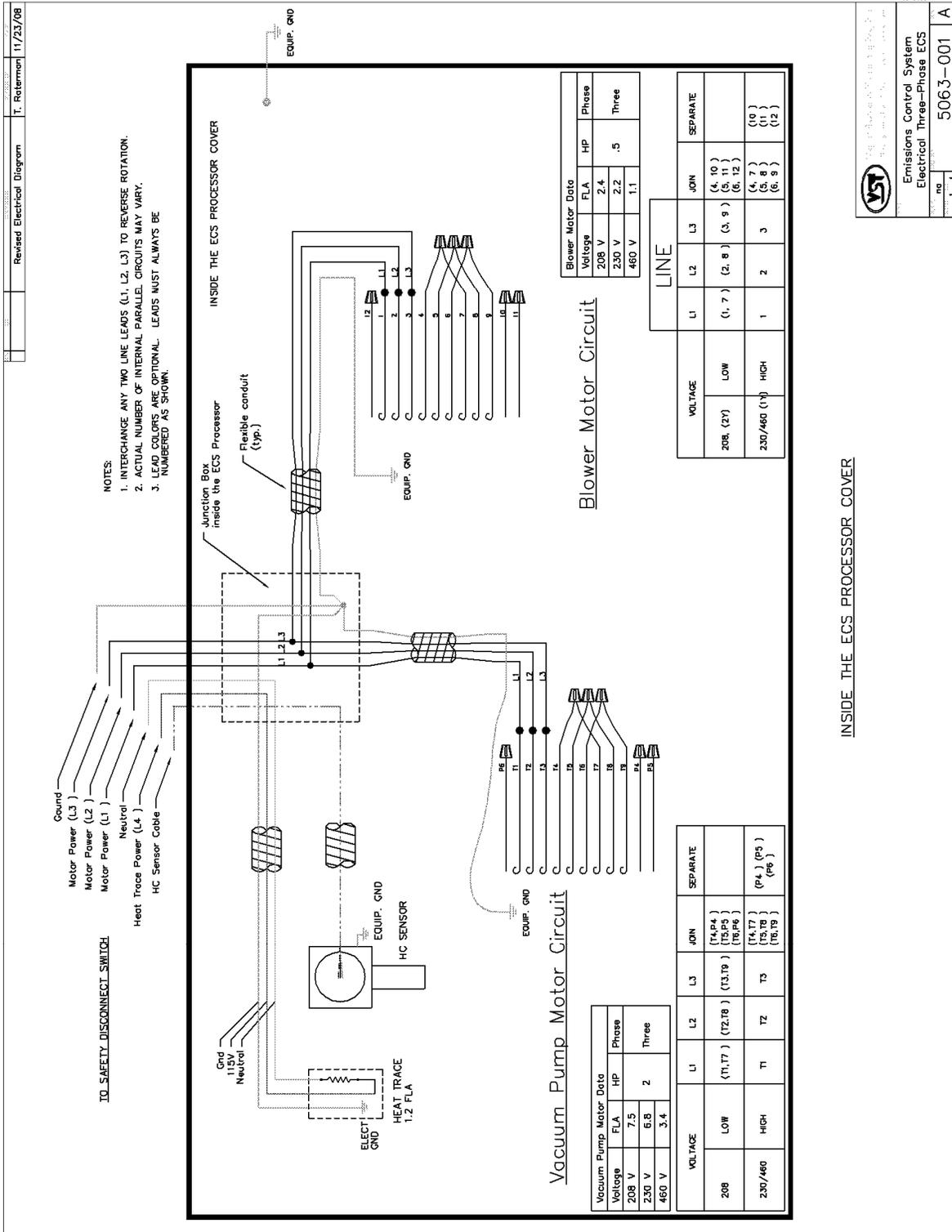


Figure 44: 3-phase elec. inside ECS

## 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:		
<b>Notes:</b> 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-H  
VR-204-H

**Version:** 2.0

***Vapor Systems Technologies, Inc.***

650 Pleasant Valley Drive

Springboro, Ohio 45066

937-704-9333 PH

937-704-9443 FX

[www.vsthose.com](http://www.vsthose.com)

# Table of Contents

- Table of Figures..... 5
- About VST ..... 7
- Notice ..... 7
- Warranty ..... 8
- Warranty Cards..... 9
- Components and Warranties ..... 10
- Activating the Processor Warranty..... 11
- VST Contractor Requirements..... 12
- Veeder-Root Contractor Requirements..... 13
- Safety Icons ..... 14
- Table of Terms & Abbreviations..... 15
- 1 ECS Membrane Processor Overview..... 16**
  - 1.1 ECS Membrane Processor Theory of Operation ..... 16
  - 1.2 Overview of How the Processor Operates ..... 17
  - 1.3 Processor Dimensions and Weight..... 17
  - 1.4 Processor Components and Their Purpose ..... 18
  - 1.5 Processor Auxiliary Components..... 20
  - 1.6 Processor Manuals ..... 20
- 2 Processor Operation ..... 26**
  - 2.1 TLS 350 Construction ..... 26
  - 2.2 Automatic Control ..... 27
  - 2.3 Manual Control of the Processor ..... 28
  - 2.4 TLS Alarms..... 29
  - 2.5 Thresholds and Algorithms..... 29
    - 2.5.1 TLS-350 (PMC): Alarm Troubleshooting Summary..... 32
    - 2.5.2 TLS-350 (ISD): Alarm Troubleshooting Summary..... 33
- 3 Post-Installation Power-Up Tests..... 35**
  - 3.1 Post-Installation Electrical Connections ..... 35
  - 3.2 Required Post-Installation Power-Up Tests ..... 37
  - 3.3 TLS Manual Mode..... 39
  - 3.4 Electrical Connection Test..... 41
  - 3.5 Motor-Rotation Test ..... 41
  - 3.6 Heat-Trace Continuity Test ..... 47

3.6.1	Preparing the heat trace electrical junction box for the test: .....	47
3.6.2	Testing the heat trace circuit.....	47
3.7	HC Sensor and HC Sentry Power Test .....	48
3.7.1	Checking 24 VDC Power to the HC Sensor.....	48
3.7.2	Checking 24VDC Power to the HC Sentry Module .....	49
3.8	Processor Leak Test: After Repair (Only) ECS Unit.....	50
3.8.1	Purpose of the Test.....	50
3.8.2	Preparation .....	50
3.8.3	Functional Test Procedures.....	50
3.9	Preparing the Processor for Field Operation.....	52
3.9.1	Setting the TLS-350 Threshold Values.....	52
3.9.2	Processor Configuration Prior to Start Up.....	52
3.10	Post-Installation Power-Up Checklist .....	53
<b>4</b>	<b>Processor Start-Up .....</b>	<b>54</b>
4.1	Processor Shut-Down Procedure .....	55
4.1.1	Processor Shut-Down Procedure.....	55
4.1.2	HC Sensor and HC Sentry Module .....	55
4.1.3	Heat-Trace Cable.....	55
<b>5</b>	<b>Processor Maintenance .....</b>	<b>56</b>
5.1	Annual System Compliance Testing.....	57
5.2	Annual Inspections and Replacements .....	58
5.3	Preventative Maintenance Checklist Form.....	59
5.4	GDF Maintenance Record.....	60
<b>6</b>	<b>ECS Unit Purging Instructions Prior to Service or Maintenance .....</b>	<b>61</b>
6.1	Purpose .....	61
6.2	Tools Required.....	61
6.3	Preparation.....	61
6.4	Procedures .....	61
6.5	Post Purging Procedures .....	62
6.6	Post Service or Maintenance .....	62
<b>7</b>	<b>Blower Replacement.....</b>	<b>63</b>
7.1	Blower Replacement Safety.....	63
7.2	Removing the Blower.....	63
7.3	Installing the New Blower .....	64
<b>8</b>	<b>Vacuum Pump Replacement .....</b>	<b>66</b>
8.1	Safety.....	66
8.2	Removing the Vacuum Pump .....	66
8.3	Installing the new Vacuum Pump and Vacuum Pump Motor Assembly.....	67
<b>9</b>	<b>Membrane Replacement .....</b>	<b>70</b>
9.1	Safety.....	70

9.2	Removing the Membrane from the Membrane Housing .....	70
9.3	Installing the New Membrane.....	72
<b>10</b>	<b>Drive Coupling Rubber Insert Replacement.....</b>	<b>73</b>
10.1	Safety.....	73
10.2	Removing the Drive Coupling Insert.....	73
10.3	Installing the Drive Coupling Insert .....	74
<b>11</b>	<b>Heat Trace Cable Replacement.....</b>	<b>76</b>
11.1	Safety.....	76
11.2	Removing the Heat Trace Electrical Box.....	76
11.3	Overview for Installing the New Heat Trace Cable .....	77
11.4	Steps for Installing the New Heat Trace Cable .....	77
<b>12</b>	<b>Hydrocarbon Infrared (HC IR) Sensor Module Replacement.....</b>	<b>88</b>
12.1	Safety.....	88
12.2	Removing HC IR Sensor from the HC IR Sensor Module Electrical Housing.....	89
12.3	Installing a New or Re-calibrated HC IR Sensor Module to the HC IR Sensor Module Electrical Housing	91
<b>13</b>	<b>Forms.....</b>	<b>93</b>
13.1	Preventative Maintenance.....	94
13.2	Preventative Maintenance Checklist Form.....	95

# Table of Figures

Figure 1: VST Registration Card.....	9
Figure 2: ECS Membrane Processor Sticker.....	9
Figure 3: How the Processor fits into the GDF layout.....	21
Figure 4: Processor Piping Diagram.....	22
Figure 5: ECS Vent Configurations.....	23
Figure 6: Processor Isometric Drawing (1 of 2).....	24
Figure 7: Processor Isometric Drawing (2 of 2).....	25
Figure 8: TLS-350 Face.....	26
Figure 9: Processor Run-Time Algorithm.....	31
Figure 10: Wiring the Motor Starter Relay Coil.....	36
Figure 11: ECS Piping Configuration.....	38
Figure 12: PMC Diagnostic Menu with PMC Software.....	39
Figure 13: PMC Diagnostic with ISD Software.....	40
Figure 14: Vacuum Pump: Single-Phase Motor Wiring Diagram.....	43
Figure 15: Vacuum Pump: Three-Phase Motor Wiring Diagram.....	44
Figure 16: Blower: Single-Phase Motor Wiring Diagram.....	45
Figure 17: Blower: Three-Phase Motor Wiring Diagram.....	46
Figure 18: Heat Trace Circuit Test.....	47
Figure 19: HC Sentry Interface Module Front View: Power and ON/OFF Switch.....	48
Figure 20: HC Sentry Interface Module Back View: Power "ON" Light.....	49
Figure 21: Processor Inlets & Outlets.....	51
Figure 22: Typical Leak Check Test Fixture.....	51
Figure 23: Processor Inlets & Outlets.....	62
Figure 24: Typical leak-check fixture.....	62
Figure 25: Blower electrical connection conduit.....	65
Figure 26: Blower inlet and outlet tubing connections and mounting bolts.....	65
Figure 27: Vacuum pump outlet tubing connection.....	68
Figure 28: Vacuum pump inlet tubing and fittings.....	68
Figure 29: Vacuum pump electrical connection / vacuum pump outlet tubing / HC sensor inlet tubing.....	69
Figure 30: Air outlet / vacuum pump outlet / HC sensor inlet tubing.....	69
Figure 31: Membrane Housing.....	70
Figure 32: Exposed membrane with top plate removed.....	70
Figure 33: Membrane extraction tool.....	71
Figure 34: Membrane base insert.....	71
Figure 35: Vacuum pump with guard removed.....	73
Figure 36: Vacuum and motor assembly.....	73
Figure 37: Vacuum pump unbolted and moved away from the motor.....	74
Figure 38: Drive coupling rubber insert.....	75

Figure 39: Termination block inside the electrical junction box.....78

Figure 40: Seam to cut to remove the insulation.....78

Figure 41: End seal kit components .....78

Figure 42: End seal kit installation instructions, page 1 of 2.....79

Figure 43: End seal kit installation instructions, page 2 of 2.....80

Figure 44: Prepare the new heat trace cable for installation into the end seal kit.....81

Figure 45: Electrical junction box installation instructions, page 1 of 4.....82

Figure 46: Electrical junction box installation instructions, page 2 of 4.....83

Figure 47: Electrical junction box installation instructions, page 3 of 4.....84

Figure 48: Electrical junction box installation instructions, page 4 of 4.....85

Figure 49: End seal kit location and heat trace cable installation .....86

Figure 50: Installed electrical junction box with electrical connections.....87

Figure 51: HC IR Sensor Module and Electrical Housing Assembly.....88

Figure 52: HC IR Sensor Module 1/4" 45° tubing and fittings .....89

Figure 53: HC IR Sensor Electrical Housing Circuit Board .....90

Figure 54: HC IR Sensor Electrical Housing Circuit Board Wiring Diagram.....90

Figure 55: HC IR sensor installation orientation .....91



## 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

 <p><b>Vapor Systems Technologies, Inc.</b> Phone: (937)-704-9333 • Fax: (937)-704-9443 www.vsthose.com</p> <p><b>IMPORTANT PRODUCT WARRANTY REGISTRATION CARD</b></p> <p>12 MONTH WARRANTY BECOMES EFFECTIVE AT TIME OF INSTALLATION. IF THIS CARD IS NOT RETURNED, WARRANTY BECOMES EFFECTIVE FROM DATE OF SHIPMENT FROM VST.</p> <p>THE MAXIMUM WARRANTY LIFE IS 18 MONTHS FROM DATE OF SHIPMENT.</p> <p>PLEASE CALL VST IF THIS PRODUCT IS BEING USED AS A REPLACEMENT. REPLACEMENT WITH A NON VST PRODUCT VOIDS ANY WARRANTY.</p>	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

Figure 1: VST Registration Card

	<b>NOTICE: THIS TAG MUST NOT BE REMOVED FOR ANY REASON</b>
<b>ECS MEMBRANE PROCESSOR UNIT</b>	
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
<b>A</b> Must be re-certified every two years	Hanging Hardware	Functional Testing Installation Maintenance Repair	No pre-requisite
<b>A/B</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
<b>C</b> 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.

# Veeder-Root Contractor Requirements

<b>Veeder-Root Level 1</b>	Contractors holding valid Level 1 Certification are approved to perform wiring and conduit routing, equipment mounting, probe and sensor installation, tank and line preparation, and line leak detector installation.
<b>Veeder-Root Level 2/3 or 4</b>	Contractors holding valid Level 2, 3, or 4 certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root Tank Monitoring Systems, including Line Leak Detection and associated accessories.
<b>PMC / ISD</b>	This course of training includes In-Stations Diagnostics/Pressure Management Control (ISD/PMC) installation checkout, startup, programming, and operations training. It also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current level 2/3 or 4 certification is a prerequisite for the ISD/PMC course. After successful completion of this course the contractor will receive a certificate as well as a Veeder-Root ISD/PMC contractor certification card.
<b>Warranty Registrations may only be submitted by selected distributors.</b>	

# Safety Icons

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

## Table of Terms & Abbreviations

<b>ASC:</b>	Authorized Service Contractor
<b>AQMD:</b>	Air Quality Management Districts
<b>ATG:</b>	Automatic Tank Gauge
<b>CARB:</b>	California Air Resources Board
<b>CDFA:</b>	California Department of Food & Agriculture
<b>CVLD:</b>	Continuous Vapor Leakage Detection, another name for Vapor Leak Detection
<b>ECS:</b>	Emissions Control System
<b>EO:</b>	Executive Order
<b>EVR:</b>	Enhanced Vapor Recovery
<b>GDF:</b>	Gasoline Dispensing Facility
<b>HC:</b>	Hydrocarbon
<b>HC IR:</b>	Hydrocarbon Infrared
<b>ISD:</b>	In-Station Diagnostics
<b>MAG Probe:</b>	A type (brand) of Tank Inventory Probe
<b>NEC:</b>	National Electric Code
<b>NFPA:</b>	National Fire Protection Association
<b>ORVR:</b>	On-Board Refueling Vapor Recovery
<b>OSHA:</b>	Occupational Safety Health Administration
<b>Permeate:</b>	Air return to atmosphere
<b>PLC:</b>	Programmable Logic Control
<b>PMC:</b>	Pressure Management Control
<b>Retentate:</b>	Vapor return to UST
<b>RVP:</b>	Reid Vapor Pressure
<b>TLS:</b>	Tank Level System
<b>TLS Console:</b>	Veeder-Root's line of environmental monitoring consoles.
<b>TS:</b>	Troubleshooting
<b>Ullage:</b>	Vapor space above liquid in a UST
<b>UST:</b>	Underground Storage Tank
<b>VCK:</b>	Vapor Collection Kit
<b>Veeder Root:</b>	Manufacturer of the TLS-350
<b>VOC:</b>	Volatile Organic Compounds
<b>VST:</b>	Vapor Systems Technologies, Inc. - manufacturer of the ECS Membrane Processor
<b>WC:</b>	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"> <li>• When the UST system pressure rises above +0.2"WC, the <i>Processor</i> turns ON.</li> </ul>
2.	<ul style="list-style-type: none"> <li>• Through the vapor inlet pipe connection at the <i>Processor</i>, the VOC vapor is drawn into the suction side of the blower.</li> </ul>
3.	<ul style="list-style-type: none"> <li>• The blower discharges the VOC vapor into the membrane housing.</li> </ul>
4.	<ul style="list-style-type: none"> <li>• Inside the membrane housing, the VOC vapor is separated in to two air streams:                             <ul style="list-style-type: none"> <li>▶ VOC depleted air (referred to as "air")</li> <li>▶ Gasoline VOC vapor</li> </ul> </li> <li>• The membrane is designed specifically for separating air from gasoline VOC vapor.</li> </ul>
5.	<ul style="list-style-type: none"> <li>• A vacuum pump draws the air from the membrane housing through a check valve.</li> </ul>
6.	<ul style="list-style-type: none"> <li>• A sample of the air flows through a hydrocarbon sensor to check the percent hydrocarbons.</li> </ul>
7.	<ul style="list-style-type: none"> <li>• From the vacuum pump, the air is vented to atmosphere via the air return.</li> </ul>
8.	<ul style="list-style-type: none"> <li>• The gasoline VOC vapor returns to the UST system via the vapor return.</li> </ul>
9.	<ul style="list-style-type: none"> <li>• When the UST system pressure drops below -0.2"WC, the <i>Processor</i> turns OFF.</li> </ul>

## 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	

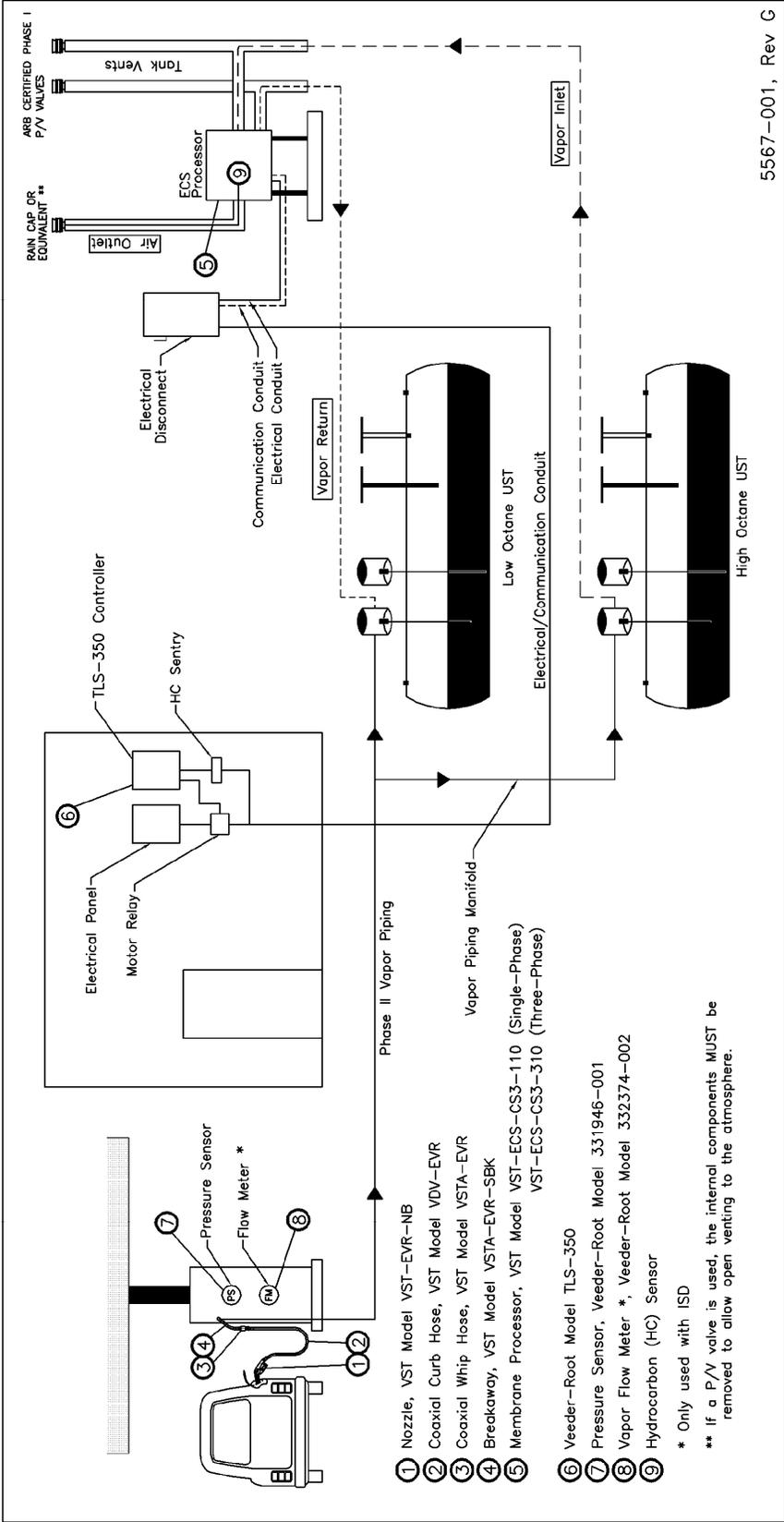
PART #	DESCRIPTION	PURPOSE
5007-004	Hydrocarbon Sensor	<p>The HC Sensor continuously monitors the amount of hydrocarbons in the air stream being vented to the atmosphere. This happens only while the <i>Processor</i> is running.</p> <p>A 4-20mA signal is sent to the TLS-350 controller that monitors the hydrocarbon percentage by volume.</p> <p>24VDC power is required and is supplied from the HC sentry.</p>
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

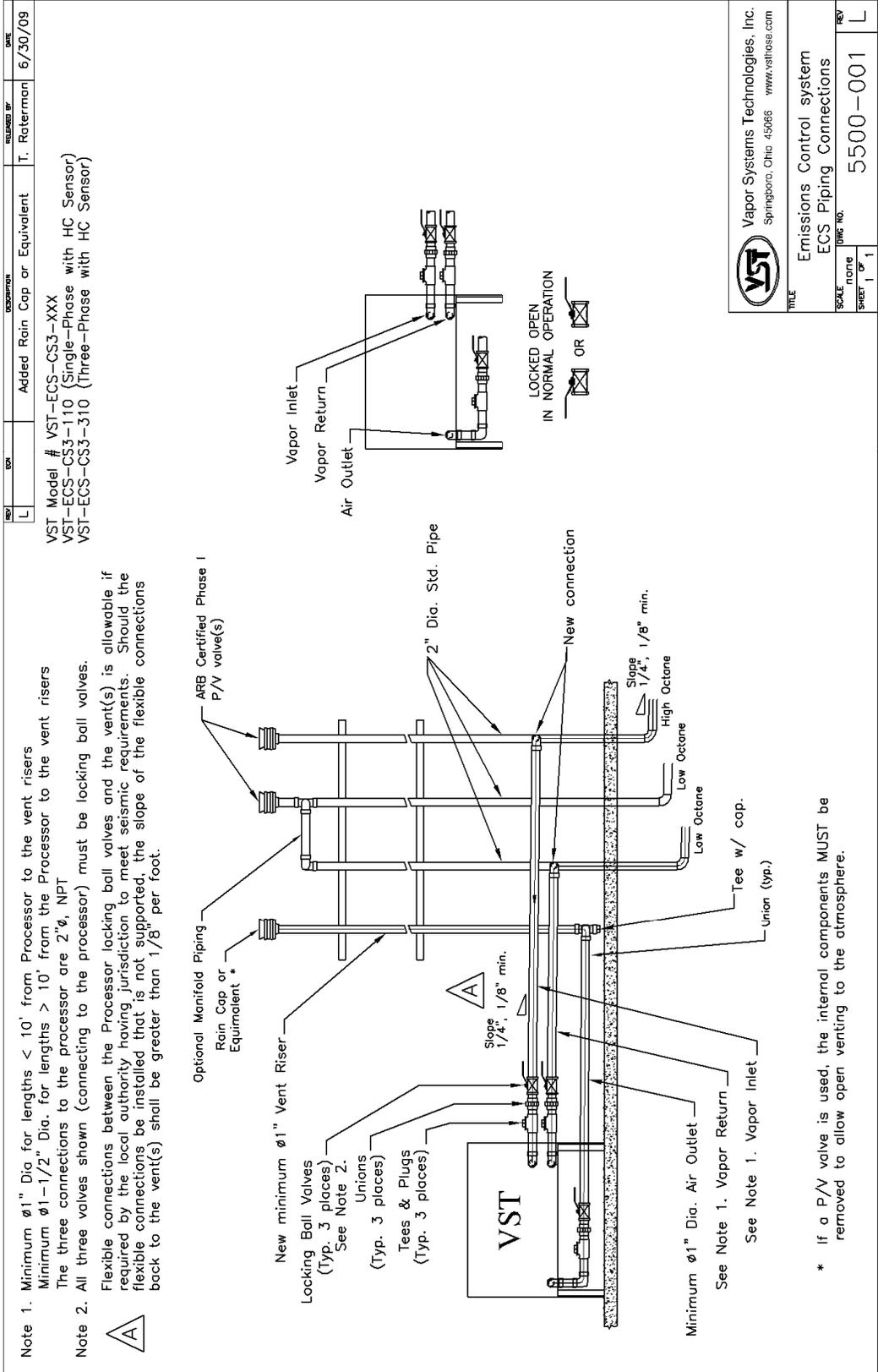


Figure 4: Processor Piping Diagram

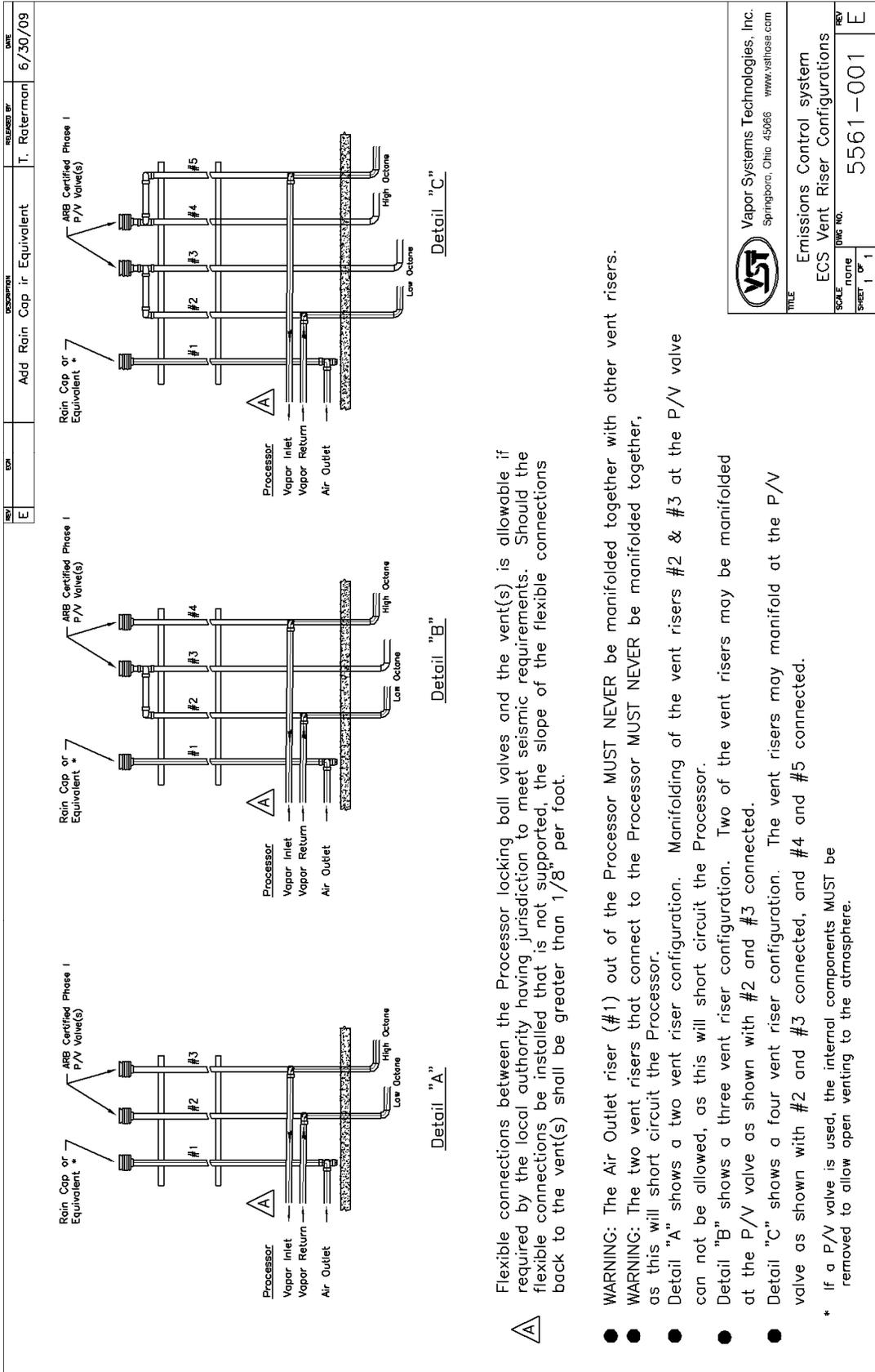


Figure 5: ECS Vent Configurations

Flexible connections between the Processor lacking ball valves and the vent(s) is allowable if required by the local authority having jurisdiction to meet seismic requirements. Should the flexible connections be installed that is not supported, the slope of the flexible connections back to the vent(s) shall be greater than 1/8" per foot.

- **WARNING:** The Air Outlet riser (#1) out of the Processor MUST NEVER be manifolded together with other vent risers.
- **WARNING:** The two vent risers that connect to the Processor MUST NEVER be manifolded together, as this will short circuit the Processor.
- Detail "A" shows a two vent riser configuration. Manifolding of the vent risers #2 & #3 at the P/V valve can not be allowed, as this will short circuit the Processor.
- Detail "B" shows a three vent riser configuration. Two of the vent risers may be manifolded at the P/V valve as shown with #2 and #3 connected.
- Detail "C" shows a four vent riser configuration. The vent risers may manifold at the P/V valve as shown with #2 and #3 connected, and #4 and #5 connected.

\* If a P/V valve is used, the internal components MUST be removed to allow open venting to the atmosphere.

<b>VST</b>	Vapor Systems Technologies, Inc. Springboro, Ohio 45066 www.vstios.com
Emissions Control system ECS Vent Riser Configurations	
SCALE	REV
none	1 of 1
DRAWING NO.	5561-001

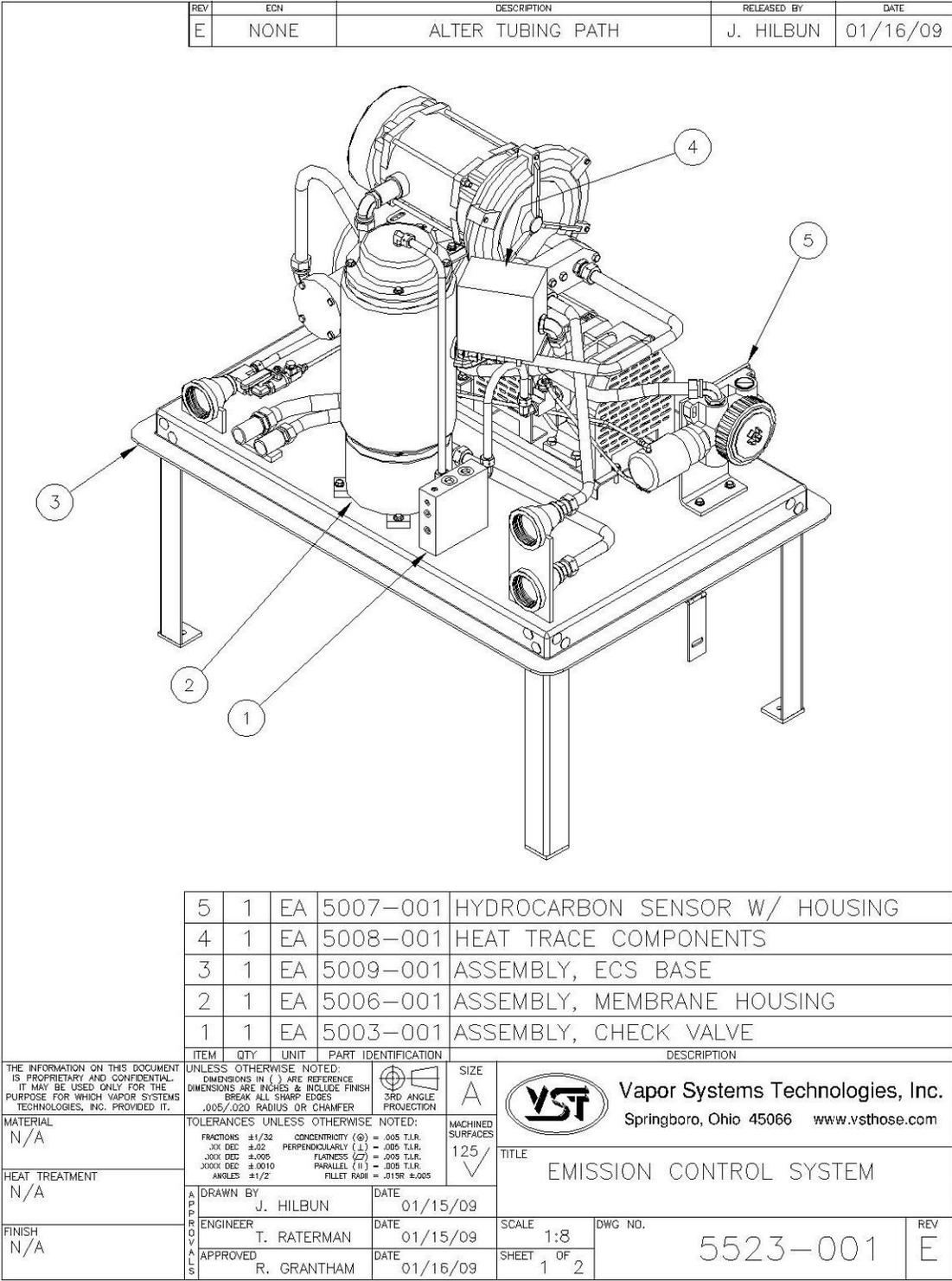


Figure 6: Processor Isometric Drawing (1 of 2)

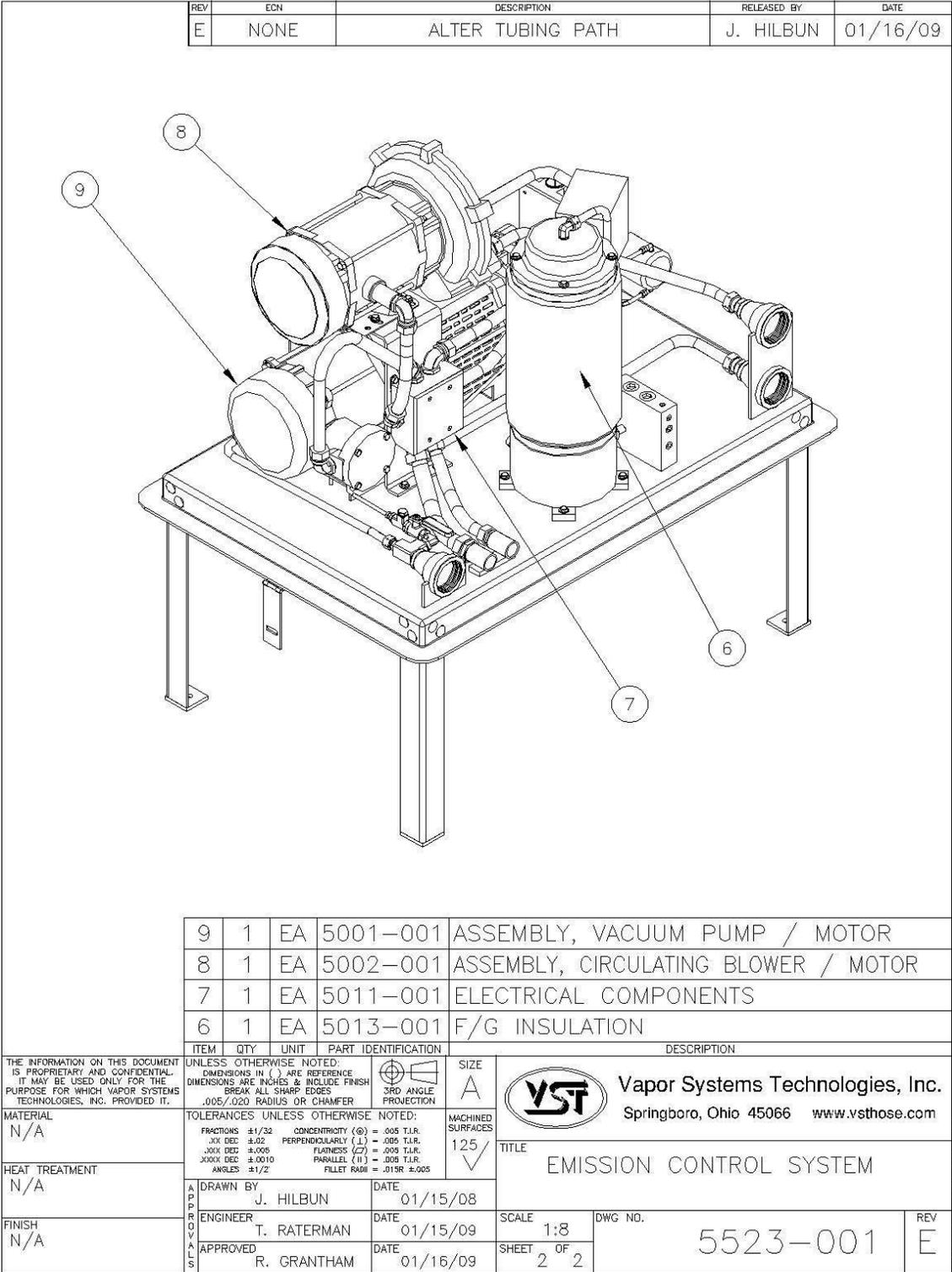


Figure 7: Processor Isometric Drawing (2 of 2)

## 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.

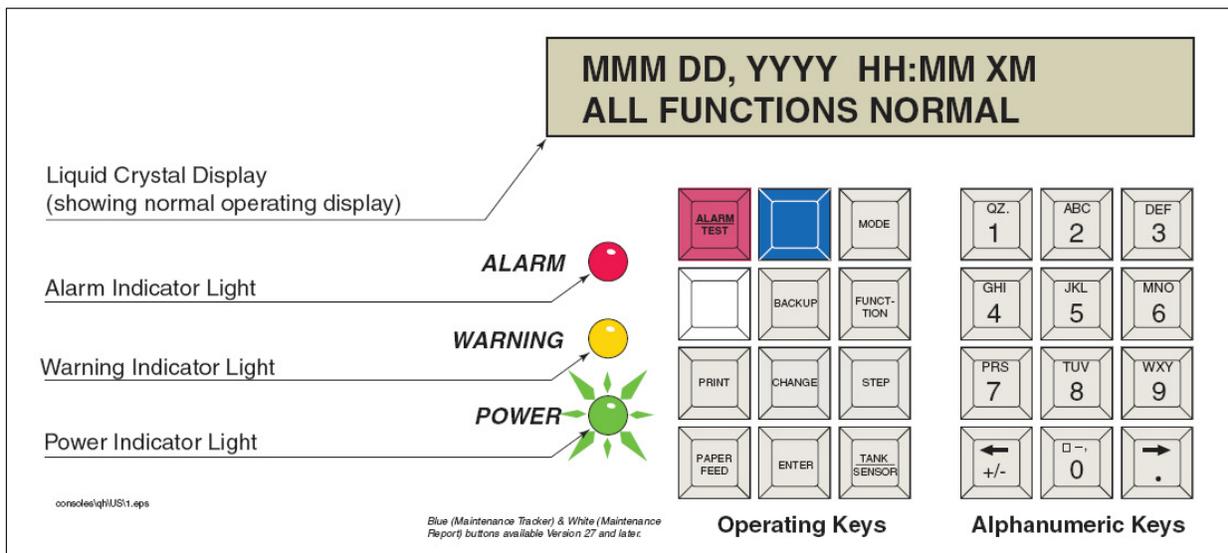


Figure 8: TLS-350 Face

### 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.

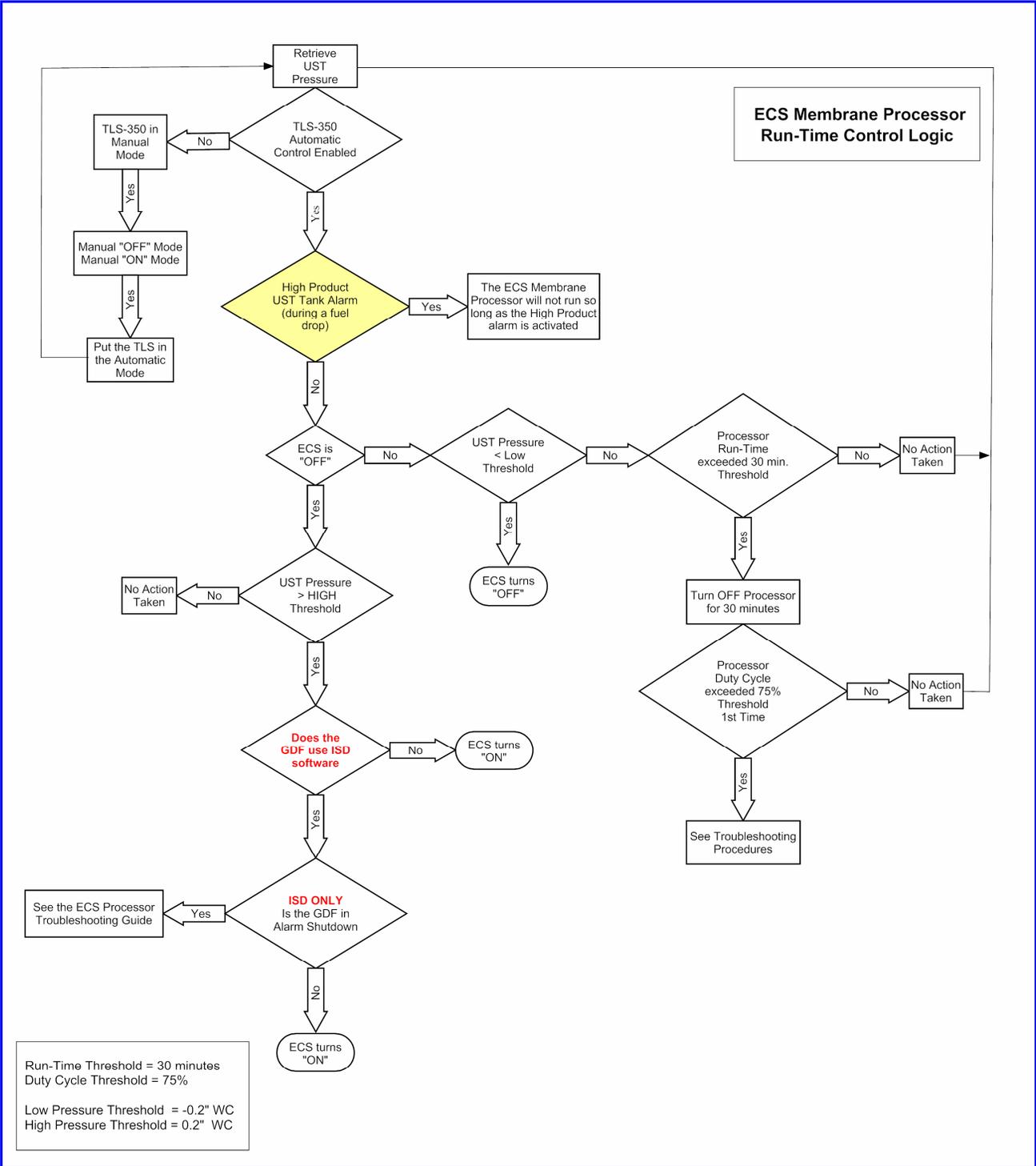


Figure 9: Processor Run-Time Algorithm

2.5.1 TLS-350 (PMC): Alarm Troubleshooting Summary

PMC Alarm Troubleshooting Summary				
Message	PMC Category	Light	Cause	Suggested Troubleshooting
VP EMISSION WARN	Processor	Yellow	Mass emission exceeded the certified threshold.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found out <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• Exhibit 8</li> <li>• Exhibit 9</li> <li>• VST ASC Level C</li> </ul>
VP EMISSION FAIL	Processor	Red	2 <sup>nd</sup> Consecutive Mass emission test failure.	
PMC SET-UP WARN	Processor	Red	PMC is not configured or missing components	<ul style="list-style-type: none"> <li>• Troubleshooting Guide <a href="http://www.vsthose.com">www.vsthose.com</a></li> <li>• Exhibit 10</li> <li>• Exhibit 9</li> <li>• See ISD Troubleshooting Guide PN 577013-819</li> </ul>
VP DUTY CYCLE WARN	Processor	Yellow	Duty cycle exceeds 18 hours per day Or 75% of 24 hours.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• TLS 350 PMC Setup Procedure</li> <li>• Exhibit 10</li> <li>• Exhibit 9</li> <li>• Exhibit 4</li> <li>• VST ASC Level C</li> </ul>
VP DUTY CYCLE FAIL	Processor	Red	2 <sup>nd</sup> Consecutive Duty Cycle Test Failure.	
<p><b>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.</b></p>				

2.5.2 TLS-350 (ISD): Alarm Troubleshooting Summary

ISD Alarm Troubleshooting Summary				
Message	ISD Category	Light	Cause	Suggested Troubleshooting <sup>1</sup>
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a></li> <li>• Exhibit 4</li> <li>• VST ASC Level C</li> </ul>
ISD VAPOR LEAKAGE FAIL <sup>2</sup>	Containment	Red	8 <sup>th</sup> Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95 <sup>th</sup> percentile of 7-days' ullage pressure exceeds 1.3 IWC.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a></li> <li>• Exhibit 10</li> <li>• Exhibit 9</li> <li>• VST ASC Level C</li> </ul>
ISD GROSS PRESSURE FAIL <sup>2</sup>	Containment	Red	8 <sup>th</sup> Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75 <sup>th</sup> percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL <sup>2</sup>	Containment	Red	31 <sup>st</sup> Consecutive Failure of Degradation Pressure Test	
hnn <sup>3</sup> : FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• Exhibit 5</li> <li>• Exhibit 6</li> <li>• VST ASC Level C</li> </ul>
hnn <sup>3</sup> : FLOW COLLECT FAIL <sup>2</sup>	Collection	Red	2 <sup>nd</sup> Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
ISD VP* STATUS WARN	Processor	Yellow	Failure of Vapor Processor Effluent Emissions or Duty Cycle test.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• Reference VP Emissions and VP Duty Cycle troubleshooting on the next page</li> <li>• VST ASC Level C</li> </ul>
ISD VP STATUS FAIL <sup>2</sup>	Processor	Red	2 <sup>nd</sup> Consecutive Failure of Vapor Processor Status test.	
ISD VP PRESSURE WARN	Processor	Yellow	90 <sup>th</sup> percentile of 1 day ullage pressure exceeds 1 IWC.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• Exhibit 10</li> <li>• Exhibit 9</li> <li>• VST ASC Level C</li> </ul>
ISD VP PRESSURE FAIL <sup>2</sup>	Processor	Red	2 <sup>nd</sup> Consecutive Failure of Vapor Processor Overpressure Test	
<p><sup>1</sup>See ISD Troubleshooting Manual P/N 577013-819 and the VST ISD Troubleshooting Guide 9513-003 found at <a href="http://www.vsthose.com">www.vsthose.com</a> for a complete list of suggestions.</p> <p><sup>2</sup>ISD Site shut down alarms      <sup>3</sup>Hose Number      *VP = Vapor Processor</p>				

ISD Alarm Troubleshooting Summary				
Message	ISD Category	Light	Cause	Suggested Troubleshooting <sup>1</sup>
VP EMISSION WARN	Processor	Yellow	Mass emission exceeded the certified threshold.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• Exhibit 8</li> <li>• Exhibit 9</li> <li>• VST ASC Level C</li> </ul>
VP EMISSION FAIL	Processor	Red	2 <sup>nd</sup> Consecutive Mass emission test failure.	
VP DUTY CYCLE WARN	Processor	Yellow	Duty cycle exceeds 18 hours per day Or 75% of 24 hours.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• PMC Setup Procedure</li> <li>• Exhibit 10</li> <li>• Exhibit 9</li> <li>• Exhibit 4</li> <li>• VST ASC Level C</li> </ul>
VP DUTY CYCLE FAIL	Processor	Red	2 <sup>nd</sup> Consecutive Duty Cycle Test Failure.	
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	<ul style="list-style-type: none"> <li>• Confirm ISD sensor &amp; module installation / communication per VR 204 IOM Section 12, Chapter 2</li> <li>• VST ASC Level C</li> </ul>
ISD SENSOR OUT FAIL	Self-Test	Red	8 <sup>th</sup> Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	<ul style="list-style-type: none"> <li>• Confirm EVR/ISD programming per VR 204 IOM Section 12</li> <li>• VST ASC Level C</li> </ul>
ISD SETUP FAIL <sup>2</sup>	Self-Test	Red	8 <sup>th</sup> Consecutive Failure of Setup Test	
<p><sup>1</sup>See ISD Troubleshooting Manual P/N 577013-819 and the VST ISD Troubleshooting Guide 9513-003 found at <a href="http://www.vsthose.com">www.vsthose.com</a> for a complete list of suggestions.  <sup>2</sup>ISD Site shut down alarms                      *VP=Vapor Processor</p>				
<p><b>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.</b></p>				

### 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.**

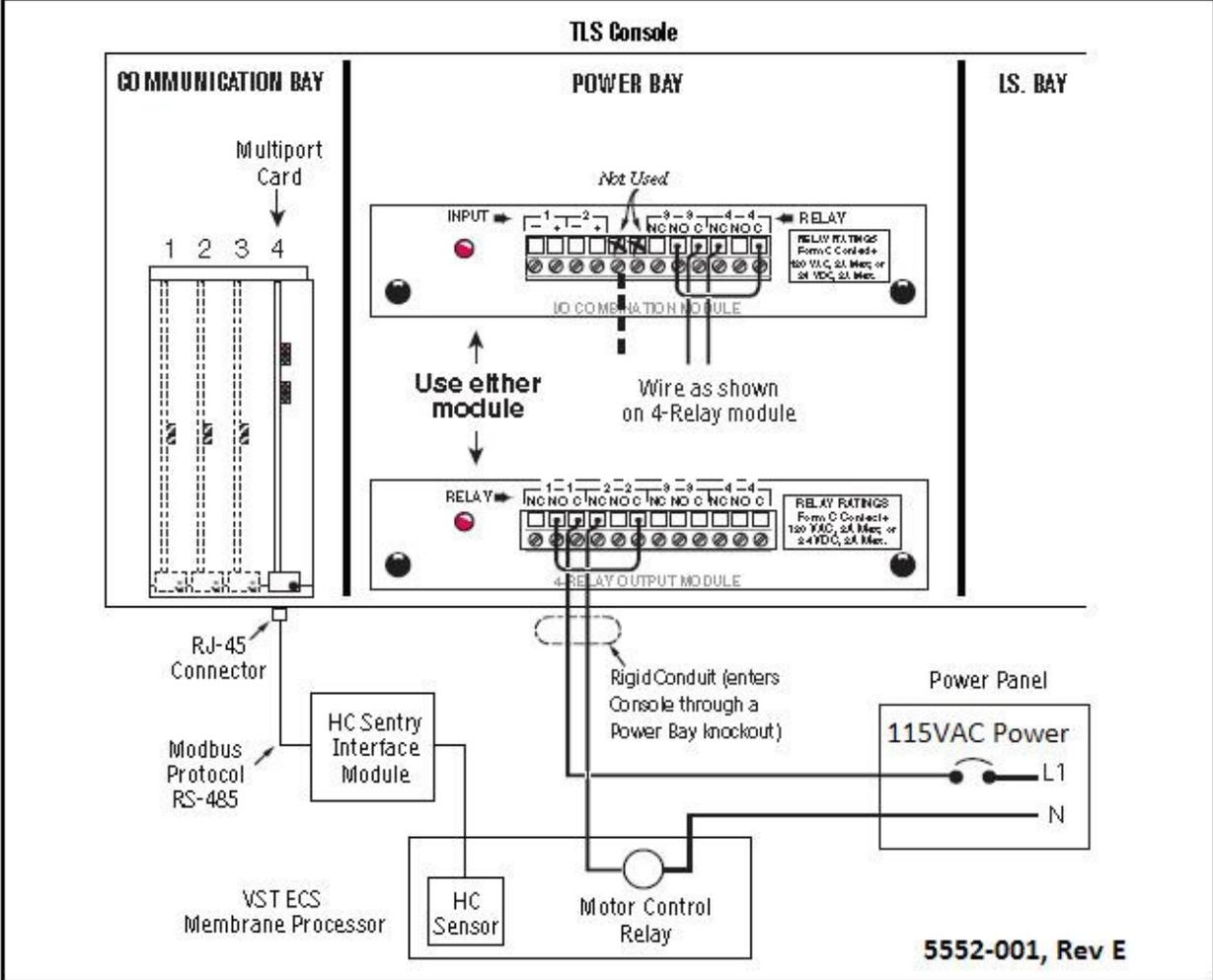
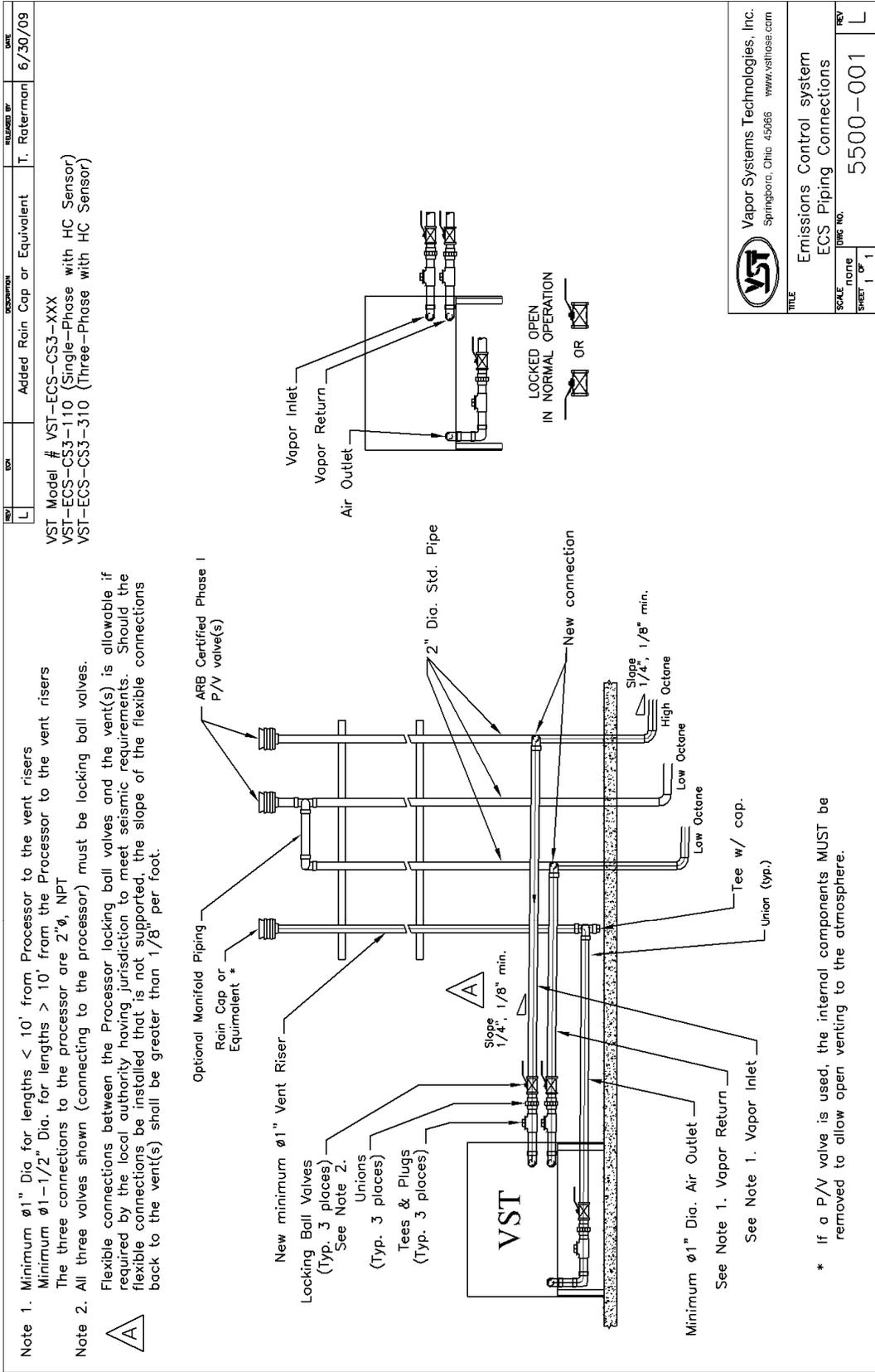


Figure 10: Wiring the Motor Starter Relay Coil

### 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.

	<b>Test</b>	<b>Page</b>
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



Vapor Systems Technologies, Inc. Springboro, Ohio 45086 www.vsttosa.com	
Emissions Control system ECS Piping Connections	
SCALE	DRAWING NO.
note 1 of 1	5500-001
SHEET	REV L

Figure 11: ECS Piping Configuration

### 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)

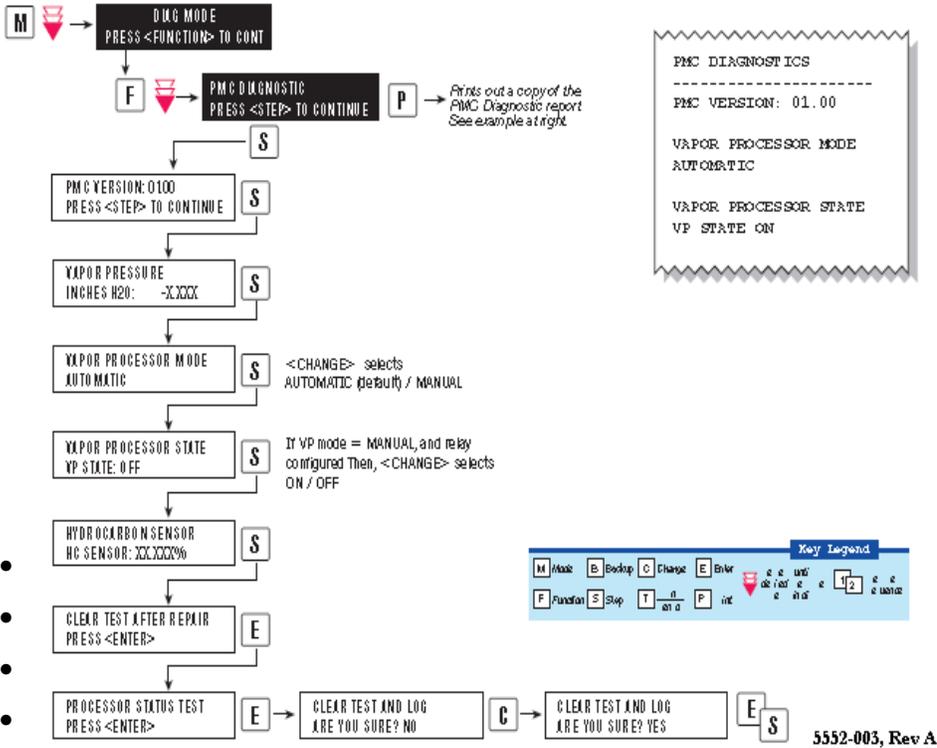


Figure 12: PMC Diagnostic Menu with PMC Software

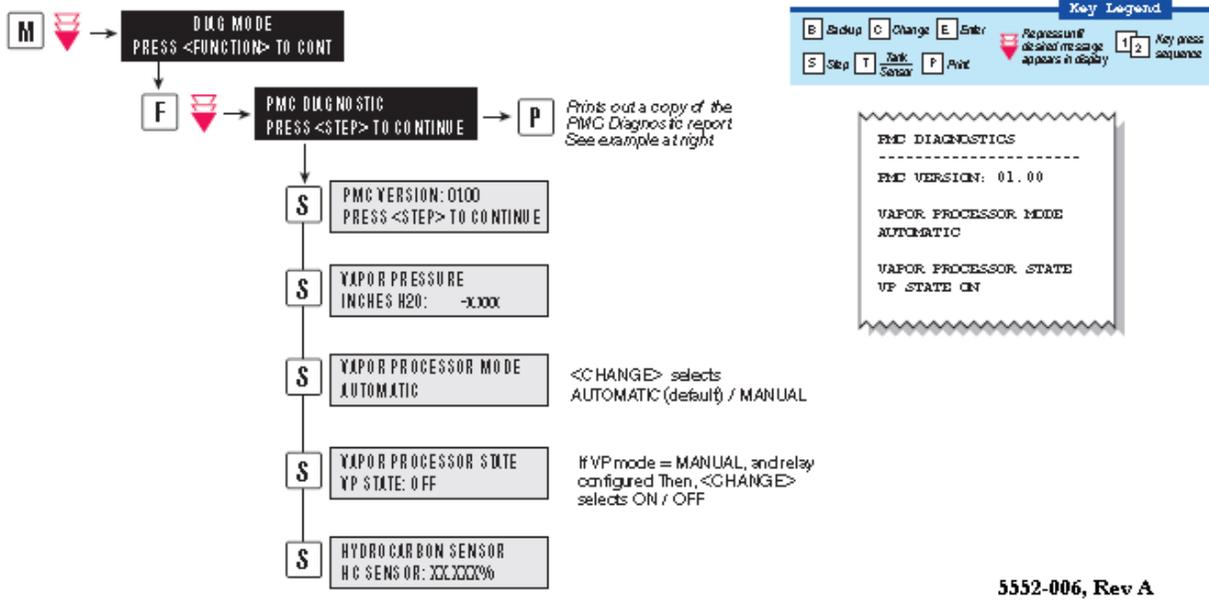


Figure 13: PMC Diagnostic with ISD Software

### 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](http://www.vsthose.com).***

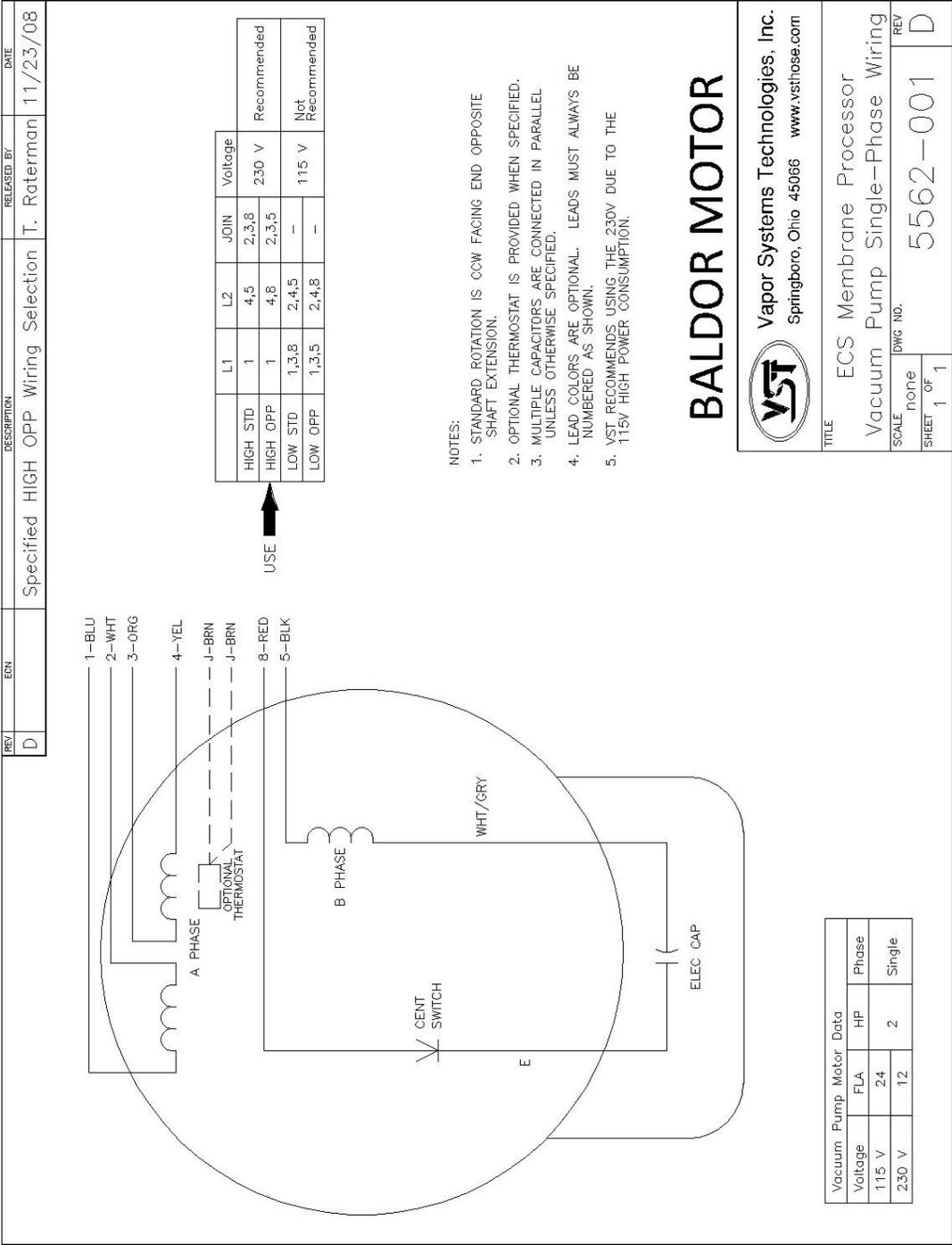


Figure 14: Vacuum Pump: Single-Phase Motor Wiring Diagram

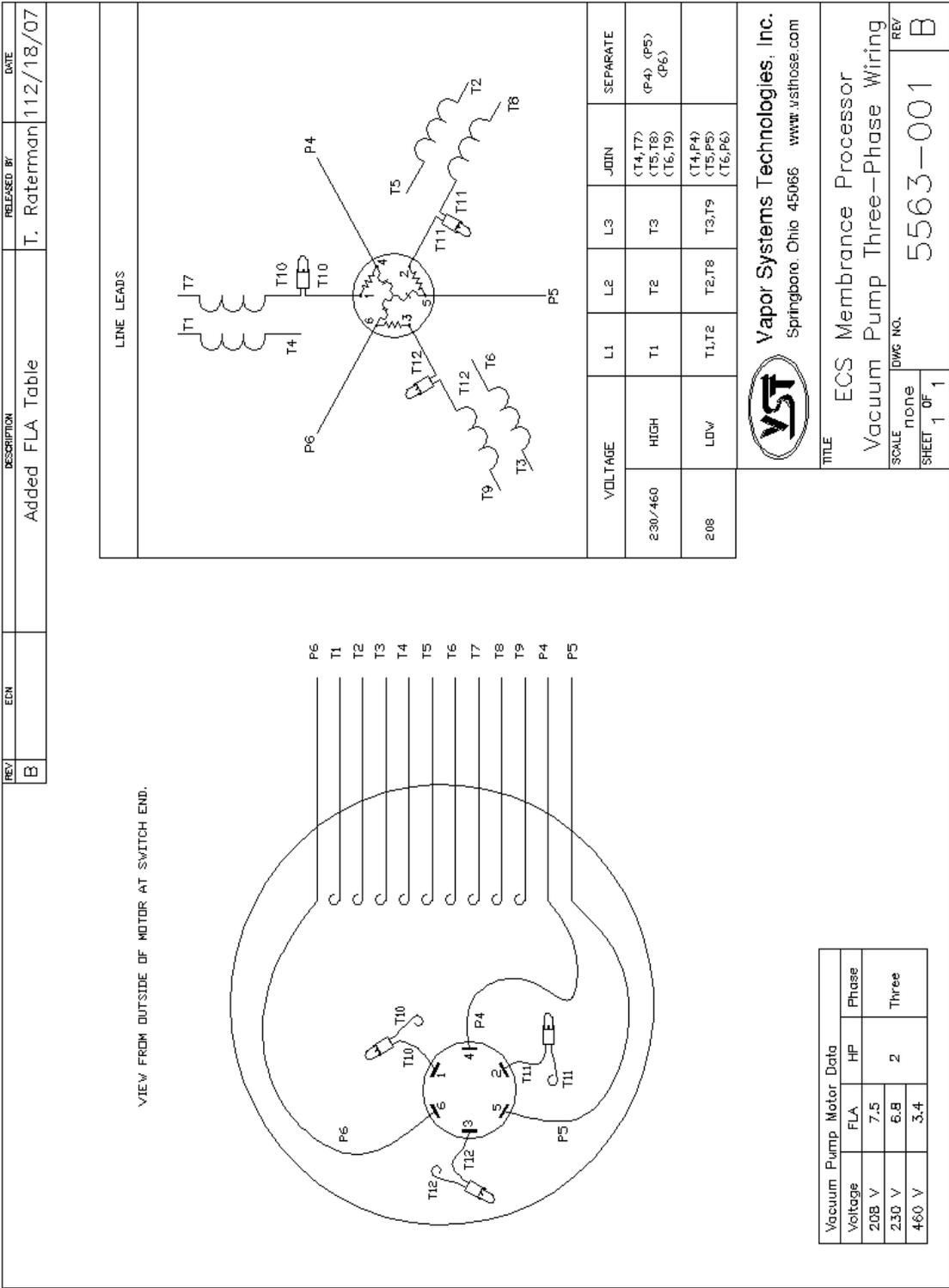


Figure 15: Vacuum Pump: Three-Phase Motor Wiring Diagram

FILENAME: 5564-001

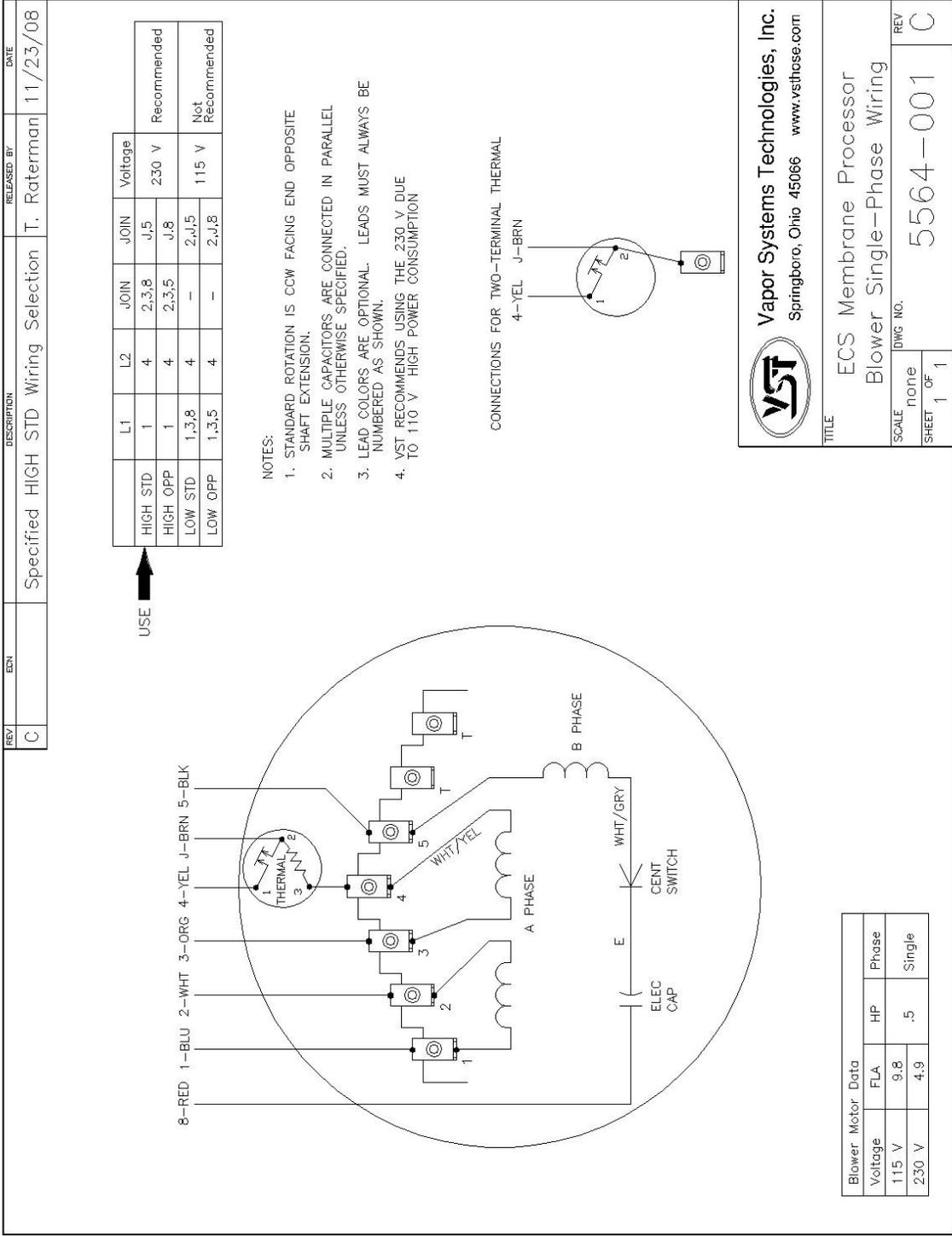
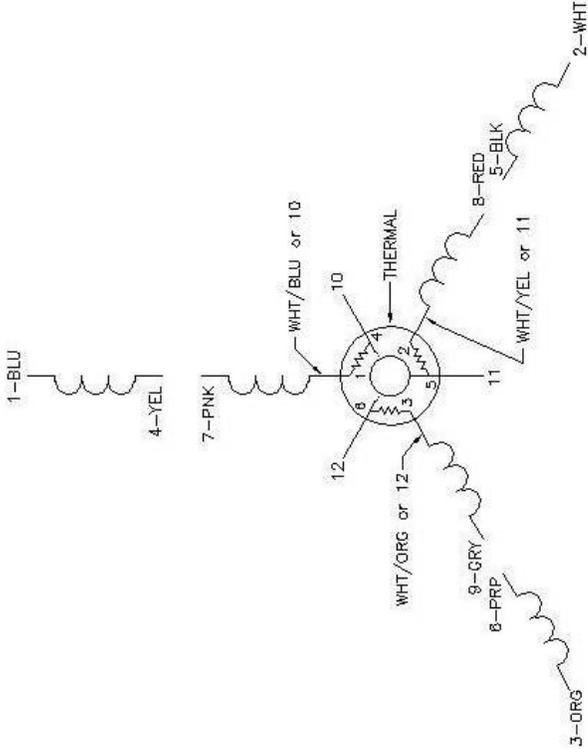


Figure 16: Blower: Single-Phase Motor Wiring Diagram

REV	EDN	DESCRIPTION	RELEASED BY	DATE
C		Revise Wiring Table	T. Raterman	11/23/08



VOLTAGE	LINE		
	L1	L2	L3
208 <2Y>	(1, 7 >	(2, 8 >	(3, 9 >
230/460 (1Y)	1	2	3

JOIN	SEPARATE
(4, 10 >	
(5, 11 >	
(6, 12 >	
(4, 7 >	(10 >
(5, 8 >	(11 >
(6, 9 >	(12 >

- NOTES:
1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
  2. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY VARY.
  3. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

**Vapor Systems Technologies, Inc.**  
Springboro, Ohio 45066 [www.vsthdsc.com](http://www.vsthdsc.com)

---

TITLE: ECS Membrane Processor  
Blower Three-Phase Wiring

SCALE	DWG NO.	REV
1 OF 1	5565-001	C

Blower Motor Data		
Voltage	FLA	HP
208 V	2.4	.5 Three
230 V	2.2	
460 V	1.1	

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.



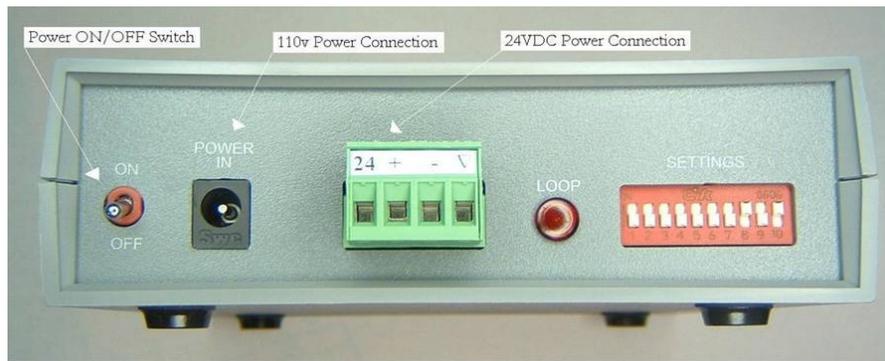
Figure 18: Heat Trace Circuit Test

### 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](http://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](http://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
<b>IN THE PMC SET UP MENU</b>	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:	
<b>Notes:</b> 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"> <li>• Make sure the plugs are installed on the 3 tees at the <i>Processor</i>.</li> </ul>
2.	<ul style="list-style-type: none"> <li>• Make sure all 3 valves are locked in the OPEN position at the <i>Processor</i>.</li> </ul>
3.	<ul style="list-style-type: none"> <li>• Make sure power is on to the:                             <ul style="list-style-type: none"> <li>▪ Heat-trace cable</li> <li>▪ HC sentry</li> <li>▪ HC sensor</li> <li>▪ ECS vacuum pump</li> <li>▪ ECS recirculation blower</li> </ul> </li> </ul>
4.	<ul style="list-style-type: none"> <li>• Make sure the pressure sensor is operational.</li> </ul>
5.	<ul style="list-style-type: none"> <li>• Make sure that the GDF is vapor tight. (TP 201.3 and Exhibit 4)</li> </ul>
6.	<ul style="list-style-type: none"> <li>• After the TLS is installed and configured and all EVR equipment has been installed, the <i>Processor</i> can become operational.</li> <li>• Put the TLS in the AUTOMATIC MODE.</li> <li>• If the pressure is above +0.2" WC, the <i>Processor</i> will start and the auxiliary relays will close.</li> <li>• 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.</li> </ul>
<p><b>NOTE:</b> 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

<b>Annual System Compliance Testing</b>	
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 Processor 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><b>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.</b></p>	

5.2 Annual Inspections and Replacements

Annual 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 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
<b>PROCESSOR</b>				
<ul style="list-style-type: none"> <li>Inspect drive coupling on the vacuum pump.</li> </ul>	Yearly		[ ]	
<ul style="list-style-type: none"> <li>Check the continuity of the heat trace cable.</li> </ul>			[ ]	
<b>RECIRCULATION BLOWER</b>				
Replace every 10 years or 15,000 hours, whichever comes first.			[ ]	
<b>VACUUM PUMP</b>				
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

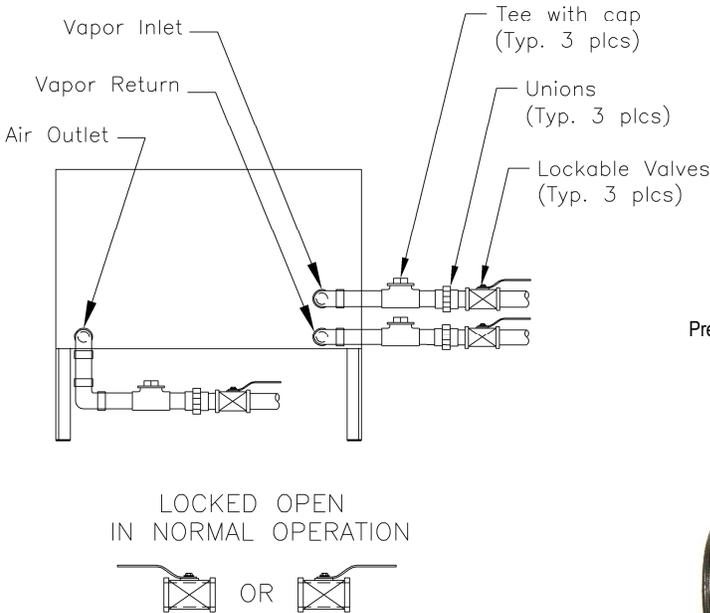


Figure 23: Processor Inlets & Outlets

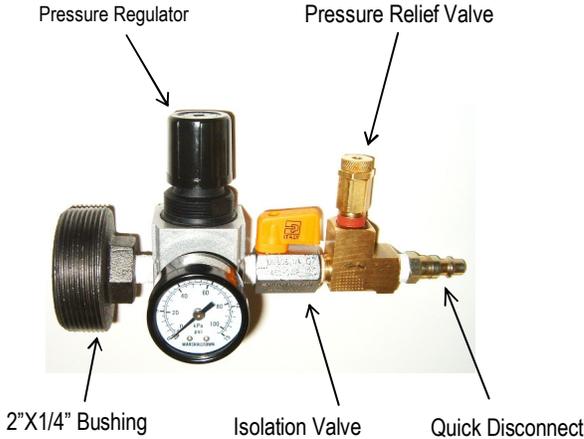


Figure 24: Typical leak-check fixture

## 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.**

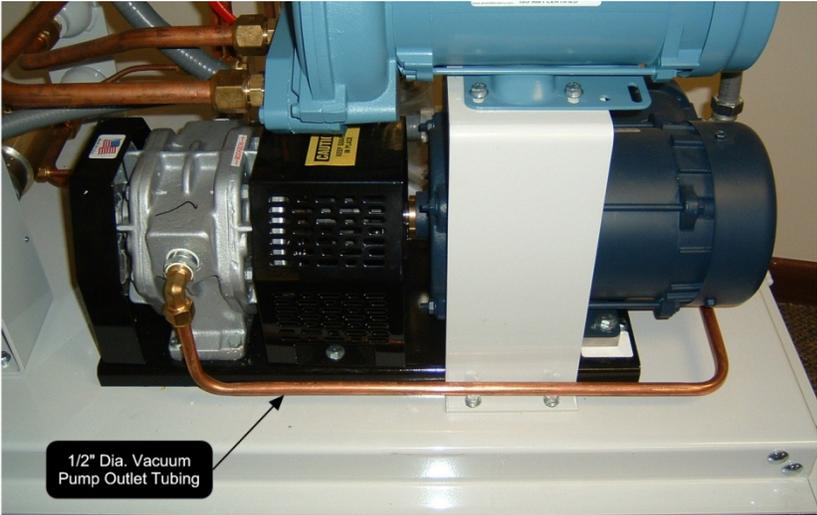


Figure 27: Vacuum pump outlet tubing connection

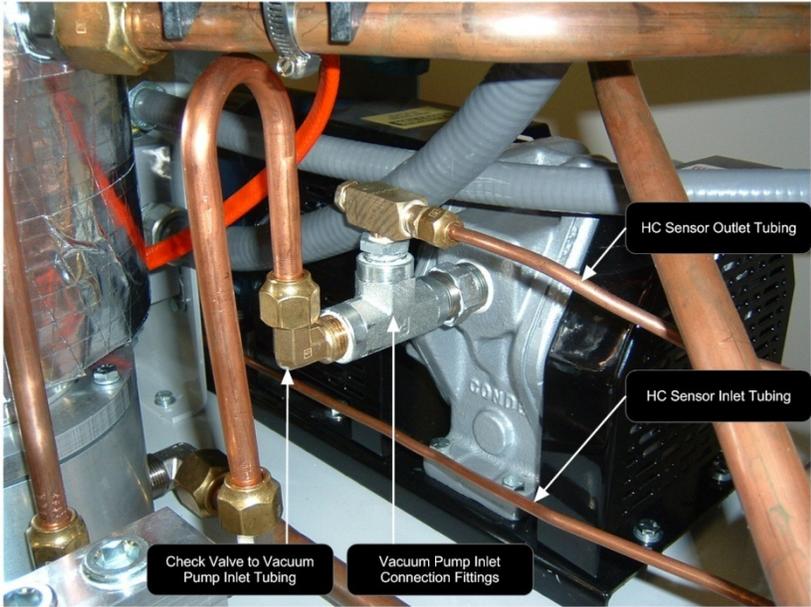


Figure 28: Vacuum pump inlet tubing and fittings

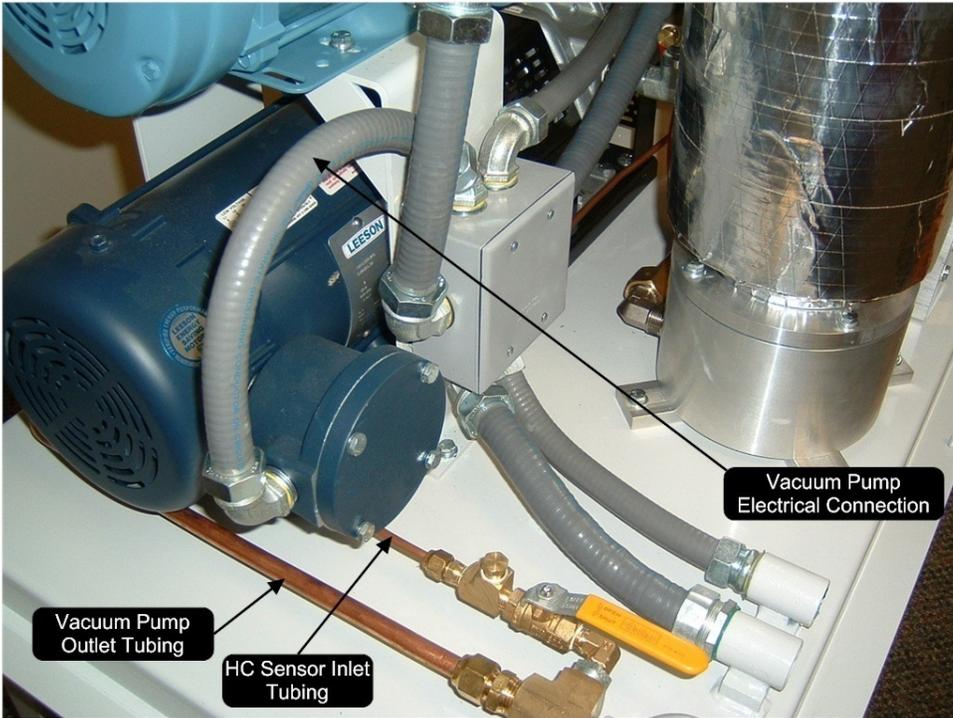


Figure 29: Vacuum pump electrical connection / vacuum pump outlet tubing / HC sensor inlet tubing

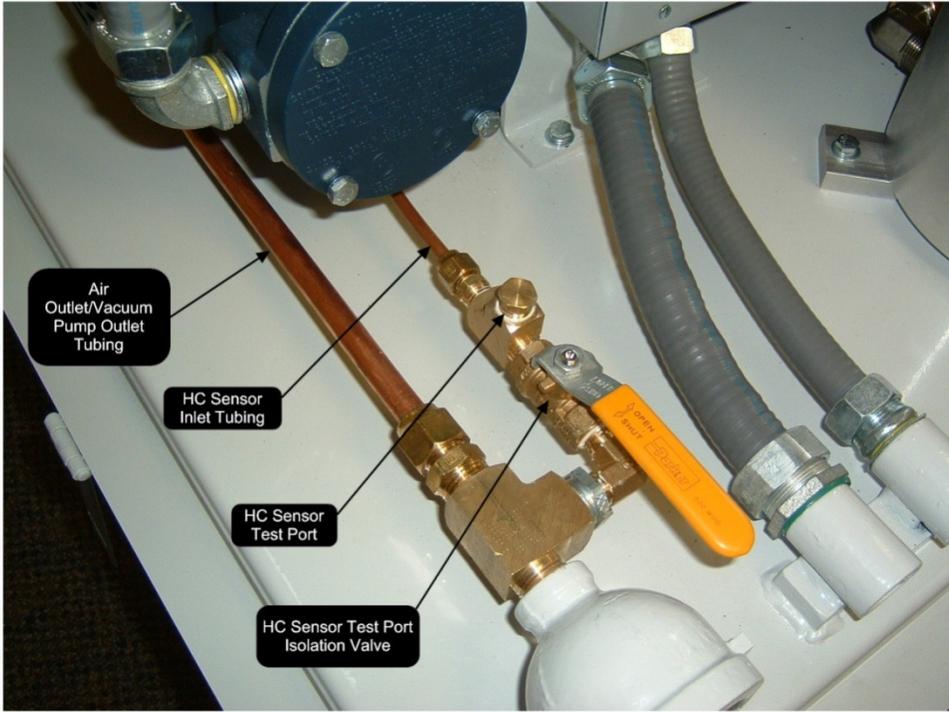


Figure 30: Air outlet / vacuum pump outlet / HC sensor inlet tubing

## 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 1/2" outlet tubing.
  - See Figure 27.
- Completely remove the vacuum pump 1/2" and 1/4" inlet 45° flare tubing and all pipe fittings connected to the vacuum pump.
  - See Figure 29.
- Completely remove the 1/4" 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

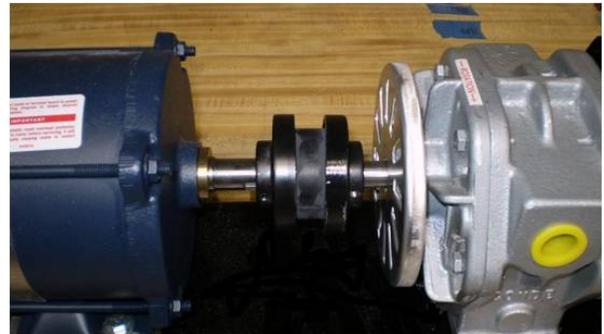
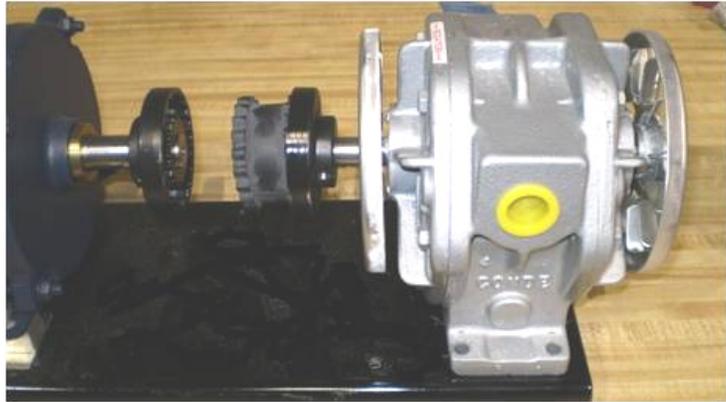


Figure 35: Vacuum pump with guard removed

Continued next page . . .

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.

continued next page . . .

15. 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

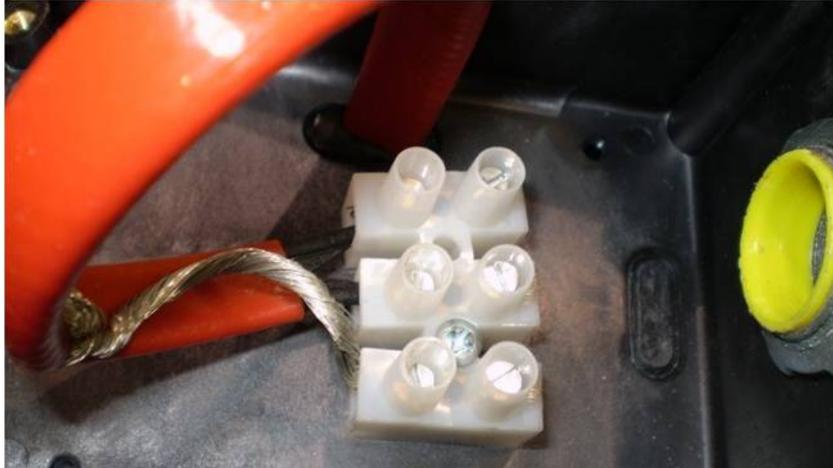


Figure 39: Termination block inside the electrical junction box



Figure 40: Seam to cut to remove the insulation



Figure 41: End seal kit components

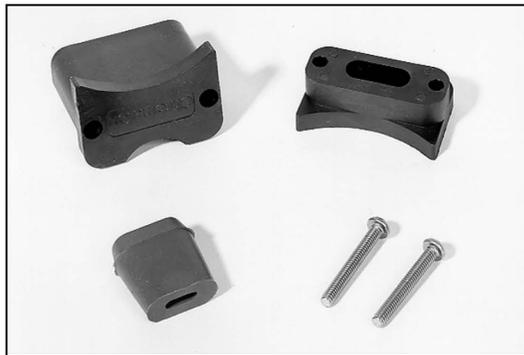
- Connection screws
- End cap
- Grommet
- Pressure plate
- Heat trace cable

# Chromalox®

## 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.

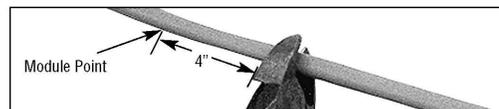


Figure 1

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.

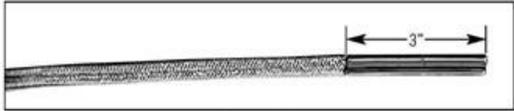


Figure 2

- 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.

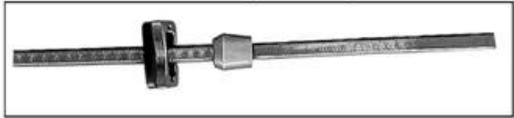


Figure 3

- 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.

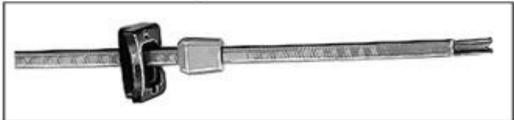


Figure 5

- 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.

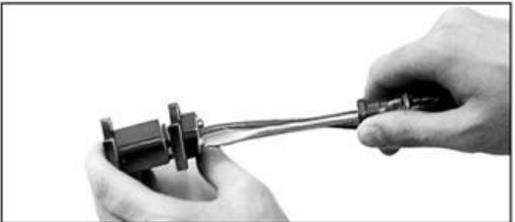


Figure 7

- 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.

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.

W2008M

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

98 - 068  
TA - Q4 - EF  
Litho in U.S.A.

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

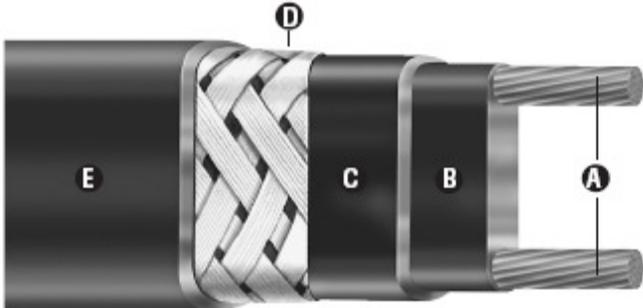


Figure 44: Prepare the new heat trace cable for installation into the end seal kit

- 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

# Chromalox<sup>®</sup>

## 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:<br>Base - Box - Lid - Hardware | 1 - Mounting Screw for Terminal Block |
| 1 - Three Position 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.

**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.

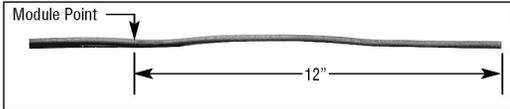


Figure 1

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

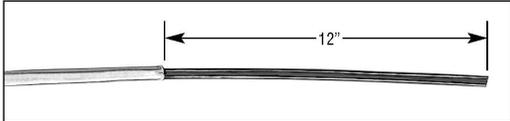


Figure 2

- 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.

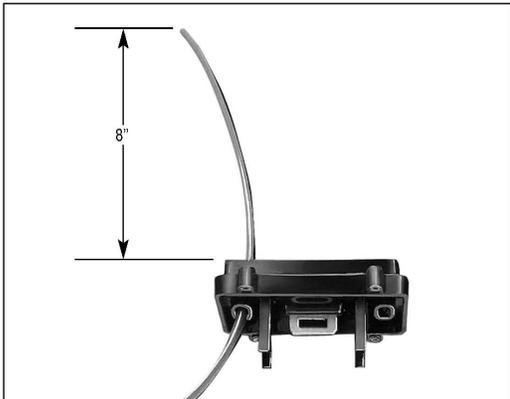


Figure 3

- 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.**

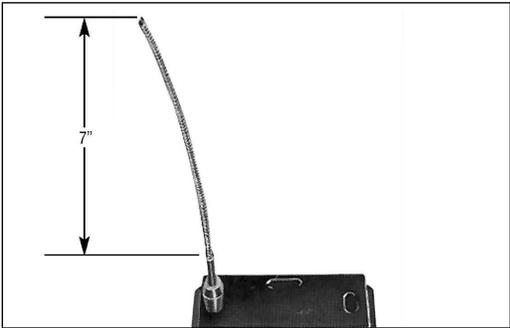


Figure 5

- 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.

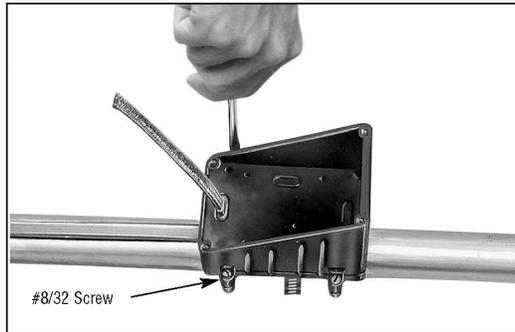


Figure 6

Figure 46: Electrical junction box installation instructions, page 2 of 4

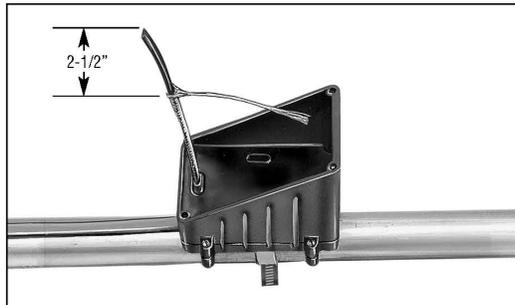
**INSTALLATION**

- 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.



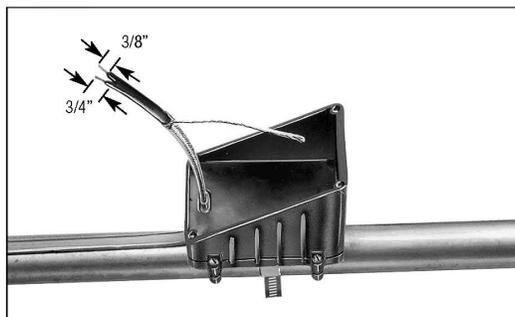
**Figure 7**

- 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**

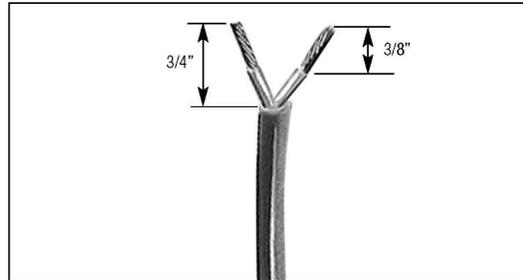
- 9. FOR SELF-REGULATING CABLES:**  
Using standard electrical cutters, cut a 3/4 inch long notch out of the cable between the conductor wires. Bare a 3/8 inch length of each conductor by stripping off the outside insulation and the inner black core material. See Figure 9.



**Figure 9**

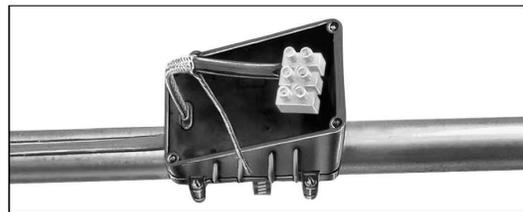
- 10. FOR CONSTANT WATTAGE CABLES:**  
Score the outer jacket 3/4 inch from the end of the cable and remove the jacket. Cut off the exposed nichrome wire, pushing any remainder back under the jacket. These cables have an inner layer of insulation which is also to be removed as

described above. Separate the buss wires and strip off the last 3/8 inch of insulation from both buss wires. See Figure 10.



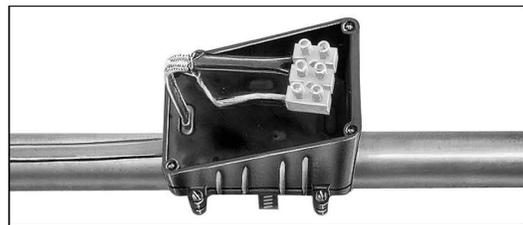
**Figure 10**

- 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.



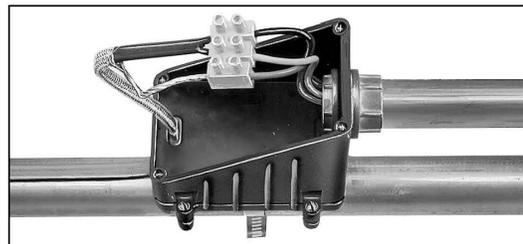
**Figure 11**

- 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.

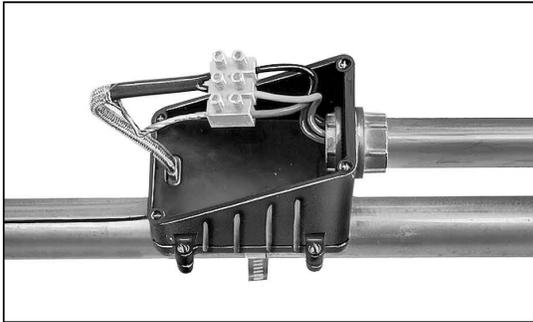


Figure 14

**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.

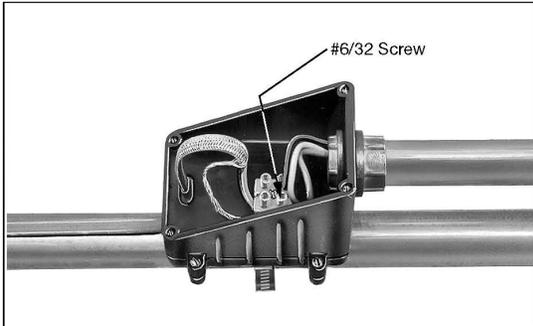


Figure 15

**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 expens-

es 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.

W2008M

**Chromalox®**  
**PRECISION HEAT AND CONTROL**

1382 HEIL QUAKER BLVD., LAVERGNE, TN 37086  
Phone: (615) 793-3900 www.chromalox.com

98 - 025  
TA - Q4 - EF  
Litho in U.S.A.

Figure 48: Electrical junction box installation instructions, page 4 of 4



*Figure 49: End seal kit location and heat trace cable installation*



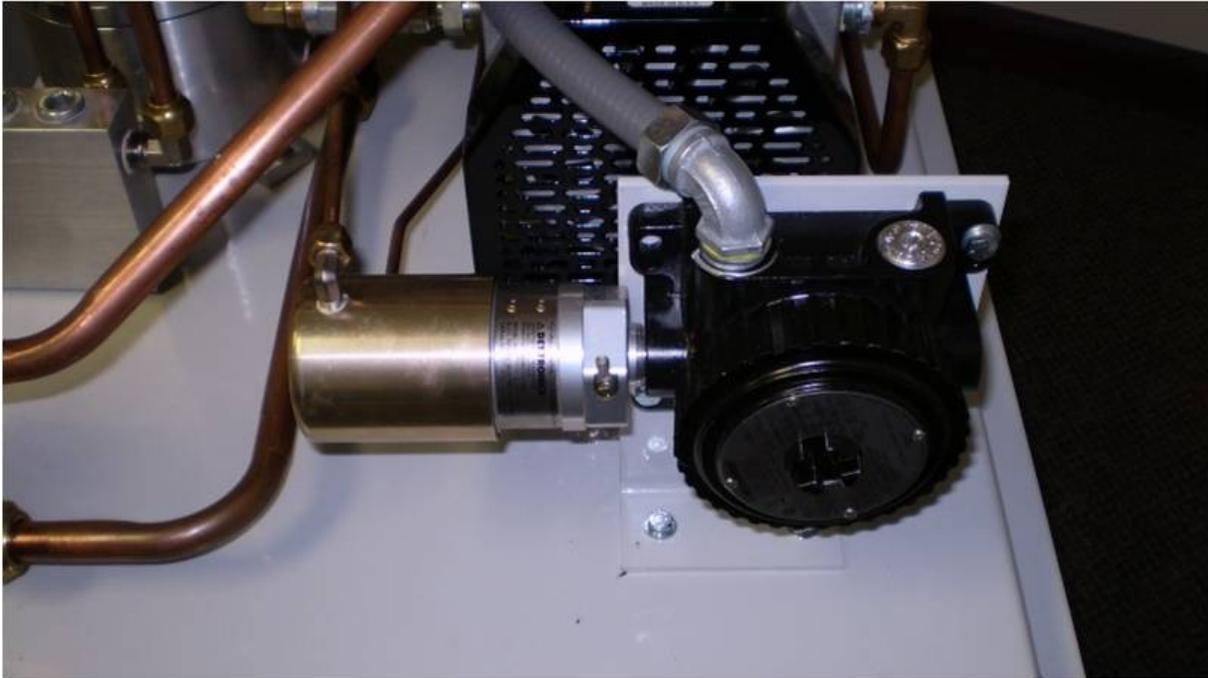
**Figure 50: Installed electrical junction box with electrical connections**

## 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.

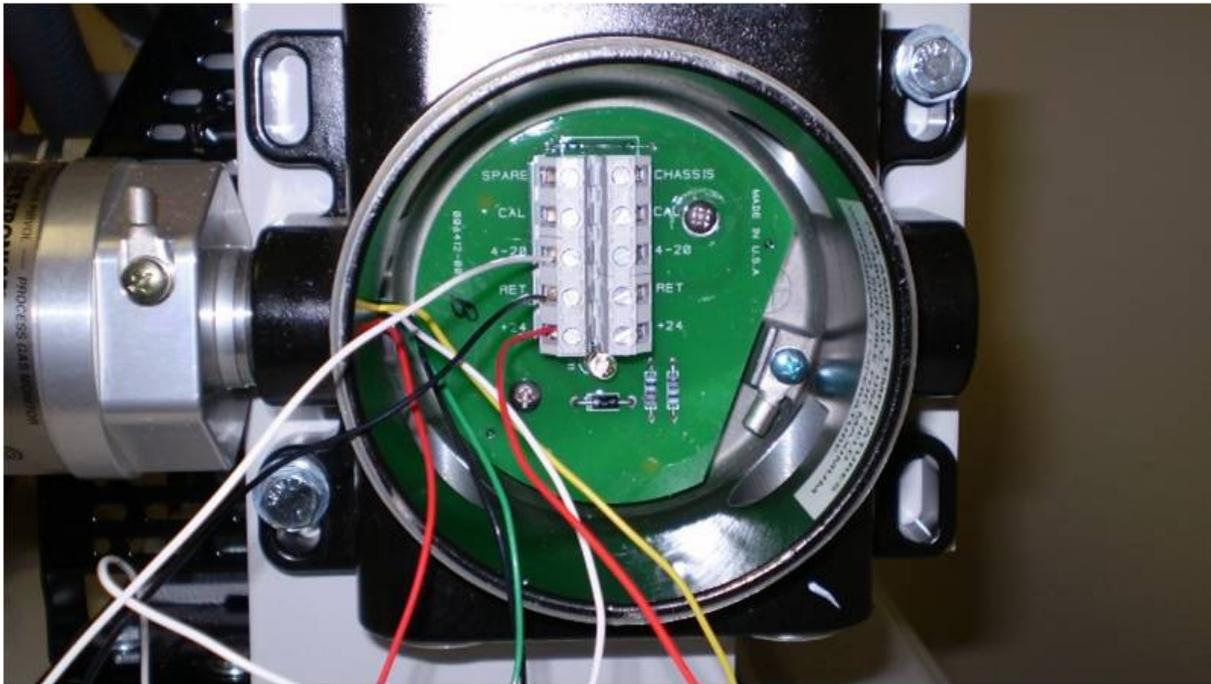


Figure 53: HC IR Sensor Electrical Housing Circuit Board

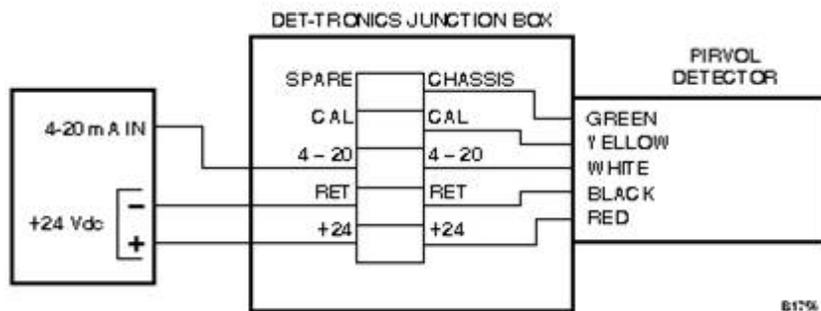


Figure 54: HC IR Sensor Electrical Housing Circuit Board Wiring Diagram

### 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.

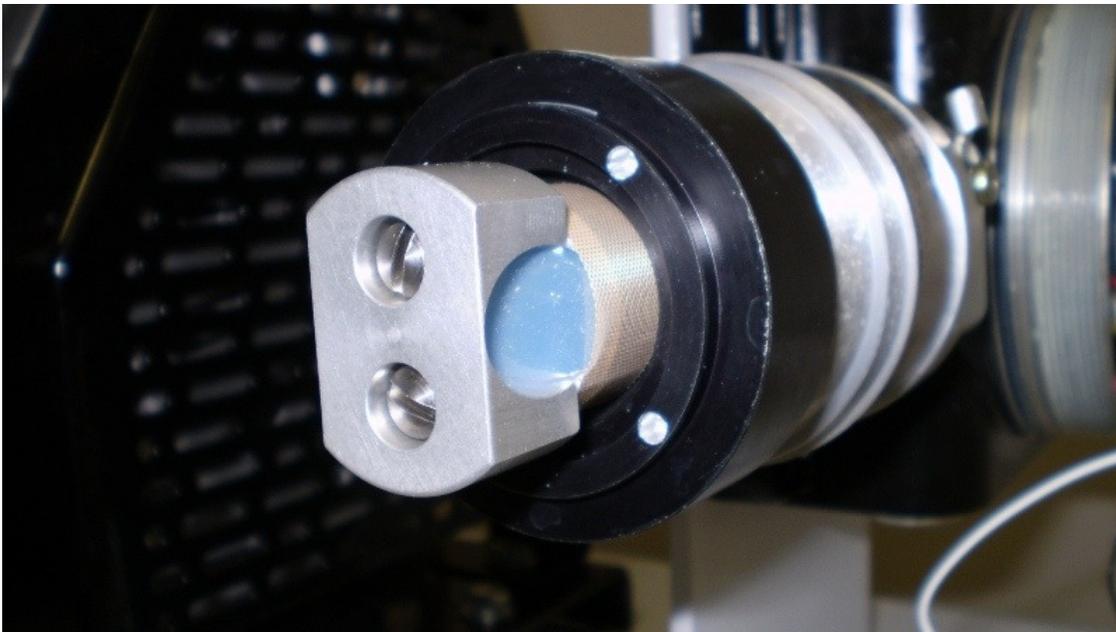


Figure 55: HC IR sensor installation orientation

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

<b>Preventative Maintenance</b>		
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:		
<b>Notes</b>		
<b>Use the form on the following page to note details of Preventative Maintenance activities.</b>		

13.2 Preventative Maintenance Checklist Form

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

# Pressure Management Control

## Install, Setup, & Operation Manual

*For VST ECS Membrane Processors*



# 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.

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.

## **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.

**WARRANTY - Please see next page, iii.**

©Veeder-Root 2010. All rights reserved.

# Warranty

---

## **TLS-350R, TLS-350 PLUS, TLS-350J AND TLS-300I/C, AND TLS-2 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 AND FUSES ARE NOT COVERED UNDER WARRANTY.**

**We shall not be responsible for any expenses incurred by the user.**

**This warranty applies only when the product is installed in accordance with Veeder-Root's specifications, and 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.**

**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 fifteen (15) months from date of invoice. We will repair or replace the product if the product is returned to us; transportation prepaid, within the warranty period, and is determined by us to be defective. 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.**

**We shall not be responsible for any expenses incurred by the user.**

## Introduction

Site Requirements .....	1
Contractor Certification Requirements .....	1
Related Manuals .....	3
Safety Precautions .....	3

## Installation

Installing TLS Console Modules - General Notes .....	4
Circuit Directory .....	5
Vapor Pressure Sensor .....	5
Smart Sensor Interface Module .....	5
NVMEM203 Board .....	6
Probe Interface Module .....	6
I/O Combination or 4-Relay Module .....	6
Multiport Card for Vapor Processor Communication .....	6
TLS Console with VST ECS Membrane Processor .....	6

## Setup

Introduction .....	8
Smart Sensor Setup .....	8
Output Relay Setup - VST ECS Membrane Processor .....	9
PMC Setup .....	10

## Operation

Alarms .....	11
Overview of TLS console Interface.....	11
Warning Posting .....	12
Alarm Posting .....	12
PMC Alarm Summary .....	13
PMC Status Report .....	14
Viewing PMC Reports Via RS-232 Connection .....	14
Connecting Laptop to Console .....	14
Connecting Laptop to Console .....	15
Sending Console Commands.....	18

## Diagnostics

Automatic Control .....	22
Manual control .....	22
PMC Diagnostic Menu .....	22

## Figures

Figure 1. TLS console Interface Module Bays.....	4
Figure 2. VST ECS Membrane Processor Connections to TLS Console.....	7
Figure 3. Smart Sensor Setup .....	8
Figure 4. Output Relay Setup for VST ECS Membrane Processor .....	9
Figure 5. Output Relay Setup Printout Examples for TLS Console Controlled Processor.....	9
Figure 6. PMC Setup .....	10
Figure 7. TLS console alarm interface.....	11
Figure 8. TLS console warning example .....	12
Figure 9. TLS console alarm example.....	12
Figure 10. PMC Status Report .....	14
Figure 11. Connecting laptop to TLS console for serial communication .....	15
Figure 12. Connection Description window .....	16

Figure 13.	Connect To window.....	16
Figure 14.	Console comm port settings printout example .....	17
Figure 15.	HyperTerminal main window .....	18
Figure 16.	Vapor Processor Status Report Details - Serial to PC Format .....	19
Figure 17.	Vapor Processor Runtime Diagnostic Report - Serial to PC Format.....	20
Figure 18.	Percent Hydrocarbon Diagnostic Report - Serial to PC Format.....	21
Figure 19.	Priority Alarm History Report - Serial to PC Format.....	21
Figure 20.	PMC Diagnostic Menus.....	22

## Tables

Table 1.	Related Manuals .....	3
Table 2.	TLS-350 (PMC) Alarm Troubleshooting Summary .....	13
Table 3.	Serial Commands for PMC Diagnostic Reports .....	19

## Introduction

This manual provides instructions to install, setup, and operate the components of Veeder-Root Pressure Management Control (PMC) equipment. The PMC feature is an option for the TLS console platform, and as such, many of the installation/setup/operation instructions for non-PMC specific tasks are covered in TLS-3XX supplied literature. Do not use this manual when PMC is installed with ISD. Use the ISD Setup & Operation Manual, 577021-800.

## Site Requirements

---

Below are the requirements for all PMC installations:

- V-R TLS-350R/EMC w/BIR, TLS-350 Plus/EMC Enhanced, TLS-350/EMC and ProMax consoles with ECPU2 - install as per TLS-3XX Site Prep manual, setup following instructions in TLS-3XX System Setup Manual.
- A flash memory board (NVMEM203) for PMC 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.
- Smart Sensor Module and Vapor Pressure Sensor. Install and connect following instructions in the Vapor Pressure Sensor installation Guide.
- Multiport card connected to a hydrocarbon sensor module installed according to processor manufacturers specifications.
- A 4-Relay or I/O Combination Module to control the vapor processor motor and setup as instructed in this manual.
- An RS-232 Port will be available for use by contractor or government inspectors.

## 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; tank and line preparation; and line leak detector installation.

**TLS-350 Technician (Level 2/3 or 4) Certification:** Contractors holding valid TLS-350 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-300 or TLS-350 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

**In-Station Diagnostics (ISD-PMC) Technician Certification:** ISD PMC Contractors holding a valid ISD/PMC Certification are approved to perform (ISD/PMC) installation checkout, startup, programming, and operations training. This training also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current Veeder-Root Technician Certification is a prerequisite for the ISD/PMC course.

**Veeder-Root ISD/PMC Including Carbon Canister Vapor Polisher Contractor Certification:** This Certification includes Executive Orders 203, 204 and the Veeder-Root Vapor Polisher. This certification is required for setup and service of the Veeder-Root Vapor Polisher.

**Warranty Registrations** may only be submitted by selected Distributors.

## Related Manuals

The manuals in Table 1 below are shipped with the equipment on the V-R Tech Docs CD-ROM and will be needed to install specific equipment.

**Table 1. Related Manuals**

V-R Manual	Part Number
TLS-3XX Site Prep Manual	576013-879
Vapor Pressure Sensor Installation Guide	577013-797
TLS-3XX Series Consoles System Setup Manual	576013-623
TLS-3XX Series Consoles Operator's Manual	576013-610
Serial Comm Modules Installation Guide	577013-528
TLS-350 Series Board and Software Replacement Manual	576013-637

## Safety Precautions

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

 <p><b>ELECTRICITY</b> High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p><b>TURN POWER OFF</b> Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>
 <p><b>READ ALL RELATED MANUALS</b> Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>	 <p><b>WARNING</b> Heed the adjacent instructions to avoid equipment damage or personal injury.</p>

<b>! WARNING</b>	
 	<p><b>The console contains high voltages which can be lethal. It is also connected to low power devices that must be kept intrinsically safe.</b></p> <p><b>Turn power Off at the circuit breaker. Do not connect the console AC power supply until all devices are installed.</b></p> <p><b>Touching a live circuit can cause electrical shock that may result in serious injury or death.</b></p>

## Installation

This section discusses the installation and wiring of the hardware required to enable the TLS console to perform pressure management of the site's gasoline vapor processor equipment:

- Vapor Pressure Sensor
- Smart Sensor Interface Module
- NVMEM203 board
- Multiport Card
- 4-Relay or I/O Combination Module



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).

### Installing TLS Console Modules - General Notes

TLS consoles have three bays in which interface modules can be installed; Comm bay, Power bay and Intrinsically-Safe bay (ref. Figure 1). Probe Interface modules and Smart Sensor modules are installed in the Intrinsically-Safe bay and the Mod Bus module is installed in the Comm bay.

**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.**



Switch off power to the TLS console before you install modules and connect sensor wiring.

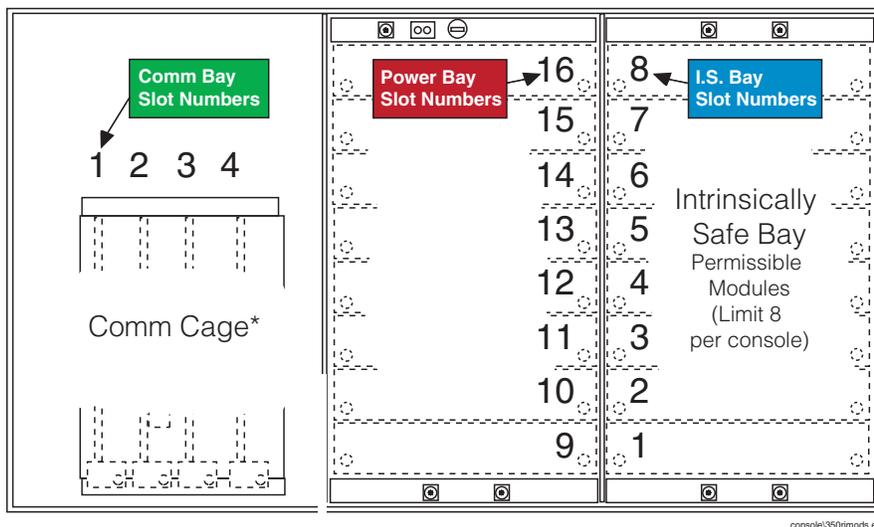


Figure 1. TLS console Interface Module Bays



**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 TLS console will not identify correctly 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., VPS: FP1&2.

## 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 Vapor Pressure Sensor Installation guide (P/N 577013-797).

## Smart Sensor Interface Module

---

The Smart Sensor Interface Module 8 input or 7 input w/embedded pressure versions monitor the 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 the sensor following instructions in the Vapor Pressure Sensor manual. 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 PMC software. No setup is required.

## 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 2.

## Multiport Card for Vapor Processor Communication

---



A Multiport card is needed for RS-485 communication with the TLS console and is required with VST ECS membrane processor installations. Verify that a Multiport card is installed in slot 4 of the card cage in the communications bay of the TLS console (ref. Figure 2). 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 2. Program the card as instructed in this manual.

## TLS Console with VST ECS Membrane Processor

---

Figure 2 shows the interconnection wiring between a TLS console and a VST ECS Membrane Processor.

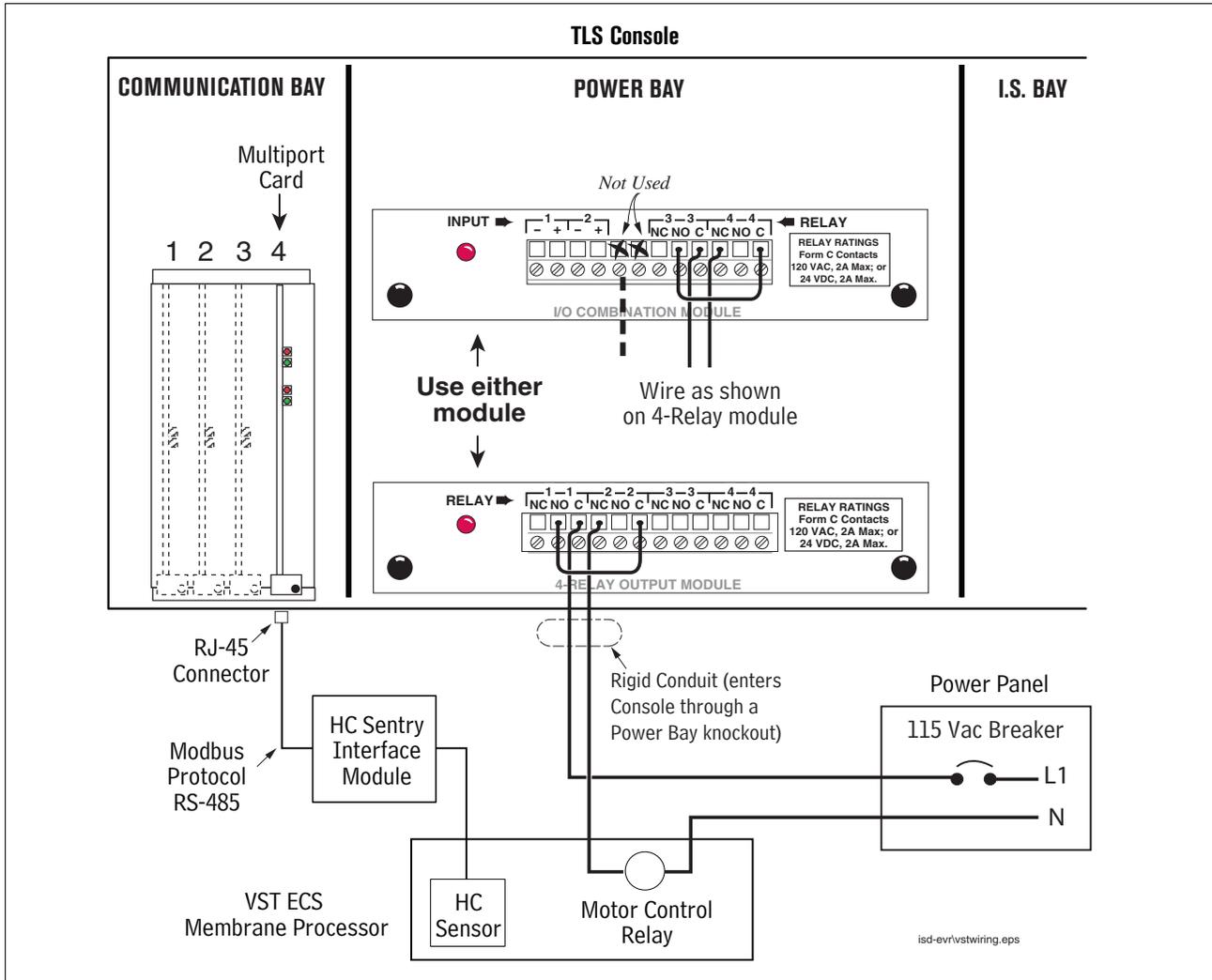


Figure 2. VST ECS Membrane Processor Connections to TLS Console

# Setup

## Introduction

This section describes how to perform PMC setup 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 PMC-related equipment must be installed in 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 console may not operate properly. 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.

## Smart Sensor Setup

The Smart Sensor Interface Module is installed in the Intrinsically-Safe bay of the TLS console. This module monitors the Vapor Pressure Sensor. Figure 3 diagrams the Smart Sensor setup procedure.

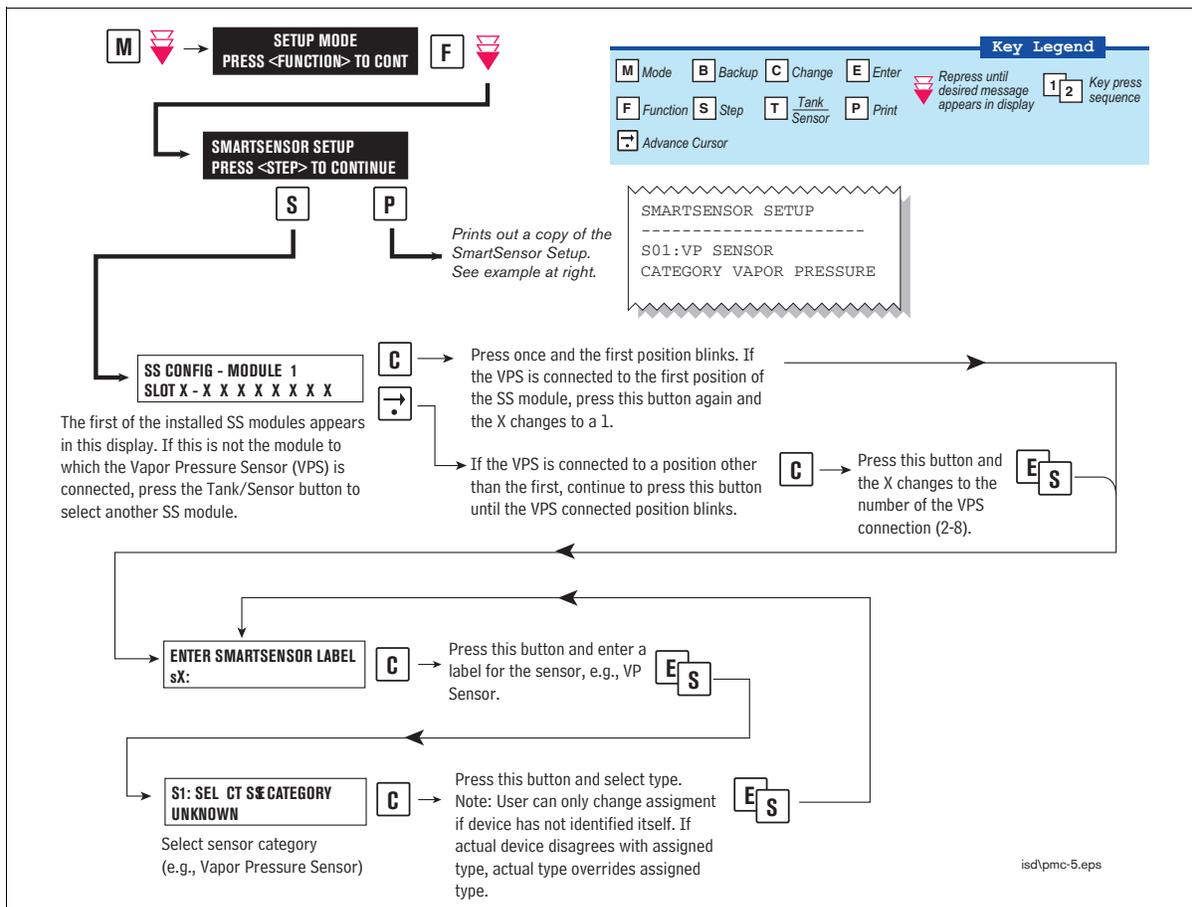


Figure 3. Smart Sensor Setup

## 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 4.

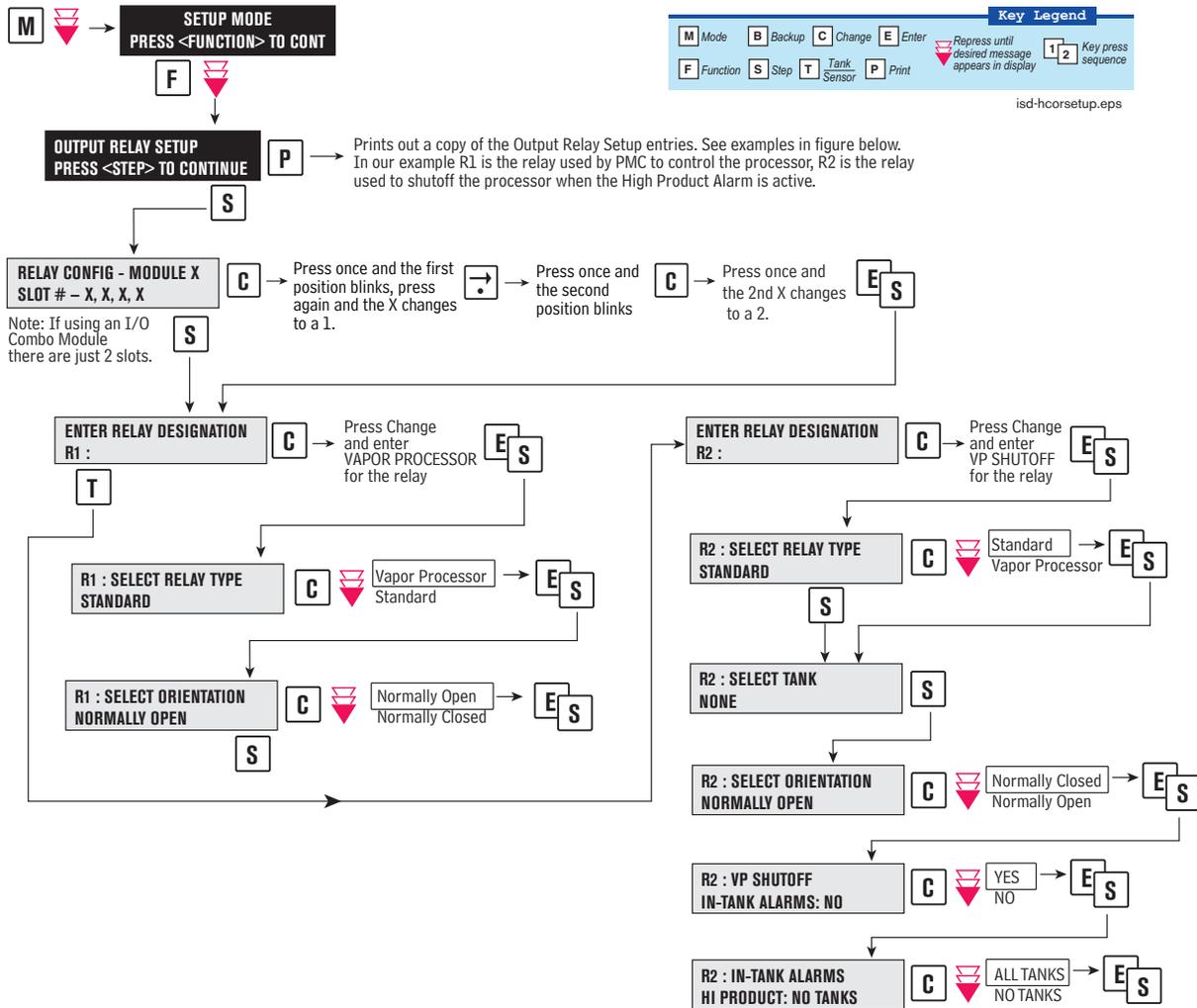


Figure 4. Output Relay Setup for VST ECS Membrane Processor

Figure 5 shows example setup printouts of the Output Relays setup.

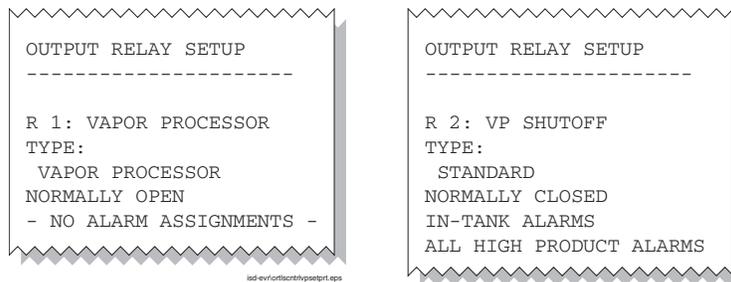


Figure 5. Output Relay Setup Printout Examples for TLS Console Controlled Processor

# PMC Setup

Figure 6 diagrams the PMC setup programming.

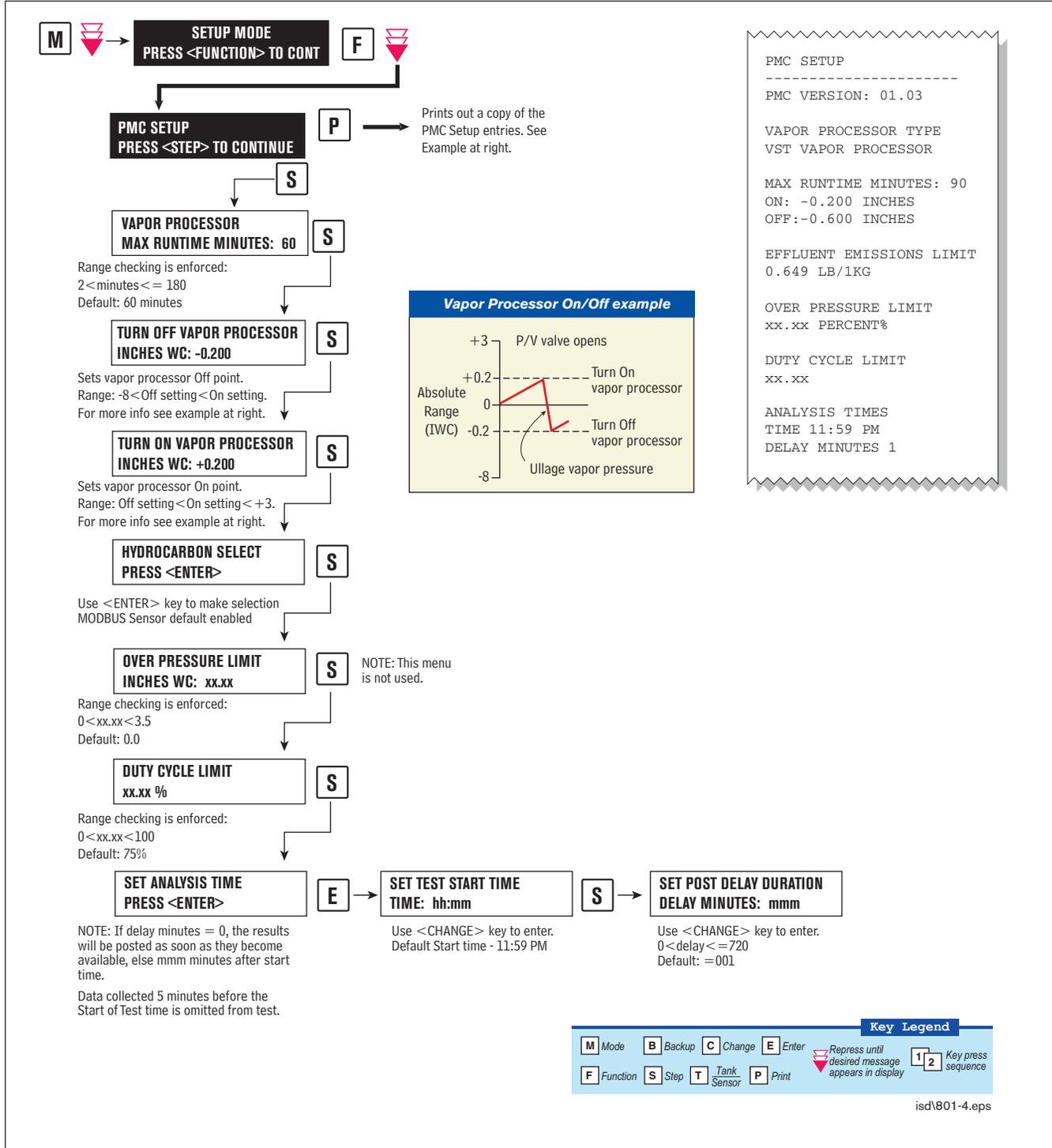


Figure 6. PMC Setup

# Operation

## Alarms

### OVERVIEW OF TLS CONSOLE INTERFACE

The TLS console is continuously monitoring the vapor recovery system and PMC sensors for alarm conditions. During normal operation when the TLS console and monitored PMC equipment 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 7).

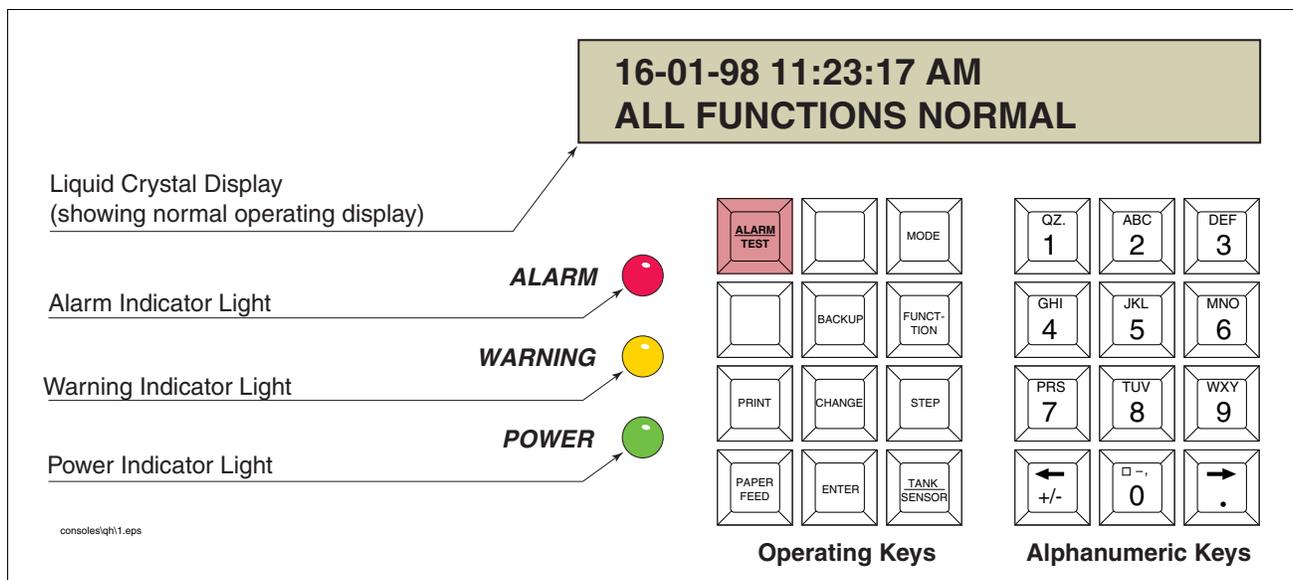


Figure 7. TLS console alarm interface

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.

### WARNING POSTING

Displayed messages alert you to the type of warning. Printed messages show the type of warning and the time the warning was posted (see Figure 8). Warnings are logged into the Non-Priority Alarm History in the TLS.

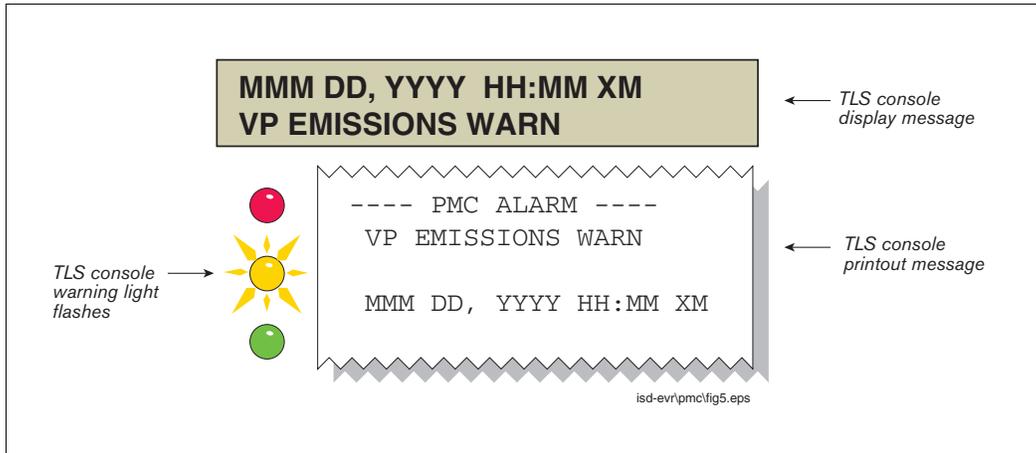


Figure 8. TLS console warning example

### ALARM POSTING

Displayed Messages alert you to the type of alarm. Printed messages show the type of alarm and the time the alarm was posted. Alarm example in Figure 9. PMC Alarms are logged into the Priority Alarm History in the TLS.

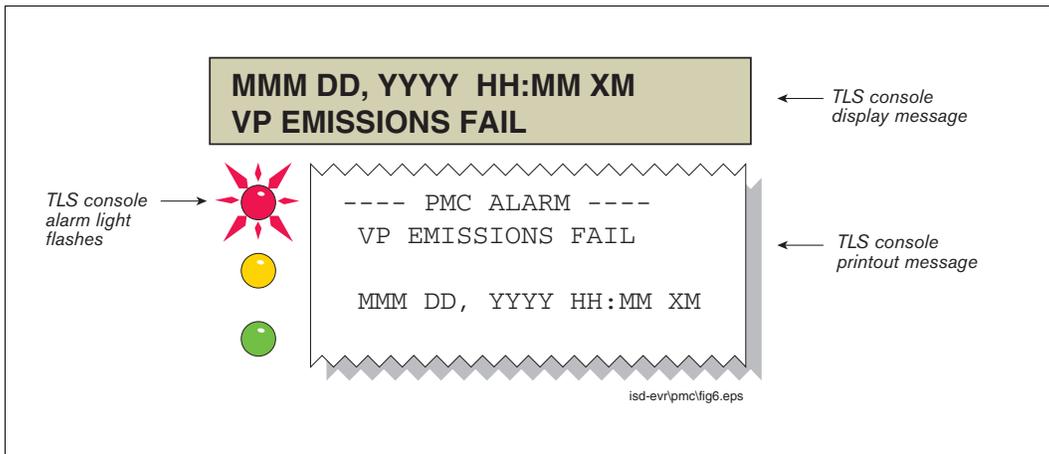


Figure 9. TLS console alarm example

## PMC Alarm Summary

Table 2 contains a listing of the PMC generated alarms including their displayed message and cause. TLS Console PMC alarms may be interspersed amongst non-PMC alarms, please see TLS-350 Series manuals for more information..

**Table 2. TLS-350 (PMC) Alarm Troubleshooting Summary**

Displayed Message	Indicator Light	Cause	Suggested Troubleshooting
VP EMISSION WARN	Yellow	Mass emission exceeded the certified threshold	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• Exhibit 6</li> <li>• Exhibit 9</li> <li>• VST ASC Level C</li> </ul>
VP EMISSION FAIL	Red	2nd Consecutive Mass emission test failure	
PMCSETUP WARN	Red	PMC is not configured or missing components. See ISD Troubleshooting Guide, P/N 577013-819.	<ul style="list-style-type: none"> <li>• Troubleshooting Guide found at <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• Exhibit 8</li> <li>• Exhibit 9</li> <li>• VST ASC Level C</li> </ul>
VP DUTY CYCLE WARN	Yellow	Duty cycle exceeds 18 hours per day Or 75% of 24 hours	<ul style="list-style-type: none"> <li>• Troubleshooting Guidefound at <a href="http://www.vsthose.com">www.vsthose.com</a>.</li> <li>• TLS-350 PMC Setup Procedure</li> <li>• Exhibit 8</li> <li>• Exhibit 9</li> <li>• Exhibit 4</li> <li>• VST ASC Level C</li> </ul>
VP DUTY CYCLE FAIL	Red	2nd Consecutive Duty Cycle Test Failure	

## PMC Status Report

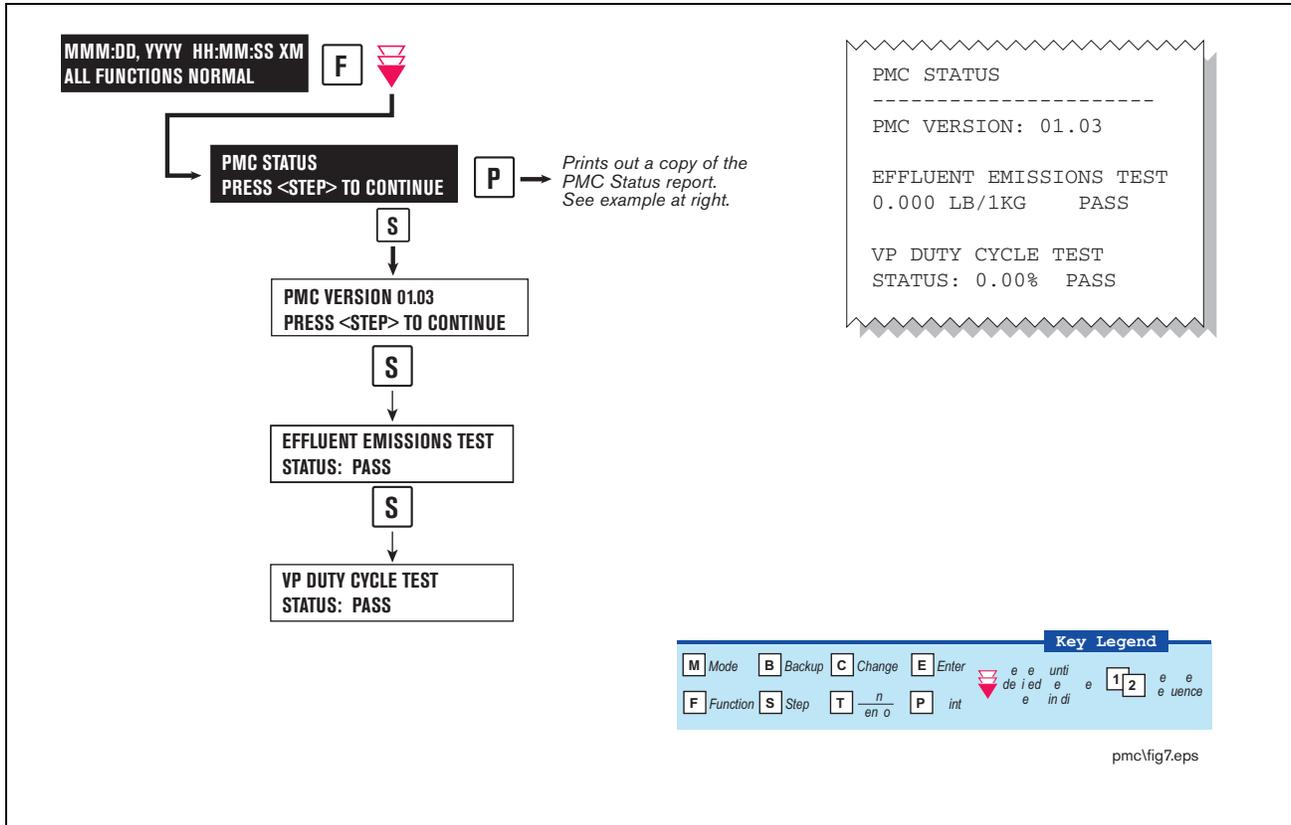


Figure 10. PMC Status Report

## Viewing PMC Reports Via RS-232 Connection

### CONNECTING LAPTOP TO CONSOLE

Connect your laptop to the TLS console's RS-232 or Multiport card using one of the methods shown in the examples in Figure 11 below.

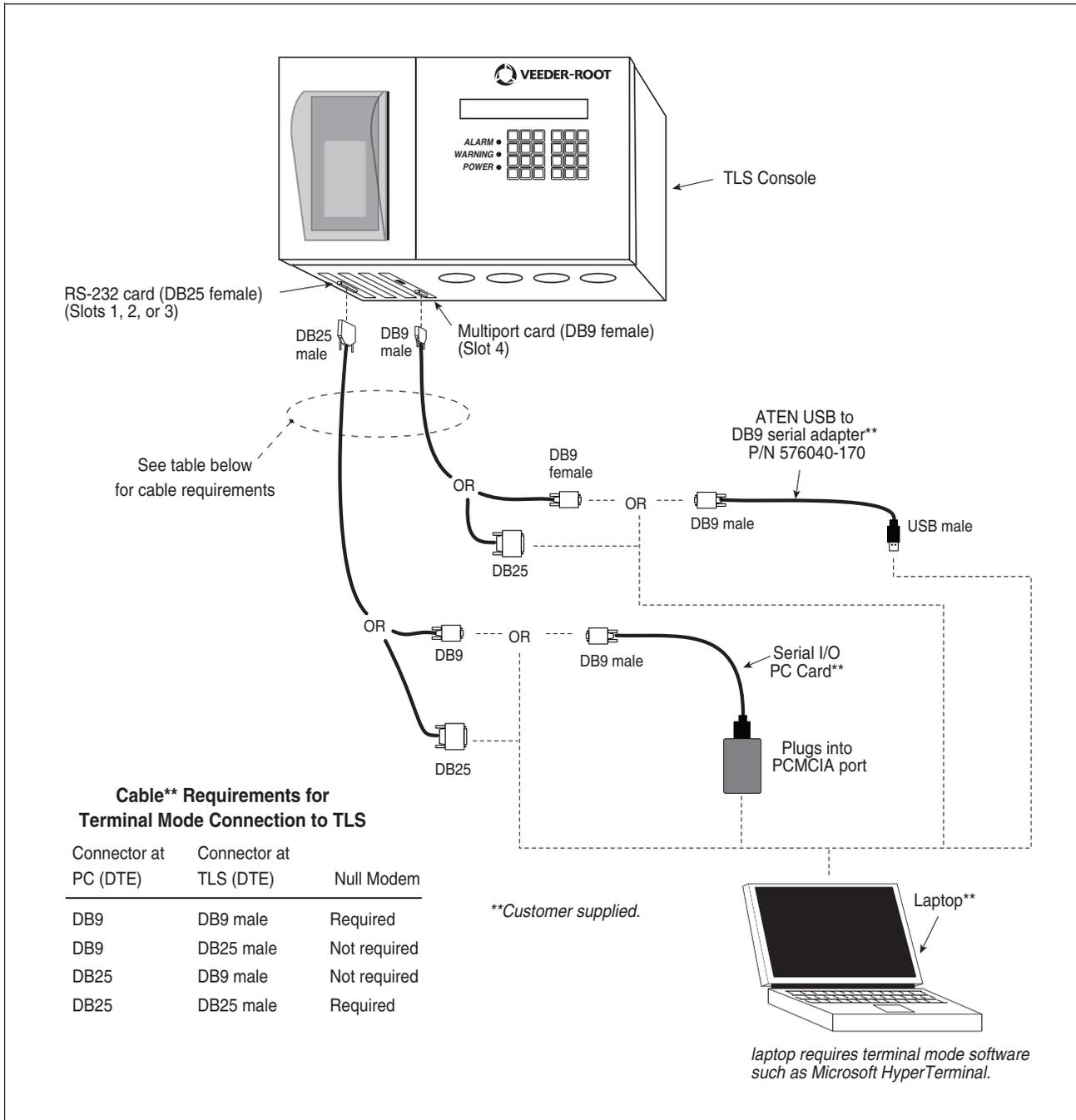


Figure 11. Connecting laptop to TLS console for serial communication

### 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 12), enter a connection name, e.g., TLSDIRECT, and click the OK button.



Figure 12. 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 13), 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 13. 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 14 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.

```

PORT SETTINGS

COMM BOARD: 1 (RS-232)
BAUD RATE: 2400
PARITY: ODD
STOP BIT: 1 STOP
DATA LENGTH: 7 DATA
RS-232 SECURITY
CODE: DISABLED
    
```

This number is the assigned by the console and indicates the slot in which the RS-232 module is installed. It could be 1, 2, or 3. However, for the RS-232 port of a Multiport module, which is installed in slot 4, this number would be 6.

Bits per second

Data Bits

If no RS-232 Security Code has been entered, you will see disabled. If a code has been entered, e.g., 000016, that 6-digit number would appear here. If a code appears, you will need to enter this code with each command you send to the console.

isd\801-1.eps

**Figure 14. 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 15).

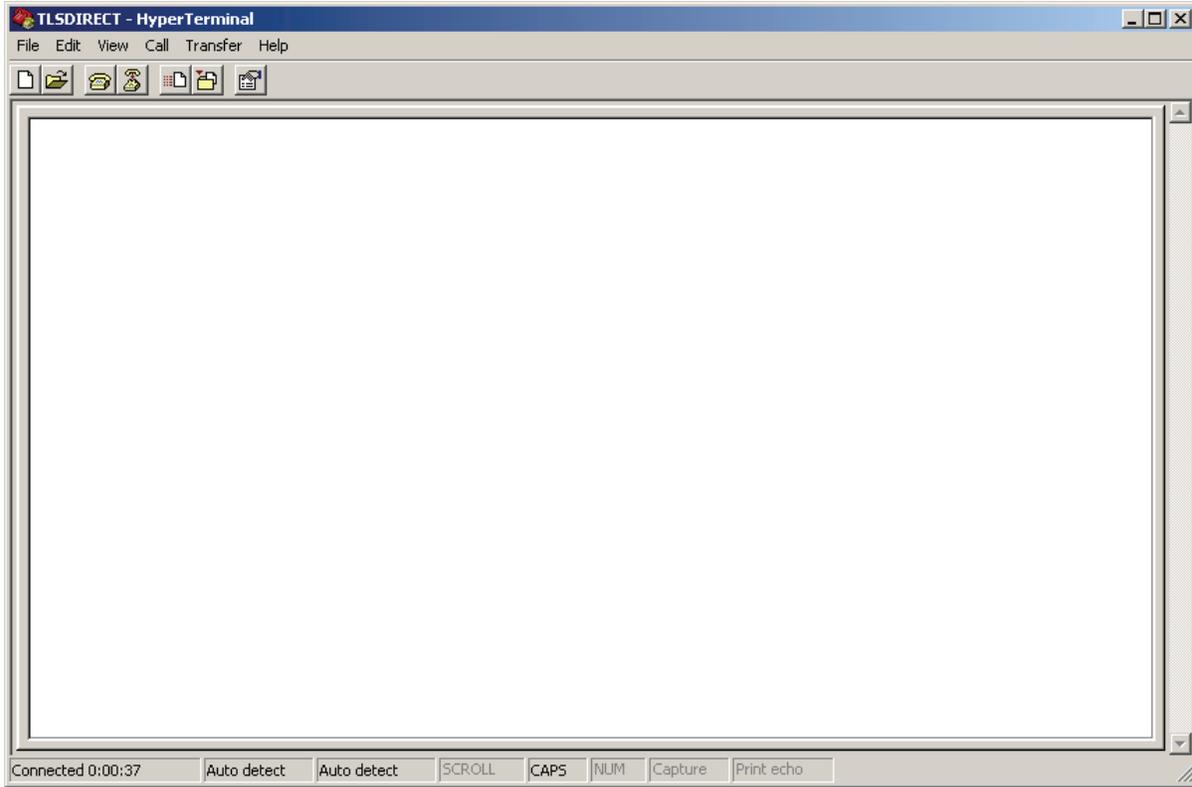


Figure 15. HyperTerminal main window

### SENDING CONSOLE COMMANDS

Table 3 shows four important PMC console commands: IV8200, IV8000, IV8100 and I11100. 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 Vapor Processor Status Report.



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 IV8200. 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 000016IV8200.

You will see the typed command on the screen:  $\text{ⓈIV8200}$  followed by the response (report) from the console. The  $\text{Ⓢ}$  symbol indicates Ctrl+A and the  $\text{♥}$  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  $\text{ⓈIV8200Ⓢ9999FF1B♥}$  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 3. Serial Commands for PMC Diagnostic Reports**

Report Type	Serial Command (PC to Console)*
Vapor Processor Status Report (See example Figure 16)	<SOH>IV8200
Vapor Processor Runtime Diagnostic Report (See example Figure 17)	<SOH>IV8000
Percent Hydrocarbon Diagnostic Report (See example Figure 18)	<SOH>IV8100
Priority Alarm History Report (See example Figure 19)	<SOH>I11100

\*<SOH> = Control A. For more information on TLS console serial commands, refer to the V-R Serial Interface Manual.

```

<SOH>
  IV8200
  JUN  1, 2002  8:07 AM

  (SITE NAME)
  (SITE STREET)
  (CITY, STATE)
  (PHONE NUMBER)

VAPOR PROCESSOR STATUS REPORT

PMC VERSION: 01.03
VAPOR PROCESSOR TYPE: VST VAPOR PROCESSOR

PMC MONITORING TEST PASS/FAIL THRESHOLDS
                                     PERIOD  BELOW  ABOVE
H2O
VAPOR PROCESSOR MASS EMISSION FAIL    1DAYS   ----   0.64 LBS/1KG
VAPOR PROCESSOR DUTY CYCLE FAIL        1DAYS   ----   75.00 %

EFFLUENT EMISSIONS TEST : PASS      (0.32 LBS/1KG)
VP DUTY CYCLE TEST      : PASS      (17.54%)
VP INPUT STATUS         : NOTEST

RUN TIME HOURS          :    4.2
DAILY THROUGHPUT        :   8421 GALS
AVG HC PERCENT          :    8.85 %
    
```

**Figure 16. Vapor Processor Status Report Details - Serial to PC Format**

```

IV8000
AUG 30, 2007 11:52 AM

(SITE NAME)
(SITE STREET)
(CITY, STATE)
(PHONE NUMBER)

VAPOR PROCESSOR
DATE-TIME ON      ELAPSED      PRESSURE     INCHES H2O   RUNTIME
MINUTES          ON           OFF          FAULT
3-08-07  8:52PM      5.53         0.209        -0.211       NO
3-08-07  8:58PM      0.98         0.303        -0.203       NO
3-09-07  5:03AM     26.60         0.221        -0.205       NO
3-09-07  1:15PM     17.92         0.278        -0.268       NO
3-10-07  3:01AM      7.70         0.200        -0.223       NO
3-10-07  4:30AM      4.02         0.202        -0.224       NO
3-10-07  7:54PM     23.62         0.306        -0.245       NO
3-11-07  11:24PM     6.55         0.256        -0.213       NO
3-12-07  11:31PM    21.23         0.228        -0.203       NO
3-13-07  3:44PM     23.95         0.926        -0.230       NO
3-15-07  1:35AM     30.00         0.202         0.154       YES
3-15-07  2:36AM      6.87         0.200        -0.205       NO
3-15-07  3:24AM     30.00         0.201         0.442       YES
3-16-07  3:10AM      4.33         0.202        -0.205       NO
3-16-07  1:28PM     20.78         0.234        -0.264       NO
3-16-07  2:38PM      1.30         0.220        -0.219       NO
3-17-07  12:44AM     6.52         0.206        -0.200       NO
3-17-07  2:00PM     27.47         0.254        -0.210       NO
    
```

Figure 17. Vapor Processor Runtime Diagnostic Report - Serial to PC Format

```

IV8100
AUG 30, 2007 11:53 AM
HYDROCARBON SENSOR  DIAGNOSTIC
DATE/TIME          READING %
8-25-07  7:58AM   1.050
8-25-07  7:58AM   1.040
8-25-07  7:58AM   1.036
8-25-07  7:58AM   1.042
8-25-07  7:57AM   1.040
8-25-07  7:57AM   1.040
8-25-07  7:57AM   1.032
8-25-07  7:57AM   1.030
8-25-07  7:56AM   1.050
8-25-07  7:56AM   1.040
8-25-07  7:56AM   1.040
8-25-07  7:56AM   1.032
8-25-07  7:55AM   1.050
8-25-07  7:55AM   1.026
8-25-07  7:55AM   1.012
8-25-07  7:55AM   1.032
8-25-07  7:54AM   1.026
8-25-07  7:54AM   1.046
8-25-07  7:54AM   1.022
8-25-07  7:54AM   1.012
8-25-07  7:53AM   1.012
8-25-07  7:53AM   1.022
8-25-07  7:53AM   1.022
8-25-07  7:53AM   1.022
    
```

**Figure 18. Percent Hydrocarbon Diagnostic Report - Serial to PC Format**

```

I11100
APR 17, 2008 12:30 AM

<Site Name>
<Site Address>
<Site Address>
<Site Address>

PRIORITY ALARM HISTORY
ID  CATEGORY  DESCRIPTION          ALARM TYPE          STATE    DATE    TIME
T 2  TANK      Premium 91          PROBE OUT           CLEAR    4-04-08 12:14PM
T 2  TANK      Premium 91          PROBE OUT           ALARM    4-04-08 12:14PM
T 2  TANK      Premium 91          LOW PRODUCT ALARM   CLEAR    4-04-08 12:04PM
T 2  TANK      Premium 91          PROBE OUT           CLEAR    4-04-08 12:04PM
T 1  TANK      Unlead 87           PROBE OUT           CLEAR    4-04-08 11:37AM
T 1  TANK      Unlead 87           PROBE OUT           ALARM    4-04-08 10:51AM
T 2  TANK      Premium 91          PROBE OUT           ALARM    4-04-08 10:42AM
T 2  TANK      Premium 91          LOW PRODUCT ALARM   ALARM    4-04-08 10:42AM
s 8  OTHER    PRES SEN 2 DISP 1-2 COMMUNICATION ALARM CLEAR    3-26-08  1:39PM
s 8  OTHER    PRES SEN 2 DISP 1-2 COMMUNICATION ALARM ALARM    3-26-08  1:37PM
      SYSTEM    BATTERY IS OFF      CLEAR    3-10-08  8:00AM
      SYSTEM    BATTERY IS OFF      ALARM    3-10-08  8:00AM
    
```

**Figure 19. Priority Alarm History Report - Serial to PC Format**

# Diagnostics

## Automatic Control

Under Automatic control, vapor pressure readings are compared to user programmable thresholds to determine the appropriate Pressure Management Device (PMD) state. When the PMD is off and the TURN ON VAPOR PROCESSOR is exceeded, an internal relay is enabled and remains so until the pressure drops below the TURN OFF VAPOR PROCESSOR threshold. Automatic control is the default mode.

## Manual control

If PMC mode is Manual, the diagnostic menu allows the PMD to be directly turned on/off through the relay. This feature is to support unit operational testing without waiting for the pressure to hit limits. The current UST ullage space vapor pressure will also be available through the diagnostic menu. The VC1 RS232 command allows for remote control of the PMD when the PMD control is manual. Note: If the PMD is on and the PMC mode is Automatic, changing the control mode to Manual mode will turn the PMD off.

When set to Manual mode, the system will revert to Automatic mode after 4 hours.

## PMC Diagnostic Menu

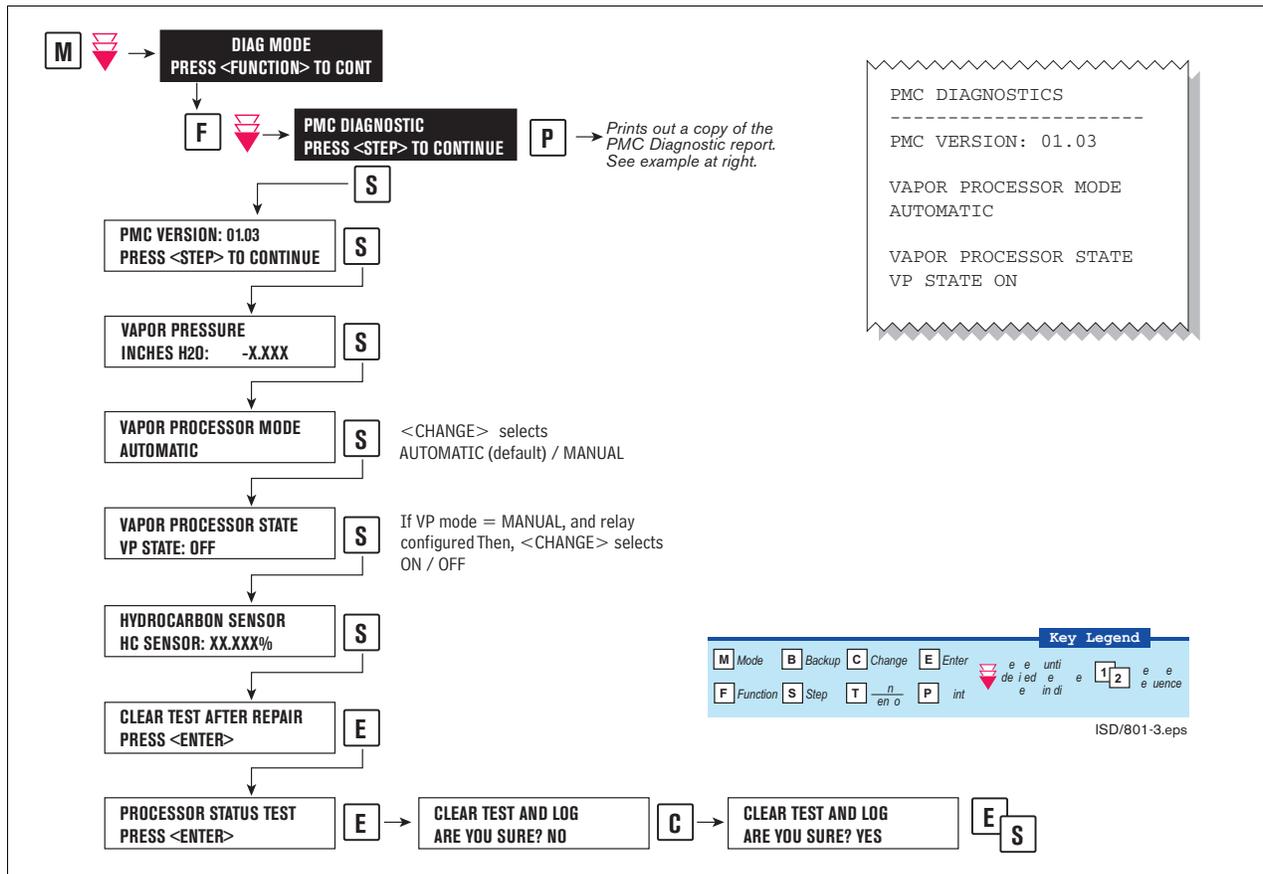


Figure 20. PMC Diagnostic Menus



# Pressure Sensor

## Installation 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.

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.

## **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.

©Veeder-Root 2009. All rights reserved.

**Pressure Sensor Installation**

Contractor Certification Requirements ..... 1  
 Related Manuals ..... 1  
 Safety Precautions ..... 2  
 Before You Begin ..... 3  
 Veeder-Root Parts ..... 3  
 Tools Required ..... 5  
 Under Dispenser Installation Steps ..... 5  
 Vapor Vent Stack Installation Step ..... 13

**Figures**

Figure 1. Table 2 Component Pictorial ..... 5  
 Figure 2. Example Pressure Sensor Install In Shear Valve Port - Preferred Non-ISD Installation (Without Vapor Flow Meter) ..... 7  
 Figure 3. Example Pressure Sensor Install In Vapor Return Line - Non-ISD Installation (Without Vapor Flow Meter) ..... 8  
 Figure 4. Example Pressure Sensor Install In Shear Valve Port - Preferred ISD Installation (With Vapor Flow Meter Above Shear Valve) ..... 9  
 Figure 5. Example Pressure Sensor Install In Horizontal Access Fitting Or Vapor Return Line - ISD Installation (With Vapor Flow Meter Below Shear Valve) ..... 10  
 Figure 6. Example Pressure Sensor Install Below Vertical Access Fitting Or Vapor Return Line - ISD Installation (With Vapor Flow Meter Below Shear Valve) ..... 11  
 Figure 7. Field wiring Pressure Sensor - Observe Polarity ..... 12  
 Figure 8. Epoxy sealing field wiring ..... 12  
 Figure 9. Connecting Pressure Sensor to TLS-3XX Smart Sensor Interface Module ..... 13  
 Figure 10. Locating Pressure Sensor Enclosure in Vapor Vent Stack ..... 15  
 Figure 11. Mounting Pressure Sensor Assembly onto Composite Panel ..... 16

**Tables**

Table 1. Under Dispenser - Pressure Sensor Installation Kit (P/N 330020-515) ..... 3  
 Table 2. Vapor Vent Stack - Pressure Sensor Installation Kit (P/N 330020-630) ..... 4

## 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; tank and line preparation; and line leak detector installation.

**TLS-350 Technician (Level 2/3 or 4) Certification:** Contractors holding valid TLS-350 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-300 or TLS-350 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

**In-Station Diagnostics (ISD-PMC) Technician Certification:** ISD PMC Contractors holding a valid ISD/PMC Certification are approved to perform (ISD/PMC) installation checkout, startup, programming, and operations training. This training also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current Veeder-Root Technician Certification is a prerequisite for the ISD/PMC course.

**Veeder-Root ISD/PMC Including Carbon Canister Vapor Polisher Contractor Certification:** This Certification includes Executive Orders 203, 204 and the Veeder-Root Vapor Polisher. This certification is required for setup and service of the Veeder-Root Vapor Polisher.

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

# ⚠ WARNING

        	<p><b>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.</b></p> <p><b>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</b></p> <p><b>The following hazards exist:</b></p> <ol style="list-style-type: none"> <li><b>1. Electrical shock resulting in serious injury or death may result if power is on during installation and the device is improperly installed.</b></li> <li><b>2. Product leakage could cause severe environmental damage or explosion resulting in death, serious personal injury, property loss and equipment damage.</b></li> </ol> <p><b>Observe the following precautions:</b></p> <ol style="list-style-type: none"> <li><b>1. Read and follow all instructions in this manual, including all safety warnings.</b></li> <li><b>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).</b></li> <li><b>3. Before installing this device, turn Off, tag/lock out power to the system, including console and submersible pumps.</b></li> <li><b>4. To protect yourself and others from being struck by vehicles, block off your work area during installation or service.</b></li> <li><b>5. Substitution of components may impair intrinsic safety.</b></li> </ol>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

## 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

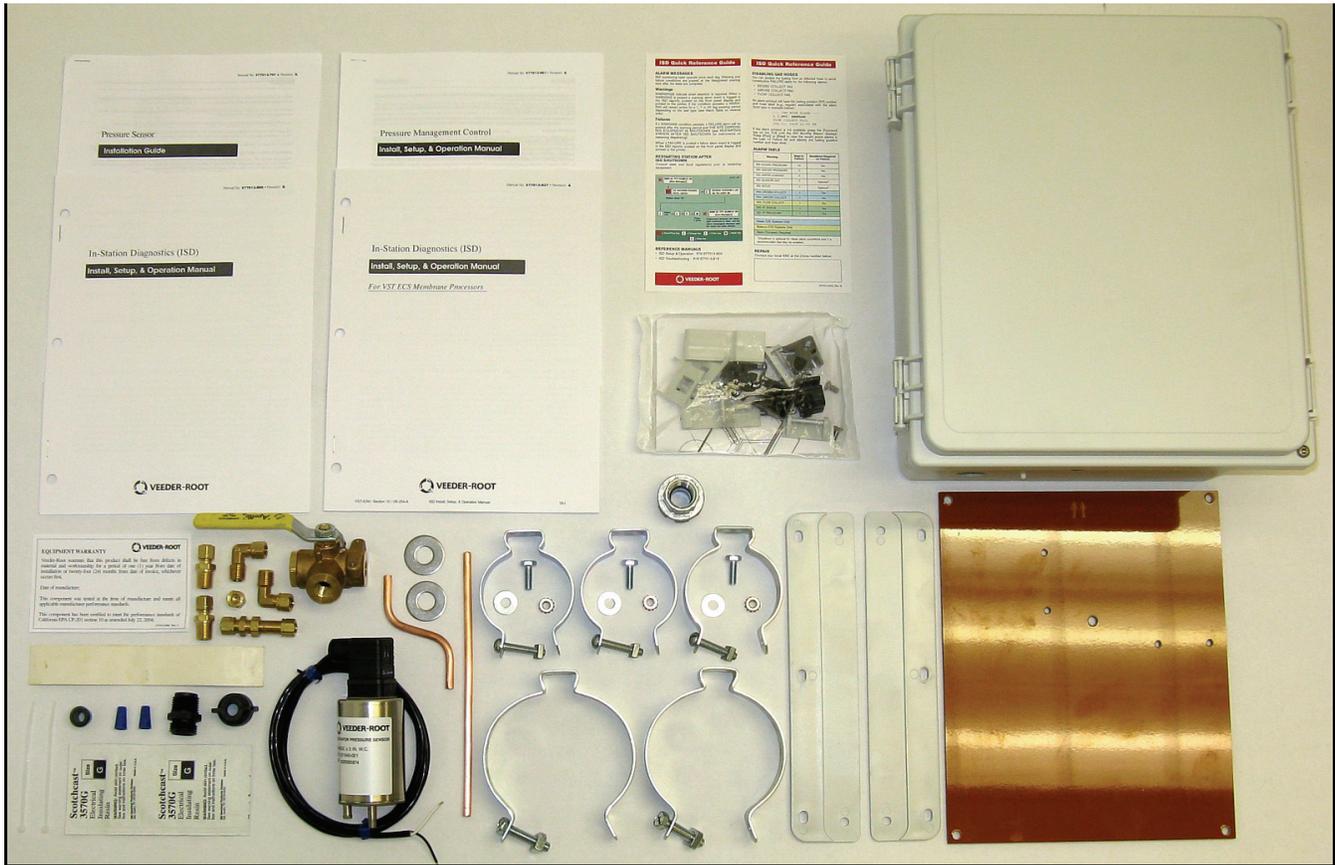


Figure 1. Table 2 Component Pictorial

## 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.

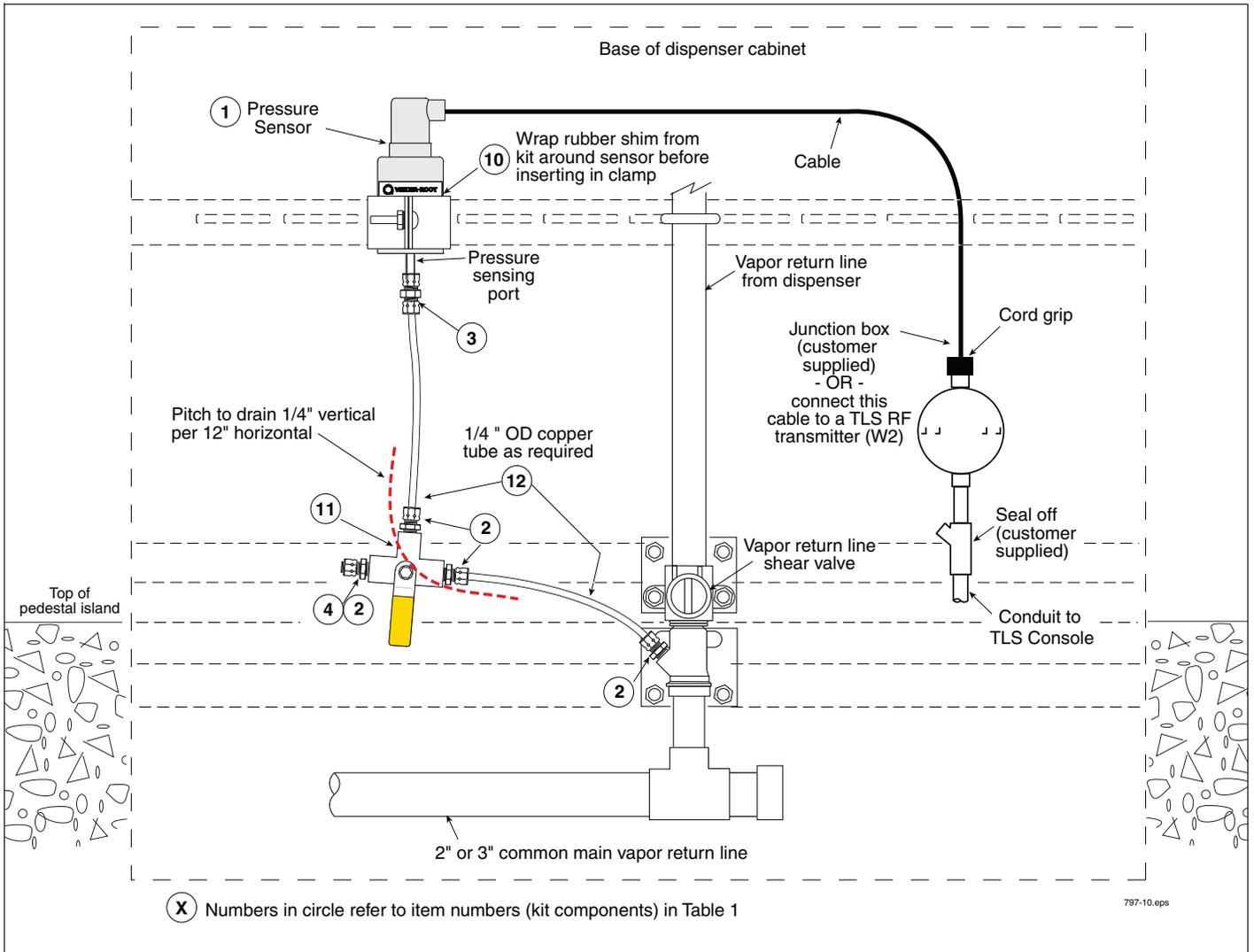


Figure 2. Example Pressure Sensor Install In Shear Valve Port - Preferred Non-ISD Installation (Without Vapor Flow Meter)



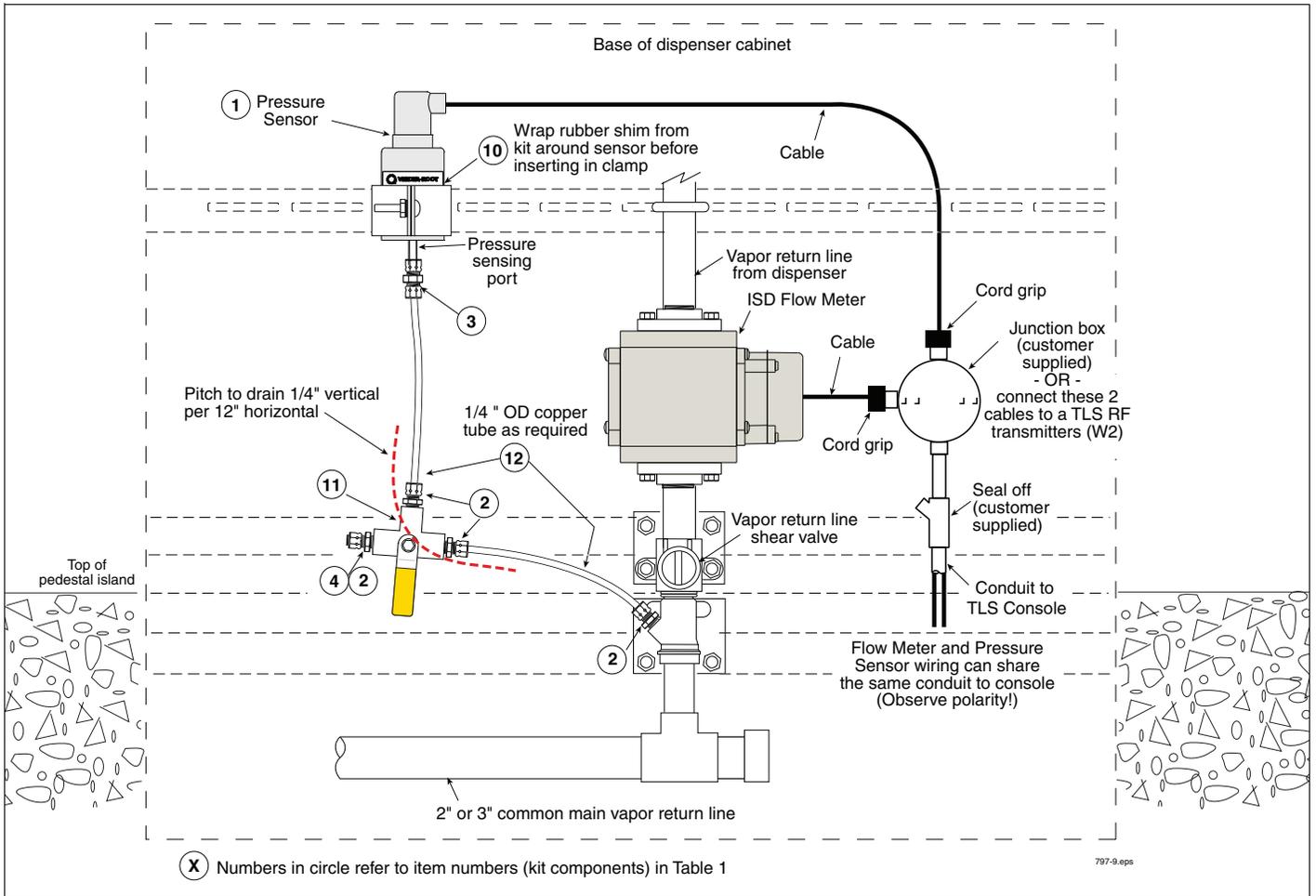


Figure 4. Example Pressure Sensor Install In Shear Valve Port - Preferred ISD Installation (With Vapor Flow Meter Above Shear Valve)

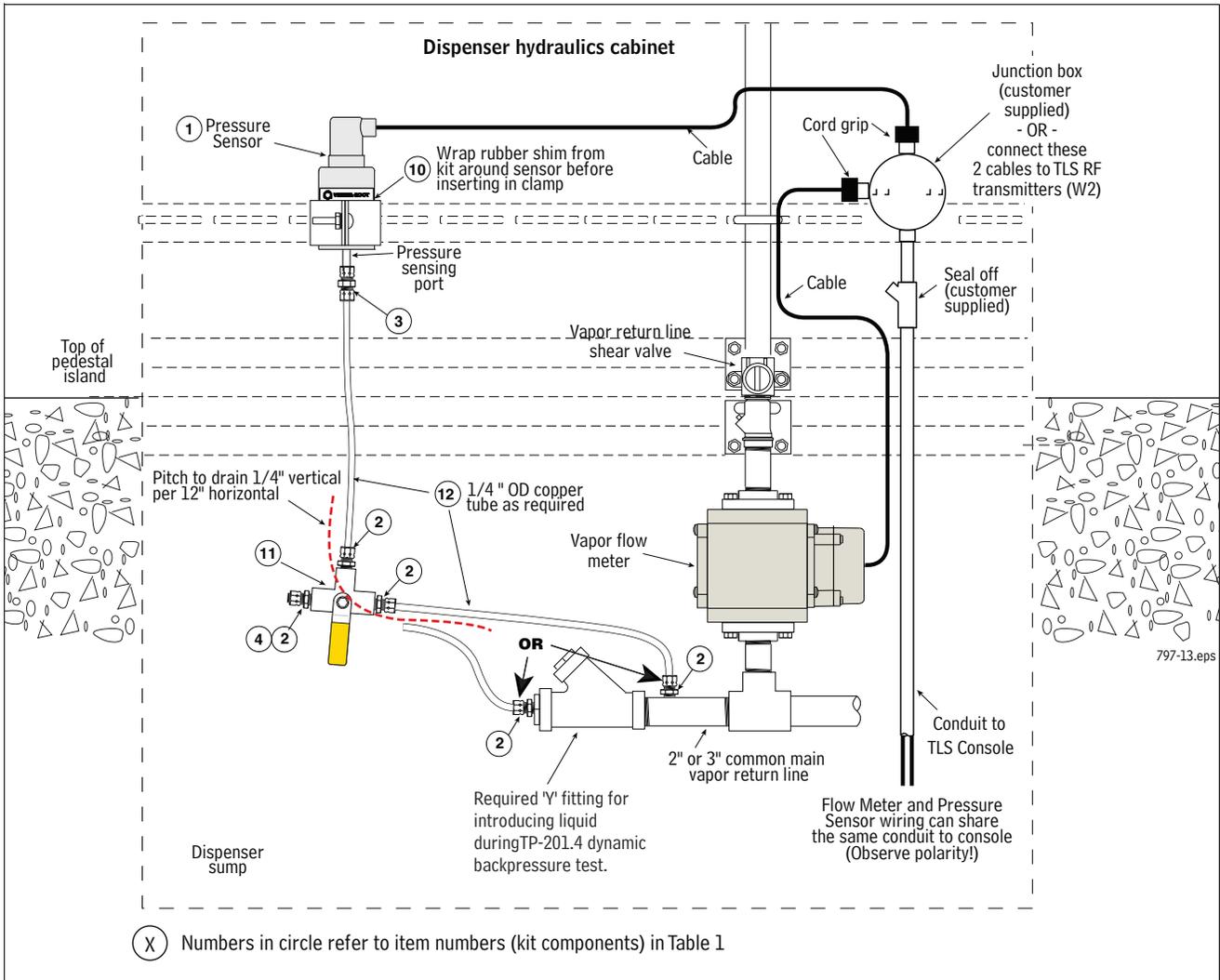


Figure 5. Example Pressure Sensor Install In Horizontal Access Fitting Or Vapor Return Line - ISD Installation (With Vapor Flow Meter Below Shear Valve)

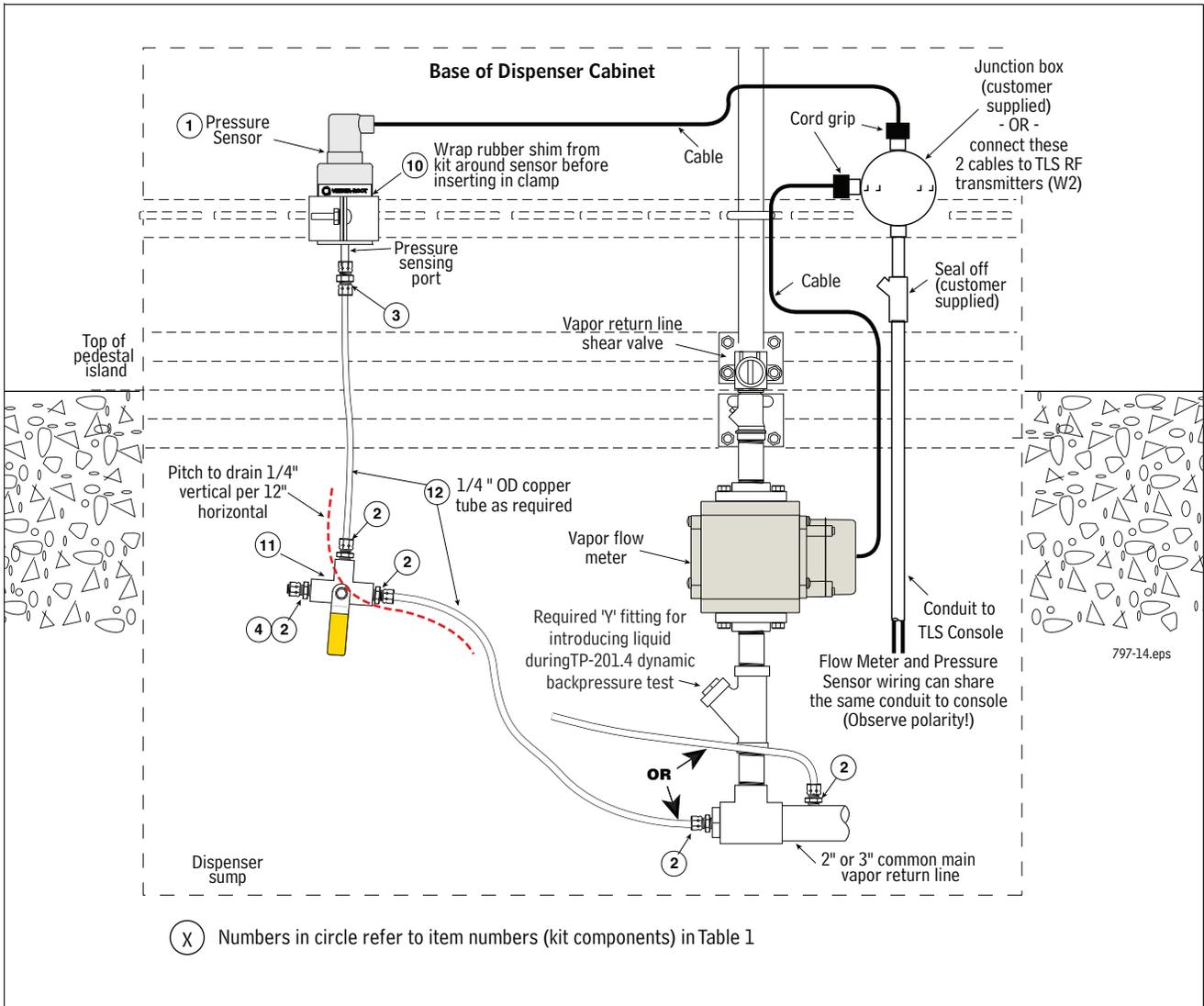


Figure 6. Example Pressure Sensor Install Below Vertical Access Fitting Or Vapor Return Line - ISD Installation (With Vapor Flow Meter Below Shear Valve)

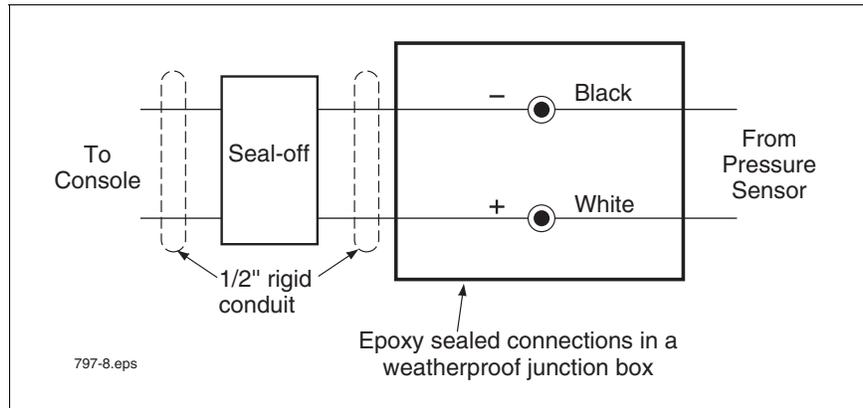


Figure 7. Field wiring Pressure Sensor - Observe Polarity

**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

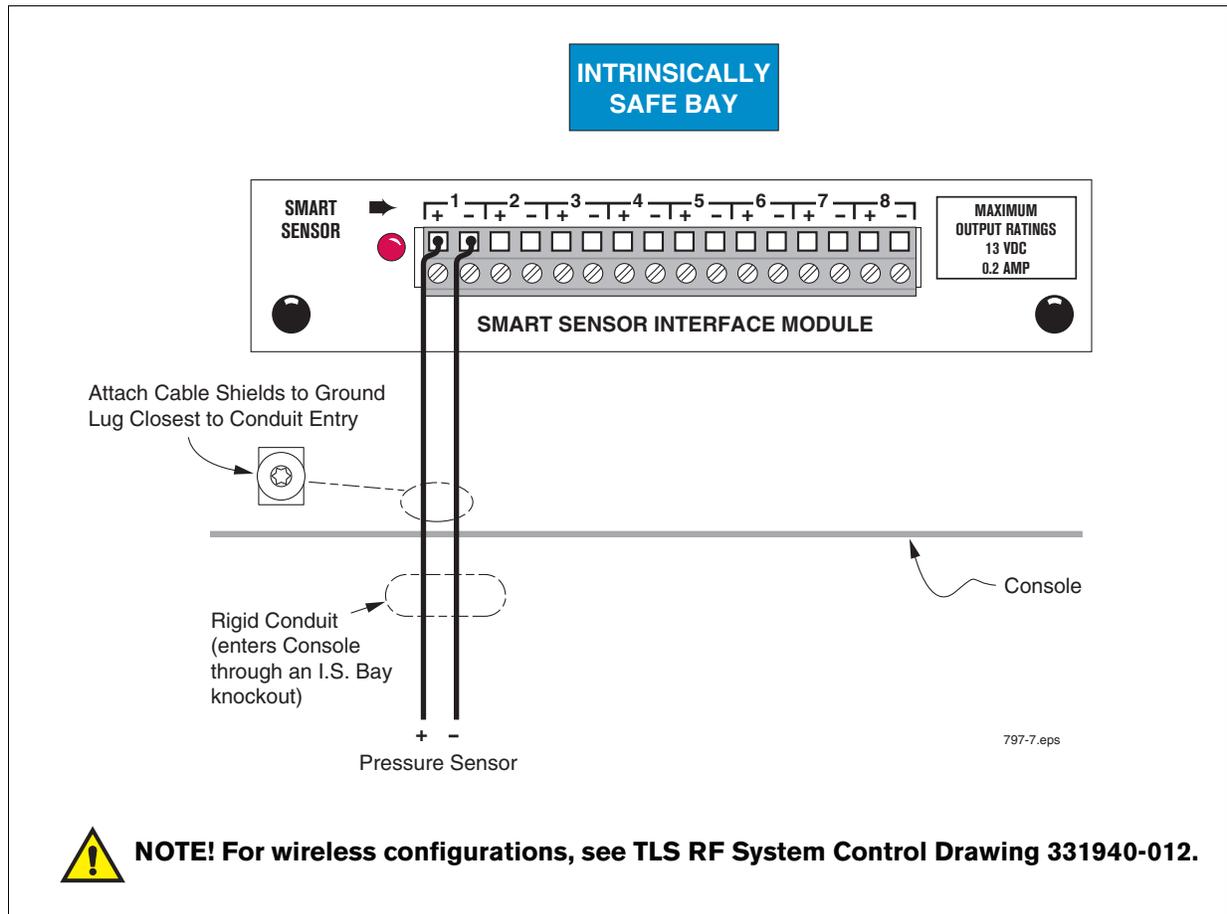


Figure 9. Connecting Pressure Sensor to TLS-3XX Smart Sensor Interface Module

## 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.

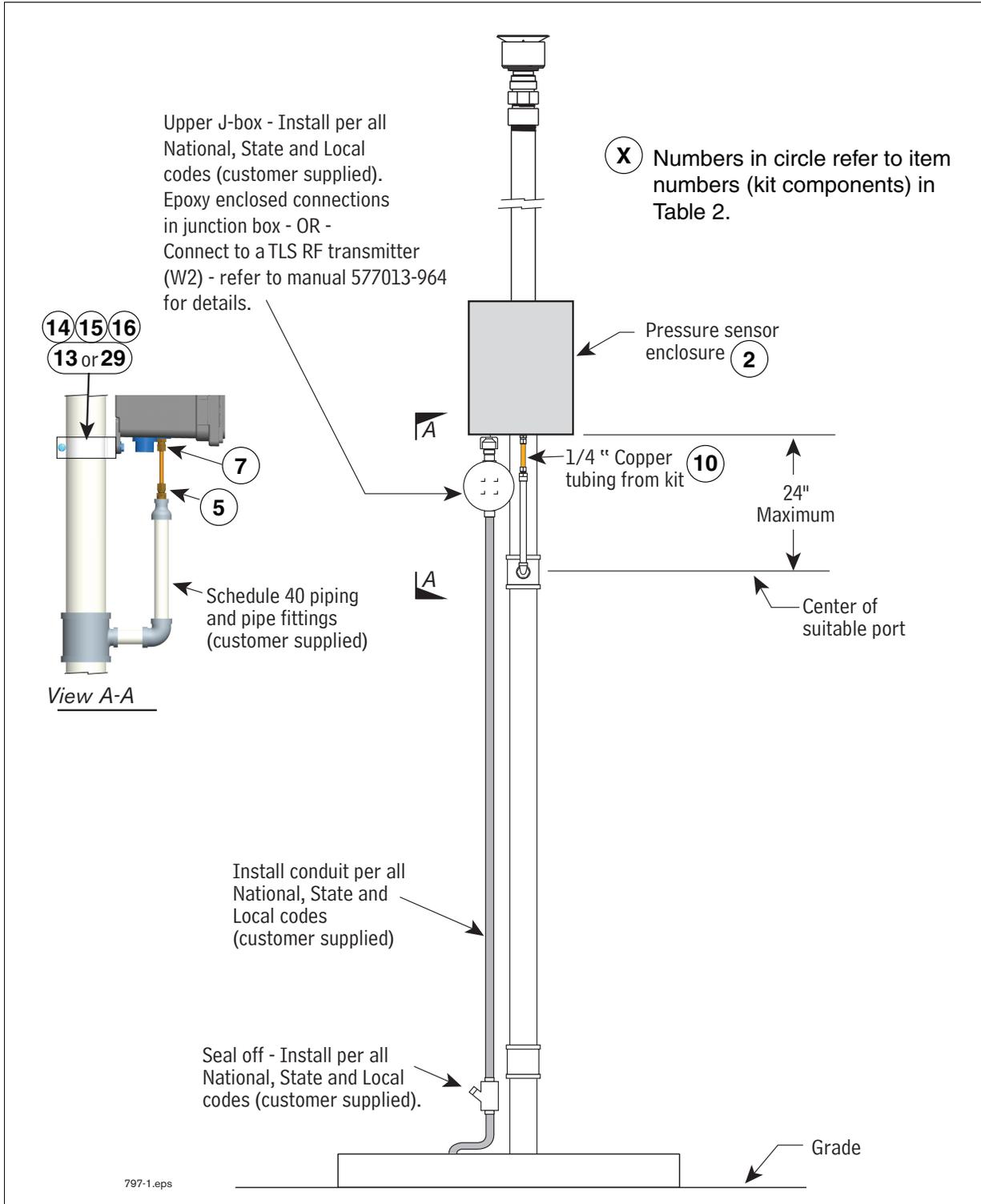


Figure 10. Locating Pressure Sensor Enclosure in Vapor Vent Stack

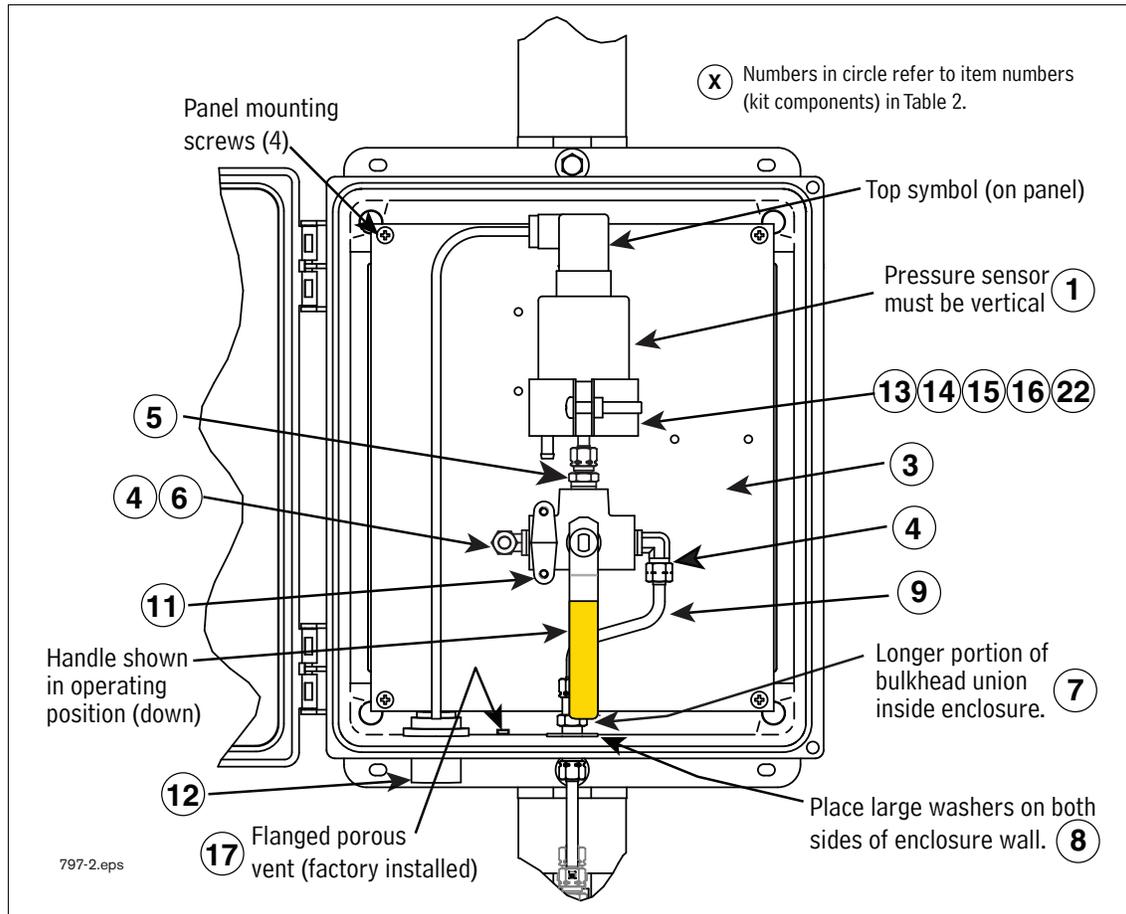


Figure 11. Mounting Pressure Sensor Assembly onto Composite Panel

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 ¼" 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.

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 ½" 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



# 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.

## **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/leo-evrphaseII.htm](http://www.arb.ca.gov/vapor/leo-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).

©Veeder-Root 2009. All rights reserved.

**Introduction**

- Contractor Certification Requirements ..... 1
- Related Documents ..... 1
- Safety Precautions ..... 1
- Before You Begin ..... 3
- Veeder-Root Parts ..... 4

**Standard Vent Stack Installation Procedure ..... 5**

**Alternate Vent Stack Installations**

- Alternate Vent Stack Installations ..... 12
- Offset Mount Installations ..... 13
- Flat Mounting ..... 13

**Test Port Installation**

- Standard Installation Procedure ..... 16
- Alternate Lowering of the Upper Test Port ..... 16

**Maintenance**

- Sensor Housing Kit (P/N 330020-644) ..... 17
- Filter Kit (P/N 330020-645) ..... 18
- Valve Enclosure Assembly Kit (P/N 330020-643) ..... 19
- Thermal Probe Kit (P/N 330020-653) ..... 21

## Figures

- Figure 1. Typical direct wired installation example ..... 6
- Figure 2. Installing CCVP onto bracket ..... 7
- Figure 3. Inlet plumbing detail and classified area definition ..... 8
- Figure 4. Locating the CCVP vapor valve connector ..... 9
- Figure 5. Field wiring CCVP vapor valve - direct-wired CCVP only ..... 9
- Figure 6. Epoxy sealing CCVP vapor valve field wiring connections - direct-wired CCVP only ..... 10
- Figure 7. Attaching CCVP vapor valve wiring to TLS-350 console - direct-wired CCVP only ..... 10
- Figure 8. Through canopy w/extended plumbing ..... 12
- Figure 9. Vent stack mounting ..... 12
- Figure 10. Offset mount on a 2" or 3" pipe ..... 14
- Figure 11. Offset mount on a supported riser ..... 15
- Figure 12. Optional lowering of upper test port ..... 16
- Figure 13. Removing sensor housing assembly ..... 17
- Figure 14. Replacing sensor housing assembly ..... 17
- Figure 15. Accessing the valve filter and o-ring ..... 18
- Figure 16. Replacing the valve filter and o-ring ..... 18
- Figure 17. Removing vapor valve assembly ..... 19
- Figure 18. Replacing vapor valve assembly ..... 20
- Figure 19. CCVP thermal probe ..... 21
- Figure 20. Preparing the thermal probe cable for the protective boot ..... 22
- Figure 21. Positioning the tie wrap over the probe cable's protective boot ..... 22

## Tables

Table 1.	CCVP 2" Installation Kit .....	4
Table 2.	CCVP 3" Installation Kit .....	4
Table 3.	CCVP Replacement Parts Kits .....	4

## 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; tank and line preparation; and line leak detector installation.

**TLS-350 Technician (Level 2/3 or 4) Certification:** Contractors holding valid TLS-350 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-300 or TLS-350 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

**In-Station Diagnostics (ISD-PMC) Technician Certification:** ISD PMC Contractors holding a valid ISD/PMC Certification are approved to perform (ISD/PMC) installation checkout, startup, programming, and operations training. This training also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current Veeder-Root Technician Certification is a prerequisite for the ISD/PMC course.

**Veeder-Root ISD/PMC Including Carbon Canister Vapor Polisher Contractor Certification:** This Certification includes Executive Orders 203, 204 and the Veeder-Root Vapor Polisher. This certification is required for setup and service of the Veeder-Root Vapor Polisher.

**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.



**EXPLOSIVE**

Fuels and their vapors are extremely explosive if ignited.



**FLAMMABLE**

Fuels and their vapors are extremely flammable.

 <p><b>ELECTRICITY</b> High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p><b>TURN POWER OFF</b> Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>
 <p><b>READ ALL RELATED MANUALS</b> Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>	 <p><b>USE SAFETY BARRICADES</b> 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><b>WARNING</b> Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.</p>	 <p><b>WEAR EYE PROTECTION</b> Wear eye protection when working with pressurized fuel lines or epoxy sealant to avoid possible eye injury.</p>
 <p><b>INJURY</b> Careless or improper handling of materials can result in bodily injury.</p>	 <p><b>GLOVES</b> 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.

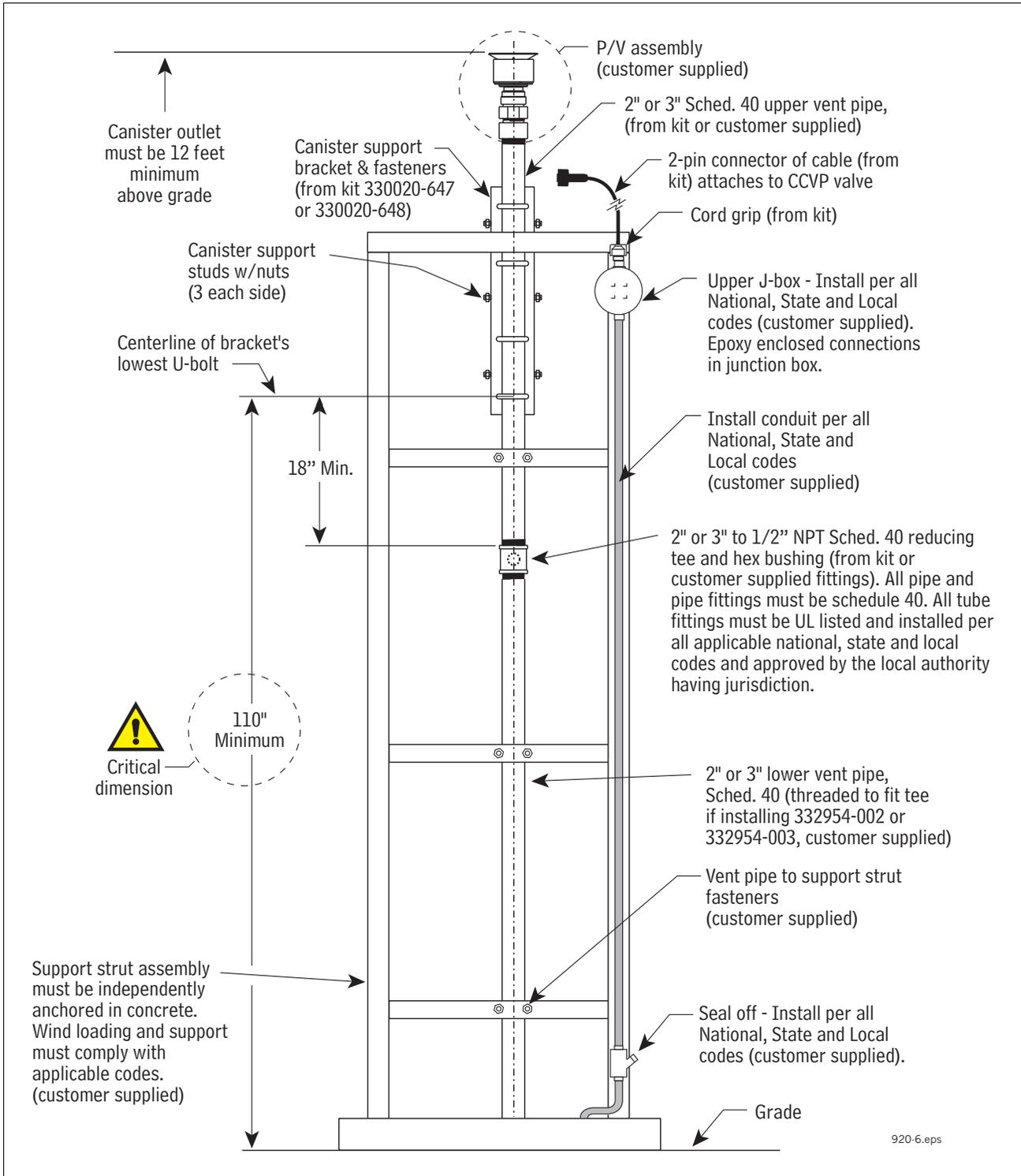


Figure 1. Typical direct wired installation example

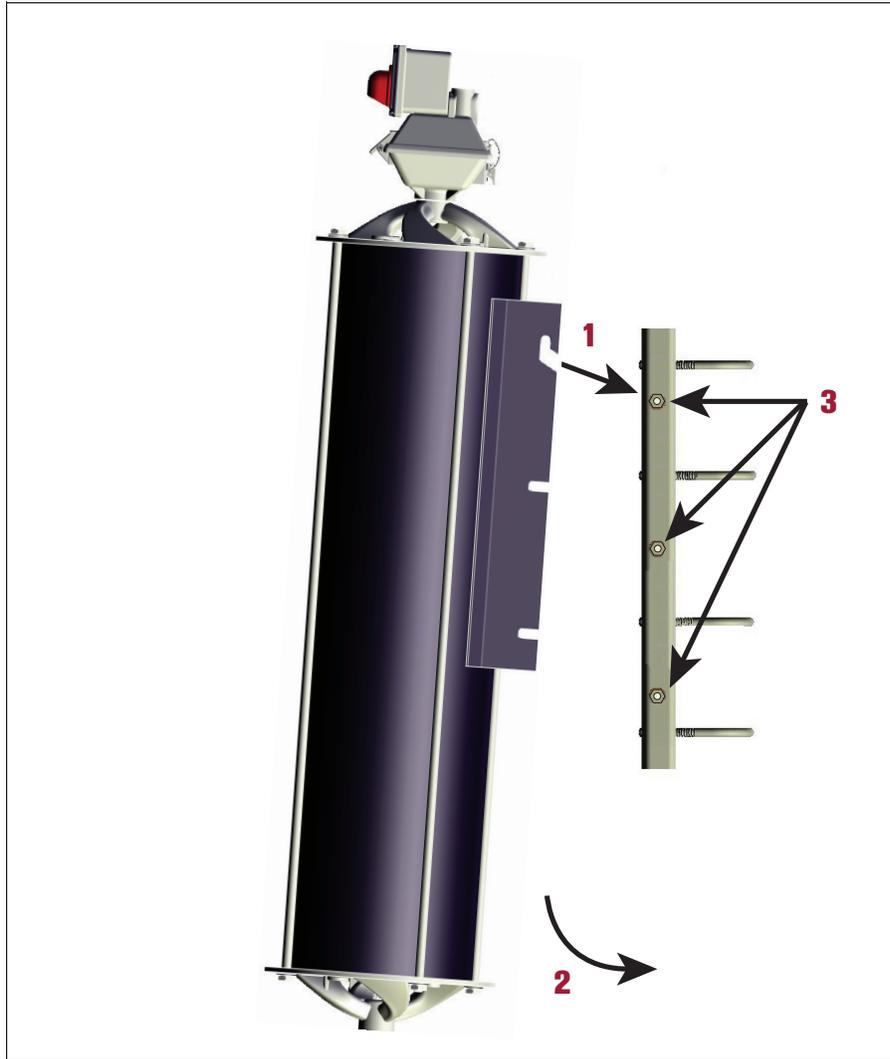


Figure 2. Installing CCVP onto bracket

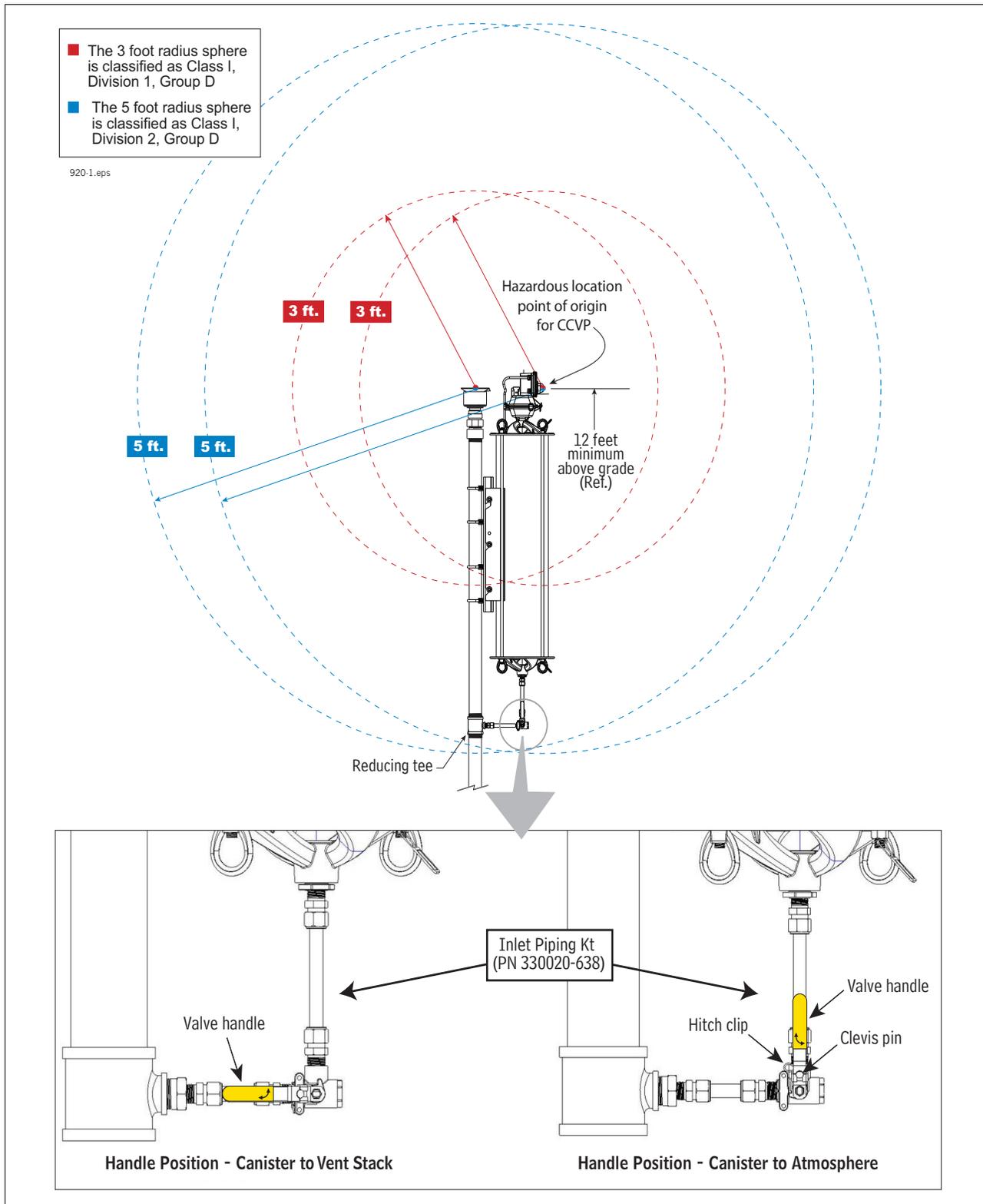


Figure 3. Inlet plumbing detail and classified area definition

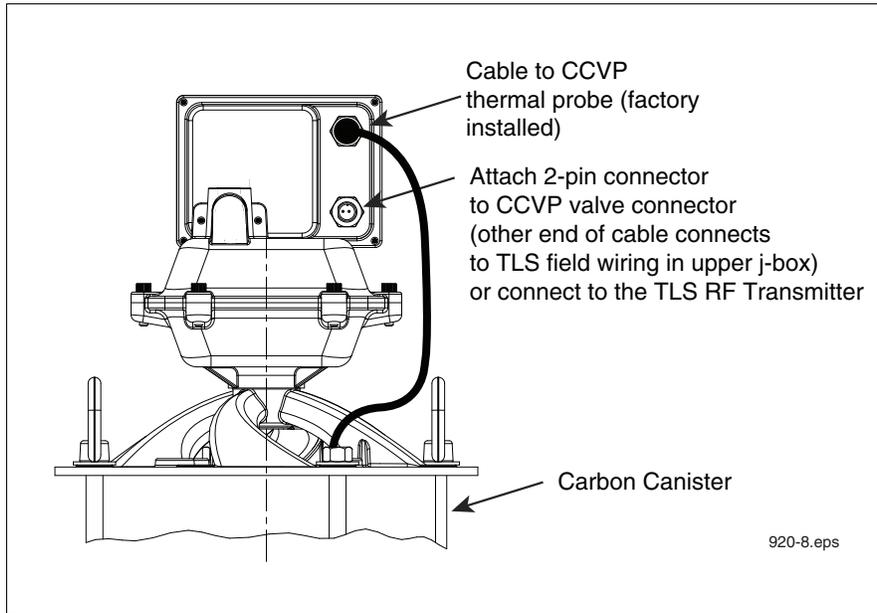


Figure 4. Locating the CCVP vapor valve connector

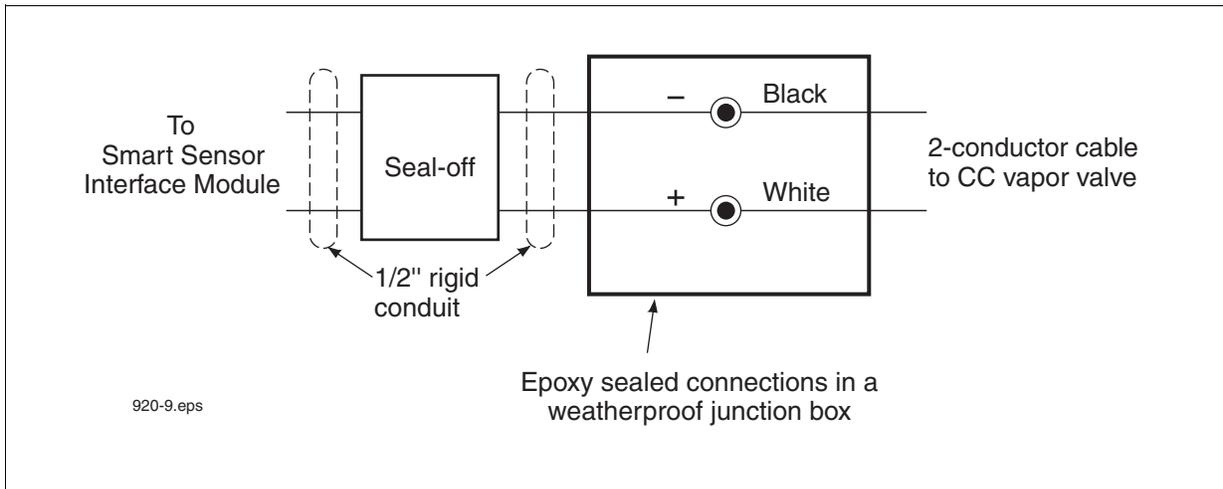


Figure 5. Field wiring CCVP vapor valve - direct-wired CCVP only

### 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 epoxycarboxylate.

**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

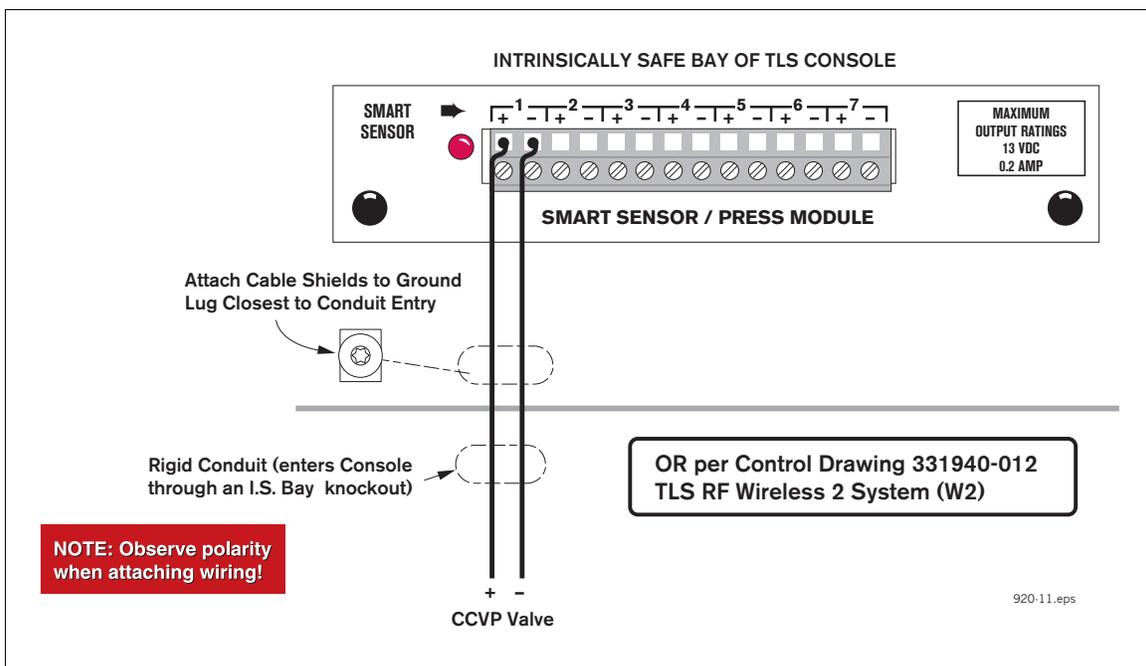


Figure 7. Attaching CCVP vapor valve wiring to TLS-350 console - direct-wired CCVP only

## 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

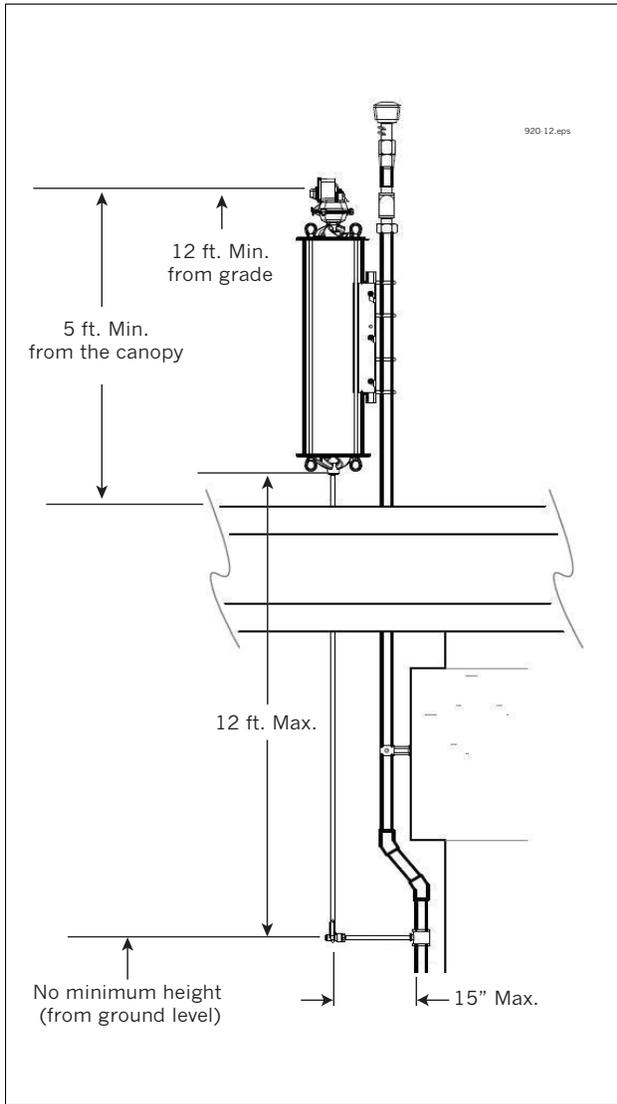


Figure 8. Through canopy w/extended plumbing

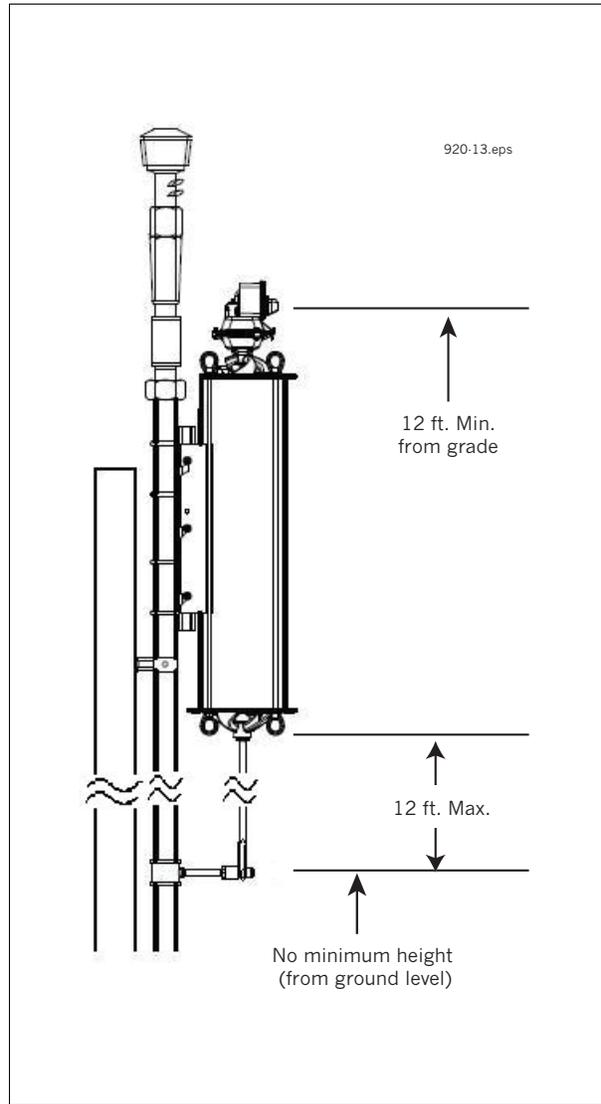


Figure 9. Vent stack mounting

## 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.

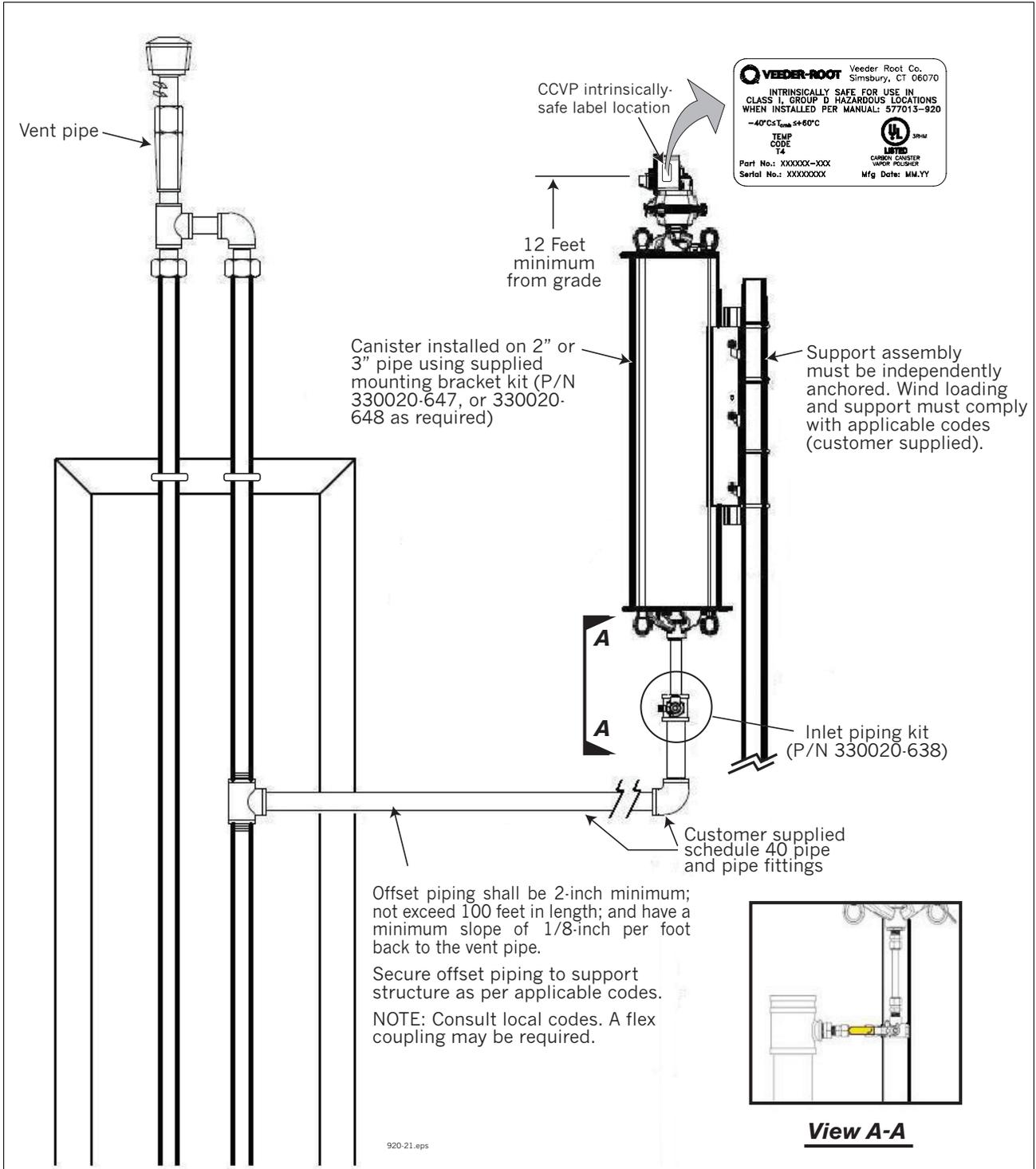


Figure 10. Offset mount on a 2" or 3" pipe

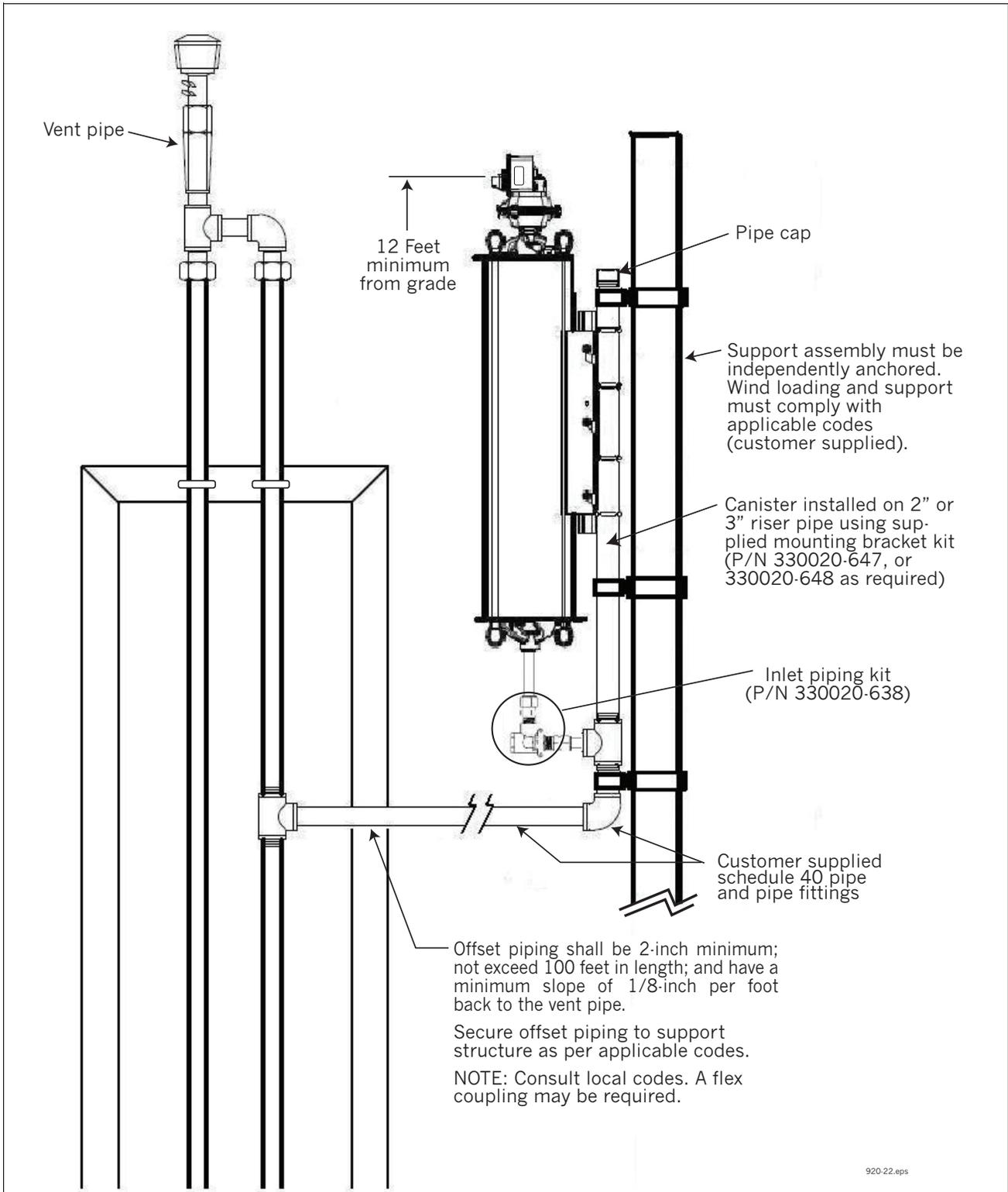


Figure 11. Offset mount on a supported riser

## 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).

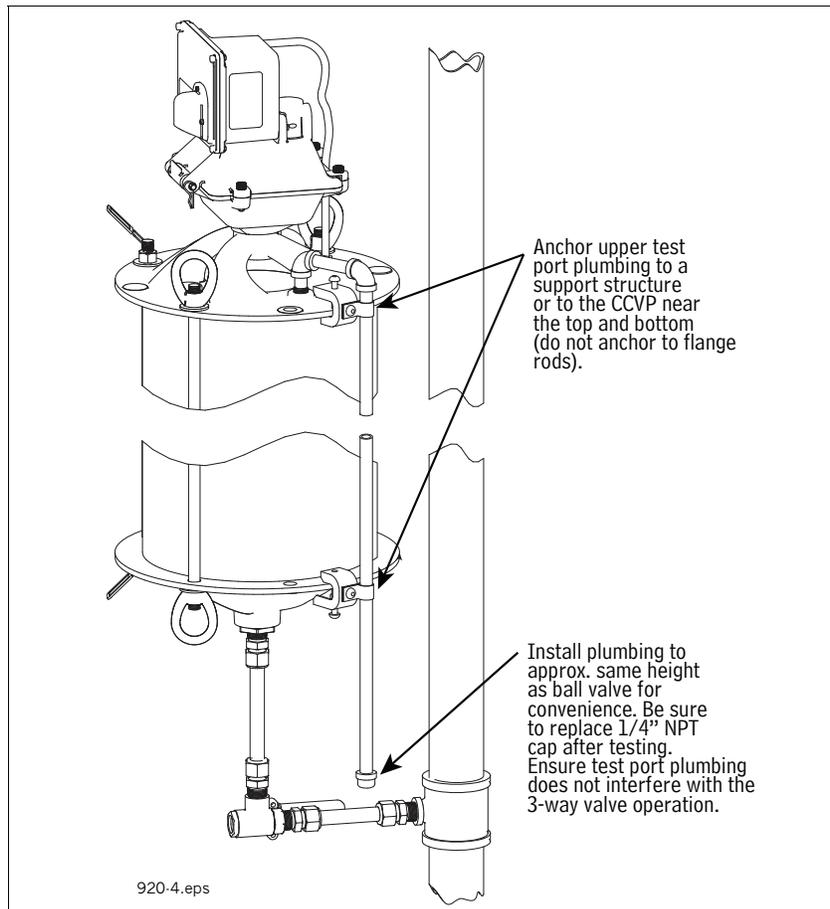


Figure 12. Optional lowering of upper test port

## 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.

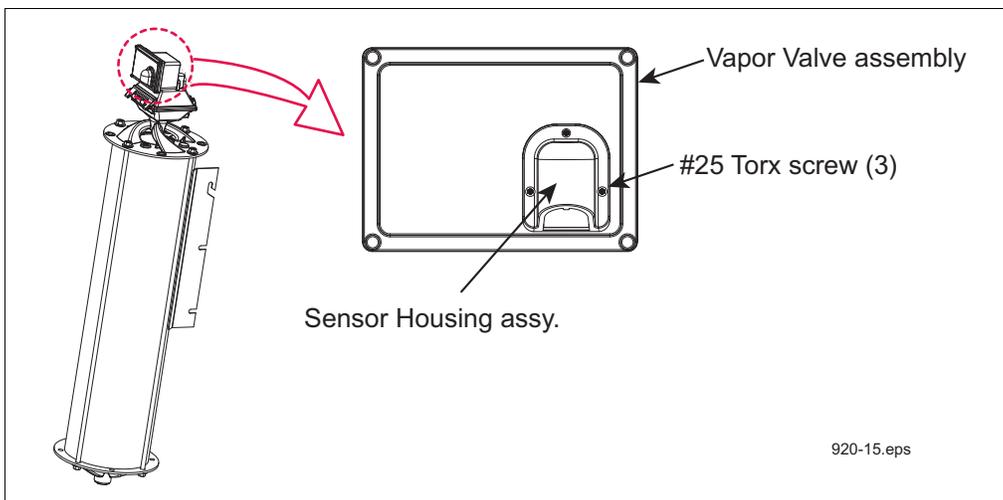


Figure 13. Removing sensor housing assembly

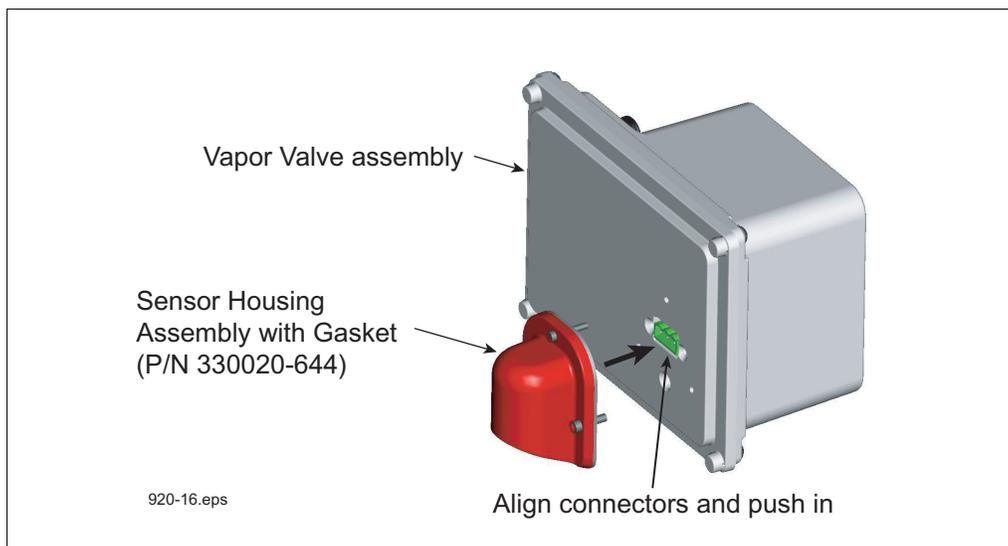


Figure 14. Replacing sensor housing assembly

## 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).

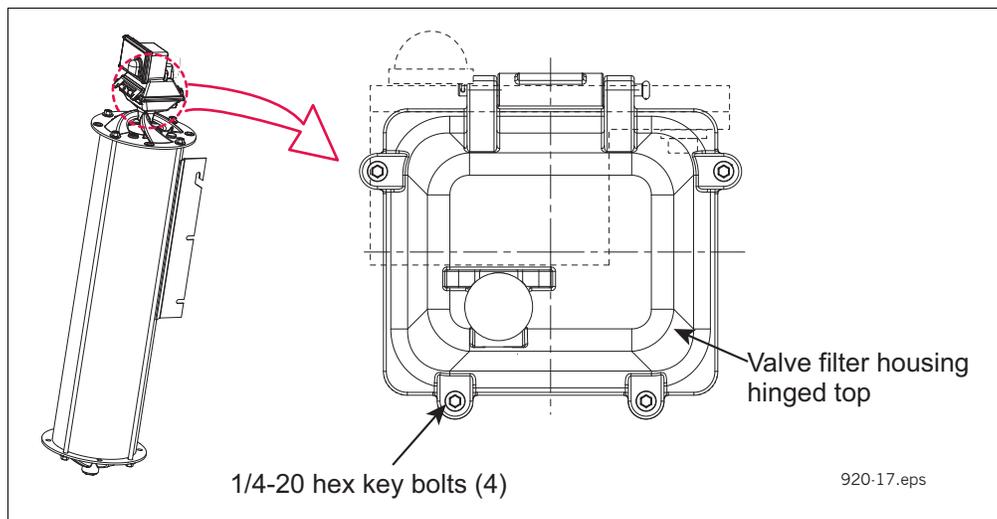


Figure 15. Accessing the valve filter and o-ring

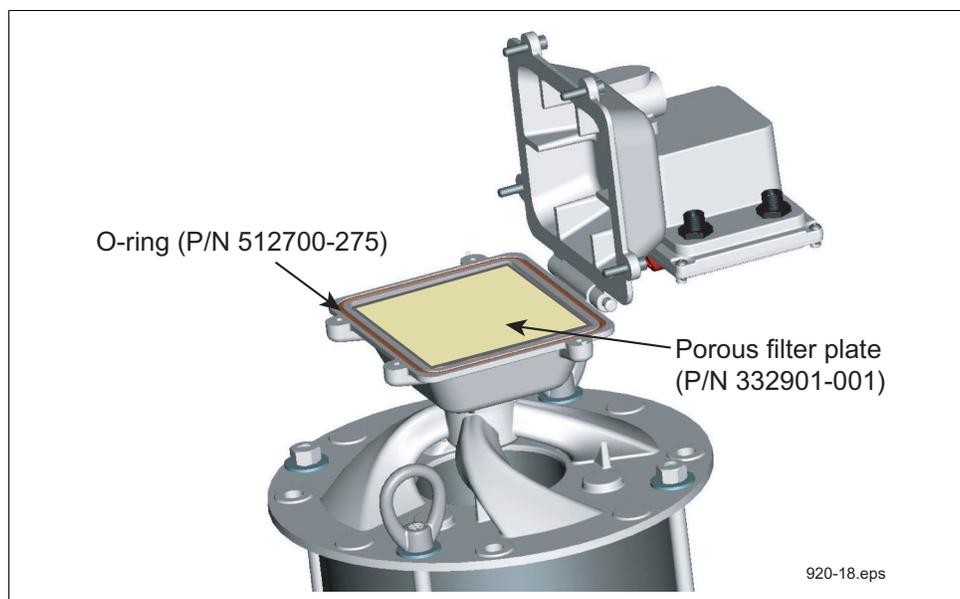


Figure 16. Replacing the valve filter and o-ring

## Valve Enclosure Assembly Kit (P/N 330020-643)

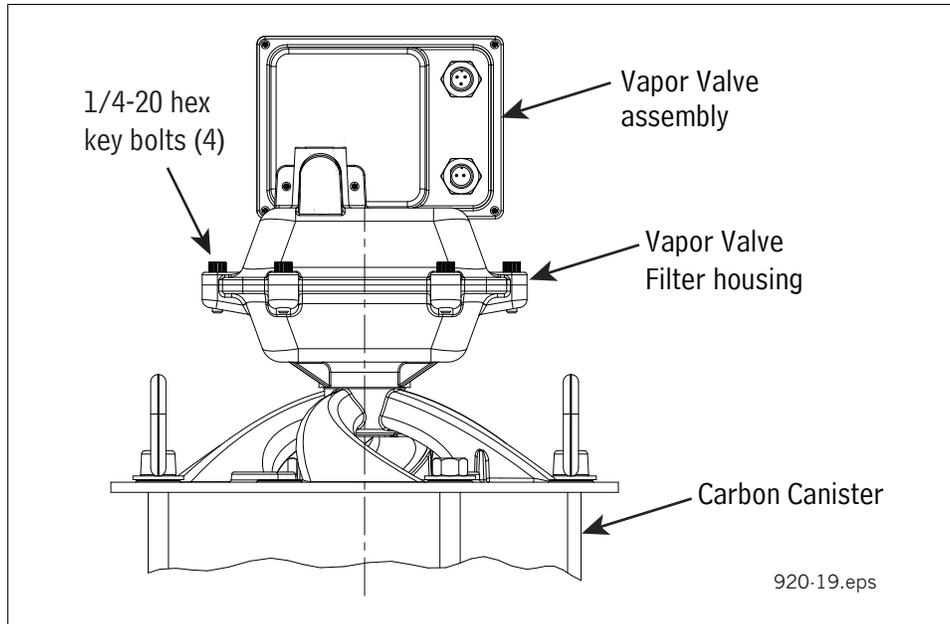


Figure 17. Removing vapor valve assembly

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).

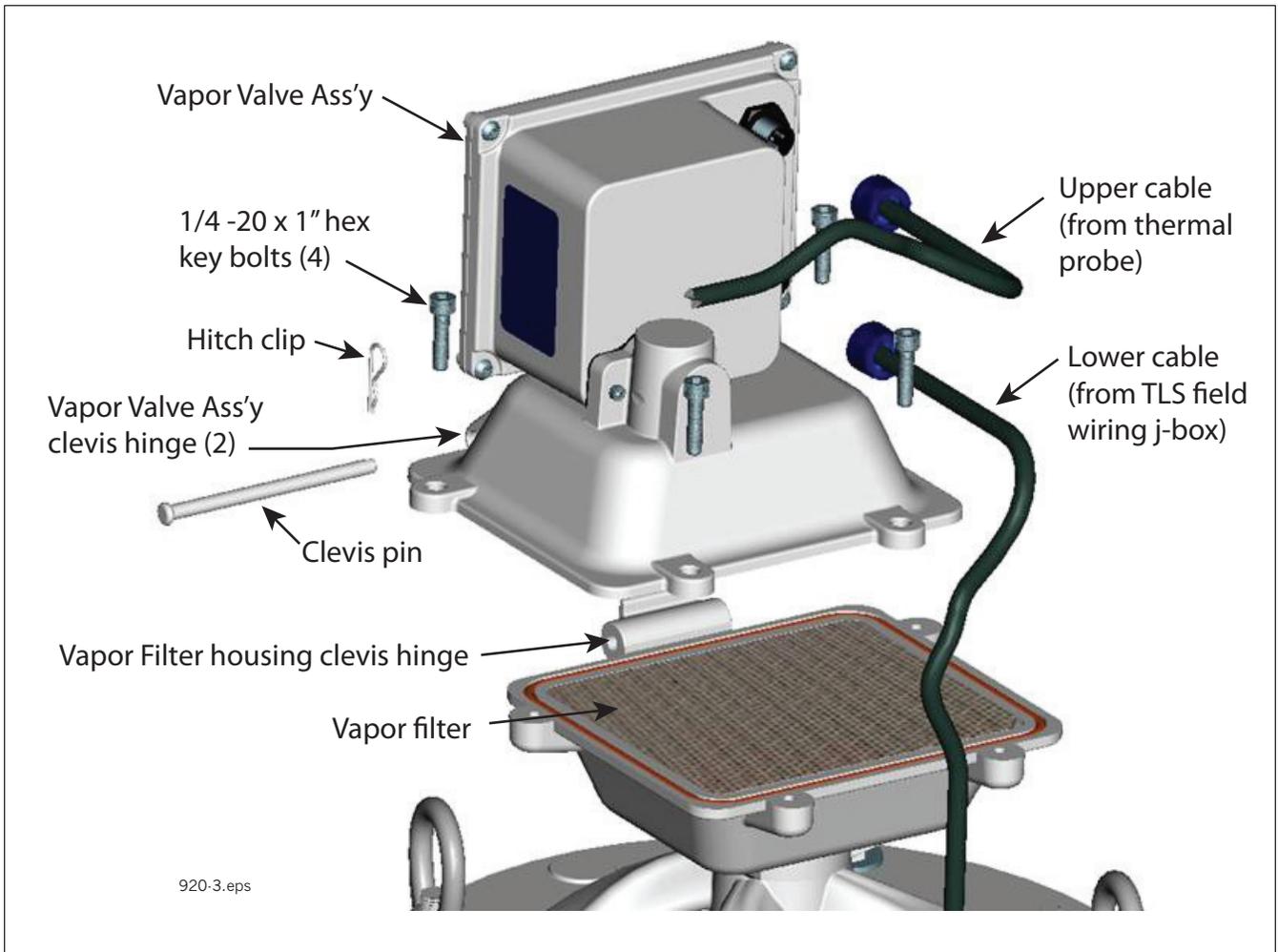


Figure 18. Replacing vapor valve assembly

## Thermal Probe Kit (P/N 330020-653)

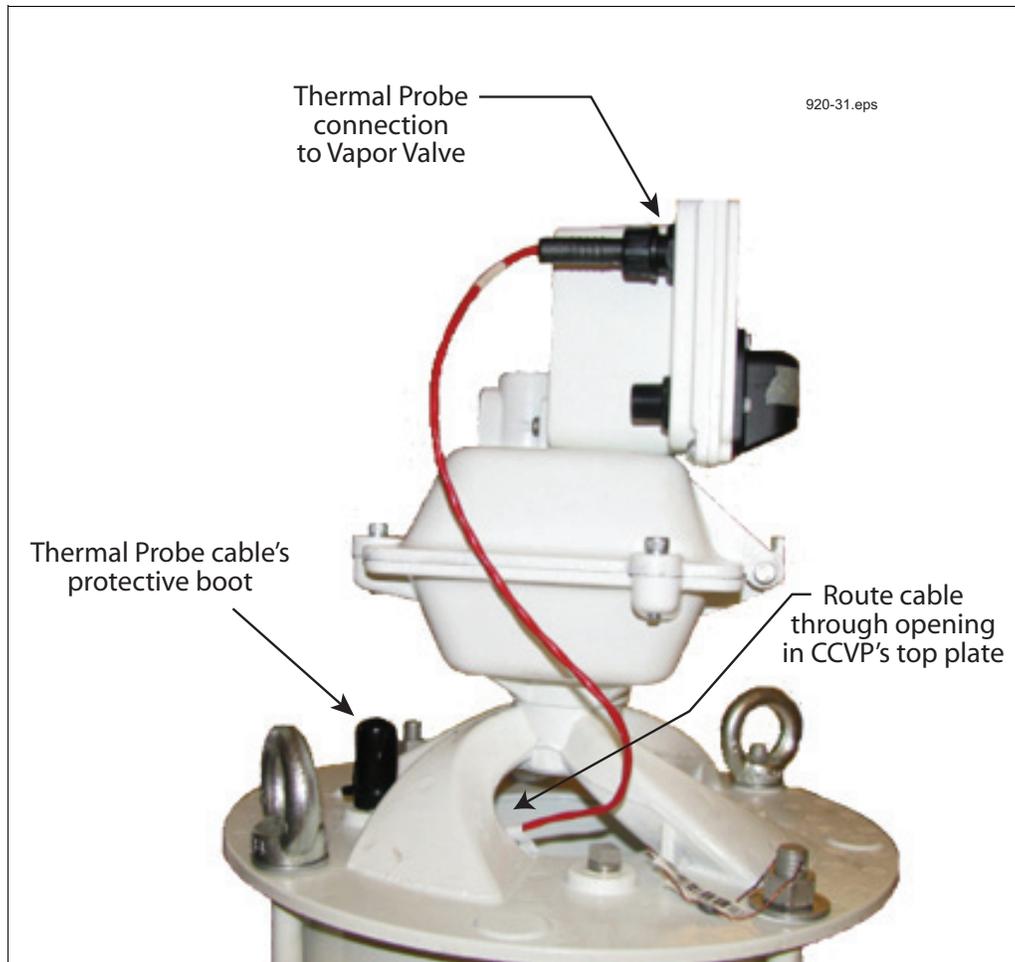


Figure 19. CCVP thermal probe

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).

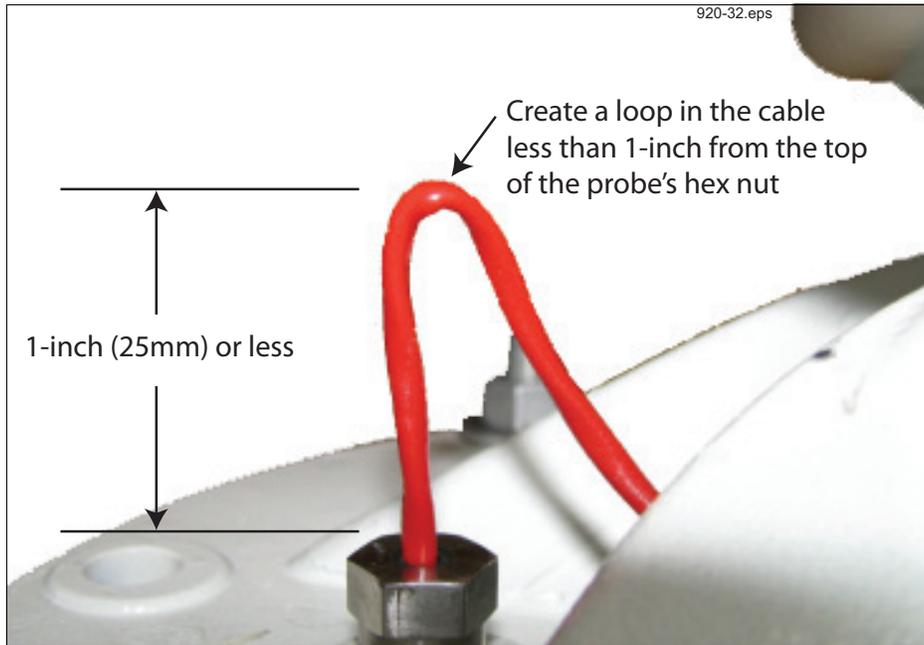


Figure 20. Preparing the thermal probe cable for the protective boot

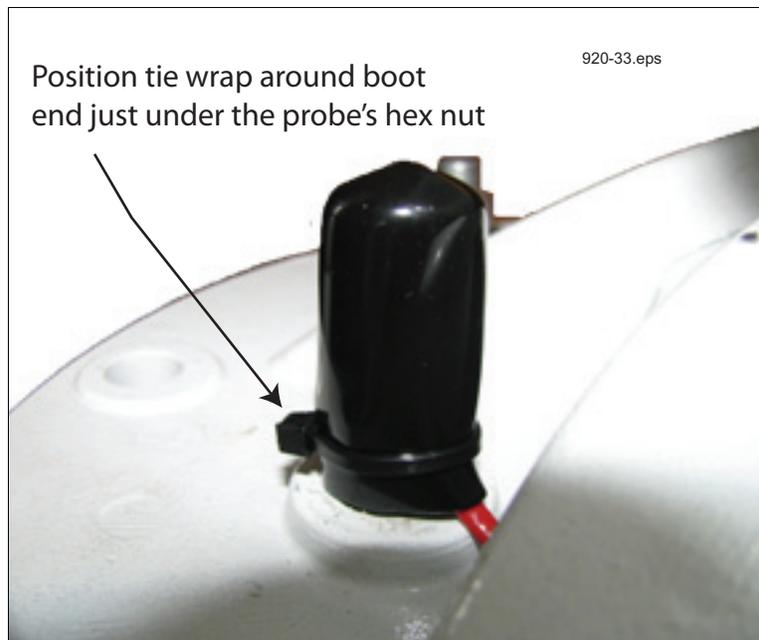


Figure 21. Positioning the tie wrap over the probe cable's protective boot



# Pressure Management Control

## Install, Setup, & Operation Manual

*For Veeder-Root Vapor Polishers*



# 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.

## **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 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/eo-evrphaseII.htm](http://www.arb.ca.gov/vapor/eo-evrphaseII.htm)) for the latest manual revisions pertaining to Executive Order VR 203 (VST Phase II EVR System).

## **WARRANTY**

**Please see next page.**

©Veeder-Root 2010. All rights reserved.

# Warranty

---

## **TLS-350R, TLS-350 PLUS, TLS-350J AND TLS-300I/C, AND TLS-2 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 AND FUSES ARE NOT COVERED UNDER WARRANTY.**

We shall not be responsible for any expenses incurred by the user.

This warranty applies only when the product is installed in accordance with Veeder-Root's specifications, and 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.

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.

## **LAMPS AND FUSES ARE NOT COVERED UNDER WARRANTY.**

This warranty applies only when the product is installed in accordance with Veeder-Root's specifications, and 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.

## **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 fifteen (15) months from date of invoice. We will repair or replace the product if the product is returned to us; transportation prepaid, within the warranty period, and is determined by us to be defective. 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.

We shall not be responsible for any expenses incurred by the user.

## **CARBON CANISTER VAPOR POLISHER**

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. 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. The user must contact the Veeder Root Customer Service for specific detailed information concerning the failed component return to ensure proper processing.

This warranty applies only when the product is installed in accordance with Veeder-Root's specifications, and a Warranty Registration and Checkout Form has been filed with Veeder-Root by an authorized Veeder-Root Distributor.

---

This warranty will not apply: (1) to any product which has been subject to misuse, abuse, negligence, accident, or drive-offs; (2) to systems that are misapplied or are not installed per Veeder-Root's specifications, or which have been modified, rebuilt or repaired by unauthorized persons; or (3) to damage resulting from acts of God.

Repair or replacement of the defective part or component under the terms of this warranty is the **EXCLUSIVE REMEDY**. 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.**

<b>Introduction</b>	
Site Requirements .....	1
Contractor Certification Requirements .....	1
Related Manuals .....	2
Safety Precautions .....	2
<b>Installation</b>	
Vapor Pressure Sensor .....	3
Carbon Canister Vapor Polisher .....	3
Installing TLS Console Modules - General Notes .....	3
Circuit Directory .....	4
Smart Sensor Interface Module .....	5
NVMEM203 Board .....	5
<b>Setup</b>	
Introduction .....	6
Smart Sensor Setup - Vapor Pressure Sensor .....	6
Smart Sensor Setup - Vapor Polisher .....	7
ATM Pressure Sensor Setup .....	7
PMC Setup .....	9
<b>Operation</b>	
Alarms .....	10
Overview of TLS console Interface.....	10
Alarm Posting .....	11
PMC Alarm Summary .....	11
PMC Status Report .....	12
Viewing PMC Reports Via RS-232 Connection .....	12
Connecting Laptop to Console .....	12
Connecting Laptop to Console .....	13
Sending Console Commands.....	16
<b>Diagnostics</b>	
Automatic Control .....	20
Manual control .....	20
PMC Diagnostic Menus .....	20
<b>Troubleshooting</b>	
PMC SETUP .....	23
PMC Sensor Fault .....	23
Example Smart Sensor reports .....	24

## Figures

Figure 1.	TLS console Interface Module Bays .....	4
Figure 2.	Smart Sensor Setup - Vapor Pressure Sensor .....	6
Figure 3.	Smart Sensor Setup - Vapor Polisher .....	7
Figure 4.	PMC Setup .....	9
Figure 5.	TLS console alarm interface .....	10
Figure 6.	TLS console alarm example .....	11
Figure 7.	PMC Status Report .....	12
Figure 8.	Connecting laptop to TLS console for serial communication .....	13
Figure 9.	Connection Description window .....	14

Figure 10.	Connect To window .....	14
Figure 11.	Console comm port settings printout example .....	15
Figure 12.	HyperTerminal main window .....	16
Figure 13.	Vapor Valve Status Report - Serial to PC Format .....	17
Figure 14.	Smart Sensor Sub Alarm History Report - Serial to PC Format .....	17
Figure 15.	Vapor Polisher Runtime Diagnostic Report - Serial to PC Format .....	18
Figure 16.	PMC Daily Vapor Polisher Diagnostic Report - Serial to PC Format .....	19
Figure 17.	SmartSensor Diagnostic Menus .....	21
Figure 18.	PMC Diagnostic Menus .....	22

## Tables

Table 1.	Related Manuals .....	2
Table 2.	PMC Alarm Summary .....	11
Table 3.	Serial Commands for PMC Diagnostic Reports .....	17
Table 4.	Vapor Polisher Runtime Diagnostic Report Event Codes .....	18
Table 5.	Smart Sensor Device Fault Summary .....	23

## Introduction

This manual provides instructions to install, setup, and operate the components of Veeder-Root Pressure Management Control (PMC) equipment. The PMC feature is an option for the TLS console platform, and as such, many of the installation/setup/operation instructions for non-PMC specific tasks are covered in TLS-3XX supplied literature. Do not use this manual when PMC is installed with ISD. Use the ISD Setup & Operation Manual, 577021-800.

## Site Requirements

---

Below are the requirements for all PMC installations:

- V-R TLS-350R/EMC w/BIR, TLS-350 Plus/EMC Enhanced, TLS-350/EMC and ProMax consoles with ECPU2 - install as per TLS-3XX Site Prep manual, setup following instructions in TLS-3XX System Setup Manual.
- A flash memory board (NVMEM203) for PMC 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.
- Vapor Pressure Sensor and Smart Sensor Module- install and connect following instructions in the Vapor Pressure Sensor Installation Guide.
- Carbon Canister Vapor Polisher - install and connect following instructions in the Carbon Canister Vapor Polisher Installation and Maintenance Guide.
- An RS-232 Port will be available for use by contractor or government inspectors.

## 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; tank and line preparation; and line leak detector installation.

**TLS-350 Technician (Level 2/3 or 4) Certification:** Contractors holding valid TLS-350 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-300 or TLS-350 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

**In-Station Diagnostics (ISD-PMC) Technician Certification:** ISD PMC Contractors holding a valid ISD/PMC Certification are approved to perform (ISD/PMC) installation checkout, startup, programming, and operations training. This training also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current Veeder-Root Technician Certification is a prerequisite for the ISD/PMC course.

**Veeder-Root ISD/PMC Including Carbon Canister Vapor Polisher Contractor Certification:** This Certification includes Executive Orders 203, 204 and the Veeder-Root Vapor Polisher. This certification is required for setup and service of the Veeder-Root Vapor Polisher.

**Warranty Registrations** may only be submitted by selected Distributors.

## Related Manuals

The manuals in Table 1 below are shipped with the equipment on the V-R Tech Docs CD-ROM and will be needed to install specific equipment.

**Table 1. Related Manuals**

V-R Manual	Part Number
TLS-3XX Site Prep Manual	576013-879
Vapor Pressure Sensor Installation Guide	577013-797
TLS-3XX Series Consoles System Setup Manual	576013-623
TLS-3XX Series Consoles Operator's Manual	576013-610
Serial Comm Modules Installation Guide	577013-528
TLS-350 Series Board and Software Replacement Manual	576013-637
Carbon Canister Vapor Polisher Installation and Maintenance Guide	577013-920
In-Station Diagnostics and PMC Troubleshooting Guide	577013-819

## Safety Precautions

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

 <p><b>ELECTRICITY</b> High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p><b>TURN POWER OFF</b> Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>
 <p><b>READ ALL RELATED MANUALS</b> Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>	 <p><b>WARNING</b> Heed the adjacent instructions to avoid equipment damage or personal injury.</p>

<b>⚠ WARNING</b>	
 	<p><b>The console contains high voltages which can be lethal. It is also connected to low power devices that must be kept intrinsically safe.</b></p> <p><b>Turn power Off at the circuit breaker. Do not connect the console AC power supply until all devices are installed.</b></p> <p><b>Touching a live circuit can cause electrical shock that may result in serious injury or death.</b></p>

## Installation

This section discusses the installation and wiring of the hardware required to enable the TLS console to perform pressure management of the site's gasoline vapor polisher equipment:

- Vapor Pressure Sensor
- Carbon Canister Vapor Polisher
- Smart Sensor Interface Module
- NVMEM203 board
- Multiport Card - only required for sites with TLS console controlled vapor processor
- I/O Combination Module - only required for sites with non-TLS console controlled vapor processor



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 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 Vapor Pressure Sensor Installation guide (P/N 577013-797).

### Carbon Canister Vapor Polisher

---

Install one Carbon Canister Vapor Polisher following the instructions in the Carbon Canister Vapor Polisher Installation and Maintenance Guide (P/N 577013-920).

### Installing TLS Console Modules - General Notes

---

TLS consoles have three bays in which interface modules can be installed; Comm bay, Power bay and Intrinsically-Safe bay (ref. Figure 1). Probe Interface modules and Smart Sensor modules are installed in the Intrinsically-Safe bay and the Mod Bus module is installed in the Comm bay.

**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.**



Switch off power to the TLS console before you install modules and connect sensor wiring.

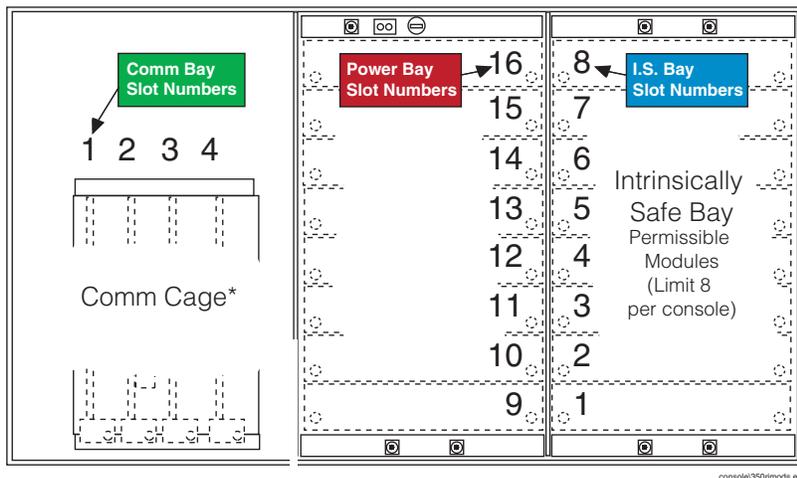


Figure 1. TLS console Interface Module Bays



**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 TLS console will not identify correctly 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., VPS: FP1.

## **Smart Sensor Interface Module**

---

Verify that a Smart Sensor Interface Module with Atmospheric Sensor (P/N 332250-001) is installed in the TLS console. Connect the field wiring from the Vapor Pressure Sensor (VPS) to the Smart Sensor Interface Module as instructed in the VPS installation manual. The Carbon Canister Vapor Polisher will also be connected to the Smart Sensor Interface Module.

## **NVMEM203 Board**

---

Verify that a NVMEM203 board is installed in the TLS console (ref. Figure 2-14 in the V-R TLS-3XX Series Consoles Troubleshooting Manual P/N 576013-818, Rev J or later). This board contains flash EEPROM and RAM needed to run PMC software and store PMC reports. No setup is required.

# Setup

## Introduction

This section describes how to perform PMC setup 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 PMC-related equipment must be installed in 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 console may not operate properly. 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.

## Smart Sensor Setup - Vapor Pressure Sensor

The Smart Sensor Interface Module is installed in the Intrinsically-Safe bay of the TLS console. This module monitors the Vapor Pressure Sensor. Figure 2 diagrams the Smart Sensor setup procedure.

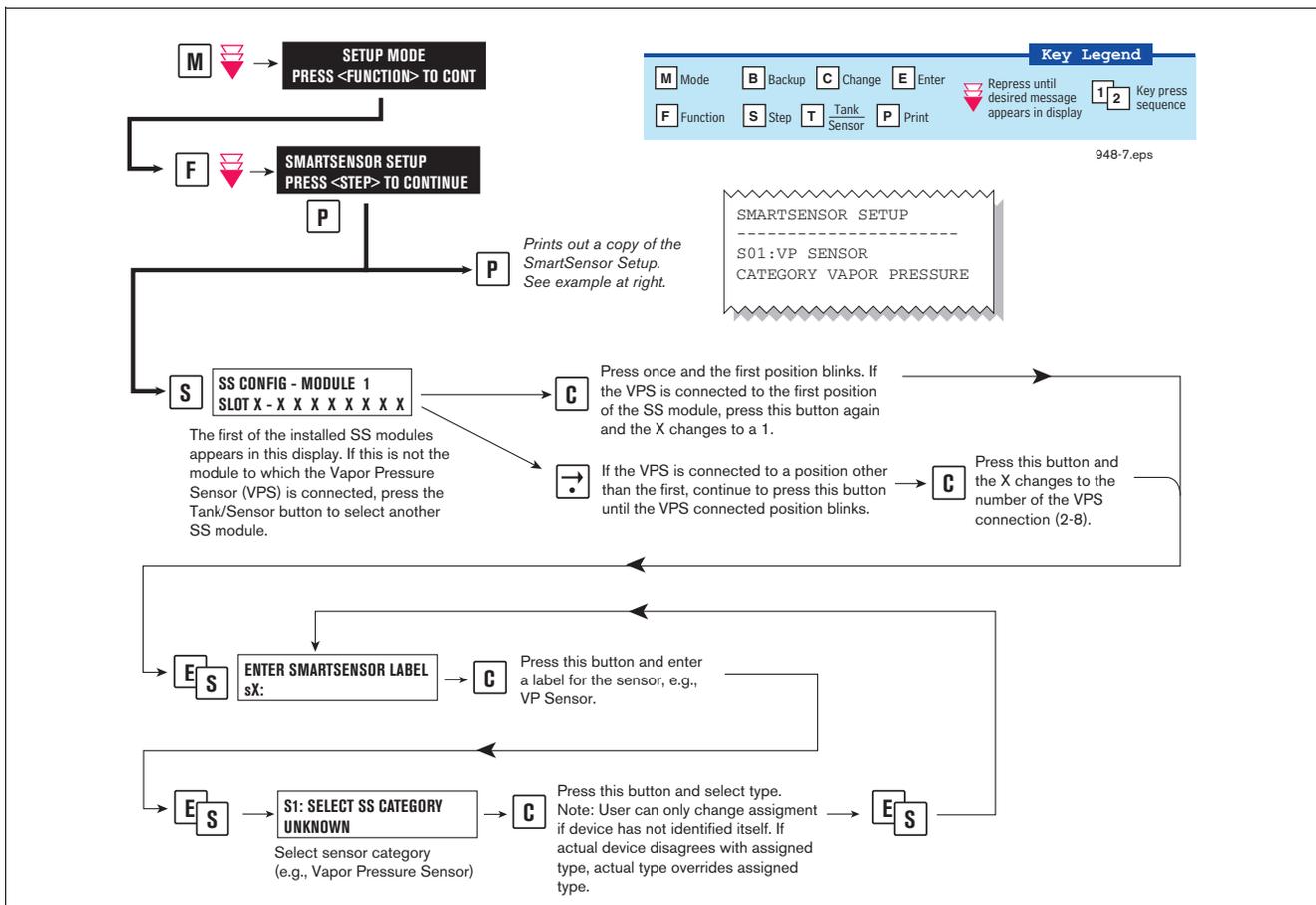


Figure 2. Smart Sensor Setup - Vapor Pressure Sensor

## Smart Sensor Setup - Vapor Polisher

The Smart Sensor Interface Module is installed in the Intrinsically-Safe bay of the TLS console. This module monitors the Vapor Polisher. Figure 3 diagrams the Smart Sensor setup procedure.

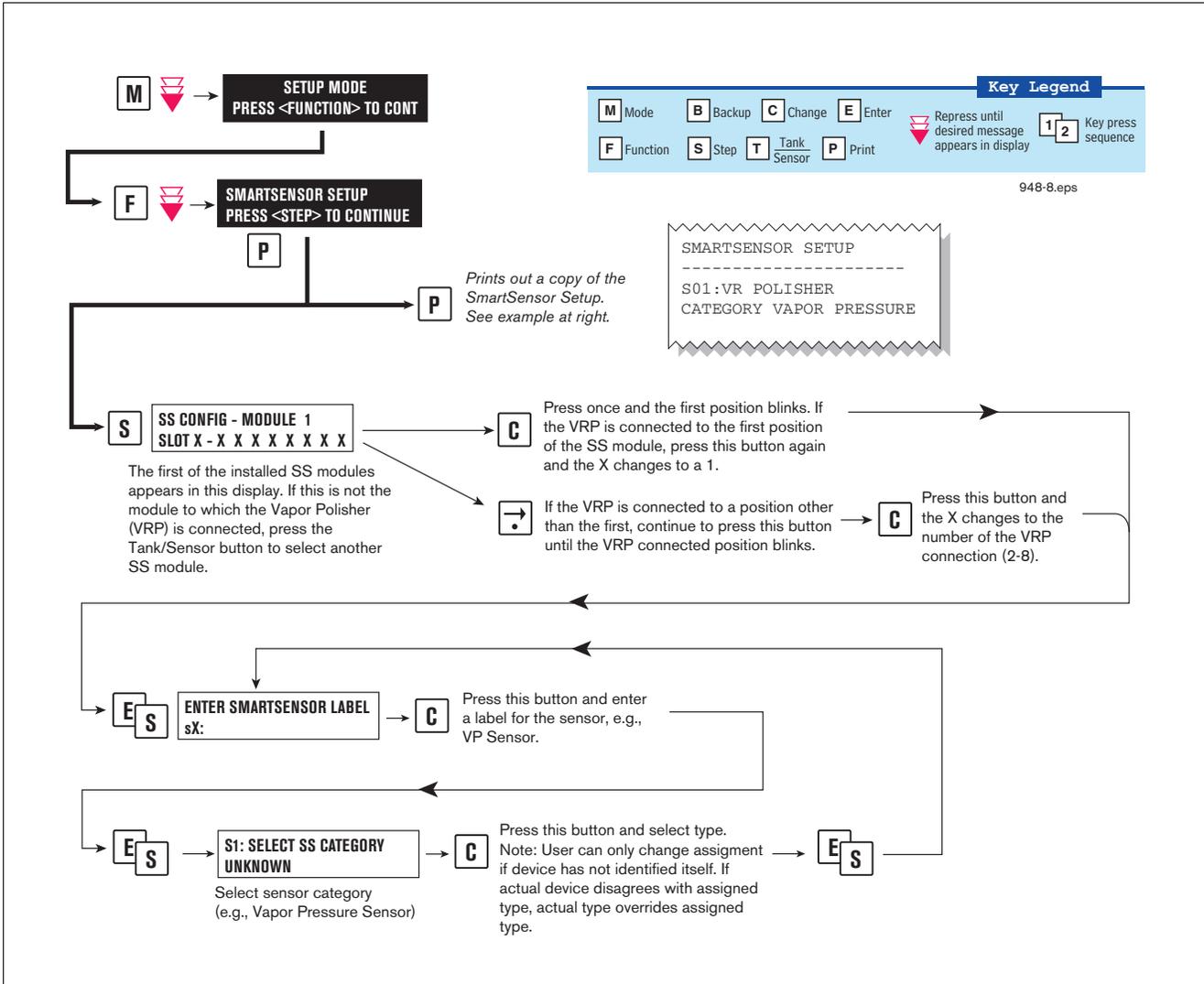


Figure 3. Smart Sensor Setup - Vapor Polisher

## 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
UKNOWN
```

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.

# PMC Setup

Figure 4 diagrams the PMC setup programming.

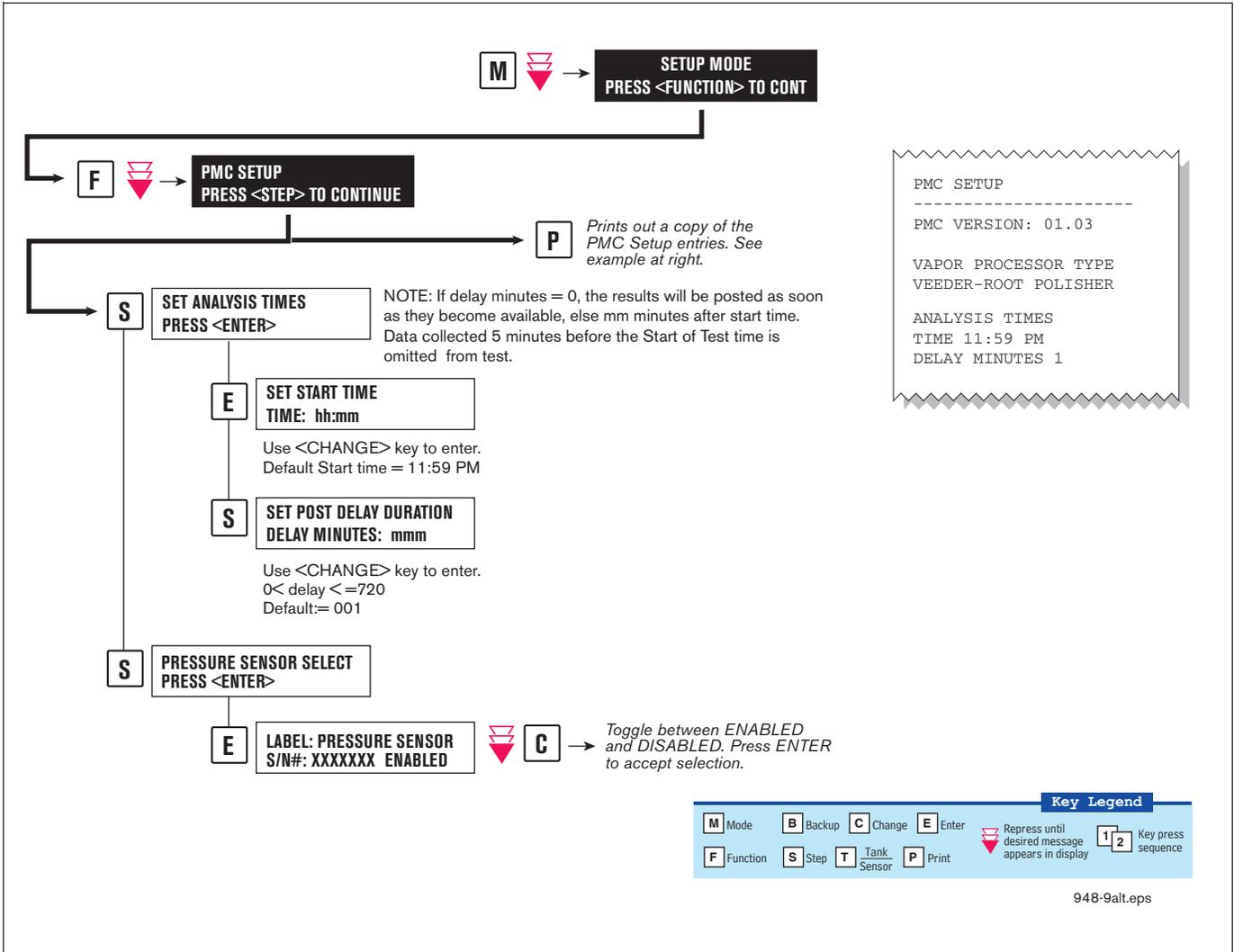


Figure 4. PMC Setup

# Operation

## Alarms

### OVERVIEW OF TLS CONSOLE INTERFACE

The TLS console is continuously monitoring the vapor recovery system and PMC sensors for alarm conditions. During normal operation when the TLS console and monitored PMC equipment 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 5).

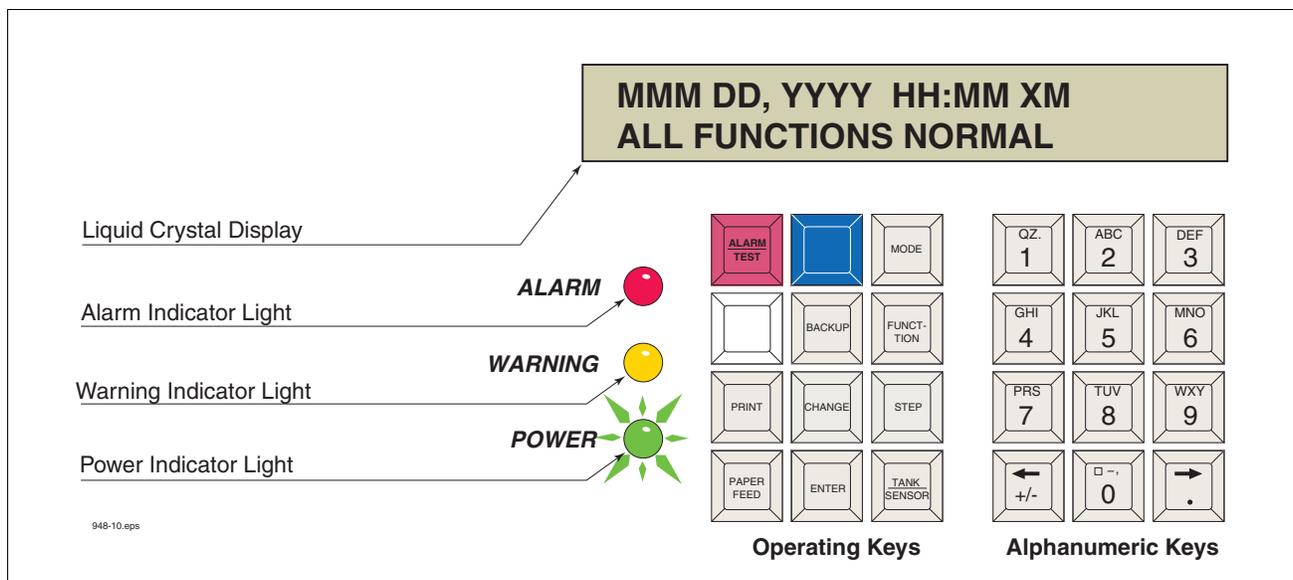


Figure 5. TLS console alarm interface

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.

Alarm posting causes the TLS console-based system to activate indicator lights, an audible alarm, and an automatic strip paper printout documenting the alarm.

## ALARM POSTING

Displayed messages alert you to the type of alarm. Printed messages show the type of alarm and the time it was posted (see Figure 6). Alarms are logged into the Non-Priority Alarm History in the TLS.

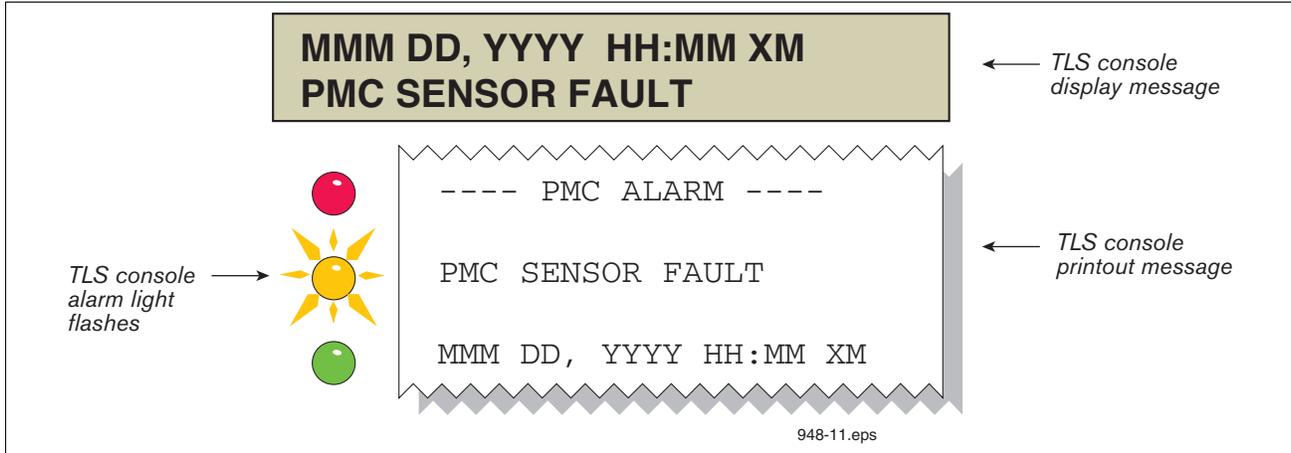


Figure 6. TLS console alarm example

## PMC Alarm Summary

Table 2 contains a listing of the PMC generated alarms including a brief description of each and associated front panel indicator. See Troubleshooting section for suggested corrective actions.

Table 2. PMC Alarm Summary

Warning Type	Description	Light Indicator	Suggested Troubleshooting <sup>1</sup>
PMC Sensor Fault	Component used by PMC has failed or reported an error condition. See Troubleshooting section of complete description of sensors and associated conditions that can cause a sensor fault.	Yellow	Check for Smart Sensor Device Alarm or Fault.
PMC Setup	A sensor used by PMC is missing or not configured.	Red	Ensure that all required components are installed and operational.

<sup>1</sup>Refer to Troubleshooting Section of this manual.

## PMC Status Report

Figure 7 below shows the procedure to view the PMC Status Report.

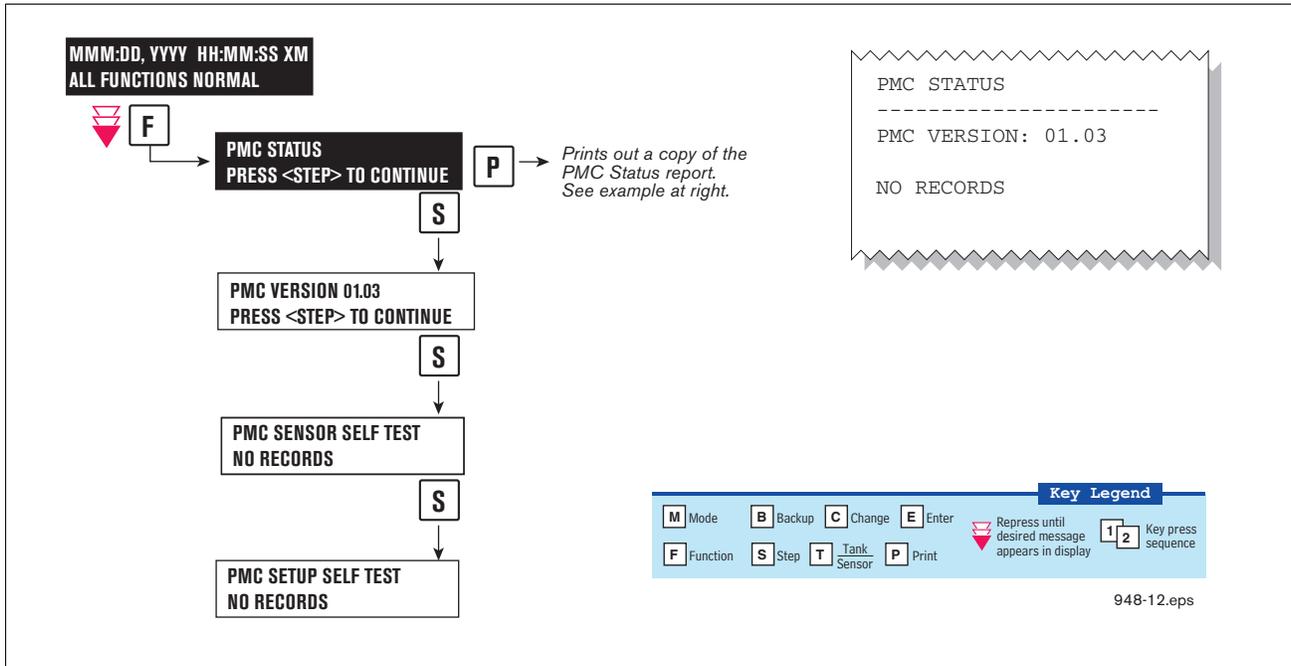


Figure 7. PMC Status Report

## Viewing PMC 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 8 below.

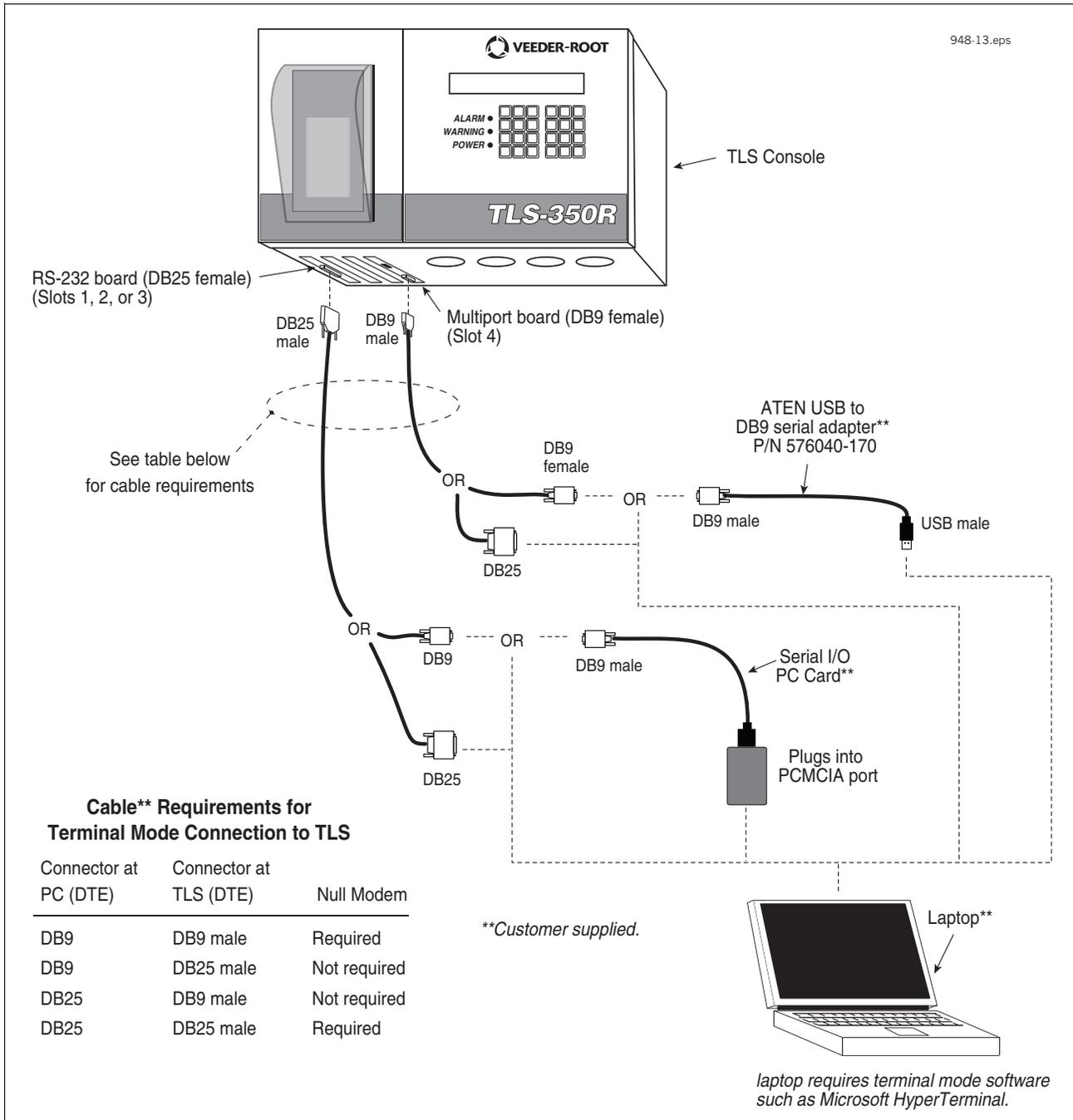


Figure 8. Connecting laptop to TLS console for serial communication

### 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 9), enter a connection name, e.g., TLSDIRECT, and click the OK button.



Figure 9. 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 10), 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 10. 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:

```

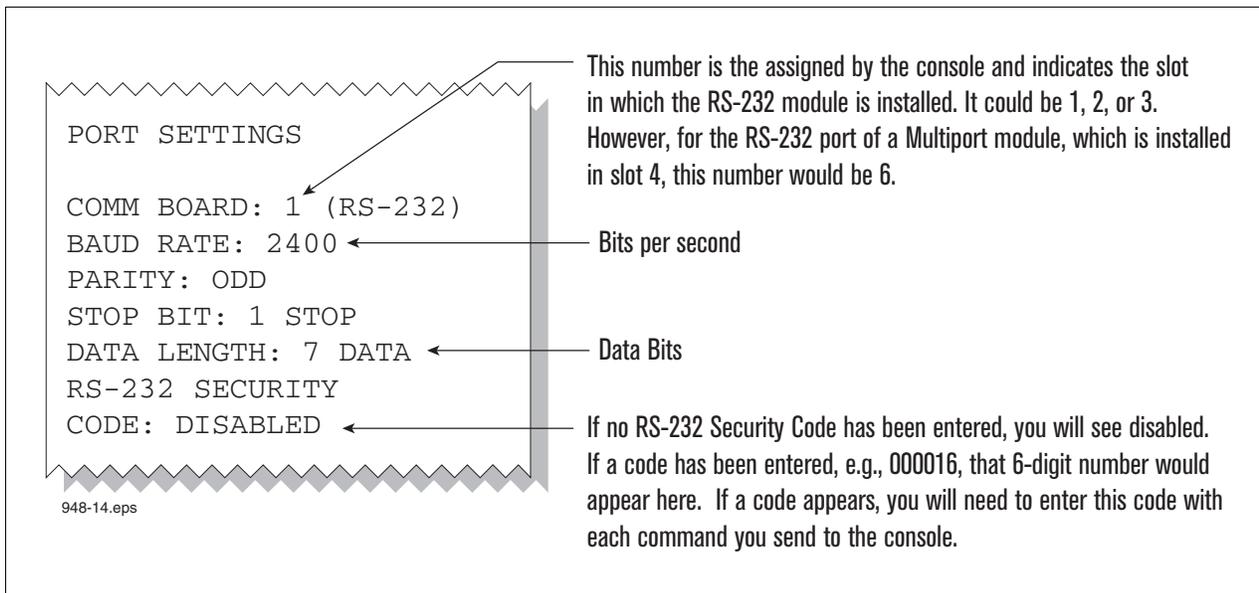
COMMUNICATIONS SETUP
PRESS <STEP> TO CONTINUE
    
```

- 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 11 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 11. 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 12).

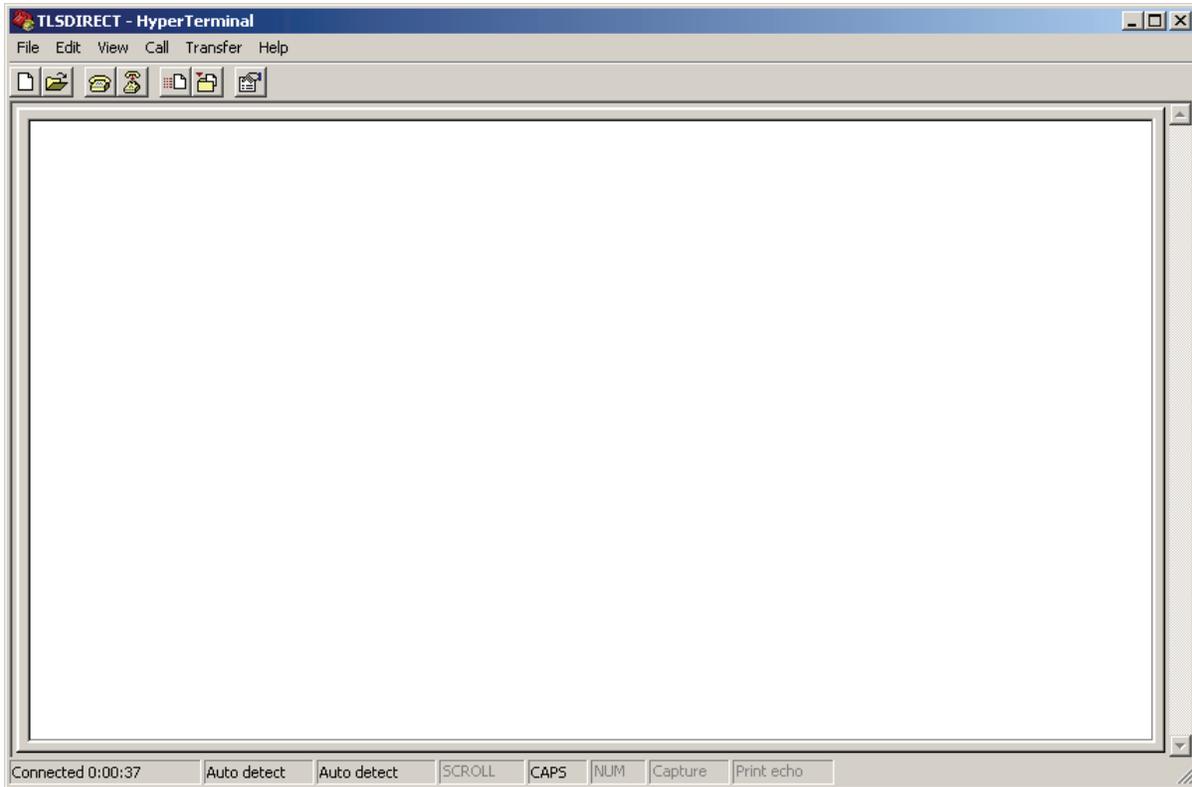


Figure 12. HyperTerminal main window

### SENDING CONSOLE COMMANDS

Table 3 shows important PMC console commands. 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 Vapor Polisher Runtime Diagnostic Report.



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 IV8000. 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 000016IV8000.

You will see the typed command on the screen: ⓂIV8000 followed by the response (report) from the console. The Ⓜ symbol indicates Ctrl+A 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 ⓂIV80000Ⓜ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 3. Serial Commands for PMC Diagnostic Reports**

Report Type	Serial Command (PC to Console)*
Vapor Valve Status Report (See example Figure 13)	<SOH>IB6100
Vapor Polisher Runtime Diagnostic Report (See example Figure 15)	<SOH>IV8000
Daily Vapor Polisher Diagnostic Report (See example Figure 16)	<SOH>IV8800

\*<SOH> = Control A. For more information on TLS console serial commands, refer to the V-R Serial Interface Manual.

Figure 13 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
    
```

**Figure 13. 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 13) command only provides active Sensor Fault conditions. Use the IB6200 command to see archived fault conditions (Figure 14).

```

IB6200
SEP 19, 2008 1:05 PM

BIG 3 OIL
123 POWER DRIVE
HELENA, MT
(406) 123-4567

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 14. Smart Sensor Sub Alarm History Report - Serial to PC Format**

Figure 15 shows an example Vapor Polisher Runtime Diagnostic Report and Table 4 explains the IV8000 report's event codes.

```

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  2:01PM        0.463      CLOSE HC LIMIT
2-01-08  2:18PM      -0.263      OPEN PURGE
2-01-08  2:27PM        0.063      CLOSE HC LIMIT
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 11:38AM        0.038      CLOSE HC LIMIT
2-04-08 11:48AM      -0.300      OPEN PURGE
2-04-08 11:50AM        0.060      CLOSE HC LIMIT
2-04-08 12:28PM      -0.263      OPEN PURGE
2-04-08 12:37PM        0.222      CLOSE HC LIMIT
2-04-08 12:42PM      -0.299      OPEN PURGE
    
```

Figure 15. Vapor Polisher Runtime Diagnostic Report - Serial to PC Format

Table 4. Vapor Polisher Runtime Diagnostic Report Event Codes

Event Code	Cause	Event Code	Cause
NO EVENT	The valve changed state outside of the carbon canister algorithm.	CLOSE FULL	Canister load has reached 100%. Further loading is not allowed.
CLOSE TEST	Manual operation of the valve	CLOSE NEAR FULL	Canister load has exceeded 80%. Further loading is not allowed unless pressure exceeds +1.3.
OPEN TEST	Manual operation of the valve	CLOSE EMPTY	Excess purging is complete.
CLOSE PURGE HI P	The canister state is in excess purge and the pressure is >0.5.	OPEN PURGE	Canister load is >0% and pressure <-0.25
CLOSE PURGE TIME	The canister state is in excess purge and the time is outside 6AM to 4PM.	OPEN EXCESS PURGE	Canister load is 0%, Excess purge is incomplete, pressure <-1.5, time is between 6AM and 4PM.
CLOSE FORCE PURGE	Canister is in startup period. Loading with pressures <+1.05 is not allowed until startup period is complete.	OPEN FILL	Canister valve is open for loading: <ul style="list-style-type: none"> <li>When pressure is greater than or equal to 0.75 IWC and Canister load is less than 80%.</li> <li>Pressure is greater than or equal to 1.3 IWC and Canister load is greater than 80% and less than 100%.</li> </ul>
CANISTER EMPTY	Canister load equals 0% after having loaded to more than 1%..		

Figure 16 shows an example PMC Daily Vapor Polisher Diagnostic Report.

```
IV8800
OCT  2, 2008  2:58 PM

PMC DAILY VAPOR POLISHER DIAGNOSTIC

          LOAD  PRGE  MIN%  MAX%  SELF  PRESS
DATE/TIME    HRS   HRS  LOAD  LOAD  TEST  TEST
08-10-02 14:58:58  3.1  2.5   15   69  WARN  FAIL
```

**Figure 16. PMC Daily Vapor Polisher Diagnostic Report - Serial to PC Format**

## 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, atmospheric 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. Purging occurs when the valve is open and the UST pressure is negative. The valve will close when the canister has either reached capacity or the canister is empty after purging.

### Manual control

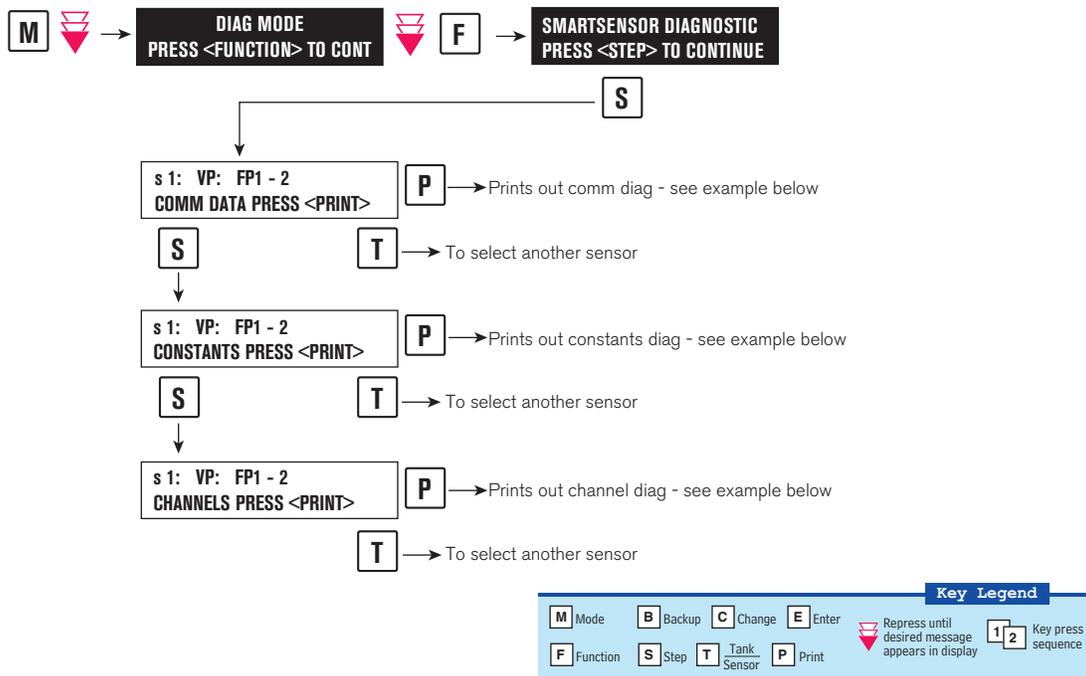
---

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 (see Exhibit 11 of VR 203) of the valve without waiting for canister to reach loading or purging thresholds. The current UST ullage space vapor pressure will also be available through the diagnostic menu.

### PMC Diagnostic Menus

---

The Smart Sensor (see Figure 17) and PMC (see Figure 18) diagnostic menus below are viewed from the TLS Console front panel.



```

SS COMM DIAG
-----
s 1: AFM1  FP1-2
SAMPLES READ    58
SAMPLES USED    54
PARITY ERR      0
PARTIAL READ    0
COMM ERR        0
RESTARTS        0
  
```

948-1.eps

```

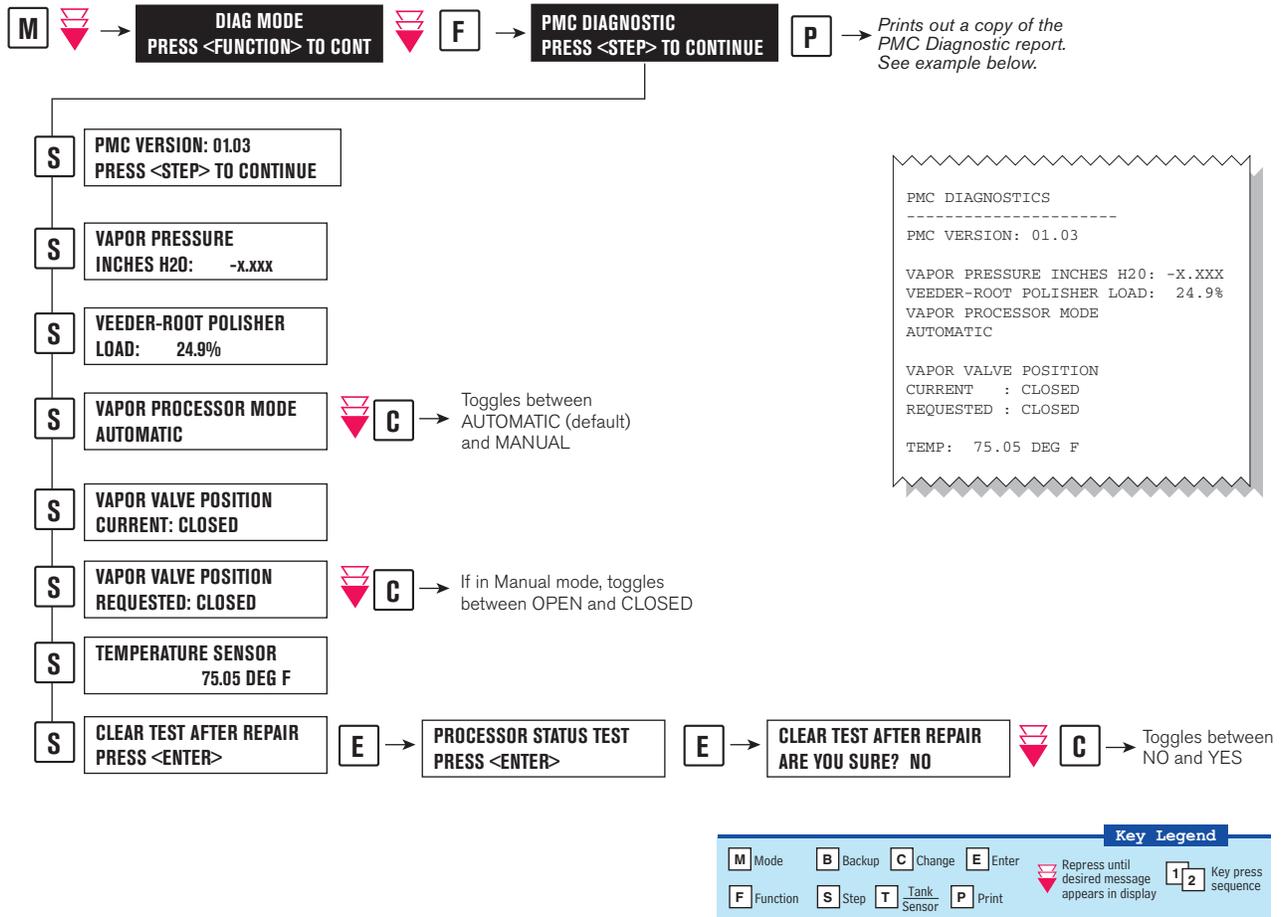
SS CONSTANTS DIAG
-----
s 1: AFM1  FP1-2

VAPOR PRESSURE
SERIAL NUMBER    1007
PROTOCOL VERSION    0
  
```

```

SS CHANNEL DIAG
-----
s 1: AFM1  FP1-2
YY-MM-DD HH:MM:SS
C00 B50B 3D68 00E0 0000
C04 0000 03EF 0000 0004
C08 0A3C 3D68 5693 0081
C12 80C4 80A4 0104 2579
C16 0000 0000 00A3 03D6
C20 0709 0032 04C9 880F
  
```

Figure 17. SmartSensor Diagnostic Menus



948-6.eps

Figure 18. PMC Diagnostic Menu

# Troubleshooting

## PMC SETUP

This warning occurs when the PMC setup is not complete.

### DIAGNOSTIC CHECKLIST

Procedure	
STEP 1.	Gasoline tanks configured? <input type="checkbox"/>
STEP 2.	ATM sensor configured and enabled? <input type="checkbox"/>
STEP 3.	Vapor valve installed and configured? <input type="checkbox"/>
STEP 4.	On the TLS press the MODE key until the DIAGNOSTIC MODE menu is displayed (this will cause a TLS console System Self-Test). <input type="checkbox"/>
STEP 5.	If alarm does not clear, contact Veeder-Root Technical Support at (800) 323-1799.

## PMC Sensor Fault

Table 5 contains a listing of the Smart Sensor Device generated alarms including their cause and suggested troubleshooting. TLS Console PMC alarms may be interspersed amongst non-PMC alarms, please see TLS Series manuals for more information.

**Table 5. Smart Sensor Device Fault Summary**

Fault Message	Devices	Cause	Suggested Troubleshooting
Communication Alarm	Vapor Valve, Pressure Sensor, Tank Probe	Device not communicating with Smart Sensor Module	Check wiring and connections from the Smart Sensor board to the device in alarm.
Smart Sensor Fault Valve Command Fault	Vapor Valve	Valve will not move when commanded	Check installation of all Vapor Valve components including Thermal Probe and Vapor Sensor Assembly. Refer to manual 577013-920.
Smart Sensor Fault Cap Not Holding		Capacitor not holding charge	
Smart Sensor Fault Cap Not Charging		Capacitor not charging	
Smart Sensor Fault Temperature Range		Temperature out of range	

**EXAMPLE SMART SENSOR REPORTS**

```

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 TMP:         65.08 F
OUTLET TMP:        75.05 F
SENSOR FAULTS:
VALVE COMMAND FAULT
    
```

```

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 TMP:         65.08 F
OUTLET TMP:        75.05 F
SENSOR FAULTS:
CAP NOT HOLDING
    
```

```

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 TMP:         65.08 F
OUTLET TMP:        75.05 F
SENSOR FAULTS:
CAP NOT CHARGING
    
```

```

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 TMP:         65.08 F
OUTLET TMP:        75.05 F
SENSOR FAULTS:
TEMPERATURE RANGE
    
```

**Operability Test Procedures**

Refer to Exhibit 11 and Exhibit 12 of VR 203 and VR 204 for applicable operability test requirements for the Vapor Polisher.



# INSTALLATION MANUAL

HIRT VCS 100  
VAPOR PROCESSOR AND INDICATOR PANEL

FOR EXECUTIVE ORDER VR-203

**HIRT COMBUSTION ENGINEERS, INC.**

3659 San Gabriel River Parkway · Pico Rivera, Ca 90660

P.O. Box 6816 · Pico Rivera, CA 90661

Tel: (562)692-1490 · Fax: (562)692-7413 · E-mail: [HirtVCS@AOL.com](mailto:HirtVCS@AOL.com)

REV. 6: 07/2009

## Table of Contents

<u>Section</u>	<u>Page</u>
1. Introduction	1
2. Safety/Warnings	1
3. Contractor Requirements	1
4. Hirt VCS 100 Processor Overview	2
4.1 Theory of Operation	
4.2 How the Processor Operates	
4.3 Indicator Panel Function	
4.4 Dimensions, Weight, Specifications	
4.5 Processor Components	
5. Installation of Processor	5
6. Installation of Indicator Panel	9
7. Connection of Electrical and Vapor Pipe	9
8. Start-Up	13
9. Maintenance Instructions	17
10. Repair and Replacement of Components	17
11. Product Warranty	17

## 1. INTRODUCTION

This Manual contains the operation, installation, interconnection, start-up, and maintenance instructions for the VCS 100 processor and Indicator Panel. Note, these instructions are written to give the best installation in a sequence easiest for the installer. If there are any instructions in this manual which seem impossible, impractical, or questionable for your installation, call the Hirt Customer Service Department at (562) 692-6970 and ask for information regarding your local Hirt representative. Note, this manual should be retained for future reference.

## 2. SAFETY/WARNINGS

**WARNING:** Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury, or death. Read instructions thoroughly before installing or servicing this equipment.

**WARNING:** When gasoline vapor abatement system (i.e. processor) is in operation, temperature inside can exceed 2,000°F. To prevent burn hazard, do not contact any part of the gasoline vapor abatement system except controls. Do not remove protective covers while gasoline vapor abatement system is in operation.

## 3. CONTRACTOR REQUIREMENTS

To prevent from voiding the product warranty, all contractors who install, startup, and/or repair the VCS 100 system must be a Hirt VCS 100 certified technician. To attend a VCS 100 training session, call Hirt Customer Service at (562) 692-6970 or send an email request to [HirtVCS@aol.com](mailto:HirtVCS@aol.com). Once Hirt training is successfully completed, the technician will receive a wallet size proof of certification card. Technicians should carry the card while on the jobsite. Hirt maintains a list of active certified installers and companies. Technician certification can be verified by calling or emailing Hirt Combustion Engineers, Inc.

Note to Contractors/Technicians: Contractors should always verify the training and certification requirements with the local Air Quality Management District (District) before beginning installation of CARB EVR systems. The District inspector may request to see your certification card(s) on-site for confirmation.

## 4. HIRT VCS 100 PROCESSOR OVERVIEW

### 4.1 THEORY OF OPERATION

The processor continuously measures the pressure of the vapor in the storage tanks. When that pressure is negative, the processor remains de-energized and completely inactive. At any time when the pressure in the storage tank vapor becomes positive, the processor energizes its turbine, which extracts vapor from the storage tanks and sends that vapor into its thermal oxidizer where that vapor is destroyed. The processor continues to extract vapor until the pressure of the vapor is returned to negative, whereupon the processor turns itself off. It remains off unless or until the pressure again becomes positive.

### 4.2 PROCESSOR MECHANIZATION

The processor is connected to the storage tanks via the tank vapor vents, or another vapor pipe. The processor contains a vacuum sensor/switch, turbine, spark igniter, pilot, flame safeguard, vapor valve, and a thermal oxidizer.

When the vacuum sensor/switch measures that the pressure in the storage tank is negative, it remains open, thus not energizing the processor. In this condition the processor is inert and has zero effect on the remainder of the dispensing facility or its Stage I/II vapor recovery systems.

When the vacuum sensor/switch measures that the pressure of the vapor in the storage tanks is positive, the switch closes thereby energizing the turbine and activating the flame safeguard. The flame safeguard generates a spark at the pilot tip (i.e. spark igniter). The vapor is forced by the turbine from the storage tanks into the pilot and hence into the spark igniter. Only ignition of the pilot can cause the flame safeguard's relay to close\*. Only when pilot ignition is present and the flame safeguard relay is closed does the vapor valve open admitting vapor to the thermal oxidizer. Note that if the pilot does not ignite, the main vapor valve does not open, thus unprocessed vapor from the thermal oxidizer cannot be vented to the atmosphere. In the thermal oxidizer, the vapor is converted into CO<sub>2</sub> and H<sub>2</sub>O and then vented to the atmosphere.

\*This electrical interlock, built into the flame safeguard, is required by the California State Fire Marshal, ETL, American Gas Association specification 1-97, and ANSI Z21.20

### 4.3 INDICATOR PANEL FUNCTION

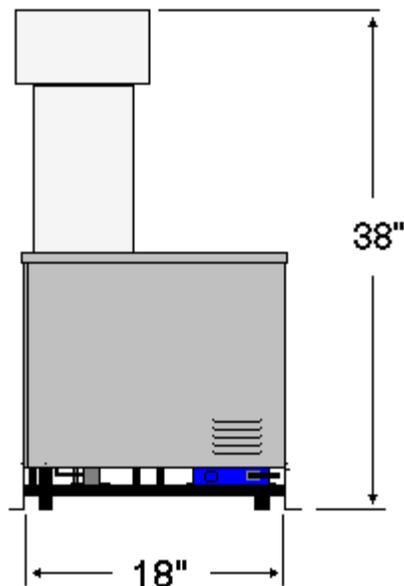
The processors' electrical power source comes thru an Indicator Panel. The panel allows the station operator to determine the current state of the

processor and whether or not the processor is operating properly. The panel includes a POWER switch with an integral POWER (green) lamp, a PROCESSING (green) lamp, and an OVERPRESSURE (red) lamp.

During normal operation, the POWER switch is on, the POWER lamp is on, the PROCESSING lamp is lit intermittently, and the OVERPRESSURE lamp is extinguished. The PROCESSING lamp is wired so it will light when the main valve is open and thermal oxidation is occurring.

The OVERPRESSURE lamp is wired to the vacuum sensor/switch and a timing module. If the UST pressure is positive for at least 1 hour, then the vacuum sensor/switch will be closed and the timing module will light the OVERPRESSURE lamp. The OVERPRESSURE lamp indicates a leak in the vapor recovery system or possibly a malfunction of the Hirt VCS 100 processor. The OVERPRESSURE lamp will extinguish after the leaks or processor malfunction is corrected and the processor has restored the UST ullage to a nominal  $-0.40$ " w.c.

#### 4.4 Processor Dimensions, Weight, and Specifications



MODEL: VCS 100

SERVICE: Outdoor, non hazardous area

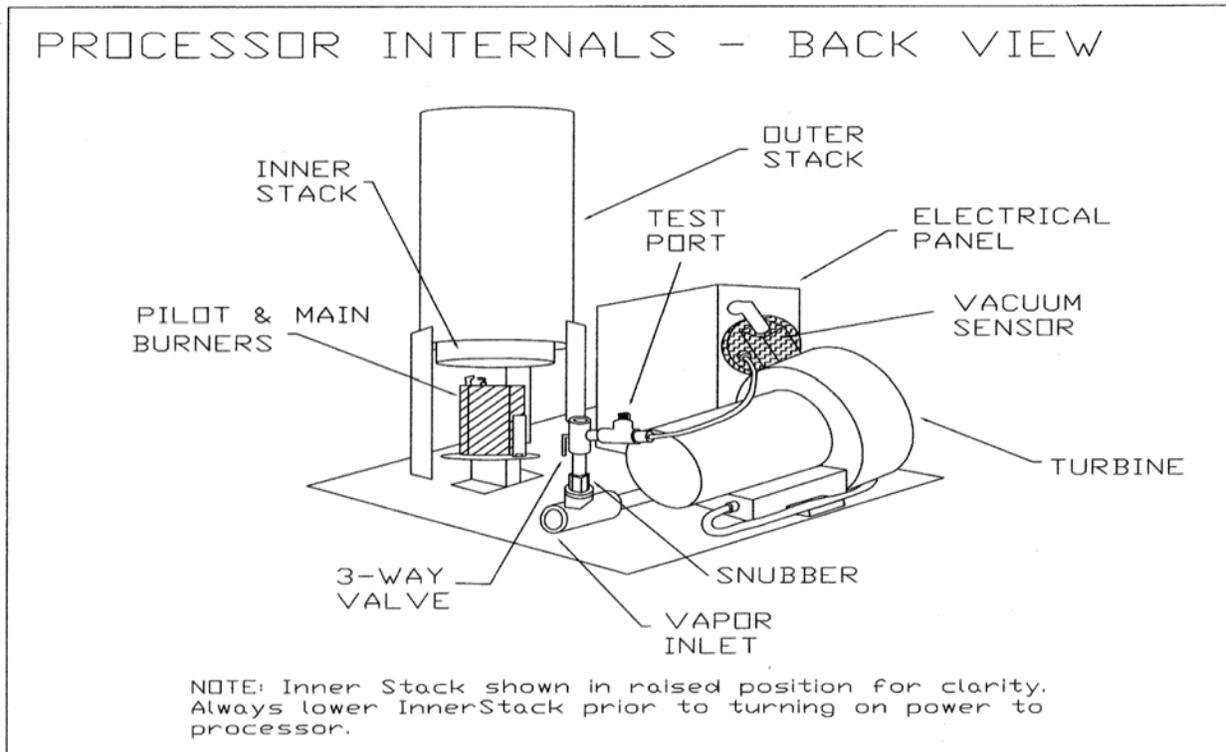
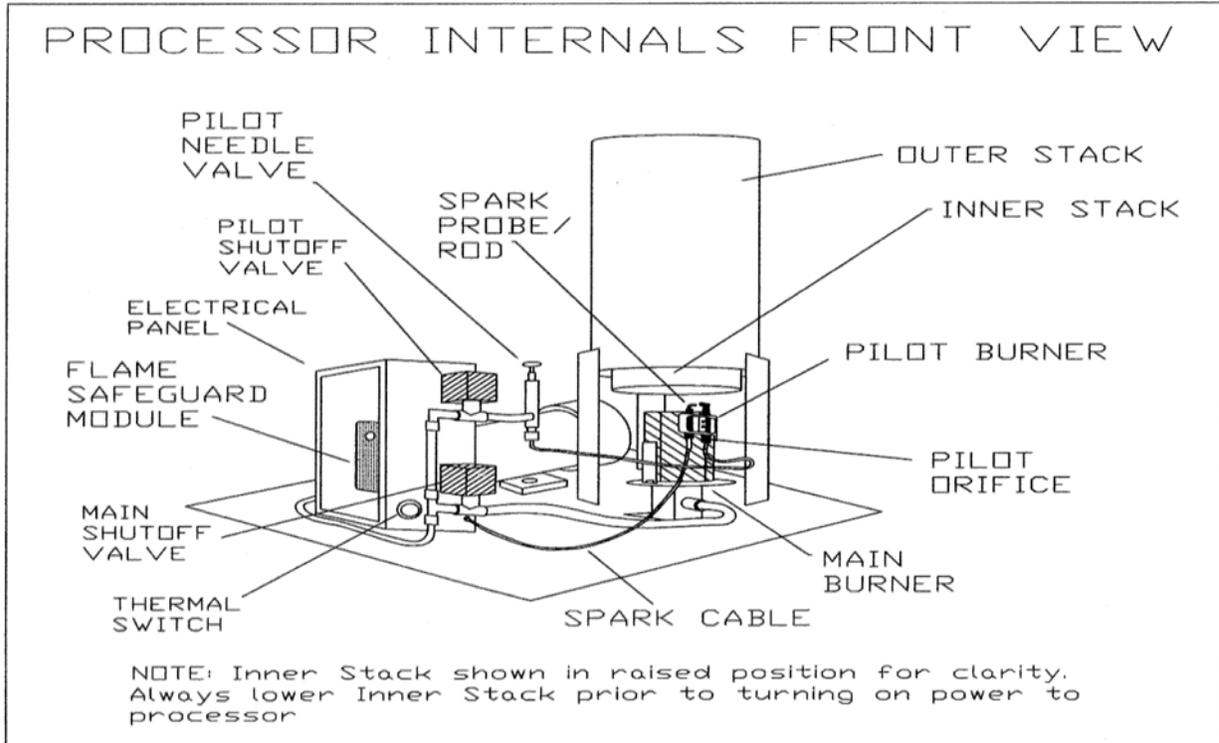
ELECTRICAL: 120 VAC, 3 Ampere, intermittent

VAPOR PIPE CONNECTION: 3/4@ NPT

WEIGHT: 80 lbs.

OVERALL DIMENSIONS: 18" wide X 18" deep x 38" high (without legs)

#### 4.5. Processor Internal Components



## 5. INSTALLATION OF PROCESSOR

### 5.1 PRE-INSTALLATION SITE REQUIREMENTS

Selection of processor location should be based on the following requirements and considerations:

- 5.1.1 Non-Hazardous area.
- 5.1.2 A minimum horizontal distance of 20 ft. from any fuel transfer point (i.e. nozzles or storage tank drop tubes).
- 5.1.3 A minimum horizontal distance of 20 ft. from pressure/vacuum valve.
- 5.1.4 Processor must be located so there is a 2 ft. clearance on all sides for maintenance.
- 5.1.5 Remote from wheel traffic, foot traffic, and valuable ground level space.
- 5.1.6 Ease of pipe run to processor from underground storage tanks(s). Typically the processor connects to the storage tank vent pipes. However, the processor can be connected to any tank fitting except for the dispenser's vapor return pipe. Note, the vapor piping must slope 1/8" per foot to prevent condensate from blocking vapor path. A slope of 1/4" per foot is recommended. (See section 7.2.2 and FIGURE 8)
- 5.1.7 Ease of conduit run to Indicator Panel.
- 5.1.8 Do not locate processor on property easement. Consult local authority, such as City Hall, to determine width of set back from property line.

The preferred location for the processor is on the roof of the building to which the vent pipes attach. Many other locations are also practical such as ground mount, canopy mount, roof mount on a remote building, and satellite mount as noted in Figures 1 through 4.

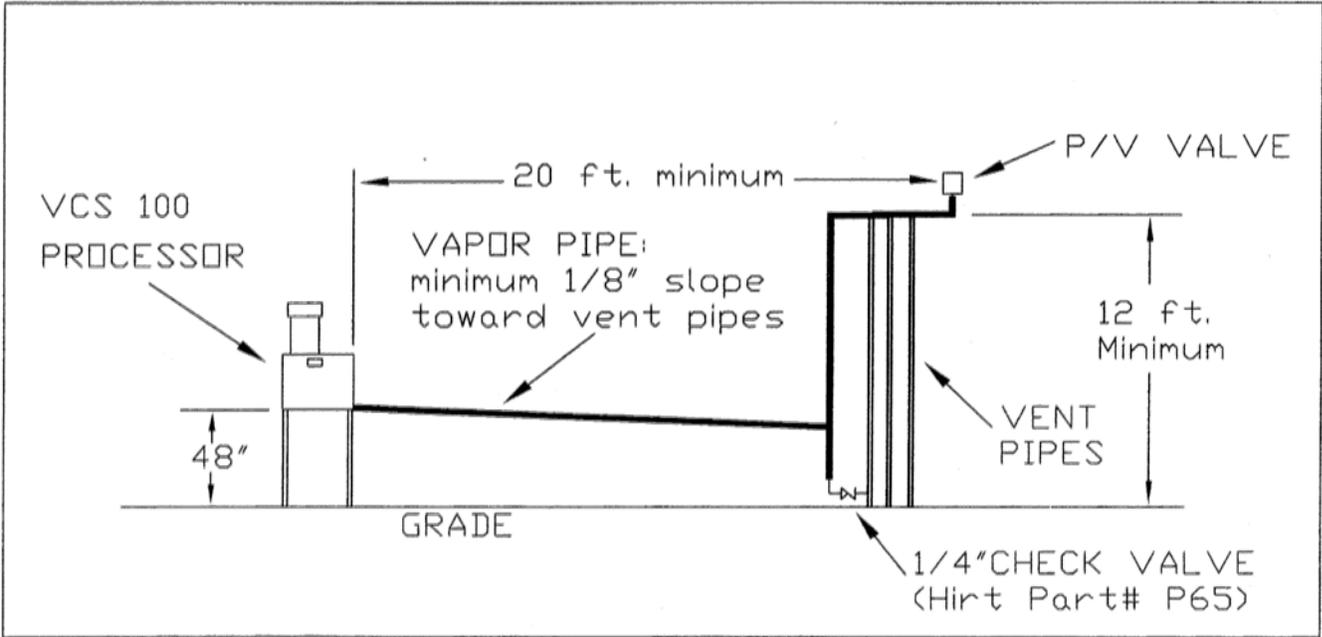
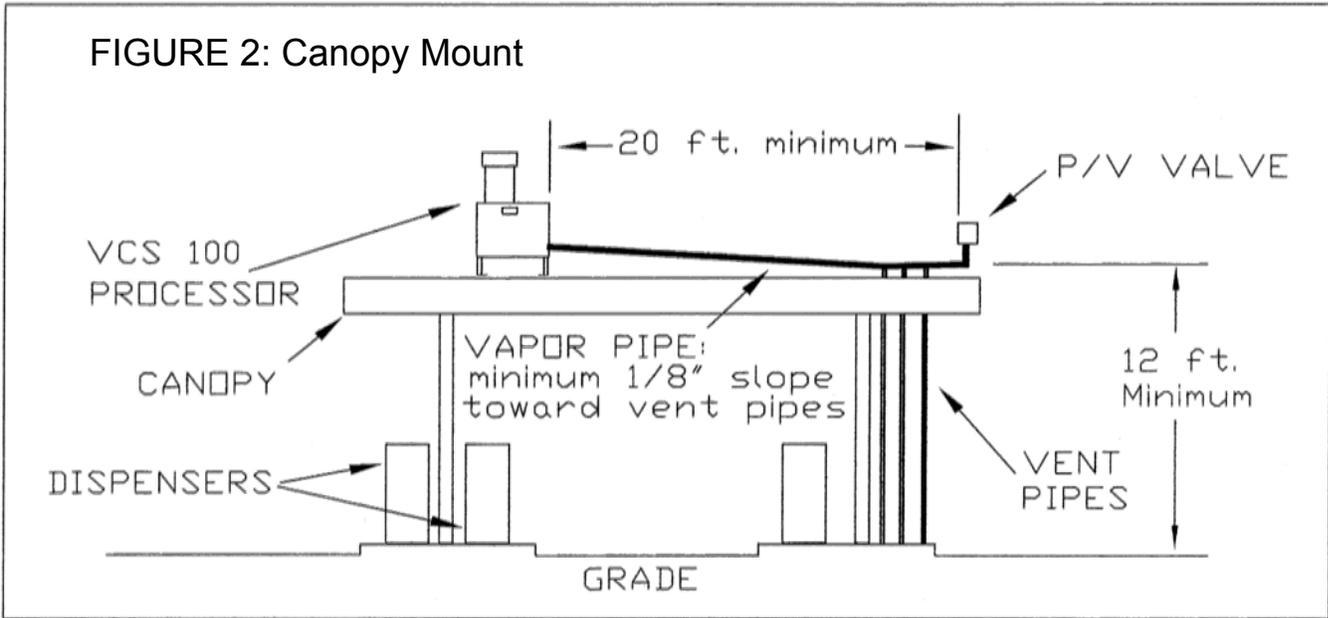
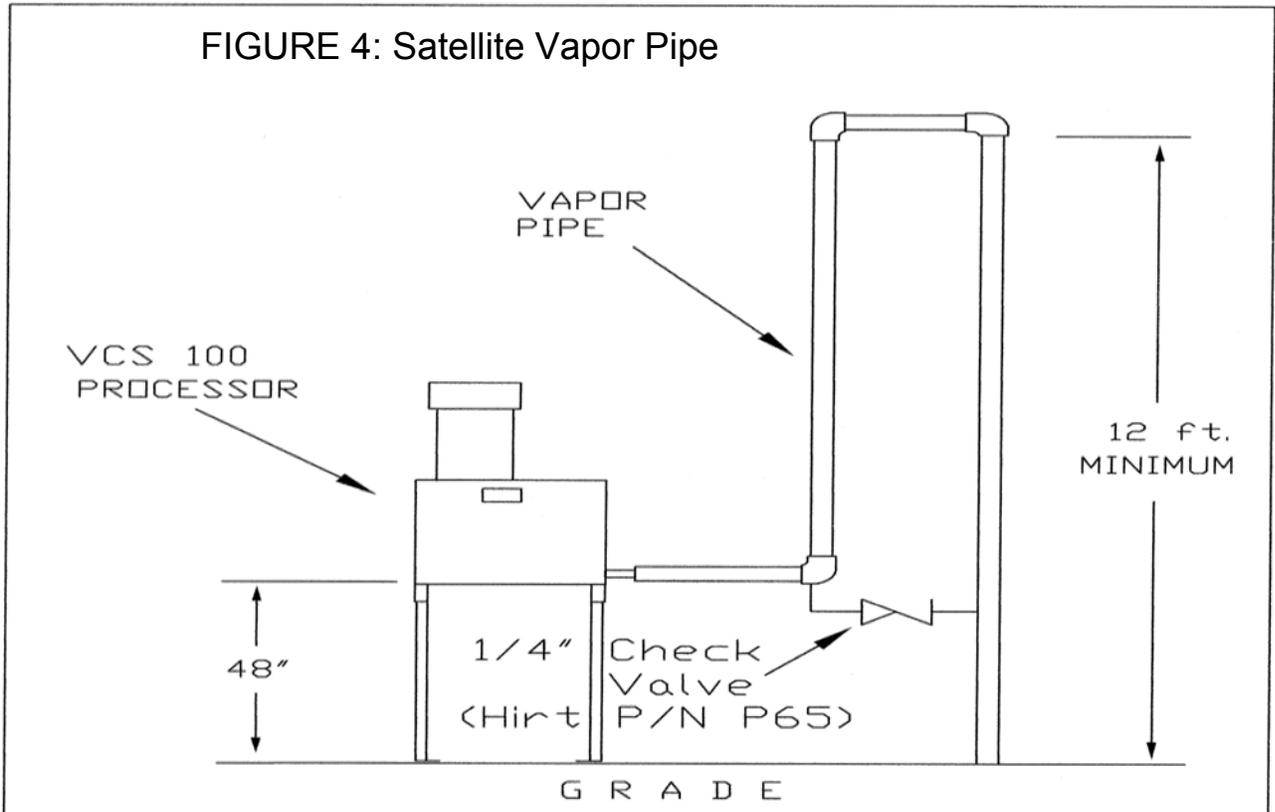
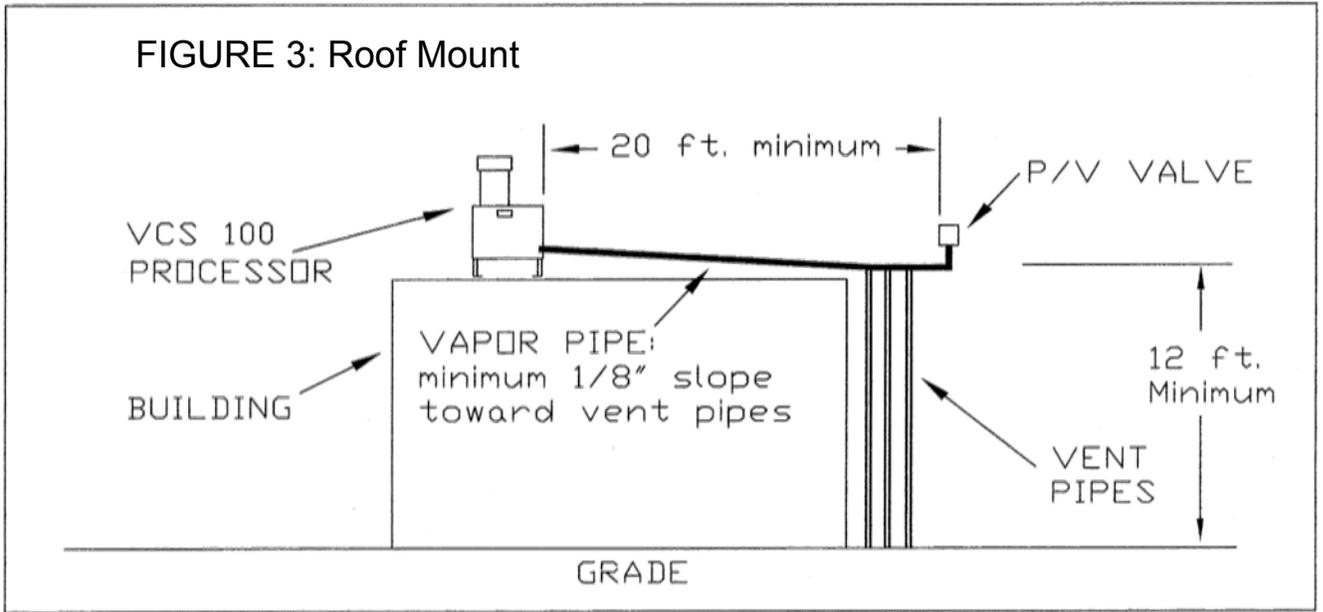


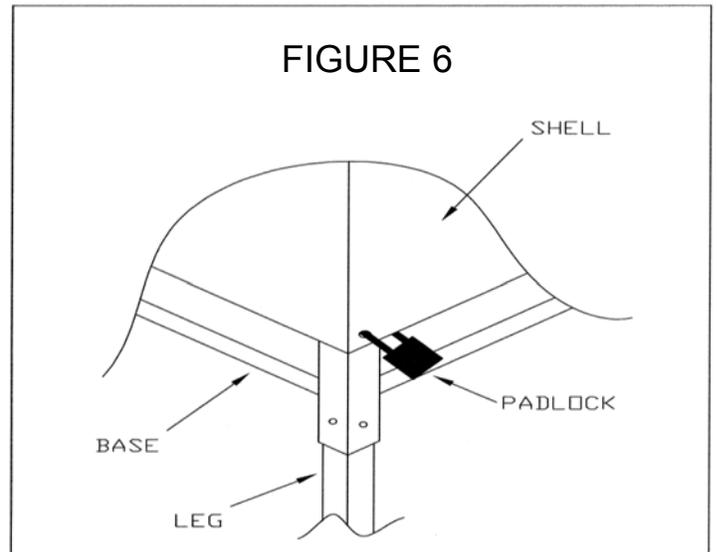
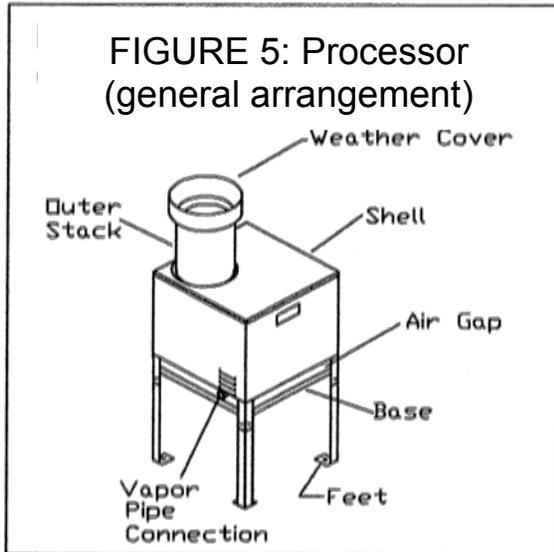
FIGURE 2: Canopy Mount





## 5.2 ASSEMBLY OF LEGS TO PROCESSOR

Please refer to FIGURE 5, the processor general arrangement drawing, for the following instructions.

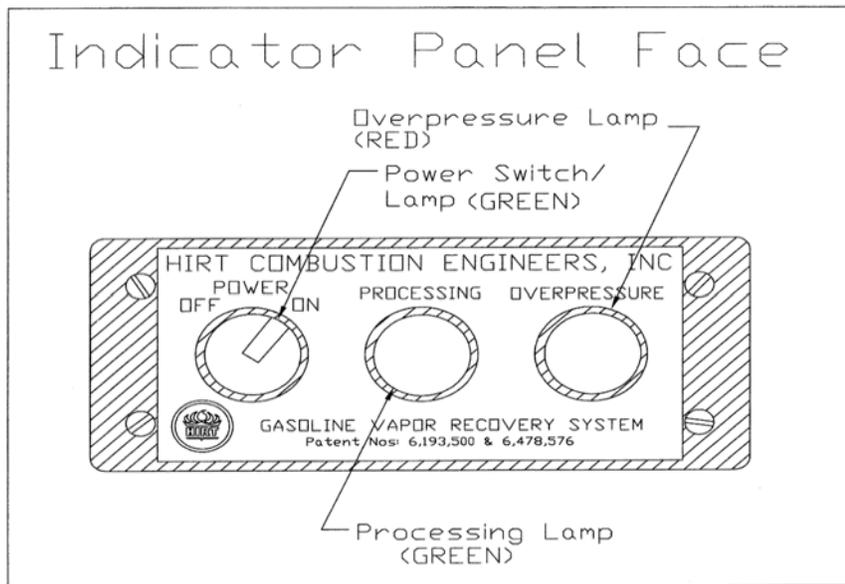


Ground level mount requires the use of the 48" Legs, and canopy or roof mount will require the 5" or longer Legs. If Legs not already purchased, see your local Hirt distributor.

- 5.2.1 Bolt appropriate Legs to Base of processor. Be sure to use the bolts, lock washers, and nuts provided with the Legs. Note that Legs attach behind corner angle brackets of Base, See FIGURE 6 for details.
- 5.2.2 Bolt feet to concrete, deck plate, and/or solid non-flammable structure. Note, concrete mount will require the use of (4) 1/4" DIA. X 3" RED HEAD wedge anchors (i.e. 2.5" embedment).

**WARNING:** Do not block 1.5" air gap between processor Shell and Base. This gap allows combustion air to reach thermal oxidizer. Also, keep the processor area free and clear from combustibles, keep a minimum clearance of 2 ft. all the way around processor.

## 6. INSTALLATION OF INDICATOR PANEL



Install the Indicator Panel at a location chosen for the following considerations:

- 6.1 Indoors
- 6.2 Access by attendant.
- 6.3 In view of attendant.
- 6.4 Ease of conduit run to station's main electrical panel.
- 6.5 Ease of conduit run to processor location.

## 7. CONNECTION OF ELECTRICAL AND VAPOR PIPE

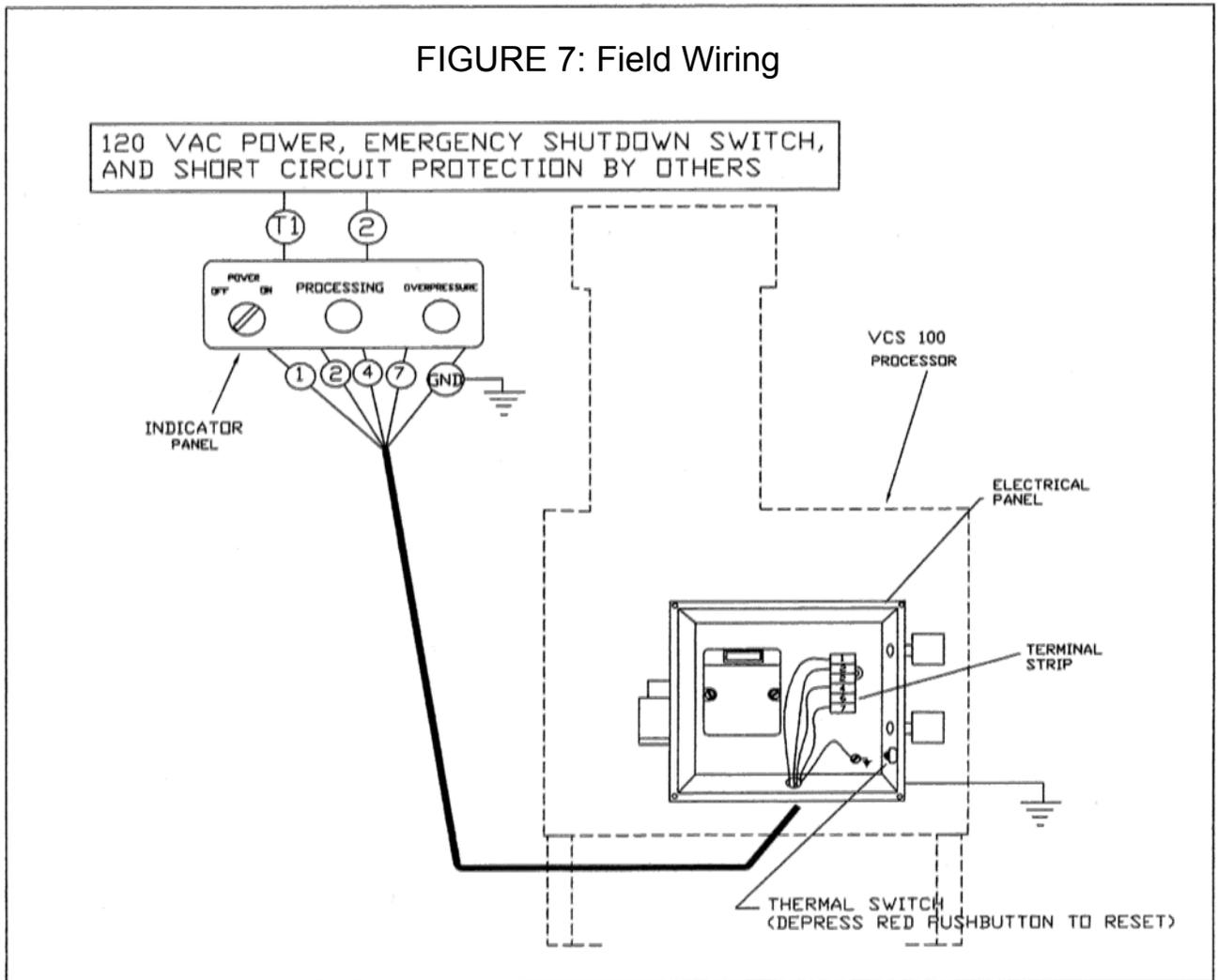
Remove Processor's Weather Cover, Shell, and electrical panel lid prior to performing the following steps.

### 7.1 ELECTRICAL POWER SUPPLY

- 7.1.1 Note that the power to the Indicator Panel and processor comes through the station master switch and the emergency pump shutdown switch. See FIGURE 7.
- 7.1.2 Wire size should be per local electrical code for an eight (8) ampere, 120 VAC load. Be sure to include circuit protection per local code. Also, system must be electrically grounded in accordance with local

codes, or in the absence of local codes, with the current edition of the National Electrical Code, ANSI/NFPA70.

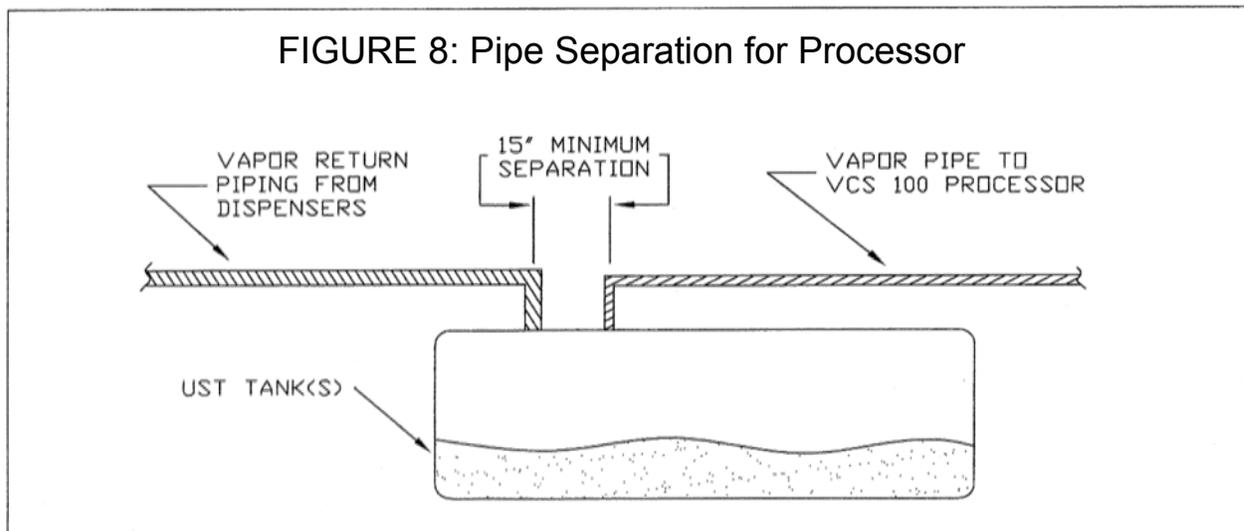
- 7.1.3 Conduit access to the processor is through the bottom of the processor's electrical panel. Be sure to use a sealed cable fitting approved for use in Class I, Groups C and D, Division 2 areas where the conduit enters the panel.



## 7.2 GASOLINE VAPOR SUPPLY

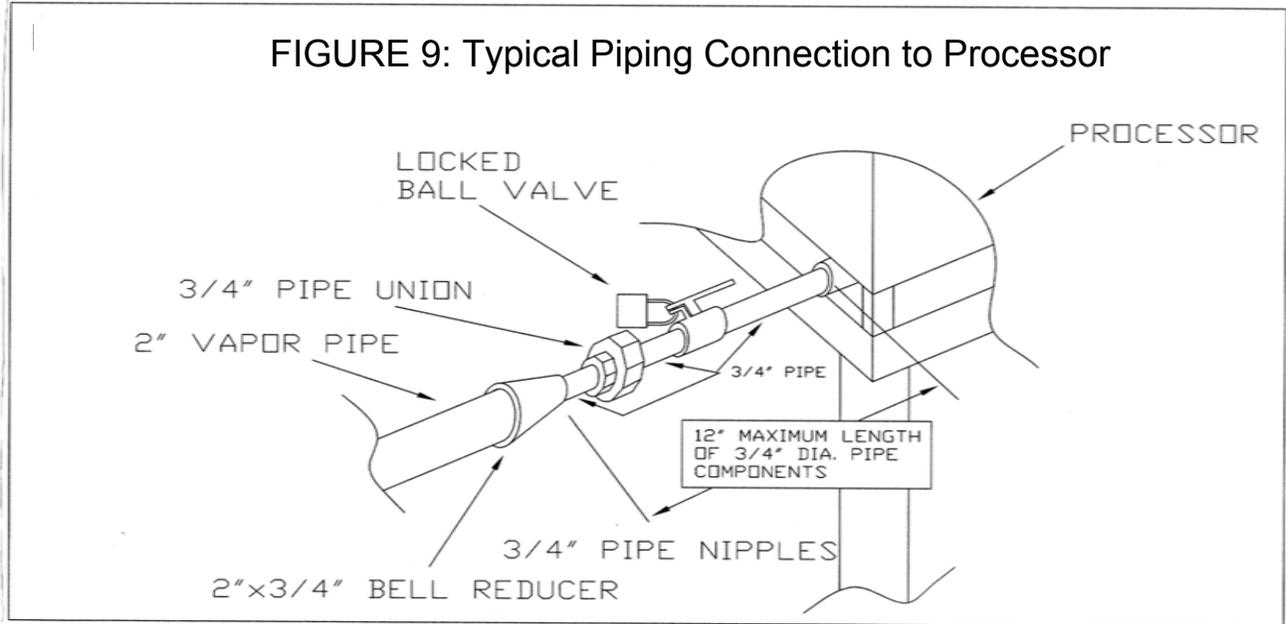
- 7.2.1 A vapor pipe is needed to connect the processor to the ullage of all the gasoline storage tanks. Use 2" NPT galvanized pipe for runs up to 300 ft. Usually the vapor pipe connects to the vent pipes, however, any connection to the ullage of the storage tanks, other than direct connection to the dispenser's vapor return pipe, is acceptable. See FIGURE 8.

FIGURE 8: Pipe Separation for Processor



- 7.2.2 Vapor pipe must rise continuously from storage tank ullage connection to processor connection, and it needs to be supported to prevent trapping liquid in droops or sags in the pipe. Pipe slope must be at least 1/8" per foot, but a slope of 1/4" per foot is recommended. Also be sure to put a pipe support close to the processor to prevent placing undue stress on the Turbine.
- 7.2.3 Vapor pipe configuration must prevent liquid gasoline from reaching processor. Acceptable solutions include locating the processor 12 ft. above grade, connecting the vapor pipe to the top of the vent pipes, and installing a 12 ft. high loop. See FIGURES 1, 2, 3, and 4.
- 7.2.4 Vapor pipe connection at the processor is with (3) 3/4" NPT nipples, (1) 3/4" NPT lockable ball valve, (1) 3/4" NPT union, and (1) 3/4" NPT to 2" NPT bell reducer. Note: The ball valve is installed in the vapor pipe at the processor for maintenance and repair. The ball valve is to be left in the locked open position (Opened to UST Ullage) during normal operation. Failure to leave valve in an open position may result in a processor malfunction. Note, use no more than a 12" length of 3/4" piping components. See FIGURE 9 for details.

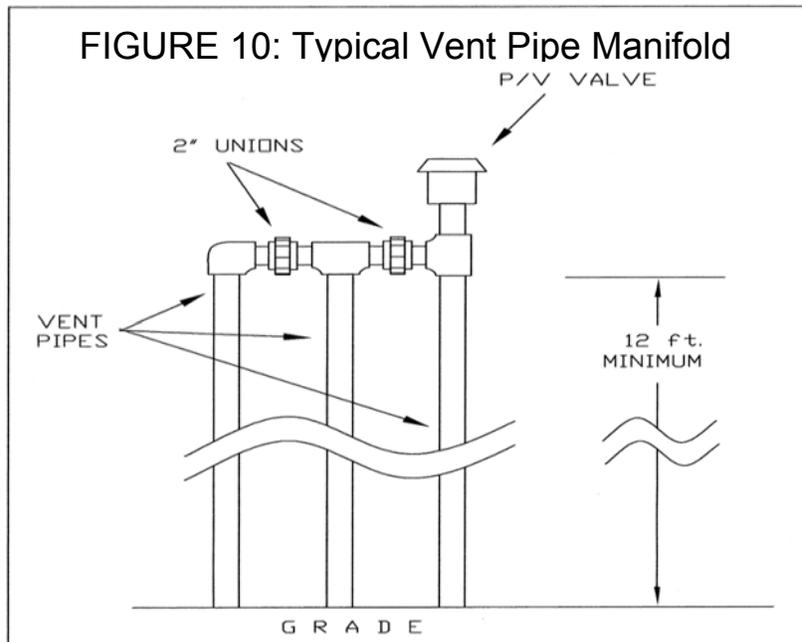
FIGURE 9: Typical Piping Connection to Processor



**CAUTION:** Hold processor internal pipe train with backing wrench to prevent twisting pipe train while connecting vapor piping.

7.2.5 If the ullage of the tanks is not already interconnected underground, then manifold the vent pipes together with 2" galvanized pipe at a minimum of 12 ft. above grade. See FIGURE 10 below. Note that at least (1) P/V Valve must remain connected to the manifold.

FIGURE 10: Typical Vent Pipe Manifold



## 8. START-UP

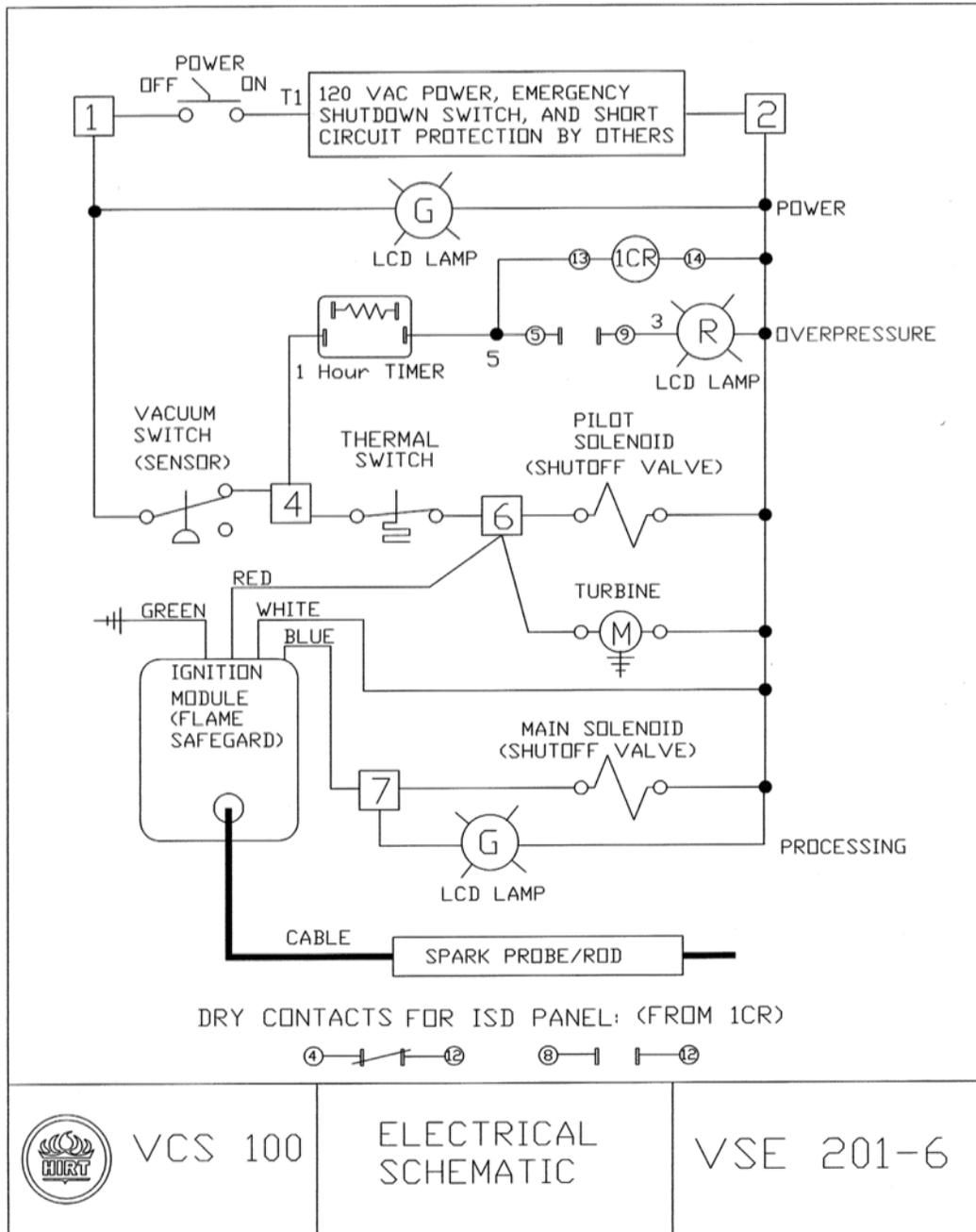
If all instructions thus far have been followed, the system should start itself and run automatically. Proceed with the following steps:

- 8.1 Check to see that nozzles are on their hangers and vapor hoses are connected. Check also to see that gasoline storage tank fittings (fill caps, dry breaks, drop tubes, drain valves, etc.) are seated and sealing.
- 8.2 At the Indicator Panel, turn the POWER switch ON. The green lamp on the switch should light, and the processor should have electrical power now. The green PROCESSING lamp will be lit intermittently (only when the processor is energized), and the red OVERPRESSURE lamp should remain extinguished.

**WARNING:** The processor (pilot and main burner) is automatic. It will cycle its thermal oxidizer ON if vacuum diminishes in the vapor spaces and OFF if there is sufficient vacuum. Therefore use caution when working close to the thermal oxidizer. It may come ON without notice. A mirror is recommended for looking down the stack.

- 8.3 Check the pressure in storage tanks.
  - 8.3.1 If UST ullage pressure is negative (vacuum), then proceed with step 8.6.
  - 8.3.2 If the storage tank pressure is positive, check to see that turbine is running and either there is a flame at pilot burner tip or a spark. If not, reset thermal switch inside processor's electrical panel, by depressing (red) pushbutton, see FIGURE 7, Field Wiring Drawing. Turbine and spark should come on. If so, proceed with step 8.4. If turbine is not running or sparking is not present, refer to Hirt VCS 100 Troubleshooting Manual.
- 8.4 Within 1 hour, the processor pilot and main burner stages should ignite. Once a vacuum of approximately -0.40" w.c. is generated, the processor should shutoff. This indicates that the processor is completely functional and controlling itself automatically. If so, go to step 8.8. If the stages don't ignite within 1 hour or if your work schedule is such that waiting 1 hour is inconvenient then continue with the following step 8.5.

8.5 The turbine in the processor should be running and the igniter/sensor probe sparking but the pilot will not be ignited. Failure of the pilot to ignite is probably because the station's vapor piping is full of air. To purge this air and replace it with vapor, use 2 short pieces of wire and jump the circuit from terminal [1] to [6] and [6] to [7] at the terminal strip inside the electrical panel inside the processor.



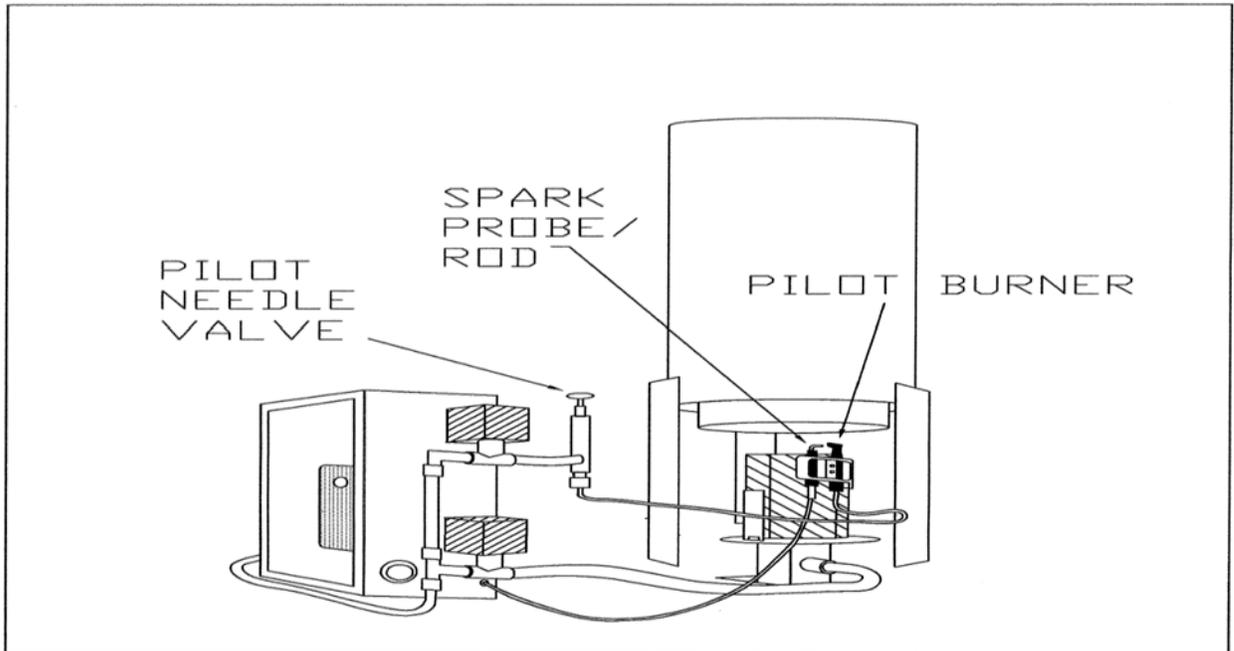
Note on the ELECTRICAL SCHEMATIC that a [1] to [6] jumper energizes the turbine, ignition module, and pilot solenoid. A [6] to [7] jumper energizes the main solenoid.

As soon as the air is purged from the vapor piping, approximately 15 minutes, the pilot and main stages will both ignite. As soon as pilot and main ignite, the 2 jumpers must be removed. If so, go to step 8.8.

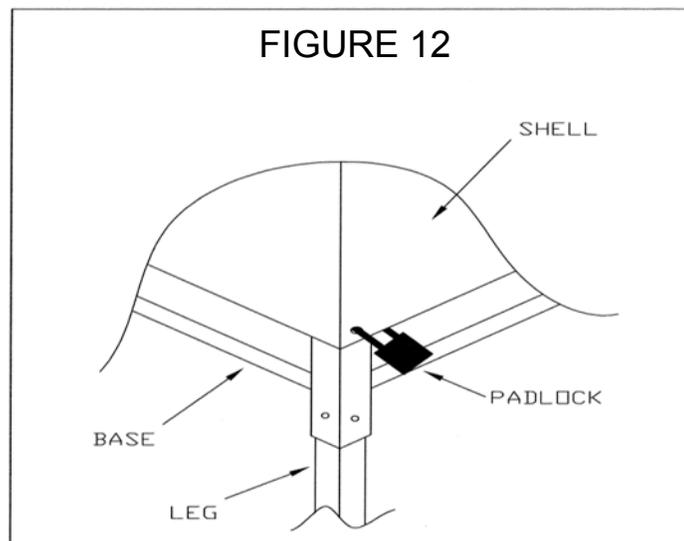
If the stages do not ignite after 15 minutes, go to step 8.7.

- 8.6 The processor will not turn on if the vacuum sensor/switch is satisfied. Therefore, any air in the vapor piping will need to be purged so the processor stages can ignite when storage tank vacuum decays. To purge this air and replace it with vapor, use 2 short pieces of wire and jump the circuit from Terminal [1] to [6] and [6] to [7] at the terminal strip inside the electrical panel inside the processor. Note on the ELECTRICAL SCHEMATIC that a [1] to [6] jumper energizes the turbine, igniter, and pilot solenoid. A [6] to [7] jumper energizes the main solenoid. As soon as the air is purged from the vapor piping, approximately 15 minutes, the pilot and main stages will both ignite. As soon as pilot and main ignite, the 2 jumpers must be removed. If so, go to step 8.8. If the stages do not ignite after 15 minutes, go to step 8.7.
- 8.7 If the pilot and main do not ignite after the jumpers have been connected for 15 minutes, it is probably because there is an air leak in the vapor piping and air is entering as fast as it is being purged.
- First remove the jumper wires. To find leak(s), conduct ARB test procedure TP-201.3 and Exhibit 4 (Items to consider when conducting TP-201.3). Check the pipe fittings, vent riser manifold, PV valve, storage tank fill tube caps, dry break gaskets and cover cap gaskets, hoses, nozzles, and vapor valves – any place where air could be entering the UST ullage space. Correct leaks and then go back to step 8.3.
- 8.8 Check setting of Pilot Needle Valve adjustment. The valve is used to adjust the length of the (2) tongues of flame at the pilot burner. The ideal pilot flames are approximately 1” long, blue in color, with yellow tips. One flame tongue licks the Spark Probe/Rod. The factory setting for the Pilot Needle Valve is 2 1/4 turns open. A small adjustment may be necessary to achieve the ideal flame length. If required, adjust the black knob on the Needle

Valve more open or closed until ideal flame setting is achieved. See FIGURE 11.



- 8.9 Installation and start-up are now complete. Turn off power to processor. Replace lid on electrical panel, Shell, and Weather Cover. If desired, the station owner can add padlocks to prevent tampering, see FIGURE 12 below. Ensure the 3/4" ball valve at the processor inlet is in the locked open position (Opened to UST Ullage). Turn on power to processor. The processor is now in normal, automatic mode.



## **9. MAINTENANCE INSTRUCTIONS**

The Hirt VCS 100 vapor processor must be inspected and tested annually. The technician must complete the Hirt VCS 100 Annual Inspection Checklist (reference section 7 of VR-205 IOM) and leave with the site's maintenance records.

## **10. REPAIR AND REPLACEMENT OF COMPONENTS**

Any Hirt VCS 100 system components which have failed cannot be repaired. Failed components must be replaced. In order to maintain the product warranty, use only genuine Hirt replacement parts. Each component comes with its own written instructions covering replacement and testing to insure proper installation and operation.

## **11. PRODUCT WARRANTY**

- HCE warrants the workmanship and materials to be free from 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 from date of shipment from HCE, if registration card is not returned.
- Liability under any implied or expressed warranty is limited to replacement of the product.
- HCE is not responsible for improperly installed or misuse of the product.
- HCE cannot be held responsible for damage to the product or its equipment due to acts of nature, vandalism, or neglect.
- HCE products are warranted to be free of defects in material and workmanship.
- In the event of a warranty claim, the purchaser must obtain a Return Authorization Number prior to returning product. All shipping costs are the responsibility of the customer.
- HCE shall repair or replace, at its option, any HCE component which proves to be defective.
- The cost of labor for any field repair, removal, replacement, or diagnosis is not covered by this warranty.
- The liability of HCE is limited solely and specifically to this warranty.

- HCE shall not be liable for any special, collateral, or consequential damages arising from this warranty, the use of this equipment or from any order accepted pursuant thereto.
- The use of parts not authorized by HCE voids the warranty.
- Installation, start-up, service, or repairs of this product by personnel not certified by HCE voids the above described warranty.

## 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](mailto: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.

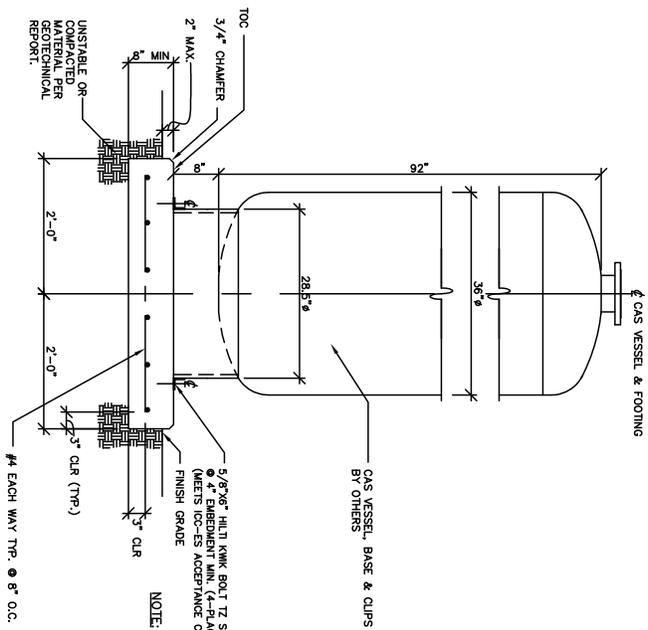
### DRAINING THE BLADDER:

- 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.

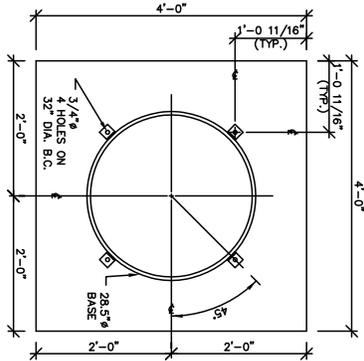
### DRAINING THE CAS:

- 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.
  3. 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.
  4. Close the ball valve (D) and replace the plug (E) into the tee.
  5. Return all ball valves to their normal locked positions.

DRW NO: 9900-9945

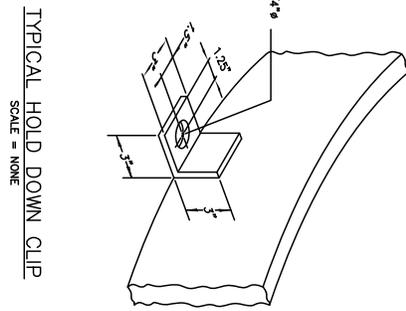


SECTION @ CAS SLAB  
SCALE = 3/4" = 1'-0"



BASE PLAN  
SCALE = 3/4" = 1'-0"

NOTE: WHERE ICC-ES ACCEPTANCE CRITERIA IS NOT REQUIRED, 5/8" X 6" HILTI KWIK BOLT 3 @ 4" EMBEDMENT MIN. CAN BE USED (PER ESR-1395 REPORT, ISSUED 09/01/04).



TYPICAL HOLD DOWN CLIP  
SCALE = NONE

CRITERIA  
SOIL BEARING 1000 psf  
BASIC WIND SPEED 100mph  
SEISMIC  $S_a = 2g$   
 $S_w = 1g$   
MIN. CONCRETE COMP STRENGTH,  $f'_c = 2500$  psi  
MIN. REINF. YIELD STRENGTH,  $f_y = 40000$  psi

The information disclosed herein includes proprietary rights of Franklin Fueling Systems, Inc. and is intended for use only in the drawing for the information disclosed. This information may be reproduced or transferred to other documents, or used or disclosed to others for any purpose without the written consent of Franklin Fueling Systems, Inc. This drawing must be returned to Franklin Fueling Systems upon request.

REV	DESCRIPTION	ECN NO	BY	DATE
7	ADDED GAS DIMENSIONS, REVERSED CRITERIA LIST	-	JF	01/02/08
6	K8-TZ SS WAS REQ, ESR-1917 WAS ESR-1386, ADDED NOTE 1	-	JF	12/21/07

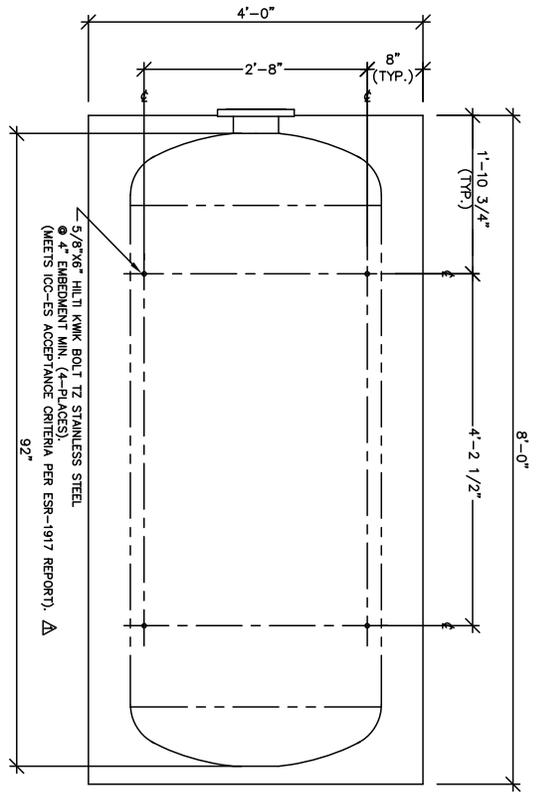
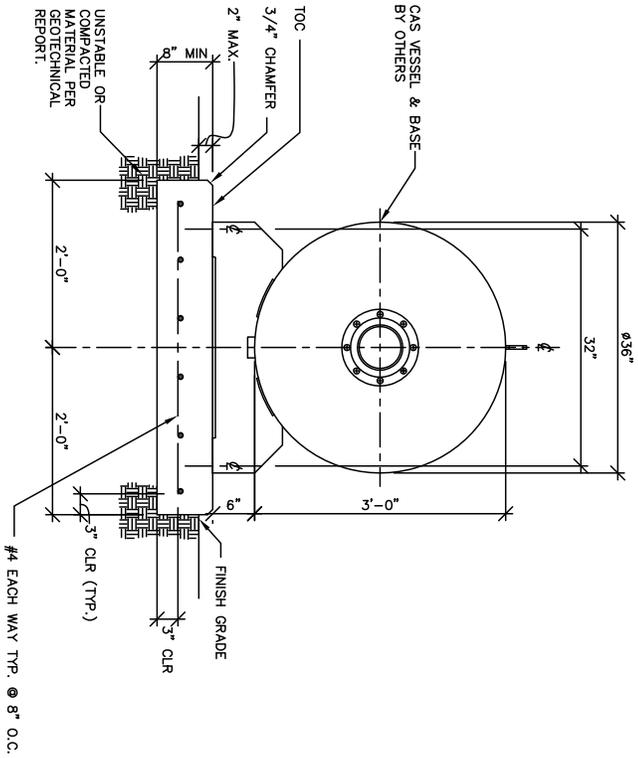
MATERIAL:		DO NOT SCALE DRAWING		XX ± .02	
STANDARD INCH TOLERANCES (UNLESS OTHERWISE SPECIFIED)		ANGULAR ± 1/2°		XXX ± .005	
SPECIAL DIST:					

TITLE:		CLEAN AIR SEPARATOR MOUNTING SLAB DETAILS	
DRAWN:	DATE:	DRW NO:	SUFFIX:
JWH	07/31/02	9900-9945	
APPROV:	DATE:	SCALE:	SHEET
		1/8	1 OF 1



Franklin Fueling Systems  
Madison, WI 53718



SECTION @ CAS SLAB

CRITERIA  
 SOIL BEARING 1000 psf  
 BASIC WIND SPEED 100mph  
 SEISMIC  $S_s=29$   
 $S_d=19$   
 MIN. CONCRETE COMP STRENGTH,  $f'_c = 2500$  psi  
 MIN. REINF. YIELD STRENGTH,  $f_y = 40000$  psi

The information disclosed hereon includes proprietary rights of Franklin Fueling Systems, Inc. Neither this drawing nor the information disclosed thereon may be reproduced or transferred to other documents, or used or disclosed to others for any purpose, except as specifically authorized in writing by Franklin Fueling Systems. This drawing must be returned to Franklin Fueling Systems upon request.

MATERIAL:	
DO NOT SCALE DRAWING	.XX ± .02
STANDARD INCH TOLERANCES (UNLESS OTHERWISE SPECIFIED)	.XXX ± .005
SPECIAL DIST:	ANGULAR ± 1/2°

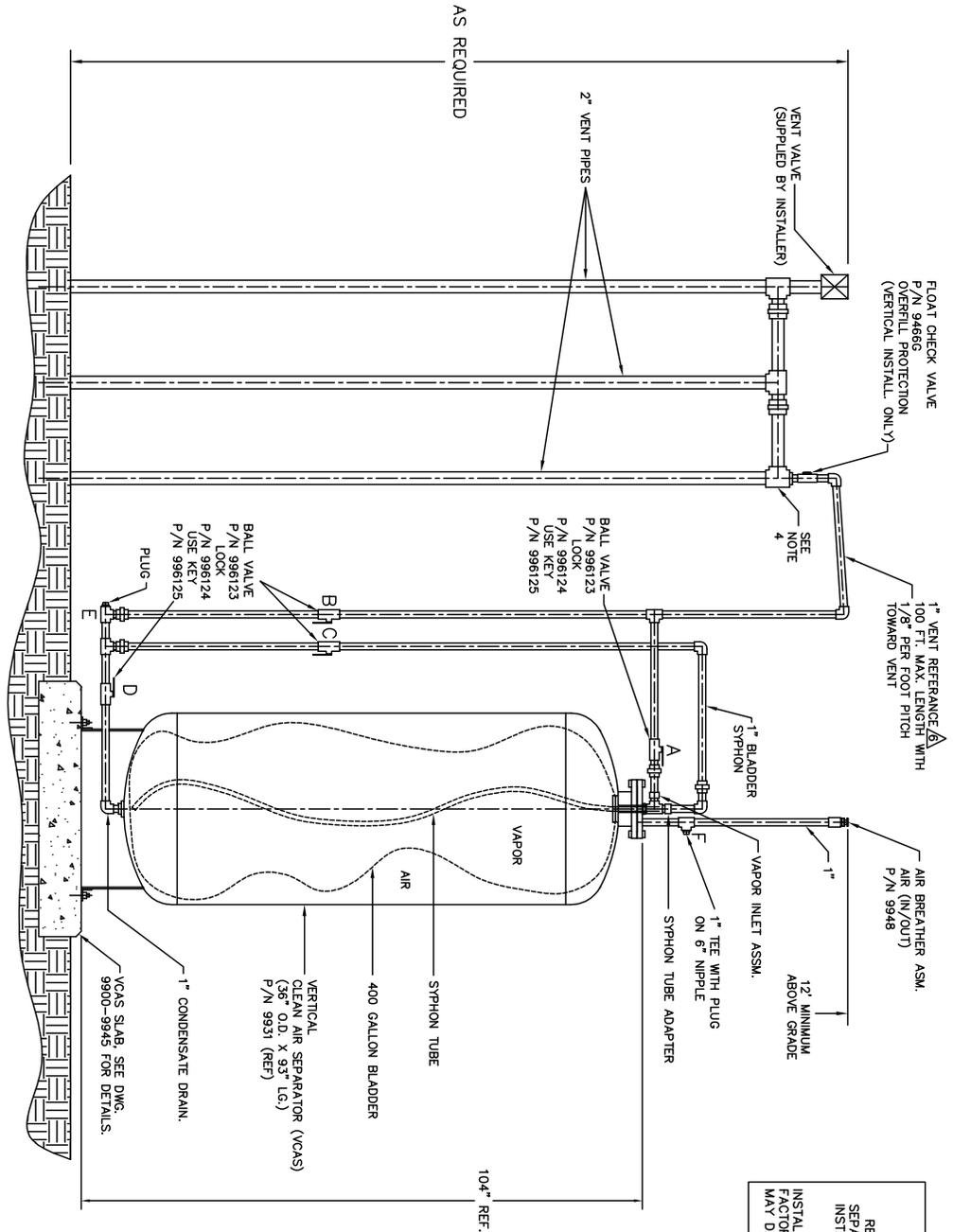
NOTE:  
 Δ WHERE ICC-ES ACCEPTANCE CRITERIA IS NOT REQUIRED, 5/8" x 6" HILT KIM BOLT 3 @ 4" EMBEDMENT MIN. CAN BE USED (PER ESR-1385 REPORT, ISSUED 09/01/04).

REV	DESCRIPTION	ECN NO	BY	DATE
5	ADDED GAS DIMENSIONS, REVISED CRITERIA LIST	-	TF	01/02/08
4	KB-TZ SS WAS KB3, ESR-1917 WAS ESR-1385, ADDED NOTE 1	-	TF	12/21/07



TITLE:		CLEAN AIR SEPARATOR HORIZONTAL MOUNTING SLAB DETAILS	
DRAWN:	DATE:	DRW NO:	SUFFIX:
TF	05/22/07	9900-9945	H
APPRVL:	DATE:	SCALE:	
MDB	06/05/07	3/4" = 1"	SHEET 1 OF 1

DRW No: 9900-9945H



- NOTE:
- 1 - ALL BALL VALVES (B.V.) TO BE UL LISTED AND HAVE PADLOCK FEATURE.
  - 2 - PASSIVE PRESSURE CONTROL-NO ELECTRICAL POWER REQUIRED.
  - 3 - AIR BREATHERS MUST BE INSTALLED AT A MINIMUM HEIGHT OF 12' ABOVE GRADE.
  - 4 - VENT LINE TIE 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.
  - 5 - ONLY GALVANIZED PIPE IS TO BE USED FOR PIPING CONNECTIONS.
- △ - A FLEXIBLE CONNECTION BETWEEN THE CLEAN AIR SEPARATOR AND THE VENT LINE(S) IS ALLOWABLE IF REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION (AAH) 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" 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 FACTORY INSTALLED FITTINGS OR FLANGE AS THIS MAY DAMAGE FACTORY SEALS AND VOID WARRANTY.

DRW NO: 9900-9942

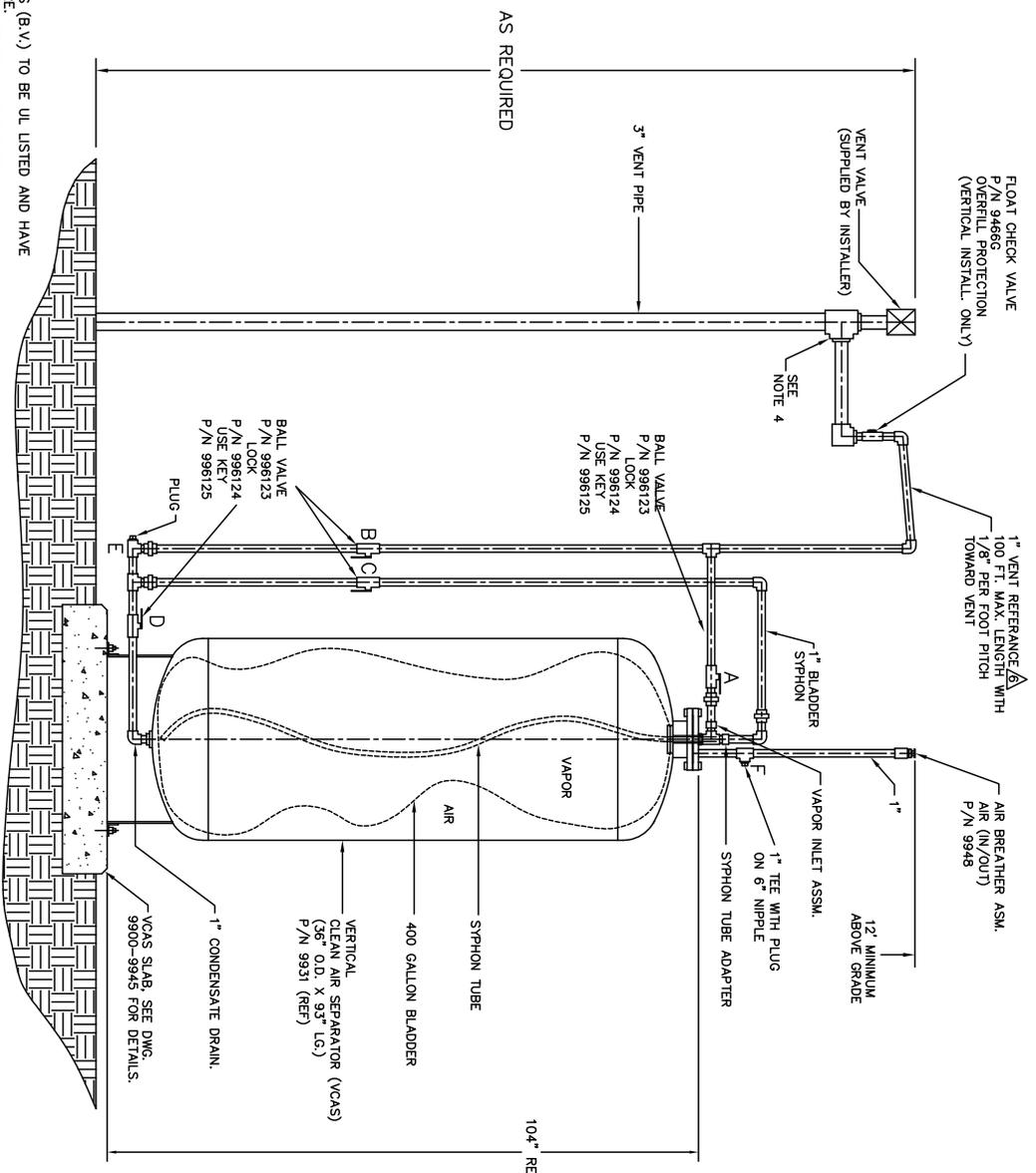
The information disclosed herein includes proprietary rights of Franklin Fuelling Systems, Inc. and is intended for use only for the specific project identified herein. It is not to be reproduced, copied, or disseminated in any form or by any means without the written consent of Franklin Fuelling Systems, Inc. This drawing must remain confidential. Any use of this information for other projects without the written consent of Franklin Fuelling Systems, Inc. is strictly prohibited.

MATERIAL:	
DO NOT SCALE DRAWING	XX ± 0.2
STANDARD TECH SPECIFICATIONS (PLEASE SPECIFY)	.001 ± .0005
SPECIAL DIST:	ANGULAR ± 1/2°

15	ADD NOTE 6	401666	TR	06/23/20/08
REV	DESCRIPTION	EON NO	BY	DATE
<b>Franklin Fuelling Systems</b> Member of SCS				
TITLE: CLEAN AIR SEPARATOR VERTICAL INSTALLATION				
DRAWN:	JWH	DATE:	05/14/02	DRW NO: 9900-9942
APPROVAL:	MOB	DATE:	06/05/07	ACAD HW SCALE: N.T.S. SHEET 1 OF 1

DRW NO: 9900-9971

**NOTICE**  
DRAWINGS ARE TWO DIMENSIONAL REPRESENTATION OF PHYSICAL CLEAN AIR SEPARATOR (CAS) INSTALLATION. ACTUAL CAS INSTALLATION SHALL BE TAKEN FROM THE REPRESENTATION SHOWN.  
INSTALLER SHALL NOT LOOSEN, ROTATE OR REMOVE FACTORY INSTALLED FITTINGS OR FLANGE AS THIS MAY DAMAGE FACTORY SEALS AND VOID WARRANTY.

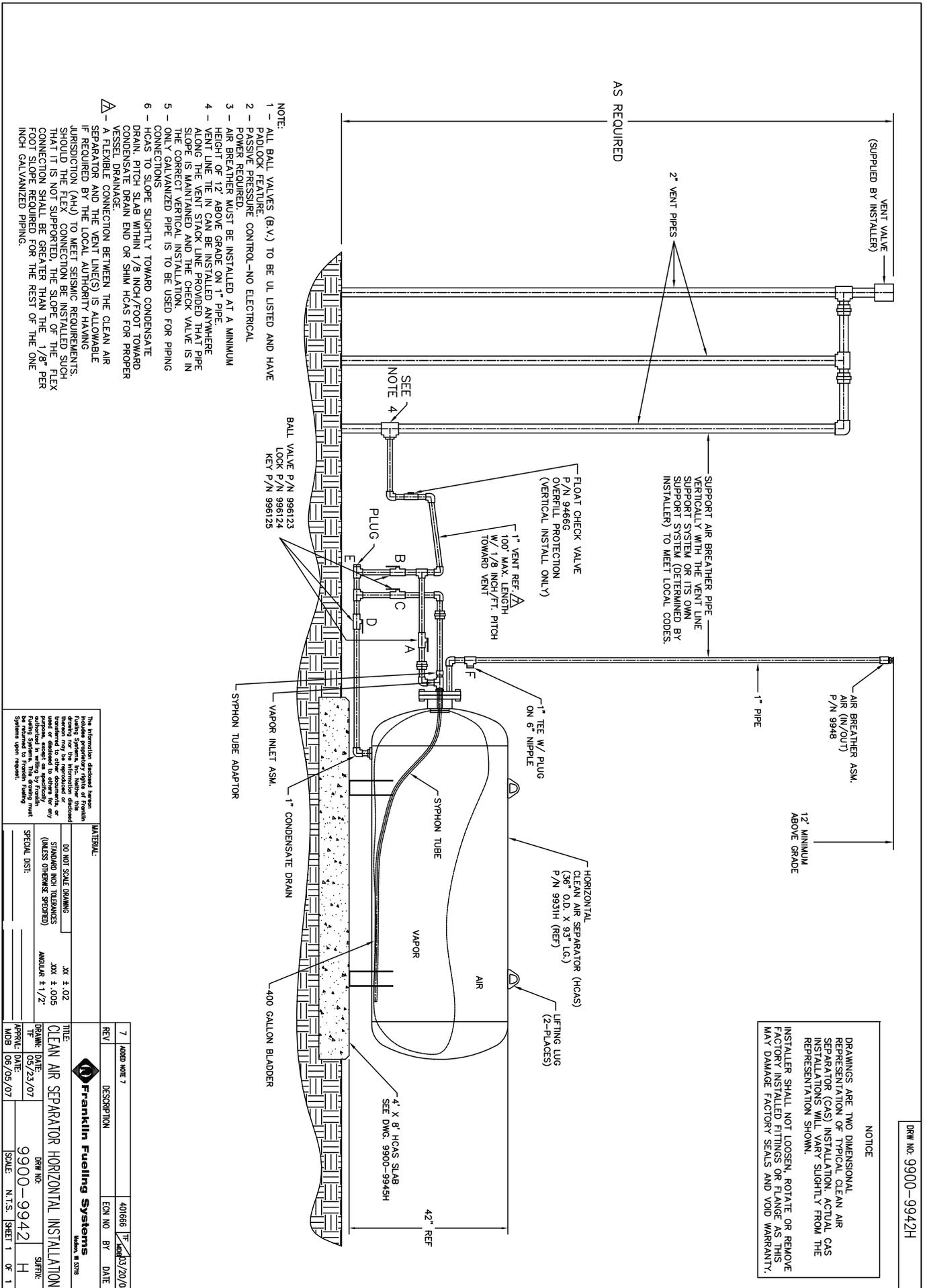


- NOTE:**
- 1 - ALL BALL VALVES (B.V.) TO BE UL LISTED AND HAVE PADLOCK FEATURE CONTROL-NO ELECTRICAL POWER REQUIRED.
  - 2 - AIR BREAKER MUST BE INSTALLED AT A MINIMUM HEIGHT OF 12' ABOVE GRADE.
  - 3 - VENT LINE TIE IN CAN BE INSTALLED ANYWHERE ALONG THE VENT STACK LINE PROVIDED THAT PIPE SLOPE IS MAINTAINED AND THE CHECK VALVE IS IN THE CORRECT VERTICAL INSTALLATION.
  - 4 - ONLY GALVANIZED PIPE IS TO BE USED FOR PIPING CONNECTIONS.
  - 5 - A FLEXIBLE CONNECTION BETWEEN THE CLEAN AIR SEPARATOR AND THE VENT LINE(S) IS ALLOWABLE IF REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION (A.H.J.) 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" PER FOOT SLOPE REQUIRED FOR THE REST OF THE ONE INCH GALVANIZED PIPING.

The information disclosed herein includes proprietary rights of Franklin Fueling Systems, Inc. and is intended for use only for the information disclosed herein. No reproduction or use of this information is allowed without the written consent of Franklin Fueling Systems, Inc. This drawing must Systems upon request.

MATERIAL:	
DO NOT SCALE DRAWING	XX ± 0.02
STANDARD TECH SPECIFICATIONS (PLEASE CHECK THESE)	.000 ± .0003
SPECIAL DIST:	ANGULAR ± 1/2°

REV: 8	ADDED NOTE 6	401666	REVISED 03/20/08
REV: 1	DESCRIPTION	EON NO.	BY DATE
<b>Franklin Fueling Systems</b> Model B 2018			
TITLE: CLEAN AIR SEPARATOR VERTICAL INSTALLATION (1 VENT)			
DRAWN: JWH	DATE: 05/14/02	DRW NO: 9900-9971	SHEET: 1 OF 1
APPROVAL: MDR	DATE: 06/05/07	ROAD HTV SCALE: N.T.S.	SHEET: 1 OF 1



**NOTICE**

DRAWINGS ARE TWO DIMENSIONAL REPRESENTATION OF TYPICAL CLEAN AIR SEPARATOR (CAS) INSTALLATION. ACTUAL CAS INSTALLATIONS WILL VARY SLIGHTLY FROM THE REPRESENTATION SHOWN.

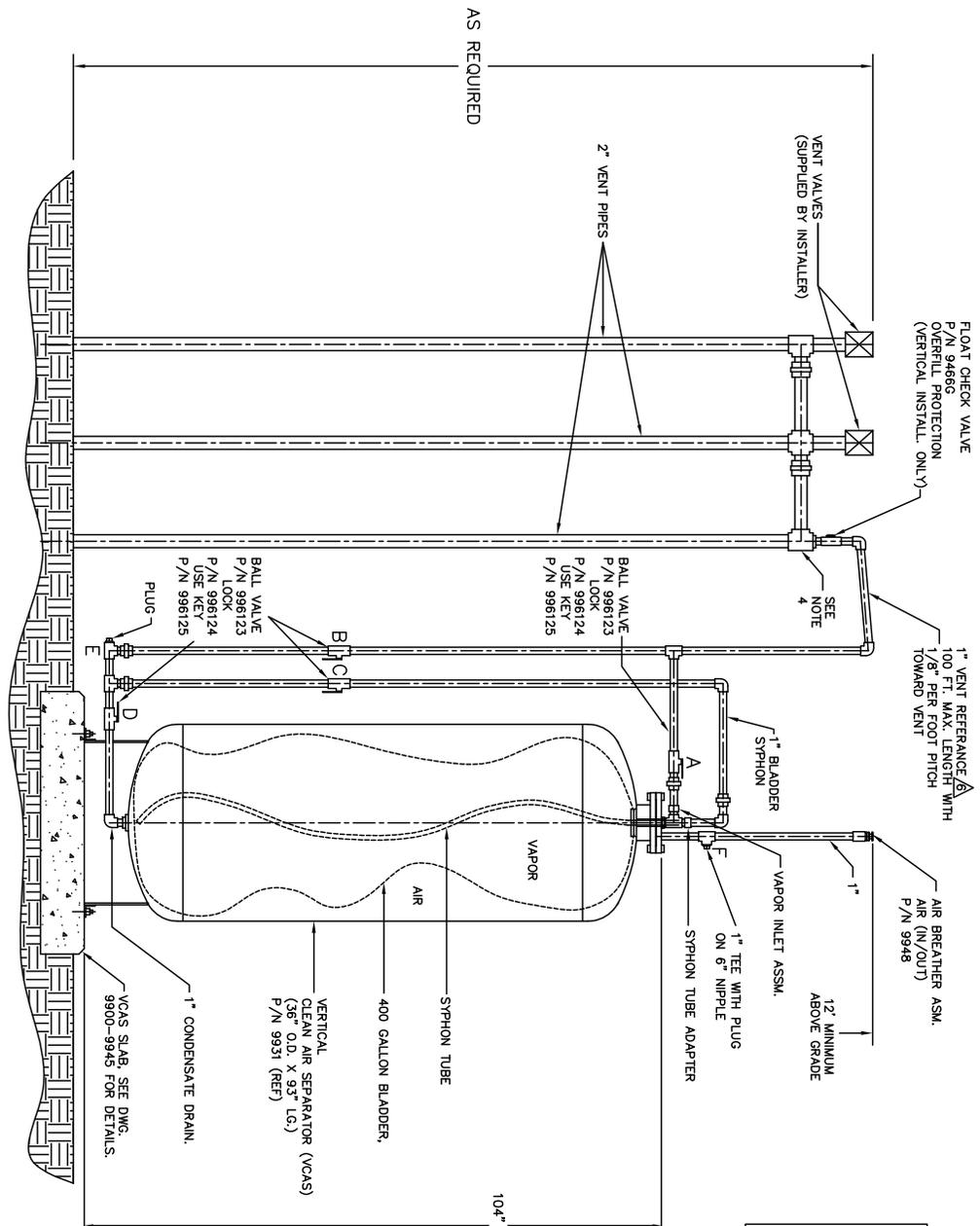
INSTALLER SHALL NOT LOOSEN, ROTATE OR REMOVE FACTORY INSTALLED FITTINGS OR FLANGE AS THIS MAY DAMAGE FACTORY SEALS AND VOID WARRANTY.

DRW NO: 9900-9942H

The information disclosed herein includes proprietary rights of Franklin Fueling Systems, Inc. and is intended for use only by the recipient. It is not to be reproduced or distributed in any form without the written consent of Franklin Fueling Systems, Inc. This drawing must be used in accordance with the Franklin Fueling Systems, Inc. Safety Systems upon request.

MATERIAL:	
DO NOT SCALE DRAWING	XX ± .02
STANDARD NICH TO DIMENSIONS (UNLESS OTHERWISE SPECIFIED)	.XXX ± .005
SPECIAL DWT:	ANGULAR ± 1/2"

7	ADD'D NOTE 7	401666	TR	05/23/08
REV	DESCRIPTION	EON NO	BY	DATE
TITLE: CLEAN AIR SEPARATOR HORIZONTAL INSTALLATION DRAWN: [Name] DATE: 05/23/07 APPR'D: [Name] DATE: 06/05/07 SCALE: N.T.S. SHEET 1 OF 1				



- NOTE:
- 1 - ALL BALL VALVES (B.V.) TO BE UL LISTED AND HAVE PADLOCK FEATURE.
  - 2 - PASSIVE PRESSURE CONTROL--NO ELECTRICAL POWER REQUIRED.
  - 3 - AIR BREAKER MUST BE INSTALLED AT A MINIMUM HEIGHT OF 12 ABOVE GRADE.
  - 4 - VENT LINE THE 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.
  - 5 - GALVANIZED PIPE IS TO BE USED FOR PIPING CONNECTIONS.
- ▲ - A FLEXIBLE CONNECTION BETWEEN THE CLEAN AIR SEPARATOR AND THE VENT LINE(S) IS ALLOWABLE IF REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION (A.H.U.) 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" 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 GAS INSTALLATIONS WILL VARY SLIGHTLY FROM THE REPRESENTATION SHOWN.  
 INSTALLER SHALL NOT LOOSEN, ROTATE OR REMOVE FACTORY INSTALLED FITTINGS OR PLATE OR STAINLESS STEEL PARTS OF CLEAN AIR SEPARATOR. THIS FACTOR US' FALLOU' FACTORY SEALS AND VOID WARRANTY.

DRW NO: 9900-9972

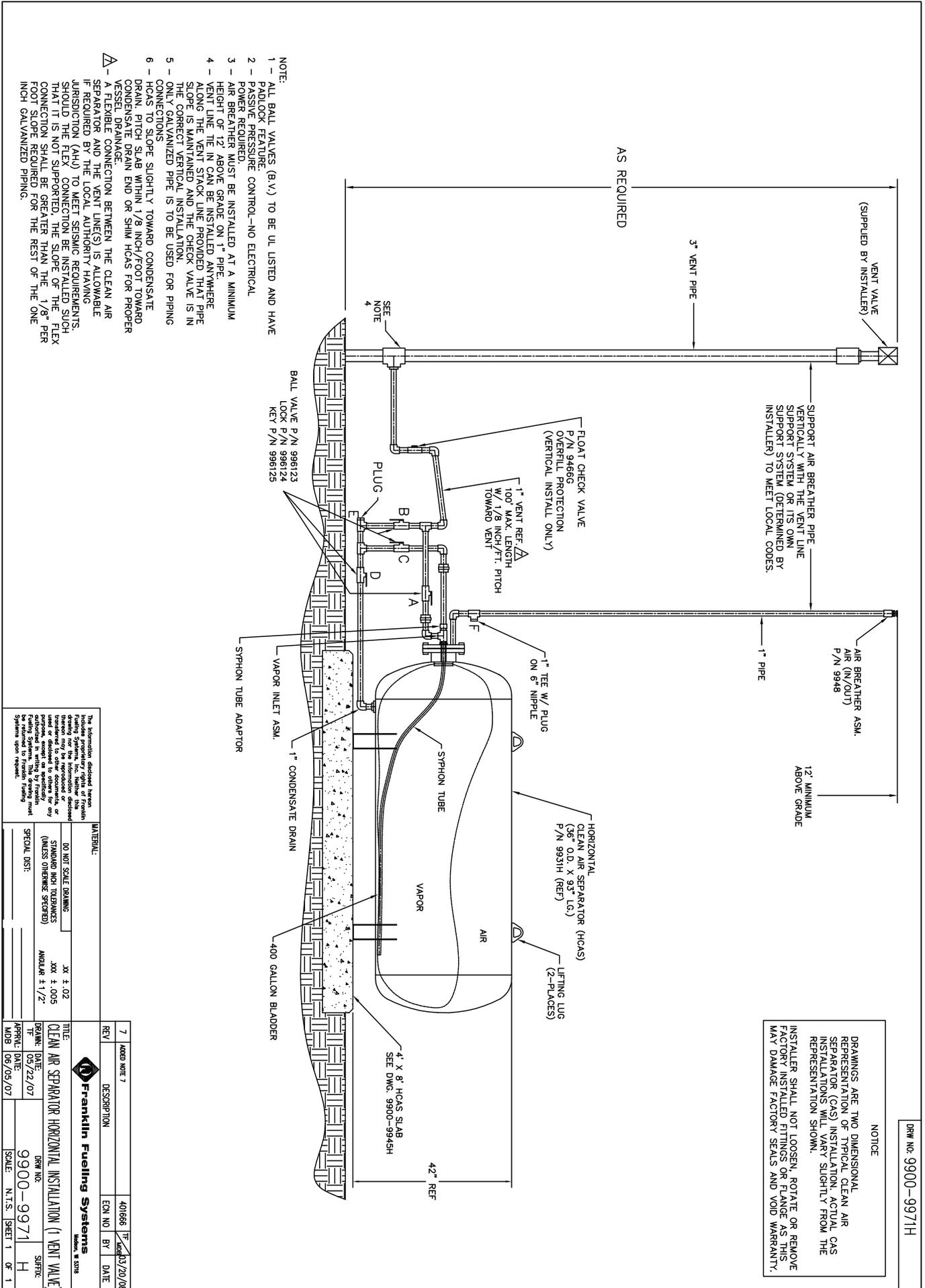
The information disclosed herein includes proprietary rights of Franklin Fuelling Systems, Inc. and is intended for use only by the recipient or those authorized in writing by Franklin Fuelling Systems, Inc. This drawing must remain confidential. No other use or copying is permitted without the written consent of Franklin Fuelling Systems, Inc.

MATERIAL:	
DO NOT SCALE DRAWING	XX ± 0.2
STANDARD RICH TOLERANCES (UNLESS OTHERWISE SPECIFIED)	.000 ± .0005
SPECIAL DIST:	ANGULAR ± 1/2°

TITLE:		CLEAN AIR SEPARATOR VERTICAL INSTALLATION (2 VENT)	
DRW NO:	9900-9972	DATE:	05/14/02
DRW BY:	JWH	DATE:	06/05/07
SCALE:	N.T.S.	SHEET:	1 OF 1



REV:	8	ADDED NOTE 6	401666	16	06/23/08
DESCRIPTION:					
EON NO:					
DATE:					



**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 FACTORY INSTALLED FITTINGS OR FLANGE AS THIS MAY DAMAGE FACTORY SEALS AND VOID WARRANTY.

DRW NO: 9900-9971H

The information disclosed herein includes proprietary rights of Franklin Fueling Systems, Inc. and is intended for use only by the recipient. It is not to be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without the prior written permission of Franklin Fueling Systems, Inc. This drawing must be used in accordance with the Franklin Fueling Systems, Inc. drawing specifications upon request.

MATERIAL:	DO NOT SCALE DRAWING	SCALE: 1/2" = 1'-0"
	STANDARD INCH DIMENSIONS (UNLESS OTHERWISE SPECIFIED)	ANGULAR ± 1/2°
SPECIAL DIST:		

TITLE:	CLEAN AIR SEPARATOR HORIZONTAL INSTALLATION (1 VENT VALVE)
DRW NO:	9900-9971H
DATE:	05/22/07
APPROVAL DATE:	06/05/07
SCALE:	N.T.S.
SHEET:	1 OF 1

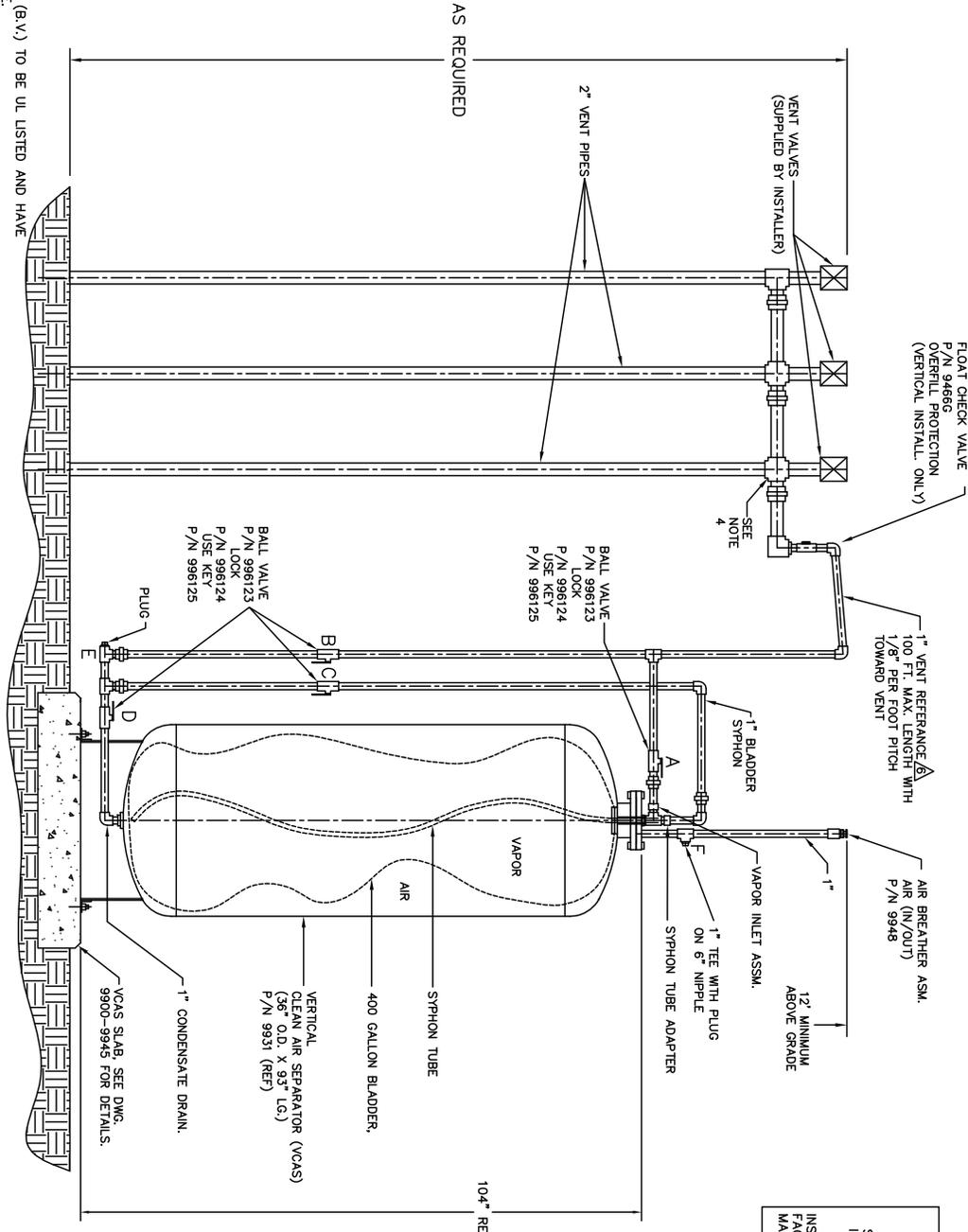


Franklin Fueling Systems  
Model # 5278

REV	7	ADDED NOTE 7	401666	TR	06/03/20/08
		DESCRIPTION	EON NO	BY	DATE

DRW NO: 9900-9973

**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 FACTORY INSTALLED FITTINGS OR FLANGE AS THIS MAY DAMAGE FACTORY SEALS AND VOID WARRANTY.



- NOTE:**
- 1 – ALL BALL VALVES (B.V.) TO BE UL LISTED AND HAVE PADLOCK FEATURE.
  - 2 – PASSIVE PRESSURE CONTROL—NO ELECTRICAL POWER REQUIRED.
  - 3 – AIR BREAKER MUST BE INSTALLED AT A MINIMUM HEIGHT OF 12" ABOVE GRADE.
  - 4 – VENT LINE THE 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.
  - 5 – ONLY GALVANIZED PIPE IS TO BE USED FOR PIPING CONNECTION BETWEEN THE CLEAN AIR SEPARATOR AND THE VENT LINE(S) IS ALLOWABLE IF REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION (LAW) TO MEET SEISMIC REQUIREMENTS. SHOUT IT IS NOT SUPPORTED, THE OPTIMUM SLOPE COEFFICIENT SHALL BE GREATER THAN THE 1/8" PER FOOT SLOPE REQUIRED FOR THE REST OF THE ONE INCH GALVANIZED PIPING.

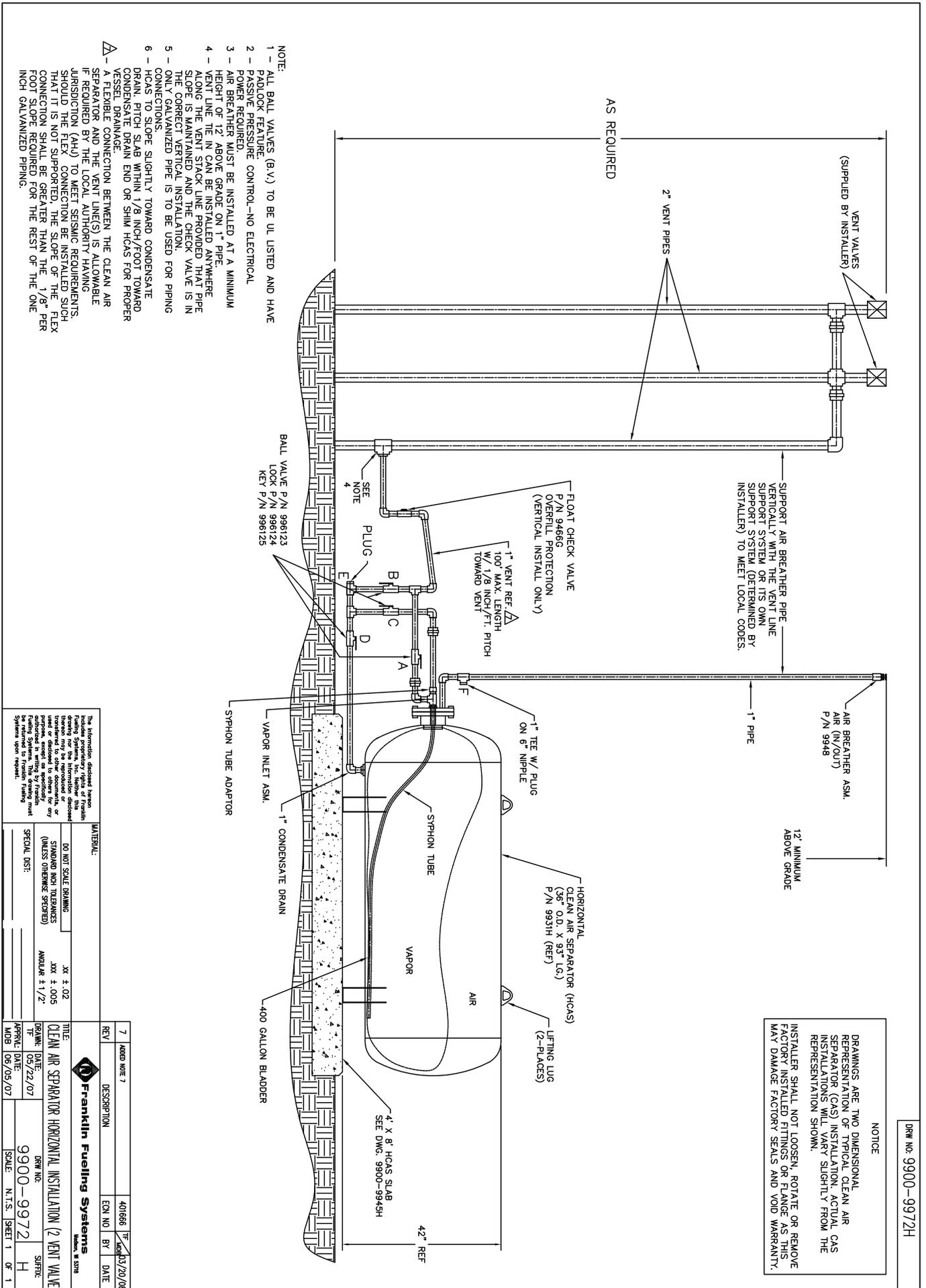
The information disclosed herein includes proprietary rights of Franklin Fueling Systems, Inc. and is intended for use only by the recipient of this information. It is not to be used or disclosed to others for any purpose other than that authorized in writing by Franklin Fueling Systems, Inc. This drawing must be used in accordance with the Systems upon request.

<b>MATERIAL:</b>	
DO NOT SCALE DRAWING	XX ± 0.02
STANDARD TECH REQUIREMENTS (PLEASE OPENING SPECIES)	.000 ± .0005
SPECIAL DIST:	ANGULAR ± 1/2°

<b>TITLE:</b>	
CLEAN AIR SEPARATOR VERTICAL INSTALLATION (3 VENT)	
<b>DRAWN:</b> JWH	<b>DATE:</b> 05/14/02
<b>APPROV:</b> MDR	<b>DATE:</b> 06/05/07
<b>DRW NO:</b> 9900-9973	<b>SCALE:</b> N.T.S.
<b>SHEET:</b> 1	<b>OF:</b> 1



<b>REV:</b> 8	<b>ADDED NOTE:</b> 6	<b>401666</b>	<b>TR</b>	<b>6/26/02/20/08</b>
<b>DESCRIPTION:</b>		<b>EON NO:</b>	<b>BY:</b>	<b>DATE:</b>



- NOTE:
- 1 - ALL BALL VALVES (B.V.) TO BE UL LISTED AND HAVE PADLOCK FEATURE.
  - 2 - PASSIVE PRESSURE CONTROL-NO ELECTRICAL POWER REQUIRED.
  - 3 - AIR BREAKER MUST BE INSTALLED AT A MINIMUM HEIGHT OF 12' ABOVE GRADE ON 1" PIPE.
  - 4 - VENT LINE TIE 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.
  - 5 - ONLY GALVANIZED PIPE IS TO BE USED FOR PIPING CONNECTIONS.
  - 6 - HGAS TO SLOPE SLIGHTLY TOWARD CONDENSATE DRAIN. PITCH SLAB WITHIN 1/8 INCH/FOOT TOWARD CONDENSATE DRAIN END OR SHIM HGAS FOR PROPER VESSEL DRAINAGE.
- △ - A FLEXIBLE CONNECTION BETWEEN THE CLEAN AIR SEPARATOR AND THE VENT LINE(S) IS ALLOWABLE IF REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION (A.H.U.) TO MEET SEISMIC REQUIREMENTS. SHOULD THE FLEX CONNECTION BE INSTALLED SUCH THAT IT IS NOT SUPPORTED, THE SLOPE OF THE CONNECTION SHALL BE GREATER THAN THE 1/8" PER FOOT SLOPE REQUIRED FOR THE REST OF THE ONE INCH GALVANIZED PIPING.

The information disclosed herein includes proprietary rights of Franklin Fueling Systems, Inc. and is intended for use only by the recipient or those authorized in writing by Franklin Fueling Systems, Inc. This drawing must be used in accordance with the Franklin Fueling Systems, Inc. drawing systems upon request.

MATERIAL:	
DO NOT SCALE DRAWING	XXX ± .02
STANDARD NICK TOLERANCES (UNLESS OTHERWISE SPECIFIED)	ANGULAR ± 1/2°
SPECIAL DIST:	

TITLE:		DRAWN NO:	
CLEAN AIR SEPARATOR HORIZONTAL INSTALLATION (2 VENT VALVE)		9900-9972	
DATE:	05/22/07	DATE:	05/22/07
APP'D:	MDP	SCALE:	N.T.S.
REV:	7	DATE:	03/20/08
DESCRIPTION:	401666	EON NO:	BY:
Franklin Fueling Systems		SHEET 1 OF 1	

NOTICE

DRAWINGS ARE TWO DIMENSIONAL REPRESENTATION OF TYPICAL CLEAN AIR SEPARATOR (CAS) INSTALLATION. ACTUAL CAS INSTALLATIONS WILL VARY SLIGHTLY FROM THE REPRESENTATION SHOWN.

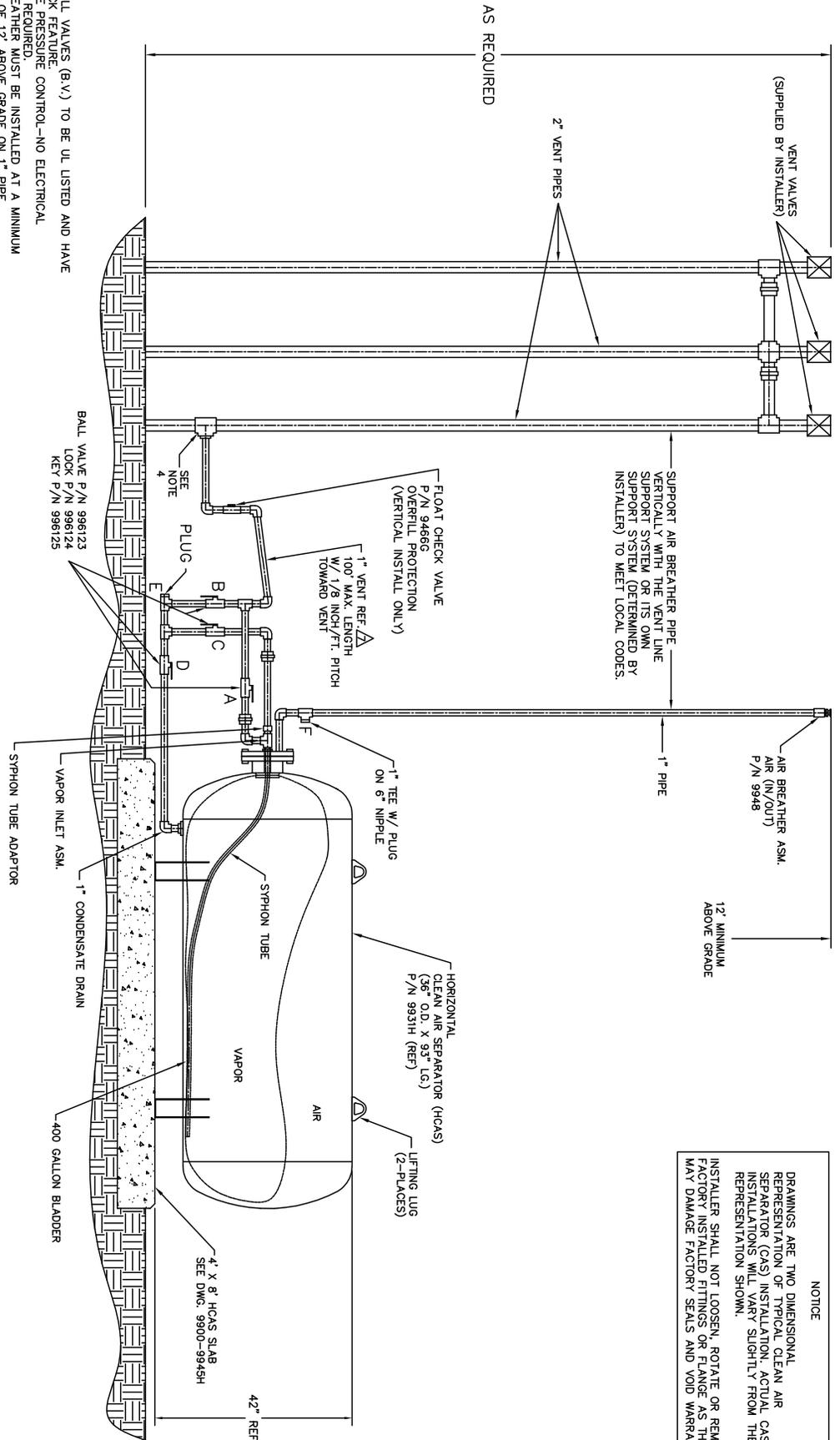
INSTALLER SHALL NOT LOOSEN, ROTATE OR REMOVE FACTORY INSTALLED FITTINGS OR FLANGE AS THIS MAY DAMAGE FACTORY SEALS AND VOID WARRANTY.

DRW NO: 9900-9972H

DRW NO: 9900-9973H

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 FACTORY INSTALLED FITTINGS OR FLANGE AS THIS MAY DAMAGE FACTORY SEALS AND VOID WARRANTY.



- NOTE:
- 1 - ALL BALL VALVES (B.V.) TO BE UL LISTED AND HAVE P/N 996123
  - 2 - PASSIVE PRESSURE CONTROL—NO ELECTRICAL POWER REQUIRED
  - 3 - AIR BREATHER MUST BE INSTALLED AT A MINIMUM HEIGHT OF 12" ABOVE GRADE ON 1" PIPE
  - 4 - VENT LINE TIE 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.
  - 5 - ONLY GALVANIZED PIPE IS TO BE USED FOR PIPING CONNECTIONS
  - 6 - HCS TO SLOPE SLIGHTLY TOWARD CONDENSATE DRAIN. PITCH SLAB WITHIN 1/8 INCH/FOOT TOWARD CONDENSATE DRAIN END OR SHIM HCS FOR PROPER VESSEL DRAINAGE.
- ▲ 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" PER FOOT SLOPE REQUIRED FOR THE REST OF THE ONE INCH GALVANIZED PIPING.

The information disclosed herein includes proprietary rights of Franklin and is not to be reproduced or used or disclosed to others for any purpose without the written consent of Franklin Fueling Systems. This drawing must be used in conjunction with the Franklin Fueling Systems upon request.

MATERIAL:	DO NOT SCALE DRAWING
	STANDARD RICH TOLERANCES (UNLESS OTHERWISE SPECIFIED)
SPECIAL DIST:	XXX ± .02 ANALUR ± 1/2"

TITLE:	7	ADD'D NO: 7	401666	TR	03/20/08
DESCRIPTION	REV	DESCRIPTION	EON NO	BY	DATE
CLEAN AIR SEPARATOR HORIZONTAL INSTALLATION (3 VENT VALVE)					
DATE: 05/22/07	DATE: 05/22/07	DATE: 05/22/07	DATE: 05/22/07	DATE: 05/22/07	DATE: 05/22/07
APP'D: MDP	APP'D: MDP	APP'D: MDP	APP'D: MDP	APP'D: MDP	APP'D: MDP
SCALE: N.T.S.	SCALE: N.T.S.	SCALE: N.T.S.	SCALE: N.T.S.	SCALE: N.T.S.	SCALE: N.T.S.
SHEET 1	SHEET 1	SHEET 1	SHEET 1	SHEET 1	SHEET 1
OF 1	OF 1	OF 1	OF 1	OF 1	OF 1



Model B 5278