ARB Approved

Installation, Operation and Maintenance Manual

For

Executive Order

VR-204-W
Balance Phase II EVR Systems Including
In-Station Diagnostics (ISD) Systems

NOTICE:

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

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 ISD Certified Technicians) are able to perform installation, maintenance or repairs of components manufactured by Franklin Fueling Systems or warranty will be void. Unless specified otherwise, only skilled technicians that are trained, certified and licensed by EMCO Wheaton Retail (i.e. EMCO Certified Technicians) are able to perform installation, maintenance or repairs of components manufactured by EMCO or ContiTech USA Inc. or warranty will be void. Unless specified otherwise, only skilled technicians that are trained, certified and licensed by Hirt Combustion Engineers (i.e. Hirt Certified Technicians) are able to perform installation, maintenance or repairs of components manufactured by Hirt or warranty will be void.

NOTE: GDF Owner / Operator can remove and install hanging hardware (nozzle, curb hose, breakaway, flow limiter and whip hose). Additional certifications may be required in accordance with local district requirements.

It is the responsibility of each VST Authorized Service Contractor (ASC), Veeder-Root technician, Healy Certified Technician, INCON ISD Certified Technician, EMCO Certified Technician, and Hirt 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, INCON ISD Certified Technician, EMCO Certified Technician, and Hirt Certified Technician to be aware of all the manuals, necessary safety precautions, and site safety requirements to assure a safe and trouble-free installation.

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

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

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

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

To confirm a Healy or INCON ISD Certified Technician training status, a person can access a searchable database at the following web site: http://techlab.franklinfueling.com/mod/resource/view.php?id=64

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

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

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

To confirm Hirt training, a person 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

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Contractor Requirements

The following are contractor training requirements for installing, maintaining, and repairing manufacturer's enhanced vapor recovery (EVR) equipment. Unless otherwise specified below, installation, maintenance and repair of system components, including removal and installation of such components in the course of any required tests, shall be performed by technicians certified by the appropriate manufacturer.

In addition to the training requirements below, the contractor is responsible for providing the warranty tag, included with each component, to the service station owner/operator at the time of installation.

VST Contractor Requirements

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

	Level A Re-cert every 2 years	Level B Re-cert every 2 years	Level C Re-cert every 2 years	Level D Re-cert every 2 years
Component	• Hanging Hardware	• Hanging Hardware • ECS Membrane Processor	• Hanging Hardware • ECS Membrane Processor	• Hanging Hardware • *Green Machine*
Authorized Tasks	• Functional Testing • Installation • Maintenance & Repair	• Installation	• Installation • Functional Testing • Start-Up • Troubleshooting • Maintenance & Repair	• Installation • Functional Testing • Start-Up • Troubleshooting • Maintenance & Repair
Training Pre-Requisites	• None	• VST Level A • *Veeder-Root Installer Certification[1] or ATG Technician Certification[2] or VR Vapor Products Certification[3].	• VST Level A/B • Veeder-Root Vapor Products certification[3]	• VST Level A • Veeder-Root Vapor Products certification[3]

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.

*Veeder-Root Installer Certification is a pre-requisite for ATG Technician Certification.

Provided that there are no other local district requirements, a GDF owner/operator can, without obtaining contractor/installer certification from VST, remove and install ARB-certified VST nozzles, curb hoses, breakaways, and whip hoses.

[1] Installer Certification – Installation (Level 1) Course in Veeder-Root UST Monitoring Systems
[2] ATG Technician Certification – Veeder-Root Startup & Service Technician (Level 2/3/4) in TLS-3XX UST Monitoring Systems (including Secondary Containment Vacuum Sensing – CA Only)
[3] Vapor Products Certification – Veeder-Root Vapor Products – In-Stage Diagnostics – Carbon Canister Vapor Polisher – PMC – Wireless ISD/PMC

- 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.
- To verify contractor training go to the following website: http://www.vsthose.com/cert_contractors.aspx

Veeder-Root Contractor Requirements

Veeder-Root Contractor Certification Requirements	Installer Certification[6]	ATG Technician Certification[7]	VR Vapor Products Certification[8]
Install[1] ISD	√	√	√
Install PMC	√	√	√
Install CCVP	√	√	√
Install Wireless ISD/PMC	√	√	√
Installation Checkout[2]		√	√
ATG Startup[3] / Training[4] / Service[5]		√	√
ISD Startup / Training / Service			√
PMC Startup / Training / Service			√
CCVP Startup / Training / Service			√
Wireless ISD/PMC Startup / Training / Service			√
Install Pressure Sensor (ATG)	√	√	√
Maintain Pressure Sensor (ATG)		√	√
Calibrate Pressure Sensor (ATG)		√	√
Clear ATG Pressure Sensor Alarm (ATG)		√	√
Clear ISD/ PMC alarms (ISD/PMC)			√

[1]Perform wiring and conduit routing; equipment mounting
[2]Inspect wiring and conduit routing; equipment mounting
[3]Turn power on, program and test the systems
[4]Provide supervised field experience in service techniques and operations
[5]Troubleshoot and provide routine maintenance as specified in the IOM
[6]UST Monitoring Systems – Installer (Level 1)
[7]Certified UST Monitoring Technician
[8]VR Vapor Products

A current Veeder-Root Installer Certification is a prerequisite for the ATG Technician Certification course.

- Veeder-Root certification training is given in a classroom environment.
- To confirm TLS or ISD training a regulator should send an email to technicaltraining@gilbarco.com with the name (and company) of the ASC to obtain verification of the ASC TLS/ISD training status or call 800-997-7725 and press “4” to get to the Veeder-Root menu and then “*” to speak to a representative or sign on to the Gilbarco Learning Suite at http://wise.gilbarco.com.

EMCO Contractor Requirements

Level	Component	Authorized Tasks	Training Pre-Requisites
A Must be re-certified every two-years	• EMCO Hanging Hardware • ContiTech Maxxim Premier Plus or Ultra Hose	• Installation • Functional Testing • Preventive Maintenance • Repair	No pre-requisite

Note:

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.

Provided that there are no other local district requirements, a GDF owner/operator can, without obtaining contractor/installer certification from EMCO, remove and install ARB-certified EMCO nozzles and breakaways and ContiTech curb hoses and whip hoses.

- EMCO certification training is given in a classroom environment.
- EMCO Certified Technicians must be able to show proof of certification if asked. Carry the wallet card or have a copy of your certification on file with the gasoline dispensing facility.
- EMCO Certified Technicians must record his or her certification number on the applicable paperwork for all warranties to be deemed valid.
- To verify EMCO contractor training go to the following website and click on contractors: http://www.emcoretail.com

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

Technician Certification	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.

NOTE:

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.

- Hirt installer certification training is given in a classroom environment.
- To verify contractor training call (562) 692-1490.

FFS/Healy Contractor Requirements (for CAS)

- Unless specified otherwise, only skilled technicians that are trained, certified and licensed by Franklin Fueling Systems (i.e. Healy or INCON Certified Technicians) are able to perform installation, maintenance or repairs of components manufactured by Franklin Fueling Systems or warranty will be void.

- It is the responsibility of each Healy Certified Technician to be familiar with the current requirements of state, federal, local codes and air district rules and regulations for installation and repair of gasoline dispensing equipment.

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

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

http://techlab.franklinfueling.com/mod/resource/view.php?id=64

INCON ISD Contractor Requirements

Level	Description of Certification
1	**Tank Sentinel (TS) Installation certification**: An installer that successfully completes this level will be certified to install the Tank Sentinel (TS) consoles, probes, and accessories. The certified technician is certified to install and wire, Consoles, Probes, sensors and auxiliary equipment.
2	**Tank Sentinel Start-up/Programming/Warranty certification.** A technician that successfully completes this level will be certified to start-up, program, and perform warranty service on Tank Sentinel (TS) consoles, probes, and accessories. The certified technician is certified to do set up programming, troubleshooting, repair work and warranty work. **Prerequisite: The individual must have successfully completed Level 1 installation certification before taking Level 2.**
5	**VRM (Vapor Recovery Monitoring).** A technician that successfully completes this level will be certified to install, operate, test, and perform warranty service on the VRM System. **Prerequisite: Prior to taking the Level 5 course the individual must successfully pass Levels 1 and 2.**
NOTE: **Depending on local codes, in addition to the INCON training, contractors may be required to take air-district training or ICC certification as an approved vapor-recovery installer.**	

- An INCON Vapor Recovery Monitoring (VRM) Certified Technician needs to have completed training Levels 1, 2, and 5.

- Only an INCON certified Vapor Recovery Monitoring (VRM) Technician or service person is allowed to make setup changes, clear alarms, and access areas internal to the Console.

- INCON VRM Certified Technicians must be able to show proof of certification if asked. Carry the certification card or have a copy of your certification on file with the gasoline dispensing facility.

  INCON VRM Certified Technicians must record his or her certification number on the applicable paperwork for all warranties to be deemed valid.
- To confirm a Healy or INCON Certified Technician training status, a regulator can access a searchable database at the following web site:

  http://techlab.franklinfueling.com/mod/resource/view.php?id=64

- Re-Certification: INCON VRM Certified Technician must be re-certified every two years for any level.

  Franklin Fueling Systems – INCON will re-certify individuals as their certification period nears expiration and notify certified individuals, in writing (via E-Mail) of any changes to the Executive Order, equipment, installation instructions, or any of the elements outlined in the training plan. Changes or additions to INCON products may require re-certification prior to the two-year expiration date. FFS will offer recertification training via face-to-face classes or on-line self-paced course work at http://techlab.franklinfueling.com/

OPW Breakaway Contractor Requirements (for 66CLP)

- OPW offers contractor training on the 66CLP breakaway, but the completion of a training course is not required to install, reconnect or repair the breakaway.
- OPW recommends that the GDF Owner/Operator or VST ASC Levels A, B, C technician or EMCO Level A technician review the latest 66CLP installation and maintenance manual on the OPW Internet site (www.opwglobal.com) prior to installing, reconnecting or repairing an OPW 66CLP breakaway.
- It is the responsibility of each GDF Owner/Operator or service technician to be familiar with the current requirements of federal, state and local codes.
- It is the responsibility of each GDF Owner/Operator or service technician to be familiar with the local air district rules and regulations for installation and repair of OPW breakaways.
- It is the responsibility of each GDF Owner/Operator or technician to be aware of all of the necessary safety precautions and site safety requirements to assure a safe and trouble free installation or repair.
- A current list of OPW EVR certified technicians is located at: http://www.opwglobal.com/Contact/EVRTrainedTechnicians.aspx

www.opwglobal.com

Weekly Inspections –Hanging Hardware

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

VST NOZZLE					
Nozzle Component	**Procedure**	**Fail Criteria**	**Corrective Action**	**Reference Manuals**	**Authorized Personnel**
Nozzle lever, lever guard, lever lock	Inspect for imperfections, 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	**Nozzle Replacement:** GDF Owner/Operator or VST ASC Levels A, B, C, or D
Nozzle Spout		Sheared or bent	Replace nozzle spout assembly with new VST Front-End Kit or Replace with new VST nozzle	IOM-7 IOM-6	**Front-End Repair:** VST ASC Levels A, B, C, or D **Nozzle Replacement:** GDF Owner/Operator or VST ASC Levels A, B, C, or D
Nozzle Vent Hole		Vent hole blocked	Clear blockage	IOM-6	**Blockage Repair:** GDF Owner/Operator or VST ASC Levels A, B, C, or D
Nozzle Collection Sleeve		If greater than 18 inches total length of cuts (if greater than 0 .4 sq. inches of material missing)	Replace vapor collection kit	IOM-7	**Front-End Repair:** VST ASC Levels A, B, C, or D
			Replace nozzle with new VST nozzle	IOM-6	**Nozzle Replacement:** GDF Owner/Operator or VST ASC Levels A, B, C, or D
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	**Front-End Repair:** VST ASC Levels A, B, C, or D
			Replace nozzle with new VST nozzle	IOM-6	**Nozzle Replacement:** GDF Owner/Operator or VST ASC Levels A, B, C, or D
Nozzle Front-End Kit (Collection sleeve and face seal)		Alignment lines are misaligned and/or the assembly is askew	Replace vapor collection kit	IOM-7	**Front-End Repair:** VST ASC Levels A, B, C, or D
			Replace nozzle with new VST nozzle	IOM-6	**Nozzle Replacement:** GDF Owner/Operator or VST ASC Levels A, B, C, or D
Nozzle Interlock Rod	Nozzle Inspection	Interlock rod sticks during engagement or disengagement	Replace vapor collection kit	IOM-7	**Front-End Repair:** VST ASC Levels A, B, C, or D
			Replace nozzle with new VST nozzle	IOM-6	**Nozzle Replacement:** GDF Owner/Operator or VST ASC Levels A, B, C, or D

Weekly Interlock Inspection – VST Nozzles

Fueling Point #	Check A		Check B	
	Pass	Fail	Pass	Fail

Fueling Point #	Check A		Check B	
	Pass	Fail	Pass	Fail

Inspected by: _____Date: _____ Inspected by: _____Date: _____

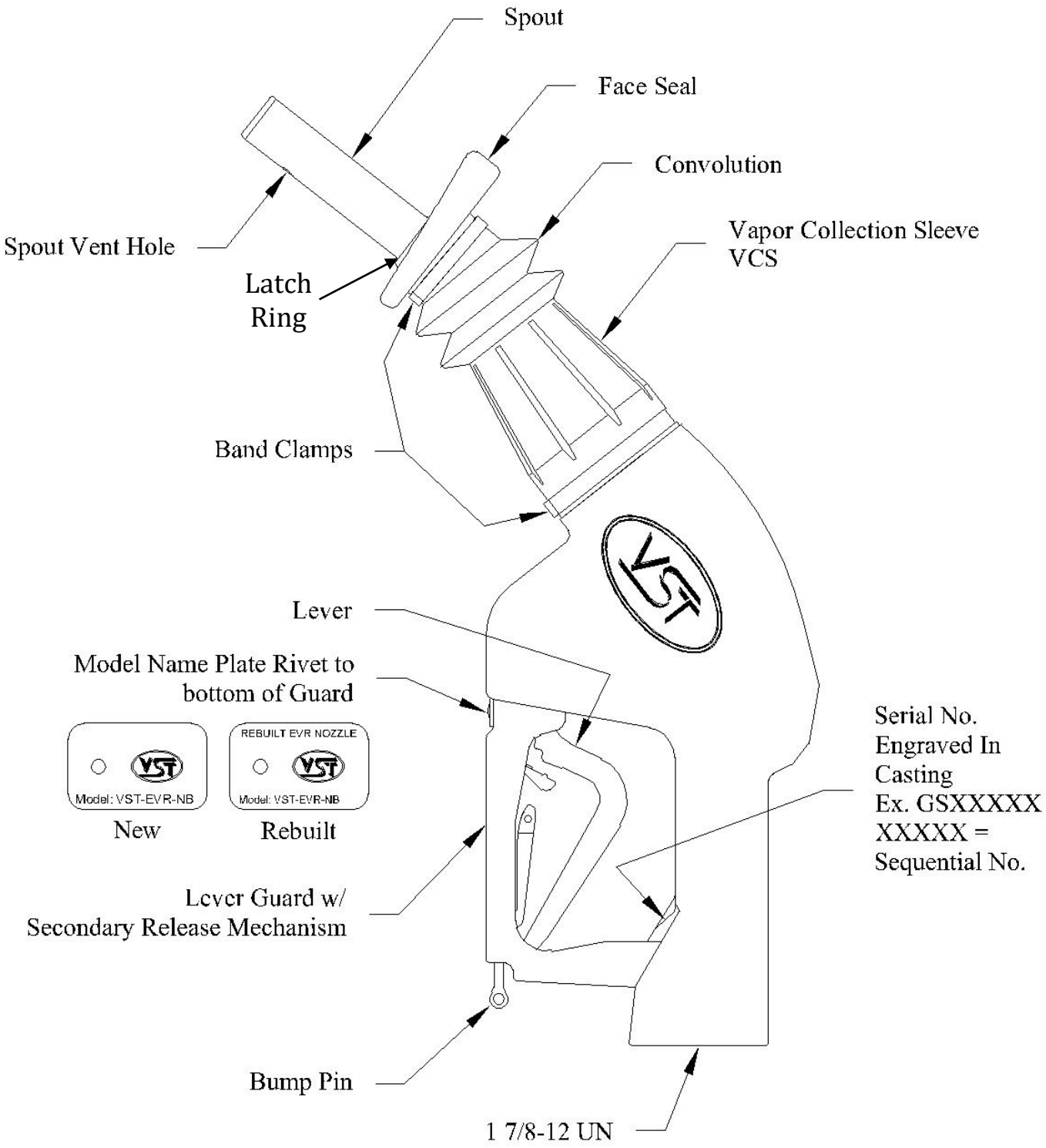
Check A

1) Make sure dispenser is de-activated (**do not turn dispenser on**).
2) Lift the nozzle from the dispenser cradle without touching the lever.
3) If hold-open latch is engaged, the nozzle fails. Tag out this Fueling Point and have the nozzle immediately serviced or replaced.
4) Point nozzle spout into a gasoline compatible container. Do not compress vapor collection sleeve (VCS).
5) Pull lever to make sure there is no spring tension.
   If the lever has **no** spring tension (dead lever), the nozzle passes.
   If the lever has spring tension (live lever i.e. same as dispensing fuel), the nozzle fails.
6) If Check A fails, tag out this Fueling Point and have the nozzle immediately serviced or replaced. Reference nozzle installation or nozzle repair instructions in the ARB Approved Installation, Operation, and Maintenance Manual of the appropriate Executive Order.
7) If Check A passes, proceed to Check B.

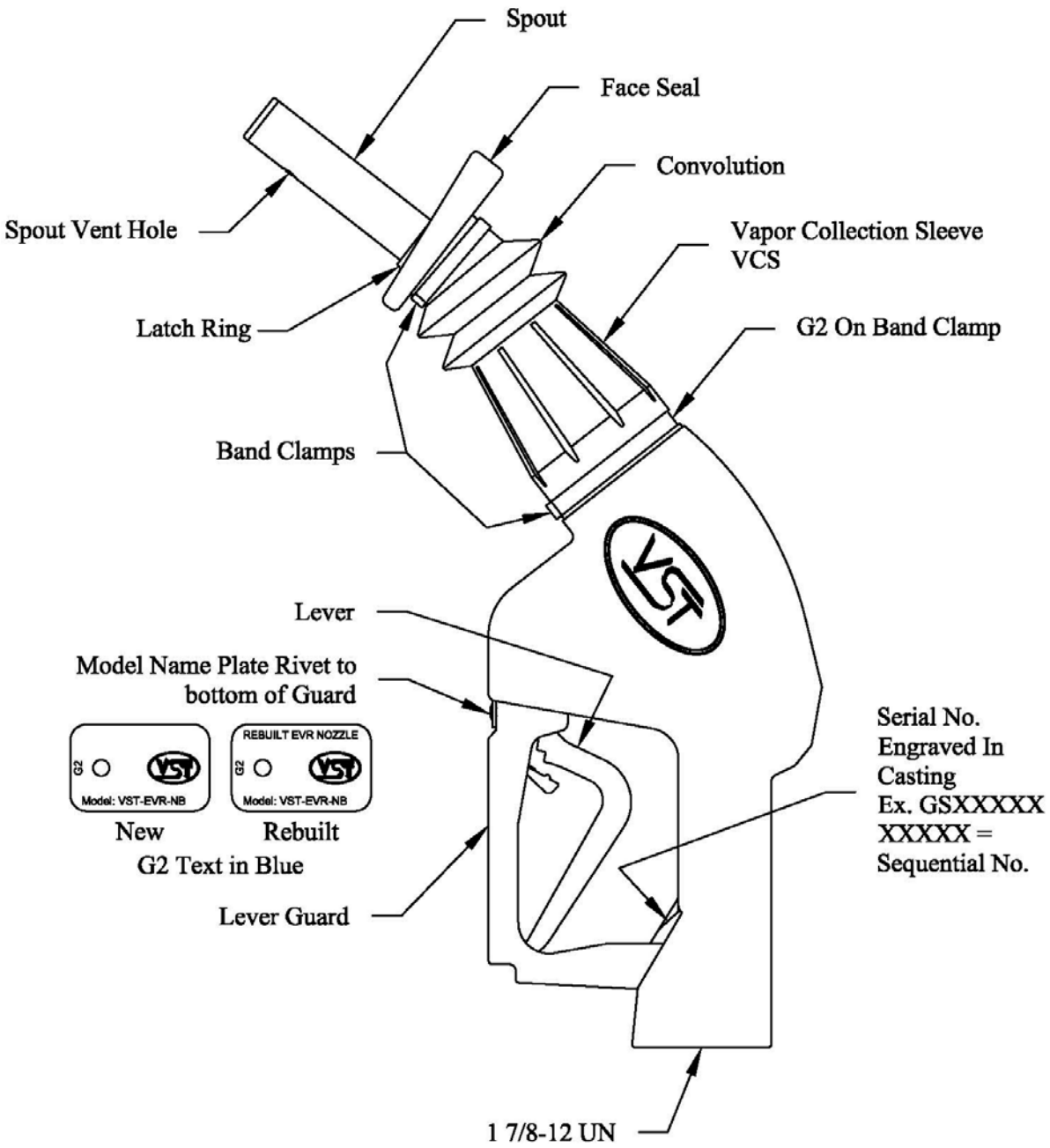
Check B

1) While still pointing the nozzle spout in the gasoline compatible container and with the dispenser de-activated, compress the vapor collection sleeve (VCS) by pressing on the face seal, and confirm the lever has spring tension (live lever).
2) Release the VCS and the lever. Then pull the lever and confirm the lever has **no** spring tension (dead lever). Make sure that the face seal is not caught on the spout latch ring.
3) If lever goes live when the VCS is compressed, and goes dead after the VCS and lever are released, then the nozzle passes.
4) If lever stays dead (when the VCS is compressed) **or** stays live (after the VCS and lever are released), then the nozzle fails.
5) If check B fails, tag out this Fueling Point and have the nozzle immediately serviced or replaced. Reference nozzle installation or nozzle repair instructions in the ARB Approved Installation, Operation, and Maintenance Manual of the appropriate Executive Order.

VST Nozzle


Spout
Face Seal
Convolution
Spout Vent Hole
Vapor Collection Sleeve
VCS
Latch
Ring
Band Clamps
Lever
Model Name Plate Rivet to
bottom of Guard
REBUILT EVR NOZZLE
Model: VST-EVR-NB
Model: VST-EVR-NB
New
Rebuilt
Serial No.
Engraved In
Casting
Ex. GSXXXXX
XXXXX =
Sequential No.
Lever Guard w/
Secondary Release Mechanism
Bump Pin
1 7/8-12 UN

VST G2 Nozzle

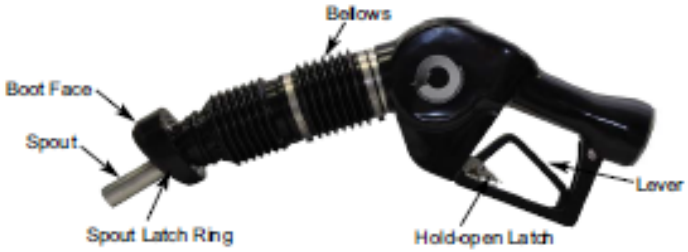


EMCO NOZZLE					
Nozzle Component	**Procedure**	**Fail Criteria**	**Corrective Action**	**Reference Manuals**	**Authorized Personnel**
Lever, Hold Open Latch, Lever Guard	Inspect for defects, cuts or damage to the: Lever Hold Open Latch Lever Guard Spout	Damaged or missing	Replace with new EMCO latch kit or nozzle	IOM – 6	**Latch Kit Repair:** EMCO Certified Technician Level A **Nozzle Replacement:** GDF Owner/Operator or EMCO Certified Technician Level A
Spout		Sheared or bent	Replace with new EMCO Spout Kit or nozzle	IOM – 6 IOM - 7	**Spout Kit Repair:** EMCO Certified Technician Level A **Nozzle Replacement:** GDF Owner/ Operator or EMCO Certified Technician Level A
Spout Vent Hole	Inspect for defects, cuts or damage to the: Spout Vent Hole Boot Face Bellows	Vent hole blocked	Clear blockage	IOM – 6	**Blockage Repair:** GDF Owner/Operator or EMCO Certified Technician Level A
Boot Face		> than 0.4 sq. inches of boot face material is missing (e.g. A triangular or similar shape in which greater than 7/16 inches of the boot face circumference is missing [accumulated])	Replace with new EMCO boot face kit or nozzle	IOM – 6 IOM - 7	**Boot Face Kit Repair:** EMCO Certified Technician Level A **Nozzle Replacement:** GDF Owner/Operator or EMCO Certified Technician Level A
Bellows		A cut across 7 consecutive bellows convolutions	Replace with new EMCO bellows kit or nozzle	IOM – 6 IOM - 7	**Bellows Kit Repair:** EMCO Certified Technician Level A **Nozzle Replacement:** GDF Owner/Operator or EMCO Certified Technician Level A

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

EMCO® WHEATON RETAIL

Models A4005EVR & RA4005EVR Balance Vapor Recovery Nozzles Weekly Insertion Interlock Test Procedure



Objective: The purpose of this test procedure is to verify proper field operation of the Model A4005EVR nozzle insertion interlock during engagement or disengagement.

Service Tools Required:

- Gasoline Approved Container
- Protective Gloves

CAUTION:

1. Always barricade work area to keep pedestrians and vehicles from accessing the dispenser during testing of the nozzle.
2. Always use a gasoline approved container when performing any type of testing or preventive maintenance on hanging hardware components. (nozzle, hose swivel, breakaway and hoses)
3. Always point the end of the spout downwards into a gasoline approved container when performing the Weekly Insertion Interlock Test Procedure. Failure may result in a hazardous gasoline spill or personal injury and/ or death.
4. Always make sure the dispenser is de-activated (off) while performing the Weekly Insertion Interlock Test Procedure. Failure may result in a hazardous gasoline spill or personal injury and/ or death.

Lever Verification:

1. Remove the nozzle from the dispenser cradle without touching the lever. If the hold-open latch is engaged, the nozzle fails. The nozzle shall not be used and must be immediately taken out of service.

2. Point the end of the spout downwards into a gasoline approval container. Engage (squeeze) the lever without compressing the bellows. Perform this step a minimum of three times to assure the lever has free motion and no tension (dead lever).

IMPORTANT: If at any time while performing step 2 the lever exhibits tension (live lever), the nozzle fails. The nozzle shall not be used and must be immediately taken out of service.

3. If the lever exhibits no tension (dead lever) while performing step 2, the nozzle has successfully passed. Record the results on the Lever Verification Form and proceed to step 4.

EMCO® WHEATON RETAIL

Models A4005EVR & RA4005EVR
Balance Vapor Recovery Nozzles
Weekly Insertion Interlock Test Procedure

Insertion Interlock Verification:

4. While pointing the end of the spout downwards into a gasoline approved container compress the bellows from its "free" extended position, and engage (squeeze) the lever. If the lever exhibits no tension (dead lever), the nozzle fails. The nozzle shall not be used and must be immediately taken out of service.

IMPORTANT: When compressing the bellows, the lever will exhibit tension (live lever) allowing both the fuel and vapor valves inside the nozzle to open to atmosphere.

7. If the lever exhibits no tension (dead lever) while performing step 6, the nozzle has successfully passed. Place the nozzle back on the dispenser cradle and record the results on the Insertion Interlock Verification Form.

5. While keeping the lever engaged, slowly allow the bellows to extend to its "free" position in a controlled manner that simulates removing the nozzle from a vehicle fill pipe. Make sure that the boot face is not caught on the spout latch ring.

IMPORTANT: The fuel and vapor valves will close once the bellows reaches its extended position. A "click" will indicate both valves are closed and the insertion interlock is disengaged.

6. While pointing the end of the spout downwards into a gasoline approved container, engage (squeeze) the lever without compressing the bellows. Perform this step a minimum of three times to assure the lever has free motion and no tension (dead lever).

IMPORTANT: If at any time while performing step 6 the lever exhibits tension (live lever), the nozzle fails. The nozzle shall not be used and must be immediately taken out of service.

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

p/n 570166
Rev. A, 11/12

EMCO® WHEATON RETAIL

Models A4005EVR & RA4005EVR Balance Vapor Recovery Nozzles
Weekly Insertion Interlock Test Procedure

Facility: ______________________ Facility Address: ______________________________

Lever Verification Form

Fueling Point #																		
Pass																		
Fail																		

Insertion Interlock Verification Form

Fueling Point #																		
Pass																		
Fail																		

Date: ____________ Performed by: ______________________

Lever Verification Form

Fueling Point #																		
Pass																		
Fail																		

Insertion Interlock Verification Form

Fueling Point #																		
Pass																		
Fail																		

Date: ____________ Performed by: ______________________

Lever Verification Form

Fueling Point #																		
Pass																		
Fail																		

Insertion Interlock Verification Form

Fueling Point #																		
Pass																		
Fail																		

Date: ____________ Performed by: ______________________

Lever Verification Form

Fueling Point #																		
Pass																		
Fail																		

Insertion Interlock Verification Form

Fueling Point #																		
Pass																		
Fail																		

Date: ____________ Performed by: ______________________

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

Table 1: Quarterly Inspections for FFS Healy Clean Air Separator Only

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

Quarterly Inspections for Healy Clean Air Separator		
Checklist results may be used to assist with filling out GDF maintenance log. This table may be also used for testing the Clean Air Separator.	**Date _____**	**Page _____ of _____**
Clean Air Separator Configuration (see Exhibit 2, Figures 2B-16 or 2B-16H)		
Valve	Circle One	
A	Open	Closed
B	Open	Closed
C	Open	Closed
D	Open	Closed
Plug	Circle One	
E	Installed	Missing
F	Installed	Missing

Table 2: Annual Inspection Requirements for VST ECS Membrane Processor:

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

Table 3: Preventative Maintenance Checklist Form for VST ECS Membrane Processor

Component	Frequency	Date Inspected	Completed	Required Action Items
VST ECS PROCESSOR	**Yearly**			
• Inspect drive coupling on the vacuum pump.			[ ]	
• Check the continuity of the heat trace cable.			[ ]	
RECIRCULATION BLOWER				
Replace every 10 years or 15,000 hours, whichever comes first.			[ ]	
VACUUM PUMP				
Replace every 10 years or 15,000 hours, whichever comes first.			[ ]	

Table 4: Annual Inspection Requirements/Checklist for Hirt VCS 100 Vapor Processor:

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	
Instructions: Perform each step and check each box after step is completed. File completed checklist with station's Maintenance Records.	

1.	Turn OFF electrical power to processor. **CAUTION:** The processor can be hot from operation. Use caution when removing Weather Cover, Shell, and raising Inner Stack; they are HOT!	☐
2.	Remove Weather Cover. Look inside stack and burner chamber to check for debris. Remove any debris.	☐
3.	Remove padlocks, if any, and remove Shell from processor.	☐
4.	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.	☐
5.	Check igniter/sensor for carbon buildup. Replace Pilot Tip assembly if Excessive buildup. See instructions that come with replacement Pilot Tip for Installation details.	☐

6.	Visually check all processor piping and tubing for leaks (this is checked when conducting TP-201.3 and Exhibit 4 of Executive Orders VR-203 and VR-204). 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 components that show any wear, cracks, or deterioration.	☐
7.	Conduct Exhibit 13 of Executive Orders VR-203 and VR-204 “Hirt VCS 100 Process With Indicator Panel Operability Test Procedure”	☐
8.	Check setting of Pilot Needle Valve adjustmet (section 8.8 of Hirt VCS 100 IOM).	☐
9.	Lower Inner Stack and Tighten bolt. Replace Shell, Weather Cover, and padlocks removed for visual inspection.	☐
10.	Verify handle on 3-way valve is in down position – Processor to UST Ullage.	☐
11.	Turn ON electrical power to processor.	☐

Table 5: Annual battery check for Veeder-Root wireless components

You can get the battery status from the TLS-350 (with software Version 30A or higher). The battery status is displayed for the wireless sensors from the Smart Sensor Diagnostics (see menu below). The wireless sensors' battery status can also be printed from this screen. The battery status for the wireless sensors is reported as Full, Medium, Low, or Replace.

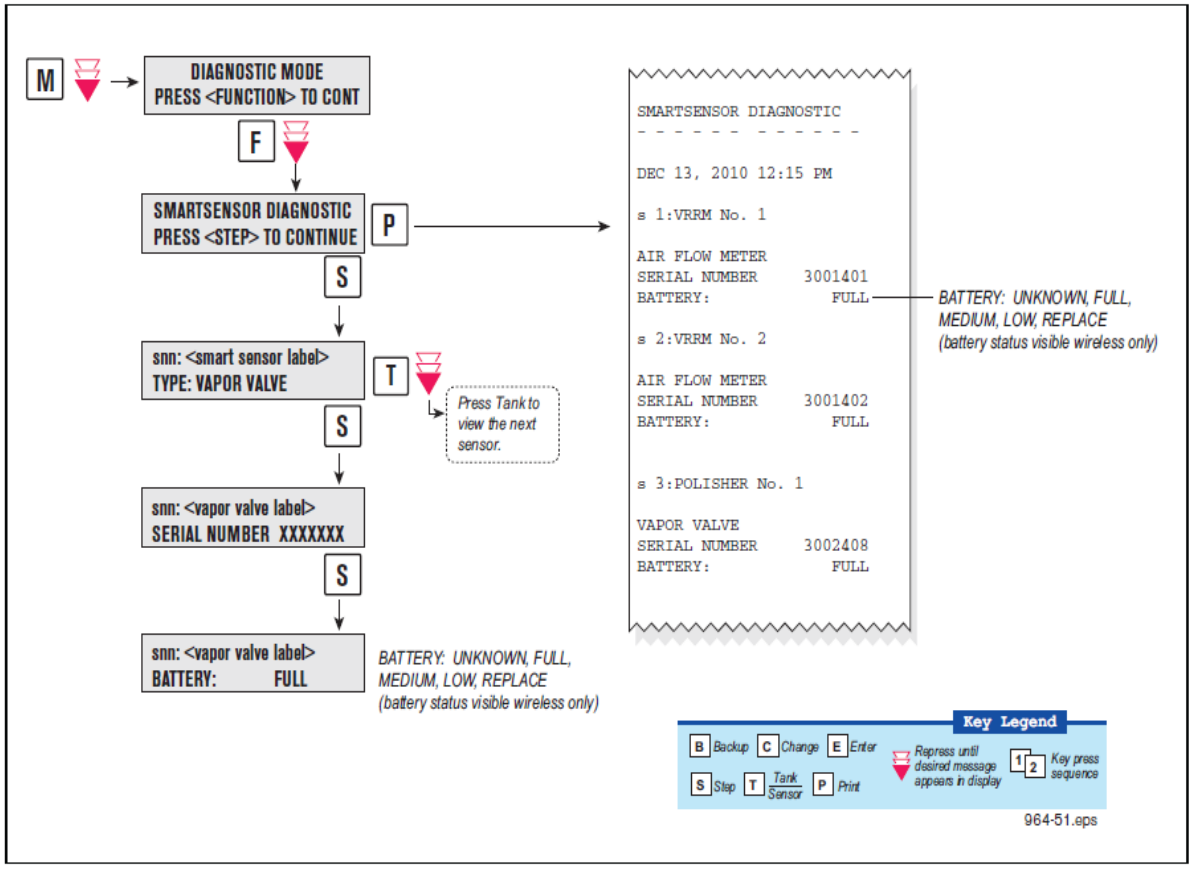


Figure 24. Device Battery Status in SmartSensor Diagnostic Menu

VR-203 and VR-204 Annual Battery Check for Veeder-Root Wireless Sensors						
					Date:_____	
Vapor Valve	Pressure Sensor	Flow Meter	Battery Status			
			Full	Medium	Low	Replace

Table 6: Annual Inspection Requirements for VST Green Machine Processor:

Annual *Green Machine* Inspections					
Component	**Procedure**	**Fail Criteria**	**Corrective Action**	**Reference Manual**	**Authorized Personnel**
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-18	VST ASC Level D
Vacuum Pump	Replace pump every 10 years or 15,000 hours			IOM-18	
VST *Green Machine* Annual Compliance Testing	Exhibit 15	Compliance Bag Test: If the value of the NOVA reading is ≥17%, the *Green Machine* is not in compliance. Continuous Monitoring Test: If a motor fault is not found then the *Green Machine* is not in compliance	Refer to the Green Machine Troubleshooting Manual for maintenance	Exhibit 15	

Executive Order VR-204 IOM Section 4: ISD Alarm Troubleshooting Summary

Due to the number of hanging hardware and vapor processor configurations available for use with the VST Phase II EVR Balance system, this section of the IOM consists of the following tables. The content of each table differs based on the type of processor and hanging hardware installed:

Table 1: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with VST ECS Membrane
Table 2: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with Veeder-Root Vapor Polisher
Table 3: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with FFS Healy Clean Air Separator
Table 4: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with Hirt VCS-100 Thermal Oxidizer
Table 5: Veeder-Root Alarms Associated with Veeder-Root Wireless ISD Components
Table 6: INCON ISD Alarm Troubleshooting Summary for Facilities Equipped with VST Phase II EVR System and FFS Healy Clean Air Separator
Table 7: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with VST Green Machine Processor
Table 8: INCON ISD Alarm Troubleshooting Summary for Facilities Equipped with EMCO Phase II EVR System and Hirt VCS-100 Vapor Processor

Table 1: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with VST ECS Membrane

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	• Exhibit 4 • TP-201.3 (or equivalent test procedure)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 Inches Water Column (IWC).	• Exhibit 9 • Exhibit 10
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	• Exhibit 5 • Exhibit 6 • Exhibit 17 • TP-201.4 (or equivalent test procedure)
FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
VP EMISSION WARN[3,4]	Processor	Yellow	Mass emission exceeded the certified threshold.	• Exhibit 8 • Exhibit 9
VP EMISSION FAIL[3,4]	Processor	Red	2nd Consecutive Mass emission test failure.	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
VP DUTY CYCLE WARN[3]	Processor	Yellow	Duty cycle exceeds 18 hours per day or 75% of 24 hours.	• PMC Setup Procedure • Exhibit 4 • Exhibit 9 • Exhibit 10 • TP-201.3 (or equivalent test procedure)
VP DUTY CYCLE FAIL	Processor	Red	2nd Consecutive Duty Cycle Test Failure.	
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL[2]	Self-Test	Red	8th Consecutive Failure of Setup Test	
PMC SETUP FAIL	N/A	Red	PMC is not configured or missing components.	• Troubleshooting Guide http://www.vsthose.com/carbs_components.aspx • See ISD Troubleshooting Guide, P/N 577013-819. • Exhibit 8 • Exhibit 9
PMC SENSOR FAULT	N/A	Red	Component used by PMC has failed or reported an error condition. See Trouble shooting section for complete description of sensors and associated conditions that can cause a sensor fault.	• Check for Smart Sensor Device Alarm or Fault.

Note: The alarms listed in above table will also activate an audible alarm

[1]See ISD Troubleshooting Manual P/N 577013-819 found at http://www.veeder.com/object/577013-819.html and the VST ISD Troubleshooting Guide 9513-003 found at http://www.vsthose.com/pdf/Troubleshooting_Guide_ECS_Membrane_Processor_Sept_2010.pdf

[2]ISD Shut Down Alarms – see Figure 48 of IOM Section 12

[3]This warning will result in an ISD VP Status Warn

[4]This failure will result in an ISD VP Status Fail

Table 2: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with Veeder-Root Vapor Polisher

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	• Exhibit 4 • Exhibit 11 • TP-201.3 (or equivalent test procedure)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	• Exhibit 10 • Exhibit 11
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	• Exhibit 5 • Exhibit 6 • Exhibit 17 • TP-201.4 (or equivalent test procedure)
FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
VP EMISSION WARN[3,4]	Processor	Yellow	Mass emission exceeded the certified threshold.	• Exhibit 11 • Exhibit 12
VP EMISSION FAIL[3,4]	Processor	Red	2nd Consecutive Mass emission test failure.	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL[2]	Self-Test	Red	8th Consecutive Failure of Setup Test	
PMC SETUP FAIL	N/A	Red	PMC is not configured or missing components.	• Ensure that all required components are installed and operational.
PMC SENSOR FAULT	N/A	Red	Component used by PMC has failed or reported an error condition. See Troubleshooting section for complete description of sensors and associated conditions that can cause a sensor fault.	• Check for Smart Sensor Device Alarm or Fault.

Note: The alarms listed in above table will also activate an audible alarm
[1]See ISD Troubleshooting Manual P/N 577013-819 at http://www.veeder.com/object/577013-819.html
[2]ISD Shut Down Alarms - see Figure 48 of IOM Section 12
[3]This warning will result in an ISD VP Status Warn
[4]This failure will result in an ISD VP Status Fail

Table 3: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with FFS Healy Clean Air Separator

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	• Exhibit 4 • Exhibit 14 • TP-201.3 (or equivalent test procedure)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	• Are ball valves for the Clean Air Separator in the correct position per Exhibit 2? • Exhibit 10
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	• Exhibit 5 • Exhibit 6 • Exhibit 17 • TP-201.4 (or equivalent test procedure)
FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL[2]	Self-Test	Red	8th Consecutive Failure of Setup Test	

Note: The alarms listed in above table will also activate an audible alarm
[1]See ISD Troubleshooting Manual P/N 577013-819 at http://www.veeder.com/object/577013-819.html
[2]ISD Shut Down Alarms - see Figure 48 of IOM Section 12

Table 4: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with Hirt VCS-100 Thermal Oxidizer

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	• Exhibit 4 • TP-201.3 (or equivalent test procedure)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	• Exhibit 10 • Exhibit 13
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	• Exhibit 5 • Exhibit 6 • Exhibit 17 • TP-201.4 (or equivalent test procedure)
FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
ISD VP PRESSURE WARN	Processor	Yellow	90th percentile of 1-day ullage pressure exceeds 2.3 IWC.	• Exhibit 13
ISD VP PRESSURE FAIL[2]	Processor	Red	2nd Consecutive Failure of Vapor Processor Overpressure Test	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VP STATUS WARN	Processor	Yellow	Triggered by an active "Extern Input Alarm" due to power loss, communication loss, or processor run time > 62 consecutive minutes	• Exhibit 4 • TP-201.3 (or equivalent test procedure) • Confirm proper installation of Hirt VCS 100 per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL[2]	Self-Test	Red	8th Consecutive Failure of Setup Test	

Note: The alarms listed in above table will also activate an audible alarm
[1]See ISD Troubleshooting Manual P/N 577013-819 at http://www.veeder.com/object/577013-819.html
[2]ISD Shut Down Alarms - see figure 48 of IOM Section 12

Table 5: Alarms Associated with Veeder-Root Wireless Components

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

Note: The alarm listed in above table will also activate an audible alarm

Table 6: INCON ISD Alarm Troubleshooting Summary for Facilities Equipped with VST Phase II EVR System and FFS Healy Clean Air Separator

Device	Description	Category	Type	Definition	Possible Cause and Solution
Fueling Point [n]	Daily Vapor Collection [1]	VRM	Warning or Alarm	This Vapor Recovery alarm occurs when the vapors being return to the UST are blocked. The alarm will occur at the assessment time that was set in the VRM Programming.	May be caused by leaking hanging hardware, blocked hoses or vapor recovery lines, jammed flow meter. Check for leaks by viewing the vanes through the site glass on the VFM, conduct Exhibit 6, or conduct Exhibit 19 of VR-204 to verify a blockage.
	Weekly or Monthly Ullage Pressure [1]	VRM	Warning or Alarm	This vapor recovery alarm occurs when the UST ullage pressure exceeds the alarm threshold for the time period specified in the alarm.	Check if ball valves for the Clean Air Separator in the correct position per Exhibit 2, or conduct Exhibit 20 (vapor pressure sensor),
	Weekly Ullage Pressure Leak Test [1]	VRM	Warning or Alarm	This vapor recovery alarm occurs when the Vapor Recovery Monitor determines a leak greater than the allowable.	May occur when there is an excessive leak in the vapor recovery containment area. Perform a pressure decay test per TP-201.3.
Channel [n]	Missing	VRM	Alarm	A flow meter is not connected or there is an open circuit in the wiring. This will only occur for a flow meter channel that is programmed to have a flow meter.	Check the connection. Measure the voltage of the terminals, which should be approximately 18Vdc.
Channel [n]	Error	VRM	Alarm	The Vapor Recovery Monitor does not understand the data transmission.	This may happen when a channel is programmed for a magnetostrictive (intake) probe but has a vapor flow meter connected instead.
	Pressure Sensor Open Circuit	VRM	Alarm	The pressure sensor is not connected to the Vapor Recovery Monitor.	Usually due to a bad connection or a broken wire. In some cases the sensor may not be working. First check the connections inside the dispenser junction box then at the Console terminal block. Second, measure the voltage at the terminal blocks and verify the voltage.
DIM Module	Module number mismatch	System	Alarm	DIM module detected does not match the number programmed	Check that the number of DIM modules installed matches the number programmed under System Configuration > Modules Expected. If problem persists, contact FFS Technical Services for support.

Device	Description	Category	Type	Definition	Possible Cause and Solution
TS-DIM	Connection Down	VRM	Alarm	The TS-DIMB is not receiving communications from the dispensers	Refer to the Vapor Recovery Monitoring Alarm and Troubleshooting identification guide 000-0529 for troubleshooting help.
	External ATG Connection Down	VRM	Alarm	No communication or bad communication between the ATG and the Console.	Check the comm. Port settings in both the ATG and the Console. These comm. Port settings should match. Make sure there is a straight serial cable between the ATG and the Console.
Slot [n]	[i] Module is offline, where i is the module number	System	Alarm	Occurs when a module is not communicating with the controller.	If RED LED is on or Green LED is blinking try cycling power.
	[i] Module number mismatch, where i is the module number	System	Alarm	Occurs when the number of modules does not match the programmed number of modules.	Check the setup at System Configuration» Modules Expected to see if the correct numbers are programmed.
	System Bus Error	System	Alarm	The communication bus is not working properly.	Check to see if a particular module has a red Error LED. If so try to trouble shoot the bad module. Also try removing the bad module and see if the alarm goes away.
TS-DTUn	Remote DTU is Offline	System	Alarm	A remote DTU is not communicating to the console DTU.	Wrong ID Number Dispenser Powered Off Not installed correctly Not on same phase voltage as console DTU
	Console DTU number mismatch	System	Alarm	The console DTU is not communicating with the console.	Bad bus connection Not powered
	DTU FFS Interference	System	Alarm	Two networks have the same Network ID	Change Network ID
Printer	Check Thermal Printer	System	Warning	Printer is out of paper, or the printer door is open.	Make sure the printer has paper, and the printer door is closed completely.
	Printer Head Temperature	System	Warning	Print head high temperature (65 ºC) persists for at least 2 minutes.	Printer will resume printing and the alarm will clear after a short cool-down period. Keep the console area cool and ventilated. If the alarm does not clear, contact FFS Technical Support.
	Printer Paper Jam	System	Warning	Indicates that paper is jammed in the printer	Carefully lift printer cover to inspect and remove jammed paper.

[1] ISD Shutdown Alarm

Table 7: Veeder-Root ISD Alarm Troubleshooting Summary for Facilities Equipped with VST Green Machine Processor

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	• Exhibit 4 • TP-201.3 (or equivalent test procedure)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	• Exhibit 9 • Exhibit 10
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3IWC.	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	• Exhibit 5 • Exhibit 6 • Exhibit 17 • TP-201.4 (or equivalent test procedure)
FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
VP EMISSION WARN[3,4]	Processor	Yellow	Mass emission exceeded the certified threshold.	• Troubleshooting Manual www.vsthose.com. • Exhibit 9
VP EMISSION FAIL[3,4]	Processor	Red	2nd Consecutive Mass emission test failure.	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL[2]	Self-Test	Red	8th Consecutive Failure of Setup Test	
PMC SETUP FAIL	N/A	Red	PMC is not configured or missing components	• See ISD Troubleshooting Manual
PMC SENSOR FAULT	N/A	Red	Component used by PMC has failed or reported an error condition. See Troubleshooting section for complete description of sensors and associated conditions that can cause a sensor fault.	• Troubleshooting Manual www.vsthose.com • Exhibit 9

Note: The alarms listed in above table will also activate an audible alarm

[1]See ISD Troubleshooting Manual P/N 577013-819 found at http://www.veeder.com/object/577013-819.html and the VST ISD Troubleshooting Manual found at http://www.vsthose.com/pdf/Troubleshooting_Manual_Green Machine.pdf

[2]ISD Shut Down Alarms – see Figure 48 of IOM Section 12

[3]This warning will result in an ISD VP Status Warn

[4]This failure will result in an ISD VP Status Fail

Table 8: INCON ISD Alarm Trouble Shooting Summary for Facilities Equipped with EMCO Phase II EVR System and Hirt VCS-100 Vapor Processor

Hirt VCS 100 Troubleshooting Summary				
VCS 100 Indicator Panel	Category	Light	Cause	Recommended Troubleshooting
MALFUNCTION LIGHT	VCS 100 Processor or System	Red	UST ullage pressure is positive for at least 1 continuous hour.	GDF Owner/Operator Responsibilities: • "Weekly Inspections" of Hanging Hardware as specified in section 2 of Installation, Operation, and Maintenance Manual. • "Drive-Offs and Other Customer Abuse" as specified in section 5 of Installation, Operation, and Maintenance Manual. • Exhibit 7 of Executive Order VR-204 • Record findings in GDF Owner/Operator Maintenance Log. Certified Contractor Responsibilities: • Follow VCS 100 Troubleshooting Guide (Contact Hirt by either Phone: (562) 692-6970 or by email: HirtVCS@aol.com to get Guide) • TP-201.3 and Exhibit 4 of Executive Order VR-204 • Exhibit 7 of Executive Order VR-204 • Exhibit 13 of Executive Order VR-204 Record findings in GDF Owner/Operator Maintenance Log.

Table 8: INCON ISD Alarm Trouble Shooting Summary for Facilities Equipped with EMCO Phase II EVR System and Hirt VCS-100 Vapor Processor

INCON ISD Troubleshooting Summary				
INCON Vapor Recovery Monitor (VRM)	Category	Type	Definition	Recommended Troubleshooting
Daily Vapor Collection, Fueling Point (n)*	VRM	Warning or Failure	This vapor recovery alarm occurs when the vapors being returned to the UST are blocked or a reduction in flow has been determined.	May be caused by leaking hanging hardware, blocked hoses or vapor recovery lines, jammed flow meter. Run Exhibit 19 of VR-204 to verify a blockage. Check for leaks by viewing the vanes through the sight glass on the VRM.
Weekly or Monthly Ullage Pressure*	VRM	Warning or Failure	This vapor recovery alarm occurs when the UST ullage pressure exceeds the alarm threshold for the time period specified in the alarm.	May be caused by a malfunction in the Hirt VCS 100. Perform a check on the processor and make sure it is turned on and processing vapors.
Weekly Ullage Pressure Leak Test*	VRM	Warning or Failure	This vapor recovery alarm occurs when the VRM determines a leak greater than the allowable	May occur when there is an excessive leak in the vapor recovery containment area. Perform a static pressure decay test per TP-201.3.
Vapor Processor Input	VRM	Warning Only	Occurs when processor run time exceeds 62 continuous minutes, or processor is shutoff, or input to ISD console is disconnected	Hirt VCS 100 is not running or operating properly. Leak in the vapor recovery containment area. Perform Exhibit 13 of VR-204. Perform a static pressure decay test per TP-201.3 to verify system integrity and identify leak(s)
Vapor Processor Warning*	VRM	Warning or Failure	Occurs when the ullage pressure exceeds 2.00 inches water column gauge (WCG) for 144 minutes in one day (90^{th} percentile > 2.00" WCG)	Hirt VCS 100 is not running or operating properly. Leak in the vapor recovery containment area. Perform Exhibit 13 of VR-204. Perform a static pressure decay test per TP-201.3 to verify system integrity and identify leak(s)
Channel (n), missing	VRM	Alarm	A flow meter is not connected or there is an open in the wiring. This will only occur for a flow meter channel that is programmed to have a flow meter.	Check the connection. Measure the voltage of the terminals, which should be approximately 18VDC
Channel (n), error	VRM	Alarm	The VRM does not understand the data transmission.	This may happen when a channel is programmed for a magnostrictive probe but has a vapor flow meter connected instead.

Table 8: INCON ISD Alarm Trouble Shooting Summary for Facilities Equipped with EMCO Phase II EVR System and Hirt VCS-100 Vapor Processor

INCON ISD Troubleshooting Summary				
INCON Vapor Recovery Monitor (VRM)	Category	Type	Definition	Recommended Troubleshooting
External TS-DIM Connection Down	VRM	Alarm	No communication between the TS-DIM and the Console.	Occurs with bad connection, TS-DIM does not have power, TS-DIM is not working. Check the wiring between the TS-DIM and the Console. Check the jumper settings in the TS-DIM, see Section 21 of this IOM
TS-DIM Read Data Error	VRM	Alarm	Bad communication to the Console.	Most likely a baud rate problem. Check the baud rate in the Console as well as the jumper settings in the TS-DIM.
External Automatic Tank Gauge (ATG) Connection Down	VRM	Alarm	No communication or bad communication between the ATG and the Console	Check the Communication Port settings in both the ATG and the Console. These settings should match. Make sure there is a straight serial cable between the ATG and the Console.
(i) Module is offline, *where i is the module number*	System	Alarm	Occurs when a module is not communicating with the controller.	If RED LED is on or Green LED is blinking, try cycling power.
(i) Module number mismatch, *where i is the module number*	System	Alarm	Occurs when the number of modules does not match the programmed number of modules	Check the setup at ***System Configuration >>Modules Expected*** to see if the correct numbers are programmed.

* If they progress to failure, these ISD alarms will result in shutdown.

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 VST BREAKAWAY WITH THE BLACK RETENTION BAND (AND UL LABEL STATING NON-REATTACHABLE) OR THE EMCO BREAKAWAY IS INVOLVED IN A DRIVEOFF, IT MUST BE REPLACED.THESE BREAKAWAYS ARE NON-RECONNECTABLE.

IF THE VST BREAKAWAY WITH THE GRAY RETENTION BAND (AND UL LABEL THAT STATES REATTACHABLE) OR THE OPW BREAKAWAY IS INVOLVED IN A DRIVEOFF, IT MAY BE RECONNECTED. THESE BREAKAWAYS ARE RECONNECTABLE.

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

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

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

Action	Test Procedure	Corrective Action	Reference Material	Authorized Personnel
Perform a thorough visual examination of the exterior of the whip hose and the curb hose for any obvious imperfections.	Obvious imperfections include, but are not limited to: Damage to the swivels Damage to the couplings Kinks / flat spots Tears to the outer hose	Replace with new hose(s).	IOM-8	**Hose replacement**: GDF Owner/Operator or VST ASC Levels A, B, C, or D or EMCO Level A for ContiTech 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, C, or D or EMCO Level A for ContiTech Hose
Perform a thorough visual inspection of the nozzle for any obvious imperfections.	Obvious imperfections include, but are not limited to: VST Nozzle: 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. EMCO Nozzle: Damage spout, broken or bent; Damage to the insertion interlock rod; Torn boot face or bellows; Damage to the lever, hold open latch and lever guard; Missing band clamp, serial plate and security rivet.	Replace damaged components where applicable.	IOM-7	**Nozzle repair:** VST ASC Levels A, B, C, or D or EMCO Level A
		Replace with new nozzle.	IOM-6	**Nozzle replacement**: GDF Owner/Operator or VST ASC Levels A, B, C, or D or EMCO Level A

Perform a thorough visual inspection of the breakaway for any obvious imperfections.	VST (Non-Reattachable) / EMCO Breakaway Non-re-connectable. Breakaway separated.	Replace with new breakaway	IOM-9	**Breakaway replacement:** GDF Owner/Operator or VST ASC Levels A, B, C, or D or EMCO Level A
	VST (Reattachable) / OPW Breakaway Re-connectable. Breakaway separated,	Replace or repair breakaway	IOM-9	**Breakaway replacement / repair:** GDF Owner/Operator or VST ASC Levels A, B, C, or D or EMCO Level A
If no imperfection or damage is visibly evident, proceed to functional testing.				

Function Testing Description

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

Test	Test Procedure	Corrective Action	Authorized Personnel
Leak Check	Verify that there are no liquid leaks in all components. Dispense fuel and check each connection between the components. A visual inspection of the nozzle can determine any obvious liquid leaks.	Any component that does not pass the functional test must be replaced. Go to IOM 6, 8, and 9	GDF Owner/Operator or VST ASC Levels A, B, C, or D or EMCO Level A
Meter Creep	Checking for meter creep will verify the integrity of the connections. 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.	Any component that does not pass the functional test must be replaced. Go to IOMs 6, 8, and 9	GDF Owner/Operator or VST ASC Levels A, B, C, or D or EMCO Level A
Automatic Shut-Off and Insertion Interlock	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).	Repair or replace the nozzle Go to IOM-6 or IOM-7	**Nozzle replacement** GDF Owner/Operator or VST ASC Levels A, B, C, or D or EMCO Level A **Nozzle repair** VST ASC Levels A, B, C, or D or EMCO Level A
Resistance	IOM-6	Any component that does not pass the functional test must be replaced. Go to IOM 6, 8, and 9	GDF Owner/Operator or VST ASC Levels A, B, C, or D or EMCO Level A

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

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Springboro, Ohio 45066 (USA)

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www.vsthose.com

For VST Model #'s:

VST-EVR-NB, VST-EVR-NB (Rebuilt),

VST-EVR-NB (G2), and VST-EVR-NB (G2 Rebuilt)

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.

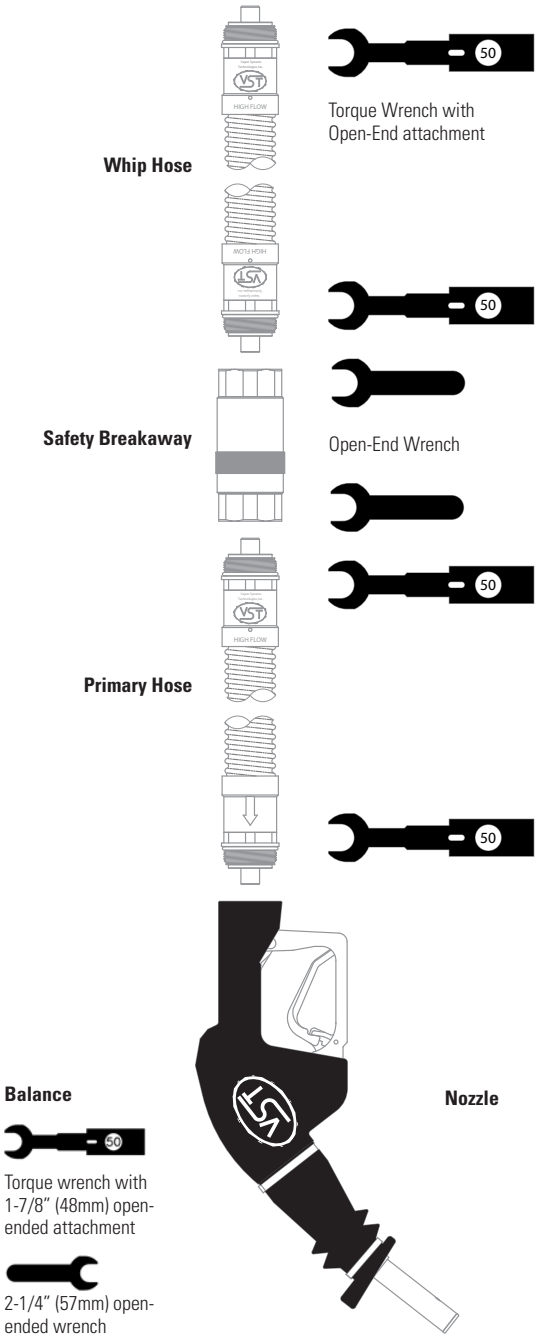
INSTALLATION AND FUNCTION TESTS

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.

1. Initial inspection and function tests:
   a. Carefully unpack nozzle from shipping carton.
   b. Inspect nozzle exterior for any damage.
   c. Inspect threads, lever, lever lock, spout, collection sleeve, band clamps, and face seal to determine that they are present and undamaged.
   d. Verify interlock rod alignment. Check interlock for engagement and release. Proper function of interlock rod requires the nozzle collection sleeve to be compressed ¼" to ½" and the lever to be engaged into the dispensing position. Nozzle will not function without interlock rod properly engaged.
   e. Inspect spout vent hole. It should be clear of debris.

Figure 1.

EVR Hanging Hardware Assembly



VST Installation Procedure for Phase II Coaxial EVR Balance Dripless Nozzles

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

cc = Scuff Guard Color Code and R = rebuilt

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 nozzle onto mating hose connection and tighten by hand.
4. 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 channellocks 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 the nozzle connection for liquid leaks and make proper adjustments at hose connection 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. 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).

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.

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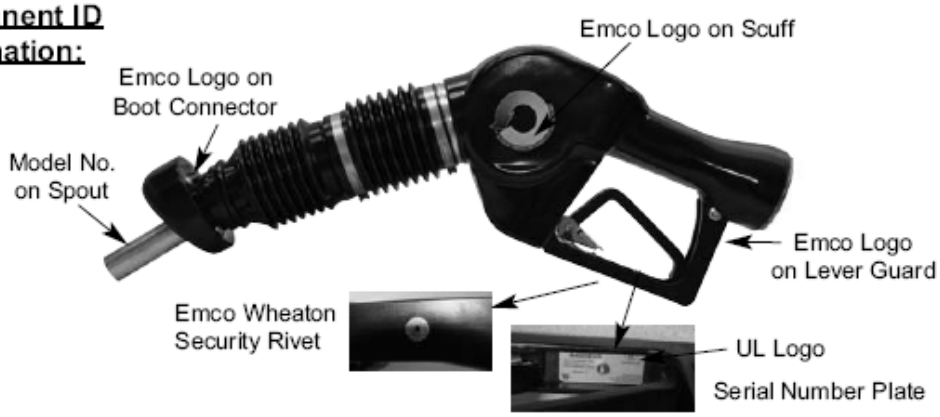
EMCO®
WHEATON RETAIL

A4005EVR

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

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

Permanent ID Information:



INSTALLATION INSTRUCTIONS

Service Tools Required:

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

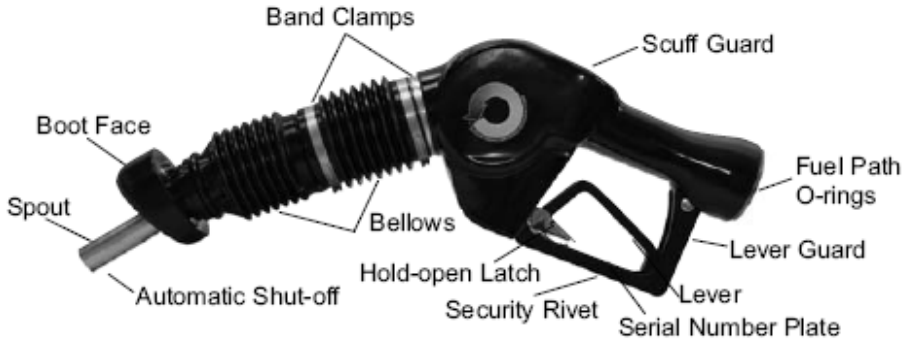
CAUTION:

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

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

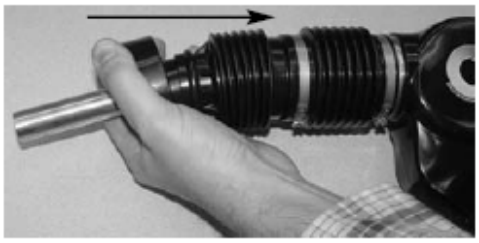
1

Pre-Inspection:



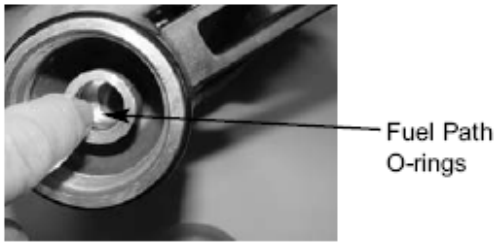
1. Carefully unpack and remove the A4005EVR nozzle from the shipping container. Evaluate the following components for damage: scuff guard, lever guard, lever, hold open latch, serial number plate, security rivet, bellows, band clamps, boot face and spout.
2. Verify the automatic shutoff located at the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

Pre-Functional Test:



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

Pre-Installation:



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

2

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

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

Installation:

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

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

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

3

Post Functional Tests:

9. Carefully purge the trapped air from the fueling point. Begin dispensing by compressing the bellows and then squeezing the lever. Dispense one gallon of fuel into a gasoline approved container.

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

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

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

Post Inspection:

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

PREVENTIVE MAINTENANCE

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

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

4

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

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

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

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

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

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

Part Number Series: VST-FEK-300 (Front End Kit Included VCK and NSA)
VST-VCK-300 (Vapor Collection Kit)
VST-NSA-300 (Nozzle Spout Assembly)

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Use ONLY on VST Nozzles:

Model #: VST-EVR-NB (G2) and VST-EVR-NB (G2 Rebuilt)

TOOLS

- Torque Wrench
- Approved Fuel Container
- Wide Mouth Funnel
- VST-SRT-200 Torque Wrench Attachment
- VST-BPT-100 Nozzle Band Clamp Pincers
- Petroleum Jelly (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 ensure 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 the spout is loose at all, replace the entire nozzle spout assembly with VST-NSA-300.
5. Drain liquid product from the hanging hardware set into an approved container prior to replacing any hanging hardware assembly.
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

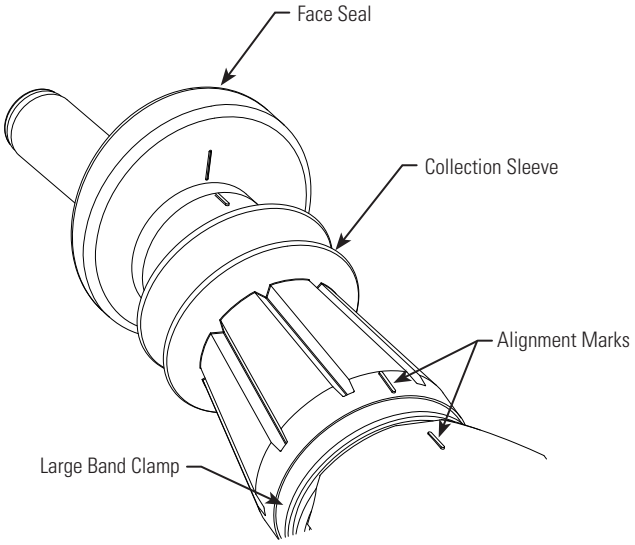
VAPOR COLLECTION KIT (VST-VCK-300) REMOVAL

(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 the 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.

Figure 1

Vapor Collection Assembly



VAPOR COLLECTION KIT (VST-VCK-300) REPLACEMENT

1. Place the large band clamp on the collection sleeve. (See Figure 1)
2. Verify the interlock rod is properly inserted into the hole of the interlock sleeve located around the spout prior to pushing the VCK into place. The rod should be visible through the side hole of the sleeve. (See Figure 2)
3. Slide the VST-VCK-300 over the spout.
4. Align and center all alignment marks on top of the vapor collection kit and nozzle scuff. (See Figure 1)
5. Engage interlock a few times to check for correct alignment and functionality. (See Functional Test 3)
6. Tighten collection band clamp until collection sleeve will not rotate. (See Figure 1)

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

Part Number Series: VST-FEK-300 (Front End Kit Included VCK and NSA)
VST-VCK-300 (Vapor Collection Kit)
VST-NSA-300 (Nozzle Spout Assembly)

Figure 2
Nozzle Spout Assembly

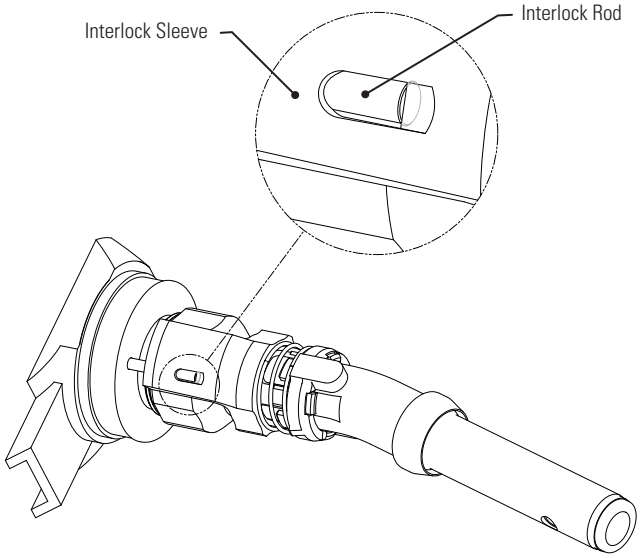


Figure 3
Interlock Rod Removal

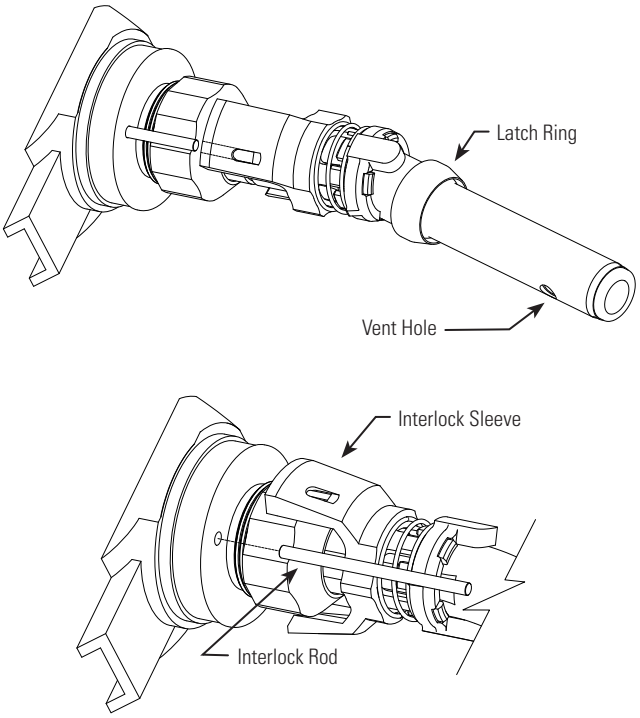
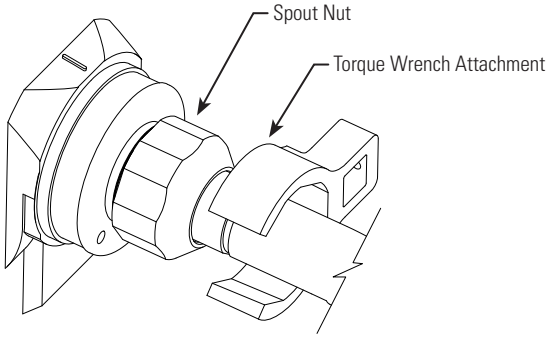


Figure 4
Torque Wrench Attachment



NOZZLE SPOUT ASSEMBLY (VST-NSA-300) REMOVAL
(See Figures 3-4)

1. Remove Vapor Collection Assembly.
2. Hold the interlock rod in place to allow the rod to be disengaged from the hole of the sleeve that is located around the spout nut. (See Figure 3)
3. Slide and rotate the sleeve away from the spout nut and remove the interlock rod. (See Figure 3)
4. Loosen spout nut with the VST-SRT-200 Spout Nut Torque Wrench Attachment. (See Figure 4) **NOTE:** Do not use pipe wrench or locking-type pliers.
5. Once threads are completely disengaged, pull the spout straight out.
6. Properly discard the removed components.

NOZZLE SPOUT ASSEMBLY (VST-NSA-300) REPLACEMENT
(See Figures 5-6)

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.

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

Part Number Series: VST-FEK-300 (Front End Kit Included VCK and NSA)
VST-VCK-300 (Vapor Collection Kit)
VST-NSA-300 (Nozzle Spout Assembly)

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. (See Figure 5)
6. Align the anti-rotation bump on the spout with the casting notch. Be careful not to damage the spout O-ring. (See Figure 5)
7. Firmly insert spout assembly into the nozzle casting.
8. Apply a dab of Loctite®271 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 6)
9. Thread spout nut onto the nozzle casting and tighten firmly. Torque to 34 foot-pounds. Use VST-SRT-200 Spout Nut Torque Wrench Attachment in order to apply the appropriate torque. Spout should be tight and not able to rotate. Do not over-tighten the spout nut.
10. After tightening the spout nut, place the interlock rod into the hole of the nozzle casting. Move the sleeve in place so the interlock rod is inserted into the recessed hole on the end of the sleeve. The interlock rod may be compressed into the nozzle to ease the insertion. The interlock rod should be visible through the side hole of the sleeve. (See Figure 2)
11. Re-install the Vapor Collection Kit Assembly per the Vapor Collection Kit Replacement instructions.

FUNCTIONAL TESTS

1. Follow the VST Installation Procedure for each hanging hardware component. (Executive Order Procedures: Section 6, 8 and 9).
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. 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 (eg. 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.
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).

Figure 5
Spout Assembly

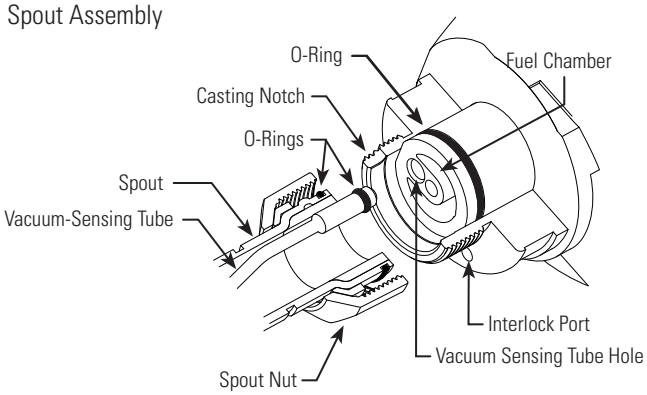
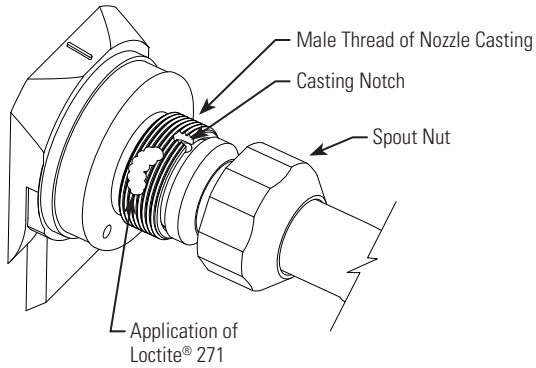


Figure 6
Application of Loctite® 271



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

Part Number Series: VST-FEK-300 (Front End Kit Included VCK and NSA)
VST-VCK-300 (Vapor Collection Kit)
VST-NSA-300 (Nozzle Spout Assembly)

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

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 6. 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 the 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" (5 mm) drill bit, drill out the rivet securing the hold-open clip, and discard the clip, spring, and all other rivet debris.

VST Installation Procedure for Use of VST-FEK-300 Front End Kits On Pre-G2 Phase II Coaxial EVR Balance Nozzles

Part Number Series:

VST-FEK-300 (Front End Kit includes VCK and NSA)

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

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www.vsthose.com

Use ONLY on VST Nozzles when replacing with the above Kits on Model # VST-EVR-NB and VST-EVR-NB (Rebuilt)

TOOLS

- Torque Wrench
- Approved Fuel Container
- Wide Mouth Funnel
- Petroleum Jelly (or suitable lubricant)
- VST-BPT-100 Nozzle Band Clamp Pincers
- VST-SRT-200 Torque Wrench Attachment

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 ensure 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 the spout is loose at all, replace the entire Front End Kit Assembly with VST-FEK-300.
5. Drain liquid product from the hanging hardware set into an approved container prior to replacing any hanging hardware assembly.
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

VERIFY NOZZLE TYPE

Check nozzle name plate against Figure 1. The type on the nameplate should be in Black, without a "G2". If the type is Blue with "G2" then go to the G2 Nozzle Repair Kit Installation Procedures. If Black with no "G2", then proceed to the next step.

Figure 1

Nozzle Nameplates

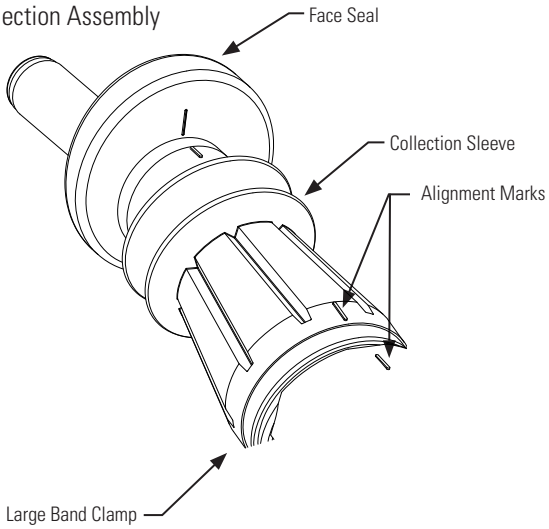
VAPOR COLLECTION KIT (VST-VCK-100) REMOVAL

(See Figure 2)

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 the 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.

Figure 2

Vapor Collection Assembly



VST Installation Procedure for Use of VST-FEK-300 Front End Kits On Pre-G2 Phase II Coaxial EVR Balance Nozzles

Part Number Series:

VST-FEK-300 (Front End Kit includes VCK and NSA)

Figure 3

Compare Nozzle Spout Assembly - Top Pre-G2; Bottom G2

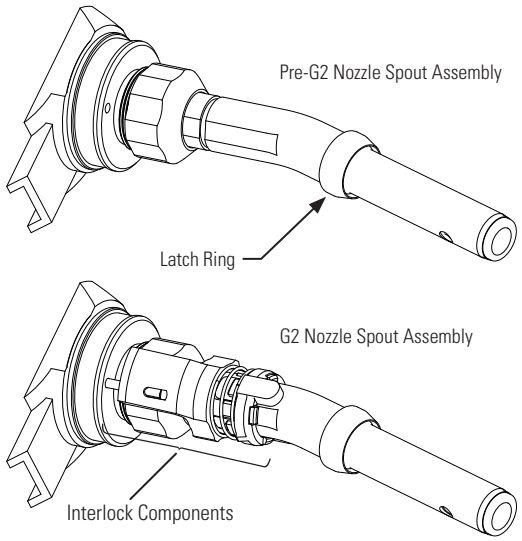
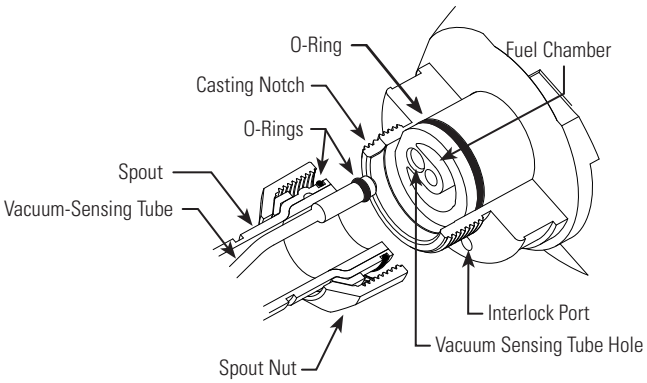


Figure 4

Spout Assembly



NOZZLE SPOUT ASSEMBLY REMOVAL

1. Check nozzle spout assembly to verify that this is a Pre-G2 nozzle spout assembly. Compare spout assembly with the top picture (Pre-G2 assembly), the spout should only have a latch ring on the spout (see Figure 3). If there are no other components, then continue to step 2 of these instructions. If any other components are on the spout assembly, this is a G2 spout assembly. Proceed to the instructions on how to replace a G2 Front End Kit (VST-FEK-300).
2. Loosen spout nut with the VST-SRT-200 Spout Nut Torque Wrench Attachment (see Figure 6). **NOTE:** Do not use pipe wrench or locking-type pliers.
3. Once threads are completely disengaged, pull the spout straight out.
4. Properly discard the removed components.

NOZZLE SPOUT ASSEMBLY (VST-NSA-300) REPLACEMENT

(See Figures 4-8)

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.
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. (See Figure 4).
6. Align the anti-rotation bump on the spout with the casting notch. Be careful not to damage the spout O-ring. (See Figure 4).
7. Firmly insert spout assembly into the nozzle casting.
8. Apply a dab of Loctite® 271 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 5).
9. Thread spout nut onto the nozzle casting and tighten firmly. Torque to 34 foot-pounds. Use VST-SRT-200 Spout Nut Torque Wrench Attachment in order to apply the appropriate torque. Spout should be tight and not able to rotate. Do not over-tighten the spout nut.
10. After tightening the spout nut, place the interlock rod into the hole of the nozzle casting. Move the sleeve in place so the

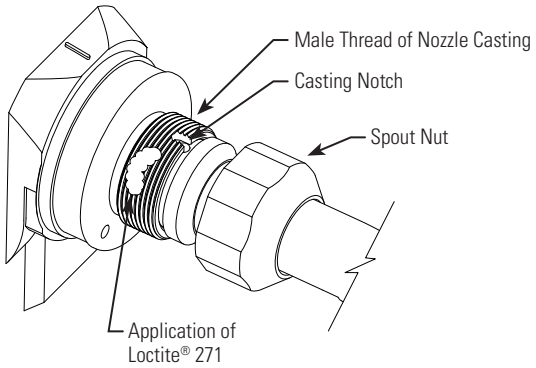
VST Installation Procedure for Use of VST-FEK-300 Front End Kits On Pre-G2 Phase II Coaxial EVR Balance Nozzles

Part Number Series:

VST-FEK-300 (Front End Kit includes VCK and NSA)

Figure 5

Application of Loctite®



interlock rod is inserted into the recessed hole on the end of the sleeve. The interlock rod may be compressed into the nozzle to ease the insertion. The interlock rod should be visible through the side hole of the sleeve. (See Figures 7 and 8).

11. Re-install the Vapor Collection Kit Assembly per the Vapor Collection Kit Replacement instructions.

VAPOR COLLECTION KIT (VST-VCK-300) REPLACEMENT

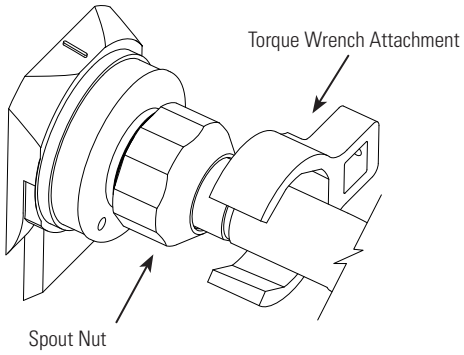
1. Place the large band clamp on the collection sleeve. (See Figure 2).
2. Verify the interlock rod is properly inserted into the hole of the interlock sleeve located around the spout prior to pushing the VCK into place. The rod should be visible through the side hole of the sleeve. (See Figure 7).
3. Slide the VST-VCK-300 over the spout.
4. Align and center all alignment marks on top of the vapor collection kit and nozzle scuff. (See Figure 2).
5. Engage interlock a few times to check for correct alignment and functionality (See Functional Test 3).
6. Tighten collection band clamp until collection sleeve will not rotate. (See Figure 2).

FUNCTIONAL TESTS

1. Follow the VST Installation Procedure for each hanging hardware component. (Executive Order Procedures: Section 6, 8 and 9).

Figure 6

Torque Wrench Attachment



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. 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 hold in the spout. Verify that the fuel flow stops when the nozzle collection sleeve is decompressed (eg. 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.
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).

VST Installation Procedure for Use of VST-FEK-300 Front End Kits On Pre-G2 Phase II Coaxial EVR Balance Nozzles

Part Number Series:

VST-FEK-300 (Front End Kit includes VCK and NSA)

Figure 7

Nozzle Spout Assembly

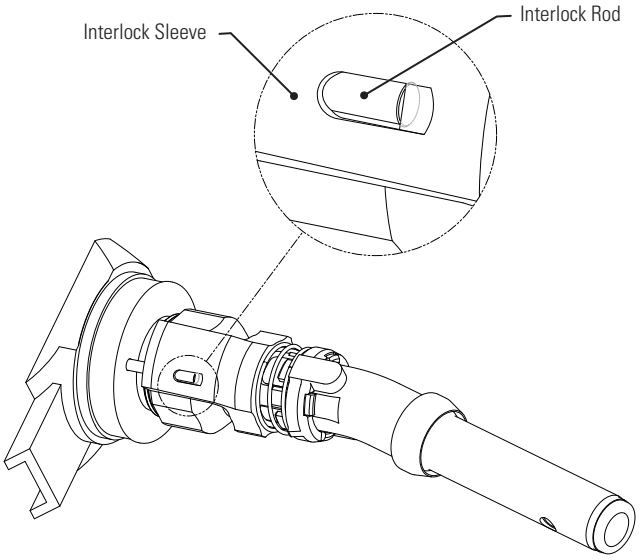
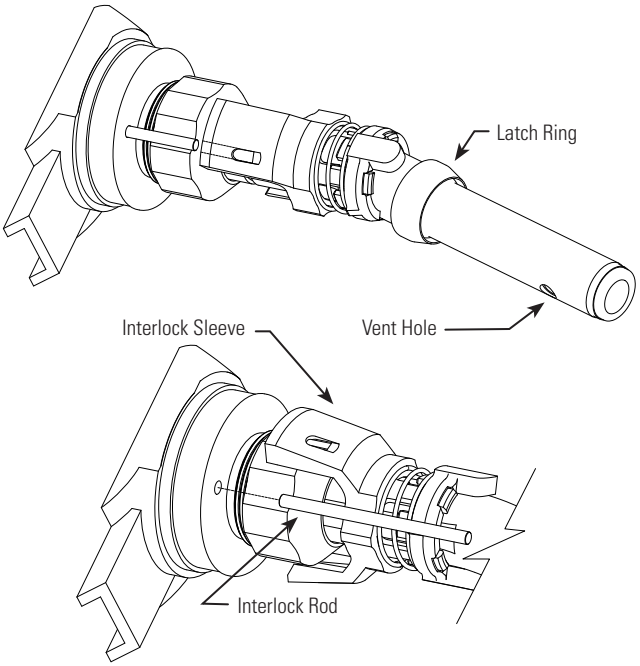


Figure 8

Interlock Rod Replacement



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 6. 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 the 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" (5 mm) drill bit, drill out the rivet securing the hold-open clip, and discard the clip, spring, and all other rivet debris.

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

Part Number Series:
VST-FEK-100 (Front End Kit Included VCK and NSA)
VST-VCK-100 (Vapor Collection Kit)

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Fax: 937-704-9443
www.vsthose.com

Use ONLY on VST Nozzles:

Model #: VST-EVR-NB and VST-EVR-NB (Rebuilt)

TOOLS

- Torque Wrench
- Approved Fuel Container
- Wide Mouth Funnel
- VST-SRT-200 Torque Wrench Attachment
- VST-BPT-100 Nozzle Band Clamp Pincers
- Petroleum Jelly (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 ensure 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 the spout is loose at all, replace the entire front end kit assembly with VST-FEK-100.
5. Drain liquid product from the hanging hardware set into an approved container prior to replacing any hanging hardware assembly.
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 back end 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 the 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 (VST-VCK-100) 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

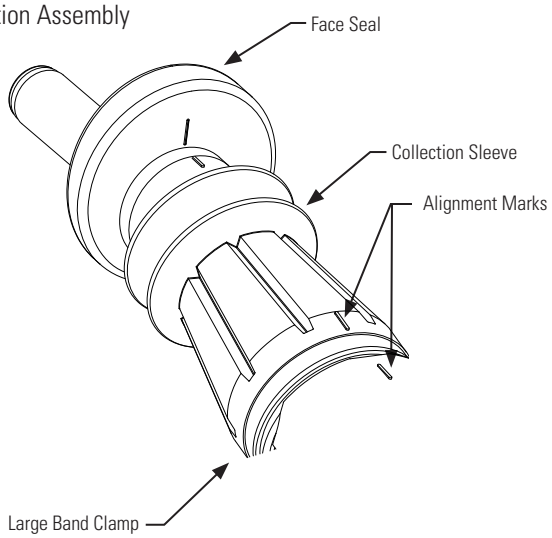
1. Remove Vapor Collection Assembly.
2. Loosen spout nut with the VST-SRT-200 Spout Nut Torque Wrench Attachment.
   NOTE: Do not use pipe wrench or locking-type pliers.
3. Once threads are completely disengaged, pull the spout straight out.
4. Properly discard the removed components.

NOZZLE SPOUT ASSEMBLY (NSA) REPLACEMENT

(See Figures 2-3)

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 Included VCK and NSA)

VST-VCK-100 (Vapor Collection Kit)

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-ring.
7. Firmly insert spout assembly into the nozzle casting.
8. Apply a dab of Loctite®271 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 34 foot-pounds. Use VST-SRT-200 Spout Nut Torque Wrench Attachment in order to apply the appropriate torque. 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

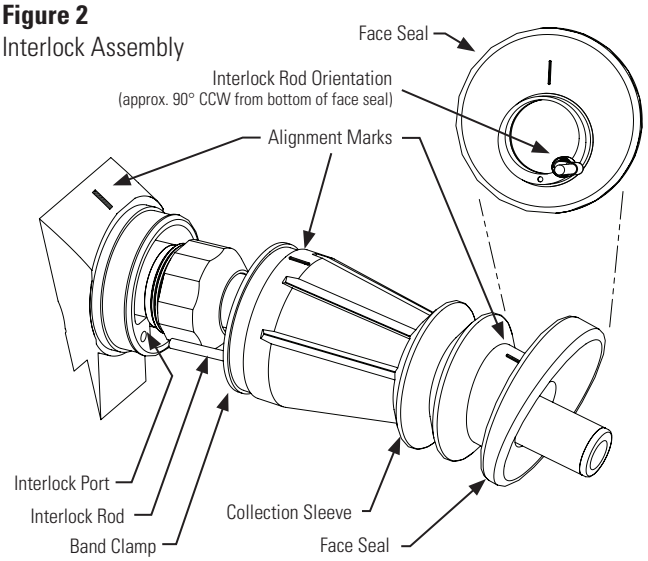
1. Follow the VST Installation Procedure for each hanging hardware component. (Executive Order Procedures: Section 6, 8 and 9).
2. Purge air from the system by pumping one-tenth (1/10) to two-tenths (2/10) of a gallon of fuel into an approved container. Inspect the nozzle connection for liquid leaks 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. 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 (eg. 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.
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.

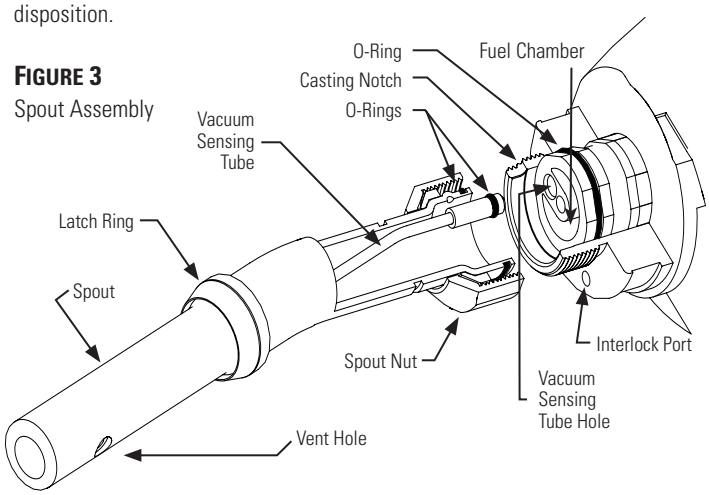
Figure 2
Interlock Assembly



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 6. 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.

FIGURE 3
Spout Assembly



NOTE

Due to the 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" (5 mm) drill bit, drill out the rivet securing the hold-open clip, and discard the clip, spring, and all other rivet debris.

EMCO® WHEATON RETAIL

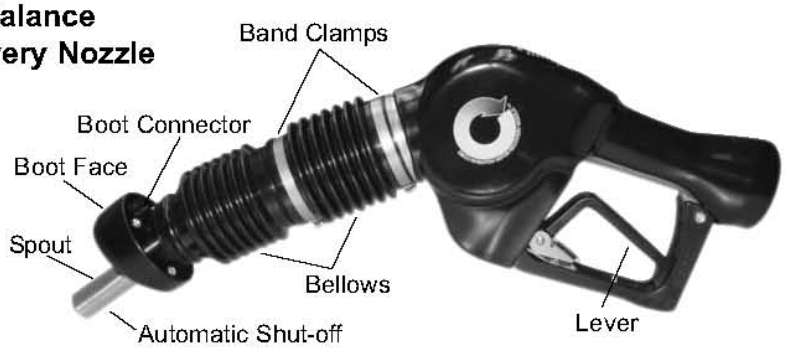
492775EVR

Bellows & Boot Face Kit

Packing List:

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

A4005EVR Balance Vapor Recovery Nozzle



INSTALLATION INSTRUCTIONS

Service Tools Required:

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

CAUTION:

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

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

Pre-Inspection:

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

Pre-Installation:

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

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

Installation:

Removing the Existing Bellows & Boot Face

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

2

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

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

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

IMPORTANT: Properly discard all removed components.

Installing the New Bellows & Boot Face

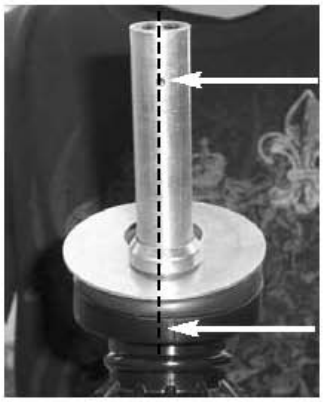
8. Before attempting to install the new bellows and boot face verify that the top of the interlock push rod is properly aligned with the bottom edge of the interlock guide.

3

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

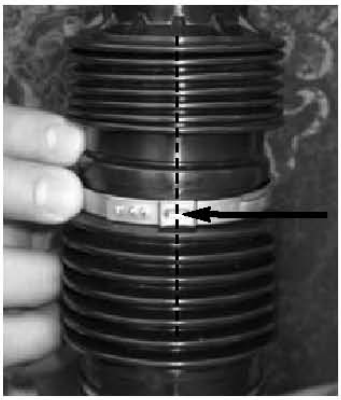
10. Slide the new bellows over the spout until the end reaches the nozzle body. Push down over the bellows o-ring until properly seated.

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



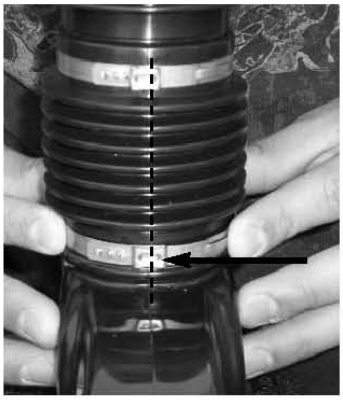
12. Slowly rotate the bellows until the parting line of the boot connector is aligned with the spout and automatic shut-off.

4



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

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



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

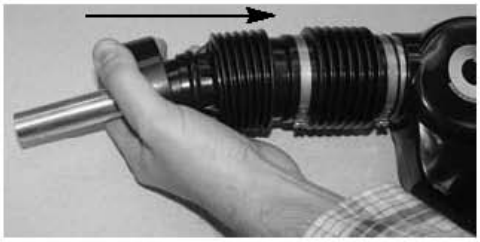
5

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

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

18. Remove the A4005EVR nozzle from the bench vise.

Post-Functional Test:



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

Post-Installation:

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

6

PREVENTIVE MAINTENANCE

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

Part Number	Description
492775EVR	Bellows & Boot Face Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

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

7

EMCO® WHEATON RETAIL

492776EVR
Boot Face Kit

Packing List:

(1) Boot Face
(4) Mounting Screws

A4005EVR
Balance Vapor Recovery Nozzle

INSTALLATION INSTRUCTIONS

Service Tools Required:

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

CAUTION:

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

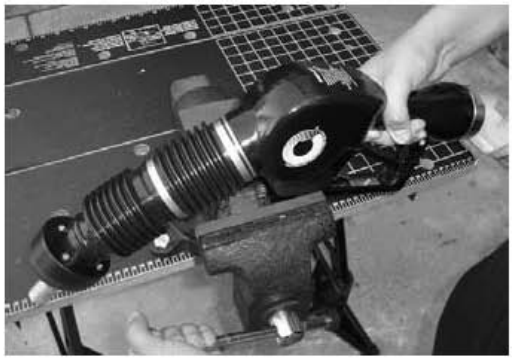
IMPORTANT: Failure to perform cautions 3 and 4 may result in a hazardous gasoline spill, damage to equipment, personal injury and/or death.

Pre-Inspection:

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

Pre-Installation:

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



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

Installation:

Removing the Existing Boot Face

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

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

IMPORTANT: Properly discard all removed components.

2

Installing the New Boot Face

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

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

Post-Installation:

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

PREVENTIVE MAINTENANCE

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

Part Number	Description
492776EVR	Boot Face Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

3

EMCO® WHEATON RETAIL

492834EVR
Spout Kit

Packing List:

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

A4005EVR Balance Vapor Recovery Nozzle

INSTALLATION INSTRUCTIONS

Service Tools Required:

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

CAUTION:

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

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

Pre-Inspection:

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

Pre-Installation:

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

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

Installation:

Removing the Existing Bellows & Boot Face

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

2

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

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

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

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

Removing the Existing Spout

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

3



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


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

11. Remove the spout by slowly pulling upward.

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

IMPORTANT: Properly discard all removed components.

4

Installing the New Spout

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

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

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

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

5

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

Installing the Existing Bellows & Boot Face

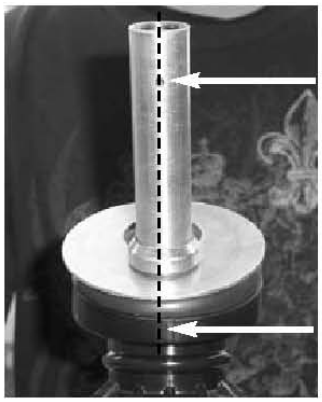
18. Before attempting to install the existing bellows & boot face verify that the top of the interlock push rod is properly aligned with the bottom edge of the interlock guide.

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

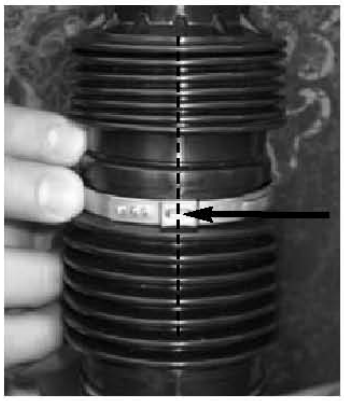
20. Slide the bellows over the spout until the end reaches the nozzle body. Push down over the bellows o-ring until properly seated.

6

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

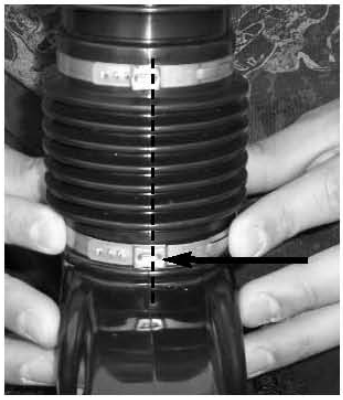


22. Slowly rotate the bellows until the parting line of the boot connector is aligned with the spout and automatic shut-off.



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

24. Use the bellows band clamp crimp tool p/n 494652EVR to crimp and secure into place. 7



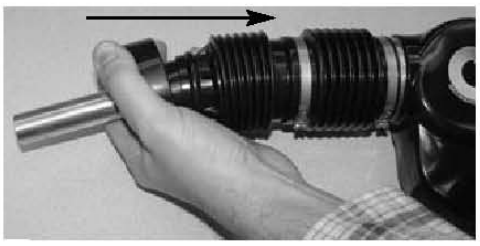
25. Install the new bottom bellows band clamp into the groove of the bellows. Lock and align the crimp portion with the parting line of the bellows.

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

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

28. Remove the A4005EVR nozzle from the bench vise.

Post-Functional Test:



8

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

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

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

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

Post-Installation:

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

PREVENTIVE MAINTENANCE

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

Part Number	Description
492834EVR	Spout Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

EMCO®
WHEATON RETAIL

494748EVR
Fuel Path O-ring Kit

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

Packing List:
(2) Fuel Path O-rings

A4005EVR Balance Vapor Recovery Nozzle

A4119EVR Coaxial Safe Break Valve

INSTALLATION INSTRUCTIONS

Service Tools Required:

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

CAUTION:

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

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

1

Pre-Inspection:

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

Pre-Installation:

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

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

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

A4005EVR Nozzle

A4119EVR Safe Break Valve

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

2

Installation:

Removing the Existing Fuel Path O-rings

A4005EVR Nozzle

A4119EVR Safe Break Valve

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

IMPORTANT: Properly discard all removed components.

Installing the New Fuel Path O-rings

A4005EVR Nozzle

A4119EVR Safe Break Valve

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

A4005EVR Nozzle

A4119EVR Safe Break Valve

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

3

Post-Installation:

9. Before attempting to reinstall the A4005EVR nozzle or A4119EVR safe break valve, please refer to the following installation instructions below.
    - A4005EVR Balance Vapor Recovery Nozzle p/n 570435
    - A4119EVR Coaxial Safe Break Valve p/n 569043

PREVENTIVE MAINTENANCE

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

Part Number	Description
494748EVR	Fuel Path O-ring Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

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

4

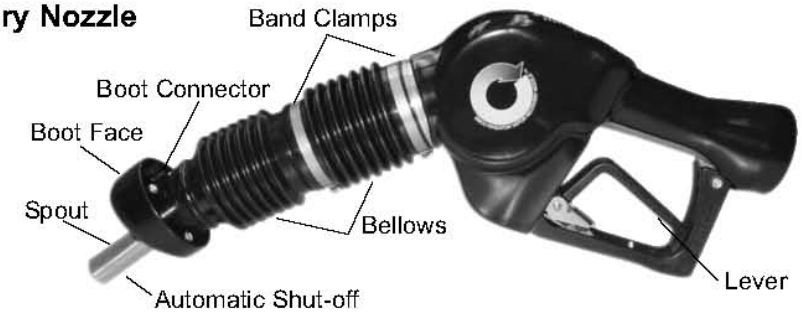
EMCO®
WHEATON RETAIL

494750EVR
Bellows Band Clamp Kit

Packing List:

(6) Bellows Band Clamps

A4005EVR Balance Vapor Recovery Nozzle



INSTALLATION INSTRUCTIONS

Service Tools Required:

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

CAUTION:

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

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

Pre-Inspection:

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

Pre-Installation:

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

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

Installation:

Removing the Existing Bellows Band Clamps

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

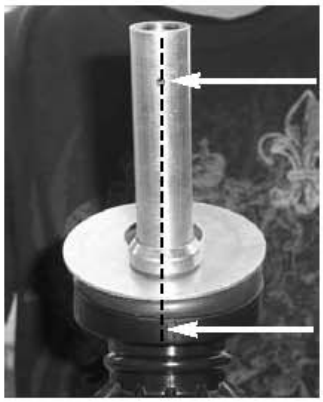
2

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

IMPORTANT: Properly discard all removed components.

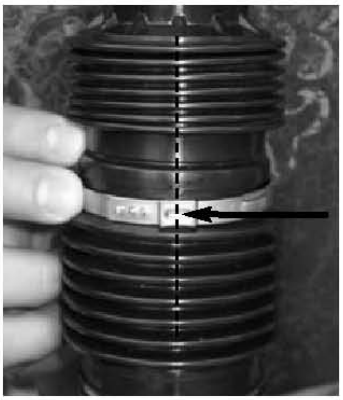
Installing the New Bellows Band Clamps

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



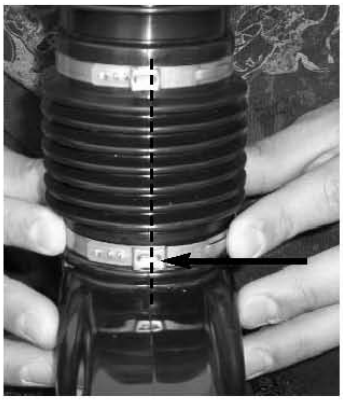
7. Slowly rotate the bellows until the parting line of the boot connector is aligned with the spout and automatic shut-off.

3



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

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



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

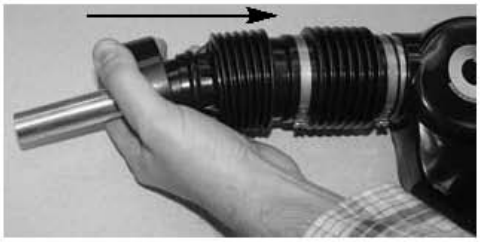
4

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

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

13. Remove the A4005EVR nozzle from the bench vise.

Post-Functional Test:



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

Post-Installation:

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

5

PREVENTIVE MAINTENANCE

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

Part Number	Description
494750EVR	Bellows Band Clamp Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

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

EMCO® WHEATON RETAIL

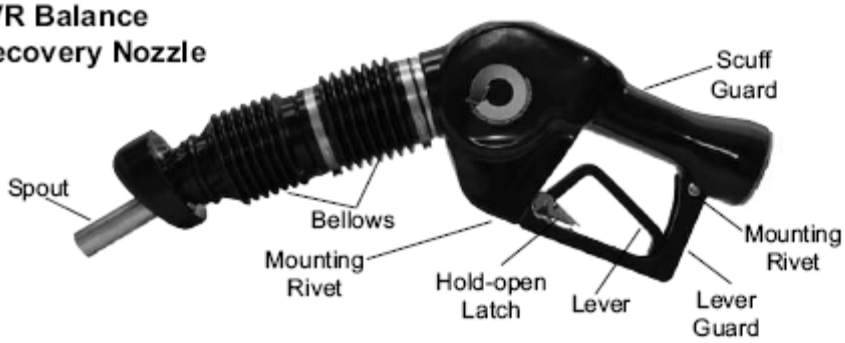
494150EVR
Latch Kit

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

Packing List:

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

A4005EVR Balance Vapor Recovery Nozzle



INSTALLATION INSTRUCTIONS

Service Tools Required:

- Pipe Wrench w/ Flat Jaws
- Flat Head Screw Driver w/ Wide Tip
- 1/8" Diameter Punch
- Bench Vise w/ 5" Jaw Width
- Awl w/ ¼"Tip
- Hammer
- 5/8" Diameter Punch
- Gasoline Approved Container
- Lever Guard Rivet Installation Tool p/n 494653EVR
- Needle Nose Pliers

CAUTION:

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

1

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

Pre-Inspection:

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

Pre-Installation:

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

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

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

Installation:

Removing the Existing Latch

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

2


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


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


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

8. Remove the lever guard from the nozzle body.

3

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

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

Installing the New Latch

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

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

4

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

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

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

Post-Installation:

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

5

PREVENTIVE MAINTENANCE

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

Part Number	Description
494150EVR	Latch Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

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

6

EMCO®
WHEATON RETAIL

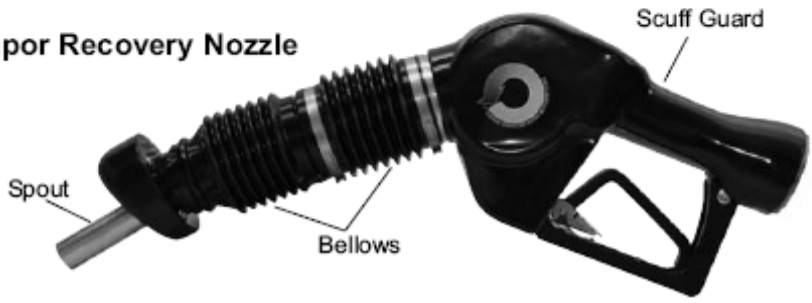
A0557EVR
Scuff Guard Kit

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

Packing List:

(1) Scuff Guard

A4005EVR
Balance Vapor Recovery Nozzle



INSTALLATION INSTRUCTIONS

Service Tools Required:

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

CAUTION:

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

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

1

Pre-Inspection:

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

Pre-Installation:

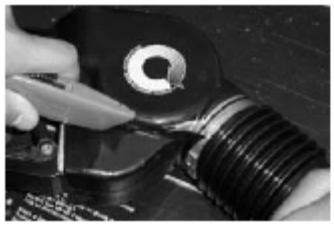
2. Empty all standing fuel within the spout and bellows into a gasoline approved container before attempting to service the scuff guard.

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

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

Installation:

Removing the Existing Scuff Guard



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

2

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

6. Remove the scuff guard from the nozzle body.

IMPORTANT: Properly discard all removed components.

Installing the New Scuff Guard

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

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

Post-Installation:

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

PREVENTIVE MAINTENANCE

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

Part Number	Description
A0557EVR	Scuff Guard Kit

3

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

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

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

p/n 570542
Rev. C, 10/10

VST Installation Procedure for Phase II Coaxial EVR Balance Fuel Hoses

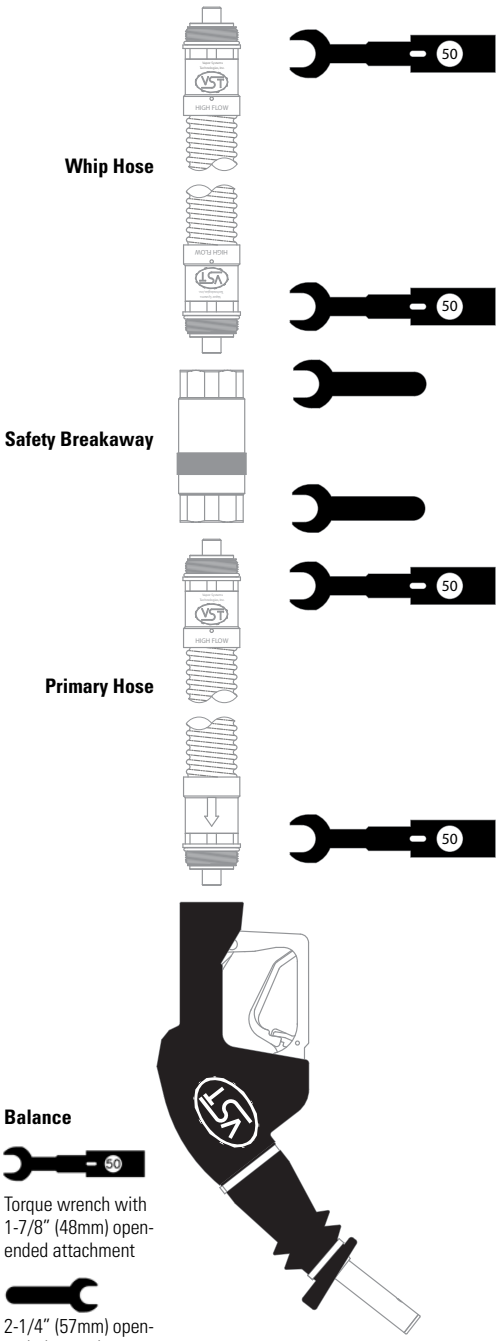
Part Number Series: VSTA-EVR, VDV-EVR, VSTAP-EVR and VDVP-EVR

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. 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 and VDVP-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

   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.

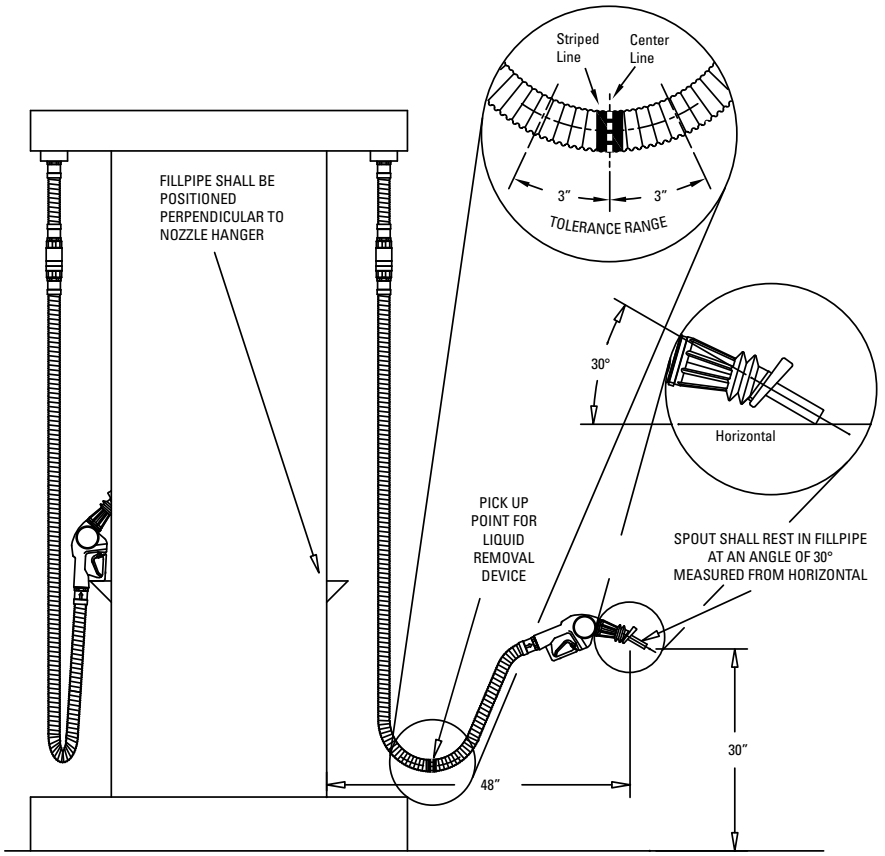


Figure 2. Procedure For Positioning the Liquid Removal Device

Installation Instructions

Whip Hose: Maxxim Premier (532-365-640-XXXXX) or Maxxim Premier Ultra (532-366-640-XXXXX)
Curb Hose: Maxxim Premier Plus (532-365-641-XXXXX) or Maxxim Premier Ultra (532-366-641-XXXXX)

1 The last 5 digits of the part # determines the length of the hose assembly. Install the correct hose length and other hanging hardware on the dispenser. This will include whip hose, breakaway, curb hose, and nozzle.

   a) When installing Maxxim Premier Plus or Maxxim Premier Ultra curb hoses, the end of the hose stamped "NOZZLE END" must be attached to the nozzle.

   b) If a hose retractor is required, use retractor clamp; part # 532-365-105-000-00.

   c) Do not use high retractor tension. High tension is difficult for customers to handle and it reduces the life of the hose. Retractor tension above 12 pounds will void the warranty.

   d) Do not mix outer or inner hose components. The mixed assembly may not be grounded and could cause a serious fire hazard.

   e) Make sure that the curb hose does not touch the pavement or the top of the island when the nozzle hangs on the dispenser hook.

2 Tighten the swivel nut to 50 ft. lbs. torque using an open end torque wrench. Do not use a pipe wrench because the teeth on the wrench will damage the fitting. This connection is sealed by an o-ring. Do not apply thread sealant.

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

   One source for an open end torque wrench is Belknap Tools, both part #'s are needed:
   - VB-0608005 open end wrench head
   - VB-100ST-I wrench handle preset at the factory to 50 ft lbs

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

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

Curb Hose Venturi Pick-up Length Instructions

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

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

4 Hold the nozzle straight out from the dispenser so that the end of the compressed bellows (simulate when the bellows is compressed in the filler neck of a car) is 48 inches away from the front face of the dispenser (see Figure 1). Hold the nozzle so that the tip of the spout is 30 inches above the pavement and the spout is at a 30° angle above the horizontal plane (see Figure 1). When the nozzle and hose are held in the position shown in Figure 1, the mark on the outer vapor hose should be within 3 inches of the bottom of the loop (see Figure 1).

5 If the mark on the hose is not within the tolerance shown in Figure 1, the installer may:

- Adjust the hose retractor (if installed);
- Install a different length whip hose; or
- Install a different long hose with the optimum venturi pick-up location. To determine the optimum venturi pick-up location (e.g., venturi pick-up tube length), conduct the following:

a) Hold the nozzle and hose in the position shown in Figure 1;
b) Measure the length from the back end of the nozzle (where the hose screws into the nozzle) to the bottom of the loop in the hose. This length is the optimum "pick-up" length for the balance venturi hose.
c) Contact your local distributor to obtain a balance hose with the optimum venturi pick-up tube length.

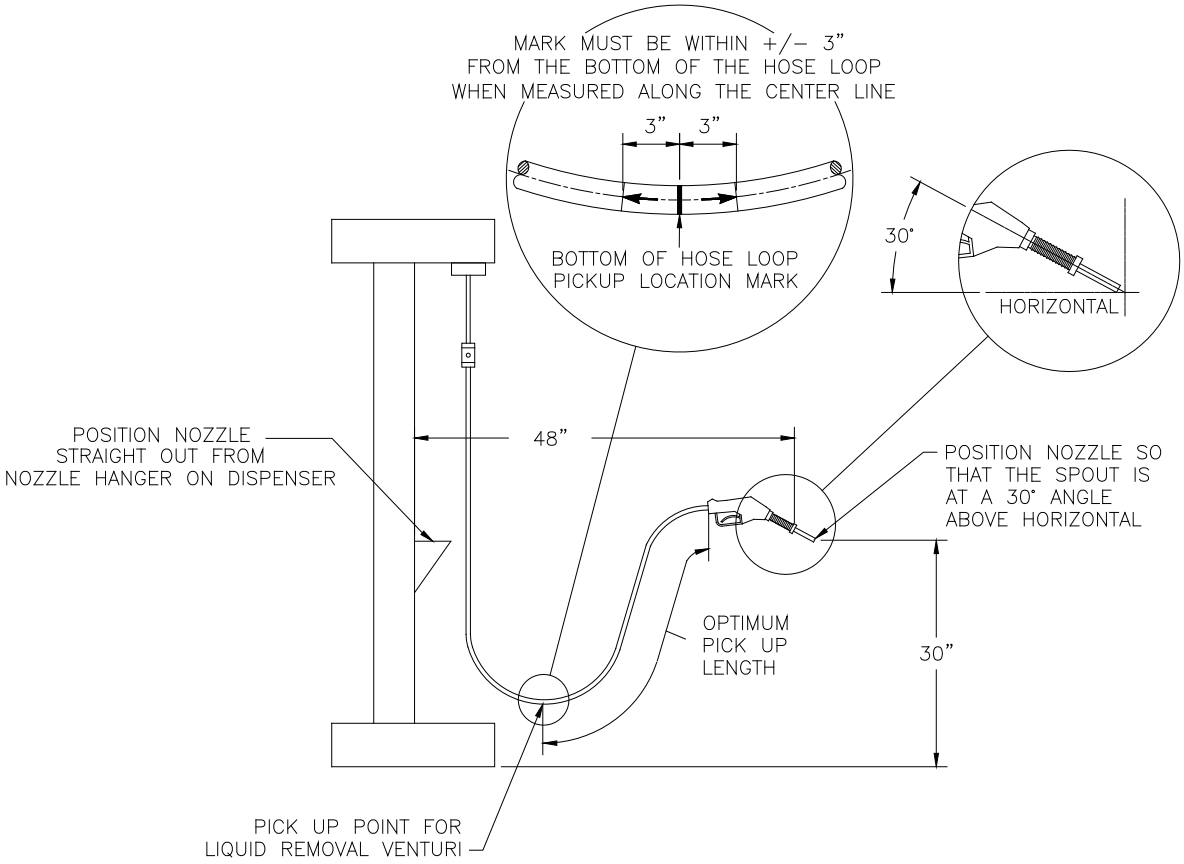


FIGURE 1

Note: It is the responsibility of the installer to be familiar with the current requirements of state, federal, local codes and air district rules and regulations for installation of gasoline dispensing equipment.
It is also the responsibility of the installer to be aware of all the necessary safety precautions and site safety requirements to assure a safe and trouble free installation.The warranty tag provided with the component is to remain with component, and must be provided to the end-user.

Questions on installation should be directed to your local distributor or Customer Service.

ContiTech USA, Inc.
703 S. Cleveland Massillon Rd.
Fairlawn, OH 44333 USA
Telephone:1-800-235-4632

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

Reattachable Breakaway Part Number Series: VSTA-EVR-SBKA

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

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. Determine that 350 lbs. 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:

a. The whip hose **ALWAYS** attaches to the dispenser. If a retractor is being used, the retractor clamp **MUST** be between the breakaway and dispenser.

b. 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

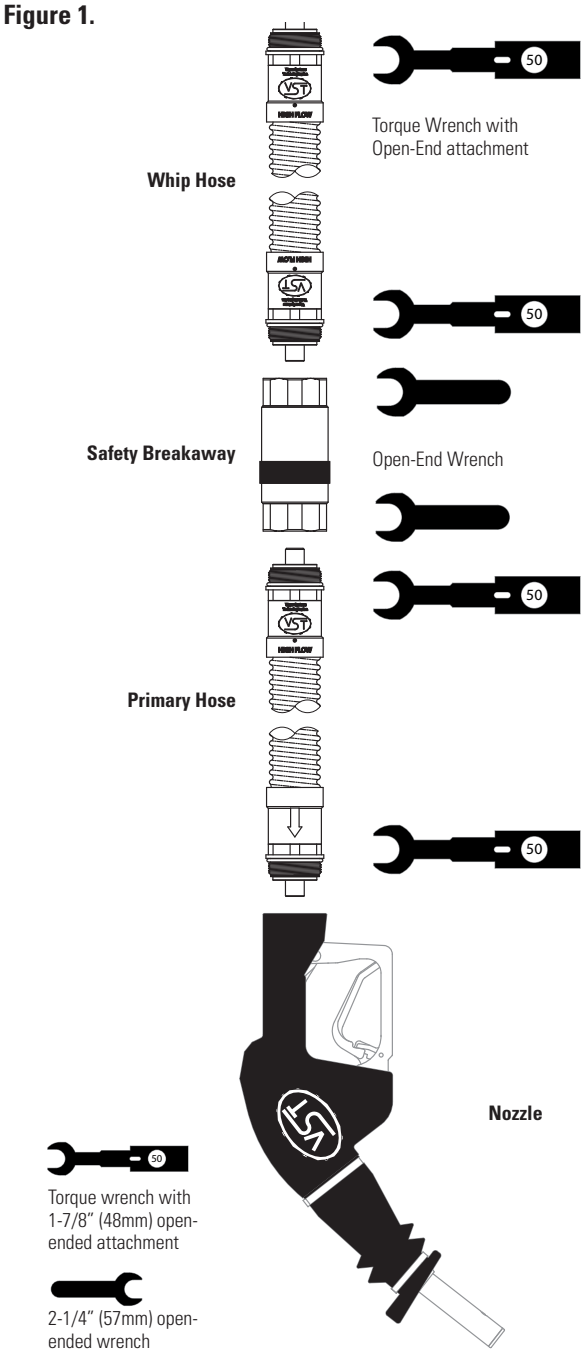
If hanging hardware components are involved in a drive-off or incur other customer abuse, each individual component must be functionally tested prior to customer dispensing activities.

Installation Preparation

These procedures must be followed to ensure leak-proof installation and operation of these safety breakaway 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 dispenser shear valve prior to performing any service work with the 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 component.

Figure 1.



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

Reattachable Breakaway Part Number Series: VSTA-EVR-SBKA

5. For the installation of a new breakaway, remove hanging hardware from the dispenser prior to making replacement component assembly connections. VST recommends connecting the whip hose to dispenser as the last connection during hanging hardware assembly.

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 FLOW DIRECTION ARROW** (where applicable). Use the hex on the breakaway body closest to the connection to tighten. **DO NOT USE** the breakaway body to tighten the unit.
4. Tighten breakaway connection to 50 foot-pounds of torque. **DO NOT OVER TIGHTEN**. Use the hex on the breakaway body closest to the connection 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. Checking for meter creep will verify the integrity of the connections. After dispensing the fuel, release the lever and move components around and/or gently shake the hose and verify if the displayed amount on the dispenser changes. If meter creep is experienced, check all components and replace as necessary.
6. Check the nozzle shut-off action by dispensing fuel into an approved container at least three times to assure proper automatic operation of the interlock rod. 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). 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).

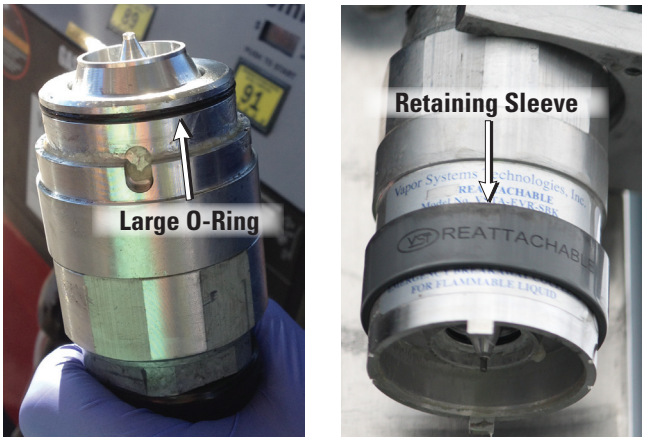


Figure 2: Check each half for damage

BREAKAWAY REATTACHMENT PROCEDURE

The VSTA-EVR-SBKA Safety Breakaway may be reconnected with the use of the VST Breakaway Assembly Tool (VST-BAT-100).

BREAKAWAY REATTACHMENT PROCEDURE

1. Follow **INSTALLATION PREPARATION** steps 1-4.
2. Inspect both safety breakaway halves for damage that may have occurred during separation. Include looking for external damage to the product and missing alignment pin, etc. See **Figures 2 and 3. If damage or missing parts are detected, replace with new product.** Ensure that the retaining sleeve is placed on the breakaway half connected to the whip hose before reassembly.

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

Reattachable Breakaway Part Number Series: VSTA-EVR-SBKA

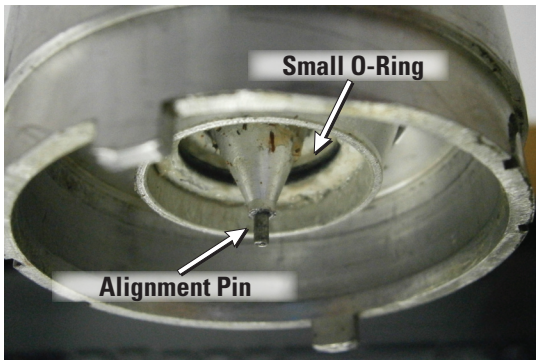


Figure 3: Check for Alignment Pin

3. Prior to reassembling, be sure the mating parts are undamaged and clean.
4. Replace all O-rings with those provided in the repair kit (VST-BRK-100).
   a. Lightly lubricate the O-rings on mating connections with petroleum jelly or other suitable lubricant. **DO NOT USE** pipe dope or thread sealant.
   b. Use the large O-ring provided in the repair kit to replace the outer O-ring on the curb hose side of the breakaway. See **Figure 5**.
   c. Use the small O-ring provided in the repair kit to replace the inner O-ring on the whip side of the breakaway. Use a plastic pick provided in the kit to remove the old O-ring. See **Figure 3**.
   5. Apply a liberal amount of lithium grease provided in the repair kit (VST-BRK-100) completely around the mating diameter surface of the curb hose side of the breakaway. The grease will need to cover the entire surface that will slide into the mating end of the breakaway. See **Figure 5**. **DO NOT USE** pipe dope or thread sealant.
6. Utilize the VST Breakaway Assembly Tool (VST-BAT-100) with the appropriate reassembly plates to reassemble the breakaway. The tool is used to provide appropriate leverage for the ease of reassembly of the breakaway and to secure the breakaway during replacement of the shear washers. This can be done without disassembling the hoses from the breakaway halves.
7. Press the button on the Breakaway Assembly Tool to spread the end clamps apart to allow the two separated breakaway halves to fit between the top and bottom clamps. Slide the top clamp of the VST Breakaway Assembly Tool behind the hex on the breakaway half connected to the whip hose. See **Figure 4**.
8. Slide the separated bottom half of the breakaway (with curb hose and nozzle attached) onto the bottom clamp of the VST Breakaway Assembly Tool. Align the shear ring grooves away from the reassembly tool for ease of insertion of the shear washers. See **Figure 4**.
9. Slowly squeeze the VST Breakaway Assembly Tool trigger to bring the breakaway halves together.
10. Carefully align the two breakaway halves. Place the alignment pin from the breakaway upper half into the hole of the inner poppet on the lower half of the breakaway

Figure 4: Attach Reassembly Tool

CAUTION: Reconnection can cause a small amount of gasoline to leak out of the breakaway. A towel wrapped loosely around the breakaway can help to minimize spills.

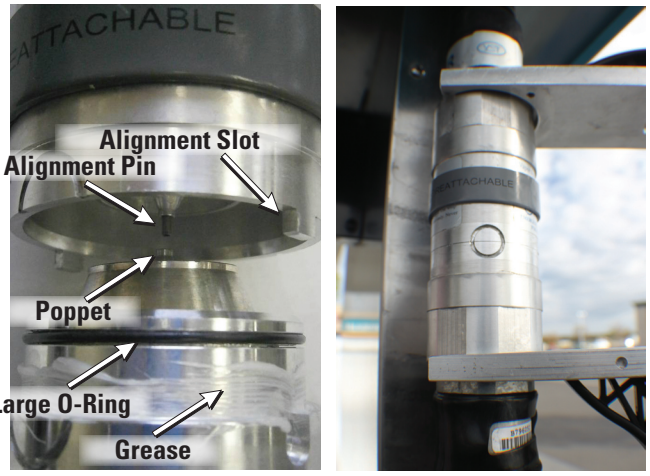


Figure 5: Align Poppet Pin from upper to lower half of breakaway and finish alignment

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

Reattachable Breakaway Part Number Series: VSTA-EVR-SBKA

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

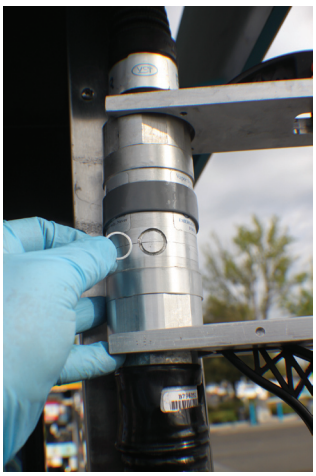


Figure 6: Add Shear Washer

Figure 7: Remove Grease

Figure 8: Reposition Retaining Sleeve

Figure 9: Verify Connection Integrity

that is connected to the nozzle end. Continue squeezing the trigger of the VST Breakaway Assembly Tool while guiding the alignment slots together to finish reassembly. See **Figure 5.**

NOTE: Once the two breakaway halves come together close enough for placement of the shear washers, do not squeeze the tool trigger any further. Unnecessary pressure on the tool could damage or break the tool.

11. Once the two aligned halves are together place one shear washer into each of the shear washer grooves (2 total) from the repair kit (VST-BRK-100). See **Figure 6**. Ensure that the shear washer is completely seated into the groove before moving the retaining sleeve into place. See **Figure 7**. Wipe off excess grease after installation of the shear rings.
12. After the two breakaway halves are reattached, remove the Breakaway Assembly Tool (press the button on the tool to allow the plates to release). Reposition the retaining sleeve to the groove between the two halves of the breakaway. See **Figure 8**. Give the reassembled breakaway a strong pull to verify that it is properly connected. See **Figure 9**.
13. If successful, follow the **Installation and Functional Tests** steps 5 – 7 in this document.

MAINTENANCE

Inspect safety breakaways regularly 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.

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

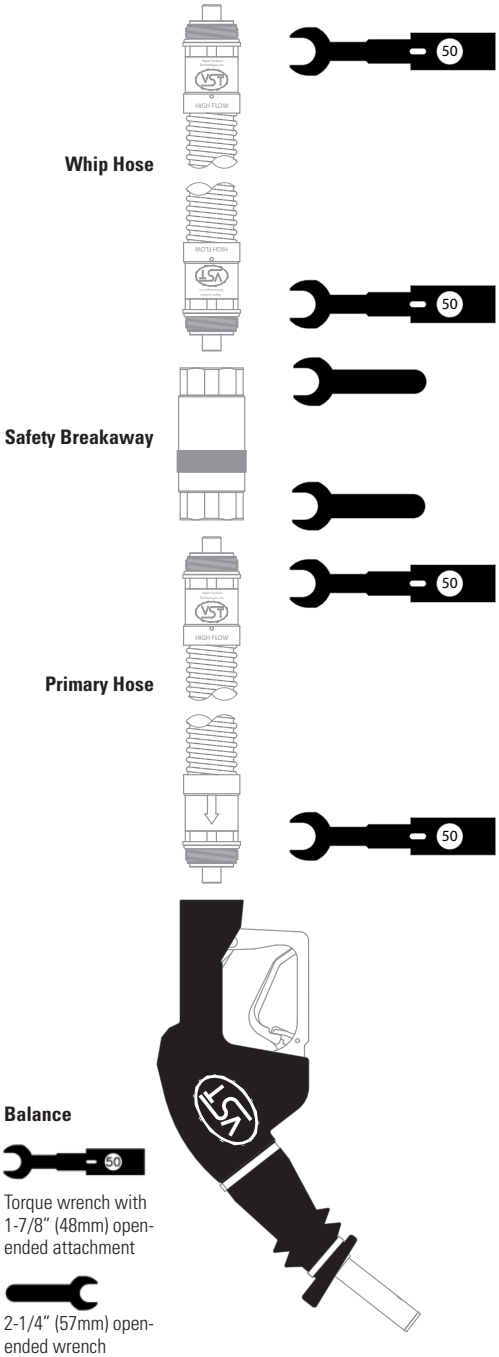
NON-Reattachable Breakaway Part Number Series: VSTA-EVR

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. 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

a. 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.

b. 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.

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

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.

VST Installation Procedure for Phase II Coaxial EVR Balance Breakaway Scuff Guards

Part Number Series: VST-BBSG-100

For Use On: VST-EVR-SBKA

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

APPLICATION

These VST Safety Breakaway scuff guards are intended for use as an optional accessory on the VST-EVR-SBKA Balance Safety Breakaways to reduce defacement of the dispenser.

Figure 1.

VST-BBSG-100

INSTALLATION PREPARATION

Follow all safety preparation procedures found in the VST Safety Breakaway Installation Procedure.

INSTALLATION

1. These scuff guards must be installed onto the breakaway after it has been disconnected from the hoses.
2. Slide the scuff guards onto the hose. The reduced diameter ridge of the scuff guards should be positioned for proper fit onto the ends of the breakaway.
3. Prior to sliding the scuff guard into place, re-connect and tighten breakaway, with proper torque, to the hose while the breakaway hex flats are still accessible. **See Figure 2.**
4. Slide the scuff guard over the breakaway hex flats. **See Figure 3.**

NOTE: Do not cover warning or identification labels.

Figure 2.

Figure 3.

EMCO® WHEATON RETAIL

A4119EVR
Coaxial Safe Break Valve

Permanent ID Information:

INSTALLATION INSTRUCTIONS

Service Tools Required:

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

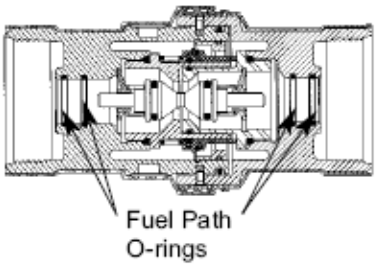
CAUTION:

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

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

1

Pre-Inspection:



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

Pre-Installation:

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

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

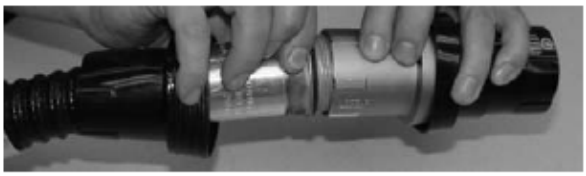
2

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

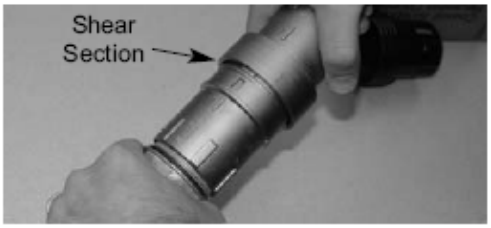
IMPORTANT: Do not use pipe thread sealant compound or Teflon tape when installing the A4119EVR safe break valve. Failure to comply will void warranty.

Installation:

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



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



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

3

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

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

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

Post Functional Tests:

10. Carefully purge the trapped air from the fueling point. Begin dispensing by compressing the bellows and then squeezing the lever. Dispense one gallon of fuel into a gasoline approved container.

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

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

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

Post Inspection:

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

PREVENTIVE MAINTENANCE

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

Part Number	Description
494748EVR	Fuel Path O-ring Kit

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

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

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

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

EMCO®
WHEATON RETAIL

494748EVR
Fuel Path O-ring Kit

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

Packing List:

(2) Fuel Path O-rings

A4005EVR Balance Vapor Recovery Nozzle

A4119EVR Coaxial Safe Break Valve

INSTALLATION INSTRUCTIONS

Service Tools Required:

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

CAUTION:

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

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

1

Pre-Inspection:

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

Pre-Installation:

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

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

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

A4005EVR Nozzle

A4119EVR Safe Break Valve

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

2

Installation:

Removing the Existing Fuel Path O-rings

A4005EVR Nozzle

A4119EVR Safe Break Valve

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

IMPORTANT: Properly discard all removed components.

Installing the New Fuel Path O-rings

A4005EVR Nozzle

A4119EVR Safe Break Valve

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

A4005EVR Nozzle

A4119EVR Safe Break Valve

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

3

Post-Installation:

9. Before attempting to reinstall the A4005EVR nozzle or A4119EVR safe break valve, please refer to the following installation instructions below.
    - A4005EVR Balance Vapor Recovery Nozzle p/n 570435
    - A4119EVR Coaxial Safe Break Valve p/n 569043

PREVENTIVE MAINTENANCE

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

Part Number	Description
494748EVR	Fuel Path O-ring Kit

PERFORMANCE STANDARDS & SPECIFICATIONS

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

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

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

OPW
A DOVER COMPANY

Leading The Way in Fueling Innovation Worldwide

206203 December 2012

66CLP BALANCED BREAKAWAY

ACOPLAMIENTOS DE SEGURIDAD EQUILIBRADOS TIPO "BREAKAWAY" 66CLP

IMPORTANT SAFEGUARDS

- For your protection, please read these safety instructions completely before installing and operating this equipment.
- Keep this manual on file for future reference.
- This manual contains material that may be required by authorities having jurisdiction to be on site at all times.
- Carefully observe all warnings, precautions and instructions for this equipment and in the operating instructions and adhere to them.

MEDIDAS PREVENTIVAS IMPORTANTES

- Para su protección, lea completamente estas instrucciones de seguridad antes de instalar y operar este equipo.
- Mantenga archivado este manual para futuras consultas.
- Las autoridades con jurisdicción pueden exigir que el material de este manual esté in situ en todo momento.
- Observe y cumpla cuidadosamente todas las advertencias, precauciones e instrucciones de este equipo, y siga las instrucciones para el funcionamiento del equipo.

THIS MANUAL MUST BE LEFT WITH FACILITY MANAGEMENT
ESTE MANUAL DEBE ESTAR EN POSESIÓN DEL ENCARGADO DE LA INSTALACIÓN

SITE NAME: NOMBRE DEL SITIO:	
ADDRESS: DIRECCIÓN:	
SERIAL NUMBER OR BREAKAWAY: NÚMERO DE SERIE DE O BREAKAWAY:	
DATE OF INSTALLATION: FECHA DE INSTALACIÓN:	
CONTRACTOR IN CHARGE OF THE FACILITY:	
CONTRATISTA A CARGO DE LA INSTALACIÓN:	

Please visit OPW's website: www.opwglobal.com for further information or contact OPW Customer Service at 1-800-422-2525 (US)
Visite el sitio web de OPW: www.opwglobal.com para más información o comuníquese con el Servicio al Cliente de OPW al 1-800-422-2525 (EE. UU.)

⚠ WARNING

Failure to comply with the following warnings could result in property damage, injury or death.

Fire Hazard
Do not use power tools (Class I Division I and Class I Division II) during installation process and maintenance of equipment.

Chemical Exposure Hazard
Always wear appropriate safety equipment during installation or maintenance of equipment.

Fire Hazard
Do not install an unlisted ad/billboard or other unlisted after-market device on any automatic nozzle. Doing so may change the sensitivity of the shut-off mechanism. Nozzle may not shut off, causing a fuel spill. Reference: sensitivity test per Underwriters Laboratories specification UL842.

⚠ ADVERTENCIA

El incumplimiento de las siguientes advertencias puede provocar daños a la propiedad, lesiones e incluso la muerte.

Peligro de incendio
No utilice herramientas eléctricas (Clase I División I y Clase I División II) durante el proceso de instalación y mantenimiento del equipo.

Peligro de exposición a sustancias químicas
Use siempre equipo de seguridad adecuado durante la instalación o el mantenimiento del equipo.

Peligro de incendio
No instale anuncios, carteleras ni dispositivos accesorios no autorizados en ninguna pistola surtidora automática. Si lo hace puede cambiar la sensibilidad del mecanismo de cierre. La pistola podría no cerrarse y provocar un derrame de combustible. Consultar: prueba de sensibilidad según la especificación UL842 de Underwriters Laboratories.

WARNINGS

- Dispensing system must be tested to determine if a maximum separation force of 350 pounds would damage it.
- Dispenser must be securely attached to the dispensing island.
- Keep gasoline away from your eyes and skin.
- Keep gasoline out of reach of children.

PREPARATION AND TEST

- Attach a spring scale to the location where the breakaway will be installed (see FIG 1).
- Apply a 350 pound pull-force at various angles to the dispenser.
- Check emergency valves, dispenser, and hose assemblies for damage.
- If there is no damage, the installation is ready for breakaways.

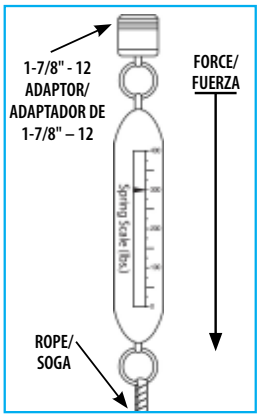


Figure 1/Figura 1

INSTALLATION – HIGH HOSE MPD

- Orient breakaway based on flow arrow on outside cover.
- Install breakaway into whip hose from the dispenser first (see FIG 2).
- Use flats at top of breakaway to tighten.
- Tighten breakaway connection to 50 foot-pounds torque.
- Install long hose into bottom of breakaway.
- Use flats at bottom of breakaway to tighten.
- Tighten breakaway connection to 50 foot-pounds torque.
- Do not wrench across the body of the breakaway.
- Do not over-tighten.
- If a separation occurs, see reconnection section on page 3.

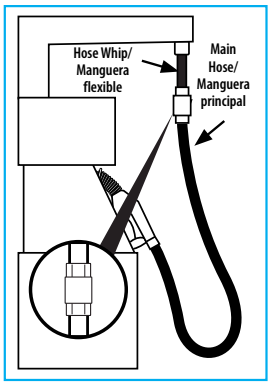


Figure 2/Figura 2

ADVERTENCIAS

- El sistema de provisión debe comprobarse para determinar si una máxima fuerza de separación de 350 libras le ocasionaría daños.
- El surtidor deberá estar conectado firmemente a la plataforma de provisión.
- Mantenga la gasolina lejos de los ojos y la piel.
- Mantenga la gasolina fuera del alcance de los niños.

PREPARACIÓN Y PRUEBA

- Conecte una báscula a resorte en el lugar en donde se instalará el acoplamiento de seguridad tipo "breakaway" (consulte la FIG. 1).
- Aplique una fuerza de tracción de 350 libras a diversos ángulos al surtidor.
- Revise las válvulas de emergencia, el surtidor y los conjuntos de mangueras en busca de daños.
- Si no hay daños, la instalación está lista para la colocación de los acoplamientos de seguridad.

INSTALACIÓN – ALTO MPD DE LA MANGUERA

- Oriente el acoplamiento de seguridad tipo "breakaway" según la flecha de flujo sobre la cubierta externa.
- Instale el acoplamiento de seguridad tipo "breakaway" en la manguera flexible primero desde el surtidor (consulte la FIG. 2).
- Utilice las piezas planas en la parte superior del acoplamiento de seguridad tipo "breakaway" para apretarlo.
- Apriete la conexión del acoplamiento de seguridad tipo "breakaway" hasta una torsión de 50 pies-libras.
- Instale la manguera larga en la parte inferior del acoplamiento de seguridad tipo "breakaway".
- Utilice las piezas planas en la parte inferior del acoplamiento de seguridad tipo "breakaway" para apretarlo.
- Apriete la conexión del acoplamiento de seguridad tipo "breakaway" hasta una torsión de 50 pies-libras.
- No apriete con llave el cuerpo del acoplamiento de seguridad tipo "breakaway".
- No apriete demasiado.
- Si se produce una separación, consulte la sección de reconexión en la página 3.

The following maintenance may be performed by the GDF owner/operator or any authorized service contractor

⚠ WARNING

It will require at least 40-50 lbs. of effort to re-connect the breakaway. An optional clamping tool is available (purchased separately) to make the re-connection process easier. If you have any questions or concerns, STOP and contact an authorized service contractor.

⚠ WARNING

Some residual pressure may be present on the dispenser side of the separated breakaway – use caution when removing. A small amount of gasoline may leak out of the connection – a towel wrapped loosely around the breakaway can help minimize fuel spills.

El siguiente mantenimiento puede ser realizado por el propietario/operador del GDF o por cualquier contratista de servicio autorizado

⚠ ADVERTENCIA

Se requerirán al menos 40-50 lbs. de esfuerzo para reconectar el acoplamiento de seguridad tipo "breakaway". Se dispone de una herramienta opcional de apriete (se compra por separado) para facilitar el proceso de reconexión. Si tiene preguntas o inquietudes, DETÉNGASE y póngase en contacto con un contratista de servicio autorizado.

⚠ ADVERTENCIA

Puede haber alguna presión residual del lado del surtidor del acoplamiento de seguridad tipo "breakaway" separado – tenga cuidado al desmontarlo. Puede haber fugas de una pequeña cantidad de gasolina en la conexión – una toalla envuelta de manera floja alrededor del acoplamiento de seguridad tipo "breakaway" puede ayudar a minimizar los derrames de combustible.

BREAKAWAY RECONNECTION PROCEDURE

1. Verify the dispenser is not authorized/activated.
2. Remove both halves of the breakaway from the hose.
3. Perform visual inspection of the breakaway body components.
   - **a.** If the "Spud" assembly (see FIG 3, page 4) is damaged beyond repair, the entire breakaway will need to be replaced.
   - **b.** If the "Body" assembly (see FIG 3, page 4) is damaged beyond repair, the entire breakaway must be replaced.
   - **c.** Ensure the "spring" is not damaged or missing (see FIG 3, page 4).
4. Replace damaged and missing breakaway components.
   - **a.** The O-ring will need to be replaced every time breakaway separation occurs, replace with part number 204870.
   - **b.** If the Spring is damaged (or missing), replace with part number 204872.
   - **c.** If the Plastic Sleeve is damaged, replace with part number 204811.

PROCEDIMIENTO DE RECONEXIÓN DEL ACOPLAMIENTO DE SEGURIDAD TIPO "BREAKAWAY"

1. Verifique que el surtidor no esté autorizado/activado.
2. Desmonte ambas mitades del acoplamiento de seguridad tipo "breakaway" de la manguera.
3. Realice una inspección visual de los componentes del cuerpo del acoplamiento de seguridad tipo "breakaway".
   - **a.** Si el ensamble con el "relieve" (consulte la FIG. 3, página 4) está dañado sin posibilidad de reparación, deberá reemplazarse todo el acoplamiento de seguridad tipo "breakaway".
   - **b.** Si el ensamble con el "cuerpo" (consulte la FIG. 3, página 4) está dañado sin posibilidad de reparación, deberá reemplazarse todo el acoplamiento de seguridad tipo "breakaway".
   - **c.** Asegúrese de que el "muelle" no esté dañado o falte (consulte la FIG. 3, página 4).
4. Reemplace los componentes dañados o faltantes del acoplamiento de seguridad tipo "breakaway".
   - **a.** El aro tórico deberá reemplazarse cada vez que ocurra una separación del acoplamiento de seguridad tipo "breakaway", reemplace con el número de pieza 204870.
   - **b.** Si el muelle está dañado (o falta), reemplace con el número de pieza 204872.
   - **c.** Si el manguito plástico está dañado, reemplace con el número de pieza 204811.

5. Re-connection procedure:
   - **a.** Lubricate the O-ring with petroleum jelly or silicone grease.
   - **b.** Push the "spud" into the "body" by applying increasing force while wiggling the "spud" in a rotating motion until it enters the spring in the "body".
   - **c.** Align the pins with slots and continue pushing the "spud" into the "body" until they latch together. The pins should be in the bottom of the slot. See "connected" picture in FIG 3.
   - **d.** Use a ratchet style one-handed bar clamp such as Bessey part number DU030-8 (Grainger part number 6XE60) or equivalent to compress the two halves together (see FIG 4).
6. Reinstall the breakaway onto the hose ends, making sure that the arrow on the label is pointing toward the nozzle.
7. Authorize the dispenser and perform functional testing, refer to VST IOM 5.

5. Procedimiento de reconexión::
   - **a.** Lubrique el aro tórico con vaselina o grasa silicónica.
   - **b.** Empuje el "relieve" en el "cuerpo" aplicando una fuerza creciente mientras desplaza suavemente el "relieve" con un movimiento rotativo hasta que ingrese el muelle en el interior del "cuerpo".
   - **c.** Alinee los pasadores con las ranuras y continúe empujando el "relieve" al interior del "cuerpo" hasta que se enganchen entre sí. Los pasadores deben llegar al fondo de la ranura. Consulte la ilustración del dispositivo "conectado" en la FIG. 3.
   - **d.** Utilice una abrazadera de barra de tipo trinquete, de uso con una mano, tal como el número de pieza de Bessey DU030-8 (número de pieza de Grainger 6XE60) o equivalente para comprimir las dos mitades entre sí (consulte la FIG. 4).
6. Vuelva a colocar el acoplamiento de seguridad tipo "breakaway" en los extremos de la manguera, asegurándose de que la flecha en la etiqueta esté orientada hacia la boquilla.
7. Autorice el surtidor y realice las pruebas funcionales; consulte VST IOM 5.

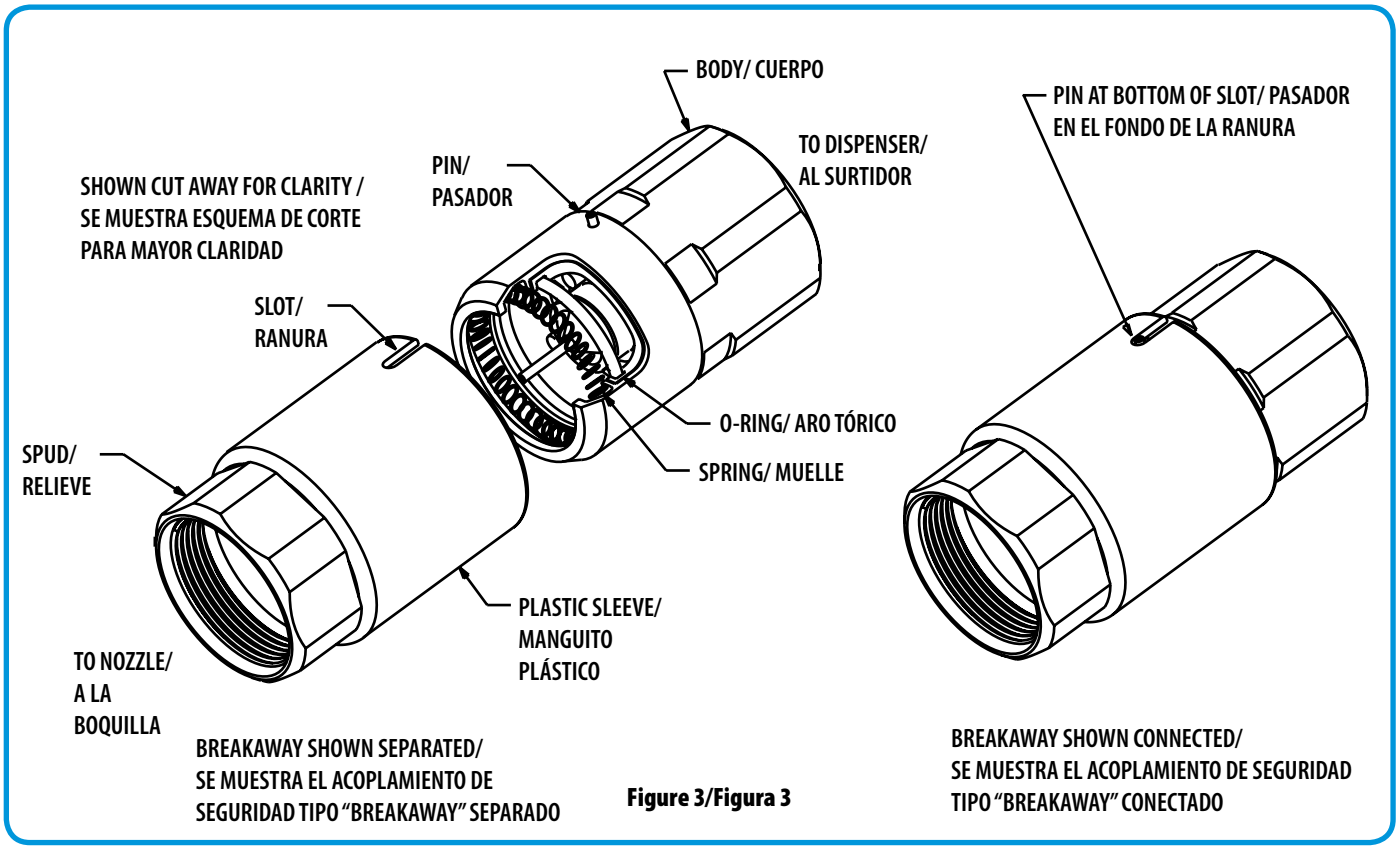


Figure 3/Figura 3

Step 1:
Place separated breakaway in clamp jaws with the pins aligned with the slots

Paso 1:
Coloque el acoplamiento de seguridad separado en mordazas de sujeción con los pasadores alineados con las ranuras

Clamping/spreading switch: Make sure it is set in the "clamp" direction

Interruptor de sujeción/ difusión: Asegúrese de que esté colocado en la dirección de "fijación"

Step 2:
Squeeze lever several times to ratchet the clamp closed to re-connect breakaway

Paso 2:
Presione varias veces la palanca de trinquete para cerrar la abrazadera y volver a conectar el acoplamiento de seguridad tipo "breakaway"

Step 3:
Breakaway is now fully connected when the pins are at the bottom of the slots. Press the release button on the clamp to release the breakaway from the clamp.

Paso 3:
El acoplamiento de seguridad tipo "breakaway" está ahora totalmente conectado cuando los pasadores están en el fondo de las ranuras. Pulse el botón de liberación de la abrazadera para liberar el acoplamiento de seguridad tipo "breakaway" de la abrazadera.

Clamp release button

Botón de liberación de la abrazadera

Figure 4/Figura 4

The following is to be completed by the individual reconnecting the breakaway:

I, _____, hereby declare that I have followed these instructions per the manufacturer's recommendations on this day _____, in the month of _____, 2012

Lo siguiente deberá ser completado por el individuo que reconecta el acoplamiento de seguridad tipo "breakaway":

Yo, _____, por este medio declaro que he seguido estas instrucciones de acuerdo con las recomendaciones del fabricante el día _____ del mes de _____ de 2012

Maintenance Log Instructions / Instrucciones del registro de mantenimiento

- For each repair or product change out, complete an entry on this form. / Haga una anotación en este formulario para cada reparación o cambio de producto.
- For each new alarm condition on the station's monitoring system, complete an entry on this form. / Haga una anotación en este formulario para cada condición de alarma del sistema de supervisión de la estación.

Repair Logs, which shall include: / **Registros de reparaciones,** que deben induir:

(i) Date and time of each repair. / Fecha y hora de cada reparación.

(ii) The name of person(s) who performed the repair, and if applicable, the name, address and phone number of the person's employer. / Nombre de la(s) persona(s) encargada(s) de la reparación y, si corresponde, nombre, dirección y número de teléfono de la empresa.

(iii) Description of services performed. / Descripción de los servicios realizados.

(iv) Each component that was repaired, serviced, or removed, including the required component identification information. *Example: manufacturer and product serial number.* Componentes reparados, revisados o retirados, incluidos los datos de identificación de cada uno de ellos. *Ejemplo: fabricante y número de serie del producto.*

(v) Each component that was installed as replacement, if applicable, including the required component identification information. *Example: manufacturer and product serial number.* / Repuestos instalados (si corresponde), incluidos los datos de identificación de cada uno de ellos. *Ejemplo: fabricante y número de serie del producto.*

(vi) Receipts for parts used in the repair and, if applicable, work orders, which shall include the name and signature of the person responsible for performing the repairs. / Recibos de los repuestos utilizados y, si corresponde, órdenes de trabajo con nombre y firma de la persona responsable de la reparación.

ALL repairs should be logged! / Se deben anotar TODAS las reparaciones
Whether the new equipment is from the station's own stock or from a maintenance company, everything should be entered into the daily repair log. / Haga todas las anotaciones necesarias en el registro diario de reparaciones, tanto si los repuestos proceden del almacén de la estación como de una empresa de mantenimiento.

Date of Problem (MM/DD/YY) / Fecha del problema (MM/DD/AA)	Description of Defect, Alarm or Spill / Descripción del defecto, la alarma o el derrame	Date/Time of Repair/ Remedy (MM/DD/YY) / Fecha y hora de la reparación/ intervención (MM/DD/AA)	Description of Repair or Remedy List each component repaired, replaced and/or installed including make, model and serial number of old and new components / Descripción de la reparación o intervención. Anote cada componente reparado, sustituido y/o instalado e incluya la marca, el modelo y el número de serie de los componentes antiguos y nuevos	Name/Company/Address Phone Number of Person Who Performed the Repair / Nombre/Empresa/Dirección / Número de teléfono de la persona encargada de la reparación
4/1/00	Nozzle #: 3 / Pistola nº: 3 Grade of Gas: 87 / Octanaje: 87 Nozzle spout for 3-87 out of round, Called repair company on 4/1. / Pérdida de circularidad en la boquilla de la pistola 3-87, Llamada a la empresa de mantenimiento el 1/4.	4/2/00 3:30 pm	Replaced OPW 11VAI-69 nozzle serial #456789 with new OPW 11VAI-69 nozzle serial #458901. / Cambio de pistola OPW 11VAI-69 (nº serie 456789 por nueva pistola OPW 11VAI-69 (nº serie 458901).	Tom Smith, ABC Nozzle Co. 1111 E. Fourth Ave. La Habra, CA 560-345-6789
	Nozzle #: / Pistola nº: Grade of Gas: / Octanaje:			
	Noozzle #: / Pistola nº: Grade of Gas: / Octanaje:			

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-P
VR-204-P

Version: 4.5

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

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Table of Figures

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 *Processor*s. 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

Safety Icons

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

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.	• When the UST system pressure rises above +0.2"WC, the *Processor* turns ON.
2.	• Through the vapor inlet pipe connection at the *Processor*, the VOC vapor is drawn into the suction side of the blower.
3.	• The blower discharges the VOC vapor into the membrane housing.
4.	• Inside the membrane housing, the VOC vapor is separated in to two air streams: ► VOC depleted air (referred to as "air") ► Gasoline VOC vapor • The membrane is designed specifically for separating air from gasoline VOC vapor.
5.	• A vacuum pump draws the air from the membrane housing through a check valve.
6.	• A sample of the air flows through a hydrocarbon sensor to check the percent hydrocarbons.
7.	• From the vacuum pump, the air is vented to atmosphere via the air return.
8.	• The gasoline VOC vapor returns to the UST system via the vapor return.
9.	• When the UST system pressure drops below -0.2"WC, the *Processor* turns OFF.

1.3 Processor Dimensions and Weight

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

1.4 Processor Components

PART #	DESCRIPTION
5001-001	Vacuum Pump/Three-Phase Motor - Shipped with Three-Phase *Processor*
5001-002	Vacuum Pump/Single-Phase Motor - Shipped with Single-Phase *Processor*
5001-003	Vacuum Pump Drive Coupling Rubber Insert
5002-001	Circulating Blower / Three-Phase Motor - Shipped with Three-Phase *Processor*
5002-002	Circulating Blower / Single-Phase Motor - Shipped with Single-Phase *Processor*
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.

- Motor Starters
- Locking Ball Valves
- Locks
- Tees
- Piping
- Pipe Fittings
- Electrical
- Electrical Fittings
- Conduit

- Lockable Disconnect
- Wires
- Electrical Seal-Offs
- Concrete
- Veeder-Root TLS-350
- Veeder-Root PMC or ISD Software
- Veeder-Root Pressure Sensor
- Veeder-Root Flow Meters (ISD only)

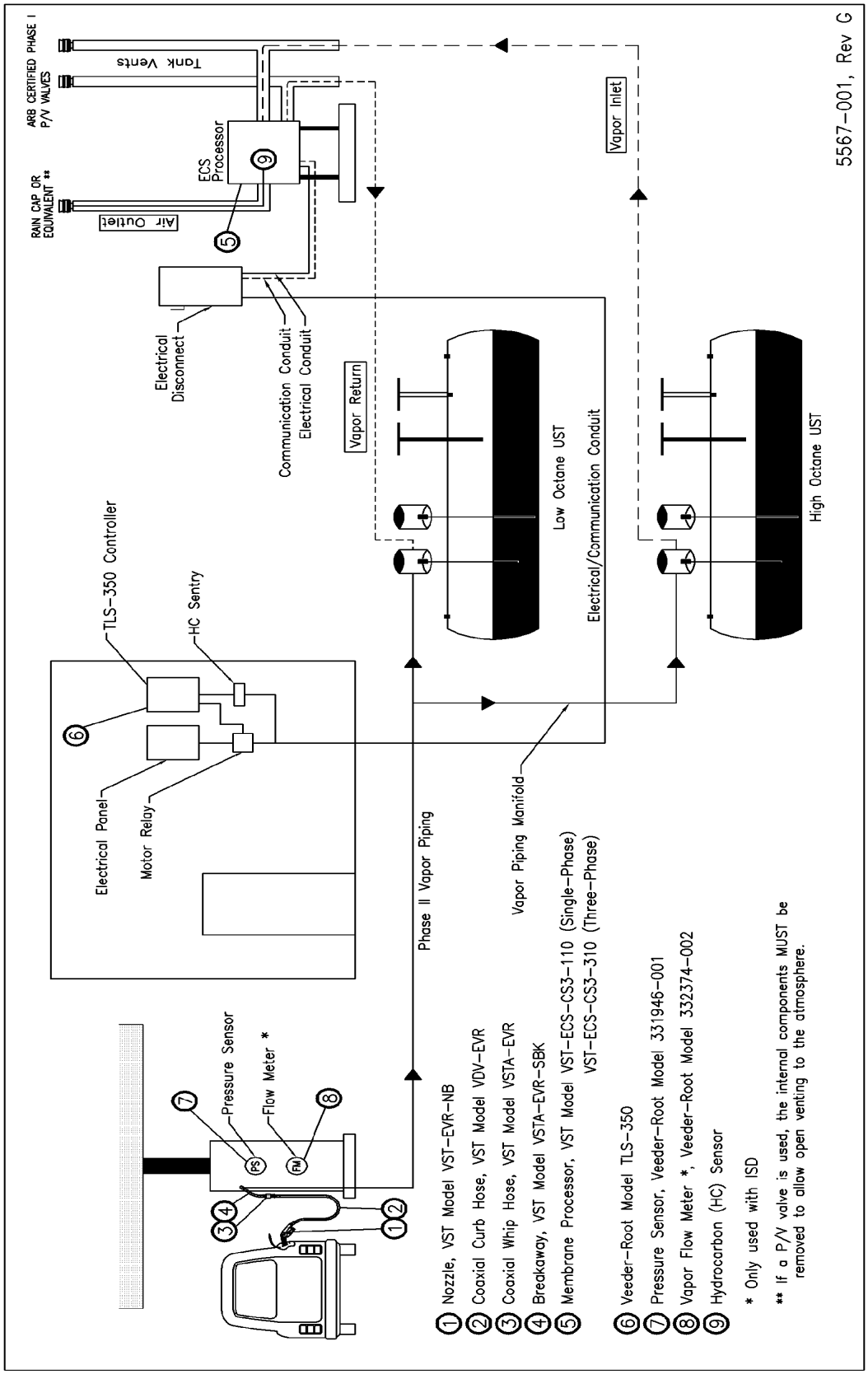


Figure 1: How the Processor fits into the GDF layout

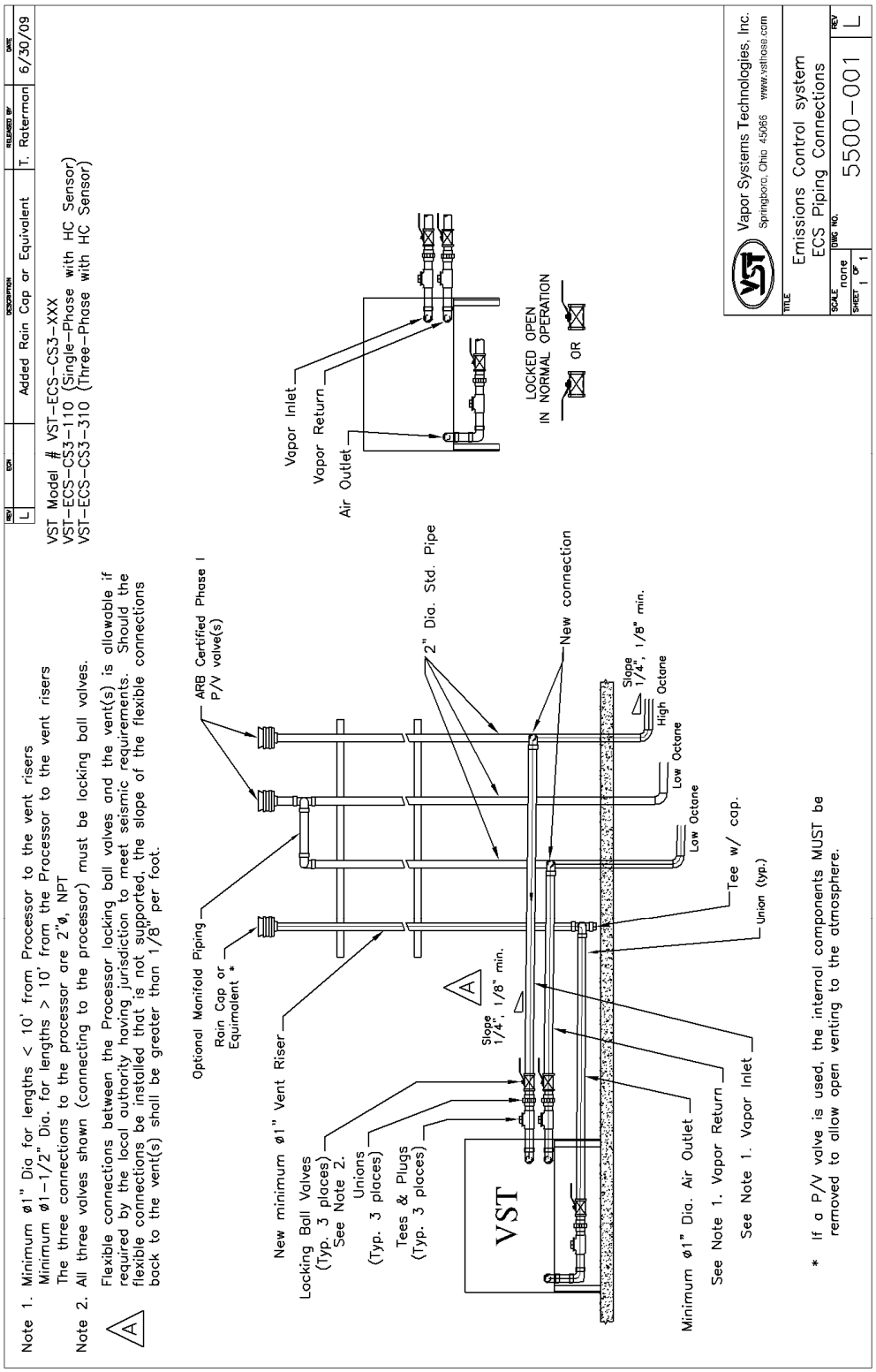


Figure 2: Processor Piping Diagram

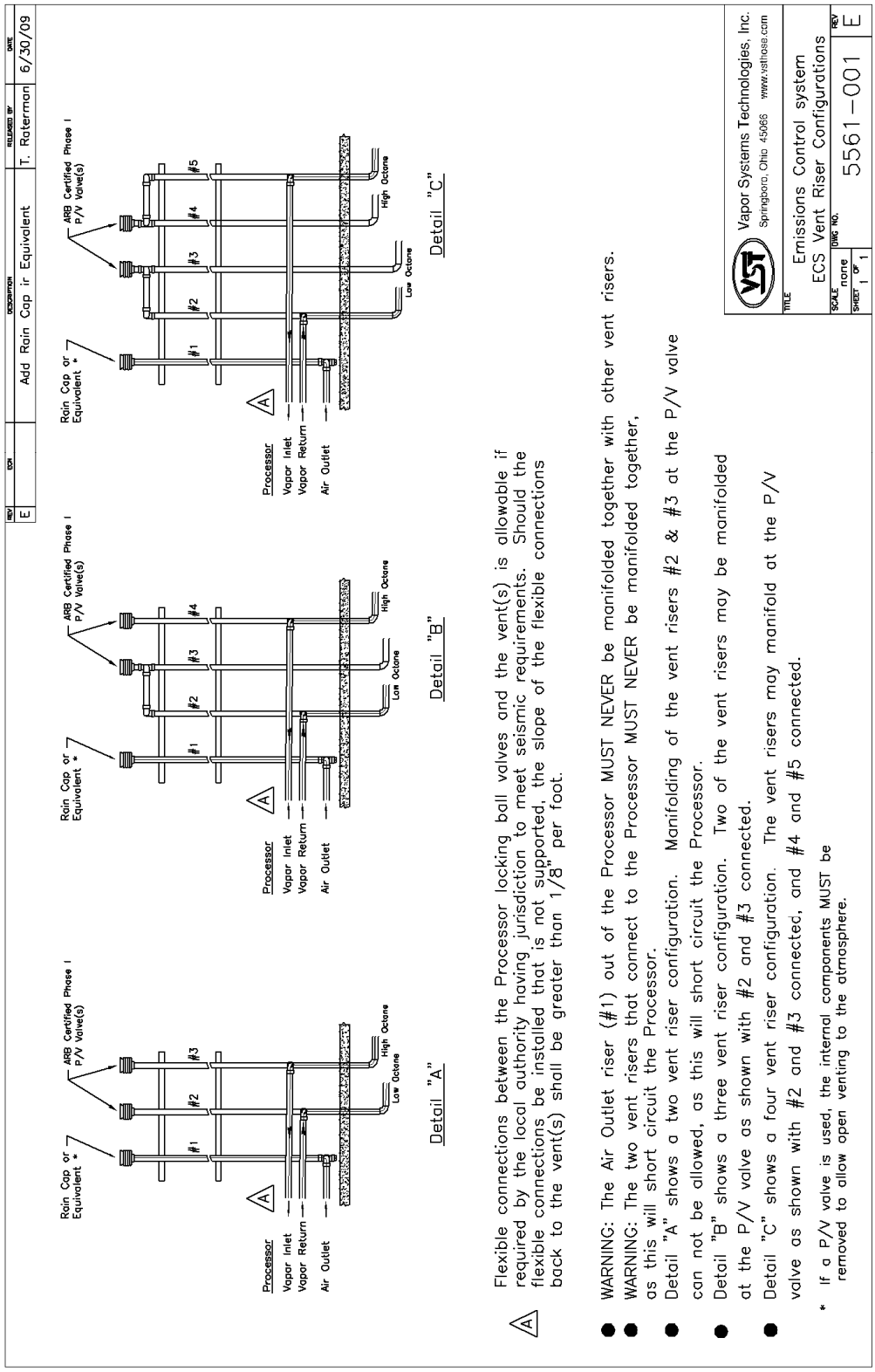
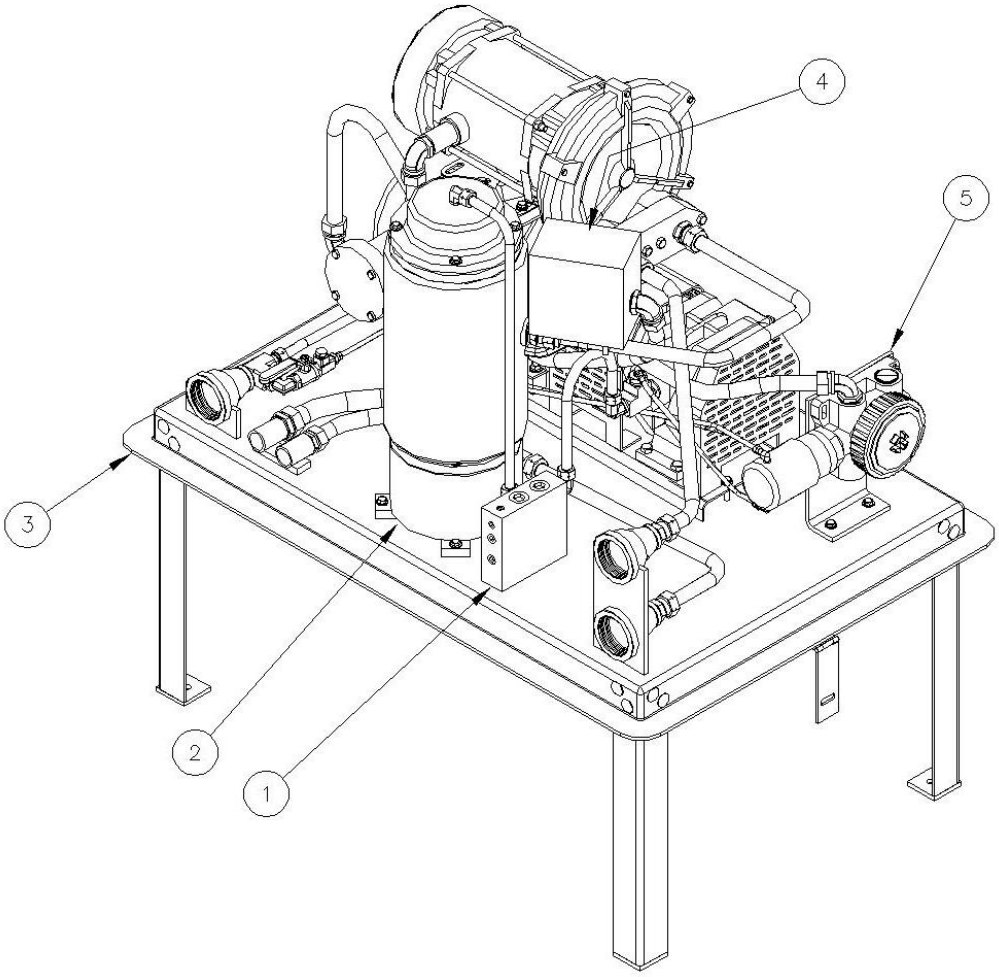


Figure 3: ECS Vent Configurations

REV	ECN	DESCRIPTION	RELEASED BY	DATE
E	NONE	ALTER TUBING PATH	J. HILBUN	01/16/09



ITEM	QTY	UNIT	PART IDENTIFICATION	DESCRIPTION
5	1	EA	5007-001	HYDROCARBON SENSOR W/ HOUSING
4	1	EA	5008-001	HEAT TRACE COMPONENTS
3	1	EA	5009-001	ASSEMBLY, ECS BASE
2	1	EA	5006-001	ASSEMBLY, MEMBRANE HOUSING
1	1	EA	5003-001	ASSEMBLY, CHECK VALVE

THE INFORMATION ON THIS DOCUMENT IS PROPRIETARY AND CONFIDENTIAL. IT MAY BE USED ONLY FOR THE PURPOSE FOR WHICH VAPOR SYSTEMS TECHNOLOGIES, INC. PROVIDED IT.

UNLESS OTHERWISE NOTED:
DIMENSIONS IN ( ) ARE REFERENCE
DIMENSIONS ARE INCHES & INCLUDE FINISH
BREAK ALL SHARP EDGES
.005/.020 RADIUS OR CHAMFER

3RD ANGLE PROJECTION

SIZE A

MATERIAL N/A

HEAT TREATMENT N/A

FINISH N/A

TOLERANCES UNLESS OTHERWISE NOTED:
FRACTIONS ±1/32 — CONCENTRICITY (◎) = .005 T.I.R.
.XX DEC ±.02 — PERPENDICULARLY (⊥) = .005 T.I.R.
.XXX DEC ±.005 — FLATNESS (▱) = .005 T.I.R.
.XXXX DEC ±.0010 — PARALLEL (∥) = .005 T.I.R.
ANGLES ±1/2 — FILLET RADII = .015R ±.005

MACHINED SURFACES 125

Vapor Systems Technologies, Inc.
Springboro, Ohio 45066 www.vsthose.com

TITLE: EMISSION CONTROL SYSTEM

APPROVALS		
DRAWN BY: J. HILBUN	DATE: 01/15/09	
ENGINEER: T. RATERMAN	DATE: 01/15/09	
APPROVED: R. GRANTHAM	DATE: 01/16/09	

SCALE 1:8 — SHEET 1 OF 2 — DWG NO. 5523-001 — REV E

Figure 4: Processor Isometric Drawing (1 of 2)

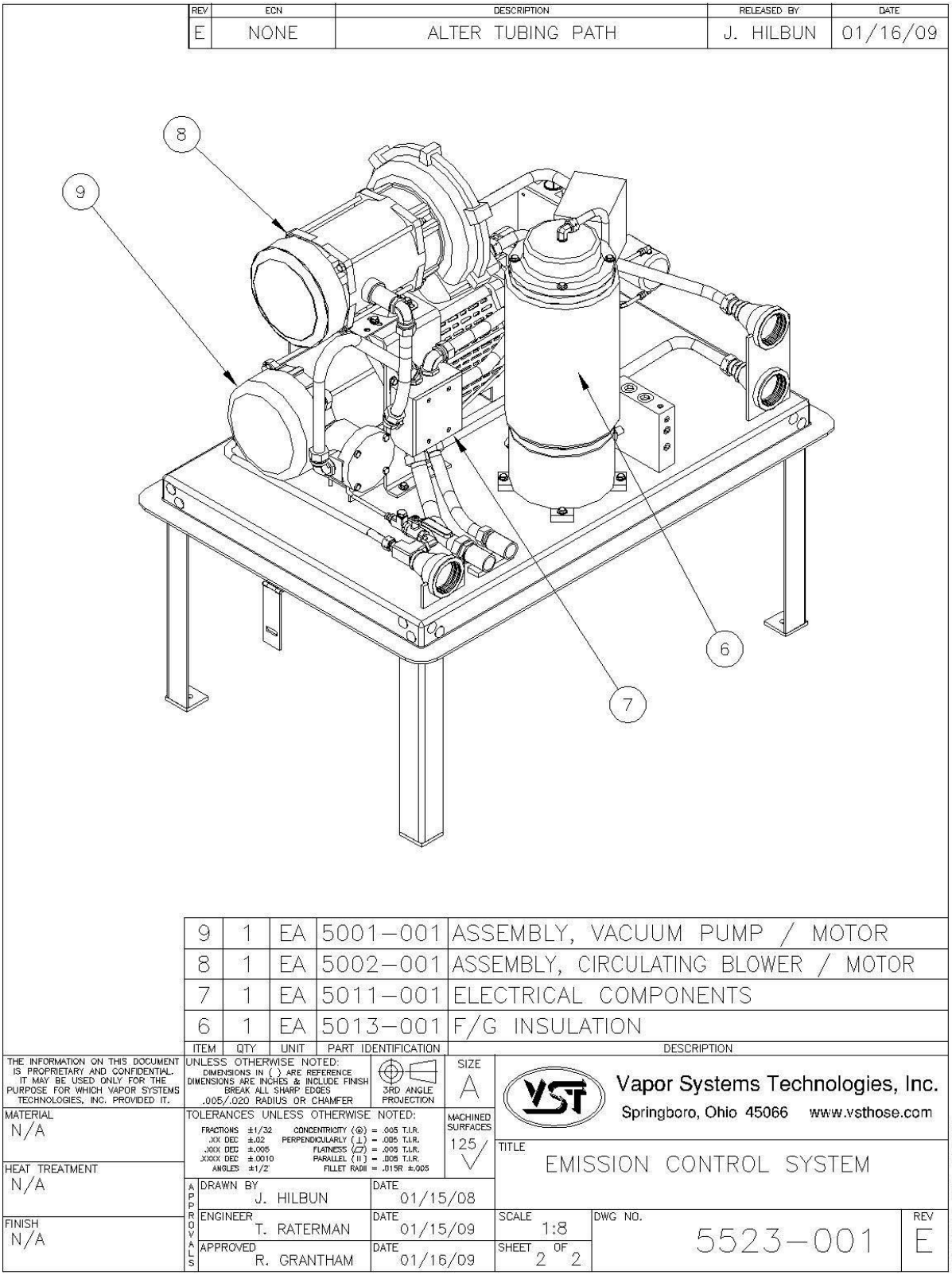


Figure 5: Processor Isometric Drawing (2 of 2)

2 Pre-Installation Site Survey

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

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

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

3 How the Processor is Shipped

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

4 Preparing the Processor for Installation

- Follow these steps to prepare the Processor for installation:

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

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

5 Pre-Installation *Processor* Leak Test

5.1 Purpose

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

5.2 Preparation

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

5.3 Functional Test Procedures

1. Place 2" NPT plugs in two of the pipe connection openings on the ECS unit. See Figure 6.

2. Install the Leak Test Fixture in the empty 2" pipe connection on the ECS unit. See Figure 7.

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 6: Processor Inlets & Outlets

Figure 7: 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

Local Air Pollution Control District

- GDF must contact the local air pollution control district for specific local vapor-recovery requirements.

Ground-Mount Location

- The local jurisdiction must allow the *Processor* to be placed on the ground.
- The *Processor* must be protected from damage.
- *Processor* must be located at least 10' from the property line.
- *Processor* must be within 100' of the vent risers.

Roof-Mount Location

- The local jurisdiction must allow the *Processor* to be placed on the roof.
- Structure must be strong enough to hold the weight of the *Processor:*
  - ► Three-phase 350 lbs. (Incl. alum. cover wt.).
  - ► Single-phase 385 lbs. (Incl. alum. cover wt.).
- VST recommends a 18" perimeter around the *Processor* for maintenance and testing.
- The height of the *Processor* must be above the building parapet to allow for the proper vapor-piping slope.

Canopy-Mount Location

- The local jurisdiction must allow the *Processor* to be placed on the canopy.
- Structure must be strong enough to hold the weight of the *Processor:*
  - ► Three-phase 350 lbs. (Incl. alum. cover wt.).
  - ► Single-phase 385 lbs. (Incl. alum.cover wt.).
- VST recommends a 18" perimeter around the *Processor* for maintenance and testing.
- All safety and code concerns have been addressed.

Three Phase Electric

- 3 empty breaker spaces 208/230-460v panel for blower and vacuum pump motors.
  - ► (1)115v breaker for the heat-trace cable.
  - ► (1) 115v outlet for the HC sentry.
  - ► GFCI protected, weatherproof, 115v convenience outlet located at the *Processor* is optional.
- 2-hp vacuum pump / ½-hp blower.

Single Phase Electric

- 2 empty 115v breaker spaces in the panel for the blower and vacuum pump motors.
  - ► (1) 115v breaker for the heat-trace cable.
  - ► (1) 115v outlet for the HC sentry.
  - ► GFCI protected, weatherproof, 115v convenience outlet located at the *Processor* is optional.
- 2-hp vacuum pump / ½-hp blower.

Vent Risers

- Recommended slope of ¼" per foot on all vapor-piping connecting the *Processor* to the vent risers or to any other UST connection. (VST requires a minimum of 1/8" per foot minimum slope for all vapor piping.)
- The maximum distance the *Processor* can be from the vent risers is 100-feet.
- Any type of trap, regardless of the *Processor* location, is not permitted in any vapor lines connected to the *Processor*.
- To install the *Processor*, there must be two vent risers connected at different locations to the UST's or to the underground vapor piping.
- If only one vent riser exists, another one must be added. Trenching to a UST or underground vapor piping is required in order to add the second vent riser.
- A 5' radius around the vent riser P/V valve is a Class I, Div. 2 hazardous area as defined in NFPA 70.

Snapshot of Site Requirements, continued . . .

UST Manifolding	Dispenser	CARB Requirements
• UST's must be manifolded below ground. • There must be at least two separate vent lines, which are not manifolded together.	• Must be a Balance dispenser. • The dispenser vapor piping must be sized adequately to meet the maximum pressure drop requirement, Item 1 of the Vapor Collection section. A minimum one inch (1") nominal internal diameter for the vapor down-pipe is recommended. **Veeder-Root Controls** • Must have TLS-350 with Veeder-Root software installed.	• VR-203 PMC • VR-204 ISD

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 ¼" per foot slope. (VST requires a minimum of 1/8" per foot slope.)
- The *Processor* must be installed in accordance with the NEC and the NFPA standards.
- 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 3.

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

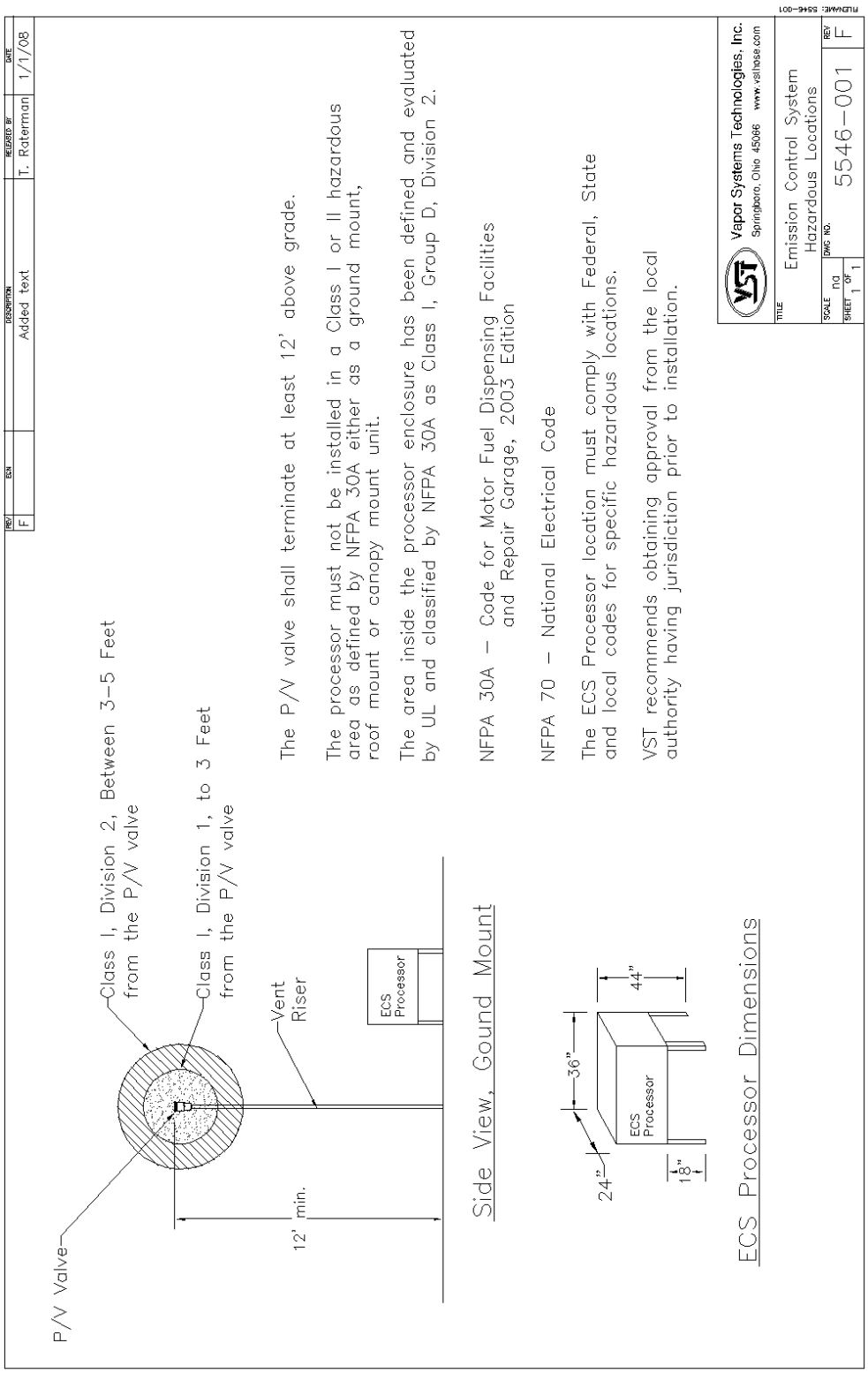


Figure 8: ECS Membrane Processor Hazardous Locations

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 9.
- 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 ½" to 4" into the slab
  - ► Extend approx. 1 ½" 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 10 or an approved equal.
3	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. ► The contractor or design engineer is responsible for sizing the expansion anchors and the concrete pad to meet seismic and cracked concrete specifications required by local, state, and federal jurisdictions. ► Since seismic regulations may be different by location, VST has not included a specific drawing for this application. ► For seismic design reference, www.us.hilti.com.
4	After the appropriate anchor bolts have been installed, position the *Processor* onto the anchor bolts in the cement slab.
5	Bolt the *Processor* 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.

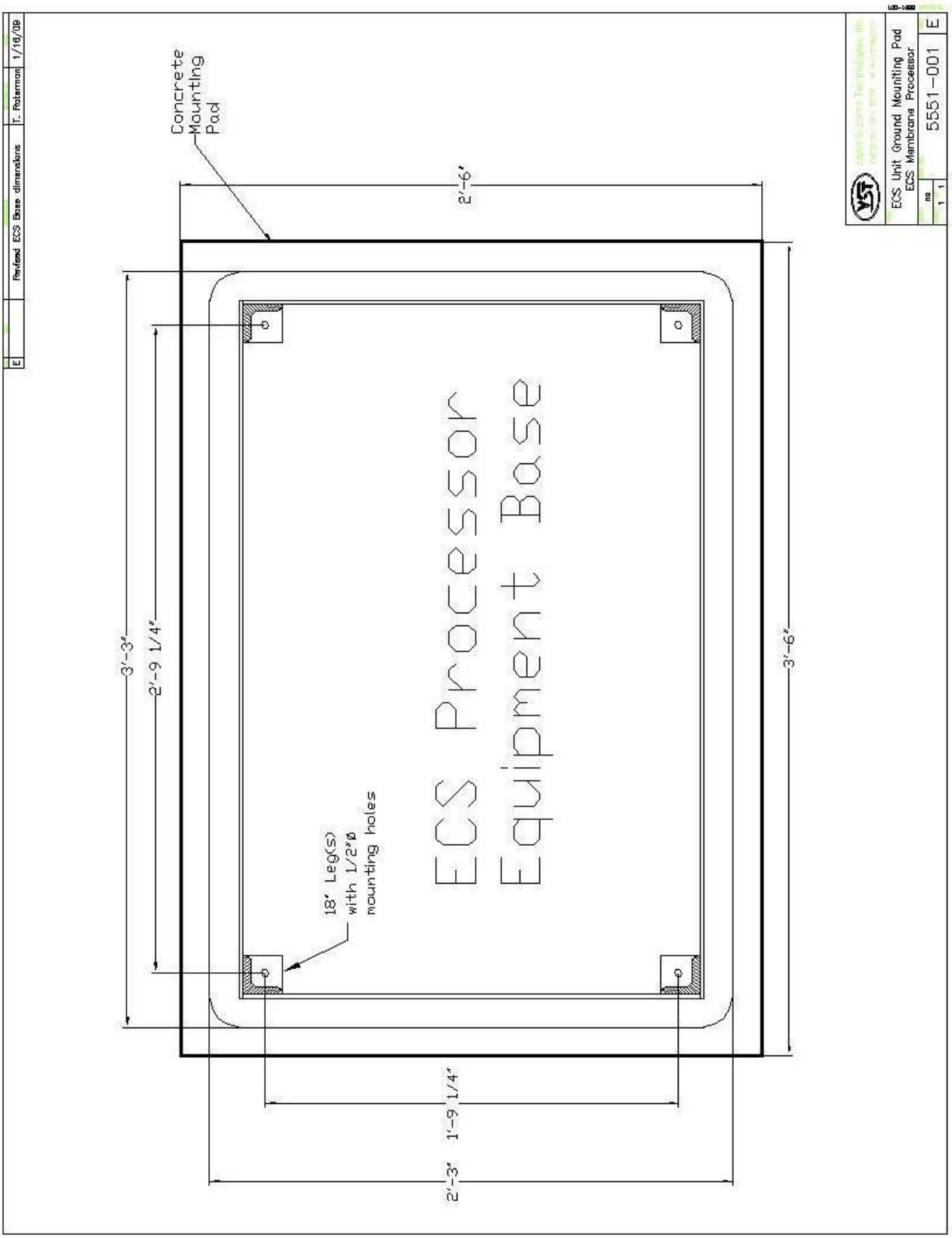


Figure 9: Concrete Mounting Pad Dimensions

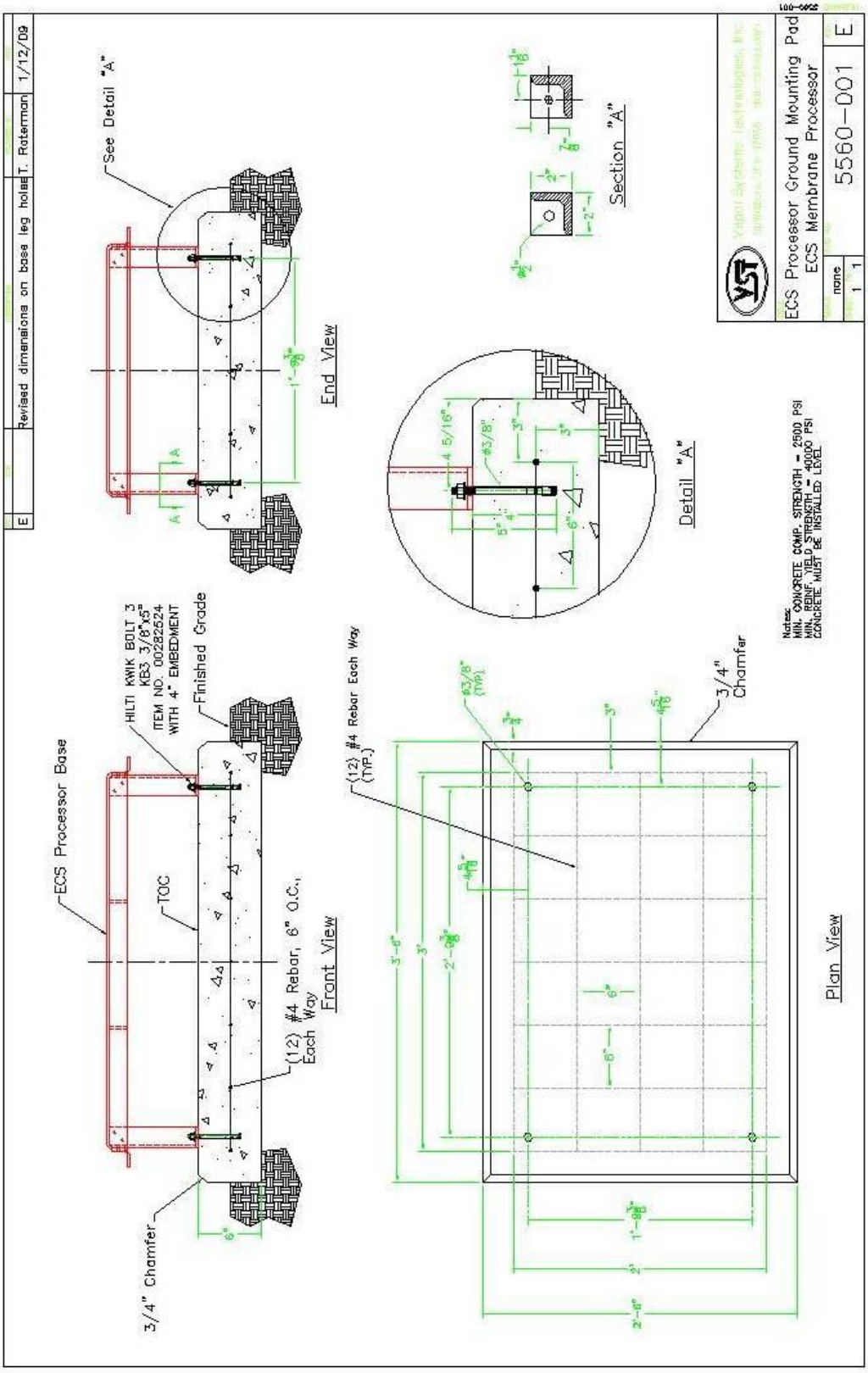


Figure 10: Processor Ground Mounting Pad

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 <u>can be built upon</u>."
  - ► 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 ¼" 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.

<u>CAUTION</u>

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

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

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

9 Canopy Top Installation

9.1 Canopy Top Installation Safety

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

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

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

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

CAUTION

Always obtain approval from the local authority having jurisdiction.

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

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

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

  NOTE: THE MINIMUM PIPING SLOPE MUST ALWAYS BE MAINTAINED.

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

10 Vapor Piping

10.1 Vapor Piping Safety

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

10.2 Piping Connection Material

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

10.3 Piping Connections to the Processor

- There are 3 piping connections to be made to the *Processor*:

1. Vapor inlet from the UST vapor-piping system
2. Vapor return back to the UST vapor-piping system
3. Air outlet to atmosphere

- The typical installation will have:
  - ► The *Processor* vapor inlet connected to the high-grade UST vent.
  - ► The *Processor* vapor return connected to the low-grade UST vent.
  - ► The *Processor* vapor air outlet vent riser is to be added next to the existing UST vent risers if possible.

CAUTION

Always obtain approval from the local authority having jurisdiction.

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

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

10.3.1 Flexible Connections

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

10.4 Trenching

- The *Processor* may be installed without any trenching provided:
  - ► There are at least 2 vent risers connected to the UST's.
  - ► The vent-riser piping connecting to the UST's will not short circuit the *Processor*.
- Trenching will be required if only one vent riser exists at the GDF to connect the *Processor* to the UST's.
  - ► When one vent riser exists at a GDF, trenching is required to return the concentrated vapor from the *Processor* to the UST's.
  - ► The existing vent riser will be used as the "Vapor Inlet" connection to the *Processor*.
  - ► A new vent riser must be installed that connects the *Processor* to the UST's.
    - The connection pipe must be a minimum of 2" ID for all underground piping.
    - All new piping must be sloped back to the UST's.
    - VST recommends a ¼" 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

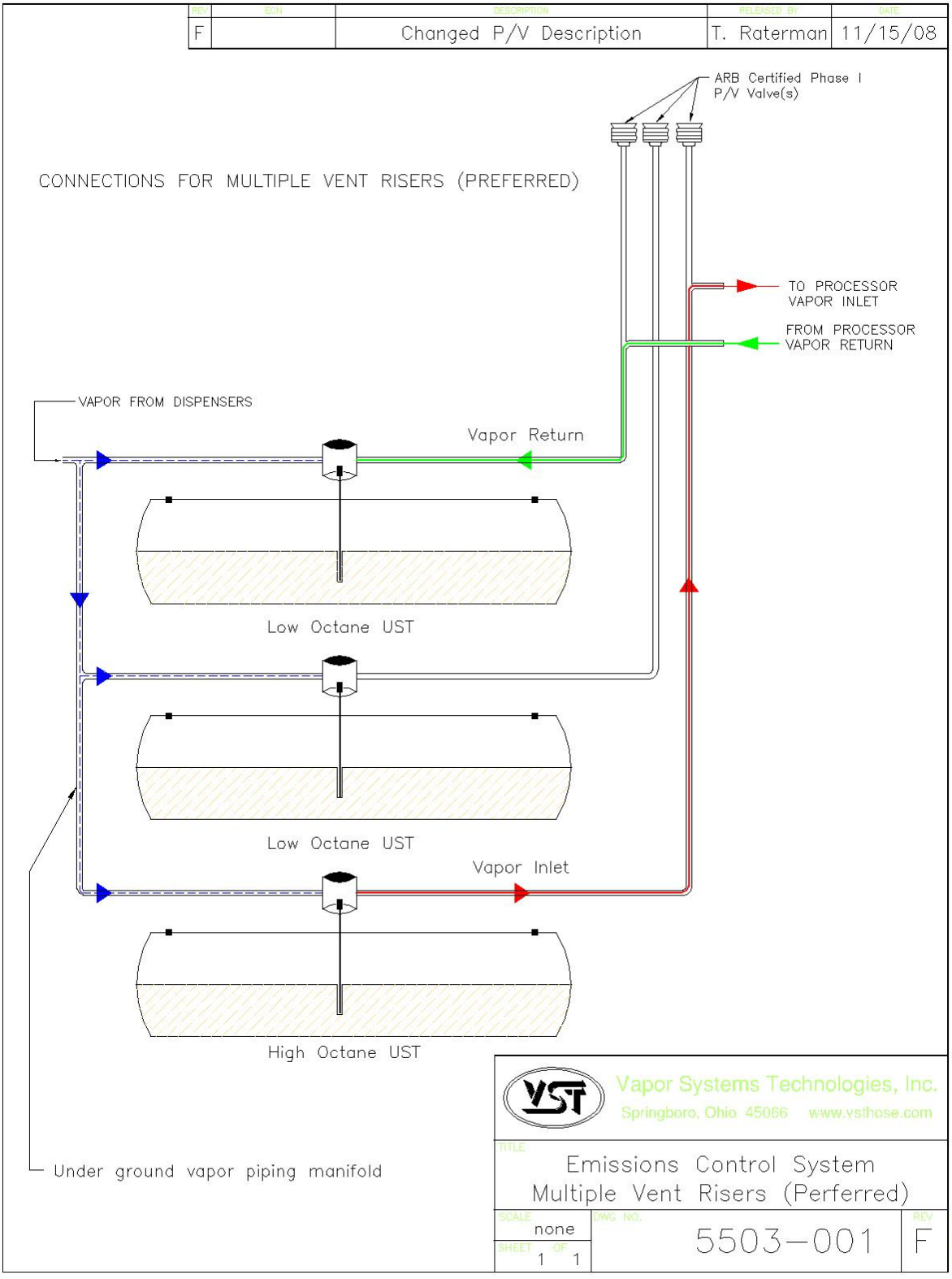


Figure 11: Processor Connections with Multiple Vent Risers

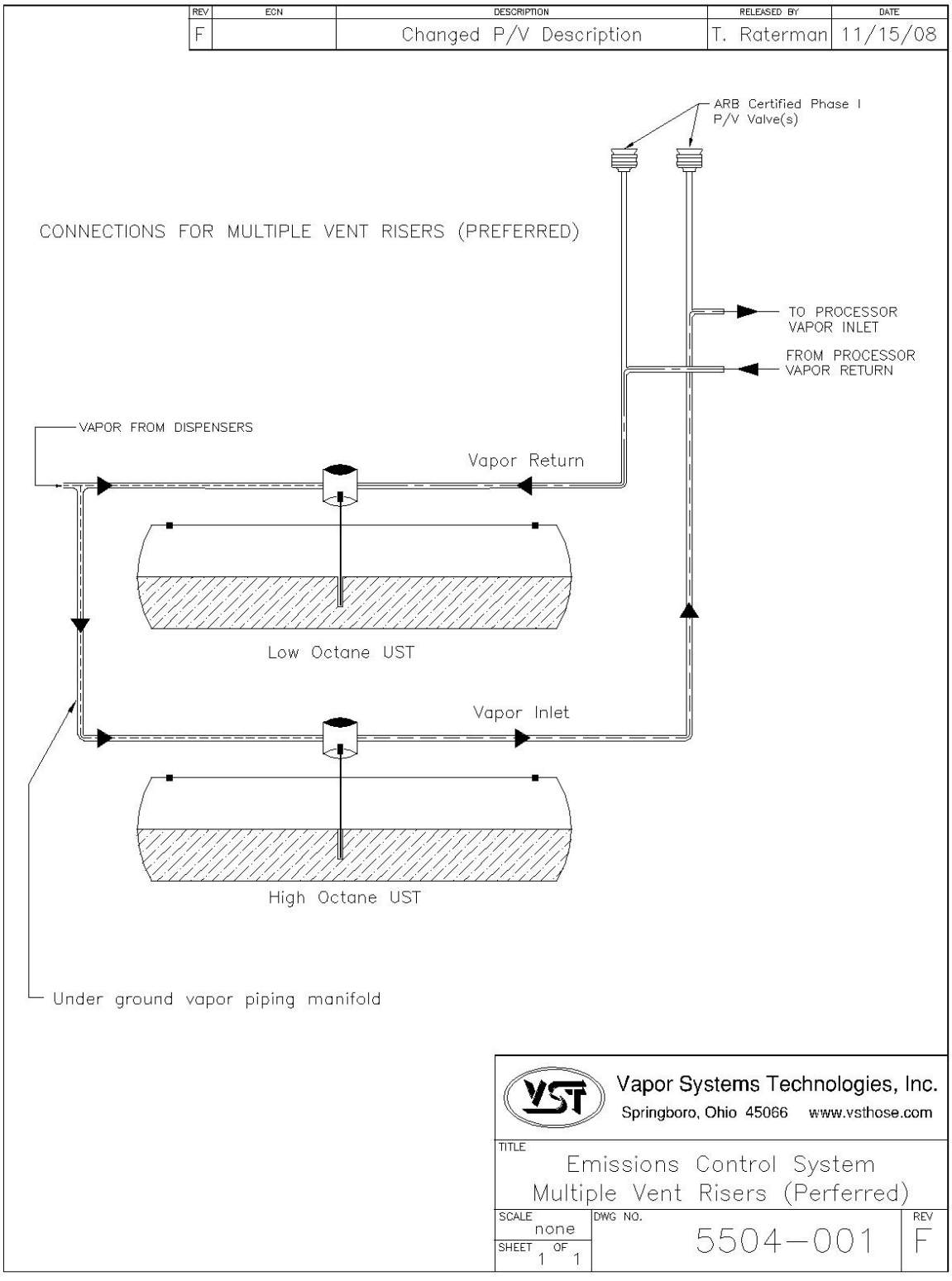


Figure 12: Processor Connections with 2 Vent Risers

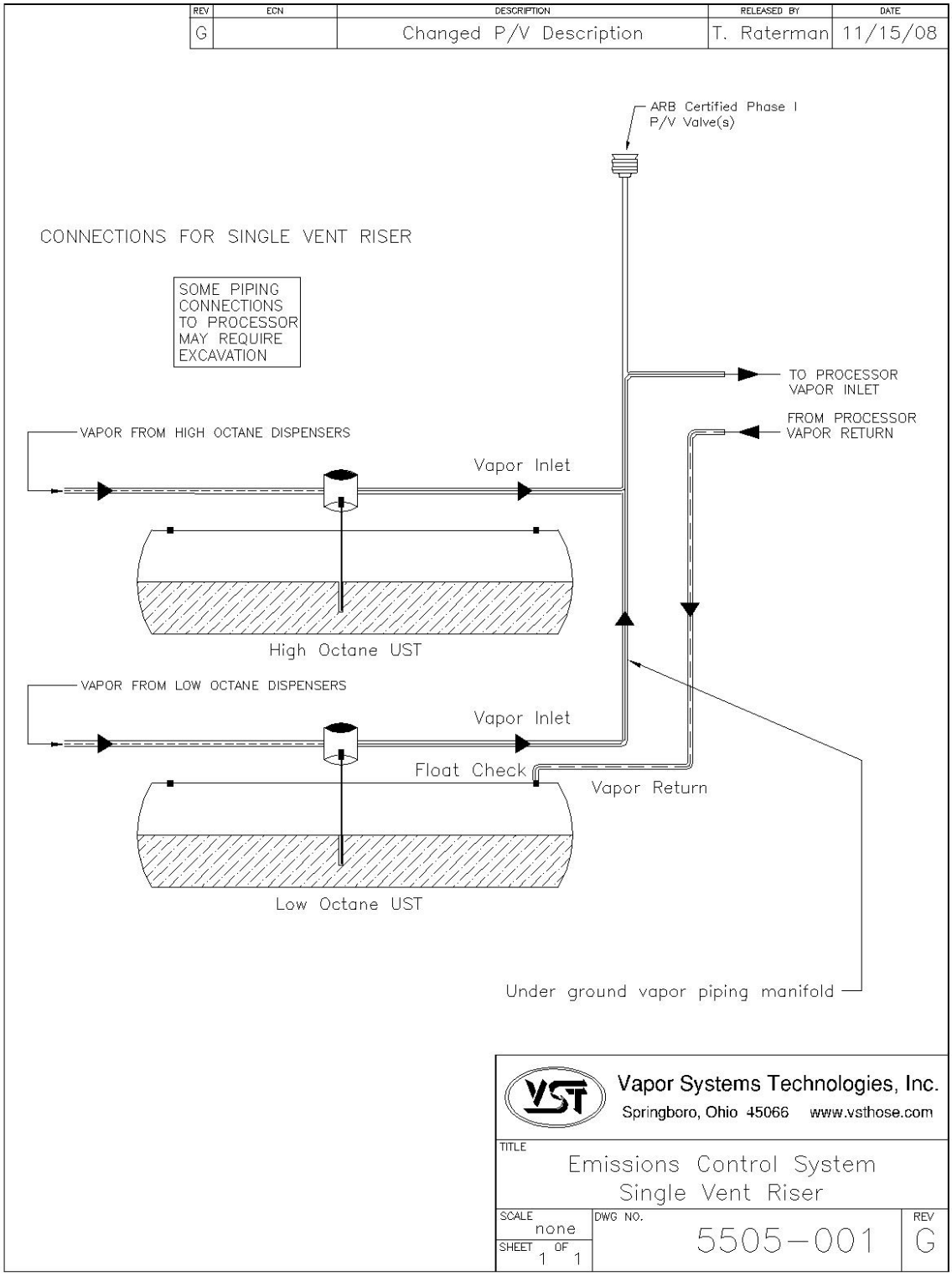


Figure 13: Processor Connections with Single Vent Riser

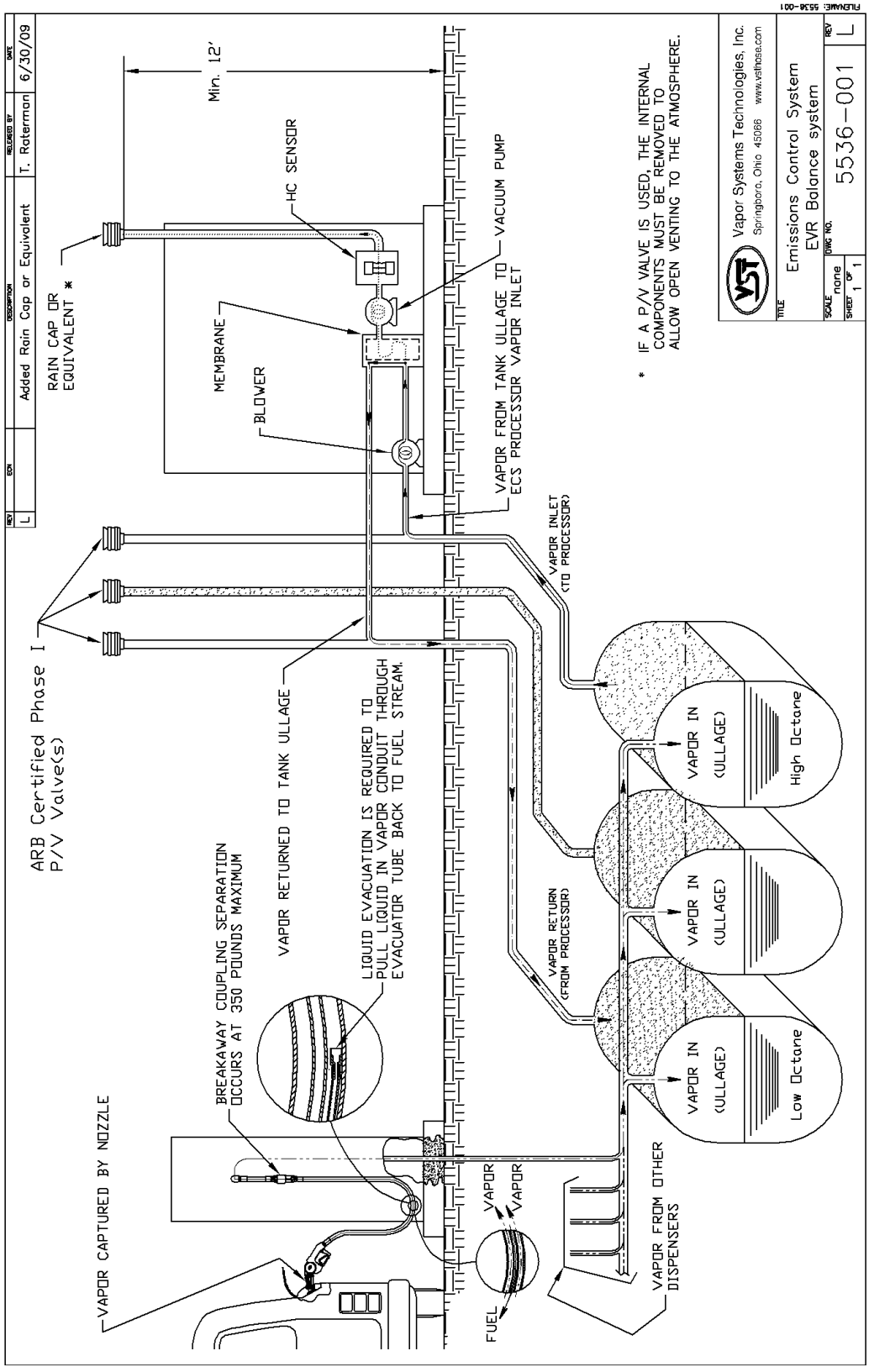


Figure 14: Typical GDF Vapor Piping Diagram for Processor

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 15 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 15.

- 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 ¼" 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.

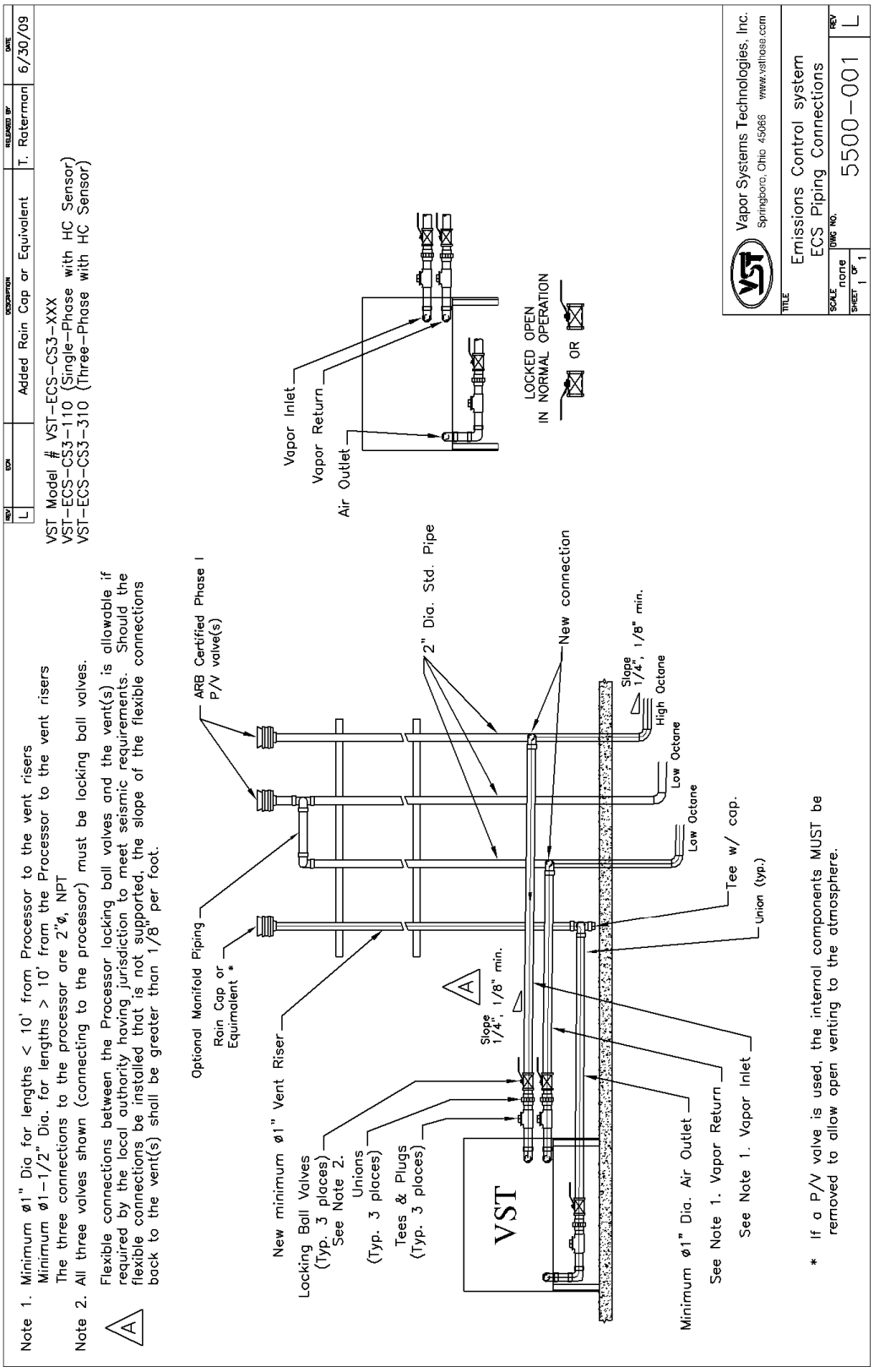


Figure 15: ECS Processor Piping Diagram

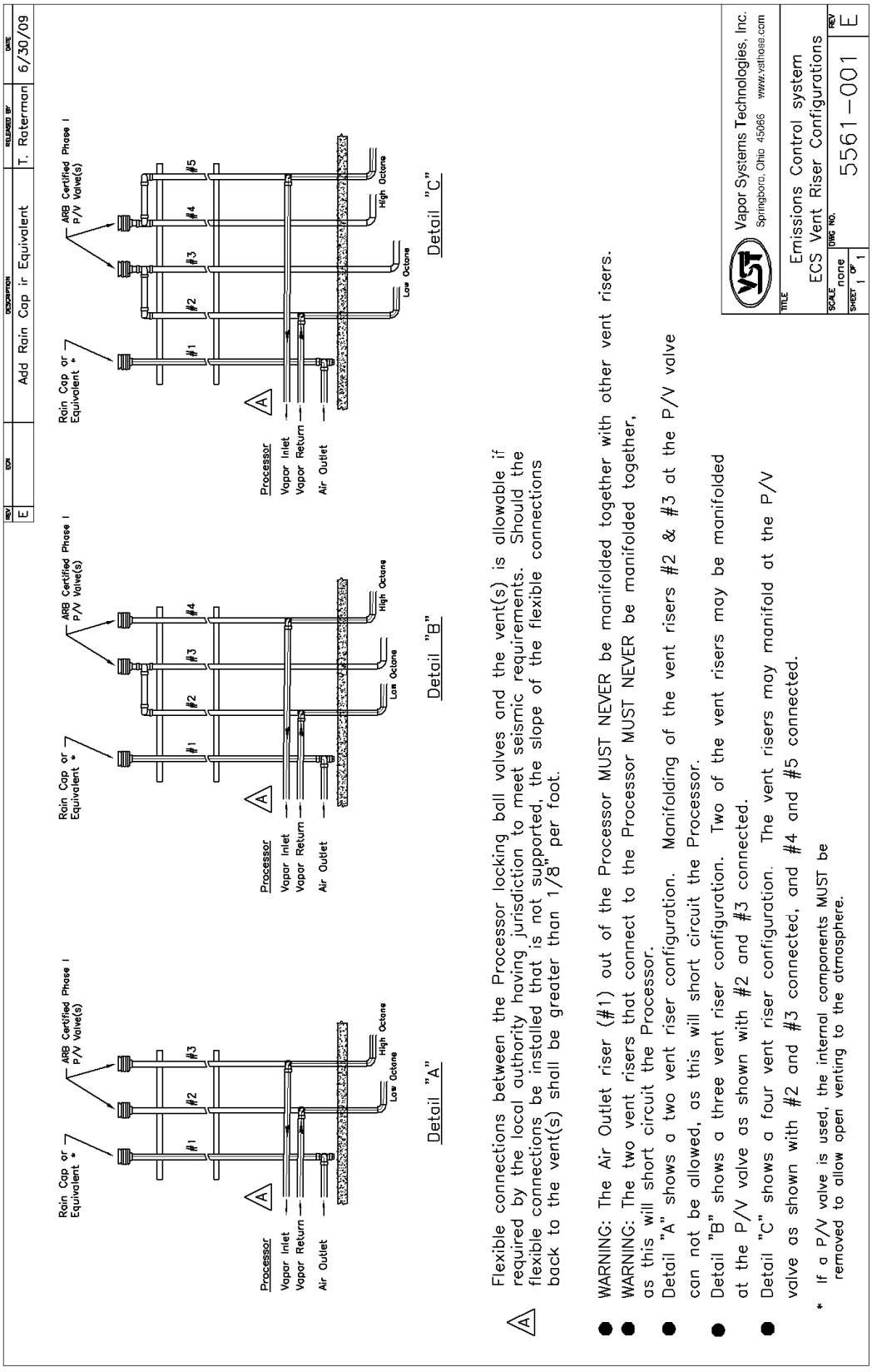


Figure 16: ECS Vent Configuration

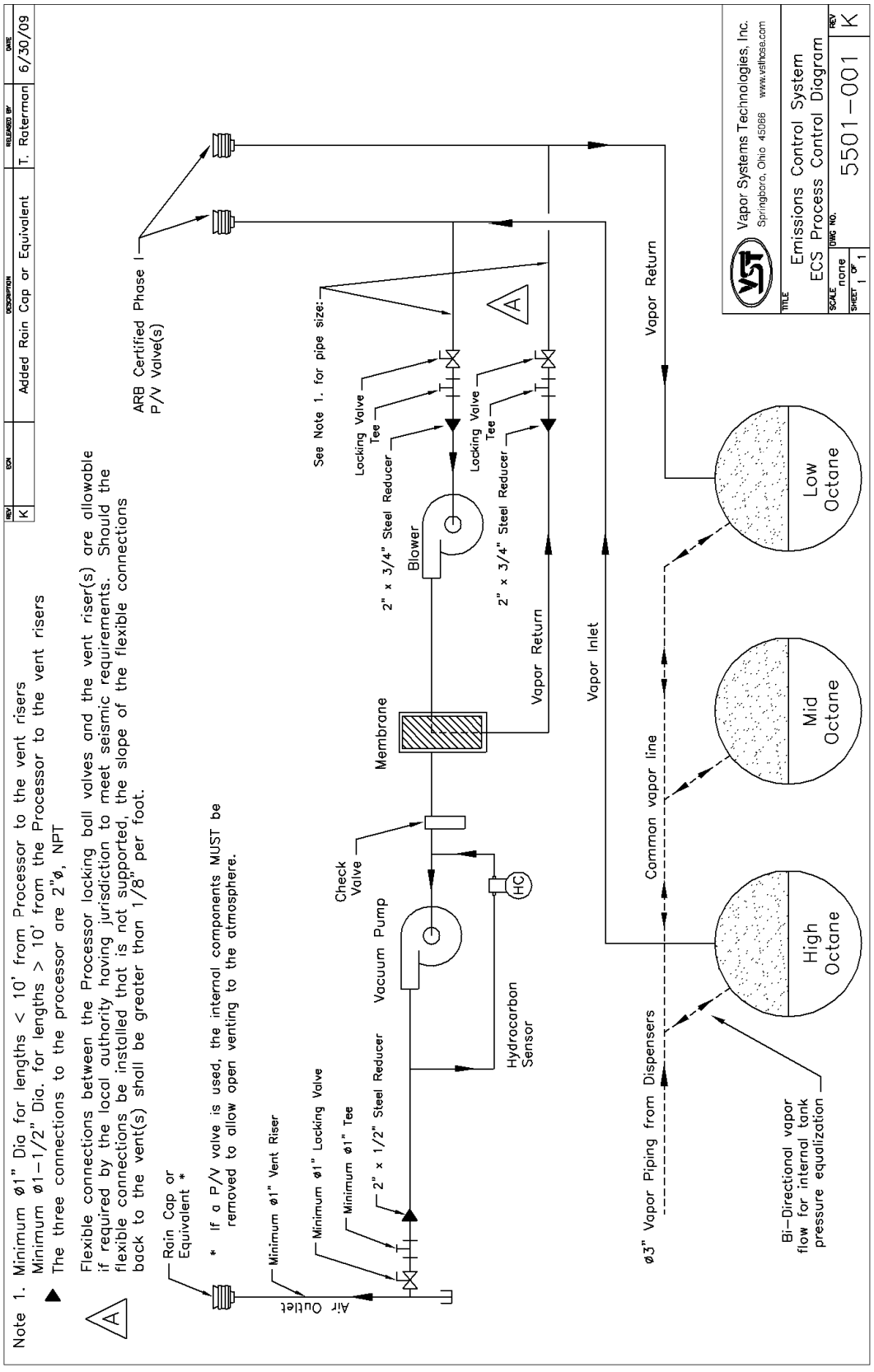


Figure 17: Processor Piping Connections

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 in 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 20.

- 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 25.

- 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).

1. The HC sentry must be installed indoors in the GDF's electrical room.

2. All electrical/control components must be installed per the NEC, with clear access for personnel.

3. 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.

4. 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*.

5. 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.

6. Install the *Processor* in accordance with the National Electrical Code (NFPA 70) and the Automotive and Marine Service Station Code (NFPA 30A).

7. 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 20 and figure 25, which are the Processor ESO (Emergency Shut-Off) wiring diagrams.

8. 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*.

9. 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 18.
  - ► See Figure 19.
  - ► See Figure 20.

- Single-phase motors wiring diagrams:
  - ► See Figure 21 for the vacuum pump single-phase motor wiring diagram
  - ► See Figure 22 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 23.
  - ► See Figure 24.
  - ► See Figure 25.

- Three-phase motors wiring diagrams:
  - ► See Figure 26 for the vacuum pump three-phase motor wiring diagram.
  - ► See Figure 27 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 Electical 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 in 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 ¾" 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 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.

13.2.3 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 ¾" diameter conduit connections on the *Processor*.
  - ► There are two ¾" diameter conduit connections on the *Processor*.
  - ► The contractor may decide to use either one or both of these conduits depending on:
    - The configuration of the electrical switch
    - Single phase or three phase *Processor*
    - Size of the wire used in the *Processor*

13.2.4 Wiring between the Processor and components:

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

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

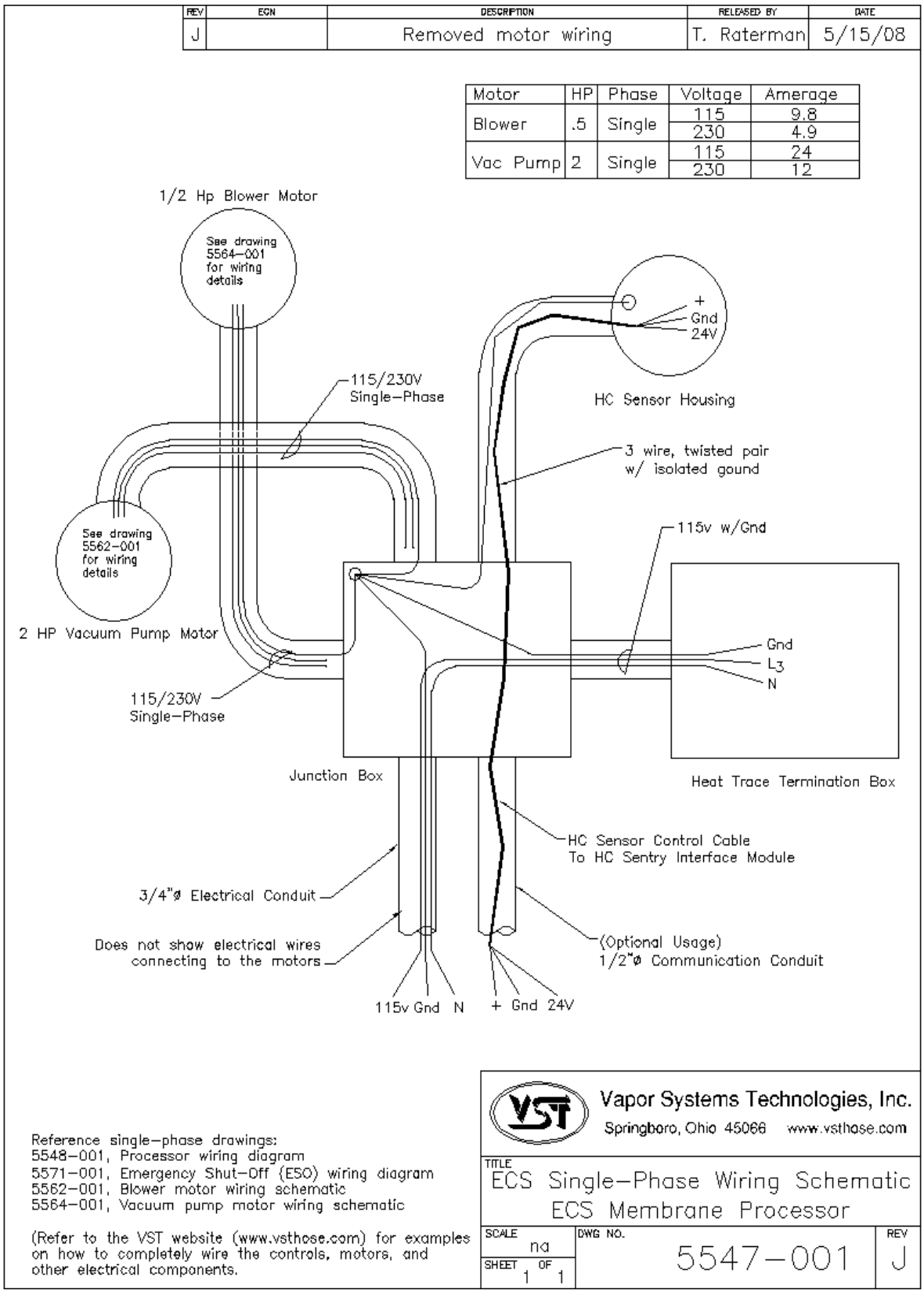


Figure 18: Single-Phase Wiring Schematic

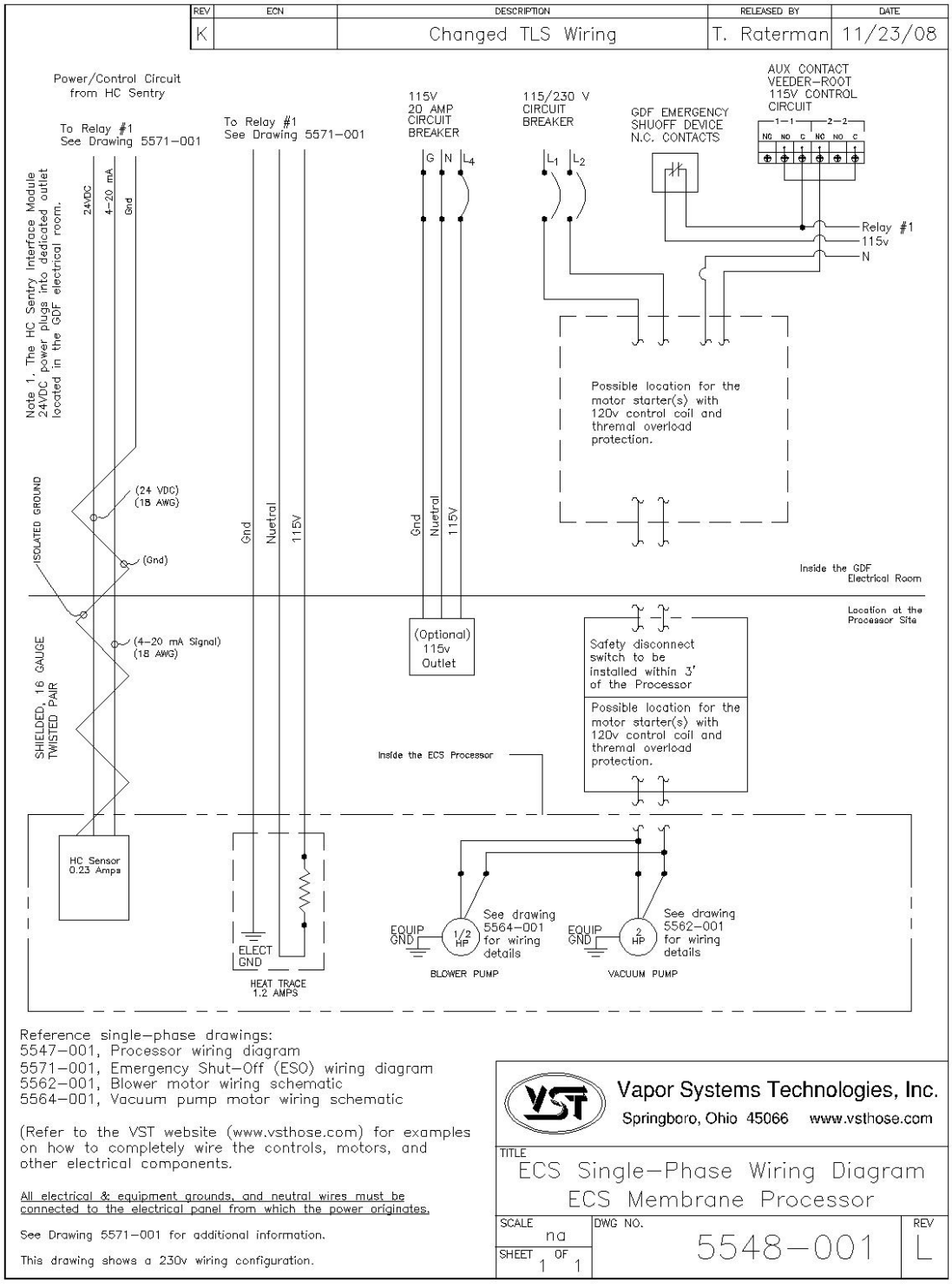


Figure 19: Processor Single-Phase Wiring Diagram

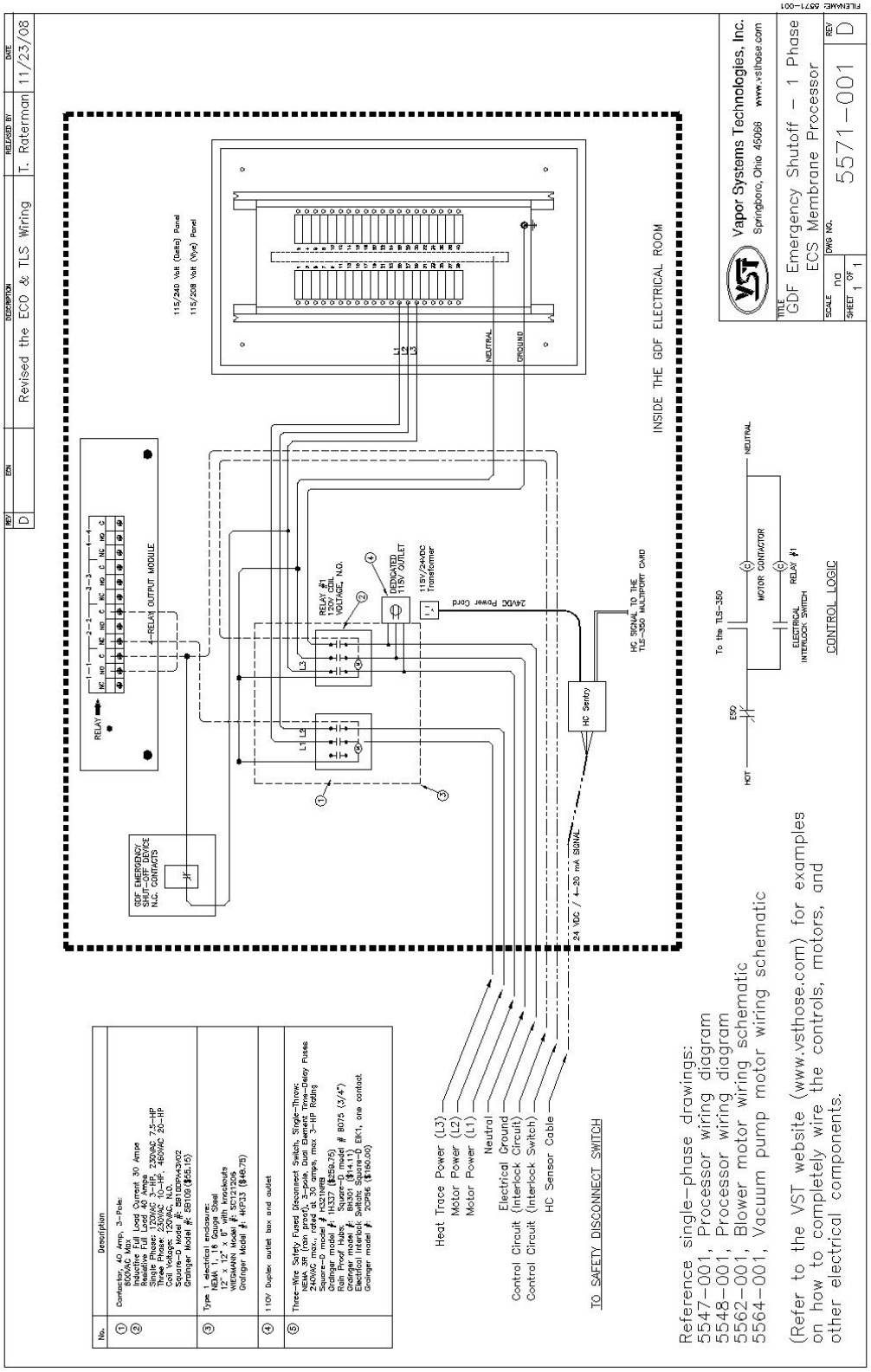


Figure 20: Processor Single-Phase ESO Wiring Diagram

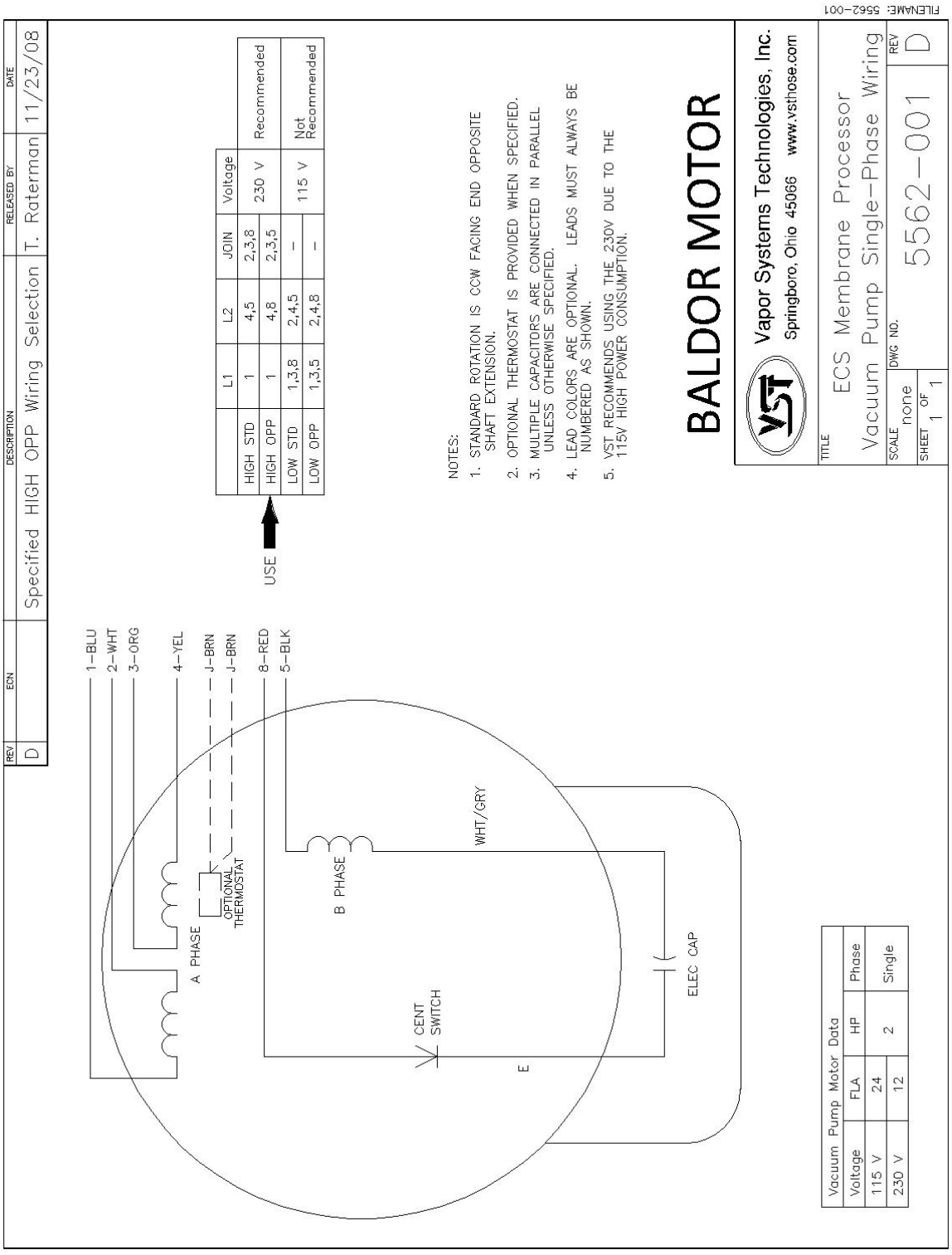


Figure 21: Vacuum Pump: Single-Phase Motor Wiring Diagram

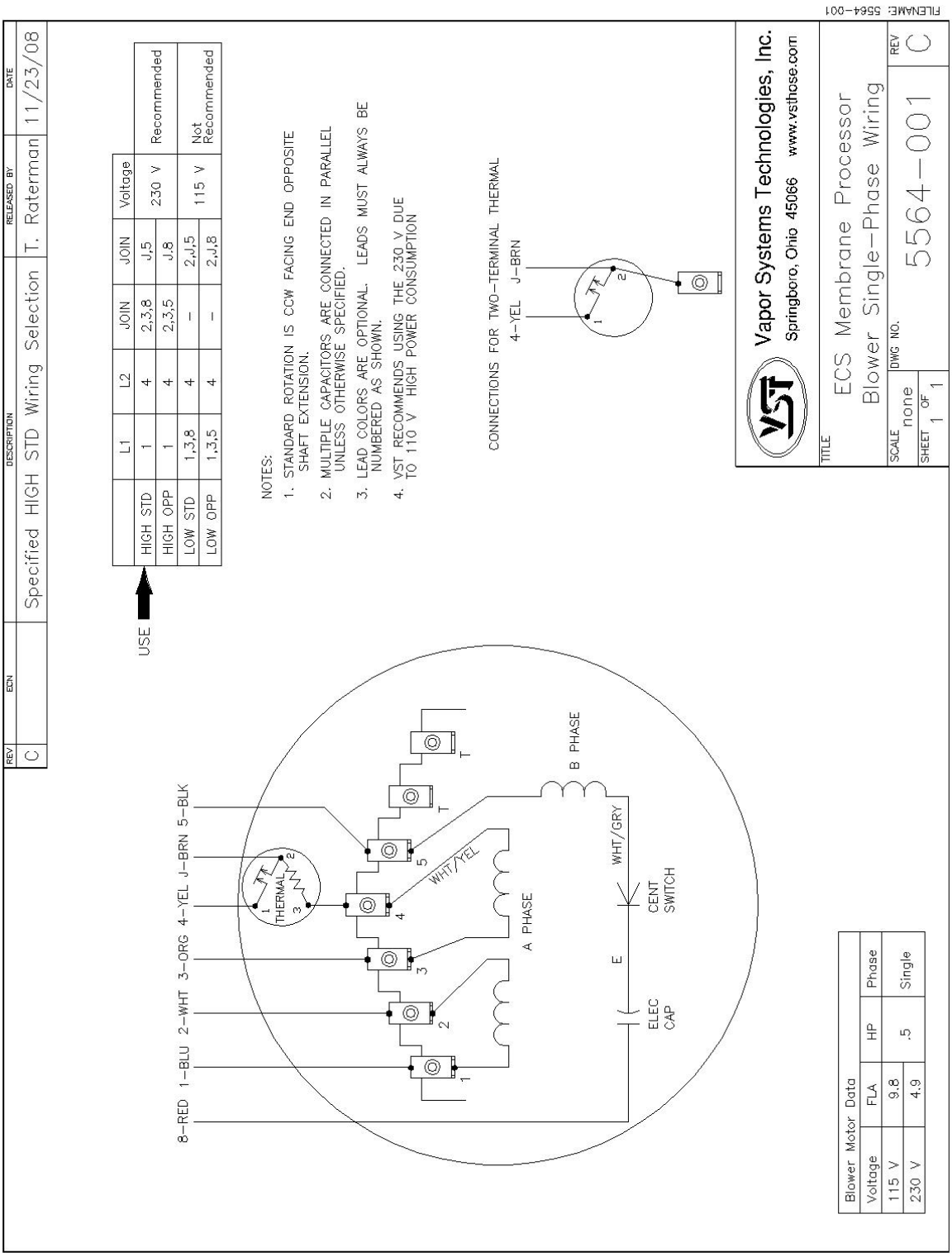


Figure 22: Blower: Single-Phase Motor Wiring Diagram

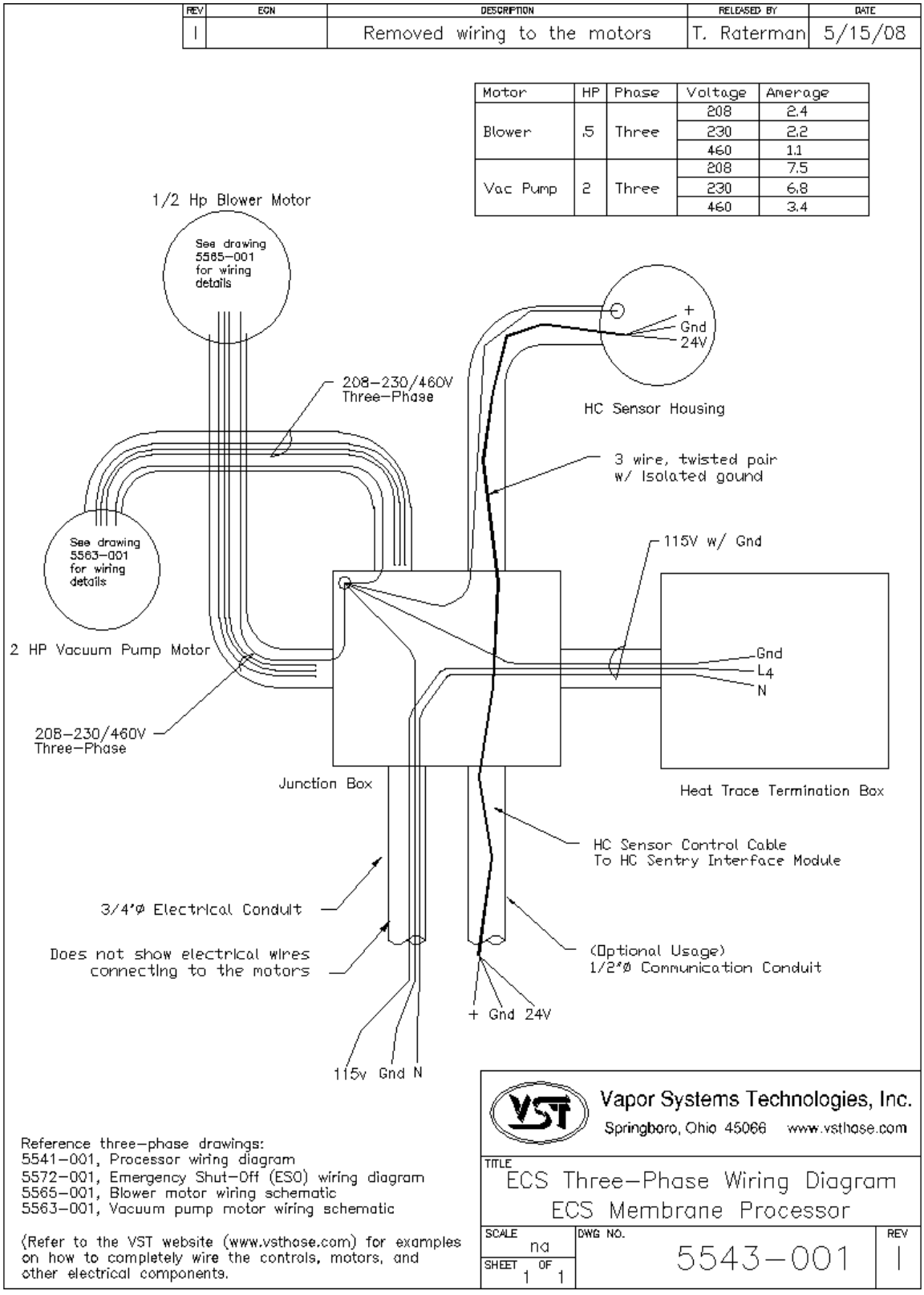


Figure 23: Processor Three-Phase Wiring Schematic

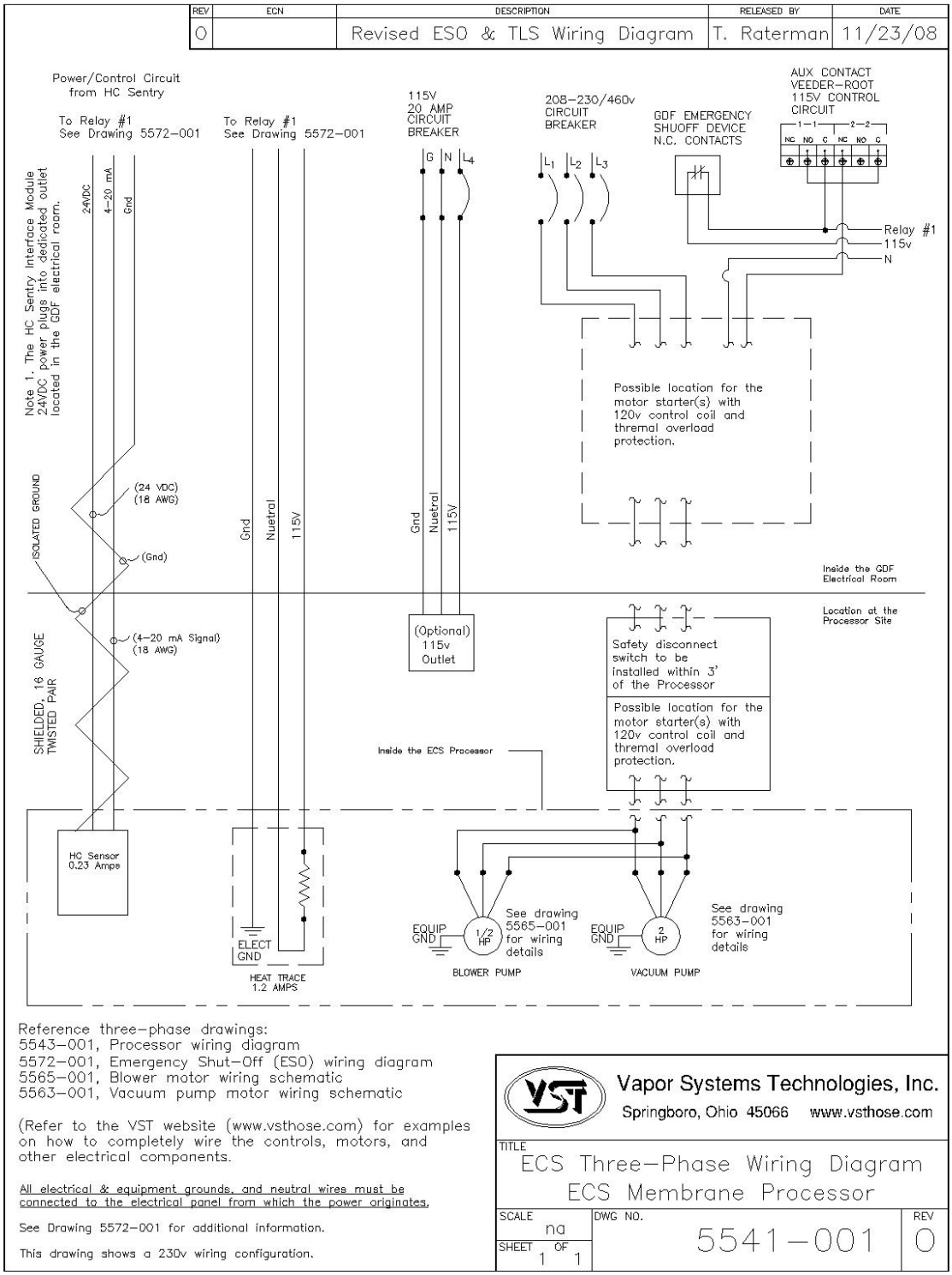
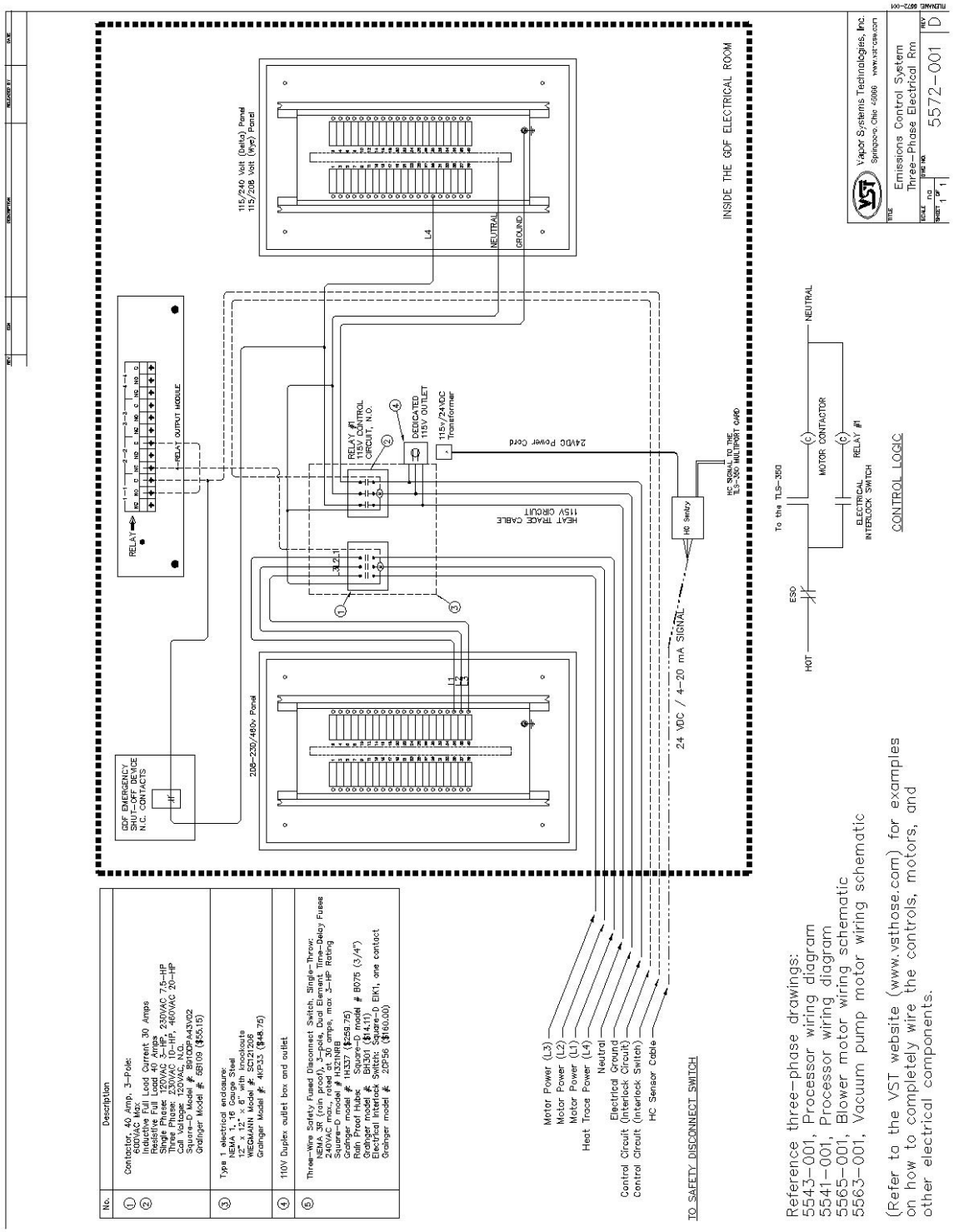


Figure 24: Processor Three-Phase Wiring Schematic



No.	Description
① ②	Contactor, 40 Amp, 3-Pole: Coil Voltage As Required Inductive Full Load Current 30 Amps Resistive Full Load 40 Amps Single Phase 120VAC 3-HP, 230VAC 7.5-HP Three Phase: 200VAC 10 HP, 460VAC 20-HP Coil Voltage: 120VAC N.O. Square-D Model #: 8910DP43V02 Grainger Model #: 5B109 ($55.15)
③	Type 1 electrical enclosure: NEMA 1, 16 Gauge Steel 14"L x 12"W x 6"D with knockouts WIEGMANN Model #: SC212306 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 Fuses (not shown) model # HSJ30 ($25.75) Ring Terminal Kit (not shown) model # B075 (3/4") Grainger model #: BH301 ($14.11) Electrical Interlock Switch: Square-D EIK1, one contact Grainger model #: 20P56 ($160.00)

Figure 25: Processor Three-Phase ESO Wiring Diagram

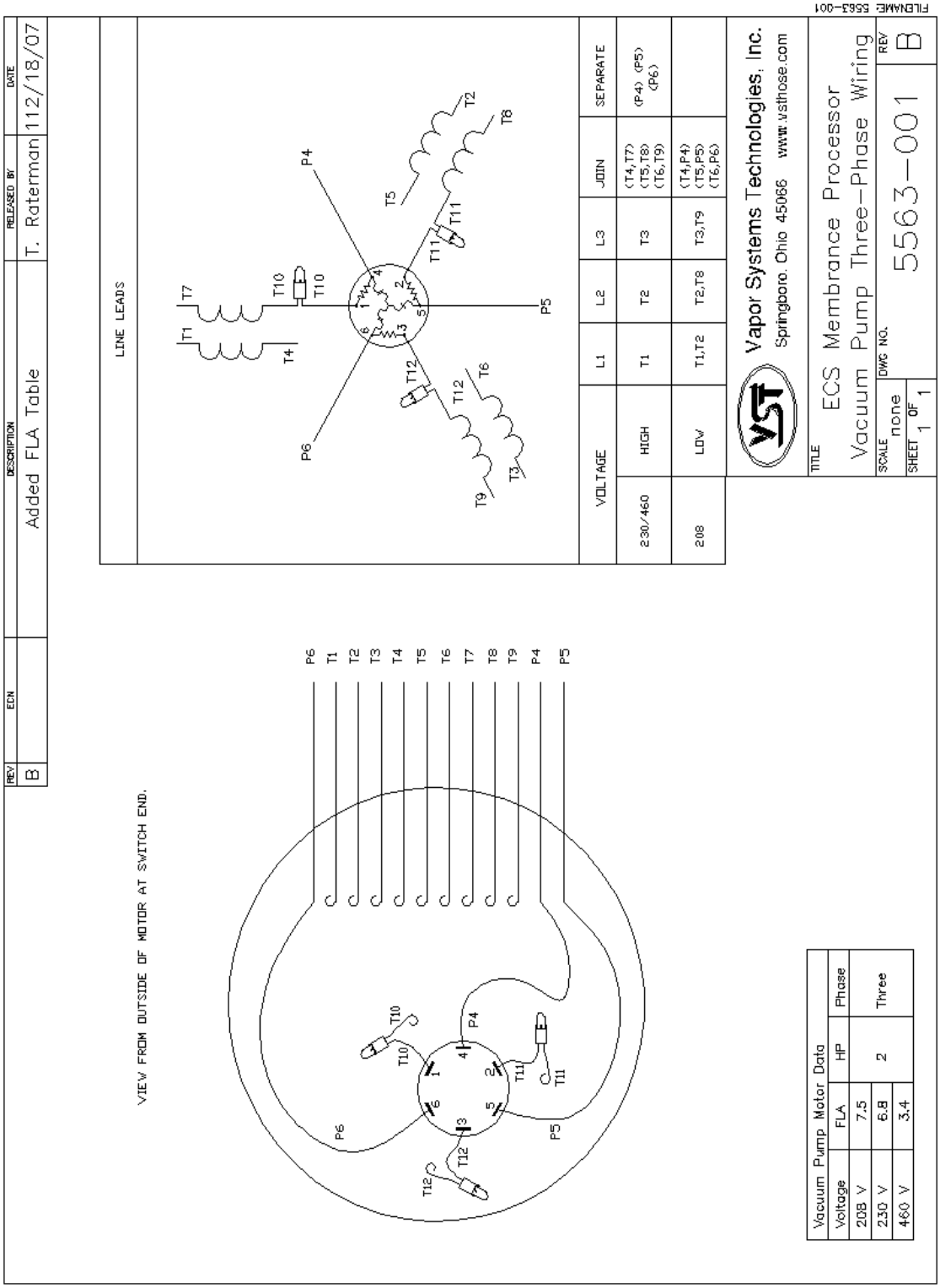


Figure 26: Vacuum Pump: Three-Phase Motor Wiring Diagram

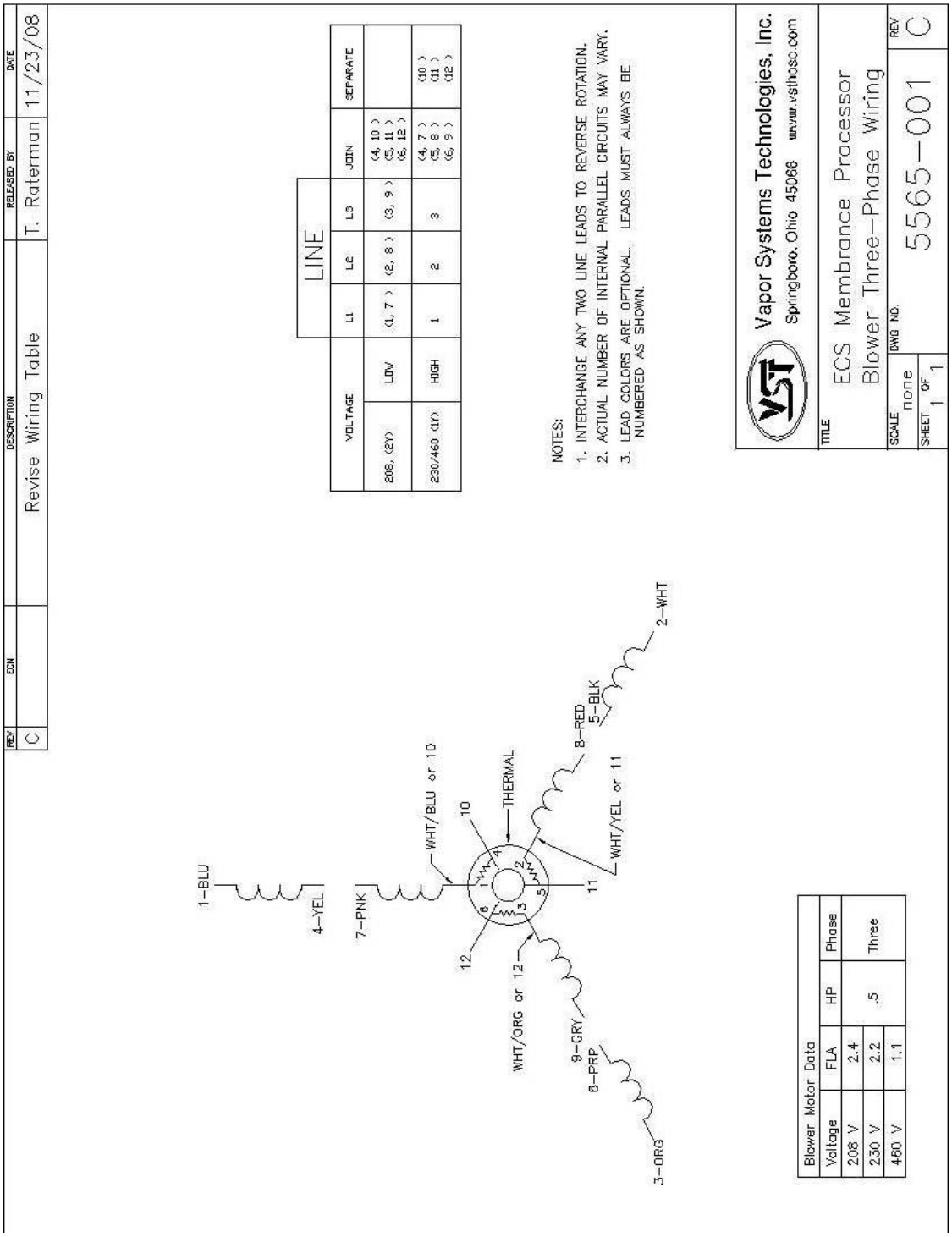


Figure 27: Blower: Three-Phase Motor Wiring Diagram

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 28.

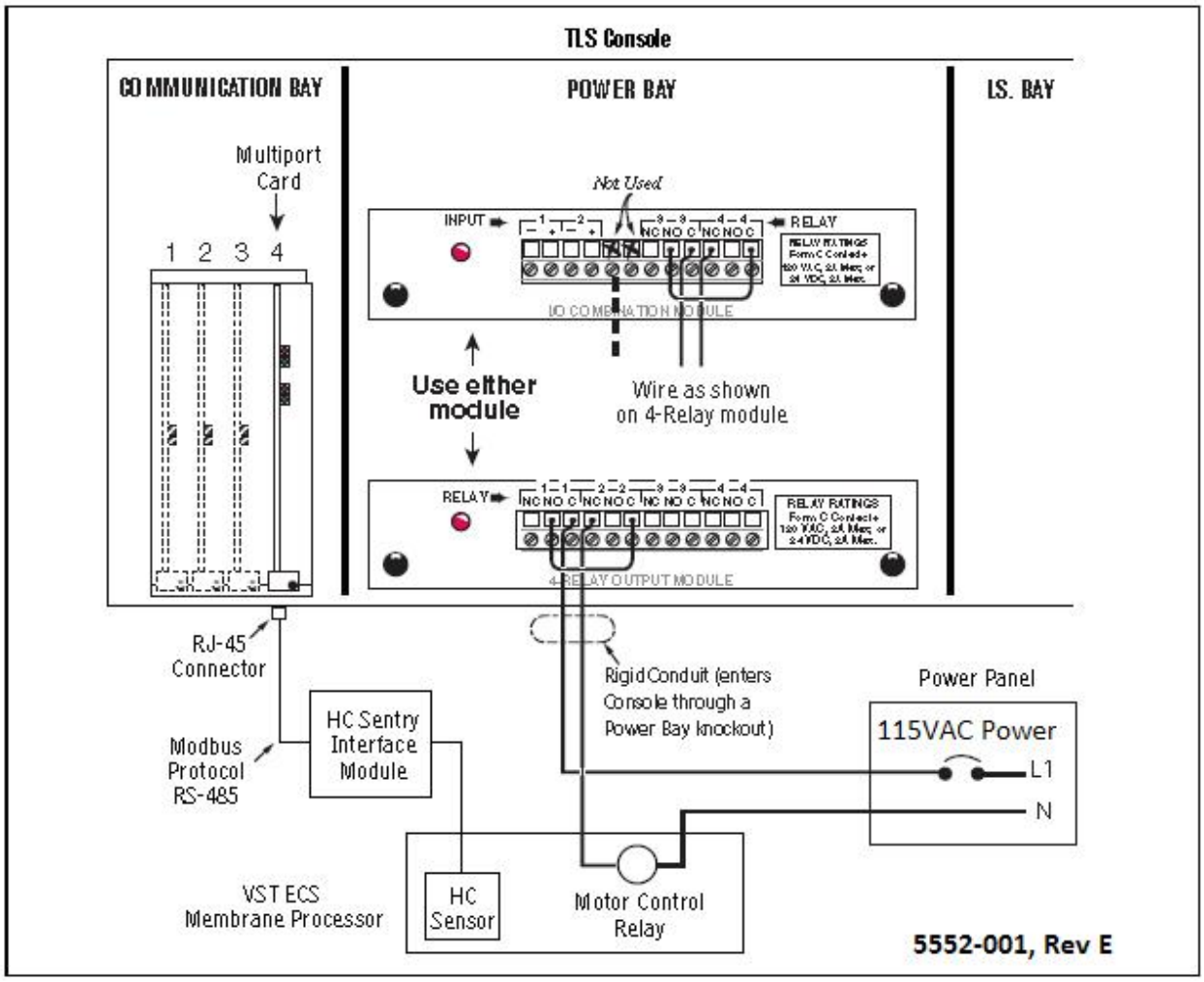
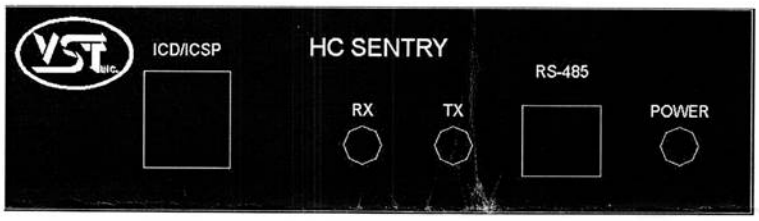


Figure 28: VR TLS Multi-Port Card Connection to HC Sentry Module

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.



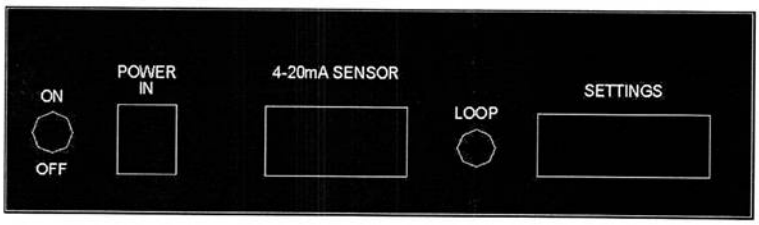
ICD/ICSP: This connector provides a means for performing in-circuit-debug and in-circuit-serial-programming utilizing the programming and debugging tools from the processor manufacturer. This connector will typically be used in production to perform initial programming, and could be used as a simple 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 29: HC Sentry Front & Back Views

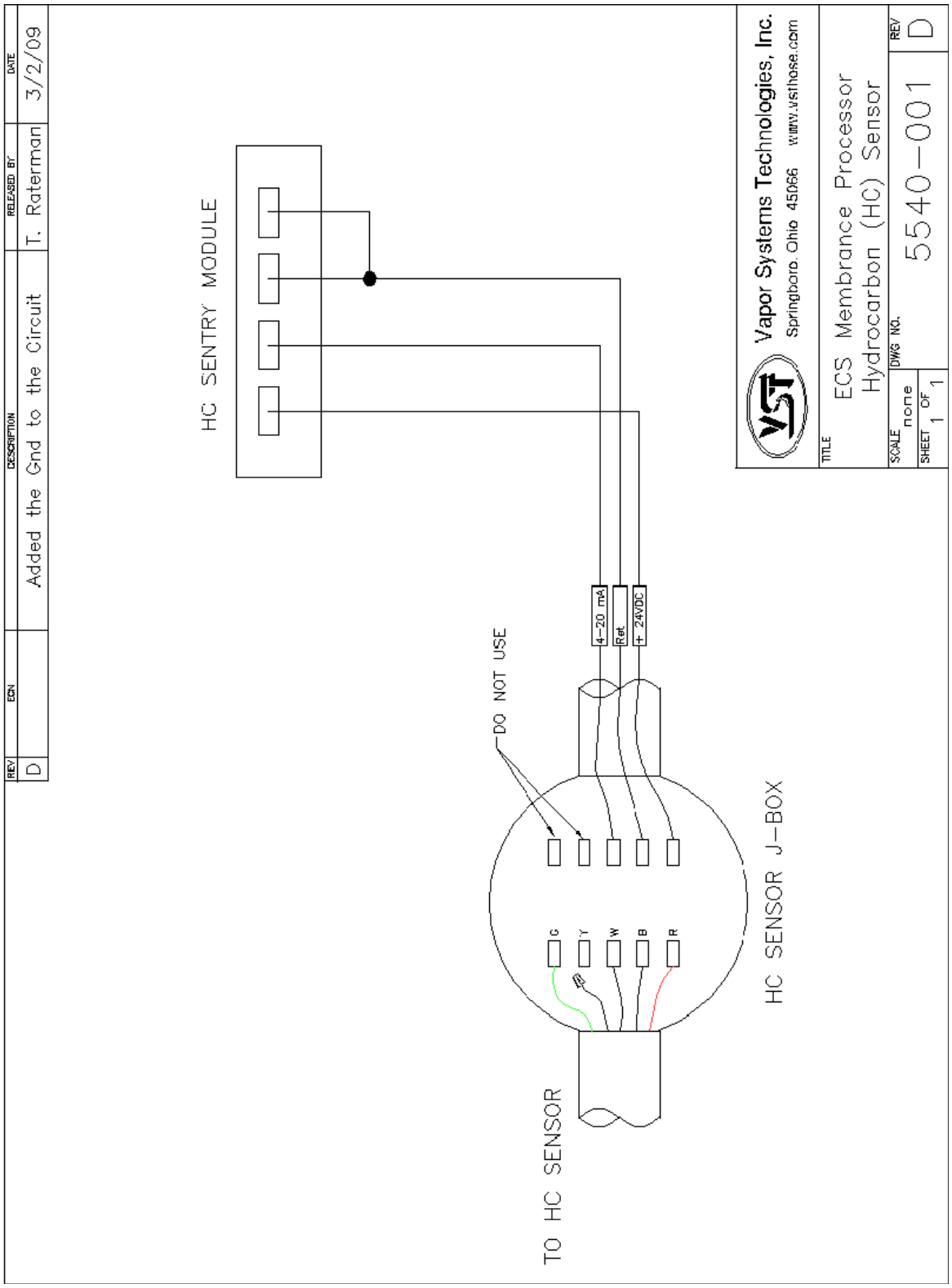
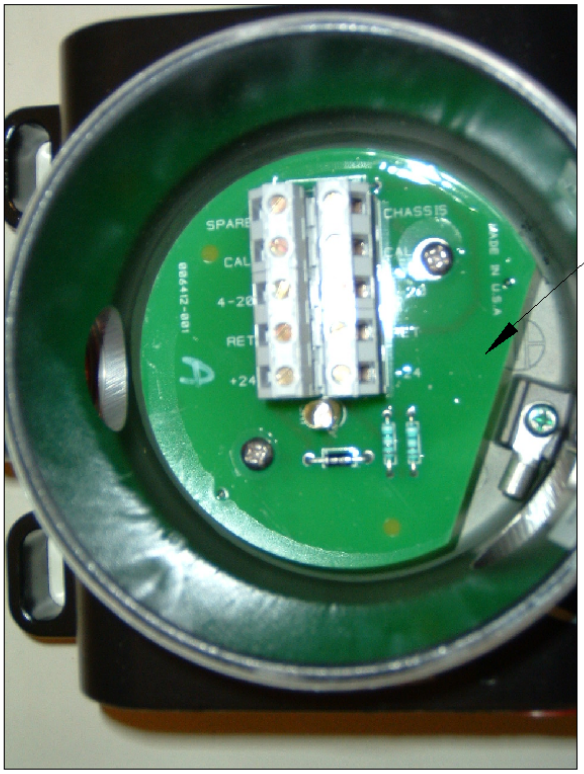


Figure 30: HC Sentry and HC Sensor Wiring Diagram

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



HC Sensor Junction box

HC Sentry (Front)

HC Sentry (Back)

Vapor Systems Technologies, Inc.
Springboro, Ohio 45066 www.vsthose.com

TITLE
Emission Control System
Hydrocarbon Sensor

SCALE	DWG NO.	REV
none	5538-001	A
SHEET 1 OF 1		

Figure 31: 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 32 TLS / HC Sentry RS-485 Cable for the wiring diagram.
  - ► VST provides the HC Sentry Interface Cable.

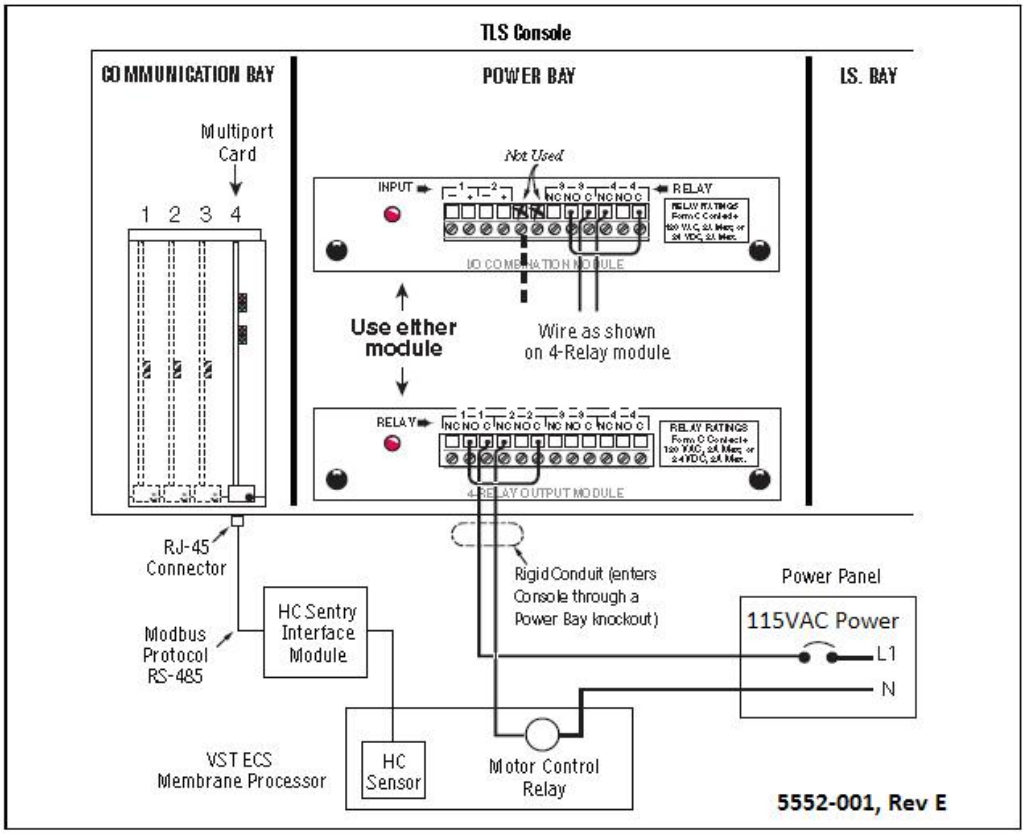


Figure 32: VR TLS Multi-Port Card Connection to the HC Sentry Module

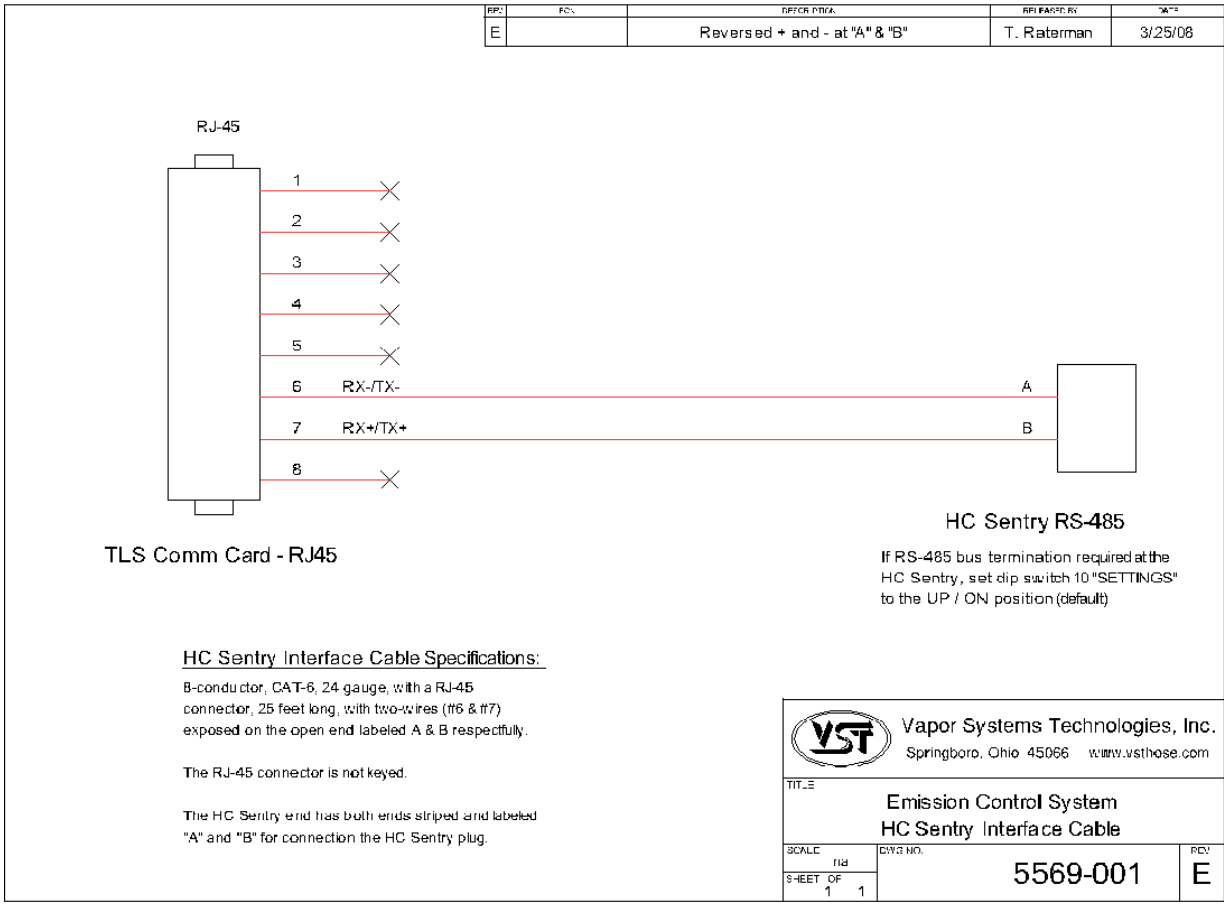
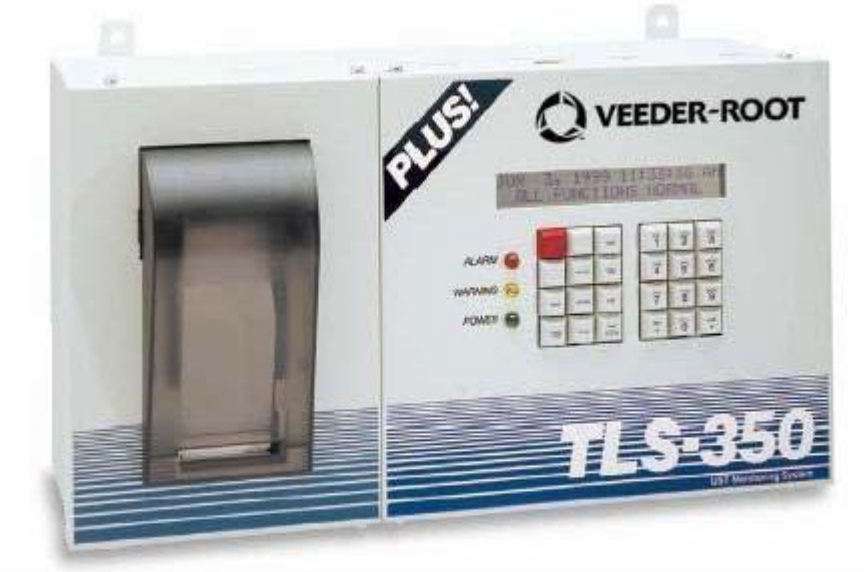


Figure 33: HC Sentry RS-485 Cable Wiring Diagram

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 34: 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.

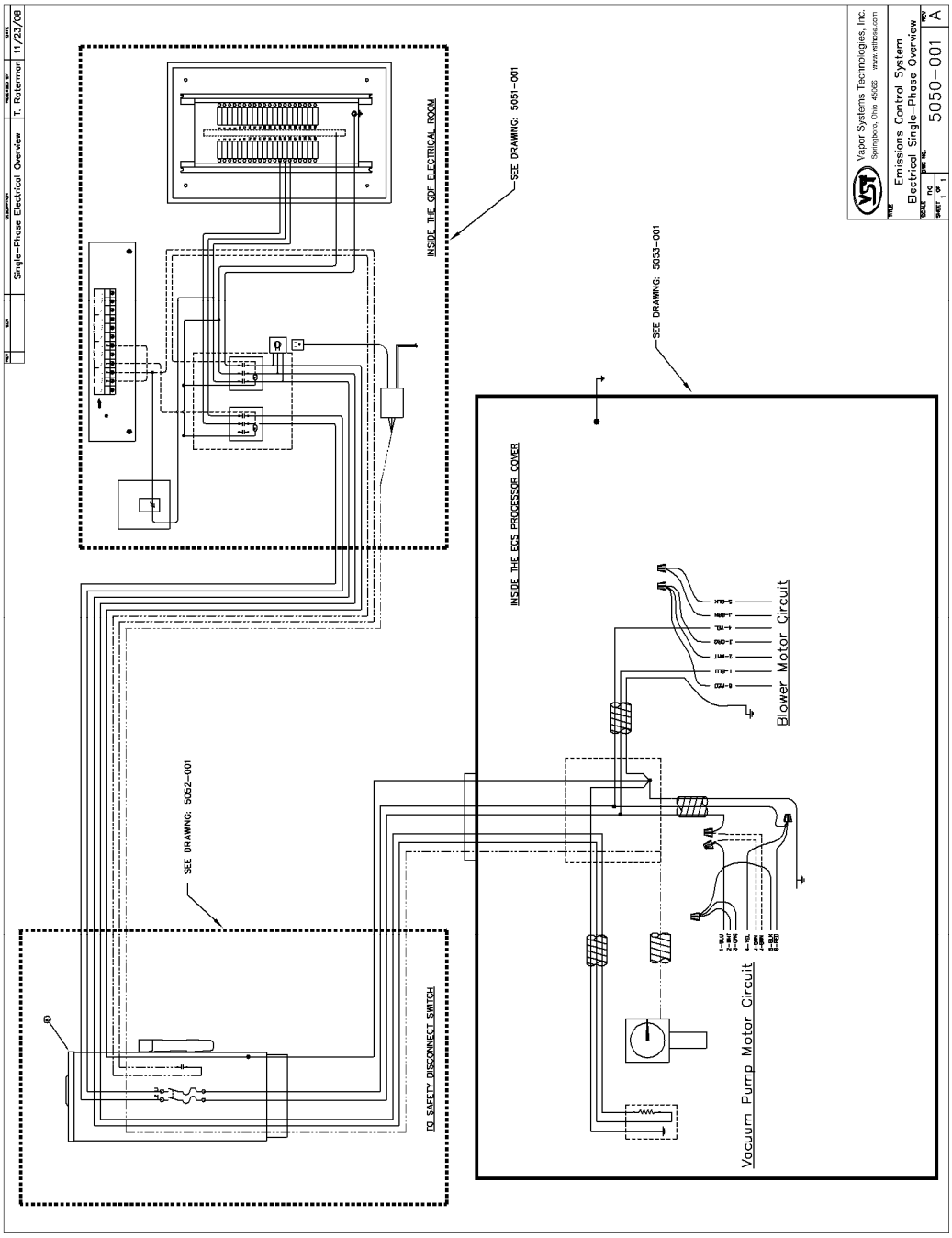


Figure 35: Single phase electrical overview

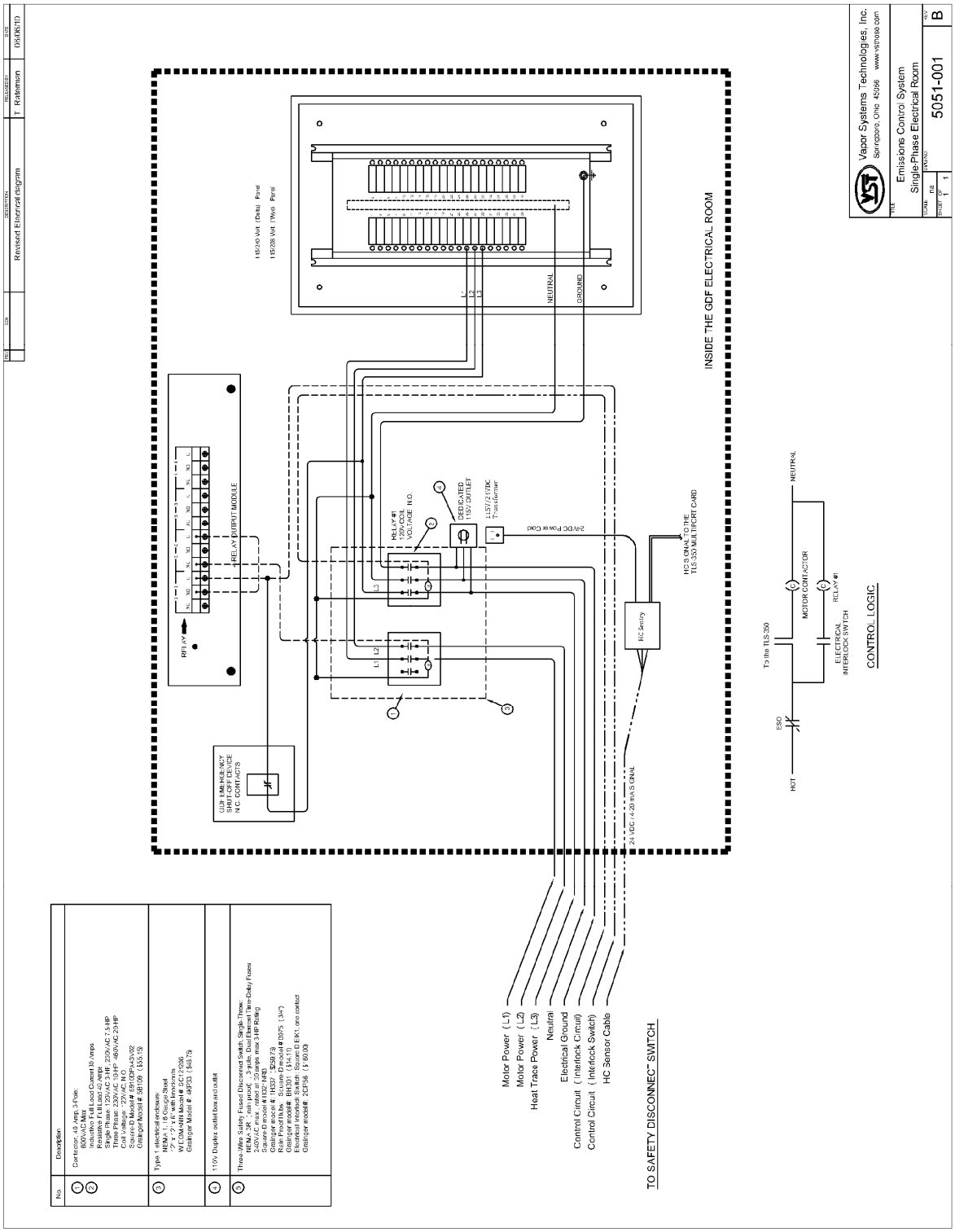


Figure 36: Single phase electrical room

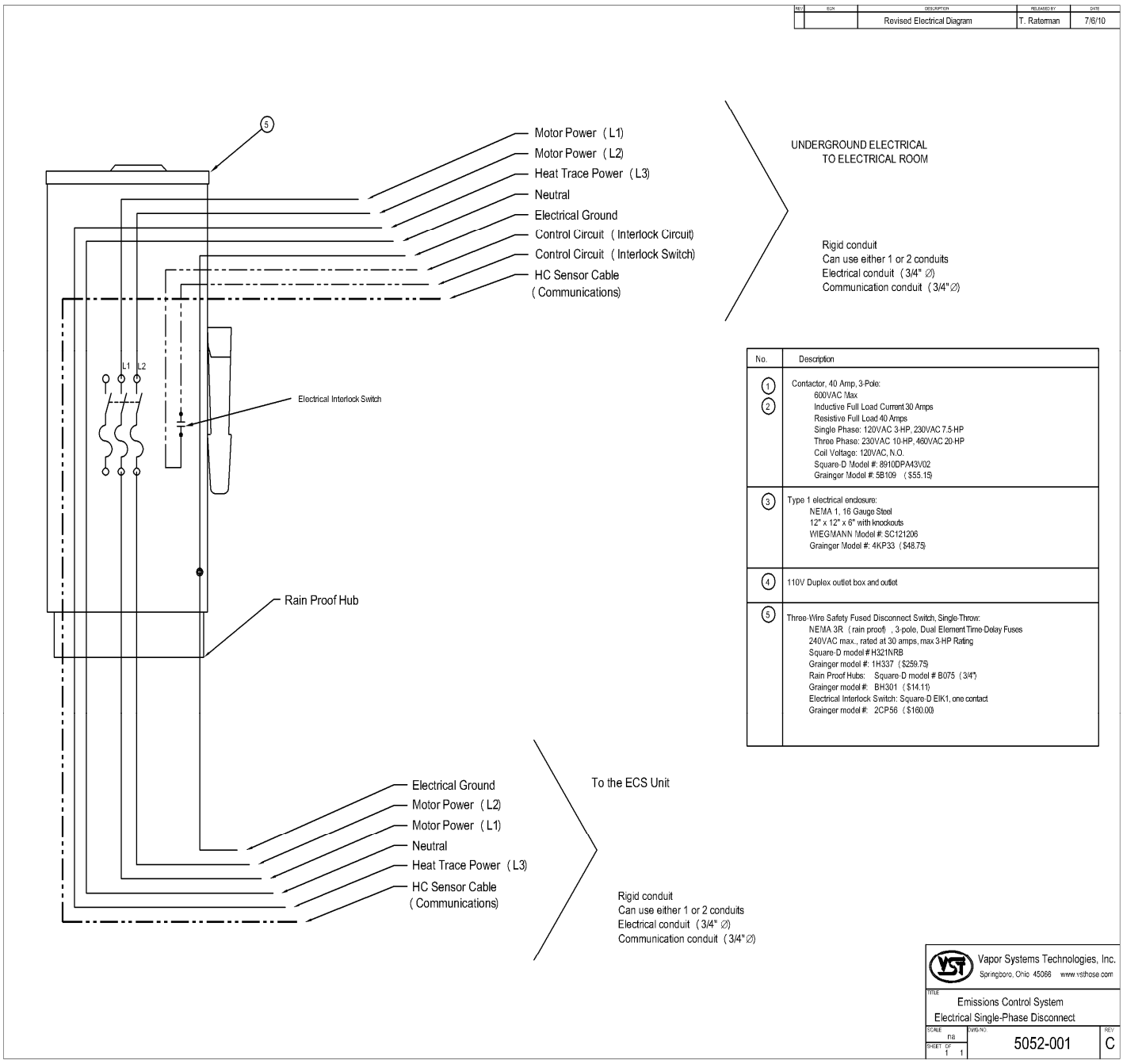


Figure 37: Single phase electrical disconnect

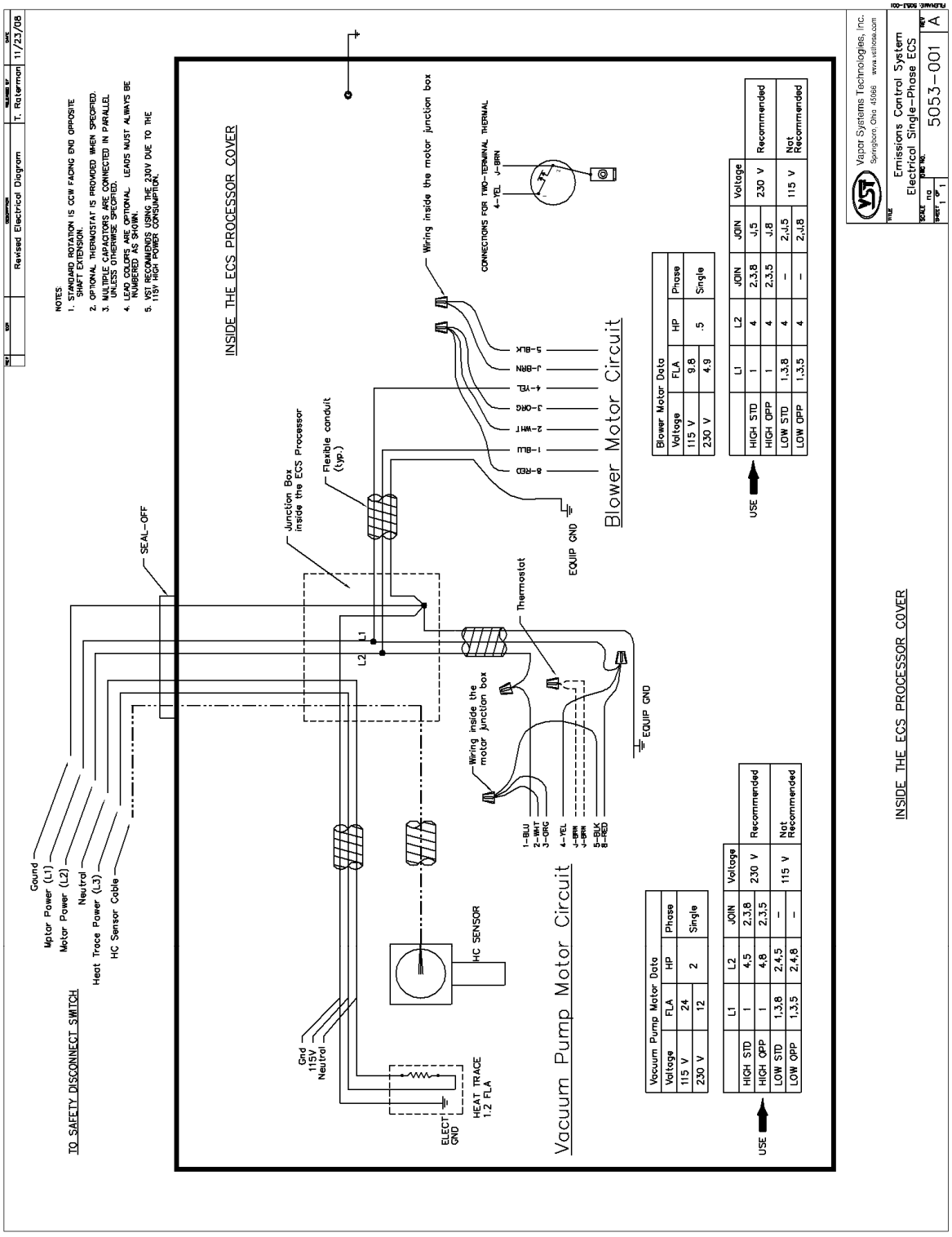


Figure 38: Single phase elec. inside the ECS

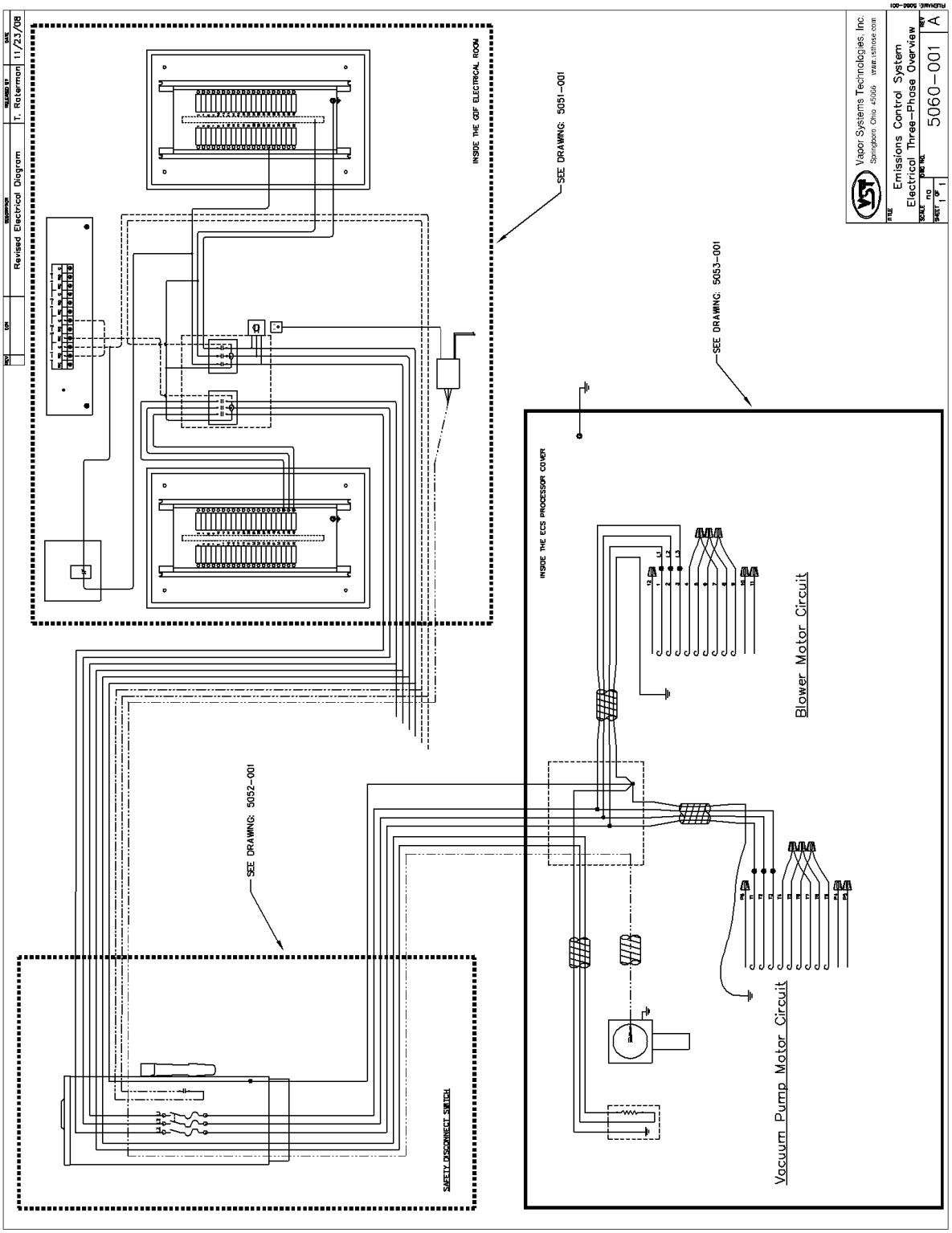
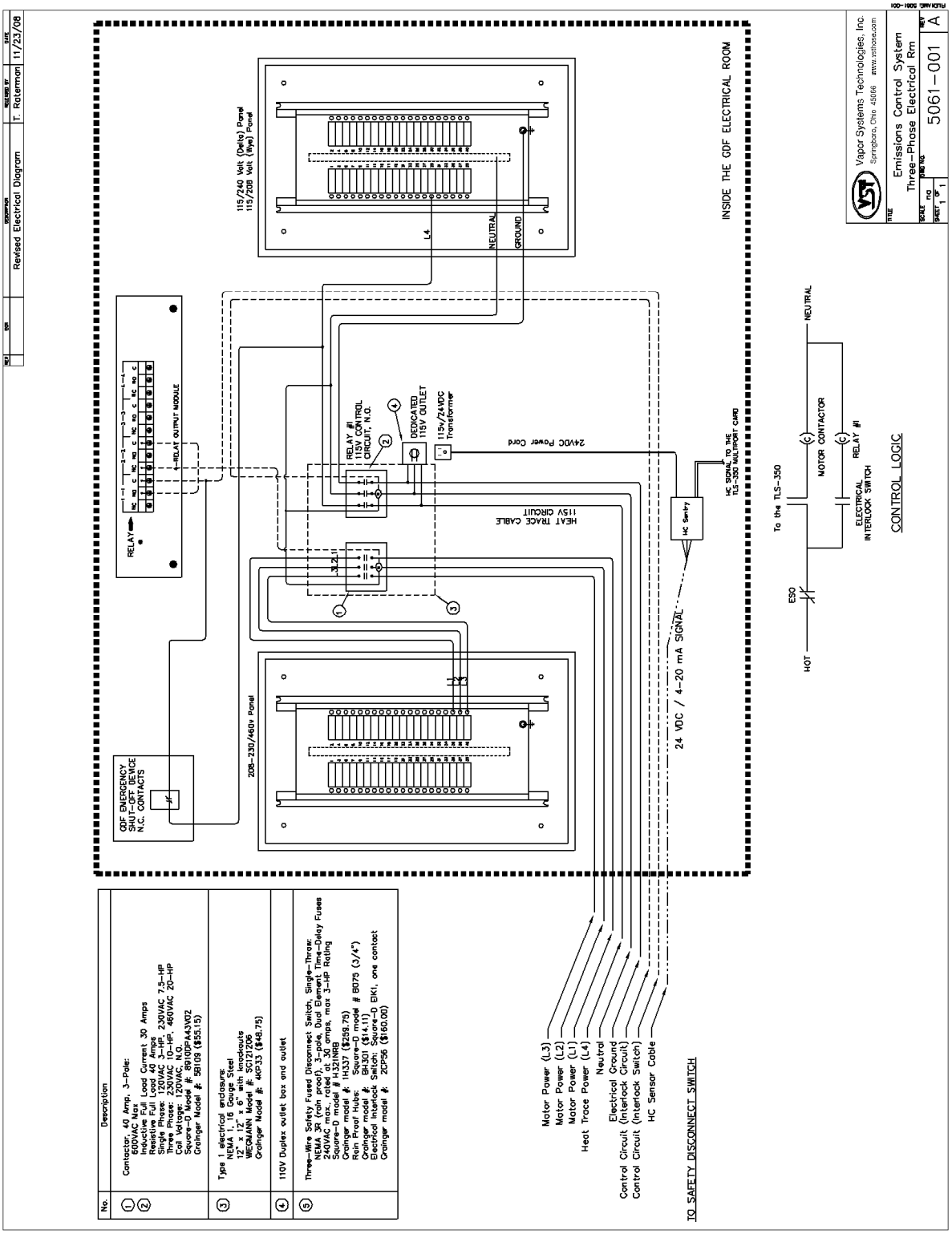


Figure 39: 3-phase electrical overview



No.	Description
1 2	Contactor, 40 Amp, 3-Pole: NEMA 1 Rating 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 #: 8910DPA43V02 Grainger Model #: 5B109 ($55.15)
3	Type 1 electrical enclosure: NEMA 1, 16 Gauge Steel 12" x 12" x 6" with knockouts WIEGMANN Model #: SC12120S Grainger Model #: 46P33 ($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, total load 32 amps, max 3-HP Rating Square-D model # H322NRB Grainger model #: 1H337 ($298.75) Rain Proof Hubs: Square-D model # BG75 (3/4") Grainger model #: 8H301 ($14.11) Electrical Interlock Switch: Square-D EIK1, one contact Grainger model #: 2CP56 ($160.00)

Figure 40: 3-phase electrical room

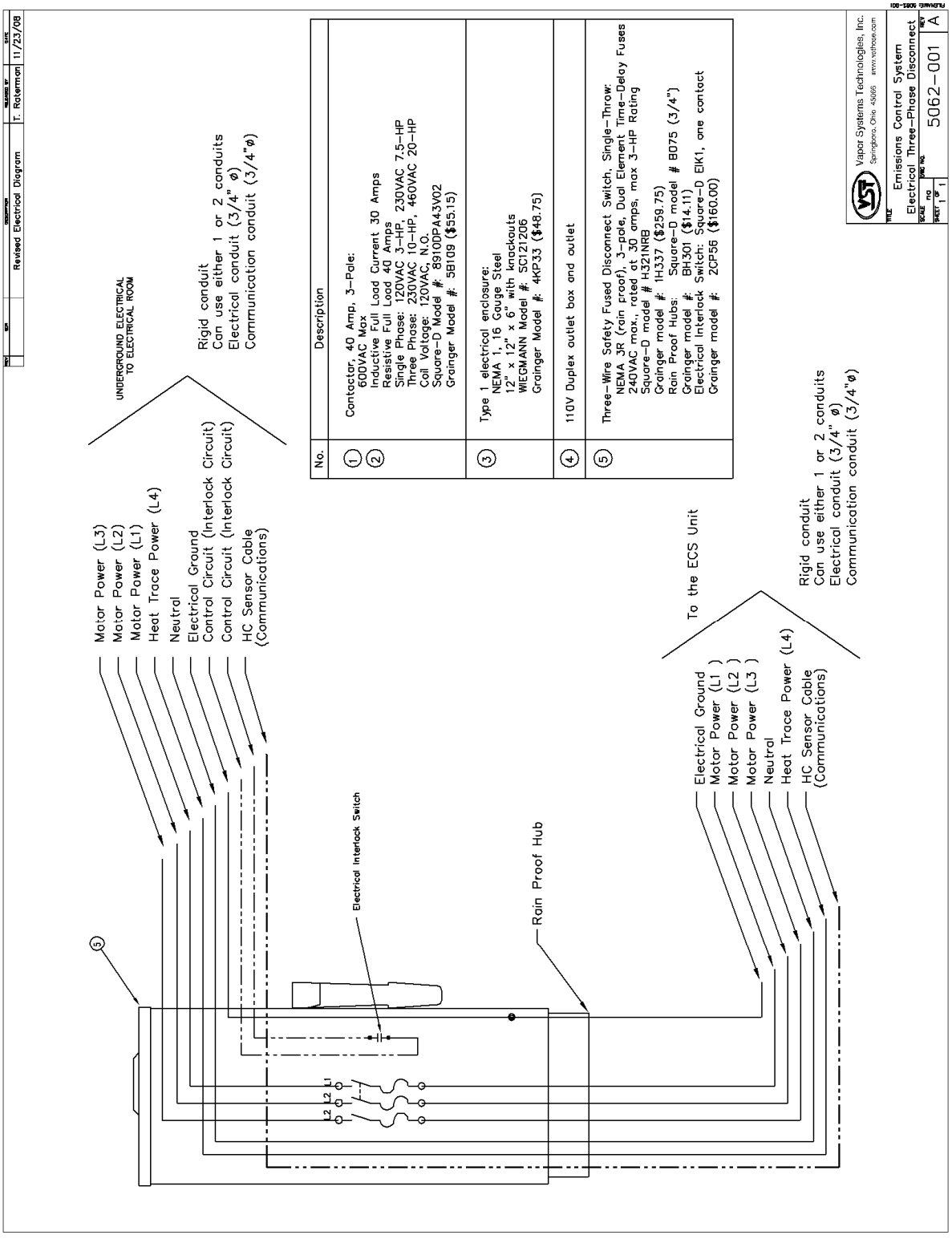


Figure 41: 3-phase electrical disconnect

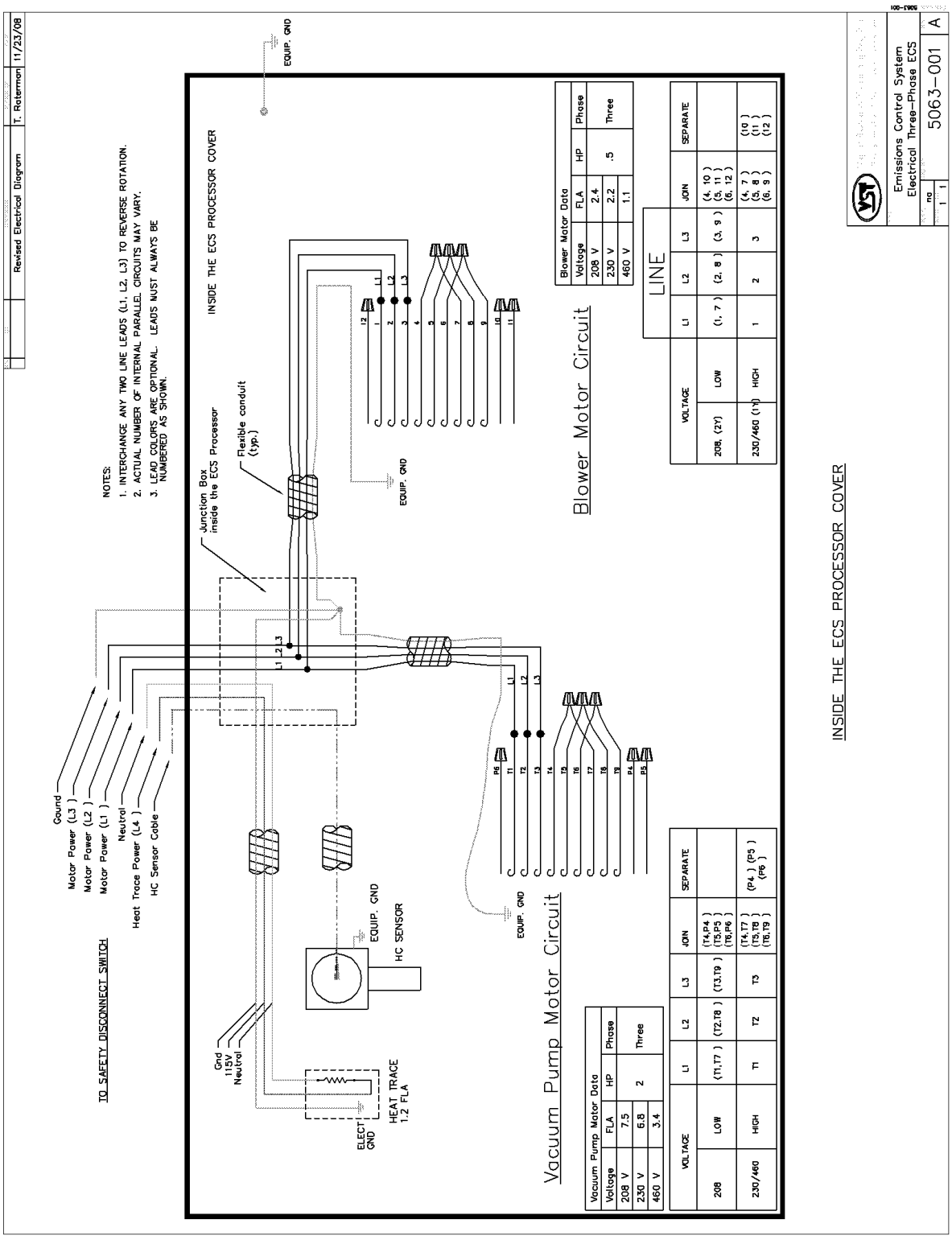


Figure 42: 3-phase elec. inside ECS

15 Post-Installation Checklist

Post-Installation Checklist					Attach product sticker with bar code here
VST ASC #:	Date:				
ASC Name:					
VST-ASC Certification Level	❑ A ❑ B ❑ C				
ASC Company:					
GDF Name:					
Address:					
City:		State:		Zip Code:	
GDF Contact Person Name:					
GDF Contact Person Title:					
GDF Contact Person Phone:		E-mail:			

Notes: Use this form to note details of the post-installation tests

Checkpoints Site Components	Yes	No	Un-known	If No or Unknown, explain
Pressure sensor installed	❑	❑	❑	
TLS-350 with ISD software installed	❑	❑	❑	
HC sentry connected to the TLS	❑	❑	❑	
Processor Leak Check	❑	❑	❑	
All vapor piping sloped away from the Processor	❑	❑	❑	
All vapor piping line size meets CP-201 requirements	❑	❑	❑	
All vapor piping slope meets CP-201 requirements	❑	❑	❑	
Checkpoints Site Components	Yes	No	Un-known	If No or Unknown, explain
All warranty information has been filled out and sent to VST	❑	❑	❑	
All connections from the *Processor* to the UST's are correct	❑	❑	❑	
The *Processor* has not been installed in a Class I, Div. 1 or Class I, Div. 2 area	❑	❑	❑	
The electrical installation meets NEC, federal, state, and local standards	❑	❑	❑	
The *Processor* installation meets CP-201 requirements	❑	❑	❑	
The ECS *Processor* has been installed per installation instructions	❑	❑	❑	

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-P
VR-204-P

Version: 4.5

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

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Table of Figures

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 *Processor*s. 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

Safety Icons

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

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.	• When the UST system pressure rises above +0.2"WC, the *Processor* turns ON.
2.	• Through the vapor inlet pipe connection at the *Processor*, the VOC vapor is drawn into the suction side of the blower.
3.	• The blower discharges the VOC vapor into the membrane housing.
4.	• Inside the membrane housing, the VOC vapor is separated in to two air streams: ► VOC depleted air (referred to as "air") ► Gasoline VOC vapor • The membrane is designed specifically for separating air from gasoline VOC vapor.
5.	• A vacuum pump draws the air from the membrane housing through a check valve.
6.	• A sample of the air flows through a hydrocarbon sensor to check the percent hydrocarbons.
7.	• From the vacuum pump, the air is vented to atmosphere via the air return.
8.	• The gasoline VOC vapor returns to the UST system via the vapor return.
9.	• When the UST system pressure drops below -0.2"WC, the *Processor* turns OFF.

1.3 Processor Dimensions and Weight

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

1.4 Processor Components and Their Purpose

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

PART #	DESCRIPTION	PURPOSE
5008-001	Heat-Trace Cable	A self-regulating heat trace cable wraps around the membrane housing and is designed to keep the membrane housing temperature between 100°-150° F. Power is continuously applied to the heat-trace cable 100% of the time whether the *Processor* is running or not. The power requirements are 115 VAC at 130 watts per foot, with a maximum of 2 amps draw. On the end of the heat-trace cable is an end-seal kit to terminate the cable.
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	The HC Sentry module acts as an interface between the TLS and the HC sensor. 115v power is supplied to the HC sentry module, which supplies 24VDC power to the HC sensor. 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.
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

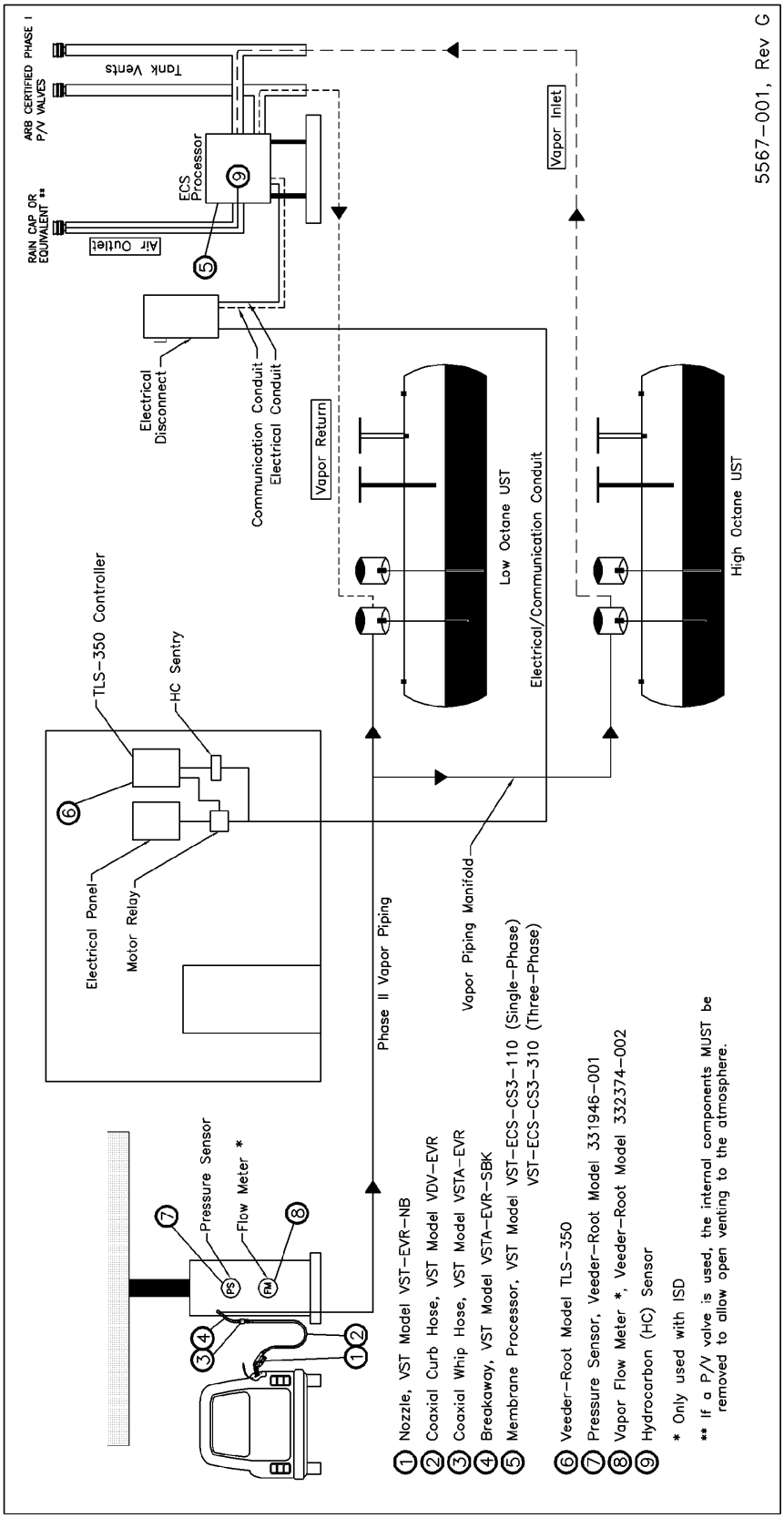


Figure 1: How the Processor fits into the GDF layout

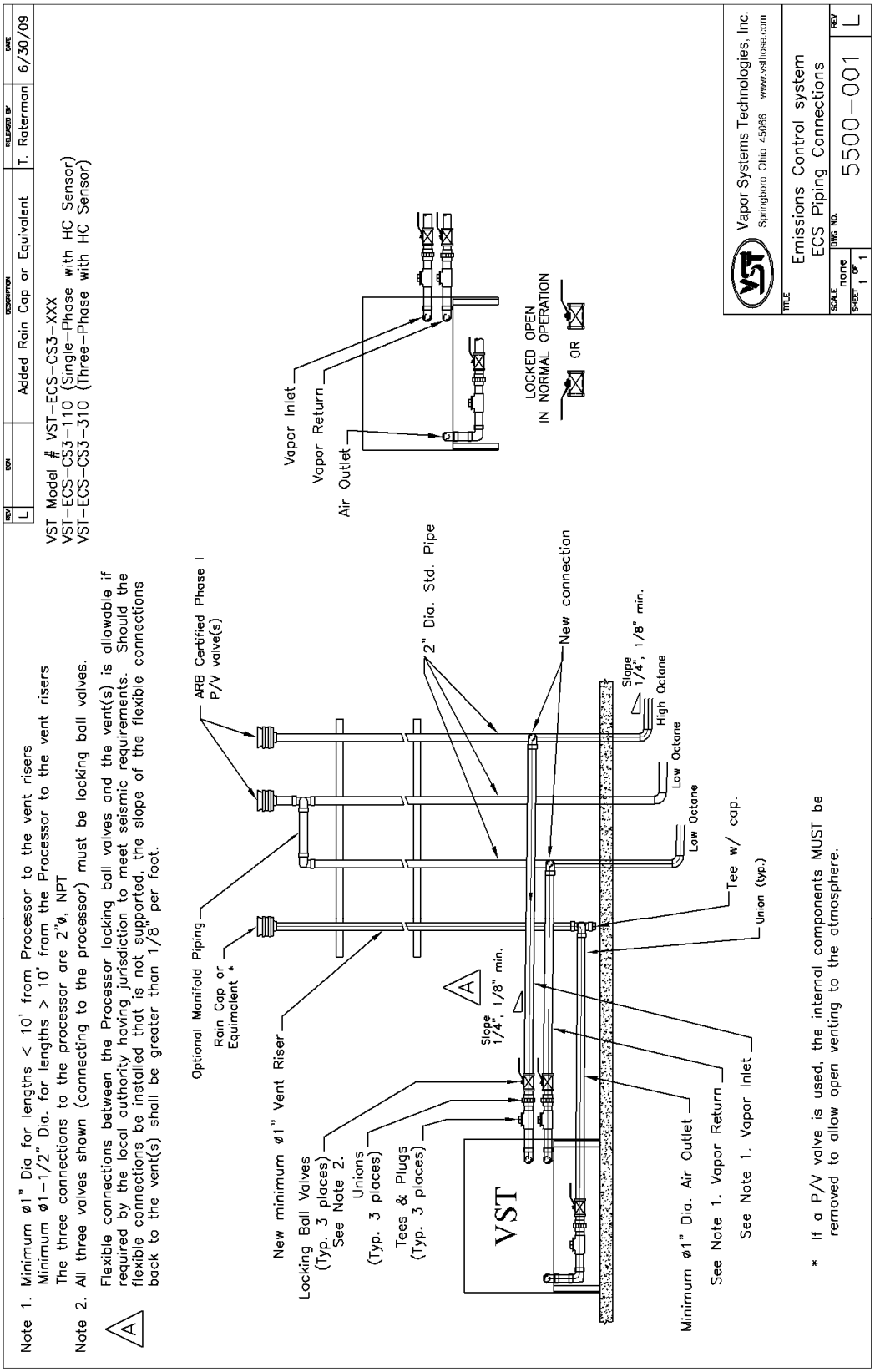


Figure 2: Processor Piping Diagram

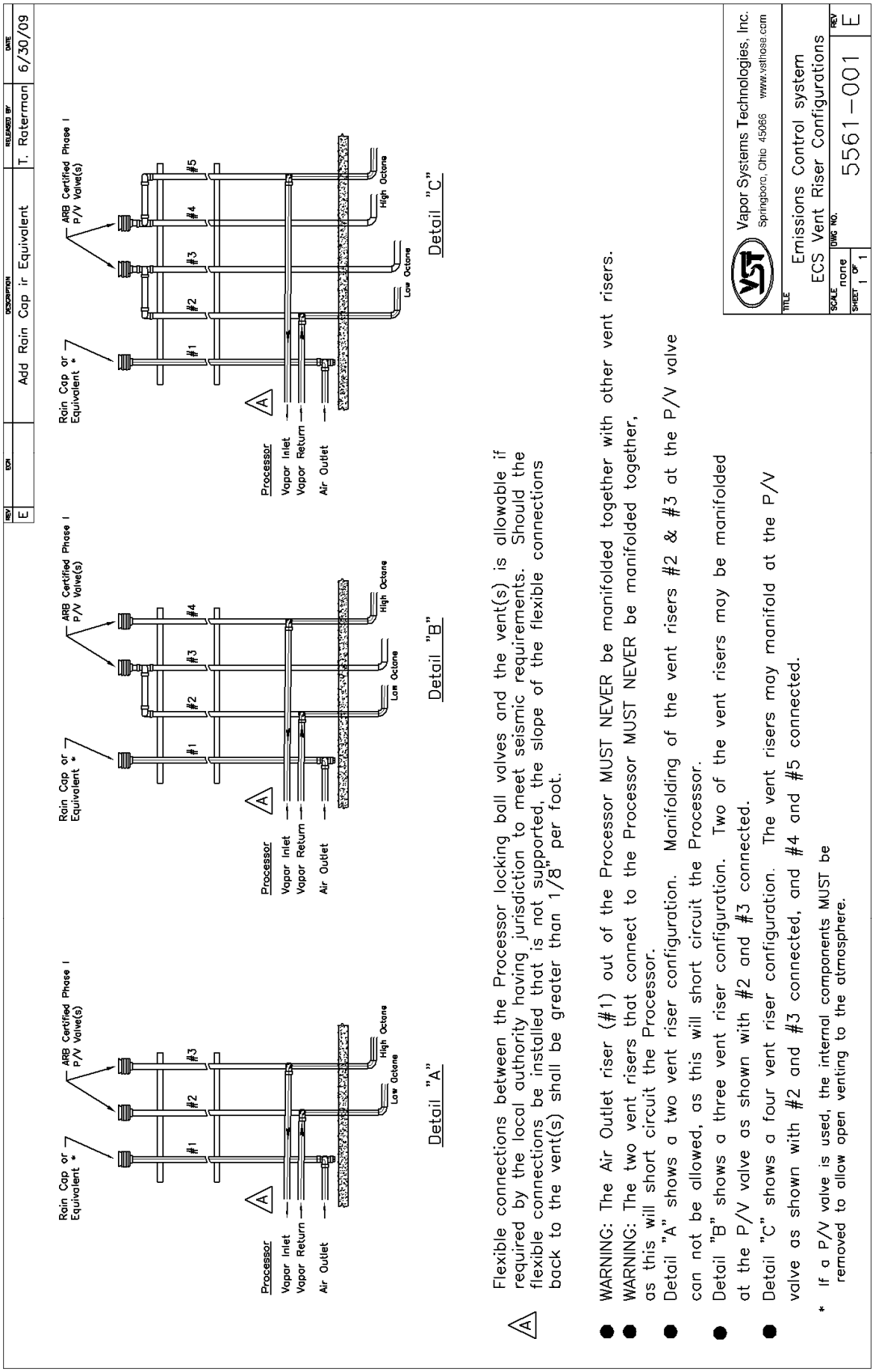


Figure 3: ECS Vent Configurations

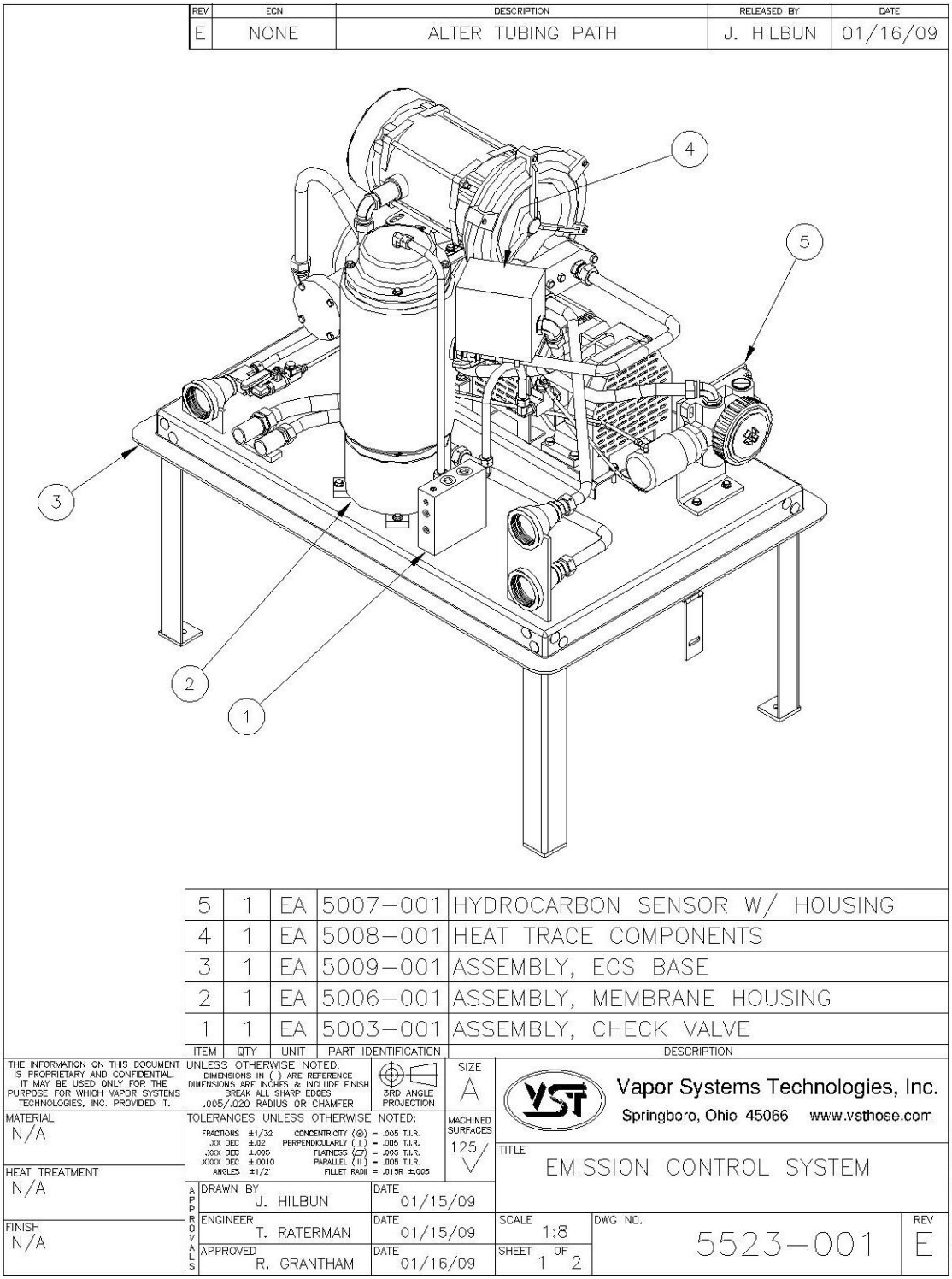
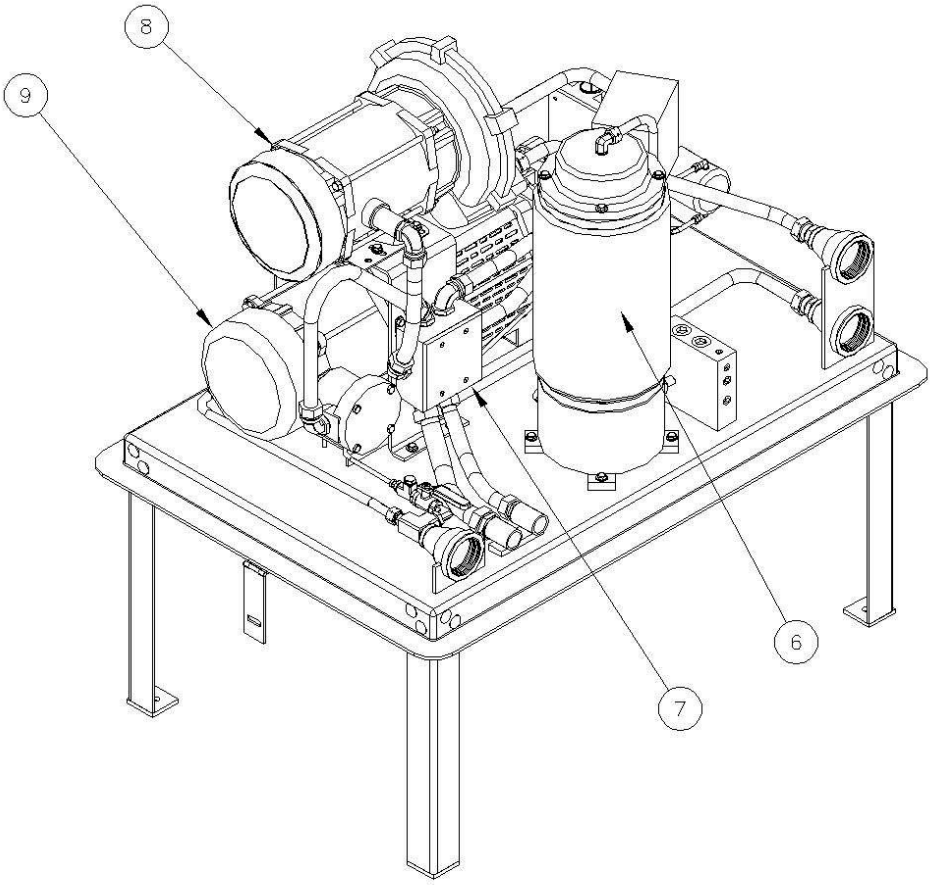


Figure 4: Processor Isometric Drawing (1 of 2)

REV	ECN	DESCRIPTION	RELEASED BY	DATE
E	NONE	ALTER TUBING PATH	J. HILBUN	01/16/09



ITEM	QTY	UNIT	PART IDENTIFICATION	DESCRIPTION
9	1	EA	5001–001	ASSEMBLY, VACUUM PUMP / MOTOR
8	1	EA	5002–001	ASSEMBLY, CIRCULATING BLOWER / MOTOR
7	1	EA	5011–001	ELECTRICAL COMPONENTS
6	1	EA	5013–001	F/G INSULATION

UNLESS OTHERWISE NOTED:
DIMENSIONS IN ( ) ARE REFERENCE.
DIMENSIONS ARE INCHES & INCLUDE FINISH
BREAK ALL SHARP EDGES
.005/.020 RADIUS OR CHAMFER

3RD ANGLE PROJECTION

SIZE A

MATERIAL N/A

HEAT TREATMENT N/A

FINISH N/A

TOLERANCES UNLESS OTHERWISE NOTED:

FRACTIONS	±1/32	CONCENTRICITY (◎)	= .005 T.I.R.
.XX DEC	±.02	PERPENDICULARLY (⊥)	= .005 T.I.R.
.XXX DEC	±.005	FLATNESS (▱)	= .005 T.I.R.
.XXXX DEC	±.0010	PARALLEL (∥)	= .005 T.I.R.
ANGLES	±1/2	FILLET RADII	= .015R ±.005

MACHINED SURFACES 125 √

Vapor Systems Technologies, Inc.
Springboro, Ohio 45066 www.vsthose.com

TITLE
EMISSION CONTROL SYSTEM

APPROVALS		
DRAWN BY	J. HILBUN	DATE 01/15/08
ENGINEER	T. RATERMAN	DATE 01/15/09
APPROVED	R. GRANTHAM	DATE 01/16/09

SCALE 1:8
SHEET 2 OF 2
DWG NO. 5523–001
REV E

Figure 5: 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.

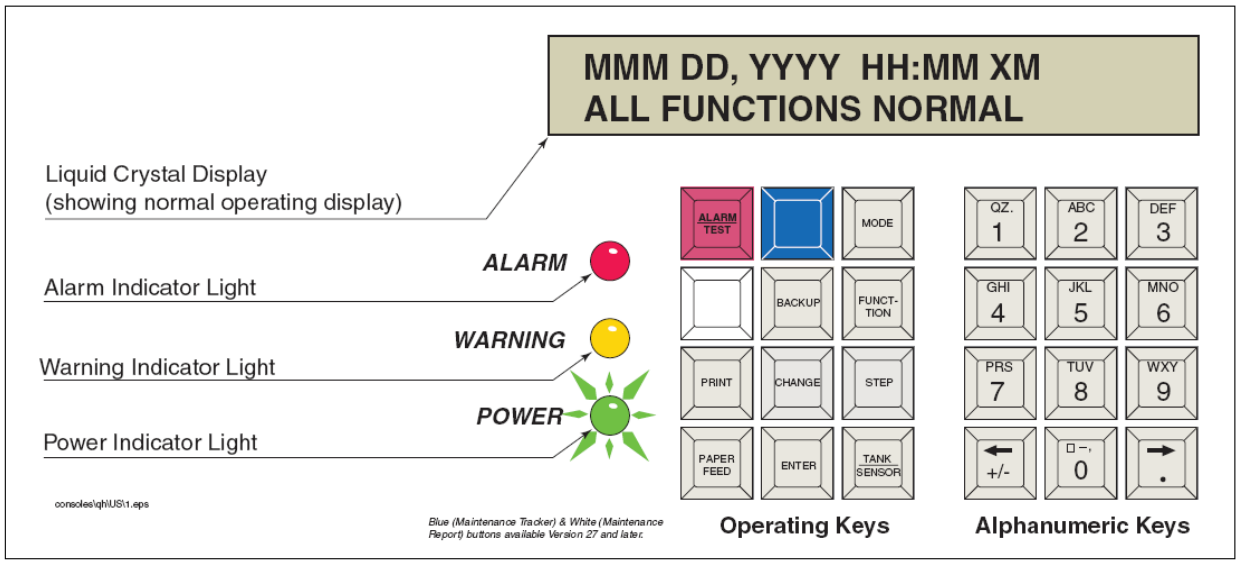


Figure 6: TLS-350 Face

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 7 shows the *Processor Run*-Time Algorithm.

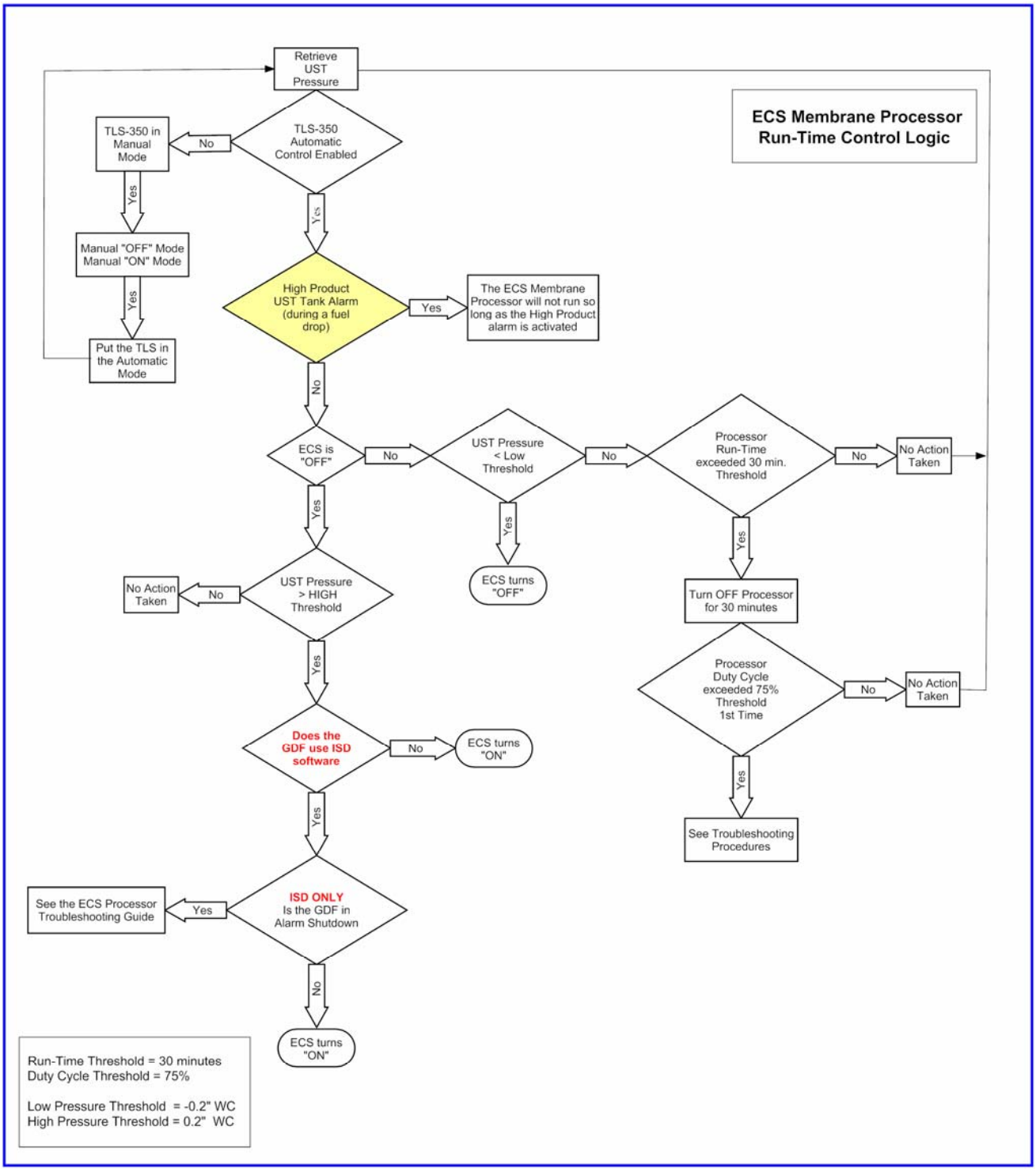


Figure 7: Processor Run-Time Algorithm

2.5.1 TLS-350 (PMC): Alarm Troubleshooting Summary

Displayed Message	Description	Light Indicator	Suggested Troubleshooting
VP EMISSION WARN	Mass emission exceeded the certified daily threshold.	Yellow	• Troubleshooting Guide www.vsthose.com. • Exhibit 8 • Exhibit 9
VP EMISSION FAIL	2nd Consecutive mass emission failure.	Red	
PMC SETUP FAIL	PMC is not configured or missing components.	Red	• Troubleshooting Guide www.vsthose.com. • See ISD Troubleshooting Guide, P/N 577013-819. • Exhibit 8 • Exhibit 9
PMC SENSOR FAULT	Component used by PMC has failed or reported an error condition. See Troubleshooting section for complete description of sensors and associated conditions that can cause a sensor fault.	Red	• Check for Smart Sensor Device Alarm or Fault.
VP DUTY CYCLE WARN	Duty cycle exceeds 18 hours per day or 75% of 24 hours.	Yellow	• Troubleshooting Guide www.vsthose.com. • TLS 350 PMC Setup Procedure • Exhibit 10 • Exhibit 9 • Exhibit 4
VP DUTY CYCLE FAIL	2nd Consecutive Duty Cycle Failure.	Red	

2.5.2 TLS-350 (ISD): Alarm Troubleshooting Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	**Exhibit 4** **TP-201.3 (or equivalent test procedure)**
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	**Exhibit 9** **Exhibit 10**
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	**Exhibit 5** **Exhibit 6** **Exhibit 17** **TP-201.4 (or equivalent test procedure)**
FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
VP EMISSION WARN[3,4]	Processor	Yellow	Mass emission exceeded the certified threshold.	**Exhibit 8** **Exhibit 9**
VP EMISSION FAIL[3,4]	Processor	Red	2nd Consecutive Mass emission test failure.	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
VP DUTY CYCLE WARN[3]	Processor	Yellow	Duty cycle exceeds 18 hours per day or 75% of 24 hours.	• **PMC Setup Procedure** • **Exhibit 4** • **Exhibit 9** • **Exhibit 10** • **TP-201.3 (or equivalent test procedure)**
VP DUTY CYCLE FAIL	Processor	Red	2nd Consecutive Duty Cycle Test Failure.	
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• **Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2**
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• **Confirm EVR/ISD programming per VR 204 IOM Section 12**
ISD SETUP FAIL[2]	Self-Test	Red	8th Consecutive Failure of Setup Test	

Note: The alarms listed in above table will also activate an audible alarm

[1]See ISD Troubleshooting Manual P/N 577013-819 found at http://www.veeder.com/object/577013-819.html and the VST ISD Troubleshooting Guide 9513-003 found athttp://www.vsthose.com/pdf/Troubleshooting_Guide_ECS_Membrane_Processor_Sept_2010.pdf

[2]ISD Shut Down Alarms – see Figure 48 of IOM Section 12

[3]This warning will result in an ISD VP Status Warn

[4]This failure will result in an ISD VP Status Fail

3 Post-Installation Power-Up Tests

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

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

3.1 Post-Installation Electrical Connections

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

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

- Install two 18 AWG wires that connect the Motor Starter Relay Coil to the TLS-350 4-Relay Module.
- See Figure 8 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.

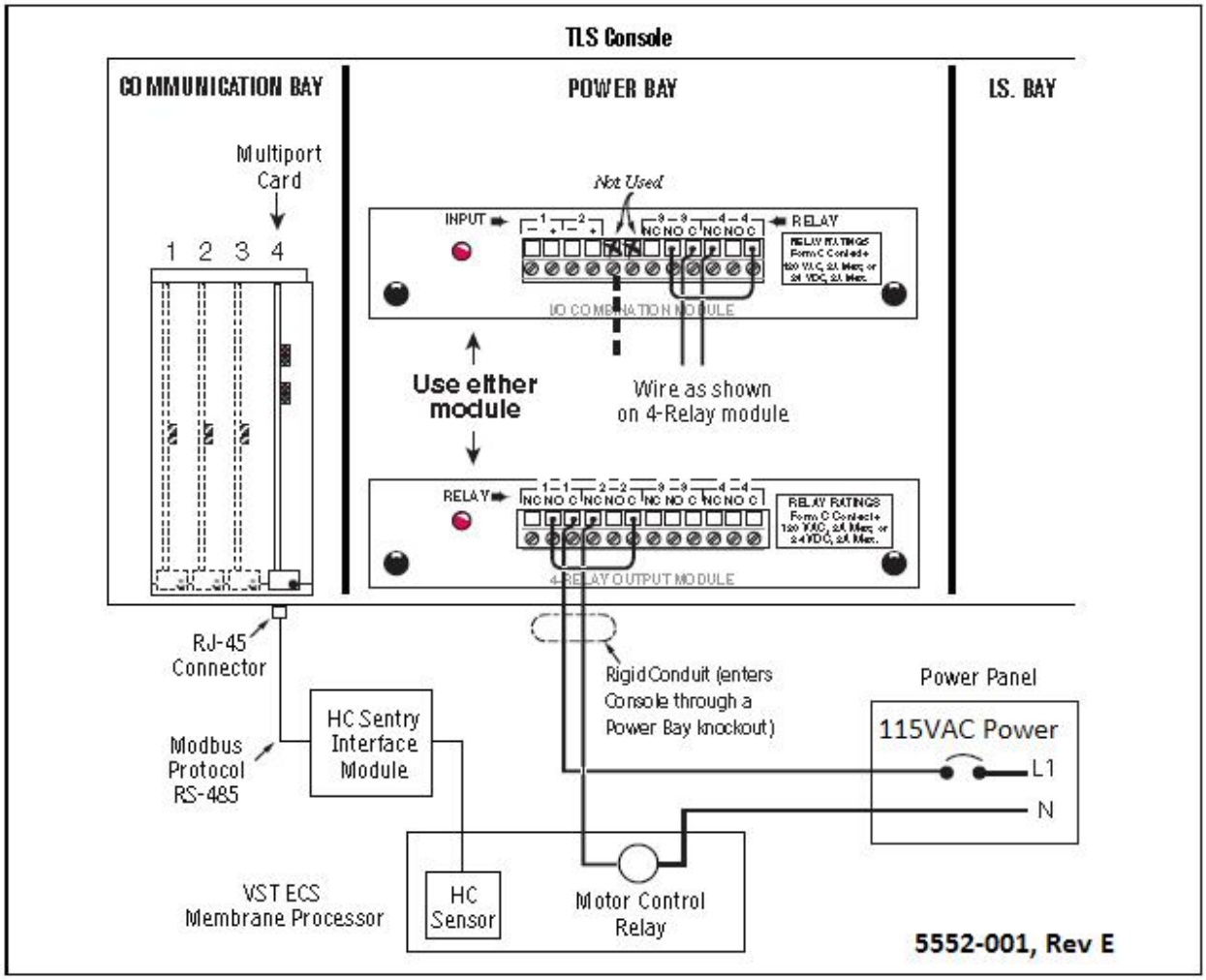


Figure 8: Wiring the Motor Starter Relay Coil

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.

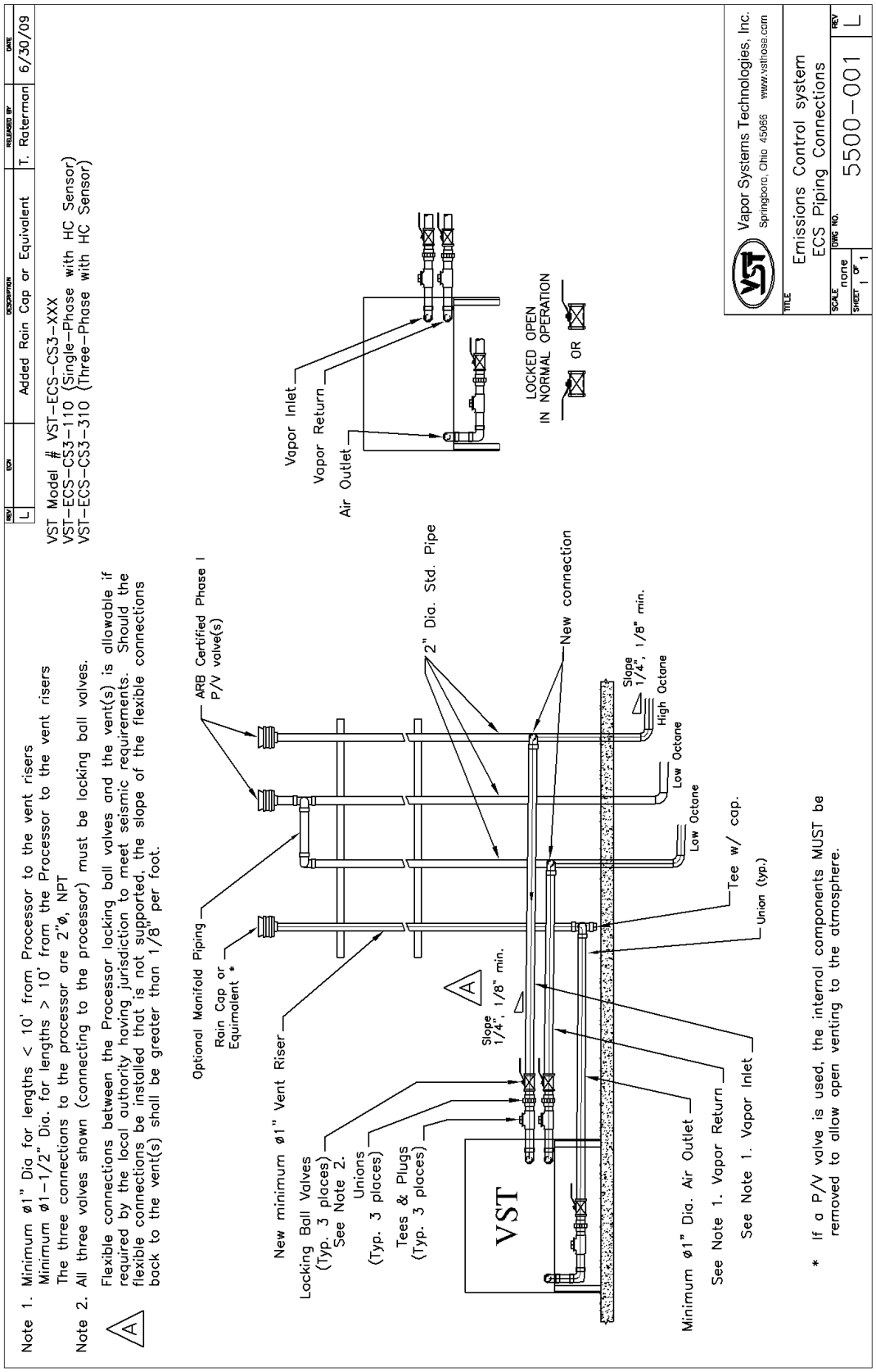


Figure 9: ECS Piping Configuration

3.3 TLS Manual Mode

- Follow the steps at the TLS console to put theTLS-350 in the Manual “OFF” Mode, as shown in Figure 10 for the PMC Diagnostic Menu and Figure 131 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)

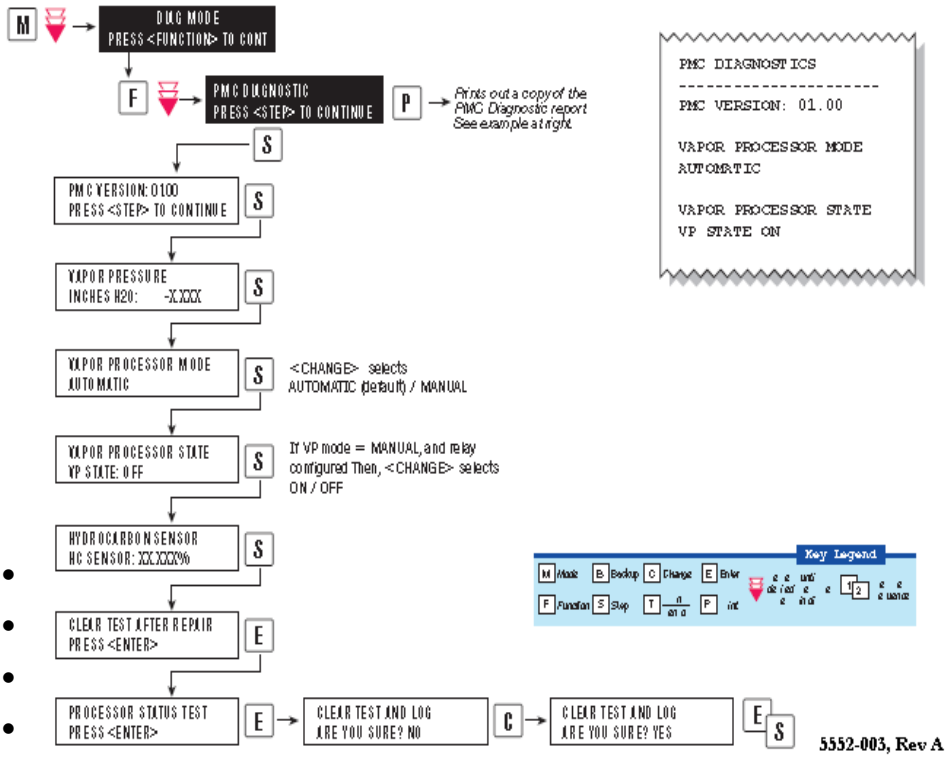


Figure 10: PMC Diagnostic Menu with PMC Software

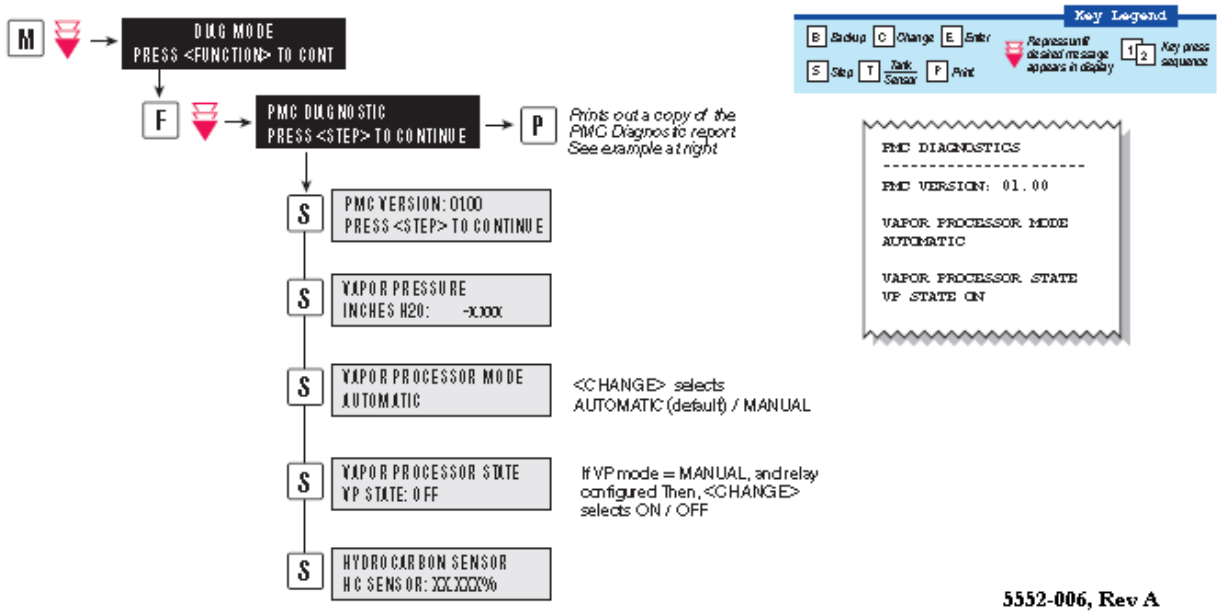


Figure 11: PMC Diagnostic with ISD Software

3.4 Electrical Connection Test

- Put the TLS-350 in the Manual OFF mode as shown in the Diagnostic Menus (See Figure 10 or Figure 11).

- 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

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

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 10 or Figure 11.

  ► 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: 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 13 and Figure 15.
- 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 12 and Figure 14.
- Remove the lock from the lock-out and apply power to the *Processor*.
- Return the *Processor* to the manual ON Mode at the TLS-350.
- Bump the power (briefly energize) power at the disconnect switch.
- Re-check the equipment for proper rotation.
- Return the *Processor* to the manual OFF mode at the TLS.

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

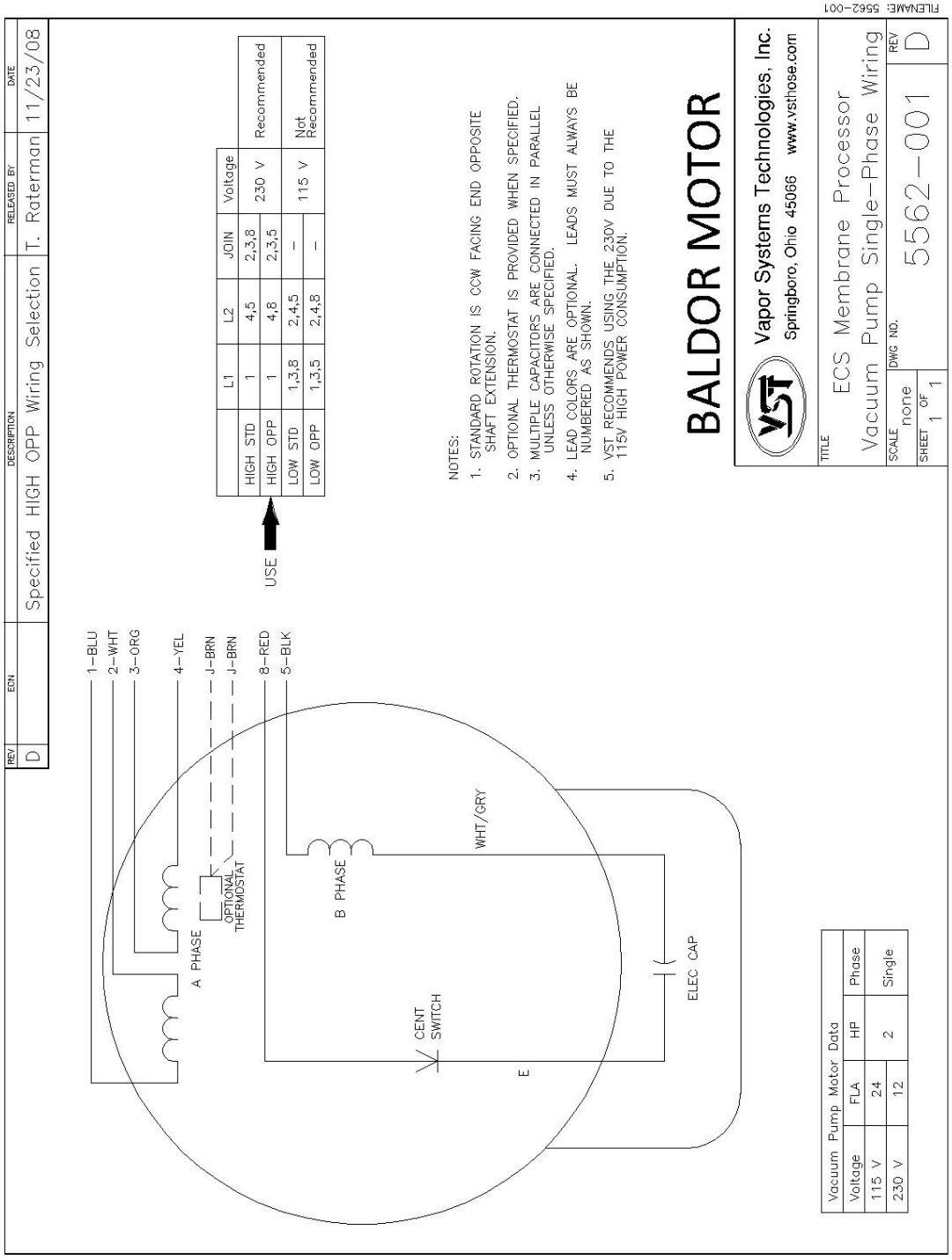


Figure 12: Vacuum Pump: Single-Phase Motor Wiring Diagram

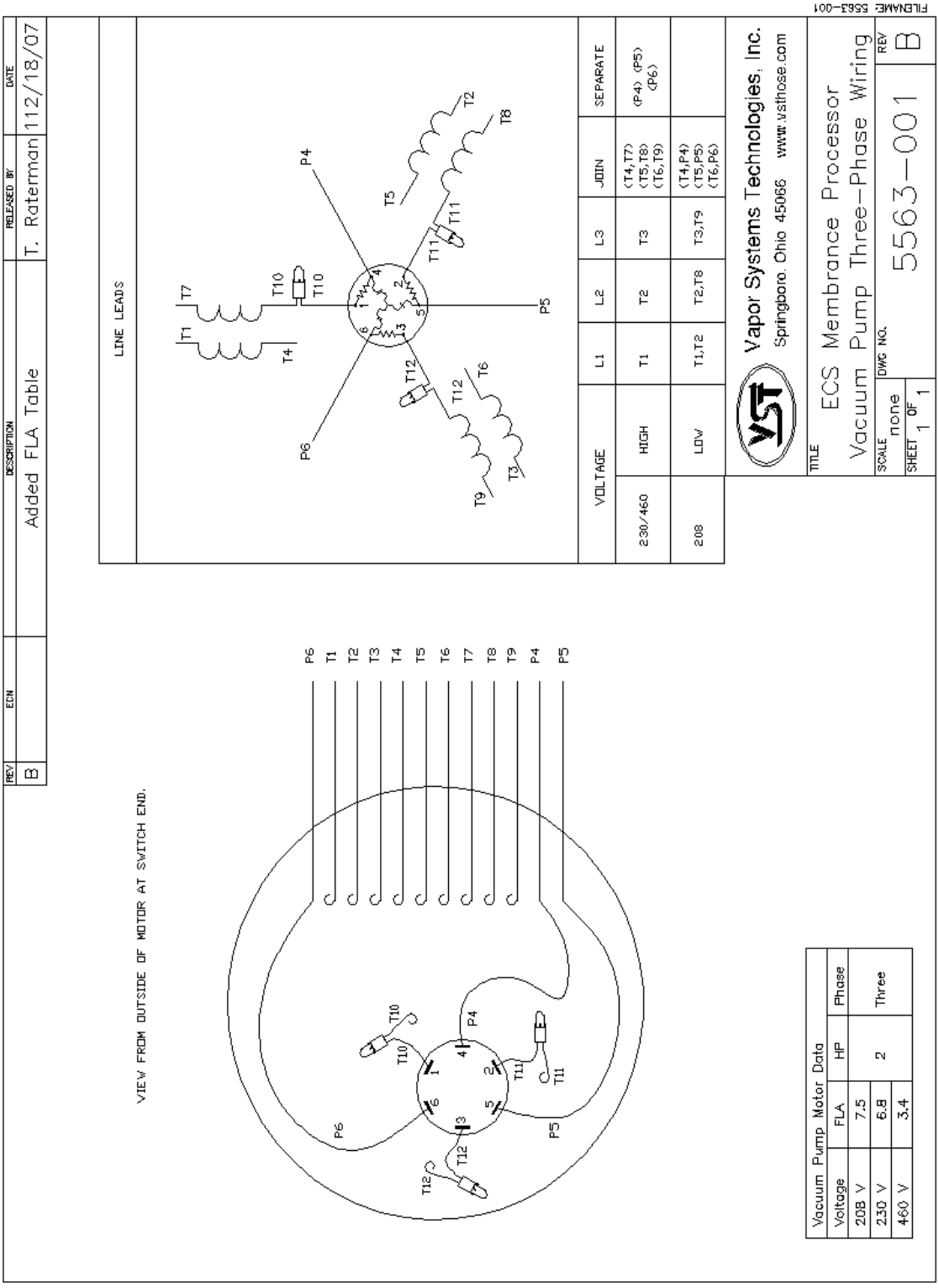


Figure 13: Vacuum Pump: Three-Phase Motor Wiring Diagram

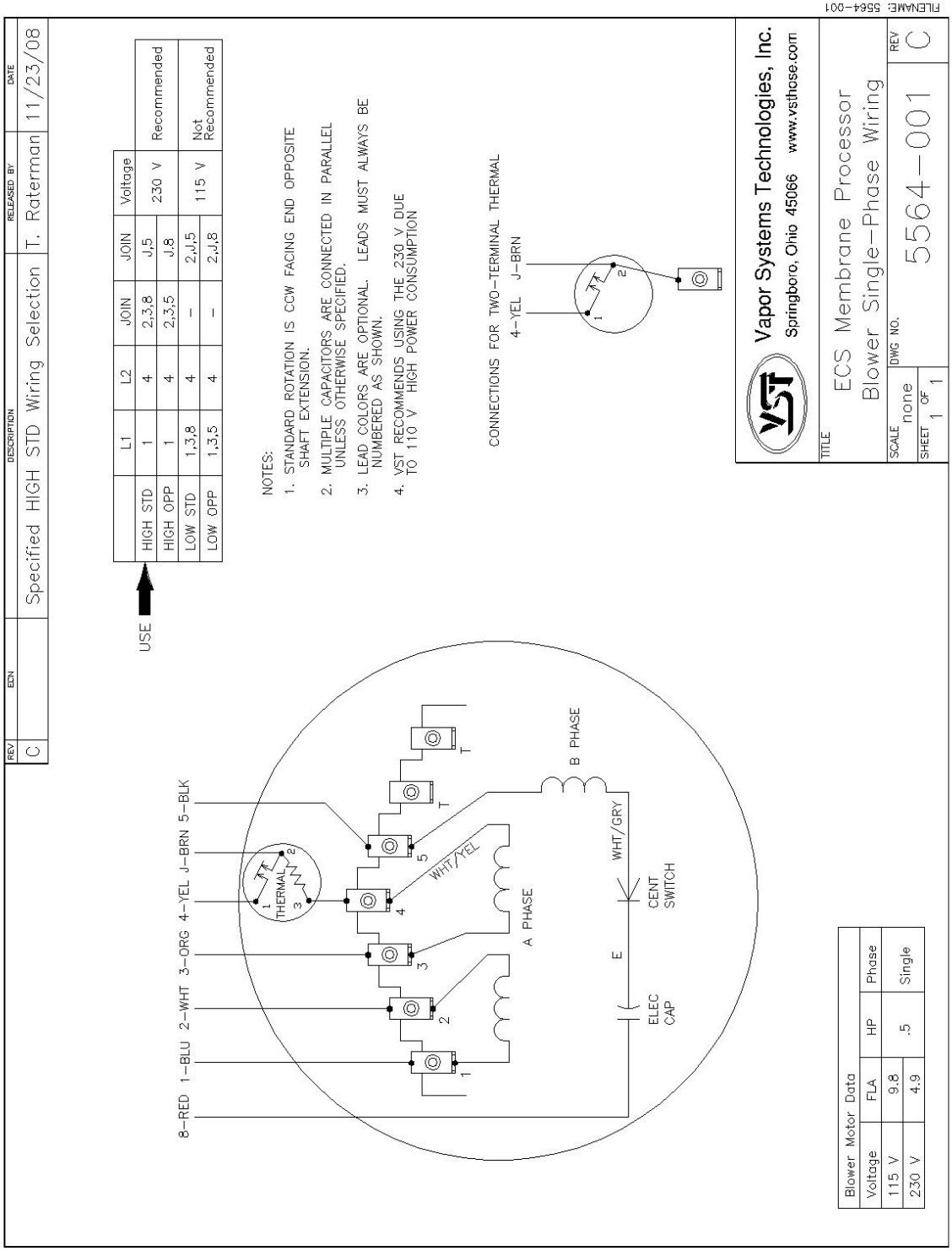


Figure 14: Blower: Single-Phase Motor Wiring Diagram

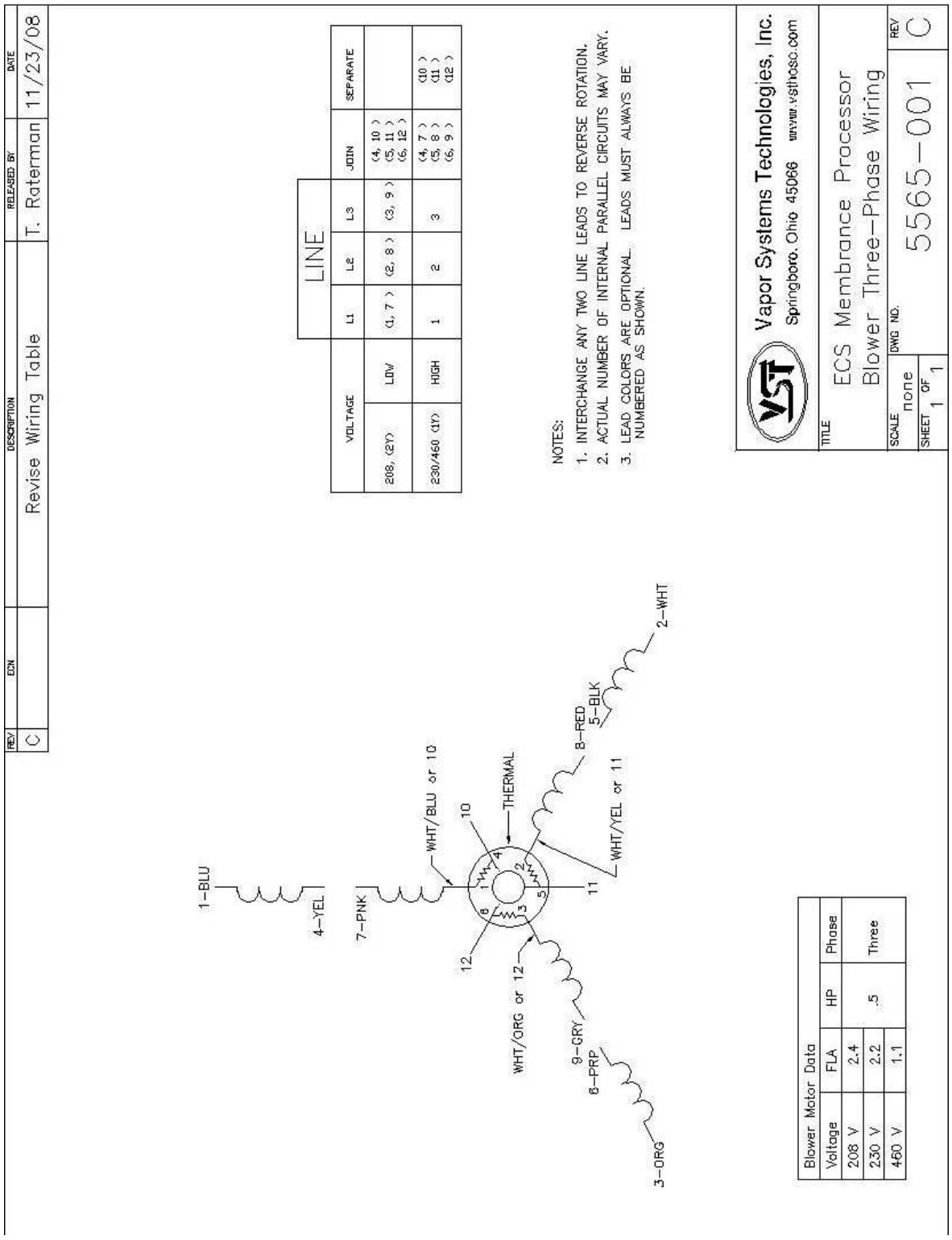


Figure 15: Blower: Three-Phase Motor Wiring Diagram

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 16.
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 16: Heat Trace Circuit Test

3.7 HC Sensor and HC Sentry Power Test

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

3.7.1 Checking 24 VDC Power to the HC Sensor

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

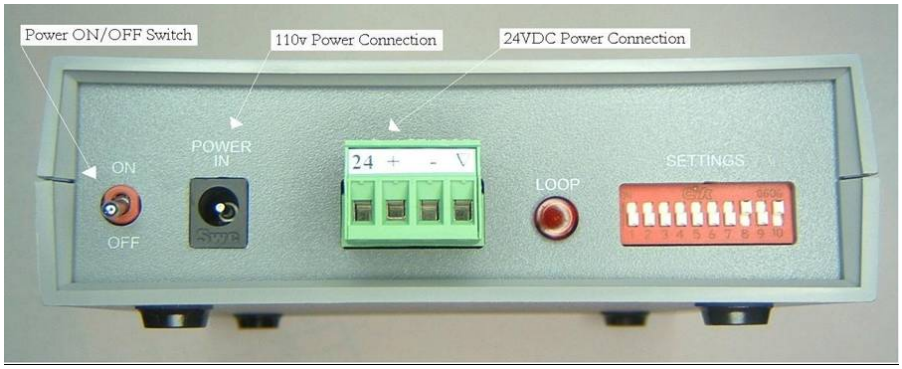


Figure 17: HC Sentry Interface Module Front View: Power and ON/OFF Switch

3.7.2 Checking 24VDC Power to the HC Sentry Module

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

Figure 18: 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 10)
3. Install the Leak Test Fixture (See Figure 21) 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 19: Processor Inlets & Outlets

Figure 20: 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:

IN THE PMC SET UP MENU	Software	Description	Default	Threshold Values
	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 10 or Figure 11.
- 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:				Attach product sticker with bar code here
ASC Name:					
VST-ASC Certification Level	❑ A ❑ B ❑ C				
ASC Company:					
GDF Name:					
Address:					
City:		State:	Zip Code:		
GDF Contact Person Name:					
GDF Contact Person Title:					
GDF Contact Person Phone:		E-mail:			
Notes: Use this form to note details of the note details of the power-up process					
Checkpoints ECS *Processor* Components	Passed	Failed	Repaired	Replaced	Action Items if Required
All electrical connections checked	❑	❑	❑	❑	
Blower motor rotation checked	❑	❑	❑	❑	
Vacuum pump motor rotation checked	❑	❑	❑	❑	
Heat-trace continuity checked	❑	❑	❑	❑	
HC sentry power checked	❑	❑	❑	❑	
HC sensor power checked	❑	❑	❑	❑	
Set threshold values	❑	❑	❑	❑	

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.	• Make sure the plugs are installed on the 3 tees at the *Processor*.
2.	• Make sure all 3 valves are locked in the OPEN position at the *Processor*.
3.	• Make sure power is on to the: ▪ Heat-trace cable ▪ HC sentry ▪ HC sensor ▪ ECS vacuum pump ▪ ECS recirculation blower
4.	• Make sure the pressure sensor is operational.
5.	• Make sure that the GDF is vapor tight. (TP 201.3 and Exhibit 4)
6.	• After the TLS is installed and configured and all EVR equipment has been installed, the *Processor* can become operational. • Put the TLS in the AUTOMATIC MODE. • If the pressure is above +0.2" WC, the *Processor* will start and the auxiliary relays will close. • If the pressure is below +0.2" WC, the *Processor* will not start because the UST system-pressure is below the high-pressure threshold.
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.	

CAUTION:
Locking ball valve handles at the *Processor* inlet and outlet must <u>not</u> be removed.

4.1 Processor Shut-Down Procedure

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

4.1.1 Processor Shut-Down Procedure

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

4.1.2 HC Sensor and HC Sentry Module

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

4.1.3 Heat-Trace Cable

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

5 Processor Maintenance

- The VST Emissions Control System consists of only two components having moving parts: a blower and a vacuum pump, which do not have any scheduled maintenance for 10 years.

- The remaining components are tested, but they require maintenance only if they fail their tests:
  - ► Heat trace cable
  - ► HC sensor
  - ► HC Sentry module

- Because the system continually monitors itself and notifies you of any problems or situations, it requires very little attention.

- The table on the following page outlines the required annual inspections and tests.
  - ► Preventative Maintenance Checklist Form
  - ► GDF Maintenance Records

5.1 Annual System Compliance Testing

Annual System Compliance Testing	
Static Pressure Test:	TP-201.3 Exhibit 4
Dynamic Back Pressure Test:	TP-201.4
Liquid Removal Test Procedure:	Exhibit 5
Hydrocarbon Sensor Verification Test:	Exhibit 8
Vapor Pressure Sensor Verification Test:	Exhibit 10
VST *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)
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.	

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 ± 1.0% HC concentration from the calibration gas concentration for zero and mid-range gas and ± 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
PROCESSOR	Yearly			
• Inspect drive coupling on the vacuum pump.			[ ]	
• Check the continuity of the heat trace cable.			[ ]	
RECIRCULATION BLOWER				
Replace every 10 years or 15,000 hours, whichever comes first.			[ ]	
VACUUM PUMP				
Replace every 10 years or 15,000 hours, whichever comes first.			[ ]	

5.4 GDF Maintenance Record

Date of Maintenance/ Test/Inspection/Failure (including date and time of maintenance call)	Repair date to correct test failure	Maintenance/Test/Inspection Performed and Outcome	Affiliation	Name and Technician ID Number of Individual Conducing 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 21.
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 21.
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 22.
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 ¼" 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

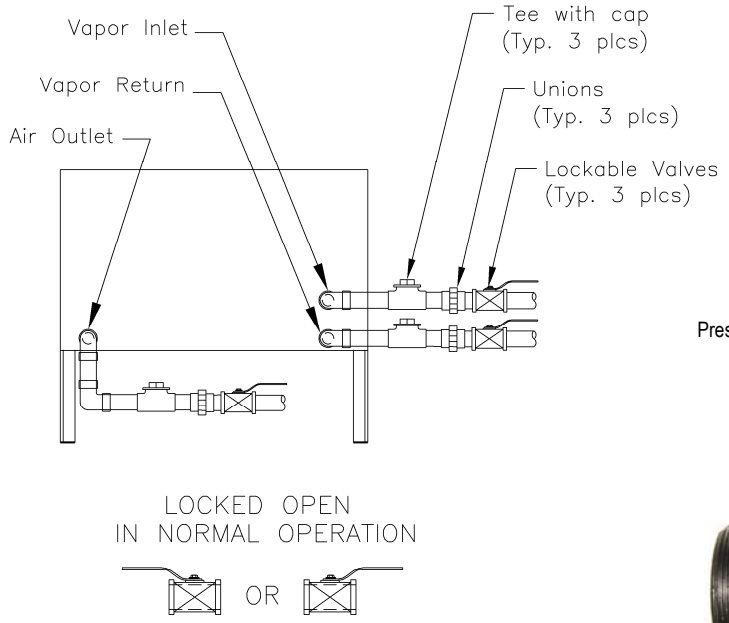


Figure 21: Processor Inlets & Outlets

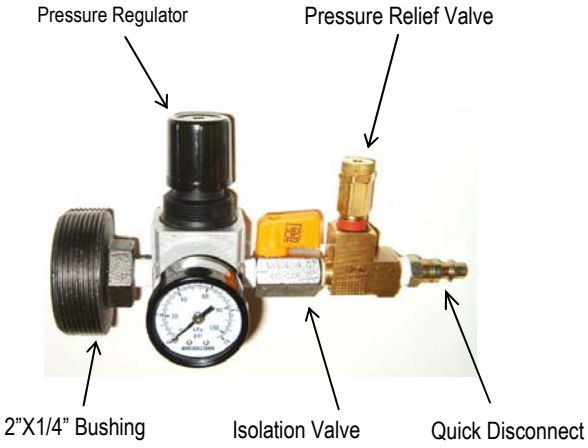


Figure 22: Typical leak-check fixture

-

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 10 or Figure 11.
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 21.
4. Conduct ECS Unit Purge Procedure (See Section 6 of this document).
5. Completely remove the two blower ¾" - 45° flare inlet and out tubes.
   - See Figure 24
   - NOTE: The nuts on the tubing are ¾" 45º flare, use caution not to damage the flared ends on the tubing or the threads on the nuts after removal.
6. Remove the two 45º flare inlet and outlet connection fittings from the blower.
7. Disconnect and remove the blower electrical from the motor.
   - See Figure 23.
8. Remove (4) ¼" x ¾" mounting bolts.
   - The 4 holes in the blower stand are tapped 1/4".
   - Keep the (4) ¼" 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 45º 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 45º 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 10 or Figure 11.

Figure 23: Blower electrical connection conduit

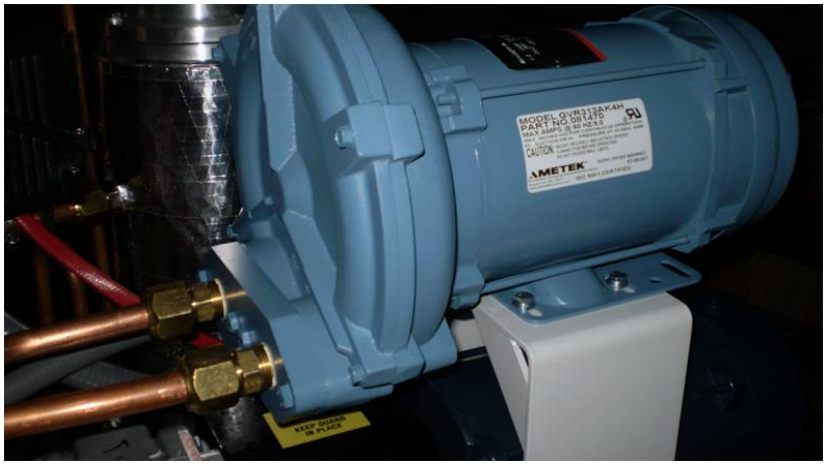


Figure 24: Blower inlet and outlet tubing connections and mounting bolts

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 10 or Figure 11.

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 25.

6. Completely remove the vacuum pump ½" and ¼" inlet 45º flare tubing and all pipe fittings connected to the vacuum pump.
   - **See** Figure 26.

7. Completely remove the ¼" HC sensor inlet tubing at the air outlet and the HC sensor.
   - **See** Figures 27 and 28.
   - NOTE: The tube ends are a Parker 45º 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) ¼" x 1-½" vacuum pump base mounting bolts.
3. Tighten the mounting bolts so that the bottom of the vacuum pump base is ⅛" from the ECS base.
4. Re-install the ½" and ¼" inlet 45° flare tubing and all pipe fittings connected to the vacuum pump.
5. Re-install the ½" outlet tubing.
6. Re-install the ¼" HC sensor inlet tubing.
   Do not use any thread sealing compound when assembling the 45 º 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.

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 10 or Figure 11.

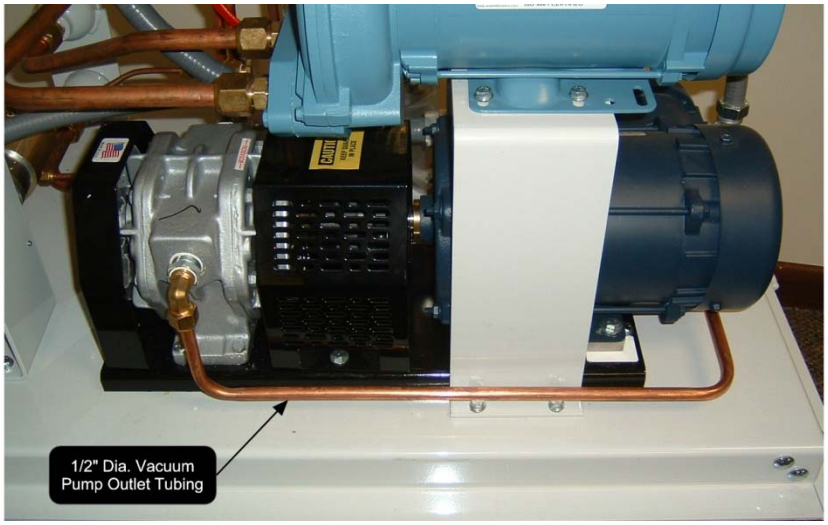


Figure 25: Vacuum pump outlet tubing connection

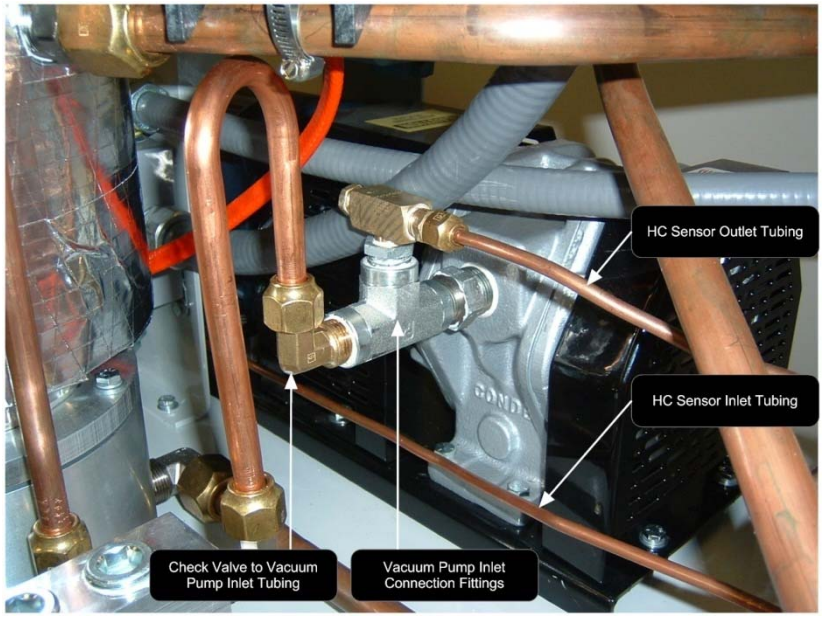


Figure 26: Vacuum pump inlet tubing and fittings

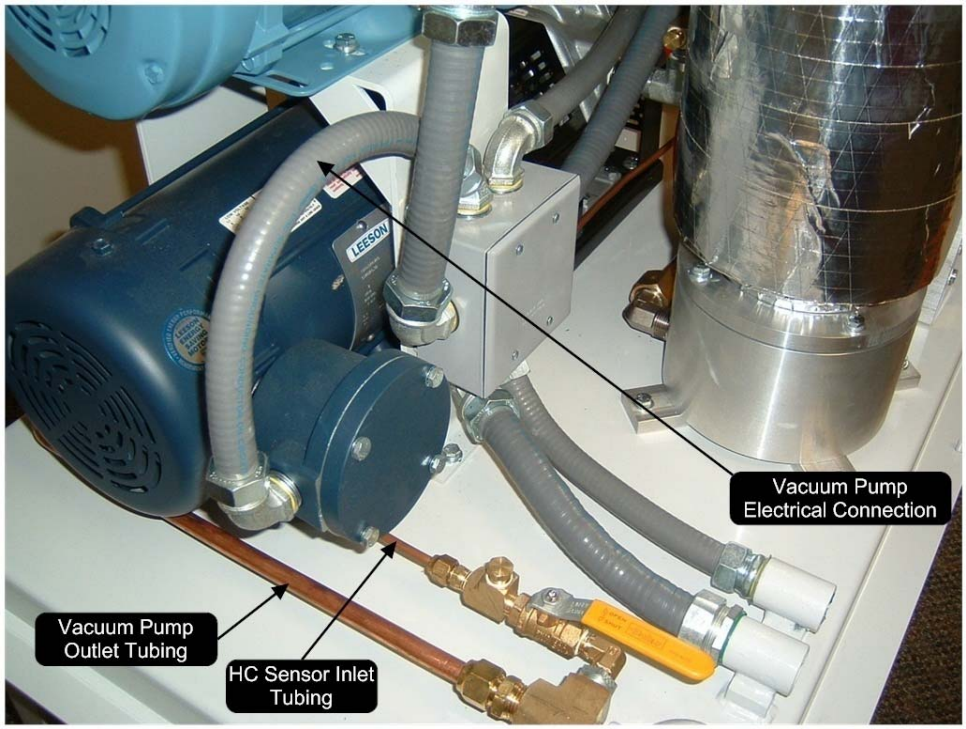


Figure 27: Vacuum pump electrical connection / vacuum pump outlet tubing / HC sensor inlet tubing

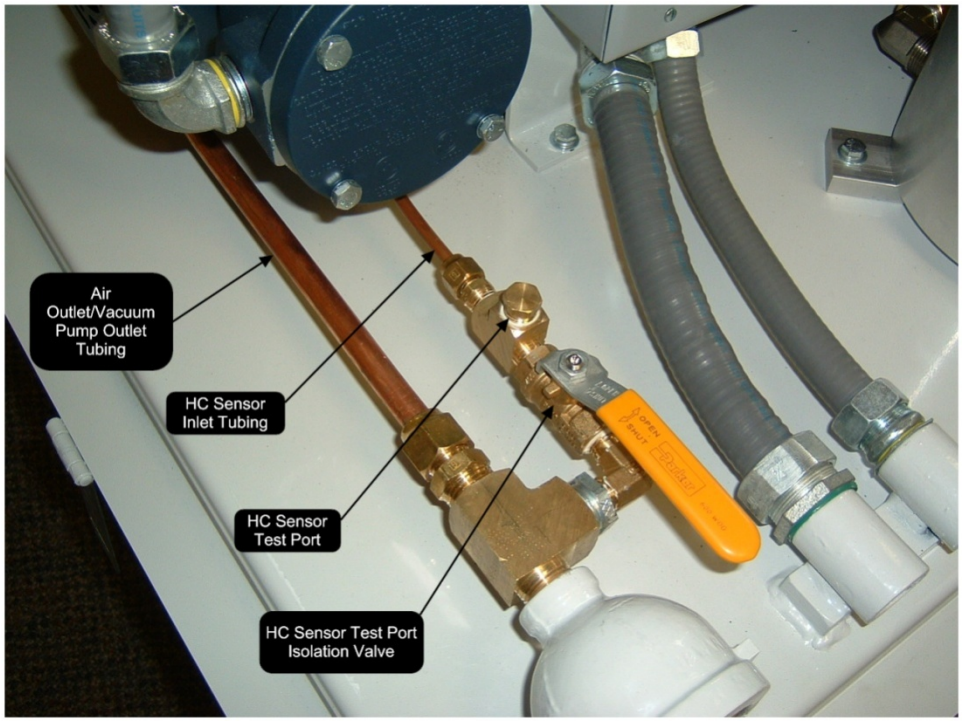


Figure 28: Air outlet / vacuum pump outlet / HC sensor inlet tubing

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 10 or Figure 11.
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 ½" 45º flare tubing from the top and side of the membrane housing: See Figure 29.

   NOTE: The nuts on the tubing are ¾" 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) ¼" 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 30.

Figure 29: Membrane Housing

Figure 30: 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 31.

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

Figure 31: Membrane extraction tool

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 32) 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.

Figure 32: Membrane base insert

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.

9.3 Installing the New Membrane

1. Install (4) new O-rings:
   (2) O-rings on the membrane (VST Part #5006-013).
   (2) O-rings on the base insert (VST Part #5006-012).

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 32.

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 10 or Figure 11.

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

1. Prior to starting work, put the TLS-350 in the Manual OFF mode.
   - See Figure 10 or Figure 11
2. Close the ball valves between the *Processor* and the vent risers.
3. At the disconnect switch and at the breaker, disconnect the power to the blower and vacuum pump motors.
4. Conduct ECS Unit Purge Procedure (See Section 6 of this document).
5. 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 34-35.
6. Completely remove the vacuum pump ½" outlet tubing.
   - See Figure 25.
7. Completely remove the vacuum pump ½" and ¼" inlet 45º flare tubing and all pipe fittings connected to the vacuum pump.
   See Figure 27.
8. Completely remove the ¼" HC sensor inlet tubing at the air outlet and the HC sensor.
   - See Figure 50.
   - NOTE: The tube ends are a Parker 45º flare, use caution not to damage the flared ends on the tubing or the threads on the nuts after removal.

Figure 34: Vacuum and motor assembly

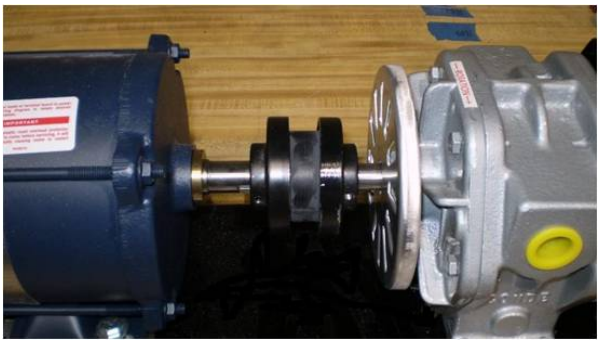


Figure 33: Vacuum pump with guard removed

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

Figure 35: 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 36.

2. Slide the vacuum pump towards the motor.
   - Place any shims under the vacuum pump in their original location.

3. Bolt the vacuum pump to the vacuum pump base.

4. Install the drive coupling and fan guards.

5. Re-install the ½" and ¼" inlet 45° flare tubing and all pipe fittings connected to the vacuum pump.

6. Re-install the ½" outlet tubing.

7. Re-install the ¼" HC sensor inlet tubing.
   Do not use any thread sealing compound when assembling the 45 ° flare nuts.
   NOTE: When tightening the 45° flare nuts: Clamp the tube flare between nut and nose body of the tube by screwing the nut on finger tight. Tighten with a wrench an additional ¼ turn for a metal-to-metal seal.

8. Perform a *Processor* leak test – see Section 3.8 of this document.

9. Remove the lock(s) and tags from the lockout & tagout.

10. Open the ball valves between the *Processor* and the vent risers.

11. At the breaker, but not at the disconnect switch, turn ON power to the blower and vacuum pump.

12. Return the TLS-350 to the manual ON mode.

13. Using the disconnect switch near the Processor, briefly cycle the power to verify that there is no excessive vibration at the coupling.

14. After work is completed, put the TLS-350 in the AUTOMATIC mode and engage the disconnect.
    See Figures 12 or 13.

Figure 36: 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 10 or 11.
   - 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 ¾" 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 37.
   - 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 38.

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 ¾" tube.

3. After the electrical junction box is attached to the ¾" 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 39. End Seal Kit Components
   - See the Figures 40-41. Chromalox End Seal Kit Installation Instruction (2-Pages -) to install the heat trace cable on the end seal kit
   - Figure 42. 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 43-46. Electrical Junction Box Installation Instructions, (4-Pages).

3. Attach the electrical junction box to the ¾" 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 47 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 48. 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 10 or 11

Figure 37: Termination block inside the electrical junction box

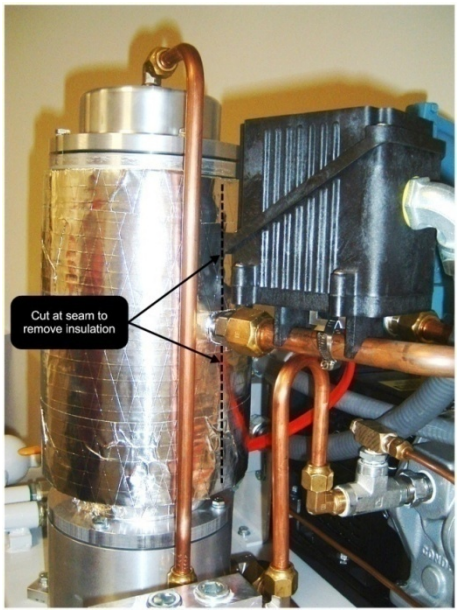


Figure 38: Seam to cut to remove the insulation

Figure 39: End seal kit components

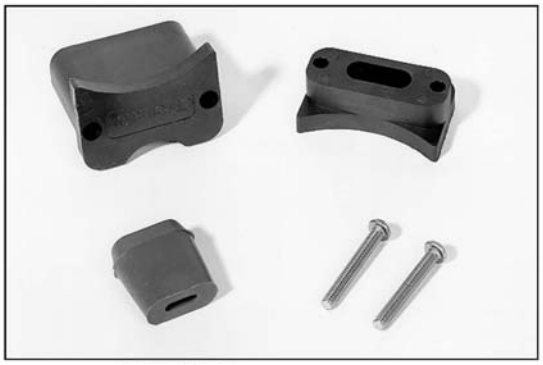
Connection screws
End cap
Grommet
Pressure plate
Heat trace cable

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
2 - Screws
1 - Pressure Plate
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 40: 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.

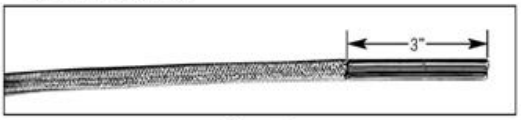


Figure 2

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.

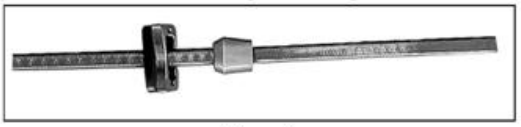


Figure 3

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.

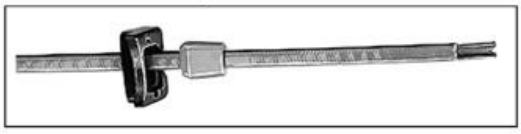


Figure 5

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.

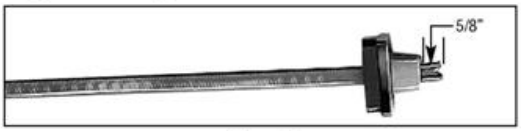


Figure 6

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.

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Figure 41: End seal kit installation instructions, page 2 of 2

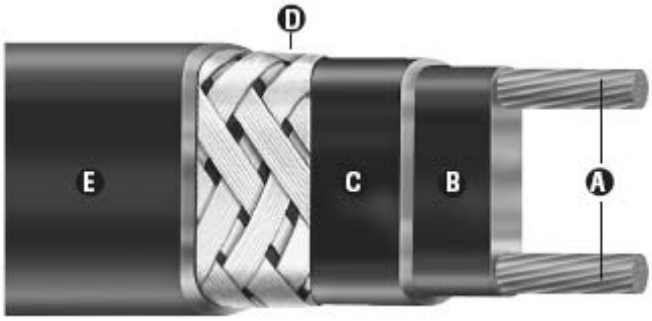

Figure 42: Prepare the new heat trace cable for installation into the end seal kit

A. Twin 14 AWG copper buss wires

B. Semi-conductive polymer core

C. High temp. fluoropolymer jacket

D. Metallic braid ground

E. High temperature fluoropolymer jacket

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Installation Instructions

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

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

RTPC Power Connection Kit Parts:

1 - Molded Junction Box consisting of: Base - Box - Lid - Hardware
1 - Three Position Terminal Block
1 - Mounting Screw for Terminal Block
1 - Cable Grommet
1 - Cover Gasket

GENERAL

⚠WARNING

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

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

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

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

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

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

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

Figure 43: Electrical junction box installation instructions, page 1 of 4

INSTALLATION

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

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

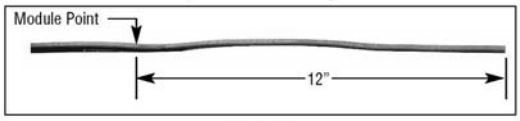

Figure 1

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

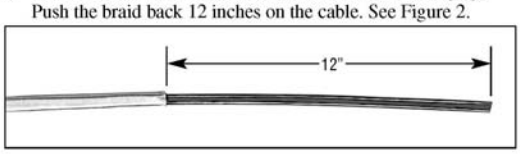

Figure 2

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

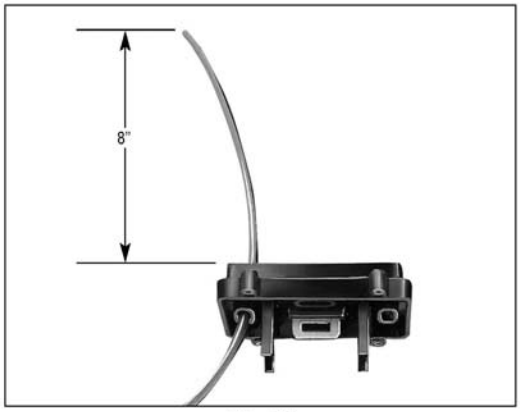

Figure 3

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

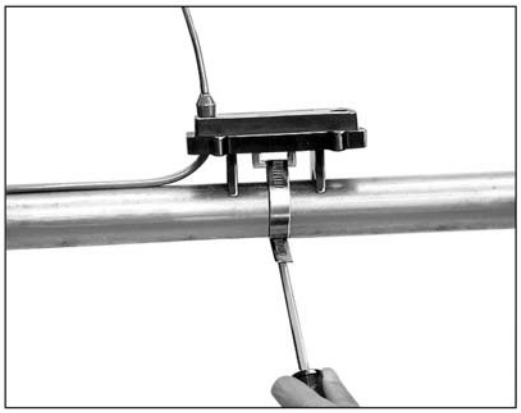

Figure 4

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

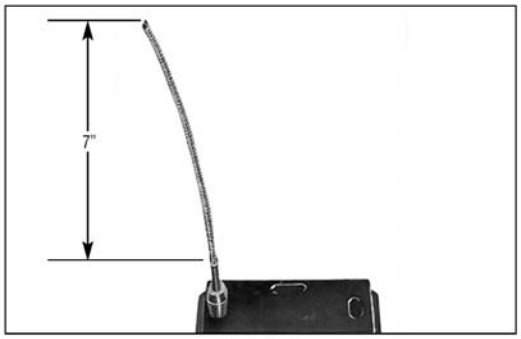

Figure 5

6. **FOR ALL CABLES:**
   Punch out the knockouts on the bottom of the box which correspond to the openings in the base through which the heating cable passes. Be careful to punch out only those knockouts to be used. If one is mistakenly punched, blank grommets can be ordered to re-establish the water tight seal. See Figure 6.

Figure 6

Figure 44: 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.

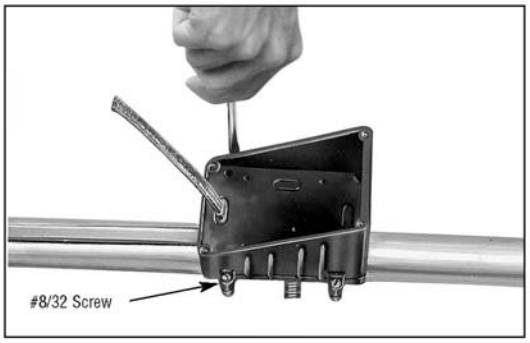

Figure 7

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.

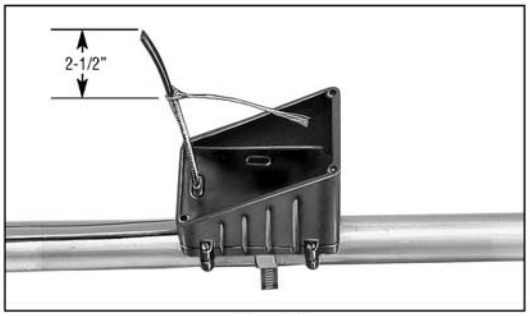

Figure 8

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.

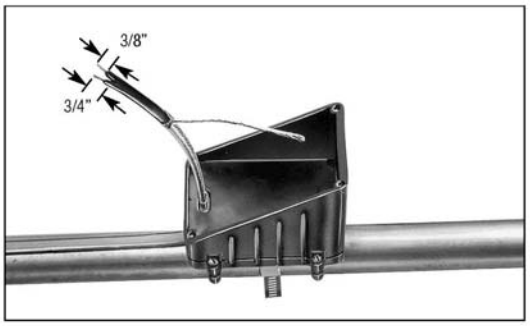

Figure 9

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.

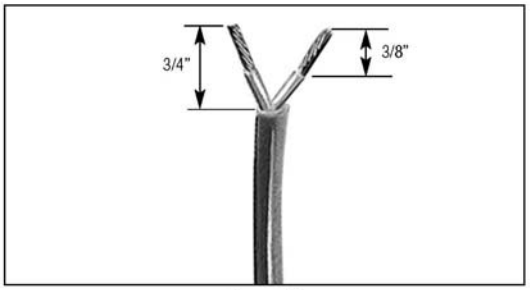

Figure 10

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.

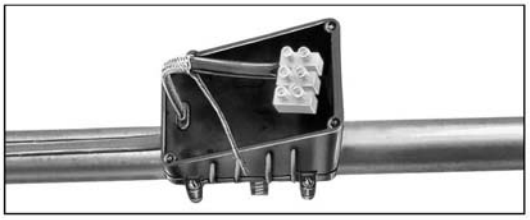

Figure 11

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.

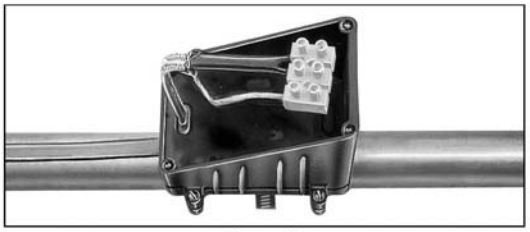

Figure 12

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.

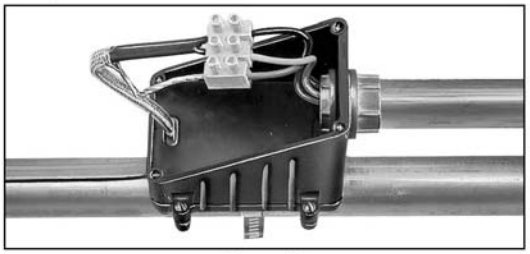

Figure 13

Figure 45: Electrical junction box installation instructions, page 3 of 4

INSTALLATION

14. FOR ALL CABLES:
Strip 3/8 inch length of each conductor of the power cord. Insert the bared ends of the conductors into the corresponding openings on the unused side of the terminal block. Remember, the green (ground) wire must be opposite of the opening of the terminal block which is either empty or contains the metal braid. See Figure 14.

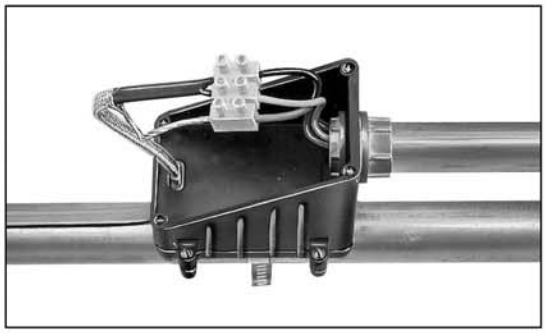

Figure 14

15. FOR ALL CABLES:
Mount terminal block to bottom of the box by driving the 6/32 self-tapping screw into the mounting hole as shown. See Figure 15.

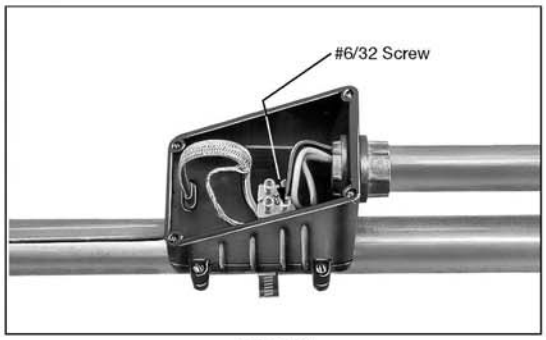

Figure 15

16. FOR ALL CABLES:
Carefully push the wires into the box. Secure the lid to box. See Figure 16.

Figure 16

17. FOR CABLE WITH EXPOSED METAL BRAID (-C):
Unravel four (4) inches of braid from the cable and twist into a pigtail.

⚠WARNING

ELECTRIC SHOCK HAZARD. The twisted braid must be effectively grounded in accordance with the National Electrical Code to eliminate electric shock hazard.

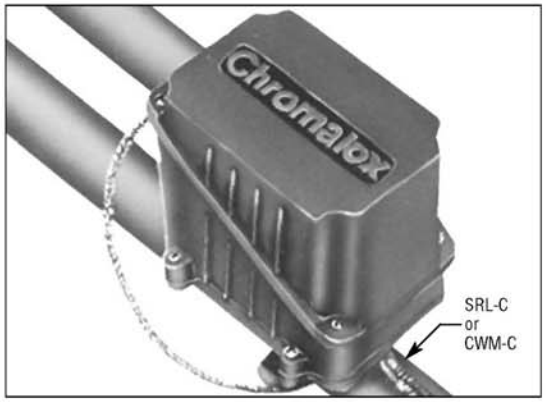

Figure 17

WARRANTY AND LIMITATION OF REMEDY AND LIABILITY

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

Notwithstanding the provisions of this WARRANTY AND LIMITATION Clause, it is specifically understood that Products and parts not manufactured and work not performed by Chromalox are warranted only to the extent and in the manner that the same are warranted to Chromalox by Chromalox's vendors, and then only to the extent that Chromalox is reasonably able to enforce such warranty, it being understood Chromalox shall have no obligation to initiate litigation unless Buyer undertakes to pay all cost and expenses therefor, including but not limited to attorney's fees, and indemnifies Chromalox against any liability to Chromalox's vendors arising out of such litigation.

Upon Buyer's submission of a claim as provided above and its substantiation, Chromalox shall at its option either (i) repair or replace its Products, parts or work at the original f.o.b. point of delivery or (ii) refund an equitable portion of the purchase price.

THE FOREGOING IS CHROMALOX'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY, AND IS BUYER'S EXCLUSIVE REMEDY AGAINST CHROMALOX FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES. BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS. IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTAL OR CONSEQUENTIAL DAMAGES AND BUYER SHALL HOLD CHROMALOX HARMLESS THEREFROM. ANY ACTION BY BUYER ARISING HEREUNDER OR RELATING HERETO, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE DATE OF SHIPMENT OR IT SHALL BE BARRED.

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

Figure 47: End seal kit location and heat trace cable installation

Figure 48: 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.

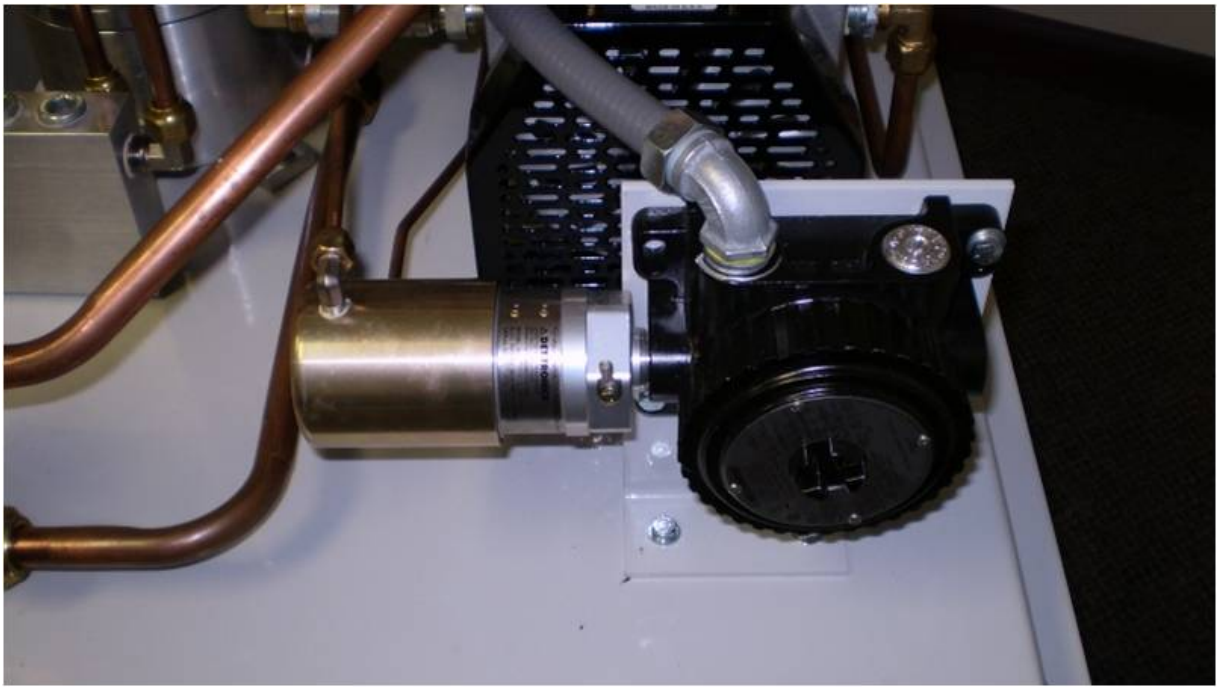


Figure 49: HC IR Sensor Module and Electrical Housing Assembly

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 10 or Figure 11.

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 ¼" 45° flare tubing from the top and bottom sides of the HC IR Sensor Module.
   - See Figure 50.
   - NOTE: The nuts on the tubing are ¼" 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 50: HC IR Sensor Module 1/4" 45º 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.

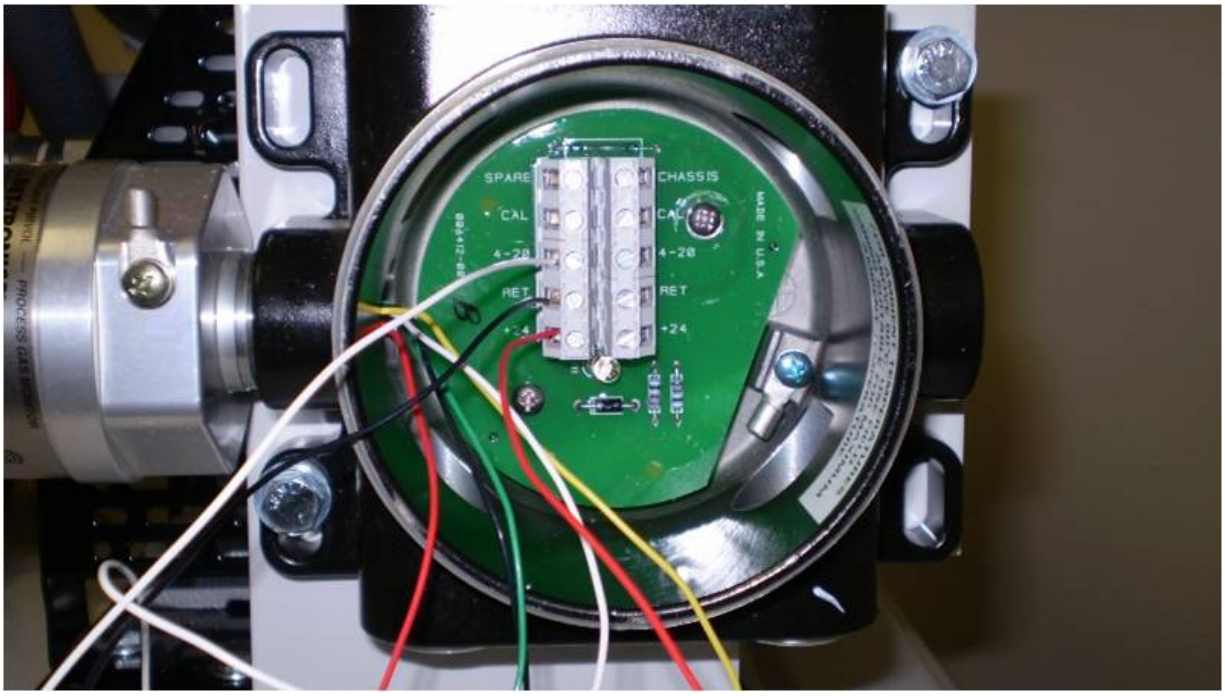


Figure 51: HC IR Sensor Electrical Housing Circuit Board

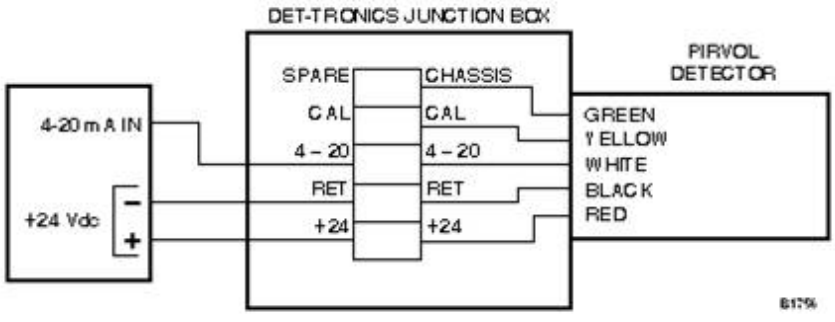


Figure 52: HC IR Sensor Electrical Housing Circuit Board Wiring Diagram

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 53.

3. Replace the aluminum cover on the HC IR sensor.

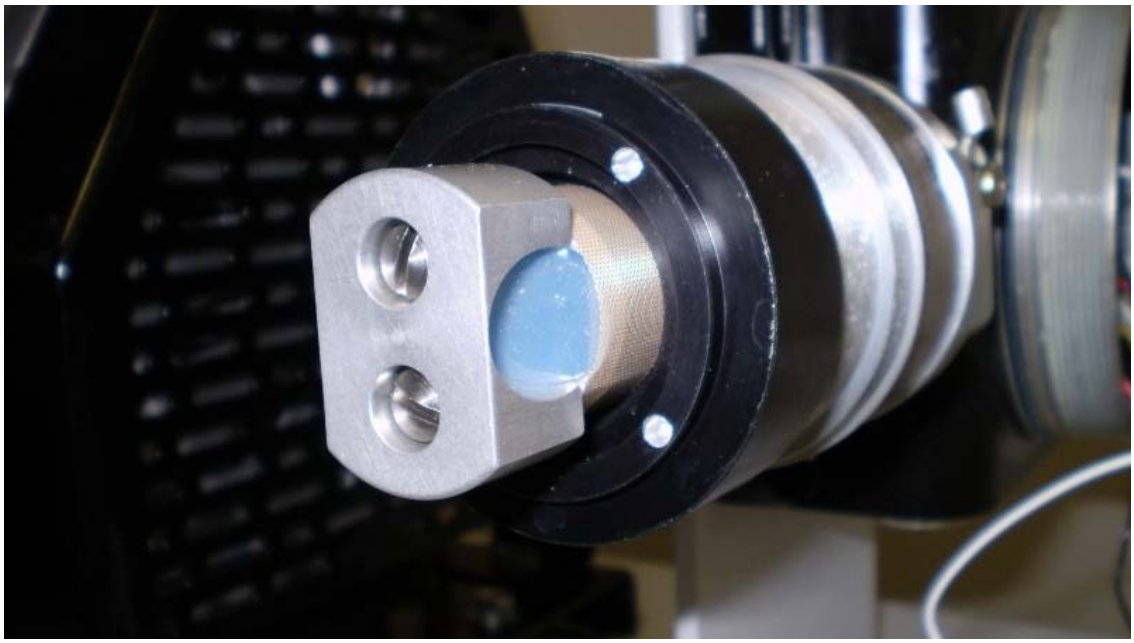


Figure 53: HC IR sensor installation orientation

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 10 or 11.

13 Forms

- The following pages contain forms for:
    - ► Scheduled preventative maintenance list
    - ► Scheduled preventative maintenance checklist

13.1 Preventative Maintenance

Preventative Maintenance			
ASC #:		Date:	
ASC Name:			
ASC Certification Level:			
ASC Company:			
GDF Name:			
Address:			
City:		State:	ZIP Code:
GDF Contact Person Name:			
GDF Contact Person Title:			
GDF Contact Person Phone:			
GDF Contact Person E-mail:			
Notes			
Use the form on the following page to note details of Preventative Maintenance activities.			

13.2 Preventative Maintenance Checklist Form

Component	Frequency	Date Inspected	Completed	Required Action Items
PROCESSOR	Yearly			
• Inspect drive coupling on vacuum pump.			[]	
• Check the continuity of the heat trace cable.			[]	
RECIRCULATION BLOWER				
• Replace every 10 years or every 15,000 hours, whichever comes first.			[]	
VACUUM PUMP				
• Replace every 10 years or every 15,000 hours, whichever comes first.			[]	

Veeder-Root In-Station Diagnostics (ISD)

Install, Setup, & Operation Manual

For VST Processors, Veeder-Root Polisher, Franklin Fueling System Clean Air Separator (CAS) and Hirt VCS 100

VEEDER-ROOT

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.

 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.

FCC INFORMATION

This equipment complies with the requirements in Part 15 of the FCC rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception requiring the operator to take whatever steps are necessary to correct the interference.

INSTALLATION IN THE STATE OF CALIFORNIA

Please refer to the California Air Resources Board Vapor Recover Certification Phase II EVR Executive Order web site (*www.arb.ca.gov/vapor/eo-evrphaseII.htm*) for the latest manual revisions pertaining to VR 204 (VST Phase II EVR System Including ISD System).

WARRANTY - Please see next page, iii.

Warranty

This warranty applies only when the product is installed in accordance with Veeder-Root's specifications by Veeder-Root certified installers. This warranty will not apply to any product which has been subjected to misuse, negligence, accidents, systems that are misapplied or are not installed per Veeder-Root specifications, modified or repaired by unauthorized persons, or damage related to acts of God. Veeder-Root is not liable for incidental, consequential, or indirect damages or loss, including, without limitation, personal injury, death, property damage, environmental damages, cost of labor, clean-up, downtime, installation and removal, product damages, loss of product, or loss of revenue or profits. This warranty applies to the initial purchaser and any subsequent purchaser for the duration of the warranty period. T**HE WARRANTY CONTAINED HEREIN IS EXCLUSIVE AND THERE ARE NO OTHER EXPRESS, IMPLIED, OR STATUTORY WARRANTIES. WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.**

TLS-350R, TLS-350 PLUS, TLS-350J AND TLS-300I/C, AND TLS2 MONITORING SYSTEMS

We warrant that this product shall be free from defects in material and workmanship and is compliant with all applicable performance standards and specifications for which it has been certified, for a period of one (1) year from the date of installation when proof of date of installation is provided or twenty-four (24 months) from the date of manufacture when proof of date of installation is not provided. During the warranty period, we or our representative will repair or replace the product, if determined by us to be defective, at the location where the product is in use and at no charge to the purchaser. **LAMPS, FUSES, AND LITHIUM BATTERIES ARE NOT COVERED UNDER THIS WARRANTY.**

If "Warranty" is purchased as part of the Fuel Management Service, Veeder-Root will maintain the equipment for the life of the contract in accordance with the written warranty provided with the equipment. A Veeder-Root Fuel Management Services Contractor shall have free site access during Customer's regular working hours to work on the equipment. Veeder-Root has no obligation to monitor federal, state or local laws, or modify the equipment based on developments or changes in such laws.

MODULES, KITS, OTHER COMPONENTS (PARTS PURCHASED SEPARATE OF A COMPLETE CONSOLE)

We warrant that this product shall be free from defects in material and workmanship and is compliant with all applicable performance standards and specifications for which it has been certified, for a period of one (1) year from the date of installation when proof of the date of installation is provided or fifteen (15) months from the date of manufacture when proof of date of installation is not provided. We warrant that the lithium batteries (excluding EVR BATTERY PACK) shall be free from defects in material and workmanship for a period of three (3) months from date of invoice. We will repair or replace the product if the product is returned to us; transportation prepaid by user, within the warranty period, and is determined by us to be defective. **LAMPS AND FUSES ARE NOT COVERED UNDER THIS WARRANTY.**

IN STATION DIAGNOSTICS (ISD)

For components used in ISD systems (Vapor Flow Sensor, Vapor Pressure Sensor, Software, TLS RF, Wireless Repeater, Wireless Transmitter & Wireless Receiver), excluding **LAMPS, FUSES, AND LITHIUM BATTERIES**, the following warranty applies:

We warrant that this product shall be free from defects in material and workmanship and is compliant with all applicable performance standards and specifications for which it has been certified,, for a period of one (1) year from the date of ISD start-up when proof of the date of install is provided or twenty-four (24) months from the date of manufacture when proof of date of installation is not provided. During the warranty period, we and or our representative will repair or replace the product, if determined by us to be defective, at the location where the product is in use, at no charge to the purchaser.

For ISD components installed after the initial ISD start-up, we warrant that these products shall be free from defects in material and workmanship and is compliant with all applicable performance standards and specifications for which it has been certified, for a period of one (1) year from the date of installation when proof of the date of install is provided or fifteen

(15) months from date of manufacture when proof of date of installation is not provided. We will repair or replace the product if the product is returned to us; transportation prepaid by user, within the warranty period, and is determined by us to be defective.

EVR BATTERY PACK

We warrant that this product shall be free from defects in material and workmanship and is compliant with all applicable performance standards and specifications for which it has been certified, for a period of one (1) year from the date of installation when proof of the date of install is provided or fifteen (15) months from the date of manufacture when proof of date of installation is not provided. **The replacement EVR Battery Pack warranty period will be the REMAINING warranty period of the original EVR Battery Pack. LAMPS, FUSES, AND LITHIUM BATTERIES OTHER THAN THE EVR BATTERY PACK, ARE NOT COVERED UNDER THIS WARRANTY.**

Figures

Tables

1 Introduction

In-Station Diagnostic (ISD) equipment is designed to monitor the collection and containment of vapors by vapor recovery equipment. The ISD software monitors the vapor recovery equipment using the Veeder-Root (V-R) TLS console platform, sensor inputs, and dispenser fuel events. ISD provides test reports, generates alarms following test/equipment failures, and finally, shuts down the site upon the occurrence of designated alarms.

This manual provides instructions to install, setup, and operate the special components of the Veeder-Root ISD system that are not covered in existing documentation shipped with other non-ISD specific V-R equipment (e.g., Mag probes, line leak detection, etc.). The ISD feature is an option for the TLS console platform, and as such, many of the installation/setup/operation instructions for non-ISD specific tasks (e.g., line leak detection) are covered in TLS-3XX supplied literature.

WARNING! Revision or reprogramming of the TLS may require notification of the local Certified Unified Program Agency (CUPA).

Site Requirements

Below are the requirements for all vapor recovery systems except where noted.

- V-R TLS-350R/EMC w/BIR, TLS-350 Plus/EMC Enhanced, TLS-350/EMC and Red Jacket ProMax consoles with ECPUII - install as per TLS-3XX Site Prep manual, setup following instructions in TLS-3XX System Setup Manual.
- A flash memory board (NVMEM203) for ISD software storage - installed on the ECPU2 board in place of the console's 1/2 Meg RAM board - install as per TLS-350 Series Board and Software Replacement Manual, no setup required.
- An available RS-232 module is required for RS-232 access to ISD reports - install as per instructions shipped with module, connect to the port using instructions in this manual.
- An output relay or dispenser relay board is required (either 4-Output Relay module, I/O Combination module) to shut down each Submersible Turbine Pump (STP) or dispenser upon activation of certain ISD alarms (these alarms can also be assigned in Line Leak Disable setup to shut down the STP or dispenser if Line Leak detection feature is installed) - install as per instructions shipped with module or line leak system, setup ISD shut down alarms either using output relays or line leak system following instructions in this manual. Two output relays on either of these two modules are also required for vapor processor motor control - install as per instructions in this manual.
- Dispenser Interface module (DIM) for the type of dispensers installed - install as per installation manual shipped with device, setup following instructions in DIM manual and TLS-3XX Setup Manual. Note: the DIM supplies flow meter event inputs needed for ISD analysis.
- One V-R Mag probe in each of the gasoline tanks being monitored - install as per installation manual shipped with device, setup following instructions in TLS-3XX Setup Manual.
- Smart Sensor module is required to monitor Air Flow Meters and Vapor Pressure Sensor (up to 8 devices per module, or 7 if customer is using Smart Sensor module / embedded pressure). Install and connect following instructions in the Air Flow Meter and Vapor Pressure Sensor installation Guides.
- Air Flow Meters (one for each dispenser) - install as per ISD Flow Meter installation manual shipped with meter, setup following instructions in this manual. Also referred to as Vapor Flow Meters within this manual.
- Vapor Pressure Sensor (one per site) - install as per ISD Pressure Sensor installation manual shipped with sensor, setup following instructions in this manual.
- When monitoring a VST ECS membrane processor a Multi-port controller module is required.

Supported Vapor Recovery Systems

Table 1 lists V-R supported vapor recovery system.

Table 1. Vapor Recovery System

Name	CARB Executive OrderBA
Balance Phase II EVR System including ISD	VR-204

Contractor Certification Requirements

Veeder-Root Contractor Certification Requirements	Installer Certification[6]	ATG Technician Certification[7]	VR Vapor Products Certification[8]
Install[1] ISD	X	X	X
Install PMC	X	X	X
Install CCVP	X	X	X
Install Wireless ISD/PMC	X	X	X
Installation Checkout[2]		X	X
ATG Startup[3] / Training[4] / Service[5]		X	X
ISD Startup / Training / Service			X
PMC Startup / Training / Service			X
CCVP Startup / Training / Service			X
Wireless ISD/PMC Startup / Training / Service			X
Install Pressure Sensor (ATG)	X	X	X
Maintain Pressure Sensor (ATG)		X	X
Calibrate Pressure Sensor (ATG)		X	X
Clear ATG Pressure Sensor Alarm (ATG)		X	X
Clear ISD/PMC Alarms (ISD/PMC)			X

[1]Perform wiring and conduit touting; equipment mounting
[2]Inspect wiring and conduit routing; equipment mounting
[3]Turn power on, program and test the systems
[4]Provide supervised field experience in service techniques and operations
[5]Troubleshoot and provide routing maintenance
[6]UST Monitoring Systems – Installer (Level 1)
[7]Certified UST Monitoring Technician
[8]VR Vapor Products

Warranty Registrations may only be submitted by selected Distributors. Certified installers are required to provide the GDF operator with the completed Equipment Warranty Notice, form 577013-868, for their records.

Related Manuals

The manuals in Table 2 below are shipped with the equipment on the V-R Tech Docs CD-ROM and will be needed to install related equipment.

Table 2. Related Manuals

V-R Manual	Part Number
TLS-3XX Site Prep Manual	576013-879
ISD Balance Flow Meter Installation Guide	IOM 15 VR-204
Vapor Pressure Sensor For Vent Stacks Installation Guide (For Sensor P/N 861190-X0X)	IOM 27 VR-204
Pressure Sensor Installation Guide (For Sensor P/N 331946-001)	IOM13 VR-204

Table 2. Related Manuals

V-R Manual	Part Number
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
ISD Troubleshooting Manual	577013-819
TLS-350 Series Board and Software Replacement Manual	576013-637
TLS-350R Point-of-Sale (POS) Application Guide	577013-401
Input/Output Modules Installation	576013-614
TLS RF Wireless 2 System (W2) Installation and Maintenance Guide	577013-964

Safety Precautions

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

ELECTRICITY
High voltage exists in, and is supplied to, the device. A potential shock hazard exists.

TURN POWER OFF
Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.

READ ALL RELATED MANUALS
Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.

WARNING
Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.

⚠ WARNING

The console contains high voltages which can be lethal. It is also connected to low power devices that must be kept intrinsically safe.

Turn power Off at the circuit breaker. Do not connect the console AC power supply until all devices are installed.

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

Example Site Diagrams

Figure 1 shows an example site with a VST ECS membrane vapor processor. The diagram shows setups unique to ISD which are discussed in this manual (marked with a star), and those setups performed following instructions in the appropriate sections of the TLS-3XX System Setup manual, such as In-Tank setup (marked with a hexagon).

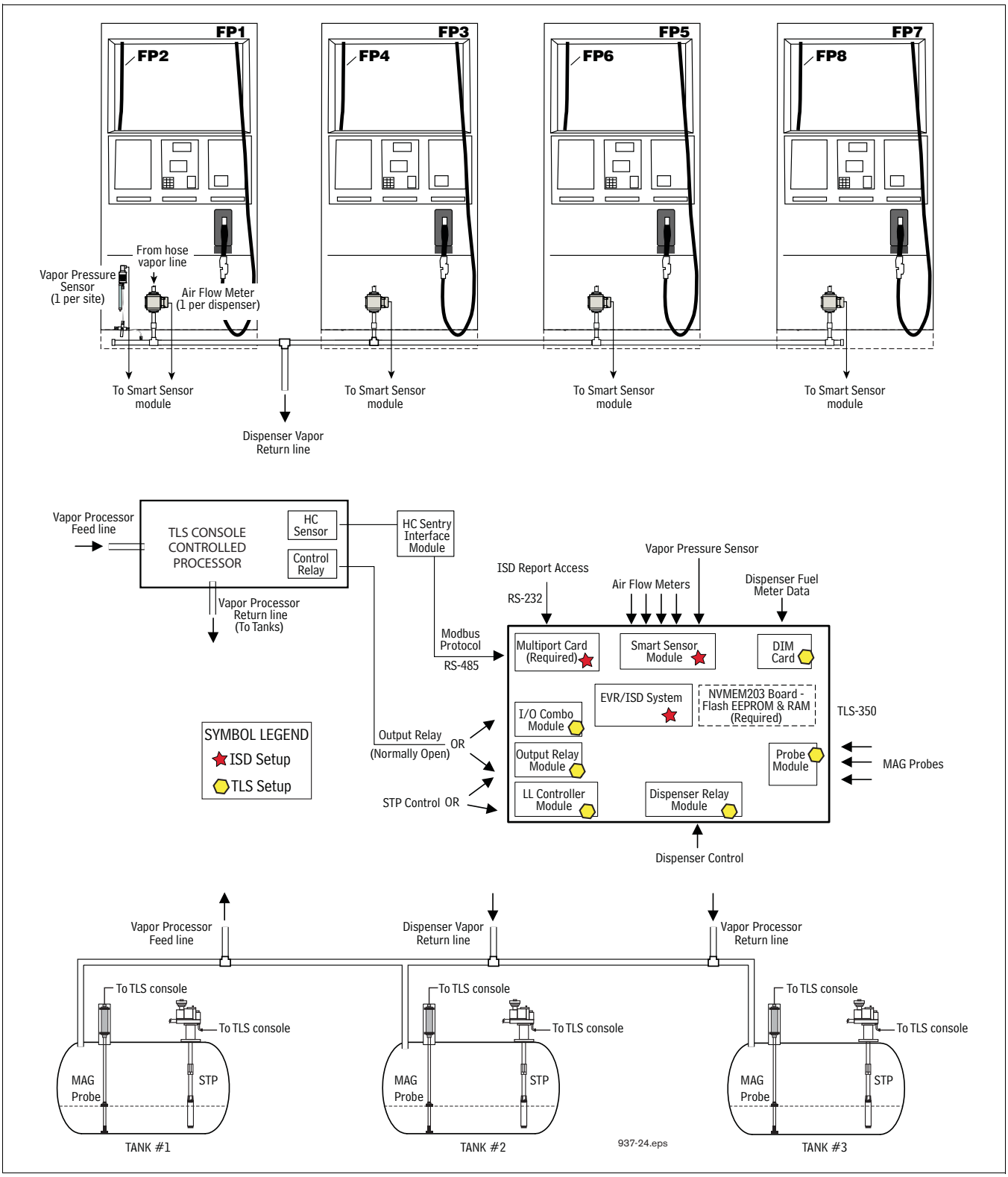


Figure 1. Example Site Diagram - TLS Console Controlled Vapor Processor

2 Installation

This section discusses the installation and wiring of the hardware required to enable the TLS console to perform ISD monitoring of the site's gasoline vapor recovery equipment (non-gas tanks are not monitored):

- Vapor Flow Meter
- Vapor Pressure Sensor
- Smart Sensor Interface Module (8 input and 7 input w/embedded pressure versions)
- NVMEM203 board - required
- 4-Relay Output Module or Dispenser Relay Module or I/O Combination Module
- Line Leak Detection
- Dispenser Interface Module
- Probe Interface Module
- Multi-port Card (for VST ECS Membrane Processor only)

All field wiring, its type, its length, etc., used for TLS console sensors must conform to the requirements outlined in the Veeder-Root TLS-3XX Site Prep manual (P/N 576013-879) and to additional field wiring requirements specified in related connected components, such as for Pressure Sensors.

Vapor Flow Meter

Install one Vapor Flow Meter in the vapor return piping of each gasoline dispenser following the instructions in the ISD Balance Flow Meter Installation guide (IOM 15 VR-204). Program the meter following instructions in this manual.

Vapor Pressure Sensor

Install one vapor pressure sensor as detailed in the applicable Pressure Sensor Installation Guide shown in Table 2. Program the meter following instructions in this manual.

Installing TLS Console Modules - General Notes

TLS consoles have three bays in which interface modules can be installed; Comm bay (left door) and Power and Intrinsically-Safe bays (right door). Smart Sensor modules are installed in the Intrinsically-Safe (I.S.) bay only (Figure 2).

Most consoles will be shipped with modules installed as ordered. If additional features are added at a later date, modules will be field installed.

In all cases, the position of the modules, their respective connectors and the devices wired to the connectors must be recorded to prevent improper replacement during installation or service. A circuit directory for Power and I.S. bay Interface Modules is adhered to the back of the right-hand door for this purpose.

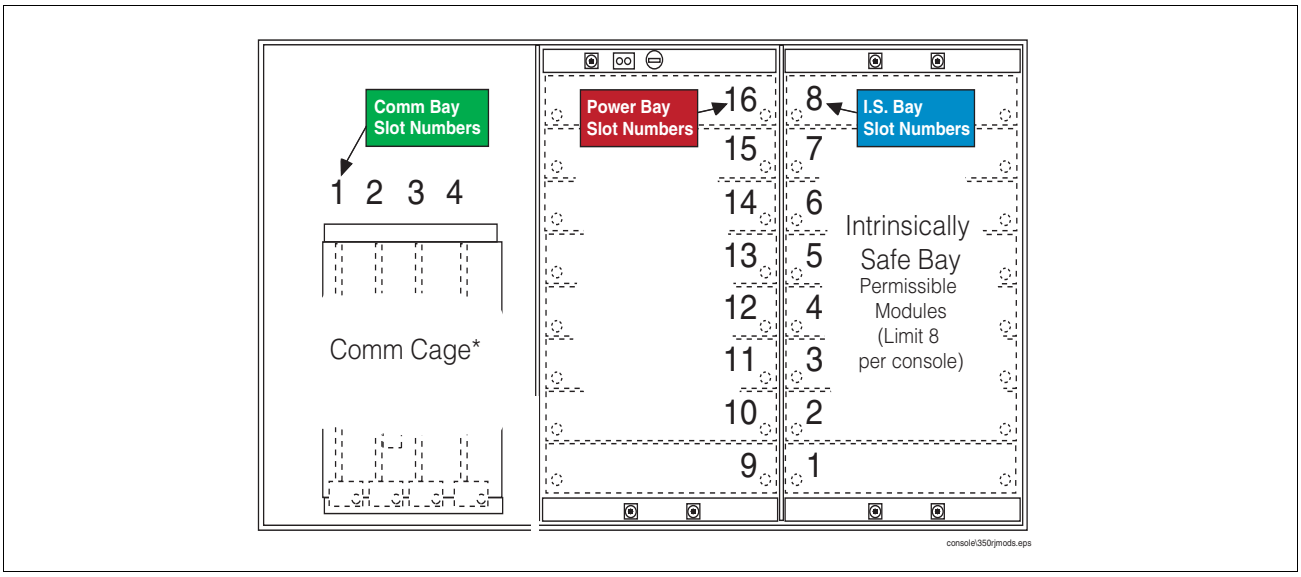


Figure 2. TLS console Interface Module Bays

CAUTION! During programming, module positions and the devices wired to each module are identified and stored in memory. If a connector is removed and reinstalled on a different module after programming, or if an entire module with its connector is removed and reinstalled in a different module slot, the system will not properly recognize the data being received.

Module Position

1. Record on the circuit directory the type of module in each slot location.
2. If a system contains multiple modules of a single type (i.e., two Smart Sensor Modules), they may be swapped between their respective slot locations, however, the connectors must remain with their original locations, not with the original modules.

Connector Position

1. Identify all connectors according to their slot location using the self-adhesive numbering labels furnished with each module. Accurately record on the circuit directory the location of each device wired to the connector as you attach wires to the module.
2. Once a device has been wired to certain terminals on a connector and the system has been programmed, the wires from that device may not be relocated to other terminals without reprogramming the system.

Grounding Probe and Sensor Shields

Connect probe and sensor cable shields to ground at the console only. Do not ground both ends of the shield.

CIRCUIT DIRECTORY

A circuit directory is adhered to the inside of the right-hand door. It should be filled out by the installer as the module's connectors are being wired.

The following information should be recorded for each slot:

- Module Type: record what type of module has been installed in the slot, e.g., Smart Sensor Module.
- Position Record: record the physical location and/or type of device wired to each terminal of the module connector in the slot, e.g., AFM1.

Smart Sensor Interface Module

The Smart Sensor Interface Module 8 input or 7 input w/embedded pressure versions monitor Air Flow Meter (AFM) and Vapor Pressure Sensor (VPS) inputs.

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

Open the right door of the console and slide the necessary Smart Sensor modules into empty I.S. Bay slots. Connect the field wiring from each of the sensors following instructions in the Flow Meter and Pressure Sensor manuals. Setup the Smart Sensor module(s) following instructions in this manual.

NVMEM203 Board

Verify that a NVMEM203 board is installed in the TLS console (ref. Figure 2-7 in the V-R TLS-3XX Series Consoles Troubleshooting Manual P/N 576013-818, Rev Q or later). This board contains flash EEPROM and RAM needed to run ISD software and store ISD reports. No setup is required.

Site Shut Down Requirements

Normal ISD operation requires TLS console control of the STP in each of the gasoline tanks. If the site has Wireless Pressure Line Leak Detection (WPLLD), Pressure Line Leak Detection (PLLD) or Volumetric Line Leak Detection (VLLD) for each tank, you can use the line leak disable setup to control the vapor recovery tanks (diesel tanks do not require shutdown). If the site does not have line leak detection for all vapor recovery tanks, you can use output relay setup to control each tank. In lieu of line leak detection, install the necessary modules (output relay) to control each gasoline tank. Alternately, you can install Dispenser Relay Modules to control dispensing.

Dispenser Interface Module (DIM)

Verify that a dispenser interface module (DIM) is installed in the TLS console communication bay (ref. Figure 2) and that it is designed to communicate with the type of gasoline dispensers installed at the site. The ISD software requires dispenser fuel flow meter data inputs. Reference TLS-350R Point-of-Sale (POS) Application Guide to select correct DIM card. Refer to the manual shipped with the DIM for installation instructions, refer to the TLS-3XX System Setup manual to program the DIM.

Probe Interface Module

Verify that a Probe Interface Module(s) is installed (Intrinsically-Safe bay) and that a Mag probe is in each gasoline tank and is connected to the module(s). Program the Mag probes following instructions in the TLS-3XX System Setup manual.

I/O Combination or 4-Relay Module

Connect the vapor processor motor control relay to two relays on either the 4-Relay or I/O Combination module as shown in Figure 4.

Multi-Port Card for Vapor Processor Communication

A Multi-port card is needed for RS-485 communication with the TLS console and is required with VST ECS membrane processor installations. Verify that a Multi-port card is installed in slot 4 of the card cage in the communications bay of the TLS console (ref. Figure). When installing this card, refer to the V-R Serial Comm Modules Installation Guide (577013-528) for instructions. Connect this card to the vapor processor as shown in Figure 4. Program the card as instructed in this manual.

TLS Console with V-R Vapor Polisher

Figure 3 shows the interconnection wiring between a TLS console and a V-R Vapor Polisher.

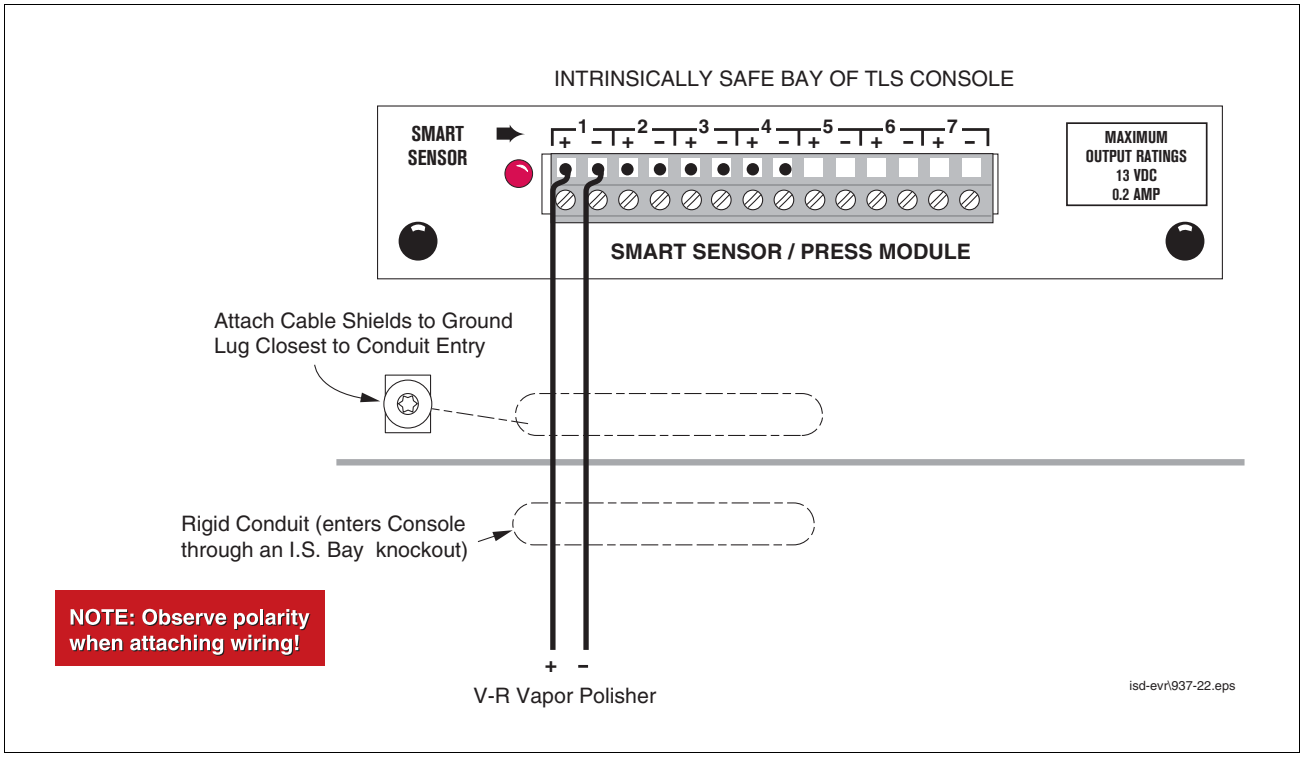


Figure 3. V-R Vapor Polisher Connections to TLS Console

TLS Console with VST Processor

Figure 4 shows the interconnection wiring between a TLS console and a VST ECS Membrane Processor. For VST Green Machine Processor see IOM V204 18.

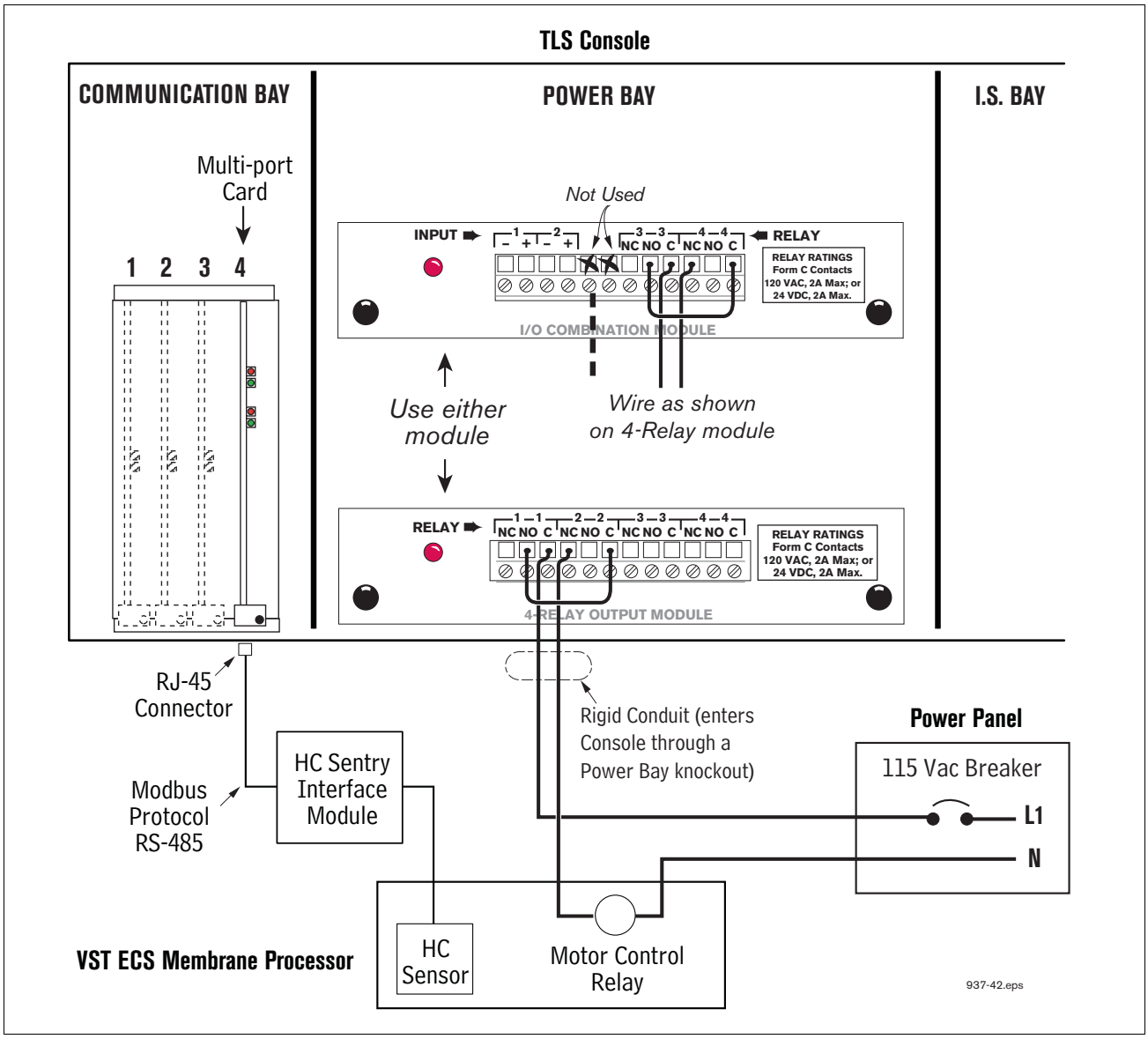


Figure 4. VST ECS Membrane Processor Connections

TLS Console with Hirt VSC 100 Processor

Figure 5 shows the interconnection wiring between a TLS console and a Hirt VCS 100 Processor.

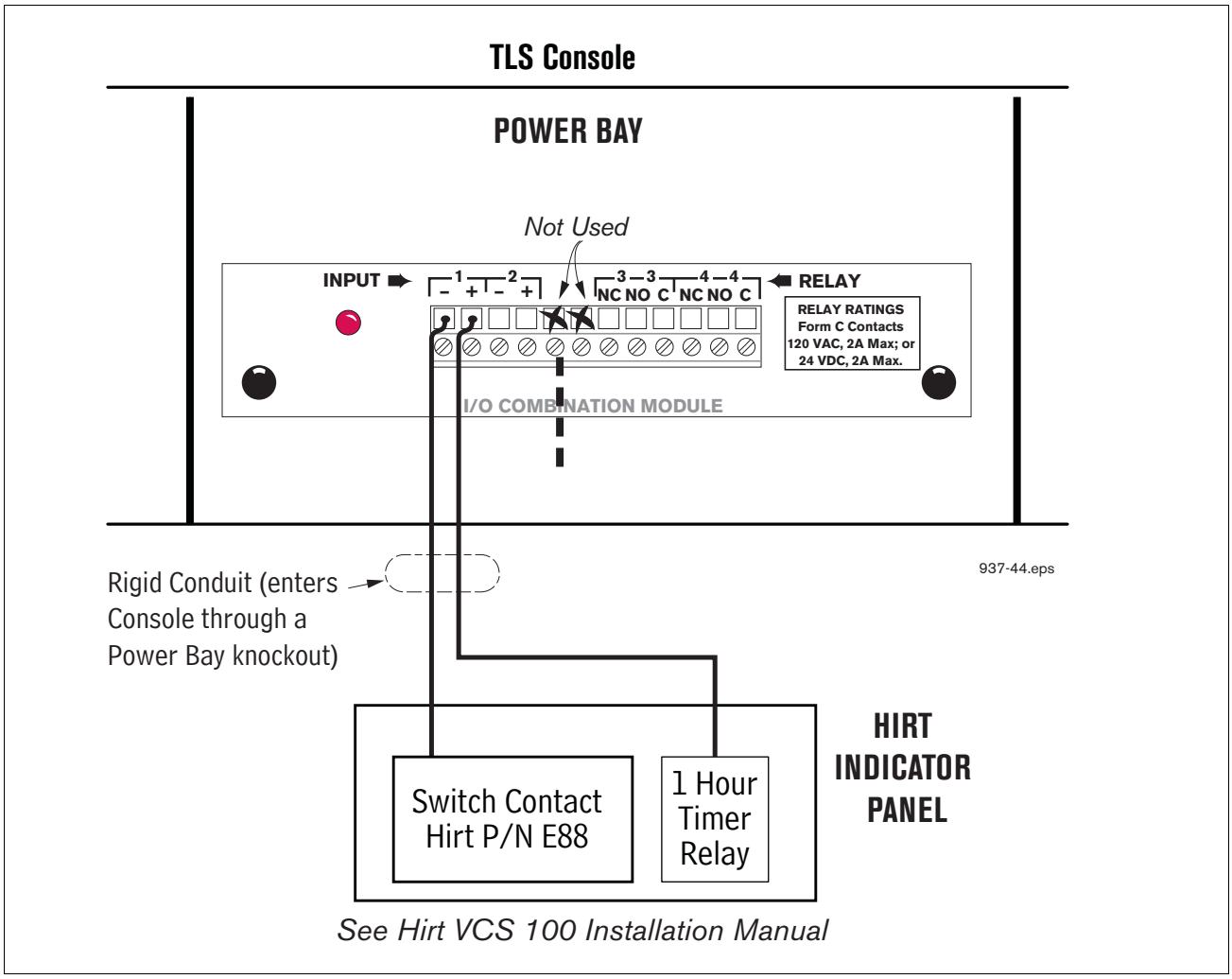


Figure 5. Hirt VCS 100 Processor Connections to TLS Console

3 Setup

Introduction

This section describes how to program the ISD system using the TLS console's front panel buttons and display. The procedures in this manual follow standard TLS console setup programming input, i.e., keypad/display interaction. If necessary, refer to Section 2 of the TLS-3XX System Setup manual (P/N 576013-623) to review entering data via the front panel keypads.

All ISD-related equipment must be installed at the site and connected to the TLS console prior to beginning the setups covered in this section. As with all TLS connections, you cannot change sensor wiring or module slots after programming or the system will not recognize the correct data. Reference the section entitled "Connecting Probe/Sensor Wiring to Consoles" in the TLS-3XX Site Prep and Installation manual (P/N 576013-879) for rewiring precautions.

SYSTEM SETUPS

- External Input Setup - Hirt VCS 100 Processor Only
- Smart Sensor Setup - All ISD site (Figure 7)
  This setup mode function programs the Smart Sensor Interface module to monitor the Air Flow Meters, ATM, Vapor Valve and the Pressure Sensor.
- EVR/ISD Setup - All ISD sites (Figure 9, Figure 10 and Figure 11)
  This setup mode function programs the TLS console for EVR/ISD vapor recovery monitoring and reporting.
- Verify Console Date/Time
  Check the console front panel to confirm display of current date and time. Reset if necessary (refer to current date/current time setups in TLS-3XX System Setup manual).

ALARM SETUPS

One or more TLS setups below must be performed to shut down the tank or the dispenser should certain ISD alarms occur:

- For ISD sites with line leak detection - XLLD Line Disable Setup (go to Figure 18)

  This setup assigns ISD alarms to a line leak detector that will shut down the tank's STP.
- For ISD sites without line leak detection - Output Relay Setup (go to Figure 20)

  This setup assigns ISD alarms to a relay that will shut down the tank's STP.
- For ISD sites with dispenser shutdown - Dispenser Relay Setup (go to Figure 22)

  This setup assigns ISD alarms to a relay that will shut down the dispenser.

External Input Setup - Hirt VCS 100 Processor Only

The I/O Combination Module is installed in the Power bay of the TLS console. Figure 7 diagrams the External Input setup procedure required with the Hirt VCS 100 processor.

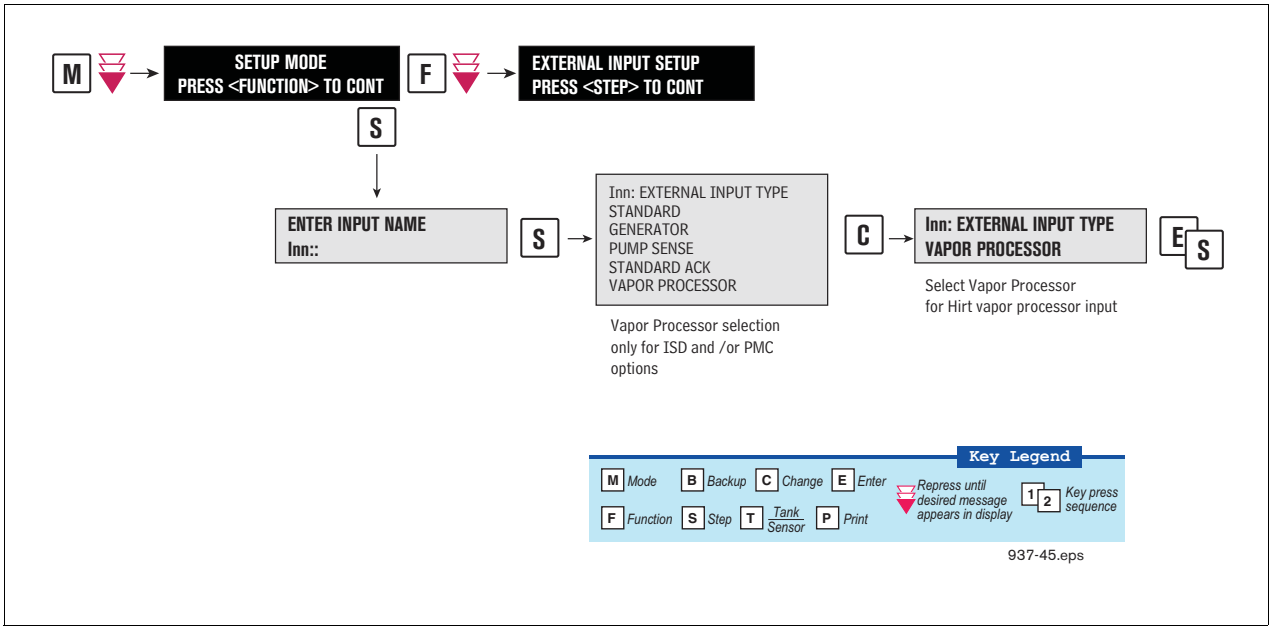


Figure 6. External Input Setup For Hirt VCS 100 Processor

Smart Sensor Setup

The Smart Sensor Interface Module is installed in the Intrinsically-Safe bay of the TLS console. This module monitors Air Flow Meters, ATM, Vapor Valve and the Vapor Pressure Sensor. Figure 7 diagrams the Smart Sensor setup procedure. Figure 8 shows a printout of the Smart Sensor setup.

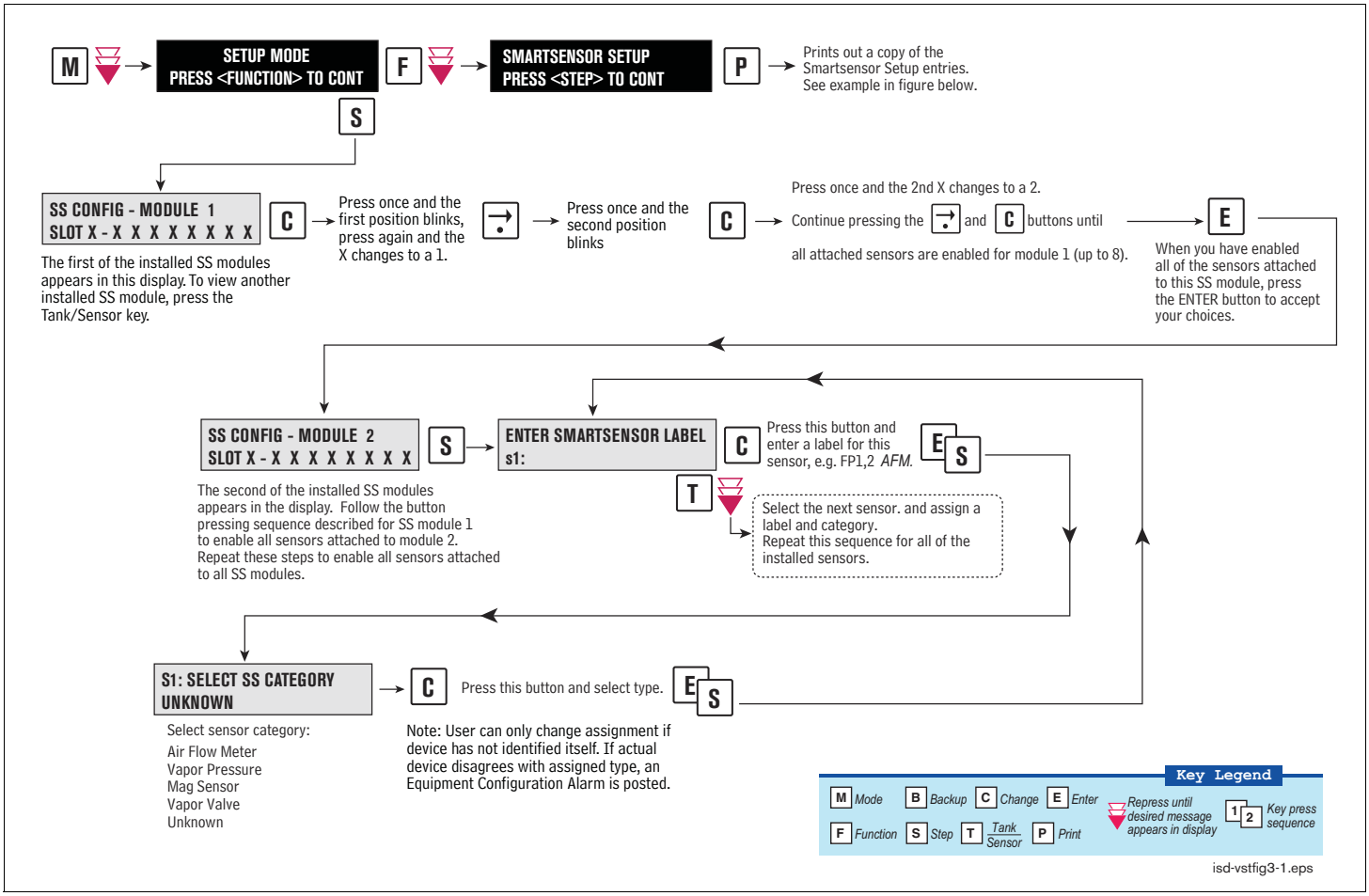


Figure 7. Smart Sensor Setup

```
SMARTSENSOR SETUP
----------------------

S01:FP 1   - 2
CATEGORY AIR FLOW METER

S02:VAPOR PRESSURE
CATEGORY VAPOR PRESSURE
```

isd-evr\sssetprt.eps

Figure 8. Smart Sensor Setup Printout Example

ATM Pressure Sensor Setup

The ATM Pressure Sensor is factory installed in the SmartSensor / Press module and preassigned to channel 8. At least one SmartSensor / Press module, which contains the ATM Pressure Sensor, must be installed in the console. You must configure at least one ATM Pressure Sensor for use by the Vapor Polisher or a PMC Set-up Fail will occur. NOTE: if more than one SmartSensor / Press module is installed, only one ATM Pressure Sensor needs to be configured.

Look in console and note the slot position of the SmartSensor / Press module. Enter the Setup Mode and press the FUNCTION key until you see the message:

SMARTSENSOR SETUP
PRESS <STEP> TO CONTINUE

Press STEP until you see the message:

SS CONFIG - MODULE *n*
SLOT *x* - X X X X X X X X

Where *x* is the slot number containing the SmartSensor / Press module. Press the → key to move the cursor to the last (8th) X. Press CHANGE and the message below should appear:

SLOT *x* - X X X X X X X 8
PRESS <STEP> TO CONTINUE

Press STEP:

ENTER SMARTSENSOR LABEL
s 8:

NOTE: In the example above, the ATM P sensor position is 8 but it could be16, 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.

EVR/ISD Setup

You must choose the appropriate data sheet from Appendix A for the vapor recovery system installed at your facility (e.g., Single or Multi-Hose Dispensers) and record in those sheets, all of the unique information from sensors/hose positions, prior to beginning the TLS EVR/ISD set up procedure below.

Figure 9 describes the first of the EVR/ISD setup programming diagrams.

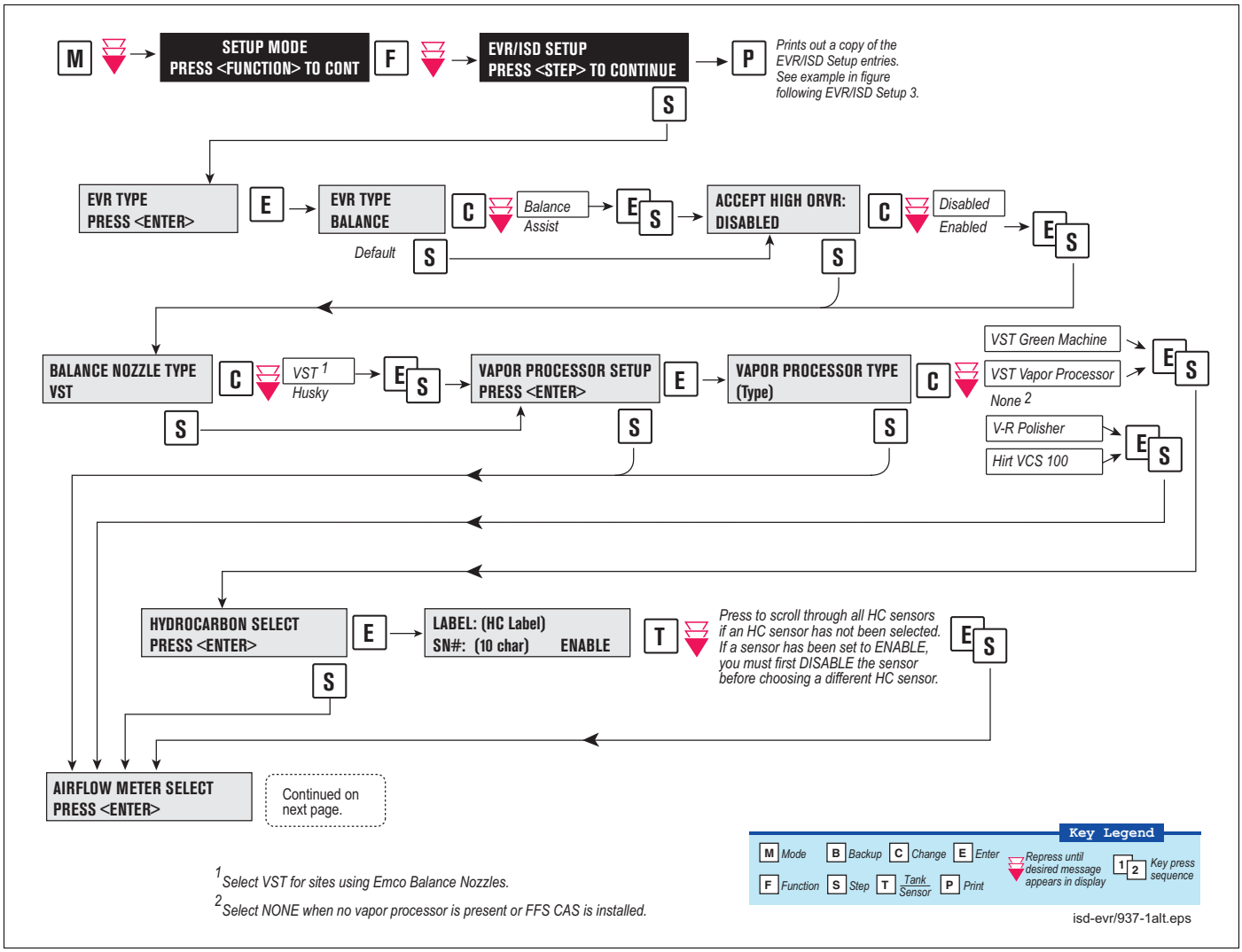


Figure 9. EVR/ISD Setup 1

Figure 10 describes the second of the EVR/ISD setup programming diagrams.

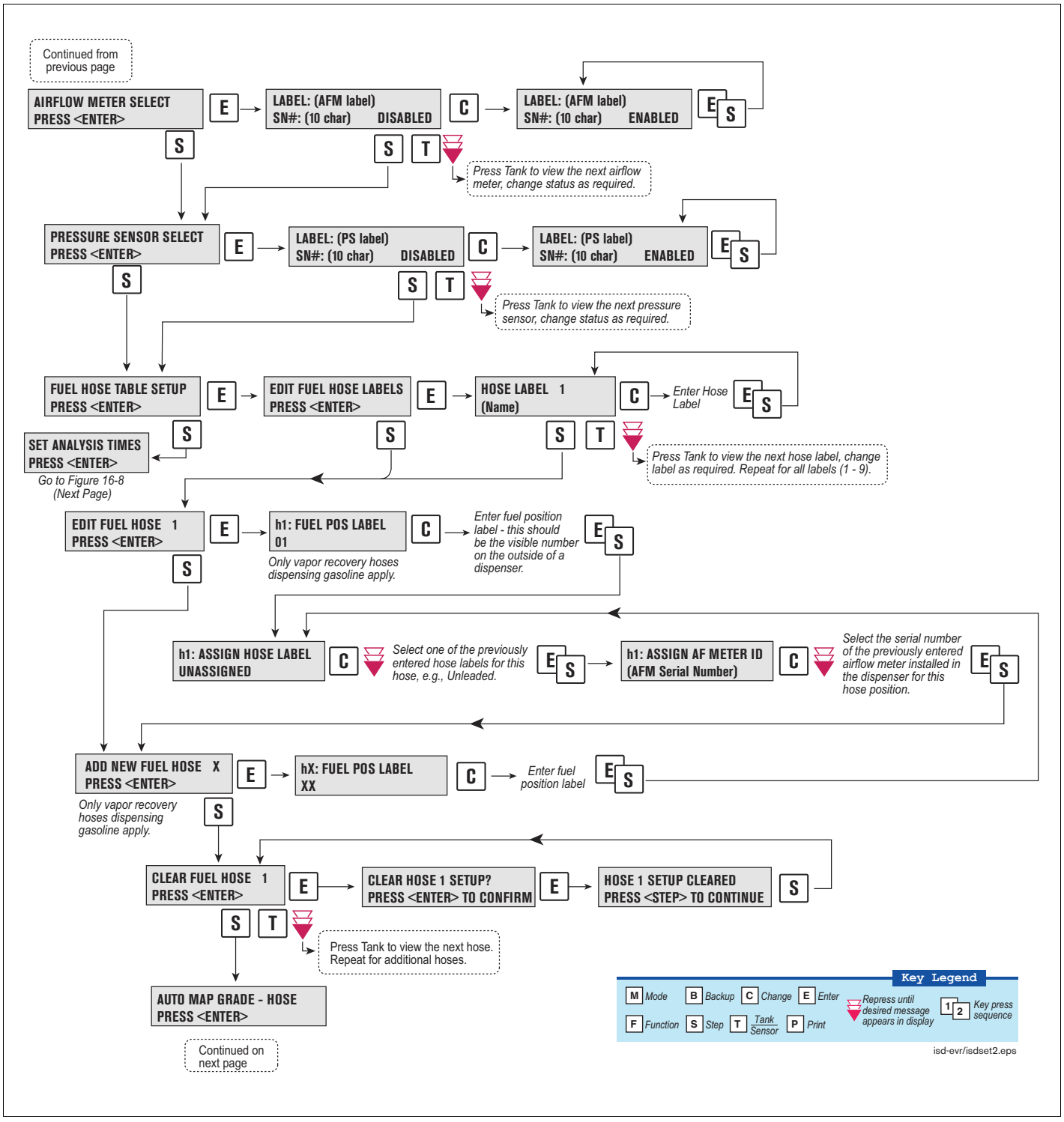


Figure 10. EVR/ISD Setup 2

Figure 11 describes the last of the EVR/ISD setup programming diagrams.

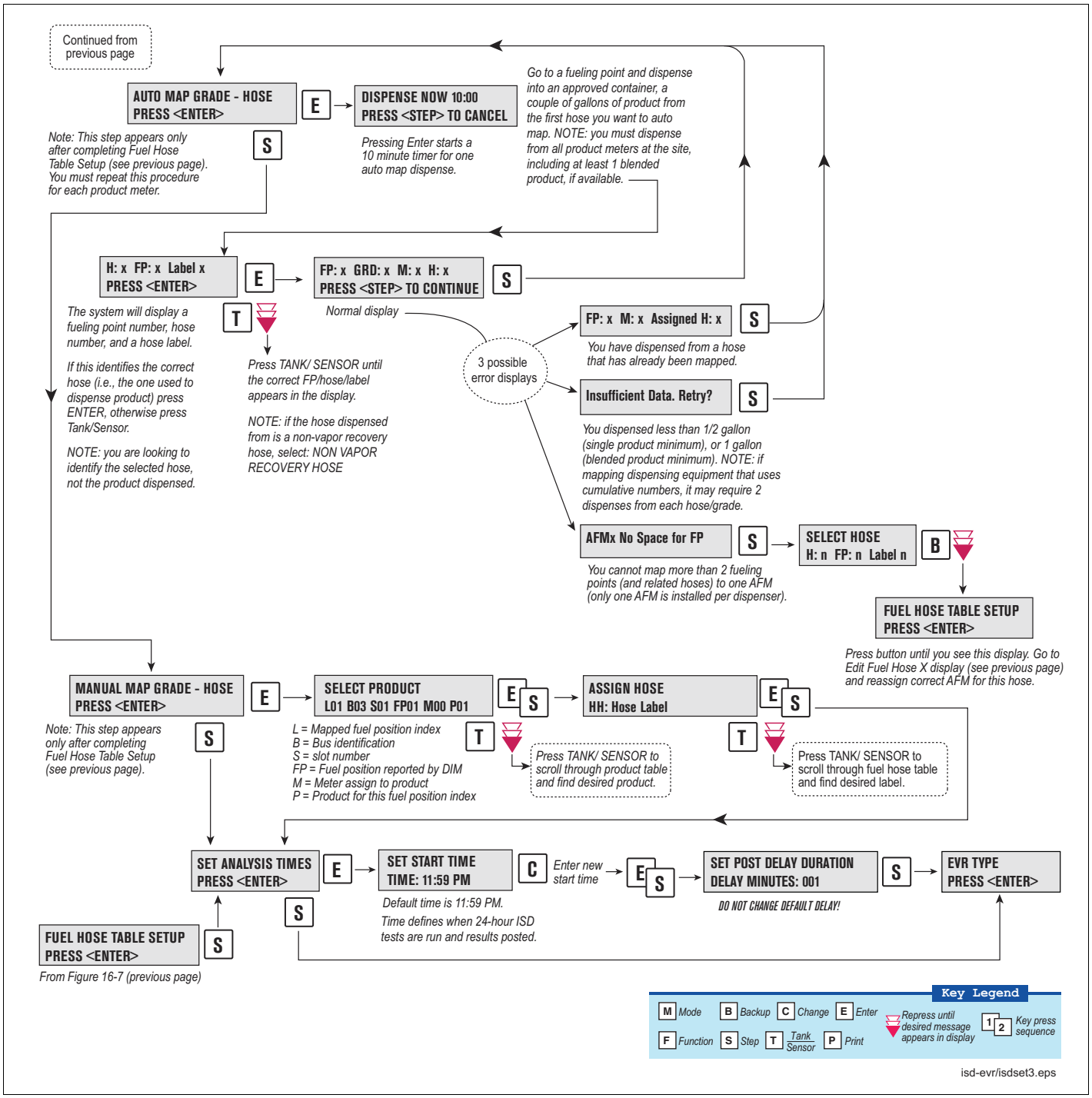
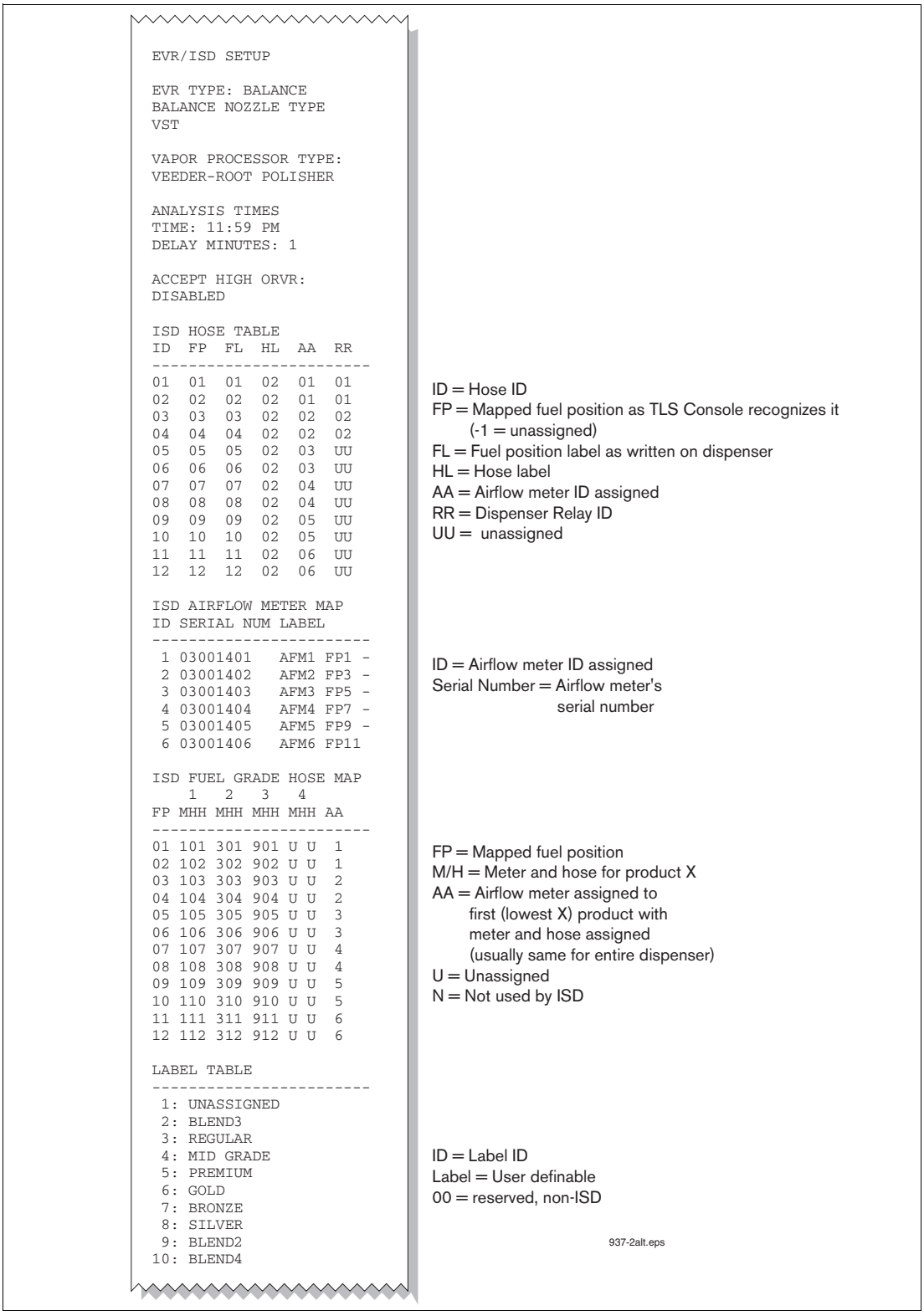


Figure 11. EVR/ISD Setup 3



```
EVR/ISD SETUP

EVR TYPE: BALANCE
BALANCE NOZZLE TYPE
VST

VAPOR PROCESSOR TYPE:
VEEDER-ROOT POLISHER

ANALYSIS TIMES
TIME: 11:59 PM
DELAY MINUTES: 1

ACCEPT HIGH ORVR:
DISABLED

ISD HOSE TABLE
ID  FP  FL  HL  AA  RR
------------------------
01  01  01  02  01  01
02  02  02  02  01  01
03  03  03  02  02  02
04  04  04  02  02  02
05  05  05  02  03  UU
06  06  06  02  03  UU
07  07  07  02  04  UU
08  08  08  02  04  UU
09  09  09  02  05  UU
10  10  10  02  05  UU
11  11  11  02  06  UU
12  12  12  02  06  UU

ISD AIRFLOW METER MAP
ID SERIAL NUM LABEL
------------------------
 1 03001401   AFM1 FP1 -
 2 03001402   AFM2 FP3 -
 3 03001403   AFM3 FP5 -
 4 03001404   AFM4 FP7 -
 5 03001405   AFM5 FP9 -
 6 03001406   AFM6 FP11

ISD FUEL GRADE HOSE MAP
    1   2   3   4
FP MHH MHH MHH MHH AA
------------------------
01 101 301 901 U U  1
02 102 302 902 U U  1
03 103 303 903 U U  2
04 104 304 904 U U  2
05 105 305 905 U U  3
06 106 306 906 U U  3
07 107 307 907 U U  4
08 108 308 908 U U  4
09 109 309 909 U U  5
10 110 310 910 U U  5
11 111 311 911 U U  6
12 112 312 912 U U  6

LABEL TABLE
------------------------
 1: UNASSIGNED
 2: BLEND3
 3: REGULAR
 4: MID GRADE
 5: PREMIUM
 6: GOLD
 7: BRONZE
 8: SILVER
 9: BLEND2
10: BLEND4
```

ID = Hose ID
FP = Mapped fuel position as TLS Console recognizes it
(-1 = unassigned)
FL = Fuel position label as written on dispenser
HL = Hose label
AA = Airflow meter ID assigned
RR = Dispenser Relay ID
UU = unassigned

ID = Airflow meter ID assigned
Serial Number = Airflow meter's serial number

FP = Mapped fuel position
M/H = Meter and hose for product X
AA = Airflow meter assigned to first (lowest X) product with meter and hose assigned (usually same for entire dispenser)
U = Unassigned
N = Not used by ISD

ID = Label ID
Label = User definable
00 = reserved, non-ISD

937-2alt.eps

Figure 12. Example VST ECS Printout

Output Relay Setup - VST ECS Membrane Processor

The Output Relay setup programs an output relay so that the TLS console can switch a controlled vapor processor on and off as shown in Figure 13.

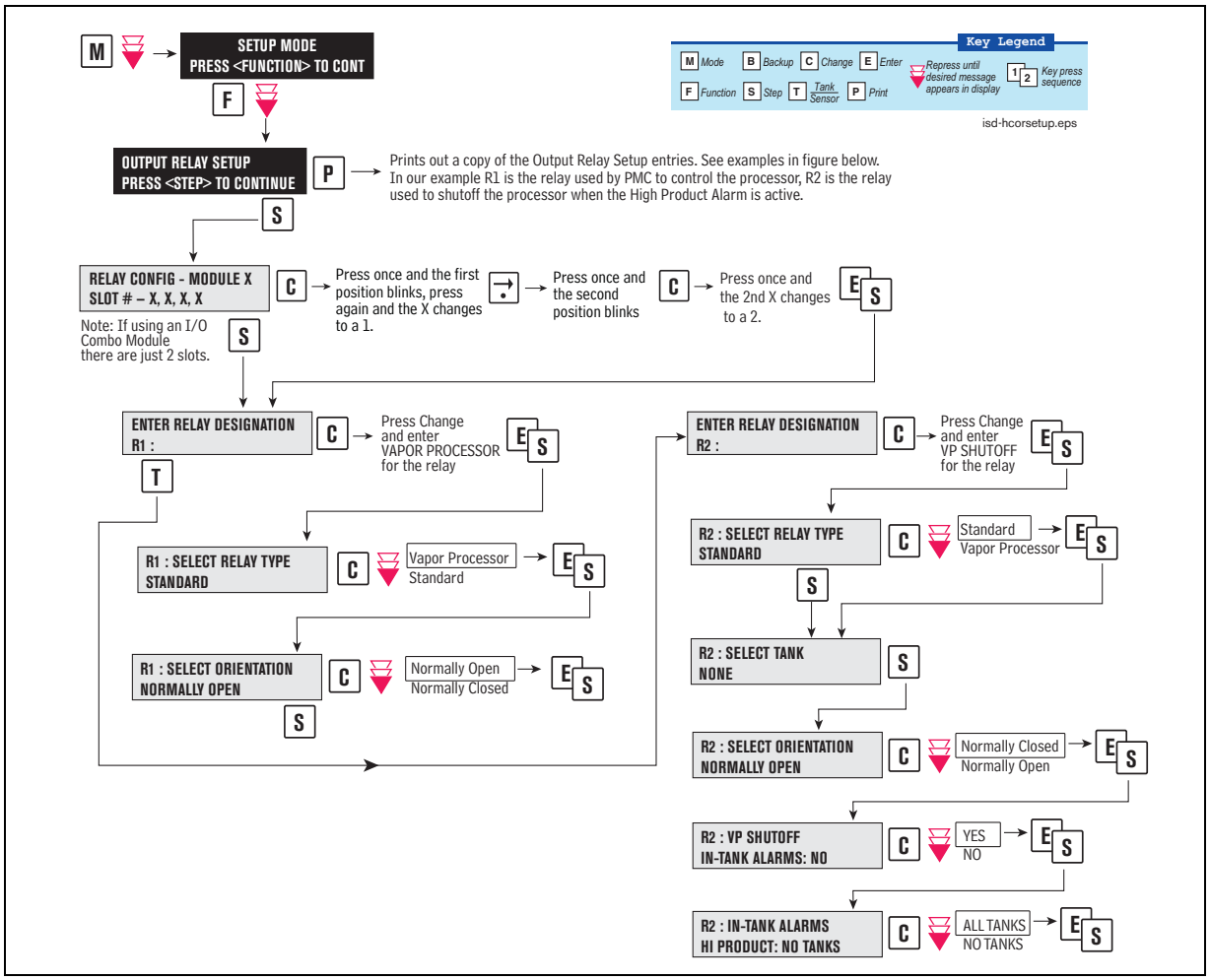


Figure 13. Output Relay Setup for VST ECS Membrane Processor

Figure 14 shows example setup printouts of the Output Relays setup.

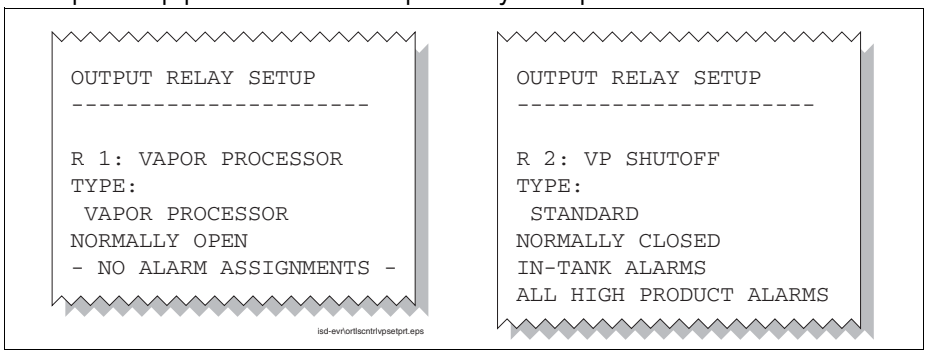


Figure 14. Output Relay Setup Printout Examples for TLS Console Controlled Processor

PMC Setup for VST Processors

PMC setup allows you to select the maximum runtime and the start/stop pressure of TLS console controlled vapor processors (see Figure 15).

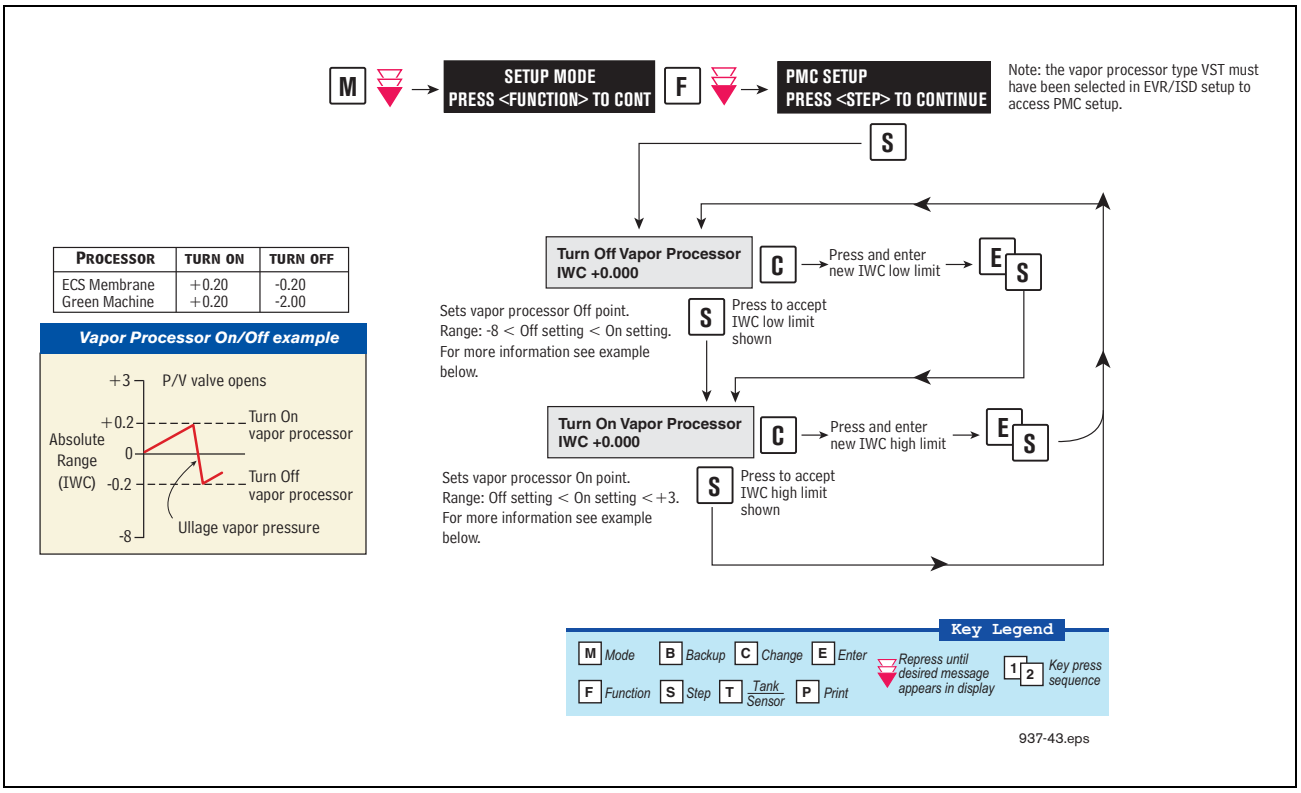


Figure 15. PMC Setup - VST Processors

Alarm Setup

INTRODUCTION

California regulations (VAPOR RECOVERY CERTIFICATION PROCEDURE, CP-201, DATED MAY 25, 2006 CERTIFICATION PROCEDURE FOR VAPOR RECOVERY SYSTEMS AT GASOLINE DISPENSING FACILITIES, Sections 9.1.2) require shut down of dispensing systems that generate specific alarm conditions. To accomplish this, the TLS must be configured to control the gasoline tank's pump (diesel tanks are not monitored) or the gasoline dispensers in order to disable them when ISD shutdown alarm conditions occur. Prior to setting up ISD shut down alarms, you will need to determine how the site's tank pumps or dispensers are controlled. If the site has line leak detection, you can shut down the line (tank) by assigning the ISD alarms in Line Leak Disable setup. In the absence of line leak detection, you can assign the ISD alarms to Output Relays which in turn can be wired to shut down the tank or assign ISD alarms to Dispenser Relays which can be used to shut down the dispenser. Figure 16 illustrates two examples of tank pump control, one using a line leak/output relay combination and one using output relays.

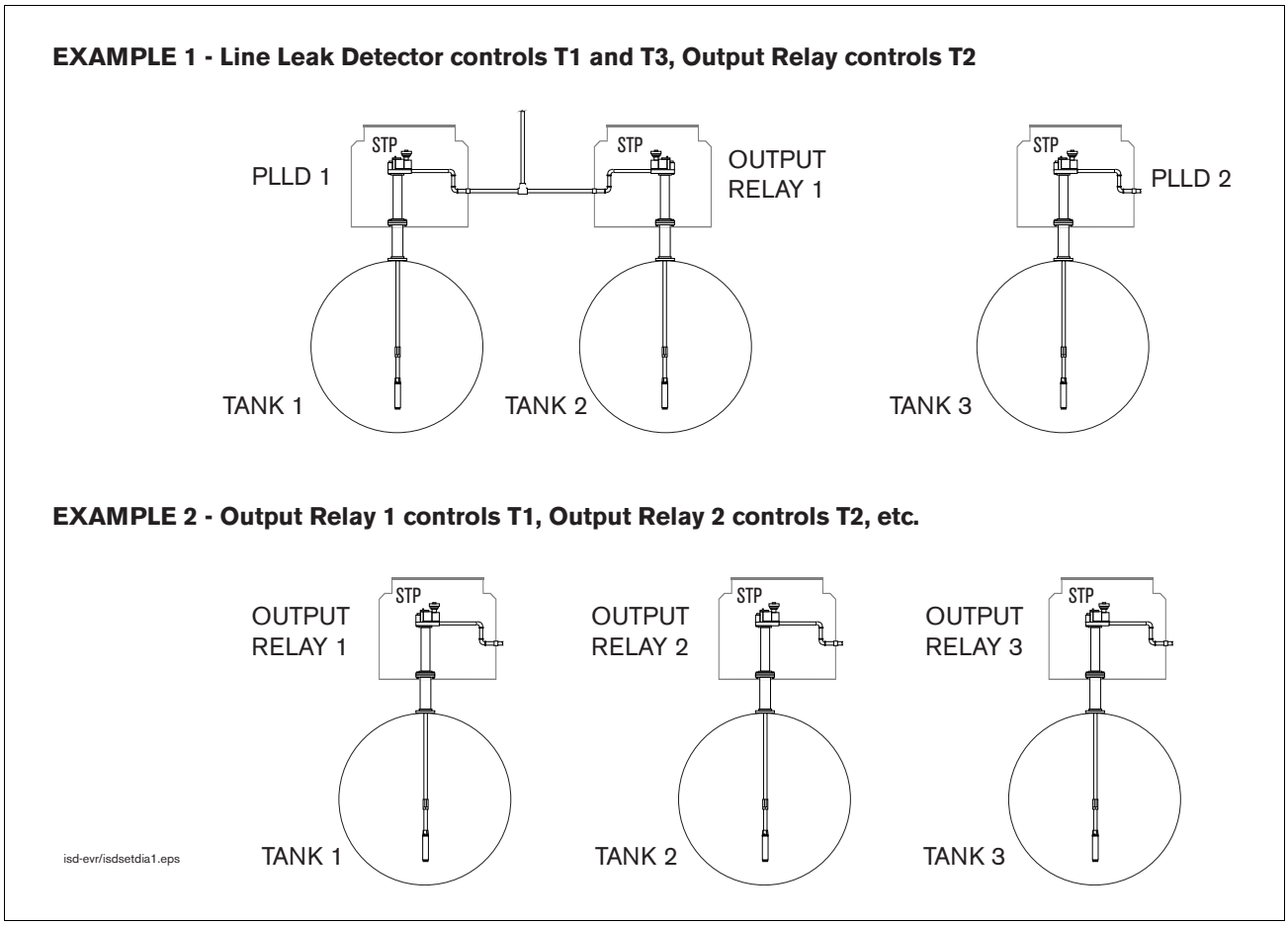


Figure 16. Site Tank Control Examples

Referencing the figure above, in example 1, you would assign the ISD shut down alarms for tank 1 to PLLD 1 in PLLD Line Leak Disable setup, for tank 2 to a relay in Output Relay Setup, and for tank 3 to PLLD 2 in PLLD Line Leak Disable setup. In example 2, you would assign the ISD shut down alarms for tank 1 to output relay 1, tank 2 to output relay 2, and tank 3 to output relay 3.

Figure 17 illustrates two examples of dispenser control using Dispenser Relay modules.

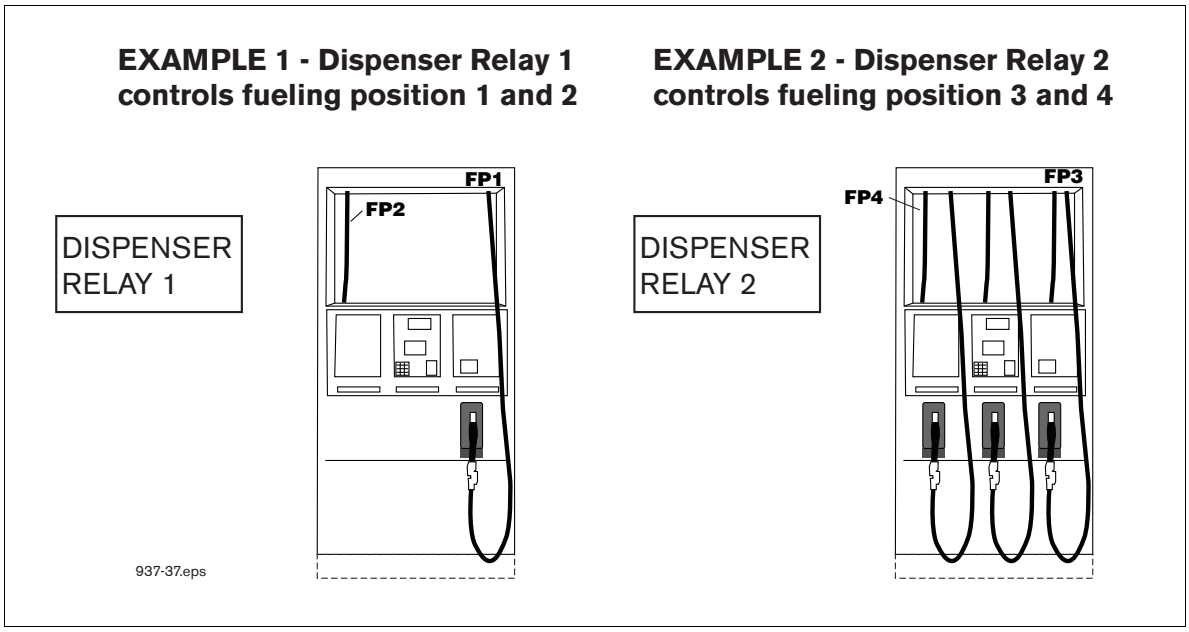


Figure 17. Dispenser Control Examples

You can assign ISD containment shut down alarms to the submersible pump output relays and assign ISD collection alarms to the dispenser relay as shown above.

ALARM SETUP FOR SITES WITH LINE LEAK DETECTION

Figure 18 illustrates the setup steps required to assign ISD Shut Down Alarms to a tank having a line leak detection system installed.

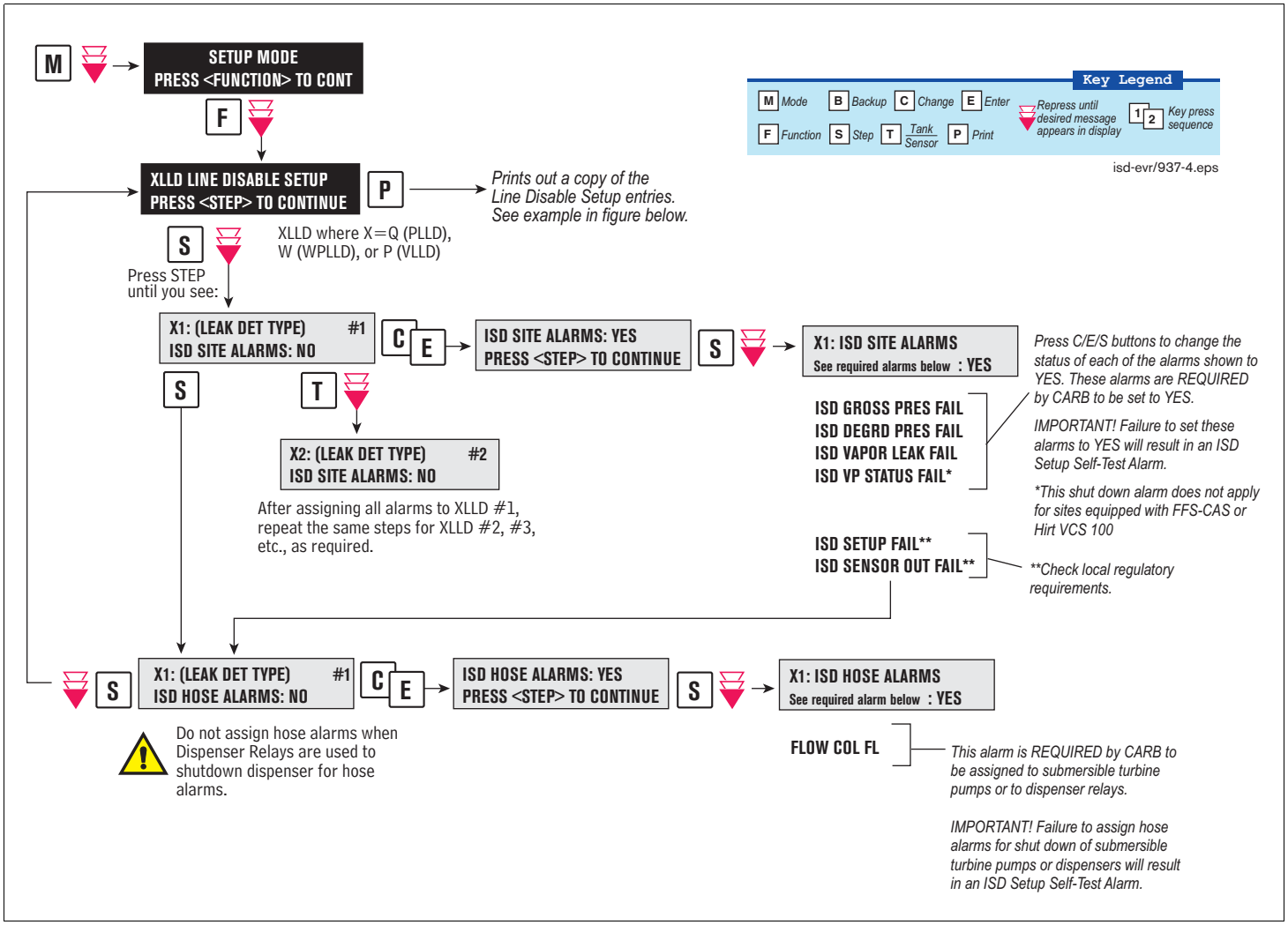


Figure 18. Assigning ISD Shut Down Alarms in Line Leak Disable Setup

Figure 19 shows a resulting printout of the Line Leak Disable setup with ISD alarms assigned when Dispenser Relay modules are not used.

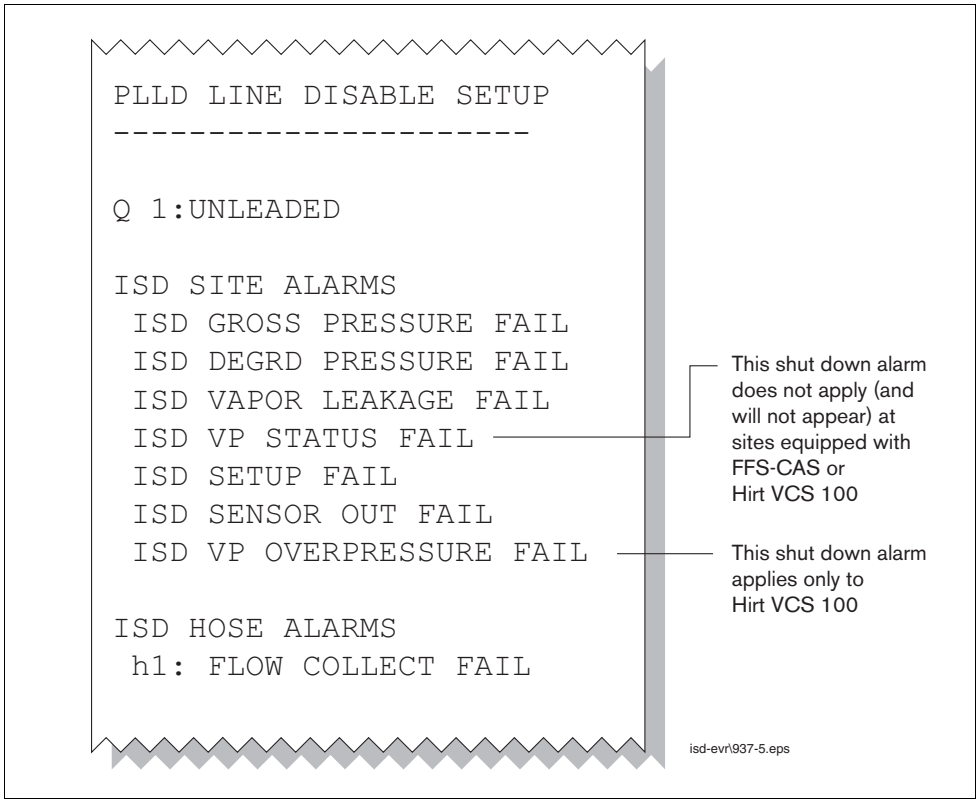


Figure 19. Example Line leak Disable Setup Printout

ALARM SETUP FOR SITES WITHOUT LINE LEAK DETECTION

Figure 20 illustrates the setup steps required to assign ISD Shut Down Alarms to a tank using either a Four Relay Output Module or an I/O Combination Module.

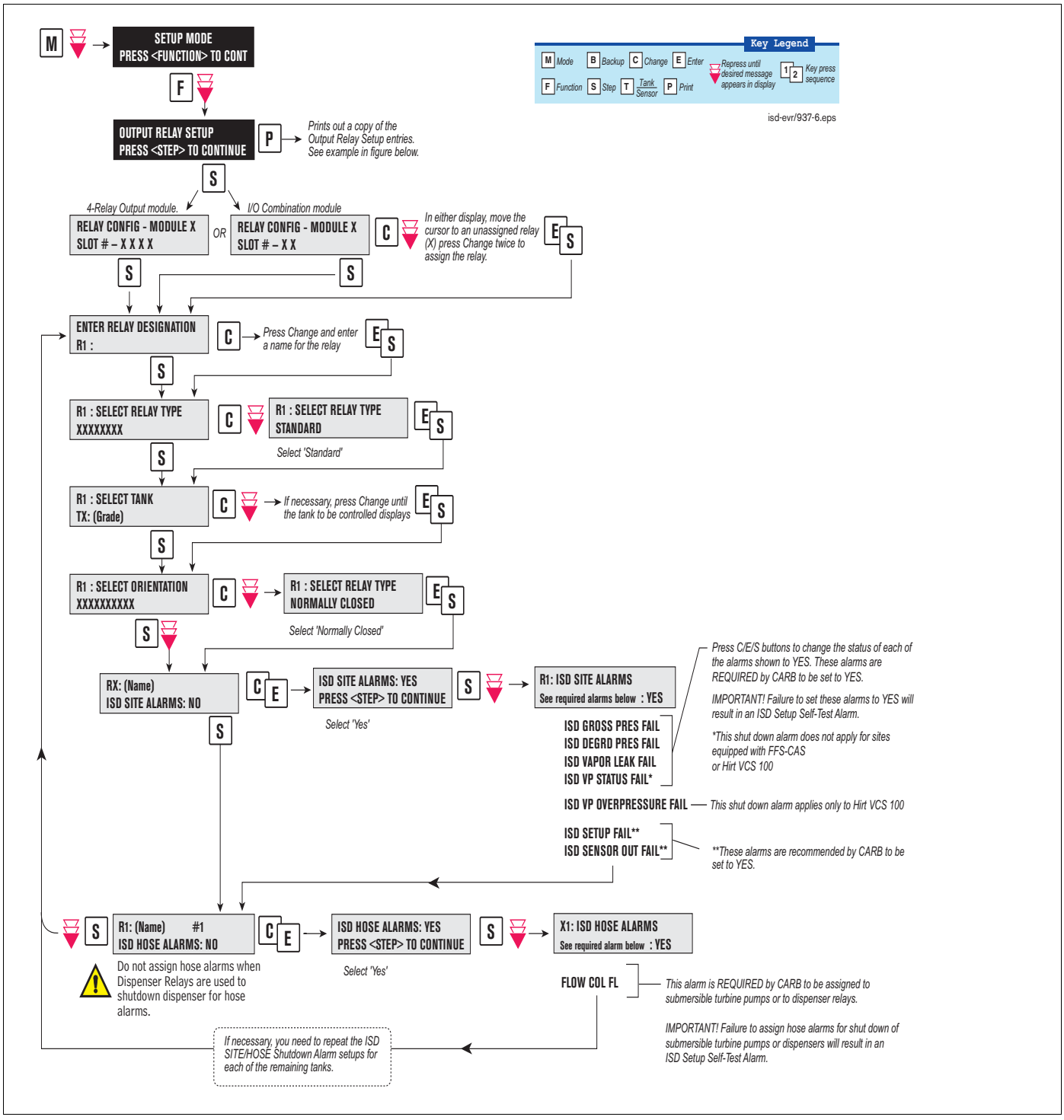


Figure 20. Assigning ISD Shut Down Alarms in Output Relay Setup

Figure 21 shows a resulting printout of the Output Relay setup with ISD alarms assigned when Dispenser Relay modules are not used.

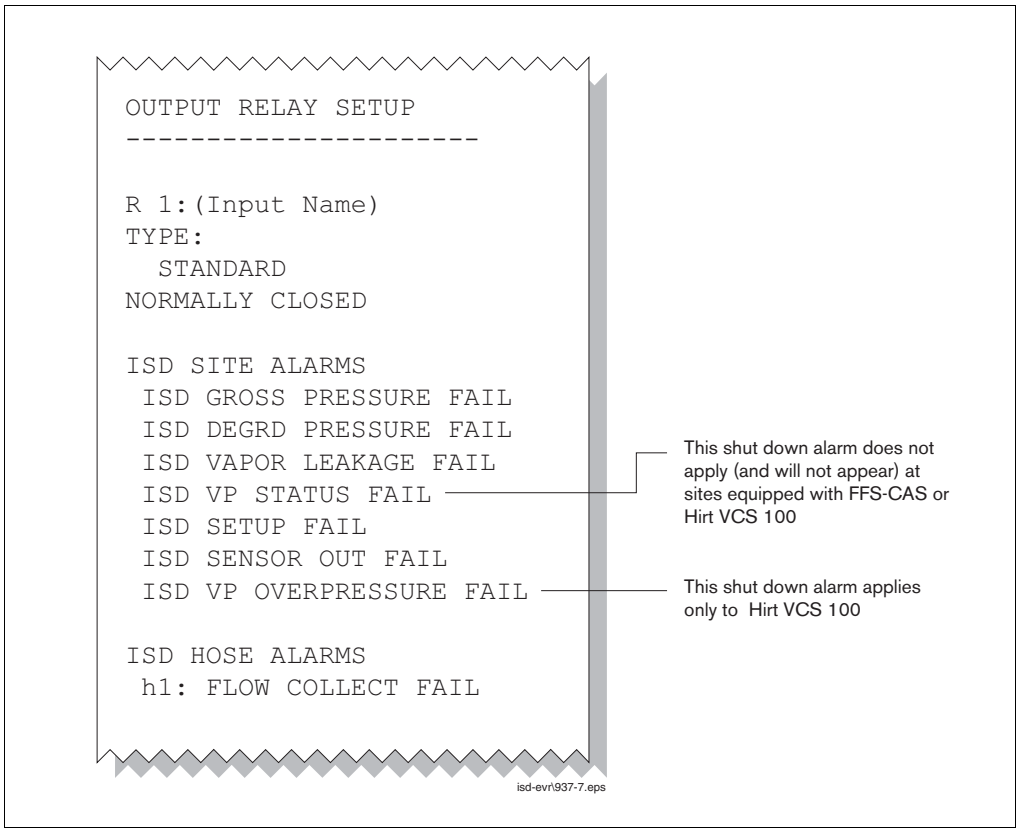


Figure 21. Example printout - ISD Alarms Assignments - Output Relay Setup

ALARM SETUP FOR SITES WITH DISPENSER RELAYS

Figure 22 illustrates the setup steps required to assign ISD Shut Down Alarms to a dispenser using a Dispenser Relay Module.

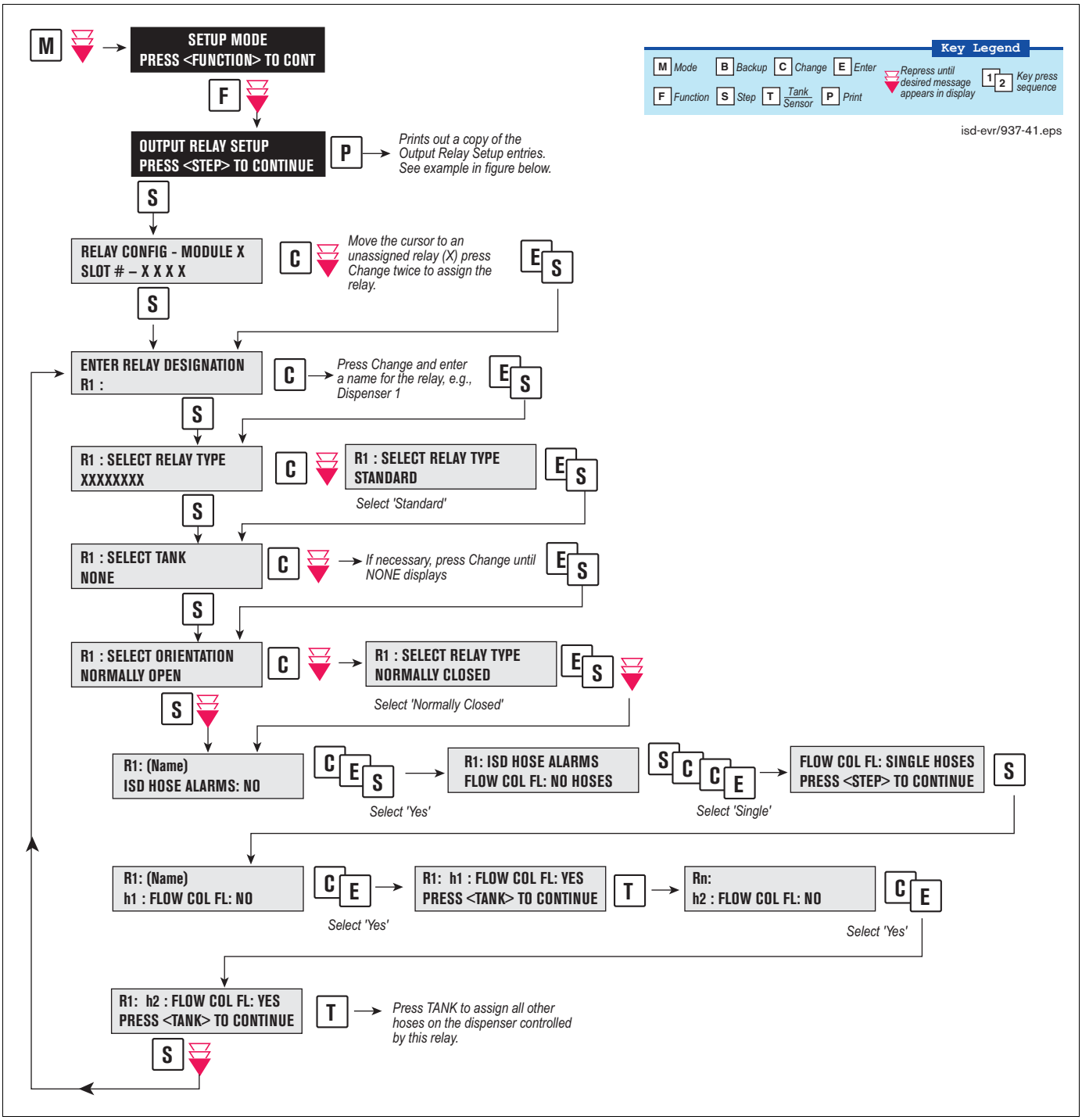


Figure 22. Assigning ISD Shut Down Alarms in Dispenser Relay Setup

Figure 23 shows a resulting printout of the Dispensor Relay setup with ISD hose alarms assigned.

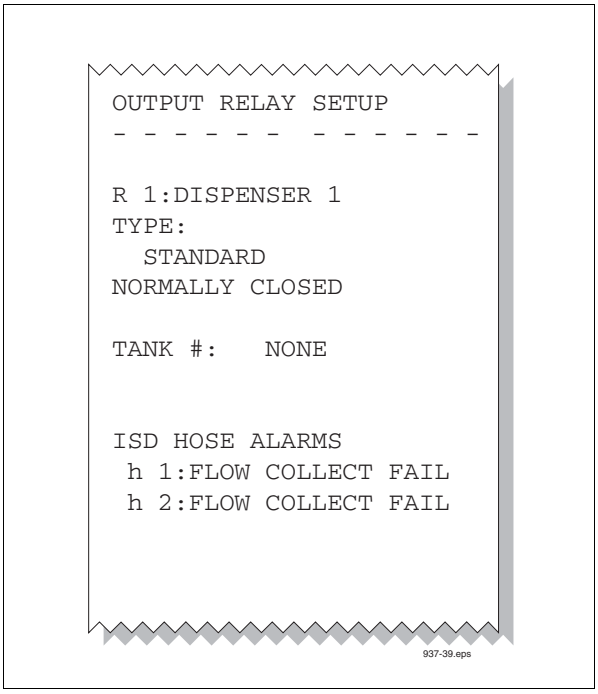


Figure 23. Example printout - ISD Hose Alarm Assignments - Dispenser Relay Setup

4 ISD Operability Test Procedure

The following procedures shall be used at field sites to determine the operability of the Veeder-Root ISD system to satisfy the requirements documented in VAPOR RECOVERY CERTIFICATION PROCEDURE, CP-201, DATED MAY 25, 2006 CERTIFICATION PROCEDURE FOR VAPOR RECOVERY SYSTEMS AT GASOLINE DISPENSING FACILITIES. Testing the ISD equipment in accordance with this procedure will verify the equipment's operability for Vapor Containment Monitoring and Vapor Collection Monitoring.

Veeder-Root's TLS console ISD System Self-Test Monitoring algorithms are designed to verify proper selection, setup and operation of the TLS console modules and sensors and will not complete and report passing test results in the event of a failure of components used in the system. Completed ISD monitoring tests are evidence that:

- The system was properly powered for data collection
- All necessary ISD sensors were setup and connected
- All necessary ISD sensors were operating within specification
- All internal components including TLS console modules were properly setup and operating within specification

Veeder-Root recommends printing a copy of the ISD ALARM STATUS and ISD DAILY report (REF. Section 5, Operation of the ISD Install, Setup & Operation Manual) periodically to determine that compliance tests are being completed in accordance with local and state regulations.

Vapor Pressure Sensor Verification Test

See EO VR 204 Exhibit 10 for the Pressure Sensor Verification Test.

Vapor Flow Meter Operability Test

See EO VR 204 Exhibit 17 for the ISD Vapor Flow Meter Operability Test Procedure.

Vapor Processor Operability Test

See EO VR 204 Exhibit 8 and 9 for the VST ECS Membrane Operability Test.

5 Operation

Alarms

OVERVIEW OF TLS CONSOLE INTERFACE

The TLS console is continuously monitoring the vapor recovery system, PMC and ISD sensors for alarm conditions such as excessively high or low vapor collection, containment system vapor leakage and equipment problems.

During normal operation when the TLS console and monitored EVR/ISD System is functioning properly and no alarm conditions exist, the "ALL FUNCTIONS NORMAL" message will appear in the system status (bottom) line of the console display, and the green Power light will be On (see Figure 22).

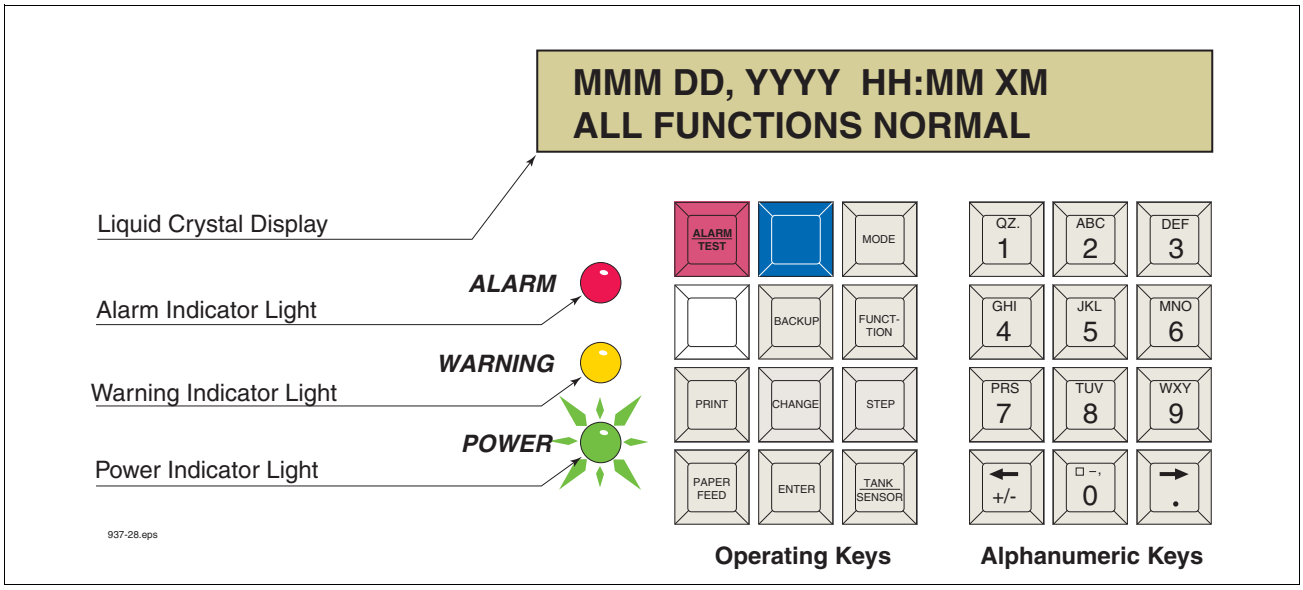


Figure 22. TLS console alarm interface

If an alarm condition occurs the system displays the condition type and its location. If more than one condition exists, the display will continuously cycle through the appropriate alarm messages. The system automatically prints an alarm report showing the alarm type, its location and the date and time the alarm condition occurred.

Warning and alarm posting causes the TLS console-based system to activate warning or failure indicator lights, an audible alarm, and an automatic strip paper printout documenting the warning or alarm. Historical reports of warning and alarm events are available for up to one year.

WARNING POSTING

Displayed messages alert you to the source and type of alarm. Printed messages show the type and location of the alarm. In the Warning example in Figure 23, the display's second line and printed message indicates that the containment system's vapor leak rate has increased above the allowed standard generating a warning.

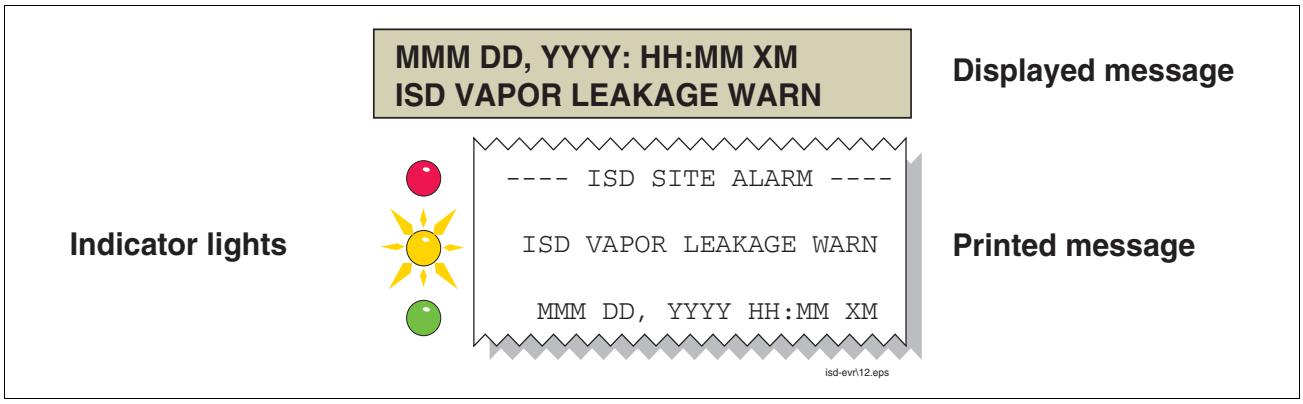


Figure 23. Example Warning posting

The TLS console also logs an entry to the Warning Log upon posting a warning.

ALARM POSTING

Displayed messages alert you to the source/number and type of alarm. Printed messages show the type and location of the alarm. In the alarm example in Figure 24 the display's second line and printed message indicates that vapor collection on hose 1, FP1 Super has dropped below the allowed standard resulting in a failure alarm. (By default, for unihose dispensers, FP1 BLEND3 will be displayed rather than FP1SUPER as shown below.)

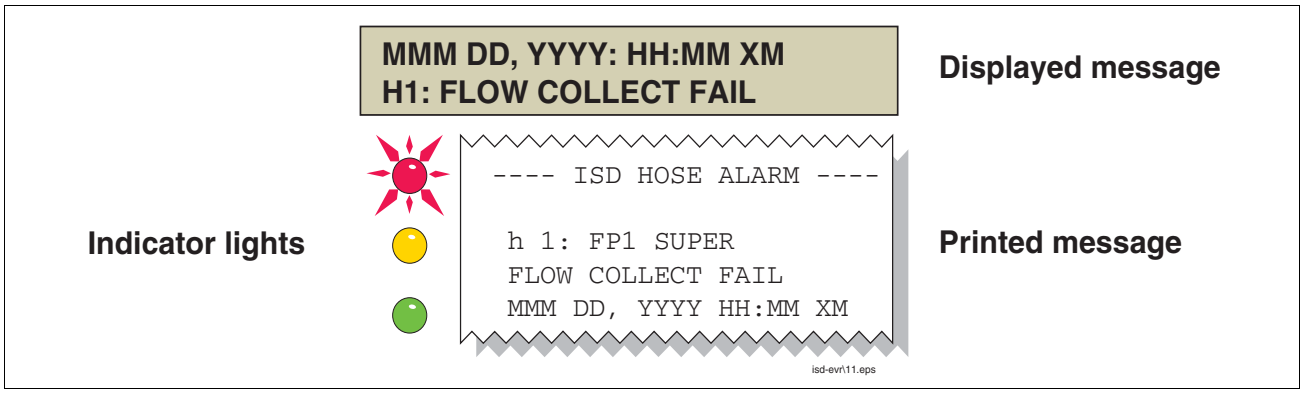


Figure 24. Example Alarm posting

Upon posting a failure alarm, the TLS console logs an entry to the Failure Log, prohibits fuel dispensing from all ISD gasoline fueling points or effected fueling points when dispenser shutdown is enabled and logs a shutdown event to the Shutdown & Misc. Event Log.

ISD can prohibit fuel dispensing from all gasoline fueling points by shutting down the submersible pumps in all gasoline tanks or individual fueling points using dispenser relays. The method of overriding an ISD Alarm shutdown is discussed in the “Site Re-enable” section.

SITE RE-ENABLE

The TLS console ALARM/TEST button allows you to perform a logged shutdown override and resume dispensing. Figure 25 illustrates the ISD alarm override procedure.

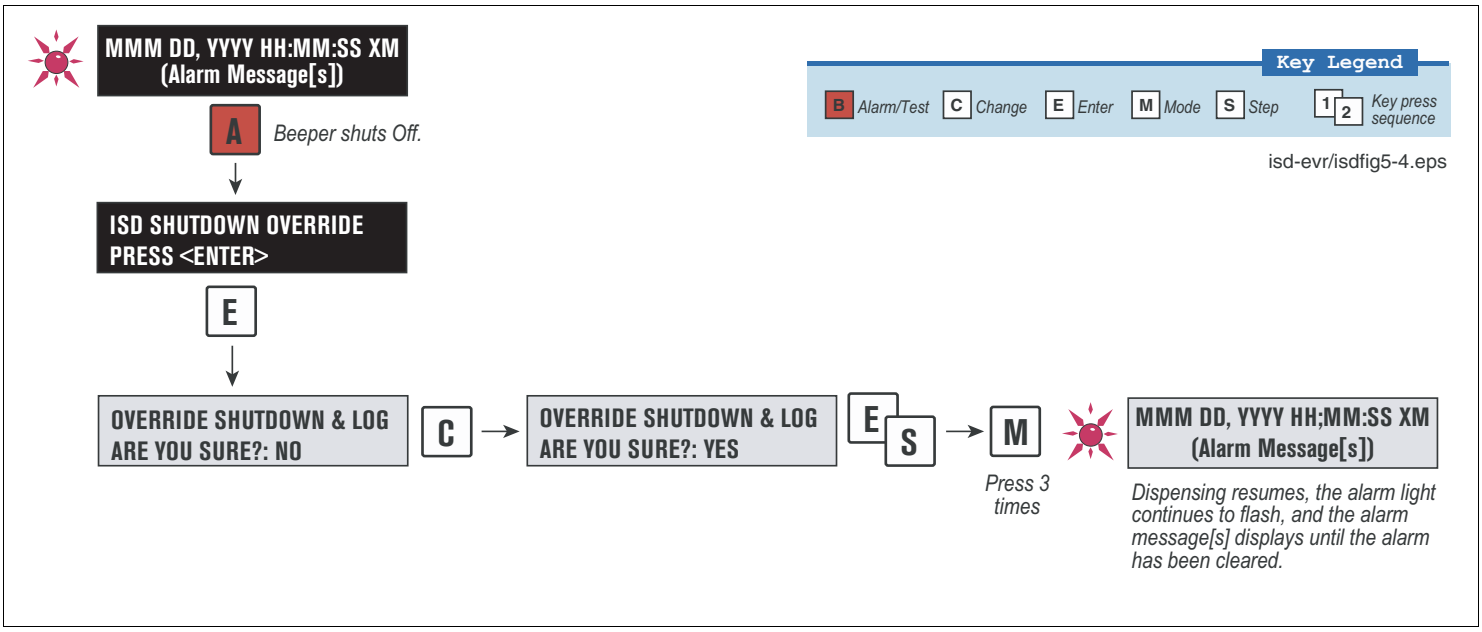


Figure 25. ISD Alarm Override Procedure

ALARM LOGS

Alarms will be recorded in the Warning Log or Failure Log of the monthly reports, which can be viewed electronically or via the integral printer (if queued in the most recent 10 events). The following example shows an excerpt from an electronically accessed monthly report.

Monthly Report Warning & Failure Log Examples:

```
WARNING ALARMS
DATE     TIME     DESCRIPTION                      READING          VALUE
08-03-15 00:01:26 FLOW PERFORMANCE HOSE BLOCKAGE   FP12 BLEND4       BLKD
08-02-17 00:00:49 FLOW PERFORMANCE HOSE BLOCKAGE   FP 1 BLEND4        0.59
08-02-01 00:01:07 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC   22.39
FAILURE ALARMS
DATE     TIME     DESCRIPTION                      READING          VALUE
08-03-14 00:01:26 FLOW PERFORMANCE HOSE BLOCKAGE   FP12 BLEND4       BLKD
08-02-13 00:01:45 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC   36.56
08-02-12 00:01:46 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC   37.74
08-02-11 00:01:57 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC   30.10
```

937-21.eps

ALARM SEQUENCE

Each ISD monitoring test operates once each day on sensor data gathered over a fixed time interval and with a minimum required number of monitored events. The interval is a fixed number of calendar days depending on the test being run. As an example, the ISD Gross Pressure Containment Monitoring test requires seven calendar days of data. In this example, each daily test result represents a test based on the prior seven days' time period. When a test first fails, a warning is posted and a warning event is logged. If this condition persists for seven more consecutive days, an alarm is posted, a failure alarm event is logged and the site is shutdown. If the condition continues, additional failure events are logged and the site will continue to be shutdown each day.

ISD Alarm Summary

Table 3 summarizes the ISD Alarms - Alarms with a superscript 2 will result in a site shutdown.

Table 3. ISD Alarm Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • Exhibit 4 • Exhibit 14 (when FFS-CAS is installed)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC	• VST Processor - Troubleshooting Guide www.vsthose.com/carbs_components.aspx - Exhibit 9 - Exhibit 10 - Check pressure sensor ball valve for correct position. • FFS-CAS Troubleshooting - Check FFS-CAS ball valves for correct positions. • Veeder Root Polisher - Check vent statck ball valve for correct position. - Check pressure sensor ball valve for correct position
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
hnn: FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • Exhibit 5 • Exhibit 6 • Exhibit 17
hnn: FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	

Table 3. ISD Alarm Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VP STATUS WARN[4, 5, 6, 8.]	Processor	Yellow	Failure of Vapor Processor Effluent Emissions or Duty Cycle test	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • VP Emission Test • VP Duty Cycle Test
ISD VP STATUS FAIL[2, 4, 5, 6, 8]	Processor	Red	2nd Consecutive Failure of Vapor Processor Status test	
VP EMISSION WARN[3, 4, 5, 6, 8]	Processor	Yellow	Mass emission exceeded the certified threshold	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • Exhibit 8 • Exhibit 9 • Exhibit 11
VP EMISSION FAIL[3, 4, 5, 6, 8]	Processor	Red	2nd Consecutive Mass emission test failure	
VP DUTY CYCLE WARN[3, 4, 8]	Processor	Yellow	Duty cycle exceeds 18 hours per day 0r 75% of 24 hours	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • PMC Setup Procedure • Exhibit 4 • Exhibit 9 • Exhibit 10
VP DUTY CYCLE FAIL[3, 4, 7, 8]	Processor	Red	2nd Consecutive Duty Cycle Test Failure	
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL	Self-Test	Red	8th Consecutive Failure of Setup Test	
ISD VP PRESSURE WARN[9]	Processor	Yellow	90th percentile of 1 day ullage pressure exceeds 2.5 IWC.	Exhibit test for HIRT
ISD VP PRESSURE FAIL[9]	Processor	Red	2nd consecutive failure of Vapor Processor Overpressure Test.	

[1]See ISD Troubleshooting Manual, P/N 577013-819, and the VST ISD Troubleshooting Guide 9513-003 found at www.vsthose.com for a complete list of suggestions.

[2]ISD Shutdown Alarms - see “Site Re-enable” on page 31.

[3]This warning will result in an ISD VP Status Warn.

[4]VST ECS Membrane Processor.

[5]Veeder-Root Polisher

[6]VST Processor

[7]This failure will result in an ISD VP STATUS FAIL.

[8]Does not apply to FFS-CAS or Hirt VCS 100 processor or VST Green Machine.

[9]Hirt VCS 100

Other Alarms

Table 4 summarizes additional alarms that may be posted by ISD related equipment. These alarms are not critical to vapor recovery functionality, but could indicate erroneous setup or equipment malfunction. NOTE: Additional TLS console alarms listed in the TLS-3XX Operator's manual may be posted and may lead to an ISD shutdown alarm if persistent (see ISD Troubleshooting Manual for details). Table 5 lists wireless related sensor alarms.

Table 4. Other Alarms

Displayed Message	Light Indicator	Set Condition	Clear Condition
MISSING RELAY SETUP	Red	One or more required shutdown alarms have not been assigned to a relay.	Setup required shutdown alarms.
MISSING TANK SETUP	Red	There are no vapor recovery (gasoline) tanks defined or a gasoline pump has not been assigned to a control (shut down) device in at least one tank.	Complete gasoline tank setup.
MISSING HOSE SETUP	Red	There are no product meters assigned to a hose.	Assign at least 1 product meter to a hose.
hnn: VPRFLOW MTR SETUP	Red	Incoming transaction from a hose with an unavailable Vapor Flow Meter.	Configure Vapor Flow Meter (Smart Sensor) and enable it in ISD.
MISSING VAPOR PRES SEN	Red	There is no Vapor Pressure Sensor setup or detected.	Complete Vapor Pressure Sensor setup.
MISSING VAPOR FLOW MTR	Red	There is no Vapor Flow Meter setup or detected.	Complete Vapor Flow Meter setup.
fnn: CHK VAPOR FLOW MTR	Red	Failure of locked rotor test - possible locked vapor flow meter.	Locked rotor test passes or vapor flow meter deconfigured, or test cleared.

Table 5. Wireless Related Sensor Alarms

Displayed Message	Device	Light Indicator	Desription	Suggested Troubleshooting
BATTERY WARNING	Vapor Valve, Vapor Flow Meter	Yellow	Device transmitter reports battery status as 'Replace' for 24 hours	Remove and replace battery pack

Reports

There are two main reports (CP-201 required) that are stored by the ISD system: the Monthly Status Report, stored for 12-months, and the Daily Status Report, stored for 365 days. A third report discussed in this section is the ISD Status Report. You can print out ISD reports from the TLS console front panel as shown in Figure 26.

- The monthly report includes:
  - ISD operational up-time (as a percentage)
  - EVR/ISD system pass time (as a percentage)
  - The Warning Log
  - The Failure Log
  - The Misc. Event Log
- The daily report includes:
  - Maximum and minimum ullage pressures
  - Results of the Vapor Containment Monitoring Gross (75th percentile), Degradation (95th percentile) ullage pressure test and Vapor Leakage Detection (CVLD) tests
  - Vapor Collection Monitoring test results for each fueling position
  - Vapor Processor Monitoring test results
- ISD Status Report
  - Last test report results

VIEWING ISD REPORTS

You can print out ISD reports from the TLS console front panel as shown in Figure 26.

.

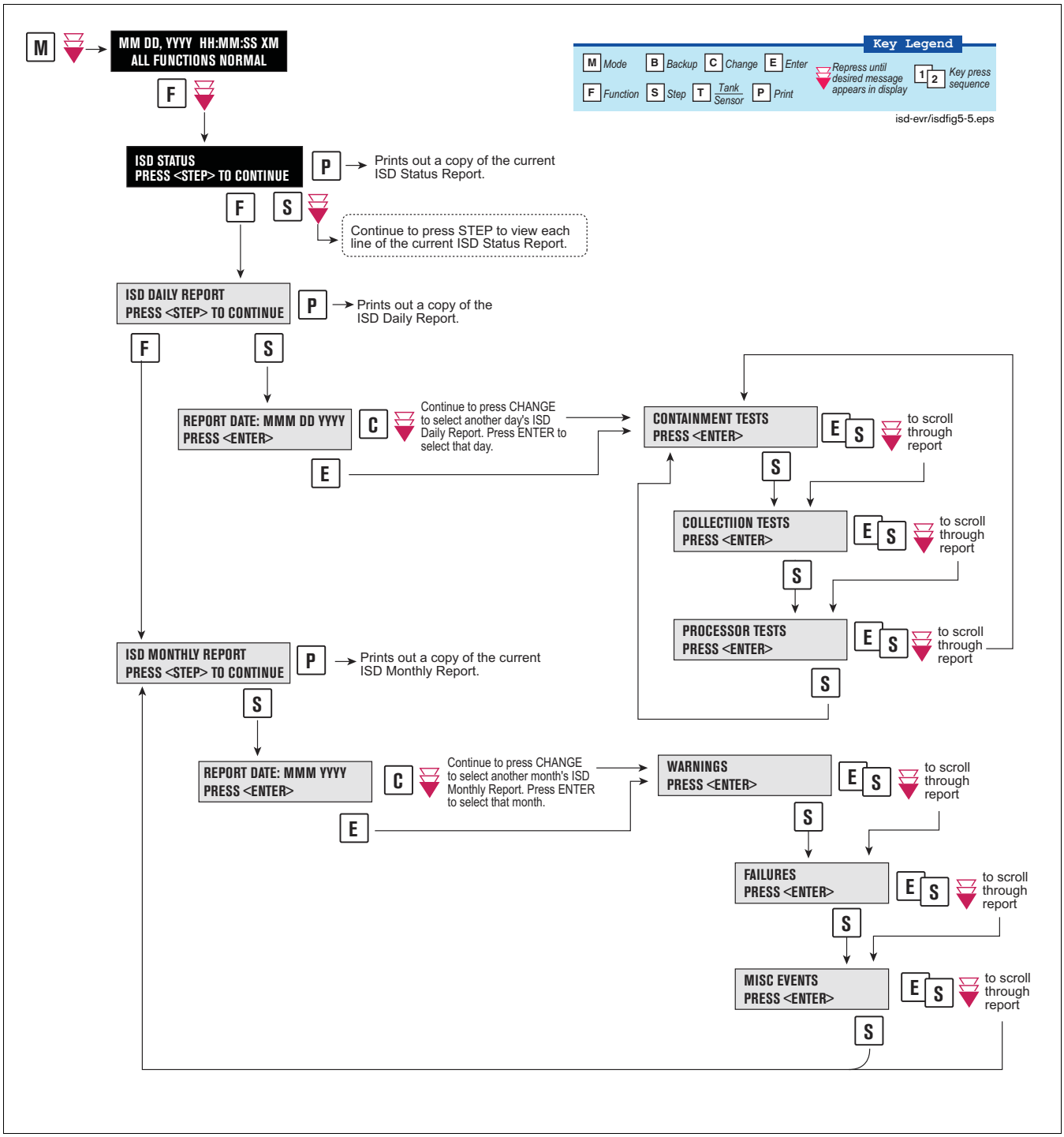


Figure 26. Printing ISD Reports on Console Printer

Figure 27 shows an example ISD Status Report.

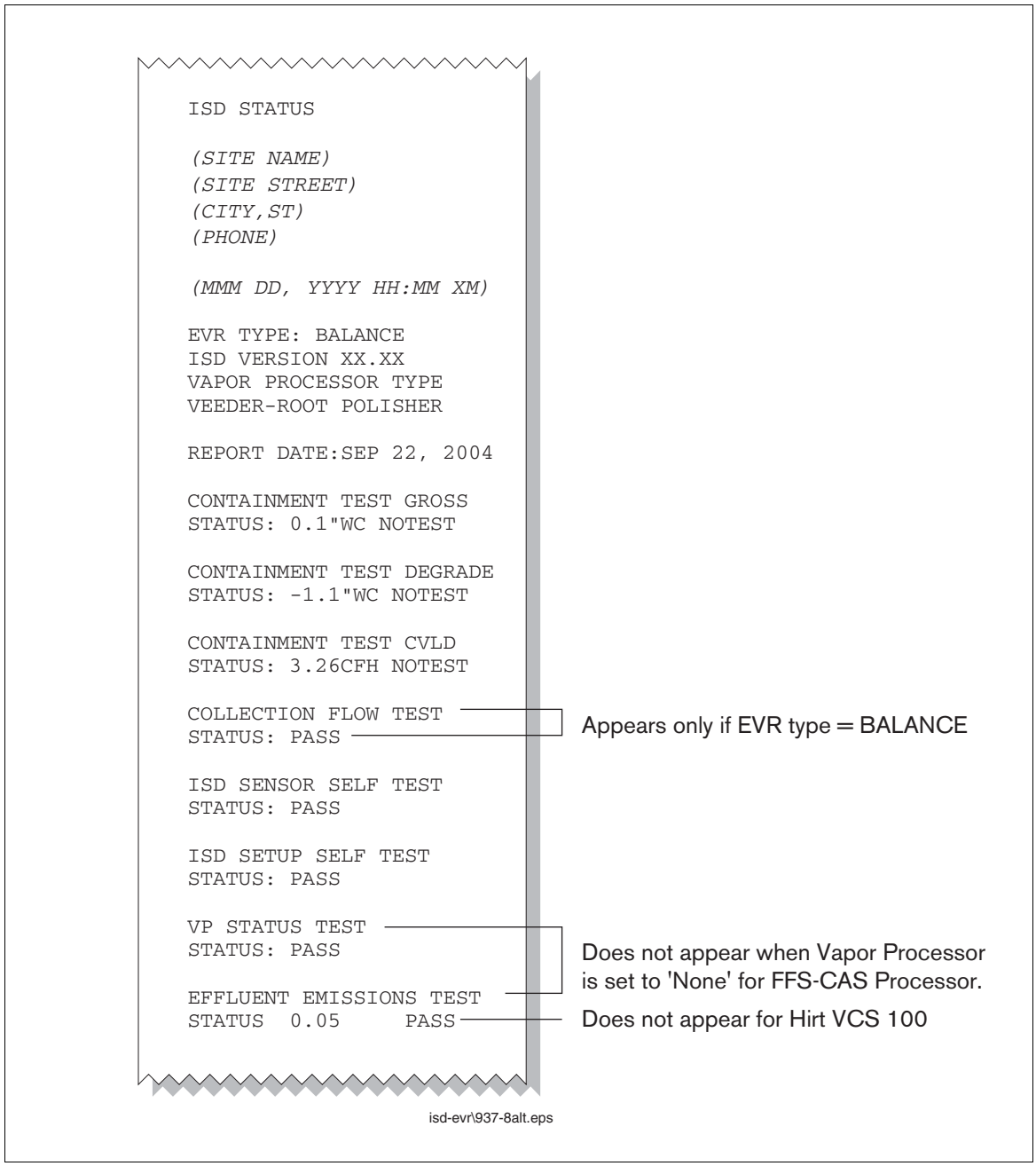


Figure 27. ISD Status Report Example - TLS console printout

Figure 28 shows an example ISD Daily Report.

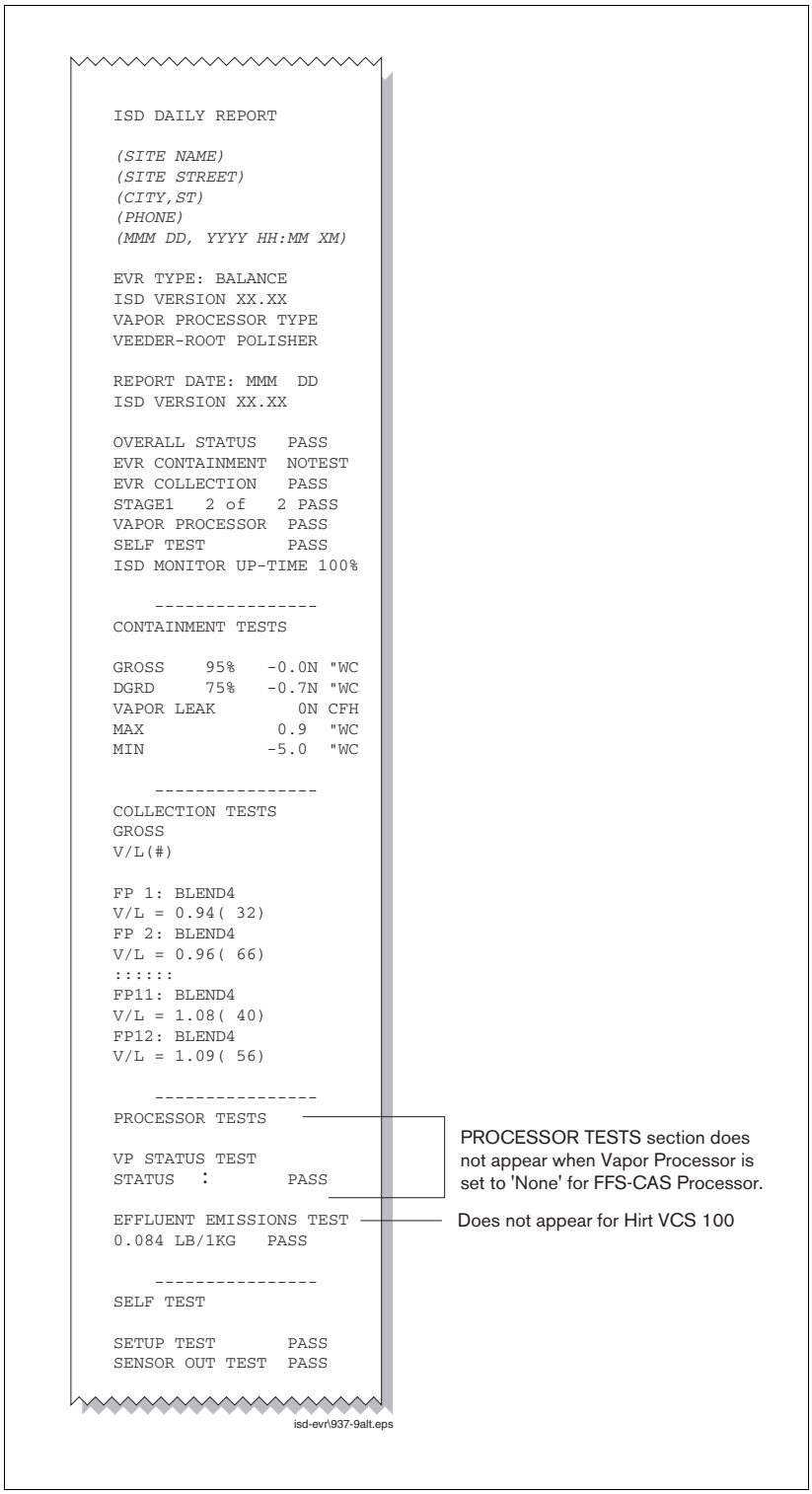


Figure 28. ISD Daily Report Example - TLS console printout

Figure 29 shows an example ISD Monthly Report.

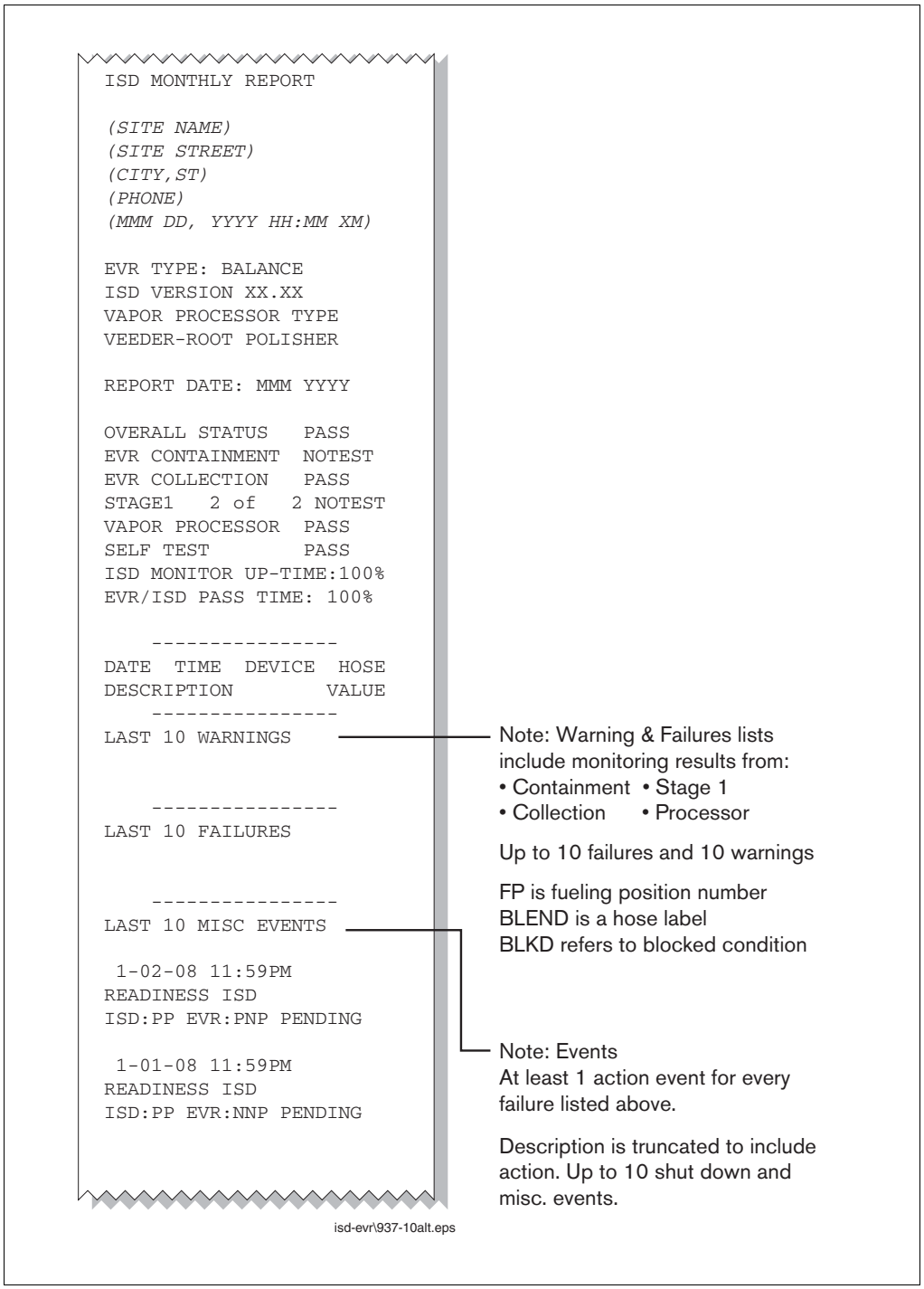
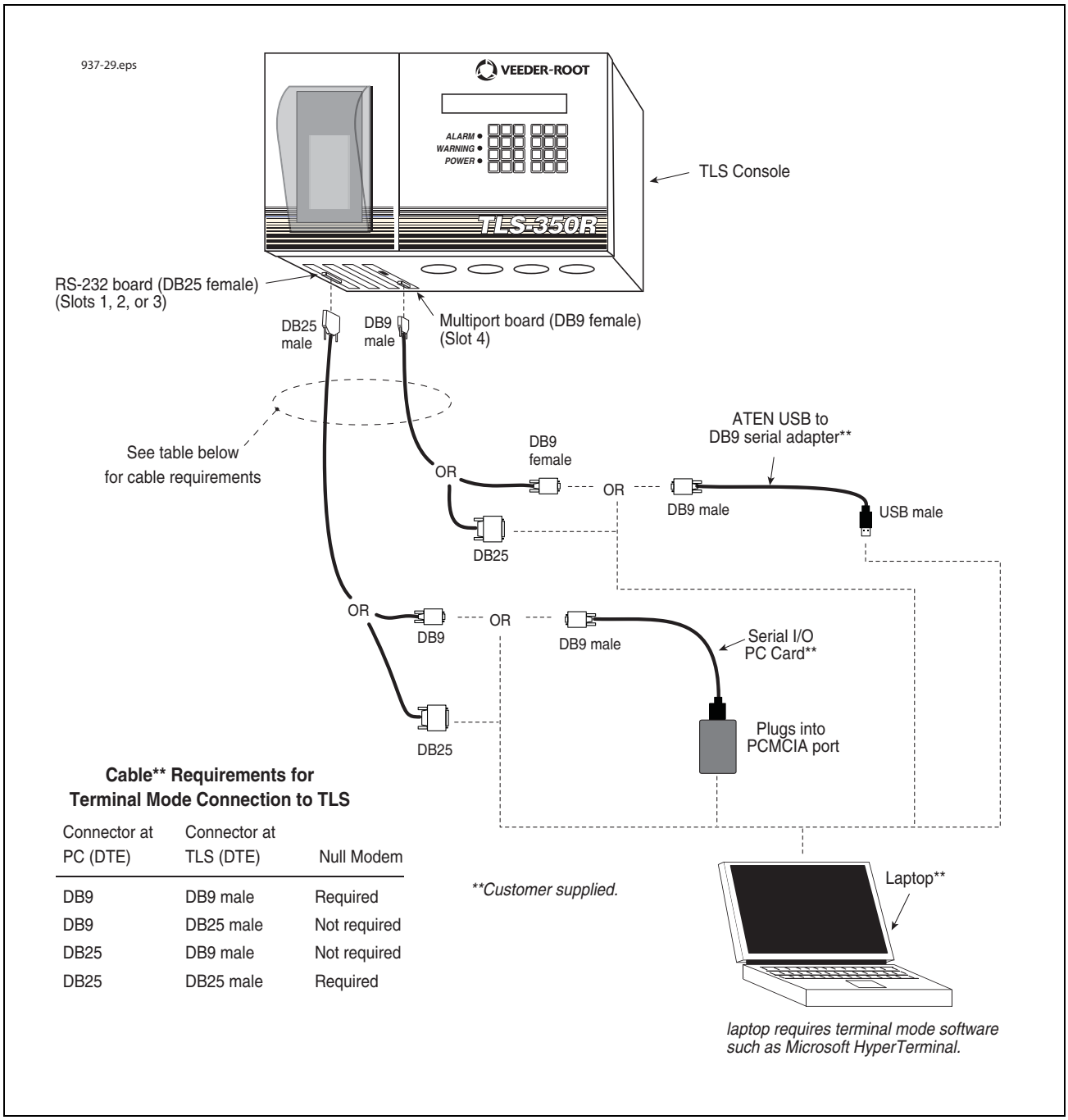


Figure 29. ISD Monthly Report Example - TLS console printout

Viewing ISD Reports via RS-232 Connection

CONNECTING LAPTOP TO CONSOLE

Connect your laptop to the TLS console's RS-232 or Multiport module using one of the methods shown in the examples in Figure 30 below.



Cable Requirements for Terminal Mode Connection to TLS**

Connector at PC (DTE)	Connector at TLS (DTE)	Null Modem
DB9	DB9 male	Required
DB9	DB25 male	Not required
DB25	DB9 male	Not required
DB25	DB25 male	Required

Figure 30. Connecting laptop to TLS console for serial communication

CONNECTING LAPTOP TO CONSOLE

1. Open your laptop's serial communication program, e.g., HyperTerminal. You can typically find HyperTerminal under: Start/Programs/Accessories/Communications.

2. After opening the terminal software program, ignore (cancel) any modem/dialing related request windows since you will be directly connecting to the console via serial communications. When the Connection Description window appears (Figure 31), enter a connection name, e.g., TLSDIRECT, and click the OK button.

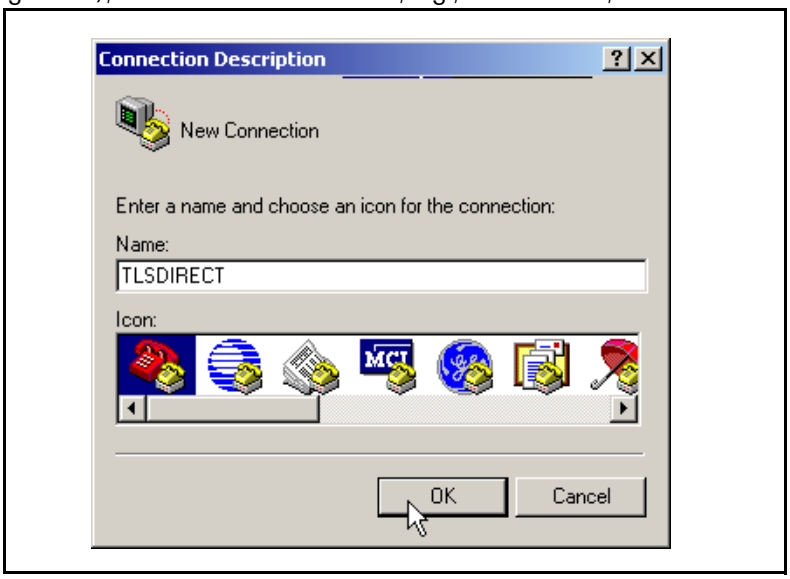


Figure 31. Connection Description window

3. After clicking the OK button, you may see a repeat of the modem/dialing windows, in which case ignore (cancel) them all.

4. When the Connect To window appears (Figure 32), depending on your connection method, select either COM1 (If RS-232 port on laptop), USB-Serial Controller (if using USB port on laptop), or Serial I/O PC Card (if using PCMCIA port on laptop) in the 'Connect using' drop down box, then click OK button.

Figure 32. Connect To window

5. Next you should see the 'Port Settings' window.

IMPORTANT! The settings of the laptop's com port must match those of the console's com port to which you are connected.

a. Go to the console front panel press the MODE key until you see:

```
SETUP MODE
PRESS <FUNCTION> TO CONT
```

b. Press the FUNCTION key until you see the message:

```
COMMUNICATIONS SETUP
PRESS <STEP> TO CONTINUE
```

c. Press the STEP key until you see the message:

```
PORT SETTINGS
PRESS <ENTER>
```

d. Press the PRINT key to printout the port settings for all communication modules installed in the console. Figure 33 shows an example port settings printout with the RS-232 module installed. Using the console port settings in the example below, your HyperTerminal 'Port Settings' window entries would be Bits per second - 2400, Data bits - 7, Parity - Odd, Stop Bits - 1. For the 'Flow Control' entry select None. Click OK.

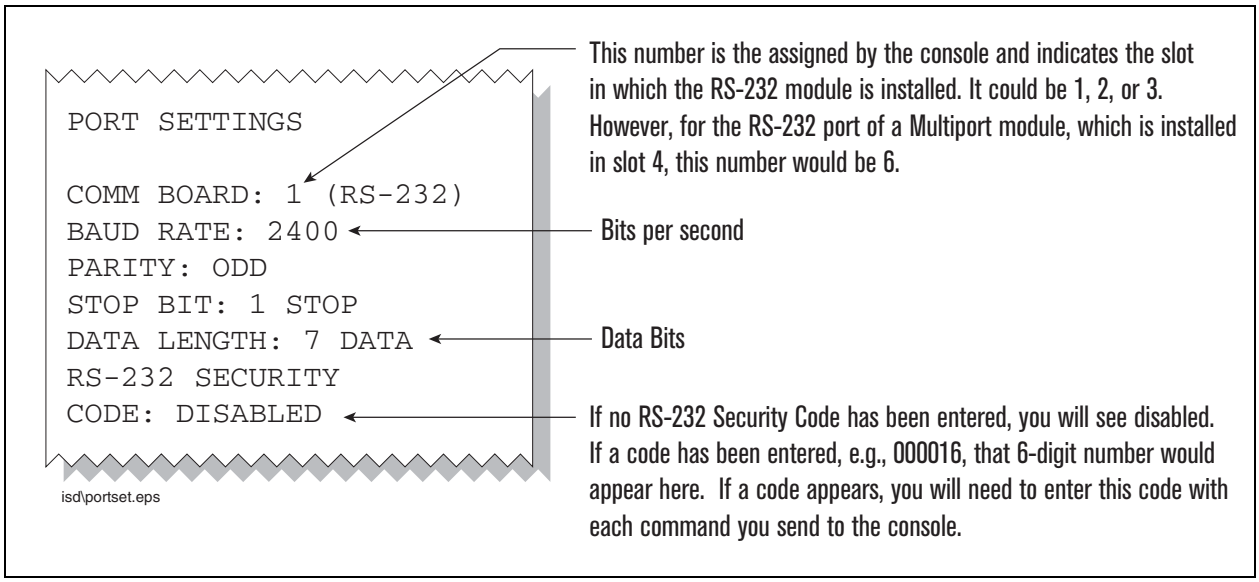


Figure 33. Console comm port settings printout example

In the example port settings printout above, the RS-232 Security Code is disabled. If the code was enabled you would see a 6-digit number which you will need to enter to access the console (refer to the 'Sending Console Commands' paragraph below for more information).

6. After entering your port settings, the program's main window appears (Figure 34).

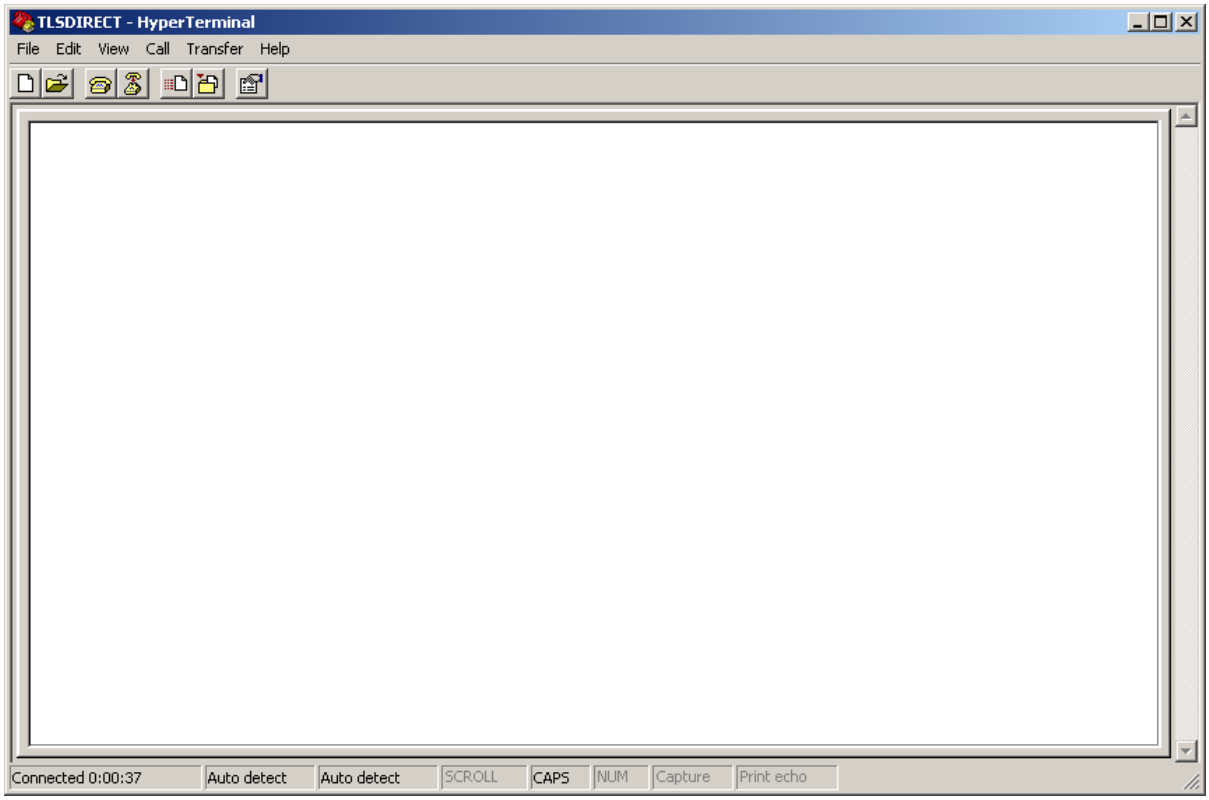


Figure 34. HyperTerminal main window

SENDING CONSOLE COMMANDS

Table 6 shows four important ISD console commands: IV0500, IV0200, IV0100, and IB6100. The <SOH> shown in the table means that you must press and hold the **Cntrl** key while you press the **A** key.

For example, let's say you want to see the Daily Report Details for the last 10 days.

Note: If you want to see the characters of the command as you type them in, click on File menu, then select Properties/Settings (tab)/ASCII Setup and click the check box for 'Echo typed characters locally', then click OK to close the window(s) and return to the main screen.

If the RS-232 Security Code is disabled - press and hold the Ctrl key while you press the A key, then type in IV0500010. If the RS-232 Security Code is enabled (e.g., 000016) you must enter the security code before the command - press and hold the Ctrl key while you press the A key, then type in 000016IV0500010.

You will see the typed command on the screen: ☺IV0500010 followed by the response (report) from the console. The ☺ symbol indicates CrtlA and the ♥ symbol indicates the end of the response.

If the console recognizes the command the response displays as soon as the command is typed in.

If the console does not recognize the command you would see something like ☺IV0500010☺9999FF1B♥ which indicates the console did not recognize the command.

All responses (Reports) can be printed or saved to a file. See the terminal program's help file for instructions.

Table 6. Serial Commands for ISD Alarm, Monthly, and Daily Reports

Report Type	Serial Command (PC to Console)[1]
Daily Report Details (See example Figure 35)	<SOH>IV0500ddd Where ddd = number of days, 001 = yesterday and today, 002 = two days ago, etc.
Monthly Status Report (See example Figure 36)	<SOH>IV0200yyyymm Where yyyy = year number, e.g. 2003, mm = month number, 01 = January, 02 = February, etc.
Alarm Status (See example Figure 37)	<SOH>IV0100
V80 Vapor Processor Runtime Diagnostic Report[2] (See examples Figure 38 and Figure 39)	<SOH>IV8000
Vapor Processor Status Report[2] (See example Figure 40)	<SOH>IV8200
Vapor Valve Status Report[2] (See example Figure 43)	<SOH>IB6100
Non-Priority Alarm History Report (See example Figure 41)	<SOH>I11100
Priority Alarm History Report (See example Figure 42)	<SOH>I11200
Smart Sensor Sub Alarm History Report (See example Figure 44)	<SOH>IB6200
Daily Vapor Polisher Diagnostic Report (See example Figure 45)	<SOH>IV8800yyyymmddnnnn Where: yyyy = year number, e.g., 2003, mm = month number (01 = January, 02 = February, etc.), dd = day of the month, nnnn = number of records after the date entered (9999 = all).

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

[2]Not available for FFS-CAS Processor or Hirt VCS 100.

IV0500
JAN 8, 2008 3:52 PM isd-evr\937-11alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD DAILY REPORT DETAILS

EVR TYPE: BALANCE
ISD TYPE: XX.XX
VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER

OVERALL STATUS :WARN EVR VAPOR COLLECTION :PASS
EVR VAPOR CONTAINMENT :WARN
ISD MONITOR UP-TIME :100% STAGE I TRANSFERS: 10 of 10 PASS
EVR/ISD PASS TIME : 81% VAPOR PROCESSOR :PASS

Status Codes: (W)Warn (F)Fail (D)Degradation Fail (G)Gross Fail
(ISD-W)ISD Self-Test Warning (ISD-F)ISD Self-Test Fail (N)No Test

	ISD	ISD	---CONTAINMENT TESTS---					STAGE		---COLLECTION TESTS		
	EVR	%UP	GROSS	DGRD	MAX	MIN	LEAK	I	VAPOR	FP1	FP2	FP3
DATE	STATUS	TIME	95%	75%	"WC	"WC	CFH	XFR	PRCSR	BLEND	BLEND	BLEND
12/28	W	100%	0.2	-0.3	0.7	-2.5	18W	PASS	PASS	0.94	1.07	1.10
12/29	W	100%	0.2	-0.3	0.7	-3.0	16W	PASS	PASS	0.95	0.85	1.11
12/30	PASS	100%	0.2	-0.3	0.7	-4.1	0	PASS	PASS	0.95N	0.99	1.02
12/31	PASS	100%	0.2	-0.3	0.8	-3.0	0	PASS	PASS	0.97	0.96	1.17
01/01	PASS	100%	0.2	-0.3	-0.2	-3.3	0		PASS	0.86	1.02	0.99
01/02	PASS	100%	0.2	-0.3	0.9	-5.0	0	PASS	PASS	0.94	0.96	1.20
01/03	PASS	100%	0.2	-0.3	1.1	-4.3	0	PASS	PASS	0.82	1.10	1.13
01/04	PASS	100%	0.4	-0.3	1.9	-2.8	0		PASS	1.07	1.01	1.10
01/05	PASS	100%	0.2	-0.3	2.8	-5.0	0	PASS	PASS	0.97	1.12	0.84
01/06	PASS	100%	0.2	-0.3	0.4	-5.0	0	PASS	PASS	0.80	1.23	1.11
01/07	PASS	100%	0.2	-0.3	0.6	-5.0	0	PASS	PASS	0.93	0.96	1.07

---COLLECTION TESTS-DAILY AVERAGE HOSE FLOW PERFORMANCE----------

	FP4	FP5	FP6	FP7	FP8	FP9	FP10	FP11	FP12
DATE	BLEND	BLEND	BLEND	BLEND	BLEND	BLEND	BLEND	BLEND	BLEND
12/28	1.06	1.16	0.96	1.21	1.10	1.03	1.08	1.13	1.13
12/29	1.03	1.12	1.16	1.07	1.13	1.01	0.97	1.06	1.06
12/30	1.04	0.96	0.95	1.06	1.11	0.97	1.14	1.18	0.94
12/31	1.07	1.20	1.05	1.10	1.00	0.90	1.09	1.07	1.27
01/01	1.03	1.18	1.19	0.85	1.16	1.24	1.13	1.31	1.16
01/02	0.94	0.98	1.10	0.97	1.10	0.91	0.98	1.08	1.09
01/03	1.12	0.96	1.17	1.12	1.07	1.06	1.12	1.12	1.10
01/04	1.04	1.18	1.09	1.16	1.16	0.90	1.19	1.05	1.13
01/05	1.13	0.94	1.11	1.02	1.10	1.10	1.21	1.19	1.04
01/06	1.11	1.14	1.09	1.10	1.18	0.95	1.15	1.09	1.05
01/07	0.96	1.13	1.07	0.84	1.13	1.02	1.06	1.12	1.00

Figure 35. ISD Daily Report Details - Serial to PC Format (Example report with Veeder-Root Polisher)

```
IV0200
JAN  8, 2008  3:53 PM                                          isd-evr\937-12alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD MONTHLY STATUS REPORT

EVR TYPE: BALANCE
ISD TYPE: XX.XX
VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER


OVERALL STATUS             :FAIL            EVR VAPOR COLLECTION :FAIL
EVR VAPOR CONTAINMENT      :WARN
ISD MONITOR UP-TIME        :100%            STAGE I TRANSFERS: 33 of 33 PASS
EVR/ISD PASS TIME          : 77%            VAPOR PROCESSOR      :WARN

CARB EVR CERTIFIED OPERATING REQUIREMENTS

ISD MONITORING TEST PASS/FAIL THRESHOLDS
                                                    PERIOD    BELOW  ABOVE

VAPOR COLLECTION BALANCE SYS FLOW PERFORMANCE        1DAYS     0.60  ----
VAPOR CONTAINMENT GROSS FAIL, 95th PERCENTILE        7DAYS     ----  1.30"wcg
VAPOR CONTAINMENT DEGRADATION, 75th PERCENTILE      30DAYS     ----  0.30"wcg
VAPOR CONTAINMENT LEAK DETECTION FAIL @2"WCG         7DAYS     ---- 12.5cfh
STAGE I VAPOR TRANSFER FAIL, 50th PERCENTILE        20MINS     ----  2.50"wcg
VAPOR PROCESSOR MASS EMISSION FAIL (LB/1KG)          1DAYS     ----  0.32

WARNING ALARMS
DATE     TIME     DESCRIPTION                     READING         VALUE
07-12-30 00:02:33 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  15.51
07-12-29 00:02:07 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  18.24
07-12-28 00:02:01 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  17.34
07-12-27 00:01:36 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  17.11
07-12-26 00:01:41 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  18.66
07-12-10 00:02:05 FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4       BLKD

FAILURE ALARMS
DATE     TIME     DESCRIPTION                     READING         VALUE
07-12-11 00:02:05 FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4       BLKD

SHUTDOWN & MISCELLANEOUS EVENTS
DATE     TIME     DESCRIPTION                     ACTION/NAME
07-12-11 00:02:18 FLOW PERFORMANCE BLK           DISABLED FP 08
```

Figure 36. ISD Monthly Status Report - Serial to PC Format (Example report with Veeder-Root Polisher)

```
IV0100
JAN  8, 2008  3:53 PM                                          937-13alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD ALARM STATUS REPORT

EVR TYPE: BALANCE
ISD TYPE: XX.XX
VAPOR PROCESSOR TYPE: VST VAPOR PROCESSOR


OVERALL STATUS             :PASS            EVR VAPOR COLLECTION :PASS
EVR VAPOR CONTAINMENT      :PASS
ISD MONITOR UP-TIME        :100%            STAGE I TRANSFERS:  2 of  2 PASS
EVR/ISD PASS TIME          :100%            VAPOR PROCESSOR      :PASS

WARNING ALARMS
DATE     TIME     DESCRIPTION                      READING          VALUE
07-12-30 00:02:33 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  15.51
07-12-29 00:02:07 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  18.24
07-12-28 00:02:01 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  17.34
07-12-27 00:01:36 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  17.11
07-12-26 00:01:41 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  18.66
07-12-10 00:02:05 FLOW PERFORMANCE HOSE BLOCKAGE   FP 8 BLEND4       BLKD
07-11-16 00:02:17 FLOW PERFORMANCE HOSE BLOCKAGE   FP 8 BLEND4       BLKD
07-11-13 00:02:28 FLOW PERFORMANCE HOSE BLOCKAGE   FP 8 BLEND4       BLKD
07-11-11 00:03:19 FLOW PERFORMANCE HOSE BLOCKAGE   FP 6 BLEND4       BLKD

FAILURE ALARMS
DATE     TIME     DESCRIPTION                      READING          VALUE
07-11-14 00:02:18 FLOW PERFORMANCE HOSE BLOCKAGE   FP 8 BLEND4       BLKD
07-11-12 00:02:38 FLOW PERFORMANCE HOSE BLOCKAGE   FP 6 BLEND4       BLKD
07-11-09 00:03:41 CONTAINMENT GROSS OVER PRESSURE WEEKLY 95%         4.60
07-10-31 00:02:45 VAPOR PROCESSOR STATUS
                  VP EMISSIONS FAIL                LB/1KB            0.693
07-10-15 00:03:14 FLOW PERFORMANCE HOSE BLOCKAGE   FP 2 BLEND4       BLKD
07-10-15 00:03:13 FLOW PERFORMANCE HOSE BLOCKAGE   FP 1 BLEND4       BLKD
07-10-14 00:03:11 FLOW PERFORMANCE HOSE BLOCKAGE   FP 2 BLEND4       BLKD

SHUTDOWN & MISCELLANEOUS EVENTS
DATE     TIME     DESCRIPTION                       ACTION/NAME
07-11-03 19:52:52 VAPOR PROCESSOR                 TEST MANUALLY CLEARED
07-11-18 00:02:24 READINESS ISD:PP EVR:PPP        ISD & EVR READY
07-11-17 13:09:06 READINESS ISD:PP EVR:NNN        EVR READINESS PENDING
07-11-17 13:09:06 ISD STARTUP
07-11-17 13:03:24 ISD SHUTDOWN
07-11-14 00:02:18 FLOW PERFORMANCE BLK            DISABLED FP 08 BLEND4
07-11-12 00:02:38 FLOW PERFORMANCE BLK            DISABLED FP 06 BLEND4
07-11-09 00:03:41 CONTAINMENT GROSS               DISABLED DISPENSERS
07-11-04 01:00:00 TIME CHANGE DETECTED AT:       07-11-04 02:00:13
07-11-03 00:01:25 VAPOR PROCESSOR PROBLEM         DISABLED DISPENSERS
```

Figure 37. ISD Alarm Status Report - Serial to PC Format (Example report with Veeder-Root Polisher)

Figure 38 shows an example VST Vapor Processor Runtime Diagnostic Report (not available with FFS-CAS or Hirt VCS 100).

```
IV8000
SEP 30, 2007 12:27 AM

(SITE NAME)
(SITE STREET)
(CITY,ST)
(PHONE)
(MMM DD, YYYY HH:MM XM)

VAPOR PROCESSOR
                    ELAPSED    PRESSURE INCHES H2O    RUNTIME
DATE-TIME ON        MINUTES       ON        OFF        FAULT
 5-04-07  3:31PM     8.87         0.244    -0.202        NO
 5-05-07  4:17AM     3.35         0.202    -0.212        NO
 5-07-07 10:17PM     3.50         0.206    -0.221        NO
 5-07-07 10:28PM    15.12         0.384    -0.356        NO
 5-08-07  8:16PM    21.77         0.325    -0.211        NO
 5-09-07  6:35PM    20.60         0.368    -0.276        NO
 5-10-07  8:03PM     6.18         0.226    -0.398        NO
 5-10-07  8:15PM     2.55         0.231    -0.227        NO
 5-13-07  8:55PM    18.23         0.314    -0.205        NO
```

937-35.eps

Figure 38. VST Vapor Processor Runtime Diagnostics Report - Serial to PC Format

Figure 39 shows an example V-R Vapor Polisher Runtime Diagnostic Report and Table 7 explains the `IV8000` report's event codes (not available with FFS-CAS or Hirt VCS 100).

```
IV8000                                                    937-30.eps
FEB  4, 2008  1:01 PM

TLS_350 UST
VEEDER-ROOT TEST LAB
125 POWDER FOREST DR
SIMSBURY, CT 06070

VAPOR POLISHER
VALVE EVENT          PRESSURE
DATE-TIME              "WC      EVENT CODE
 1-31-08  3:44PM      -0.700    OPEN PURGE
 1-31-08  3:47PM       0.038    CLOSE FORCE PURGE
 1-31-08  3:51PM      -0.255    OPEN PURGE
 1-31-08  8:08PM      -0.300    CLOSE PURGE Hi P
 2-01-08  1:59PM      -0.300    OPEN PURGE
 2-01-08  2:18PM      -0.263    OPEN PURGE
 2-01-08  2:33PM      -0.289    OPEN PURGE
 2-04-08 11:22AM      -0.560    NO EVENT
 2-04-08 11:28AM      -0.560    OPEN PURGE
 2-04-08 11:48AM      -0.300    OPEN PURGE
 2-04-08 12:28PM      -0.263    OPEN PURGE
 2-04-08 12:42PM      -0.299    OPEN PURGE
```

Figure 39. V-R Vapor Polisher Runtime Diagnostics Report - Serial to PC Format

Table 7. Vapor Processor Runtime Diagnostic Report Event Codes

Event Code	Cause	Event Code	Cause
NO EVENT	The valve changed state outside of the carbon canister algorithm.	CLOSE NEAR FULL	Canister load is between 80 and 100% and pressure is <1.05.
CLOSE TEST	Manual operation of the valve	OPEN PURGE	Canister load is >0% and pressure <-0.25
OPEN TEST	Manual operation of the valve	OPEN EXCESS PURGE	Canister load is 0%, Excess purge is incomplete, pressure <-1.5, time is between 6AM and 4PM.
CLOSE PURGE HI P	The canister state is in excess purge and the pressure is above -0.5.	OPEN FILL	Canister valve is open for loading: • When pressure is greater than or equal to 0.75 IWC and Canister load is less than 80%. • Pressure is greater than or equal to 1.3 IWC and Canister load is greater than 80%.
CLOSE PURGE TIME	The canister state is in excess purge and the time is outside 6AM to 4PM.	CLOSE CVLD TEST	Valve was closed to collect data for ISD contamination leak test.
CLOSE FORCE PURGE	Canister is in startup period. Loading with pressures <+1.05 is not allowed until startup period is complete.	CLOSE LIMIT	Valve closed because canister has reached allowable extended capacity loading limit.
CANISTER EMPTY	Canister was loaded above 1% and purged to 0%. No valve state change.	CANISTER FULL	No valve state change. The canister load passed from below 95% to/thru the 100% point and not yet at day's emission limit.
CLOSE EMPTY	Excess purging has completed.		

Figure 40 shows an example Vapor Processor Status Report (not available with FFS-CAS or Hirt VCS 100).

```
IV8200
DEC  8, 2010  4:29 AM

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

VAPOR PROCESSOR STATUS REPORT

PMC VERSION: XX.XX

ASSESSMENT TIME: DEC  7, 2010 11:59 PM


VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER

PMC MONITORING TEST PASS/FAIL THRESHOLDS
                                              PERIOD    BELOW  ABOVE
VAPOR PROCESSOR MASS EMISSION FAIL             1DAYS     ----   0.32 LBS/1KG

EFFLUENT EMISSIONS TEST : PASS     (0.00 LBS/1KG)

DAILY THROUGHPUT  :   6989 GALS
```

Figure 40. Vapor Processor Status Report - Serial to PC Format

Figure 41 shows an example Non-Priority Alarm History Report.

```
I11200
DEC  9, 2010  4:20 AM

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

NON-PRIORITY ALARM HISTORY
ID  CATEGORY  DESCRIPTION          ALARM TYPE           STATE    DATE    TIME
T 3 TANK      DIESEL               LOW TEMP WARNING     CLEAR  12-08-10  3:00PM
T 3 TANK      DIESEL               LOW TEMP WARNING     ALARM  12-08-10  3:00PM
T 3 TANK      DIESEL               HIGH PRODUCT ALARM   CLEAR  12-08-10  3:00PM
T 3 TANK      DIESEL               HIGH PRODUCT ALARM   ALARM  12-08-10  2:56PM
    SYSTEM                         PRINTER ERROR        CLEAR  11-17-10 10:51AM
    SYSTEM                         PAPER OUT            CLEAR  11-17-10 10:51AM
    SYSTEM                         PAPER OUT            ALARM  11-17-10 10:50AM
    SYSTEM                         PRINTER ERROR        ALARM  11-17-10 10:50AM
```

Figure 41. Non-Priority Alarm History Report - Serial to PC Format

Figure 42 shows an example Priority Alarm History Report.

```
I11100
DEC  9, 2010  4:20 AM

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

PRIORITY ALARM HISTORY
ID  CATEGORY  DESCRIPTION          ALARM TYPE           STATE    DATE    TIME
T 2 TANK      91 OCTANE            PROBE OUT            CLEAR  12-08-10  7:55PM
T 2 TANK      91 OCTANE            PROBE OUT            ALARM  12-08-10  7:07PM
T 2 TANK      91 OCTANE            OVERFILL ALARM       CLEAR  11-17-10 11:46AM
T 2 TANK      91 OCTANE            OVERFILL ALARM       ALARM  11-17-10 11:45AM
```

Figure 42. Priority Alarm History Report - Serial to PC Format

Figure 43 shows an example Vapor Valve Status report.

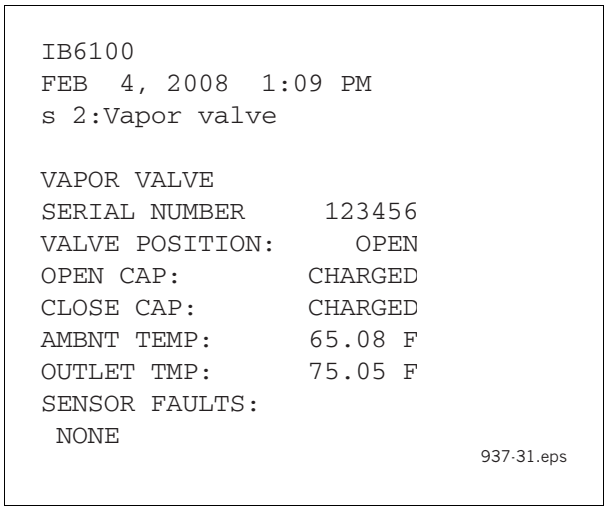


Figure 43. Vapor Valve Status Report - Serial to PC Format

The IB6100 command reports the current state of the Vapor Valve Components. The current position of the valve is reported as Open or Closed. The Capacitors are used to move the valve and are reported as Charged or Discharged. Outlet Temperature is the Canister thermal probe temperature. Ambient Temperature is the temperature at the Vapor Valve ambient temperature sensor. Sensor Faults are the active faults reported by the Vapor Valve. The IB6100 (Figure 43) command only provides active Sensor Fault conditions. Use the IB6200 command to see archived fault conditions (Figure 44).

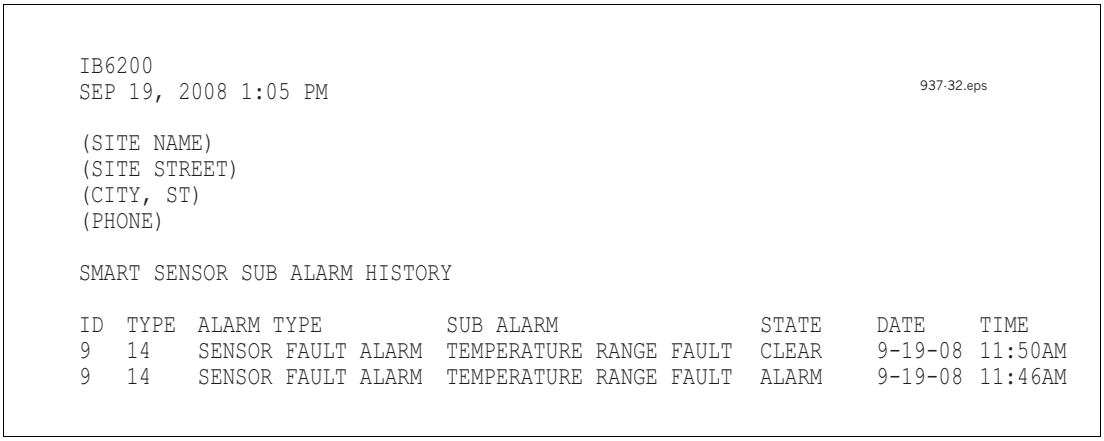


Figure 44. Smart Sensor Sub Alarm History Report - Serial to PC Format

Figure 45 shows an example PMC Daily Vapor Polisher Diagnostic Report.

```
IV8800                                                    937-33.eps
OCT 2, 2008  2:58 PM

PMC DAILY VAPOR POLISHER DIAGNOSTIC

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

Figure 45. PMC Daily Vapor Polisher Diagnostic Report - Serial to PC Format

6 Maintenance

TLS Console

The TLS console, including interface modules, do not require scheduled maintenance, but the station operator is responsible to ensure printer paper is properly loaded and front panel indicator lights are operational. ISD System Self-Test Monitoring algorithms are designed to verify proper selection, setup and operation of the TLS console and sensors. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

Vapor Flow Meter

There is no recommended maintenance, inspection nor calibration for the Air Flow Meter. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

Vapor Pressure Sensor

There is no recommended maintenance, inspection nor calibration for the Vapor Pressure Sensor. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

7 Diagnostic Menus

The diagnostic menus below are accessed and viewed from the TLS console front panel.

Smart Sensor Diagnostic Menu

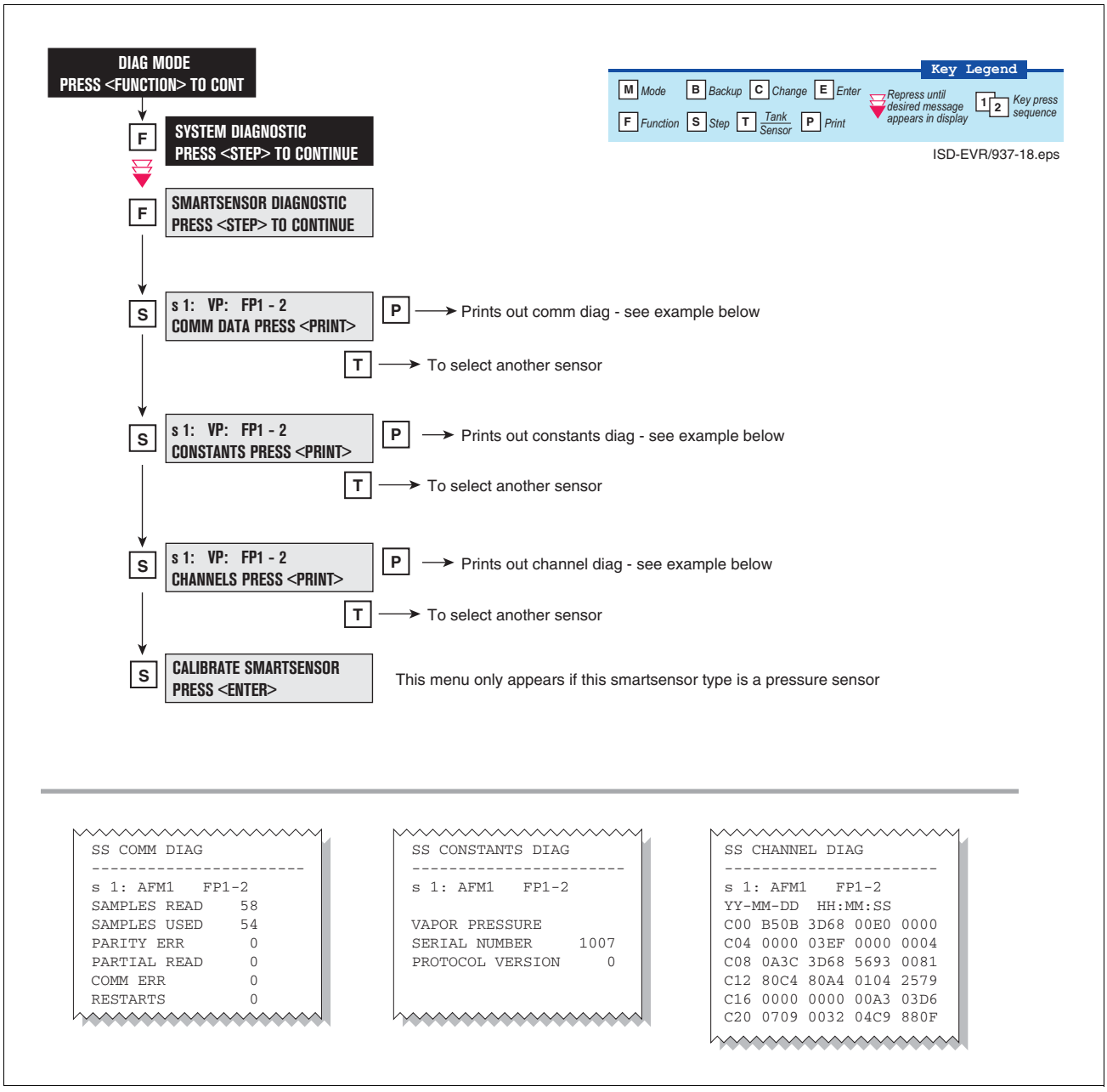


Figure 46. Smart Sensor Diagnostic Menu

Calibrate Smart Sensor Menu

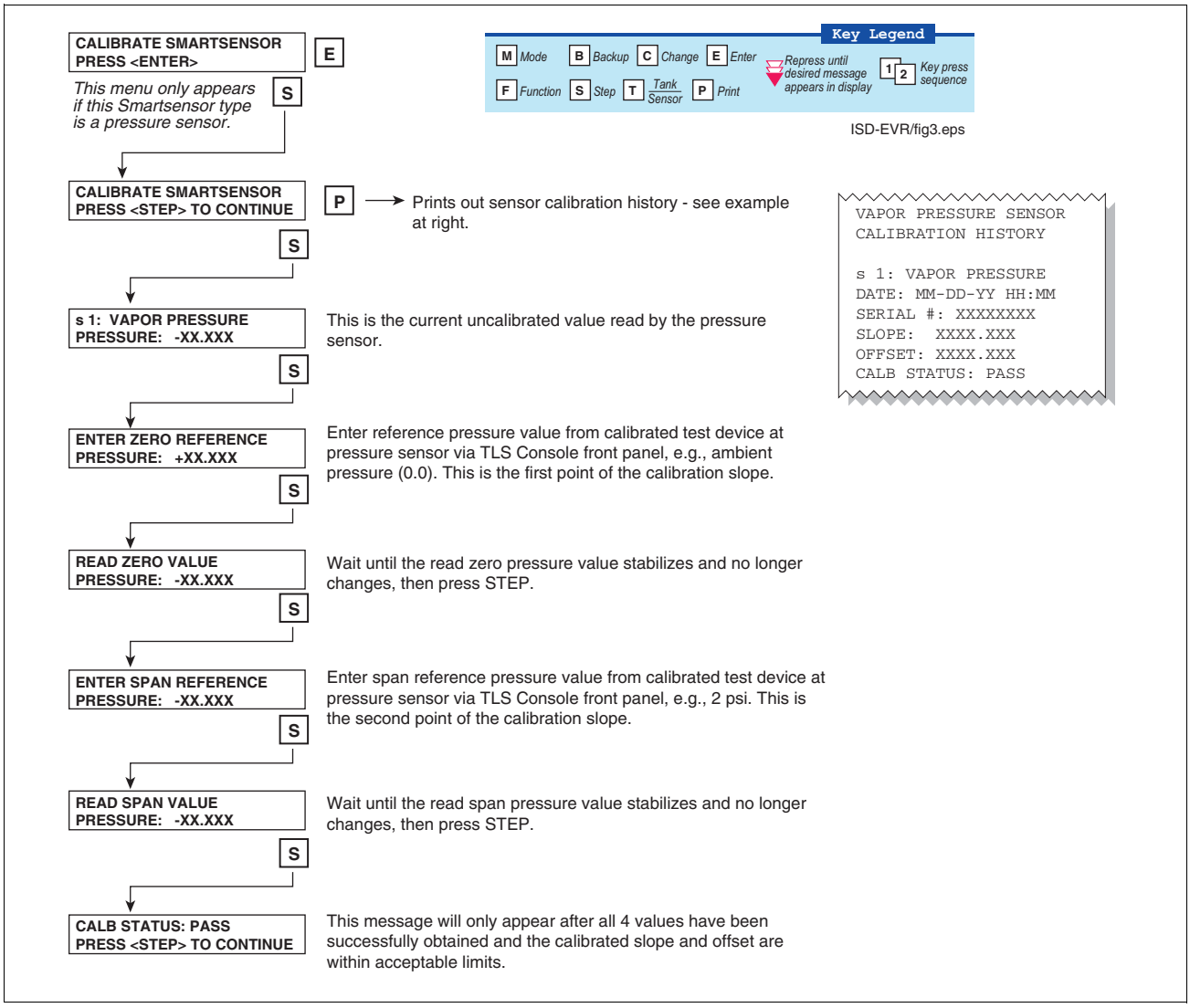
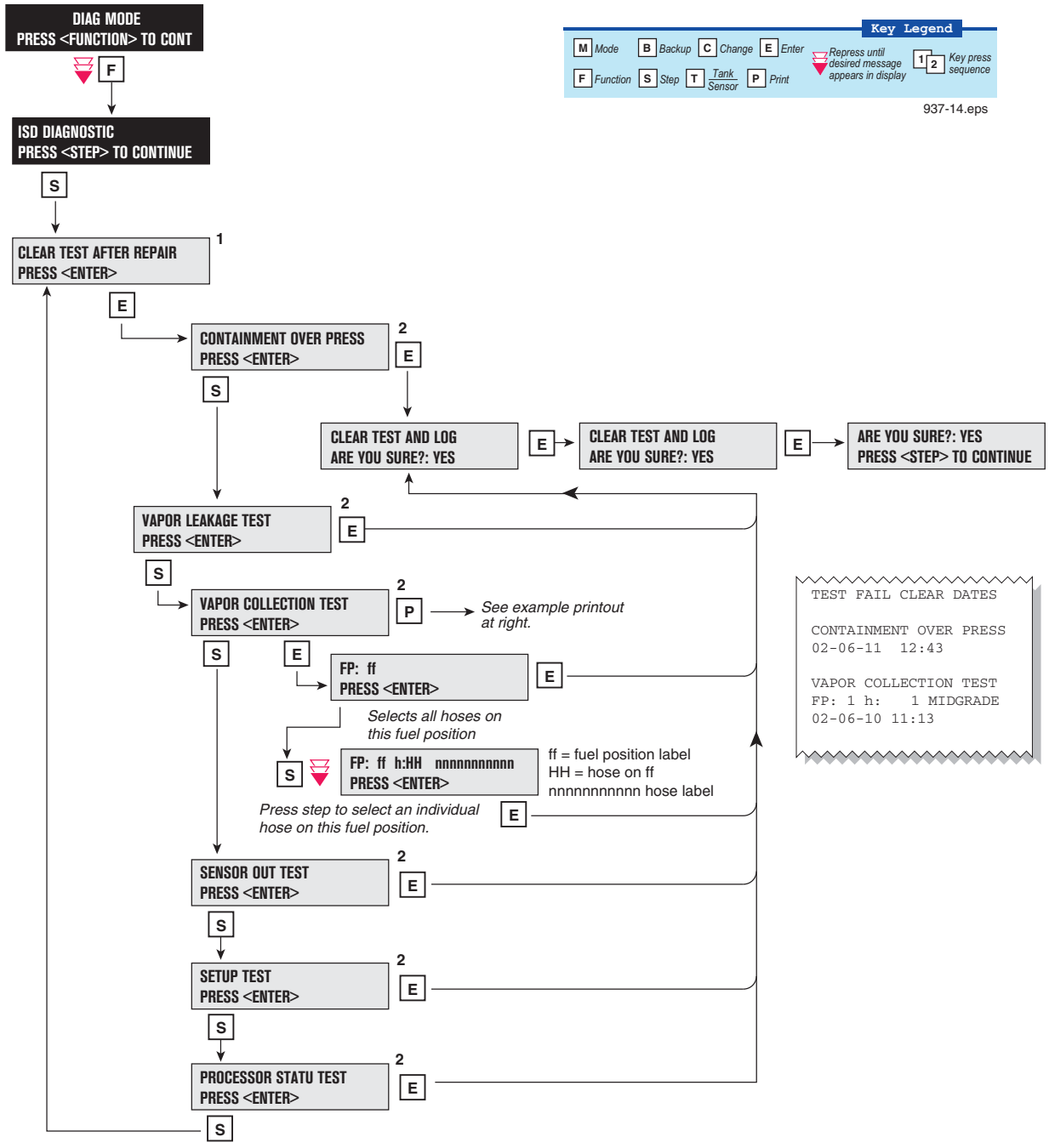


Figure 47. Smart Sensor Calibration Menu

ISD Diagnostic Menu



Notes:

1. All repair dates are saved in the Miscellaneous Event Log.
2. Reference the Clear Test Repair Menu table on the next page.

Figure 48. ISD Diagnostic Menu

Table 8. Clear Test Repair Menu

Menu Selection	Clears Alarms	Reset Dates
Containment Over Press	ISD GROSS PRESSURE WARN ISD GROSS PRESSURE FAIL ISD DEGRD PRESSURE WARN ISD DEGRD PRESSURE FAIL	Containment Test Time
Vapor Leakage Test	ISD VAPOR LEAKAGE WARN ISD VAPOR LEAKAGE FAIL	Vapor Leak Test Time
Vapor Collection Test	GROSS COLLECT WARN GROSS COLLECT FAIL DEGRD COLLECT WARN DEGRD COLLECT FAIL FLOW COLLECT WARN FLOW COLLECT FAIL AIRFLOW MTR SETUP	Hose Test Time
Sensor Out Test	ISD SENSOR OUT WARN ISD SENSOR OUT FAIL	Sensor Out Test Time
Setup Test	ISD SETUP WARN ISD SETUP FAIL	Setup Self Test Time
Processor Status Test[1]	ISD VP OVERPRESSURE WARN ISD VP OVERPRESSURE FAIL ISD VP STATUS WARN ISD VP STATUS FAIL VP EMISSIONS WARN VP EMISSIONS FAIL VP DUTY CYCLE WARN VP DUTY CYCLE FAIL	Valid Vapor Processor Test Time

[1]These tests and alarms are not available with FFS-CAS.

VST ECS Membrane Processor Diagnostic Menu

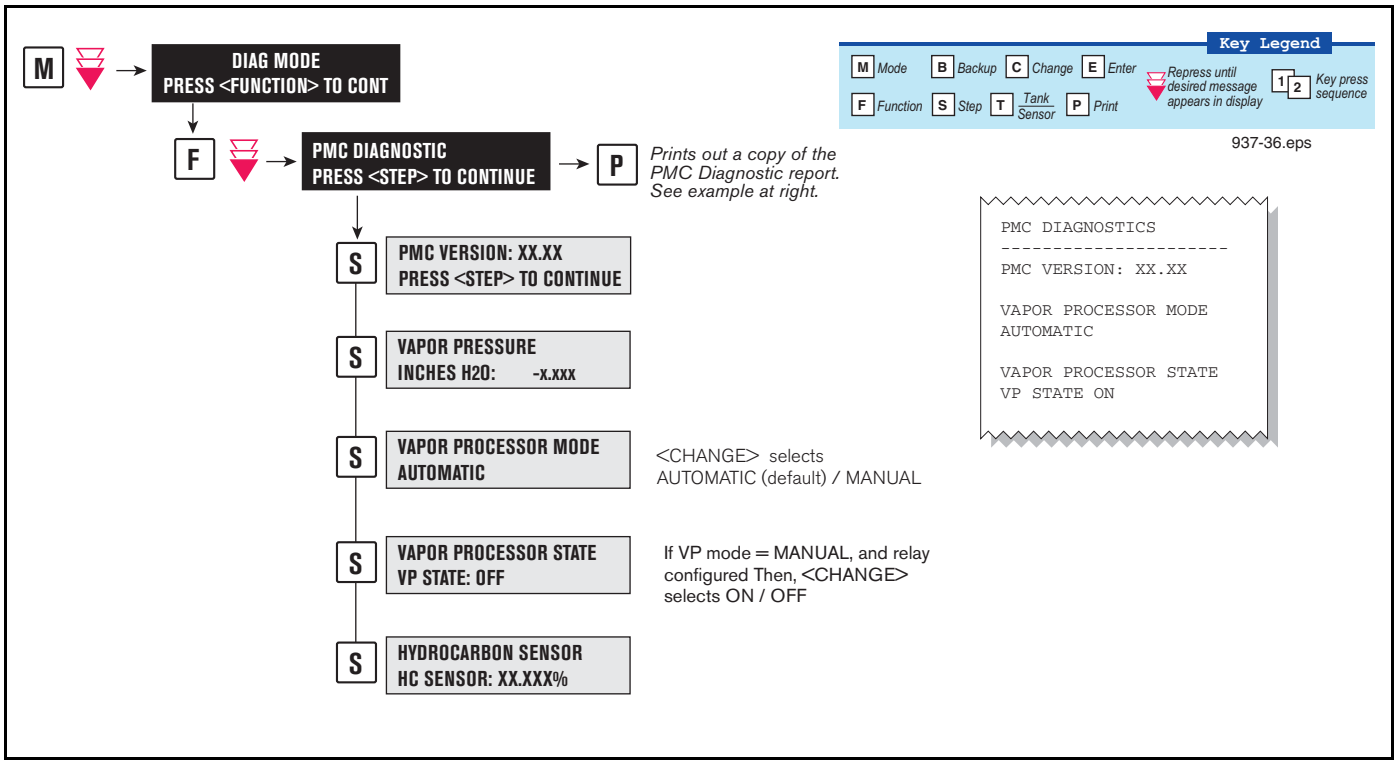


Figure 49. VST ECS Membrane Processor Diagnostic Menu

Veeder-Root Vapor Polisher Diagnostics

AUTOMATIC CONTROL

If PMC mode is in AUTOMATIC, PMC will control flow through the canister using a vapor control valve. The control algorithms will monitor tank pressure, vapor temperature and carbon temperature to monitor carbon canister loading. When the pressure is positive the valve is opened to relieve the pressure and begin loading the canister. When the UST pressure becomes negative the valve is opened and the purging process begins. The valve will close when the canister has either reached capacity or the canister is empty after purging.

MANUAL CONTROL

If PMC mode is in MANUAL, the diagnostic menu allows the valve to be opened (ON) or closed (OFF) manually. This feature is to support testing operation of the valve without waiting for canister to reach loading or purging thresholds. It also provides the necessary controls to perform 2" decay tests. The current UST ullage space vapor pressure will also be available through the diagnostic menu.

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

Veeder-Root Vapor Polisher PMC Diagnostic Menu

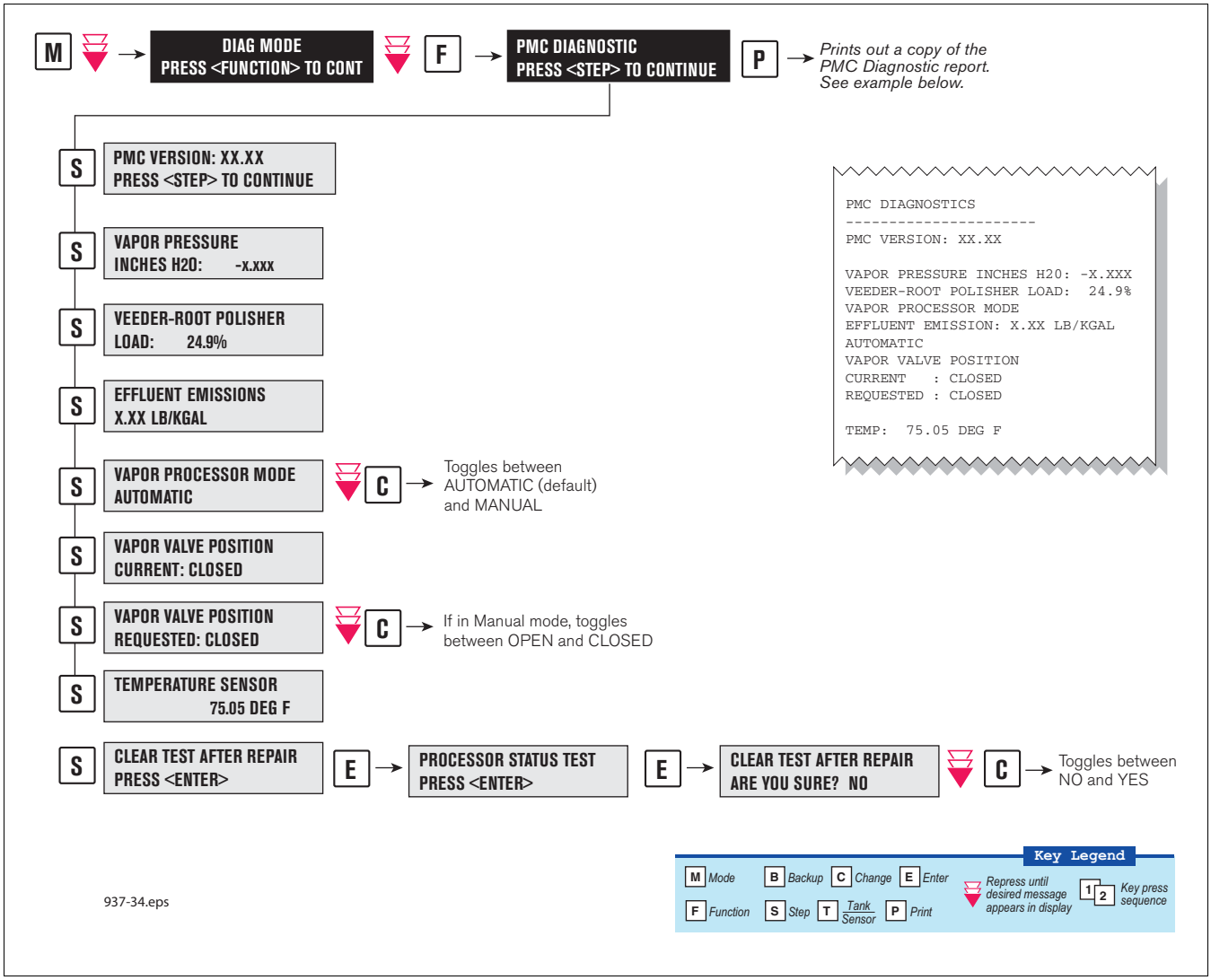


Figure 50. PMC Diagnostic Menus

Appendix A: Site EVR/ISD Equipment Location Worksheet

You should create a table listing each hose, fueling point, Air Flow Meter's serial number, etc.. This information will be required when you perform the EVR/ISD Setup hose/meter dispenses. This appendix contains blank worksheets for sites with single- and multi-hose dispensers. You are advised to fill in all of the appropriate information about your installed equipment, complete the TLS console's EVR/ISD setup, then perform the Product Meter ID dispensing procedure.

Single-Hose Fueling Position Dispensers

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST			
					Product Dispense(s)[6]			
Hose ID[1]	FP[2]	Hose Label[3]	AFM Serial Number[4]	AFM Label[5]	1st	2nd	3rd	4th
1		Blend		AFM FP__&__				
2		Blend						
3		Blend		AFM FP__&__				
4		Blend						
5		Blend		AFM FP__&__				
6		Blend						
7		Blend		AFM FP__&__				
8		Blend						
9		Blend		AFM FP__&__				
10		Blend						
11		Blend		AFM FP__&__				
12		Blend						
13		Blend		AFM FP__&__				
14		Blend						
15		Blend		AFM FP__&__				
16		Blend						

[1]Each hose must have a unique number (1 - 99).

[2]This is the Fuel Position Label which is the visible number on the outside of the dispenser (1 -2 digits).

[3]The hose label is always Blend for single-hose dispensers.

[4]This is the serial number on the Air Flow Meter (1 per dispenser).

[5]This is the AFM label entered in EVR/ISD setup (1 per dispenser and must be in the format shown, e.g., AFM FP1&2 - *where 1 and 2 refer to the one [or two] numbers on the outside of the dispenser*).

[6]After you have entered the contents of columns 1 - 5 into the TLS EVR/ISD hose table setup, you now must follow automap procedure and dispense from each gas meter AND one blend grade that feeds each hose. Enter a check beneath each product following a dispense from the hose.

FILL OUT - USE TO SETUP HOSE TABLE					AUTO MAP CHECK LIST			
					Product Dispense(s)			
Hose ID	FP	Hose Label	AFM Serial Number	AFM Label	1st	2nd	3rd	4th
17		Blend		AFM FP__&__				
18		Blend						
19		Blend		AFM FP__&__				
20		Blend						
21		Blend		AFM FP__&__				
22		Blend						
23		Blend		AFM FP__&__				
24		Blend						
25		Blend		AFM FP__&__				
26		Blend						
27		Blend		AFM FP__&__				
28		Blend						
29		Blend		AFM FP__&__				
30		Blend						
31		Blend		AFM FP__&__				
32		Blend						
33		Blend		AFM FP__&__				
34		Blend						
35		Blend		AFM FP__&__				
36		Blend						

FILL OUT - USE TO SETUP HOSE TABLE					AUTO MAP CHECK LIST			
					Product Dispense(s)			
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**1st**	**2nd**	**3rd**	**4th**
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
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		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						

Multi-Hose Fueling Position Dispensers

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID[1]	**FP[2]**	**Hose Label[3]**	**AFM Serial Number[4]**	**AFM Label[5]**	**Product Dispense[6]**
				AFM FP__&__	
				AFM FP__&__	

[1]Each hose must have a unique number (1 - 99).

[2]This is the Fuel Position Label which is the visible number on the outside of the dispenser (1 -2 digits).

[3]The hose label is the grade.

[4]This is the serial number on the Air Flow Meter (1 per dispenser).

[5]This is the AFM label entered in EVR/ISD setup (1 per dispenser and must be in the format shown, e.g., AFM FP1&2 - *where 1 and 2 refer to the one [or two] numbers on the outside of the dispenser*).

[6]After you have entered the contents of columns 1 - 5 into the TLS EVR/ISD hose table setup, you now must follow automap procedure and dispense from each hose. Enter a check in this column following a dispense from the hose.

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**Product Dispense**
				AFM FP__&__	
				AFM FP__&__	
				AFM FP__&__	

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**Product Dispense**
				AFM FP__&__	
				AFM FP__&__	
				AFM FP__&__	

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**Product Dispense**
				AFM FP__&__	
				AFM FP__&__	
				AFM FP__&__	

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**Product Dispense**
				AFM FP__&__	
				AFM FP__&__	
				AFM FP__&__	

VEEDER-ROOT

For technical support, sales or other assistance, please visit: www.veeder.com

Pressure Sensor

Installation Guide

VEEDER-ROOT

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DAMAGE CLAIMS / LOST EQUIPMENT

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

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

1. Contact Veeder-Root Customer Service at 800-873-3313 with the specific part numbers and quantities that were missing or received damaged.
2. Fax signed Bill of Lading (BOL) to Veeder-Root Customer Service at 800-234-5350.
3. Veeder-Root will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

CUSTOMER'S PREFERRED CARRIER

1. It is the customer's responsibility to file a claim with their carrier.
2. Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
3. If "lost" equipment is delivered at a later date and is not needed, Veeder-Root will allow a Return to Stock without a restocking fee.
4. Veeder-Root will NOT be responsible for any compensation when a customer chooses their own carrier.

RETURN SHIPPING

For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

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) for the latest manual revisions pertaining to VR 204 (VST Phase II EVR System Including ISD System).

Pressure Sensor Installation

Figures

Tables

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.

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 Contractor Certification Requirements	Installer Certification[6]	ATG Technician Certification[7]	VR Vapor Products Certification[8]
Install[1] ISD	X	X	X
Install PMC	X	X	X
Install CCVP	X	X	X
Install Wireless ISD/PMC	X	X	X
Installation Checkout[2]		X	X
ATG Startup[3] / Training[4] / Service[5]		X	X
ISD Startup / Training / Service			X
PMC Startup / Training / Service			X
CCVP Startup / Training / Service			X
Wireless ISD/PMC Startup / Training / Service			X
Install Pressure Sensor (ATG)	X	X	X
Maintain Pressure Sensor (ATG)		X	X
Calibrate Pressure Sensor (ATG)		X	X
Clear ATG Pressure Sensor Alarm (ATG)		X	X
Clear ISD/PMC Alarms (ISD/PMC)			X

[1]Perform wiring and conduit touting; equipment mounting
[2]Inspect wiring and conduit routing; equipment mounting
[3]Turn power on, program and test the systems
[4]Provide supervised field experience in service techniques and operations
[5]Troubleshoot and provide routing maintenance
[6]UST Monitoring Systems – Installer (Level 1)
[7]Certified UST Monitoring Technician
[8]VR Vapor Products

Warranty Registrations may only be submitted by selected Distributors. Certified installers are required to provide the GDF operator with the completed Equipment Warranty Notice, form 577013-868, for their records.

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.

EXPLOSIVE
Fuels and their vapors are extremely explosive if ignited.

FLAMMABLE
Fuels and their vapors are extremely flammable.

ELECTRICITY
High voltage exists in, and is supplied to, the device. A potential shock hazard exists.

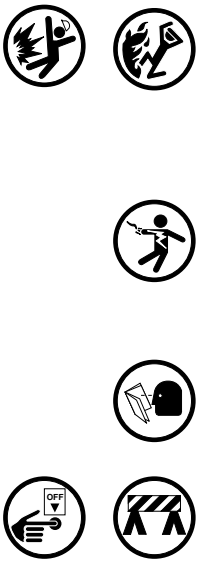
TURN POWER OFF
Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.

WARNING
Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.

USE SAFETY BARRICADES
Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.

READ ALL RELATED MANUALS
Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.

⚠ WARNING



This product is to be installed and operated in the highly combustible environment of a gasoline dispenser where flammable liquids and explosive vapors may be present.

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

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. **To be installed in accordance with the National Electrical Code (NFPA 70) and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A).**
3. **Before installing this device, turn Off, tag/lock out power to the system, including console and submersible pumps.**
4. **To protect yourself and others from being struck by vehicles, block off your work area during installation or service.**
5. **Substitution of components may impair intrinsic safety.**

Before You Begin

- Comply with all recommended safety practices identified by OSHA (Occupational Safety and Health Administration) and your employer.
- Review and comply with all the safety warnings in the installation manuals and any other national, State or Local requirements.
- When direct wiring to a TLS console, a 2-conductor, 18 AWG shielded cable must be installed in intrinsically safe conduit from the dispenser or from the vapor vent stack to the TLS console.
- The Pressure Sensor must be installed in a VERTICAL position with the sensing port pointing down. Its connection in the base of the dispenser to the vapor return line must be made BELOW the vapor return line shear valve mechanism, AND BELOW the Vapor Flow Meter outlet (if a flow meter is installed).
- For all connections requiring sealant, use only UL classified yellow Gas/TFE Teflon tape.
- When installing on a vent stack, customer supplied pipe and pipe fittings shall be standard full-weight (ASTM Schedule 40) wrought iron or steel.
- Customer supplied copper tubing shall be soft tempered, 1/4-inch O.D., with a minimum wall thickness of 0.0265 inches.
- Pipe threads shall be in accordance with the Standard for Pipe Threads, General Purpose (Inch) ANSI/ASME B1.20.1-1983.

Veeder-Root Parts

Veeder-Root parts and kits required to install the Pressure Sensor are listed in Table 1 and Table 2.

Table 1. Under Dispenser - Pressure Sensor Installation Kit (P/N 330020-515)

Item	Qty.	Description	P/N
1	1	Pressure sensor	331946-001 or 861190-201
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 or 861190-201
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

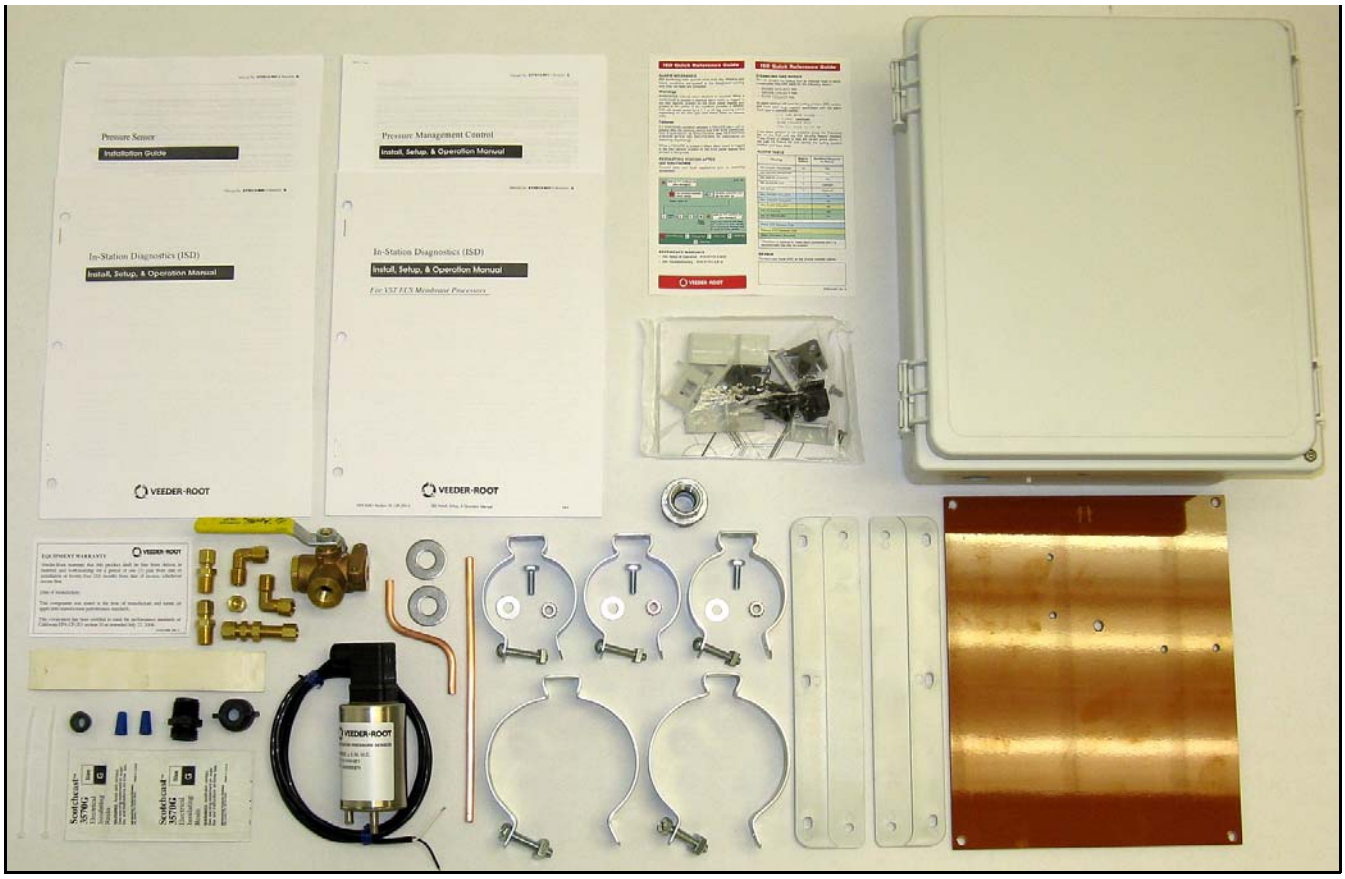


Figure 1. Table 2 Component Pictorial

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 ¼" 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 ¼" OD copper tube that runs between the ¼" 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.

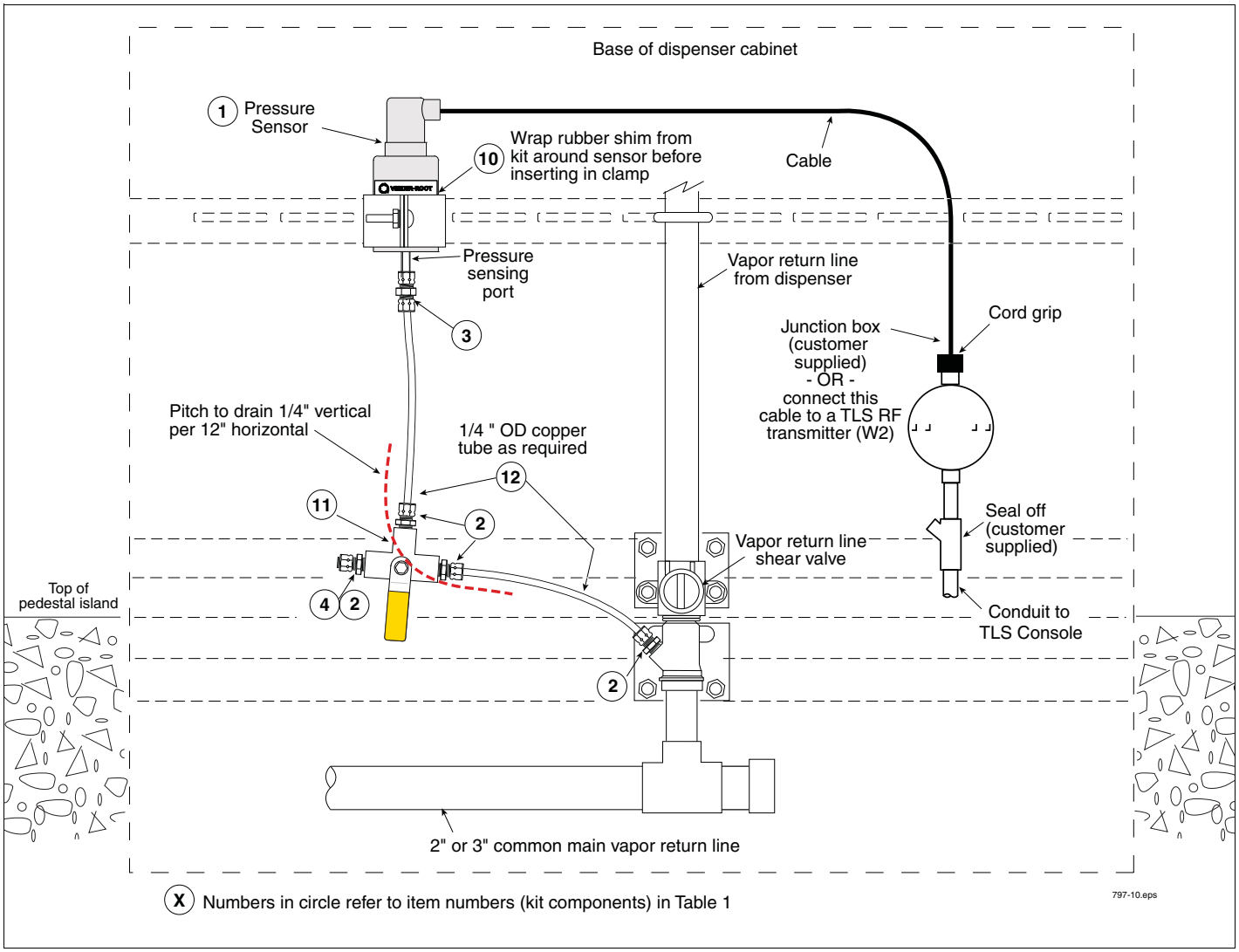


Figure 2. Example Pressure Sensor Install In Shear Valve Port - Preferred Non-ISD Installation (Without Vapor Flow Meter)

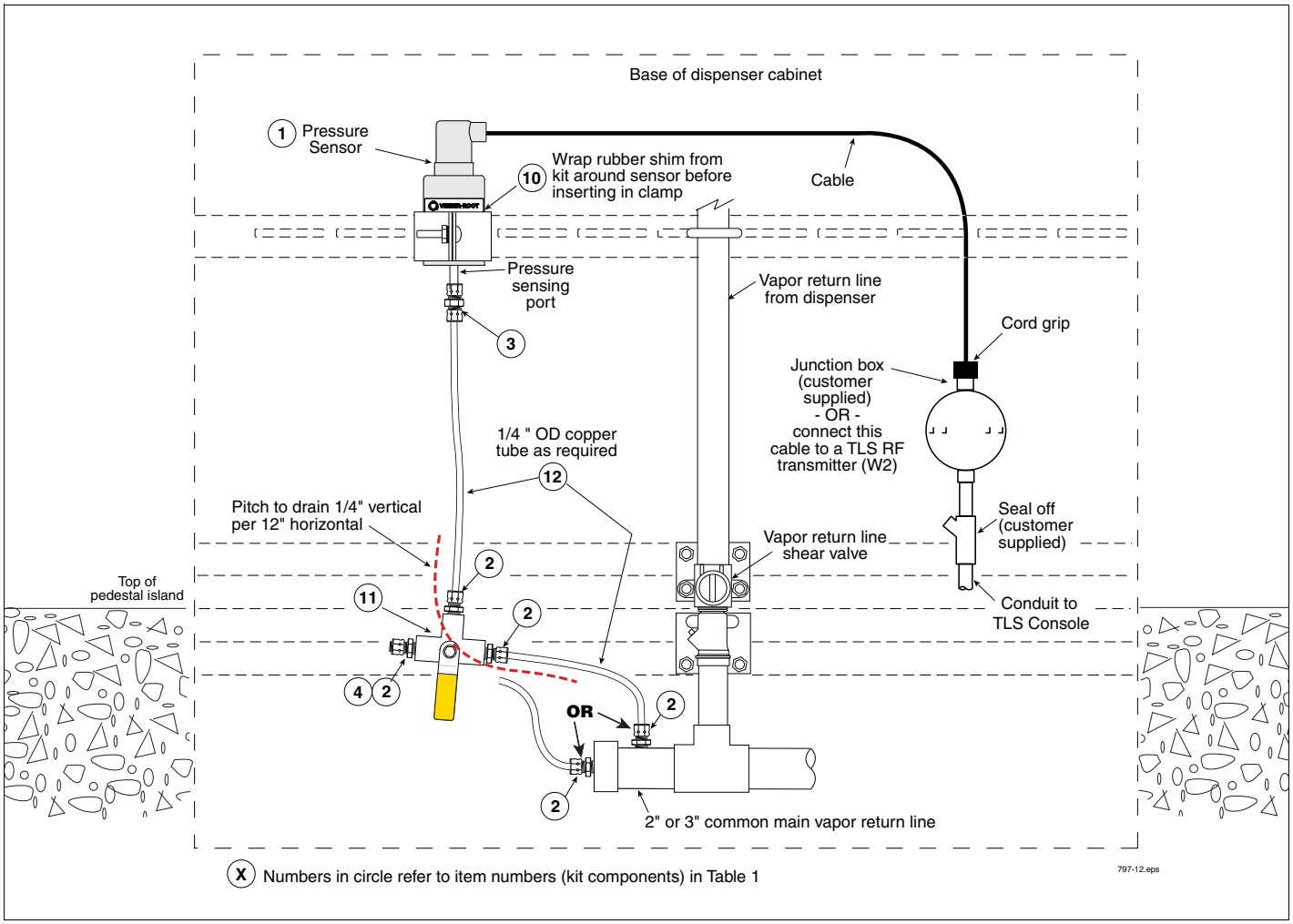


Figure 3. Example Pressure Sensor Install In Vapor Return Line - Non-ISD Installation (Without Vapor Flow Meter)

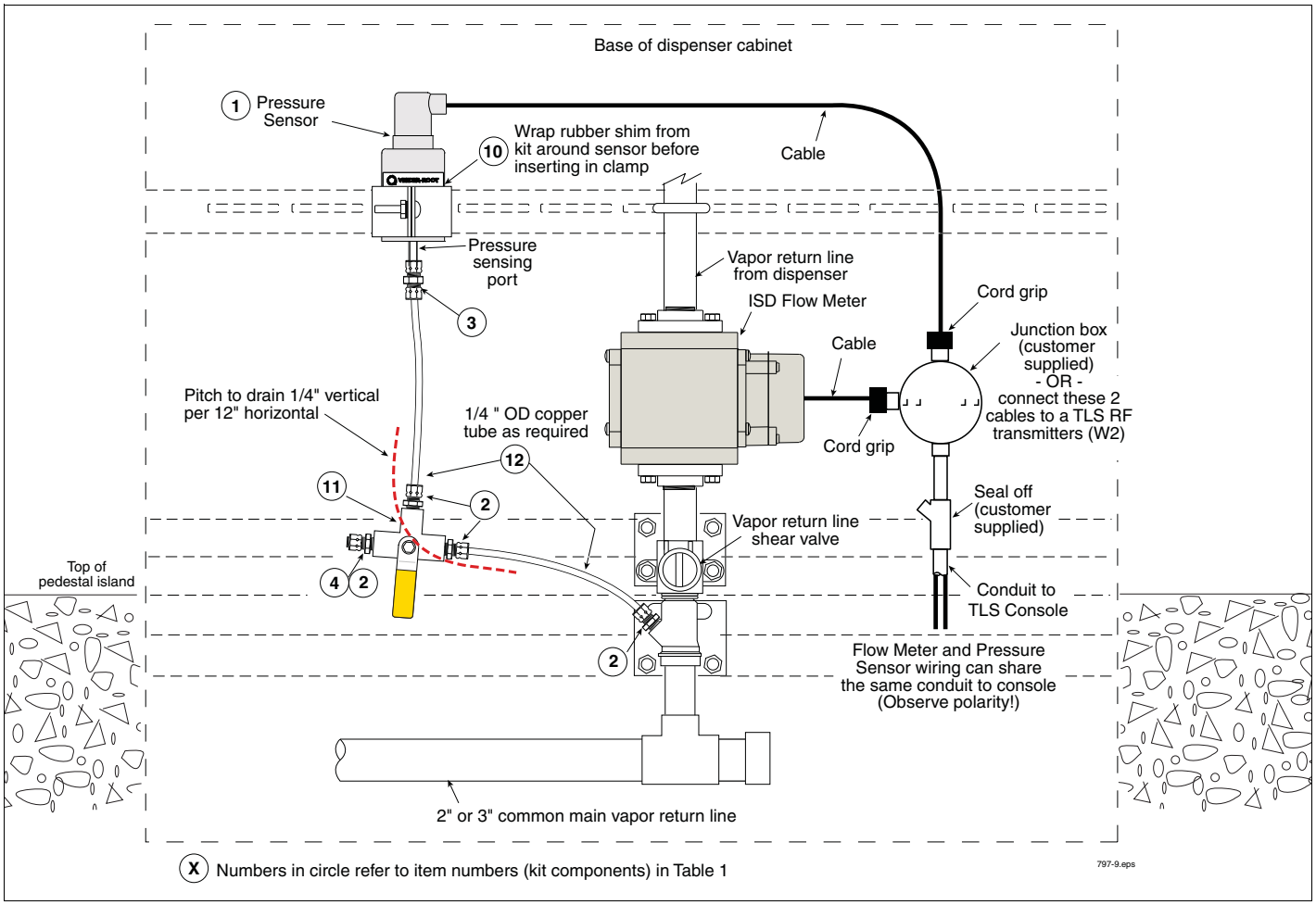


Figure 4. Example Pressure Sensor Install In Shear Valve Port - Preferred ISD Installation (With Vapor Flow Meter Above Shear Valve)

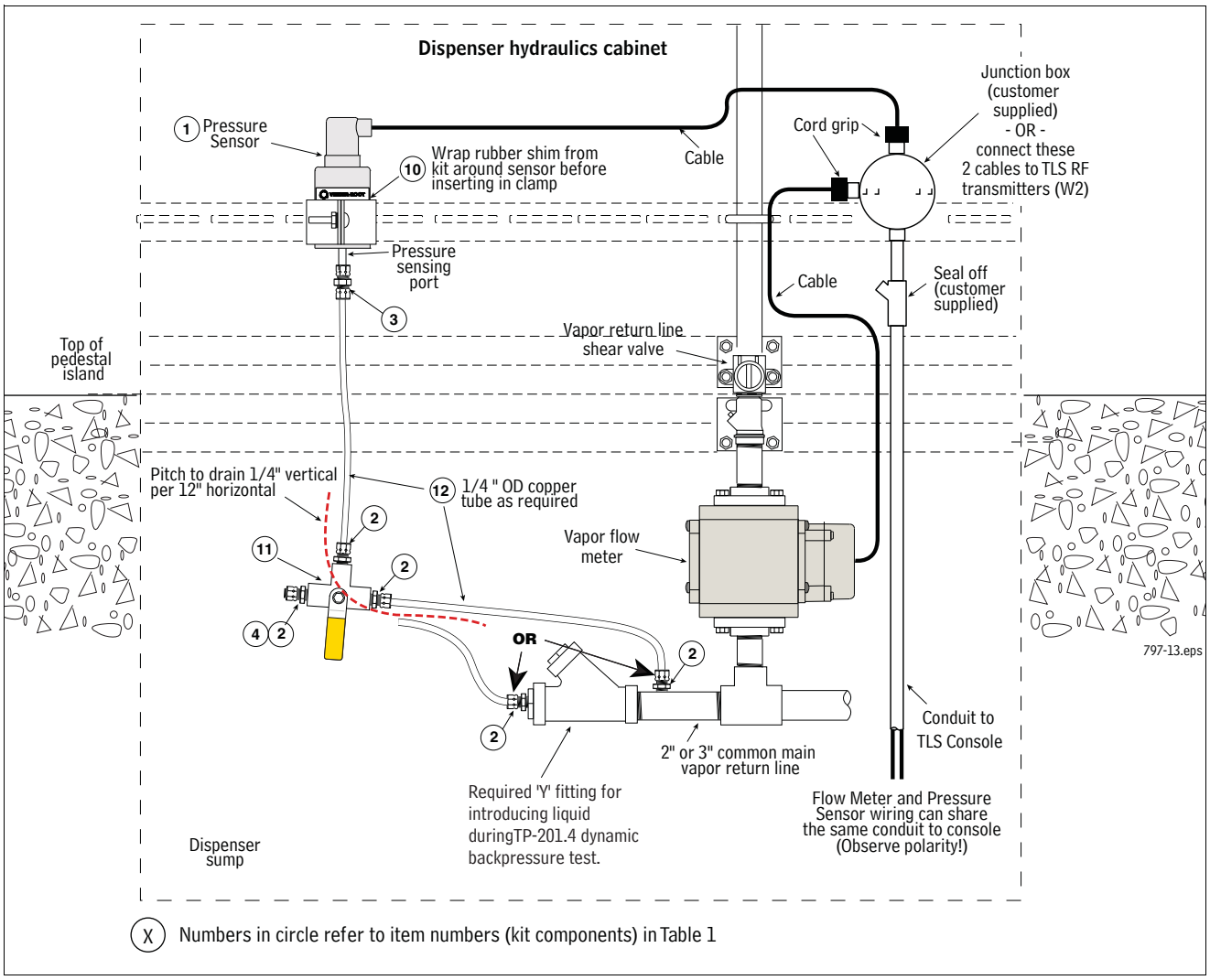


Figure 5. Example Pressure Sensor Install In Horizontal Access Fitting Or Vapor Return Line - ISD Installation (With Vapor Flow Meter Below Shear Valve)

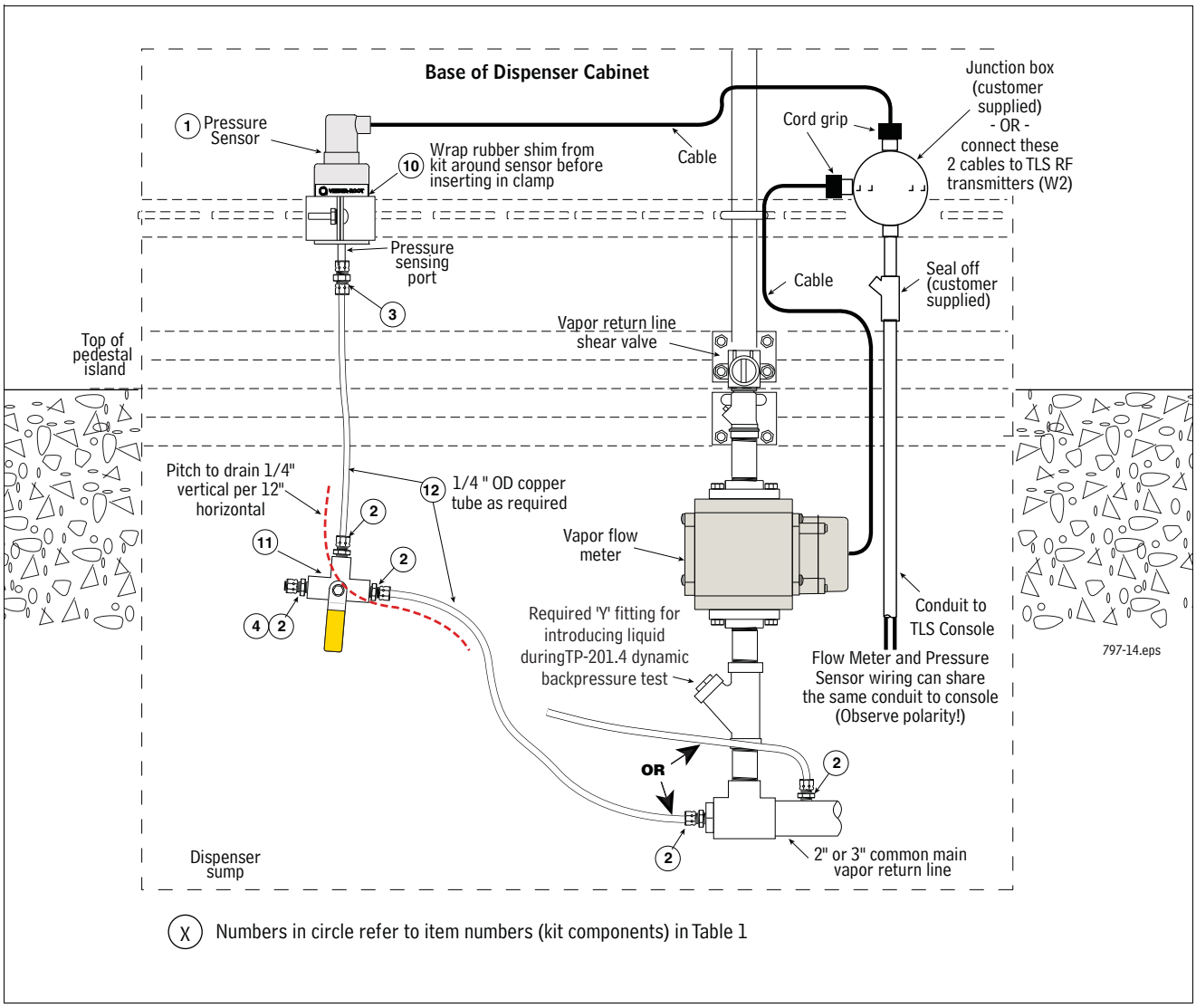


Figure 6. Example Pressure Sensor Install Below Vertical Access Fitting Or Vapor Return Line - ISD Installation (With Vapor Flow Meter Below Shear Valve)

.

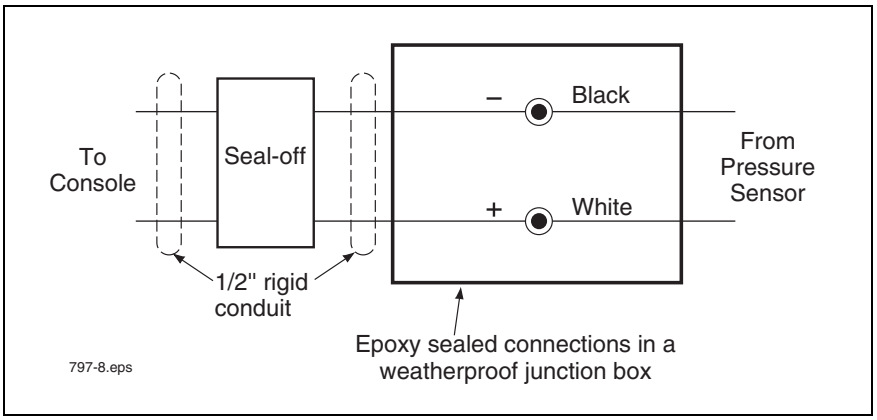
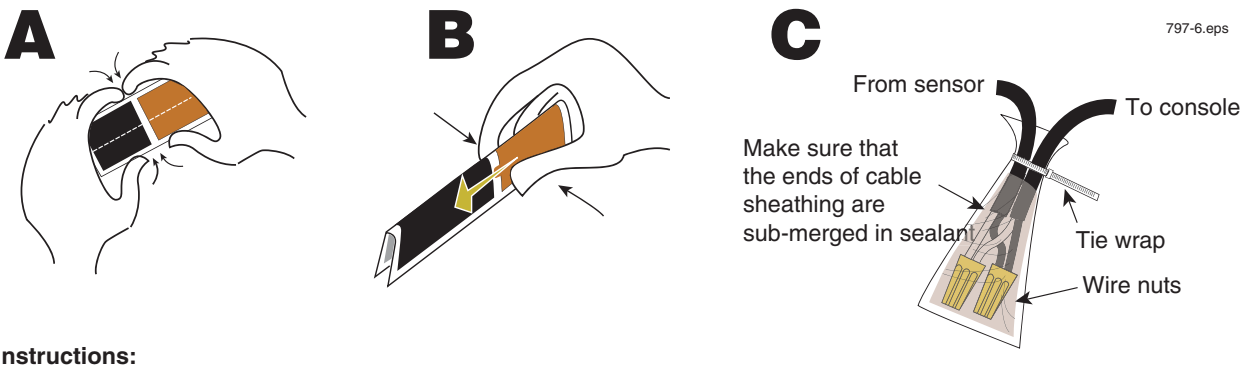


Figure 7. Field wiring Pressure Sensor - Observe Polarity



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 epoxycarboxylate.

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

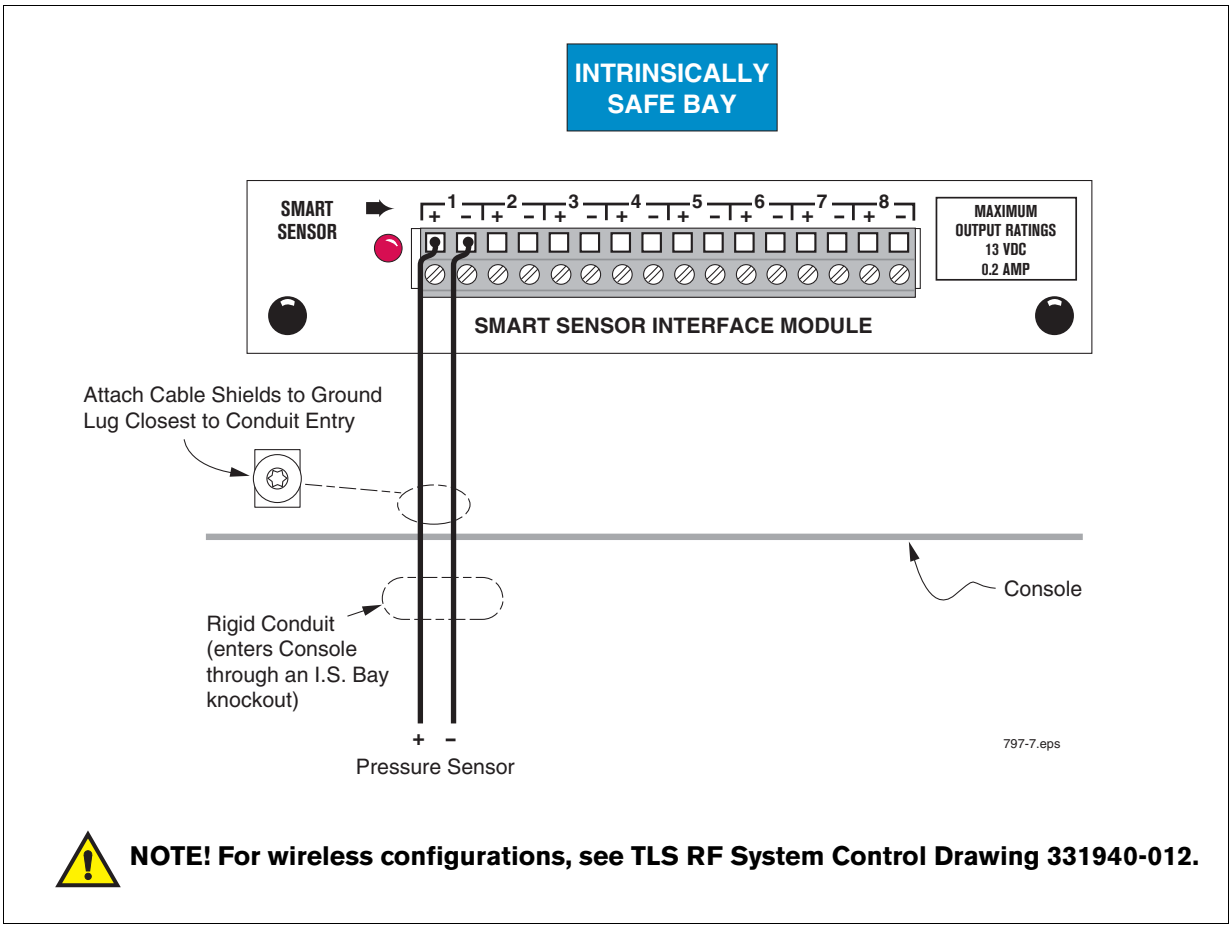


Figure 9. Connecting Pressure Sensor to TLS-3XX Smart Sensor Interface Module

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 two169CA-4-4 male elbows (item 4 in Table 2) into each end of the 3-way calibration valve (item 11 in Table 2) as shown (see Figure 11).
6. Install one 68CA-4-4 male connector (item 5 in Table 2) into the center port of the 3-way calibration valve, and then directly attach it to the pressure sensor inlet port (see Figure 7).
7. Screw the 59CA-4 plug (item 6 in Table 2) onto the left port's male elbow (see Figure 11).
8. Install the two plastic enclosure mounting plates to the back of the enclosure. Use the four short flat-head screws included in the enclosure hardware bag.
9. Install the composite panel into the enclosure (item 2 in Table 2) such that the sensor cable outlet is facing up and the pressure sensing port tube in the base of the sensor is facing down. The top symbol on the panel should be facing upward. Use the four short screws included in the enclosure hardware bag.
10. Make sure that the white flanged porous vent (factory installed - item 17 in Table 2) is still securely installed into the hole in the bottom of the enclosure (see Figure 11).
11. Insert the S-bend ¼" 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.

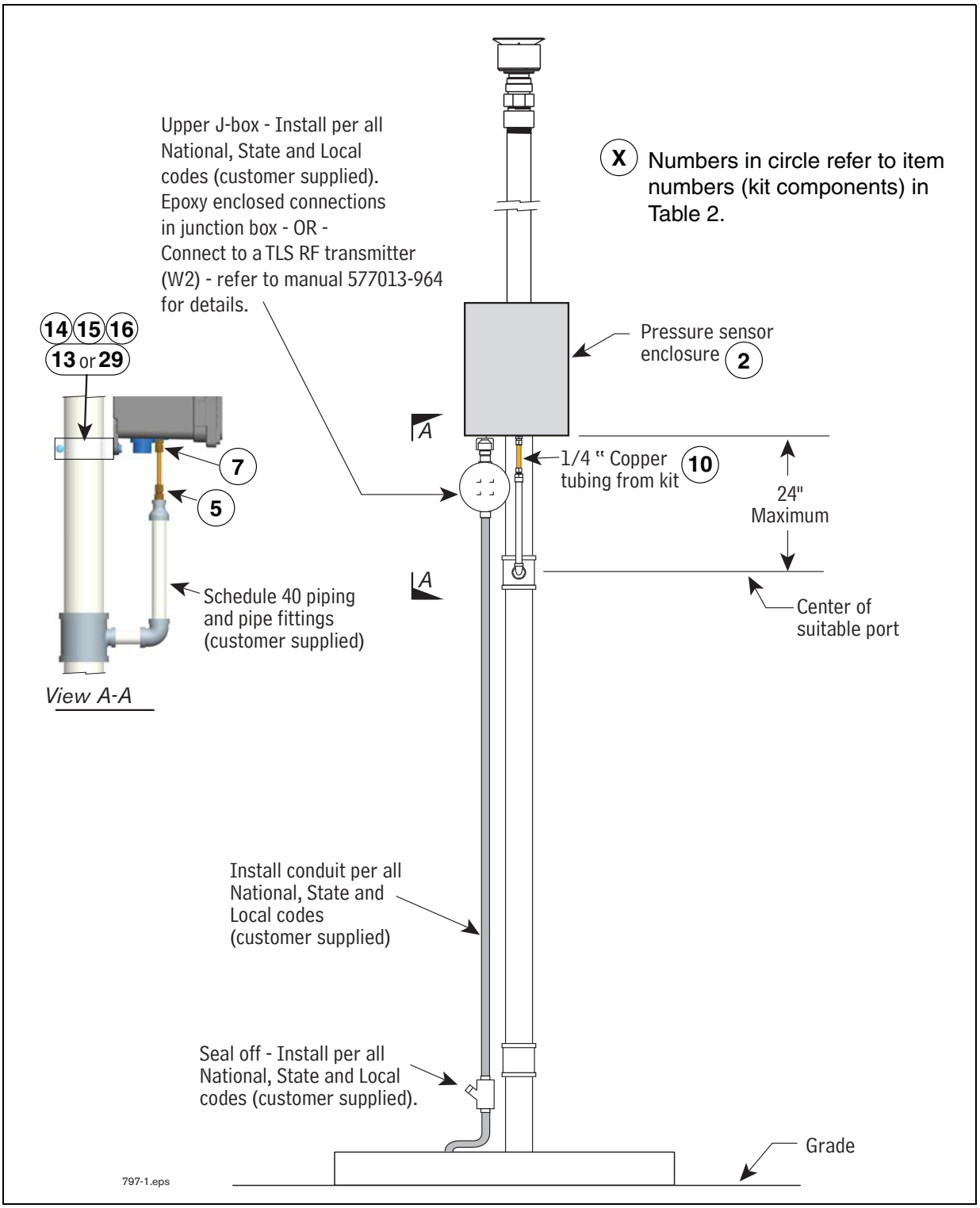


Figure 10. Locating Pressure Sensor Enclosure in Vapor Vent Stack

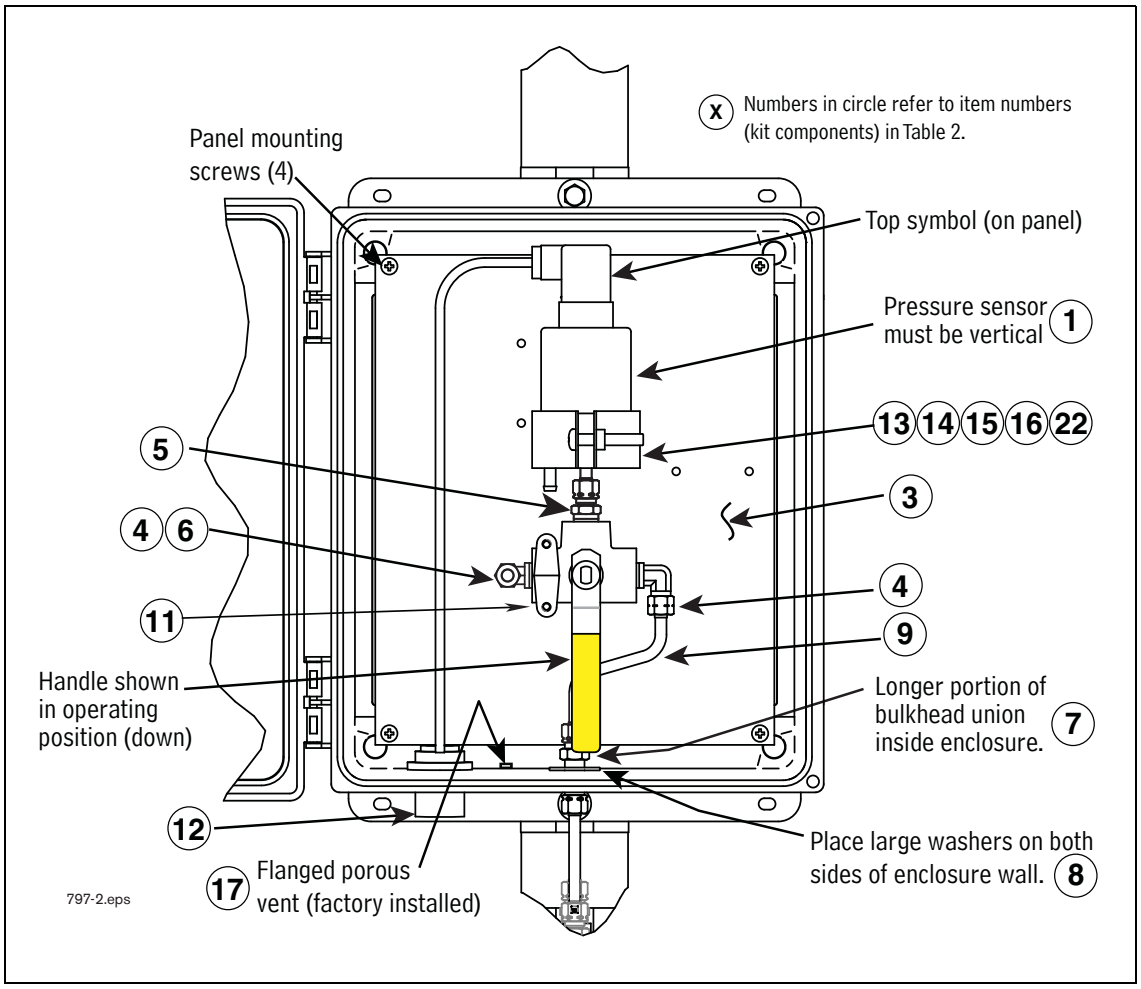


Figure 11. Mounting Pressure Sensor Assembly onto Composite Panel

21. Make sure the valve's handle is set to connect the sensor to the vapor vent stack and not to the capped (ambient) port.
22. Install two tamper-resistant screws from the enclosure hardware bag into the two holes on the enclosure door (if not already installed) using a Torx bit for tamper-resistant screws. Discard any remaining items in the enclosure hardware bag.
23. When direct wiring to a TLS console, install 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.

VEEDER-ROOT


For technical support, sales or
other assistance, please visit:
www.veeder.com

Carbon Canister Vapor Polisher

Installation and Maintenance Guide

VEEDER-ROOT

Notice

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DAMAGE CLAIMS / LOST EQUIPMENT

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

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

1. Contact Veeder-Root Customer Service at 800-873-3313 with the specific part numbers and quantities that were missing or received damaged.
2. Fax signed Bill of Lading (BOL) to Veeder-Root Customer Service at 800-234-5350.
3. Veeder-Root will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

CUSTOMER'S PREFERRED CARRIER

1. It is the customer's responsibility to file a claim with their carrier.
2. Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
3. If "lost" equipment is delivered at a later date and is not needed, Veeder-Root will allow a Return to Stock without a restocking fee.
4. Veeder-Root will NOT be responsible for any compensation when a customer chooses their own carrier.

RETURN SHIPPING

For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

FOR INSTALLATIONS IN THE STATE OF CALIFORNIA

Please refer to the California Air Resources Board Vapor Recovery Certification Phase II EVR Executive Order web site (*www.arb.ca.gov/vapor/eo-evrphaseII.htm*) for the latest manual revisions pertaining to Executive Order VR 203 (VST Phase II EVR System) and VR 204 (VST Phase II EVR System Including ISD System).

Figures

Tables

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 Contractor Certification Requirements	Installer Certification[6]	ATG Technician Certification[7]	VR Vapor Products Certification[8]
Install[1] ISD	X	X	X
Install PMC	X	X	X
Install CCVP	X	X	X
Install Wireless ISD/PMC	X	X	X
Installation Checkout[2]		X	X
ATG Startup[3] / Training[4] / Service[5]		X	X
ISD Startup / Training / Service			X
PMC Startup / Training / Service			X
CCVP Startup / Training / Service			X
Wireless ISD/PMC Startup / Training / Service			X
Install Pressure Sensor (ATG)	X	X	X
Maintain Pressure Sensor (ATG)		X	X
Calibrate Pressure Sensor (ATG)		X	X
Clear ATG Pressure Sensor Alarm (ATG)		X	X
Clear ISD/PMC Alarms (ISD/PMC)			X

[1]Perform wiring and conduit touting; equipment mounting
[2]Inspect wiring and conduit routing; equipment mounting
[3]Turn power on, program and test the systems
[4]Provide supervised field experience in service techniques and operations
[5]Troubleshoot and provide routing maintenance
[6]UST Monitoring Systems – Installer (Level 1)
[7]Certified UST Monitoring Technician
[8]VR Vapor Products

Warranty Registrations may only be submitted by selected Distributors. Certified installers are required to provide the GDF operator with the completed Equipment Warranty Notice, form 577013-868, for their records.

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.
 **ELECTRICITY** High voltage exists in, and is supplied to, the device. A potential shock hazard exists.	 **TURN POWER OFF** Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.
 **READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.	 **USE SAFETY BARRICADES** Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.
 **WARNING** Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.	 **WEAR EYE PROTECTION** Wear eye protection when working with pressurized fuel lines or epoxy sealant to avoid possible eye injury.
 **INJURY** Careless or improper handling of materials can result in bodily injury.	 **GLOVES** Wear gloves to protect hands from irritation or injury.

⚠ 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.

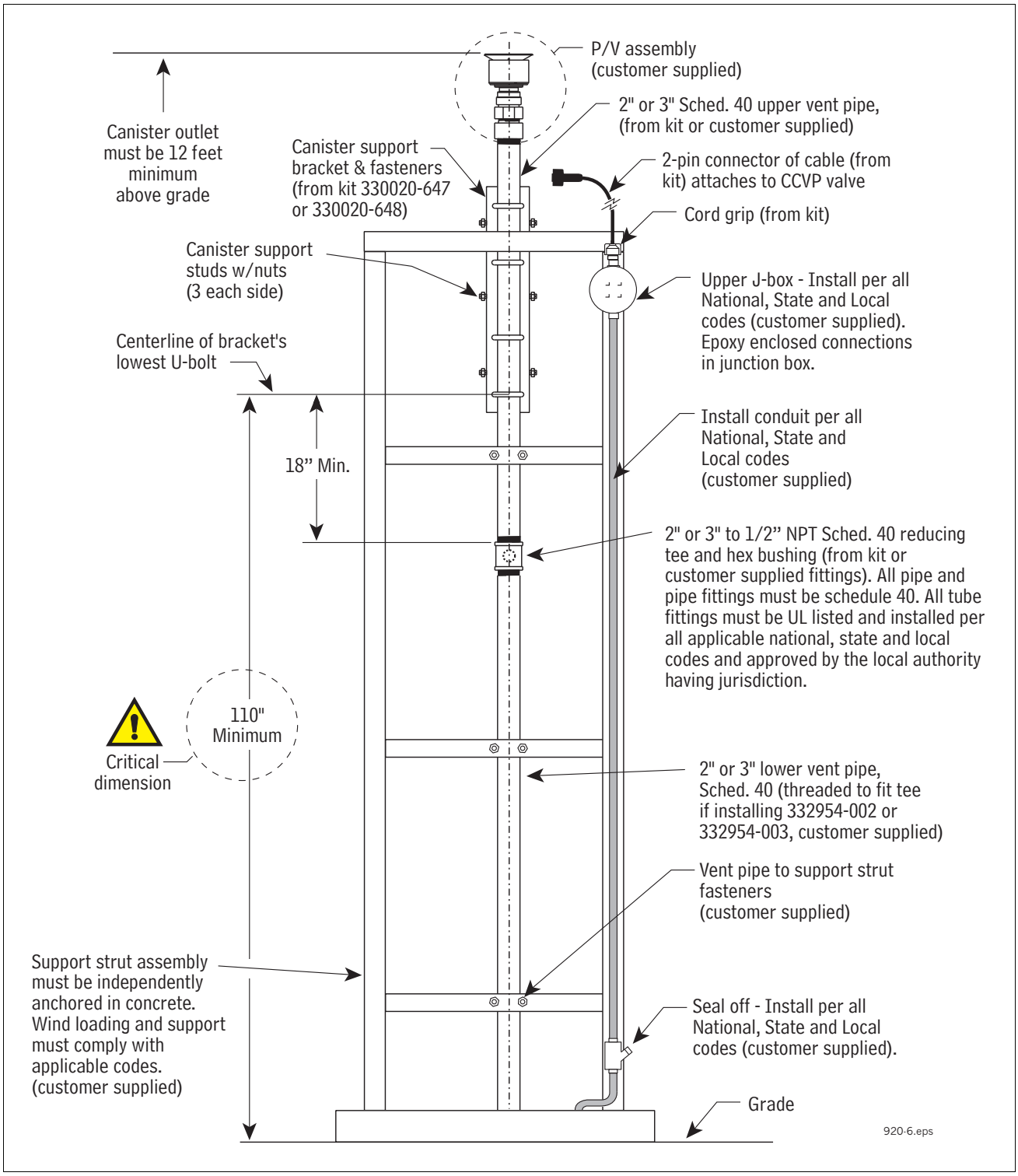

Figure 1. Typical direct wired installation example

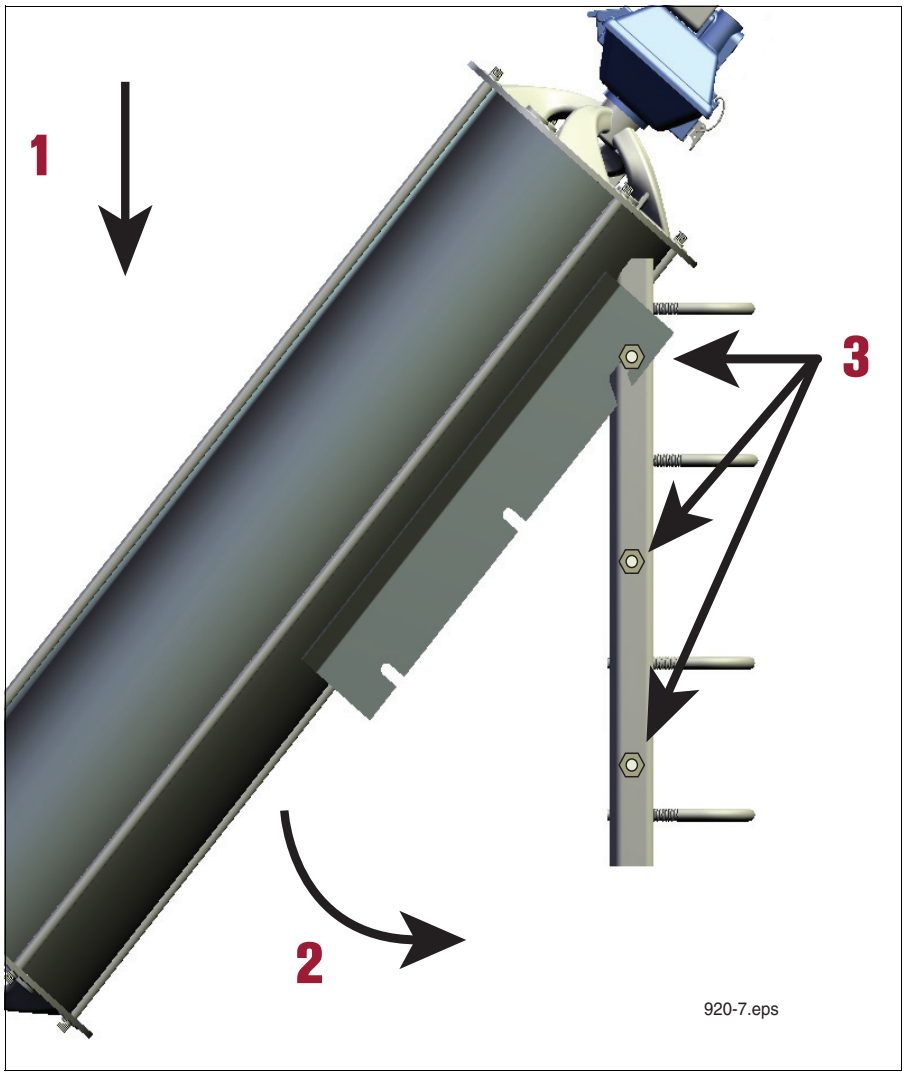

Figure 2. Installing CCVP onto bracket

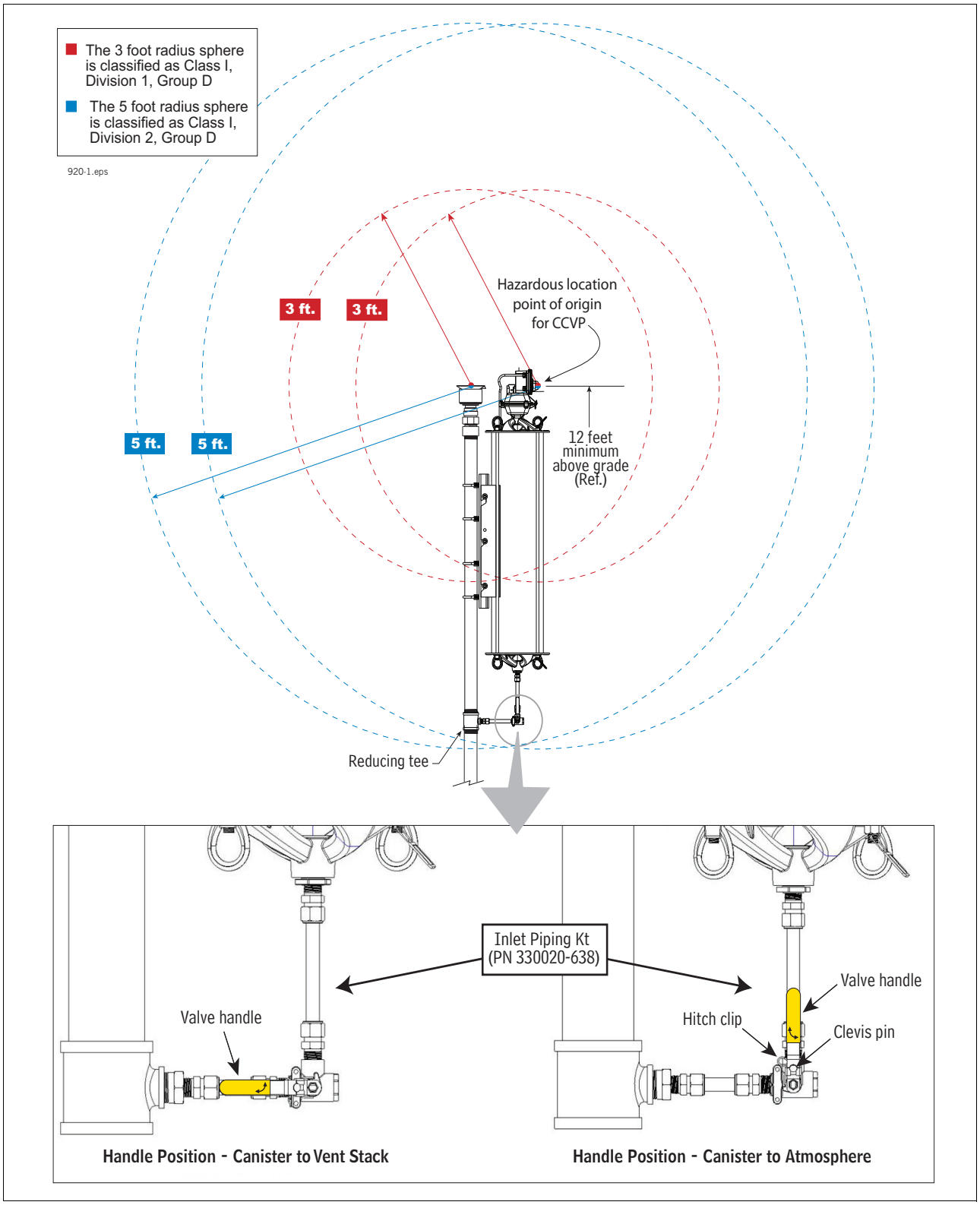

Figure 3. Inlet plumbing detail and classified area definition

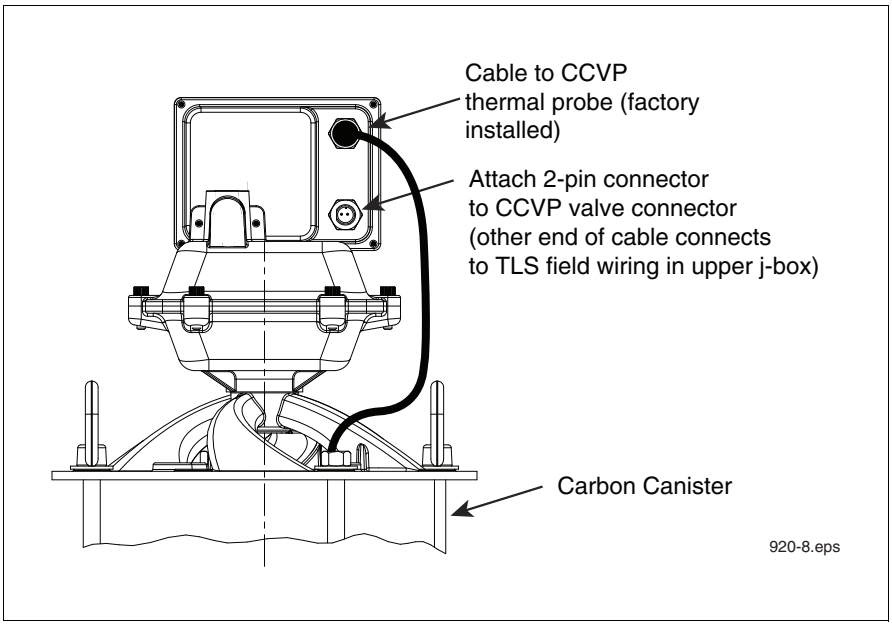

Figure 4. Locating the CCVP vapor valve connector

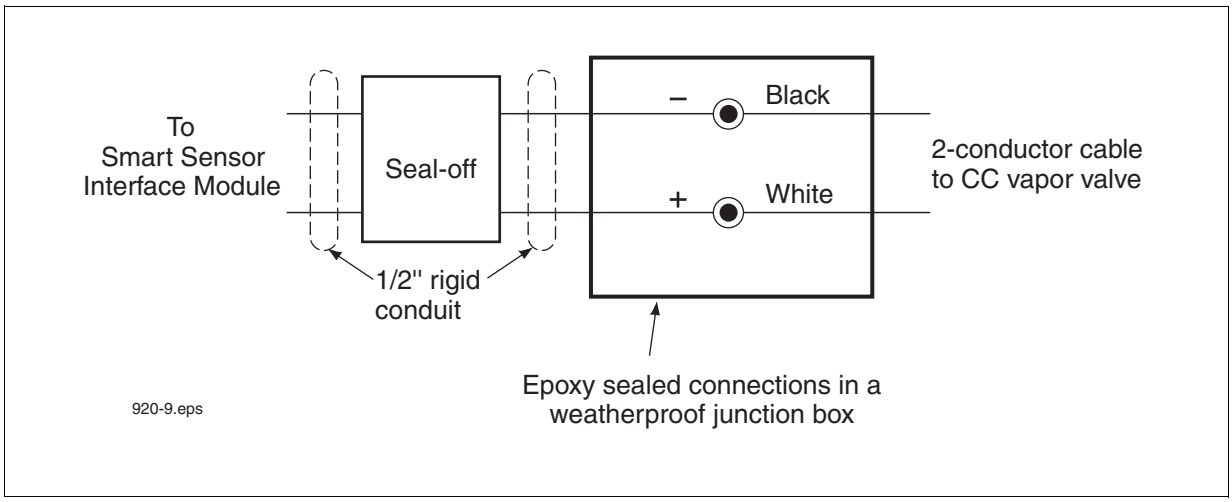

Figure 5. Field wiring CCVP vapor valve - direct-wired CCVP only

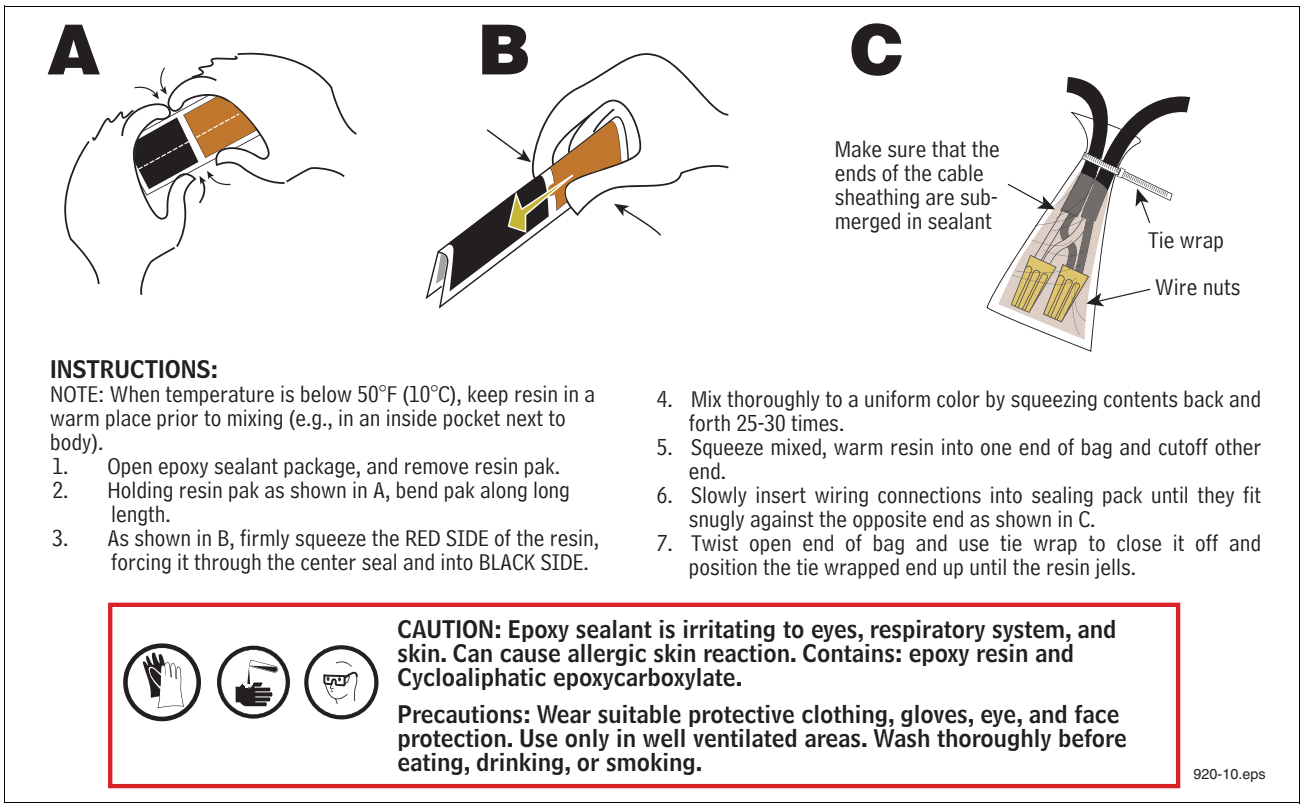

Figure 6. Epoxy sealing CCVP vapor valve field wiring connections - direct-wired CCVP only

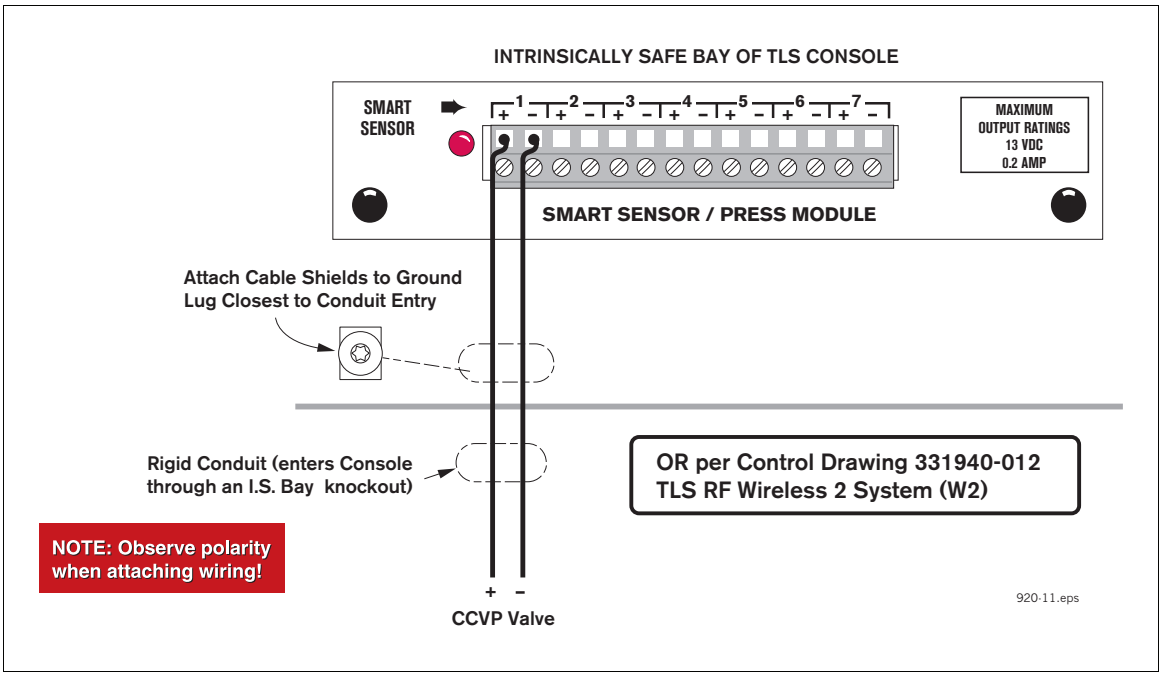

Figure 7. Attaching CCVP vapor valve wiring to TLS-350 console - direct-wired CCVP only

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

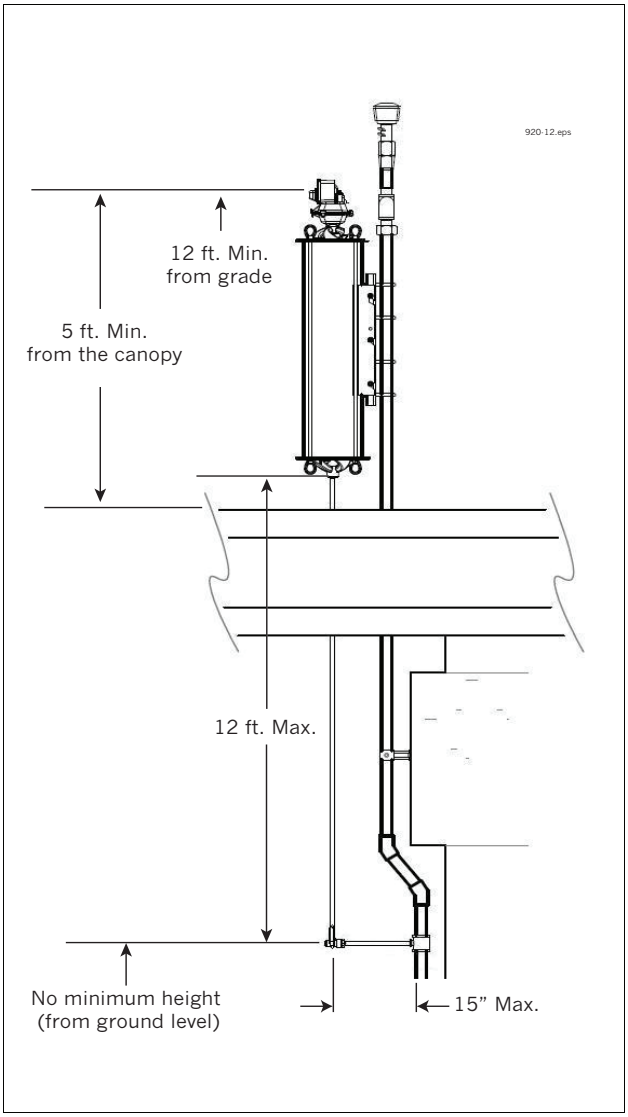

Figure 8. Through canopy w/extended plumbing

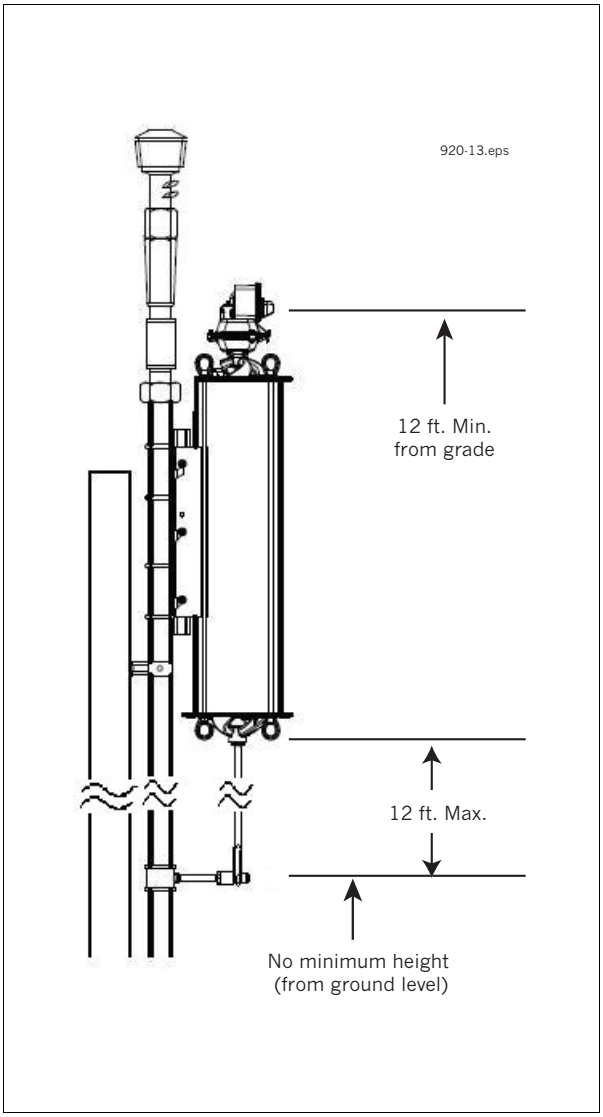

Figure 9. Vent stack mounting

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.

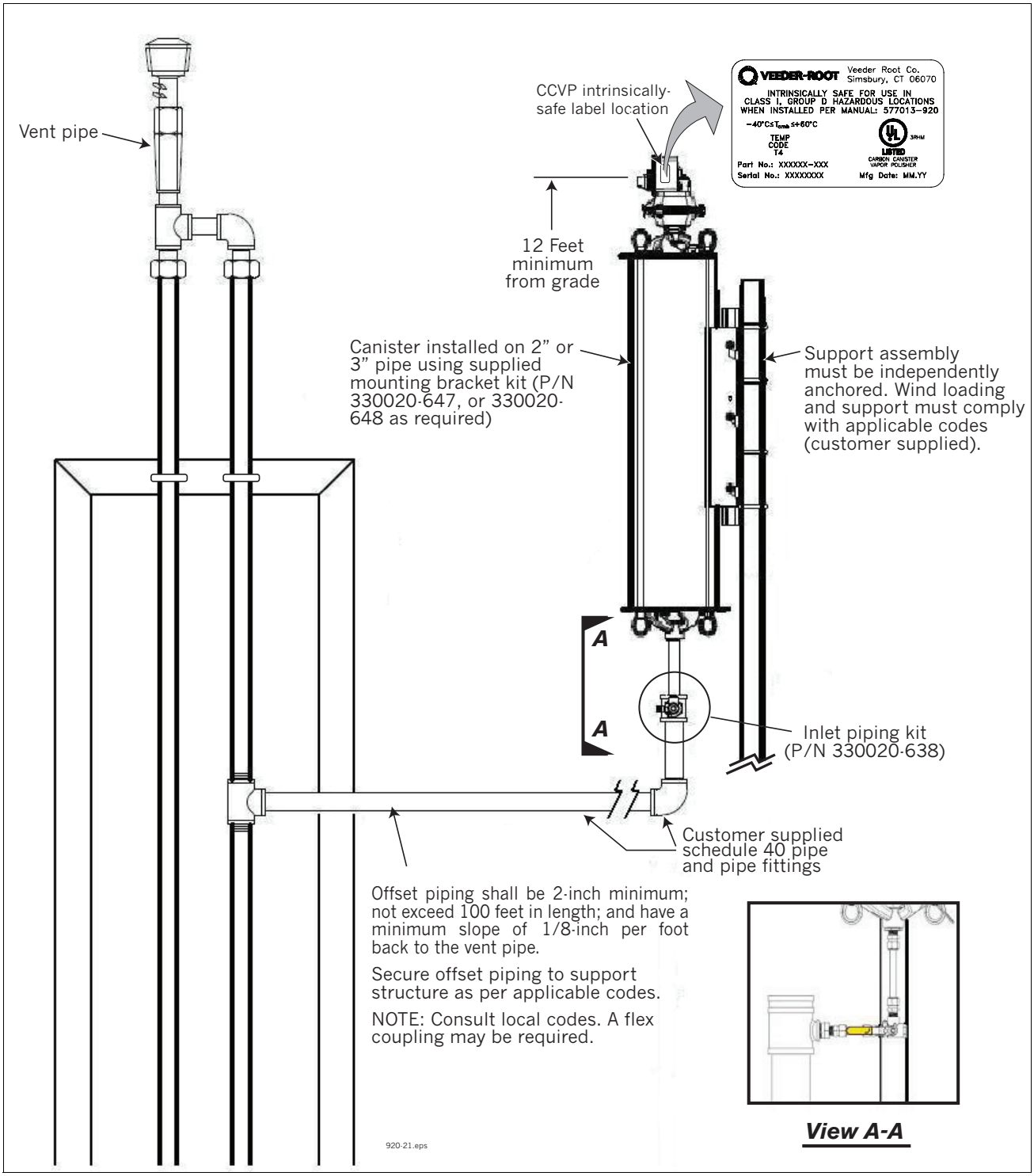

Figure 10. Offset mount on a 2" or 3" pipe

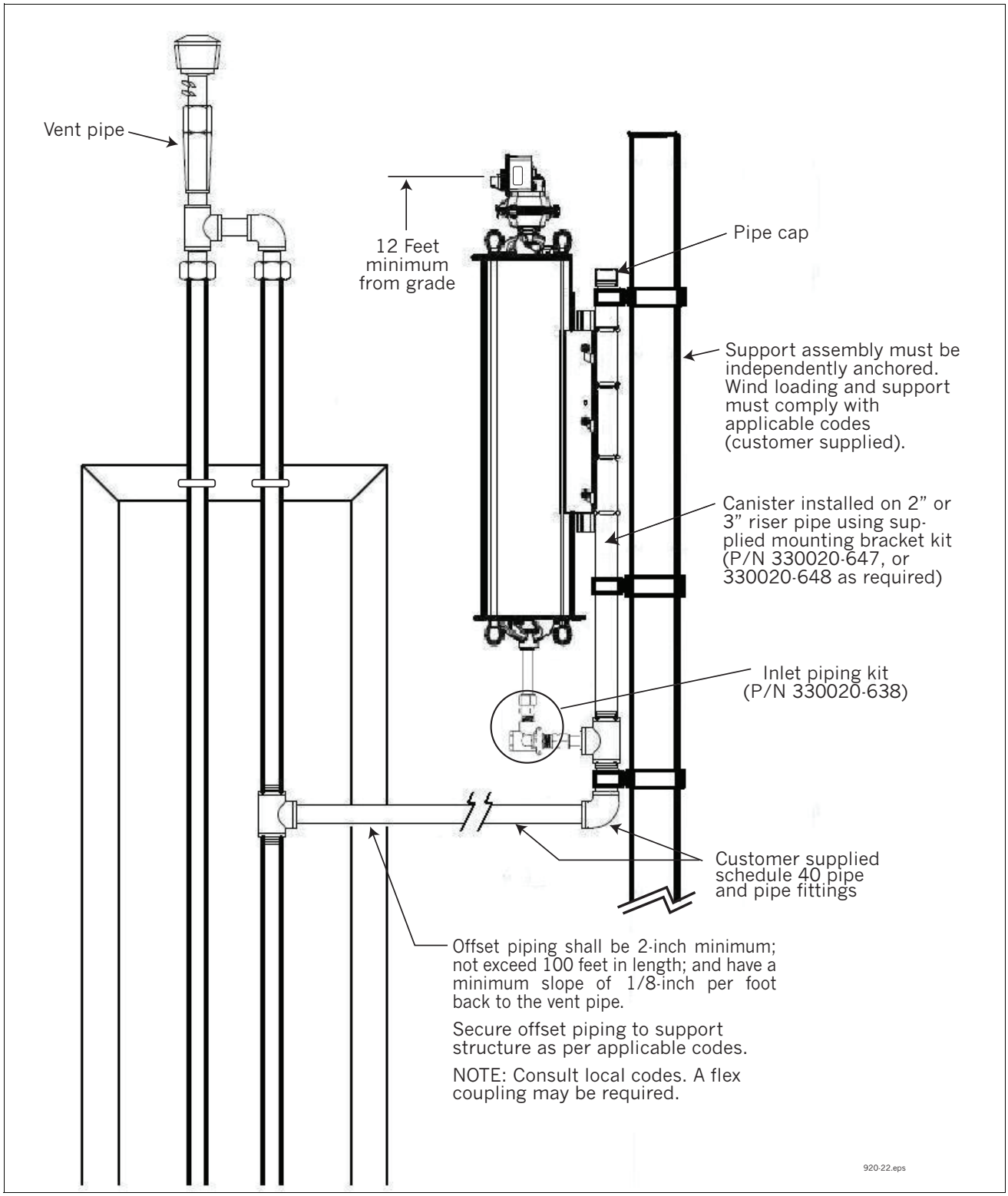

Figure 11. Offset mount on a supported riser

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 ¼ turn past snug.
3. Install the outlet test port cap by applying Teflon™ tape to the threads and tighten the cap ¼ 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).

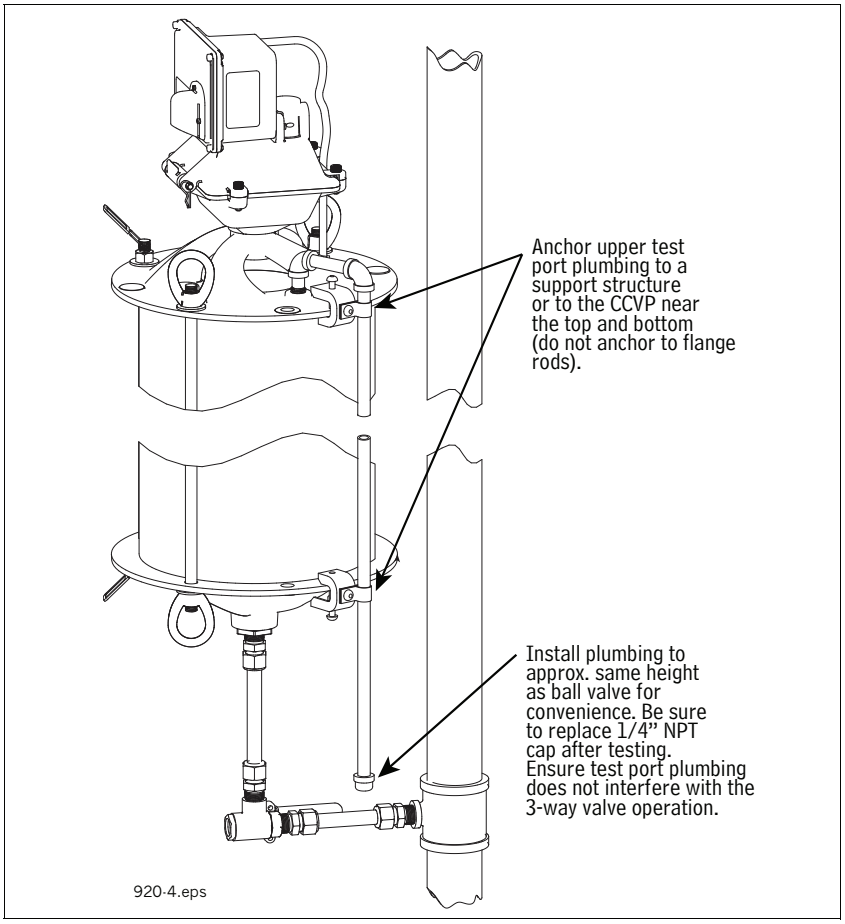

Figure 12. Optional lowering of upper test port

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.

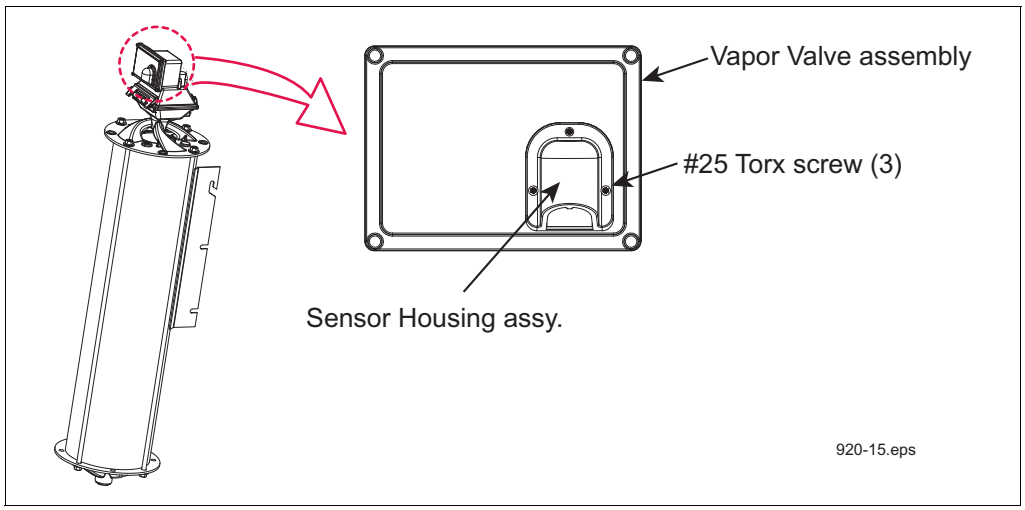

Figure 13. Removing sensor housing assembly

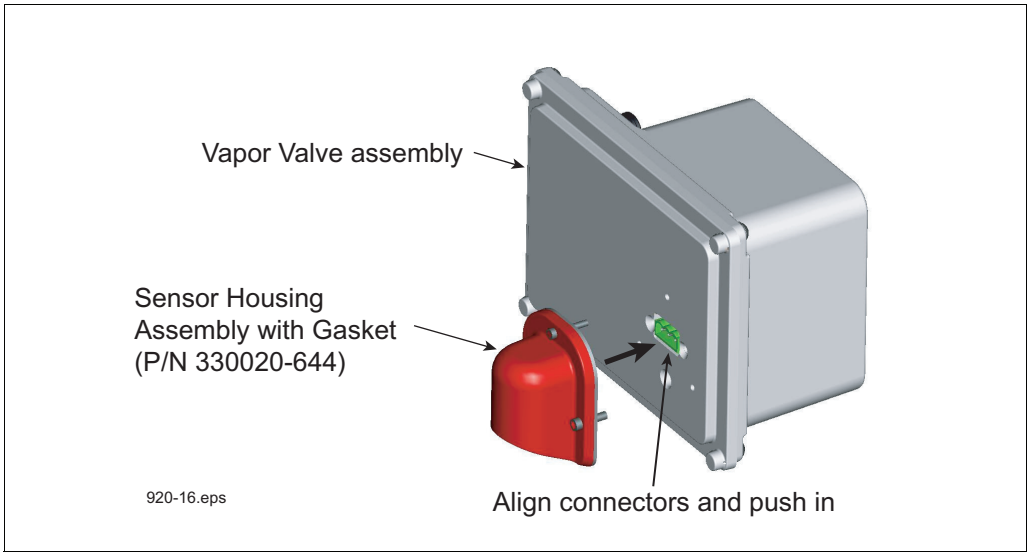

Figure 14. Replacing sensor housing assembly

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).

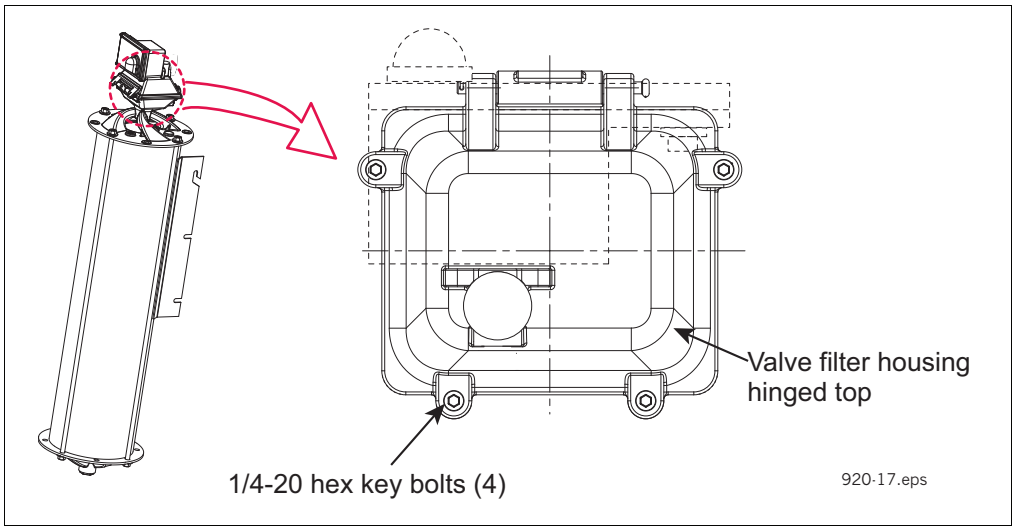

Figure 15. Accessing the valve filter and o-ring

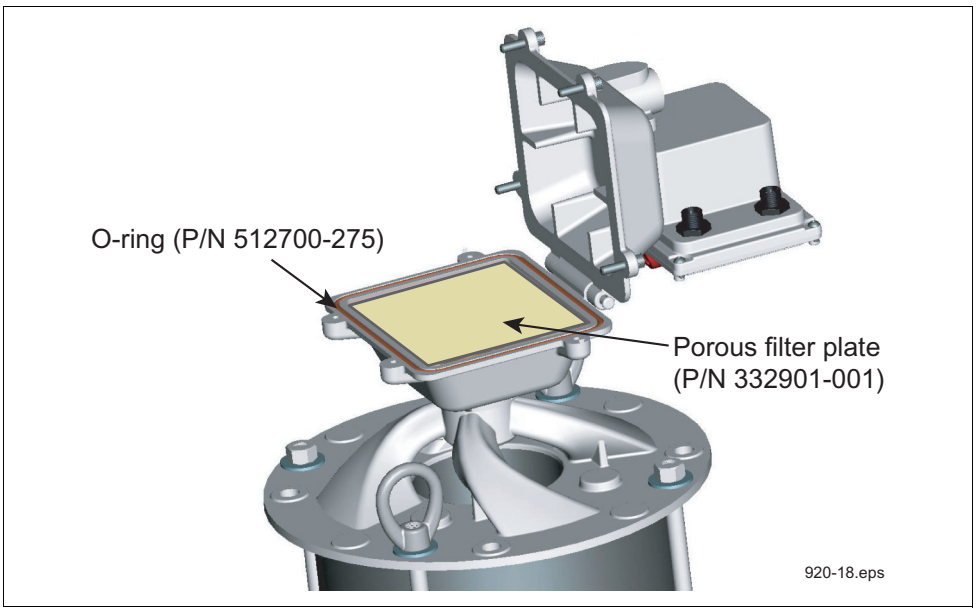

Figure 16. Replacing the valve filter and o-ring

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

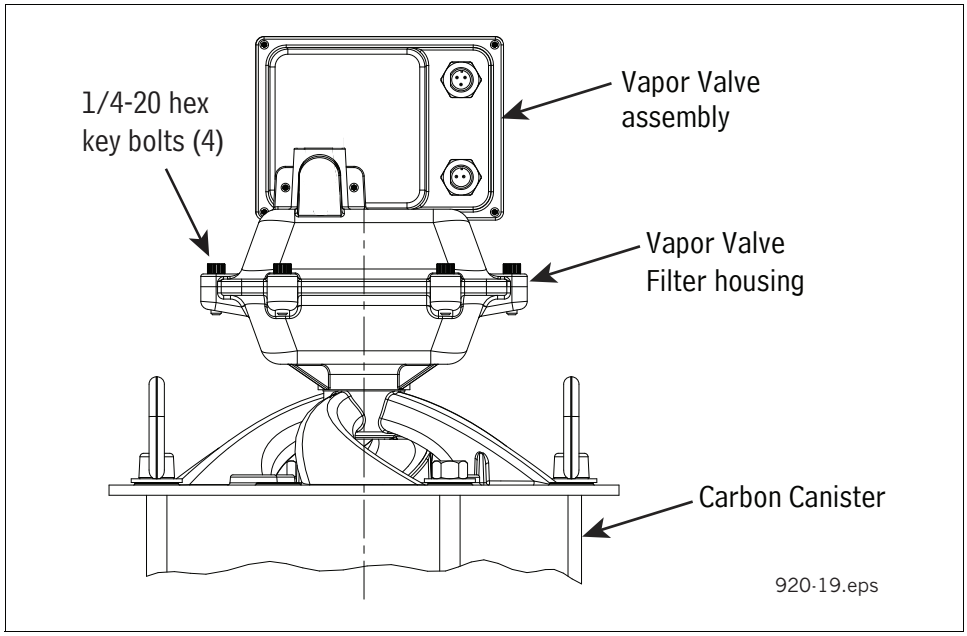

Figure 17. Removing vapor valve assembly

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).

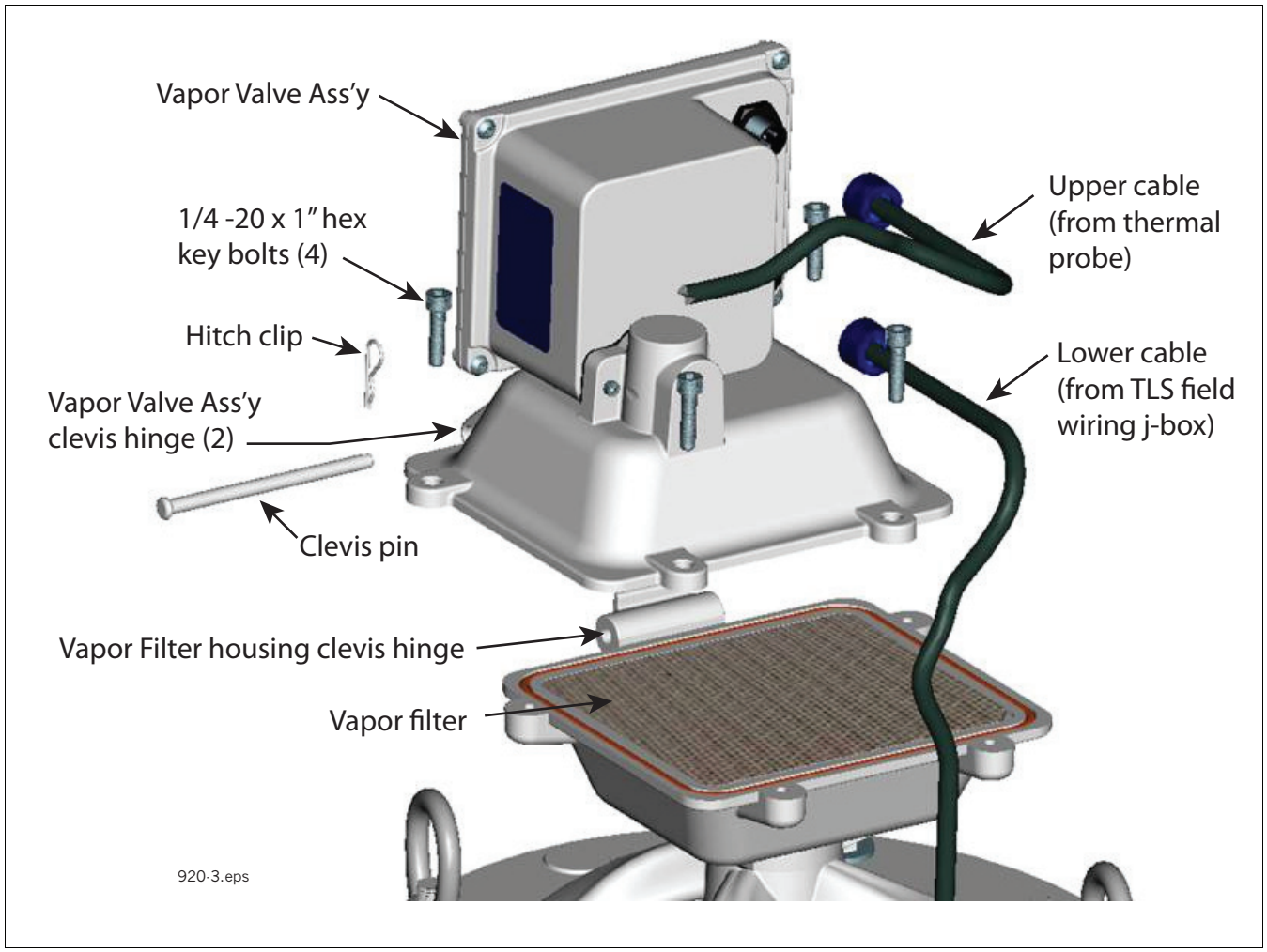

Figure 18. Replacing vapor valve assembly

Thermal Probe Kit (P/N 330020-653)

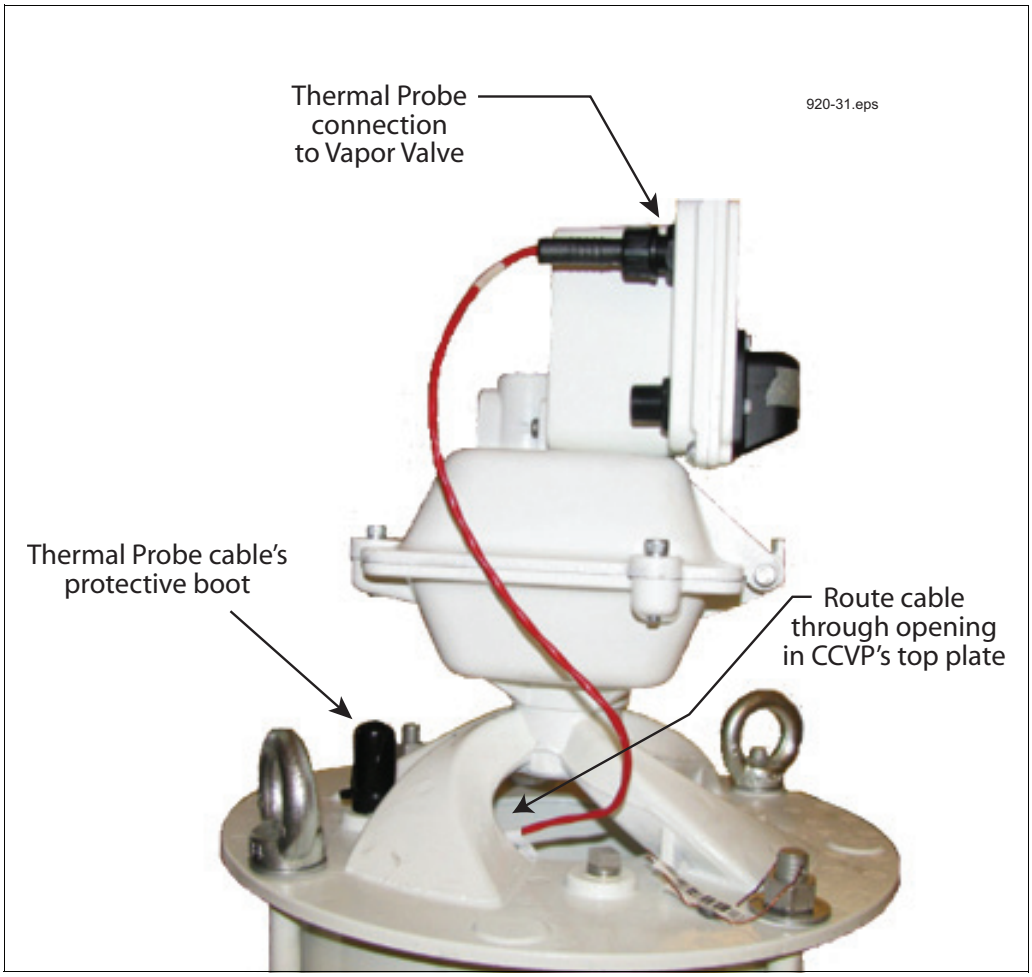

Figure 19. CCVP thermal probe

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).

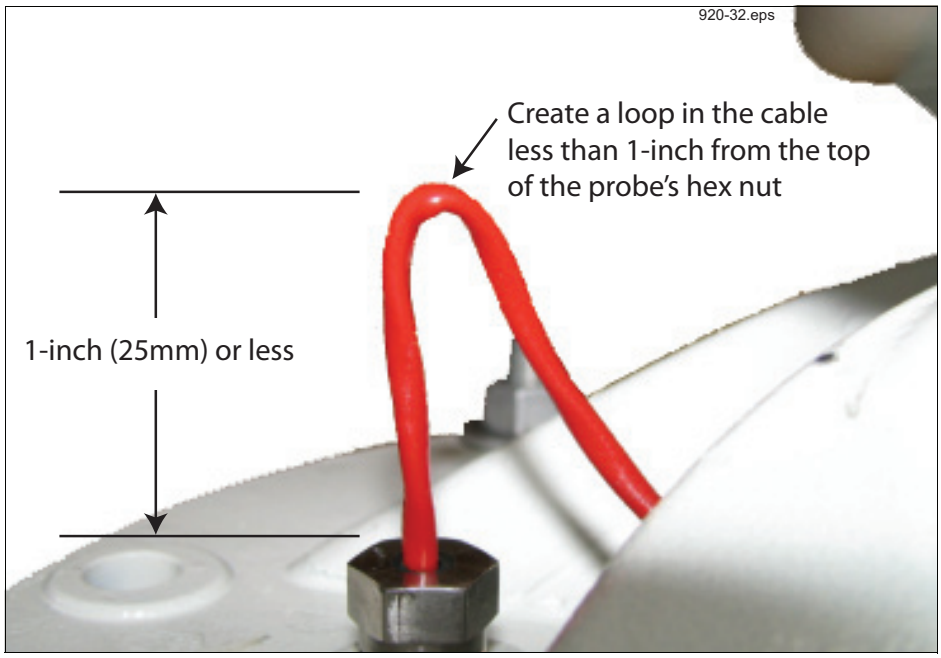

Figure 20. Preparing the thermal probe cable for the protective boot

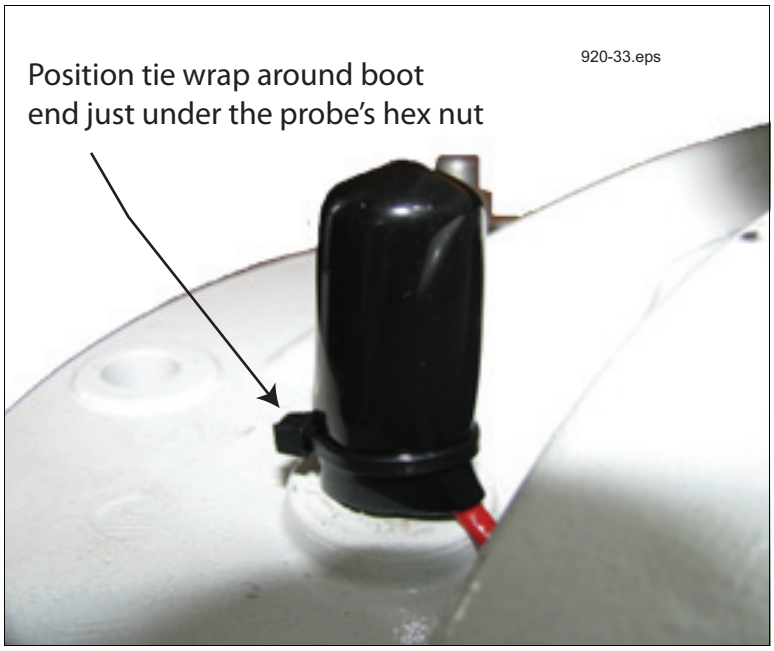

Figure 21. Positioning the tie wrap over the probe cable's protective boot

VEEDER-ROOT

For technical support, sales or other assistance, please visit: www.veeder.com

ISD Balance Vapor Flow Meter

Installation Guide

VEEDER-ROOT

Notice

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Veeder-Root reserves the right to change system options or features, or the information contained in this publication as approved by ARB.

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DAMAGE CLAIMS / LOST EQUIPMENT

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

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

1. Contact Veeder-Root Customer Service at 800-873-3313 with the specific part numbers and quantities that were missing or received damaged.
2. Fax signed Bill of Lading (BOL) to Veeder-Root Customer Service at 800-234-5350.
3. Veeder-Root will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

CUSTOMER'S PREFERRED CARRIER

1. It is the customer's responsibility to file a claim with their carrier.
2. Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
3. If "lost" equipment is delivered at a later date and is not needed, Veeder-Root will allow a Return to Stock without a restocking fee.
4. Veeder-Root will NOT be responsible for any compensation when a customer chooses their own carrier.

RETURN SHIPPING

For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

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) for the latest manual revisions pertaining to VR 204 (VST Phase II EVR System Including ISD System).

ISD Vapor Flow Meter Installation

Figures

Tables

ISD Vapor Flow Meter Installation

This manual contains instructions to install a Veeder-Root ISD (In-Station Diagnostic) Vapor Flow Meter in a dispenser's vapor return line in balance systems.

This manual assumes all preliminary site preparation is completed, and that wiring from the console to the Vapor Flow Meter junction box is in place and meets the requirements set out in the TLS-3XX Series Site Prep and/or TLS RF Wireless 2 system (W2) installation manuals.

Contractor Certification Requirements

Veeder-Root Contractor Certification Requirements	Installer Certification[6]	ATG Technician Certification[7]	VR Vapor Products Certification[8]
Install[1] ISD	X	X	X
Install PMC	X	X	X
Install CCVP	X	X	X
Install Wireless ISD/PMC	X	X	X
Installation Checkout[2]		X	X
ATG Startup[3] / Training[4] / Service[5]		X	X
ISD Startup / Training / Service			X
PMC Startup / Training / Service			X
CCVP Startup / Training / Service			X
Wireless ISD/PMC Startup / Training / Service			X
Install Pressure Sensor (ATG)	X	X	X
Maintain Pressure Sensor (ATG)		X	X
Calibrate Pressure Sensor (ATG)		X	X
Clear ATG Pressure Sensor Alarm (ATG)		X	X
Clear ISD/PMC Alarms (ISD/PMC)			X

[1]Perform wiring and conduit touting; equipment mounting
[2]Inspect wiring and conduit routing; equipment mounting
[3]Turn power on, program and test the systems
[4]Provide supervised field experience in service techniques and operations
[5]Troubleshoot and provide routing maintenance
[6]UST Monitoring Systems – Installer (Level 1)
[7]Certified UST Monitoring Technician
[8]VR Vapor Products

Warranty Registrations may only be submitted by selected Distributors. Certified installers are required to provide the GDF operator with the completed Equipment Warranty Notice, form 577013-868, for their records.

Product Marking Information

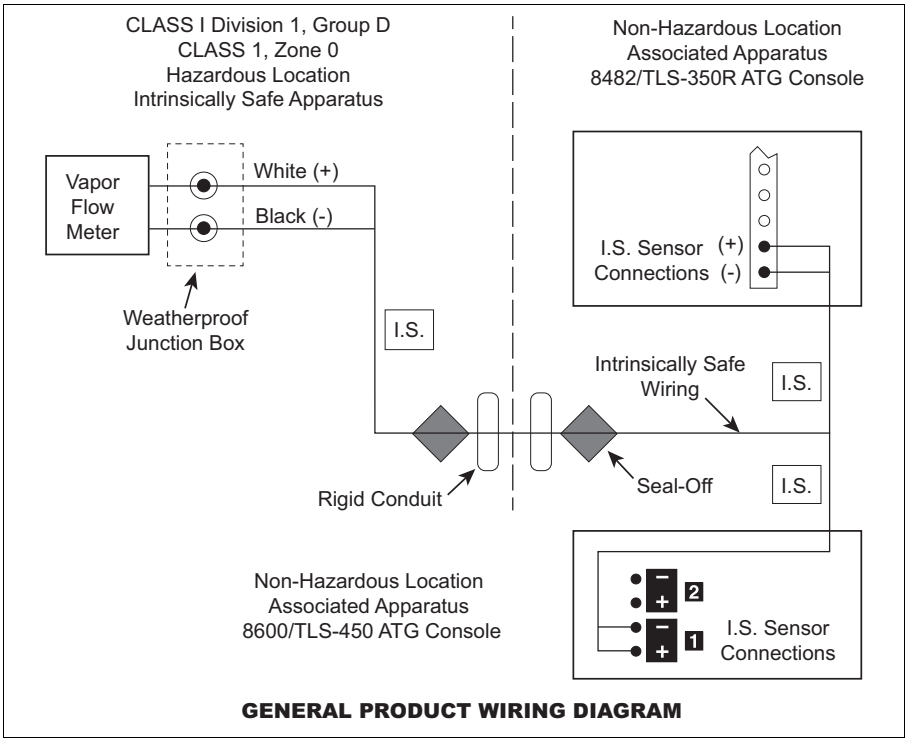
RELATED DOCUMENTS

Documents Required to Install Equipment

This intrinsically safe apparatus is only for use as part of a Veeder-Root Automatic Tank Gauging System (ATG Console with probes and sensors). To install intrinsically safe apparatus, use the specific control drawing that appears on the nameplate of the applicable associated apparatus (ATG Console):

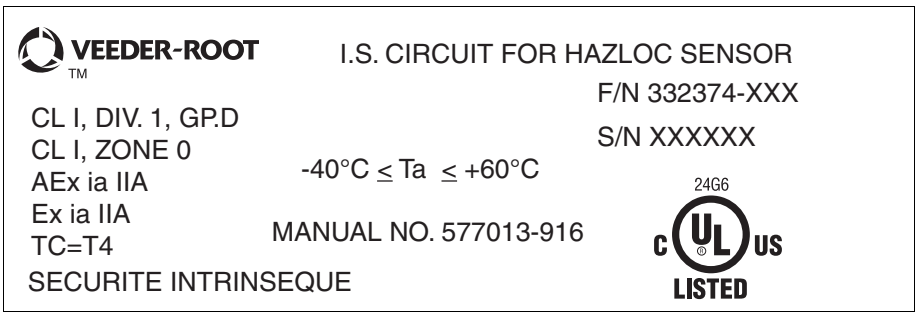
Equipment	UL/cUL Control Drawing Document No.
Associated Apparatus	
TLS-450/8600	331940-008
TLS-350, TLS-350R	331940-011
Intrinsically Safe Apparatus for Wireless Applications	
Tank Gauge Accessories	331940-012

The control drawings contain information related to the correct installation of the overall intrinsically Safe System. This includes information such as maximum number of apparatus, specific apparatus allowed in the system, maximum cable lengths, references to codes, proper grounding and so on. Control drawings can be found on the accompanying Compact Disk (TECH DOCS CD) or on the internet at veeder.com under SUPPORT; VR TECHNICAL DOCUMENTS; DRAWINGS.



GENERAL PRODUCT WIRING DIAGRAM

Product Label Contents



Safety Warnings

To protect yourself and your equipment, observe the following warnings and important information:

⚠ WARNING

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

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

1. **Read and follow all instructions in this manual, including all safety warnings to protect yourself and others from serious injury, explosion, or electrical shock.**
2. **Comply with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes.**
3. **To protect yourself and others from being struck by vehicles, block off your work area during installation or service.**
4. **Do not alter or modify any component or substitute components in this kit.**
5. **Warning! Substitution of components may impair intrinsic safety.**
6. **Field wiring to the Flow Meter must not share a conduit with any non-intrinsically safe device's wiring**
7. **Warning! To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.**
8. **Materials used in the construction of this device contain aluminum. Care must be taken to avoid ignition hazards due to impact or friction.**
9. **Before installing or taking the unit into a hazardous area, earth the unit in a safe area to remove any static charge. Then immediately transport the unit to the installation site. Do not rub or clean the unit prior to installation. Cleaning is not required under normal service conditions. Do not rub or clean the unit after installation. If the unit is not fixed to a known earth point when installed, ensure that a separate earth connection is made to prevent the potential of a static discharge. When fitting or removing the unit, use of anti-static footwear or clothing is required.**

NOTE ***Failure to install this product in accordance with its instructions and warnings will result in voiding of all warranties with this product.***

Safety Precautions

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

 **EXPLOSIVE** Fuels and their vapors are extremely explosive if ignited.	 **FLAMMABLE** Fuels and their vapors are extremely flammable.
 **ELECTRICITY** High voltage exists in, and is supplied to, the device. A potential shock hazard exists.	 **TURN POWER OFF** Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.
 **READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.	 **USE SAFETY BARRICADES** Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.
 **WARNING** Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.	 **WEAR EYE PROTECTION** Wear eye protection when working with pressurized fuel lines or epoxy sealant to avoid possible eye injury.
 **INJURY** Careless or improper handling of materials can result in bodily injury.	 **GLOVES** Wear gloves to protect hands from irritation or injury.

Reference Manuals

576013-879	TLS-3XX Series Consoles Site Prep Manual
VR-204 Sec 12	In-Station Diagnostics Install, Setup & Operation Manual
331940-012	TLS-RF System Control Drawing
VR-203 and VR-204 Sec 19	TLS RF Wireless 2 System (W2) Installation and Maintenance Guide

Before You Begin

- A level 1 or higher certified Veeder-Root Technician must be available (on site) to assist in this type of installation.
- Comply with all recommended safety practices identified by OSHA (Occupational Safety and Health Administration) and your employer.
- Follow all installation requirements as per NFPA (National Fire Protection Association) 30, 30A, and 70.
- Review and comply with all the safety warnings in the installation manuals and any other national, State or Local requirements.

- When direct wiring to a TLS console, a 2-conductor, 18 AWG shielded cable must be installed in intrinsically safe conduit from each dispenser to the intrinsically safe wiring compartment of the TLS console.
- Debris from plumbing modifications should be flushed through the piping system prior to installing the ISD Vapor Flow Meter.
- Use only UL recognized Gas/TFE yellow teflon tape on all fittings. Do not use pipe dope to seal pipe threads or fittings in and out of the ISD Vapor Flow Meter.

Veeder-Root Parts

- Sensor Installation Kit, see Table 1.

Table 1. Vapor Flow Meter Installation Kit (P/N 330020-585)

Item	Qty.	Description	P/N
1	1	ISD Vapor Flow Meter	332374-002
2	2	Flange with 1” NPT threaded hole	332091-001
3	4	5/16-18 UNC-2B x 3/4” hex head bolt	514100-426
4	2	1-11.5 NPT x 2 “ male to male threaded steel nipple	576008-655
5	2	O-ring (Parker size # 2-218, Nitrile)	512700-258
6	1	Cord grip group	331028-001
7	1	Sealing pack	514100-304
8	2	Wire nut	576008-461
9	2	Tie wrap	510901-337
10	4	5/16” Lock washer	514100-436

Tools Required

- Pipe wrench suitable for tightening 1-inch NPT pipe.
- 1/2’’ socket wrench to install Vapor Flow Meter flange bolts.
- Necessary pipe fitter’s equipment and a non-hazardous work space suitable to modify dispenser vapor line for Vapor Flow Meter installation, when necessary.

Installation Steps - Balance Systems Above Shear Valve

1. Before installing this device, turn off, tag/lock out power to the system, including console and submersible pumps.
2. Remove the dispenser's lower sheet metal doors to access the vapor plumbing.
3. Loosen any factory installed mounts and/or brackets in order to provide room to disconnect any factory installed vapor return plumbing from the shear valve.
4. Disconnect the factory installed vapor return plumbing from the vapor shear valve (see Figure 1).
5. Remove any unneeded field installed plumbing above the vapor shear valve. The Vapor Flow Meter with flanges attached can be used for sizing the required head space of approximately 8 inches. Approximately 3 inches of clearance is required on both sides of the piping to accommodate the width of the meter body.
6. Thread one of the flanges (two provided in installation kit) onto the dispenser vapor return piping.

   Note: Prior to modifying any piping in the dispenser, consult the dispenser manufacturer to determine if ISD ready retrofit kits are available. Any factory installed plumbing that must be modified in order to install the vapor flow meter, must be removed to a non hazardous work area before any cutting or threading takes place. After modifications to any plumbing, it must be reinstalled in accordance with the dispenser manufacturers installation guidelines.
7. Install any necessary plumbing and the lower flange above the vapor shear valve.

   Note: The use of 90° elbows should be kept to a minimum to minimize pressure drop, maximize vapor collection efficiency and to prevent liquid traps. All horizontal plumbing must pitch to drain.

IMPORTANT: Upper and lower flanges must align to within 1/16" center-to-center before installing flow meter. If piping is improperly aligned, torque could damage the flow meter and result in vapor leakage.

8. Clean all debris around the inlet and outlet plumbing prior to installing the Vapor Flow Meter. Do not blow compressed air through the Vapor Flow Meter to prevent damaging the internal screens.
9. Install the o-ring into the lower mounting flange.
10. Taking care that foreign material (chips, debris, sealant, etc.) does not enter the open piping or Vapor Flow Meter, carefully insert the o-ring and then connect the Vapor Flow Meter to the upper flange. Note that the flow arrow on the side of the meter body must point down.
11. Connect the lower flange to the Vapor Flow Meter.
12. Tighten any loose fittings and hardware
13. Route the wiring to the TLS RF transmitter (W2) or into the junction box via the supplied cord grip assembly when direct wiring to a TLS console.
14. Connect the wires from the Vapor Flow Meter to the field wiring from the console and cap with wire nuts (see Figure 2). Not required when connecting to the TLS RF transmitter (W2).
15. After all other ISD Vapor Flow Meters and the ISD Pressure Sensor are installed, pressurize the tank ullage space and vapor piping to at least 2 inches WC and test for leaks using leak detection solution.

IMPORTANT: Upper and lower flanges must align to within 1/16” center-to-center before installing flow meter. If piping is improperly aligned, torque could damage the flow meter and result in vapor leakage.

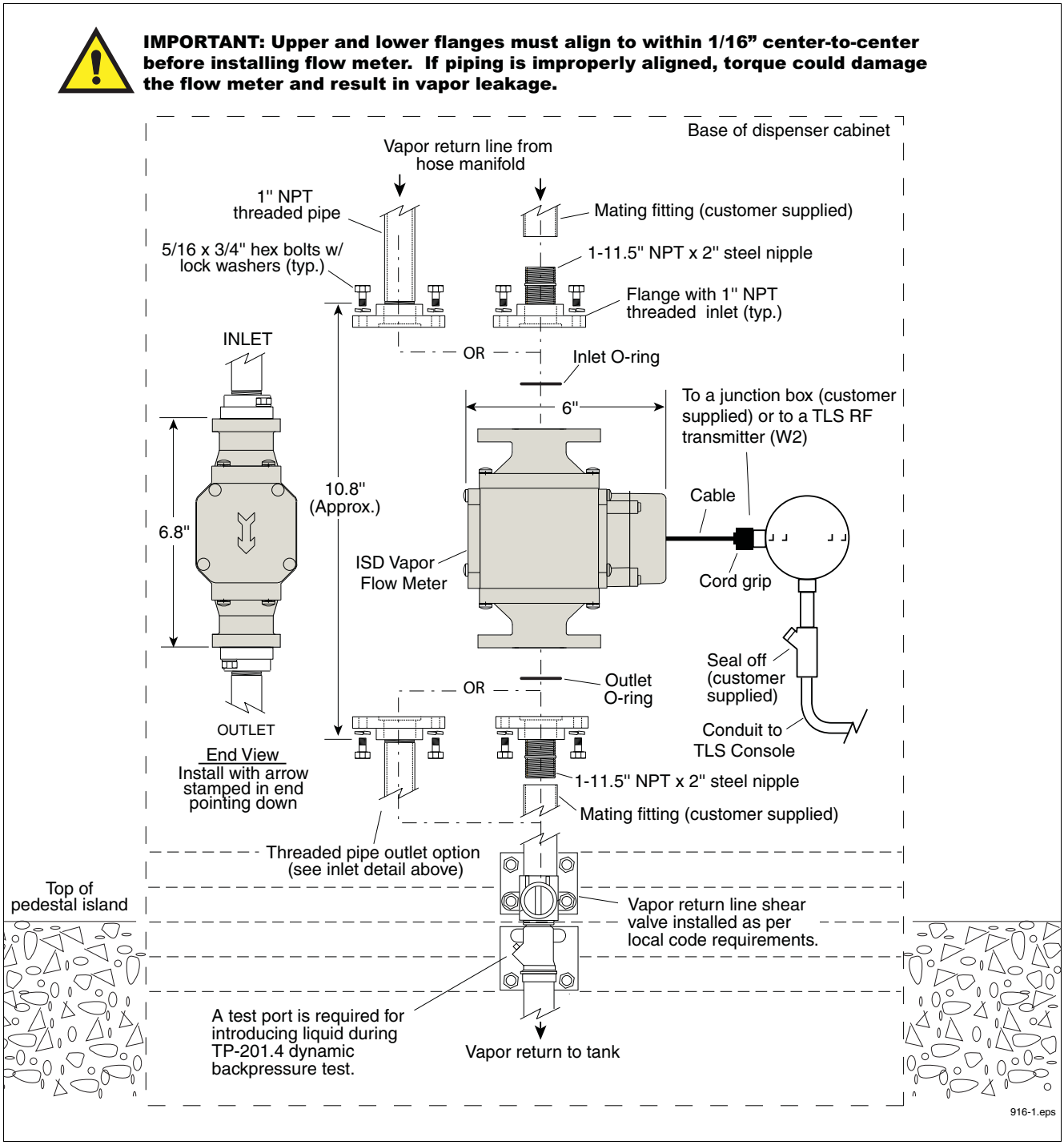


Figure 1. Example Vapor Flow Meter Installation Above Shear Valve

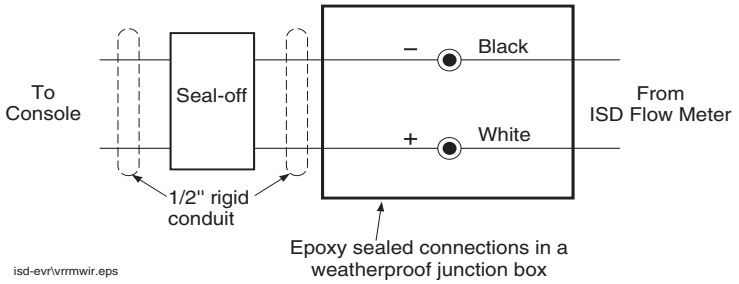


Figure 2. Field wiring Vapor Flow Meter - Observe Polarity

Installation Steps - Balance Systems Below Shear Valve

1. Before installing this device, turn Off, tag/lock out power to the system, including console and submersible pumps.
2. Remove the dispenser's lower sheet metal doors to access the vapor plumbing, if necessary.
3. Remove any unneeded field installed plumbing between the vapor shear valve and the vapor return line fitting. Figure 3 shows two example installations of the Vapor Flow Meter with the required lateral or wye fitting for running the TP-201.4 back-pressure test. Approximately 3 inches of clearance is required on both sides of the piping to accommodate the width of the meter body.

IMPORTANT: Upper and lower flanges must align to within 1/16" center-to-center before installing flow meter. If piping is improperly aligned, torque could damage the flow meter and result in vapor leakage.

4. Connect the lower flange to the pipe that is connected to the lateral or wye access fitting (see Figure 4).
5. Install the Vapor Flow Meter over the lower flange.
6. Connect the upper flange with o-ring above the Vapor Flow Meter.
7. Using a close nipple, thread the shear valve into the upper flange.
8. Using nipples, unions, and other plumbing as required, connect the plumbing outlet to the shear valve.
9. Route the wiring into the junction box via the supplied cord grip assembly. Connect the wires from the Vapor Flow Meter to the field wiring from the console and cap with wire nuts (see Figure 2) - OR - connect the wires to the TLS RF transmitter (W2).
10. After all other ISD Vapor Flow Meters and the ISD Pressure Sensor are installed, pressurize the tank ullage space and vapor piping to at least 2 inches WC and test for leaks using leak detection solution.

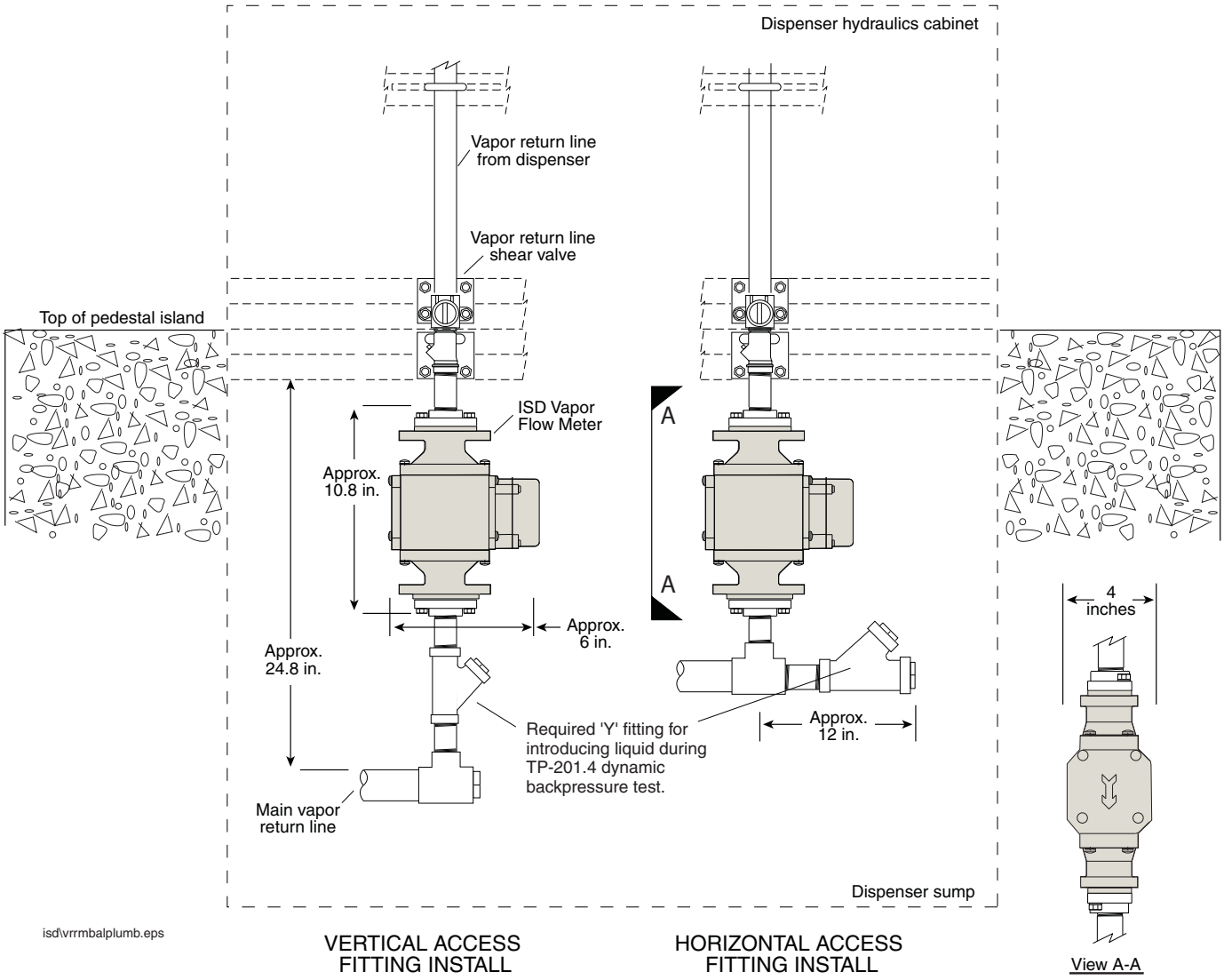


Figure 3. Example flow meter installations with approximate clearances

IMPORTANT: Upper and lower flanges must align to within 1/16” center-to-center before installing flow meter. If piping is improperly aligned, torque could damage the flow meter and result in vapor leakage.

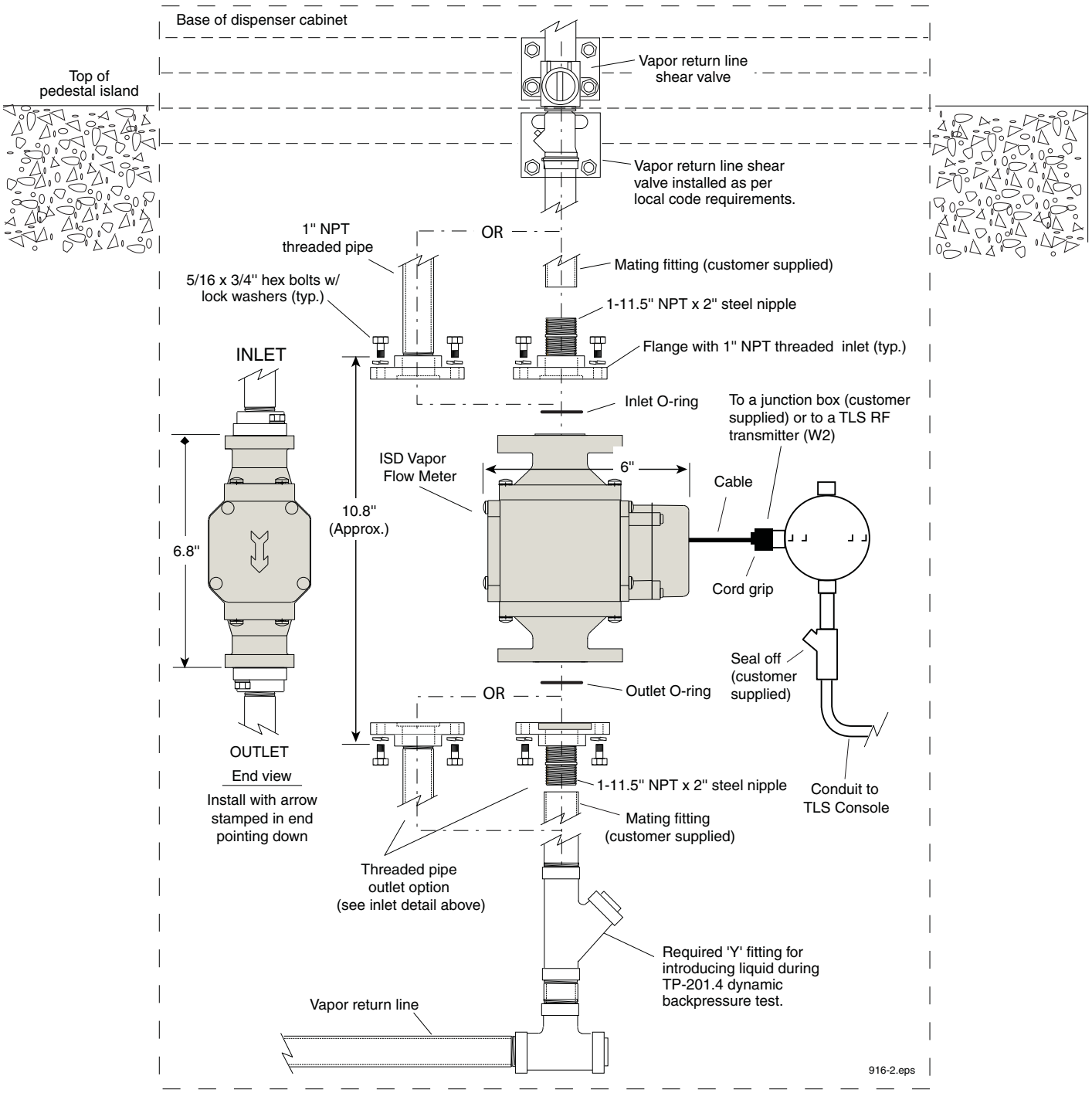


Figure 4. Example Vapor Flow Meter Installation Below Shear Valve

Seal and Connect Field Wiring

1. Seal wire nuts with epoxy sealant following the instructions in Figure 5. Note - wire sealing is not required for installations using a wireless interface.

CAUTION: Epoxy sealant is irritating to eyes, respiratory system, and skin. Can cause allergic skin reaction. Contains: epoxy resin and Cycloaliphatic epoxycarboxylate. Precautions: Wear suitable protective clothing, gloves, eye, and face protection. Use only in well ventilated areas. Wash thoroughly before eating, drinking, or smoking.

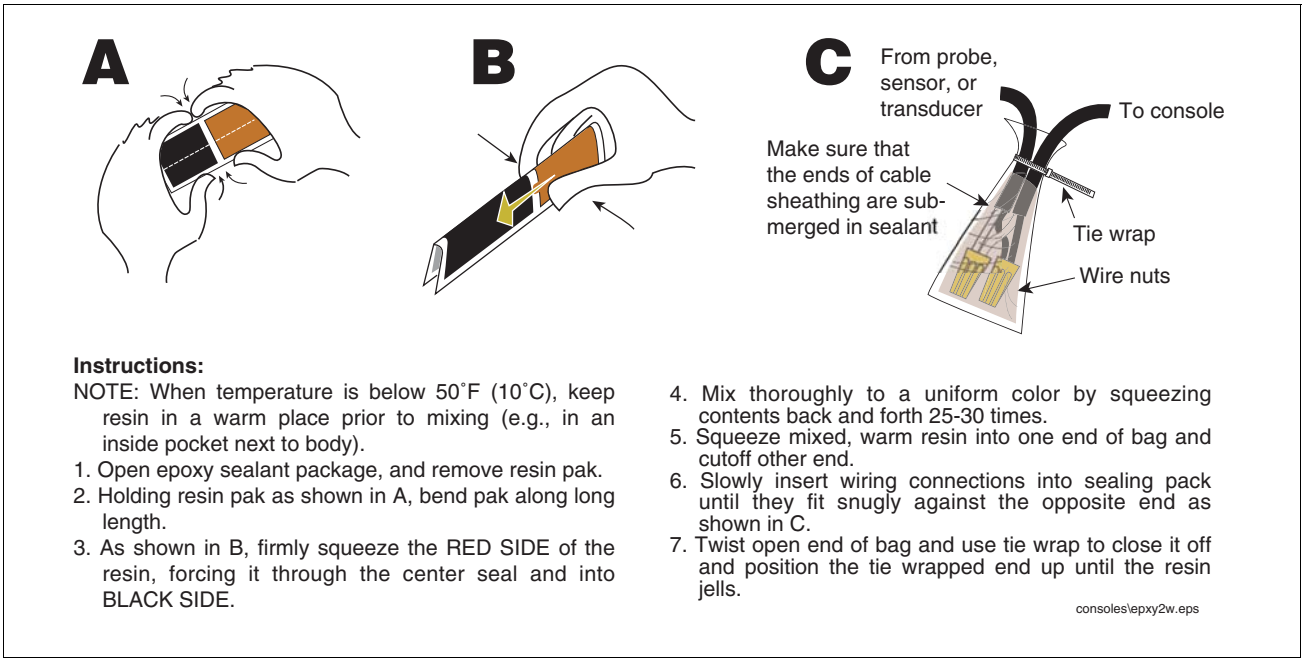


Figure 5. Epoxy sealing field wiring

2. Push the epoxy sealed bag into the junction box. Replace and tighten the junction box cover.
3. Terminate field wiring into TLS Console and connect to Smart Sensor Module located in the intrinsically safe wiring compartment of the TLS as shown in Figure 6. Note: you must observe polarity! Also, the cable length between the console and sensor must not exceed the distance stated in the TLS-3XX Site Prep manual (P/N 576013-879). For the wireless version, terminate the wires in the TLS RF transmitter (W2).
4. Replace the lower sheet metal doors in the dispenser.

   Note: Intrinsically safe devices must be installed in accordance with Article 504 of the National Electrical Code, ANSI/NFPA 70, for installation in the United States, or Section 18 of the Canadian Electrical Code for installations in Canada.

   This intrinsically safe vapor flow meter P/N 332374-002, has only been evaluated for connection to a UL listed TLS-350 Series Liquid Level Gauge / Leak Detector.

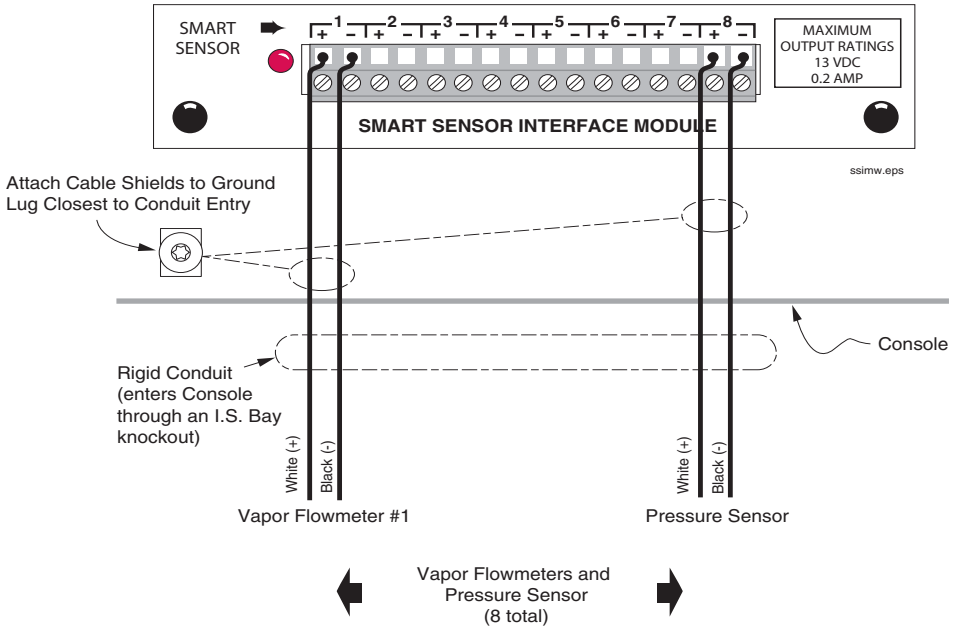


Figure 6. Direct Wiring Vapor Flow Meter to Smart Sensor Interface Module

NOTE! For wireless configurations, see TLS RF System Control Drawing 331940-012.

VEEDER-ROOT

For technical support, sales or other assistance, please visit: www.veeder.com

INSTALLATION MANUAL

HIRT VCS 100 VAPORTEK®
VAPOR PROCESSOR AND INDICATOR PANEL

FOR EXECUTIVE ORDERS VR-203 & VR-204

HIRT COMBUSTION ENGINEERS, INC.
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P.O. Box 6816 · Pico Rivera, CA 90661
Tel: (562)692-1490 · Fax: (562)692-7413 · E-mail: HirtVCS@AOL.com

Table of Contents

1. INTRODUCTION

This Manual contains the operation, installation, interconnection, start-up, and maintenance instructions for the VCS 100 Vaportek® 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 Vaportek® 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. 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 Phase 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_2 and H_2O 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

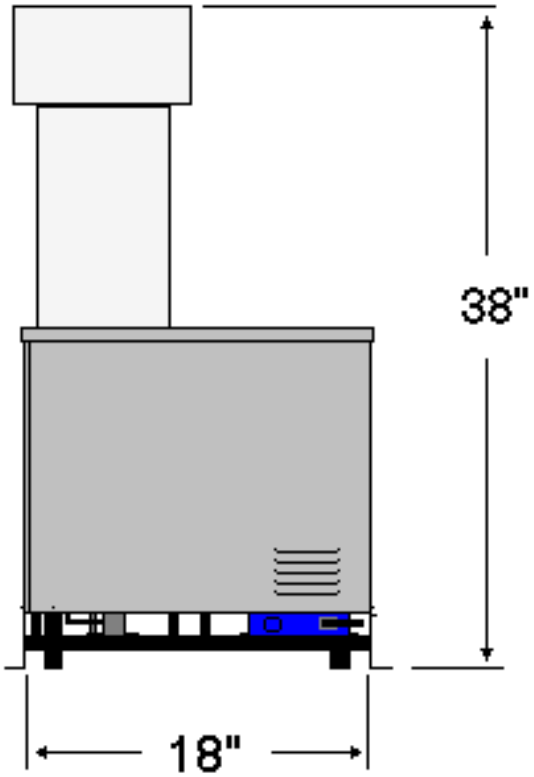
For both the ISD equipped and non-ISD versions, the processors' electrical power source comes thru the Hirt Indicator Panel. The panel allows the station operator to determine the current state of the processor and whether or not the processor is operating properly. The panel includes a POWER switch with an integral POWER (green) lamp, a PROCESSING (green) lamp, and an MALFUNCTION (red) lamp.

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

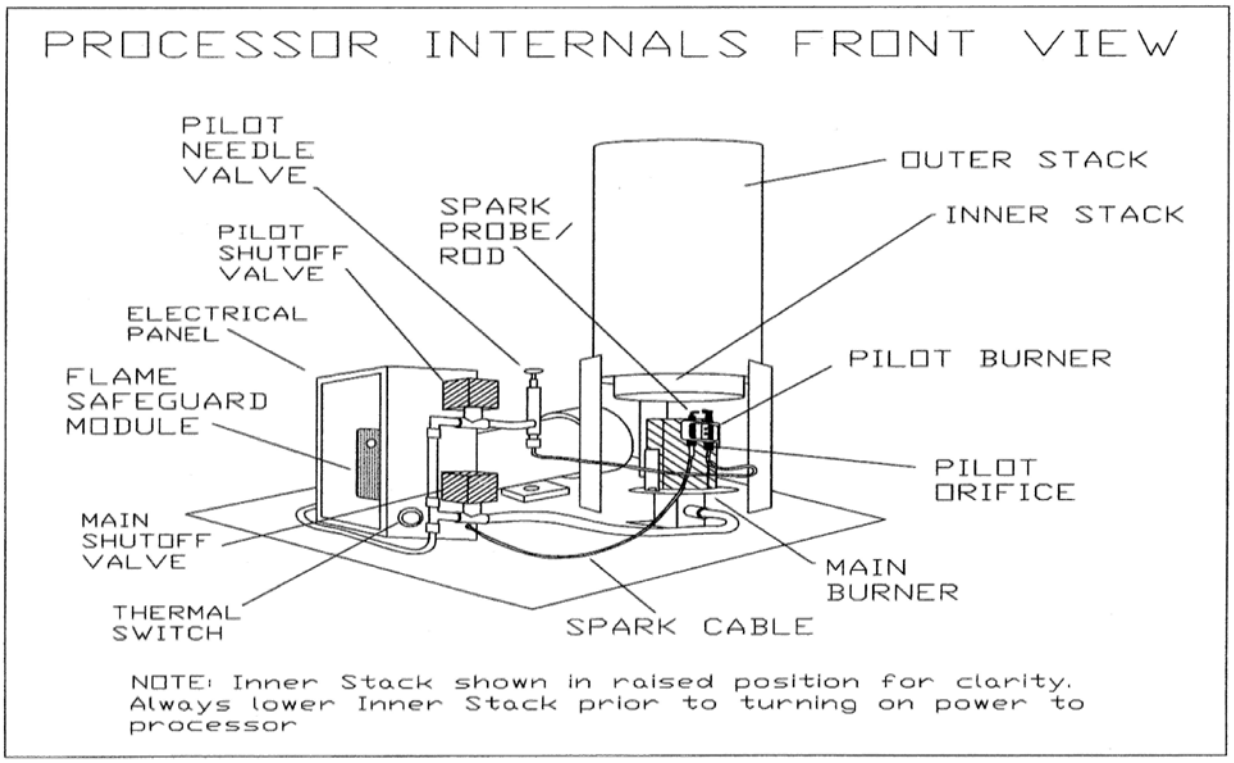
The MALFUNCTION lamp is wired to the vacuum sensor/switch and a timing module. If the UST pressure is positive for at least 1 hour, then the vacuum sensor/switch will be closed and the timing module will light the MALFUNCTION lamp. The MALFUNCTION lamp indicates a leak in the vapor recovery system or possibly a malfunction of the Hirt VCS 100 processor. The MALFUNCTION 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.

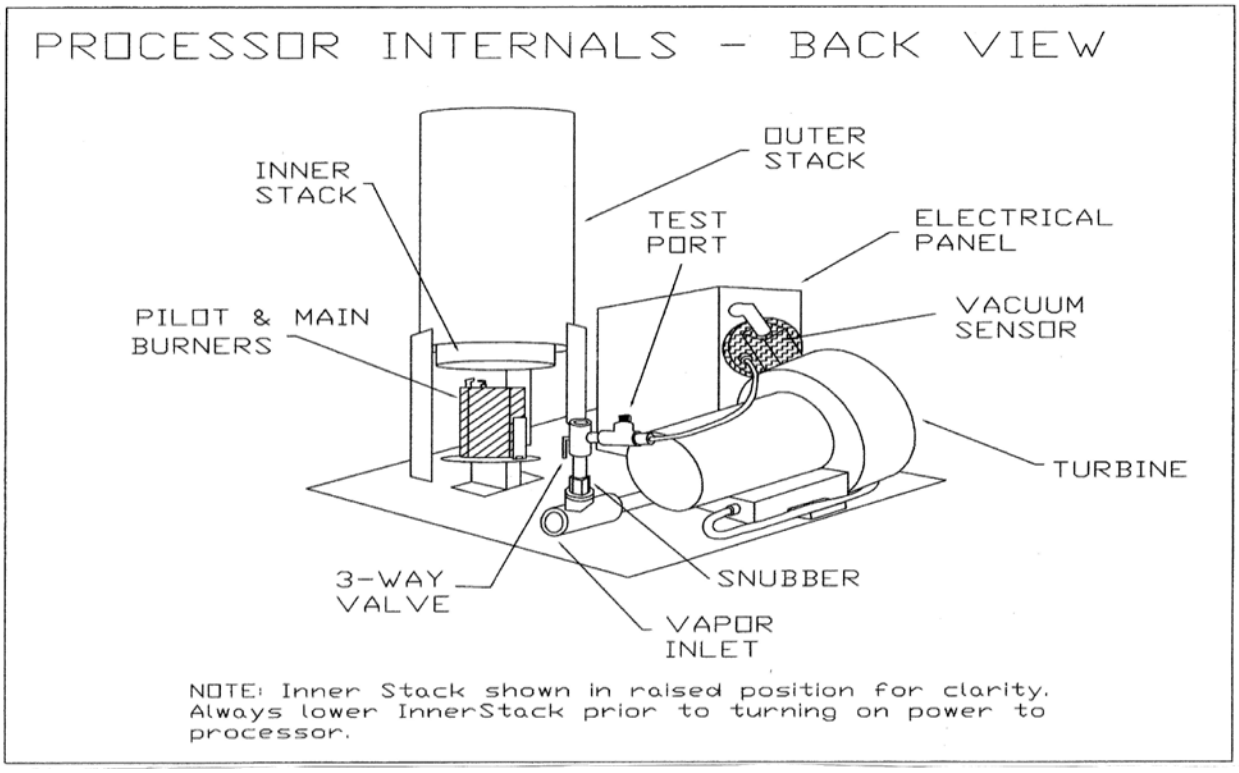
4.4 PROCESSOR DIMENSIONS, WEIGHT, AND SPECIFICATIONS

MODEL: VCS 100 Vaportek®
SERVICE: Outdoor, non hazardous area
ELECTRICAL: 120 VAC, 3 Ampere, intermittent
VAPOR PIPE CONNECTION: ¾" 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 ¼" 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 properly 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.

Note, Satellite Vapor Pipe (Figure 4) arrangement is for situations where it is impractical to connect processor to storage tank vent pipes. It features a high pipe loop to insure that a storage tank overfill should not allow liquid gasoline to be sent to the processor. For this configuration, the storage tank vent pipes still need to be manifolded together and connected to at least one P/V Valve.

FIGURE 1: Ground Mount

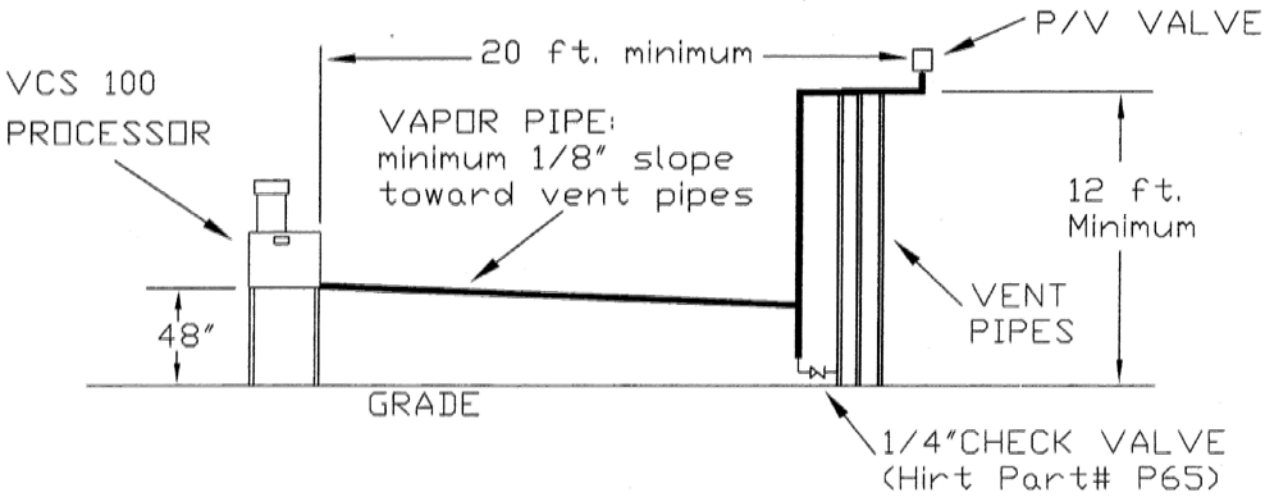


FIGURE 2: Canopy Mount

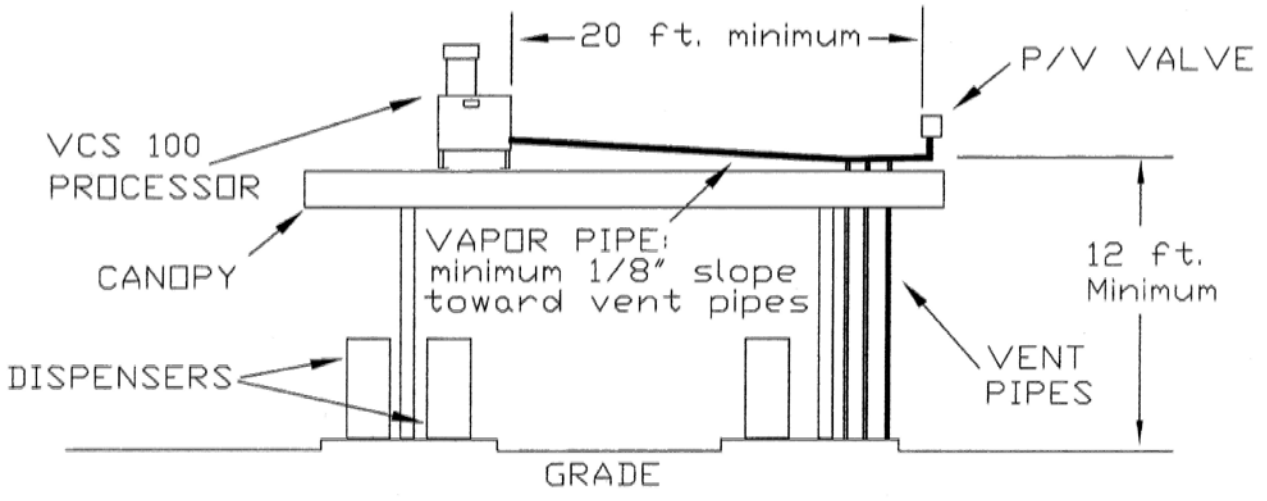


FIGURE 3: Roof Mount

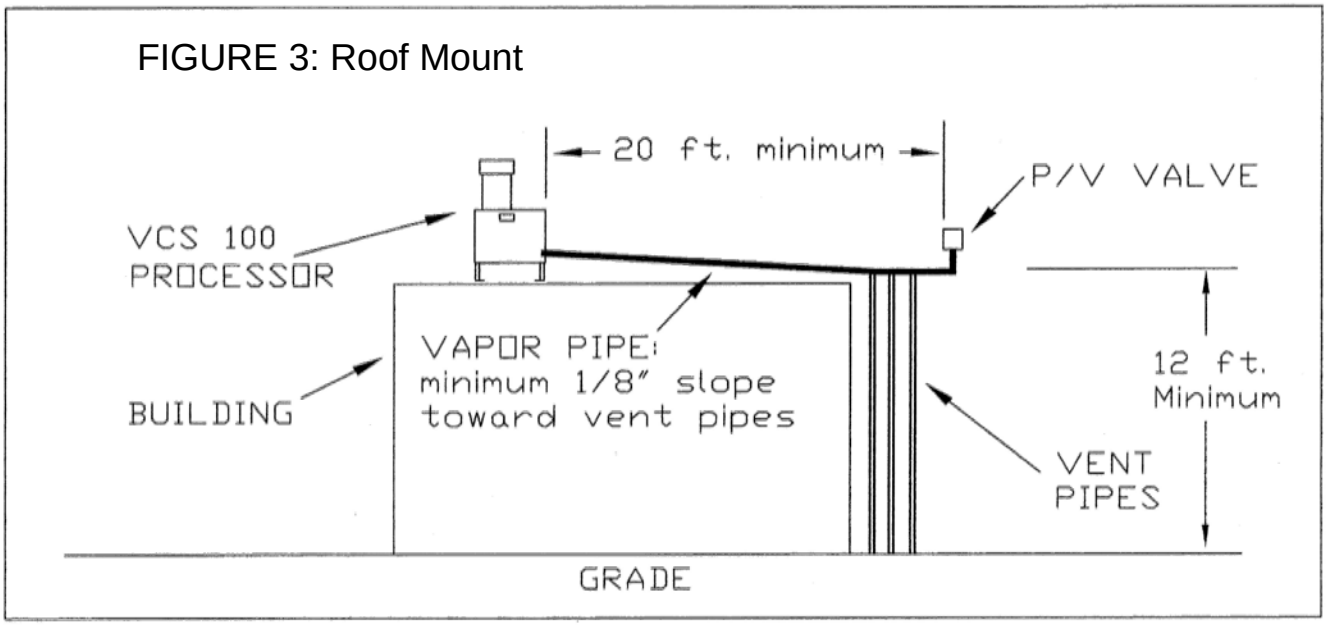
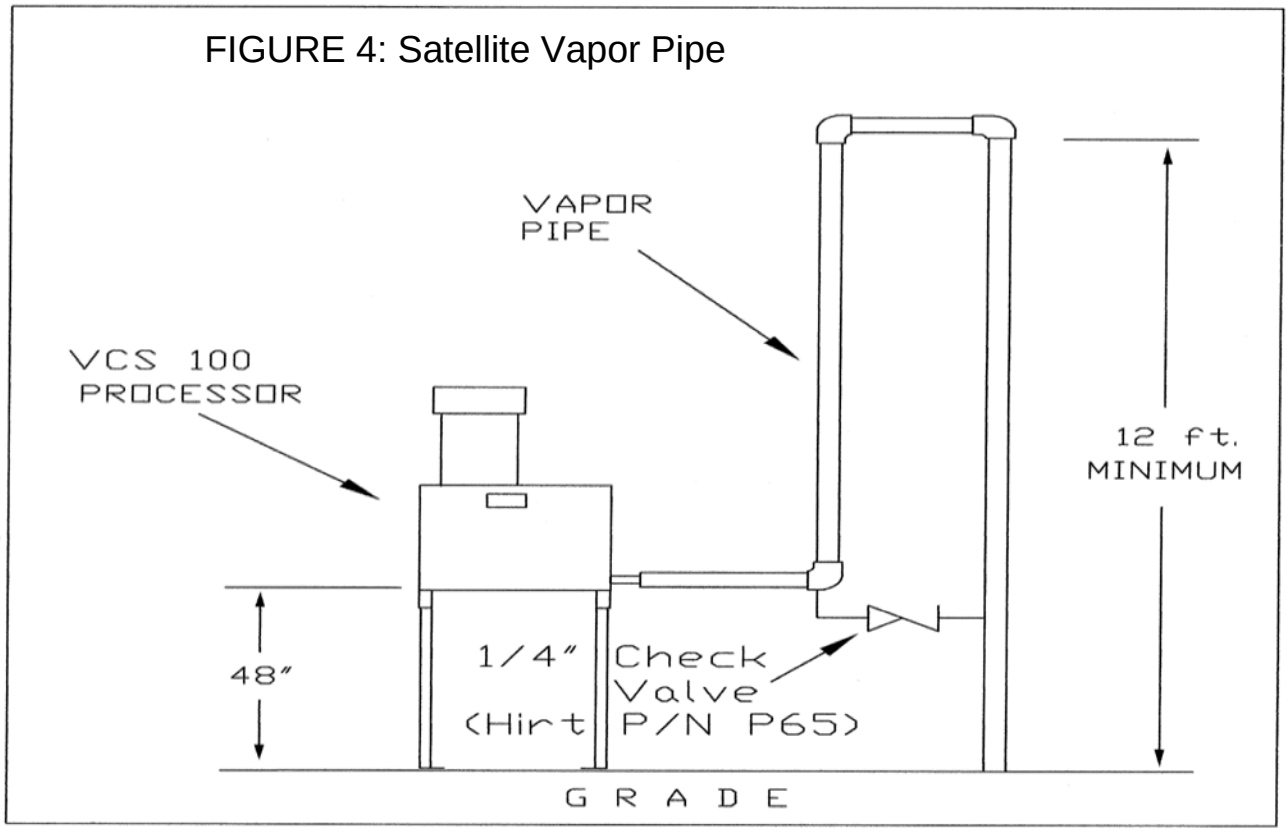


FIGURE 4: Satellite Vapor Pipe



5.2 ASSEMBLY OF LEGS TO PROCESSOR

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

FIGURE 5: Processor (general arrangement)

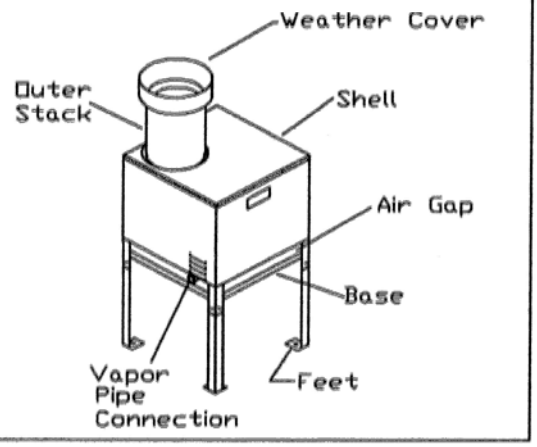
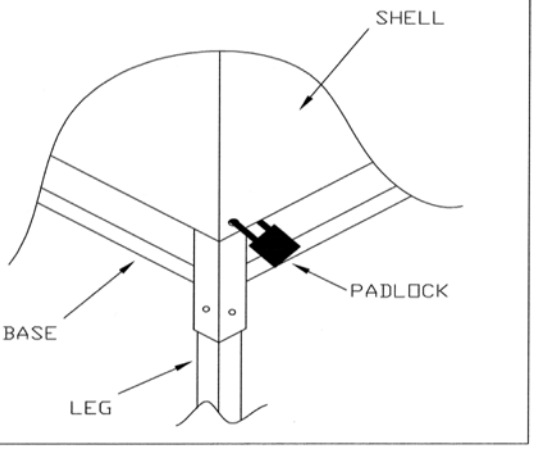


FIGURE 6



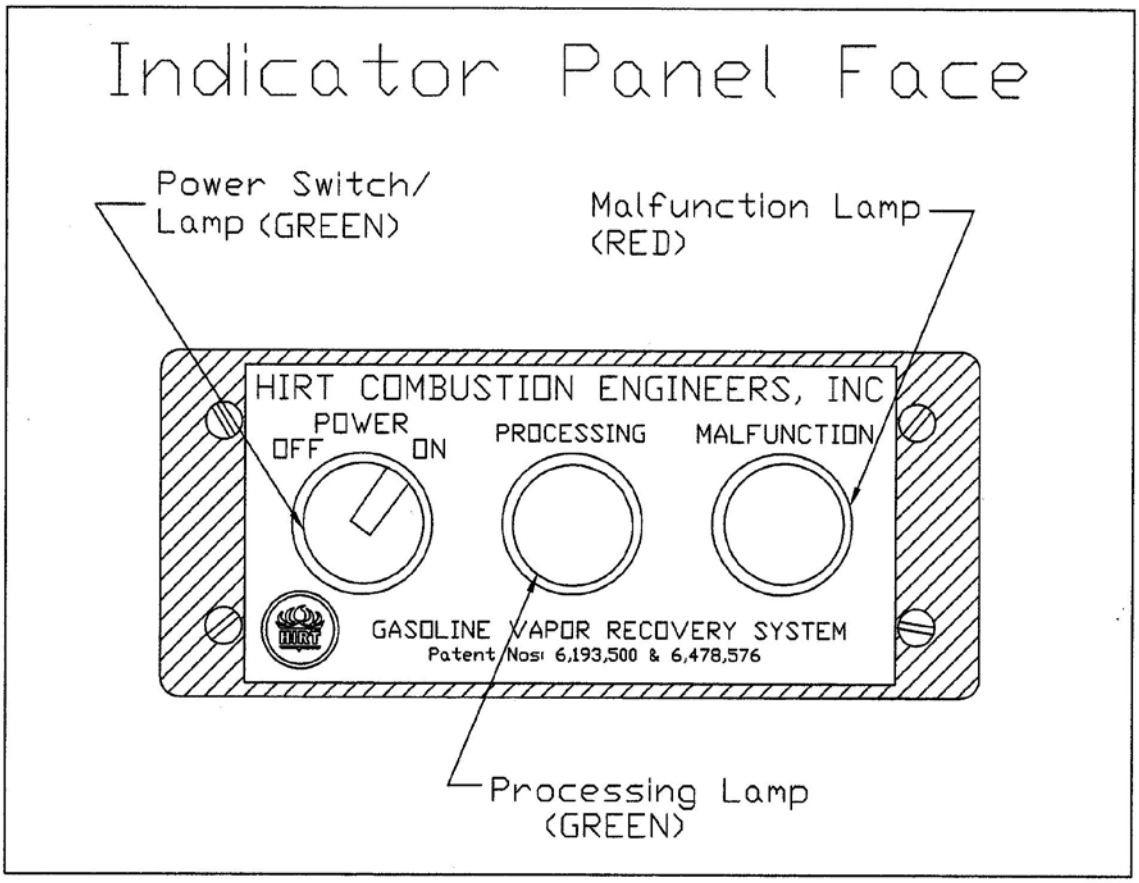
Ground level mount requires the use of the 48” Legs, and canopy or roof mount will require the 5” or longer Legs. If Legs not already purchased, see your local Hirt distributor.

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.

6.6 Ease of conduit run to In Station Diagnostic System (ISD) if required

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 AND ISD WIRING

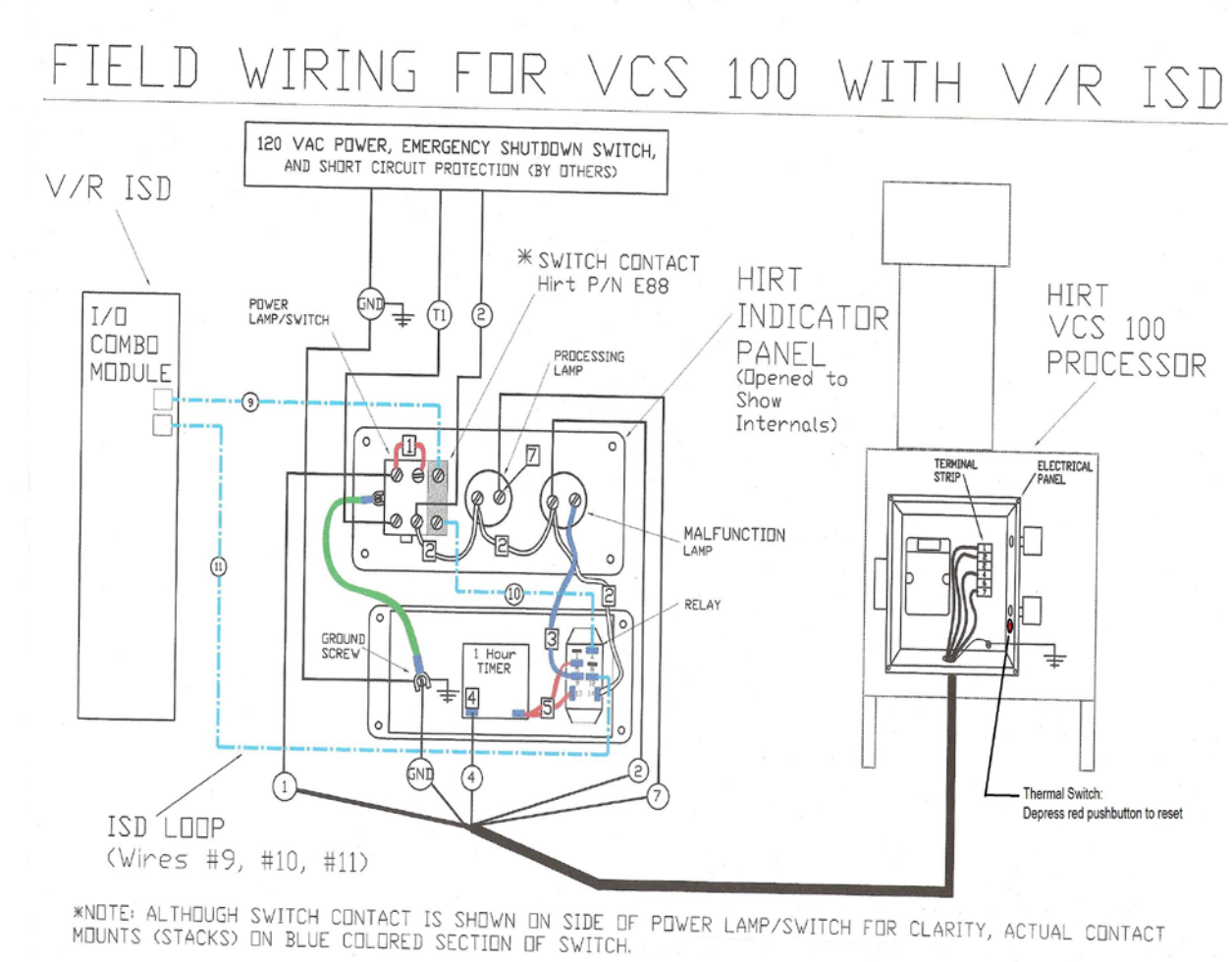
7.1.1 Note that the power to the Hirt Indicator Panel and VCS 100 processor comes through the station master switch and the emergency pump shutdown switch. See FIGURE 7.

7.1.2 Note, wire numbers 9, 10, & 11, and Switch Contact (Hirt P/N E88) are added when system connected to Veeder Root ISD system. Be sure to use the correct size insulated female disconnects (3/16" tab size) provided when connecting to relay inside Hirt Indicator Panel. Use of oversize female disconnect can cause nuisance ISD alarms.

7.1.3 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.

7.1.4 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 l, Groups C and D, Division 2 areas where the conduit enters the panel.

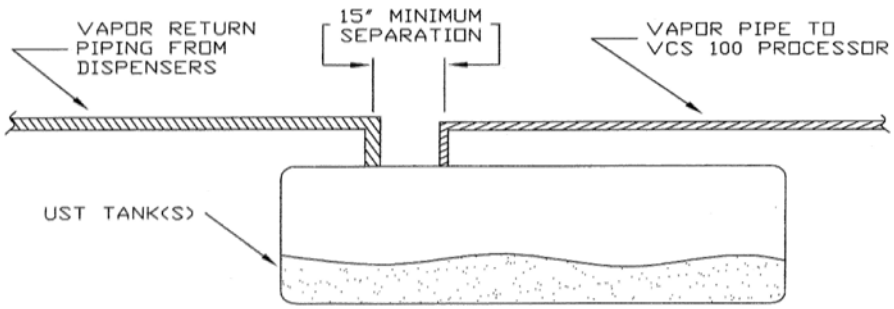
Figure 7


FIELD WIRING FOR VCS 100 WITH V/R ISD
120 VAC POWER, EMERGENCY SHUTDOWN SWITCH, AND SHORT CIRCUIT PROTECTION (BY OTHERS)
V/R ISD
I/O COMBO MODULE
POWER LAMP/SWITCH
GND
T1
2
*SWITCH CONTACT Hirt P/N E88
PROCESSING LAMP
HIRT INDICATOR PANEL (Opened to Show Internals)
HIRT VCS 100 PROCESSOR
TERMINAL STRIP
ELECTRICAL PANEL
MALFUNCTION LAMP
RELAY
GROUND SCREW
1 Hour TIMER
ISD LOOP (Wires #9, #10, #11)
Thermal Switch: Depress red pushbutton to reset
*NOTE: ALTHOUGH SWITCH CONTACT IS SHOWN ON SIDE OF POWER LAMP/SWITCH FOR CLARITY, ACTUAL CONTACT MOUNTS (STACKS) ON BLUE COLORED SECTION OF SWITCH.

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

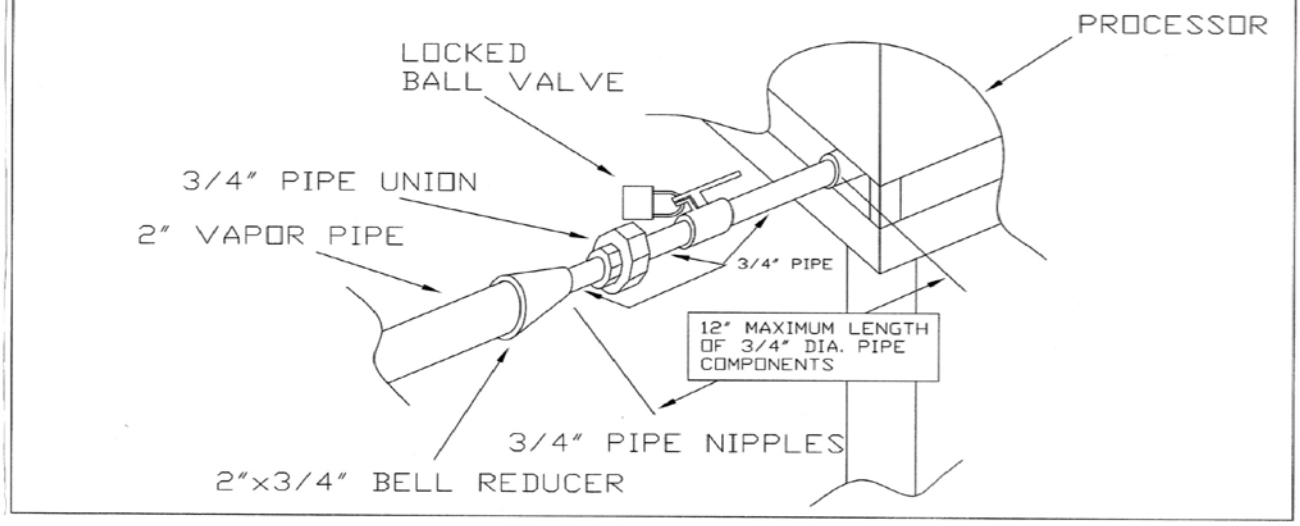


7.2.2 Vapor pipe must rise continuously from storage tank ullage connection to processor connection, and it needs to be supported to prevent trapping liquid in droops or sags in the pipe. Pipe slope must be at least 1/8" per foot, but a slope of 1/4" per foot is recommended. **Also be sure to put a pipe support close to the processor to prevent placing undue stress on the Turbine.** Excessive force on Turbine can cause its seals to fail, and any leaks will require Turbine replacement.

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.

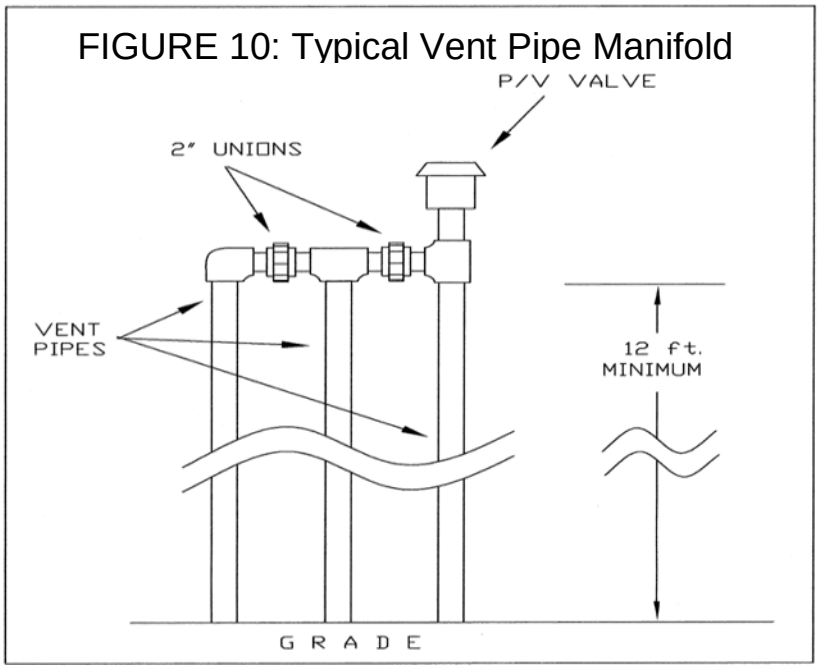
FIGURE 9: Typical Piping Connection to Processor



CAUTION: Hold processor internal pipe train with backing wrench to <u>prevent</u> 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 Vaportek® 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 MALFUNCTION 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.

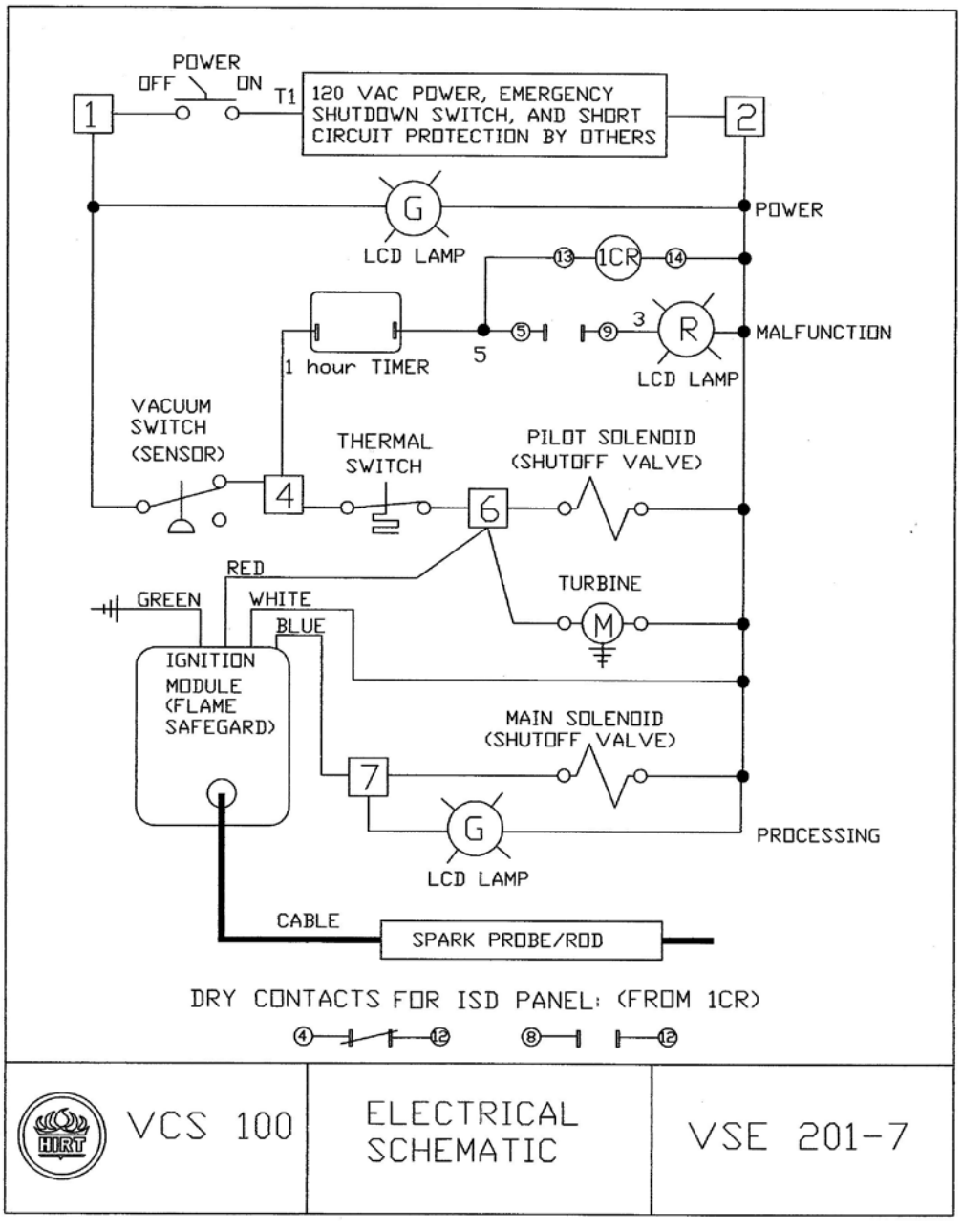
8.3 Check the pressure in storage tanks.

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.

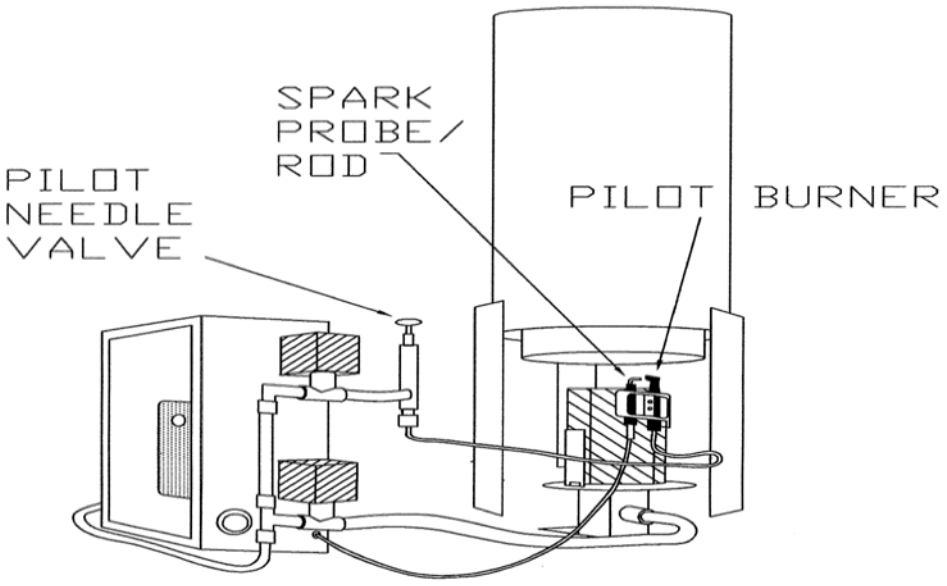
8.6 The processor will not turn on if the vacuum sensor/switch is satisfied. Therefore, any air in the vapor piping will need to be purged so the processor stages can ignite when storage tank vacuum decays. To purge this air and replace it with vapor, use 2 short pieces of wire and jump the circuit from 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.

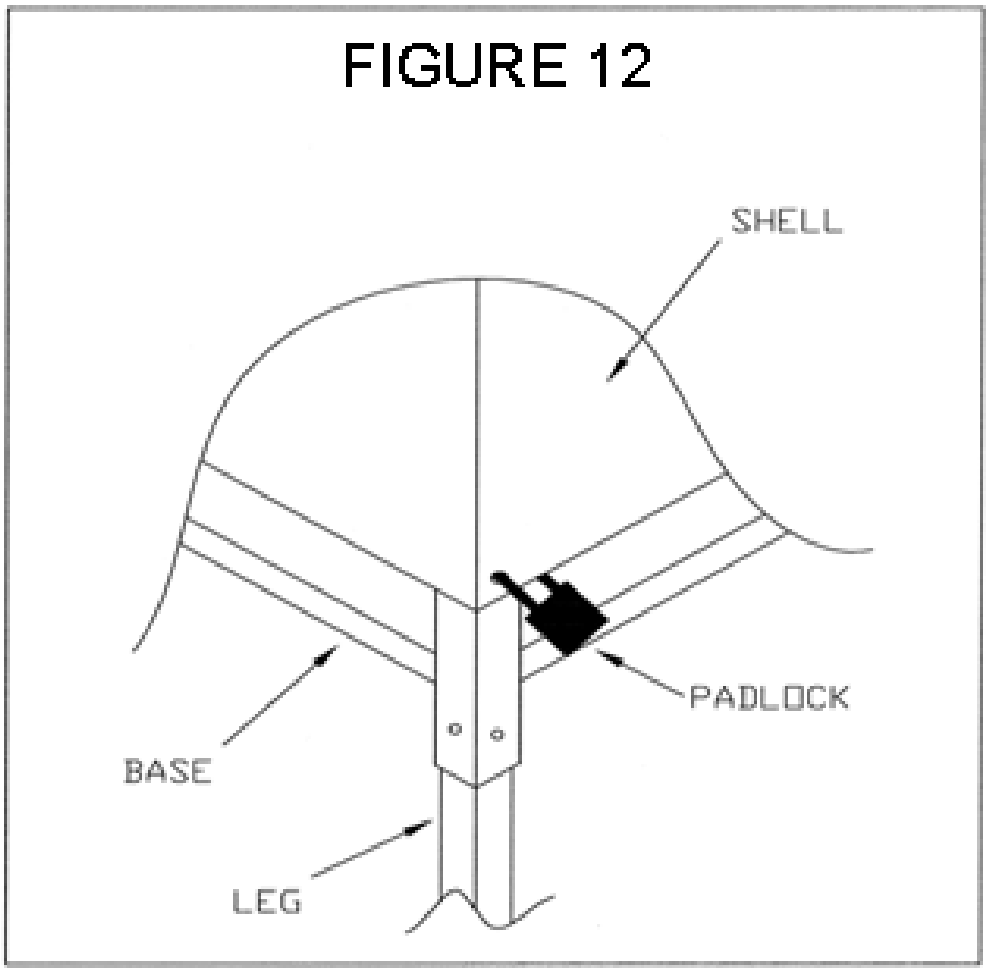
8.8 Check setting of Pilot Needle Valve adjustment. The valve is used to adjust the length of the (2) tongues of flame at the pilot burner. The ideal pilot flames are approximately 1" long, blue in color, with yellow tips. One flame tongue licks the Spark Probe/Rod. The factory setting for the Pilot 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.

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.

FIGURE 12



9. MAINTENANCE INSTRUCTIONS

The Hirt VCS 100 Vaportek® vapor processor must be inspected and tested annually. The technician must perform the Hirt VCS 100 Operability Test Procedure (reference Executive Order VR 203/204, Exhibit 13) and complete the Hirt VCS 100 Annual Inspection Checklist. See Section 3 of the Installation, Operation, and Maintenance Manual for requirements. The Annual Inspection Checklistt is to be left with the site's maintenance records.

10. REPAIR AND REPLACEMENT OF COMPONENTS

Any Hirt VCS 100 Vaportek® 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

- This product has a 12 month warranty, which becomes effective at time of installation. This warranty applies to the initial purchaser and any subsequent purchasers, during the warranty period.
- This product is warranted to meet all the applicable performance standards and specifications, for the duration of the warranty period.
- 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 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.

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:

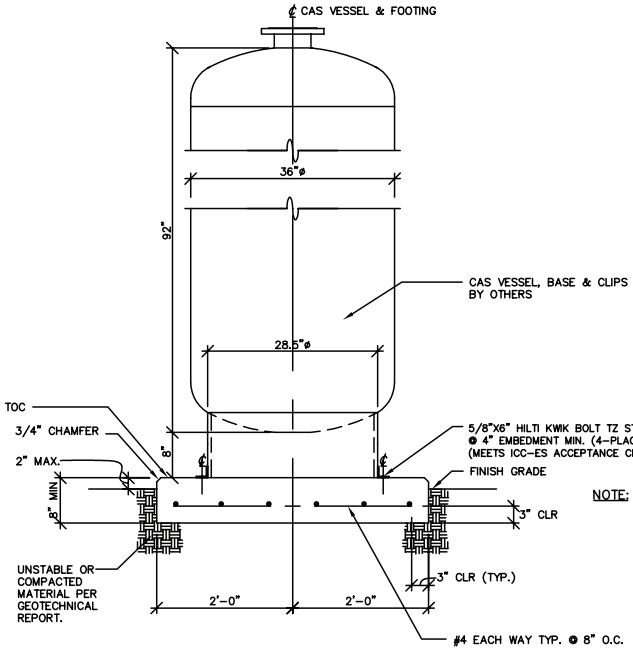
- Any liquid coming over from the vent system would have collected above the valve (A) in the riser pipe before going into the bladder. An inspection of the need to drain the bladder is easily made by removing the plug (E) at the tee on the bottom plumbing of the CAS. Before removing this plug, open 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.

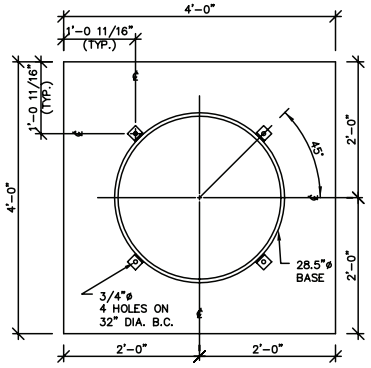
DRAINING THE CAS:

- 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

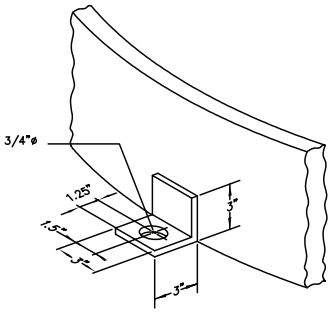


SECTION @ CAS SLAB
SCALE = 3/4" = 1'–0"



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–1385 REPORT, ISSUED 09/01/04).



TYPICAL HOLD DOWN CLIP
SCALE = NONE

CRITERIA
SOIL BEARING 1000 psf
BASIC WIND SPEED 100mph
SEISMIC S_s=2g
S_{s1}=1g
MIN. CONCRETE COMP STRENGTH, f_c' = 2500 psi
MIN. REINF. YIELD STRENGTH, f_y = 40000 psi

REV	DESCRIPTION	ECN NO	BY	DATE
7	ADDED CAS DIMENSIONS, REVISED CRITERIA LIST	–	TF/MB	01/02/08
6	KB–TZ SS WAS KB3, ESR–1917 WAS ESR–1385, ADDED NOTE 1	–	TF/MB	12/21/07

MATERIAL:

DO NOT SCALE DRAWING

STANDARD INCH TOLERANCES (UNLESS OTHERWISE SPECIFIED)

.XX ± .02
.XXX ± .005
ANGULAR ± 1/2°

SPECIAL DIST:

Franklin Fueling Systems
Madison, WI 53718

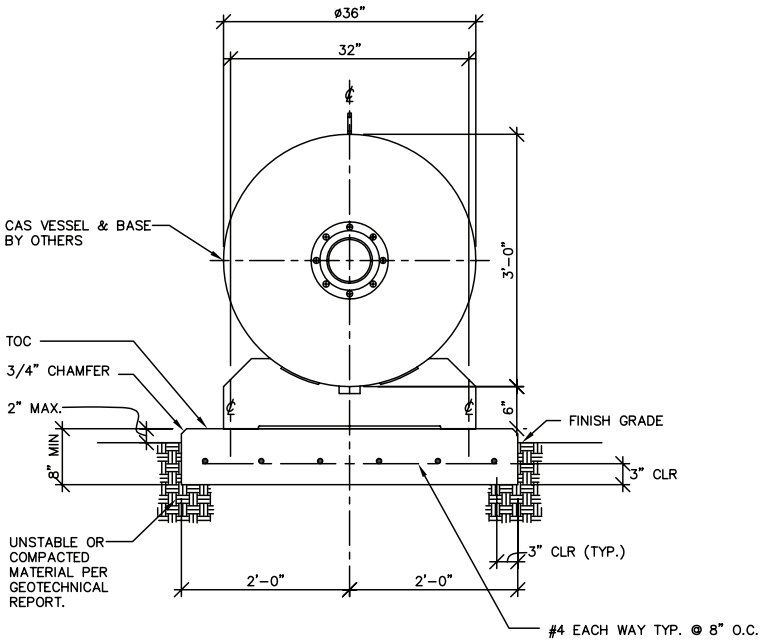
TITLE: CLEAN AIR SEPARATOR MOUNTING SLAB DETAILS

DRAWN:	DATE:	DRW NO:	SUFFIX:
JWH	07/31/02	9900–9945	
APPRVL:	DATE:	SCALE: 1/8	SHEET 1 OF 1

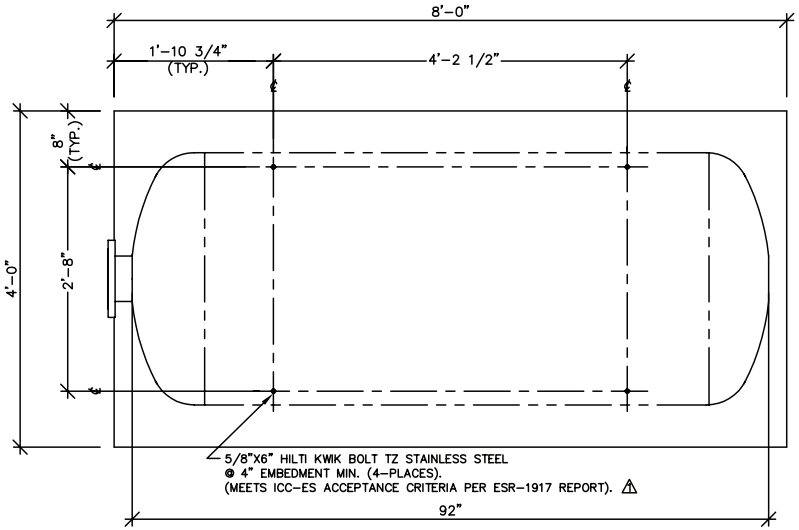
17 B

ARB Approved IOM 17 - Healy Clean Air Separator Model 9961 and 9961H - Executive Orders VR-203 and VR-204

DRW NO: 9900–9945H



SECTION @ CAS SLAB



BASE PLAN

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–1385 REPORT, ISSUED 09/01/04).

CRITERIA
SOIL BEARING 1000 psf
BASIC WIND SPEED 100mph
SEISMIC S_s=2g
S_{s1}=1g
MIN. CONCRETE COMP STRENGTH, f_c' = 2500 psi
MIN. REINF. YIELD STRENGTH, f_y = 40000 psi

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

MATERIAL:

DO NOT SCALE DRAWING

STANDARD INCH TOLERANCES (UNLESS OTHERWISE SPECIFIED)

.XX ± .02
.XXX ± .005
ANGULAR ± 1/2°

SPECIAL DIST:

Franklin Fueling Systems
Madison, WI 53718

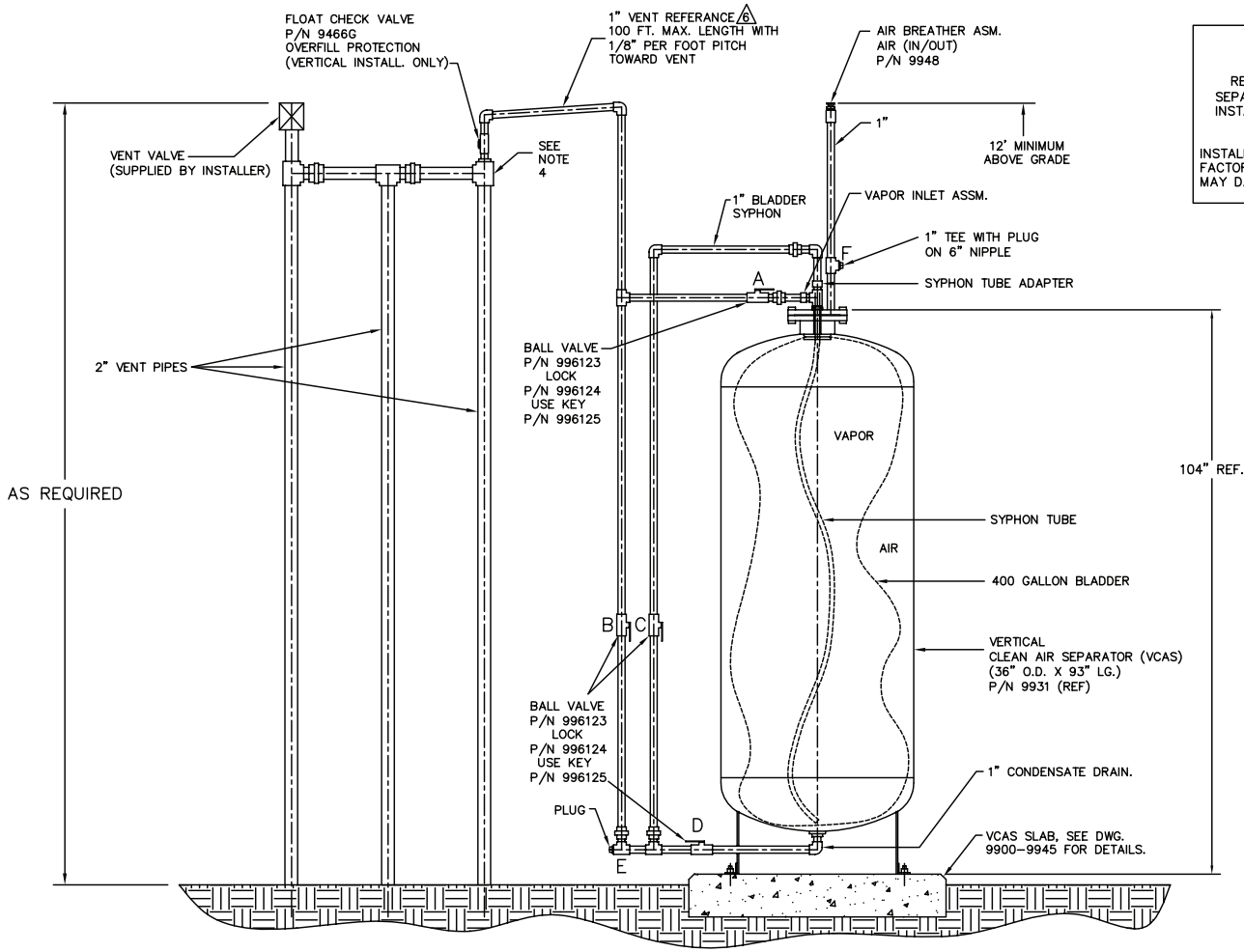
TITLE:
CLEAN AIR SEPARATOR HORIZONTAL MOUNTING SLAB DETAILS

DRAWN:	DATE:	DRW NO:	SUFFIX:
TF	05/22/07	9900–9945	H
APPRVL: MDB	DATE: 06/05/07	SCALE: 3/4"=1'	SHEET 1 OF 1

17.4

ARB Approved IDM 17 - Healy Clean Air Separator Model 9961 and 9961H - Executive Orders VR-203 and VR-204

DRW NO: 9900-9942



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 BREATHER 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
6 – 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.

REV	DESCRIPTION	ECN NO	BY	DATE
15	ADDED NOTE 6	401666	TF / MDB	03/20/08

MATERIAL:

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

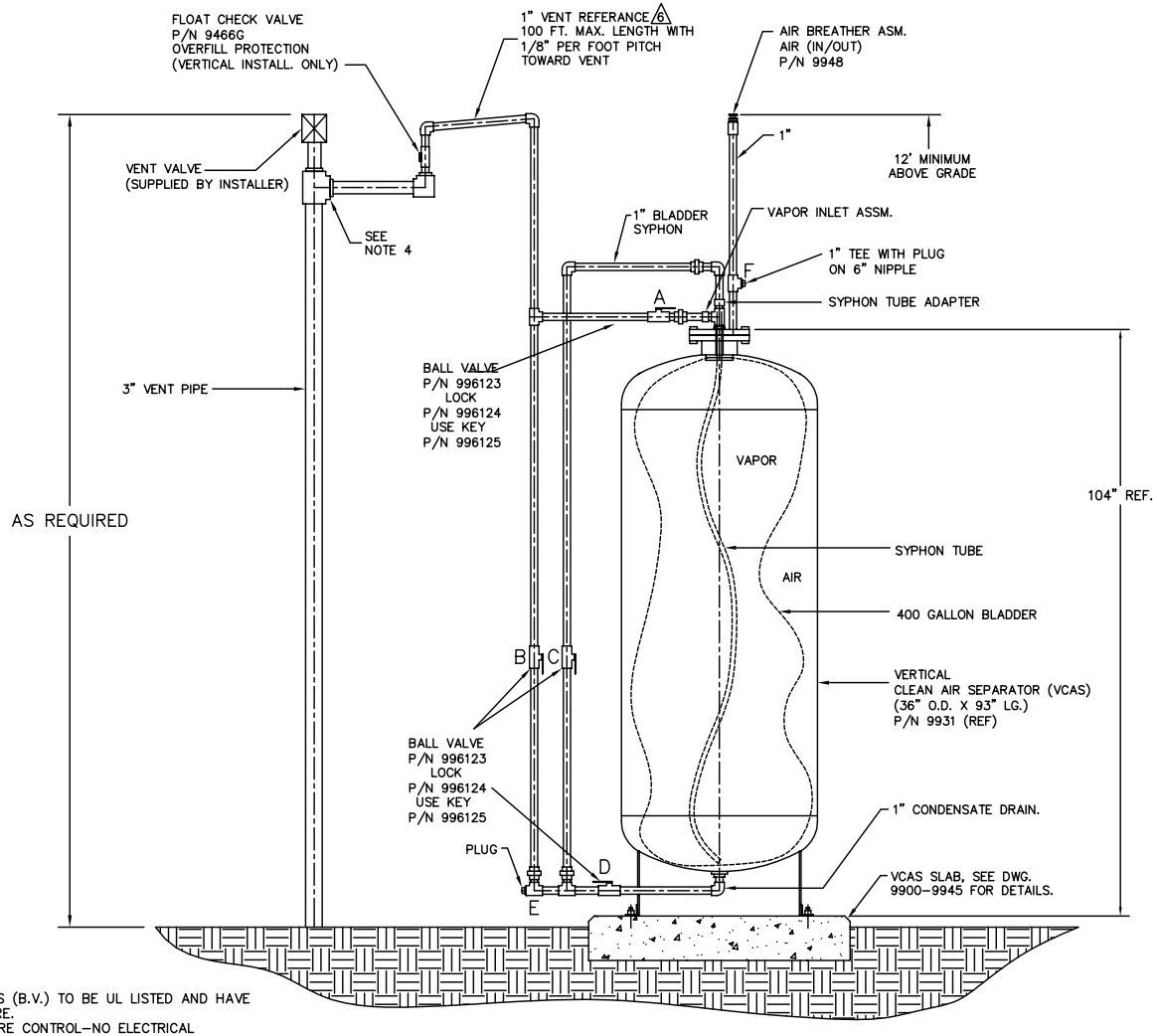
SPECIAL DIST:

Franklin Fueling Systems
Madison, WI 53718

TITLE: CLEAN AIR SEPARATOR VERTICAL INSTALLATION

DRAWN:	DATE:	DRW NO:	SUFFIX:
JWH	05/14/02	9900-9942	
APPRVL: MDB	DATE: 06/05/07	ACAD HLY	SCALE: N.T.S.	SHEET 1 OF 1

DRW NO: 9900–9971



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 BREATHER 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.
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REV	DESCRIPTION	ECN NO	BY	DATE
8	ADDED NOTE 6	401666	TF MDB	03/20/08

MATERIAL:

DO NOT SCALE DRAWING

STANDARD INCH TOLERANCES (UNLESS OTHERWISE SPECIFIED): .XX ± .02, .XXX ± .005, ANGULAR ± 1/2°

SPECIAL DIST:

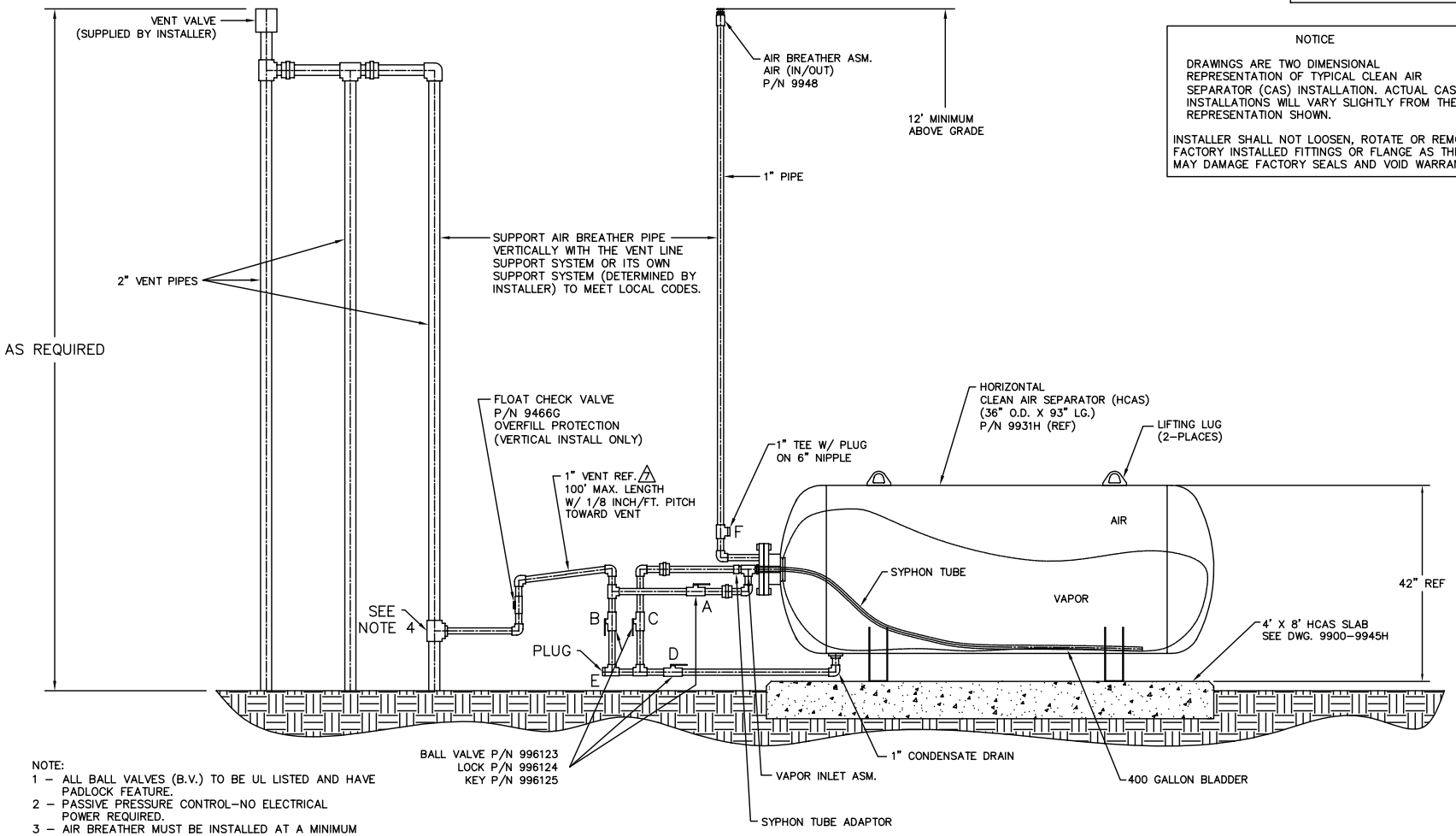
Franklin Fueling Systems
Madison, WI 53718

TITLE: CLEAN AIR SEPARATOR VERTICAL INSTALLATION (1 VENT)

DRAWN:	DATE:	DRW NO:	SUFFIX:
JWH	05/14/02	9900–9971	
APPRVL:	DATE:	ACAD HLY	SCALE: N.T.S.	SHEET 1 OF 1
MDB	06/05/07		

17-6
ARB Approved IOM 17 - Healy Clean Air Separator Model 9961 and 9961H - Executive Orders VR-203 and VR-204

DRW NO: 9900–9942H



NOTICE

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NOTE:
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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.
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STANDARD INCH TOLERANCES (UNLESS OTHERWISE SPECIFIED)
.XX ±.02
.XXX ±.005
ANGULAR ±1/2°

SPECIAL DIST:

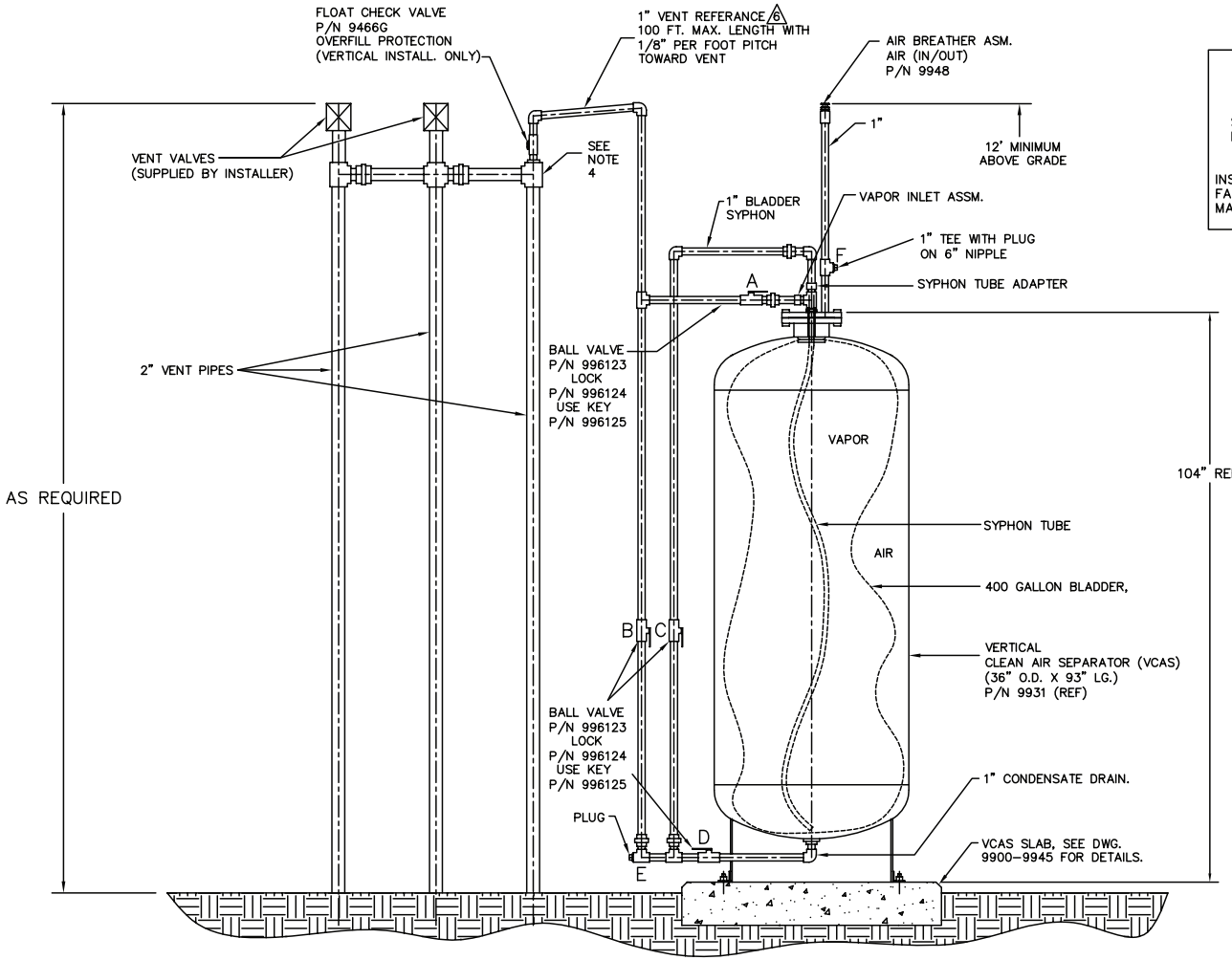
REV	DESCRIPTION	ECN NO	BY	DATE
7	ADDED NOTE 7	401666	TF MDB	03/20/08

Franklin Fueling Systems
Madison, WI 53718

TITLE: CLEAN AIR SEPARATOR HORIZONTAL INSTALLATION

DRAWN:	DATE:	DRW NO:	SUFFIX:
TF	05/23/07	9900–9942	H
APPRVL:	DATE:		
MDB	06/05/07	SCALE: N.T.S.	SHEET 1 OF 1

DRW NO: 9900-9972



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8	ADDED NOTE 6	401666	TF/MDB	03/20/08

Franklin Fueling Systems
Madison, WI 53718

TITLE: CLEAN AIR SEPARATOR VERTICAL INSTALLATION (2 VENT)

DRAWN:	DATE:	DRW NO:	SUFFIX:
JWH	05/14/02	9900-9972	
APPRVL:	DATE:		
MDB	06/05/07		

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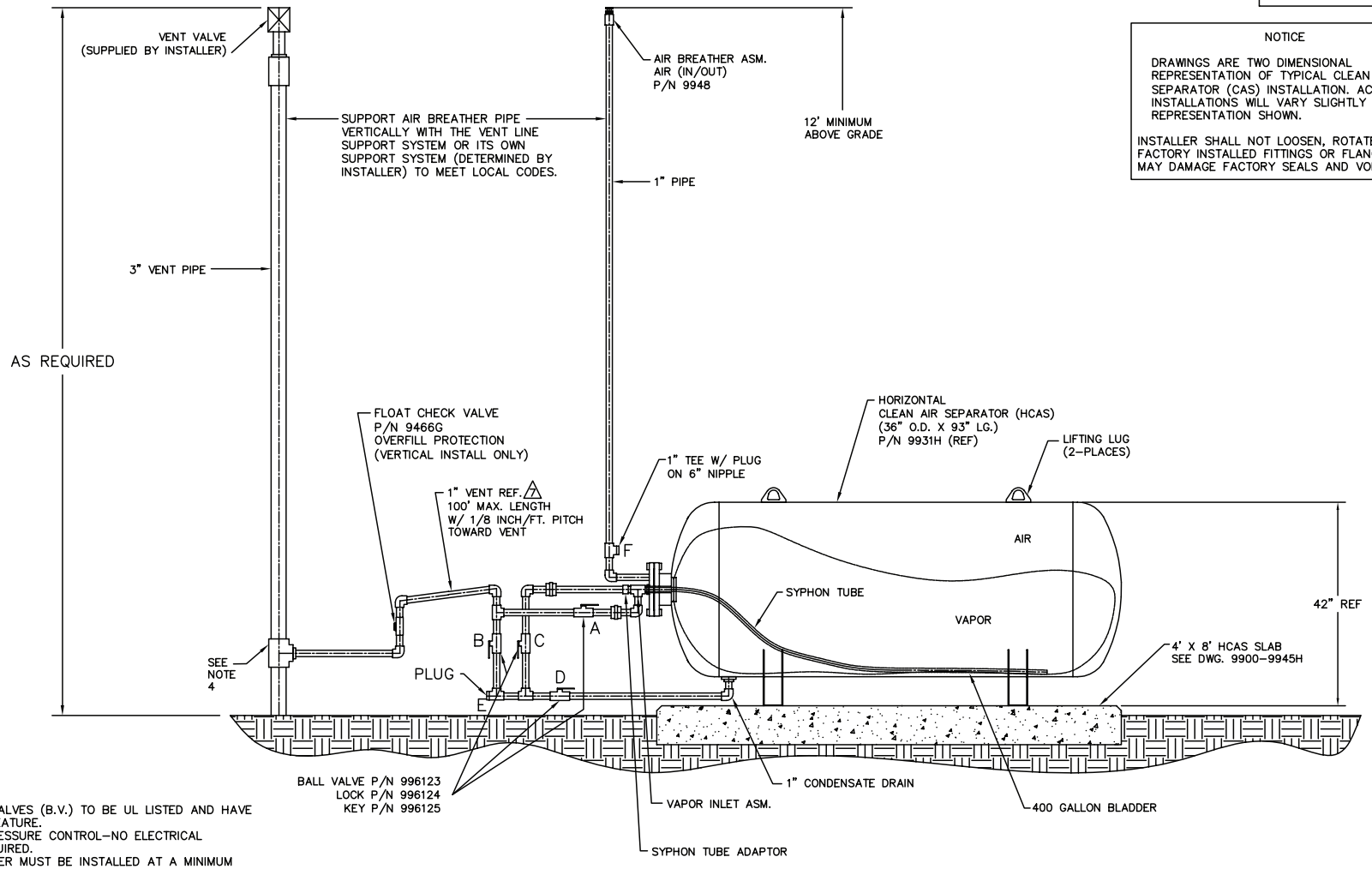
DRW NO: 9900-9971H



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Franklin Fueling Systems
Madison, WI 53718

TITLE: CLEAN AIR SEPARATOR HORIZONTAL INSTALLATION (1 VENT VALVE)

DRAWN:	DATE:	DRW NO:	SUFFIX:
TF	05/22/07	9900-9971	H
APPRVL:	DATE:	SCALE: N.T.S.	SHEET 1 OF 1
MDB	06/05/07		

DRW NO: 9900–9973

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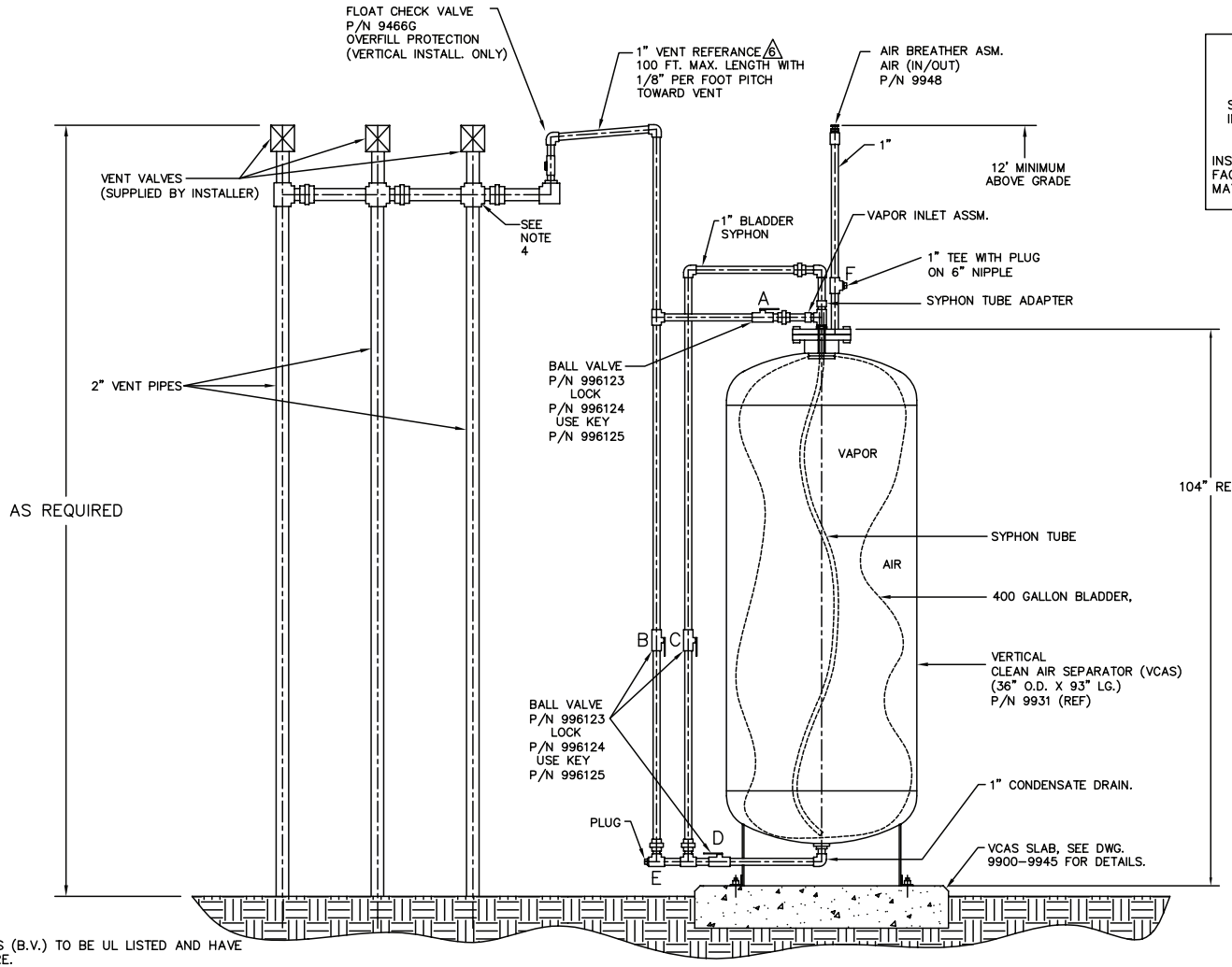

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DRAWN:	DATE:	DRW NO:	SUFFIX:
JWH	05/14/02	9900–9973	
APPRVL:	DATE:		
MDB	06/05/07		

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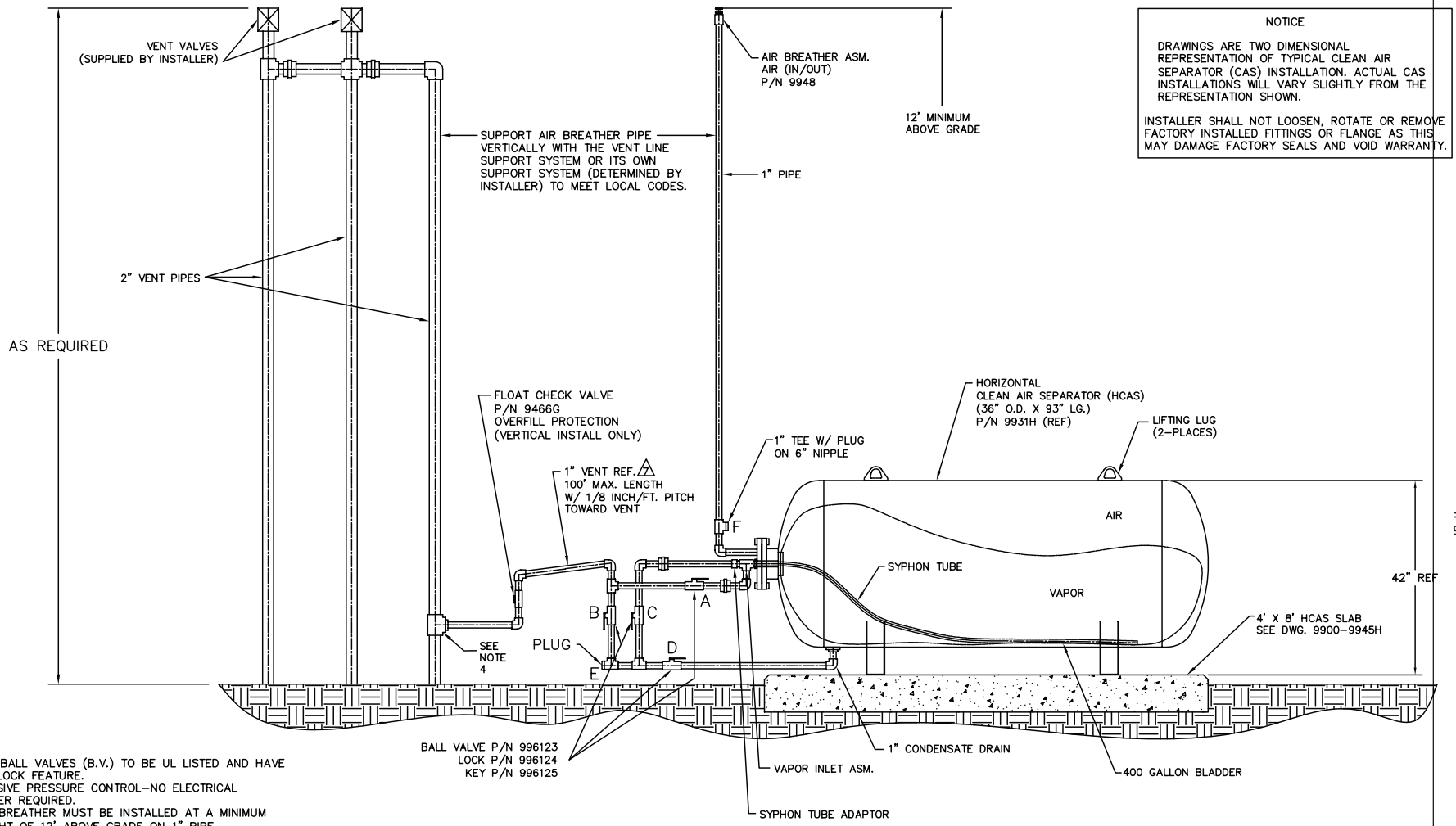
17-10

ARB Approved IOM 17 - Healy Clean Air Separator Model 9961 and 9961H - Executive Orders VR-203 and VR-204

DRW NO: 9900-9972H



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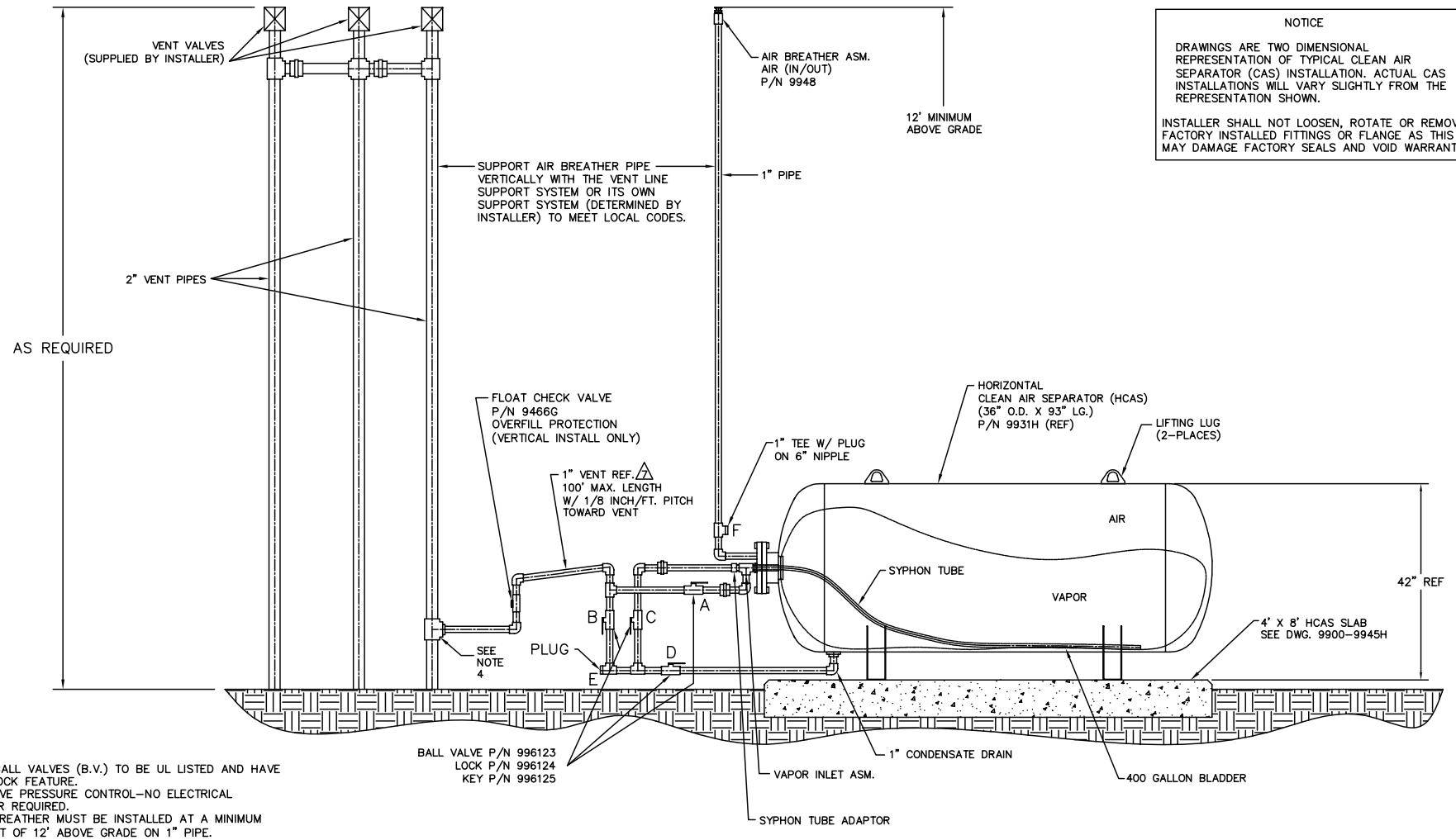

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Clean Air Separator

Bladder Field Replacement

Franklin Fueling Systems • 3760 Marsh Rd. • Madison, WI 53718 USA

Tel: +1 608 838 8786 • 800 225 9787 • Fax: +1 608 838 6433 • www.franklinfueling.com

Important Safety Messages

Franklin Fueling Systems (FFS) equipment is designed to be installed in association with volatile hydrocarbon liquids such as gasoline. Installing or working on this equipment means working in an environment in which these highly flammable liquids may be present. Working in such a hazardous environment presents a risk of severe injury or death if these instructions and standard industry practices are not followed. Read and follow all instructions thoroughly before installing or working on this, or any other related, equipment.

As you read this guide, please be aware of the following symbols and their meanings:

Warning  This symbol identifies a warning. A warning sign will appear in the text of this document when a potentially hazardous situation may arise if the instructions that follow are not adhered to closely. A potentially hazardous situation may involve the possibility of severe bodily harm or even death.

Caution  This is a caution symbol. A caution sign will appear in the text of this document when a potentially hazardous environmental situation may arise if the instructions that follow are not adhered to closely. A potentially hazardous environmental situation may involve the leakage of fuel from equipment that could severely harm the environment.

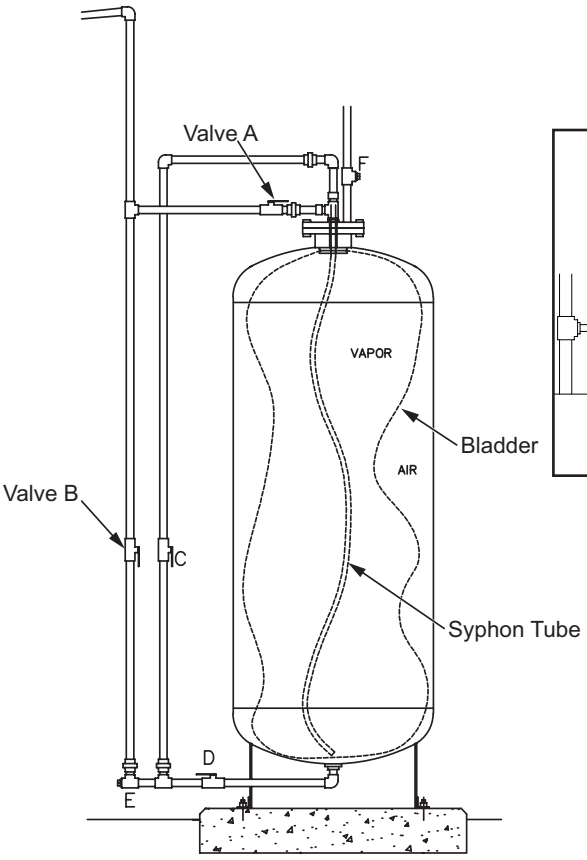
Warning  **Follow all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and any related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on during installation or servicing. Please refer to the Installation and Owner's Manual for this equipment, and the appropriate documentation for any other related equipment, for complete installation and safety information.**

Warning  **Follow all federal, state and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30A and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage and/or environmental contamination.**

Warning  **Always secure the work area from moving vehicles. The equipment in this manual is usually mounted underground, so reduced visibility puts service personnel working on this equipment in danger from moving vehicles entering the work area. To help eliminate these unsafe conditions, secure the area by using a service truck to block access to the work environment, or by using any other reasonable means available to ensure the safety of service personnel.**

Warning  **Use circuit breakers for multiple disconnect to turn off power and prevent feedback from other dispensers.**

Note: Persons doing this bladder replacement must be trained by a FFS Field service engineer before attempting this procedure.



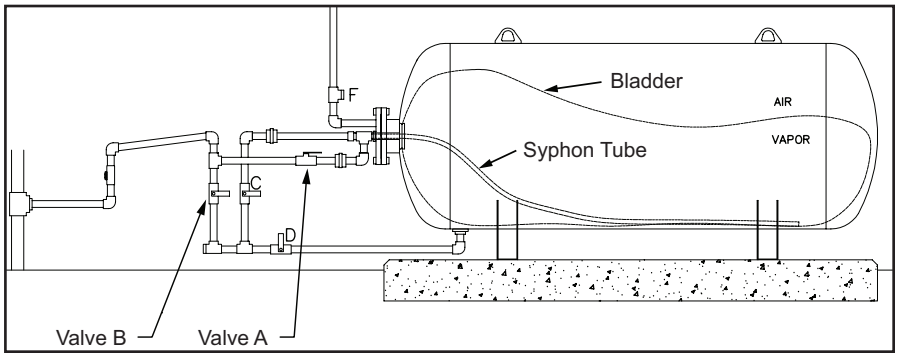


Figure 1: Clean Air Separators: Component Locations

Replacement Bladder Part# 9943

1. Close valves A & B, then disconnect piping from the Clean air Separator (CAS).
2. **It is highly recommended that Vertical Clean Air Separators be placed horizontally prior to repair.** (A powered lifting device will be needed).

Note: Lower the vertical CAS slowly and place cushioning (i.e. cardboard) under it to prevent scarring the surface.

3. Remove the syphon tube.
4. Deflate the bladder to ease its removal and to prevent damage during removal.

Warning **Explosion potential. Assume gasoline vapors are present. Use an intrinsically safe or explosion-proof vacuum source to deflate the bladder.**

5. Remove the (8) ¾" bolts securing the flange. Be aware that a thread-locking compound was used on the threads, and more force will be required to remove them.

Note: Account for all parts removed and reinstall in the same order.

6. Carefully remove bladder from the Clean Air Separator.
7. Remove the (6) ¼-20 bolts from the bladder flange (9940).
8. Inspect bladder flange and nipple to ensure there are no sharp edges that could create a hole in the bladder.
9. Replace bladder by fitting the new bladder's end opening around the flange (Figure 2).

Figure 2: Place Bladder on Flange

10. Lower the Clamp Ring with lubricated O-ring to hold the bladder in position.
11. Install the (6) ¼-20 bolts securing the clamp ring and bladder to the bladder flange.

Note: Using a couple 1" ¼-20 bolts can help hold the flange components in position while the other bolts are secured.

12. Tighten all (6) screws to 65-88 in-lbs using torque wrench set to break at 80 in-lbs

13. Inflate bladder to 2" of water column and check for leaks in accordance with CARB exhibit 4.
14. Deflate bladder and fold into thirds lengthwise.
15. Feed bladder into the Clean Air Separator. Take care not to damage bladder as you feed it into CAS. Support the flange end so no additional stress is put on the bladder as you feed the bladder into the CAS. Best to use 2 people during this step
16. Align marks and secure the flange using the (8) ¾" bolts. Apply Loctite* to bolts.

Figure 3: Align Marks

17. Torque bolts to 80 ft / pounds.
18. Inflate bladder to 2" of water column and install syphon tube (Figure 4).

Figure 4: Install Syphon Tube

19. Reinstall the Clean Air Separator per ARB Approved IOM - EO VR-203 and VR-204. Test the Clean Air Separator in accordance with Exhibit 14.

* Loctite is a registered trademark of Henkel Corporation

HEALY
Franklin Fueling Systems
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Franklin Fueling Systems GmbH
Rudolf-Diesel-Strasse 20 • 54516 Wittlich, GERMANY
Tel: +49-6571-105-380 • Fax: +49-6571-105-510

Installation & Maintenance Manual

Green Machine™ - PMC / ISD - California

Revision 1.12

Vapor Systems Technologies, Inc.
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Springboro, Ohio 45066
(937) 704-9333 PH
(937) 704-9443 FX
www.vsthose.com

Table of Contents

Table of Figures

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 - *Green Machine*. 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

1 This Document

1.1 Safety Icons

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

1.2 Table of Terms & Abbreviations

ASC:	Authorized Service Contractor
AQMD:	Air Quality Management Districts
ATG:	Automatic Tank Gauge
CAPCOA:	California Air Pollution Control Office Association
CARB:	California Air Resources Board
CDFA:	California Department of Food & Agriculture
CVLD:	Continuous Vapor Leakage Detection, another name for Vapor Leak Detection
EO:	Executive Order
ESO:	Emergency Shut Off
EVR:	Enhanced Vapor Recovery
GDF:	Gasoline Dispensing Facility
GM:	*Green Machine*
HC:	Hydrocarbon
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
PMC:	Pressure Management Control
PTO:	Permit to Operate
P/V Valve:	Pressure Vacuum Valve
TLS:	Tank Level System
Ullage:	Vapor space above liquid in a UST
UST:	Underground Storage Tank
VOC:	Volatile Organic Compounds
VST:	Vapor Systems Technologies, Inc.
WC:	Water Column

2 Safety

- The *Green Machine* will be installed near locations where highly flammable and explosive gasoline vapors may be present.
- Installation of the *Green Machine* 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 *Green Machine* prior to installation.

CAUTION: ALL SERVICEABLE / REPLACEMENT PARTS MUST BE OBTAINED FROM VST TO MAINTAIN SUITABILITY FOR A DIVISION 2 LOCATION.

3 *Green Machine* Description

3.1 Green Machine Theory of Operation

- The VST *Green Machine* does not interact directly with the other balance system hardware. It is in place to 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 *Green Machine* will typically not need to operate.

    - During periods of less activity, such as the GDF being shut down overnight, winter fuels being present or other conditions that promote the pressurization of the ullage space, the *Green Machine* will operate as needed to control the pressure in the ullage space to an accepted level. The *Green Machine* will turn on at an ullage pressure of +0.20 inches of water. Currently, the *Green Machine* unit is monitored and controlled through the TLS-350 PMC or ISD software and the VST Control Panel.

- When the UST pressure increases to above +0.20 inches of water, a TLS-350 AUX contact closes. The AUX contact is connected to the VST Control Panel, which is the mechanism that starts the *Green Machine*. The VST Control Panel manages the operation of the *Green Machine* including the ON, PURGE, and OFF cycles.

- These preset pressure measurements control the UST pressure below atmospheric pressure. The pressure data is provided to the TLS-350 for system monitoring functions.

- The TLS-350 monitors the UST pressure via a pressure sensor located in a dispenser. **See Figure 1**.

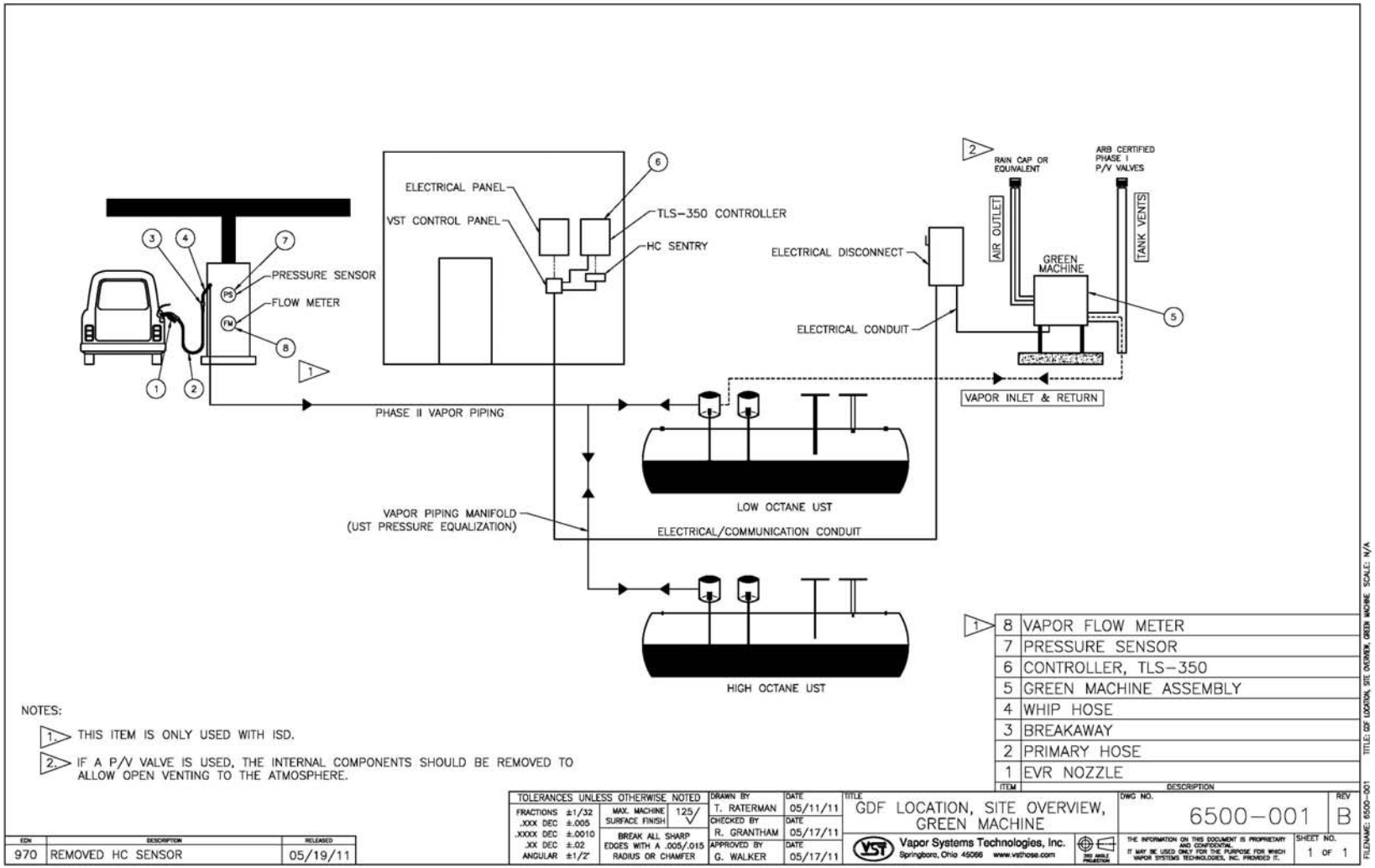

Figure 1: *Green Machine* GDF Layout

3.2 Regulations & Jurisdiction

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

- 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 *Green Machine* cover has been evaluated as a Class I, Division 2 hazardous area as defined by the National Electric Code /NFPA 70 Article 514 table 514.3(B)(1) and verified by Intertek."

C A U T I O N

Always obtain approval from the local authority having jurisdiction.

Installation of the *Green Machine* 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

3.3 Green Machine Dimensions & Weight

Description	Dimensions	Weight
Green Machine	L-39" x W-27" x H-43" Height includes 18" legs	225 lbs. w/o Cover w/o Control Panel
Green Machine Aluminum Cover	L-39" x W-27" x H-25" (one-piece unit)	24 lbs.
Green Machine Fire-Resistant Enclosure (Optional)	L-41" x W-27" x H-36" (side panels are removable)	100 lbs.

3.4 Green Machine Replacement Components

CAUTION: ALL SERVICEABLE/REPLACEMENT PARTS MUST BE OBTAINED FROM VST TO MAINTAIN SUITABILITY FOR A DIVISION 2 LOCATION.

Part #	Description
GM-004	Coupling Rubber Sleeve

3.5 How the Green Machine is Shipped

The *Green Machine* is shipped with the following:

- *Green Machine* - VST-GM-CS1-100
  - Aluminum Cover
  - Control Panel
  - 4 Steel Legs
  - 16 3/8" bolts / washers / nuts
    (to attach the legs to the *Green Machine* base)
  - HC Sentry Interface Module with 24 VDC power supply
  - HC Sentry Interface Cable
- Bolted to a skid
- Owner package with warranty paperwork to be filled out and returned to VST.

Shipping Check

When you open the container:

- Verify that all the item**s** are in the shipping container.

- Visually inspect all the items for any obvious damage.

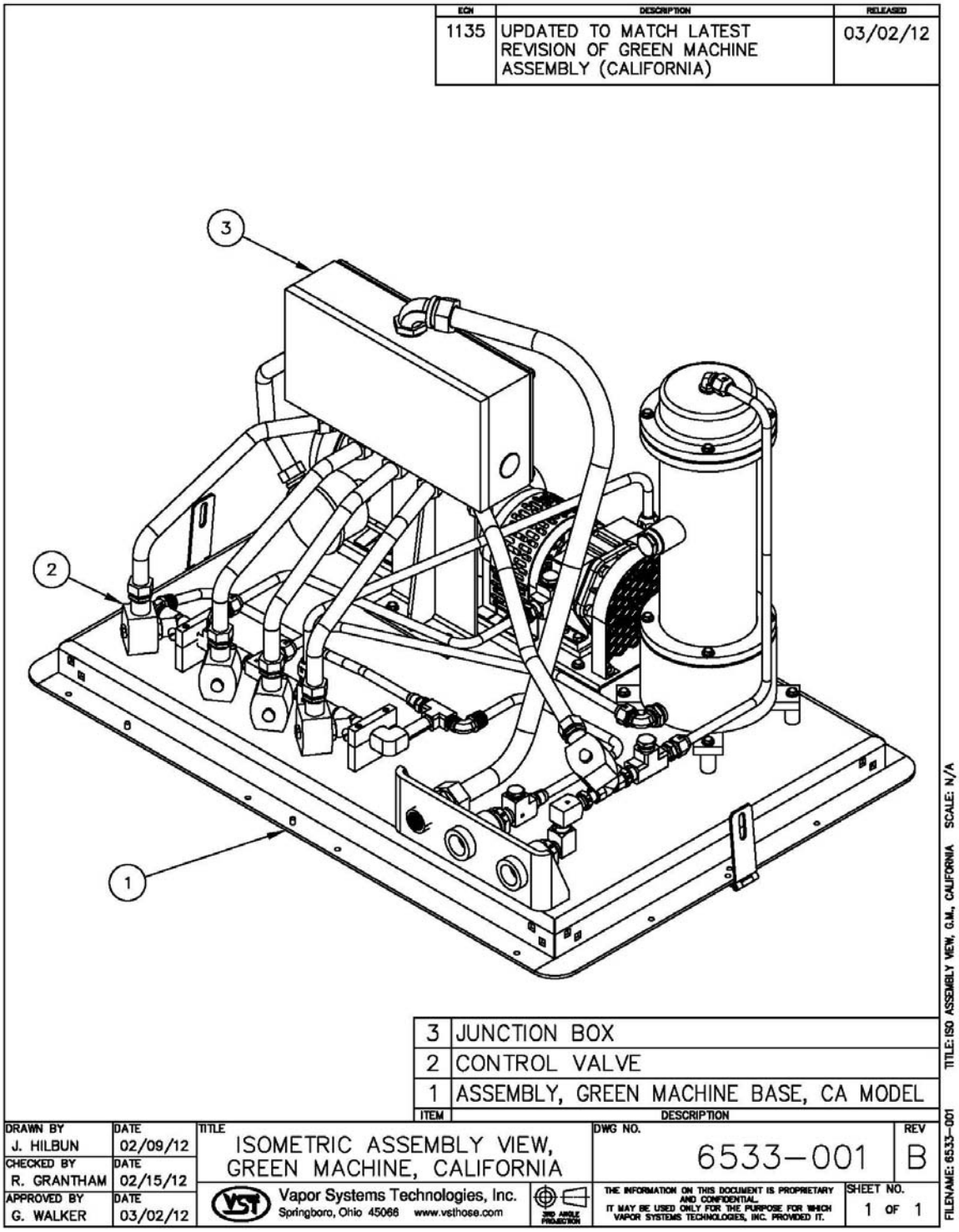

Figure 2: *Green Machine* Isometric View (1 of 2)

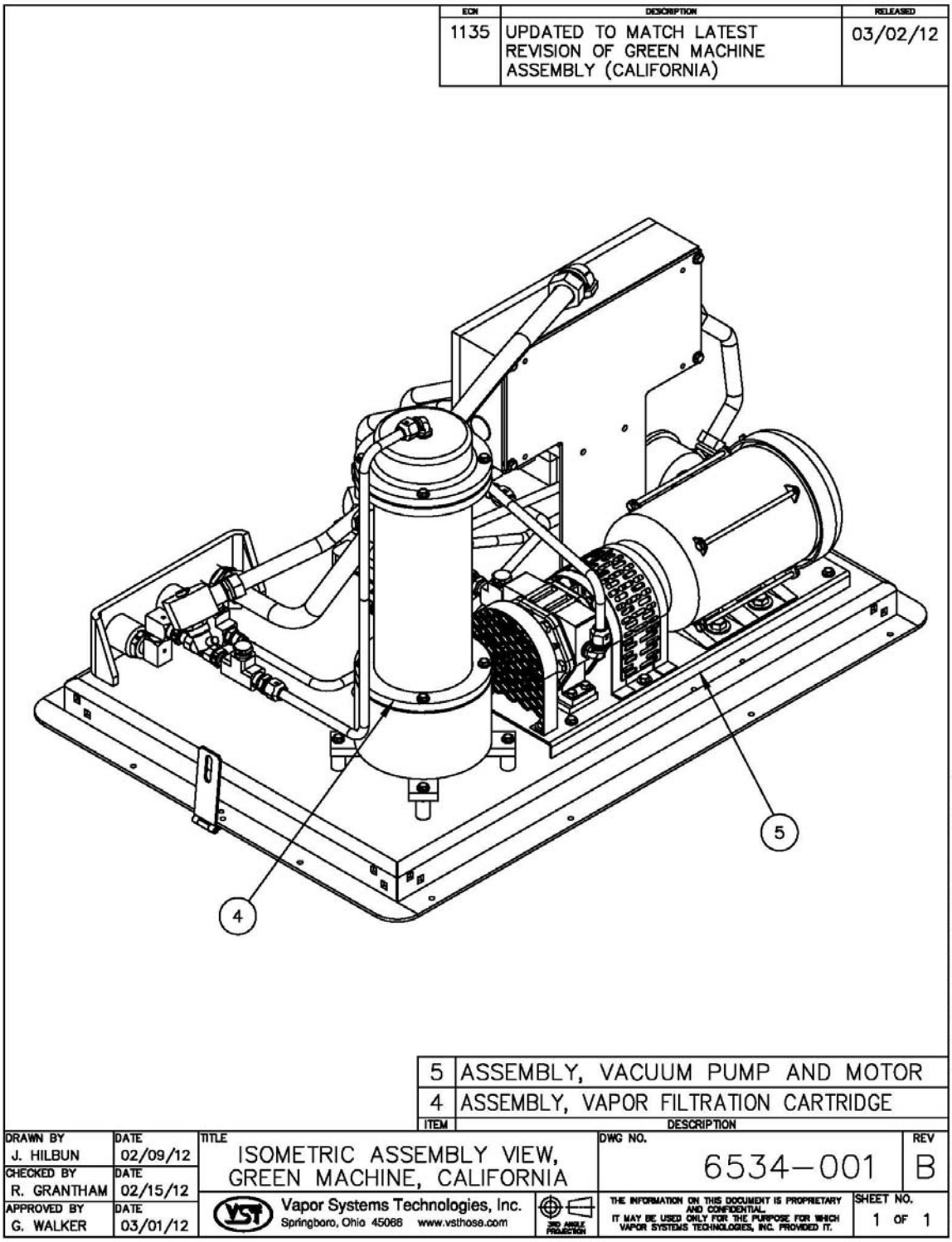

Figure 3: ***Green Machine*** **Isometric View (2 of 2)**

Installation

4 Snapshot of Site Requirements

Local Air Pollution Control District
• GDF must contact the local air pollution control district for specific local vapor recovery requirements.
Common Requirements
• The *Green Machine* must be protected from damage.
• VST recommends an 18" perimeter around the *Green Machine* for maintenance and testing.
• The *Green Machine* must be located at least 10' from the property line unless a variance is obtained from the local authority.
• The *Green Machine* must be located within 100' of the vent risers.
Ground-Mount Location
• Obtain approval from the local jurisdiction for the *Green Machine* to be placed on the ground.
Vent Riser Mount
• Obtain approval from the local jurisdiction for the *Green Machine* to be placed on the vent riser support structure.
• The support structure must be of adequate strength to support the *Green Machine.*
Roof-Mount Location
• Obtain approval from the local jurisdiction for the *Green Machine* to be placed on the roof.
• Structure must be strong enough to hold the weight of the *Green Machine.*
• The height of the *Green Machine* must allow for the proper vapor-piping slope.
Canopy-Mount Location
• Obtain approval from the local jurisdiction for the *Green Machine* to be placed on the canopy.
• Structure must be strong enough to hold the weight of the *Green Machine.*
• All safety and code concerns have been addressed.
UST Manifolding
• UST's must be manifolded either below grade or at the vent risers. • Only a single vent is required.
Dispensers
• The dispenser vapor piping must be sized adequately to meet the maximum pressure drop requirement. A minimum one-inch (1") nominal internal diameter for the vapor down pipe is recommended.
UST Fuel Level Management
• Must be able to access an Overfill Alarm contact with the VST Control Panel *Green Machine* Controller.

Snapshot of Site Requirements, cont.

VST Control Panel
• VST Control Panel completely powers the *Green Machine* via one 115VAC, 20-amp breaker.
• The VST Control Panel must be installed inside the GDF electrical room.
• The VST Control Panel is UL approved.
Vent Risers
• Only 1 vent riser is required for the installation of the *Green Machine.*
• Recommended slope of ¼" per foot on all vapor-piping connecting the *Green Machine* 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.)
• Any type of trap, other than the ARB-approved liquid-condensate trap (regardless of the *Green Machine* location), is not permitted in any vapor lines connected to the *Green Machine.*
• A 5' radius around the vent riser P/V valve is a Class I, Div. 2 hazardous area as defined in NFPA 70.
Veeder-Root Controls
• Must have TLS-350 with appropriate Veeder-Root software installed.
CARB Requirements
• Executive Order: VR-203/204.

4.1 Pre-Installation Site Survey

- VST created a "*Green Machine* Pre-Installation Site Survey" as a guide to help certified installers and troubleshooters in the planning of a *Green Machine* installation.

- The "*Green Machine* 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 "*Green Machine P*re-Installation Site Survey" on our website at www.vsthose.com.

5 Contractor Supplied Components

5.1 Contractor Supplied - Vapor Piping Components

Quantity	Component(s)
2	1” diameter straight tee’s with caps
2	1” diameter unions
2	1” diameter locking ball valves
1	Straight tee (sized to match existing vent riser)
1	1” x 2” galvanized reducer bushing
1	Straight tee with cap (sized to match new vent riser)
1	Rain cap (on new vent riser)
As required	1” diameter pipe, elbows, and misc. pipe fittings
5	Locks: 2- cover, 2-locking ball vales, 1-control cabinet

5.2 Contractor Supplied - Electrical Components

Component(s)
• Wires
• Conduits
• Fittings
• Seal-Offs
• Safety Disconnect Switch
• Optional 115 VAC Outlet
• 115 VAC relay

6 Ground Mount Installation

6.1 Protecting the Green Machine

- Take measures to protect the *Green Machine* 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 *Green Machine* with lockable hasps to prevent tampering. The contractor will provide the locks for the hasps.

- VST requires a lockable ball valve be used at both the inlet and outlet connections at the *Green Machine*.
  - VST does not include any locks or lockable valves for the *Green Machine*; 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.
  - Some local jurisdictions may require that the lockable Safety Disconnect Switch, ball valves, and the cover be locked.

- The *Green Machine* standard aluminum cover and the optional 2-hour Fire Resistant Enclosure are both designed and built to withstand snow accumulation, rain, and landscaping sprinklers.

6.2 Ground-Mount Location

Ground Mount Requirements
• The *Green Machine* must be protected from damage.
• VST recommends an 18" perimeter around the *Green Machine* for maintenance and testing.
• The *Green Machine must* be located at least 10' from the property line unless a variance is obtained from the local authority.
• The *Green Machine must* be located within 100' of the vent risers.
• The local jurisdiction must allow the *Green Machine* to be placed on the ground.
• To minimize the installation cost and to maximize operating efficiency, locate the *Green Machine* adjacent to the existing vent risers.
• A new air outlet vent riser connected to the *Green Machine* must be installed to release air to the atmosphere.
• VST requires setting the *Green Machine* on a concrete pad with the recommended following minimum dimensions: o 6" concrete pad o 3'6" long x 2'6" wide
• Follow the local jurisdiction's building codes: o VST does not provide any hardware to install the *Green Machine* on the pad.

6.3 Installing the Green Machine on the Concrete Pad

1.	After the concrete has properly cured, install the expansion anchor bolts according to the manufacturer's recommendations.
2.	VST recommends using the HILTI KWIK TZ (KB-TZ) BOLT, KB-TZ 3/8" x 5", approved equal for seismic and non-seismic installations.
3.	Since seismic regulations may be different by location, VST has not included a specific drawing for this application. For seismic design reference, www.us.hilti.com.
4.	The contractor or design engineer is responsible for sizing the expansion anchors and the concrete pad to meet specifications required by local jurisdictions.
5.	After the appropriate anchor bolts have been installed, position the *Green Machine* onto the anchor bolts in the cement slab.
6.	Bolt the *Green Machine* 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.	VST CANNOT BE RESPONSIBLE FOR DAMAGE CAUSED BY IMPROPER *GREEN MACHINE* FOUNDATION SUPPORT.

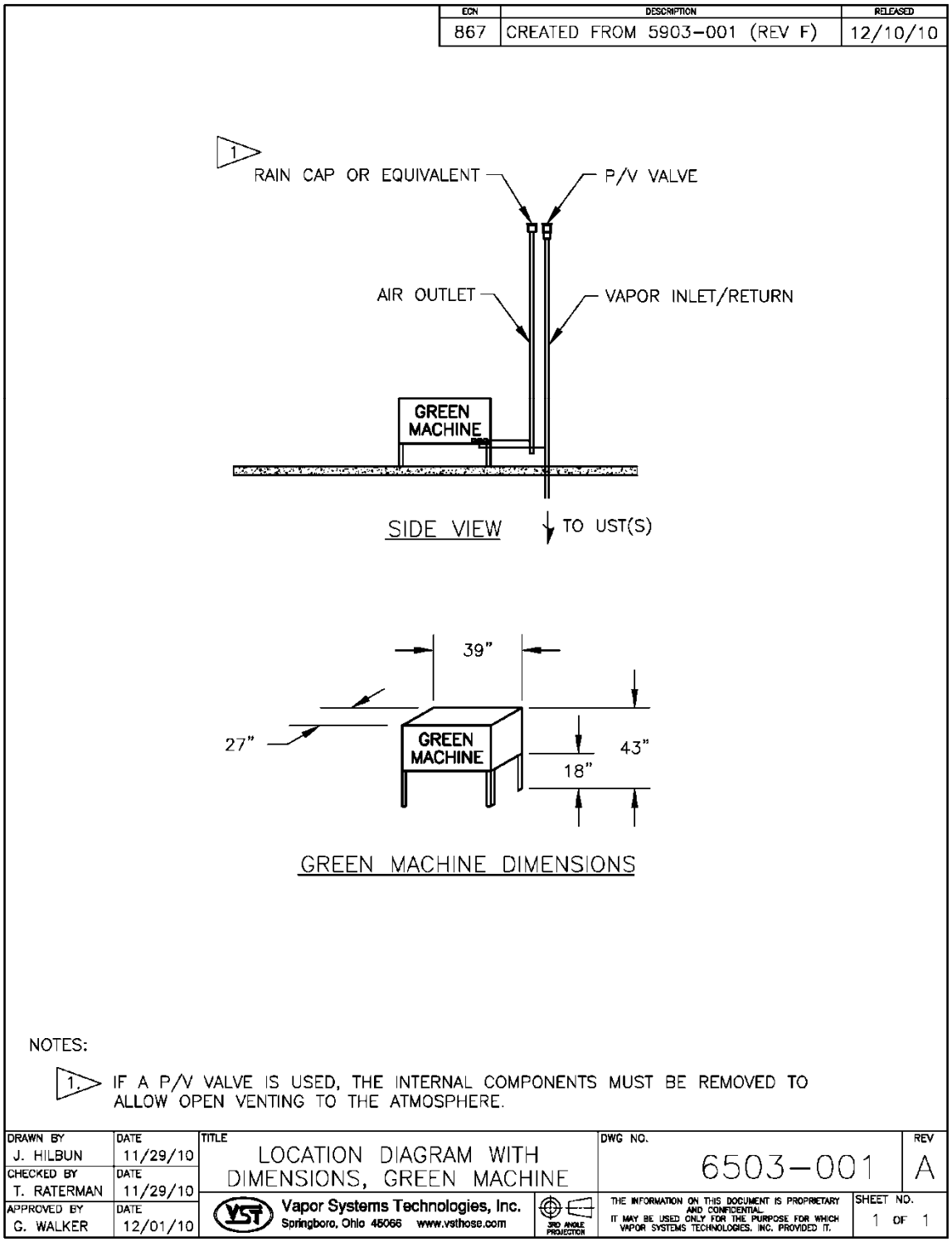

Figure 4: Location & Dimensions

6.4 After an Earthquake

- Insure the *Green Machine* unit is:
  - Level
  - All piping fittings are leak free by conducting a Leak Test as outlined in this document.
  - All the electrical fitting and connections are tight.

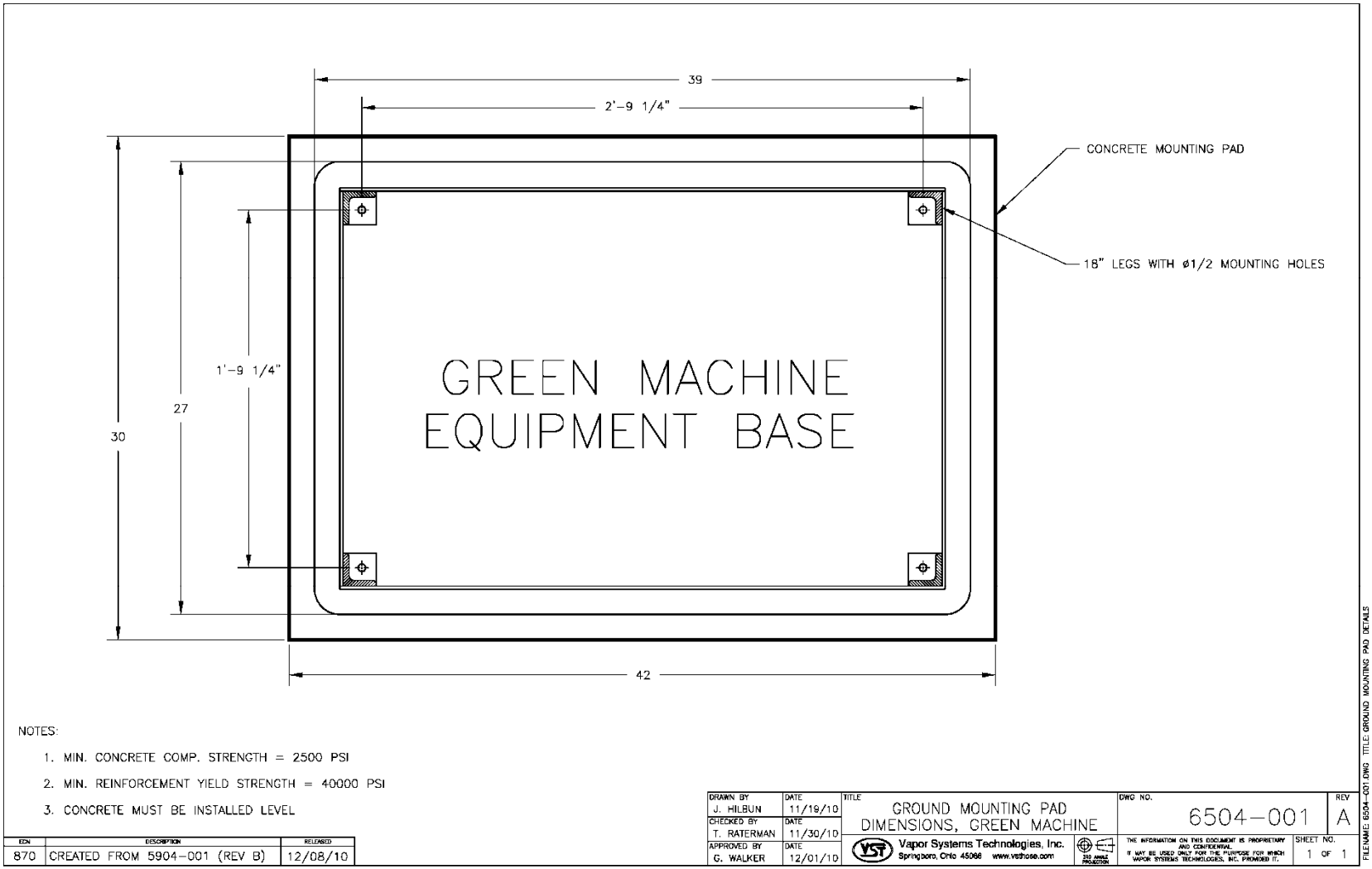

Figure 5: Mounting Pad Plan View

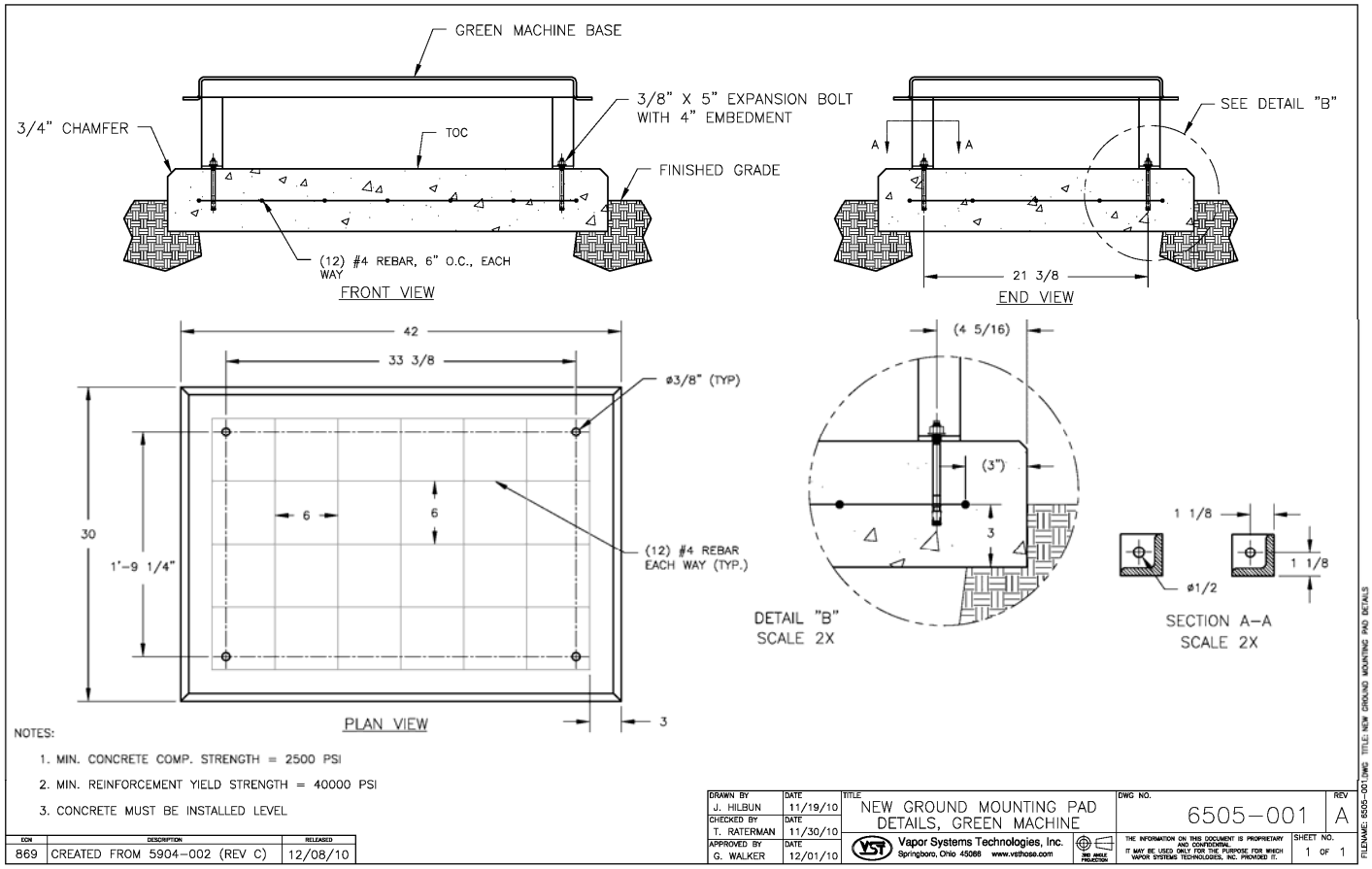

Figure 6: 6" Mounting Pad Details

7 Roof-Top Installation

Roof Top Installation Requirements
• The *Green Machine* must be protected from damage.
• VST recommends an 18" perimeter around the *Green Machine* for maintenance and testing.
• The *Green Machine* must be located at least 10' from the property line unless a variance is obtained from the local authority.
• The *Green Machine* must be located within 100' of the vent risers.
• The local jurisdiction must allow the *Green Machine* to be placed on the roof.
• The *Green Machine* may be installed on a station's roof provided the structure can support the weight of the *Green Machine.*
• The height of the *Green Machine* must allow for the proper vapor-piping slope.
• Due to a variety of roof construction designs, VST cannot recommend how the *Green Machine* should be mounted on the roof; however, the *Green Machine* must be installed at a height allowing the piping inlet and outlets to be above or through the building parapet.
• The *Green Machine* may be secured to a steel structure attached to the roof.
• A new air outlet vent riser connected to the *Green Machine* must be installed to release air to the atmosphere.
• All safety and code concerns should be taken into consideration prior to a rooftop installation.
• VST CANNOT BE RESPONSIBLE FOR DAMAGE CAUSED BY IMPROPER *GREEN MACHINE* FOUNDATION SUPPORT.

8 Canopy-Top Installation

Canopy Top Installation Requirements
• The *Green Machine* must be protected from damage.
• VST recommends an 18” perimeter around the *Green Machine* for maintenance and testing.
• The *Green Machine* must be located at least 10’ from the property line unless a variance is obtained from the local authority.
• The *Green Machine* must be located within 100’ of the vent risers.
• The local jurisdiction must allow the *Green Machine* to be placed on the canopy.
• The *Green Machine* may be installed on a station’s roof provided the structure can support the weight of the *Green Machine.*
• The height of the *Green Machine* must allow for the proper vapor-piping slope.
• Due to a variety of canopy construction designs, VST cannot recommend how the *Green Machine* should be mounted on the canopy.
• The *Green Machine* may be secured to a steel structure attached to the roof.
• A new air outlet vent riser connected to the *Green Machine* must be installed to release air to the atmosphere.
• All safety and code concerns should be taken into consideration prior to a canopy installation.
• VST CANNOT BE RESPONSIBLE FOR DAMAGE CAUSED BY IMPROPER *GREEN MACHINE* FOUNDATION SUPPORT.

9 Vent-Stack Mount Installation

Vent Stack Installation Requirements
• The *Green Machine* must be protected from damage.
• VST recommends an 18" perimeter around the *Green Machine* for maintenance and testing.
• The *Green Machine* must be located at least 10' from the property line unless a variance is obtained from the local authority.
• The *Green Machine* must be located within 100' of the vent risers.
• The local jurisdiction must allow the *Green Machine* to be placed on the canopy.
• The *Green Machine* may be installed elevated next to existing vent risers provided there is an existing structure that can support the weight of the *Green Machine,* or a structure can be installed to the support the weight of the *Green Machine.*
• Due to a variety of construction designs, VST cannot recommend how the *Green Machine* should be installed or mounted on vent riser supports; however, the structure that supports the *Green Machine* must be designed and installed at a height allowing the piping inlet and outlets to connect to the existing vent risers.
• A new air outlet vent riser connected to the *Green Machine* must be installed to release air to the atmosphere.
• The *Green Machine must* not be installed within 5' of a P/V valve opening.
• A Registered Design Engineer is responsible for designing the support structure, support base, all required hardware and bolting connections, and the support structure foundation to meet seismic specifications that may be required by local jurisdictions.
• VST CANNOT BE RESPONSIBLE FOR DAMAGE CAUSED BY IMPROPER *GREEN MACHINE* FOUNDATION SUPPORT.

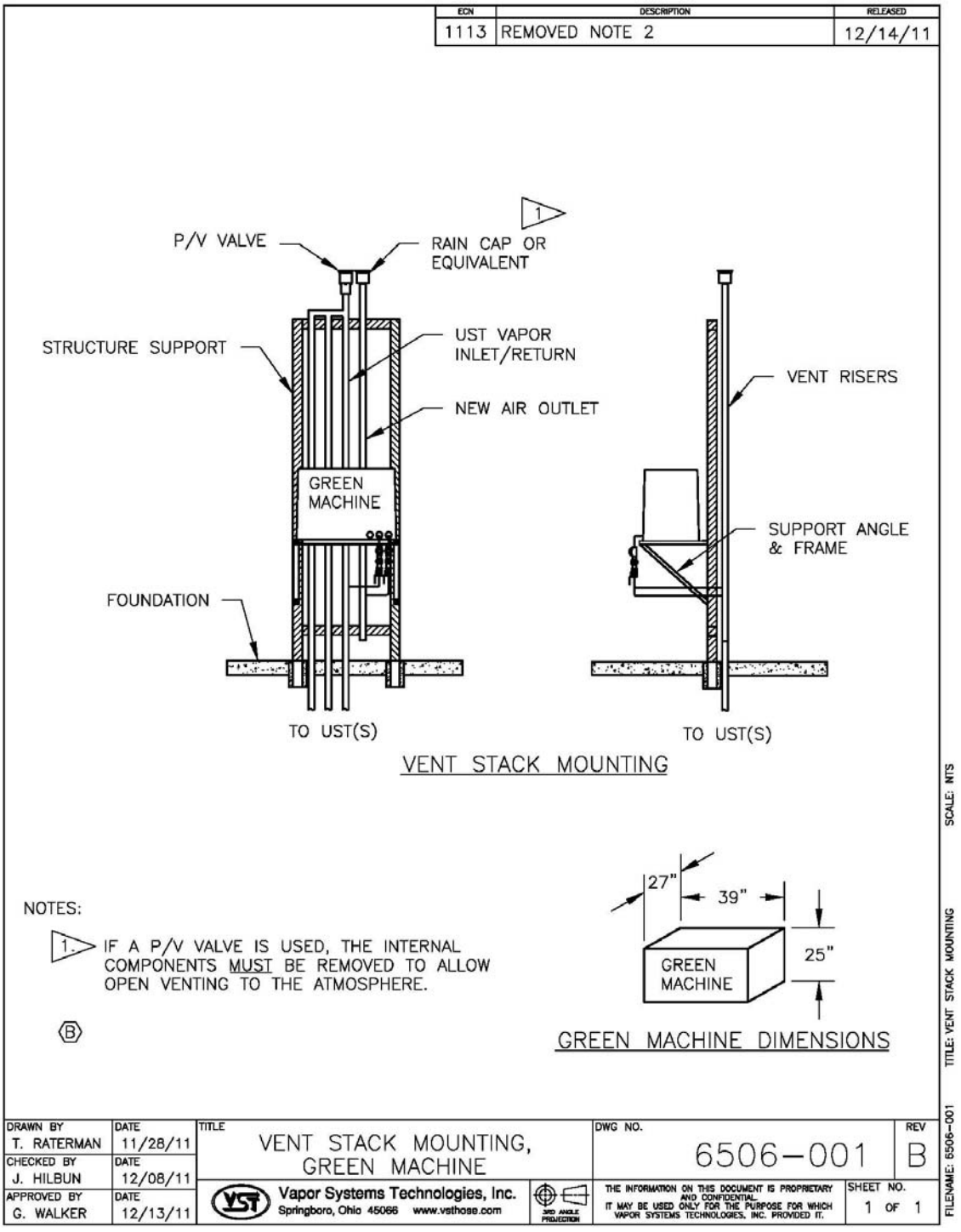

Figure 7: Vent Stack Installation

10 Vapor Piping

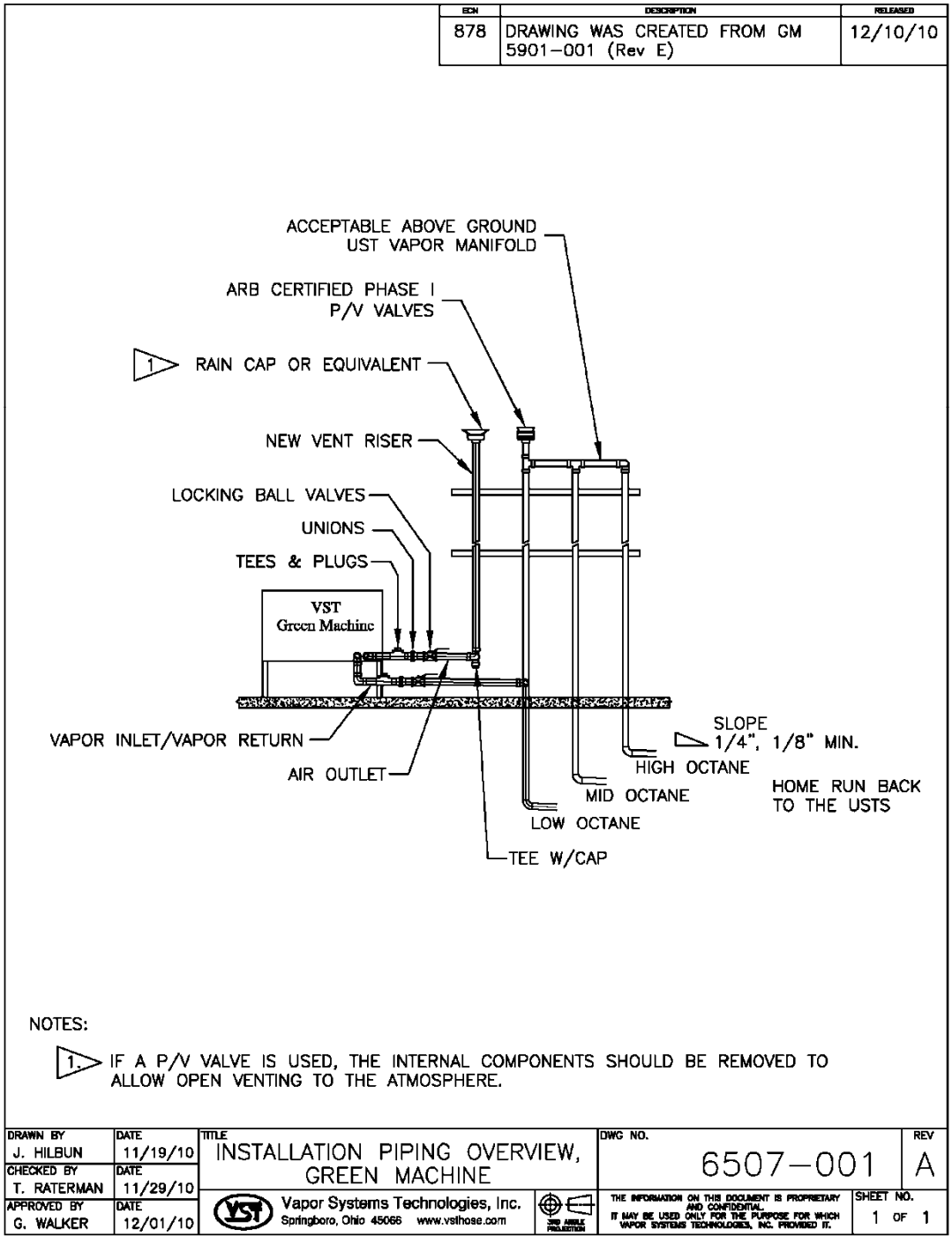

Figure 8: Vapor Piping Overview

Vapor Piping (continued)

- There are 2 piping connections to be made to the *Green Machine*:
  - Vapor inlet/return to the UST vapor-piping system.
  - Air outlet to atmosphere.

- The *Green Machine* piping connections are 1” diameter National Pipe Thread (NPT).

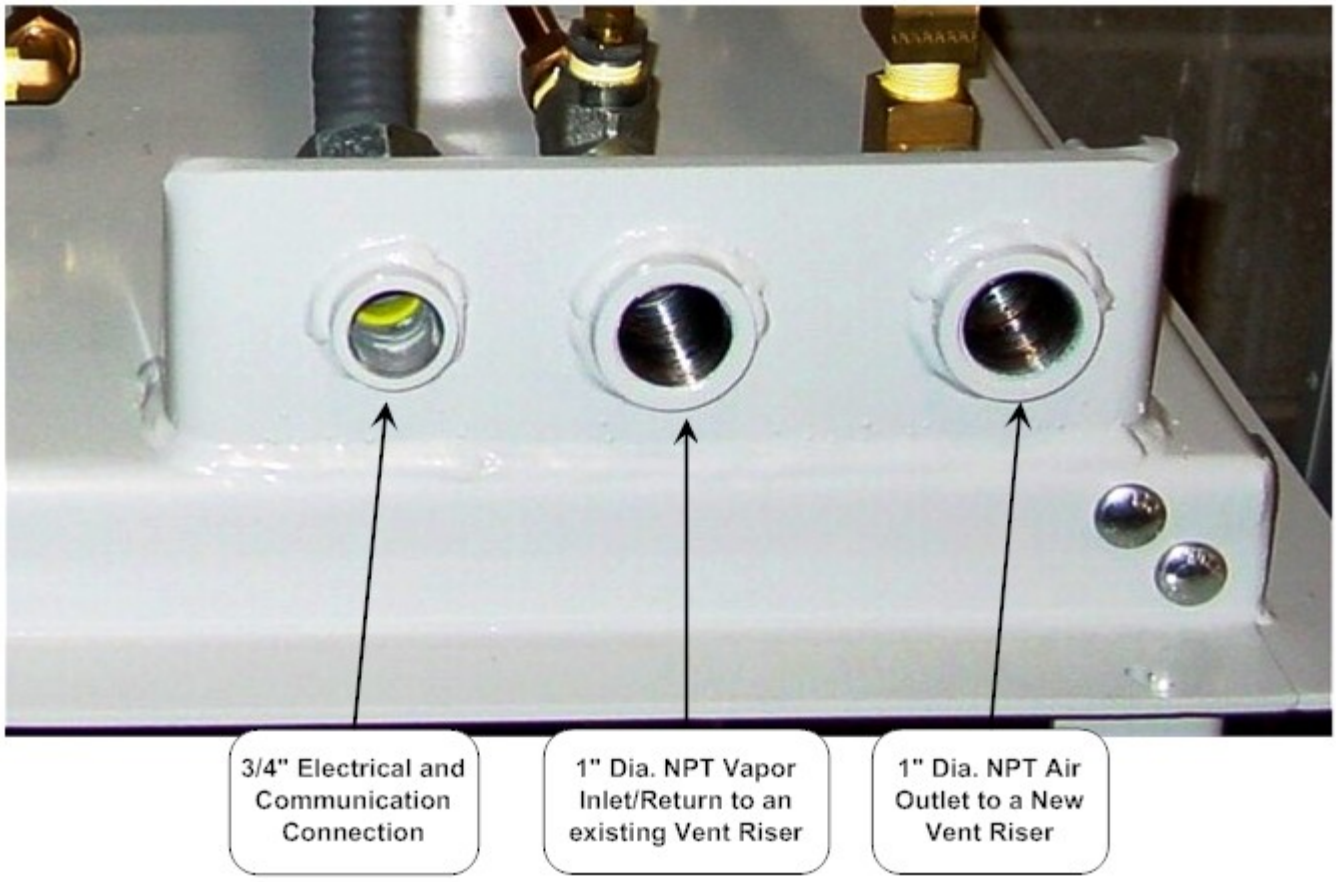

Figure 9: *Green Machine* Connections

10.1 Vapor Piping Installation Instructions

1. Install the vapor air inlet/return piping as shown in **Figure 9** from the vapor inlet/return connections on the *Green Machine* to an existing vent riser.
    - The existing vent riser must be modified by adding a tee for connecting the existing vent riser to the *Green Machine*.
    - The new tee must be installed to allow for slope from the *Green Machine* to the existing vent riser.
    - If there are multiple-grade UST's and multiple vent risers, VST recommends connecting the *Green Machine* to the lowest octane vent riser.

2. Install piping as shown in **Figure 9** from the vapor air outlet to a new vent riser.
    - The new vent riser may be installed next to the existing vent riser.
    - The piping from the *Green Machine* to the new vent riser MUST slope AWAY from the *Green Machine*.
    - 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.
    - A rain cap or equivalent must be installed on the new air outlet vent riser. Equivalent: If a PV vent valve is used the internal components must be removed to allow open venting to the atmosphere.
    - Install a tee with a cap at the bottom of the new air outlet vent riser to provide for drainage.

3. If flexible piping is required by the local authority to meet seismic requirements, install the flexible piping between the *Green Machine* locking ball and the vent riser(s).
    - The slope of the flex connection from the *Green Machine* back to the vent riser must be greater than 1/8" per foot slope.
    - The flexible connector must be UL approved for a service station above-ground application.
    - Support the flexible piping per manufacturer's recommendation.
    - The local contractor is responsible for providing all necessary galvanized piping, non-hardening pipe-joint compound, and plumbing fittings.

4. Make sure the gasoline UST tanks vapor piping is manifolded either above ground or below ground.

5. Local jurisdictions require that locks be installed on the cover of the *Green Machine*, on the Safety Disconnect Switch, and on the valves to prevent unauthorized tampering of the equipment.
    - Under normal operation, the valves must be locked in the open position.

10.2 Vapor Piping Post Installation

- After all piping has been installed; make sure the 2 lockable ball valves are in the closed position.
- Make sure all the pipe connections are tight.
- Make sure there is proper slope from the *Green Machine* to the vent risers.
- Make sure there are no traps between the *Green Machine* and the vent risers.
- If flex piping is used, make sure the flexible piping is adequately supported.
- All connections to the *Green Machine* must be galvanized pipe.

10.3 Vapor Piping Bill of Material - Contractor Supplied

Quantity	Component(s)
2	1” diameter straight tee’s with caps
2	1” diameter unions
2	1” diameter locking ball valves
1	Straight tee (sized to match existing vent riser)
1	1” x 2” galvanized reducer bushing
1	Straight tee with cap (sized to match new vent riser)
1	Rain cap (on new vent riser)
As required	1” diameter pipe, elbows, and misc. pipe fittings
5	Locks: 2- cover, 2-locking ball vales, 1-control cabinet

11 Electrical

- The VST Control Panel and the electrical junction box inside the *Green Machine* arrive from the factory pre-wired.

- The contractor is responsible for supplying all wires, conduits, fittings, seal-offs, and the safety disconnect-switch.

- Lockable safety disconnect-switch as required by the NEC:
  - Must include an interlock device and wired per included drawings.
  - Must be installed within eye-sight of the *Green Machine.*
  - Must not be installed within 3-feet of the *Green Machine.*
  - Consult the NEC for restrictions, location, and type of disconnect.
  - Not provided by VST.

- The *Green Machine* is installed in a Class I, Division 2 hazardous location and therefore requires electrical seal-offs when connecting to ordinary, non-hazardous electrical locations. Consult the NEC and NFPA for installation instructions.

- All wiring (115 VAC and 24VDC) to be TFFN or THHN with 600V insulation.

- All wiring must be gasoline and oil resistant.

- The contractor is responsible for sizing the wire, cable, and conduit according to the NEC.

- All power (115 VAC and 24VDC), the neutral, and the ground wires connected to the *Green Machine* will be disconnected when:
  - The Emergency Shut-Off (ESO) is activated.
  - The safety disconnect-switch is opened.
  - The VST Control Panel breaker is switched OFF at the main distribution panel breaker.
  - The disconnect switch on the VST Control Panel is turned OFF.

11.1 Electrical Requirements

VST Control Panel Power Requirements					
Equipment	**Phase**	**Voltage**	**Amperage**	**Frequency**	**Fuse/Breaker Size**
Main power	1-Phase	115 VAC	20	60-Hz	20 amp breaker
Vacuum Pump Motor	1-Phase	115 VAC	8.8 (See note 1)	60-Hz	10 amp breaker
Control Valves	1-Phase	115 VAC	1.0	60-Hz	5 amp fuse (3 each)
24VDC Power supply	1-Phase	115 VAC	4.0	60-Hz	4 amp fuse
HC Sentry Module	1-Phase	115 VAC	<1.0	60-Hz	
Green Machine Controller		24VDC			Protected by 24VDC power supply

NOTE 1: The 8.8 amp listed is only for the ½ HP, 115 VAC, 1-PH Leeson motor

11.2 Electrical Safety

- The *Green Machine* 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 *Green Machine* or while working on electrical components.
- Always power OFF any electrical components connected to the *Green Machine*. **The *Green Machine* 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 *Green Machine* prior to installation.

11.3 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 *Green Machine* may be required by local jurisdictions to meet seismic code requirements.

- Following such procedures may be required by local, state, and national authorities.

  - The *Green Machine must be installed* in accordance with the National Electric Code (NEC), NFPA 70, and with the Automotive and Marine Service Station Code (NFPA 30A).

  - 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.

  - 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."

11.4 Electrical Components

Existing Components	VST Supplied Components	Contractor Supplied Components
• 115 VAC Main Electrical Panel	• VST Control Panel	• Safety Disconnect Switch with an Interlock

• TLS-350 with:
  • Comm Board
  • Relay Board
  • I.S. Interstitial Module
	• *Green Machine*:
	  • Pre-wired Internal Junction Box
		• All conduit

• Emergency Shut Off	• HC Sentry	• Electrical Seal-Offs • Wire and Cable
	• HC Sentry Interface Cable	• 115VAC relay

11.5 Electrical Installation Procedures

SAFETY PRECAUTION:
PRIOR TO STARTING ANY ELECTRICAL WORK, VERIFY THE BREAKER INSIDE THE PANEL AND THE VST CONTROL PANEL IS LOCKED OUT/ TAGGED OUT, AND VERIFY THAT THE TLS-350 IS IN THE MANUAL OFF MODE.

11.5.1 VST Control Panel Field Wiring Procedure

- **See Figures 16 & 17**
- Drill holes in the VST Control Panel for all wiring connections.
- Install the VST Control Panel **only inside** the GDF per NEC regulations. The location may vary within the GDF given the allowable space. When possible, place the VST Control Panel as close to the TLS-350 as possible.
- Install or have available a 115 VAC, 20-amp, single-phase breaker in the main distribution panel.
- Make sure the 20-amp breaker inside the distribution panel is turned **OFF** and follow lockout/tagout safety procedures.
- Install the 115 VAC power, the neutral, and the ground from the main distribution panel to the VST Control Panel.
  - The wire labels are:
    - Terminal block 02011 – 115 VAC (hot)
    - Terminal block 02012 – 115 VAC (neutral)
    - Terminal block GND - Ground (Gnd)

11.5.2 VST Control Panel Terminal Block Wire Numbers & Descriptions

Use the terminal blocks and description to field wire the VST Control Panel to the Green Machine and supporting electrical equipment.

CAUTION: Power to the VST Control Panel maybe supplied by multiple 115 VAC external power sources.

External power may exist inside the VST Control Panel when:

1. The main 115 VAC power to the panel is turned OFF.
2. The panel ON/OFF switch is turned OFF.
3. The Safety Disconnect is turned OFF.
4. The ESO is activated or not activated.

Terminal Block 02032 - ESO (115 VAC IN)
Terminal Block 02032 - 4-RELAY MODULE (115 VAC OUT)
Terminal Block 02032 - INTERLOCK (115 VAC OUT)
Terminal Block 02023 - INTERLOCK (115 VAC IN)
Terminal Block 02043 - TLS-350 (115 VAC IN)
Terminal block 02044 – OVERFILL (115 VAC IN)

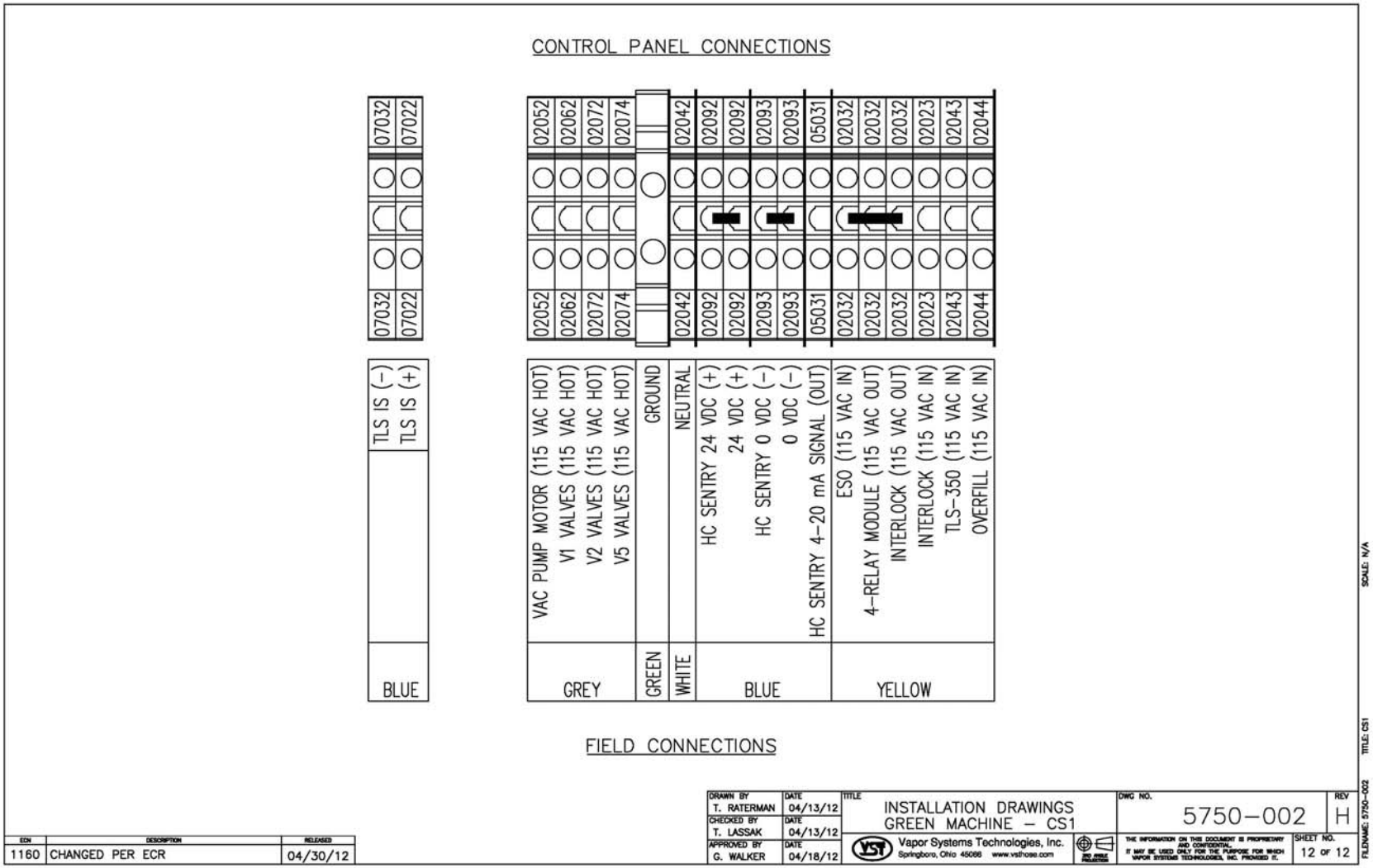

Figure 10: VST Control Panel Field Wiring Numbers and Descriptions

11.5.3 TLS-350 4-Relay Module*: Machine* RUN and Overfill Alarm Output Relay Wiring Procedure

CAUTION: The GM Run and OVERFILL ALARM output relays inside the TLS-350 4-Relay Module can be powered by a 115 VAC power source inside the VST Control Panel or from an external 115 VAC power source. Refer to the TLS-350 installation manual for connecting to and configuring the correct output relays.

GM Run Output Relay:

- **See Figures: 16 & 17 for Option 1, and 18 & 19 for Option 2**
- GM Run output relay (N.O.) closes and turns on the Green Machine when the UST pressure increases to 0.2" WC.
- The GM Run output relay can be powered from the VST Control Panel as OPTION 1. or from an external 115 VAC power source as OPTION 2.
- OPTION 1: If the GM Run output relay is powered from the VST Control Panel, install two wires from the VST Control Panel to the 4-Relay Module.
  - The wire labels are:
    - Terminal block 02032 – 115 VAC IN
    - Terminal block 02043 – 115 VAC OUT
- OPTION 2: Install one wire from the VST Control Panel to the 4-Relay Module if the GM Run output relay is powered from an external 115 VAC power source. The external power source may be from the ESO or another external power source.
  - The wire label is:
- Terminal block 02043 – 115 VAC OUT

OVERFILL ALARM Run Output Relay:

- **See Figures: 16 & 17 for Option 1, and 18 & 19 for Option 2**
- The OVERFILL ALARM output relay (N.O.) shuts down the *Green Machine* when a UST reaches max volume level during a fuel drop.
- The OVERFILL ALARM output relay can be powered from the VST Control Panel as **OPTION 1**. Or from an external 115 VAC power source as **OPTION 2**.
- **OPTION 1**. If the OVERFILL ALARM output relay is powered from the VST Control Panel, install two wires from the VST Control Panel to the 4-Relay Module
  - The wire labels are:
    - Terminal block 02032 – 115 VAC IN (May not be required if the 03023 - 115 VAC wire was used in the GM Run output relay circuit as described above).
    - Terminal block 02043 – 115 VAC OUT.
- **OPTION 2**. If the OVERFILL ALARM output relay is powered from an external 115 VAC power source, install one wire from the VST Control Panel to the 4-Relay Module. The external power source may be from the ESO or another external power source.
  - The wire label is:
    - Terminal block 02043 – 115 VAC OUT

11.5.4 VST Control Panel to the TLS-350 Intrinsically Safe (I.S.) Bay Wiring Procedure

- **See Figures: 15 & 24**
  - The VST Control Panel uses a current transducer to monitor the vacuum pump motor amperage when the Green Machine is running.
  - If the motor amperage falls below a certain value, a relay closes inside the VST Control Panel, which energizes a relay in the I.S. Bay of the TLS-350.
  - Do not run the wire in any conduit where high voltage is present.
  - Connect the wire to an open liquid sensor channel. If there are not any open channels, an additional module will be required.
  - Program the TLS-350 liquid sensor channel as NORMALLY CLOSED for the channel used (ex. L 8).
  - Give the channel that was used a custom label to identify it as the Green Machine Motor Fault input: "GM Motor Fault."
  - The TLS will display: "LX: Fuel Alarm" when the GM is in a Motor Fault condition, with "X" being the channel used for the sensor.
  - After the Motor Fault alarm occurs, the printer will show the "GM Motor Fault" label on the automatic printout.
- Install a 2-conductor, shielded, 18 gauge, twisted pair, with a drain wire, cable from the VST Control Panel I.S Bay.
  - Terminate field wiring into TLS Console and connect to Interstitial Sensor Interface Module located in the intrinsically safe wiring compartment of the TLS as shown in Figure 4. Note: observe polarity! The cable length between the console and sensor must not exceed 1000 feet.
  - Attach the cable shield to the ground lug closest to the conduit entry inside the I.S. Bay. Do not ground both ends of the shield.
  - Terminal block 07022 – (+)
  - Terminal block 07032 – (-)

CAUTION: Refer to the TLS-350 installation manual for connecting to and configuring the correct output relays.

Note: Intrinsically safe devices must be installed in accordance with Article 504 of the National Electrical

11.5.5 RS422 to RS232 Adapter to TLS-350 RS32 Port Connections

- See **Figures 11 - 15**

- Per ARB Advisory 355, there must be an available RS232 port for the district inspector to use for downloading data from the TLS-350. Check the TLS-350 to see if there are 2 or more available RS232 serial ports. One DB9 female RS232 port will be found on the required Multi-port MODBUS communication card in the TLS-350. Check to see if there is an additional port on another card available. If there are two or more ports available, use Option A for the connections. This is a direct connection from the Adapter to the TLS-350. If there is only one port available, use Option B for the connections. This connection method uses an RS232 Port Combiner to allow sharing of a serial port.

- The RS422 to RS232 adapter is attached to the top of the VST Control Panel.
  See figures 12 & 13.

- **OPTION A**: Using the 6 foot RS232 (DB9 Male to Male) serial cable supplied with the VST *Green Machine*, connect one end of the serial cable into the RS232 port on the Adapter located on top of the VST Green Machine Control Panel and the other directly to the TLS-350 Multi-port MODBUS card. Secure these connections. If a longer cable is needed it may be ordered, however the cable length should not exceed 50 feet. Finally set the communications setting for the COM 6 in the TLS-350 to 9600 BPS, 8 data bits, 1 stop bit, No parity. **See figure 11.**

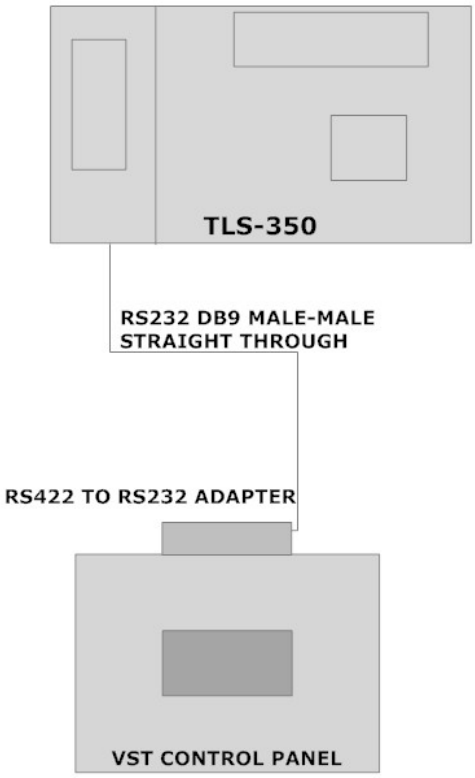

Figure 11: RS422 to RS232 Adapter to TLS-350 Connection - Option A Direct Connection

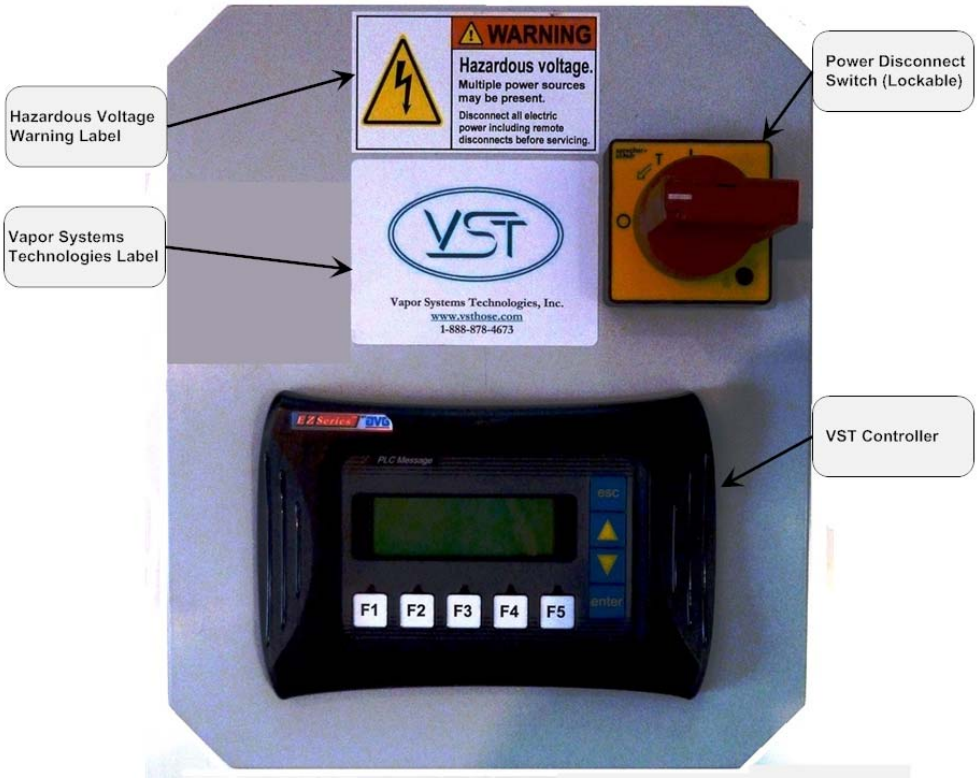

Figure 12: VST *Green Machine* Control Panel Front View

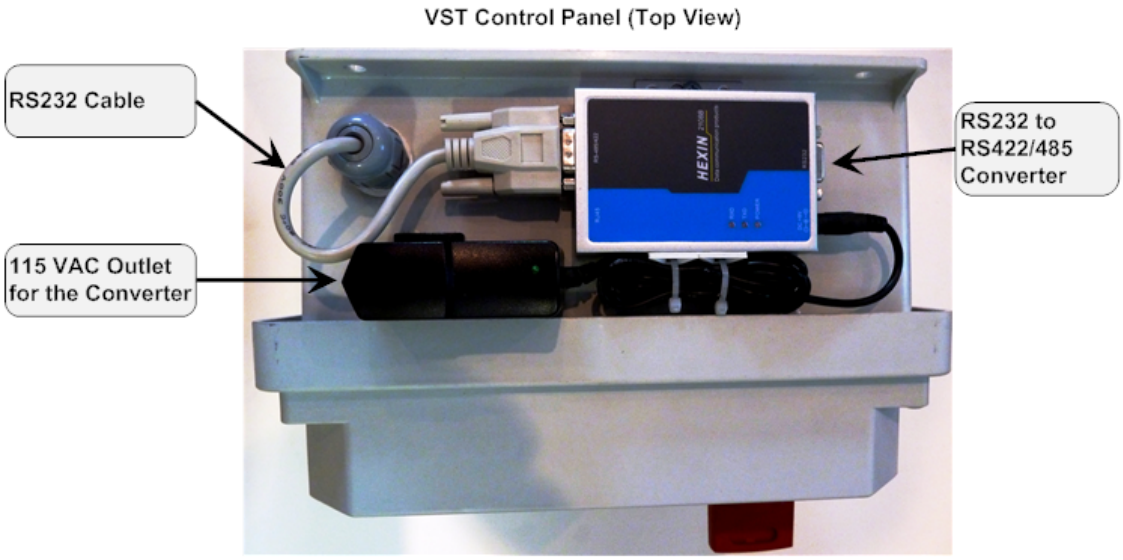

Figure 13: VST *Green Machine* Control Panel Top View of Adapter

- **OPTION B**: If there is not an available communications port for the inspector to use, an RS232 Port Combiner must be used to allow sharing of the serial port. This optional TLS-350 Inspector Port Communications Kit, GM-032, containing an RS232 Port Combiner, an RS232 Null Modem DB9 Male to Male cable, an RS232 Straight Through DB9 Male to Male cable and AC adapter for the Port Combiner must be purchased through VST. The inspector may gain access to the TLS-350 through the Port Combiner's open port.

- Using the 6 foot RS232 Null Modem (DB9 Male to Male) serial cable supplied with the VST *Green Machine*, connect one end of the serial cable into the RS232 port on the Adapter located on top of the VST Green Machine Control Panel and the other into the slave connection on the Port Combiner. If a longer cable is needed it may be ordered, however the cable length should not exceed 50 feet. Connect one end of the RS232 Straight Through DB9 Male to Male cable to the Master port on the Port Combiner and the other end directly to the TLS-350 Multi-port MODBUS card. Secure these connections. This leaves the second slave port open for the inspector's use. Install the Null Modem adapter to this port. Finally set the communications setting for the COM 6 in the TLS-350 to: 9600 BPS, 8 data bits, 1 stop bit, No parity. **See figure 14.**

- Attach the port combiner and its power source next to an available outlet close to the TLS-350. Having the port combiner next to the TLS-350 will be a convenience for the inspector.

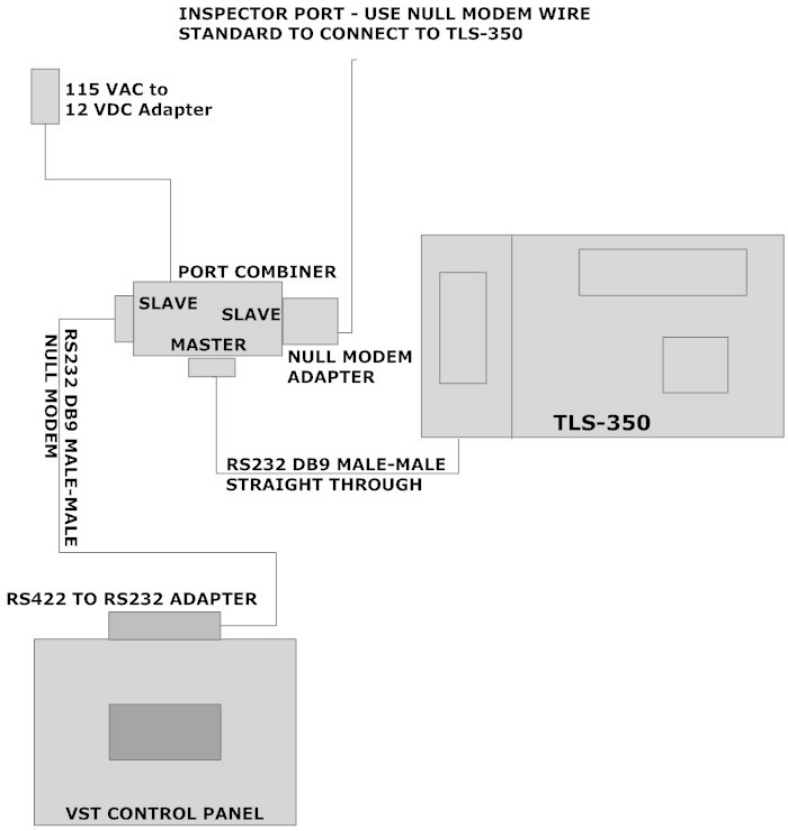

Figure 14: RS422 to RS232 Adapter to TLS-350 Connection - Option B Using a Port Combiner

11.5.6 GDF ESO to the VST Control Panel Wiring Procedure

- **See Figures: 16 & 17 for Option 1, and 18 & 19 for Option 2**
  - The ESO (N.C.), when activated, will turn OFF all power and disconnect the neutral and the ground wires to the *Green Machine*.
  - The ESO wire connecting to the VST Control Panel will be 115 VAC HOT as an external power source.

- Install one wire from the VST Control Panel to the ESO control system output relay.

- The wire label is:
  - Terminal block 02032 - ESO (115 VAC HOT).

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

NOTE: The Green Machine will not operate if the ESO is not connected to the VST Control Panel.

11.5.7 VST Control Panel to Safety Disconnect Switch Wiring Procedure

- **See Figures 15 & 20**

- Install 8 wires from the VST Control Panel to the Safety Disconnect Switch
  - 2 wires connect to the interlock switch located in the Safety Disconnect Switch
    - The terminal block label is:
      - Terminal block 02032 - INTERLOCK (+) 115VAC
      - Terminal block 02023 - INTERLOCK (-) 115 VAC
      - Note: The Green Machine will not operate if this circuit is not complete.

  - 5 wires connect to the Safety Disconnect Switch:
    - L1 is for the Vacuum Pump power:
      - Wire number 02052 - VAC PUMP MOTOR (115 VAC HOT).
      - Requires a 10 amp fast acting fuse.
    - L2 is for the V1 Control Valves:
      - Wire number 02062 - V1 VALVES (115 VAC HOT).
      - Requires a 5 amp fast acting fuse.
    - L3 is for the V2 Control Valves:
      - Wire number 02072 - V2 VALVES (115 VAC HOT).
      - Requires a 5 amp fast acting fuse.
    - L4 is for the V5 Control Valves:
      - Wire number 02074 - V5 VALVES (115 VAC HOT).
      - Requires a 5-amp, fast-acting fuse.
    - One ground wire: GND.

  - 1 wire passes through the safety-disconnect switch without any connections:
    - 1 neutral wire.

11.5.8 Safety Disconnect Switch to Internal Junction Box Wiring Procedure

- **See Figures 15 & 21**

- Install 6 wires
  - 6 wires connect to the *Green Machine* Internal Junction Box.
  - L1 is for the Vacuum Pump power:
    - Wire number 02052 - VAC PUMP MOTOR (115 VAC HOT).
  - L2 is for the V1 Control Valves:
    - Wire number 02062 - V1 VALVES (115 VAC HOT).
  - L3 is for the V2 Control Valves:
    - Wire number 02072 - V2 VALVES (115 VAC HOT).
  - L4 is for the V5 Control Valves:
    - Wire number 02074 - V5 VALVES (115 VAC HOT).
  - One neutral wire: 02042 - Neutral.
  - One ground wire: Gnd.

11.5.9 HC Sentry Wiring Procedure

- Install a 2-conductor, 24 gauge (minimum), twisted pair, with a drain wire, shielded cable from the VST Control Panel to the HC Sentry Interface Module.
  - **See Figures 15 & 23**
- Install the HC Sentry Interface Cable from the HC Sentry to the TLS-350 Multiport Card/Communication Port.
  - **See Figures 15 & 23**

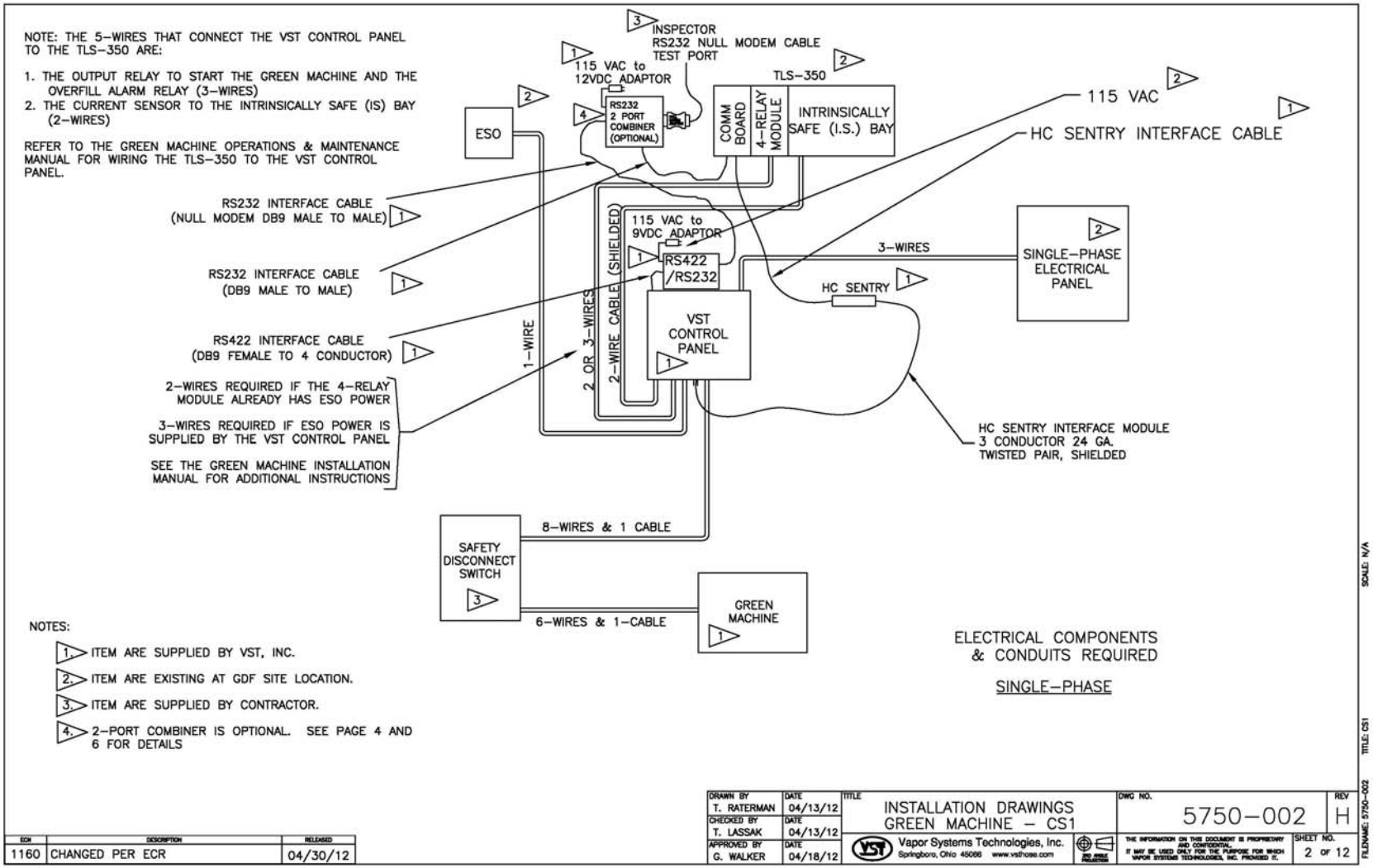

Figure 15: VST Control Panel Wiring Diagram

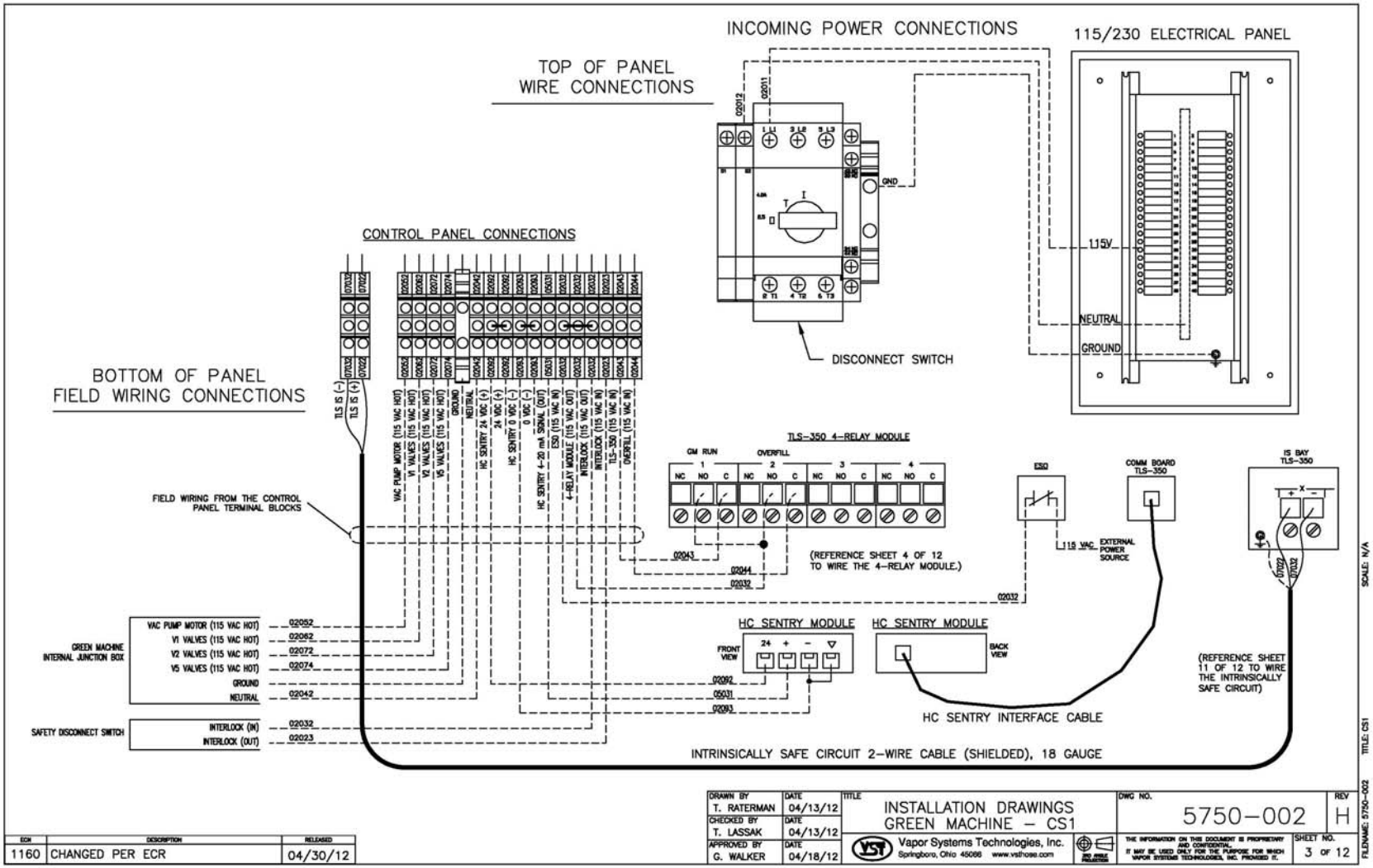

Figure 16: Field Wiring the VST Control Panel, Option 1

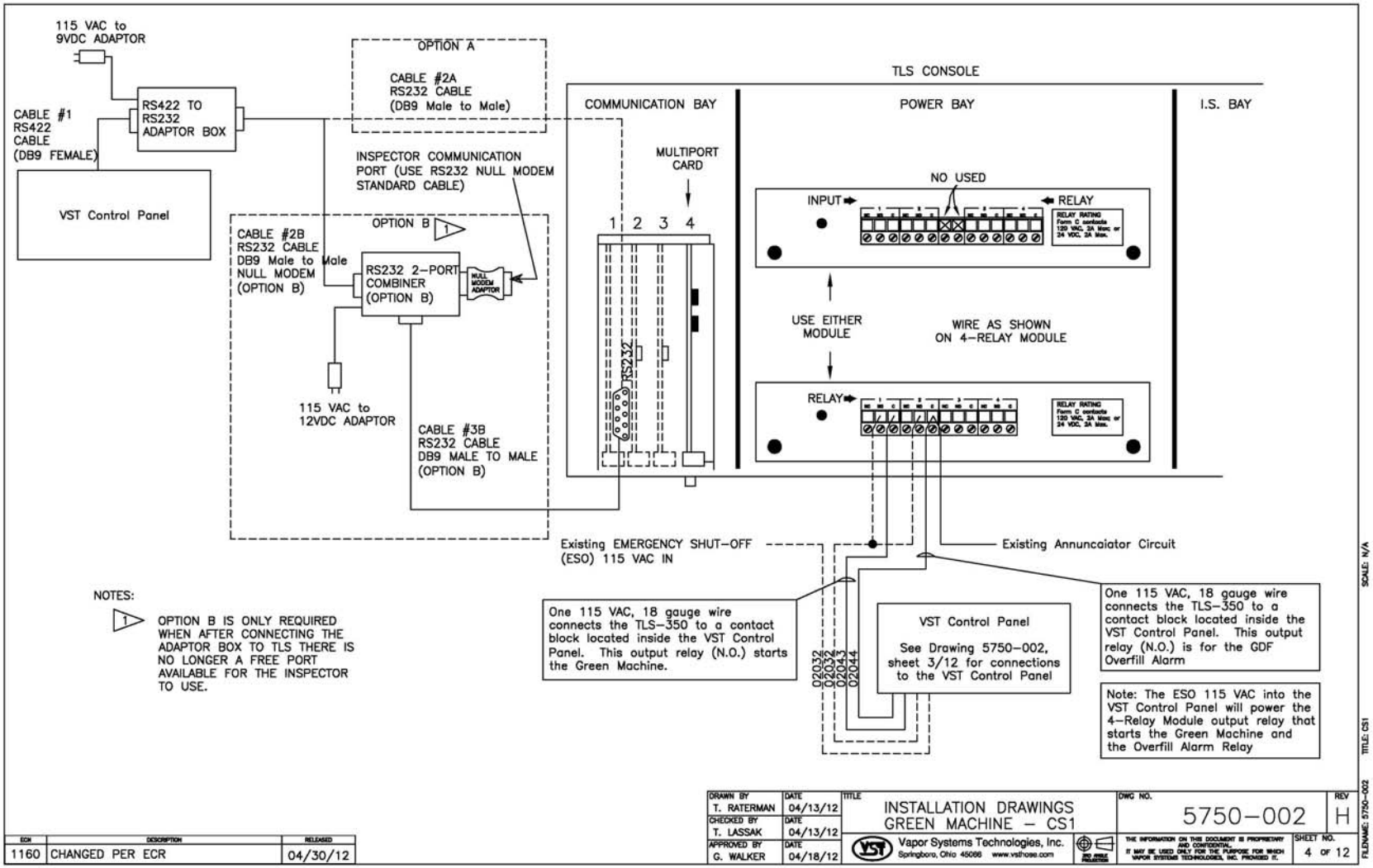

Figure 17: Field Wiring the TLS-350 4-Relay Module for the ESO, GM Run, and Overfill Alarm, Option 1

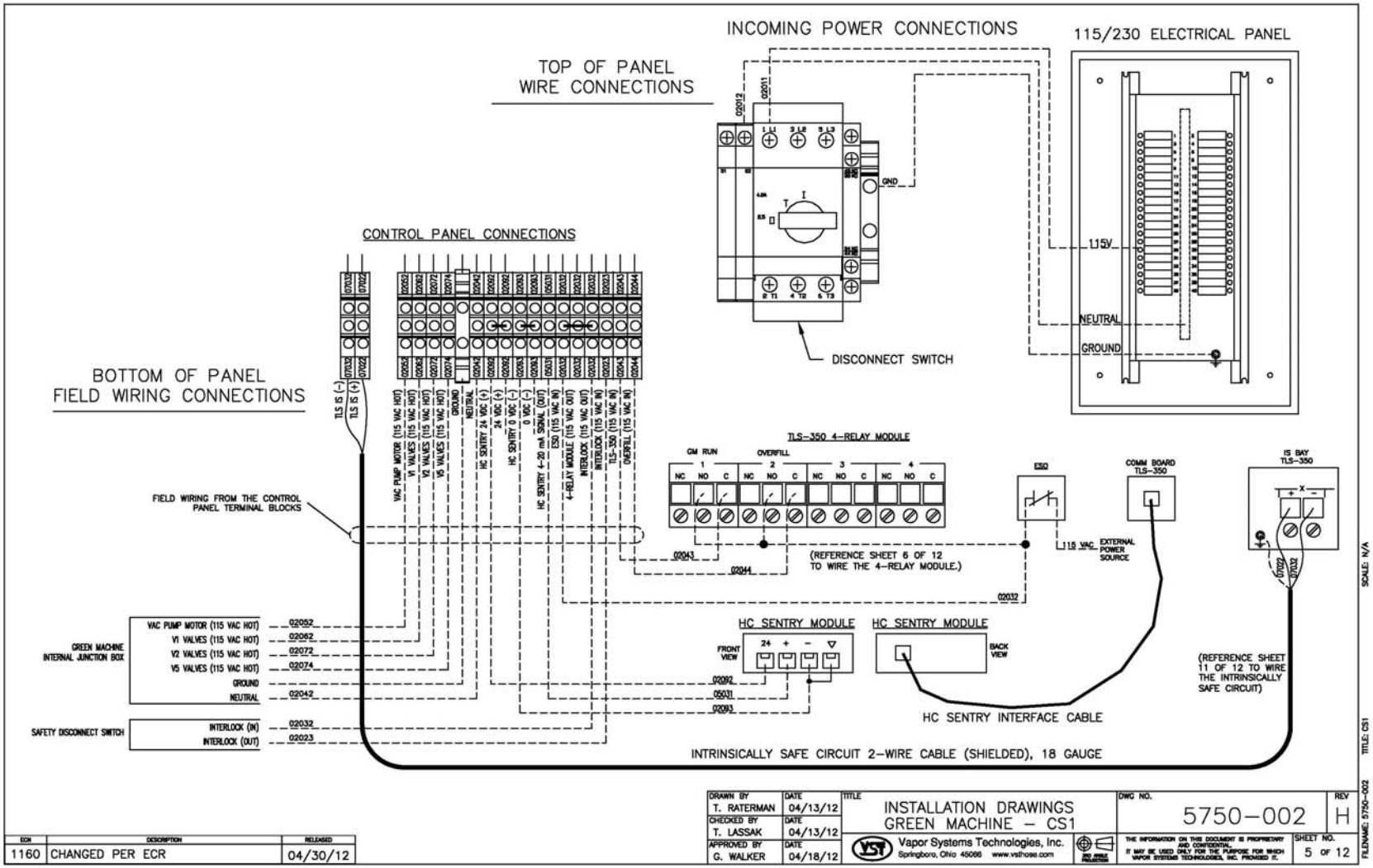

Figure 18: Field Wiring the VST Control Panel, Option 2

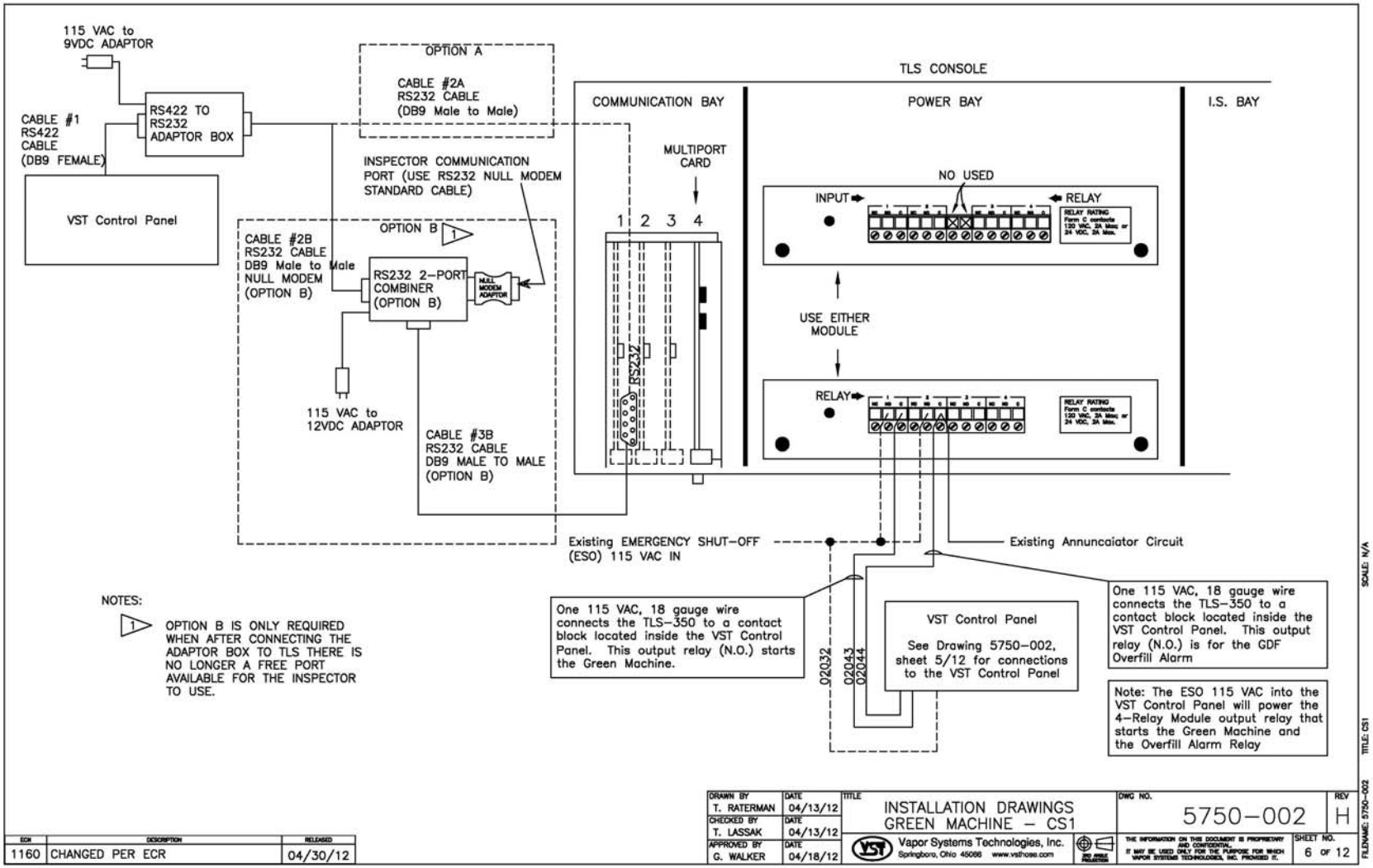

Figure 19: Field Wiring the TLS-350 4-Relay Module for the ESO, GM Run, and Overfill Alarm, Option 2

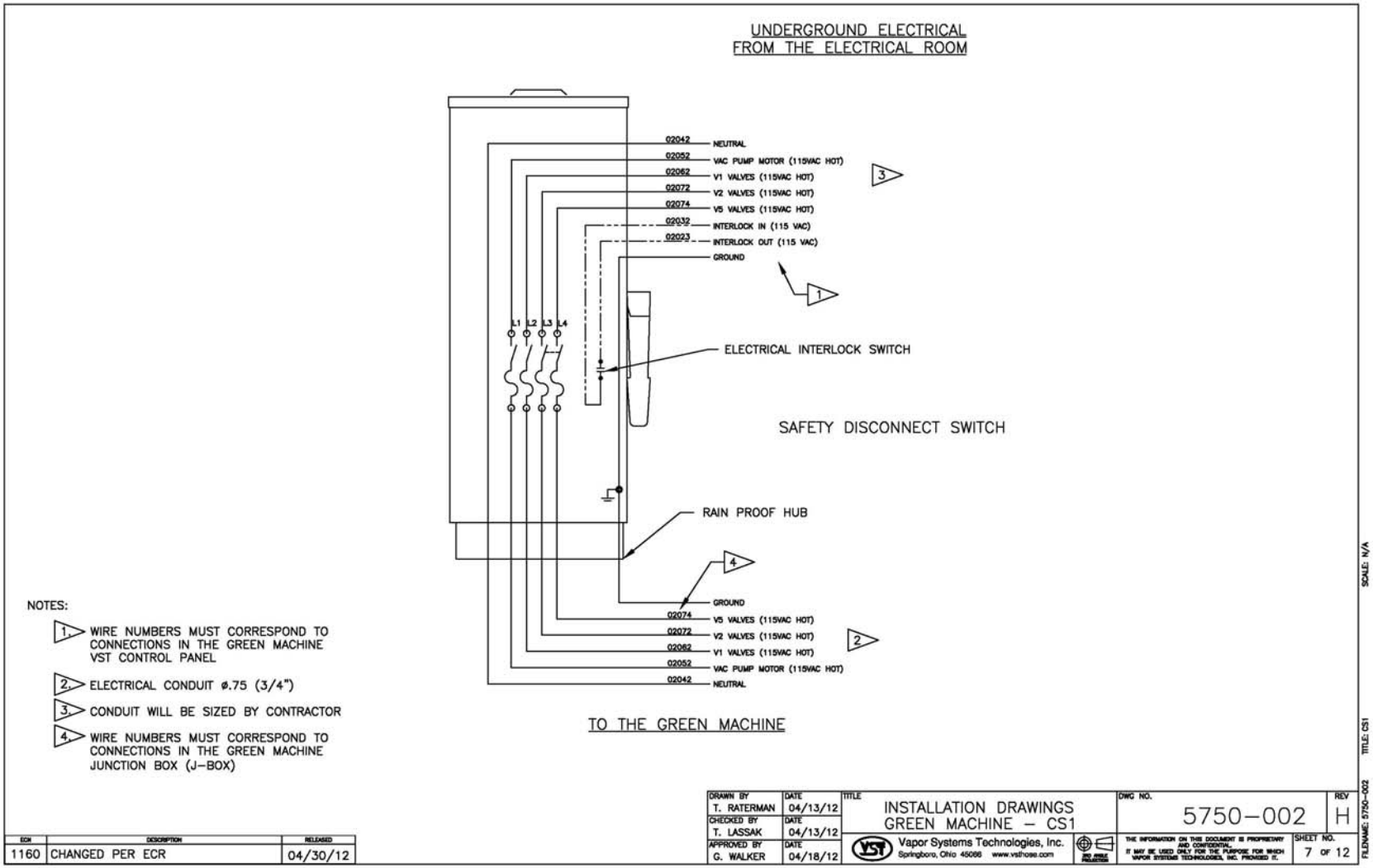

Figure 20: Safety Disconnect Switch Field Wiring Diagram

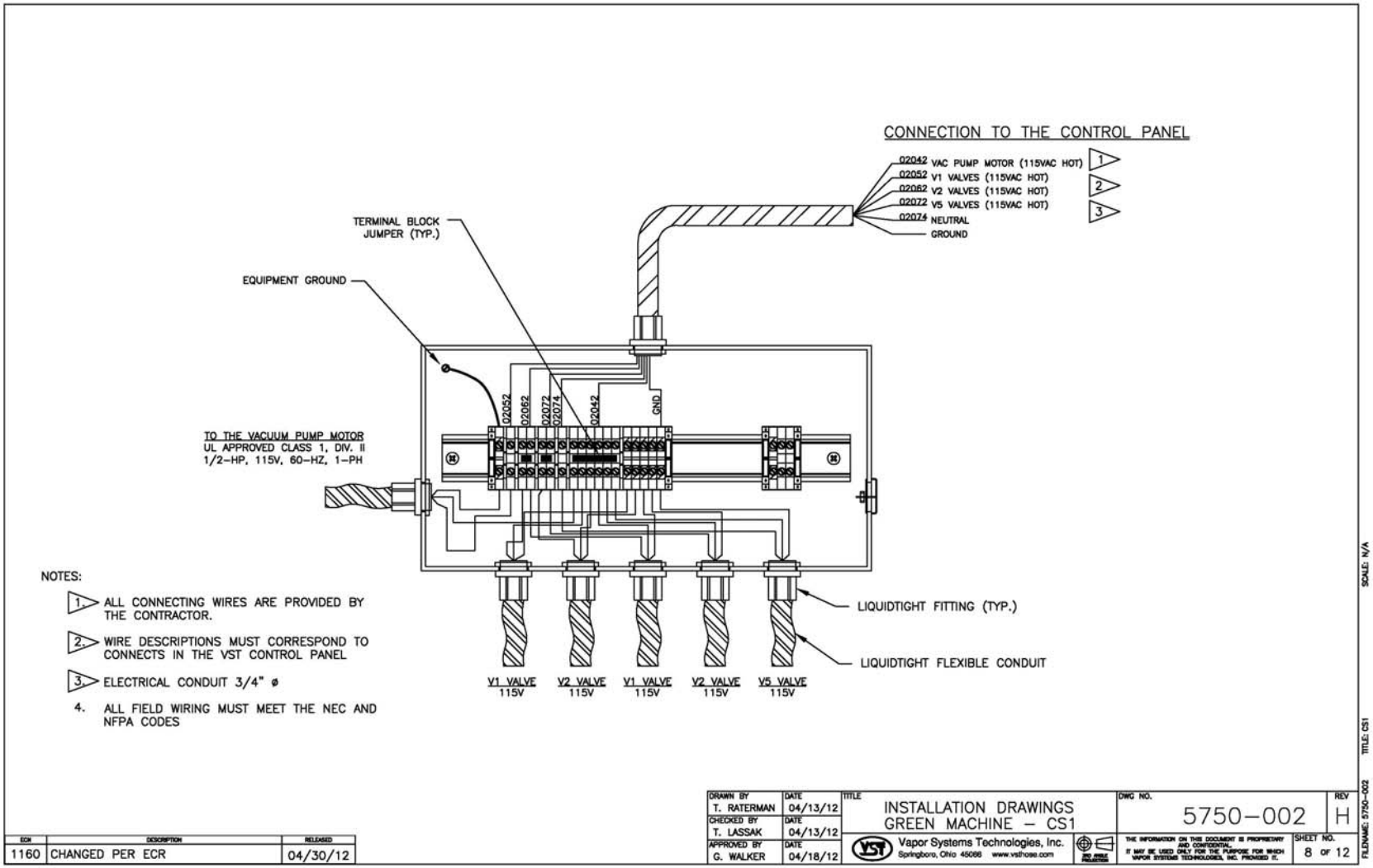

Figure 21: Green Machine Junction Box Field Wiring Diagram

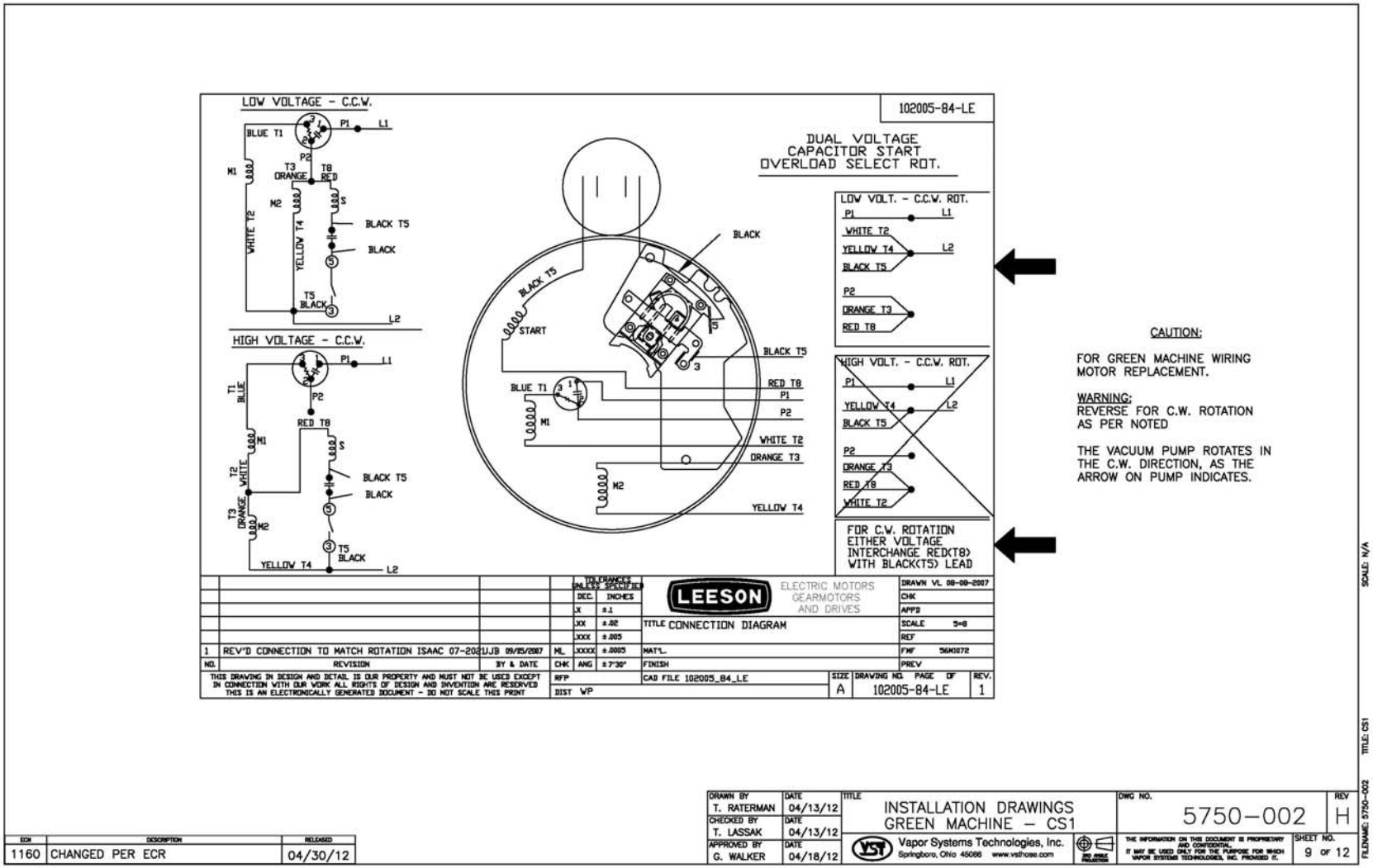

Figure 22: Vacuum Pump Motor Wiring Diagram

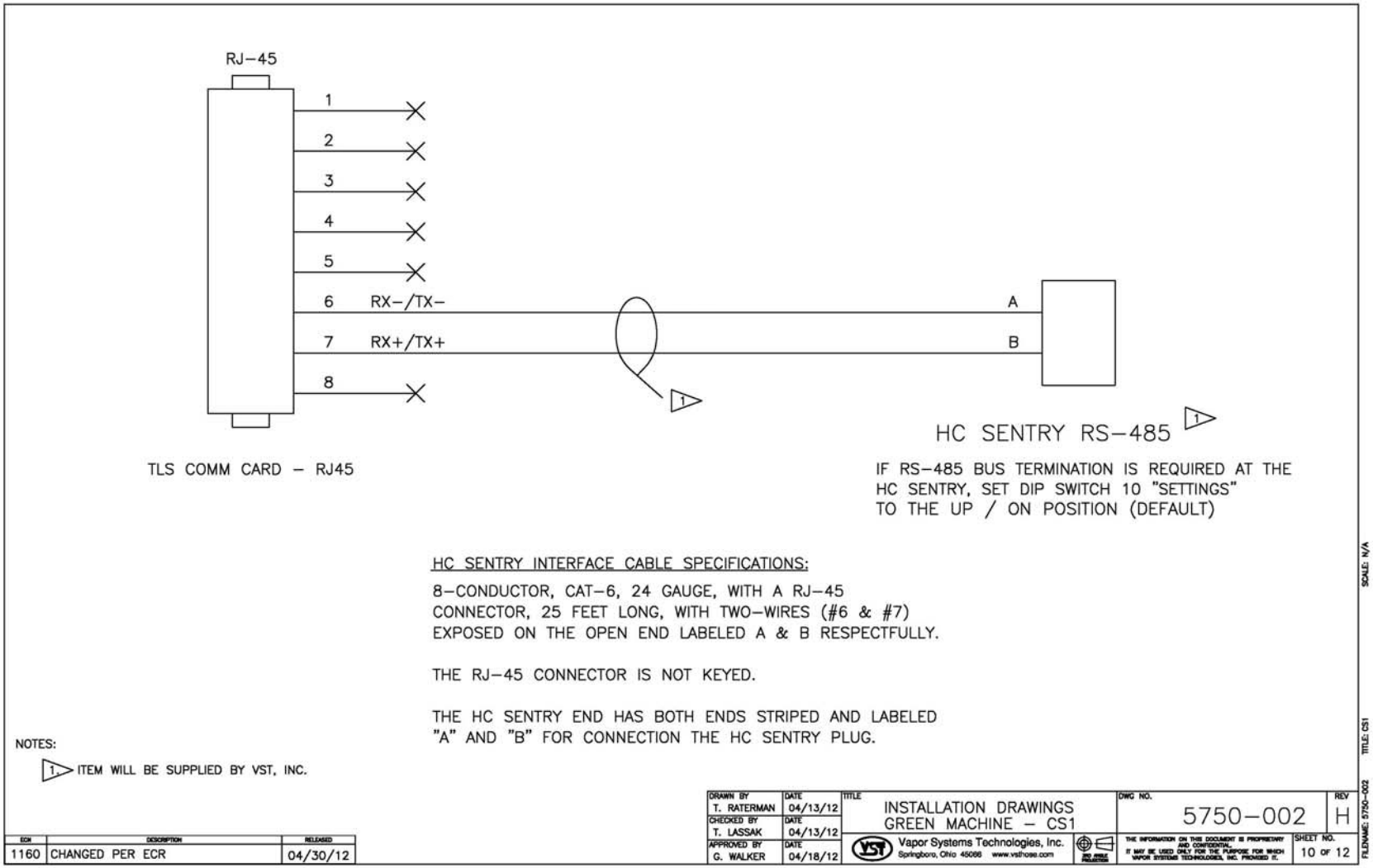

Figure 23: HC Sentry Interface Cable Connections

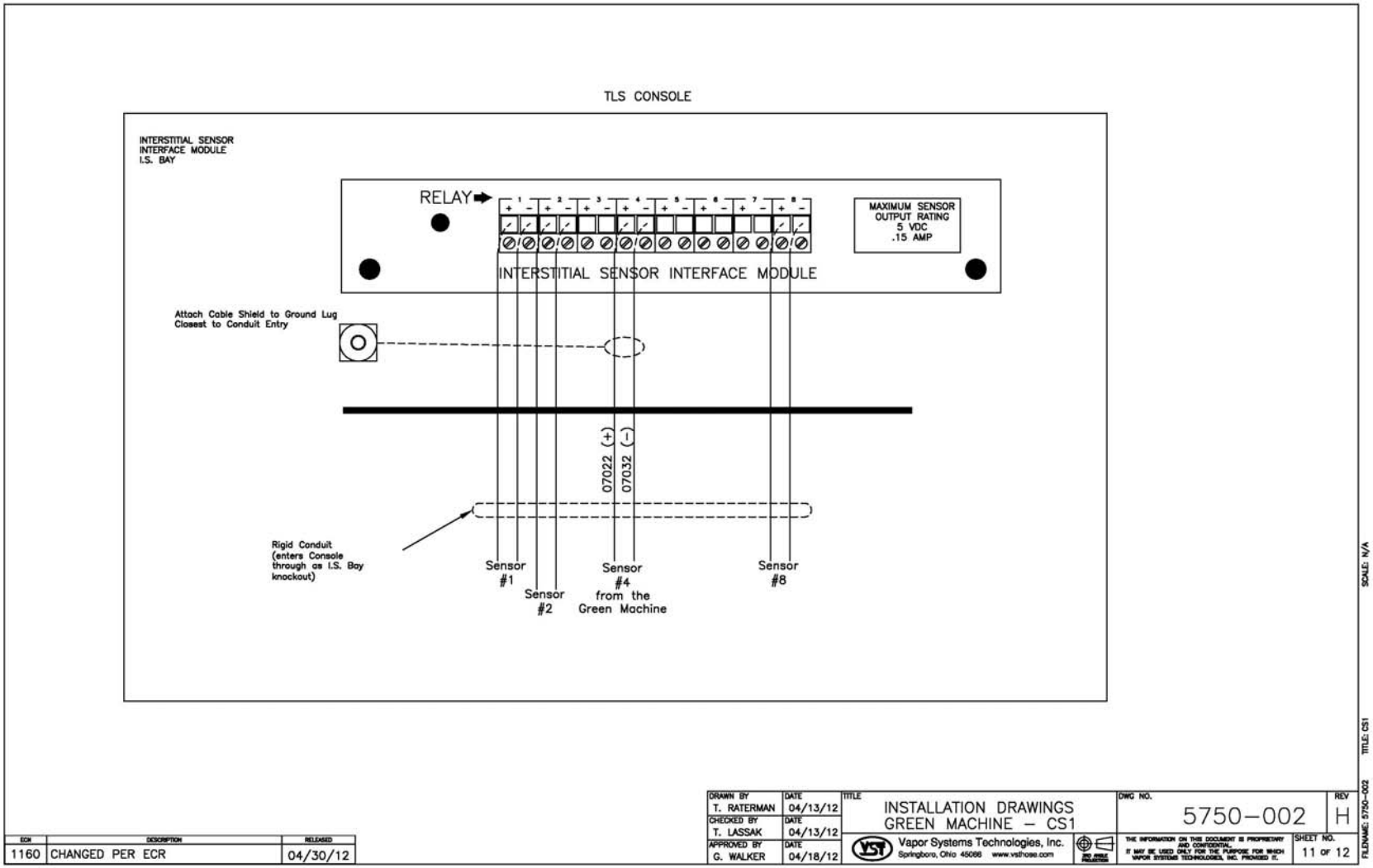

Figure 24: Field Wiring the TLS-350 Interstitial Sensor Interface Module – I.S. Bay

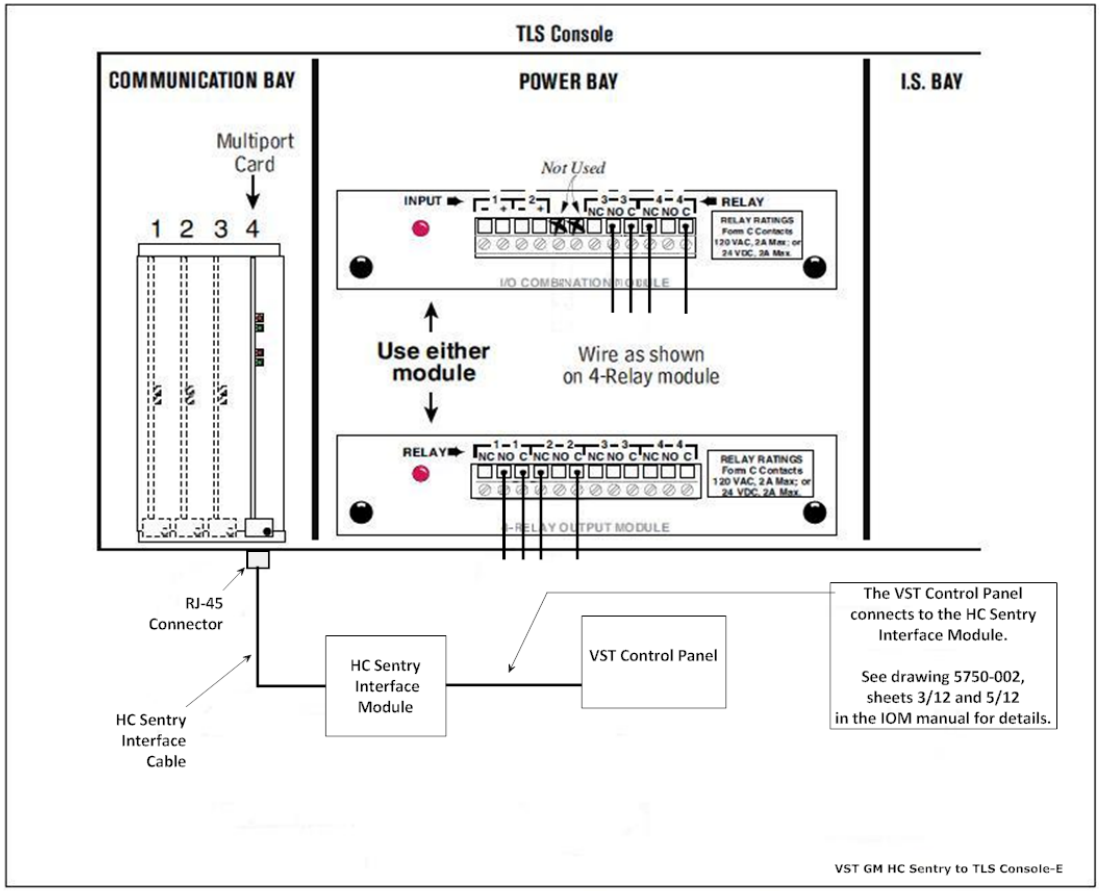

Figure 25: HC Sentry to TLS-350 Connections

12 VST Control Panel

The VST Control Panel is designed to manage the operation of the *Green Machine* based on input from the TLS-350 , which is managing the UST vapor pressure. **Figure 26** shows the front of the Control Panel with the following items:

- The *Green Machine* controller:
  - Operates the *Green Machine* based on UST vapor pressure

- The electrical Power ON/OFF disconnect switch:
  - The electrical switch provides a means to turn OFF and disconnect the "main" power from the Control Panel.
  - CAUTION: THIS CONTROL PANEL MAY HAVE FOUR (4) 115 VAC POWER SUPPLY. CONNECTION POINTS IDENTIFIED BY YELLOW TERMINAL BLOCK AND HOT WIRES INSIDE THE CONTROL PANEL. FAILURE TO DISCONNECT THE FOUR POWER SUPPLY CONNECTION POINTS BEFORE SERVICING COULD RESULT IN DEATH OR SERIOUS INJURY.
  - Can be locked in the OPEN or CLOSED position (lockout/tagout procedures).

Figure 26: VST *Green Machine* Control Panel, Front View

12.1 Start up Screen and Function Buttons

Figure 27: Startup Screen and Function Buttons

12.1.1 Main Screen Overview

- The *Green Machine* will always power up in the Main Screen
- The *Green Machine* will always be in the NORMAL OPERATING mode unless there is an Overfill Alarm or a test is being conducted.
- The *Green Machine* Modes:

ON Mode	Screen display: *Green Machine* ON
PURGE Mode	Screen display: *Green Machine* ON
As required, the OFF Mode	Screen display: *Green Machine* OFF

- Function Buttons

F1	To start the Leak Test
F2	To start the Functionality Test
F3	To start the GM Continuous Monitor Test
F4	To start the *Green Machine* Annual Compliance Test
F5	• To terminate testing & return the *Green Machine* to a NORMAL OPERATING mode • Reset the Motor Fault

- The esc button:
  - Push the esc button the first time to access the Startup screen.
  - Push the esc button a second time to return to the previous screen.
  - The esc button can be used at any time.

12.2 The Green Machine ON Screen

Figure 28: *Green Machine* ON Screen

- The *Green Machine* ON screen indicates the *Green Machine* is in either a ON mode or a PURGE mode. The *Green Machine* ON screen will be shown when the TLS-350 Output Relay (that starts the *Green Machine*) is closed.

12.2.1 *Green Machine* in the ON Mode

The VST Controller is programmed to start the *Green Machine* when the TLS output relay closes. The TLS-350 output relay closes when:

- The *Green Machine* is in the Automatic mode at the TLS-350 and the UST pressure is above 0.2" WC.
- The *Green Machine* is in the Manual ON mode at the TLS-350.

When the *Green Machine* is in the ON mode:

- Gasoline vapors are being pulled into the *Green Machine* from the USTs.
- The UST pressure is decreasing.
- The Vapor Filtration Cartridge is collecting hydrocarbons.
- Clean air is venting to atmosphere.
- There is not an Overfill Alarm condition.
- There is not a Motor Fault.
- Tests are not being conducted.
- After the ON mode is completed, the *Green Machine* will go into the PURGE mode.

12.2.2 *Green Machine* in the PURGE Mode:

The PURGE Mode will be active regardless of the TLS-350 output relay being opened or closed.

- The PURGE mode is controlled by the *Green Machine* VST Controller.

When the *Green Machine* is in the PURGE mode:

- Hydrocarbons are being returned to the UST.
- Zero airflow to atmosphere out of the Clean Air Outlet.
- There is not an Overfill Alarm condition.
- There is not a Motor Fault.
- Tests are not being conducted.
- Normally, when the PURGE mode is completed, the *Green Machine* will return to the Off Mode.

12.3 Green Machine OFF Screen

Figure 29: *Green Machine* OFF screen

- The OFF mode screen will be shown after the PURGE mode is completed, and when the TLS-350 output relay is open.

The TLS-350 output relay is open when:

- The *Green Machine* is in the Automatic mode at the TLS-350 and the UST pressure is below 0.2" WC.
- The *Green Machine* is in the Manual OFF mode at the TLS-350.
- If there is an Overfill Alarm condition:
  - The *Green Machine* will not operate and will remain OFF for 2-hours after the Overfill Alarm clears.

When the *Green Machine* is OFF:

- The Vacuum Pump is not running.
- All valves are closed.
- Clean air is not being vented to atmosphere.
- UST pressure is not reducing.
- Testing can be performed.
- An Overfill Alarm condition may exist.
- A Motor Fault condition may be active.

12.4 TLS-350 Operations Overview

- A NORMAL OPERATING mode is when the *Green Machine* is in the Automatic mode at the TLS-350.
- The *Green Machine* cycles through the ON and PURGE modes to reduce UST pressure.

12.4.1 TLS-350 4-Relay Module Information

- The TLS-350 has two sets of output relays that connect to the VST Control Panel:
    1. The output relay that starts the *Green Machine.*
    2. The OVERFILL ALARM output relay.

- Output relay that starts the *Green Machine*
    - The *Green Machine* is in the Automatic mode or the Manual ON mode at the TLS-350.
    - In the Automatic mode: This output relay is open when the UST pressure is below 0.2." WC and closed when the UST pressure is above 0.2" WC.
    - In the Manual ON mode: This relay will remain closed.
    - In the Manual OFF mode: This relay will remain open.

- OVERFILL ALARM output relay
    - The OVERFILL ALARM output relay is normally open when there is not an OVERFILL ALARM condition.
    - If there is an OVERFILL ALARM, the OVERFILL ALARM output relay closes which will keep the *Green Machine* from operating.
    - In an OVERFILL ALARM condition, the *Green Machine* will not operate in the AUTOMATIC mode, MANUAL ON mode, or in any test conditions.
    - The *Green Machine* will remain OFF for 2-hours after the OVERFILL ALARM clears.
    - See the OVERFILL ALARM summary in this document for more information.

12.4.2 TLS Intrinsically Safe (I.S.) Bay Information

- The TLS-350 Intrinsically Safe (I.S.) Bay should have an Interstitial Sensor Interface Module installed with an open channel/port for use with the *Green Machine*. If an open channel/port is not available, an interstitial sensor interface module will need to be purchased and installed in the Intrinsically Safe Bay per Veeder-Root instructions in Section 12 – "Installing TLS Console Modules".
- The Current Sensor will connect the open relay through an intrinsically safe barrier located in the VST control panel.
- When the Vacuum Pump Motor Faults:
    - The relay will close and post an ALARM to the TLS.
    - Will not shutdown the GDF.
    - Will not have to Clear Test After Repair.

12.5 Overfill Alarm

Figure 30: Overfill Alarm Screen

Whenever there is a UST gasoline Overfill Alarm at the station, the TLS-350 is configured to alarm.

1. The Veeder Root TLS-350 Fuel Management System has a Tank Overfill Alarm output relay wired to the VST Control Panel.
    - An overfill condition exists when during a fuel drop, the gasoline level in the UST exceeds the Overfill Alarm setting, which is usually between 90-95% capacity of the UST.

2. When an overfill occurs, the OVERFILL ALARM output relay closes at the TLS-350.

3. The VST Control Panel Controller senses when the Overfill Alarm output relay closes:
    - The *Green Machine* will turn OFF if it is running.
    - Prevents the *Green Machine* from starting if it is not running.

4. When the gasoline level drops below the Overfill Alarm level:
    - The TLS-350 Overfill Alarm output relay opens and the alarm clears.
    - A VST Control Panel 2-hour overfill timer starts to countdown.

5. When the 2-hour overfill time elapses, the *Green Machine* will PURGE for 15-minutes

6. When the PURGE mode ends, the *Green Machine* goes into a NORMAL OPERATING mode provided the *Green Machine* is in the Automatic mode at the TLS-350.

An Overfill Alarm condition:

- Blocks the testing function buttons.
- Ends any tests that may be running.
- Ends the ON mode or PURGE mode during a NORMAL OPERATING cycle.

12.6 Motor Fault

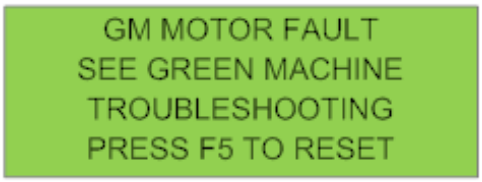

Figure 31: Motor Fault Screen

The VST Control Panel is equipped with a current transducer that samples the vacuum pump motor current during the Purge cycle.

1. If the motor current is below set a value for at least 60 seconds a motor fault is created.
   - The motor fault closes an intrinsically safe relay contact inside the VST Control Panel that is connected to the TLS-350 intrinsically safe (I.S.) bay via an intrinsically safe circuit.
   - The Green Machine will turn OFF and remain OFF until the F5 button is pushed.
   - A Motor Fault is then displayed on the controller.
2. Once a motor fault has occurred, the fault can be cleared by pressing F5 on the VST Control Panel controller.
3. When the motor fault is reset via F5, the Green Machine will automatically go into the purge cycle.
4. After the purge cycle is successfully completed without a motor current fault, the Green Machine is now able to go into the Run cycle if the TLS is providing the signal to do so.

CAUTION: With the motor fault active, the Green Machine will remain OFF until the F5 button is pushed.

12.7 VST Control Panel Test Buttons

- **F1 - Leak Test**
  - Refer to this manual for the testing procedure.
- **F2 - Functionality Test**
  - Refer to this manual for the test procedure.
- **F3 - GM Continuous Monitor Test**
  - Refer to the VR-203 and VR-204 Exhibit 15 for the testing procedure.
- **F4 - Annual Compliance Test (GM Bag Test)**
  - Refer to the VR-203 and VR-204 Exhibit 15 for the testing procedure.

13 *Green Machine* Pre Start-Up Testing

13.1 Check PMC/ISD Settings on the TLS-350

- Prior to starting the *Green Machine,* make sure the proper Veeder-Root software for the *Green Machine* has been installed on the TLS-350: PMC = 1.04 or higher; ISD = 1.05 or higher.

- See **PMC only** parameter settings in Veeder-Root manual:
  - Smart sensor setup
  - Output relay setup
  - PMC setup

- See **ISD** parameter settings in Veeder-Root manual:
  - Smart sensor setup
  - EVR/ISD setup
  - Output relay setup
  - PMC setup

13.2 Green Machine Post-Installation Start-Up Tests

- During post-installation testing, the *Green Machine* will use outside air, not gasoline vapor from the USTs, to conduct these tests.
  - Functionality Test
  - Leak Test

- VST *Green Machine* Annual Compliance Tests, Exhibit 15:
  - GM Bag Test - uses gasoline vapor from the USTs
  - Continuous Monitor Test

- During post-installation testing, the *Green Machine* will use gasoline vapor from the USTs to conduct this test.
  - Determination of VST *Green Machine* Activation Pressure - VR-203/204, Exhibit 9.

13.3 Functionality Test

Purpose of the Test

- To verify that the valves and the Vacuum Pump are operating properly.

Preparation

- Put the *Green Machine* in the Manual OFF mode at the TLS-350.
- Push the F5 button to make sure no other tests are running.
- The *Green Machine* is now OFF and will not operate.
- Make sure power is **ON** to the VST Control Panel.
- Close the two valves between the *Green Machine* and the vent risers, and remove the caps from both of the tees.

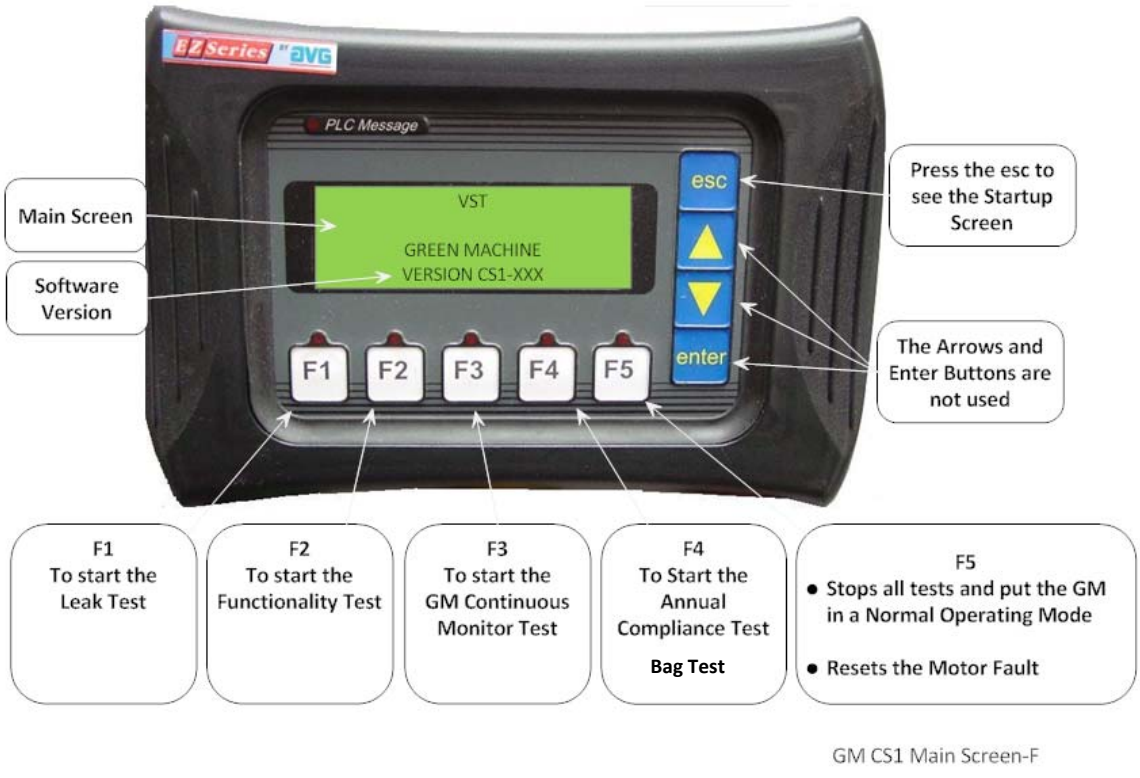

Figure 32: Functionality Test Screen

Testing Procedures

1. Push the F2 button to start the Functionality Test (**See Figure 32**)
   - The *Green Machine* will RUN for 60-seconds then PURGE for 60-seconds, (this is one cycle).
   - The *Green Machine* will continue to cycle 5-times or until the F5 button is pushed to end the test.
   - There are 5-cycles to provide enough time to conduct the test.
   - Pushing the F5 button will cancel the test and the screen will show *Green Machine* OFF.

2. During the 60-second RUN mode: (**See Figure 33**)
    - Place your hand over the tee opening at the vapor inlet and feel for suction
    - Next, place your hand over the tee opening at the air outlet and feel for air blowing
3. During the 60-second PURGE cycle: (**See Figure 33**)
    - After the PURGE cycle has begun, place your hand over the tee opening at the vapor inlet and feel for air blowing. The blowing air will reduce to zero flow soon after the PURGE cycle begins.
    - Next, place your hand over the tee opening at the air outlet and feel for zero airflow.
4. If all the conditions hold true for the above test, the valves and the Vacuum Pump are working as expected.
5. Continuous airflow during the PURGE cycle would indicate a leak in the *Green Machine* internal system:
    - Push the F5 button to end the Functionality Test and the screen will show *Green Machine* OFF.
    - Conduct a Leak Test, as shown in this IOM, to find where the leak is occurring.
6. After 5-cycles are complete, the Functionality Test has ended:
    - The *Green Machine* Controller will automatically go back to the *Green Machine* OFF screen.
    - Open the two ball valves between the *Green Machine* and the vent risers, and replace the caps on the two tees.
    - Put the *Green Machine* in the Manual ON mode at the TLS-350.

CAUTION: DO NOT PUT THE *GREEN MACHINE* IN THE MANUAL ON MODE AT THE TLS-350 UNTIL THE VALVES BETWEEN THE *GREEN MACHINE* AND THE VENT RISERS ARE OPENED. PUTTING THE *GREEN MACHINE* IN THE MANUAL ON MODE, WHEN THE VALVES ARE CLOSED, WILL NOT ALLOW THE *GREEN MACHINE* TO OPERATE PROPERLY AND MAY CAUSE DAMAGE TO INTERNAL COMPONENTS.

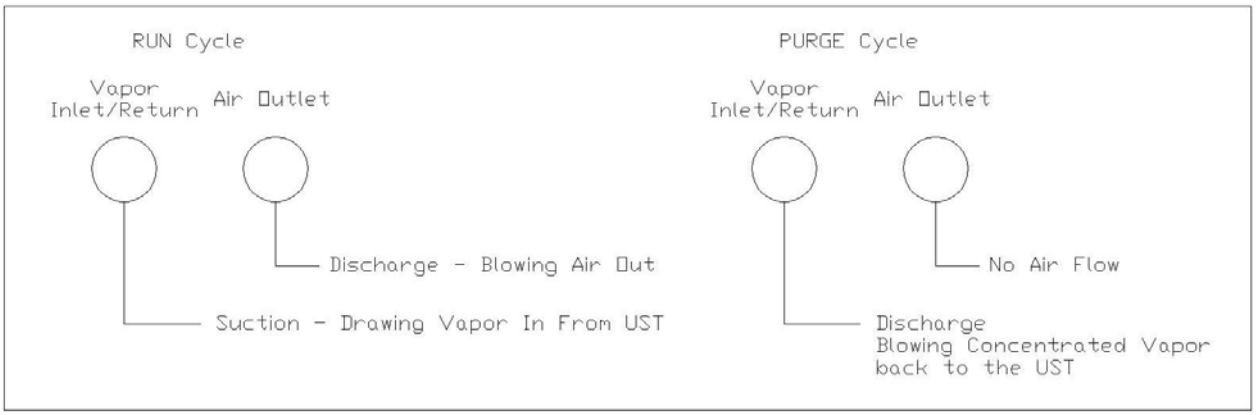

Figure 33: *Green Machine* Operation Diagram

14 Leak Test

Purpose and Applicability

- The purpose of the Leak Test is to insure that all of the tubing fittings and tubes located inside the VST *Green Machine* are leak free.
- The leak test will be required only at installation, during certain troubleshooting, and any time after the *Green Machine* plumbing, fittings, or connections have been loosened or adjusted.

Principle and Summary of Test Procedure

- The *Green Machine* is configured in the MANUAL OFF operating mode and the solenoid valves are set such that all internal *Green Machine* piping and connections can be pressurized with nitrogen. Once pressurized, all piping and connections are checked by applying a soapy solution. Any nitrogen escaping from leaks will cause the soapy solution to bubble. The absence of bubbles indicates that the piping and connections are free of leaks.

Equipment and Supplies

- Cylinder of compressed nitrogen gas with regulator capable of establishing an outlet pressure of less than 20 psi.
- VST Leak Test Fixture (**See Figure 34**).
- Soapy solution that will produce visible bubbles when exposed to nitrogen gas leaking from piping and connections.

Pre-Test Requirements

- Close the manual inlet and outlet valves at the *Green Machine,* and remove a cap from one of the tees (**See Figure 35**). Only one open tee is required for this test.
- Install the Leak Test Fixture in the empty 1" pipe tee on the *Green Machine* as shown in **Figure 35**.
- Ensure that the shut-off valve on the VST Leak Test Fixture is closed, and then connect the nitrogen source. Set the nitrogen regulator to approximately 5 psi outlet pressure, making sure that it does not exceed a maximum of 20 psi outlet pressure.
- The leak check is conducted with 1.0 to 2.0 PSI nitrogen.

Test Procedure

1. Manually turn off the VST *Green Machine* as follows:
    - On the TLS Console front panel, use the 'mode key' to scroll to 'DIAG MODE' and then use the function and step keys to view the 'VAPOR PROCESSOR MODE' menu.
2. From the 'VAPOR PROCESSOR MODE' menu, change the vapor processor mode of operation from automatic to manual mode. From the 'VAPOR PROCESSOR STATE' menu, verify the VP STATE is in the "off" mode. The processor shall be in the off mode for the duration of the test.

CAUTION:

If by chance the TLS is in the Auto Mode during the Leak Check Test, the PLC, after the F1 button is pushed, will control the *Green Machine* as indicated in Step 1 above. After the F5 button is pushed or the 30-minute timer times out, the PLC will convert back to a Normal Operating Mode and the *Green Machine* will start automatically if the UST pressure is above + 0.2"WC. Since this test is conducted with either the *Green Machine* inlet and outlet valve closed, starting the *Green Machine* automatically will NOT ALLOW THE GREEN MACHINE TO OPERATE PROPERLY AND MAY CAUSE DAMAGE TO INTERNAL EQUIPMENT.

3. Make sure power is ON to the VST Control Panel

4. At the VST Control Panel (**See Figure 36**), press the F1 button to disable running the vacuum pump and to open all of the control valves. The vacuum pump will remain off until one of the following conditions is met:
    - The F5 button is pushed OR
    - The PLC internal timer times out at 30 minutes
    - If additional time is needed to conduct the Leak Test, push the F1 button again to re-start the 30 minute timer.

5. Slowly and carefully pressurize the *Green Machine* to between 1.0 and 2.0 psi as follows:
    - Make sure the shut-off valve on the Leak Test Fixture is fully closed.
    - Make sure the Leak Test Fixture pressure regulator is fully closed.
    - Slowly open the valve on the test fixture to pressurize the *Green Machine* at 1.0 to 2.0 PSI nitrogen.

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

6. With the *Green Machine* pressurized between 1.0 to 2.0 PSI 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.

7. Continue this process until all the internal tube fittings have been checked and found leak free.

8. Once this test is complete and all the piping fittings are leak free, remove the compressed nitrogen connection to the Leak Test Fixture.

9. Remove the Leak Test Fixture and Re-install the 1” pipe plug.

10. Open the manual inlet and outlet valves at the *Green Machine*.

11. After the testing is completed, push the F5 button on the VST Control Panel to put the PLC back to normal operating mode. If the F5 button is not pushed, the PLC will convert back to normal operating mode 30 minutes after the F1 button was pushed.

12. Use the TLS-350 to put the *Green Machine* back into the **Automatic** mode.

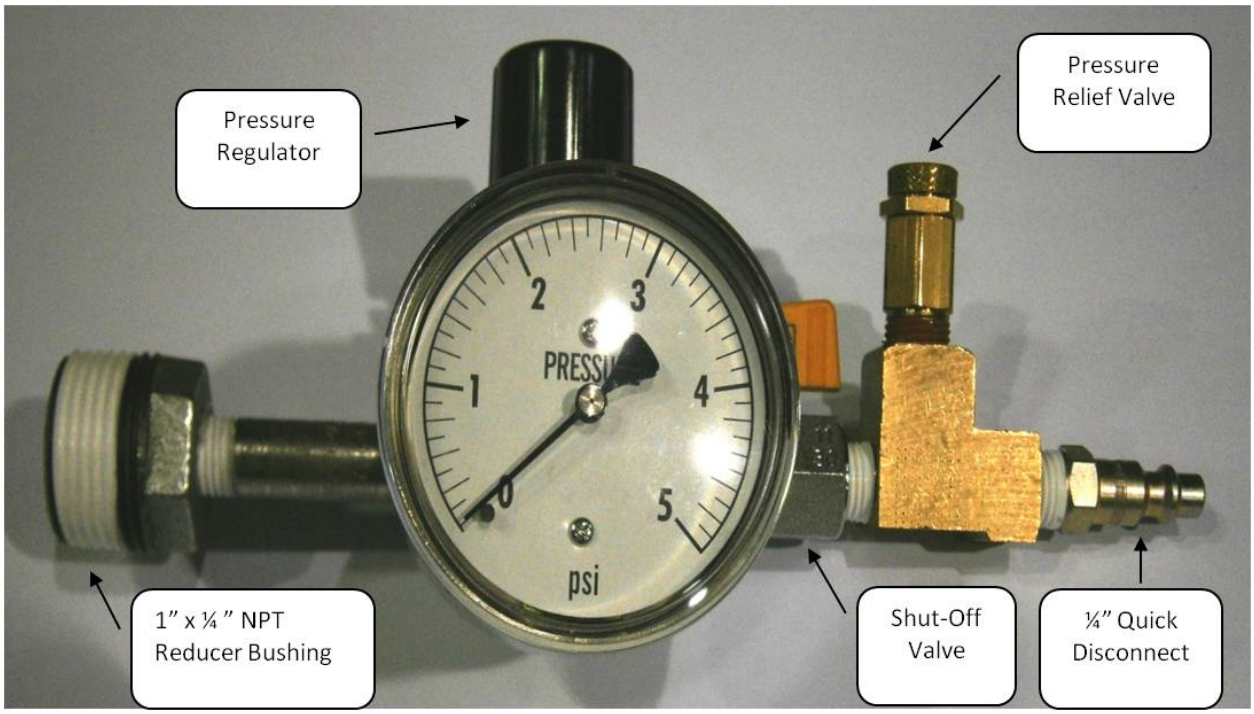

Figure 34: Leak Check Fixture

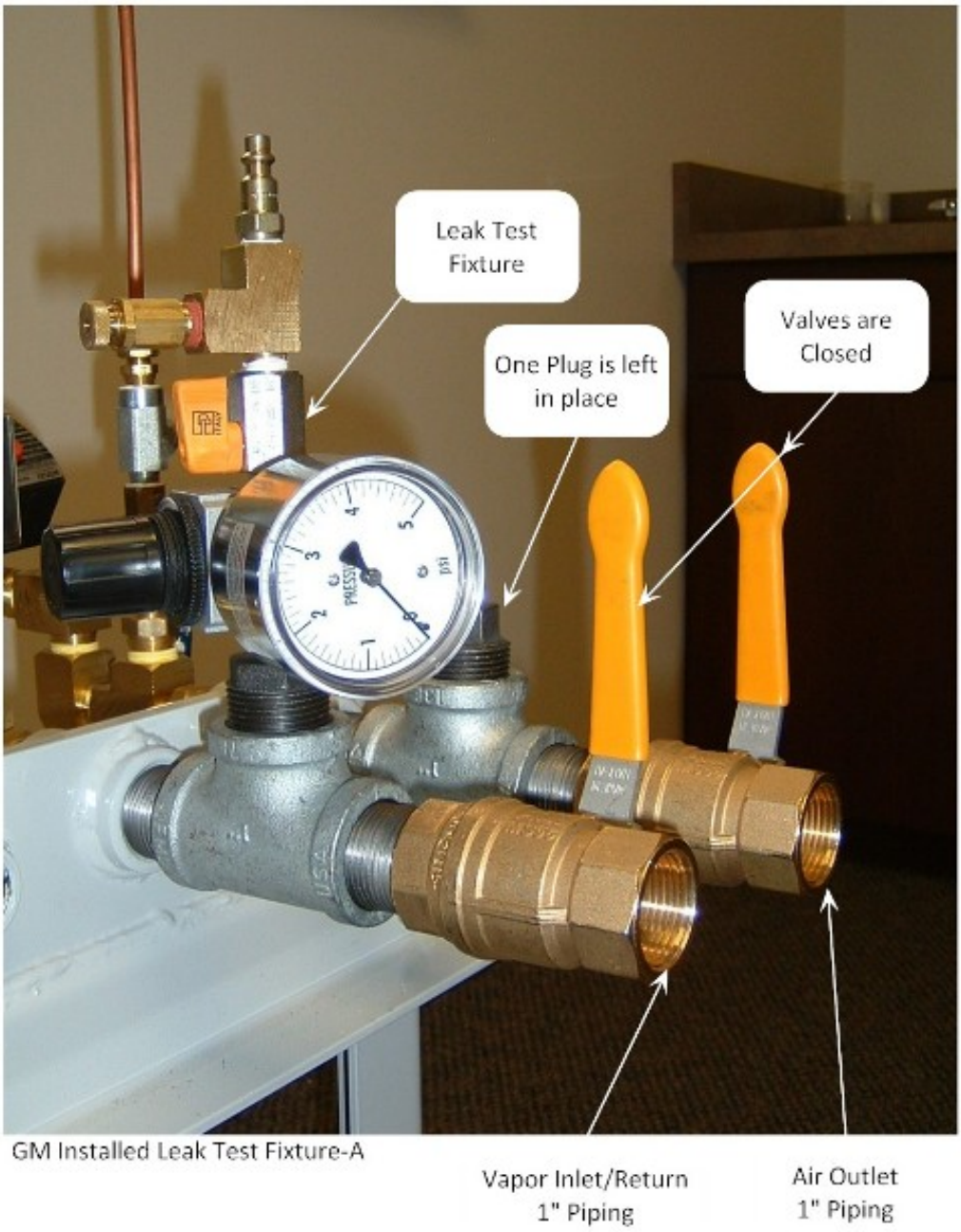

Figure 35: Green Machine Inlet and Outlet Valves Closed, and Leak Check Fixture Attached

Figure 36: Green Machine Controller

Alternative Test Procedures

This procedure shall be conducted as specified. Modifications to this test procedure shall not be used to determine compliance unless prior written approval has been obtained from the ARB Executive Officer, pursuant to Section 14 of Certification Procedure CP-201.

Data Form for Recording Results of VST Green Machine Leak Check Test

Site Information	
GDF Name:	
GDF Address:	
District Permit #:	
Pre-Test Procedures	
Inlet and outlet valves closed for test?	*Comments* ☐ Yes ☐ No
Processor set to MANUAL OFF mode for test?	☐ Yes ☐ No
VST Controller set to TEST mode (F1) for test?	☐ Yes ☐ No
Test Results	
Test conducted at a pressure between 1.0 and 2.0 psi?	*Comments* ☐ Yes ☐ No
Leaks identified during test? *If yes, describe leak location and corrective action taken.*	☐ Yes ☐ No
Leaks present at conclusion of test?	☐ Yes ☐ No
Post-Test Procedures	
Inlet and outlet valves opened after test?	*Comments* ☐ Yes ☐ No
Pipe plug replaced after test?	☐ Yes ☐ No
Processor returned to AUTOMATIC mode after test?	☐ Yes ☐ No
VST Controller set to NORMAL mode (F5) after test?	☐ Yes ☐ No
Technician Information	
VST Certified Technician Name:	
VST Certification Number:	
Certification Expiration Date:	
Test Company:	
Date Test Conducted:	

14.1 Determination of VST Green Machine Activation Pressure-Exhibit 9

- See VR-203 and VR-204 Exhibit 9 and follow instructions.

14.2 VST Green Machine Annual Compliance Test – Exhibit 15

- Emissions Compliance Test (GM Bag Test)
- VST Continuous Monitor Test

15 *Green Machine* Start-Up Procedure

- Use the following start-up procedure when initially starting or re-starting after maintenance or testing.

START-UP PROCEDURE	
1.	• Make sure the plugs are installed on the 2 tees at the *Green Machine.*
2.	• Make sure the 2 valves are locked in the OPEN position at the *Green Machine*.
3.	• Make sure power is on to the VST Control Panel.
4.	• Make sure the pressure sensor in the dispenser is operational.
5.	• Make sure that the GDF is vapor tight. (TP 201.3 and Exhibit 4).
6.	• After the TLS is installed and configured for the *Green Machine* and all EVR equipment has been installed, the *Green Machine* can become operational. • Put the TLS in the **AUTOMATIC MODE**. • Make sure the VST Control Panel is operational. • If the pressure is above +0.2" WC, the TLS Auxiliary relays will close and the *Green Machine* will start. • If the pressure is below +0.2" WC, the *Green Machine* will not start because the UST system-pressure is below the high-pressure threshold.
7.	• If the pressure is above 0.2"WC and the Green Machine does not start automatically, see the Green Machine Troubleshooting Manual.
NOTE: All exhibits can be found in Executive Order VR-203 and VR-204	

CAUTION: Locking ball valve handles at the *Green Machine* inlet and outlet must <u>not</u> be removed.

16 Green Machine Operation

16.1 Veeder-Root TLS-350

- The *Green Machine* is controlled by a Veeder-Root (VR) TLS-350.
- VST does not provide the TLS-350 controller or the software required by the TLS-350.
- The TLS-350 operates the *Green Machine* using 3 Modes:

    1. Automatic Mode - Used for normal operation.
    2. Manual OFF Mode - The *Green Machine* is OFF and will not run regardless of UST pressure.
    3. Manual ON Mode:
        - CAUTION: Used for maintenance and testing only.
        - The *Green Machine* will continue to cycle and PURGE regardless of UST pressure.

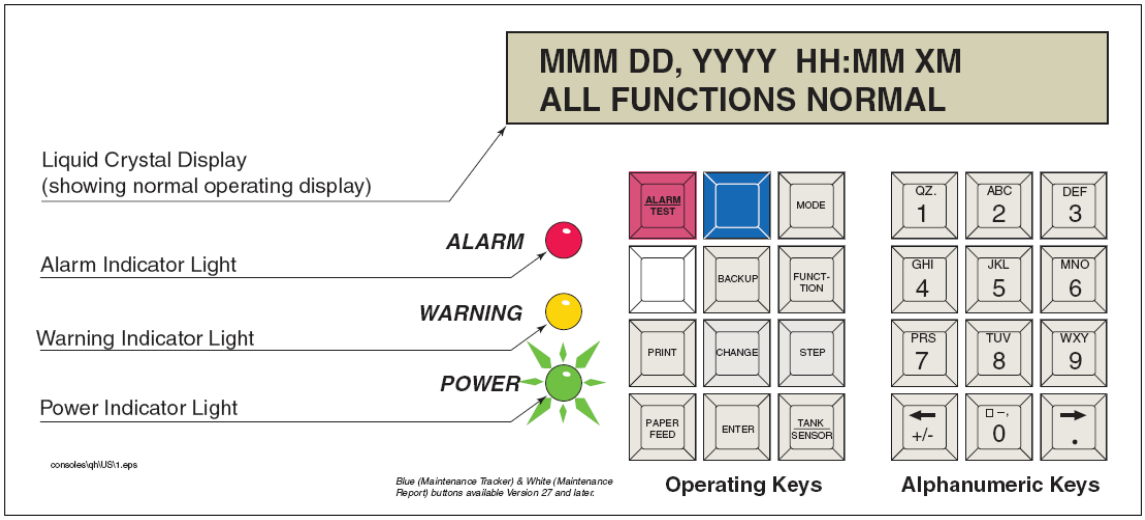

Figure 37: TLS-350 Front Panel

TLS-350 Troubleshooting

17 TLS Warnings and Alarms (PMC & ISD)

- 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

17.1 TLS-350 PMC Alarms - Troubleshooting Summary

Displayed Message	Description	Light Indicator	Suggested Troubleshooting
VP EMISSION WARN	Mass emission exceeded the certified daily threshold.	Yellow	• Troubleshooting Manual www.vsthose.com. • Exhibit 9
VP EMISSION FAIL	2nd Consecutive mass emission failure.	Red	
PMC SETUP FAIL	PMC is not configured or missing components.	Red	• See ISD Troubleshooting Manual, P/N 577013-819
PMC SENSOR FAULT	Component used by PMC has failed or reported an error condition. See Troubleshooting section for complete description of sensors and associated conditions that can cause a sensor fault.	Red	• Troubleshooting Manual www.vsthose.com. • Exhibit 9

17.2 TLS-350 ISD Alarms - Troubleshooting Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	• Exhibit 4 • TP-201.3 (or equivalent test procedure)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	• Exhibit 9 • Exhibit 10
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	• Exhibit 5 • Exhibit 6 • Exhibit 17 • TP-201.4 (or equivalent test procedure)
FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
VP EMISSION WARN[3,4]	Processor	Yellow	Mass emission exceeded the certified threshold.	• Troubleshooting Manual www.vsthose.com. • Exhibit 9
VP EMISSION FAIL[3,4]	Processor	Red	2nd Consecutive Mass emission test failure.	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL[2]	Self-Test	Red	8th Consecutive Failure of Setup Test	

Note: The alarms listed in above table will also activate an audible alarm

[1]See ISD Troubleshooting Manual P/N 577013-819 found at http://www.veeder.com/object/577013-819.html and the VST ISD Troubleshooting Manual found at http://www.vsthose.com/pdf/Troubleshooting_Manual_Green Machine.pdf

[2]ISD Shut Down Alarms – see Figure 48 of IOM Section 12

[3]This warning will result in an ISD VP Status Warn

[4]This failure will result in an ISD VP Status Fail

Maintenance

18 Overview

- The Vacuum Pump and Control Valves are the only components with moving parts in the *Green Machine*; therefore it requires very little maintenance.

- Because the system continually monitors itself and notifies you of any problems or situations, it requires very little attention.

- VST recommends annually inspecting the Vacuum Pump Rubber Flange Sleeve.

- If the *Green Machine* is not functioning properly consult the VST *Green Machine* Troubleshooting Manual to determine which component may need to be repaired or replaced.

- Exhibit 15 (*Green Machine* Annual Compliance test) may be used as an indicator of performance.
  - GM Bag Test
  - Continuous Monitoring Test

19 Rubber Flange Sleeve Replacement

NOTE: The Rubber Flange Sleeve replacement is done with the motor still attached to the *Green Machine* base.

Safety

Use lockout / tagout procedures prior to starting work.

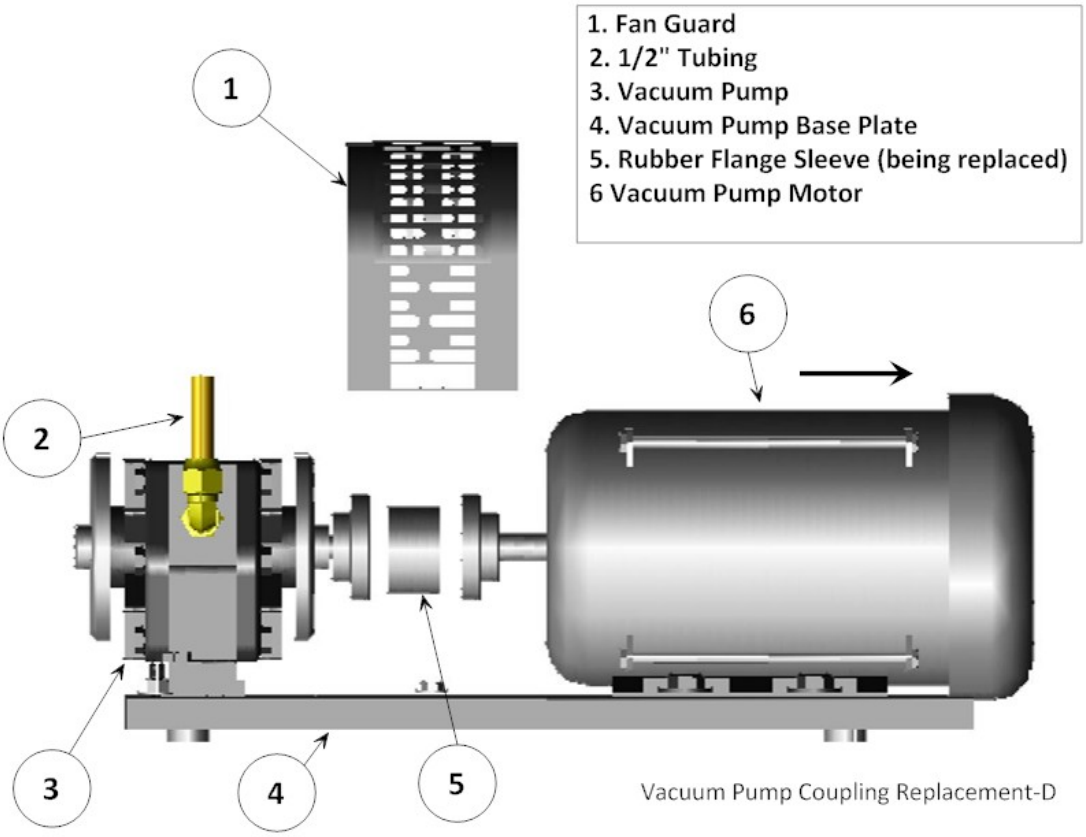

Figure 38: Vacuum Pump Coupling Replacement

19.1 Removing the Rubber Flange Sleeve

Figure 38	
1.	Disconnect power to the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the *Green Machine*).
2.	Follow lockout/tagout procedures.
3.	Unlock the hasps and remove the cover from the *Green Machine* **NOTE**: The Vacuum Pump and tubing will not be affected by moving the Motor.
4.	Remove the Fan Guard over the Coupling Flanges.
5.	Remove 4 motor mounting bolts from the base plate.
6.	Without removing the electrical service from the Motor, slide the Motor away from the Vacuum Pump so the Rubber Flange Sleeve can be removed.

19.2 Replacing the Rubber Flange Sleeve

Figure 38	
1.	Insert a new coupling sleeve P/N GM-004 and slide the Motor towards the Vacuum Pump so the sleeve is tight between the coupling flanges.
2.	Re-install and tighten the 4 motor mounting bolts to the base plate.
3.	Re-install the fan guard over the coupling flanges.
4.	Remove the lock(s) and tags from the lockout/tagout.
5.	After the work is completed, turn ON power to the VST Control Panel. The *Green Machine* is now operational.
6.	At the *Green Machine*, check to make sure the Vacuum Pump and Motor are running without excessive vibration or noise.
7.	Put the cover on the *Green Machine* and lock the hasps.

Annual *Green Machine* Inspections and Replacements

Annual *Green Machine* Inspections					
Component	**Procedure**	**Fail Criteria**	**Corrective Action**	**Reference Manuals**	**Authorized Personnel**
Vacuum Pump Rubber Flange Sleeve	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 Rubber Flange Sleeve	IOM – 18	VST ASC Level D
Vacuum Pump	Replace pump every 10 years or 15,000 hours			IOM-18	
VST *Green Machine* Annual Compliance Testing	Exhibit 15	Compliance Bag Test: If the value of the NOVA reading is ≥17%, the *Green Machine* is not in compliance. Continuous Monitoring Test: If a motor fault is not found then the *Green Machine* is not in compliance	Refer to the Green Machine Troubleshooting Manual for maintenance	Exhibit 15	

TLS RF Wireless 2 System (W2)

Installation and Maintenance Guide

VEEDER-ROOT

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.

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

DAMAGE CLAIMS / LOST EQUIPMENT

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

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

1. Contact Veeder-Root Customer Service at 800-873-3313 with the specific part numbers and quantities that were missing or received damaged.
2. Fax signed Bill of Lading (BOL) to Veeder-Root Customer Service at 800-234-5350.
3. Veeder-Root will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

CUSTOMER'S PREFERRED CARRIER

1. It is the customer's responsibility to file a claim with their carrier.
2. Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
3. If "lost" equipment is delivered at a later date and is not needed, Veeder-Root will allow a Return to Stock without a restocking fee.
4. Veeder-Root will NOT be responsible for any compensation when a customer chooses their own carrier.

FCC INFORMATION

This equipment complies with the requirements in Part 15 of the FCC rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception requiring the operator to take whatever steps are necessary to correct the interference.

RETURN SHIPPING

For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

FOR INSTALLATIONS IN THE STATE OF CALIFORNIA

Please refer to the California Air Resources Board Vapor Recovery Certification Phase II EVR Executive Order web site (www.arb.ca.gov/vapor/eo-evrphaseII.htm) for the latest manual revisions pertaining to Executive Order VR202 (Healy Phase II EVR System Including ISD System), VR 203 (VST Phase II EVR System) and VR 204 (VST Phase II EVR System Including ISD System).

Appendix B: Device DIP Switch Settings

Appendix C: Lithium Battery Safety Data

Figures

Tables

Introduction

This manual describes site preparation and installation procedures for the Veeder-Root TLS RF Wireless 2 System (W2) for Vapor Recovery monitoring. The TLS RF Wireless 2 System (W2) features two-way communication utilizing a client/server architecture resulting in improved data collection.

Veeder-Root strongly recommends the use of hard wiring for connecting Veeder-Root sensors to the TLS Console. Wired connections provide a robust communication link that is far superior to wireless networks.

A wide variety of devices can be integrated into the TLS RF Wireless 2 System (W2) network depending on the console(s) installed as shown in Table 1. Wireless component kit part numbers are shown in Table 2.

Table 1. Wireless 2 Devices Per TLS Console

Consoles	Wireless Device		Total Number of Wireless Devices per TLS console
	Vapor Flow Meter	Carbon Canister Vapor Polisher	
8470 TLS-350 Console			32
8482 TLS-350R Console	Up to 32	1	32

Table 2. Wireless Component Kit Numbers

V-R Kit Order Number	V-R Component Number					
	RF Console 332242-002	Transmitter 332235-016	Repeater 332440-030	Receiver 332440-029	Battery Pack 332425-011	Enclosure 330020-716
858090-203	X		X	X		
858090-204	X		X	X		
858090-205		X			X	
330020-716						X
330020-668	X					
330020-674		X				
330020-670			X			
330020-669				X		
330020-718					X	

Procedures Contained Within This Manual

- Mounting the TLS RF and connecting power wiring.
- Installing Receiver, Repeater and Transmitters.

- Connecting the TLS RF to the TLS console.

After installing the TLS RF Wireless System devices, you must configure the sensors in the console following instructions contained in the TLS console's System Setup Manual.

Contractor Certification Requirements

Veeder-Root Contractor Certification Requirements	Installer Certification[6]	ATG Technician Certification[7]	VR Vapor Products Certification[8]
Install[1] ISD	X	X	X
Install PMC	X	X	X
Install CCVP	X	X	X
Install Wireless ISD/PMC	X	X	X
Installation Checkout[2]		X	X
ATG Startup[3] / Training[4] / Service[5]		X	X
ISD Startup / Training / Service			X
PMC Startup / Training / Service			X
CCVP Startup / Training / Service			X
Wireless ISD/PMC Startup / Training / Service			X
Install Pressure Sensor (ATG)	X	X	X
Maintain Pressure Sensor (ATG)		X	X
Calibrate Pressure Sensor (ATG)		X	X
Clear ATG Pressure Sensor Alarm (ATG)		X	X
Clear ISD/PMC Alarms (ISD/PMC)			X

[1]Perform wiring and conduit touting; equipment mounting
[2]Inspect wiring and conduit routing; equipment mounting
[3]Turn power on, program and test the systems
[4]Provide supervised field experience in service techniques and operations
[5]Troubleshoot and provide routing maintenance
[6]UST Monitoring Systems – Installer (Level 1)
[7]Certified UST Monitoring Technician
[8]VR Vapor Products

Warranty Registrations may only be submitted by selected Distributors. Certified installers are required to provide the GDF operator with the completed Equipment Warranty Notice, form 577013-868, for their records.

RF Transmitter Considerations

Installation of this equipment in wet or below grade locations requires that the installer take steps to ensure that the equipment is mounted above the maximum water level.

CAUTION! – The Transmitter will not function properly in water. Also, submersion of the Transmitter in water can cause permanent damage to the internal electronics.

Wireless 2 devices will not function properly if certain conditions arise such as, but not limited to, the following:

- **Ambient Interference – Due to site layout or vehicles parked in the RF transmission path. For example, CSLD will not function if the transmission path is blocked for more than a few minutes.**
- **Improper equipment installation – Keep objects from improperly coming in contact with the antenna. Follow these installation instructions and mount the transmitter in a fixed position to ensure maximum RF connectivity. Antenna orientation is significant in achieving an optimal transmission path.**
- **Equipment Sump Parameters – Sumps intended for use with RF equipment must accommodate the worst case rainfall condition that could reasonably occur. The RF Transmitter and antenna are weatherproof but will not function properly underwater.**

TLS System performance will be degraded should any of the above conditions occur and is not covered under the Veeder-Root Product Warranty. Corrective actions to such conditions are the responsibility of the station-site owner. Veeder-Root is not liable for any event that is a result of an improper installation or use of this equipment.

It is important that installers have knowledge of all relevant procedures before installing a wireless system. Read and understand all manuals thoroughly. If you do not understand a procedure, contact a certified contractor or contact Veeder-Root. Each TLS Console has its own setup and installation manuals.

Related Documents

IOM 13 VR-203 and VR-204 or IOM 18 VR-202	Vapor Pressure Sensor Installation Guide
IOM 15 VR-204	ISD Balance Flow Meter Installation Guide
IOM 14 VR-203 and VR-204	Carbon Canister Vapor Polisher Installation and Maintenance Guide
576013-623	TLS-3XX System Setup Manual
331940-012	TLS RF System Control Drawing

Product Marking Information

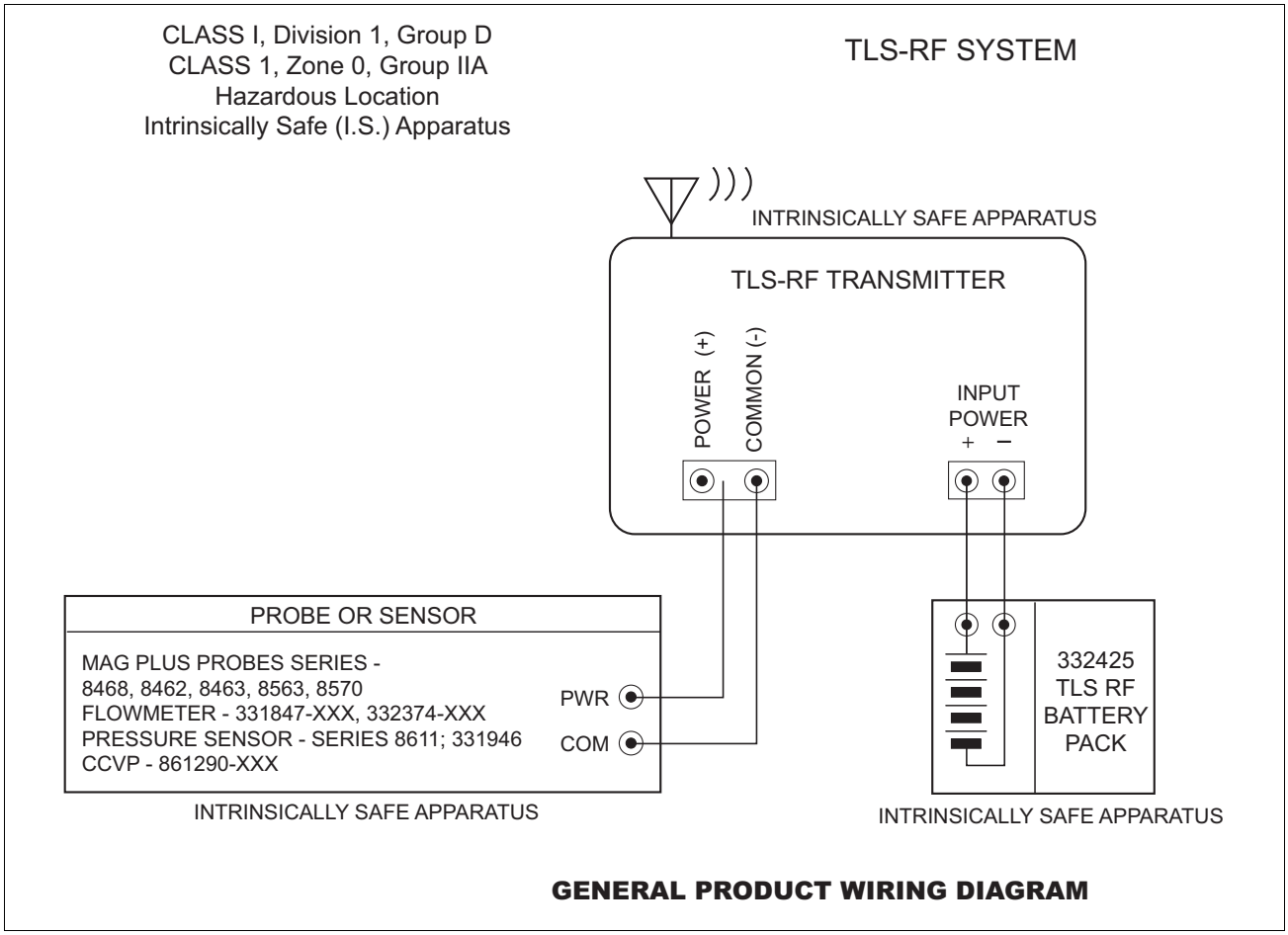
RELATED DOCUMENTS

Documents Required to Install Equipment

This intrinsically safe apparatus is only for use as part of a Veeder-Root Automatic Tank Gauging System (ATG Console with probes and sensors). To install intrinsically safe apparatus, use the specific control drawing that appears on the nameplate of the applicable associated apparatus (ATG Console):

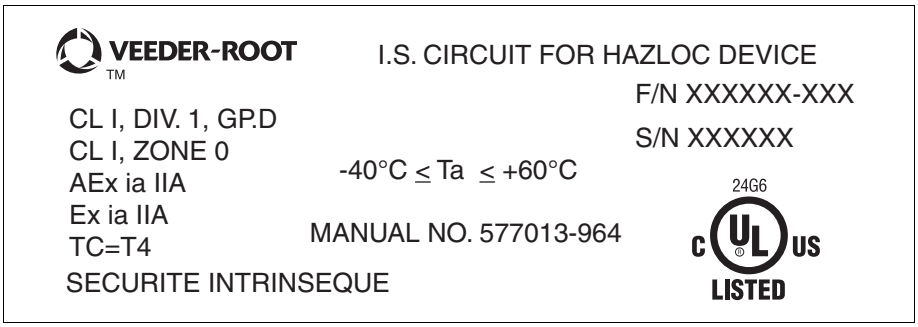
Equipment	UL/cUL Control Drawing Document No.
Associated Apparatus	
TLS-450/8600	331940-008
TLS-350, TLS-350R	331940-011
TLS-300	331940-013
TLS-50 or TLS2 or TLS-IB	331940-014
TLS4/8601	331940-018
TLS-XB/8603	331940-019
Intrinsically Safe Apparatus for Wireless Applications	
Tank Gauge Accessories	331940-012

The control drawings contain information related to the correct installation of the overall intrinsically Safe System. This includes information such as maximum number of apparatus, specific apparatus allowed in the system, maximum cable lengths, references to codes, proper grounding and so on. Control drawings can be found on the accompanying Compact Disk (TECH DOCS CD) or on the internet at veeder.com under SUPPORT; VR TECHNICAL DOCUMENTS; DRAWINGS.



GENERAL PRODUCT WIRING DIAGRAM

Product Label Contents



Safety Warnings

To protect yourself and your equipment, observe the following warnings and important information:

⚠ WARNING

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

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

1. **Read and follow all instructions in this manual, including all safety warnings to protect yourself and others from serious injury, explosion, or electrical shock.**
2. **Comply with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes.**
3. **To protect yourself and others from being struck by vehicles, block off your work area during installation or service.**
4. **Do not alter or modify any component or substitute components in this kit.**
5. **Warning! Substitution of components may impair intrinsic safety.**
6. **Field wiring to the Probe must not share a conduit with any non-intrinsically safe device's wiring.**
7. **Warning! To prevent ignition of flammable or combustible atmospheres, disconnect battery before servicing.**
8. **Materials used in the construction of this device contain aluminum. Care must be taken to avoid ignition hazards due to impact or friction.**
9. **Before installing or taking the unit into a hazardous area, earth the unit in a safe area to remove any static charge. Then immediately transport the unit to the installation site. Do not rub or clean the unit prior to installation. Cleaning is not required under normal service conditions. Do not rub or clean the unit after installation. If the unit is not fixed to a known earth point when installed, ensure that a separate earth connection is made to prevent the potential of a static discharge. When fitting or removing the unit, use of anti-static footwear or clothing is required.**

NOTE ***Failure to install this product in accordance with its instructions and warnings will result in voiding of all warranties with this product.***

Safety Symbols

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

EXPLOSIVE
Fuels and their vapors are extremely explosive if ignited.

FLAMMABLE
Fuels and their vapors are extremely flammable.

ELECTRICITY
High voltage exists in, and is supplied to, the device. A potential shock hazard exists.

TURN POWER OFF
Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.

WARNING Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.	**READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.
SAFETY BARRICADES Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.	

General Precautions

Retain and follow all product safety and operating instructions. Observe all warnings on the product and in the operating instructions. To reduce the risk of bodily injury, electric shock, fire, or damage to the equipment, observe the following precautions.

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

GENERAL PRECAUTIONS

Heed service markings: Opening or removing the console cover may expose you to electric shock. Servicing of Veeder-Root equipment must be done by Veeder-Root authorized service contractors.

Use product with approved equipment: This product should be used only with Veeder-Root components identified as suitable for use with the TLS RF Wireless System.

Use the correct external power sources: This product should be operated only from the type of power sources indicated on the electrical ratings labels affixed to the components. If you are not sure of the type of power source required, consult your Veeder-Root authorized service contractor.

When not in use, a longer battery life can be achieved by keeping the battery pack in a cool, dry location where the temperature never exceeds 30°C or 86°F and does not go below 10° C or 50° F.

SPECIAL TOOLS REQUIRED

- #15 Torx screwdriver
- Small blade screwdriver (maximum blade width 3/32”)
- Wire strippers

National Electrical Code Compliance

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that electrical equipment and wiring located in Class I, Division 1 and 2 installations shall comply with the latest appropriate articles found in the National Electric Code (NFPA 70) and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A), or other local code such as the CEC, Canadian Electrical Code.

TLS RF-TO-TLS CONSOLE WIRING

Wire Type
To ensure the best operating systems available, Veeder-Root REQUIRES the use of shielded cable.

Wire Length
Improper system operation could result in undetected potential environmental and health hazards if the TLS RF-to-TLS Console wire runs exceed 1000 feet. Wire runs must be less than 1000 feet to meet intrinsic safety requirements.

Splices
Veeder-Root recommends that a minimum number of splices are used in the wire run between the TLS RF and the TLS Console. Each splice degrades signal strength and could result in poor system performance.

Wire Gauges - Color coded
Shielded cable must be used in all installations. TLS RF-to-TLS Console wires must be #14 to #18 AWG stranded copper wire and installed as a Class 1 circuit.

Alternate Method
When approved by the local authority having jurisdiction, 22 AWG wire such as Belden 88761 may be suitable in installations with the following provisions:

- Wire run is less than 750 feet
- Capacitance does not exceed 100 pF/foot
- Inductance does not exceed 0.2 µH/foot

TLS RF AC POWER WIRING

Wires carrying 120 or 240 Vac from the power panel to the TLS RF must be at least#14 AWG copper wire for line, neutral and chassis ground (3); and #12 AWG copper wire for barrier ground (1).

NOTE: Note: See page 36 for details of Repeater Power Wiring.

TLS RF Wireless System Site Layout

Figure 1 illustrates an example TLS RF Wireless System installation. The Repeater component may be required if the system Receiver, mounted on building's outside wall, has difficulty receiving signals from any of the Transmitters. See page 36 for Repeater installation.

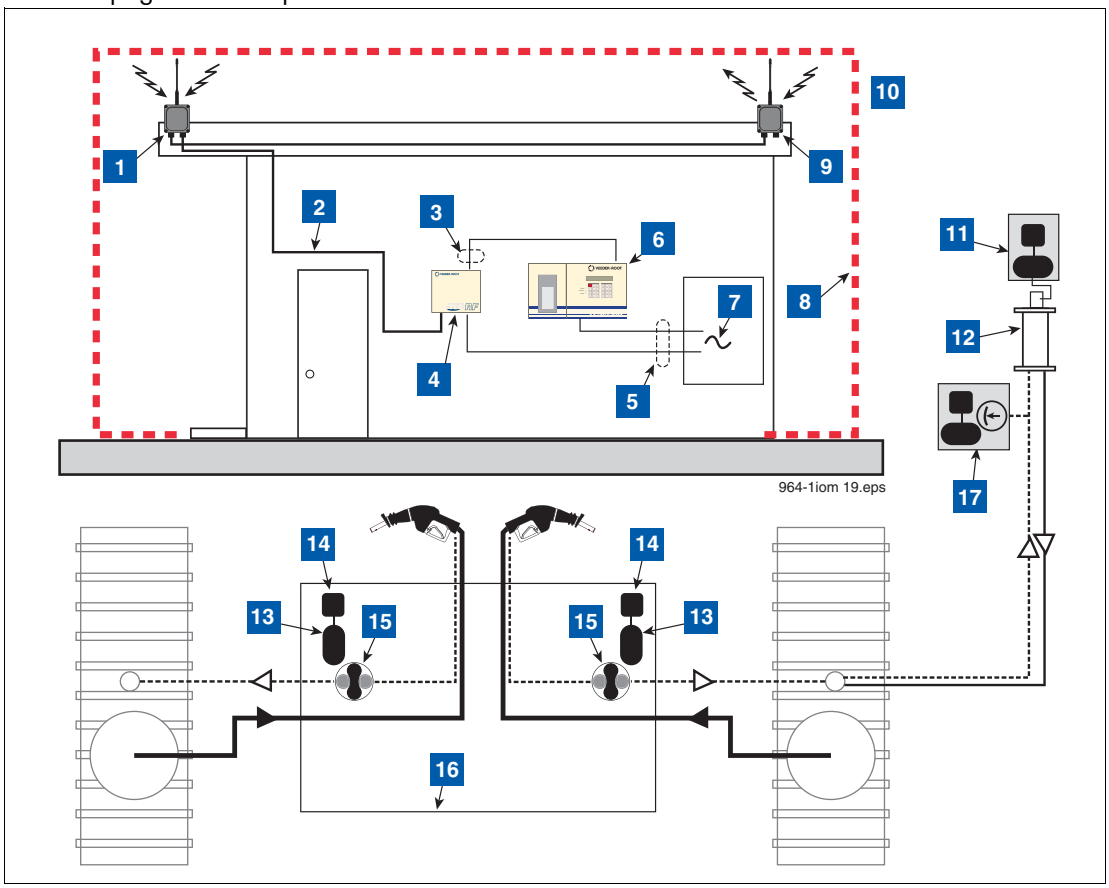


Figure 1. Example TLS RF Wireless System Site Layout

LEGEND FOR NUMBERED BOXES IN Figure 1

To be installed in accordance with the National Electrical Code, NFPA 70 and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A), or other local codes such as the CEC, Canadian Electrical Code.

WARNING! Substitution of components may impair intrinsic safety.

Circuitry within the console barrier forms an intrinsically safe, energy-limited system. This system is intrinsically safe for use in a Class I, Group D hazardous location.

1. Receiver (1 per RF System)
2. RS-485 Cable (Belden #3107A or equiv.)
3. NOTE: Intrinsically safe wiring shall be installed in accordance with Article 504-20 of the NEC, ANSI/ NFPA 70. Max cable length 1000 ft. (304 m).W2 Receiver (1 per RF System)
4. TLS-RF
5. Conduit that enters power wiring knockout.
6. TLS console (Vm = 250 V)
7. 120 or 230 Vac from power panel
8. Non-hazardous area
9. Repeater (1 per RF System)
10. Hazardous area (Class I, Div. 1, Group D)
11. CCVP transmitter/battery enclosure
12. Carbon Canister Vapor Polisher
13. Transmitter
14. Battery Pack
15. Vapor Flow meter
16. Dispenser sump
17. VPRS sensor (w/transmitter/battery in enclosure)

Equipment Dimensions

Dimensions of the TLS RF are shown in Figure 2.

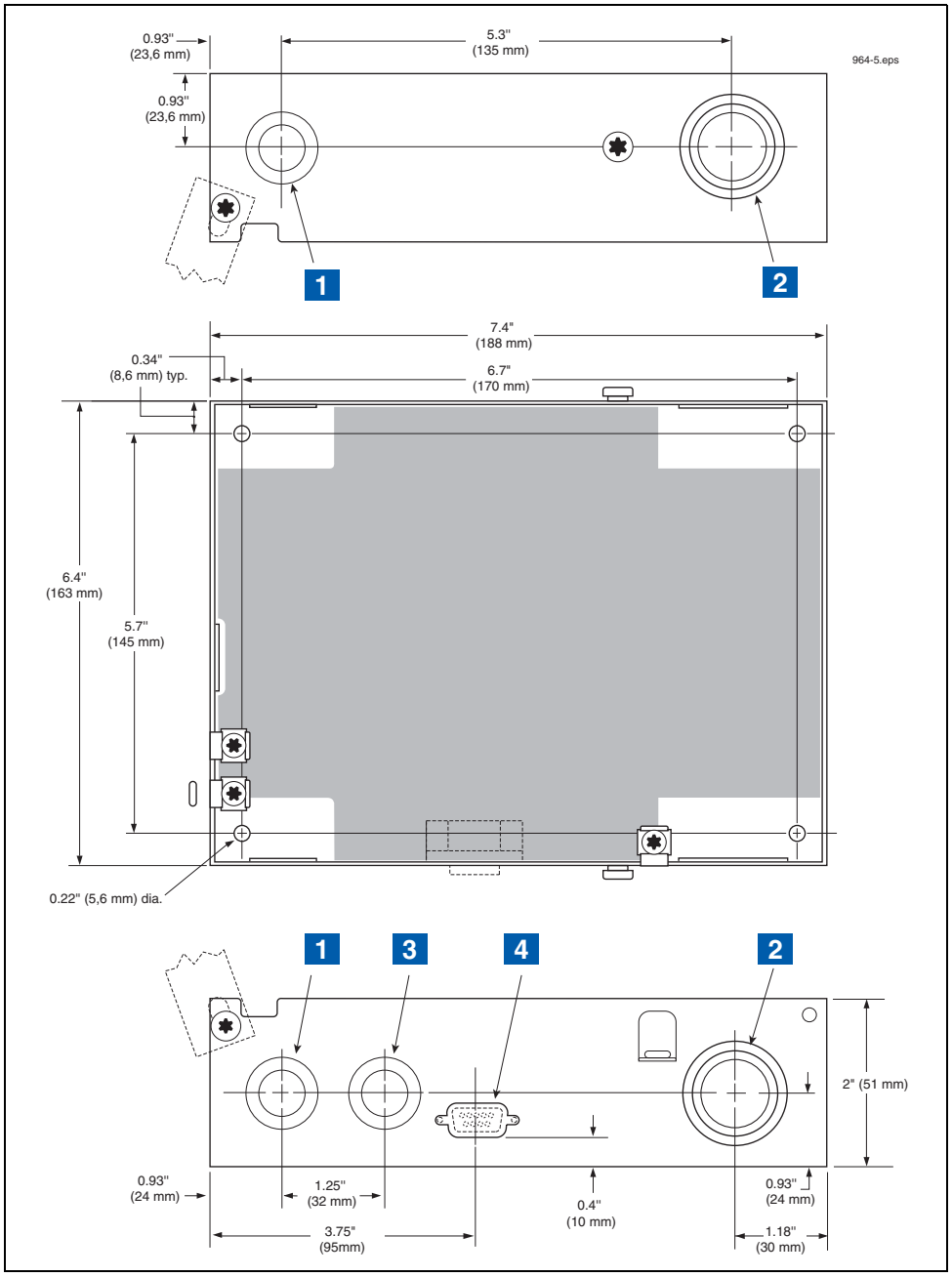


Figure 2. TLS RF Dimensions And Designated Conduit Knockouts

LEGEND FOR NUMBERED BOXES IN Figure 2	
1. Designated power wiring knockouts	3. RS-485 knockout
2. Designated intrinsically-safe wiring knockouts	4. RS-232 knockout

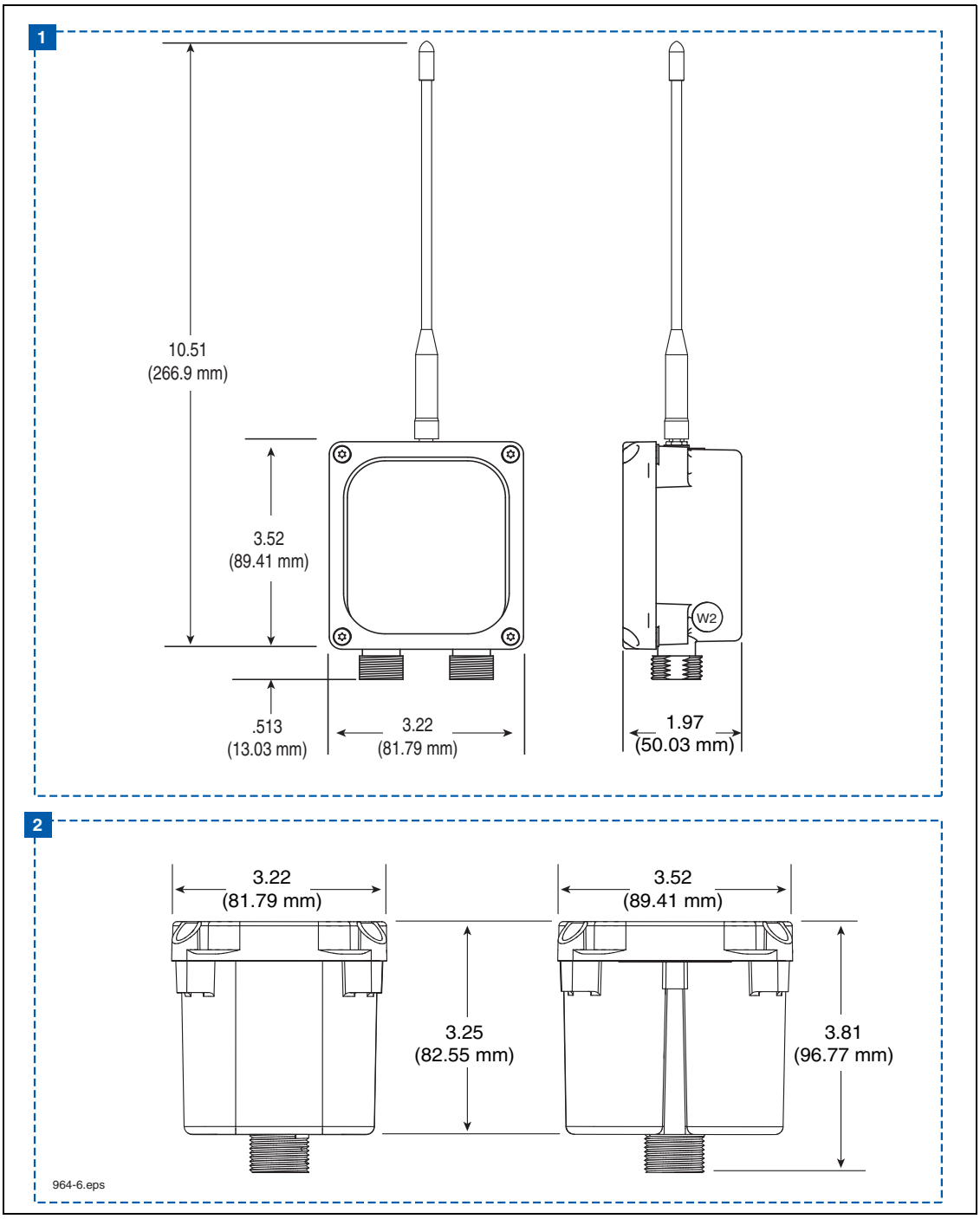


Figure 3. Wireless Component Dimensions

LEGEND FOR NUMBERED BOXES IN Figure 3	
1. W2 Receiver, W2 Transmitter, and W2 Repeater dimensions	2. Battery housing dimensions

Pre-Installation Component Setup and Functional Check

The steps below describe the process of verifying the Wireless System component functionality; listed steps are only for one TLS RF. If there are more than 8 Sensors installed at the site, refer to Appendix B on how to setup the DIP Switches for auxiliary TLS RF(s).

1. Remove all the hardware from their boxes; lay the TLS RF, Receiver, Repeater, and all the Transmitters on a table.
2. Set Site ID for the Receiver, Repeater, and all the Transmitters (refer toAppendix B on how to set up the Site ID). Typically the Site ID is set to 0 (default). **If there is a nearby wireless site, the Site IDs must be different.**
3. Set all Transmitter's Device Numbers and connect the battery cables to all the Transmitters. Label each Transmitter with its site ID.
   a. Using a #15 torx driver, remove the cover of the Transmitter.
   b. Remove the nut from the battery cable cord grip (right side cord grip) and slide it over the non-connector end of the battery cable.
   c. Make sure the battery/dc power cable is not connected to the battery pack or dc power source at this time. Push the battery cable through the battery cable cord grip bushing and into the Transmitter.
   d. Strip back the cable jacket and wires as shown in Figure 4.
   e. Connect the battery pack/dc power cable to the BATTERY terminal block (white to +IN and black to -IN) as shown in Figure 5.
   f. **Hand tighten both cable entry cord grip nuts to prevent water entry!**
   g. Replace the cover of the Transmitter, but do not tighten down cover screws at this time.

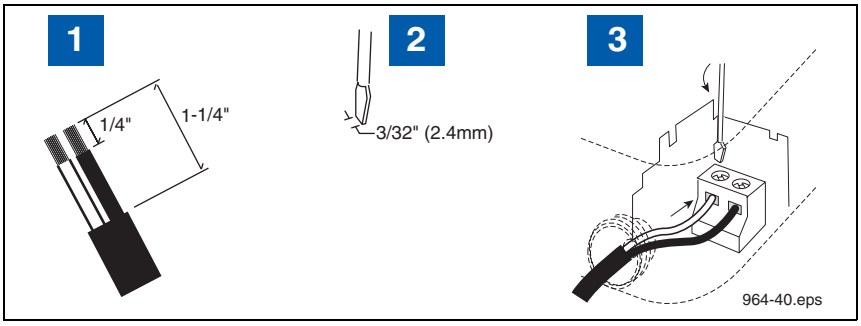


Figure 4. Connecting Wiring To Device Terminal Blocks

LEGEND FOR NUMBERED BOXES IN Figure 4	
1. Strip back cable and wire jackets the amount shown.	3. Both wires must be tight in terminals!
2. Use a screwdriver with the proper blade width.	

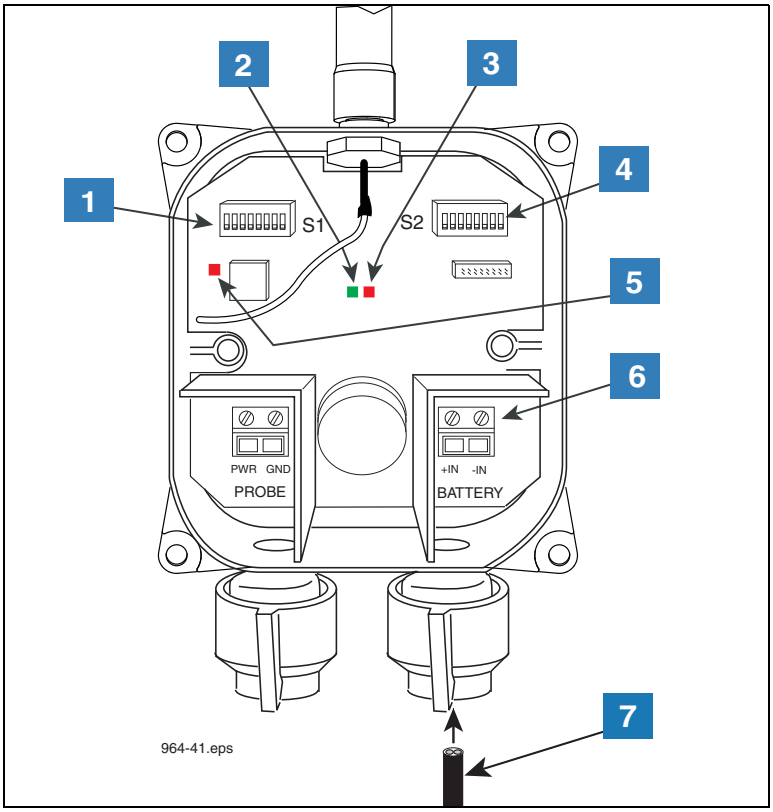


Figure 5. Wiring The Battery Cable To The Transmitter

LEGEND FOR NUMBERED BOXES IN Figure 5	
1. S1 DIP switch	6. Battery power-in terminals (+IN and –IN). Observe polarity!
2. Green LED – Unit status.	**Pay close attention to the polarity of the +15 Vdc. Reversing the connections can cause damage to the TLS RF.**
3. Red LED – Radio status.	7. Cable from battery pack
4. S2 DIP switch	
5. Red LED – Flashes only when radio is powered on in Diagnostic Mode.	

4. Using a #15 torx driver, open the covers of the TLS RF, Repeater and Receiver. Make a temporary ac power cord with a grounded plug on one end. Connect the ac power cord to the TLS RF's input power terminals and ground terminal (refer to Figure 6 and Figure 7). Connect a necessary length of RS-485 cable from the TLS RF's RS-485 terminals to the Receiver's RS-485 terminals (refer to Figure 23). Connect a necessary length of 2-conductor cable from the Receiver's Repeater terminals to the Repeater's Repeater terminals (refer to Figure 24).

5. The steps below are to verify the communication between the TLS RF Unit and the Receiver.

   a. Plug the TLS RF's ac power cord into a 120/240 Vac outlet. Confirm the Green /Red LEDs (refer to item 2 in Figure 12), are flashing rapidly. This is an indication there is RS-485 network activity between the TLS RF and the Receiver.

   b. If it is, continue to Step 6.

   c. If it is not, check PWR LED (refer to item 3 in Figure 12), if not lit; check power wiring. If the wiring is correct, measure the voltage across the twisted pair power wires, it should read +15Vdc. If it is not, the TLS RF is bad.

d. If the Red LED (refer to item 2 in Figure 12) is not flashing, confirm the TLS RF address is set to Master (refer to Appendix B, Figure B-1on how to set the TLS RF Device Number). If it is, the TLS RF has failed.

e. If the Red LED is flashing and the Green LED is not flashing, the TLS RF is not receiving a response from the Receiver.

f. Confirm the Receiver PWR LED is lit (refer to item 1 in Figure 23). If not check the power wiring.

- If the power wiring is correct, measure across the +15V and GND (refer to item 4 in Figure 23), it should be +15Vdc. If it is not, measure the voltage across the +15V and GND terminals in the TLS RF, it should read +15Vdc. If it does, replace the twisted pair power wires. If it does not, the Receiver is bad.
- Check the RS-485 Green LED (refer to item 1 (PWR LED) in Figure 23), if it is flashing; it is receiving Data from the TLS RF. If it is not flashing, check the RS-485 cabling between the TLS RF and the Receiver.
- Check the Red LED (XMIT LED, [item 1 in Figure 23]), if it is flashing; check the cabling. If it is not flashing, the Receiver is at fault; replace the Receiver.

6. This step is to verify to make sure Data from the Transmitter is being received by the TLS RF. Make sure the power to the Repeater is off.

   a. Connect the first Transmitter's battery cable to a battery pack; noting the Red LED should be flashing momentarily then followed by the Green LED (refer to item 2 and 3 in Figure 5). Since there is no Sensor connected, the two LEDs should be flashing. This is an indication a Sensor communication error and is acceptable at this step.
   TIP - Normal flashing is when an LED turns On for over 1 second and turns Off for over 1 second. Error flashing is when an LED turns On and Off every 1/2 second or less.

   b. Go to the TLS RF, open its cover. One of the 8 Red received LEDs should be flashing (refer to item 5 in Figure 12). Observe which LED is lit and compare it against the Transmitter Device Number; they should match. For example, if the Transmitter ID is set to 1, the LED number 1 in the TLS RF should be flashing.

   c. If the Transmitter Device Number and the LED in the TLS RF do not match, disconnect the Transmitter's battery cable from the battery pack. Move this DIP switches back and forth a few times to make sure they are set properly. Reset this DIP Switch to the correct setting; reconnect the battery cable; confirm that the correct LED is flashing.

   d. If they still do not match, disconnect the Transmitter's battery cable from the battery pack; change the Transmitter Device Number to different setting and repeat Step 6.

   e. If resetting the Transmitter to a different Device Number and the LED position in the TLS RF matches; that DIP Switch position is bad, the Transmitter is at fault.

   f. If resetting the Transmitter to a different Device Number and the LEDs in the TLS RF and the Transmitter are not matched; remove the power from the Transmitter and put it aside.

   g. Repeat Step 6 with the next Transmitter.

   h. If both Transmitters have the same problems, it could be the Receiver or the TLS RF.

   i. In the case where the LED in the TLS RF is not flashing, check the Site ID in the Receiver and the Transmitter to make sure they are correct. If the Site IDs are correct, the Transmitter or the Receiver is at fault. NOTE: Sometimes it is necessary to disconnect the battery cable from the battery pack and wait for 2 minutes and retry again to make sure the connection is established properly.

7. If all the Transmitters have been verified to be working properly, they are now ready to be installed.

8. Unplug the TLS RF, disconnect the temporary power cable and RS-485 cable to the Receiver and close the cover of the TLS RF, but do not tighten the cover screws at this time.

9. Disconnect the temporary RS-485 and 2-conductor cables from the Receiver and replace its cover, but do tighten at this time. Disconnect the temporary 2-conductor cable from the Repeater and replace its cover, but do not tighten at this time.

TLS RF Installation

Selecting A Location

⚠ WARNING

Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed. The TLS RF is not explosion proof.

An explosion or fire resulting in serious injury or death, property loss and equipment damage could occur if the console is installed in a volatile, combustible or explosive atmosphere (Class I, Division 1 or 2).

Do not install this unit in a volatile, combustible, or explosive atmosphere.

The TLS RF must be mounted indoors, protected from severe vibration, extremes in temperature and humidity, and other conditions that could harm computerized electronic equipment.

Ensure that the TLS RF is located where neither it nor its associated cabling will be damaged by doors, furniture, etc. Consider the ease of routing wiring, and ducting to the TLS console. Check that the mounting surface is strong enough to support the unit's weight of about 4 pounds.

Mounting the TLS RF

Install the unit's fastening devices to the mounting surface using the hole pattern (6.7" x 5.7") shown in Figure 2. Mounting screws up to 3/16" diameter may be used.

Install metal conduit (1/2-inch I.P.S.) between the upper power side knockout on the unit and the power panel. Figure 2 shows the two designated knockouts (one each on top and bottom) through which power wiring can safely enter the unit.

Also install metal conduit (1/2-inch I.P.S.) between the lower intrinsically-safe wiring knockout on the TLS RF and an intrinsically-safe wiring knockout on the TLS console for device data wiring.

Wiring the TLS RF

⚠ WARNING

The unit contains voltages which can be lethal.

Connecting power wires to a live circuit can cause electrical shock that may result in serious injury or death.

Turn power off at the circuit breaker before connecting wiring to the TLS RF.

Attach conduit from the power panel to the unit's power wiring knockouts only (1 on top and 1 on bottom, ref. Figure 2)

To connect power wiring see Figure 6. To connect Receiver wiring see Figure 7. To daisy chain two TLS RFs, see Figure 9 and Figure 10. To connect TLS RF data output wiring to the TLS console see Figure 6.

WARNING! Do not apply power to the TLS RF Console until all device wiring is complete. This includes the wiring for the Receiver, Repeater, the probes and additional TLS RF Consoles.

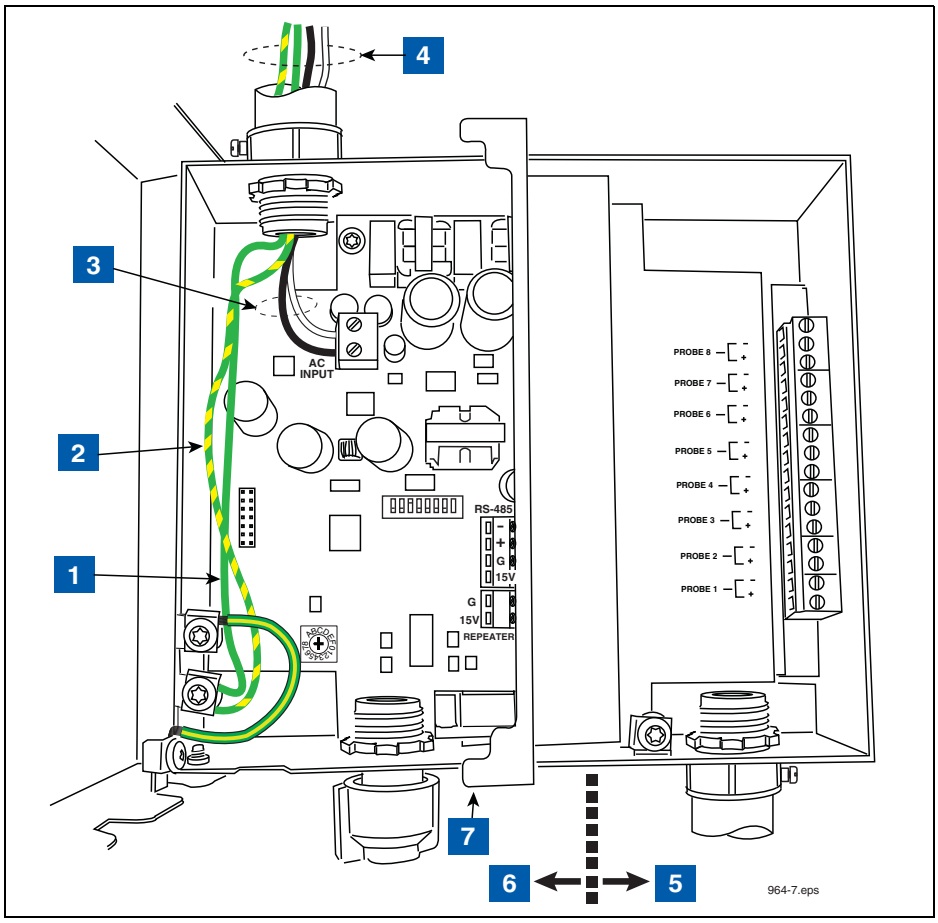


Figure 6. Wiring AC Power To The TLS RF

LEGEND FOR NUMBERED BOXES IN Figure 6

1. Attach chassis ground wire (#14 AWG) to ground lug.
2. Protective earthing conductor (green and yellow). Attach #12AWG barrier ground wire to ground lug. Ground must be the same as the supply and less than 1.0 ohms to ground.
3. AC power input wires (#14 AWG) to AC INPUT terminals.
4. POWER WIRING NOTES:
   - Barrier ground must be #12 AWG or larger diameter.
   - Check to be sure that the electrical resistance between the unit ground lug and a known good earth ground is less than 1 ohm.
   - Connect the power supply wires in the power panel to a separate dedicated circuit.
   - Electrical rating power input - 120 Vac or 240 Vac, 50/60 Hz, 2 A max.
   - See Figure 2 for actual locations of power conduit knockouts into the unit. Power wiring must enter only in one of these knockouts.
5. Intrinsically-safe side
6. Power side
7. RS-232 diagnostic port:
   - Baud rate - 9600
   - Data length - 8
   - Parity - None
   - Stop bits - 1

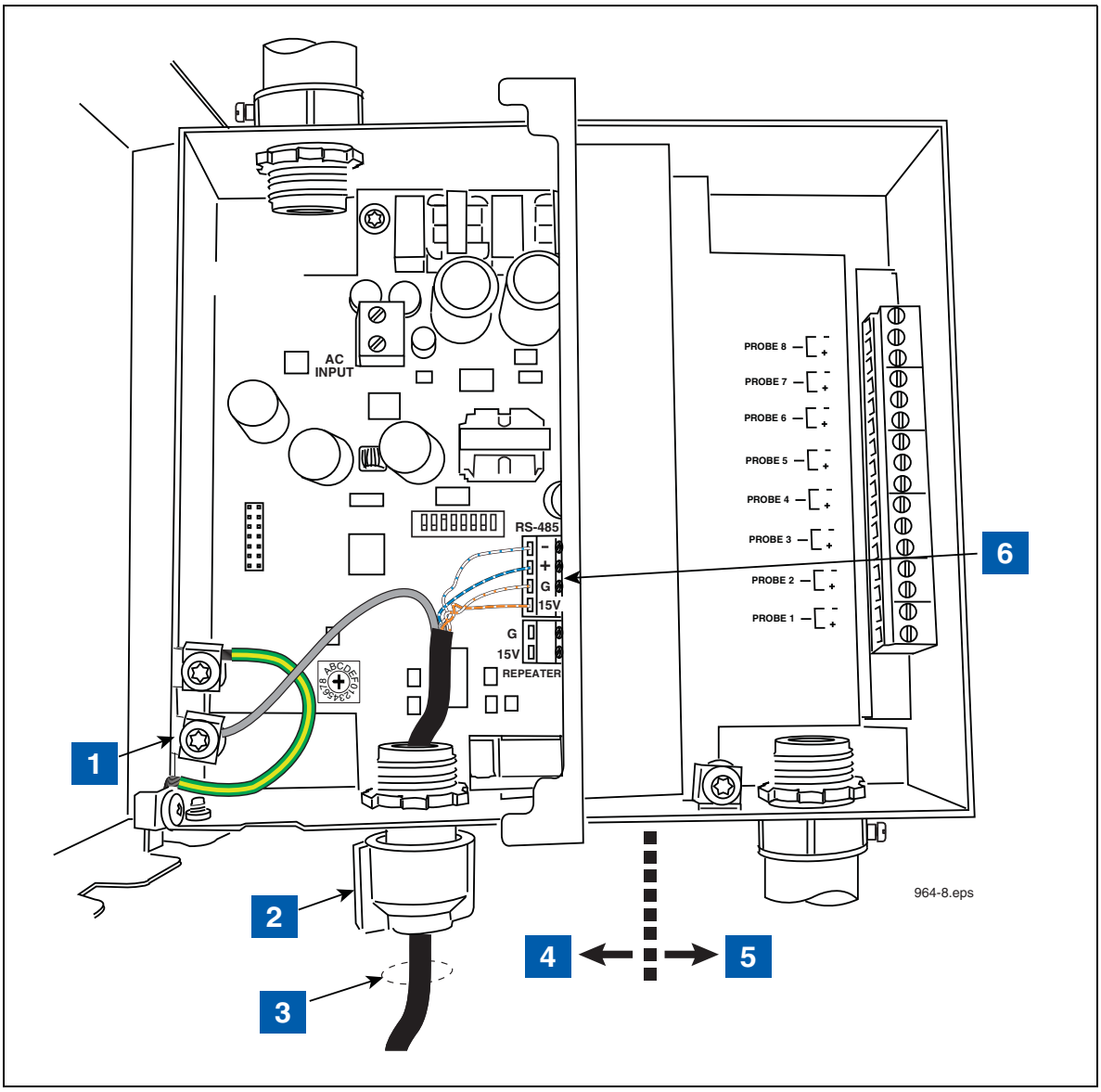


Figure 7. Wiring Receiver To The TLS RF

LEGEND FOR NUMBERED BOXES IN Figure 7	
1. Connect the shield of the RS-485 cable to the ground lug. 2. Cord grip 3. RS-485 cable to Receiver 4. Power side 5. Intrinsically-safe side 6. NOTE: Attach one end of RS-485 cable to the RS-485 terminals in the TLS RF and other end to the RS-485 terminals in the Receiver. One twisted pair connects to terminals - and + (RS-485 signals) and the second twisted pair connects to terminals +15 and G (Receiver power).	6 (Cont'd.). Connect each of the four wires to the same terminals in the Receiver (ref. Figure 23). NOTE: see Figure 4 for wire connection tips.NOTE: In sites with more than one TLS RF, the Receiver is only connected to the master TLS RF.

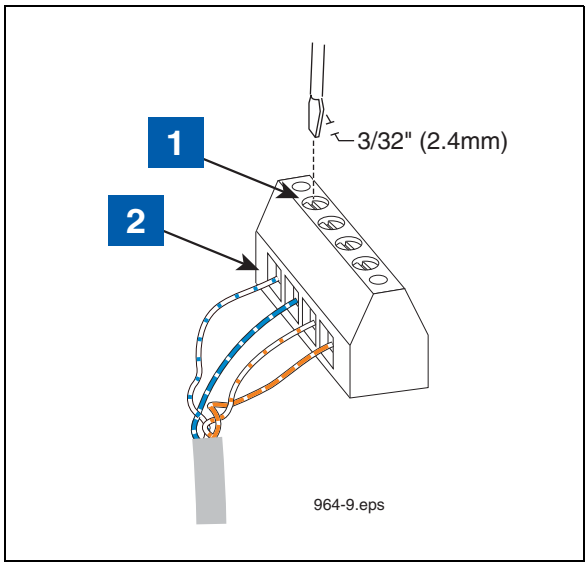


Figure 8. Connecting RS-485 Wiring

LEGEND FOR NUMBERED BOXES IN Figure 8	
1. Use small blade screwdriver and loosen terminal by turning top screw over desired terminal counter clockwise. DO NOT raise screw head above top of hole or it may disengage from clamp.	2. Insert 1/4" stripped wire into terminal clamp's side opening and tighten screw clockwise until wire cannot be moved in or out.

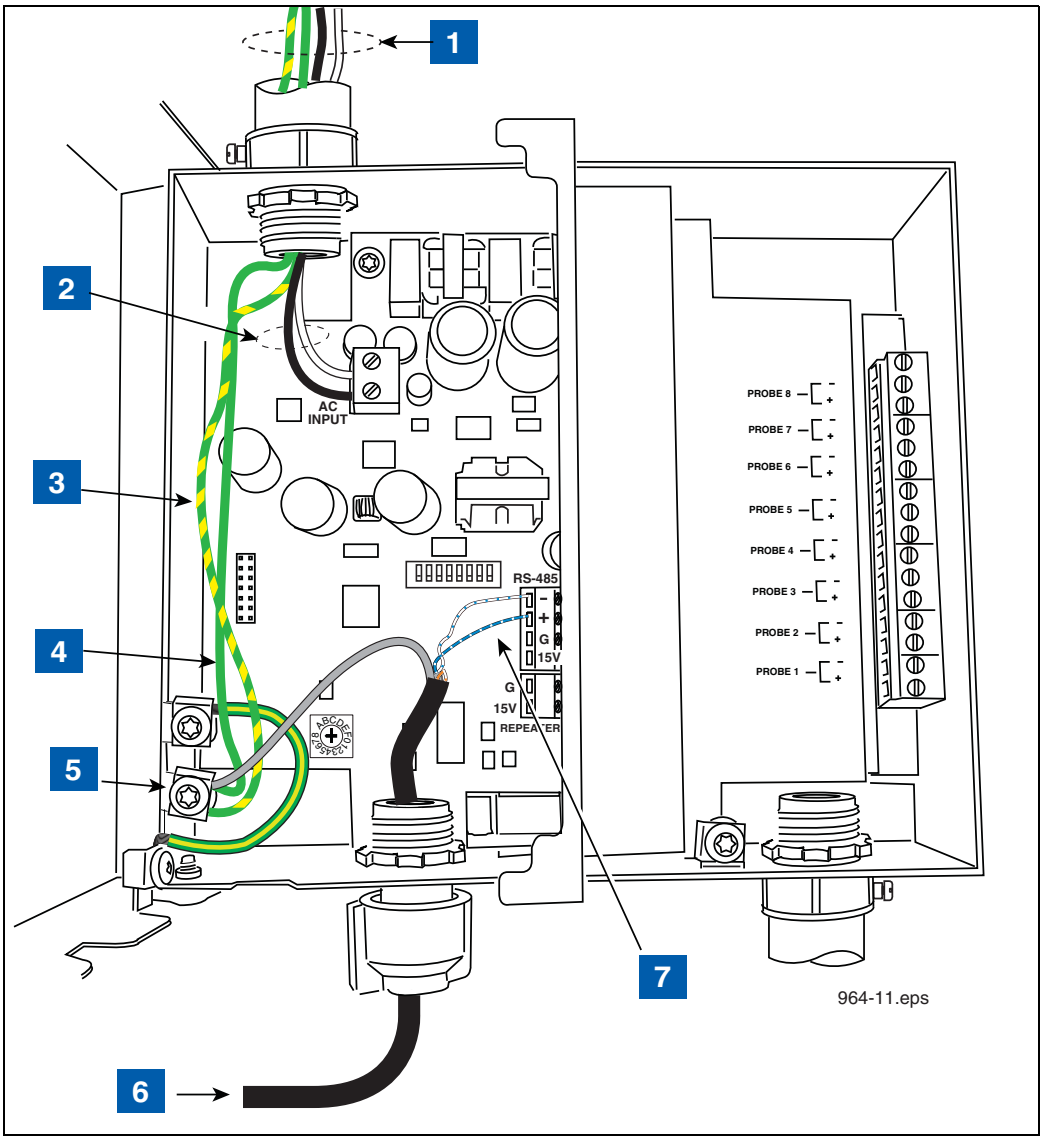


Figure 9. Power Connections To A Daisy Chained TLS RFs

LEGEND FOR NUMBERED BOXES IN Figure 9

1. POWER WIRING NOTES:
   - Barrier ground must be #12 AWG or larger diameter.
   - Check to be sure that the electrical resistance - between the unit ground lug and a known good earth ground is less than 1 ohm.
   - Connect the power supply wires in the power panel to a separate dedicated circuit.
   - Electrical rating power input - 120 Vac or 240 Vac, 50/60 Hz, 2 A max.
   - See Figure 2 for actual locations of power conduit knockouts into the unit. Power wiring must enter only in one of these knockouts.
2. AC power input wires (#14 AWG) to AC input terminals.
3. Protective earthing conductor (green and yellow). Attach #12AWG barrier ground wire to ground lug. Ground must be the same as the supply and less than 1.0 ohms to ground.
4. Attach chassis ground wire (#14 AWG) to ground lug.
5. Connect the shield of the RS-485 cable to the ground lug.
6. RS-485 cable from master TLS RF.
7. See Figure 10 for connections.

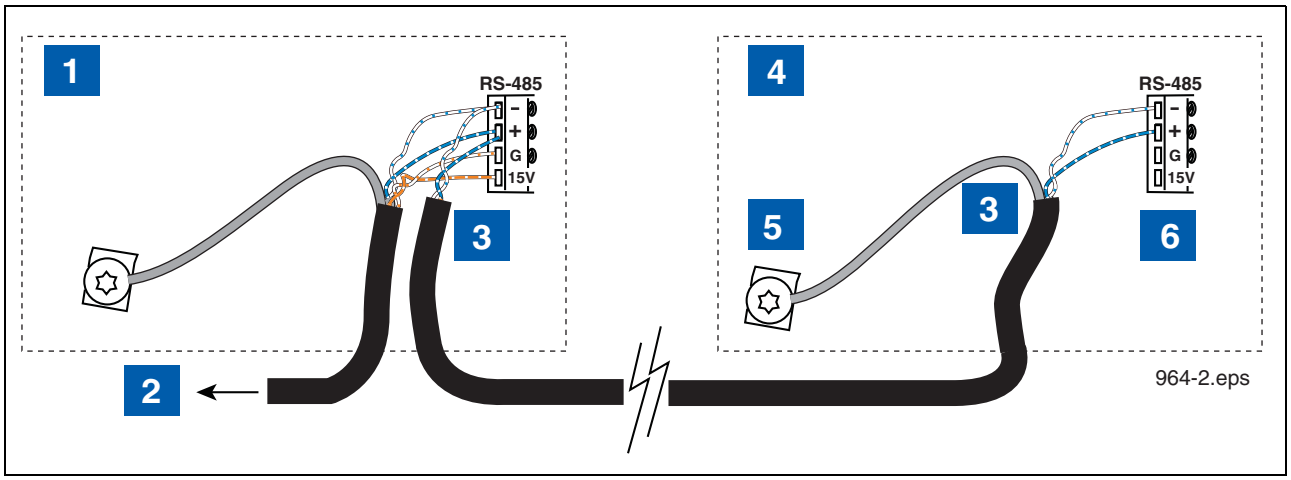


Figure 10. RS-485 Cable Connections When Daisy Chaining Two TLS RFs

LEGEND FOR NUMBERED BOXES IN Figure 10	
1. Master TLS RF	5. Connect the shield of the RS-485 cable to the ground lug.
2. RS-485 cable to Receiver.	6. Connect like colored wires of the twisted pair to like terminals in the auxiliary TLS RF. Each additional TLS RF connects in the same way.
3. RS-485 cable to auxiliary TLS RF. Cut the unused twisted pair back to the cable's jacket at each end of the cable. Maximum cable length is 500 feet if a communication grade cable is used.	
4. Auxiliary TLS RF	

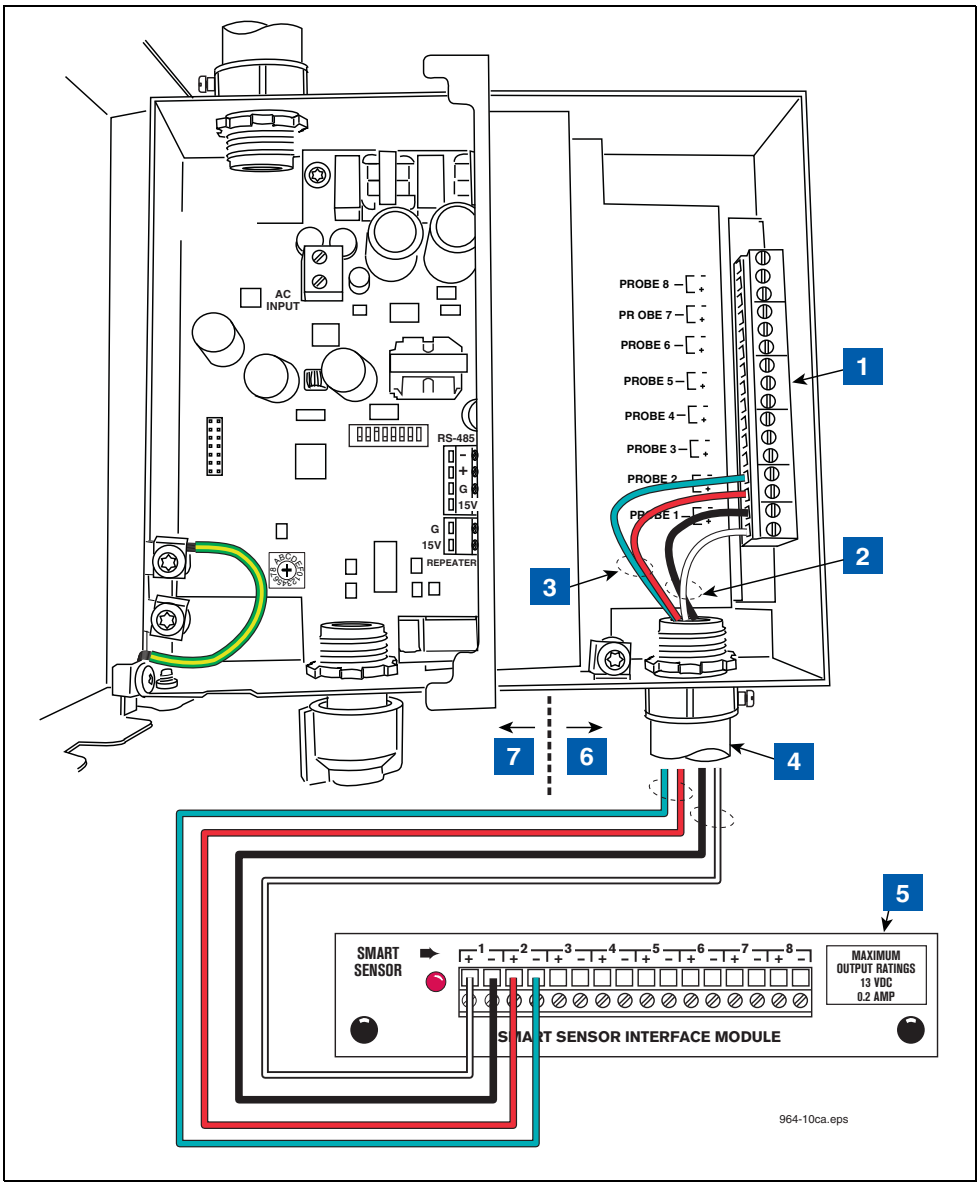


Figure 11. Wiring Data Outputs from TLS RF to TLS Console

LEGEND FOR NUMBERED BOXES IN Figure 11

Note: Output wiring from the TLS RF to the TLS console is an intrinsically safe circuit.

NOTE: Intrinsically safe wiring shall be installed in accordance with Article 504-20 of the NEC, ANSI/NFPA 70.

1. Received Transmitter data output terminals (1-8).
2. In this example, device output 1 is a CCVP transmitter - Observe polarity. Note: each time a transmission is received from this device, LED 1 (see item 5 in Figure 12) will flash.
3. In this example, device output 2 is a Flow Meter - Observe polarity. Note: each time a transmission is received from this device, LED 2 (see item 5 in Figure 12) will flash.
4. 1/2" i.p.s. conduit to TLS console
5. SmartSensor interface module in TLS console
6. Intrinsically-safe side
7. Power side

Figure 12 locates the diagnostic lights and setup switches in the TLS RF.

Each TLS RF in the site network must have a unique device set number (0,1,2 or 3). The factory default setting is '0'. You must select '0' for the master TLS RF. The site's Receiver must also be connected to the master TLS RF.

If a second TLS RF is required, enter '1' in the auxiliary TLS RF. For additional TLS RFs, enter '2' for the third and '3' for the fourth.

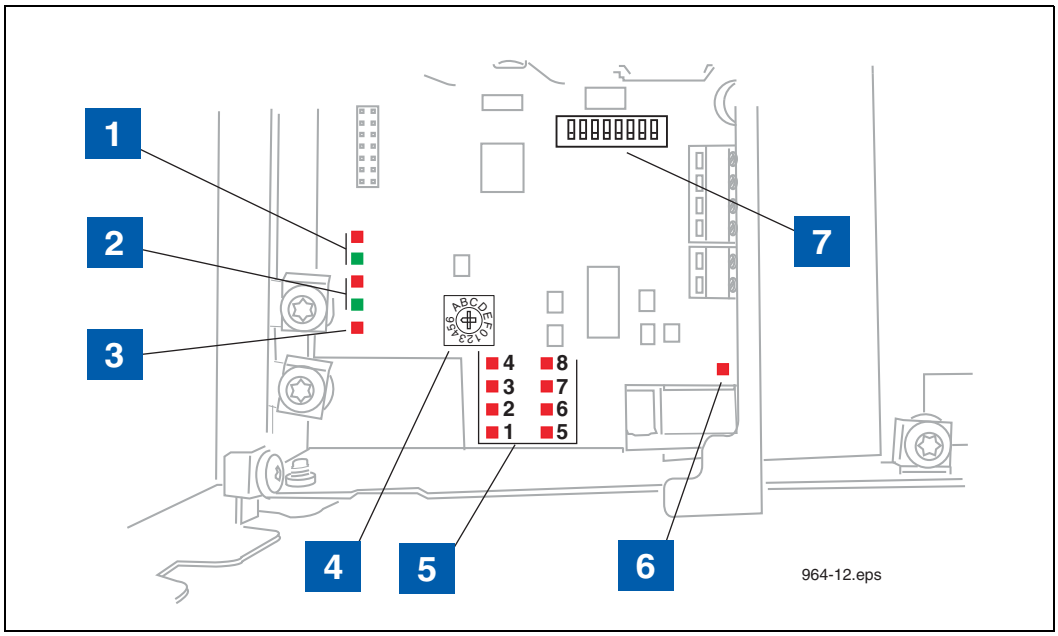


Figure 12. TLS RF Diagnostic LEDs And Switch Locations

LEGEND FOR NUMBERED BOXES IN Figure 12

1. These LEDs flash when there is comm activity on RS-232 port (Red = TX, Green = RX).
2. These LEDs flash when there is comm activity on the RS-485 network (between TLS RF and Receiver).
3. Red LED is lit when TLS RF is powered on.
4. Device time out rotary switch selects the maximum allowed time to wait for communication from Transmitter before a Comm alarm is posted by TLS console (see Appendix B for selections). Position 1 (10 minutes) is the factory default setting.
5. These red LEDs flash when a message is received from a Transmitter in the monitored device set. LED 1 is the device wired to I.S. output terminal 1. LED 2 is the device wired to output terminal 2, etc.
6. Red LED flashes when TLS console is polling for device data.
7. S2 DIP switches 1–2 enter device set address (seeAppendix B).

Vapor Flow Meter Installation - Dispenser

1. A Transmitter/battery pack pair must be installed with the Veeder-Root Vapor Flow Meter (VFM) in the dispenser cabinet.
2. Install the VFM in the dispenser following instructions accompanying the VFM.
3. Using two taptite screws from the kit, attach the Transmitter housing to the side of the battery support bracket that has the two circular slots (see Figure 13). Do not tighten screws at this time.
4. Remove the cover from the transmitter. Attach the non-connector end of the cable from the VFM to the transmitter as described in the section below entitled “Connecting Cables To The Transmitter” on page 31, then attach the transmitter/L bracket assembly to the back mounting surface using two #10 taptite screws from the kit.
5. Determine a support location within the dispenser cabinet that will allow you room for the transmitter/battery support bracket. Clamp the bracket to an available support structure (see Figure 14).
6. Rotate the Transmitter antenna as close as possible to a horizontal position then tighten two mounting screws in housing.
7. Insert the battery pack into its support bracket - do not connect the battery cable to the battery pack at this time.
8. Do not replace dispenser sheet metal cover until completing the “Site Startup Procedure”.

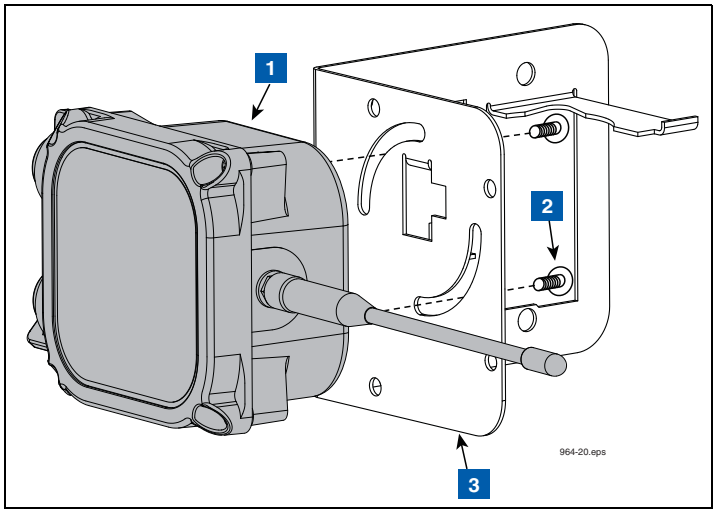


Figure 13. Attaching Transmitter To Battery Support Bracket

LEGEND FOR NUMBERED BOXES IN Figure 13
1. Transmitter
2. #10 x 1/2” taptite screws (2)
3. Battery support bracket

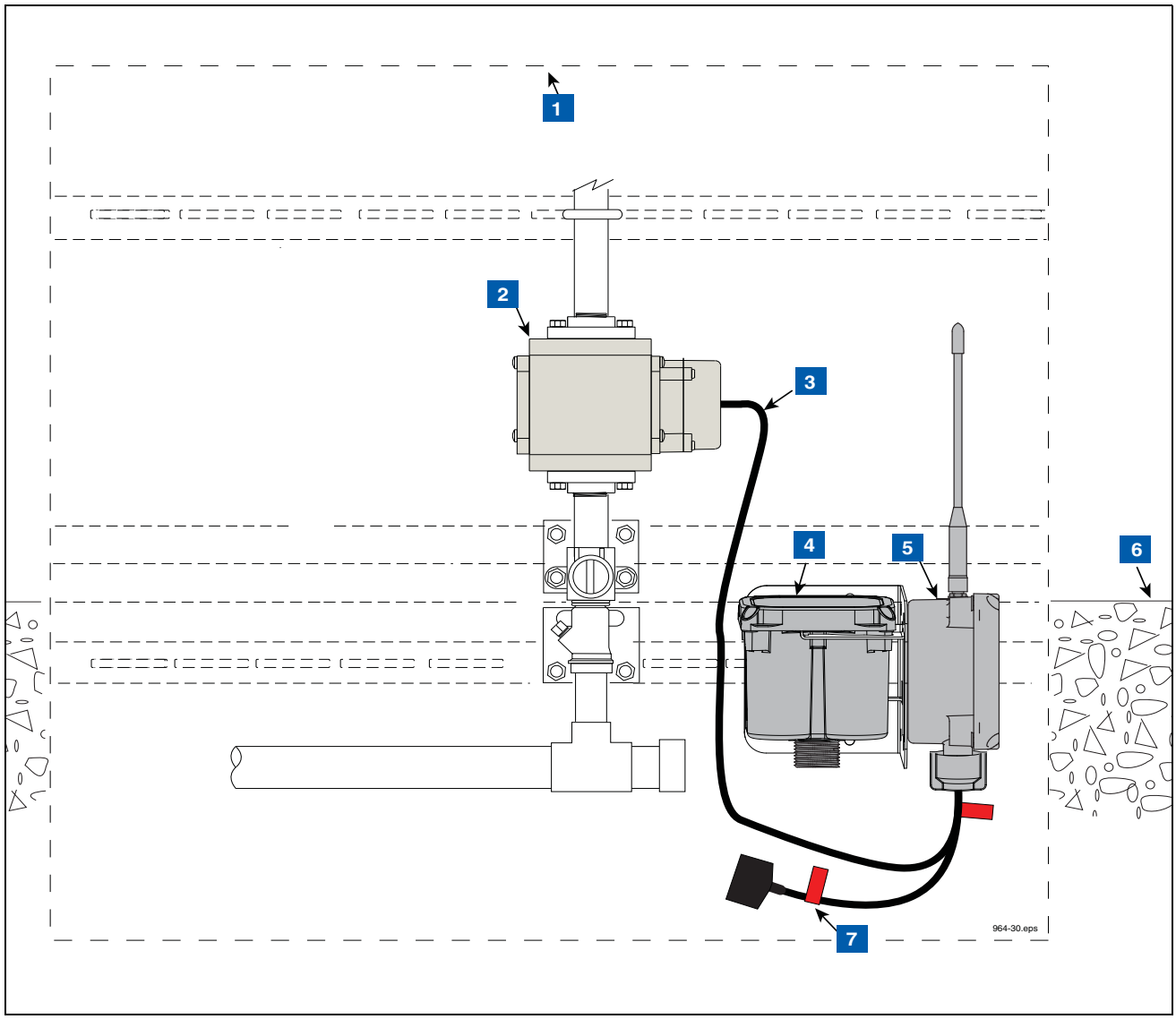


Figure 14. Example VFM Transmitter Installation In Dispenser

LEGEND FOR NUMBERED BOXES IN Figure 14	
1. Base of dispenser cabinet	5. Transmitter
2. VFM	6. top of dispenser pedestal
3. VFM cable	7. Battery caution label attached to battery cable (2 places)
4. Battery pack	

Carbon Canister Vapor Polisher Installation

1. During the installation, all required National, State and local safety codes must be followed.
2. A Transmitter /battery pack pair must be installed with the Veeder-Root Carbon Canister Vapor Polisher (CCVP) in a weatherproof enclosure mounted on the vent stack (see Figure 15).
3. Install the CCVP sensor following instructions accompanying the sensor.
4. Using two #10 taptite screws from the kit, attach the Transmitter housing to the side of the L bracket from the wireless installation kit - do not attach L bracket/transmitter assembly to the back mounting surface at this time.
5. Get the battery pack mounting bracket from the wireless installation kit and put the threaded connector fitting of the battery housing through the large hole in the bracket.
6. Get the thin hex nut from the kit and screw it onto the battery housing cable connector threaded fitting until snug (see item 3 in Figure 16).
7. Attach the battery housing/bracket assembly to the back mounting surface of the enclosure using two #10 taptite screws from the kit (see item 4 in Figure 16).
8. Remove the cover of the transmitter. Connect the non-connector end of the cable that connects the CCVP to the transmitter as described in the section below entitled “Connecting Cables To The Transmitter” on page 31, then attach the transmitter/L bracket assembly to the back mounting surface using two #10 taptite screws from the kit.
9. Attach the connector end of the CCVP cable to the Carbon Canister’s Vapor Valve connector (see Figure 17).
10. Insert the battery pack into its support bracket - do not connect the battery cable to the battery pack at this time.

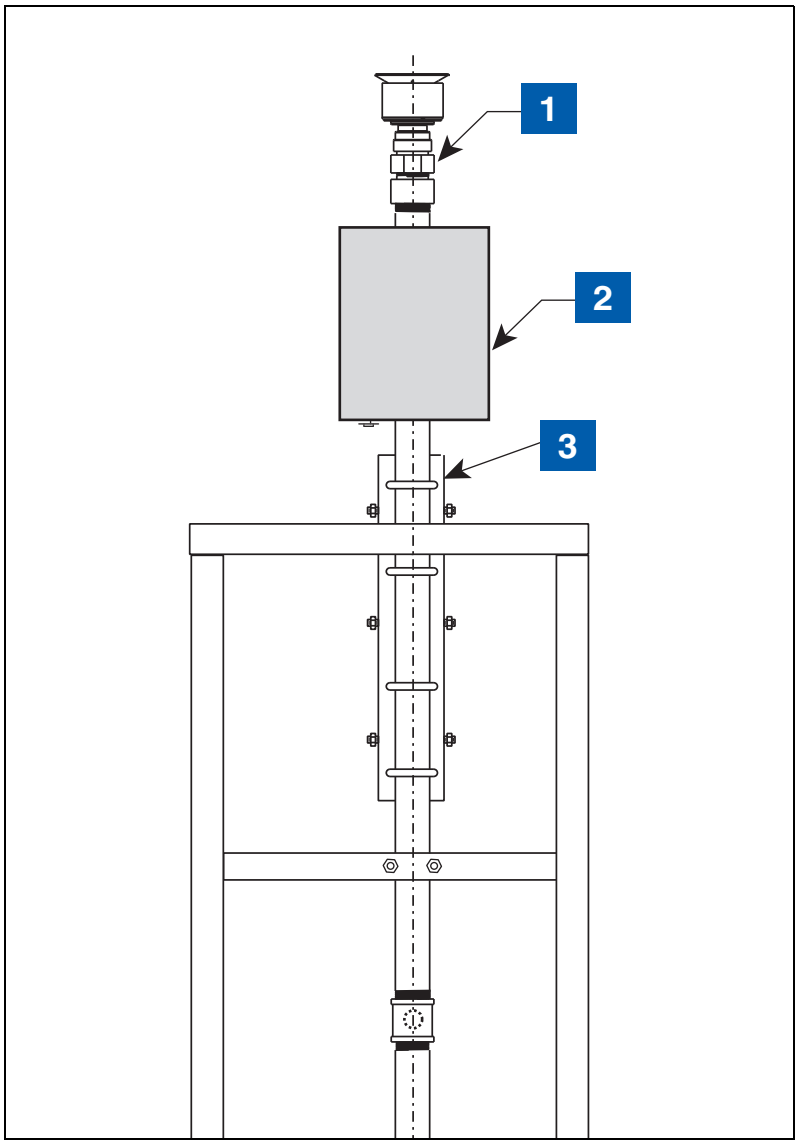


Figure 15. Example CCVP installation

LEGEND FOR NUMBERED BOXES IN Figure 15	
1. CCVP transmitter/battery enclosure on vent stack	2. CCVP support bracket

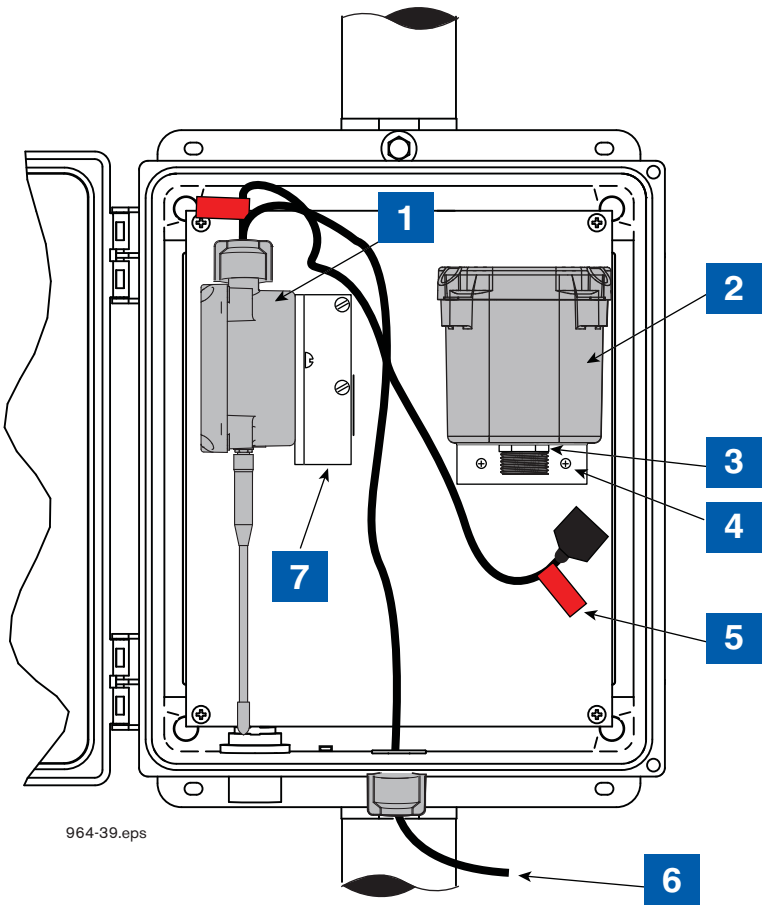


Figure 16. Example CCVP transmitter/battery pack installation in vent stack enclosure

LEGEND FOR NUMBERED BOXES IN Figure 16	
1. Transmitter	5. Battery caution label attached to battery cable (2 places)
2. Battery pack	6. Cable from CCVP
3. Thin hex nut	7. Attach Transmitter L bracket using two #10 taptite screws
4. Attach Battery L bracket using two #10 taptite screws	

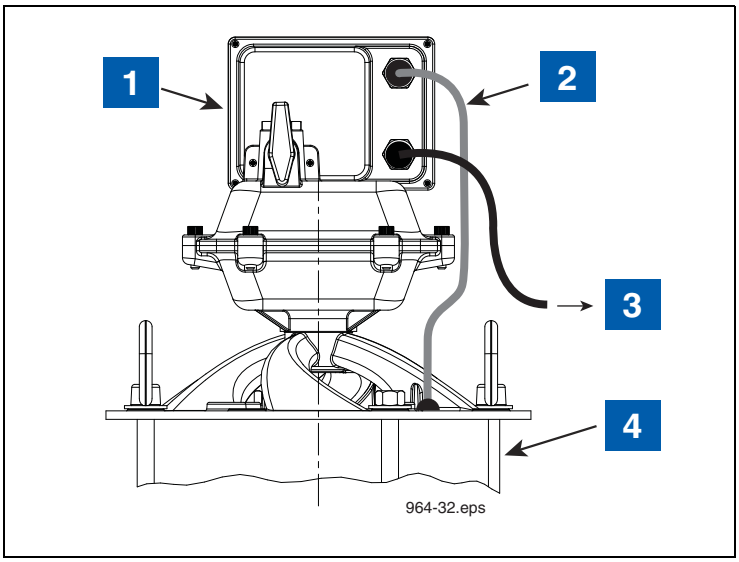


Figure 17. Attaching transmitter cable to CCVP vapor valve

LEGEND FOR NUMBERED BOXES IN Figure 17	
1. Vapor Valve assembly	3. Cable to CCVP transmitter
2. Cable to CCVP thermal probe (factory installed)	4. CCVP

Vapor Return Pressure Sensor Installation

VENT STACK INSTALLATION EXAMPLE

1. A Transmitter/battery pack pair must be installed with the Veeder-Root Vapor Return Pressure Sensor (VRPS) in the Universal Enclosure and mounted on the vent stack (see Figure 18).
2. Install the VRPS sensor in the Universal Enclosure following instructions accompanying the sensor. During the installation, all required National, State and local safety codes must be followed.
3. Using two #10 taptite screws from the Universal Enclosure kit, attach the Transmitter housing to the side of the L bracket from the Universal Enclosure kit - do not attach L bracket/transmitter assembly to the back mounting surface at this time.
4. Get the battery pack mounting bracket from the Universal Enclosure kit and put the threaded connector fitting of the battery housing through the large hole in the bracket.
5. Get the thin hex nut from the kit and screw it onto the battery housing cable connector threaded fitting until snug (see item 4 in Figure 19).
6. Attach the battery housing/bracket assembly to the back mounting surface of the Universal Enclosure using two #10 taptite screws from the kit (see item 5 in Figure 19).
7. Connect the VRPS and battery cables to the VRPS transmitter as described in the section below entitled “Connecting Cables To The Transmitter” on page 31, then attach the transmitter/L bracket assembly to the back mounting surface using two #10 taptite screws from the kit.

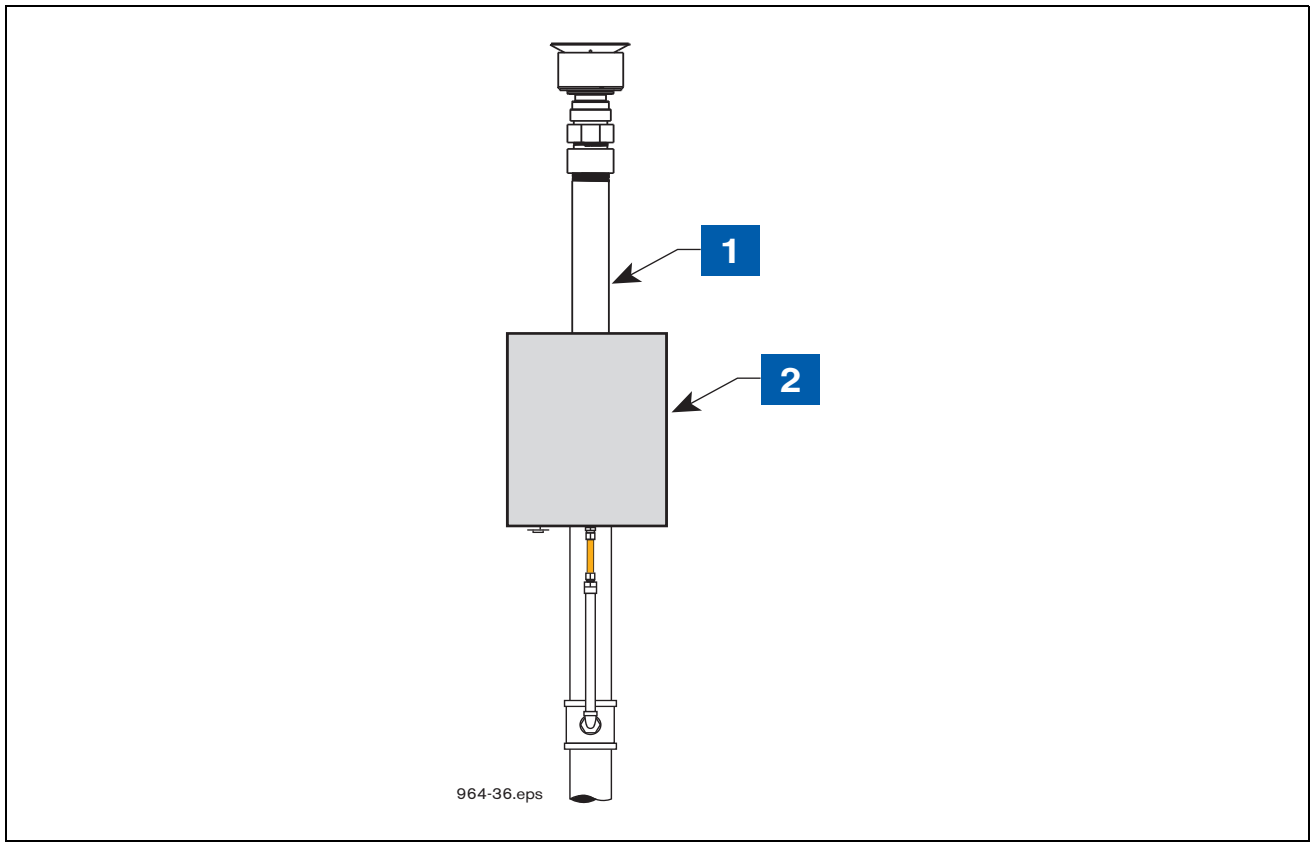


Figure 18. VRPS Mounted In Universal Enclosure On The Vent Stack

LEGEND FOR NUMBERED BOXES IN Figure 18	
1. Vent stack	2. VRPS sensor, wireless transmitter/battery in Universal Enclosure

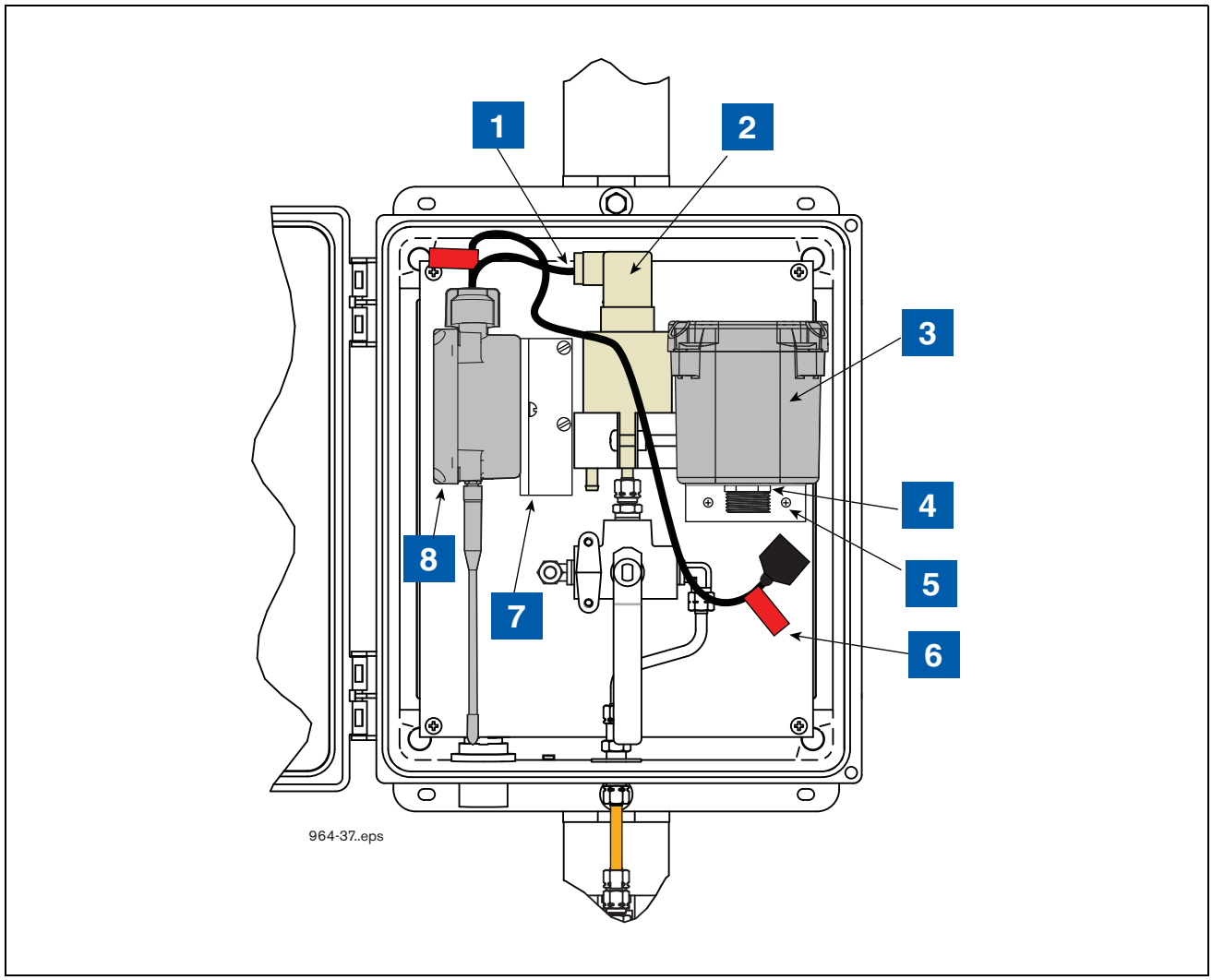


Figure 19. Example VRPS Transmitter/battery Pack Installation In The Universal Enclosure

LEGEND FOR NUMBERED BOXES IN Figure 19	
1. VRPS cable	5. Attach Battery L bracket using two #10 taptite screws
2. VRPS	6. Battery caution label attached to battery cable (2 places)
3. Battery pack	7. Attach Transmitter L bracket using two #10 taptite screws
4. Thin hex nut	8. Transmitter

Connecting Cables To The Transmitter

Note: The dip switches in each transmitter must be set to the proper dip switch settings listed in Appendix B. If the dip switches are set incorrectly, this device will fail to operate properly.

1. Using a #15 torx driver, remove the cover of the Transmitter.
2. Make sure the battery/DC power cable is not connected to the battery pack (item 5 in Figure 14) or dc power source at this time.

WARNING! To prevent ignition of flammable or combustible atmosphere disconnect power before servicing.

3. Remove the nut from the probe/sensor cable cord grip (left side cord grip) and slide it over the non-connector end of the probe/sensor cable. Push the end of the cable into the Transmitter.
4. Strip back cable jacket and wires as shown in Figure 20.
5. All probe/sensor cables connect to the PROBE terminal block the SAME WAY - the white wire to the PWR terminal and the black wire to the GND terminal as shown in Figure 21.

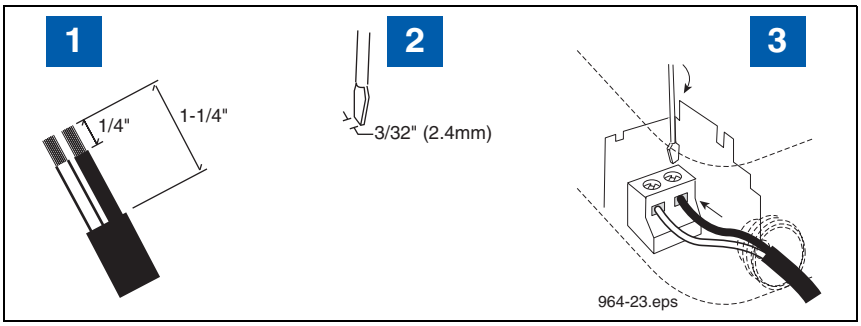


Figure 20. Connecting Input Wiring To Transmitter Terminal Blocks

LEGEND FOR NUMBERED BOXES IN Figure 20	
1. Strip back cable and wire jackets the amount shown.	3. Both wires must be tight in terminals!
2. Use a screwdriver with the proper blade width.	

6. Remove the nut from the power cable cord grip (right side cord grip) and slide it over the non-connector end of the power cable. Push the end of the cable into the Transmitter.
7. Strip back cable jacket and wires as shown in Figure 20.
8. Connect power cable wires to the BATTERY terminal block placing the white wire in the +IN terminal and the black wire in the –IN terminal as shown in Figure 21.
9. **Hand tighten both cable entry cord grip nuts to prevent water entry!**

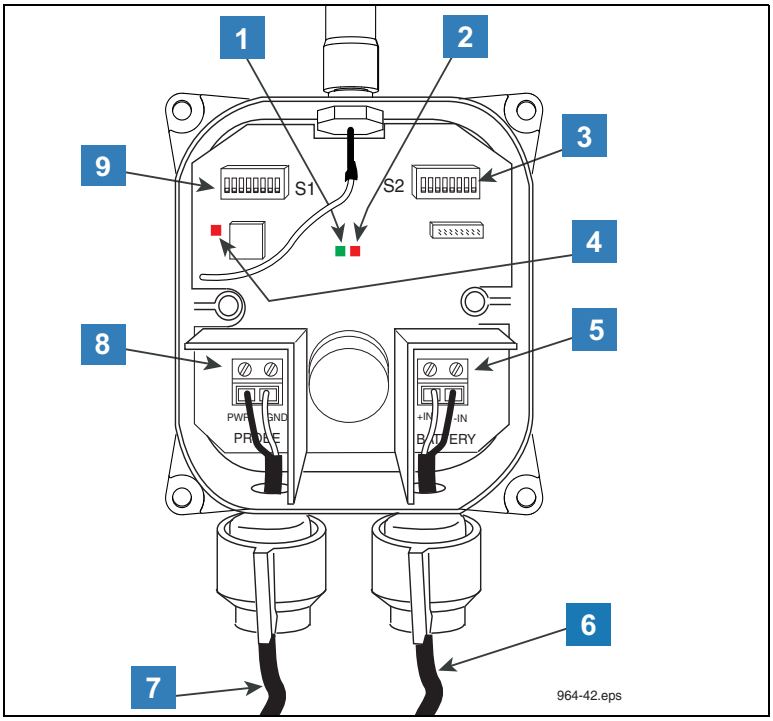


Figure 21. Wiring The Transmitter

LEGEND FOR NUMBERED BOXES IN Figure 21

1. Green LED – Unit status.
2. Red LED – Radio status.
3. S2 DIP switch.
4. Red LED – Flashes only when radio is powered on in Diagnostic Mode.
5. BATTERY power-in terminals (+IN and –IN). Observe polarity!
6. Cable from battery or DC power source.
7. Cable from probe/sensor.
8. PROBE input terminals (PWR and GND). OBSERVE POLARITY!
9. S1 DIP switch.

Pay close attention to the polarity of the battery input connections. Reversing the connections can cause damage to the TLS RF.

10. To assure a water-tight seal between the cover and the enclosure, follow these steps:
    a. Insert the four cover screws through the cover and then press on the retaining washers to hold the screws in place.
    b. Make sure that the cover gasket is free of dirt and debris on both sides of the gasket and that the inside of the cover is clean in the gasket area.
    c. Position the gasket into the cover groove, assuring that it is pressed fully into the groove and sitting completely flat.
    d. Assemble the cover onto the enclosure, tightening the screws in a couple of turns each. Using an alternating 'X' pattern, continue to tighten the screws until they are all tight.
11. If you haven't done so already, attach the red battery labels from the installation kit onto the power cable below the power cord grip and at the battery pack connector or DC power source.
12. Do not attach the power cable at the battery pack or dc power source until ready to begin the "Site Startup Procedure".

Receiver Installation

1. One Receiver is required per site and it is mounted in the vertical position (antenna up) on the outer wall of the same building housing the TLS RF. The Receiver is attached to its mounting bracket with #10 x 1/2" taptite screws from its install kit (see Figure 22). The L-bracket is then mounted on the outer wall of the building using appropriate fasteners (customer supplied). If the Receiver will be exposed to the weather, attach the L-bracket to the mounting surface inside a weatherproof enclosure. This enclosure is not required when mounting the Receiver under a roof overhang and shielded from the weather.

   NOTE: When locating the mounting position, keep in mind that the RS-485 cable connecting the Receiver to the TLS RF must be less than 250 feet in length. Avoid placing the Receiver near motors (e.g., power roof vents), fluorescent lighting (min. 1 foot separation), pumps, welders.

   Locate the Receiver on the same side of the building as the transmitters. If additional transmitters are either too far away or on the opposite side of the building, the Repeater can be located either on a structure near the remote transmitter(s) or on the opposite side of the building facing those transmitter(s) - see Repeater installation.

The Receiver is only suitable for use in a non-hazardous location.

2. Run the RS-485 cable (Belden #3107A or equiv.) from the TLS RF through the building's wall to the Receiver. Caulk the cable where it passes through wall openings. Use cable clamps at appropriate intervals to secure the cable to the walls.
3. Note that the Receiver cover label indicates the cord grip to be used for the RS-485 cable from the TLS RF and the cable to the Repeater (if used). Remove the cover of the Receiver and set it aside.
4. Set S1 and S2 DIP settings as desired (ref. Appendix B, Figure B-2). NOTE: set all dip switches prior to attaching the TLS RF RS-485 cable as the dip switches are only read during power up.
5. Slide the nut over the cable. Choose the correct size bushing and slide it over the cable. Dress the cable jacket according to the dimensions in Figure 20. Insert the cable into the appropriate opening at the bottom of the housing. Insert each wire into the appropriate terminal and tighten. Leave a small amount of slack in each wire. Slide the bushing into the bottom of the housing. Hand tighten the nut.
6. Note that there are two twisted pair color-coded wires in the cable (e.g., a white with blue stripe and blue with white stripe pair and a white with orange strip and orange with white stripe pair). One of the pairs is for RS-485 communication (- & + terminals) and the other pair is for Receiver power (+15 Vdc & Gnd). Using Figure 23 as a guide, attach the wires of the two twisted pairs to the RS-485 terminals.

   Record which wire attaches to each terminal to help you attach the other end of that wire to the identically marked terminal in the TLS RF.

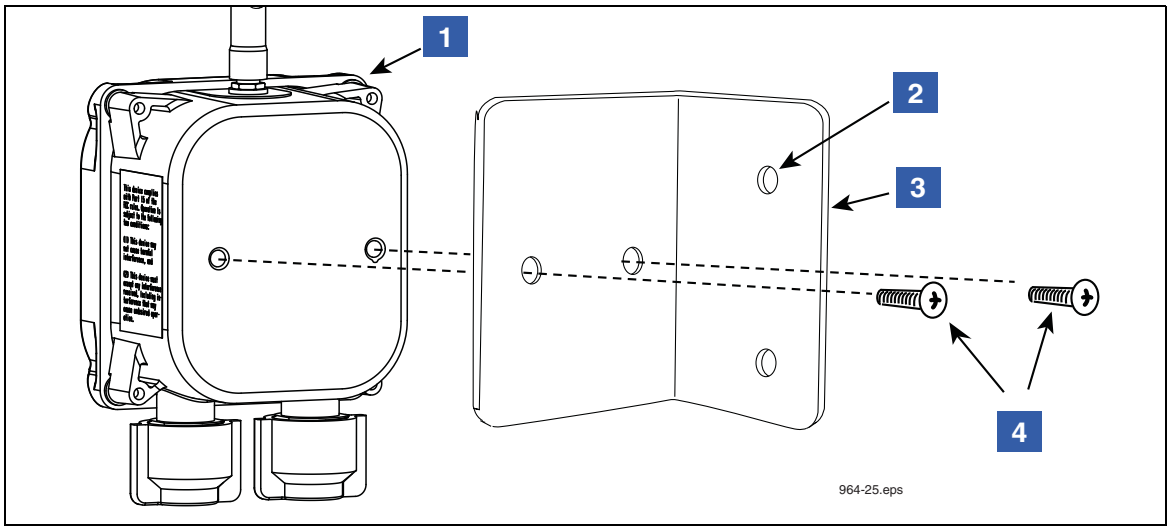


Figure 22. Attaching Mounting Bracket To Receiver Or Repeater

LEGEND FOR NUMBERED BOXES IN Figure 22	
1. Receiver or Repeater	4. #10 x 1/2" taptite screws
2. 0.280" diameter hole (2) – mount this narrow side of bracket to wall or post	
3. Mounting bracket.	

7. Referring to your connection notes in step 5 above, connect the other end of the RS-485 cable to the RS-485 terminal block in the TLS RF (ref. Figure 7 on page 16).
8. If a Repeater is used and powered by the Receiver, push the two wire power cable (to Repeater) through the +15 Vdc cord grip of the Receiver (item 7 in Figure 23).
9. Slide the nut over the cable. Choose the correct size bushing and slide it over the cable. Dress the cable jacket according to the dimensions in Figure 20. Insert the cable into the appropriate opening at the bottom of the housing. Insert each wire into the appropriate terminal and tighten. Leave a small amount of slack in each wire. Slide the bushing into the bottom of the housing. Hand tighten the nut.
10. Attach the dc power cable (white to +15 Vdc and black to GND) to the Repeater terminal block (item 9 in Figure 23).
11. **Hand tighten both cable entry cord grip nuts to prevent water entry!**
12. To assure a water-tight seal between the cover and the enclosure, follow these steps:
    a. Insert the four cover screws through the cover and then press on the retaining washers to hold the screws in place.
    b. Make sure that the cover gasket is free of dirt and debris on both sides of the gasket and that the inside of the cover is clean in the gasket area.
    c. Position the gasket into the cover groove, assuring that it is pressed fully into the groove and sitting completely flat.
    d. Assemble the cover onto the enclosure, tightening the screws in a couple of turns each. Using an alternating 'X' pattern, continue to tighten the screws until they are all tight.

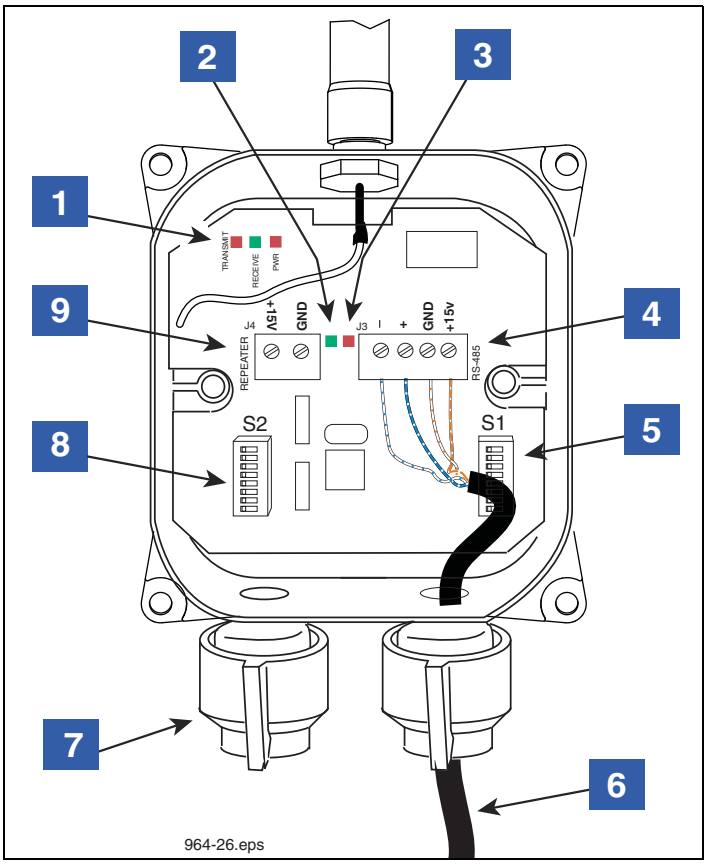


Figure 23. Wiring The Receiver

LEGEND FOR NUMBERED BOXES IN Figure 23

1. RS-485 Comm Activity:
   - XMIT (Red) LED – flashes when message transmitted to TLS-RF
   - RCV (Green) LED – flashes when message received from TLS-RF
   - PWR (Red) LED – Receiver power on indicator
2. Green LED – Unit status
3. Red LED – Radio status
4. Connect the color pairs of the RS-485/power cable to the same RS-485 terminals in both the Receiver and the master TLS RF (ref. "Connecting RS-485 Wiring" on page 17).
5. S1 DIP switch
6. RS-485 cable - Maximum cable length is 500 feet if a communication grade cable is used.
7. A solid bushing must be installed to seal the Receiver when this cord grip is unused. In sites where a Repeater is powered from the Receiver, the Repeater's power cable enters through this cord grip and attaches to the Repeater terminal block (item 9).

HAND TIGHTEN BOTH CABLE ENTRY CORD GRIP NUTS TO PREVENT WATER ENTRY!

8. S2 DIP switch
9. +15 Vdc power source for the Repeater. If used, connect two wires from item 9 connector in Receiver to item 7 connector in Repeater, see Figure 24.

Pay close attention to the polarity of the +15 Vdc and GND wires used as Repeater power source. Reversing these connections can cause damage to the TLS RF.

Repeater Installation

1. Use of a single repeater is optional but may improve system performance when installed correctly. The Repeater should be located closer to the device transmitters to rebroadcast messages to the Receiver. Use the 15 Vdc power source provided in the Receiver to power the Repeater, or use a customer supplied non-interruptible, Class 2, 15 Vdc power source. The most common method of powering the Repeater power is to use the Repeater power terminal block J4 in the Receiver (see item 9 in Figure 23).

   When device transmitters are on the opposite side of the building from the Receiver, the Repeater should be mounted on the side of the building facing those transmitters. Mount the Repeater with its transmitter antenna in the up or vertical orientation.

2. The Repeater is attached to its mounting bracket with #10 x 1/2" taptite screws from its install kit (ref. Figure 22 on page 34). The L-bracket is then attached to the outer wall of the building using appropriate fasteners (customer supplied). If the Repeater will be exposed to the weather, attach the L-bracket to the mounting surface inside a weatherproof enclosure. This enclosure is not required when mounting the Repeater under a roof overhang and shielded from the weather.

The Repeater is only suitable for use in a non-hazardous location.

3. Set S1 and S2 as desired (refer to Appendix B). NOTE: set all dip switches prior to connecting the +15 Vdc power cable as the dip switches are only read during power up.

4. Note the cover of the Repeater indicates the cord grip to be used for the cable connecting the Repeater to its dc power source (item 5 in Figure 24). Remove the cover of the Repeater and set it aside.

5. Slide the nut over the cable. Choose the correct size bushing and slide it over the cable. Dress the cable jacket according to the dimensions in Figure 20. Insert the cable into the appropriate opening at the bottom of the housing. Insert each wire into the appropriate terminal and tighten. Leave a small amount of slack in each wire. Slide the bushing into the bottom of the housing. Hand tighten the nut.

6. Connect the 2-wire dc power cable to the Repeater terminal block, white to +15 Vdc and black to GND (see item 7 in Figure 24).

7. Hand tighten both cable entry cord grip nuts to prevent water entry!

8. To assure a water-tight seal between the cover and the enclosure, follow these steps:

   a. Insert the four cover screws through the cover and then press on the retaining washers to hold the screws in place.

   b. Make sure that the cover gasket is free of dirt and debris on both sides of the gasket and that the inside of the cover is clean in the gasket area.

   c. Position the gasket into the cover groove, assuring that it is pressed fully into the groove and sitting completely flat.

   d. Assemble the cover onto the enclosure, tightening the screws in a couple of turns each. Using an alternating 'X' pattern, continue to tighten the screws until they are all tight.

9. The other end of the Repeater's dc power cable connects to the Receiver's +15 Vdc output terminal (ref. item 9 in Figure 23), or to a non-interruptible, Class 2, 15 Vdc power source.

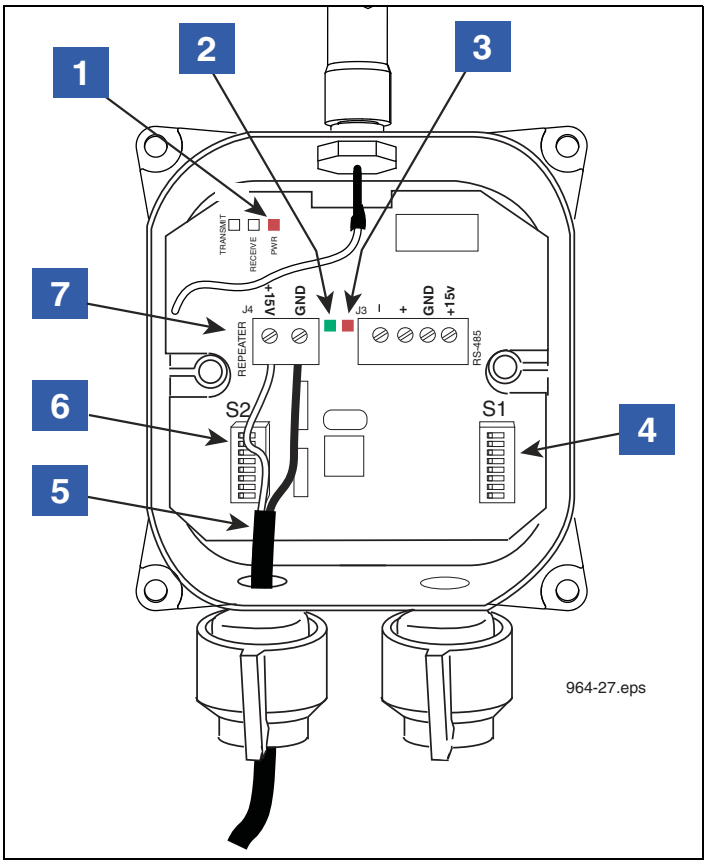


Figure 24. Wiring The Repeater

LEGEND FOR NUMBERED BOXES IN Figure 24	
1. Red LED – on when power is applied. 2. Green LED – Unit status 3. Red LED – Radio status 4. S1 DIP switch 5. DC Power input cable (from Receiver [item 9 connector - see Figure 23], or dc power source)	6. S2 DIP switch 7. DC power input terminals - +15 Vdc and ground **Pay close attention to the polarity of the +15 Vdc and GND wires from the Receiver or DC power source. Reversing these connections can cause damage to the TLS RF.**

Network Setup

Hardware Overview

An example TLS RF Wireless System site network illustrating a 32 Transmitter configuration is shown in Figure 25. The maximum number of Transmitters permissible in a site is 32 (requires 4 TLS RFs).

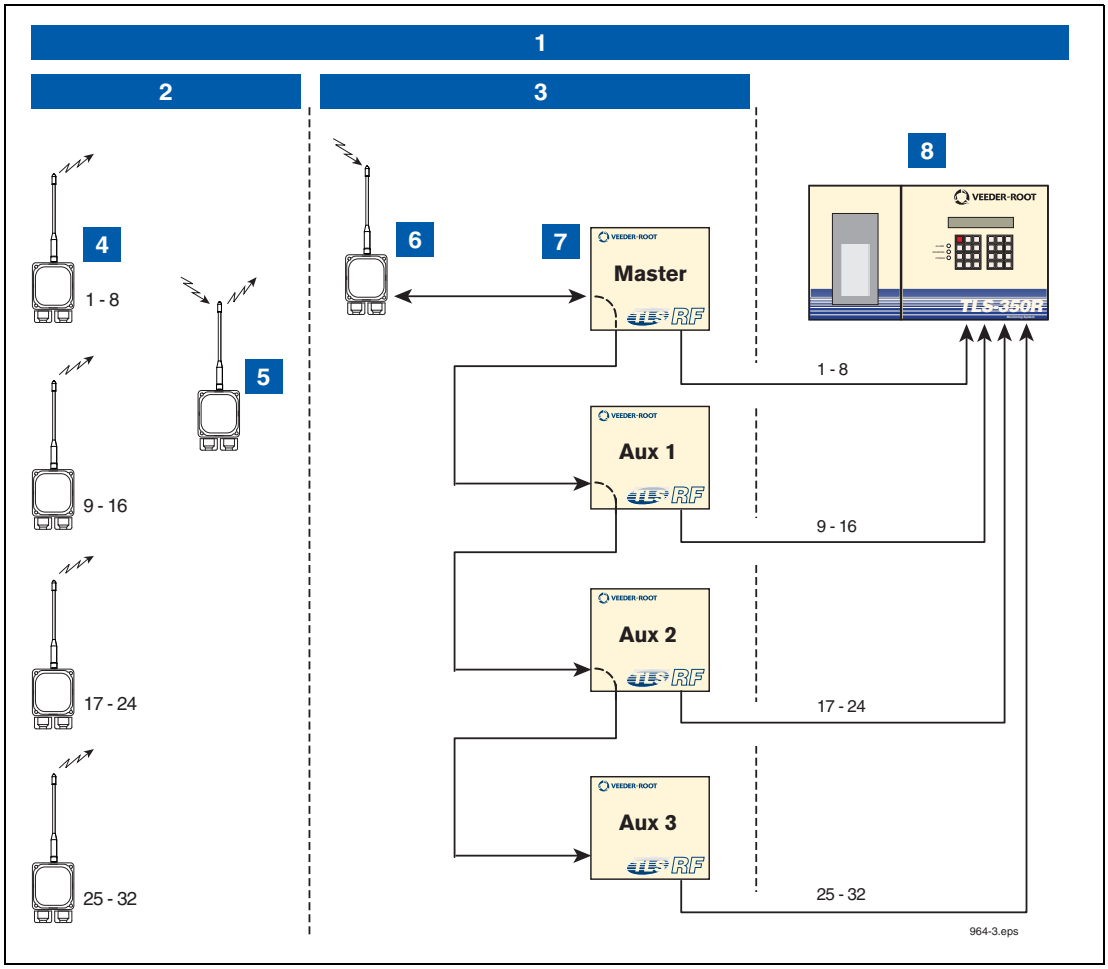


Figure 25. Example Site Network Diagram

LEGEND FOR NUMBERED BOXES IN Figure 25

1. Site Network
2. Wireless network
3. VR bus
4. Transmitters
5. Repeater
6. Receiver
7. TLS RF, one required per 8 Transmitters
8. TLS console

Identifying Devices in the TLS RF Wireless Site Network

The Site ID must be identical for all Transmitters, the Repeater, and the Receiver in the site's wireless network. Each Transmitter in the site's wireless network must have a unique Device Number (from 1 – 32). Each TLS RF in the site's network must have a unique Device Number (Master at 0 and Auxiliaries at1, 2, and/or 3).

All Device Numbers are entered using DIP switches located in each device and are entered in each device before it is installed.

Making up a site network worksheet before actually setting device DIP switches or connecting signal wires will help prevent mistakes when entering Site IDs/Device Numbers or making wiring connections between the TLS RF(s) and the TLS console.

Entering Device Numbers for the Site Network

TRANSMITTER DEVICE NUMBER

Each of the transmitters must have a unique Device Number (1 – 32). Enter this number by setting DIP switches 4 – 8 on S1 (see Figure 21 on page 32) in the 'off' position or 'on' position as shown below.

Device Number	S1 DIP Switch Settings					Device Number	S1 DIP Switch Settings				
	4	5	6	7	8		4	5	6	7	8
1	off	off	off	off	on	**17**	on	off	off	off	on
2	off	off	off	on	off	**18**	on	off	off	on	off
3	off	off	off	on	on	**19**	on	off	off	on	on
4	off	off	on	off	off	**20**	on	off	on	off	off
5	off	off	on	off	on	**21**	on	off	on	off	on
6	off	off	on	on	off	**22**	on	off	on	on	off
7	off	off	on	on	on	**23**	on	off	on	on	on
8	off	on	off	off	off	**24**	on	on	off	off	off
9	off	on	off	off	on	**25**	on	on	off	off	on
10	off	on	off	on	off	**26**	on	on	off	on	off
11	off	on	off	on	on	**27**	on	on	off	on	on
12	off	on	on	off	off	**28**	on	on	on	off	off
13	off	on	on	off	on	**29**	on	on	on	off	on
14	off	on	on	on	off	**30**	on	on	on	on	off
15	off	on	on	on	on	**31**	on	on	on	on	on
16	on	off	off	off	off	**32**	off	off	off	off	off

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TLS RF DEVICE NUMBER

Each TLS RF in the site network must have a unique Device Number (0 – 3). You must select 0 if it is the only TLS RF in the site, or if it is the TLS RF in a site with multiple TLS RFs that is monitoring the first Device Set (transmitters 1 – 8). You would enter a 1 for the TLS RF monitoring the second Device Number (transmitters 9 – 16), etc. The site's receiver must also be connected to the TLS RF having Device Number '0'. The factory default setting is '0'.

Enter this number by setting DIP switches 1 and 2 on S2 (see Figure 12 on page 21) in the 'off' position or 'on' position as shown below.

Transmitter Device Number	TLS RF Device Number	S2 DIP switch Settings		TLS RF
		1	2	
1-8	**0**	off	off	Master
9-16	**1**	off	on	AUX 1
17-24	**2**	on	off	AUX 2
25-32	**3**	on	on	AUX 3

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Entering the Site ID Number

All of the site's Transmitters, Repeater and Receiver must have the same Site ID number (0 – 15) entered in S2 DIP switches 5 - 8 (see settings below). The TLS RF does not require a Site ID. The factory default Site ID number for all components is set to 0.

NOTE: You must change the factory set Site ID when another site is nearby. Adjoining sites will experience data reception 'crosstalk' if both are left at the same number.

Site ID Number	S2 DIP switch Settings				Site ID Number	S2 DIP switch Settings			
	5	6	7	8		5	6	7	8
0	off	off	off	off	**8**	on	off	off	off
1	off	off	off	on	**9**	on	off	off	on
2	off	off	on	off	**10**	on	off	on	off
3	off	off	on	on	**11**	on	off	on	on
4	off	on	off	off	**12**	on	on	off	off
5	off	on	off	on	**13**	on	on	off	on
6	off	on	on	off	**14**	on	on	on	off
7	off	on	on	on	**15**	on	on	on	on

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Site Startup Procedure

Depending on the site layout, it is permissible to install RF devices in a variety of locations including dispensers and containment sumps. After all the wireless equipment has been installed, follow the steps below to verify the final setup. For transmitters installed in Dispensers, do not close the dispenser's cover after installing the Transmitter in case signal strength is a problem. Close the dispenser's cover only after the Transmitter passes a second verification process.

1. Turn on power to the TLS RF(s) and leave the covers open.
2. Go to the first Transmitter and connect the power cable to its power source.
3. At the TLS RF you should see one of the 8 red LEDs flashing (item 5 in Figure 12). This is an indication the transmission from the Transmitter is being received. If it is, go to Step 2a. If one of the 8 LEDs is not flashing go to Step 2b.
   a. Go back to the Transmitter, and if applicable, replace the dispenser's cover. Return to the TLS RF and verify that the same LED is still flashing.
      i. If it is, disconnect the battery cable from the battery pack and repeat Step 1 on the next Transmitter.
      ii. If it is not, the Receiver is not picking up the Transmitter's signal. Go back to the Transmitter; remove the dispenser's cover, reorient the antenna or lower the Transmitter, then go back to the TLS RF to verify that the same LED is flashing.
      iii. If reorienting the antenna or moving the Transmitter doesn't help, disconnect the battery cable from the battery pack and make a note that the signal is not being received at this particular dispenser.
      iv. Repeat Step 1 with the next Transmitter.
   b. If applicable, go back to the dispenser, remove the Transmitter's cover; the green LED (item 2 in Figure 5) should be flashing indicating that the sensor is being read. If the green LED is not flashing, check the sensor cable's wiring connections. If the wiring is correct, check Site ID. If it is correct, it means either the Transmitter is bad or there is a problem with the sensor, disconnect the battery cable from the battery pack and continue to Step 1 with the next Transmitter.
4. After verifying that each Transmitter is being received at the TLS RF(s), go around to each Transmitter; reconnect the Transmitters' battery cable to the battery pack. Replace dispenser's cover as appropriate. Go to the TLS console and configure all site sensors. Check for any comm alarms. If none are observed, the startup is complete.

NOTE: If some Transmitters are not being received at the TLS RF, relocating the Receiver and/or the Repeater may improve reception.

Initial TLS Console Setup Procedure

CAUTION! Failure to follow your applicable startup procedure will result in the probes/sensors not being recognized.

- **Sites with a New TLS-450/, TLS4 or TLS-XB Only**
  1. Power up all wireless devices.
  2. Power up the TLS RF console and wait about 5 minutes.
  3. Power up the TLS-450 console and wait 5 minutes until the device 'Discover Mode' is Complete.
- **Sites with all Other TLS Consoles**
  1. Power up all wireless devices
  2. Power up both the TLS and TLS RF consoles.

Diagnostics

Alarms

During normal operation when the TLS Console and monitored PMC and ISD System are functioning properly and no warning or alarm conditions exist, the “ALL FUNCTIONS NORMAL” message will appear in the system status area of the console display. Regardless of the TLS Console in use at this site, record the software part number as well as the software revision.

There is an additional alarm, Battery Status (TLS-350 only), when wireless equipment is used in place of wires. ISD, PMC and Smart Sensor warnings and alarm are the same. If a warning or alarm condition occurs as a result of a failure in the wireless communication hardware the system displays the communication failure for the effected Smart Sensor. If more than one condition exists, the display will alternately flash the appropriate messages. The system automatically prints an alarm report showing the warning or alarm type, its location and the date and time the warning or alarm condition occurred.

Any break in link between transmitter and sensor, or between TLS and TLS RF results in Communication Alarm. All other alarms related to individual sensor types, such as sensor fault alarm, are supported as they are with a wired system. When the Sensor Transmitter has determined the communication with the RF box has failed it will command the Vapor Valve to close. The valve will remain closed until an open command is sent (from the TLS) after communication is reestablished.

Battery Diagnostics

You can get the battery status from the TLS-350 (with software Version 30A or higher). The battery status is displayed for the wireless sensors, from the Smart Sensor Diagnostics (see Figure 26). The wireless sensors’s battery status can also be printed from that screen.

The battery status for the wireless sensors is reported as Full, Medium, Low or Replace.

- Full: greater than or equal to 3.4 Volts
- Medium Range: 3.2V to 3.4 Volts
- Low range: 3.0V to 3.2V
- Replace: Below 3.0V

When the Smart Sensor battery reports a status ‘Replace’ continuously for 24 hours, a Smart Sensor warning will be posted on the TLS to alert the operator that the battery requires replacement. The warning will persist in the TLS until the battery reports ‘Medium’ or ‘Full’. The alarm will clear at that time. This is a low priority TLS warning which will sound the beeper, flash the yellow warning light, post on the two line display, print on the printer and be recorded in the non-priority alarm history. The warning can be accessed remotely and be reported remotely similar to all TLS warnings and alarms. This warning will not appear in the ISD or PMC reports (only sensor failures are recorded in the ISD and PMC reports).

WIRELESS SENSOR DIAGNOSTIC MENU (TLS-350 CONSOLES)

The Battery Status for all wireless Smart Sensors will be displayed in the menu after the Serial Number (see Figure 26).

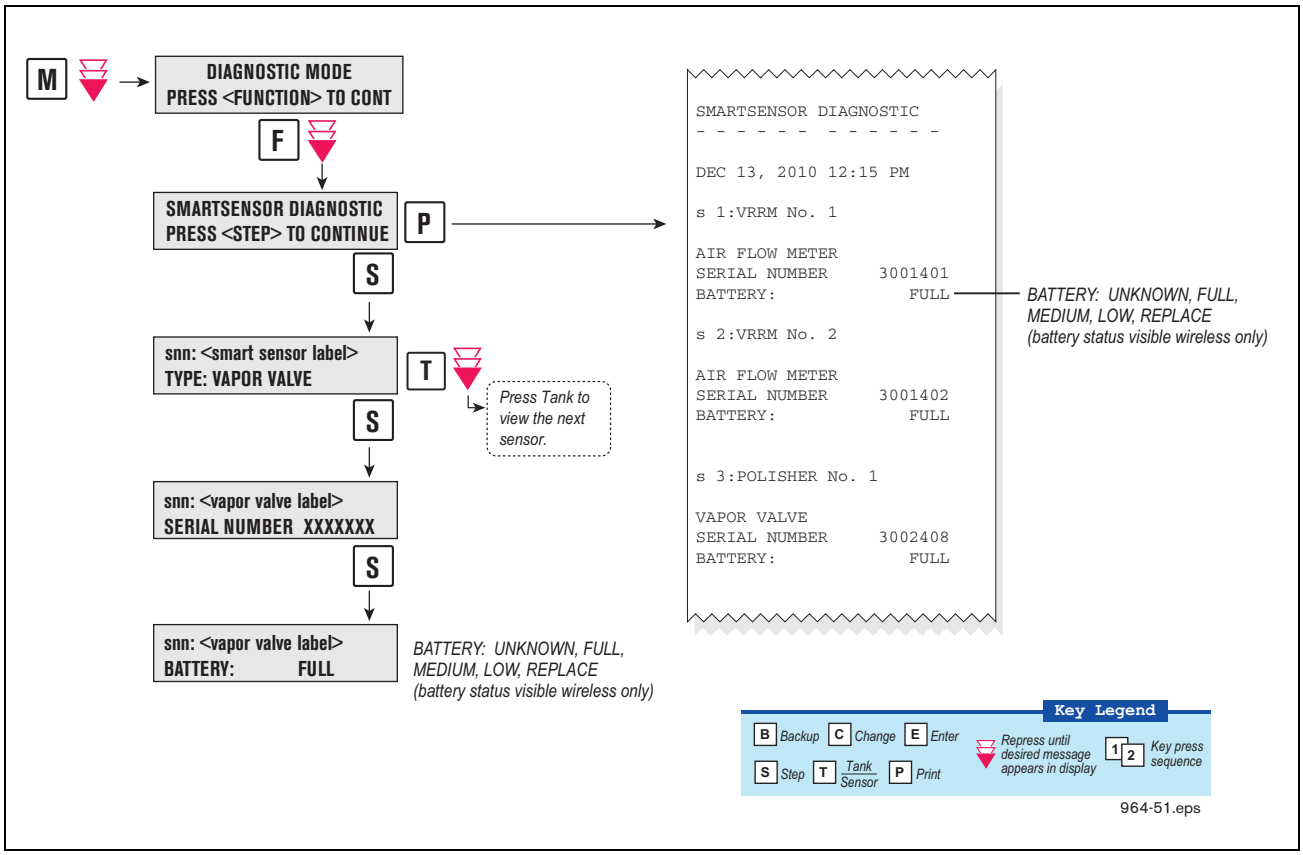


Figure 26. Device Battery Status In TLS-350 SmartSensor Diagnostic Menu

Appendix A: Regulatory Information

Federal Communications Commission Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio or television technician for help.

MODIFICATIONS

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Veeder-Root Company may void the authority to operate the equipment.

CABLES

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

DECLARATION OF CONFORMITY FOR PRODUCTS MARKED WITH THE FCC LOGO–UNITED STATES ONLY

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions regarding your product, contact:

Veeder-Root Company

125 Powder Forest Drive

Simsbury, CT 06070

Or, call 1-800-323-1799

For questions regarding this FCC declaration, contact:

Veeder-Root Company

125 Powder Forest Drive

Simsbury, CT 06070

Or, call 1-800-323-1799

To identify this product, refer to the Part, Series, or Model number found on the product.

Canadian Notice

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

AVIS CANADIEN

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Battery Warning

WARNING: The TLS RF Wireless System Battery Pack contains lithium batteries. To reduce the risk of fire or burns, do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.

Because of the type of batteries used in TLS RF Wireless System, follow local regulations regarding the safe disposal of the battery. Consult Appendix D of this manual for more information on battery disposal.

Wireless Notices

In some environments, the use of wireless devices may be restricted. Such restrictions may apply aboard airplanes, in hospitals, near explosives, in hazardous locations, etc. If you are uncertain of the policy that applies to the use of this device, please ask for authorization to use it prior to turning it on.

U.S. Regulatory Wireless Notice

WARNING: Exposure to Radio Frequency Radiation. The radiated output power of this device is below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. To avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna should be minimized.

Canadian Regulatory Wireless Notice

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. The term “IC:” before the certification/registration number only signifies that the Industry Canada technical specifications were met.

System Specifications

Note: Not all models described are available in all regions.

Appendix B: Device DIP Switch Settings

TLS RF Number Settings

The Dip Switch Locations to set the unique Device number for the TLS RF(s) are shown in the Figure B-1. The TLS RF that monitors the Receiver and Transmitter IDs 1 - 8 is considered the site's master TLS RF and must have its Device ID set to 0 (default).

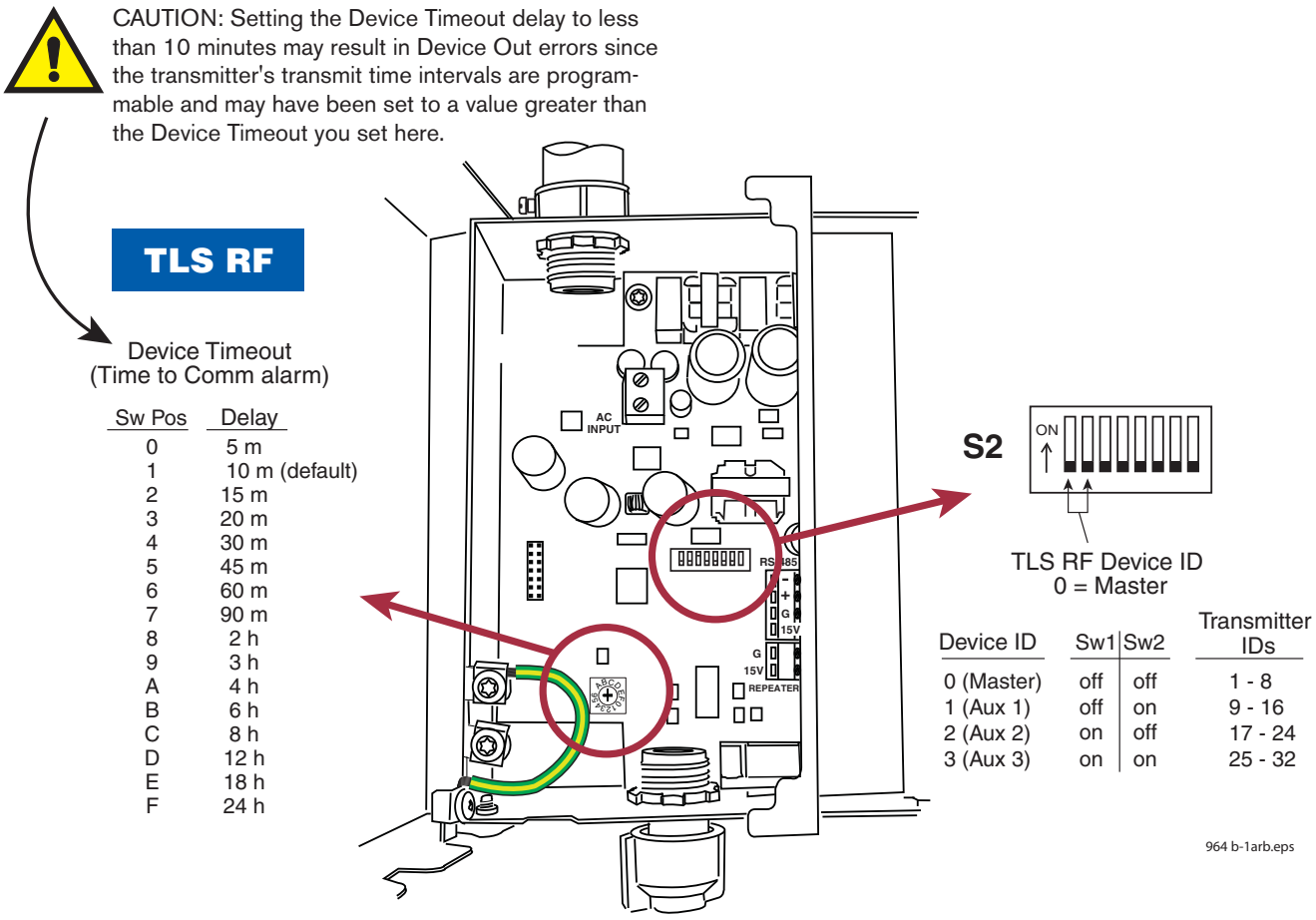


Figure B-1. TLS-RF switch settings

Transmitter/Receiver/Repeater DIP Switch Settings

DIP switch locations for the Transmitter, Receiver and Repeater are shown in Figure B-2. Device DIP switch settings for these devices are listed in Figure B-3 through Figure B-7 (use the appropriate settings for your software version 1 or 3).

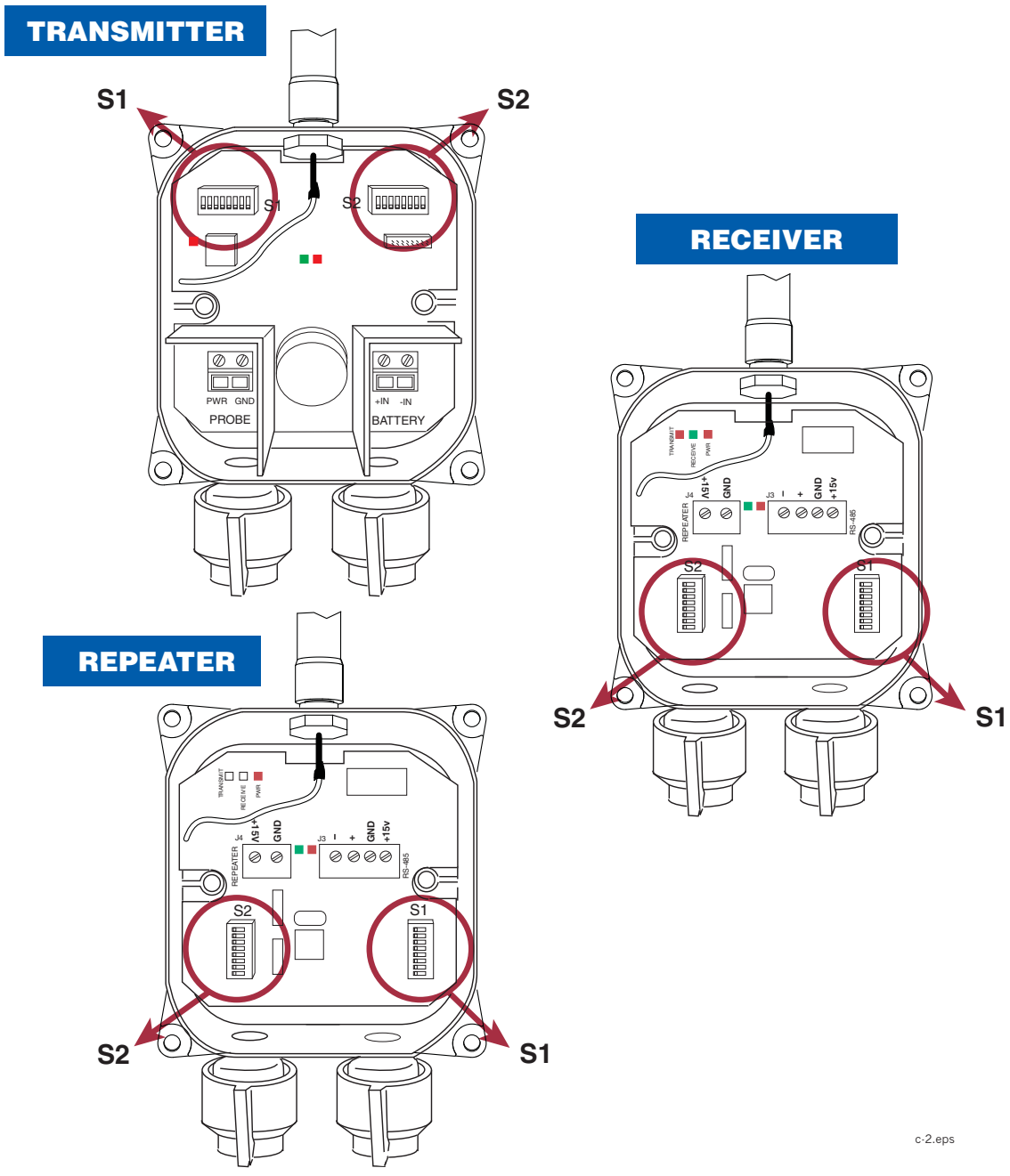


Figure B-2. DIP switch settings

All Wireless 2 (W2) Transmitters			
S1: Positions			Function
1	2	3	
OFF	OFF	OFF	Enable Transmitter

c-3.eps

Figure B-3. S1: DIP switch positions 1-3 – (W2) All Devices

All Wireless 2 (W2) Transmitters							
S1: Positions					TRANSMITTER		
4	5	6	7	8	Device Number		
OFF	OFF	OFF	OFF	ON	1 (Master TLS-RF Device 1)	Master TLS RF	
OFF	OFF	OFF	ON	OFF	2 (Master TLS-RF Device 2)	Connects to	
OFF	OFF	OFF	ON	ON	3 (Master TLS-RF Device 3)	Receiver	
OFF	OFF	ON	OFF	OFF	4 (Master TLS-RF Device 4)		
OFF	OFF	ON	OFF	ON	5 (Master TLS-RF Device 5)		
OFF	OFF	ON	ON	OFF	6 (Master TLS-RF Device 6)		
OFF	OFF	ON	ON	ON	7 (Master TLS-RF Device 7)		
OFF	ON	OFF	OFF	OFF	8 (Master TLS-RF Device 8)		
OFF	ON	OFF	OFF	ON	9 (Aux 1 TLS-RF Device 1)	Aux 1 is the second	
OFF	ON	OFF	ON	OFF	10 (Aux 1 TLS-RF Device 2)	TLS RF Console	
OFF	ON	OFF	ON	ON	11 (Aux 1 TLS-RF Device 3)		
OFF	ON	ON	OFF	OFF	12 (Aux 1 TLS-RF Device 4)		
OFF	ON	ON	OFF	ON	13 (Aux 1 TLS-RF Device 5)		
OFF	ON	ON	ON	OFF	14 (Aux 1 TLS-RF Device 6)		
OFF	ON	ON	ON	ON	15 (Aux 1 TLS-RF Device 7)		
ON	OFF	OFF	OFF	OFF	16 (Aux 1 TLS-RF Device 8)		
ON	OFF	OFF	OFF	ON	17 (Aux 2 TLS-RF Device 1)	Aux 2 is the third	
ON	OFF	OFF	ON	OFF	18 (Aux 2 TLS-RF Device 2)	TLS RF Console	
ON	OFF	OFF	ON	ON	19 (Aux 2 TLS-RF Device 3)		
ON	OFF	ON	OFF	OFF	20 (Aux 2 TLS-RF Device 4)		
ON	OFF	ON	OFF	ON	21 (Aux 2 TLS-RF Device 5)		
ON	OFF	ON	ON	OFF	22 (Aux 2 TLS-RF Device 6)		
ON	OFF	ON	ON	ON	23 (Aux 2 TLS-RF Device 7)		
ON	ON	OFF	OFF	OFF	24 (Aux 2 TLS-RF Device 8)		
ON	ON	OFF	OFF	ON	25 (Aux 3 TLS-RF Device 1)	Aux 3 is the fourth	
ON	ON	OFF	ON	OFF	26 (Aux 3 TLS-RF Device 2)	TLS RF Console	
ON	ON	OFF	ON	ON	27 (Aux 3 TLS-RF Device 3)		
ON	ON	ON	OFF	OFF	28 (Aux 3 TLS-RF Device 4)		
ON	ON	ON	OFF	ON	29 (Aux 3 TLS-RF Device 5)		
ON	ON	ON	ON	OFF	30 (Aux 3 TLS-RF Device 6)		
ON	ON	ON	ON	ON	31 (Aux 3 TLS-RF Device 7)		
OFF	OFF	OFF	OFF	OFF	32 (Aux 3 TLS-RF Device 8)		

c-4.eps

Figure B-4. S1: DIP switch positions 4-8 – (W2) All Devices

Wireless 2 (W2) CCVP-Carbon Can Vapor Processor					
S2: Positions				Transmitter Interval in Seconds	
1	2	3	4	Read	TX
* → OFF	OFF	OFF	OFF	32	16

c-7.eps

* = Recommended settings

Figure B-5. S2: DIP switch positions 1-4 – (W2) CCVP

Wireless 2 (W2) Vapor Flowmeter					
S2: Positions				Transmitter Interval in Seconds	
1	2	3	4	Read	TX
* → OFF	ON	OFF	OFF	32	32

c-9.eps

* = Required settings

Figure B-6. S2: DIP switch positions 1-4 – (W2) Vapor Flow Meter

Wireless 2 (W2) Transmitters, Receiver and Repeater (All Site ID settings must be the same)						
S2: Positions				TRANSMITTER	REPEATER[1]	RECEIVER[1]
5	6	7	8	Site ID	Site ID	Site ID
OFF	OFF	OFF	OFF	0	0	0
OFF	OFF	OFF	ON	1	1	1
OFF	OFF	ON	OFF	2	2	2
OFF	OFF	ON	ON	3	3	3
OFF	ON	OFF	OFF	4	4	4
OFF	ON	OFF	ON	5	5	5
OFF	ON	ON	OFF	6	6	6
OFF	ON	ON	ON	7	7	7
ON	OFF	OFF	OFF	8	8	8
ON	OFF	OFF	ON	9	9	9
ON	OFF	ON	OFF	10	10	10
ON	OFF	ON	ON	11	11	11
ON	ON	OFF	OFF	12	12	12
ON	ON	OFF	ON	13	13	13
ON	ON	ON	OFF	14	14	14
ON	ON	ON	ON	15	15	15

c-10.eps

[1] Set all remaining dip switches (S2 1-4 and S1 1-8) to OFF for both the Repeater and Receiver.

Figure B-7. S2: DIP switch positions 5-8 – (W2) All Devices

Appendix C: Lithium Battery Safety Data

This appendix contains the manufacturer supplied Transportation Certificate and Material Safety Data Sheet for the lithium batteries used in the TLS RF Wireless 2 (W2) System.

Lithium Battery Disposal Considerations

1. Waste disposal must be in accordance with the applicable regulations.
2. Disposal of the Lithium batteries should be performed by permitted, professional disposal firms knowledgeable in Federal, State or Local requirements of hazardous waste treatment and hazardous waste transportation.
3. Incineration should never be performed by battery users, but by trained professionals in an authorized facility with proper gas and fume containment.
4. Recycling of battery can be done in authorized facility, through licensed waste carrier.

Material/Product Safety Data Sheet
(MSDS-PSDS)

LS/LSG/LSH/LST/LSX products	**Lithium/Thionyl chloride single cells and multi-cell battery packs**
Revision 8 Date 10/2008	

1. Identification of the Substance or Preparation and Company

Product	**Primary Lithium/Thionyl chloride unit cells and multi-cell battery packs ($Li\text{-}SOCl_2$)**			
Production sites	Saft Ltd. River Drive Tyne & Wear South Shields NE33 2TR – UK Ph. :+44 191 456 1451 Fax :+44 191 456 6383	Saft Rue Georges Leclanché BP 1039 86060 Poitiers cedex 9 France Ph. :+33 (0)5 49 55 48 48 Fax :+33 (0)5 49 55 48 50	Saft America Inc 313 Crescent Street Valdese NC 28690 – USA Ph. :+1 828 874 4111 Fax :+1 828 874 2431	Saft Batteries Co., Ltd Zhuhai Free Trade Zone Lianfeng Road Zhuhai 519030 Guangdong Province China Ph. : +86 756 881 9318 Fax : +86 756 881 9328
www.saftbatteries.com (section « Contact »)				
Emergency contact Within the USA	+1 (703) 527 3887 +1 (800) 494 9300	(CHEMTREC US Service Center)		

2. Hazards Identification

Do not short circuit, recharge puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of product. Risk of fire or explosion.

The Lithium-Thionyl chloride batteries described in this Safety Data Sheet are sealed units which are not hazardous when used according to the recommendations of the manufacturer.

Under normal conditions of use, the electrode materials and liquid electrolyte they contain are not exposed to the outside, provided the battery integrity is maintained and seals remain intact. Risk of exposure only in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. Electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow, depending upon the circumstances.

3. Composition & Information on Ingredients

Ingredient	Content	CAS No.	CHIP Classification		
Lithium *(Li)*	3,5-5%	7439-93-2			**F**; R14/15 **C**; R34 R14/15, R21,R22, R35, R41, R43 S2, S8, S45
Thionyl chloride *($SOCl_2$)*	40-46%	7719-09-7	 		**C;** R14, R21, R22, R35, R37, R41,R42/43 S2, S8, S24, S26, S36, S37, S45

Aluminum chloride anhydrous *($AlCl_3$)*	1-5%	7446-70-0			R14, R22, R37, R41, R43. S2, S8, S22, S24, S26, S36, S45
Carbon *(C_n)*	3-4%	1333-86-4			NONE KNOWN
Amount varies depending on cell size.					

4. First Aid Measures	
Inhalation	Remove from exposure, rest and keep warm. In severe cases obtain medical attention.
Skin contact	Wash off skin thoroughly with water. Remove contaminated clothing and wash before reuse. In severe cases obtain medical attention.
Eye contact	Irrigate thoroughly with water for at least 15 minutes. Obtain medical attention.
Ingestion	Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.
Further treatment	All cases of eye contamination, persistent skin irritation and casualties who have swallowed this substance or been affected by breathing its vapours should be seen by a doctor.

5. Fire Fighting Measures

CO_2 extinguishers or, even preferably, copious quantities of water or water-based foam, can be used to cool down burning Li-$SOCl_2$ cells and batteries, as long as the extent of the fire has not progressed to the point that the lithium metal they contain is exposed (marked by deep red flames).
Do not use for this purpose sand, dry powder or soda ash , graphite powder or fire blankets.
Use only metal (Class D) extinguishers on raw lithium.

Extinguishing media	Use water or CO_2 on burning Li-$SOCl_2$ cells or batteries and class D fire extinguishing agent only on raw lithium.

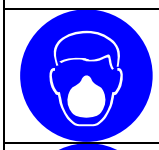
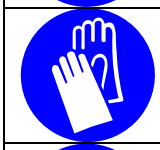
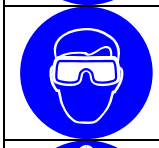
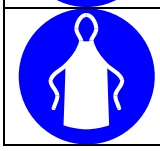
6. Accidental Release Measures

Remove personnel from area until fumes dissipate. Do not breathe vapours or touch liquid with bare hands.

If the skin has come into contact with the electrolyte, it should be washed thoroughly with water.

Sand or earth should be used to absorb any exuded material. Seal leaking battery and contaminated absorbent material in plastic bag and dispose of as Special Waste in accordance with local regulations.

7. Handling and Storage	
Handling	Do not crush, pierce, short (+) and (-) battery terminals with conductive (i.e. metal) goods. Do not directly heat or solder. Do not throw into fire. Do not mix batteries of different types and brands. Do not mix new and used batteries. Keep batteries in non conductive (i.e. plastic) trays.
Storage	Store in a cool (preferably below 30°C) and ventilated area, away from moisture, sources of heat, open flames, food and drink. Keep adequate clearance between walls and batteries. Temperature above 100°C may result in battery leakage and rupture. Since short circuit can cause burn, leakage and rupture hazard, keep batteries in original packaging until use and do not jumble them.
Other	Lithium-Thionyl chloride batteries are not rechargeable and should not be tentatively charged. Follow Manufacturers recommendations regarding maximum recommended currents and operating temperature range. Applying pressure on deforming the battery may lead to disassembly followed by eye, skin and throat irritation.

8. Exposure Controls & Personal Protection					
Occupational exposure standard		Compound Sulfur dioxide Hydrogen chloride	8hr TWA 1 ppm 1 ppm	15min TWA 1 ppm 5 ppm	SK - -
	**Respiratory protection**	In all fire situations, use self-contained breathing apparatus.			
	**Hand protection**	In the event of leakage wear gloves.			
	**Eye protection**	Safety glasses are recommended during handling.			
	**Other**	In the event of leakage, wear chemical apron.			

9. Physical and Chemical Properties	
Appearance	Cylindrical or prismatic shape
Odour	If leaking, gives off a pungent corrosive odour.
pH	Not Applicable
Flash point	Not applicable unless individual components exposed
Flammability	Not applicable unless individual components exposed
Relative density	Not applicable unless individual components exposed
Solubility (water)	Not applicable unless individual components exposed
Solubility (other)	Not applicable unless individual components exposed

10. Stability and Reactivity	
Product is stable under conditions described in Section 7.	
Conditions to avoid.	Heat above 100°C (150°C for the LSH 20-150 cells and the battery packs assembled from them) or incinerate. Deform. Mutilate. Crush. Pierce. Disassemble Recharge. Short circuit. Expose over a long period to humid conditions.
Materials to avoid	Oxidising agents, alkalis, water. Avoid electrolyte contact with aluminum or zinc.
Hazardous decomposition Products	Hydrogen (H_2) as well as Lithium oxide (Li_2O) and Lithium hydroxide (LiOH) dust is produced in case of reaction of *lithium metal* with water. Chlorine (Cl_2), Sulfur dioxide (SO_2) and Disulfur dichloride (S_2Cl_2) are produced in case of thermal decomposition of *thionyl chloride* above 140°C. Hydrochloric acid (HCl) and Sulfur dioxide (SO_2) are produced in case of reaction of *Thionyl chloride* with water at room temperature. Hydrochloric acid (HCl) fumes, Lithium oxide, (Li_2O), Lithium hydroxide (LiOH) and Aluminum hydroxide ($Al(OH)_3$) dust are produced in case of reaction of *Lithium tetrachloroaluminate ($LiAlCl_4$)* with water.

11. Toxicological Information	
Signs & symptoms	None, unless battery ruptures. In the event of exposure to internal contents, corrosive fumes will be very irritating to skin, eyes and mucous membranes. Overexposure can cause symptoms of non-fibrotic lung injury and membrane irritation.
Inhalation	Lung irritant.
Skin contact	Skin irritant
Eye contact	Eye irritant.
Ingestion	Tissue damage to throat and gastro-respiratory tract if swallowed.
Medical conditions generally aggravated by exposure	In the event of exposure to internal contents, eczema, skin allergies, lung injuries, asthma and other respiratory disorders may occur.

12. Ecological Information	
Mammalian effects	None known if used/disposed of correctly.
Eco-toxicity	None known if used/disposed of correctly.
Bioaccumulation potential	None known if used/disposed of correctly.
Environmental fate	None known if used/disposed of correctly.

13. Disposal Considerations
Do not incinerate, or subject cells to temperatures in excess of 100°C. Such abuse can result in loss of seal, leakage, and/or cell explosion. Dispose of in accordance with appropriate local regulations.

14. Transport Information	
Label for conveyance	For the single cell batteries and multi-cell battery packs that are non-restricted to transport (non-assigned to the Miscellaneous Class 9), use lithium batteries inside label. For the single cell batteries and multi-cell battery packs which are restricted to transport (assigned to Class 9), use Class 9 Miscellaneous Dangerous Goods and UN Identification Number labels. In all cases, refer to the product transport certificate issued by the Manufacturer.
UN numbers	UN3090 (shipment of cells and batteries *in bulk*) UN 3091 (cells and batteries *contained in equipment* or *packed with it*)
Shipping names	Lithium Metal Batteries
Hazard classification	Depending on their lithium metal content, some single cells and small multi-cell battery packs may be non- assigned to Class 9 (Refer to Transport Certificate)
Packing group	II
Specific dispositions	IATA: A45, A88, A99, P968, P969, P970 IMDG: 188, 230, 310, P903 ADR/RID: 188, 230, 310, 636, P903, P903a
IMDG Code	3090 (Li Batteries) 3091 (Li Batteries contained in equipment or packed with it)
CAS	
EmS No.	F-A, S-I
Marine pollutant	No
ADR Class	Class9

15. Regulatory Information			
Risk phrases	Lithium *(Li)*	R14/15 R21 R22 R35 R41 R42/43	Reacts violently with water, liberating extremely flammable gases. Harmful in contact with skin. Harmful if swallowed. Causes burns. Risk of serious damage to eye. May cause sensitization by inhalation and skin contact.
	Thionyl chloride *($SOCl_2$)*	R14 R22 R35 R37 R41 R42/43	Reacts with water. Harmful if swallowed. Causes burns. Irritating to respiratory system. Risk of serious damage to eye. May cause sensitization by inhalation and skin contact.
	Aluminum chloride anhydrous *($AlCl_3$)*	R14 R22 R37 R41 R43	Reacts with water. Harmful if swallowed. Irritating to respiratory system. Risk of serious damage to eye. May cause sensitization by skin contact.
Safety phrases	Lithium *(Li)*	S2 S8 S45	Keep out of reach of children Keep away from moisture In case of incident, seek medical attention.
	Thionyl chloride *($SOCl_2$)*	S2 S8 S24 S26 S36 S37 S45	Keep out of reach of children. Keep away from moisture. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable protective clothing. Wear suitable gloves. In case of incident, seek medical attention.

	Aluminum chloride anhydrous *($AlCl_3$)*	S2 S8 S22 S24 S26 S36	Keep out of reach of children. Keep away from moisture. Do not breathe dust. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable protective clothing.
UK regulatory references	Classified under CHIP		

16. Other Information

This information has been compiled from sources considered to be dependable and is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty (either expressed or implied) or guarantee is made to the accuracy, reliability or completeness of the information contained herein.

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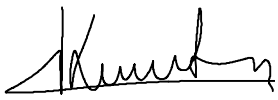
Signature 

Alain Kerouanton
Lithium Product Manager


For technical support, sales or
other assistance, please visit:
www.veeder.com

Liquid Condensate Trap
Installation, Operations, and Maintenance Manual

1. PRE-INSTALLATION NOTES:

State Water Resources Control Board (SWRCB) Requirements are listed in California Health and Safety Code, Chapter 6.7 and California Code of Regulations Title 23 Div. 3 Chapter 16. SWRCB Local Guidance Letters LG-113 and LG-169 address in detail these regulatory requirements that apply to Liquid Condensate Traps. Installers should familiarize themselves with these requirements to ensure compliance.

Some of the highlights of the SWRCB requirements are: Vapor condensate traps are permitted as part of the Underground Storage Tank (UST) System and are regulated like any other UST System. Requirements will vary depending on the date of installation, but secondary containment, interstitial monitoring, periodic secondary containment testing, cathodic protection, periodic integrity testing, and overfill prevention may be required. Automatic evacuation of vapor condensate traps are equipped with a suction line (typically connected to a siphon port on the turbine) that can automatically evacuate liquid and return it to the UST. Because the suction line contains liquid product, it is subject to the same regulatory requirements as any other product suction piping on the UST system. Depending on the installation date of the UST and the presence or absence of check valves, secondary containment, interstitial monitoring, or periodic integrity testing of the suction line may be required.

CAUTION: Always obtain approval from the local authorities having jurisdiction before beginning any work. Installation of the Liquid Condensate Trap must comply with (if applicable):

- Air Resources Board Certification Procedure CP-201;
- Balance Phase II EVR Executive Orders (EO) VR-203 and 204;
- Veeder-Root Level 1 certification required when installing and wiring LCT liquid sensor to a Veeder-Root tank monitoring system.
- INCON Level 1 certification required when installing and wiring LCT liquid sensor to an INCON tank monitoring system.
- Certified Unified Program Agency (CUPA) – List of CUPAs can be found at (www.calepa.ca.gov/CUPA/Directory/default.aspx);
- Fire Marshall;
- SWRCB;
- Local Air Pollution District;
- International Code Council (ICC) Note: Anyone working on an LCT system must have an ICC certification for UST Service Technician, or UST Installation and Retrofitter;
- NEC;
- NFPA 30 and 30A;
- UL;
- Any other applicable Federal, State and local codes.

2 LIQUID CONDENSATE TRAP PHASE II EVR COMPONENTS

Exhibit 1 of VR-203 and 204 lists components required for a Phase II EVR System with a Liquid Condensate Trap. Existing Liquid Condensate Traps may already have some of these components installed. Some of these required components are (reference all Figures):

Riser Adaptor — INCON Model TSP-K2A
This riser adaptor is to be installed on all risers that are connected to the Liquid Condensate Trap, except for the Liquid Condensate Trap suction tube riser.

In-Line Filter — Swagelok B-4F2-140 or SS-4F2-140 (or equivalent)
The purpose of the in-line filter is to trap debris and rust particles that are traveling inside the suction line to prevent them from blocking the syphon jet valve at the turbine pump. This in-line filter is installed at the syphon inlet of the turbine pump.

Stainless Steel Wired Braided Hose or 1/4″ Copper Tubing (rated for use with gasoline)
Connects the suction tube to the turbine pump.

Aluminum or Stainless Steel Insect Screen with Stainless Steel Hose Clamp
This screen can be purchased from almost any hardware store. The specifications are: 18 X 14 mesh for aluminum insect screen and 18 X 18 for stainless steel insect screen. A small section of this screen material is installed over the end of the suction tube inside the Liquid Condensate Trap and secured with a SS hose clamp.

Liquid Sensor Connection to the UST Monitoring System
Many sites already have existing liquid sensors installed inside the Liquid Condensate Trap. If a liquid sensor does not exist inside the Liquid Condensate Trap then one must be installed.

Any Liquid sensor installed inside the Liquid Condensate Trap must meet the following minimal requirements:

- Provides a visual and audible alarm in case of failure of the evacuation system;
- The audible and visual alarm monitoring system must be installed at a location that is most likely to be heard by the station attendant during normal station operation;
- Set the liquid sensor to the height shown in Figure 5.
-

Various Pipe Fittings in ¼" and 2″ Sizes
For adapting the suction line as required, and to add a fuel entry point with a plug or cap to the Liquid Condensate Trap riser.

Optional Equipment:

Secondary Syphon Kit — Franklin Fueling Systems Part Number 402507930
For use when two syphon primers are required for one Submersible Turbine Pump (STP). One to syphon the Liquid Condensate Trap, and one for siphoning two or more tanks of like product grade.

3. PRIOR TO INSTALLING THE EQUIPMENT LISTED IN EXHIBIT 1 OF THE EO

WARNING Highly flammable vapors or liquids may be present in the environment in which this equipment is installed or serviced. Installing or working on this equipment means working in an environment that presents risks of severe injury or death if instructions and standard industry practices are not followed. Follow all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment. Refer to the *Installation and Owner's Manual* of this equipment and any related equipment for complete installation and safety information.

Prior to installing the Liquid Condensate Trap Equipment listed in Exhibit 1 of the EO VR-203 or VR-204, you must flush out the Liquid Condensate Trap to remove any dirt or debris that may have accumulated inside the Liquid Condensate Trap.

Installer will need to document the capacity, in gallons, of the Liquid Condensate Trap on an aluminum 'tag' and attach this tag to the suction riser above the Fuel Entry Port. The capacity could be documented using a metal stamp or metal engraving pen, or a waterproof ink marker on the aluminum tag. A vinyl covered steel cable or a 'zip tie' could be used to attach to the riser. Strips of aluminum can be purchased at most hardware stores.

Example LCT Capacity Tag

LCT Capacity - 9.9 Gallons

Flushing the Liquid Condensate Trap and attached Piping:

Flushing out the Liquid Condensate Trap of any debris is very important to avoid blocking the suction tube, suction line, the in-line filter, and the syphon jet at the turbine pump during liquid evacuation. This process must be performed before installing the required Liquid Condensate Trap Equipment listed in Exhibit 1 of the EO VR-203 or VR-204.

- Use appropriate equipment to flush out the Liquid Condensate Trap of any debris. One method used is:

a) Disconnect the suction line from the suction tube at the suction riser to prevent the turbine pump syphon from sucking any debris into the suction line and syphon jet during the flushing process.

b) Using a hand pump, pump approximately 5 gallons of fresh gasoline into the Liquid Condensate Trap. Using the same hand pump, reverse the hoses and pump out the gasoline you just added. Repeat this procedure using fresh clean gasoline each time until the gasoline you are removing is clean and clear. This process may require a number of flushes (may be as many as 20 or more) before the gasoline being removed is clean and clear.

Note: Handle gasoline in a safe manner, following industry safety practices and all applicable State regulations and local codes.

c) With the suction line disconnected from the Liquid Condensate Trap and disconnected at the turbine syphon port, blow compressed air through the suction line to remove any debris and check for any blockages.

4. INSTALLATION OF THE PHASE II EVR EQUIPMENT LISTED IN EXHIBIT 1 OF EO VR-203 AND 204

Figures 1 through 3 show a typical layout of a Phase II EVR Liquid Condensate Trap after completion of installing the equipment listed in Exhibit 1 of EO VR-203 and VR-204.

Figure 1
Typical Liquid Condensate Trap Installed Below the Transition Sump

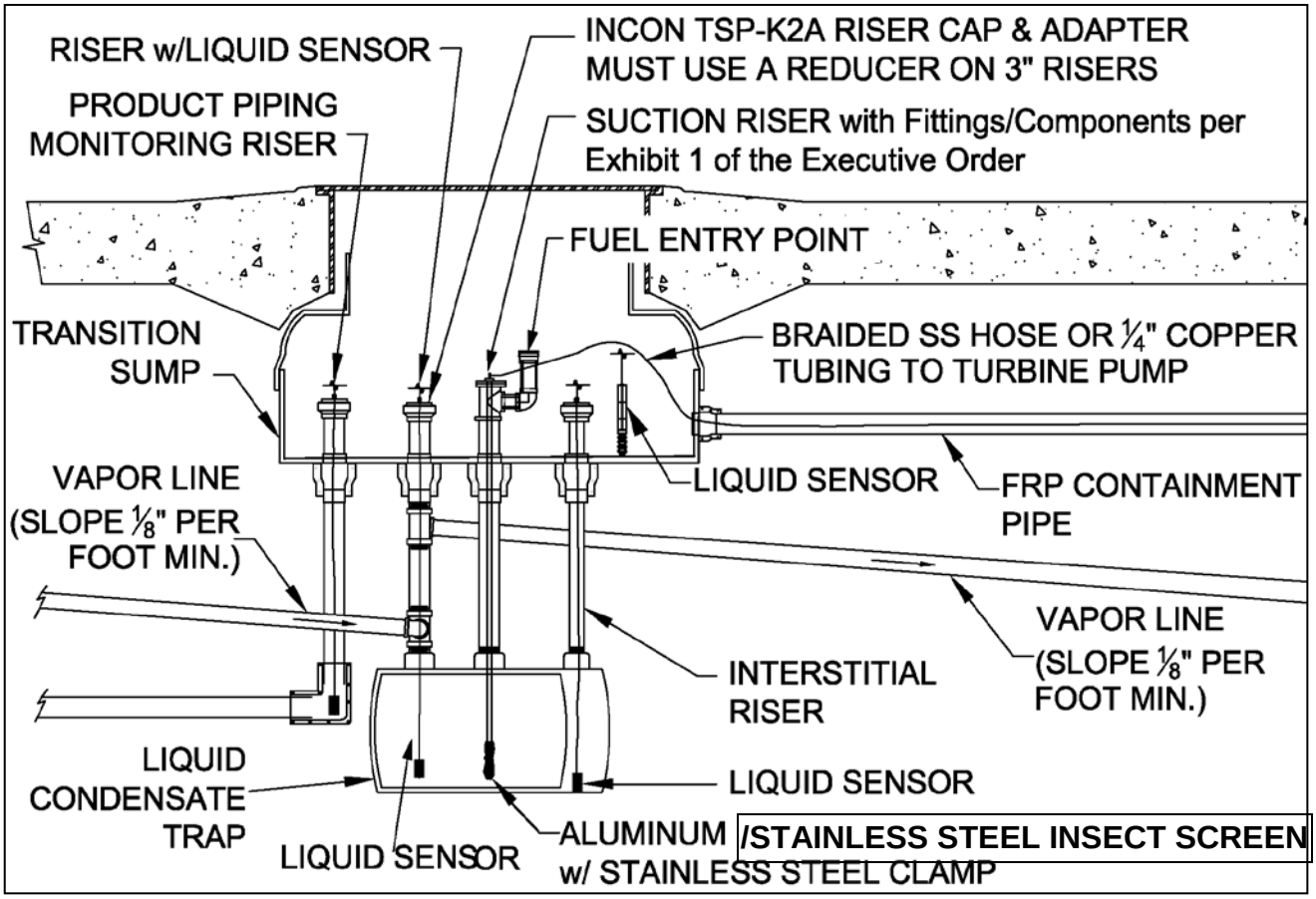


Figure 2
Typical Liquid Condensate Trap Installed Inside the Transition Sump

Note: A Liquid Condensate Trap installed inside a liquid AND vapor tight transition sump that is monitored with a liquid sensor can be single walled (if installed before July 1, 2004).

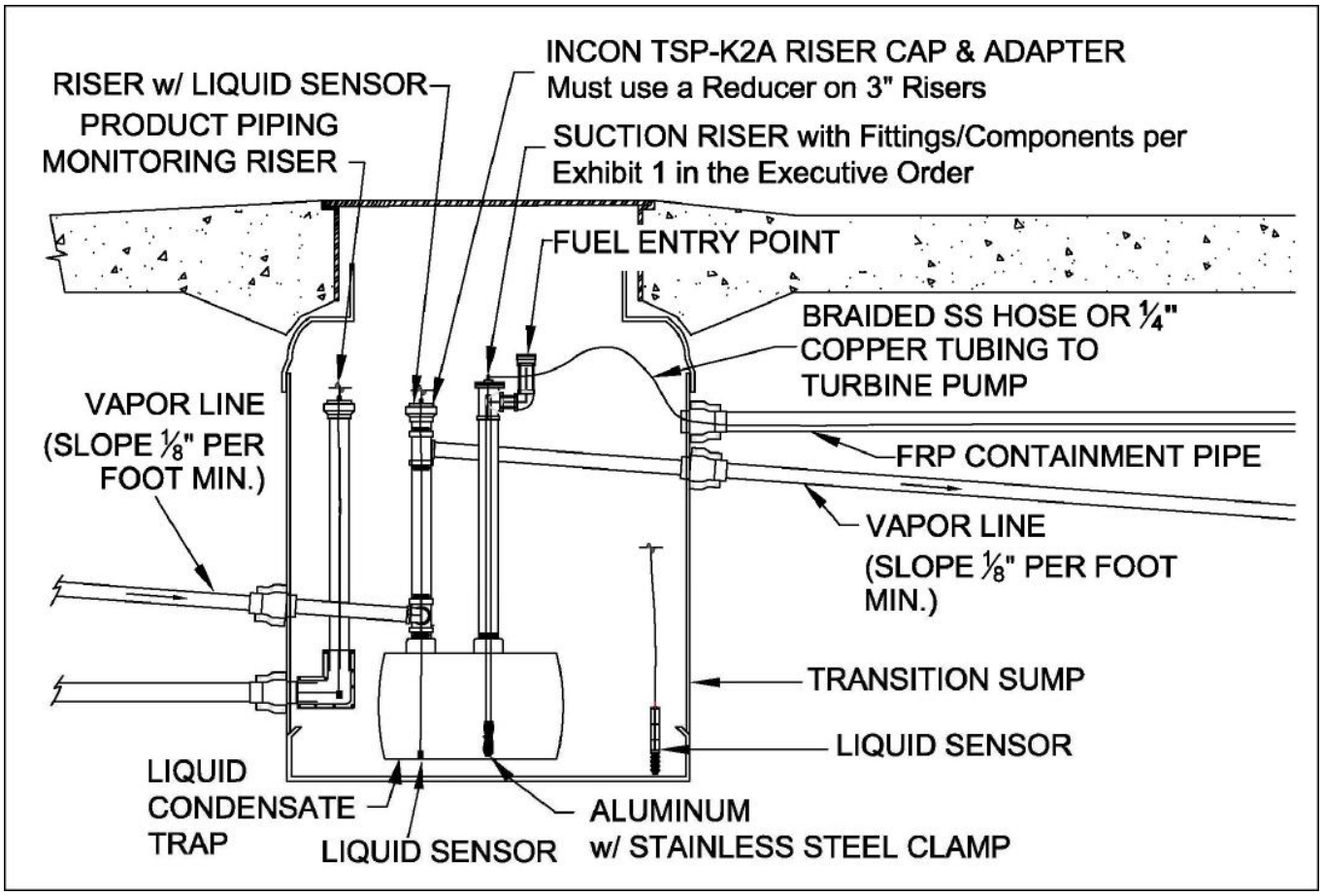
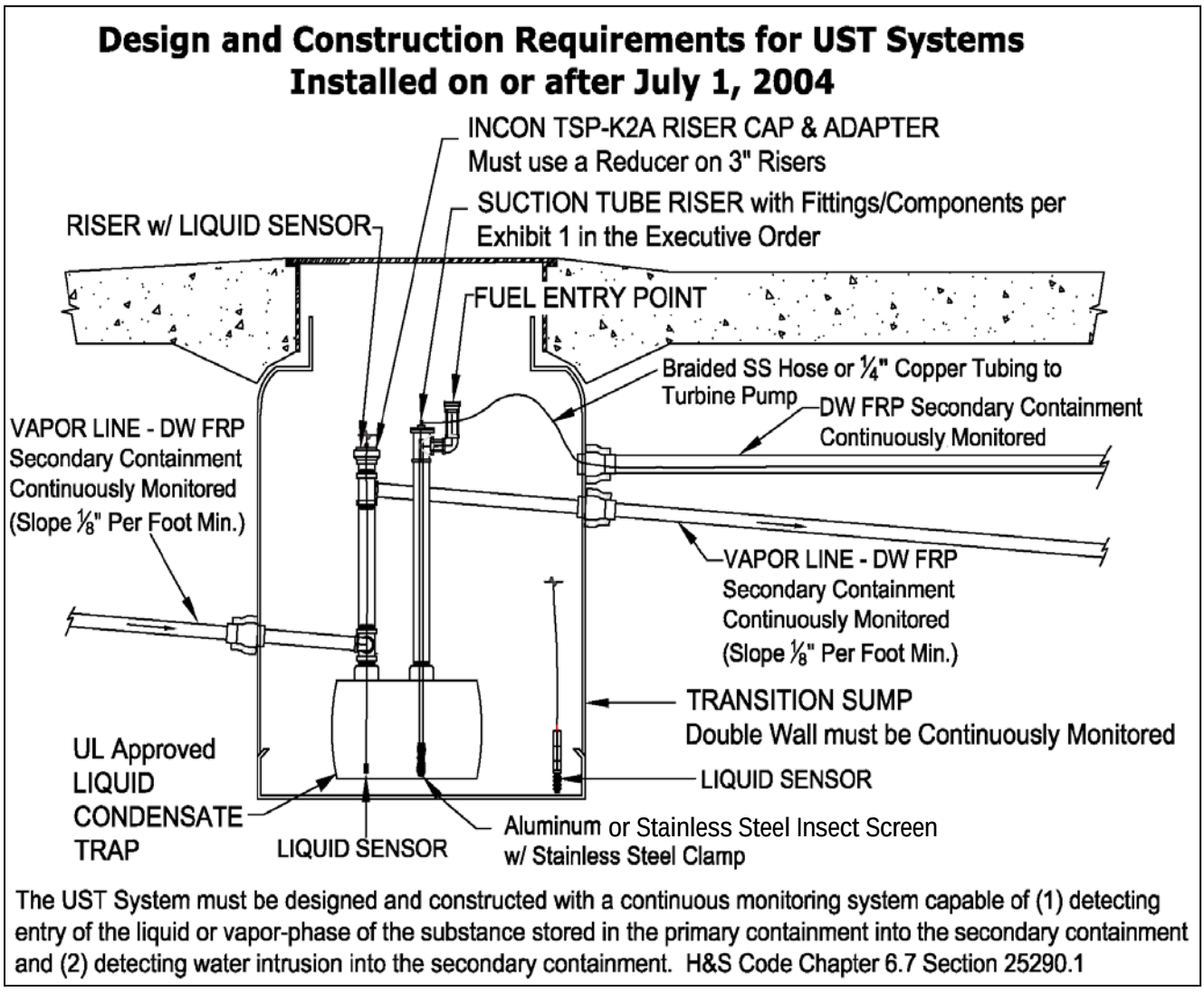


Figure 3
Typical Layout of a Liquid Condensate Trap Installed Inside in a UST System That Was Installed On or After July 1, 2004 and After the Installation of the Equipment Listed in Exhibit 1 of Executive Orders VR-203 and VR-204



4.1 Installation of Swagelok 140 Micron In-Line Filter (or equivalent).

Swagelok instructions are used for guidance purposes. Individual manufacturer's installation instructions must be followed.

Swagelok In-Line filter B-4F2-140 Specifications

Body----------Brass
Connection---------1/4" Male NPT
Pore Size ----------140 Micron

Apply Teflon tape to the male NPT threads on both ends of the in-line filter. Install the in-line filter with the direction of the arrow pointing towards the syphon jet port on the Submersible Turbine Pump (STP).

Figure 4
Top View of STP Sump

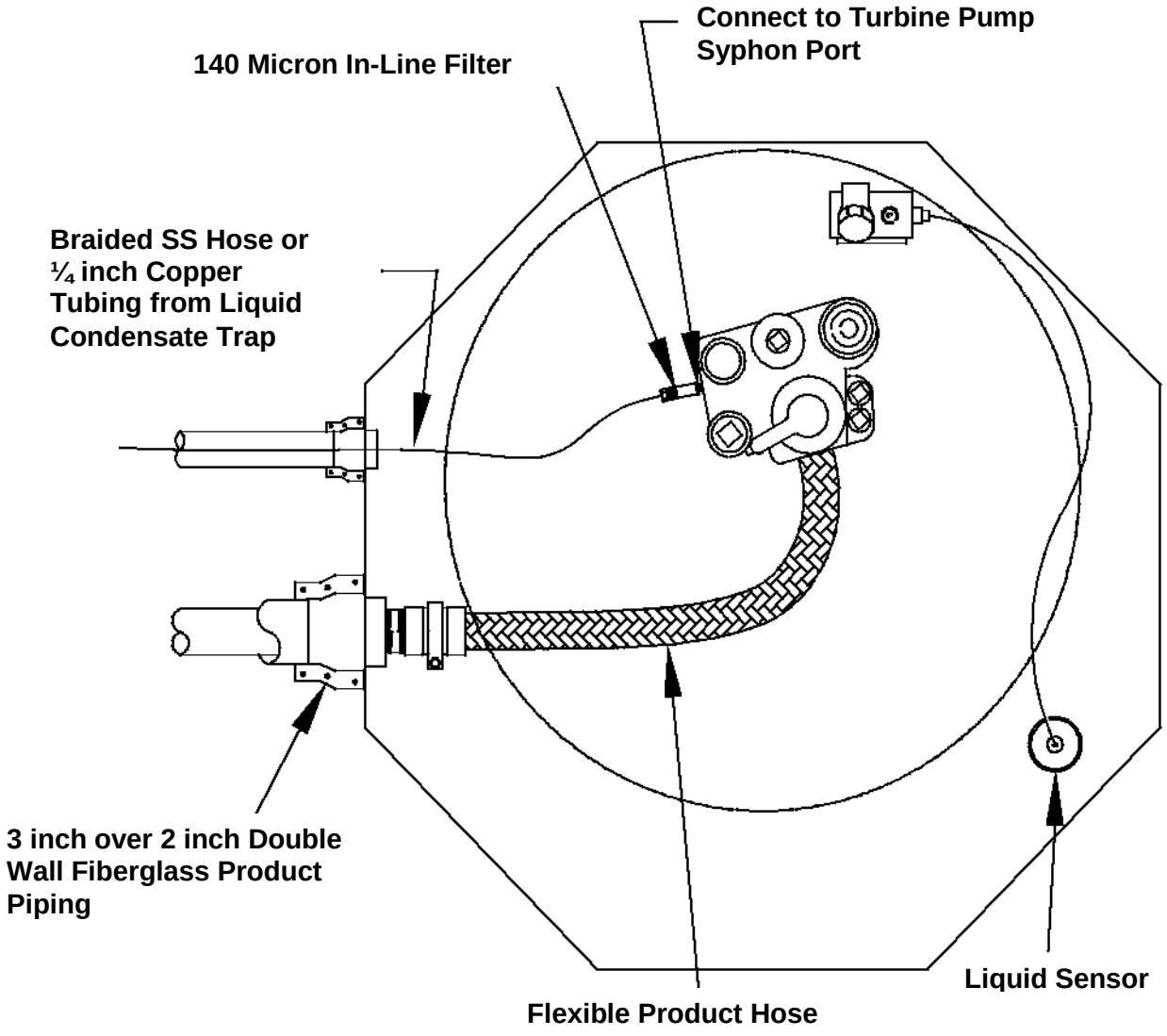


Figure 4a
Cut Away side view of an STP

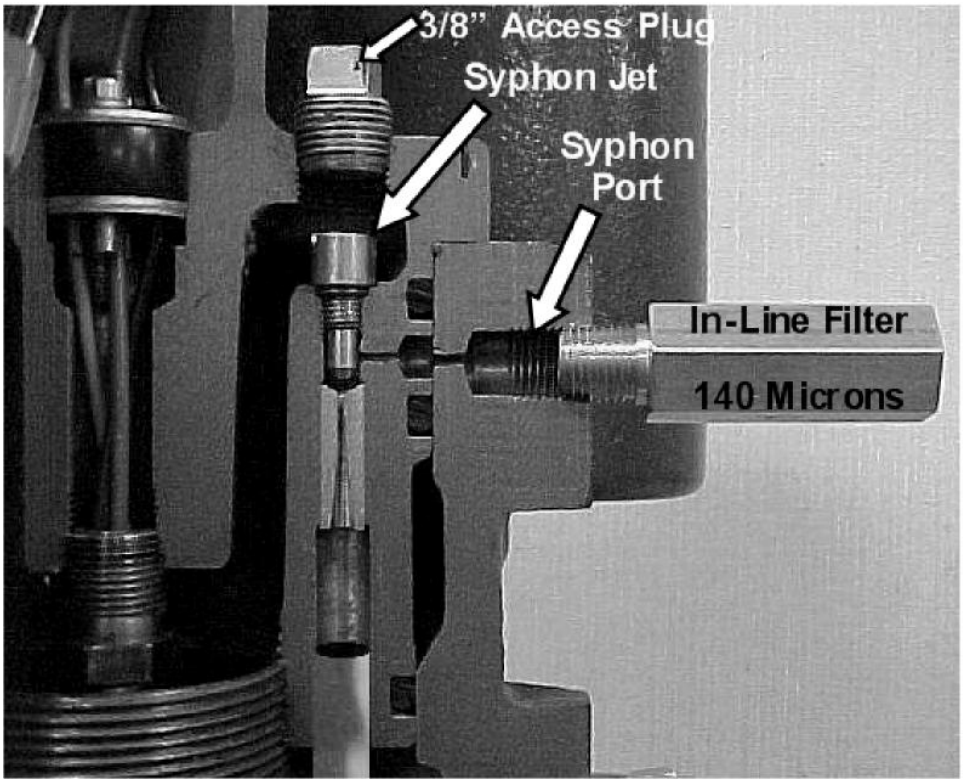
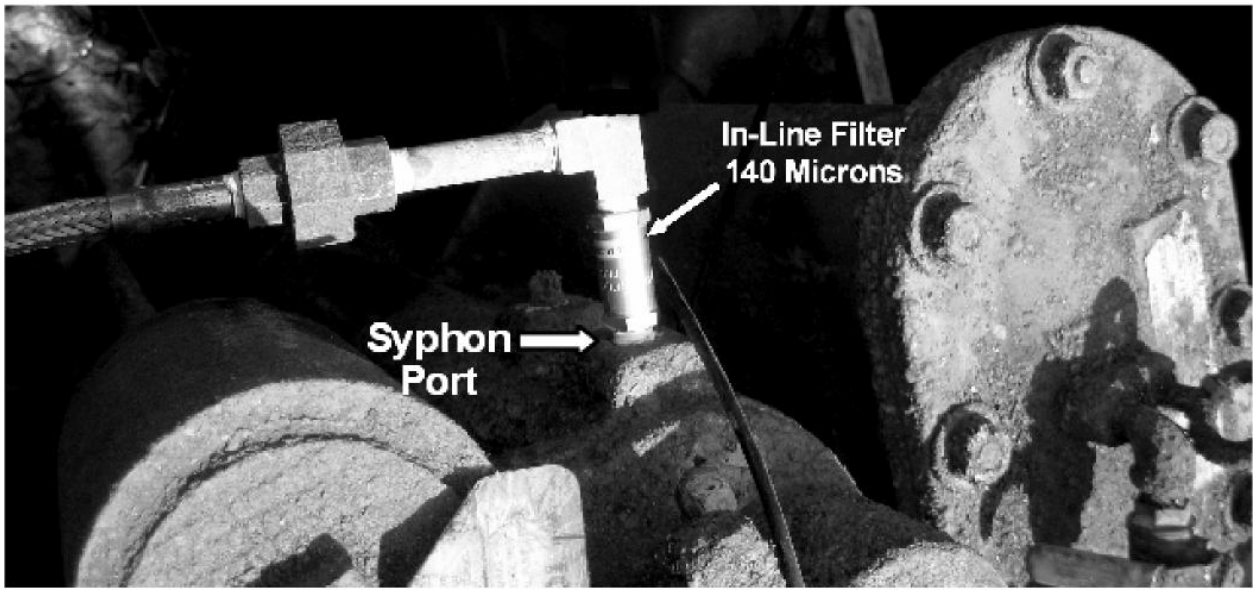


Figure 4b
In-Line Filter connection to syphon port



4.1.1 Replacing Micron Filter Element Inside the In-Line Filter Swagelok

(or equivalent) instructions are used for guidance purposes. Individual manufacturer's installation instructions must be followed.

If the filter element becomes blocked from debris clean or replace the filter element – Swagelok P/N SS-4F-K4-140. See replacement instructions in Appendix B.

4.2 Installation of INCON TSP-K2A Riser Adaptor

WARNING **Follow all federal, state and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30, 30A and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage and/or environmental contamination.**

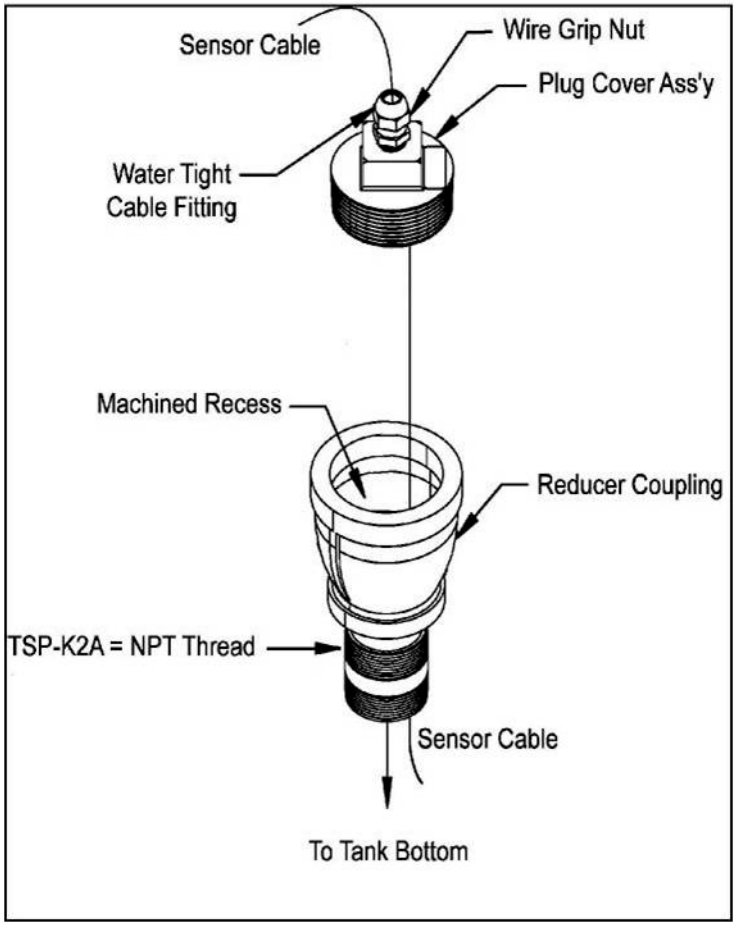
WARNING **Always secure the work area from moving vehicles. The equipment in this guide is usually mounted underground, so reduced visibility puts service personnel working on this equipment in danger from moving vehicles entering the work area. To help eliminate these unsafe conditions, secure the area by using a service truck to block access to the work environment, or by using any other reasonable means available to ensure the safety of service personnel.**

Procedure

1. Install a close fit 2" threaded nipple (field supplied) into the existing pipe.
2. Install the Reducer Coupling onto the threaded nipple.

Note: Use BOTH Teflon® Tape and a brushed-on thread sealant on all threaded connections to form a vapor-tight seal.

3. Insert the Sensor Cable through the wire grip nut so that the end of the sensor is on the inside of the Reducer Coupling.
4. Make all of the connections and test the sensor.
5. Tape and seal the Plug Cover Assembly into the Reducer Coupling. Make sure that the wire leads through the Wire Grip are loose and do not rotate when tightening the Plug Cover Assembly.
6. Tighten the Wire Grip Nut to 75-100 in. lbs. of torque to secure the cable. Use a torque wrench with McMaster Carr # 5347A148, 1-1/16 inch Open End Head, for Interchangeable-Head Torque Wrench or equivalent.



7. Retest the sensor functionality.

Figure 5
INCON TSP-K2A Riser Adaptor

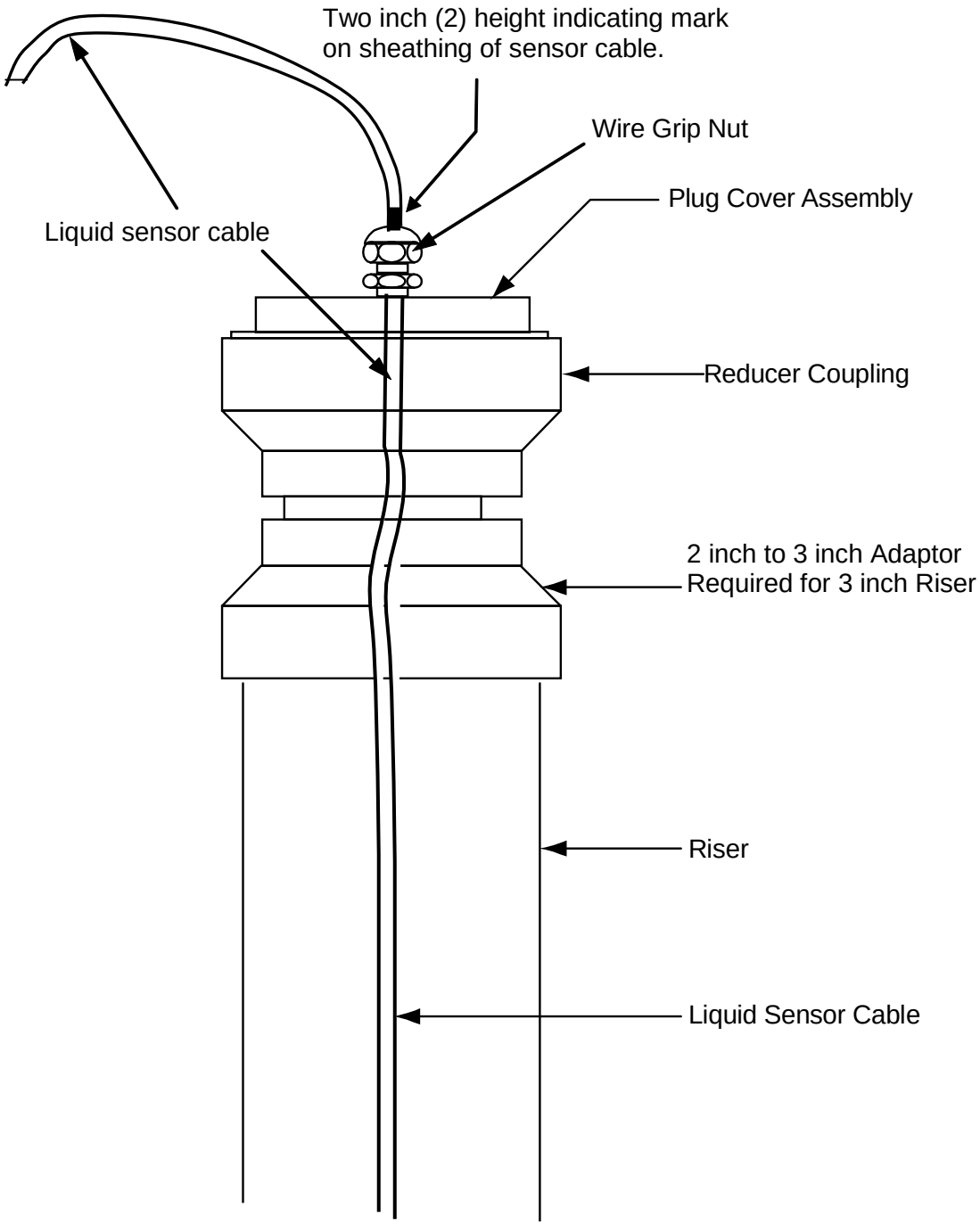
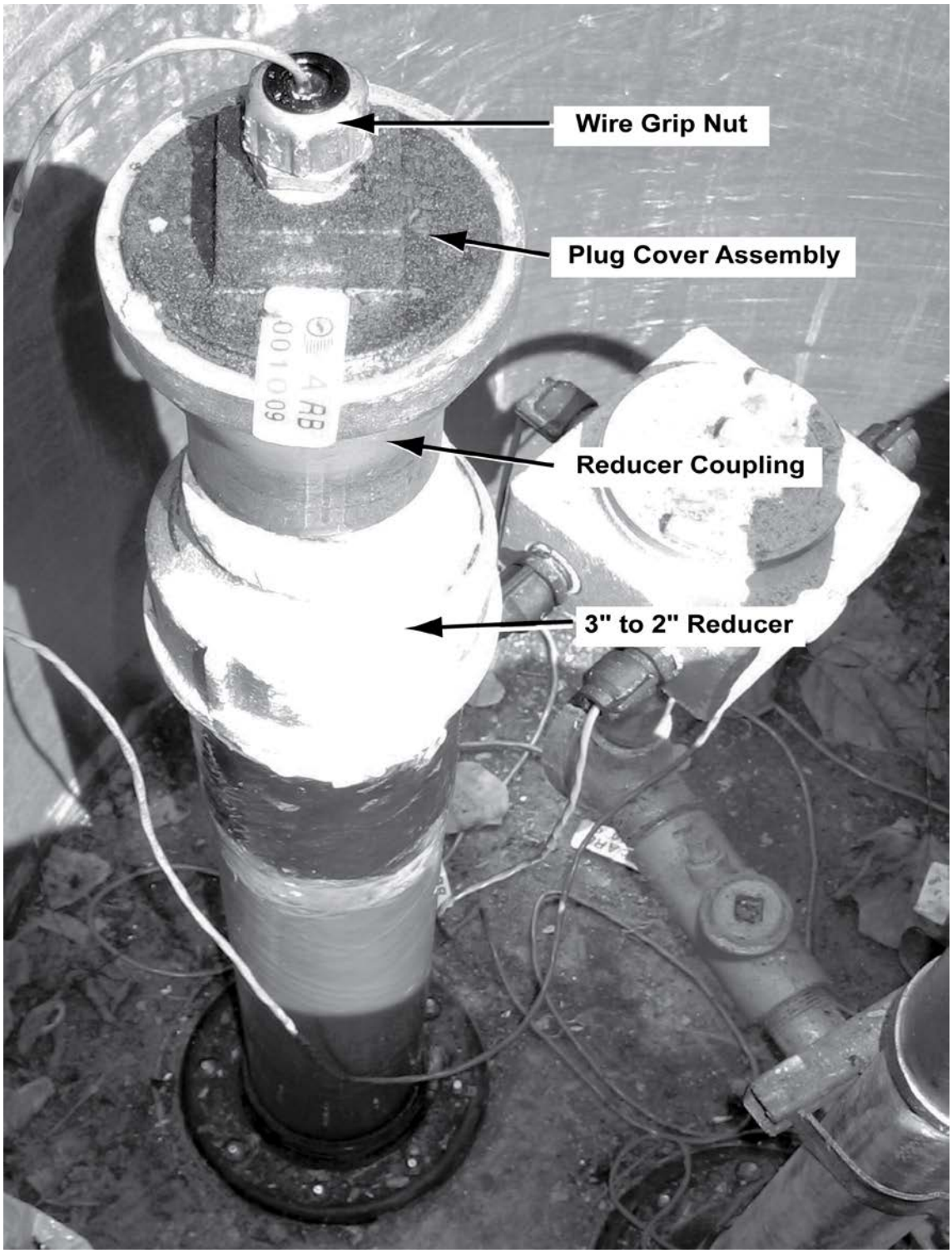


Figure 5a
INCON TSP-K2A Riser Adaptor



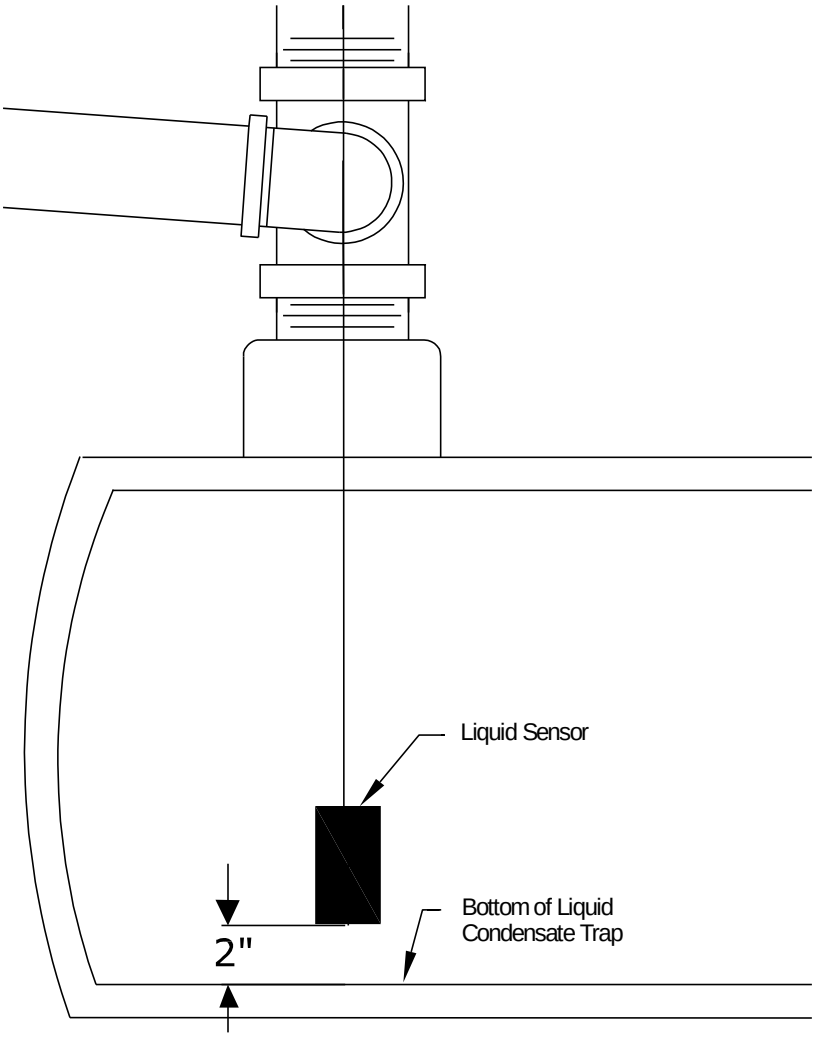
4.3 Liquid Sensor - Installation of a liquid sensor requires technician to meet applicable requirements as specified in the SWRCB Local Guidance Letter 167 (LG 167).

If not already present, install a liquid sensor following the manufacture's installation instructions. Set the liquid sensor two (2) inches from the bottom of the Liquid Condensate Trap. See Figure 6. Then tighten the wire grip nut (of the TSP-K2A) around sensor cable.

At the point where the cable exits the top of the wire grip, place a permanent indicating mark on the sheathing of the cable (*e.g.* using a waterproof marker such as a Sharpie™) which indicates the sensor is placed two (2) inches above the bottom of the Liquid Condensate Trap (see Figure 5).

When programming the LCT liquid sensor at the UST tank monitoring console, label the sensor with "LCT" in the title, *e.g.* L10 would be labeled "LCT High Liquid".

Figure 6
Liquid Sensor Height Setting



4.4 Installation of Suction Tube Riser, Suction Tube and Screen

For all installations you must use fuel rated pipe sealant on all threaded connections.

For new installations cut to size and thread a 2 inch galvanized steel riser for the suction tube and install it into a 2 inch bung at the top of the Liquid Condensate Trap.

For all installations install a 2 inch Tee fitting for the Fuel Entry Point on top of the 2 inch galvanized steel riser.

Measure the length of the suction tube to ensure it can meet the distance requirement in Figure 7. Cut the suction tube to length. When installing the suction tube, ensure the bottom of the suction tube is no more than 1 inch to 1 1/2 inches from the bottom of the Liquid Condensate Trap.

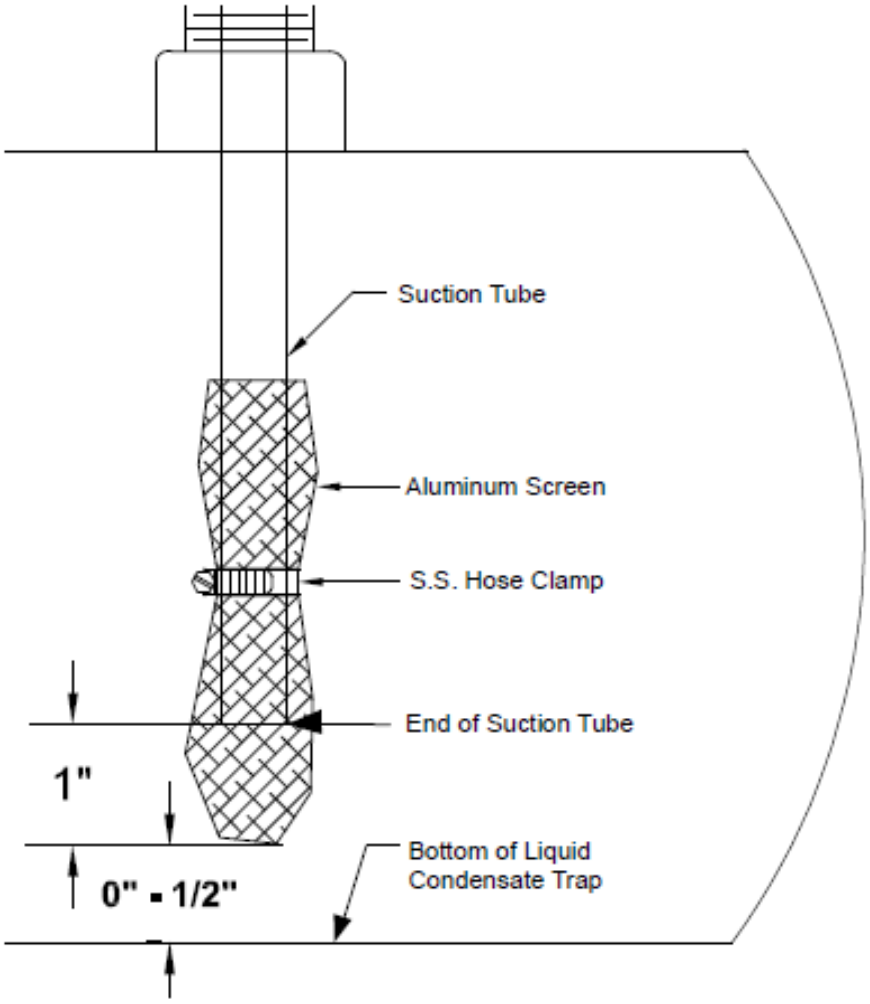
Cut a piece of 4 inch by 4 inch piece of screen material, either 18 x 14 aluminum mesh or 18 x 18 stainless steel mesh. Wrap it around the end of the suction tube as shown in Figure 7, leaving approximately 1 inch of screen below the end of the suction tube. Tighten the stainless steel hose clamp around the screen securing it approximately 3/8 inch or more from the bottom of the suction tube.

Once the aluminum screen is installed, the suction tube is ready to screw into the bottom of a double-tap bushing.

This double tap bushing, with the suction tube, is then installed into the top of the tee fitting.

Connect the suction line to the top of the double tap bushing using appropriate fittings (Figures 8 thru 8c) and the other end of the suction line connects to the 140 micron in-line filter installed at the turbine syphon port per section 4.1 (Figures 4a and 4b).

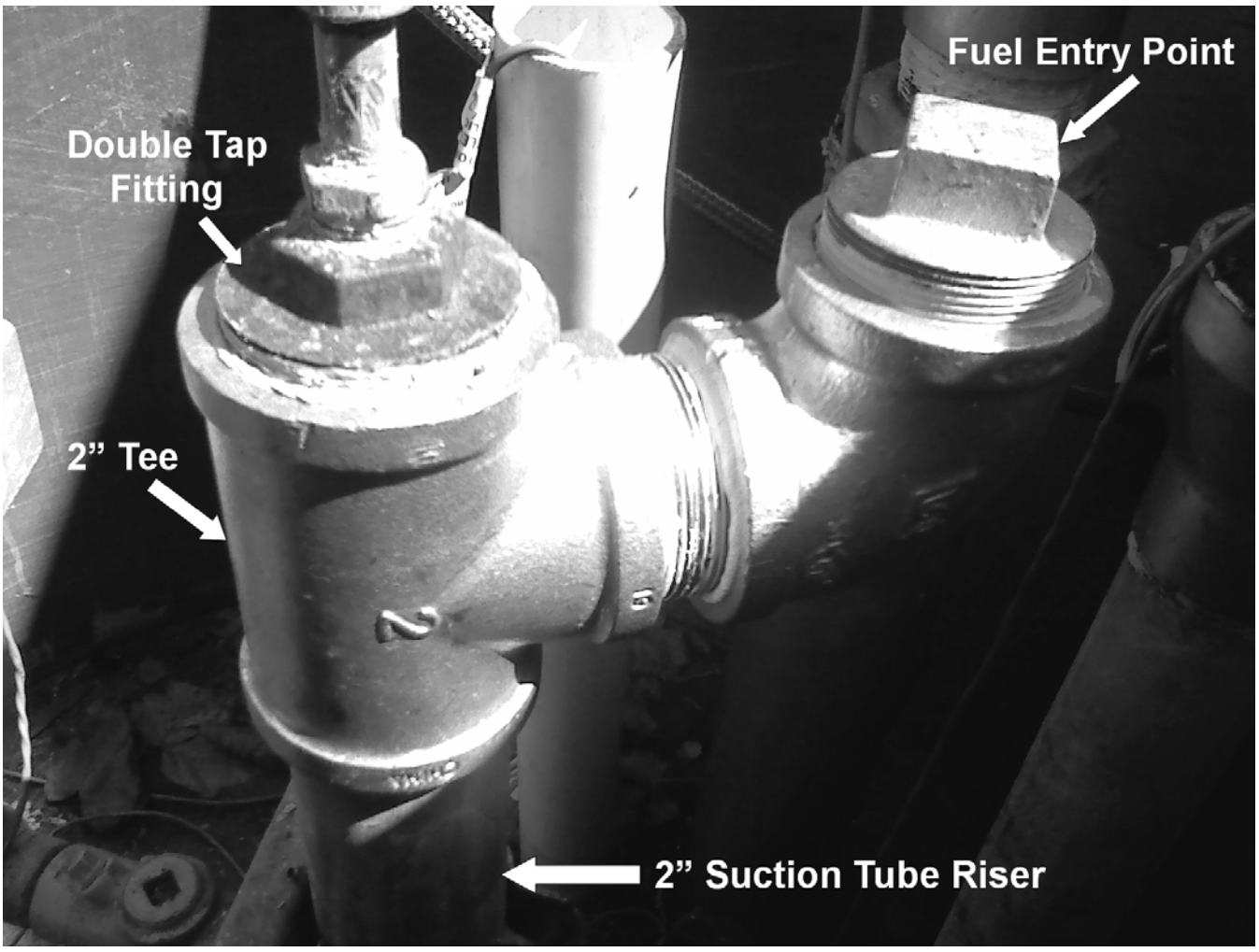
Figure 7
Aluminum Screen and Suction Tube Installation



4.5 **Fuel Entry Point** – On top of the 2 inch galvanized steel pipe install a 2 inch tee, 2 inch nipple, 2 inch elbow, additional 2 to 4 inch nipple (if using cap). Prior to installing cap or plug, conduct Exhibit 16 (VR-203 or VR-204). Install 2 inch cap or plug using pipe thread sealant (all pipe fittings must be galvanized steel.) See figures 8 & 8a, 8b, 8c and 8d.

4.6 Conduct TP-201.3, Determination of 2 Inch WC Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities, and Exhbit 4.

Figure 8
Assembly of Fuel Entry Point



5. In the event that the turbine connected to the Liquid Condensate Trap is replaced, Exhibit 16 of Exevcutive Orders VR-203 or VR-204 shall be conducted following replacement of the turbine.

Figure 8a

Assembly of Fuel Entry Point

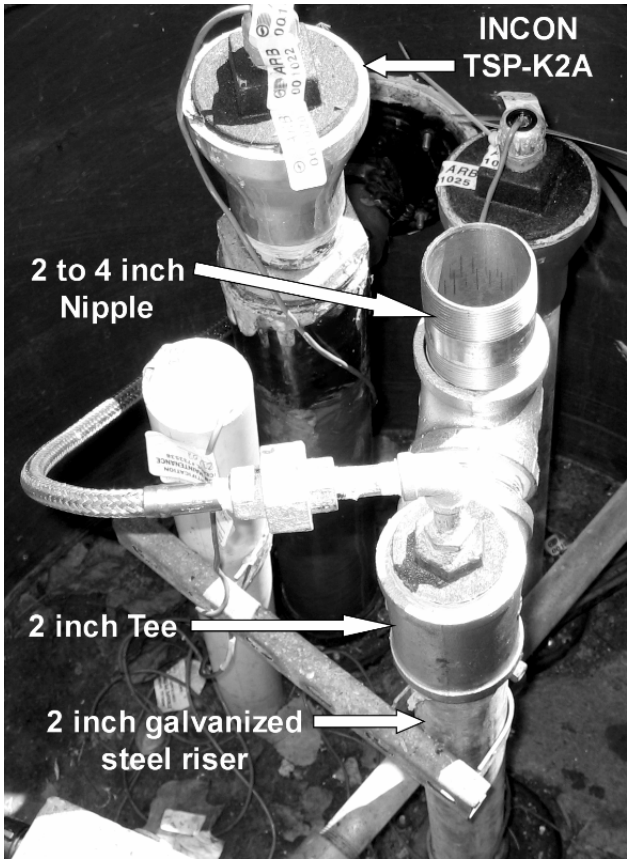


Figure 8b
Assembly of Fuel Entry Point

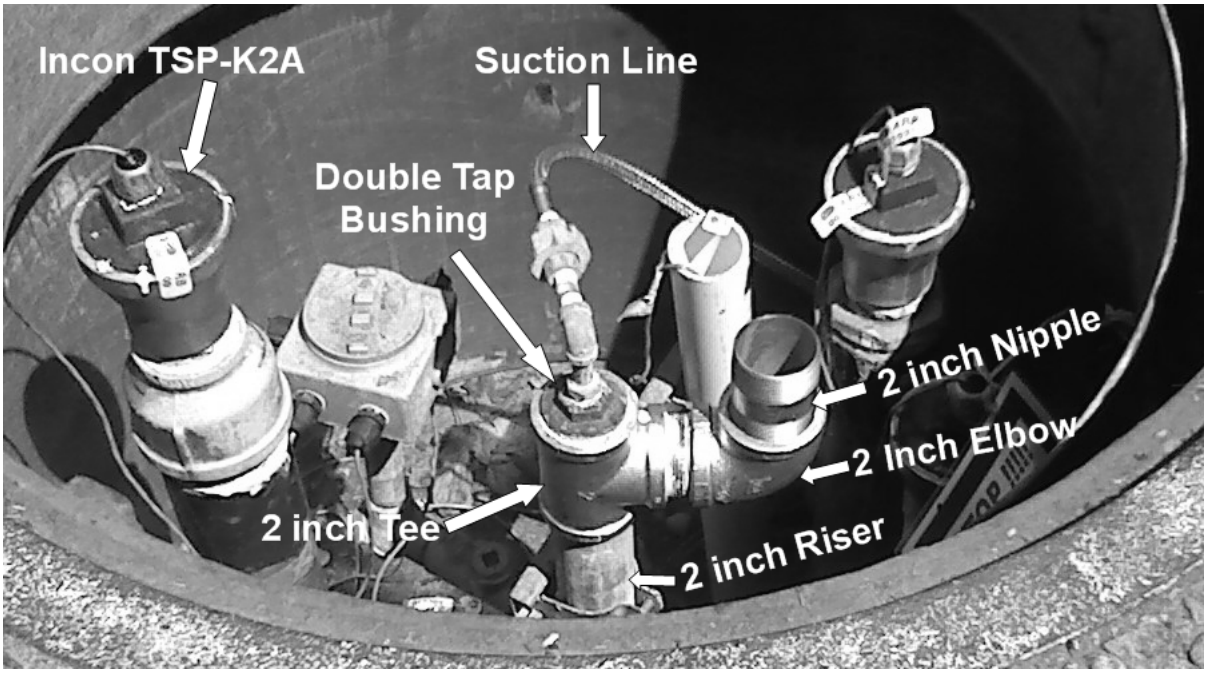


Figure 8c
Additional View Assembly of Fuel Entry Point

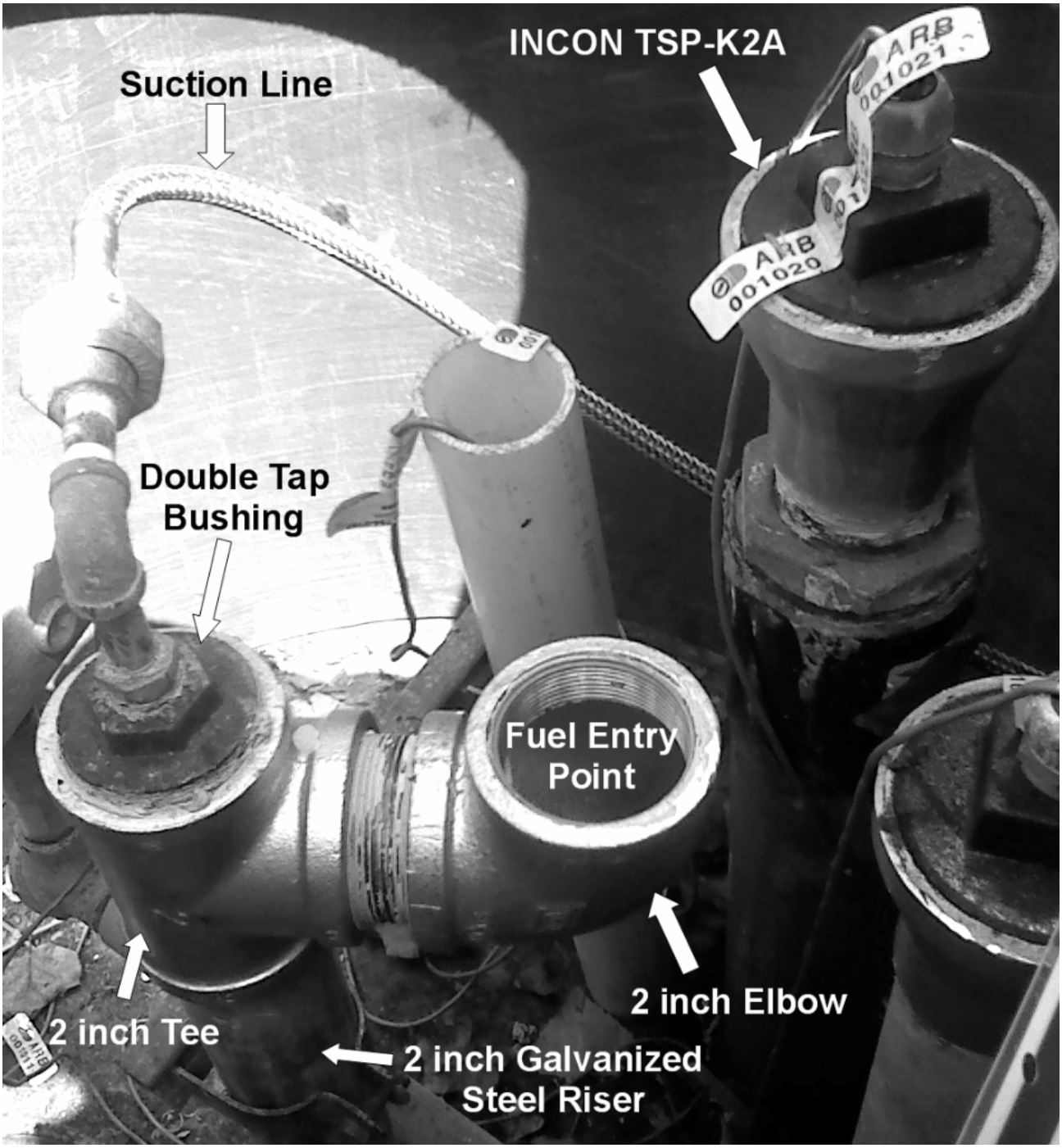

INCON TSP-K2A
Suction Line
ARB
001021
ARB
001020
Double Tap
Bushing
Fuel Entry
Point
2 inch Elbow
2 inch Tee
2 inch Galvanized
Steel Riser

Figure 8d

Various Pipe Fittings

TROUBLESHOOTING PROCEDURES FOR LIQUID CONDENSATE TRAP

WARNING **Installing or working on this equipment means working in an environment that presents risks of severe injury or death if instructions and standard industry practices are not followed. Obey all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment.**

1. Test The Turbine Pump For Normal Vacuum Readings:

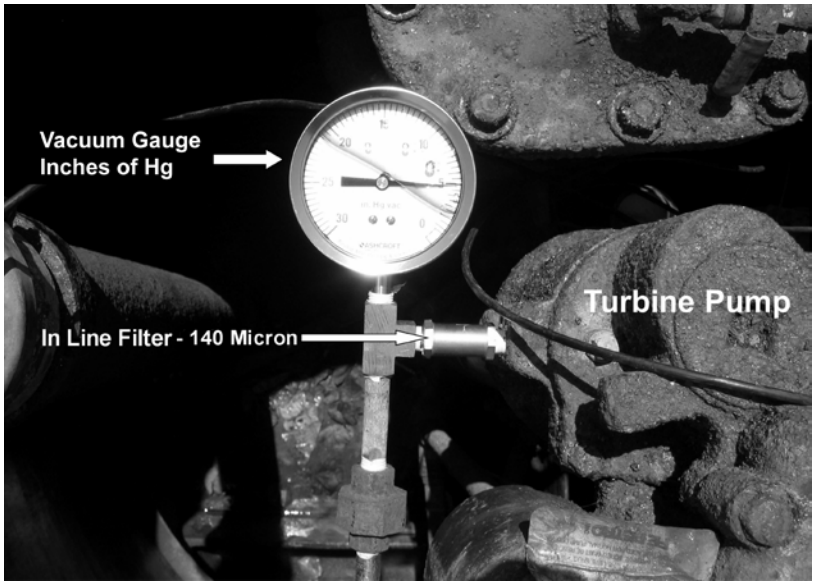
- Follow FE Petro syphon jet test procedures. See Appendix A, FFS FE Petro Service Bulletin SB005 “Syphon System Testing” (SB005). When using this test procedure for testing the turbine pump connected to the Liquid Condensate Trap only, perform Steps 1– 4. Do not use a syphon check valve and skip the syphon check valve test (for other turbine pump manufacturers, refer to their test procedure.)
- This will ensure the turbine pump is operating correctly and producing the correct amount of vacuum at the syphon port (minimum vacuum is 16 to 28 inches Hg). Make any necessary repairs to the turbine pump to meet the syphon port minimum vacuum levels.
- If the turbine pump is creating the appropriate amount of vacuum (16 to 28 inches Hg) at the syphon port, remove the test fixture called out in SB005 and install the 140 micron in-line filter.
- Check the vacuum level again with the in-line filter installed using the vacuum gauge in Figure 9. The amount of vacuum should be between 16 to 28 inches Hg.

2. Required Troubleshooting Test Equipment

Install the following Liquid Condensate Trap evacuation troubleshooting equipment:

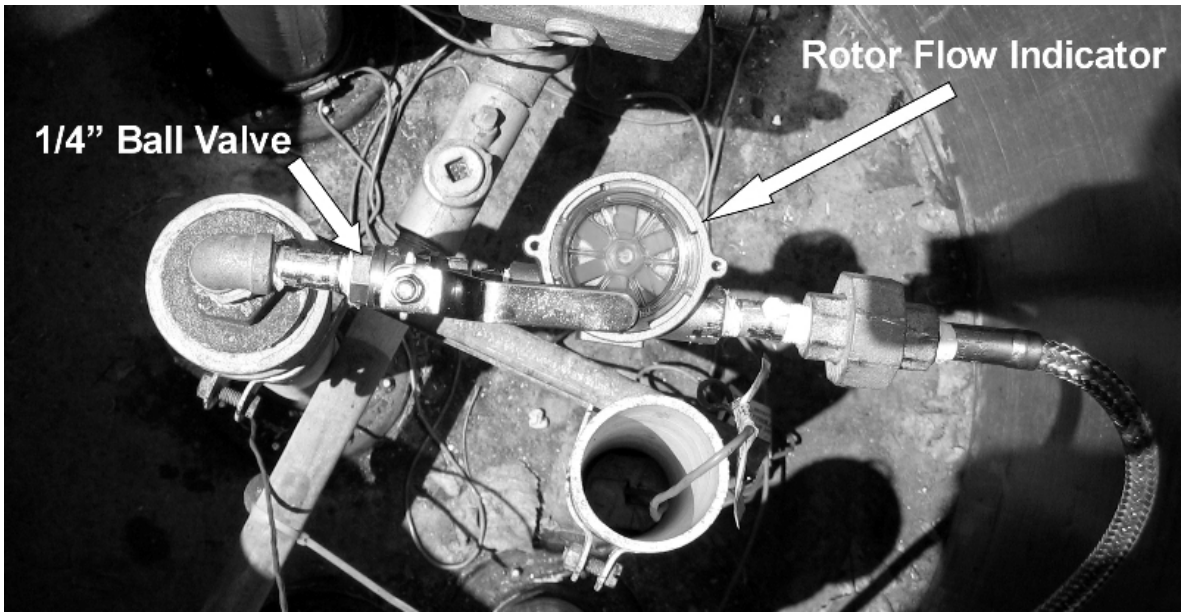
2.1 Ashcroft liquid-filled stainless steel, inches of Hg vacuum gauge, Grainger #2C879, 2C927 or equivalent. Install this gauge before the 140 micron in-line filter so that it is visible from outside the sump. See Figure 9.

Figure 9



2.2 Install a ¼ inch **full port** ball valve (ball valve) and rotor flow indicator Grainger Model 1AMD7 (or equivalent). The rotor flow indicator provides a visual indication of fuel flow when evacuating the Liquid Condensate Trap. Install this equipment so that it can be viewed from outside the sump. See Figure 10.

Figure 10



3. With the troubleshooting equipment installed perform the following procedures:

a. With the ball valve in the CLOSED position, fill the Liquid Condensate Trap with gasoline using the same method used in the Liquid Condensate Trap Compliance Test Procedure. The liquid sensor should be approximately 2 inches from the bottom of the Liquid Condensate Trap. Start the turbine pump connected to the Liquid Condensate Trap if it is not already running.

b. With the ball valve CLOSED, check the vacuum gauge and verify it is reading between 16 to 28 inches Hg of vacuum. If you do not have the correct amount of vacuum then look for a vacuum leak in the system. Check for a blocked in-line filter or syphon jet. See the table titled "If You Experience the Following Conditions".

c. OPEN the ball valve and watch for rotation of the rotor flow indicator. Rotation of the rotor flow indicator will indicate the flow of gasoline. The rotor flow indicator will not rotate at a high speed and will not rotate at all if no liquid is flowing through the indicator. The rotor flow indicator provides a visual indication that liquid is being evacuated from the Liquid Condensate Trap. If any air is getting into the syphon system during evacuation the liquid flow rate will change or stop.

d. When first opening the ball valve, the vacuum pressure may drop to zero inches of Hg (0" Hg) during priming of the suction line; however the vacuum should rise up to approximately 4 to 5 inches Hg during evacuation. Monitor the rotor flow indicator for steady rotation.

e. When the Liquid Condensate Trap is almost empty and/or the liquid is below the end of the suction tube the rotor flow indicator will stop then start a few times and then completely stop. This is an indication that air is getting into the system. If the liquid sensor is out of alarm and the Liquid Condensate Trap is empty or almost empty (liquid level is at or below the bottom of the suction tube) you have successfully evacuated the Liquid Condensate Trap.

   Note: At this time the vacuum gauge will read near zero inches of Hg (0" Hg) because the suction tube is sucking in air and not liquid.

4. When you have successfully passed this **Troubleshooting** section, remove the troubleshooting equipment and retest the system again using the "Liquid Condensate Trap Compliance Test Procedure" (Exhibit 16 of VR-203 or VR-204).

IF YOU EXPERIENCE THE FOLLOWING CONDITIONS:	
Symptom:	**Troubleshooting steps:**
The ball valve is open, no rotation of the rotor flow indicator, and high vacuum (16″ Hg to 28″ Hg)	o There is a blockage in the piping before the vacuum gauge. o Check the suction tube and suction line from the bottom of the suction tube to the vacuum gauge. o Check for kinks or pinches in the suction line.
The ball valve is open and the rotor flow indicator stops and starts intermittently. This indicates a small vacuum leak or an intermitting blockage	o Check the screen at the bottom of the suction tube for debris, dirt, rocks, etc. o Check the in-line filter and/or syphon jet for debris and blockage. o Check the fittings and connections from the suction tube to the syphon jet for any vacuum leaks.
With the ball valve open, no rotation of the rotor flow indicator, zero vacuum (0” Hg), and the liquid condensate trap still has liquid above the bottom of the suction tube.	o Check the in-line filter and/or syphon jet for debris and blockage. Small particle of debris (rust particles) can block the in-line filter and/or syphon jet causing the vacuum level to drop to zero. o Check the in-line filter and/or syphon jet for debris and clean or replace the filter element and/or syphon jet as necessary. o There may be a vacuum leak somewhere in the system. If you had the correct amount of vacuum before you opened the ball valve, then the vacuum leak is between the ball valve and the end of the suction tube; or the liquid level inside the Liquid Condensate Trap is below the bottom of the suction tube and you are sucking in air.
The ball valve is closed and there is zero inches (0” Hg) of vacuum on the gauge	o Check the in-line filter and/or syphon jet for debris and blockage. Small particles of debris (rust particles) can block the in-line filter and/or the syphon jet causing the vacuum level to drop to zero. o Check the in-line filter and/or syphon jet for debris and clean or replace the filter element and/or syphon jet as necessary. o Check for a vacuum leak between the vacuum gauge and the ball valve.

Appendix A

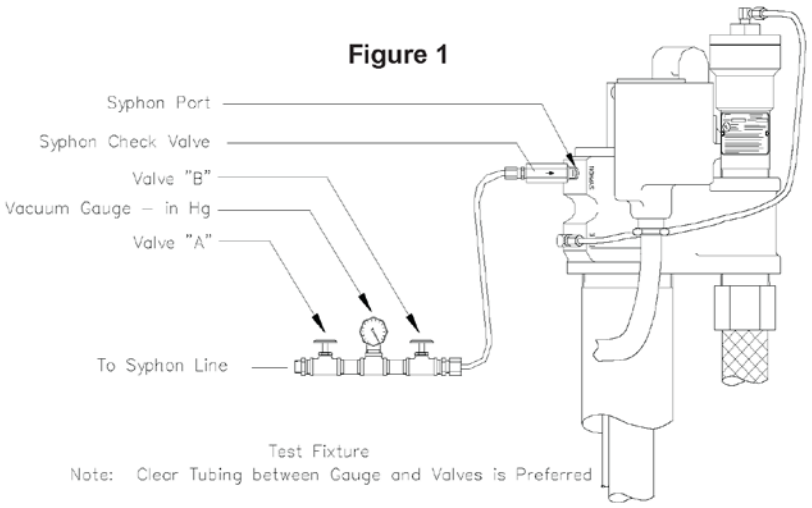
FE PETRO
Franklin Fueling Systems

SERVICE BULLETIN
SB005 Rev 2
January 20, 2009

Syphon System Testing

The following procedure illustrates syphon system testing techniques on 4" pumps.

Figure 1



When manifolded tanks are not maintaining equal product levels (i.e., loss of syphon prime) there are several possible causes: the Submersible Turbine Pump (STP) is not generating a vacuum, the syphon check valve is not holding prime when the STP is off, there is a leak in the syphon loop (i.e., tube, fittings, or pipe), there is foreign material blocking the syphon pipe, and/or the syphon system was not properly installed (i.e., the syphon bar is not sloped, the syphon pipes are too short, the tanks are different diameters, the tanks are on different planes, etc.).

Warning **Highly flammable vapors or liquids may be present in the environment in which this equipment is installed or serviced. Installing or working on this equipment means working in an environment that presents risks of severe injury or death if instructions and standard industry practices are not followed. Follow all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment. Refer to the *Installation and Owner's Manual* of this equipment and any related equipment for complete installation and safety information.**

Vacuum Testing Procedure

1. Turn off the power at the load center, then lock out and tag the circuit breaker.
2. Install a test fixture into the syphon line as shown in Figure 1.
3. Run the STP with the dispenser nozzles and valve "A" closed, and with valve "B" open. The normal vacuum reading should be 20-28" Hg. If the vacuum is normal, continue with Step 4. If there isn't any vacuum or it is somewhat less than 20" Hg, there is the possibility of blockage in the STP syphon passages.

   Note: Vacuum readings should be taken without any product delivery. Also, check if the Pump Motor Assembly is producing correct pressures.

4. To remedy abnormal vacuum conditions, remove the 3/8" plug from the manifold discharge head (see Figure 3) and unscrew the brass Syphon Jet using a large standard screwdriver. Pull the Syphon Jet out and clean it, making sure that the Syphon Jet only allows for downward flow when installed. Before reinstalling the Syphon Jet, ensure that the Syphon Port and the Vapor Return Tube have open passages by using a stiff wire or other similar device to check. Replace or reinstall the Syphon Jet and 3/8" plug. Check for normal vacuum. If the passages are clear and the vacuum is still abnormal, check the STP Extractable O-rings for damage and make sure that the Vapor Return Tube is not pinched. To check the Vapor Return Tube, remove the STP Extractable and repair as necessary (see Figure 2). If the condition has been corrected, continue with the next step to test the remaining syphon system. If abnormal vacuum conditions continue, contact FFS Petro Technical Support.

5. Run the submersible with dispenser nozzles and valve "A" closed, but leave valve "B" open. When the vacuum reading reaches 20-28" Hg, shut the submersible off. The vacuum should hold for at least 15 minutes. If this worked, continue with the next step. If the vacuum does not hold, the Syphon Check Valve is not holding or the Test Fixture fittings may be loose. Providing the Test Fixture fittings are tight, remove the Syphon Check Valve and clean or replace it. Repeat this step until the problem has been corrected, then continue with the next step.

Note: Syphon Check Valves may hold at high vacuum, but may fail under low vacuum. Test the Syphon Check Valve at a lower vacuum by bleeding off the vacuum and re-testing at 5" Hg.

6. Run the STP with valves "A" and "B" both open and the dispenser nozzles closed. Normal priming should take approximately 5-10 minutes. When first priming with both valves open, the vacuum gage will indicate 0" Hg. After awhile, vacuum will begin to show. For every inch of mercury vacuum shown, the product level in the syphon pipes is about 1-½ feet above the tank fluid level. When air is being removed from the syphon system, the vacuum gauge needle will bounce. This bouncing should stabilize as more air is removed. If not, this would be a good indication that there is a leak in the syphon system. This air may also be visible if using a Test Fixture with clear tubing. The air would indicate that there is a leak in the syphon line between the tanks or the possibility of foreign material blocking the syphon pipe. Repair any leaks or blockage and repeat this step. If there is no evidence of air, then continue with the next step.
7. Close valve "B" and then shut off the STP. The gauge should hold constant for 30-40 minutes after the submersible is turned off. The vacuum may increase if the syphon system wasn't fully primed before closing the valve. If the vacuum drops, there is a leak in the syphon line between the tanks or the possibility of foreign material blocking the syphon pipe. Repair any leaks or blockages and then repeat this step.

Note: If there is a leak in the syphon line, product will drain out of the horizontal pipes before vacuum gauge readings indicate a leak.

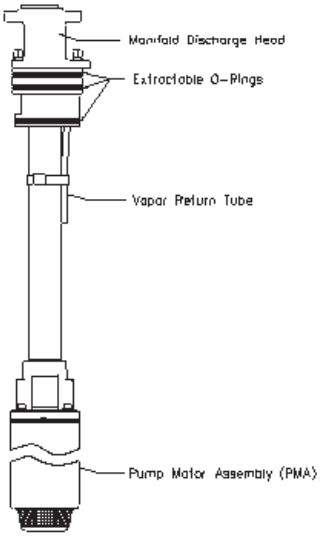


Figure 2
(STP Extractable)

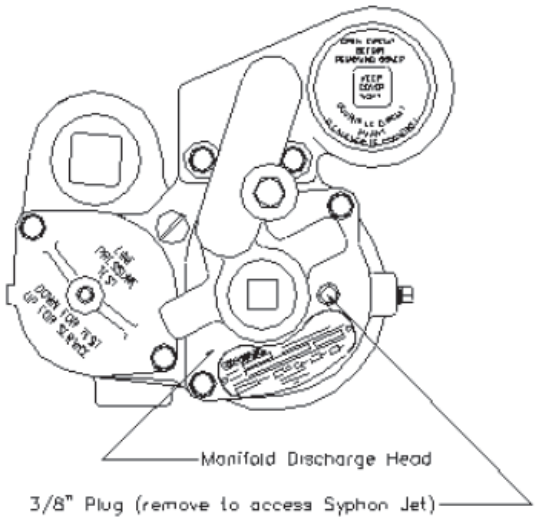


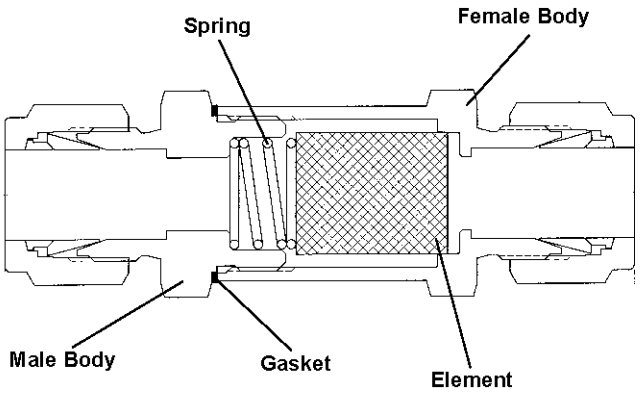
Figure 3
(Top View of STP)

Contact FFS Technical Support for any assistance

Franklin Fueling Systems ▪ 3760 Marsh Rd. ▪ Madison, WI 53718 USA
Tel: +1 608 838 8786 ▪ 800 225 9787 ▪ Fax: +1 608 838 6433 ▪ www.franklinfueling.com

APPENDIX B

Swagelok F-Series In-Line Filter Service Instructions



Disassembly

1. Loosen male and female bodies and disassemble.
2. If replacing the filter element, remove and discard used element.

Reassembly

3. Before reassembling the filter, be certain that all components are clean.
4. Align the new filter element parallel to the filter bore of the female body. Position the open end of the element towards the body and press in place.
5. Lubricate the gasket with a thin film of system-compatible lubricant. Place gasket on male body seal surface.
6. Place the spring in to the male body.
7. Thread the male and female bodies together, and tighten finger-tight.
8. Tighten the bodies to the proper torque as shown in the table below.
9. Test the filter for proper operation and leak-tight sealing.

	Torque, in.-lb. (N-m)		
	Standard Assembly		Unplated Gasket
Size and Series	**Stainless Steel**	**Brass**	**Stainless Steel**
1F, 2F, 3F-MM	135 (15)	125 (14)	—
4F, 6F-MM	350 (40)	325 (36)	500 (56)
6F, 8F, 10F-MM, 12F-MM	500 (56)	450 (50)	800 (90)

INCON®

Franklin Fueling Systems

Vapor Recovery Monitoring

Installation, Operation, and Maintenance Manual

For use with VST Systems and CAS
Softw*are Version 1.3.0 and 1.3.1*

For use with Hirt VCS100
Softw*are Version 1.3.1*

Franklin Fueling Systems • 3760 Marsh Rd. • Madison, WI 53718 USA
Tel: +1 608 838 8786 • 800 225 9787 • Fax: +1 608 838 6433 • www.franklinfueling.com

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Inspection of Materials

Visually inspect all components for defects or damage prior to installation. If any defects or damage is found, do not use the product and contact FFS for further assistance.

Return Shipping Charges

FFS will not accept shipments of returned products without a Return Goods Authorization (RGA) number. RGAs are obtained by contacting FFS's Technical Service Division — NO RGAs will be given without the unit's serial number(s). Returned goods remain the property of the buyer until replaced or repaired.

Contacting Franklin Fueling Systems (FFS)

Please feel free to contact us by mail at:

Franklin Fueling Systems
3760 Marsh Rd.
Madison, WI 53718 USA

Or contact us by phone, fax, or email:

Tel: 1 608 838 8786
Fax: 1 608 838 6433
Tel: US & Canada 1 800 225 9787
Tel: México 001 800 738 7610
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techserve@franklinfueling.com

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Please visit our Web site at www.franklinfueling.com

Contents

Important Safety Messages

INCON equipment is designed to be installed in association with volatile hydrocarbon liquids such as gasoline and diesel fuel. Installing or working on this equipment means working in an environment in which these highly flammable liquids may be present. Working in such a hazardous environment presents a risk of severe injury or death if these instructions and standard industry practices are not followed. Read and follow all instructions thoroughly before installing or working on this, or any other related, equipment.

As you read this guide, please be aware of the following symbols and their meanings:

Warning  This symbol identifies a warning. A warning sign will appear in the text of this document when a potentially hazardous situation may arise if the instructions that follow are not adhered to closely. A potentially hazardous situation may involve the possibility of severe bodily harm or even death.

Caution  This is a caution symbol. A caution sign will appear in the text of this document when a potentially hazardous environmental situation may arise if the instructions that follow are not adhered to closely. A potentially hazardous environmental situation may involve the leakage of fuel from equipment that could severely harm the environment.

Danger  This symbol identifies an electrical danger. An electrical danger sign will appear in the text of this document when a potentially hazardous situation involving large amounts of electricity may arise if the instructions that follow are not adhered to closely. A potentially hazardous situation may involve the possibility of electrocution, severe bodily harm, or even death.

Warning  **Follow all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and any related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on during installation or servicing. Please refer to the *Installation and Owner's Manual* for this equipment, and the appropriate documentation for any other related equipment, for complete installation and safety information.**

Warning  **Follow all federal, state and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30, 30A and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage and/or environmental contamination.**

Warning  **Always secure the work area from moving vehicles. The equipment in this manual is usually mounted underground, so reduced visibility puts service personnel working on this equipment in danger from moving vehicles entering the work area. To help eliminate these unsafe conditions, secure the area by using a service truck to block access to the work environment, or by using any other reasonable means available to ensure the safety of service personnel.**

Warning  **When the console system is used to monitor tanks containing gasoline or other flammable substances, you may create an explosion hazard if you do not follow the requirements in this manual carefully.**

Warning  **All wiring must enter the console's enclosure through the designated knockouts. An explosion hazard may result if other openings are used.**

Warning  **All wiring from probes or sensors to the console must be run in conduit separate from all other wiring. Failure to do so will create an explosion hazard.**

Warning  **Substituting components could impair intrinsic safety. T5 series consoles are intrinsically safe for sensors installed in – Class I, Division 1, Group D – hazardous locations. Substitution of components could make the energy limiting circuitry in the system ineffective and could cause an explosion hazard. Repairs to a T5 series console or attached components should only be performed by a qualified, factory-trained technician.**

Introduction

The purpose of this manual is to guide installers, operators, and store owners with setting up their INCON Vapor Recovery Monitoring (VRM) system. The VRM system has been tested and approved by the California Air Resource Board as an In-Station Diagnostics (ISD) system per CP-201. This manual introduces the user interface then proceeds to setup and lastly, maintaining your VRM system.

For installation of the TS-550, TS-5000, TS-EMS and its components please refer to the *TS-5xxx Series Installation Guide* (p/n 000-2150).

Certified Contractor Requirements

Please read this entire manual carefully. Failure to follow the instructions in this manual may result in faulty operation, equipment damage, injury or death.

Contractor Certification Levels

- LEVEL I - Automatic Tank Gauge Installer Certification Training
- LEVEL II - Automatic Tank Monitor Start-Up and Service / Warranty Certification Training
- LEVEL III - LLD Installer / Service/Warranty Certification Training
- LEVEL IV - TS-STS Operation/Repair Test
- LEVEL V - Vapor Recovery Monitoring Installation/Operation

Certified Programmer/Service Person: Only an INCON certified VRM Technician or service person is allowed to make setup changes, clear alarms, and access areas internal to the Console. A certified contractor needs to have completed training levels I, II, and V.

Station Owner/Operator: The station owner or operator of the console is only allowed to print reports and re-enable dispensers. Making setup changes, clearing alarms, and accessing areas internal to the console is strictly prohibited.

Definitions and Acronyms

A/L – Air over Liquid ratio, this ratio is calculated at the end of the day for each fueling point.
ATG – Automatic Tank Gauge
CARB – California Air Resources Board
DTU - Data Transfer Unit. Device used to transmit VFM and VPS data over existing power lines
EVR – Enhanced Vapor Recovery
GDF – Gasoline Dispensing Facility
ISD – In-Station Diagnostics. This refers to the whole system as defined in CP-201.
ISP – Internet Service Provider
LLD – Line Leak Detector
Modules – These are the different plug-in cards within the T5 series console enclosure. They are the inputs and outputs for all the field wiring.
Console – The console is the physical box installed on the wall. The system console holds the entire electronic slide-in modules and runs the general operating system. The VRM application is available in the TS-550 / EMS/5000 models of the console.
PLC - Power Line Communication. This refers to the technology of transferring digital data over AC power lines
TS-VFM – Vapor Flow Meter
TS-VPS – Vapor Pressure Sensor
TSA – Tank Sentinel Anyware is the web-based interface to the console.
VRM – Vapor Recovery Monitoring is the application that runs on the console and performs In-Station Diagnostics.

Related Documents

000-2144, *TS-VFM Installation Guide*
000-2143, *TS-VPS Installation Guide*
000-2150, *TS-5xxx Installation Guide for TS-5, TS-550, TS-5000, and TS-EMS*
000-2142*, TS-5xxx Programmer's Guide for TS-5, TS-550, TS-500, and TS-EMS*
000-2151*, TS-5xxx Operator's Guide*
CP-201, *Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities*
TP-201.3, *Determination of a 2" Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities*
TP-201.5, *Air to Liquid Volume Ratio*

Product Description

Vapor Recovery Monitoring

The Vapor Recovery Monitoring System (VRM) consists of the following components.

Vapor Recovery Monitoring Application

The Vapor Recovery application uses data from the Vapor Flow Meters (VFMs) and the Vapor Pressure Sensor (VPS) to perform assessments on the site's vapor recovery system. VRM is an optional application on the console and may be accompanied by Fuel Management System or Secondary Containment Monitoring.

Console

The Console consist of either the TS-550 or TS-5000 Fuel Management Systems or the TS-EMS, Environmental Monitoring System. The console options for ISD monitoring will always include the VRM application and at least one of each of the following components. (See Figure 1)

- AC Input Module
- Relay/10A Relay Module
- Probe Module
- 4-20mA Module
- Dispenser Interface Module
- Printer
- Touchscreen

Vapor Flow Meter

The Vapor Flow Meter (TS-VFM) is a volume measuring meter. When a mixture of air and gasoline vapors are returned from an automobile's gasoline tank to the underground storage tank during a dispense, the vapors are measured and analyzed. The console uses these VFMs as a way to assess how well the vapor collection process is working. The VFM is used to perform the following CP-201 assessments.

Assessment Type	Duration	EVR System	Threshold
Daily Vapor Collection	Daily	Balance	50% reduction in vapor return

There shall be one VFM per dispenser, and they wire into the Probe Module. Refer to document *Vapor Flow Meter Install Guide* (p/n 000-2144) for installation methods.

Vapor Pressure Sensor

The Vapor Pressure Sensor (TS-VPS) is a low vapor pressure transmitter. The primary purpose of the VPS is to continually measure the underground storage tank's vapor containment pressure. This vapor containment area includes the tank ullage area, and the vapor piping. The VRM continually samples the VPS and performs assessments for Over Pressurization and leakage in the vapor containment area. These assessments include:

Assessment Type	Duration	Threshold
Weekly Over-pressurization	Calendar Week	Pressure > 1.3" WCG for 5% of week
Monthly Over-Pressurization	Calendar Month	Pressure > 0.3" WCG for 25% of month
Weekly Leak Test	Calendar Week	Pressure Leak is greater than 2x TP-201.3

There is only one VPS per ISD installation. The VPS connects to the 4-20 mA Module, refer to the *Vapor Pressure Sensor Install Guide* (p/n 000-2143). The pressure sensor shall be installed in the dispenser closest to the underground storage tanks.

AC Input Module

In VRM Version 1.2.0, the use of dispenser AC Hook signals is not required*. The AC Input Module may be used to monitor the dispenser hook signals. Dispenser hooks are the signals from the dispensers that are normally used to activate the submersible pumps. For the VRM application they are also used to signal the start and end of a transaction for gasoline products only. Vapor Recovery does not apply to Diesel and Kerosene products so the hook signals for these grades do not need to be monitored. Dispenser Hook Signals are to be wired to the AC-Input Module and the installation directions are in the *TS-5xxx Installation Guide* (p/n 000-2150).

***** The exception would be with Tokhiem dispensers. Hook signal wiring is still necessary with Tokhiem dispensers.

Dispenser Interface Module

The Dispenser Interface Module (TS-DIM) is used to acquire the volume of gasoline that was pumped during each transaction. Refer to the *TS-5xxx Installation Guide* (p/n 000-2150) for wiring the TS-DIM.

Ullage Volume

The VRM System uses ullage volume for performing vapor containment leak detection. The console gathers ullage volume from internal inventory probes or an external ATG. When using an existing ATG for collecting ullage, then the ATG must have an available RS-232 port and have the ability to respond to TLS-250 or TLS-350 inventory command.

Relay/10A Relay Module

Power to the dispensers will be controlled by the console in the event of a VRM Failure alarm. The dispenser power is to be controlled by the Relay Module per the installation directions in the *TS-5xxx Installation Guide* (p/n 000-2150). Electrical current through the Relay Module is not to exceed the maximum rated current listed on the module. If options in the dispensers will cause the current to exceed the rated current, including startup current,an external power relay will need to be used and it's coil controlled by the Relay Model. See the *TS-5xxx Installation Guide* (p/n 000-2150) for installation instructions for the Relay Module and 10A Relay Module.

DTU Module

The DTU Module is an optional device used to transmit the signals of the VPS and VFM to the console. The DTU will provide the ability to communicate over existing dispenser power lines thus eliminating the need to install field cable. For installation instructions of the DTU, refer to the TS-DTU Dispenser Retrofit Manual (pn 000-2146) and the Console DTU Installation Instructions (pn 000-0080).

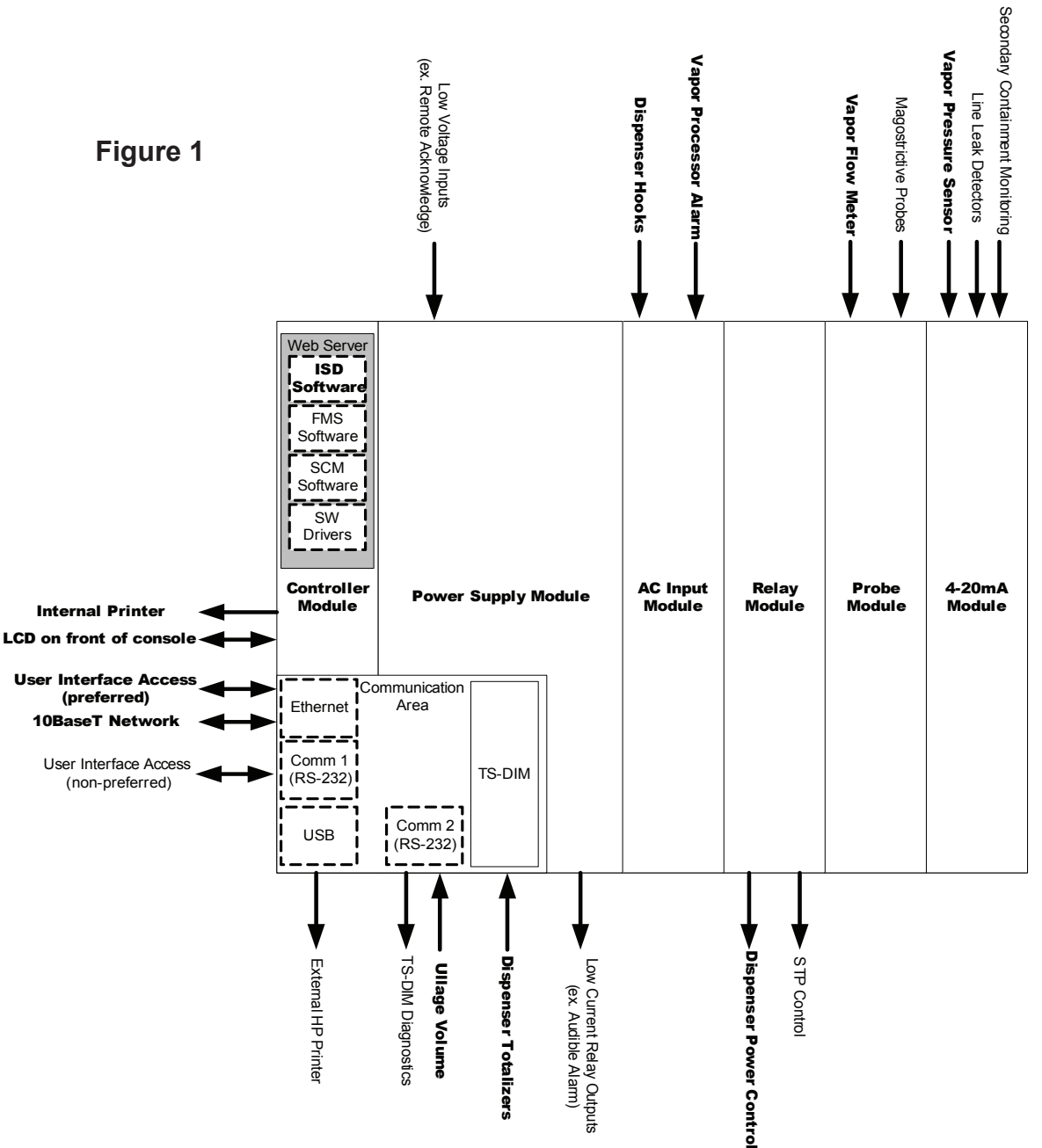
Alarms

The user will be automatically notified of VRM or other system alarm conditions via the alarm LEDs and touchscreen display. An audible alarm will sound and the system can also be setup to print or E-mail alarms (Ethernet connection required). Dispenser power is controlled by the console and cannot be disabled.

VRM System Specification

Refer to the Executive Order 202, Exhibit 2, for the most up to date system specifications. The required equipment to be installed for the INCON VRM system is discussed below. Figure 1 shows the different components and where they attach to the Console. All items in bold are items directly related to the VRM application.

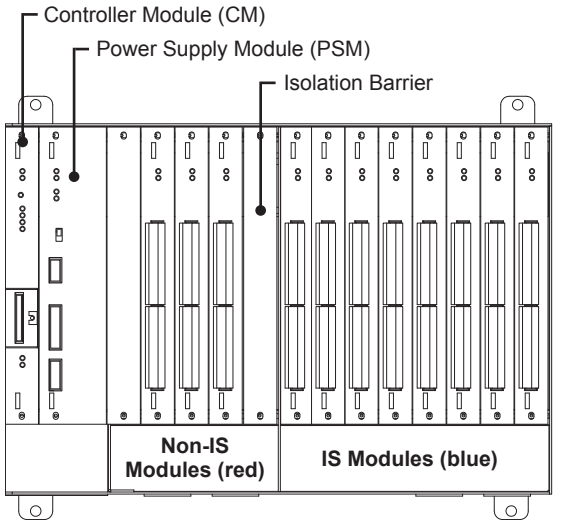
Figure 1



Installation & Startup

TS-550/5000/EMS Console Installation

The console will be shipped with all modules installed and tested. Refer to the *TS-5xxx Installation Guide* (p/n 000-2150) for mounting and wiring instructions.



TS-5000 (front view with cover removed)

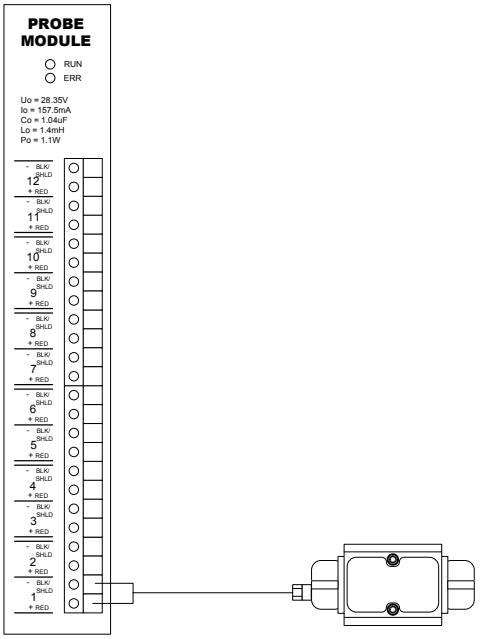
TS-VFM Installation

Field Installation

To mount the Vapor Flow Meter (VFM) in the dispenser and make the field wiring connections, follow the instructions in the *TS-VFM Install Guide* (p/n 000-2144).

Console Wiring Connection

See Probe Module diagram at right. The VFM is wired to the Probe Module inside the Console. Wire the Red wire to the + terminal and the Black wire to the – terminal.



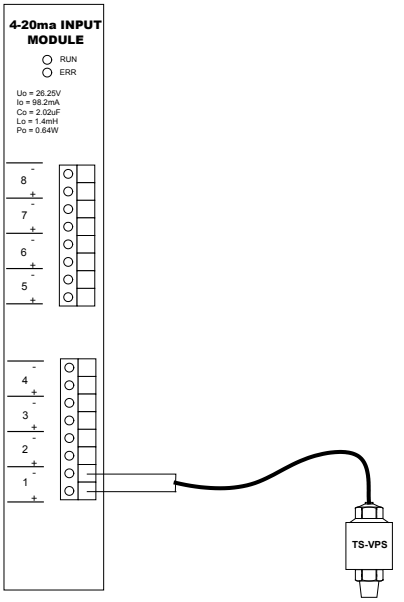
TS-VPS Installation

Field Installation

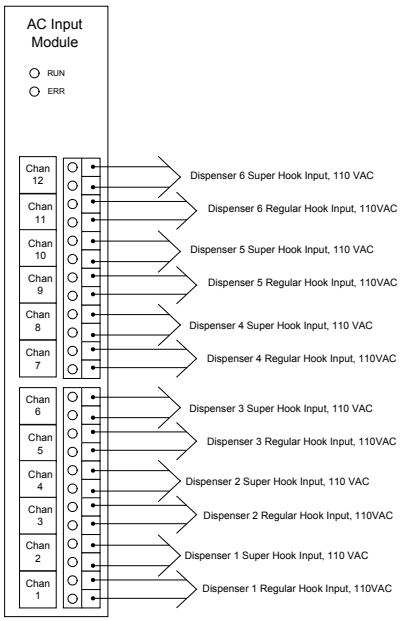
To mount the Vapor Pressure Sensor (VPS) and make the field wiring connections, follow the instructions in the, *TS-VPS Install Guide* (p/n 000-2143). There will be only one pressure sensor per ISD System.

Console Wiring

See diagram at right. The VPS is wired to the 4-20ma Module inside the Console. Wire the sensor's Black wire to the + terminal and the sensor's White wire to the - terminal.



There are several different wiring schemes that may be encountered when connecting the AC Input Module and Relay Module. These are dependent upon the use of optional features like Dispenser Hook Isolation, Line Leak Detection (LLD) and Turbine Pump Interface that can affect the way these modules are wired. The description below assumes that this is strictly a VRM system that is sensing the dispenser hook signals from gasoline products only and not controlling the Submersible Turbine Pumps. For more information on the different wiring options see the *TS-5xxx Installation Guide* (p/n 000-2150) or contact Franklin Fueling Systems Technical Support at 1-800-984-6266.



Dispenser Hook Signals

Note: Dispenser hook signals are required on installations prior to VRM versions 1.2.0.

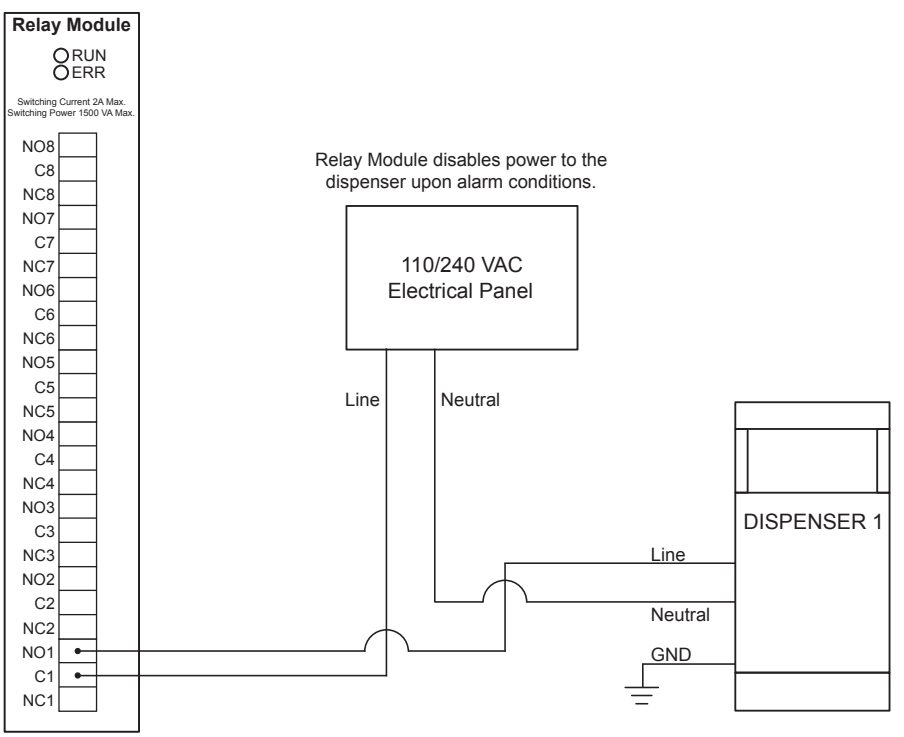
The dispenser hook signals are sampled by the AC Input Module so that the VRM can monitor the start and end of gasoline sales transactions. Follow the instructions below to tap into the Dispenser Hook Signals with a parallel wire to the AC Input Module. This method will not take control of the Submersible Pumps.

1. Locate the gasoline product only dispenser hook signals at a point where they are still separated by dispenser. This may be a dispenser hook isolation box or other method or they may just all be connected with a wire nut.
2. Separate them by dispenser number then by fueling grade.
3. Connect a wire in parallel from the line and neutral of each dispenser hook signal to the AC Input Module. All existing wiring should remain as is.
4. When wiring the Dispenser Hook signals to the AC Input Module, make dispenser 1 signals (all gasoline grades) go to the first set of terminals. For example, if there are two hooks per dispenser (Regular and Super) then wire Dispenser 1 to positions 1 & 2, then Dispenser 2 to positions 3 & 4.

Dispenser Power Control

In order for the console to shutdown a dispenser or all the dispensers in response to an alarm condition, the dispenser power must be controlled by the Relay Module. Run the coil of the dispenser power relay through the a channel of the Relay Module.

The 10A Relay Module is rated for 10 amps of continuous current. If the dispenser power, including startup current, exceeds 10A then an external high powered relay must be installed to control the dispensers. It is a good practice to wire the dispenser power in a logical order such as Dispenser 1 to Relay Channel 1, Dispenser 2 to Relay Channel 2, etc.



Vapor Processor Connection

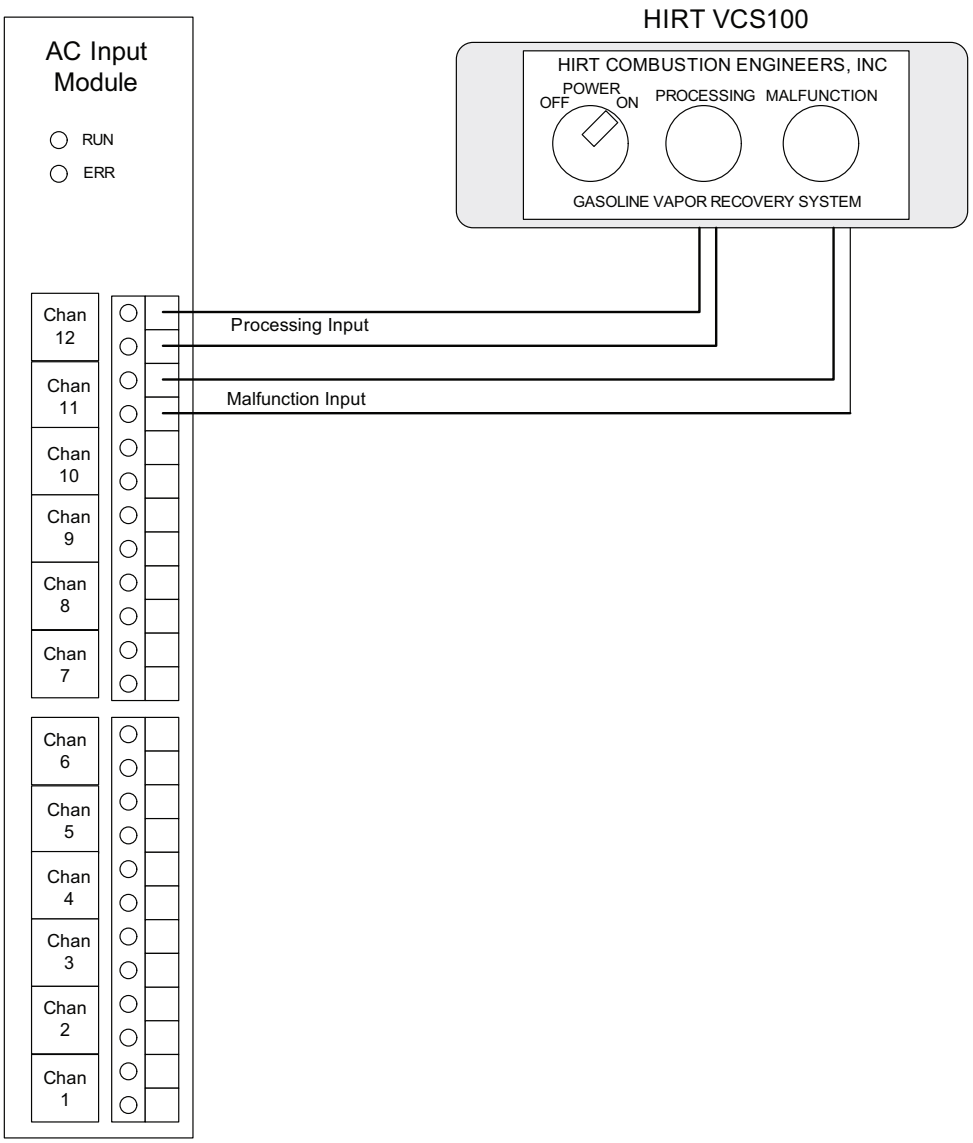
The ISD system monitors the VCS100 through two high voltage inputs and a pressure based monitoring. Two input lamps need to be wired to the AC Input Module for monitoring of run time and alarm state of the VCS100. The first input signals to the ISD system when the VCS100 is running and is called the Processing Lamp. The second input signals when the VCS100 is in alarm or the input has lost power and is called the Malfunction Lamp. If the Malfunction Lamp goes to 0 VAC, then the ISD system will issue a Vapor Processor Input Warning alarm. This alarm is cleared when the input signal goes back high.

The ISD system also has a pressure monitoring function to ensure the VCS100 is running and processing vapors. The ISD system monitors on a daily basis that the 90th percentile pressure does not exceed 2" WCG. If the pressure does exceed 2” WCG then a Vapor Processor Warning Alarm will be generated at the ISD assessment time. If a second consecutive day the 90th percentile pressure exceeds 2"WCG, then the ISD system will issue a Vapor Processor Warning Failure Alarm and shutdown all fueling points.

Wiring Input Lamps

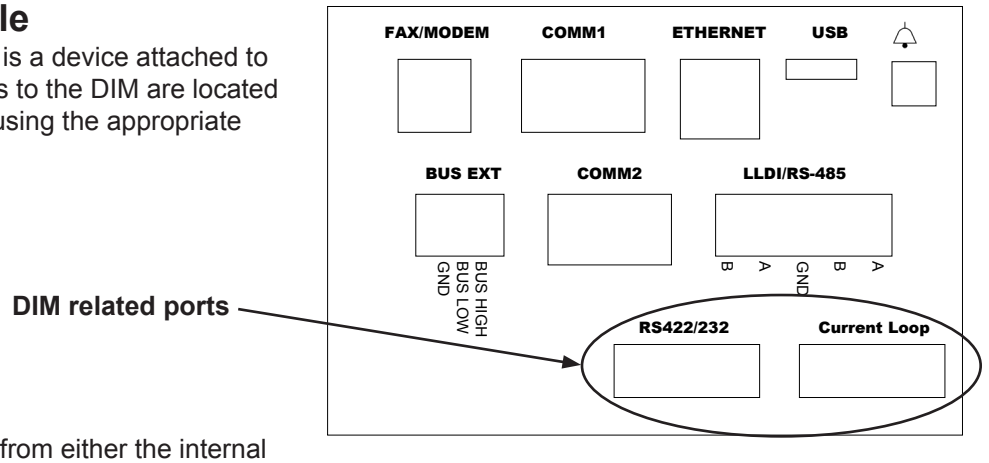
Two input lamps need to be wired to the AC Input Module for monitoring of run time and alarm state of the VCS100.

1. The connection of the VCS100 must be made to the AC Input Module after all the dispenser hook signals have been assigned.
2. Wire the Line Voltage and Neutral from the processing lamp to a spare input channel.
3. Wire the Line Voltage and Neutral from the Malfunction lamp to a spare input channel.



Dispenser Interface Module

The Dispenser Interface Module (DIM) is a device attached to the Power Supply Module. Connections to the DIM are located on the bottom left side of the Console using the appropriate cable kit based on the dispenser type.



Ullage Volume Input

The console can gather ullage volume from either the internal inventory probes or from existing inventory probes through an External ATG.

Using Internal Magnetostrictive Probes

To use internal magnetostrictive probes, you must have Fuel Management System (FMS) enabled in the registration. See the *TS-5xxx Programming Manual* for instructions for programming the FMS section. The FMS section must be programmed before the VRM section.

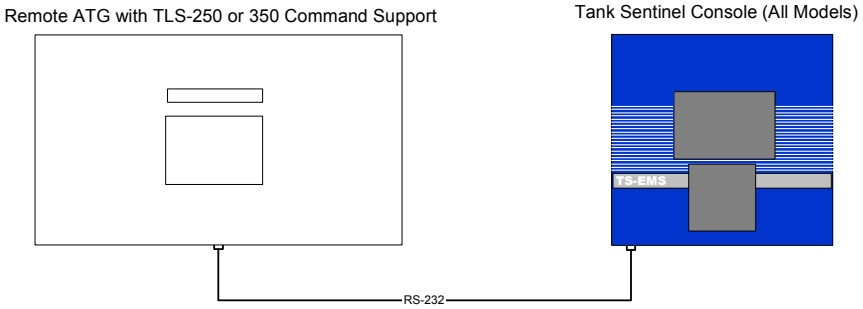
Using an External ATG

There are certain requirements in order to retrieve ullage volume from an external ATG.

- Continuous access to a RS-232 connection
- Ability to respond to the following serial Command:
  Command: **i201TT** - *In-Tank Inventory Report, TLS-350 command set*
  Command: **10T** – *Inventory Report*, TLS-250 command set
- Serial Cable with the following specifications:
  Cable must be a 'Null' Serial
  DB9 Male (INCON Console) to either DB25 Male or DB9 Male (ATG)

Use the following steps to connect an External ATG to a Console:

1. Connect the DB9 female end of the cable to Comm 2 on the Console.
2. Connect the other end of the cable to the serial port of the External ATG.
3. Set the serial port parameters to match between the Console and the External ATG, see *TS-5xxx Setup Programming Guide*.
4. Validate there is no "External ATG Communication" alarm.



Note: A DB25 to DB9 Null Serial Cable may be purchased from INCON, PN 600-0099. See the *TS-5xxx Series Installation Manual* "Communication Ports" section for pinouts of Comm Port 2.

Setup and Programming

Startup

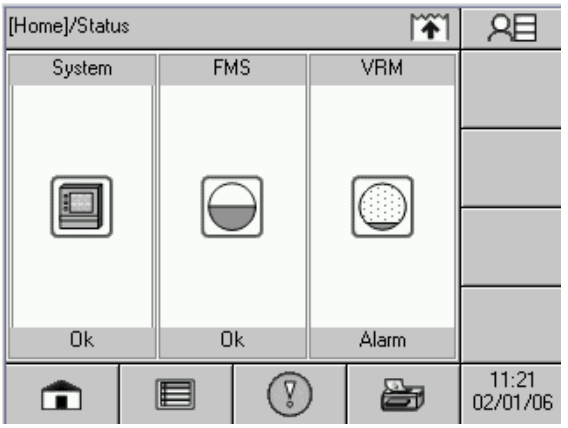
Upon completing the installation of the Vapor Recovery Monitoring (VRM) System and powering up the Console, programming the setup is the next step.

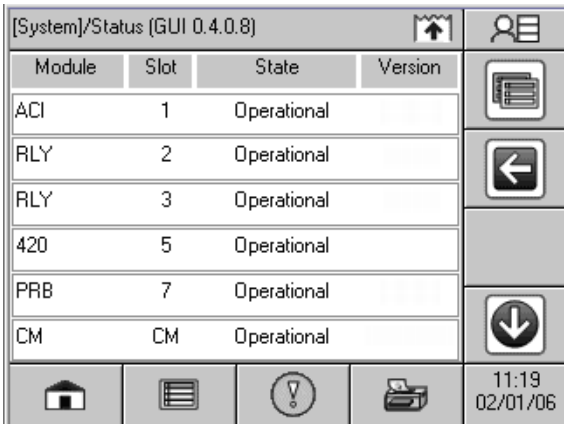
System Status

The Console will arrive at the site with the VRM application already enabled. Upon first powering up the console you may see a screen that looks like the one in Figure 2a. The system with the screen in Figure 2a has the VRM application as well as the Fuel Management System (FMS) application enabled. These applications are set by a registration key at the time of purchase.

The first step before programming the VRM is to check to see if all the modules are powered up and operational. Select the ***System*** box which brings up the ***System Status*** page as shown in Figure 2b.

Figure 2a and 2b





Verify all the modules are present and operational. If all the modules are “Operational” then you may proceed to setup and programming. If not, refer to the Alarm Codes and Troubleshooting section of this manual.

Programming the Console for Vapor Recovery Monitoring

The following programming instructions are specifically intended for the Vapor Recovery Monitoring (VRM) System. For additional programming refer to the *TS-5xxx Programming Manual* (p/n 000-2142). This manual covers both the hardware programming and the application programming. The method shown below is the same whether the user programs through the local touchscreen or a Web Browser. Inclusion of other options like the FMS application, Dispenser Hook Isolation and Line Leak Detection (LLD) will effect the programming of the VRM system. The *TS-5xxx Programming Manual* (p/n 000-2142) describes the proper programming and sequencing for the console setup. The following sections show how to program the setup as it relates to the VRM system. Contact Franklin Fueling Technical Support at 800-984-6266 for assistance with these applications.

Data Transfer Units

This is an optional hardware interface to communicate the VPS and VFM and Dispenser Shutdown over existing dispenser AC power line. If a TS-DTU was installed then the following setup is required.

Group Name	Parameter Name	Parameter Value	Explanation
Remote Data Transfer Units	Network ID	**1**	Leave as default. In rare circumstances the network ID may need to change if another network is near.
Dispenser Configuration	Number of Units	1	Enter the number of DTU Modules at the dispensers. This does not include the console DTU.
TS-DTU 1	Unit ID	14-EEA8-FFFF-0000-1A	This is the unique ID located on the DTU label. The console uses this ID to know which modules to communicate with.

Dispenser Hooks Mapping

Mapping the gasoline dispenser hooks signals correctly is important for the VRM to properly identify active fueling points. The dispenser hooks must be wired correctly as explained in the *TS-5xxx Installation Guide* (p/n 000-2150).

Note: Dispenser Hook Signals are only required on installations prior to VRM Version 1.2.0.

Group Name	Parameter Name	Parameter Value	Explanation
AC Input Modules	Number Gasoline Hooks per dispenser	0	Set to zero if not using dispenser hook signals, otherwise the number of gasoline hooks coming from each dispenser
Module #	Channels	(n)	Select number of gasoline dispenser hook signals available from each dispenser. The Vapor Recovery Monitor does not use any non-gasoline products.
Channel #	Name	Ex. Dispenser 1 Hook Regular	Unique name for the hook signal
	Enabled	Yes	Select “Yes”
	Active High	Yes	Set to “Yes”

Vapor Flow Meter Select

The Vapor Flow Meter (VFM) select is located under the Probe Module. This is where we define the number of input channels and select the VFM. Go to the Probe Module setup and make the following changes. If the FMS application is also running, some of the channels will be designated for probes.

Group Name	Parameter Name	Parameter Value	Explanation
Probe Modules			
Module #	Channels	(n)	Select the number of flow meters/probes at the site
Channel #	Name	Ex. VFM Disp 1	Unique name for Vapor Flow Meter
	Enabled	Yes or No	Set to “Yes”
	Type	TS-VFM	Select Vapor Flow Meter type

Vapor Pressure Sensor Select

The Vapor Pressure Sensor (VPS) Select is located under the 4-20mA module setup. This is where we define the input channel and select the VPS. Go to the 4-20mA Module setup and make the following changes. If Electronic Line Leak detection is being installed, some channels will be used for the LLD transducers.

Group Name			Parameter Name	Parameter Value	Explanation
4-20mA Input Modules					
	Module #		Channels	(n)	Select “1” for the Vapor Pressure Sensor
		Channel #	Name	Ex. ISD Pressure Sensor	Unique name for VPS
			Enabled	Yes	Keep as “Yes”
			Service Type	Vapor Recovery Monitor	Select correct service type for application

Remote ATG Serial Port Settings

If the Console will be getting ullage volume from a Remote ATG then the serial port must match that of the other tank gauge.

Group Name		Parameter Name	Parameter Value	Explanation
Power Supply Module				
	COMM 2	Baud Rate	9600	Set to match External ATG
		Data Bits	8	Set to match External ATG
		Parity	None	Set to match External ATG
		Stop Bits	1	Set to match External ATG
		Response Timeout	8	Leave as default

Relay Mapping

Relay mapping is necessary for proper shutdown of dispensers. The programming of the Relay Module will tell the VRM which Vapor Flow Meter will control which Dispenser. As you will see this is why we enter a unique name for each Flow Meter so we can easily identify the channel.

Note: By mapping the relay to the VFM in the following setup, we now enable the VRM to automatically shutdown dispensing upon ISD alarms.

Group Name			Parameter Name	Parameter Value	Explanation
Relay Module					
	Module #		Channels	(n)	Select number of dispensers
		Channel #	Name	Dispenser 1 Power	Unique name for relay’s purpose
			Enabled	Yes	set to “Yes”
			Type	Dispenser	
			Polarity	Normal	Set to Normal
			Logic	OR Logic	Set to OR
			Physically Wired As	Normally Closed	Set to Normally Closed
			Number of Inputs	1	Set to 1
		Input 1	Type	Probe Module	Select Probe Module
			Channel	VFM Disp 1	Select the VFM associated with this Dispenser

Additional relays may be used for other purposes such as submersible pump control or external alarms. See the *TS-5xxx Installation Guide* (p/n 000-2150) for more information.

Dispenser Interface

The Dispenser Interface setup is where the Dispenser Interface Module is programmed. For this setup, you will need to know what kind of D-Box the Dispenser Interface module is connecting up to and what type of communication interface it is using. For more information on the installation and setup of the Dispenser Interface Module, see the TS-5xxx Installation Manual and TS-5xxx Setup and Programming Manual.

Group Name	Parameter Name	Parameter Value	Explanation
Dispenser Interface			
Precision	Volume Precision	3	Leave as default
	Dispenser Volume	Gross	Leave as default
Grades	Number of Grades	3	Select number of different gasoline only grades at facility
Grade 1	Name Include in Vapor recovery	Regular Unleaded Yes	Enter a Name for the Grade
Grade 2	Name Include in Vapor recovery	Premium Unleaded Yes	Enter a Name for the Grade
Grade 3	Name Include in Vapor recovery	Super Unleaded Yes	Enter a Name for the Grade
Dispenser Interface Modules			
DIM 1	Type	Wayne	
	Communication	Current loop	
Fueling Points	Number of Fueling Points	12	Enter the number of gasoline fueling points
Fueling Point 1	Number of Hoses	3	
Hose 1 QC	Grade Association	Regular Unleaded	Enter a Name for the Grade
	Position	0	Select position of Grade
Hose 2	Grade Association	Premium Unleaded	Enter a Name for the Grade
	Position	1	Select position of Grade
Hose 3	Grade Association	Super Unleaded	Enter a Name for the Grade
	Position	2	Select position of Grade
Fueling Point 2	Number of Hoses	3	

Vapor Recovery Monitoring Setup

This is the final setup to get the Vapor Recovery Monitor (VRM) to work properly. This is where we select the type of vapor recovery system and call in the appropriate external sensors.

Group Name	Parameter Name	Parameter Value	Explanation
Vapor Recovery Monitor	Method Type	Balance or Assist	Select the type of EVR system installed.
	Hour Assessment	0	Set time of VRM alarm action
	Week Day Assessment	Sunday	Set Day of VRM alarm action
Dispenser Configuration	Dispenser Type	Wayne or Gilbarco	Select the dispenser model
	Multihose Dispenser Site Number of Dispensers	No 0 (1 to 48)	Select yes or no Equal to the number of flow meters installed
Dispenser 1	First Fueling Point	1	Select correct fueling points for dispenser number.
	Second Fueling Point	2	Select correct fueling points for dispenser number.
	Flow Meter	Unique Name	Select Meter by name from list of enabled meters
Ullage Pressure Input	Sensor	Sensor name	Select the correct sensor name
Ullage Volume Input	Acquire Ullage	Internal, external	Select internal if using LL2 probes or external if connected to remote ATG.
	Security Code	0	Set a security code
	Number of tanks	#	Number of tanks
Tank 1 Ullage	Enabled	Yes or No	Select Yes if part of EVR System
Tank 2 Ullage	Enabled	Yes or No	Select Yes if part of EVR System
Pressure Management System	Enabled	Yes or No	Yes
	Type	Clean Air Separator	Select appropriate device

Setup for Multi-Hose Dispensers

This section provides instruction for upgrading the INCON VRM software for Multi-Hose dispensers.
The instructions described below show screen shots from the console web pages. The procedures can be run on either the web pages or the local LCD on the console.

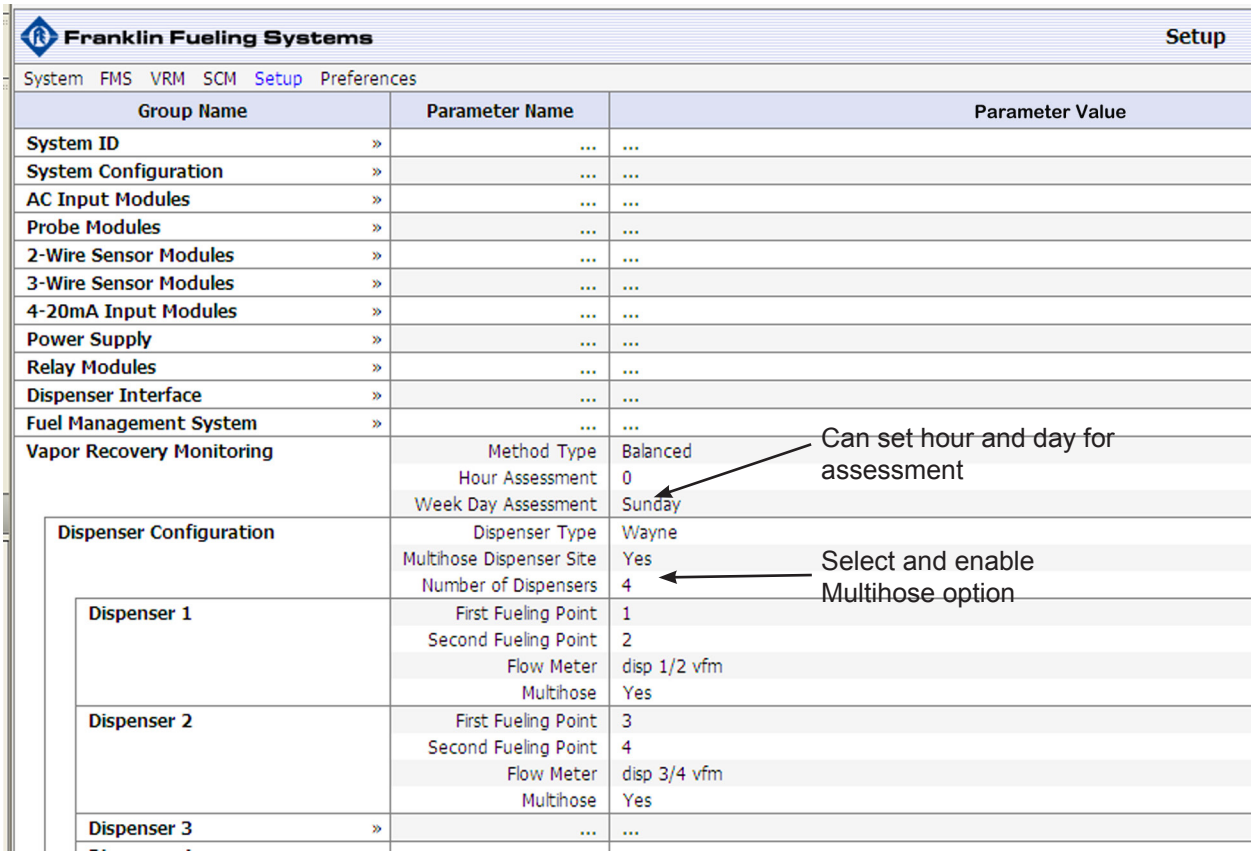
Procedure

1. **Important!** Print out the following for the entire year:
   - ISD Daily Reports
   - ISD Monthly Reports
   - Alarm History Report

These reports may be needed for local regulators and the ISD data **will be lost** when the multi-hose setup is enabled.

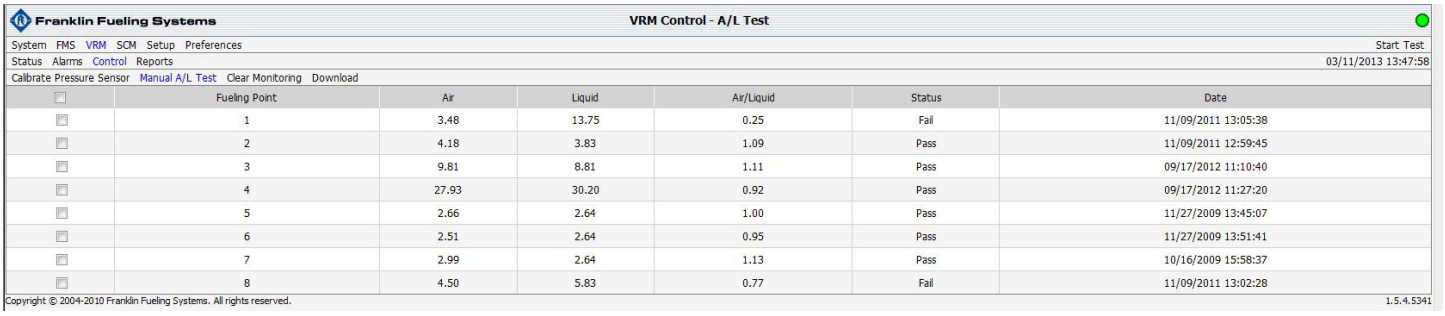
Note: To save paper, generate the reports from the console web pages and print to a PDF file.

2. Upgrade the firmware in the console to the latest version (rev 1.2.0 or higher) using the released TSA Upgrade Tool.
3. Setup will need to be modified to change from Uni-hose configuration to Multi-hose configuration.



Hose positions need to be verified that they are mapped to the correct grades. This can be done easily by pumping a little fuel on each grade and verifying it on the console. The following steps will guide you through the verification of the hose mapping.

4. Starting on Dispenser 1, block off both fueling points for testing.
5. Navigate to the VRM > Control page > Manual A/L. Notice you will now see each hose listed in the table.



Verifying DIM Mapping

a. Enable all the check-boxes for fueling point 1 and 2 and then click START TEST in upper right corner.
b. Starting at Fueling point 1 pump two gallons from the 87 unleaded hose. Complete the transaction and then pump 2.5 gallons from 89 unleaded hose. Complete transaction and then pump 1 gallon from 91 unleaded hose.
c. Return to laptop screen and verify the amounts pumped correspond to the correct grade.
d. If NO fuel amounts appear under the liquid column after 30 seconds of hanging up the nozzle, then that hose position number may be incorrect.
e. If the fuel amounts appeared under a different hose (i.e. 87-2 gallons show up under the 91 row) then the hose position numbers may be in the wrong order. If this is the case edit the position numbers under each hose to match where the amounts populated. (i.e. if the 2 gallons pumped on 89 appear under the 91 hose then change the position number assigned to 89 to 91 and so on.)
f. Repeat A through E on each fueling point.

If the mapping of the first 2 dispensers is incorrect, running the DIM Query is recommended.

Verify the mapping of all hoses after query.

Note: If dispensers are not verified, daily and weekly assessments may not occur.

Managing Rules

Alarms will be generated automatically and can be seen on the touchscreen display or the Alarm pages on the web browser. These alarms can be programmed to generate various outputs based on the Rules setup.

Note: VRM alarms will automatically disable dispensers and this feature cannot be turned off per CP-201 requirements.

Additional actions can be created by setting up Rules. Rules are the way to create actions and notifications based on specific events change. Events are the inputs to the rule, for example it can be a failed test or a sensor gone bad, but it can also be a simple test completion notification. Actions are the outputs for the Rules, for example you can program the console to send emails, trip relays, or sound alarms. The Rules are entirely flexible and allow stations owners to customize the alarm notification process.

There are three default rules enabled on the Console. These rules all have actions to sound the internal audible alarm. These rules can be disabled or can have their action changed. New Rules can be added for complete customization for notification. Below is an example of a new rule that emails a notification on any new VRM alarm. A more descriptive explanation on Rules can be found in the *TS-5xxx Programming Guide* (p/n 000-2142).

Rules

Variable					+ or -	Explanation
Rules					+	
	Rule – Power On »					Default Rule, Internal audible alarm output
	Rule – Application Events »					Default Rule, Internal audible alarm output
	Rule – New Alarm Occurred »					Default Rule, Internal audible alarm output
	Rule – New Rule #1				-	
		Name				Enter a name for the rule. Once entered, the name will appear next to the above Rule.
		Enabled				Select whether the rule is to run or not
		Events			+	By pressing the + sign, you can have one or multiple events
			Event		-	Below is an example of a new rule to send an email for any new VRM alarms
				Type		Select “New Alarm Occurred”
				Category		Select VRM
				Code		Select “Any”
				Device		Select “Any”
				State		Select “Active”
		Actions			+	
			Action		-	
				Type		Select “E-Mail” (See next section for setting up email notification)
				Address		Enter in your email address
				Content		Select “Generated” to have the Console automatically produce the contents in the email. Otherwise you can have the email contain exactly what you specify.
				Template		Select “HTML”. You can have either a text or HTML email.

Setting Up E-mail Notification

The E-mail notification is a feature that allows store owners and managers to receive e-mails from their console. These e-mails include alarms, events and test results. In order for the system to send e-mails and text messages based on the Rules configurations, certain parameters need to be configured. These parameters will tell the console how to transmit e-mails to the outside.

Email

Variable	Description
“From” Address	Unique e-mail address to identify the VRM console (e.g. Site@city.state)
SMTP Host	This is to be provided by network administrator or ISP
SMTP Port	Check with network administrator or ISP
Enable Authentication	Some e-mail providers require authentication in order to send e-mails. See Internet Service Provider
Maximum Queue Size	The number of e-mails that can be waiting to be sent
Retry Timeout	The number of seconds to wait between failed tries. Default is 3600 seconds or 1 hr.
Watchdog Timeout	This is the inactivity timeout.

System Operation

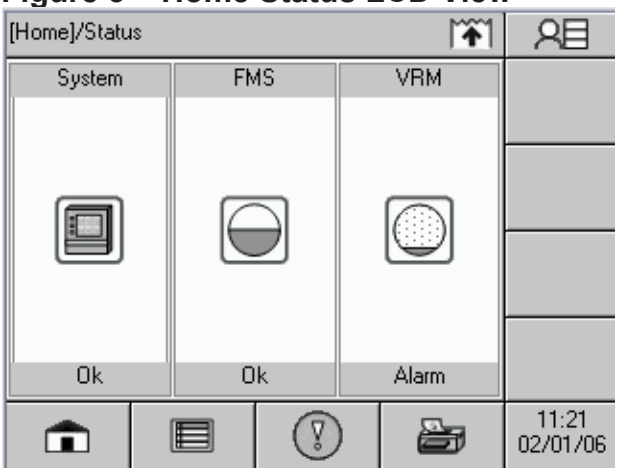
Run-Time Status

The VRM application has several useful run–time menus to check status or to get current test status.

Home»Status

The home-status page shows the current status of all applications running in the Console, see Figure 3. Depending on the applications that are running on the console, the Home-Status will display only the ones enabled. In Figure 3 below, we have FMS (Fuel Management System), and VRM (Vapor Recovery Monitoring). At anytime you can get to the Home Status menu by pressing the **Home Box**.

Figure 3 – Home Status LCD View



System»Status

The System-status window shows the state, slot location, and module version number of each module inside the physical console.

VRM»Status

The VRM-Status window gives the current status of each Vapor Flow Meter, pressure sensor, and other VRM related data. See Figure 5b.

Vapor Recovery Web Pages

VRM Status Page (Web Page View)

The ***VRM»Status*** page will show up to date status for each fueling point. The status is based on the previous days results. In the Current Status column a Pass (✓), Failure (**X**), Warning (**!**), or Insufficient (*) symbol will show up for each fueling point. The final assessment for each fueling point will occur at the end of the day and can be viewed in the ISD reports. The following describes the remaining information in the VRM status page. Refer to Figure 4 - VRM Status Page.

Auto Refresh: The LCD automatically refreshes the screen with the latest data. Using the web version, the VRM Status page has an optional Auto Refresh mode and can be enabled by selecting the “Auto Refresh” link in the upper right-hand corner. The default refresh rate is set to 30 seconds but can be changed to a faster or slower rate. To change the refresh rate go to the ***Preferences*** page.

Dispenser: This is the dispenser number as associated with the Point of Sale system.

Dispenser Status: Shows the activity of the dispenser, Idle (or inactive), Dispensing, or Shutdown. This status is linked to the dispenser hook signals only.

TS-VFM: Shows the state of the vapor flow meters and is only in the web-based view. There are four possible states:

Operational – The VFM has no alarms

Missing – The VRM has lost communication with the vapor flow meter. This may occur during an open circuit or the vapor flow meter is not installed on the port in which it was programmed for.

No Data – The VRM is unable to understand the input data. This may occur when a port is programmed for a flow meter but a magnostrictive probe is connected instead.

Error – The flow meter data was not sent correctly. This may occur when with excessive noise in the system or it is an indication that the flow meter is not functioning correctly.

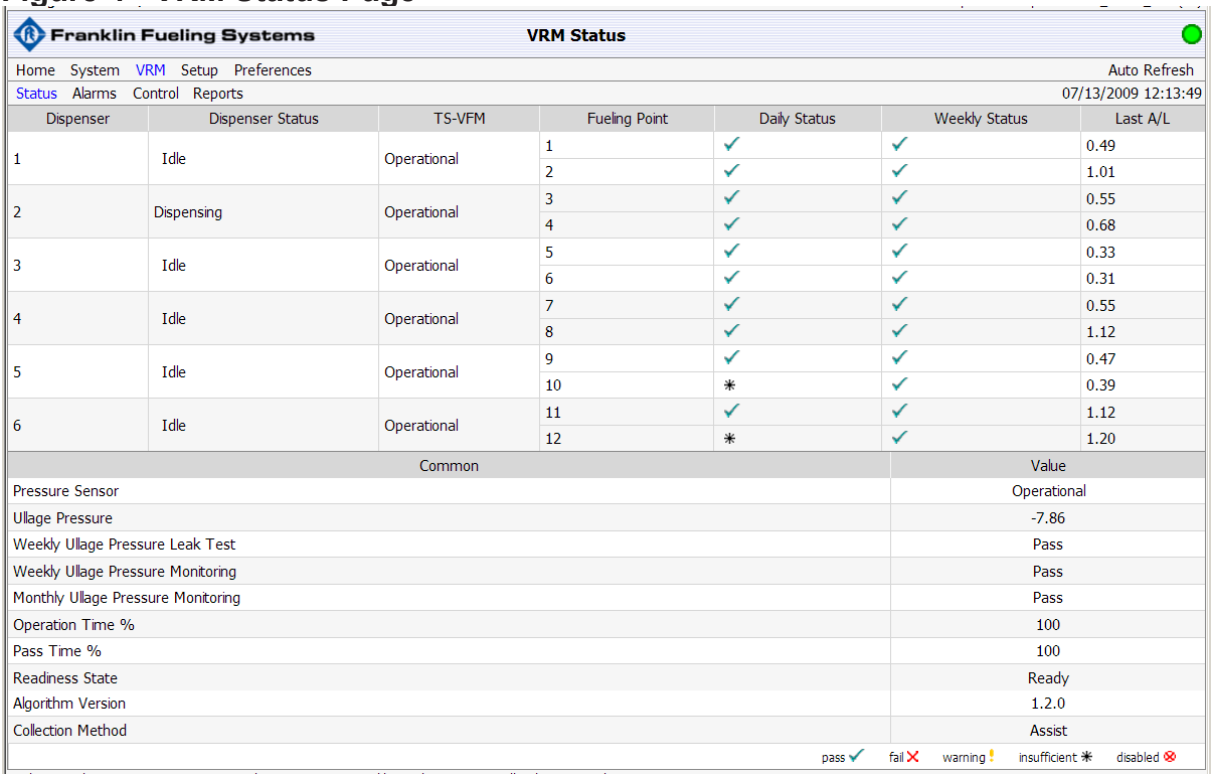
Fueling Point: This is the assigned fueling point number from setup.

Daily Status: The daily status shows the last completed daily assessment for each fueling point/hose. One of four symbols will be displayed for each fueling point/hose.

Weekly Status: The weekly status shows the last completed weekly assessment for each fueling point/hose.

Last A/L: This value is the fueling point's last calculated A/L ratio result. The value is based only on a single transaction.

Figure 4 - VRM Status Page



Franklin Fueling Systems — VRM Status

Home System VRM Setup Preferences — Auto Refresh

Status Alarms Control Reports — 07/13/2009 12:13:49

Dispenser	Dispenser Status	TS-VFM	Fueling Point	Daily Status	Weekly Status	Last A/L
1	Idle	Operational	1	✓	✓	0.49
			2	✓	✓	1.01
2	Dispensing	Operational	3	✓	✓	0.55
			4	✓	✓	0.68
3	Idle	Operational	5	✓	✓	0.33
			6	✓	✓	0.31
4	Idle	Operational	7	✓	✓	0.55
			8	✓	✓	1.12
5	Idle	Operational	9	✓	✓	0.47
			10	✳	✓	0.39
6	Idle	Operational	11	✓	✓	1.12
			12	✳	✓	1.20

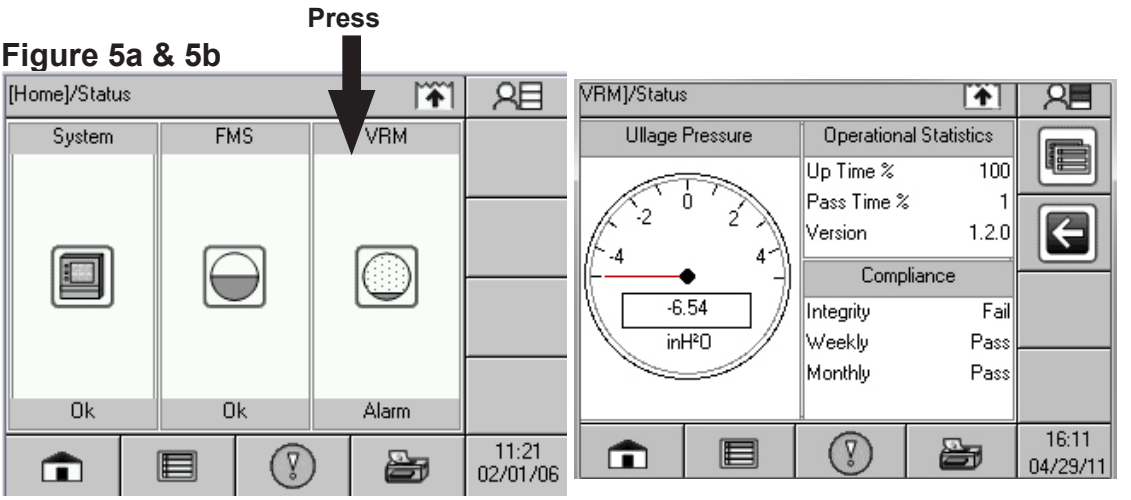
Common	Value
Pressure Sensor	Operational
Ullage Pressure	-7.86
Weekly Ullage Pressure Leak Test	Pass
Weekly Ullage Pressure Monitoring	Pass
Monthly Ullage Pressure Monitoring	Pass
Operation Time %	100
Pass Time %	100
Readiness State	Ready
Algorithm Version	1.2.0
Collection Method	Assist

pass ✓ fail ✕ warning ! insufficient ✳ disabled ⊗

VRM Status (LCD View)

The LCD view provides the same information as the web page but is broken into two different screens. The VRM-Status on the LCD will show the real time information for the ullage pressure and last run pressure test results as shown in Figure 5a & 5b. The VRM-Dispenser is the second screen which shows current status of the dispensers as shown in Figure 6a & 6b.

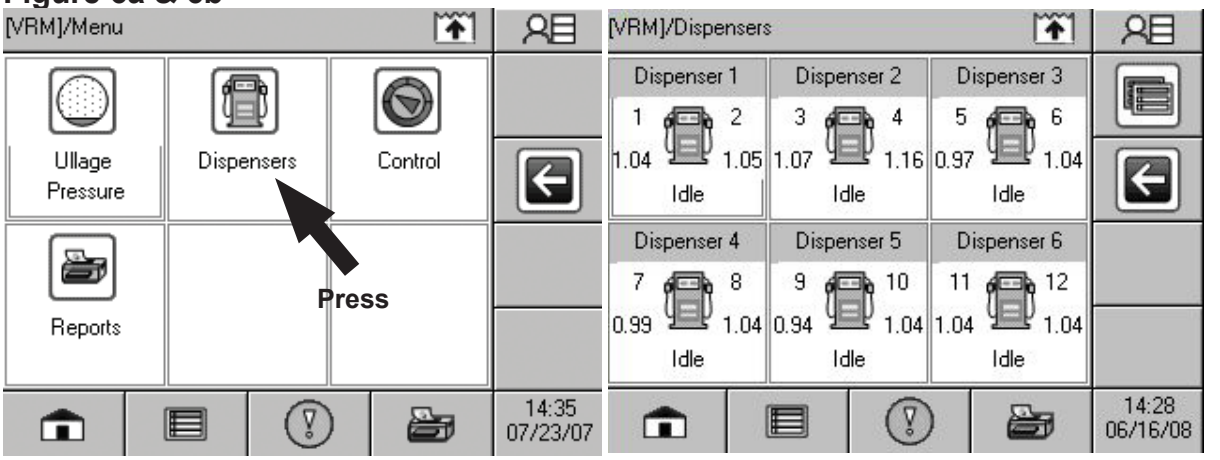
Figure 5a & 5b



VRM»Dispensers (LCD View)

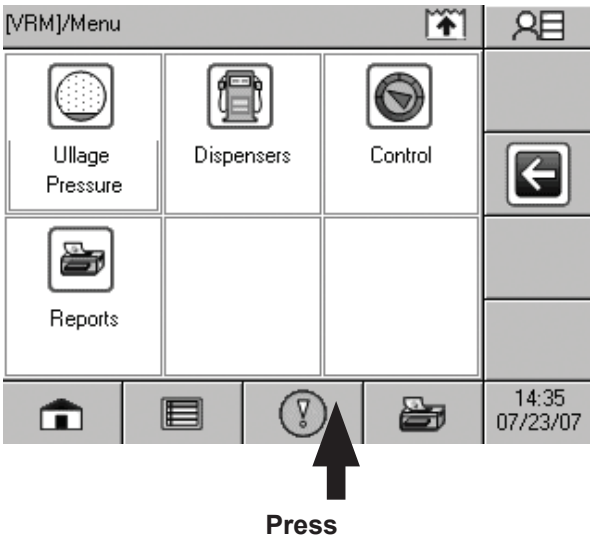
By pressing the Application Menu button  in the upper right-hand corner of the ***VRM»Status*** screen it will bring you to a page of several submenus for VRM. The Status box is the same page as shown in Figure 5b. The Dispensers page will bring up a new page that looks like the one in Figure 6b.

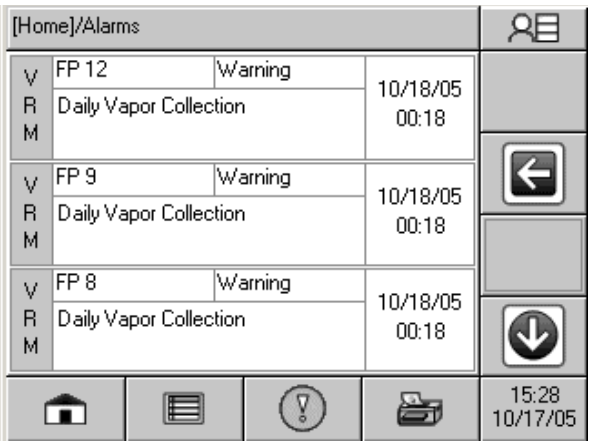
Figure 6a & 6b



VRM»Alarms Page (LCD View)

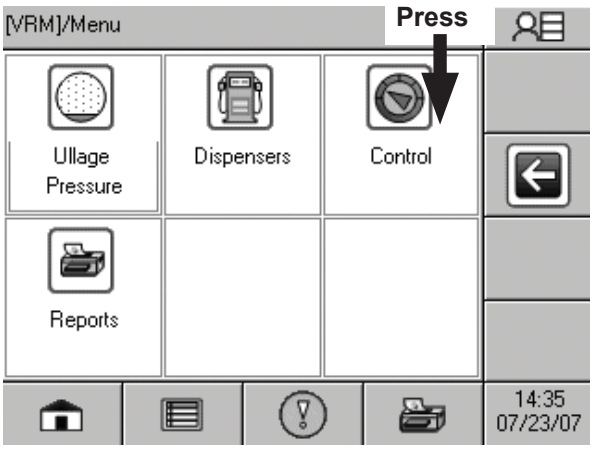
The ***VRM»Alarms*** page shows all current alarms for the Vapor Recovery Monitor. When an alarm clears it will be removed from this page but will be kept in memory. The Alarm History report will provide information on previous alarms.





VRM»Control (LCD View)

The VRM control page is setup to run manual test and calibrate the pressure sensor. These features are described later in this manual.



Alarms, Warnings, and Failures

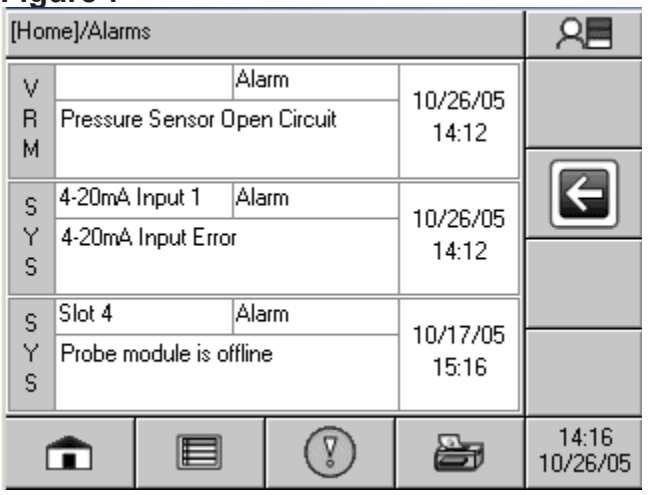
Alarms, warnings, and failures are designed to alert you with specific details when a problem occurs so that you can take appropriate corrective action. System alarms, VRM alarms, VRM warnings, and VRM Failures will always notify the user in certain ways, other notification options are programmable.

Figure 7 shows an example of two System Alarms, and one VRM alarm. All active alarms can be viewed from the LCD by pressing the Alarm button,  , at the bottom of the LCD. Once the alarm goes inactive it will disappear from the **Home/Alarm** page but will remain stored in memory. Any outputs that are programmed to activate based on alarms will go active. These outputs can be customized to activate based on specific alarms or all alarms in the Rules setup.

System Alarms

System alarms are non-application related alarms. These alarms are usually related to hardware such as an internal module is offline or a printer problem.

Figure 7



VRM Alarms

Vapor Recovery alarms are hardware problems related to the Vapor Recovery Monitoring application. VRM alarms will be generated immediately with a flashing RED LED. A VRM alarm will not cause a dispenser(s) shutdown.

VRM Warnings and Failures

VRM Warnings and Failures are monitoring alarms related only to the Vapor Recovery Monitoring application. These Warnings and Failures are directly related to the CP-201 ISD requirement to monitor collection and containment of the vapor recovery system. A VRM warning will occur when either a fueling collection point or the entire vapor containment does not meet the operating thresholds. A warning is the first sign of a vapor recovery problem. A VRM failure will follow the warning if the specific problem with the vapor recovery component does not get fixed within the monitoring time period. This failure will cause either a single or site shutdown, depending on the type. The following provides more detail on the specific warning and failure types.

Vapor Collection Warning and Failure

Vapor collection warning and failures (A/L) generally occur due to poor or no vapor being returned to the underground storage tank during fueling transactions. The VRM system makes both a daily and weekly assessment on the quantity of the vapor collection. If the collection is below the lower failure limit or above the higher failure limit, then the VRM will go into alarm.

Upon a Vapor Collection Warning condition, it is highly recommended to get the fueling point(s) serviced as soon as possible. If a fueling point goes untreated, then the VRM will issue a failure alarm and shut down the affected dispenser. If this condition occurs, the entire dispenser should be placed out of service until a Franklin Fueling Systems certified technician can troubleshoot the problem. All other dispenser will remain in operation. See Appendix A for the Alarm Code description and possible solution, or the *Vapor Recovery Monitoring Troubleshooting and Diagnostics Guide* available on the Franklin Fueling Systems Web site: www.franklinfueling.com.

Vapor Pressure Containment Warnings and Failures
A Weekly or Monthly Ullage Pressure warning or failure occurs when the vapor pressure exceeds the operating threshold. The VRM system makes both a weekly and monthly assessment on the amount of time the vapor containment pressure exceeds a threshold over a specific period of time. If the containment pressure rises above the overpressure limits for either the weekly or monthly thresholds, then the VRM will issue a warning. A second consecutive period of exceeding the overpressure threshold will result in a failure alarm and a shutdown of all dispensers.

A Weekly Ullage Pressure Leak Test warning or failure is an indication that the containment space (vapor space) is leaking vapors beyond the allowable limit. This assessment is performed on a weekly basis. If a vapor containment is leaking, the VRM will issue a warning at the end of the first week and if it is not fixed by the end of the second week then all dispenser will become disabled.

See Appendix A for the Alarm Code description and possible solution, or the *Vapor Recovery Monitoring Troubleshooting and Diagnostics Guide* available on the Franklin Fueling Systems Web site: www.franklinfueling.com.

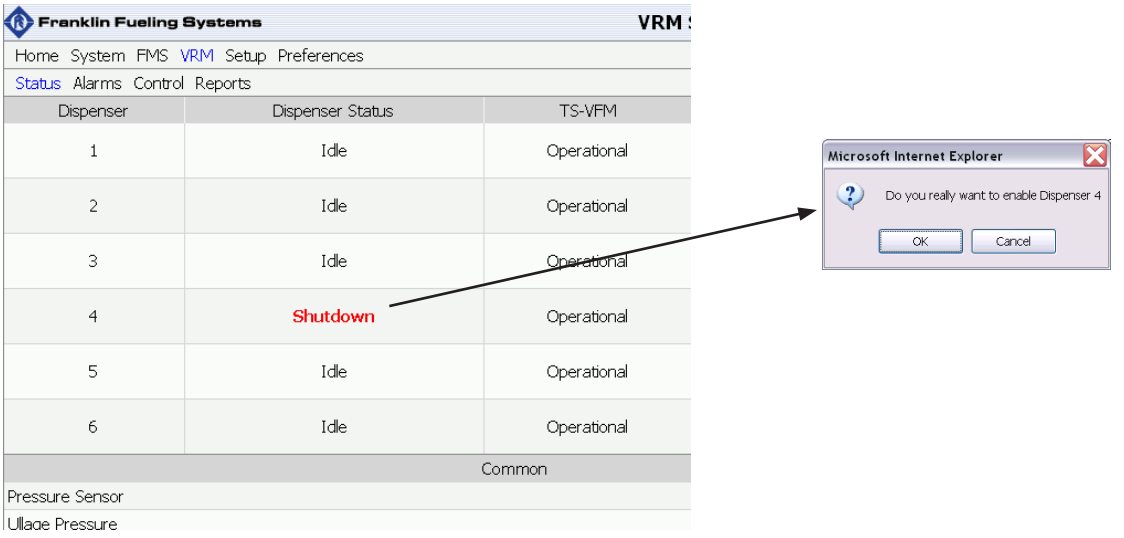
Re-enabling Dispenser(s)
Dispensers can be re-enabled by the following method. Note that this procedure does not clear any warnings or failures, it only re-enables dispensing.

Warning **The Failed fueling point requires immediate attention and should be bagged so it is not used until the problem has been fixed by a certified Service Technician. Continuous use of a failed Fueling Point will result in another shutdown.**

Warning **Refer to local districts before putting a shutdown dispenser back into operation.**

From the LCD:
1. Go to the ***VRM»Dispensers*** menu (see Figure 5a & 5b and Figure 6a & 6b).
2. Press the dispenser showing “Shutdown”.
3. Press “Yes” on the confirmation box.

From the Web Browser:
1. Go to the ***VRM»Status*** page.
2. Press the red “Shutdown” for each dispenser showing shutdown.
3. Press “Yes” to enable the dispenser or all dispensers.



Note: If a dispenser shutdown was caused by poor vapor collection, you will only be able to enable one dispenser at a time. If the shutdown was caused by a pressure failure, you will be able to enable all dispensers at the same time by pressing any dispenser.

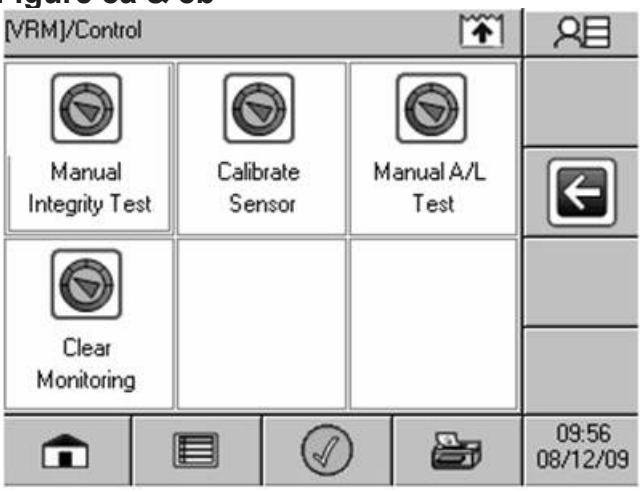
Clearing Alarms

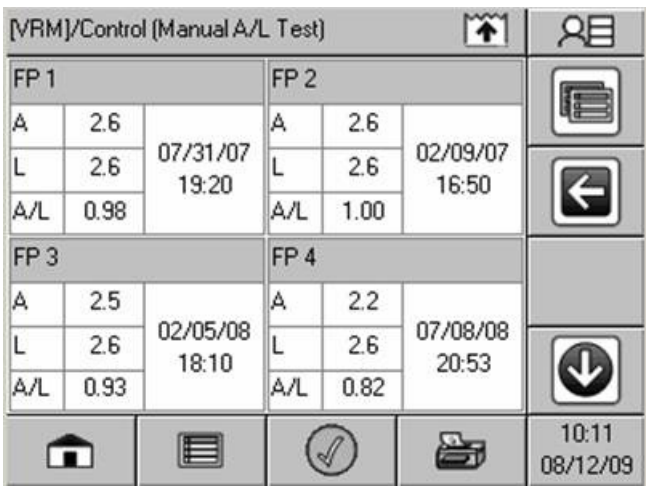
Vapor Flow and Vapor Pressure alarms can be cleared by running the respective manual test or by waiting until the next assessment period has passed.

Clearing Vapor Collection (A/L) Alarms

Once a certified technician has fixed the cause of the vapor flow problem, the alarm can be cleared by two methods: running a manual test or letting the fueling point go through a full day of transactions. The manual A/L test is much faster and will allow the technician to clear the alarm before leaving the site. To run a manual test, go to ***VRM»Control*** then select **"Manual A/L Test"**. Now select the fueling point(s) that are in alarm and on the next dispense, if there is an A/L passes then the alarm will clear. See Figure 8a & 8b.

Figure 8a & 8b





Note: The manual A/L test should be done on either a known non-ORVR vehicle or test container that will return air/vapor mixture back to the UST. If the A/L does not meet the required threshold then the fueling point will remain in alarm.

Clearing Pressure Related Alarms

A technician will also have two methods of clearing pressure related alarms by either letting the system go through its normal assessment period or manually clearing pressure alarms.

To clear a Pressure Related Alarms, do the following:

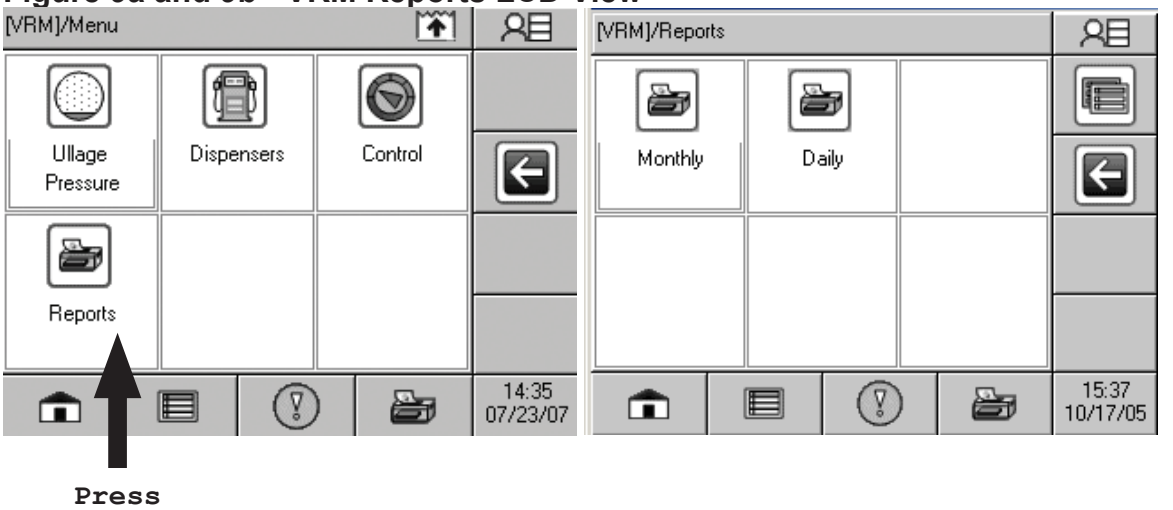
1. Go to the ***VRM»Control*** Page and select **"Clear Monitoring"**.
2. Enter in your Franklin Fueling Systems technician ID number.
3. Enter in the administrator password.
4. All the Pressure Monitoring Alarms shall clear.

Reports & Printing

Creating Reports

Reports can be generated and printed based on the last 30 days, by month, or by year. The console stores ISD history for two years.

Figure 9a and 9b - VRM Reports LCD View



Alarm Reports

Alarm reports can be generated either from the ***System»Reports*** page or the ***VRM»Alarms*** web page. The ***System»Reports*** page will generate both the system alarms and application alarms while the ***VRM»Alarms*** will only generate VRM related application alarms.

VRM Reports

There are two different VRM reports that can be generated, a Daily Report and a Monthly Report. The Daily Report generates a list of results for each day on a rolling 30 day basis. The information included in the report is:

Daily Report

ISD Up-Time

The ISD up-time is the percentage that the ISD System is running the VRM application. It calculates the up-time based on actual run-time during a 24-hour period. It is stated in CP-201 that the ISD system must be running 95% of the time on an annual basis.

Highest and Lowest Ullage Pressure

The highest and lowest ullage pressure is the highest and lowest average hourly pressure for each day.

75th and 95th Percentile Ullage Pressure

The VRM records and stores the 75th and 95th highest ullage pressure for each day.

Fueling Point Assessments

This shows the daily status of each fueling point. There are four assessments that each fueling point can be classified into; pass, failure, warning, or insufficient data.

Monthly Report

ISD Operation Time, %

The ISD operation time is the cumulative operation time of the VRM application. It is stated in CP-201 that the ISD system must be running 95% of the time on an annual basis.

EVR Operating Requirements

The EVR operating requirements list what EVR components are installed at the site and what each component should be operating at if applicable.

EVR Pass Time, %

The EVR pass time is the percentage of time the entire EVR system is not in an Alarm state.

ISD Monitoring Requirements

The ISD monitoring requirements are the limits in which alarms are triggered by.

Warning, Failures

This is a list of current and past warnings and failures that relate to VRM.

Event Log

The event log shows a description of any shutdowns and the action to re enable any fueling points.

Printing Reports

Printing from a Web Browser

Printing reports can be done directly from the web browser. Once a report is generated it can simply be printed by going to the ***File>Print*** on the on the web browser's tool bar.

Printing from the Local LCD

To print from the local LCD to the internal printer, press the print button  and it will navigate you to the print menu. From the print menu, you can choose the type of report you want to print.

Printed VRM Report Examples

{Site Name}
{ID Line 1}
{ID Line 2}
{ID Line 3}
{ID Line 4}
{ID Line 5}
12/26/2008 11:25:39

VRM Daily Report
From: {date}
To: {date}

Pressure: inH20
ISD Version: 1.2.0
ISD Up Time 100%

12/26/2008

ISD Up Time	100.00
ISD Pass Time	0.00
Pressure Max	0.26
Pressure Min	-2.53
Pressure 75th	-0.77
Pressure 95th	-0.11

FP1	P0.98
FP2	P1.03
FP3	P1.03
FP4	P1.05
FP5	P0.98
FP6	P1.01
FP7	P1.01
FP8	P1.05
FP9	P0.97
FP10	P1.02
FP11	P1.03
FP12	P1.05

12/25/2008

ISD Up Time	100.00
ISD Pass Time	0.00
Pressure Max	0.22
Pressure Min	-2.67
Pressure 75th	-0.90
Pressure 95th	-0.21
FP1	P0.98
FP2	P1.03
FP3	P1.03
FP4	P1.05
FP5	P0.98
FP6	P1.01
FP7	P1.01
FP8	P1.05
FP9	P0.97
FP10	P1.02
FP11	P1.03
FP12	P1.05

{Site Name}
{ID Line 1}
{ID Line 2}
{ID Line 3}
{ID Line 4}
{ID Line 5}
12/20/2005 11:25:39

VRM Monthly Report
From: {date}
To: {date}

Statistics
December 2005
Operation [%]
100
Pass [%]
100

Operation Requirements
Vapor Collect Method
Assist
A/L Low
0.95
A/L High
1.15

Monitoring Requirements
Dly Vapor Coll. A/L
Low
0.33
High
1.90

Wkly Vapor Coll. A/L
Low
0.81
High
1.32

Wkly Ullage Press. Mon.
High
1.30

Mthy Ullage Press. Mon.
High
0.30

Warning Alarms
Occurred
12/09/2005 00:05:00
Cleared
12/10/2005 02:15:00
Daily Vapor Collection
Fueling Point 10

Failure Alarms
11/27/2005 00:00:05
Weekly Ullage Pressure Leak

Events
Occurred
12/20/2005 07:07:14

Maintenance

General Inspection

Maintenance is not required on the ISD equipment. All ISD Vapor Flow Meters and Vapor Pressure Sensors are checked every day for proper operability. The Console also does a self-check on all the internal modules as well on a daily basis.

If the Console identifies a problem with any components or Vapor Recovery Sensors, they will need to be diagnosed. See the replacement part numbers for the failed component and contact Technical Service.

Console and Vapor Recovery Equipment Replacement Parts

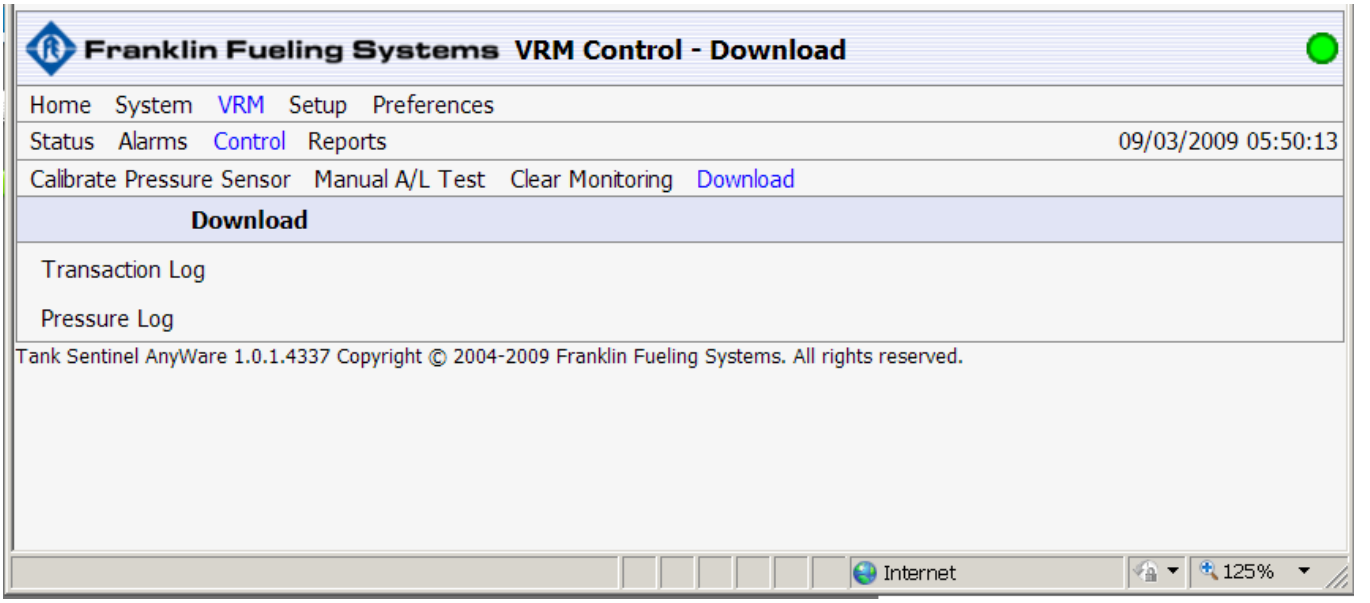
Part Number	Description
TS-PRB	12 Input Probe Module
TS-420IB8	8 Input 4-20ma Module
TS-RLY	8 Channel Relay Module
TS-ACI	12 Channel AC Input Module
TSSP-CM	Control Module
TSSP-PS	Power Supply Module
TSSP-LCD	LCD Display
TSSP-IFB5X	TS-550/EMS Interface Board
TSSP-IPPTR	Impact Printer Assembly
TSSP-T550MB	TS-550/EMS Motherboard
TSSP-T5000MB	TS-5000 Motherboard
TS-VFM	Vapor Flow Meter
TS-VPS	Vapor Pressure Sensor
TS-DIMIB	Internal Dispenser Interface Module
TSP-ENCD	Flow Meter Encoder Replacement
TSSP-BAT	3V Lithium Battery
TSSP-F4	Fuse, 3A (Relay and Power Supply)
TSSP-ISBS	I.S. Barrier Shield
TS-TP5000	TS-EMS/550/5000 Impact Printer Paper
TS-INKRB	TS-EMS/550/5000 Inker Ribbon
TSSP-TRMBLK	Package of 10 Terminal Blocks
TSSP-TMPTR	Thermal Printer
TS-TP2	Paper for the Thermal Printer (1 box of 5)

Diagnostics

Pressure and Transaction Log Files

The console records pressure and transaction data on a continuous rolling basis. There are two .csv (comma separated values) files that can be downloaded from the VRM download page. These files are Microsoft Excel compatible and can be used as a diagnostics tool to help troubleshoot sites.

Note: This feature is only available in VRM Version 1.2.0 or higher.



Pressure Log Files

The pressure log file contains 2 weeks of pressure samples in one minute increments. Below is an explanation of the columns in the pressure log file.

Term	Description
DATE_LOCAL	This column is the date the pressure sample was recorded.
TIME_LOCAL	This column is the time the pressure sample was recorded.
QUIET_TIME	This value indicate if there was active dispensing at the time of the sample. A “1” indicates at least one fueling point is dispensing and a “0” indicates no fueling points are dispensing.
PRESSURE	This is the pressure sample recorded by the console. The Vapor Pressure Sensor has a range between -8 Inches WC and +8 Inches WC. The pressure value may reach as far as 9 Inches WC, this is ok.
ULLAGE	The ullage is the amount of vapor space in the vapor containment area. The units are in gallons.

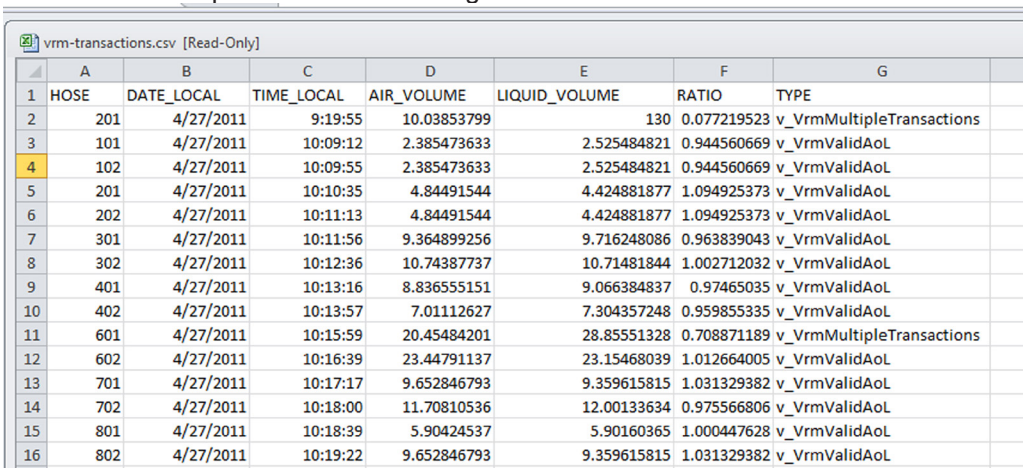
	A	B	C	D	E	F
1	DATE_LO	TIME_LOCAL	QUIET_TIME	PRESSURE	ULLAGE	
2	8/15/2009	20:05:00	0	-8.92	19645	
3	8/15/2009	20:06:00	0	-8.92	19645	
4	8/15/2009	20:07:00	0	-8.90	19646	
5	8/15/2009	20:08:00	0	-8.90	19646	
6	8/15/2009	20:09:00	0	-8.88	19646	
7	8/15/2009	20:10:00	0	-8.84	19646	
8	8/15/2009	20:11:00	0	-8.84	19646	
9	8/15/2009	20:12:00	0	-8.84	19646	
10	8/15/2009	20:13:00	0	-8.82	19646	

Transaction Log Files

The transaction log file records and stores 1000 transactions per fueling point.

Term	Description
HOSE	This column indicates the hose or fueling point number the transaction occurred on. The value shown is a combination of fueling point number and hose number. The right two digits indicate the hose number and the left digits indicate the fueling point number. For uni-hose dispensers, the right two digits can be ignored. You will see a 100 for fueling point 1, 200 for fueling point 2, etc. For multi-hose dispensers, you will see values such as 101 indicating fueling point 1 hose 1 or 703 indicating fueling point 7 hose 3.
DATE_LOCAL	This column is the date at the beginning of the transaction.
TIME_LOCAL	This column is the time at the beginning of the transaction. The time is a local reference to the console.
AIR_VOLUME	This column is the air or vapor returned through the ISD flow meter. The units are in gallons.
LIQUID_ VOLUME	This is the amount of gasoline that was dispensed during the transaction. The units are in gallons.
RATIO	This is the A/L ratio of the transaction.
TYPE	This is the classification of the transaction. Only v_VRMValidAoL type transactions are used as part of the daily and weekly average: **v_VrmValidAoL** is a single transaction that was either less than 0.15 or greater than 0.50. **v_VrmORVRPotential** is a single transaction that was between 0.15 and 0.50. **v_VrmMultipleTransactions** is when both sides of a dispenser were active at the same time. **v_VrmDispenseVolumeZero** occurs when no liquid volume is dispensed. This may occur when a transaction is aborted before pumping any fuel. **v_VrmSmallFuelVolume** occurs when less than 1 gallon of gasoline is dispensed. **v_VrmTransactionLost** occurs when the console does not receive the volume of gasoline dispensed from the dispenser or a new transaction occurs too quickly. **v_VrmReferenceTest** is assigned to a transaction when the transaction is being run as part of a Manual A/L. This is usually done when clearing vapor collection alarms.

Below is an example of a transaction log file as viewed in MS Excel.



vrm-transactions.csv [Read-Only]

	A	B	C	D	E	F	G
1	HOSE	DATE_LOCAL	TIME_LOCAL	AIR_VOLUME	LIQUID_VOLUME	RATIO	TYPE
2	201	4/27/2011	9:19:55	10.03853799	130	0.077219523	v_VrmMultipleTransactions
3	101	4/27/2011	10:09:12	2.385473633	2.525484821	0.944560669	v_VrmValidAoL
4	102	4/27/2011	10:09:55	2.385473633	2.525484821	0.944560669	v_VrmValidAoL
5	201	4/27/2011	10:10:35	4.84491544	4.424881877	1.094925373	v_VrmValidAoL
6	202	4/27/2011	10:11:13	4.84491544	4.424881877	1.094925373	v_VrmValidAoL
7	301	4/27/2011	10:11:56	9.364899256	9.716248086	0.963839043	v_VrmValidAoL
8	302	4/27/2011	10:12:36	10.74387737	10.71481844	1.002712032	v_VrmValidAoL
9	401	4/27/2011	10:13:16	8.836555151	9.066384837	0.97465035	v_VrmValidAoL
10	402	4/27/2011	10:13:57	7.01112627	7.304357248	0.959855335	v_VrmValidAoL
11	601	4/27/2011	10:15:59	20.45484201	28.85551328	0.708871189	v_VrmMultipleTransactions
12	602	4/27/2011	10:16:39	23.44791137	23.15468039	1.012664005	v_VrmValidAoL
13	701	4/27/2011	10:17:17	9.652846793	9.359615815	1.031329382	v_VrmValidAoL
14	702	4/27/2011	10:18:00	11.70810536	12.00133634	0.975566806	v_VrmValidAoL
15	801	4/27/2011	10:18:39	5.90424537	5.90160365	1.000447628	v_VrmValidAoL
16	802	4/27/2011	10:19:22	9.652846793	9.359615815	1.031329382	v_VrmValidAoL

Steps to download log files

1. Navigate to the VRM>Control>Download web page.
2. Click on the either the Transaction Log file or Pressure Log file.
3. A message box will appear asking if you want to Open, Save, or Cancel. If you choose to save, you will be prompted to save it to a directory of your choice. The file may take up to five minutes to completely download.

4. Once downloaded, the file can be opened by double clicking on it. The file is best viewed when Microsoft Excel is installed on the PC.

START-UP/NEW INSTALLATION FORM
INCON VAPOR RECOVERY MONITORING (VRM) SYSTEM

DATE_____

INCON VRM Startup Checklist

Service Company Name	Telephone Number
Service Technician	INCON Tech Cert #
Station Address	City
Phase I EVR Equipment Manufacturer	Phase II EVR Equipment Manufacturer

Dispenser Equipment Checklist		YES	NO	Initials
1	Franklin Fueling Systems, Healy Phase II EVR System, Including ISD System installed according to CARB E.O. VR202?			
2	Is the Vapor Pressure Sensor test port installed in the correct direction? When the ball valve is closed it should isolate the Vapor Pressure Sensor from the containment area. See Figure 11 of the procedure. If it is not then it must be configured such that the pressure sensor is isolated when the valve is closed.			
3	Is the Pressure Sensor in the Open position with the plug in the test port? See Figure 11 of the procedure.			
4	Was Teflon Tape used on the threads for the Vapor Flow Meter rather than pipe dope?			
5	Was a pressure decay test run per TP201.3?			
6	Was the Healy Dispenser Vapor Line Integrity Test run to check for leaks in the dispensing equipment?			

Tank Sentinel Equipment Checklist		YES	NO	Initials
7	Was the dispenser maximum load current measured and recorded? Be sure the proper size Relay Module is used. Use the 10A Relay Module if the current exceeds 2 Amps.			
8	For Balance systems, were the Gasoline Dispenser Hook Signals wired **individually** to the AC Input Module with dispenser 1 wired to the first set of channels? Verify all non-gasoline hook signals are installed after the last gasoline hook signal.			
9	Has the Administrator Password been set?			
10	Was the External ATG alarm able to be generated and cleared?			

Appendix A: Alarm Codes

Device	Description	Category	Type	Definition	Possible Cause and Solution
Fueling Point [n]	Daily Vapor Collection or Weekly Vapor Collection [1]	VRM	Warning or Alarm	This Vapor Recovery alarm occurs when the vapors being return to the UST are blocked. The alarm will occur either at the end of the day or the end of the week depending on the type of vapor recovery system is installed.	May be caused by leaking hanging hardware, blocked hoses or vapor recovery lines, jammed flow meter. Run Exhibit 5 of VR-202 to verify a blockage. Check for leaks by viewing the vanes through the site glass on the VFM.
	Weekly or Monthly Ullage Pressure [1]	VRM	Warning or Alarm	This vapor recovery alarm occurs when the UST ullage pressure exceeds the alarm threshold for the time period specified in the alarm.	Look for problems using one or more of the following VR-202 procedures/ tests: Dispenser Integrity Test B-3m (i.e. “Plumbing Tightness test), Exhibit 4, Exhibit 5, Exhibit 9 (pressure sensor only) or flow rate verification per section 1.2.3.
	Weekly Ullage Pressure Leak Test [1]	VRM	Warning or Alarm	This vapor recovery alarm occurs when the Vapor Recovery Monitor determines a leak greater than the allowable.	May occur when there’s an excessive leak in the vapor recovery containment area. Perform a pressure decay test per TP-201.3.
	Vapor Processor Input	VRM	Warning	Occurs when the processor runtime exceeds 62 continuous minutes in a single day or processor is shutoff or input to ISD console is disconnected.	Vapor Leak, Processor is shut off or input is disconnected.
	Vapor Processor Warning [1]	VRM	Warning or Failure	This alarm occurs when the ullage pressure exceeds 2.00" WCG for 144 minutes in one day.	Vapor Processor is not running.
Channel [n]	Missing	VRM	Alarm	A flow meter is not connected or there is an open in the wiring. This will only occur for a flow meter channel that is programmed to have a flow meter.	Check the connection. Measure the voltage of the terminals, which should be approximately 18Vdc.
Channel [n]	Error	VRM	Alarm	The Vapor Recovery Monitor does not understand the data transmission.	This may happen when a channel is programmed for a magnostrictive probe but has a vapor flow meter connected instead.
	Pressure Sensor Open Circuit	VRM	Alarm	The pressure sensor is not connected to the Vapor Recovery Monitor.	Usually due to a bad connection or a broken wire. In some cases the sensor may not be working. First check the connections inside the dispenser junction box then at the Console terminal block. Second, measure the voltage at the terminal blocks and verify the voltage. See page 17.
	External TS-DIM Connection Down	VRM	Alarm	No communication between the TS-DIM and the Console.	Occurs with bad connection, TS-DIM does not have power, TS-DIM is not working. Check the wiring between the TS-DIM and the Console. Check the jumper settings in the TS-DIM, see installation manual.
	TS-DIM Read Data Error	VRM	Alarm	Bad communication to the Console.	Most likely a baud rate problem. Check the baud rate in the Console as well as the jumper settings in the TS-DIM.
	External ATG Connection Down	VRM	Alarm	No communication or bad communication between the ATG and the Console.	Check the comm. Port settings in both the ATG and the Console. These comm. Port settings should match. Make sure there is a straight serial cable between the ATG and the Console.

[1] ISD Shutdown Alarm

Device	Description	Category	Type	Definition	Possible Cause and Solution
Printer	Check Thermal Printer	System	Warning	Printer is out of paper, or the printer door is open.	Make sure the printer has paper, and the printer door is closed completely.
	Printer Head Temperature	System	Warning	Print head high temperature (65°C) persists for at least 2 minutes.	Printer will resume printing and the alarm will clear after a short cool-down period. Keep the console area cool and ventilated. If the alarm does not clear, contact FFS Technical Support.
	Printer Paper Jam	System	Warning	Indicates that paper is jammed in the printer	Carefully lift printer cover to inspect and remove jammed paper.
Slot [n]	[i] Module is offline, *where i is the module number*	System	Alarm	Occurs when a module is not communicating with the controller.	If RED LED is on or Green LED is blinking try cycling power.
	[i] Module number mismatch, *where i is the module number*	System	Alarm	Occurs when the number of modules does not match the programmed number of modules.	Check the setup at ***System Configuration»Modules*** *Expected* to see if the correct numbers are programmed.
	System Bus Error	System	Alarm	The communication bus is not working properly.	Check to see if a particular module has a red Error LED. If so try to trouble shoot the bad module. Also try removing the bad module and see if the alarm goes away.
TS-DTUn	Remote DTU is Offline	System	Alarm	A remote DTU is not communicating to the console DTU.	Wrong ID Number Dispenser Powered Off Not installed correctly Not on same phase voltage as console DTU
	Console DTU number mismatch	System	Alarm	The console DTU is not communicating with the console.	Bad bus connection Not powered
	DTU FFS Interference	System	Alarm	Two networks have the same Network ID	Change Network ID

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Intentionally Blank

INCON®

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INCON®

Franklin Fueling Systems

TS-VFM

Installation Guide

This install guide provides necessary installation instructions for the mounting of the INCON Vapor Flow Meter inside a dispenser or inside a dispenser sump. Information regarding the cabling and the connection to the Tank Sentinel Console is found in the Tank Sentinel Installation Guide (p/n 000- 2150). All documentation relating to operability, maintenance, and testing of the Vapor Flow Meter is found in the Vapor Recovery Monitor Operator's Guide (p/n 000-2058).

Important: See the Vapor Recovery Install / Operators Manual or Tank Sentinel Installation Manual for Important Safety Messages.

Required Tools

- Pipe joint tape (Teflon Tape)
- Pipe Wrench
- Small screwdriver (terminal block connection)
- Slip joint pliers (crimping splice connector)

Related Documents

- 000-2058: *Vapor Recovery Monitor Operators Guide*
- 000-2150: *Tank Sentinel Installation Guide - TS-5XXX Series*
- 000-2142: *Tank Sentinel Programming Guide - TS-5XXX Series*
- 000-2151: *Tank Sentinel Operator's Guide - TS-5XXX Series*

Preparation

Only use approved pipe joint tape (Teflon Tape) for joints connecting to the Vapor Flow Meter. The use of non hardening, "pipe-dope," thread sealant is strictly prohibited and will void the warranty.

1. Perform a site inspection. Determine how the Vapor Flow Meter will be installed. The preferred installation method for this product is to install above the vapor shear valve. If there is not enough room between the vapor shear valve and the vapor pump, installation below the shear valve may be needed.
2. If the Vapor Recovery equipment is going to be installed on an existing service station, verify that there is a run of intrinsically safe conduit going back to the console. Vapor Flow Meter wiring can share the same space with other intrinsically safe cables, but cannot be run with non-intrinsically safe cables.
3. Make sure that all contractor-supplied piping materials are compatible with California fuels and meet all local codes. If existing vapor piping in the dispenser requires modification, consult the dispenser manufacturer for approved retrofit kits.

Parts List and Materials Needed

Table 1 - Above Shear Valve

Item Description	Supplied By	Quantity
Vapor Flow Meter, TS-VFM	INCON	1
Sensor Installation Kit, 020-1509	INCON	1
Weatherproof Junction Box	Contractor	1
1.5" to 1" reducing bushing	Contractor	1
1.5" to __" reducing bushing*	Contractor	1
1" pipe nipple	Contractor	1
__" pipe nipple*	Contractor	1
Pipe Union	Contractor	1

Table 2 - Below Shear Valve

Item Description	Supplied By	Quantity
Vapor Flow Meter, TS-VFM	INCON	1
Sensor Installation Kit, 020-1509	INCON	1
Weatherproof Junction Box	Contractor	1
1.5" pipe nipple	Contractor	2
1.5" pipe union	Contractor	1

* Piping size is dependent on vapor piping size inside the dispenser. Typically the connection to a Healy VP1000 is a 1/2" NPT. Thus the bushing size will be 1.5" to 0.5". For a Balance System, 1" NPT is typical. Thus a 1.5" to 1" bushing would be needed.

Installation Steps

Above Shear Valve

1. Lock and tag out power to the dispenser and the console before attempting any work on the dispenser.
2. Refer to Figure 1 for reference.
3. Do not remove the protective caps on the Vapor Flow Meter until you are ready to thread the nipples into the Flow Meter.
4. Begin by connecting the two 1.5" to 1" reducing bushings to the Vapor Flow Meter's body. Be sure to use only Teflon tape when sealing these threads. Take special precaution not to let any foreign material fall inside of the Vapor Flow Meter.
5. Next, start assembling the hardware from the bottom up. Connect a short, 1" NPT threaded nipple to the top of the vapor shear valve and to the 1.5" to 1" reducing bushing on the flow meter.
6. Connect another 1" pipe nipple to the top reducing bushing followed by a 1" pipe union. The existing dispenser piping can now connect to the top of the union.
7. If there is not already a watertight junction box for the intrinsically safe cables, then install one as described earlier in Tools Required.
8. Pull the black Vapor Flow Meter cable through the supplied cable grip and into the junction box. Using the supplied crimp connectors, splice the flow meter cable to the field cable. The wiring color codes on the black flow meter cable are: Red wire = + (plus) and Black wire = – (minus)

Below Shear Valve

1. Lock and tag out power to the dispenser and the console before attempting any work on the dispenser.
2. Refer to Figure 2 for reference.
3. Do not remove the protective caps on the Vapor Flow Meter until you are ready to thread the nipples into the Flow Meter.
4. Begin by connecting two 1.5" NPT pipe nipples to the Vapor Flow Meter's body. Be sure to use only Teflon tape when sealing these threads. Take special precaution not to let any foreign material fall inside of the Vapor Flow Meter.
5. Next, prepare the piping inside of the dispenser sump to connect to the Vapor Flow Meter. If flexible piping is currently installed, make sure, when adding the Vapor Flow Meter, that there are no bend radii that are too sharp, kinks, or traps. The contractor may need to replace the existing flexible piping with a shorter length in order to avoid potential flow restrictions.
6. Add the Vapor Flow Meter between the existing piping in the sump and the bottom of the vapor shear valve. In most cases the vapor shear valve will need to be temporary removed in order to assist with making the connection. Add a union to either the top of the shear valve or below the shear valve.
7. If there is not already a watertight junction box for the intrinsic safe cables, then install one as described earlier in Tools Required.
8. Pull the black Vapor Flow Meter cable through the supplied cable grip and into the junction box. Using the supplied crimp connectors, splice the flow meter cable to the field cable. The riring color codes on the black flow meter cable are: Red wire = + (plus) and Black wire = – (minus)

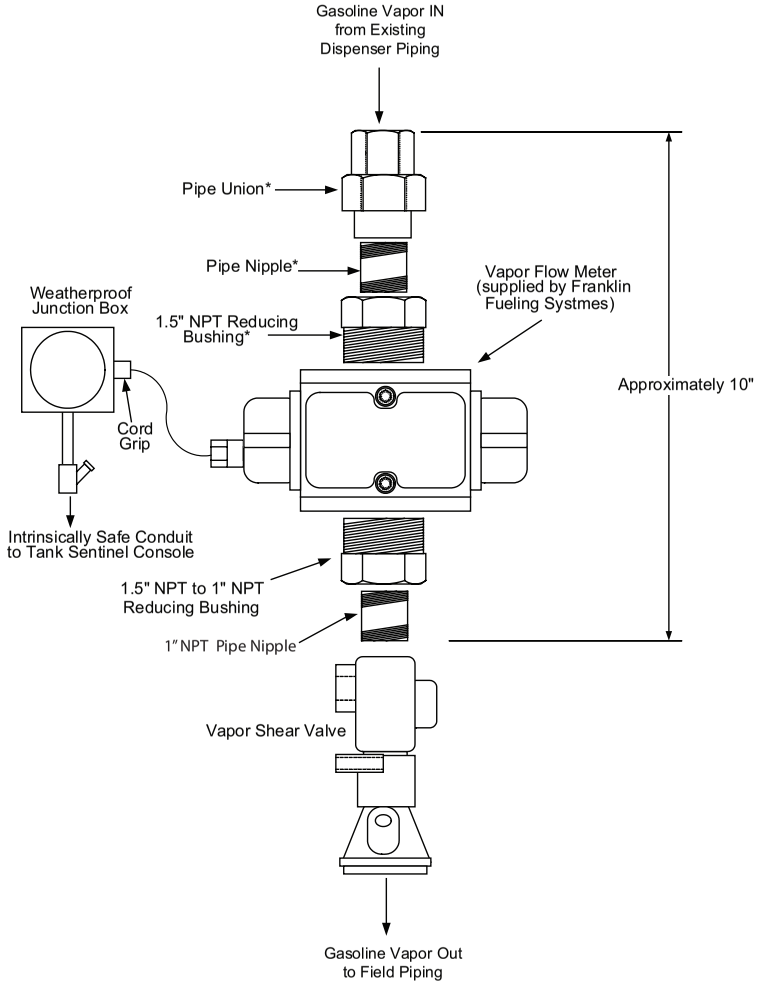


Figure 1
Flow Meter Above Shear Valve

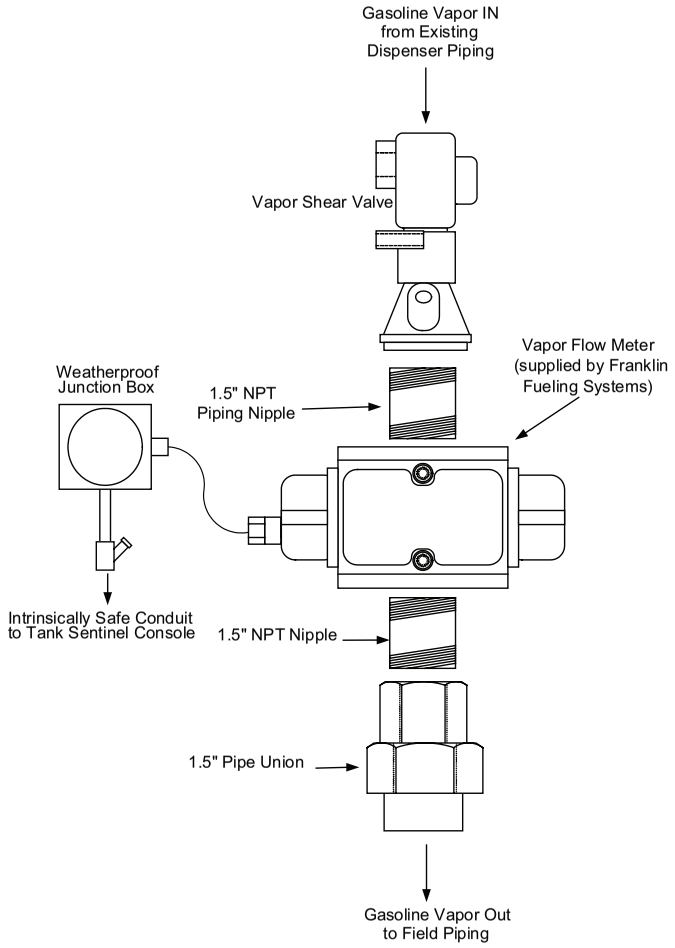
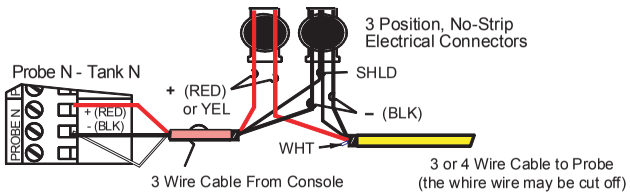
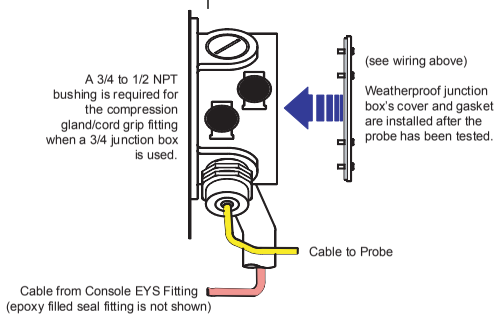


Figure 2
Flow Meter Below Shear Valve



To splice: Insert unstripped wires and use a slip-joint pliers to seat the black piece.



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TS-VPS

Installation Guide

This install guide provides necessary installation instructions for the mounting of the INCON Vapor Pressure Sensor inside a dispenser, inside a dispenser sump, or on the top of a tank riser. Information regarding the cabling and the connection to the Tank Sentinel Console is found in the *Tank Sentinel Installation Guide*, (p/n 000-2150). All documentation relating to operability, maintenance, and testing of the Vapor Pressure Sensor is found in the *Vapor Recovery Monitor Operator's Guide* (p/n 000-2058).

Important: See the Vapor Recovery Install/Operators Manual or Tank Sentinel Installation Manual for Important Safety Messages.

Required Tools

- Pipe joint tape (Teflon Tape)
- Adjustable Wrench
- Small screwdriver (terminal block connection)
- Slip joint pliers (crimping splice connector)

Related Documents

- 000-2058 : *Vapor Recovery Monitor Operators Guide*
- 000-2150 : *Tank Sentinel Installation Guide - TS-5XXX Series*
- 000-2142 : *Tank Sentinel Programming Guide - TS-5XXX Series*
- 000-2151 : *Tank Sentinel Operator's Guide - TS-5XXX Series*

Preparation

1. Perform a site inspection. Determine how the Vapor Pressure Sensor will be installed. The preferred installation method for this product is to come off the horizontal 1" port of the vapor shear valve. If this is not possible, then a piping tee may need to be installed below the Vapor Flow Meter.
2. If the Vapor Recovery equipment is going to be installed on an existing service station, verify that there is a run of intrinsically safe conduit going back to the console. Vapor Flow Meter wiring can share the same space with other intrinsically safe cables, but cannot be run with non-intrinsically safe cables.
3. Make sure that all contractor-supplied piping materials are compatible with California fuels and meet all local codes.

Parts List and Materials Needed

Table 1 - Off Shear Valve

Item Description	Supplied By	Quantity
Vapor Pressure Sensor, TS-VPS	INCON	1
Sensor Installation Kit, 020-1509	INCON	1
Weatherproof Junction Box	Contractor	1
1" to 0.5" reducing bushing	Contractor	1

Table 2 - Below Shear Valve

Item Description	Supplied By	Quantity
Vapor Pressure Sensor, TS-VPS	INCON	1
Sensor Installation Kit, 020-1509	INCON	1
Weatherproof Junction Box	Contractor	1
1" to 0.5" reducing bushing	Contractor	1
1.5" Piping Tee	Contractor	1

Installation Steps

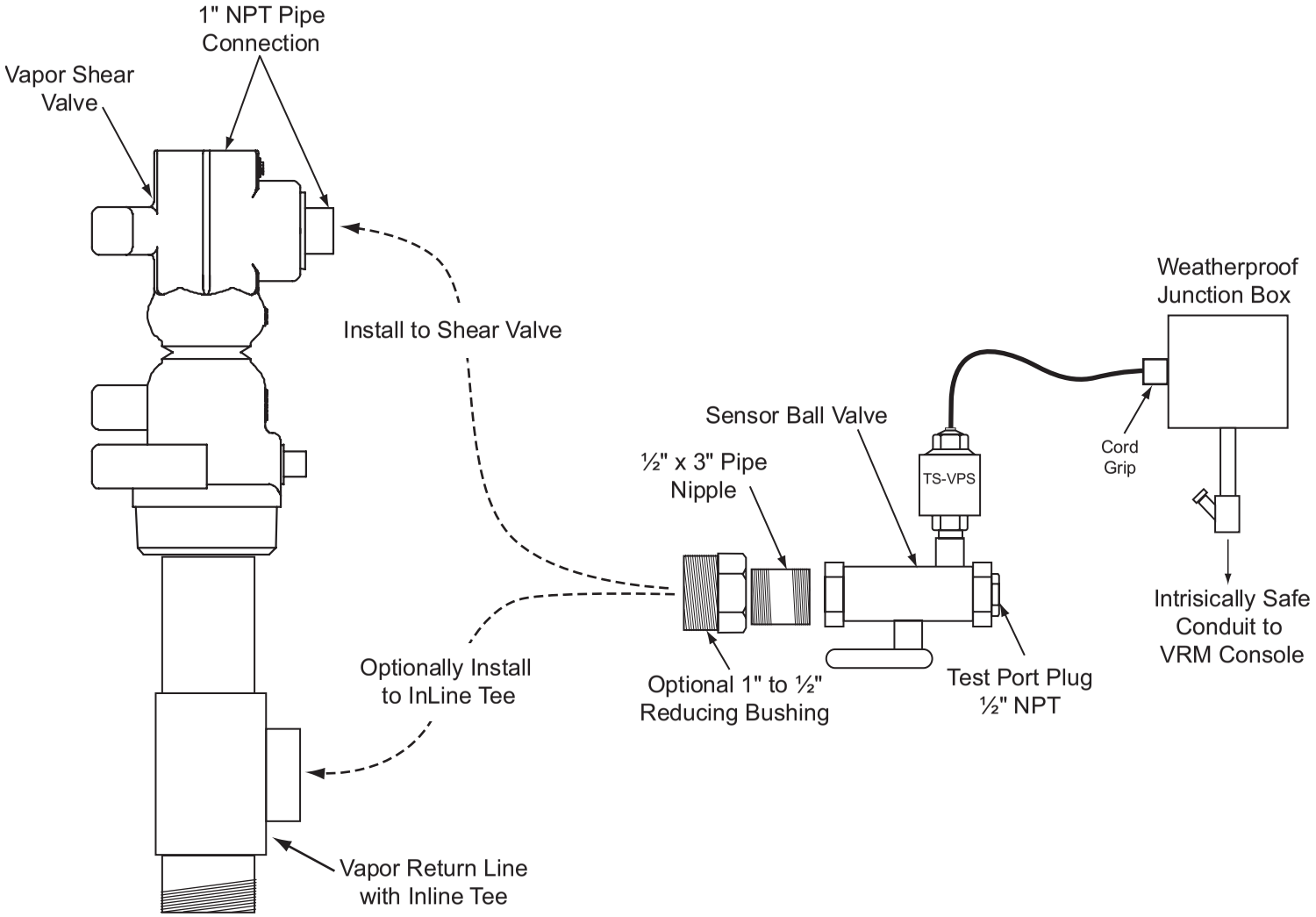
Installation Steps Off the Vapor Shear Valve

1. Lock and tag out power to the dispenser and the console before attempting any work on the dispenser.
2. Refer to Figure 1 for reference.
3. Begin by removing the 1" plug from the vapor shear valve and installing a 1" to ½" reducing bushing.
4. If there is not already a watertight junction box for the intrinsically safe cables, then install one as described earlier in Tools Required.
5. Pull the black Vapor Pressure Sensor cable through the supplied cable grip and into the junction box. Using the supplied crimp connectors, splice the flow meter cable to the field cable. The wiring color codes on the black Vapor Pressure Sensor cable are: Black wire = + (plus) and White wire = - (minus).

Installation Steps Below the Vapor Shear Valve

1. Lock and tag out power to the dispenser and the console before attempting any work on the dispenser.
2. Refer to Figure 1 for reference.
3. Install a 1.5" piping tee below the Vapor Shear Valve.
4. Install an appropriate bushing sized to get to the supplied ½" piping nipple.
5. If there is not already a watertight junction box for the intrinsically safe cables, then install one as described earlier in Tools Required.
6. Pull the black Vapor Pressure Sensor cable through the supplied cable grip and into the junction box. Using the supplied crimp connectors, splice the flow meter cable to the field cable. The wiring color codes on the black Vapor Pressure Sensor cable are: Black wire = + (plus) and White wire = - (minus).

Figure 1



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Console DTU (Data Transfer Unit)

Installation Instructions

Overview

The TS-DTU will be installed in the dispenser when it is used as a Remote DTU or inside the building when used as a Console DTU. These installation instructions are to be used for installing the TS-DTU inside the building.

When used as a Console DTU, data is received from the Remote DTU units via power line communication. The data is then sent to the System Console (TS-550/5000/EMS) for processing. Unlike the Remote DTU units, the Console DTU will have no Intrinsically safe sensors connected to it.

Site Inspection

A licensed electrician should perform a site inspection before installing any equipment. The Console DTU must be connected to all electrical phases that supply power to dispensers containing Remote DTUs.

Check for any electrical isolation. Isolation between the electrical panel and the dispenser can result in poor or no communication with the DTU. Make sure there is not a power conditioner between the Console DTU and dispenser power.

Installation Procedure

Tools and Supplies Needed

• 1/2 " Cord grip/strain relief	• Small slotted screwdriver
• Multimeter	• Mounting screws
• 2-wire shielded cable	• 14 AWG wire (one for each phase and ground)

Step 1 – Remove System Power

Remove power from the TS-5XXX Series System Console and do NOT return power to the System Console or to the Console DTU until instructed to do so.

Electrical Hazard! Always disconnect power supplies before installing or servicing the console TS-DTU. Use proper lock-out and tag-out procedures to ensure no power is accidentally applied to the system. Failure to do so could result in severe injury or death.

Step 2 – Mounting the Console DTU

Mount the Console DTU as close to the circuit breaker panel that is suppling the dispenser(s). Remove the cover and insert a screw (not supplied) into each of the four corners of the enclosure. Mount the unit to the wall. You may optionally use the supplied mounting brackets.

Step 3 – Power Connection

The Console DTU may use the same circuit breaker as the System Console but **DO NOT** connect the power for the Console DTU inside the Console enclosure. Install a junction box or wire the Console directly to the circuit breaker panel.

Ideally, the circuit selected for the console power will be on the same phase as all dispensers and no further power connections will be required. If any dispensers are on a different phase, run wires from the L2 and L3 connections on the Console DTU to the appropriate circuit breakers for the required extra phases. If there is any question about what phase some of the dispensers are on, it is recommended to connect all three phases to the Console DTU.

Connect the neutral for the Console DTU to the same neutral supplying the dispensers. If there is not a clean neutral return for the DTU then poor quality may result.

Warning: Cycling power to the Console DTU without powering off the System Console will cause the System Console to reboot.

Installer must use conduit for connecting the DTU on the power connection side.

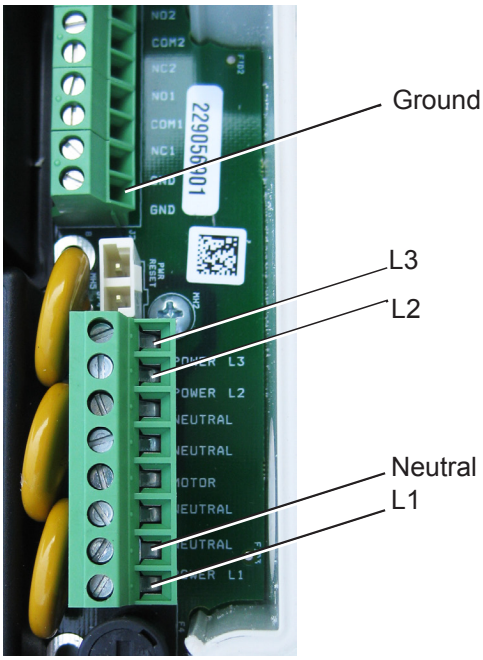


Figure 1: Power Connections to the Console DTU

Step 4 – Bus Termination Jumper Removal
The Console DTU will provide system bus termination when installed and running. Therefore the system bus termination currently provided by the Power Supply Module needs to be removed. Refer to the TS-5XXX Series Installation Guide for instructions on how to remove a module.

Be extremely careful when removing the power supply module so it does not rub against any other part of the system. After it is removed from the system, locate the system bus termination jumper JP1 and remove it (Figure 2).

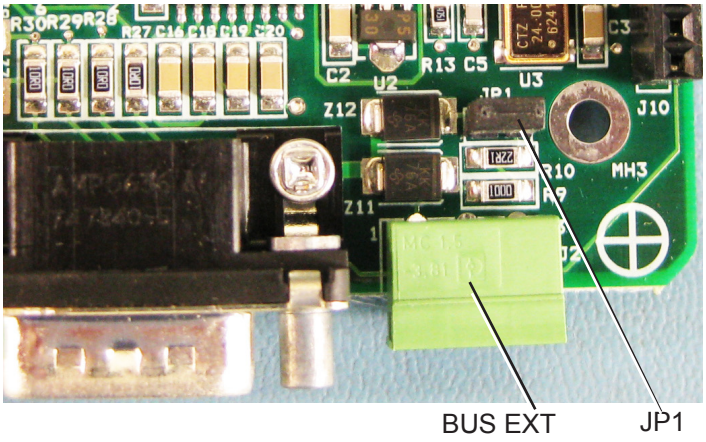


Figure 2: JP1 Location on the Power Supply Module

Re-Install the power supply module, securing it properly in place and replace the communication bracket as required.

Step 5 – Data Connection
The Console DTU acts as an external System Console module and therefore must be connected to the system bus. This is made possible via the external BUS EXT connection, located on the power supply module.

The bus connection requires 2-wire shielded cable and FFS recommends Belden 87761. On the Console DTU, the cable enters through the Intrinsically Safe (I.S.) opening but is connected outside of the I.S. area, which is not used in the Console DTU. Therefore the I.S. shield will need to be removed and discarded. Secure the bus cable on the Console DTU side using a cord grip.

On the System Console communications bracket, locate the BUS EXT connector (Figure 4). The connector is removable for convenient wiring. Refer to the following table and make the proper BUS (HIGH, LOW, GND) connections (Figure 3). To make the necessary connections between the System Console and the DTU, plug the BUS EXT connector back into the System Console. Secure the bus cable so it is not accidentally disconnected.

Belden Cable	BUS EXT	Console DTU Connection
Red Wire	HIGH	HIGH
Black Wire	LOW	LOW
Shield	GND	GND

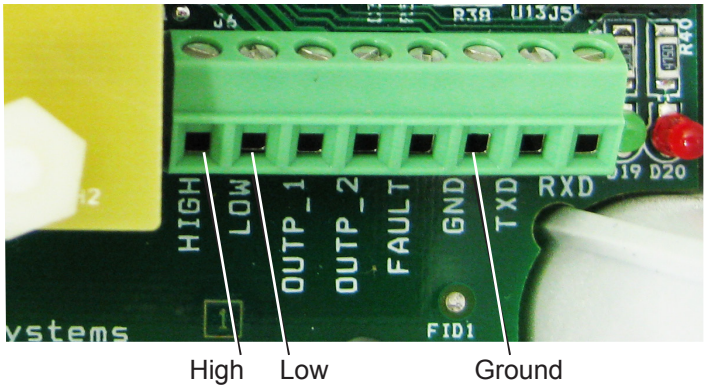


Figure 3: Console DTU BUS EXT Connection

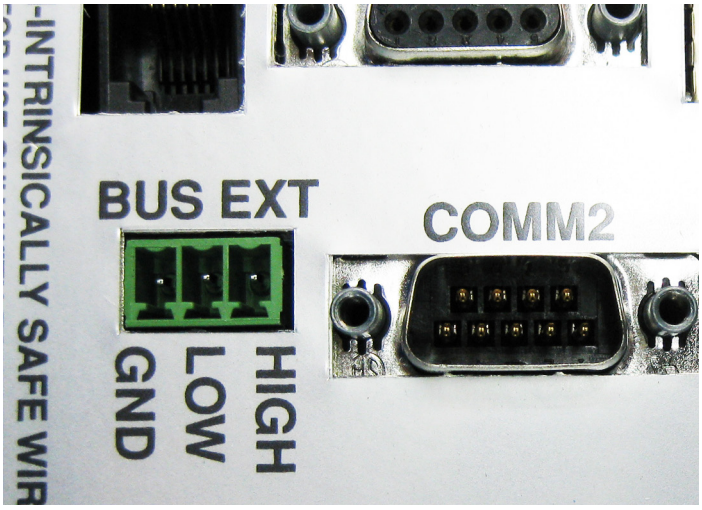


Figure 4: Console Side BUS EXT Connection

Step 6 – Review All Connections
Review power and data connections and make sure the cable is attached securely. Finally replace the Console DTU Cover.

Step 7 – Power Up
Return power to the System Console and the newly installed Console DTU.

Related Documents

000-2146	DTU Dispenser Retrofit Manual
000-2142	T5 Console Programming Manual, rev D or higher
000-2150	T5 Installation Manual
000-2058	VRM IOM manual rev C or higher

NOTES:

1.) THE MODEL TS-DTU/P SHALL NOT BE CONNECTED TO ANY EQUIPMENT WHICH USES OR GENERATES GREATER THAN 250V.

2.) EACH GROUND TERMINAL SHALL BE CONNECTED TO A SUITABLE SYSTEM EARTH GROUND. THE DC RESISTANCE BETWEEN GROUND TERMINALS AND EARTH GROUND SHALL BE LESS THAN 1 OHM.

3.) THE MODEL TS-DTU/P WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE NATIONAL OR LOCAL CODES. CONDUCTORS OF DIFFERENT INTRINSICALLY SAFE CIRCUITS RUN IN THE SAME CABLE/CONDUIT MUST HAVE AT LEAST 0.25mm OF INSULATION.

4.) CAPACITANCE AND INDUCTANCE OF THE FIELD WIRING FROM THE INTRINSICALLY SAFE EQUIPMENT TO THE BARRIER SHOULD BE CALCULATED AND SHOULD BE INCLUDED IN THE SYSTEM CALCULATIONS AS SHOWN IN TABLE 1, 1A. CABLE CAPACITANCE (Cc) PLUS INTRINSICALLY SAFE EQUIPMENT CAPACITANCE (Ci) MUST BE LESS THEN THE MARKED CAPACITANCE (Co) SHOWN ON ANY BARRIER USED. THE SAME APPLIES FOR INDUCTANCE (Li AND Lo, RESPECTIVELY) WHERE THE CABLE CAPACITANCE AND INDUCTANCE PER FOOT ARE NOT KNOWN, THE FOLLOWING VALUES SHALL BE USED: Cc=60pF/ft., (200pF/M) Lc=0.2uH/ft (0.7uH/M).

5.) WIRING, CABLING AND SEALS MUST BE INSTALLED IN ACCORDANCE WITH THE NEC, CEC OR OTHER APPLICABLE NATIONAL OR LOCAL CODES.

6.) USE ONLY CABLE THAT IS SPECIFIED IN USER INSTALLATION MANUAL OR LISTED EQUIVALENT FOR THE INSTALLATION OF LIQUID LEVEL PROBES.

7.) USE THE FOLLOWING WIRE TYPES:
FOR I.S. WIRING USE 18AWG MINIMUM OIL AND GASOLINE RESISTANT TYPES, TFFN, THWN, THHN.
FOR POWER AND GROUND WIRING
POWER L1 AND NEUTRAL - USE 14 AWG OR LARGER.
POWER L2 AND L3 - USE 16 AWG OR LARGER.
SAFETY GROUND - USE 12 AWG OR LARGER.
FOR TS-5XXX WIRING SEE NEC ARTICLE 725 FOR CABLE TYPES OR USE AWM STYLE 2464 OR 2576.

8.) ONLY USE CRIMP TYPE CONNECTORS FOR ELECTRICAL CONNECTIONS (DO NOT USE WIRE NUTS OR OTHER TYPE CONNECTORS).

9.) SEAL ALL FIELD WIRING CONNECTIONS FROM MOISTURE WITH EPOXY SEAL - PACKS.

10.) SEE INSTALLATION MANUAL FOR MORE DETAIL.

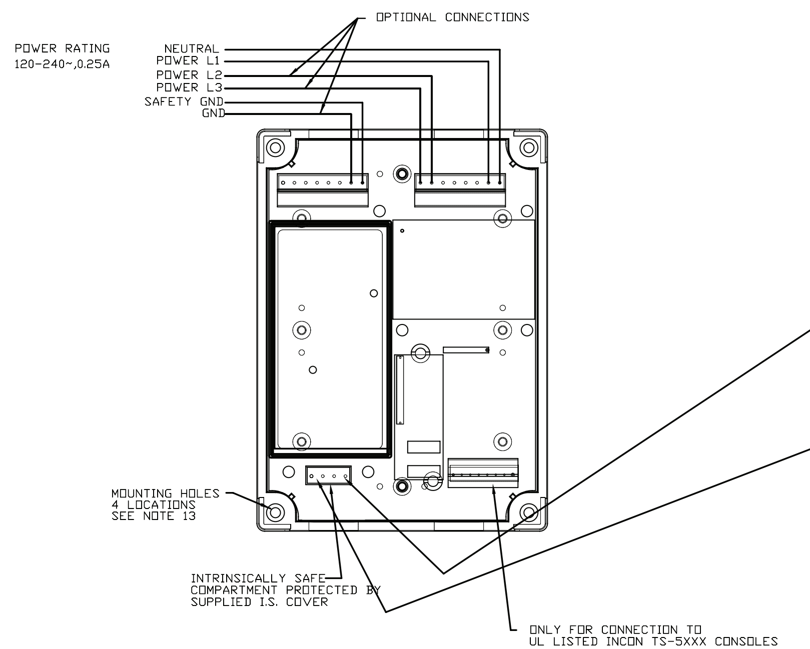
11.) THE GENERAL CONTRACTOR MUST SUPPLY THE SPECIFIED WIRE, CONDUITS AND ALL ELECTRICAL ACCESSORIES.

12.) THE ENTITY CONCEPT ALLOWS THE USER TO IDENTIFY ACCEPTABLE COMBINATIONS OF INTRINSICALLY SAFE APPARATUS AND ASSOCIATED APPARATUS THAT HAVE NOT BEEN EXAMINED AS A SYSTEM. EACH APPARATUS IS EXAMINED SEPARATELY BY A NATIONALLY RECOGNIZED TEST LABORATORY (NRTL) OR NOTIFIED BODY AND ASSIGNED A SET OF PARAMETERS CALLED ENTITY PARAMETERS. THE ENTITY PARAMETERS TS-DTU/P (ASSOCIATED APPARATUS) CAN BE FOUND IN TABLE 1, 1A. TO DETERMINE THE Vmax (Ui), Imax (Ii), Ci, AND Li VALUES THE CONTROL DRAWING FOR THE INTRINSICALLY SAFE APPARATUS SHALL BE USED. THE COMBINATION OF THE INTRINSICALLY SAFE APPARATUS AND ASSOCIATED APPARTUS MUST COMPLY WITH THE FOLLOWING:
Uo (Voc) </= Ui (Vmax)
Io (Isc) ,</= Ii (Imax)
Po </= Pi (Pmax)
Co (Ca) >/= Ci + Ccable
Lo (La) >/= Li + Lcable.
(SEE NOTE 4).

13.) USE MOUNTING HOLES TO SECURE TS-DTU/P TO WALL OR MOUNTING BRACKET (SUPPLIED).

REVISIONS

LTR	ECO	DESCRIPTION	DATE	APPROVED
B		FOR REVIEW	01/22/03	



CLASS I, DIV 2, GROUP D OR NON-HAZARDOUS LOCATION

MODELS TS-DTU/P

ASSOCIATED APPARATUS
[EEx iA] IIA

HAZARDOUS LOCATION

CLASS I, DIV. I, GROUP D
GROUP IIA, ZONE 0

BLK VFM-
RED VFM+
SHLD
-(BLK)
+(RED)

TO INTRINSICALLY SAFE APPARATUS

TABLE 1A - ENTITY PARAMETERS PROBE INPUT

TERMINAL	Uo/Voc	Io/Isc	Co/Ca	Lo/La	Po
RED VFM+ , BLK VFM-	28.35Vdc	0.1575A	1.04uF	1.4 mH	1.1W

VPS+
VPS-

TO TWO WIRE 4-20mA INTRINSICALLY SAFE APPARATUS

TABLE 1 - ENTITY PARAMETERS 4-20mA INPUT

TERMINAL	Uo/Voc	Io/Isc	Co/Ca	Lo/La	Po
VPS +, VPS -	26.25Vdc	0.0982A	1.25uF	20 mH	0.64W

UL Certified Product ~Schedule Drawing~ ATTENTION: No modification permitted without approval of the Notified Body

AUTOCAD FILE NO. 0001724A.DWG

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES
DECIMALS .XX ± .01 .XXX ± .005
ANGULAR: ± 0°30'
FRACTIONAL ± 1/64
THIRD ANGLE

DRAWN 8/23/01

INCON INTELLIGENT CONTROLS, INC.

CONTROL DRAWING
TS-DTU/P

SIZE D DO NOT SCALE DRAWING DWG NO. 000-1724 REV B

SHEET 1 OF 1

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INCON®

Franklin Fueling Systems

Data Transfer Unit

Dispenser Retrof t Manual

Model TS-DTU

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Tel: +1 608 838 8786 • 800 225 9787 • Fax: +1 608 838 6433 • www.franklinfueling.com

Important Safety Messages

Franklin Fueling Systems (FFS)/Healy equipment is designed to be installed in association with volatile hydrocarbon liquids such as gasoline and diesel fuel. Installing or working on this equipment means working in an environment in which these highly f ammable liquids may be present. Working in such a hazardous environment presents a risk of severe injury or death if these instructions and standard industry practices are not followed. Read and follow all instructions thoroughly before installing or working on this, or any other related, equipment.

As you read this guide, please be aware of the following symbols and their meanings:

Warning This symbol identif es a warning. A warning sign will appear in the text of this document when a potentially hazardous situation may arise if the instructions that follow are not adhered to closely. A potentially hazardous situation may involve the possibility of severe bodily harm or even death.

Caution This is a caution symbol. A caution sign will appear in the text of this document when a potentially hazardous environmental situation may arise if the instructions that follow are not adhered to closely . A potentially hazardous environmental situation may involve the leakage of fuel from equipment that could severely harm the environment.

Warning **Follow all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and any related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on during installation or servicing. Please refer to the Installation and Owner's Manual for this equipment, and the appropriate documentation for any other related equipment, for complete installation and safety information.**

Warning **Follow all federal, state and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30A and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage and/or environmental contamination.**

Warning **Always secure the work area from moving vehicles. The equipment in this manual is usually mounted underground, so reduced visibility puts service personnel working on this equipment in danger from moving vehicles entering the work area. To help eliminate these unsafe conditions, secure the area by using a service truck to block access to the work environment, or by using any other reasonable means available to ensure the safety of service personnel.**

Warning **Use circuit breakers for multiple disconnect to turn off power and prevent feedback from other dispensers.**

Important: All electrical and hydraulic plumbing f ttings referred to in these instructions must be UL "listed" or "recognized" for the purpose.

Important: The TS-DTU will increase the current draw of the dispenser by 0.25 amps. Use the label supplied to note this change.

Contents

Purpose:

This procedure describes the tools, methods and skill levels required to install an INCON/Franklin Fueling Systems model TS-DTU, Data Transfer Unit in UL Approved Dispensers. Each installation of a TS-DTU in a dispenser requires that a TS-DRK, dispenser installation kit, be used. The TS-DRK is ordered by specif c dispenser types. Refer to Table 1 for the correct TS-DRK model. Only INCON/Franklin Fueling Systems trained and certif ed contractors will be able to perform these retrof ts or warranty will be void. The installer shall be a skilled petroleum technician and thoroughly familiar with the requirements of State, Federal and local codes for installation and repair of gasoline dispensing equipment. Also, they shall be aware of all the necessary safety precautions and site safety requirements to assure a safe and trouble free installation. NOTE: All electrical f ttings referred to in these instructions must be UL “listed” or “recognized” for the purpose.

Important Safety Messages

Before installing the equipment, read, understand and follow:

- The National Electrical Code (NFPA 70)

- The Automotive and Marine Service Code (NFPA 30A)

- Any national, state and local codes that may apply.

The failure to install the equipment in accordance with NFPA 30A and 70 may adversely affect the safe use and operation of the system. Accurate, sound installations reduce service calls: Use experienced, licensed contractors that practice accurate, safe installation techniques. Careful installation provides a sound troubleshooting framework for f eld repairs and can eliminate potential problems.

1. Read all instructions before beginning.
2. Follow all safety precautions:
   - Barricade the area.
   - Do not allow vehicles or unauthorized people in the area.
   - Do not smoke or allow open f ames in the area.
   - Do not use power tools in the work area.
   - Wear eye protection during installation.
3. Use circuit breaker for multiple disconnects to turn off power and prevent feedback from other dispensers.

Specifications:

Power 100-240 VAC, 60 Hz, 0.25 A

Parts List

The TS-DTU and TS-DRK installation kit consists of the following major components. Make sure you have these parts before installing the DTU.

Figure 1: TS-DTU/P Data Transfer Unit

- TS-DTU
- Mounting Plate
- Fasteners (5 screws, nuts, and washers)

Figure 2: 020-1513 IS Conduit Kit

- Straight Conduit Fitting
- 90degree Conduit Fitting
- Conduit Reducer
- Flexible Conduit (1/2”PVC)
- Two splice connectors

Figure 3: 131610 Potted Nipple Assembly

One harness included per instal kit. Refer to table 1 for list of install kits.

Power Harness 600-0166 when using Wayne Dispenser	
Power Harness 600-0167 when using Gilbarco Encore Dispenser	
Power Harness 600-0168 when using Gilbarco Advantage Dispenser	
Power Harness 600-0165 when using Tokheim Dispenser	

Figure 4: Power Harness Kits

General Instructions

Tools Required

(This applies to all dispenser installation procedures)

Assorted Open End Wrenches 1/4” through 3/4”
Wire Cutters/Strippers 16 AWG to 26 AWG
3/8” Drill Assembly
Assorted Drill Bits 1/16” through 7/16”
Assorted Screwdrivers (Flat blade-one must be 1/8” wide)
3/4" Conduit Hole Punch (For potted nipple assembly)
Electrical Multi-meter
12” adjustable Wrench
18” Channel lock Pliers

Attaching the Mounting Bracket

For each dispenser installation, the mounting bracket will need to be attached to the back side of the TS-DTU. Refer to each dispenser installation instruction as it will specify the correct orientation of the bracket

1. Remove the TS-DTU enclosure cover and set it aside.
2. Find the correct orientation for the mounting bracket in the dispenser-specif c instructions.
3. Find two screws, washers, and star nuts from the TS-DTU/P kit. Insert the two screws into the two mounting holes of the front face of the TS-DTU enclosure.
4. Put the mounting bracket on the side of the DTU enclosure and install a washer and star nut.

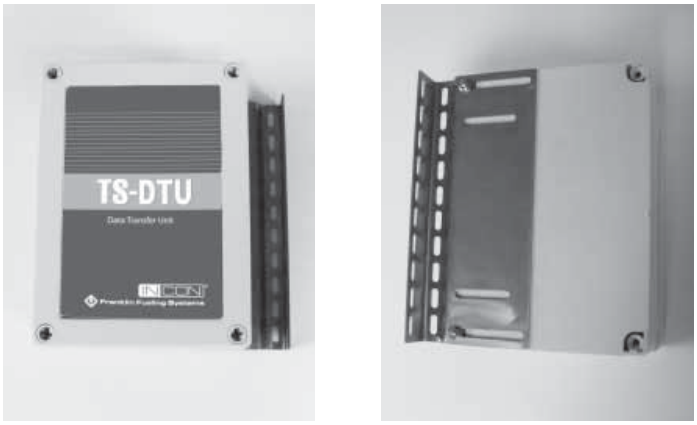

Figure 5: Mounting Bracket On Side Of Unit

Figure 6: Mounting Bracket On Bottom Of Unit

Intrinsically Safe Wiring

The Intrinsically safe wiring is the same for all type of dispensers. The wires from the top end of a potted nipple should be connected to the TS-DTU module and from the bottom end to the TS-VFM and TS-VPS. These wires connect intrinsically safe devices (TS-VFM and TS-VPS) to the associated apparatus (TS-DTU) and therefore must be protected in non-hazardous area where TS-DTU is located.

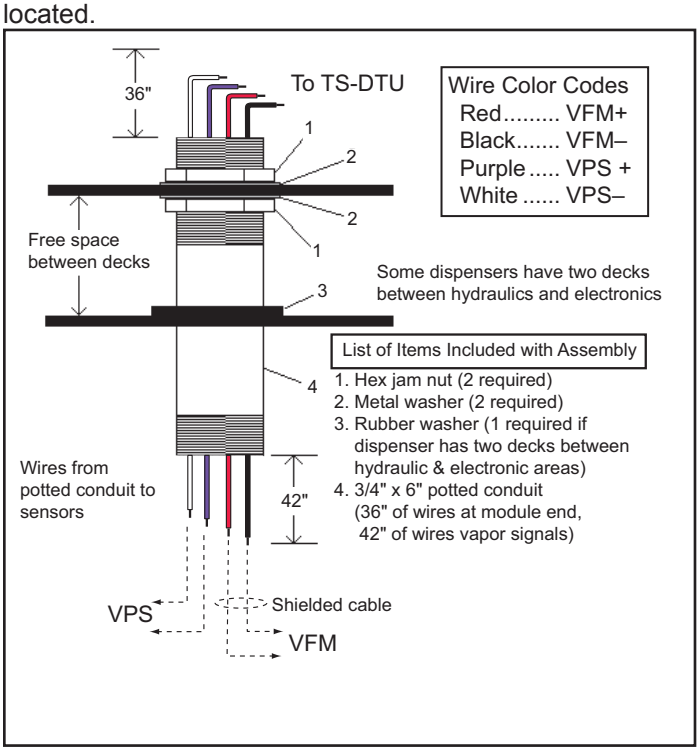

Figure 7: Potted Nipple Assembly

Follow the dispenser-specif c instructions for the installation location and procedure of the potted nipple on the dispenser vapor barrier.

Connecting the Vapor Flow Meter and Vapor Pressure Sensor

The connection of potted nipple to the TS-VFM and TS-VPS in the lower section of the dispenser is the same for all dispensers. For ease of installation, a junction box may be connected directly to the bottom of the potted nipple. Note, the potted nipple is a ¾" conduit thread, see Figure 8.

Figure 8: Junction Box Connected to Potted Nipple

TS-VFM Splice

1. Find two-splice connectors in the IS Wiring Kit, 020-1513.
2. Make the following splice connections:

- Red wire of potted nipped to Red wire of TS-VFM cable.
- Black wire of potted nipple to Black wire of TS-VFM cable.

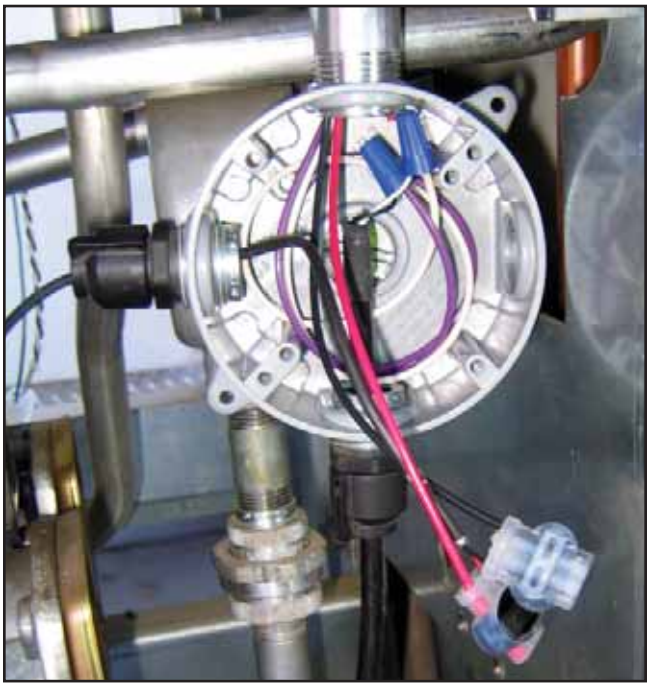

Figure 9: VFM and VPS Spices

TS-VPS Splice

1. Find two wire nuts in the Power Harness Kit, 600-016X.
2. Make the following splice connections:

- Purple wire of potted nipped to Black wire of TS-VPS cable.
- White wire of potted nipple to White wire of TS-VPS cable (Refer to Figure 9).

Dispenser Specific Installation

This manual covers the following types of dispensers:

Make	Type	Installation Kit
Gilbarco	Advantage	TS-DRK/A
	Encore 300 & 500	TS-DRK/E
Tokheim	Premier B	TS-DRK/T
Tokheim	Premier C	TS-DRK/T
Wayne	Ovation	TS-DRK/W
	Vista 1V, 2V, 3V	TS-DRK/W

Table 1: Dispenser Kits

Gilbarco Advantage Narrow Frame

This section illustrates the basic components needed to retrof t a TS-DTU module into an existing or UL remanufactured dispenser. This system can be installed in any “Non-Vapor or Vapor Ready” dispenser including dispensers with existing “Balance” or “VacAssist” piping.

1. Loosen three bolts at the bottom of each main door assembly.

Figure 1: Loosen Bolts

2. Unlock the left options door on each main door.

Figure 2: Open Options Door

3. Lift latch on right side of left options door opening to release right options door on each side of the dispenser.

Figure 3: Release Options Door

4. Disengage two latches, one in each right and left options door openings, and open main door on both sides of dispenser.
5. Move to side A of dispenser. Side A can be determined by the side that the credit card reader (crind) tray pops out.
6. Find ground wire mounting location shown and remove screw and star washer.

Figure 4: Find Ground Wire

7. Reinstall ground with ring terminal screw and star washer in alternate location shown. Tighten screw securely.

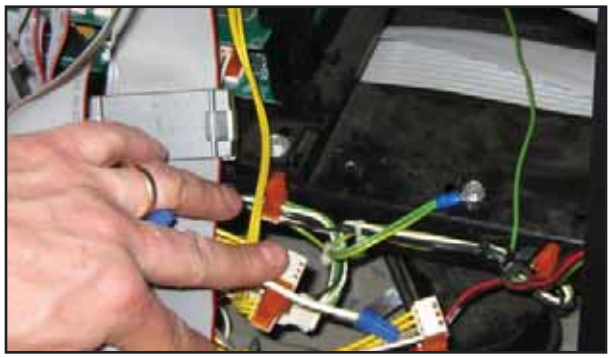

Figure 5: Reinstalled Ground Wire

8. Find shield covering opening in air gap and remove two bolts from shield. Retain shield and bolts for future reassembly.

Figure 6: Air Gap Shield

9. Remove two screws from upper air gap knock-out cover and remove. Discard cover but keep screws for reuse.

Figure 7: Remove Screws

10. Remove two screws from lower air gap knockout cover and remove. Discard cover and screws.
11. Remove lower door from side A of dispenser using key lock on right side of door. Save door for future reassembly
12. Find potted nipple assembly, 131610. Remove all washers and nuts and set aside.
13. Pull wires from top side of potted nipple assembly through dispenser hydraulics enclosure up through opening in lower air gap knock-out.

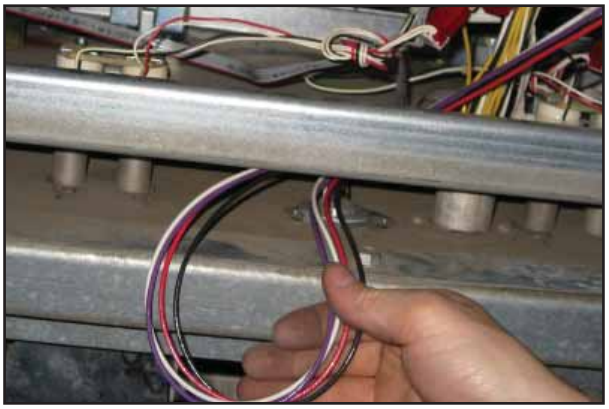

Figure 8: Potted Conduit wires

14. Attach one nut and washer onto the potted nipple assembly before pushing wires up through electrical enclosure.
15. Pull wires and then nipple assembly up into electronics enclosure. Fit washer and nut over wires and tighten nut securely in place, as shown in Figure 9.

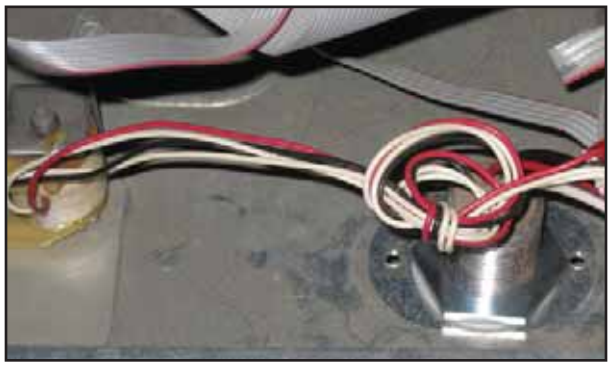

Figure 9: Potted Nipple Installed

16. Reattach air gap shield using screws previously retained in step 8.
17. Reinstall the screws previously retain in step 9. These screws seal the holes left behind by the air gap knockout.
18. Find TS-DTU/P kit and remove brackets, DTU, and hardware from box.
19. Remove cover from DTU.
20. Install mounting bracket to DTU with two screws, nuts and washers from hardware provided with DTU as described in the General Information section. Ensure that bracket is installed on correct side as shown.

Figure 10: Mounting Bracket on DTU

21. Remove two screws from IS wiring cover inside the DTU and remove cover. Retain cover and screws for reassembly
22. Find the 90 degree f tting from IS wiring kit, 020-1513. Remove nut from 90 degree f tting. Attach f tting to opening nearest IS wiring terminal block of DTU using nut previously removed.
23. Find power harness kit part number 600-0168. Find the Gilbarco Advantage power harness and ground with ring terminal as shown in f gure 4 of the Parts List.
24. Put wiring harness end with crimp connector through opening in DTU nearest terminal block J1. Attach white lead to terminal block position labeled NEUTRAL and black lead to terminal block position labeled L1 on terminal block J1 of DTU. Attach ground wire to terminal block position labeled GND of J2 on DTU.

Figure 11: DTU Power Connections

25. Move DTU assembly to dispenser nearest intended mounting location

26. Find reducer from IS wiring kit, 020-1513. From electrical enclosure, pull wires from potted nipple assembly through 3/4” opening of reducer and attach reducer to the top of the nipple assembly.
27. Find straight conduit f tting from IS wiring kit, 020-1513. From electrical enclosure, pull wires from the potted nipple assembly through opening of straight conduit f tting. Attach straight conduit f tting onto the reducer.
28. Remove nut and bushing from straight conduit f tting. Place bushing on one end of f exible conduit. Push wires from nipple assembly through bushing / f exible conduit and secure f exible conduit to straight conduit f tting using nut.

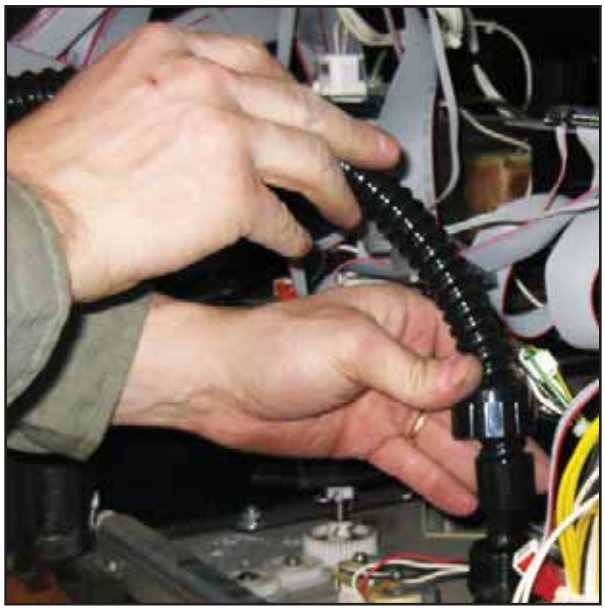

Figure 12: Attaching Flexible Conduit

29. Remove nut and bushing from 90 degree conduit f tting and push f exible conduit through nut. Put bushing on unattached end of f exible conduit. Push wires from f exible conduit through the 90 degree conduit f tting and pull excess wire into DTU. Attach f exible conduit to 90-degree f tting with nut.

Figure 13: Attach Flexible Conduit to DTU

30. Cut excess wire inside DTU allowing a length of 2” for terminal block wiring. Strip insulation $^{3}/_{8}$” from ends of wire. Attach wires to DTU terminal block as follows (DIAGRAM)

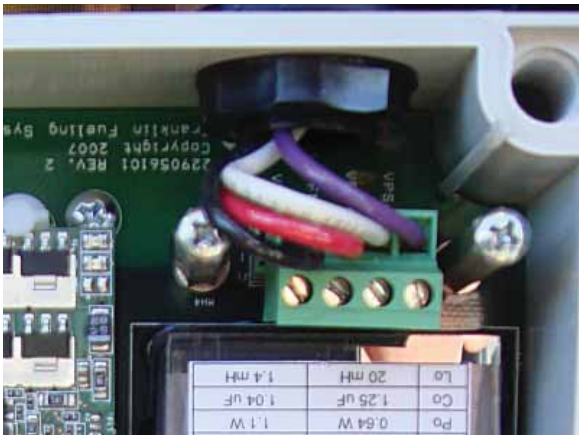

Figure 14: Attach Wiring to DTU

31. Reinstall barrier cover using screws that were removed in step 23.
32. Replace DTU cover.
33. Install the DTU assembly on the horizontal cross bracket as shown in Figure 15. Use the two screws, washers, and nuts as supplied in the TS-DTU/P hardware kit.

Figure 15: Attach DTU Mounting Bracket

34. Find input connector on AC distribution wiring harness and disconnect.
35. Insert new power harness with ferrites between input power and AC distribution harness.

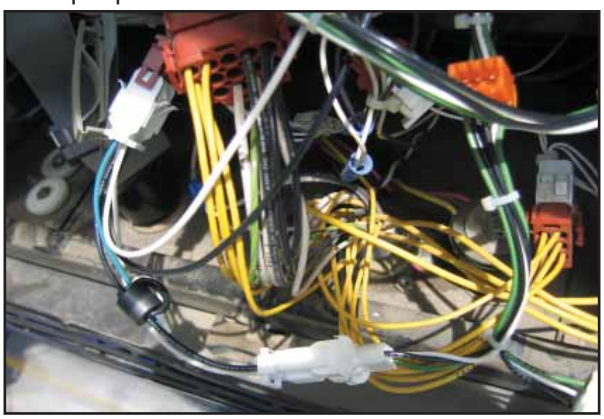

Figure 16: Connecting to Dispenser Power

36. Attach ring terminal of DTU ground wire to dispenser with bolt, nut and star washer.

Figure 17: Attach Ground Wire

37. Use wire-wrap ties to attach excess wires from AC wiring harness together.
38. Use wire-wrap ties to attach excess wire from DTU power harness and ground away from door and gears.
39. Find cable assembly extending from TS-VFM vapor meter in dispenser hydraulics enclosure.
40. Find wiring from previously installed potted nipple assembly inside hydraulics enclosure.
41. Find two wire-splice connector kits. Inside hydraulics enclosure, connect black wire from potted nipple assembly to black wire from TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
42. Inside the hydraulics enclosure, connect red wire from the potted nipple assemble to red wire from the TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
43. Find cable extending from TS-VPS inside hydraulics enclosure. Cut yellow and blue leads from end of cable.
44. Find purple and white wires from potted nipple assembly in hydraulics enclosure. Strip wiring insulation $^{3}/_{8}$" from end of wire.
45. Using wire nuts provided with kit, attach purple wire from potted nipple assembly to black wire of TS-VPS and white wire from potted nipple assembly to white wire of the TS-VPS.
46. Close main doors on Side A and Side B.
47. Engage main door latches located in both option openings for each side. Refer to f gure 2 & 3.
48. Tighten the three bolts at the bottom of each main door assembly. See f gure 1.
49. Reinstall side A lower dispenser door. Firmly attach using key lock on right side of door.

Gilbarco Encore 300 and 500 Series

This section illustrates the basic components needed to retrof t a TS-DTU module into an existing dispenser. This system can be installed in any “Non-Vapor or Vapor Ready” dispenser including dispensers with existing “Balance” or “VacAssist” piping.

1. Unlock interface doors on both sides of dispenser. Open two latches on left side of interface door and open main doors.

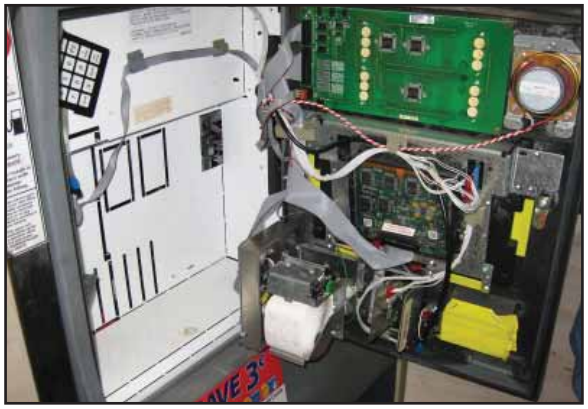

Figure 1: Open Doors

2. Find TS-DTU/P from kit and remove brackets, DTU, and hardware from box.
3. Remove cover from DTU.
4. Install mounting bracket to DTU using two screws, nuts and washers from hardware provided with DTU as described in the General Information section. Make sure the bracket is installed on correct side as shown.

Figure 2: Install Mounting Bracket

5. Install the DTU assembly on the horizontal cross bracket as shown in Figure 3. Use the two screws, washers, and nuts as supplied in the TS-DTU/P hardware kit.

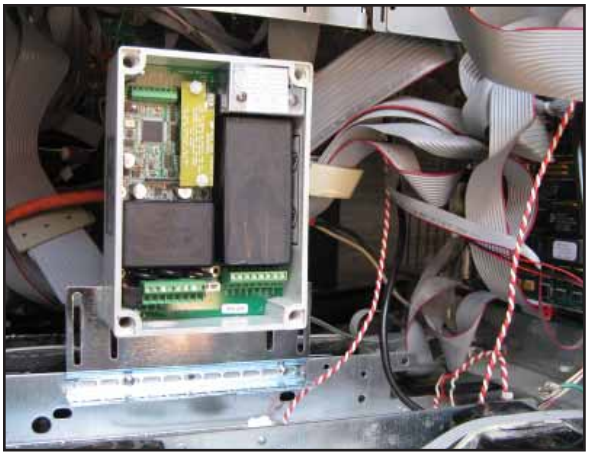

Figure 3: Mount DTU in Dispenser

6. Find power harness kit part number, 600-0167. Find the Gilbarco power harness as shown in f gure 4 of the Parts List. Remove tie-wraps and uncoil. The Gilbarco cable will have green ground wire.
7. Inside dispenser, f nd the incoming power connection. Attach the new power extension cable between the original dispenser power connectors. Notice that the wire colors match up with the original connection.

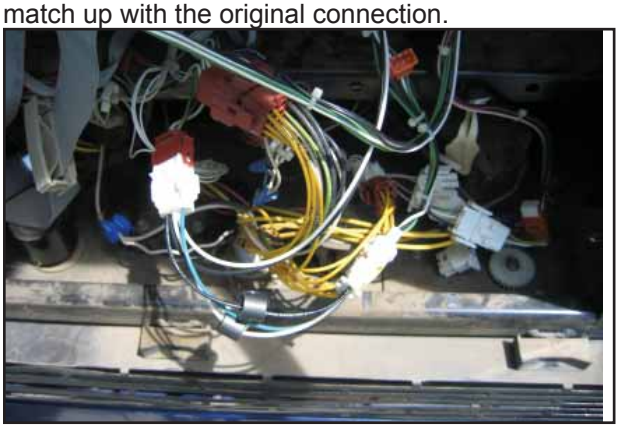

Figure 4: Power Distribution Wires

8. Carefully route DTU power wiring harness to DTU.

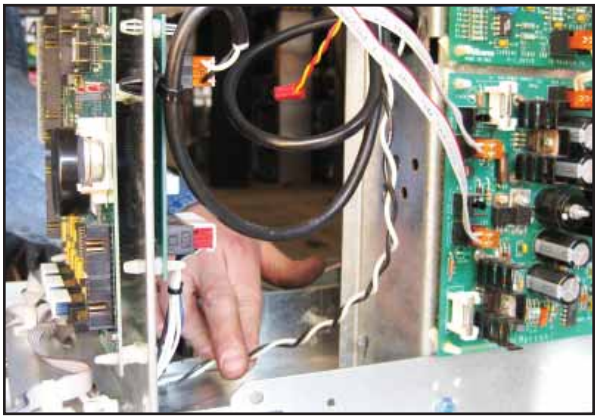

Figure 5: Power Wiring

9. Route crimp terminal end of harness through opening in the bottom of the DTU and connect white lead to terminal block position labeled NEUTRAL and black lead to terminal block position labeled L1 on terminal block J1 of DTU.

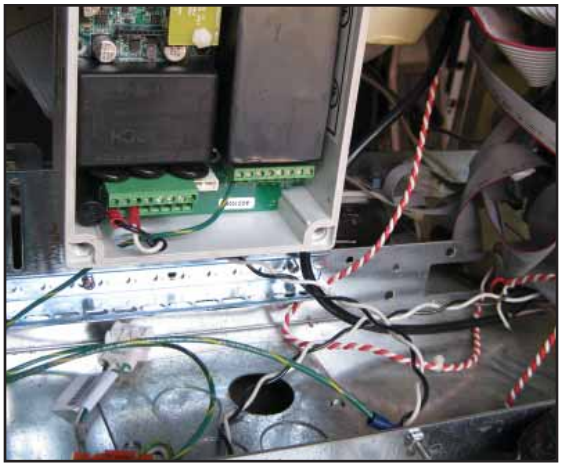

Figure 6: Connect Power Leads

10. Find ground wire from power harness kit 600-0167. Remove ties and uncoil. From end without ring coil, strip insulation 3/8” from end of wire.
11. Route ground wire end with out ring terminal through DTU and secure to terminal block.
12. Attach ring terminal of ground wire to dispenser bracket using screw and nut as shown. Coil excess wiring and tie it to ensure that it does not interfere with door closing.

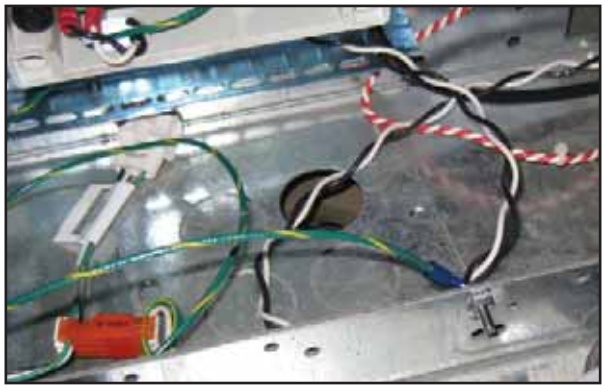

Figure 7: Attach Ground Wire

13. Find side of dispenser opposite of power supply. Remove lower door on that side of dispenser by loosening two screws.
14. Remove lower doors on both sides of dispensers. Set doors aside and save for later assembly
15. Find knockout panel on the bottom of the electrical enclosure closest to the DTU (See Figure 7).
16. Using screwdriver, remove one knockout plug from knockout panel.
17. Find potted nipple assembly, 131610. Undo wire ties and uncoil wiring.
18. Remove top nut from potted nipple and remove one washer by pulling over wire leads. Keep nut and washer for future use.
19. Pull wires from top of potted nipple assembly up through the opening created in step 16 from the hydraulics enclosure to the electrical enclosure. Ensure that wiring is not damaged by sharp edges.

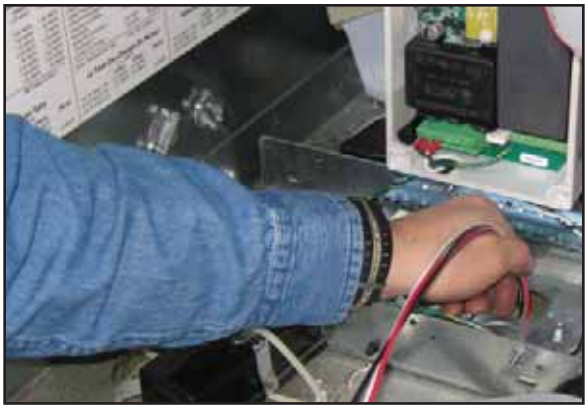

Figure 8: Pulling Wires Through Opening

20. Pull top of potted nipple assembly through the bottom of the electrical enclosure as shown in Figure 9.

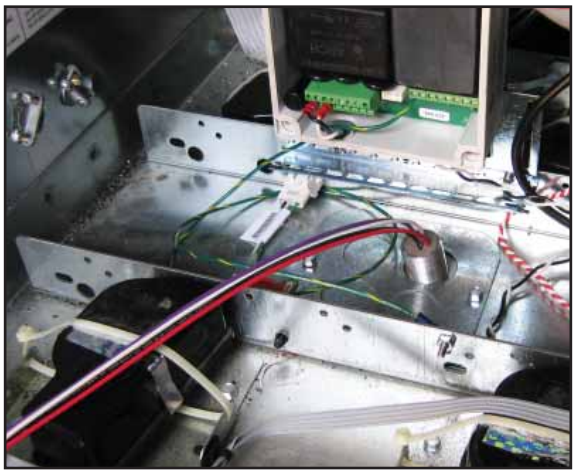

Figure 9: Potted Nipple in Position

21. Put wires in electrical enclosure through washer and nut that were removed from potted nipple assembly in step 18.
22. Tighten nut to tightly hold potted nipple assembly.
23. Find reducer from IS wiring kit, 020-1513. From electrical enclosure, pull wires from the potted nipple assembly through ¾” opening of reducer and attach reducer to the top of the nipple assembly.

24. Find straight conduit f tting from IS wiring kit 020-1513. From electrical enclosure, pull wires from the potted nipple assembly through opening of straight conduit f tting. Attach straight conduit f tting onto the reducer. Refer to Figure 10.

Figure 10: Reducer Installed

25. Remove two screws from IS wiring cover inside the DTU and remove cover. Keep cover and screws for future reassembly.
26. Find the 90-degree f tting from IS wiring kit, 020-1513. Remove nut from 90-degree f tting. Attach f tting to opening of DTU nearest the IS connector using nut previously removed.

Figure 11: 90-degree Fitting Installed

27. Find the f exible conduit from the IS Wiring Kit, 020-1513. Using 90-degree f tting and straight f tting installed earlier, determine length of f exible conduit assembly needed and cut to f t. Refer to Figure 12.

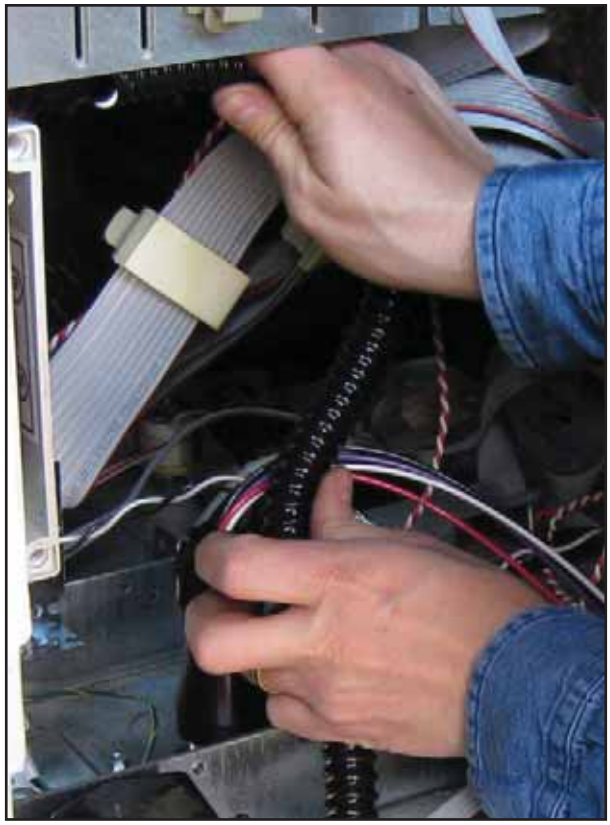

Figure 12: Flexible Conduit Installation

28. Pull wires from potted nipple assembly through f exible conduit.
29. Remove nut and bushing from straight conduit f tting.
30. Push bushing onto end of f exible conduit and reattach to straight f tting using nut.
31. Remove bushing and nut from 90-degree conduit f tting on DTU and pull wiring / f exible conduit through.
32. Route wires through 90-degree conduit f tting and pull into the DTU enclosure.

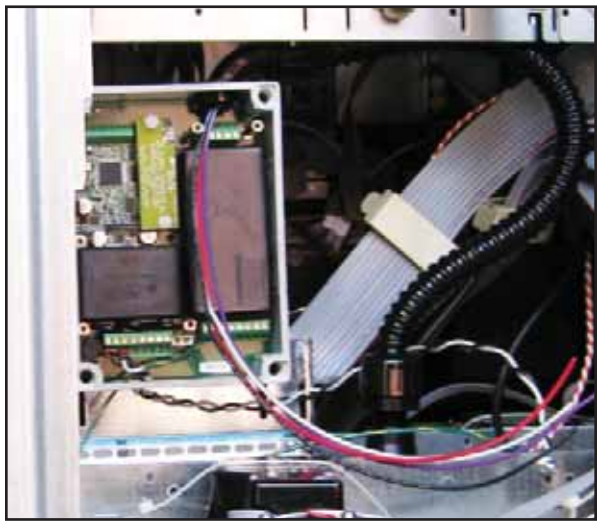

Figure 13: Wires in Flexible Conduit

33. Using nut and then bushing, attach f exible conduit to 90-degree conduit f tting.

34. Cut excess wire inside DTU allowing a length of 2” for terminal block wiring. Strip wire insulation 3/8” from the end. Connect wires to DTU terminal block.

Figure 14: Wiring Connection to DTU

35. Reinstall barrier cover using screws from step 23.

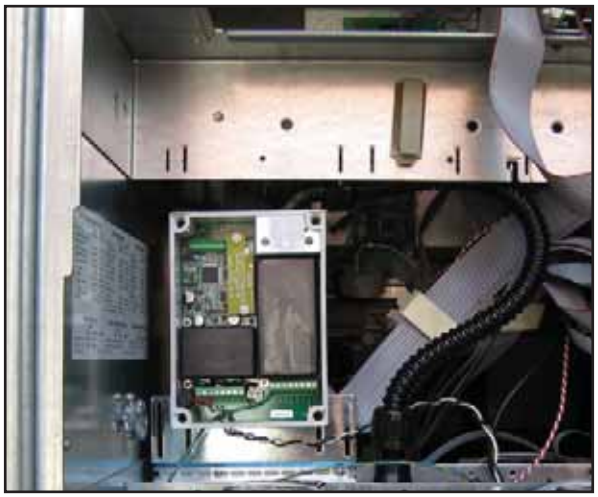

Figure 15: Reinstall Barrier

36. Replace DTU cover.

Figure 16: Replace Cover

37. Find cable assembly extending from TS-VFM vapor meter in dispenser hydraulics enclosure.
38. Find wiring from previously installed potted nipple assembly inside hydraulics enclosure.
39. Find two wire splice connector kits. Inside hydraulics enclosure connect black wire from potted nipple assembly to black wire from TS-VFM f ow meter by putting each lead into an opening in the wire splice connector and push f tting closed to lock.
40. Inside the hydraulics enclosure, connect red wire from the potted nipple assemble to red wire from the TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
41. Find cable extending from TS-VPS inside hydraulics enclosure. Cut yellow and blue leads from end of cable.
42. Find purple and white wires from potted nipple assembly in hydraulics enclosure. Strip wiring insulation 3/8” from end of wire.
43. Using wire nuts provided with kit, attach purple wire from potted nipple assembly to black wire of TS-VPS and white wire from potted nipple assembly to white wire of the TS-VPS.
44. Attach lower hydraulics covers to dispenser and secure each using key lock.
45. Close both main doors of dispenser. Securely attach the two latches on the left side of each interface door.
46. Close both interface doors and lock.

Tokheim Premier B (422B)

This section illustrates the basic components needed to retrof t a TS-DTU module into an existing dispenser. This system can be installed in any “Non-Vapor or Vapor Ready” dispenser including dispensers with existing “Balance” or “VacAssist” piping.

Note: Conduit knockouts measure 1 1/4”. Holes are too small for conduits to make a good seal. These knockouts cannot be used. New conduit knockouts will need to be made.

1. Open right options door with key on Side A of dispenser. Side A has manufacturer’s nameplate. Remove door and set aside for future installation.

Figure 1: Unlocking door

2. Open printer door on B side of dispenser.

Figure 2: Unlock Printer Door

3. Unlock right options door on B side of dispenser.

Figure 3: Release Latch

4. Release latch on display cover on B side of dispenser.

Figure 4: Lower Display Assembly

5. Loosen two screws on display assembly and lower it.
6. Remove lower hydraulics door from side A of dispenser by releasing key lock on either side of door.
7. From side A of dispensers, examine opening on right side of electrical enclosure. Choose drilling location ensuring that components in electrical enclosure and hydraulics enclosure will not be disturbed by the drilling. Use washer to insure proper clearance after install.

Figure 5; Mark Drilling Location

8. Using a low speed pneumatic drill, drill a small pilot hole through the bottom of the electrical enclosure.

Note: During drilling, put a catch pan under the drilling location to catch shavings and metal f ling during drilling operation.

9. Carefully remove all metal f ling and shavings from inside of electrical enclosure.

10. Using a ¾" conduit hole punch, open hole previously drilled.

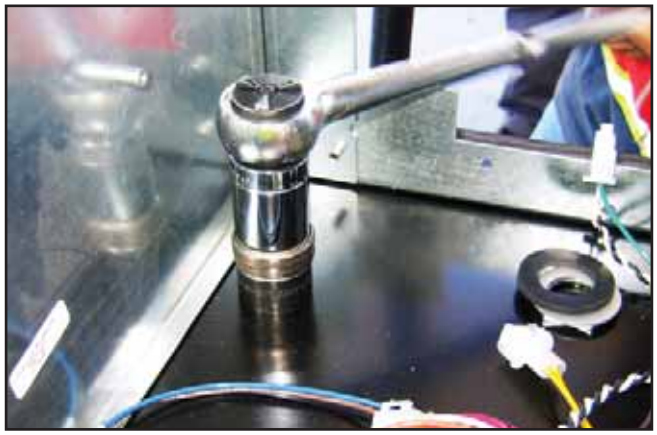

Figure 6: Use Hole Punch

11. Find potted nipple assembly, 131610. Undo wire ties and unwind wiring.
12. Remove and dispose of rubber washer from assembly.
13. Remove top nut and washer from potted nipple. Keep nut and washer for future use.
14. Pull wires from top of potted nipple assembly up from the hydraulics enclosure to the electrical enclosure. Make sure wiring is not damaged by sharp edges.
15. Pull top of potted nipple assembly through opening in electrical enclosure. Push wires inside electrical enclosure through washer and nut retained in step 13. Securely attach potted nipple assembly by tightening nut.

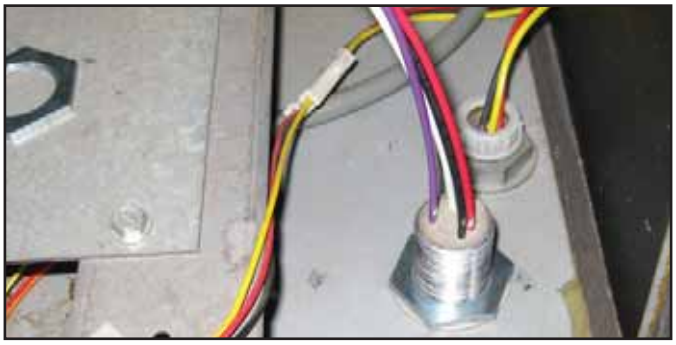

Figure 7: Potted Nipple Assembly Attached

16. Find reducer from IS wiring kit 020-1513. From electrical enclosure, pull wires from the potted nipple assembly through ¾" opening of reducer and thread reducer to the top of the nipple assembly.
17. Find straight conduit f tting from IS wiring kit. From electrical enclosure, pull wires from the potted nipple assembly through opening of straight conduit f tting. Attach straight conduit f tting onto the reducer.
18. Find TS-DTU/P kit and remove brackets, DTU, and fasteners from box.
19. Remove cover from DTU.

Figure 8: DTU Open

20. Install mounting bracket to DTU with two screws, nuts and washers from hardware provided with DTU as described in the General Information section. Ensure that bracket is installed on correct side as shown.
21. Remove two screws from IS wiring cover inside the DTU and remove cover. Retain cover and screws for future reassembly
22. Find 90-degree f tting from IS wiring kit. Remove nut from 90-degree f tting. Attach f tting to opening nearest IS wiring terminal block of DTU using nut previously removed.

Figure 9: Attach 90-degree Fitting

23. Find power harness kit part number 600-0165. Find the Tokheim power harness and ground wire with ring terminal as shown in f gure 4 of the Parts List. Remove tie-wraps and uncoil.
24. Route wiring harness end with crimp connector through opening in DTU nearest terminal block J1. Attach white lead to terminal block position labeled NEUTRAL and black lead to terminal block position labeled L1 on terminal block J1 of DTU. Attach ground wire to terminal block position labeled GND of J2 on DTU.

25. Remove nut and bushing from straight conduit f tting. Place bushing on one end of f exible conduit. Push wires from nipple assembly through bushing / f exible conduit and attach f exible conduit to straight conduit f tting using nut.

Figure 10: Attach Flexible Conduit to Potted Nipple

26. Remove nut and bushing from 90-degree conduit f tting and pull f exible conduit through nut. Attach bushing on unattached end of f exible conduit. Pull wires from f exible conduit through the 90-degree conduit f tting and pull excess wire into DTU.
27. Attach f exible conduit to 90-degree f tting with nut.

Figure 11: Attach Flexible Conduit to 90-Degree Fitting

28. Cut excess wire inside DTU allowing a length of 2” for terminal block wiring. Strip wire insulation 3/8’ from the ends of wire. Attach wires to DTU terminal block as follows.

Figure 12: Wiring Connection to DTU

29. Reinstall barrier cover using screws uninstalled in step 23.

Figure 13: Reinstall Barrier Cover

30. Replace DTU cover.
31. Install the DTU assembly on the dispenser vertical bracket as shown in Figure 14. Use the two screws, washers, and nuts as supplied in the TS-DTU/P hardware kit.

Figure 14: DTU Attached to Dispenser

32. Route power cable along bottom of electrical enclosure and attach to AC power distribution board as shown. Ensure that wiring is kept away from sharp edges and will not interfere with door closing.
33. Plug the connector from the Tokheim power harness into available connector on AC power distribution board.

Figure 15: Connect to AC Power Board

34. Attach ring terminal of ground wire to dispenser bracket using screw and nut as shown. Coil excess wiring and secure with tie-wraps to ensure that it does not interfere with door closing.

Figure 16: Attach Ground Wire

35. Find cable assembly extending from TS-VFM in dispenser hydraulics enclosure.
36. Find wiring from previously installed potted nipple assembly inside hydraulics enclosure.
37. Find two wire splice connector kits. Inside hydraulics enclosure, connect black wire from potted nipple assembly to black wire from TS-VFM f ow meter by putting each lead into an opening in the wire splice connector and push f tting closed to lock.
38 Inside the hydraulics enclosure, connect red wire from the potted nipple assemble to red wire from the TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
39. Find cable extending from TS-VPS inside hydraulics enclosure. Cut yellow and blue leads from end of cable.
40. Find purple and white wires from potted nipple assembly in hydraulics enclosure. Strip wiring insulation 3/8”from end of wire.
41. Using wire nuts provided with kit, attach purple wire from potted nipple assembly to black wire of TS-VPS and white wire from potted nipple assembly to white wire of the TS-VPS.
42. Replace lower hydraulics door to side A and lock with key.
43. Lift the display assembly back to normal position and tighten with two attached screws.
44. Lock latch on display cover on B side of dispenser.
45. Close right options door on B side and lock.
46. Close printer door on B side and lock.
47. Close right options door on A side and lock.

Tokheim Premier C

This section illustrates the basic components needed to retrof t a TS-DTU module into an existing dispenser. This system can be installed in any “Non-Vapor or Vapor Ready” dispenser including dispensers with existing “Balance” or “VacAssist” piping.

1. Unlock left door from each side of dispenser and open the door.

Figure 1: Unlock Door

2. Release inside latch from left door assembly and open center door.

Figure 2: Release Inside Latch

3. Repeat step 2 for right door assembly.

Figure 3: Right Door Assembly

4. Find side B of dispenser. Side B will be the side without the AC distribution board. Unit will be installed on the right side of side B
5. Find TS-DTU/P kit and remove brackets, DTU, and fasteners from box.
6. Remove cover from DTU.
7. Install mounting bracket to DTU with two screws, nuts and washers from hardware provided with DTU as described in the General Information section. Ensure that bracket is installed on correct side as shown.

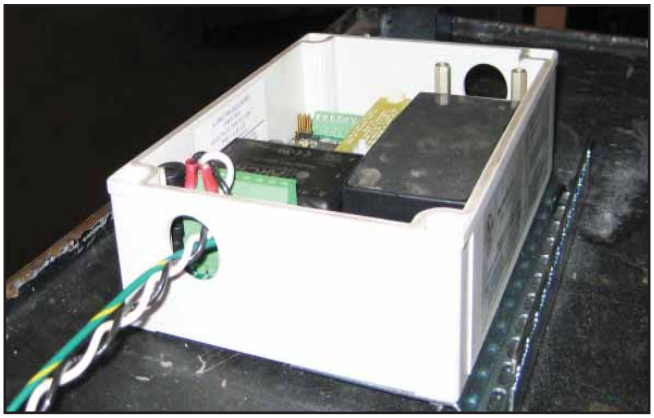

Figure 4: Attaching DTU

8. Remove two screws from IS wiring cover inside the DTU and remove cover. Keep cover and screws for future reassembly.
9. Find 90-degree f tting from IS wiring kit 020-1513. Remove nut from 90 degree f tting. Attach f tting to opening nearest IS wiring terminal block of DTU using nut previously removed.
10. Find power harness kit part number 600-0165. Find the Tokheim power harness and ground wire with ring terminal as shown in f gure 4 of the Parts List. Remove tie-wraps and uncoil.
11. Pull wiring harness end with crimp connector through opening in DTU nearest terminal block J1. Attach white lead to terminal block position labeled NEUTRAL and black lead to terminal block position labeled L1 on terminal block J1 of DTU. Attach ground wire to terminal block position labeled GND of J2 on DTU.
12. Find vapor barrier plug on bottom of dispenser electronics barrier enclosure.
13. Remove lower door on side A of dispenser (side with AC distribution board).

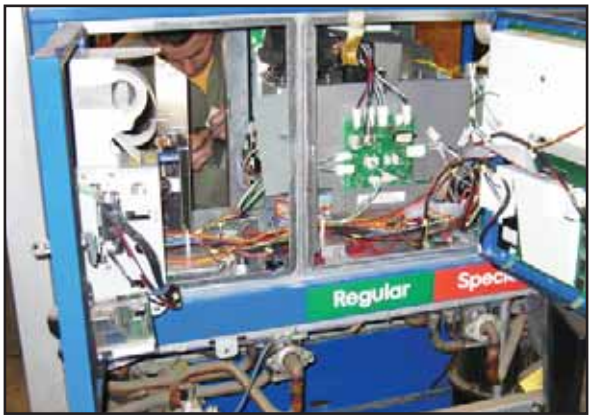

Figure 5: Remove Lower Door

14. Remove nut from top of plug using wrench.
15. Remove plug, washers, and nuts and discard all hardware.

Figure 6: Remove Nut

16. Find potted nipple assembly 131610. Untie wire ties and unwind wiring.
17. Remove and dispose of rubber washer from assembly.
18. Remove top nut from potted nipple and remove nut and one washer by pulling over wire leads. Keep nut and washer for future use.
19. Put wires from top of potted nipple assembly up from the hydraulics enclosure to the electrical enclosure. Ensure that wiring is not damaged by sharp edges.

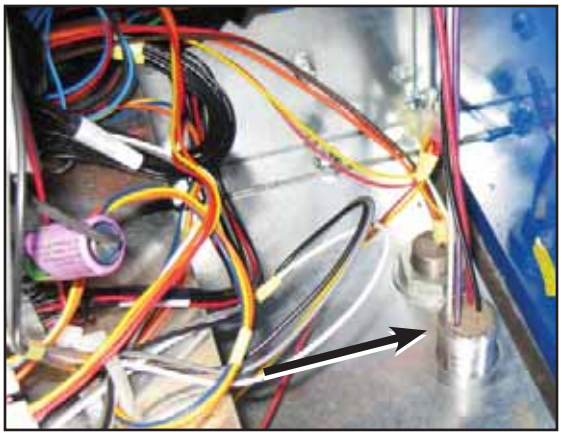

Figure 7: Potted Nipple Location

20. Push top of potted nipple assembly through opening in electrical enclosure. Pull wires inside electrical enclosure through washer and nut kept in step 8. Secure potted nipple assembly by tightening nut.

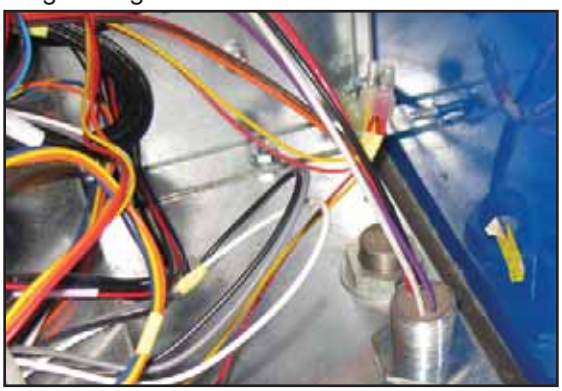

Figure 8: Potted Nipple Installed

21. Find reducer from IS wiring kit, 020-1513. From electrical enclosure, pull wires from the potted nipple assembly through ¾" opening of reducer and attach reducer to the top of the nipple assembly.

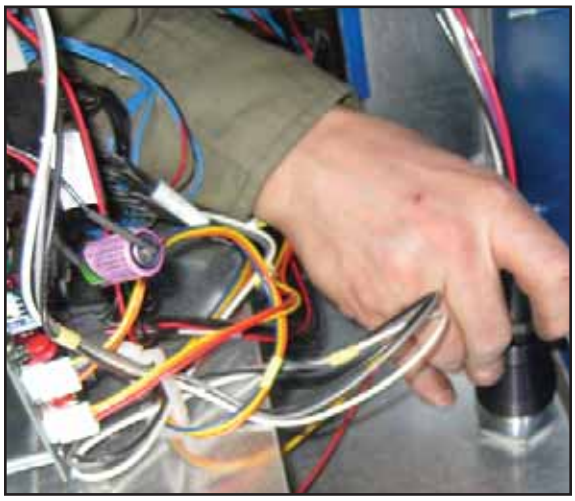

Figure 9: Attach Reducer

22. Find straight conduit f tting from IS wiring kit. From electrical enclosure, pull wires from the potted nipple f tting through opening of straight conduit assembly. Attach straight conduit f tting onto reducer.
23. Remove two screws from IS wiring cover inside the DTU and remove cover. Keep cover and screws for future reassembly.
24. Find 90-degree f tting from IS wiring kit. Remove nut from 90-degree f tting. Attach f tting to top opening of DTU using nut previously removed.
25. Find f exible conduit from IS wiring kit 020-1513. Using 90-degree f tting and straight f tting installed earlier, determine length of f exible conduit needed and cut to f t.
26. Pull wires inside electrical enclosure through f exible conduit.

Figure 10: Wire in Flexible Conduit

27. Remove nut and bushing from straight conduit f tting.

28. Push bushing onto end of f exible conduit and reattach to straight f tting using nut.

Figure 11: Flexible Conduit Connected

29. Remove bushing and nut from 90-degree conduit f tting on DTU and pull wires through the bushing.
30. Pull wires through 90-degree conduit f tting.

Figure 12: Pull wires through 90-degree fitting

31. Using nut, f rmly attach f exible conduit to 90 degree conduit f tting.

Figure 13: 90-Degree Conduit Connected

32. Cut excess wire inside DTU allowing a length of 2" for terminal block wiring. Strip wire insulation $^{3}/_{8}$" from ends of wire. Attach wires to DTU terminal block as follows.

Figure 14: Wiring Connection to DTU

33. Reinstall barrier cover using screws that were removed in step 23.
34. Replace DTU cover.

Install the DTU assembly on the supporting studs located on the vertical side of the dispenser as shown in Figure 15. Use two 10-24 locking nuts to secure the assembly to the dispenser.

Figure 15: DTU Attached to Dispenser

35. Route power cable along bottom of electrical enclosure to AC power distribution board as shown. Ensure that wiring is kept away from sharp edges and will not interfere with door closing.

Figure 16: Power Cable Installation

36. Attach connector from the Tokheim power harness into available connector on AC power distribution board.

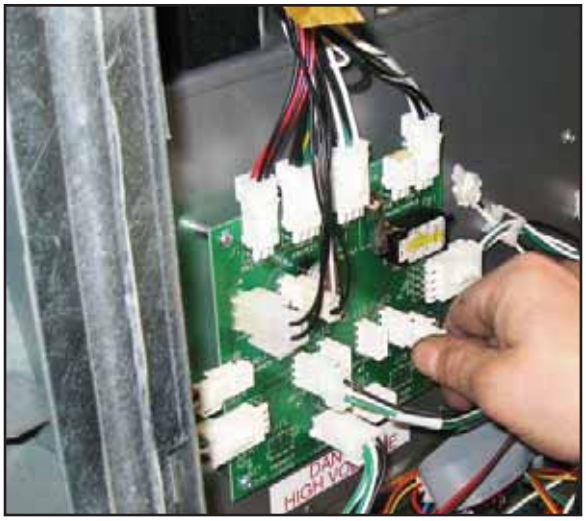

Figure 17: Attach White Connector

37. Attach ring terminal of ground wire to dispenser bracket using screw and nut as shown. Coil excess wiring with tie wraps to ensure that it does not interfere with door closing

Figure 18: Ground Wire Attached

38. Find cable assembly extending from TS-VFM vapor meter in dispenser hydraulics enclosure.
39. Find wiring from previously installed potted nipple assembly inside hydraulics enclosure.
40. Find two wire splice connector kits. Inside hydraulics enclosure connect black wire from potted nipple assembly to black wire from TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
41. Inside the hydraulics enclosure, connect red wire from the potted nipple assemble to red wire from the TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
42. Find the cable extending from TS-VPS inside hydraulics enclosure. Cut yellow and blue leads from end of cable.
43. Find purple and white wires from potted nipple assembly in hydraulics enclosure. Strip wiring insulation $^{3}/_{8}$" from end of wire.
44. Using wire nuts provided with kit, attach purple wire from potted nipple assembly to black wire of TS-VPS and white wire from potted nipple assembly to white wire of the TS-VPS.
45. Close right door assembly and tighten latch. Refer to Figure 3.
46. Close center door assembly and tighten latch. Refer to Figure 2.
47. Close and lock left options door.
48. Repeat steps 45 through 47 for opposite side of dispenser.

Wayne Ovation

This section illustrates the basic components needed to retrof t a TS-DTU module into an existing dispenser. This system can be installed in any “Non-Vapor or Vapor Ready” dispenser including dispensers with existing “Balance” or “VacAssist” piping.

1. Open the upper dispenser door on both sides by loosening two screws on each door.

Figure 1: Open Dispenser

2. Find TS-DTU/P kit and remove brackets, DTU, and hardware from box.
3. Remove cover from DTU.
4. Install the mounting bracket on DTU with two screws, nuts and washers from hardware provided with DTU as described in the General Information Section. Ensure that bracket is installed on correct side as shown.

Figure 2: Mounting Bracket Installed

5. Install the DTU assembly in the vertical dispenser bracket as shown in Figure 3. Use the two screws, washers, and nuts as supplied in the TS-DTU/P hardware kit.

Figure 3: Attach DTU to Dispenser

6. Find power harness kit part number 600-0166. Find the Wayne power harness as shown in Figure 4 of the Parts List. Remove tie-wraps and uncoil.
7. Pull wiring harness end with crimp connector through bottom of DTU. Attach white lead to terminal block position labeled NEUTRAL and black lead to terminal block position labeled L1 on terminal block J1 of DTU.

Figure 4: Attach Power Wiring

8. Inside dispenser, f nd the incoming power connection on the dispenser power supply board and disconnect.
9. Attach the Wayne power extension cable between the incoming power connector and the power supply board (Figure 5).

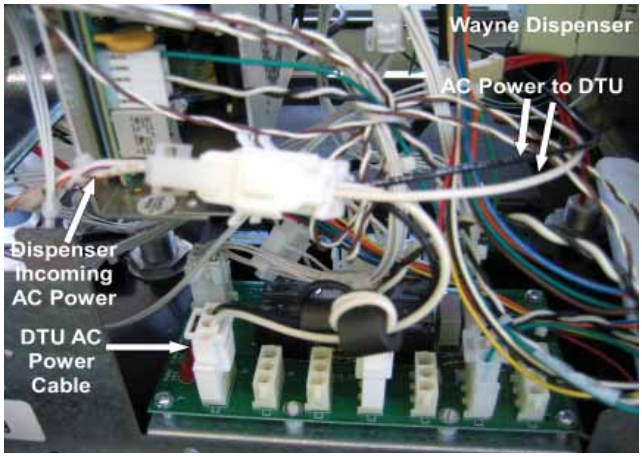

Figure 5: Attach Power extension Cable

Figure 6: Attach Power Connector to Board

10. Pull wires away from door using positioning devices included with dispenser
11. Find ground wire from power wiring harness kit. From end without ring terminal, strip 3/8” of wiring insulation.
12. Attach ground wire to terminal block position labeled GND of J2 on DTU.
13. Attach ring terminal of ground wire to dispenser bracket using screw and nut as shown. Wind excess wiring and attach with tie wraps to ensure that it does not interfere with door closing.

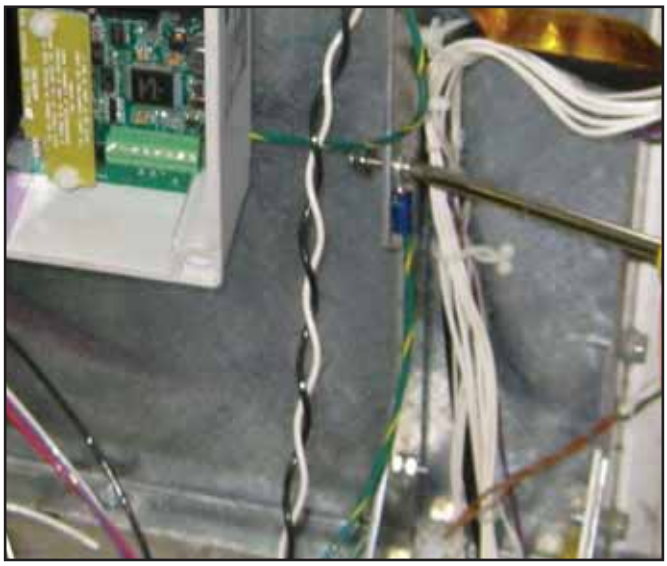

Figure 7: Attach Ground Wire to Frame

14. Find the side of dispenser opposite of power supply. Remove lower door on that side by loosening two screws. Set door aside and save for later assembly.
15. Remove nut from hole plug located at the bottom of the electrical enclosure using two wrenches. Remove bolt, nut, and washers and dispose of them.

Figure 8: Remove Hole Plug

16. Find potted nipple assembly, 131610.
17. Remove and dispose of rubber washer from assembly.
18. Turn top nut from potted nipple counter-clockwise and remove nut and one washer by pulling it over wire leads. Keep nut and washer for future use.
19. Using ¾” conduit hole punch, increase size of 1/2” hole exposed after following step 14.

Figure 9: Increase Hole Size

20. Push wires from top of potted nipple assembly up from the hydraulics enclosure through to the electrical enclosure. Make sure that wiring is not damaged by sharp edges.

Figure 10: Push Wire to Electrical Enclosure

21. Push top of potted nipple assembly through opening in electrical enclosure. Pull the wires inside electrical enclosure through washer and nut retained in step 18. Tighten potted nipple assembly nut.

Figure 11: Install Potted Nipple

22. Find reducer in IS conduit kit. From electrical enclosure, pull wires from the potted nipple assembly through ¾" opening of reducer and thread reducer to the top of the nipple assembly.
23. Find straight conduit f tting from IS wiring kit. From electrical enclosure, pull wires from the potted nipple assembly through opening of straight conduit f tting. Turn straight conduit f tting clockwise onto reducer.
24. Remove two screws from IS wiring cover inside the DTU and remove cover. Retain cover and screws for future reassembly.

Figure 12: Remove Wiring Cover

25. Find 90-degree f tting from IS conduit kit. Remove nut from 90-degree f tting. Attach f tting to top opening of DTU using nut previously removed.

Figure 13: Attach 90-Degree Fitting

26. Find f exible conduit f tting in IS conduit kit, 020-1513. Using 90-degree f tting and straight f tting installed earlier, determine length of f exible conduit needed and cut to f t.
27. Pull wires inside electrical enclosure through IS conduit assembly.
28. Remove nut and bushing from straight conduit f tting.

29. Push bushing onto end of f exible conduit and reattach to straight f tting using nut.

Figure 14: Attach Flexible Conduit to Potted Nipple

30. Remove bushing and nut from 90-degree f tting on DTU and pull wiring and f exible conduit through.
31. Pull wires through 90-degree f tting and pull into the DTU enclosure.
32. Use nut and attach f exible conduit to 90-degree f tting.

Figure 15: Attach Flexible Conduit to 90-Degree Fitting

33. Cut excess wire inside DTU allowing a length of 2” for terminal block wiring. Strip insulation 3/8” from end of wire. Attach wires to DTU terminal block as follows

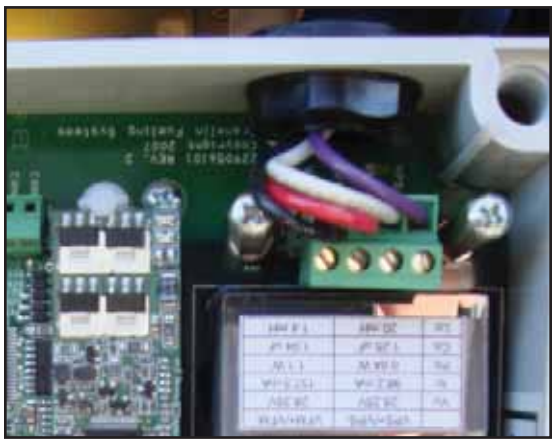

Figure 16: Terminal Block Wiring

34. Reinstall barrier cover using screws removed in step 24.
35. Replace DTU cover.

Figure 17: Attach Cover to DTU

36. Find cable assembly extending from TS-VFM vapor meter in dispenser hydraulics enclosure.
37. Locate wiring from previously installed potted nipple assembly inside hydraulics enclosure.
38. Find two-wire splice connector kits. Inside hydraulics enclosure connect black wire from potted nipple assembly to black wire from TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
39. Inside the hydraulics enclosure, connect red wire from the potted nipple assemble to red wire from the TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
40. Find cable extending from TS-VPS inside hydraulics enclosure. Cut yellow and blue leads from end of cable.
41. Find purple and white wires from potted nipple assembly in hydraulics enclosure. Strip wiring insulation at end 3/8”.
42. Using wire nuts provided with kit, attach purple wire from potted nipple assembly to black wire of TS-VPS and attach white wire from potted nipple assembly to white wire of the TS-VPS.
43. Replace lower hydraulics door using two screws on door.
44. Close dispenser doors on each side of the unit and f rmly attach with two screws located in each door.

Wayne Vista 1

This section illustrates the basic components needed to retrof t a TS-DTU module into an existing dispenser. This system can be installed in any “Non-Vapor or Vapor Ready” dispenser including dispensers with existing “Balance” or “VacAssist” piping.

1. Remove lower brand panel door using key locks.
2. Remove two thumb screws from each side of bezel and pull bezel off of dispenser
3. Remove product select connector from center bezel.

Figure 1: Lower Door Panel Open

4. Remove keypad data P2 cable, and LCD power connectors from door

NOTE: Alternate display assembly will require the removal of a fourth connector from the LCD/keypad assembly.

Figure 2: 4th Connector

5. Remove bezel and retain for future reassembly
6. Repeat steps 2 through 5 for other side
7. Using two wrenches, remove nut from hole plug found at the bottom of the electrical enclosure. Remove bolt, nut, and washers and dispose of them.

Figure 3: Remove Hole Plug

8. Find potted nipple assembly, 131610. Open wire ties and unwind wiring.
9. Remove and dispose of rubber washer from assembly.
10. Remove top nut from potted nipple and remove nut and one washer by pulling over wire leads. Keep nut and washer for future use.
11. Pull top wires of potted nipple assembly from the hydraulics enclosure to the electrical enclosure. Ensure that wiring is not damaged by sharp edges.
12. Pull top of potted nipple assembly through opening in electrical enclosure. Route wires inside electrical enclosure through washer and nut retained in step 10. Attach potted nipple assembly by tightening nut.

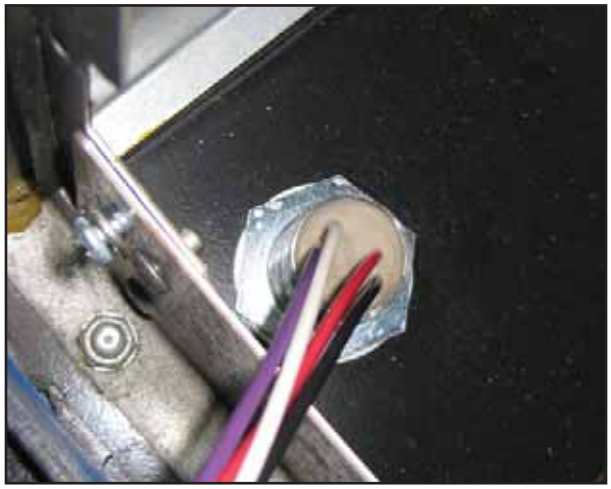

Figure 4: Potted Nipple Installed

13. Find reducer from IS conduit kit, 020-1513. From electrical enclosure, pull wires from the potted nipple assembly through ¾” opening of reducer and attach reducer to the top of the nipple assembly.
14. From electrical enclosure, pull wires from the potted nipple assembly through opening of straight conduit. Attach straight conduit f tting onto reducer.

Figure 5: Straight Conduit Installed

15. Find TS-DTU/P kit and remove brackets, DTU, and hardware from box.
16. Remove cover from DTU.
17. Attach mounting bracket to DTU with two screws, nuts and washers from hardware provided with DTU as described in the General Information Section. Ensure that bracket is installed on correct side as shown in Figure 6.

Figure 6: Mounting Bracket on DTU

18. Remove two screws from IS wiring cover inside the DTU and remove cover. Keep cover and screws for reassembly.
19. Find 90-degree f tting in IS conduit kit, 020-1513. Remove nut from 90-degree f tting. Attach f tting to opening nearest IS wiring terminal block of DTU using nut previously removed.

Figure 7: 90-Degree Fitting Installed

Note: The installation of the DTU in the dispenser will occur after all connections have been made to the DTU.

20. Find power harness kit part number 600-0166. Find the Wayne power harness and ground wire with ring terminal as shown in f gure 4 of the Parts List. Remove tie-wraps and uncoil.
21. Push wiring harness end with crimp connector through opening in DTU nearest power terminal block J1. Attach white lead to terminal block position labeled NEUTRAL and black lead to terminal block position labeled L1 on terminal block J1 of DTU. Attach ground wire to terminal block position labeled GND of J2 on DTU.

Figure 8: DTU Wiring

22. Cut connector off the Wayne power harness kit. Strip wire insulation 3/8” from the end of the wire.
23. Pull wire underneath bracket, along bottom of dispenser and through wire bushing in display assembly.

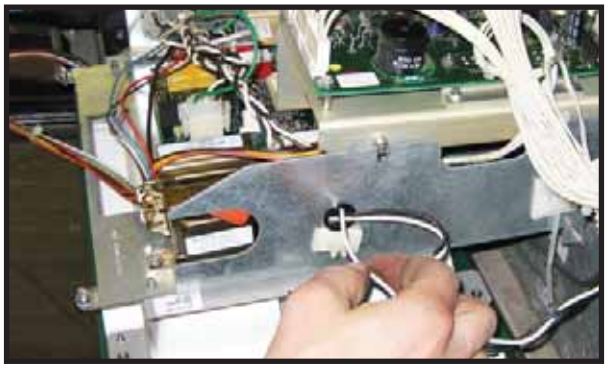

Figure 9: Power Harness Wiring

24. Find black/white pair of twisted wires inside display assembly. Cut wires, forming four leads and uncoil. Strip wire insulation 3/8” from the end of the wire.

25. Using wire nuts provided, connect all three white wires together. Connect three black wires together.

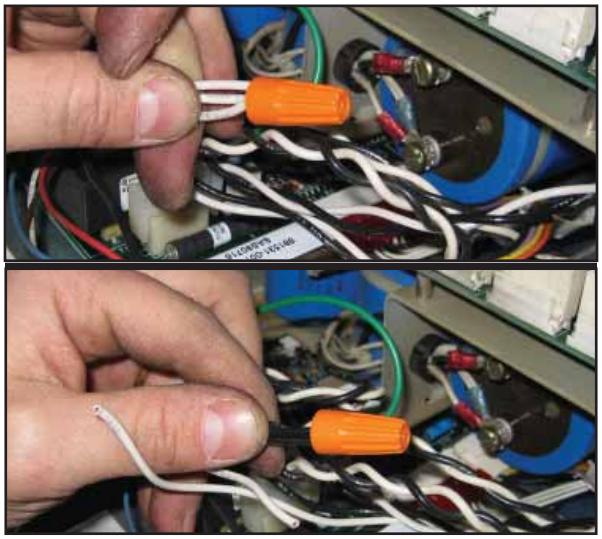

Figure 10: Connect Wires

26. Use tie-wrap to attach connections together.

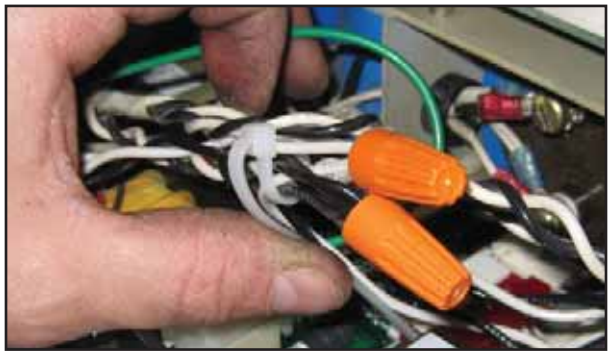

Figure 11: Wrap Wires

27. Attach wiring from power wiring harness to the side of the display assembly using adhesive backed anchor and wire tie.

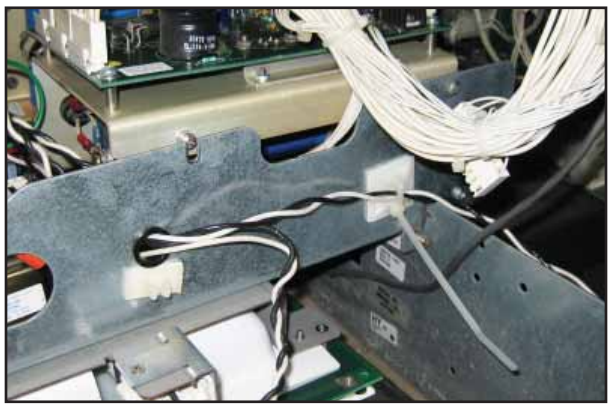

Figure 12: Attach Power Wiring Harness

28. Close display assembly and f rmly attach using two screws. Ensure that all wiring is free of sharp edges and pinching when doors close. If sharp edges or pinching is observes, use additional tie wraps and anchors to reroute wiring as necessary.
29. Attach ring terminal of ground wire to dispenser bracket using screw and nut as shown. Wind excess wiring and f rmly attach with tie wraps to ensure that it does not interfere with door closing.
30. Find straight conduit f tting and f exible conduit from IS conduit kit, 020-1513. Remove nut and bushing from straight conduit f tting. Push bushing on one end of f exible conduit. Pull wires from nipple assembly through bushing / f exible conduit and attach f exible conduit to straight conduit f tting using nut.

Figure 13: Attach Flexible Conduit

31. Remove nut and bushing from the 90-degree conduit f tting and feed f exible conduit through nut. Put bushing on unattached end of f exible conduit. Pull wires from f exible conduit through the 90-degree conduit f tting and pull excess wire into DTU. Use nut to attach f exible conduit to 90-degree f tting.

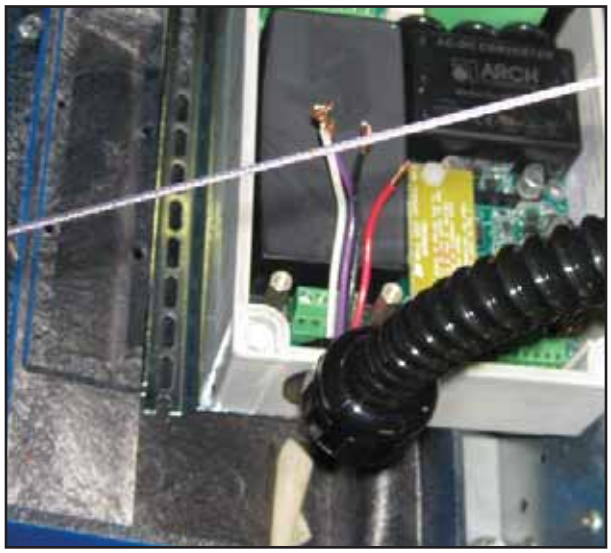

Figure 14: Flexible Conduit DTU Connection

32. Cut excess wire inside DTU allowing a length of 2” for terminal block wiring. Strip wire insulation 3/8” from the end of the wire.

33. Attach wires to DTU terminal block as follows

Figure 15: Wires Connected to DTU

34. Reinstall barrier cover using screws that were removed in step 20.
35. Replace DTU cover.
36. Install the DTU assembly on the horizontal cross bracket as shown in Figure 16. Use the two screws, washers, and nuts as supplied in the TS-DTU/P hardware kit. Take care that the f exible conduit does not interfere with the electronics on the side of the dispenser.

Figure 16: DTU Installed with Cover On

Note: Moving the 90-degree conduit f tting on DTU slightly away from the dispenser PCB board will aid in separating the conduit from the that board.

37. Find cable assembly extending from TS-VFM vapor meter in dispenser hydraulics enclosure.
38. Find wiring from previously installed potted nipple assembly inside hydraulics enclosure.
39. Find two wire splice connector kits. Inside hydraulics enclosure, connect black wire from potted nipple assembly to black wire from TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
40. Inside the hydraulics enclosure, connect red wire from the potted nipple assemble to red wire from the TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
41. Locate cable extending from TS-VPS inside hydraulics enclosure. Cut yellow and blue leads from end of cable.
42. Find purple and white wires from potted nipple assembly in hydraulics enclosure. Strip wire insulation 3/8” from the end of the wire.
43. Using wire nuts provided with kit, attach purple wire from potted nipple assembly to black wire of TS-VPS. Attach white wire from potted nipple assembly to white wire of the TS-VPS.
44. Reinstall lower hydraulic door using key-lock
45. Reinstall all connectors removed in step 3 & 4.
46. Close the bezel on the dispenser and secure using two thumb screws from each side of the bezel.
47. Repeat steps 44 & 45 for the opposite side of the dispenser.

Wayne Vista 2

This section illustrates the basic components needed to retrof t a TS-DTU module into an existing dispenser. This system can be installed in any “Non-Vapor or Vapor Ready” dispenser including dispensers with existing “Balance” or “VacAssist” piping.

1. Using key-lock, remove lower door on B side of dispenser. B side of the dispenser does not have dispenser marking at the base.
2. Open upper dispenser door on both sides by loosening two screws on each door.

Figure 1: Open Upper Dispenser Door

3. On “B” side, remove two screws holding display assembly and carefully lower into resting position.

Figure 2: Carefully Lower Door

4. DTU will be installed in the location shown below. (The DTU will not be installed until step 21) Examine the bottom of the electrical enclosure to determine location of unused hole plugs and choose the appropriate side of dispenser.

Figure 3: DTU Installed

Note: Hole plugs beneath plastic catch pans cannot be used as there is not enough clearance to install conduit f ttings.

5. Remove lower dispenser door using key lock closest to the hole plug chosen in step 2.
6. Using two wrenches, remove nut from hole plug found at the bottom of the electrical enclosure. Remove bolt, nut, and washers and dispose of them.

Figure 4: Remove Hole Plug

7. Find potted nipple assembly, 131610. Open wire ties and unwind wiring.
8. Remove and dispose of rubber washer from assembly.
9. Remove top nut from potted nipple and remove nut and one washer by pulling over wire leads. Keep nut and washer for future use.
10. Pull top wires of potted nipple assembly from the hydraulics enclosure to the electrical enclosure. Ensure that wiring is not damaged by sharp edges.
11. Pull top of potted nipple assembly through opening in electrical enclosure. Route wires inside electrical enclosure through washer and nut retained in step 9. Attach potted nipple assembly by tightening nut.

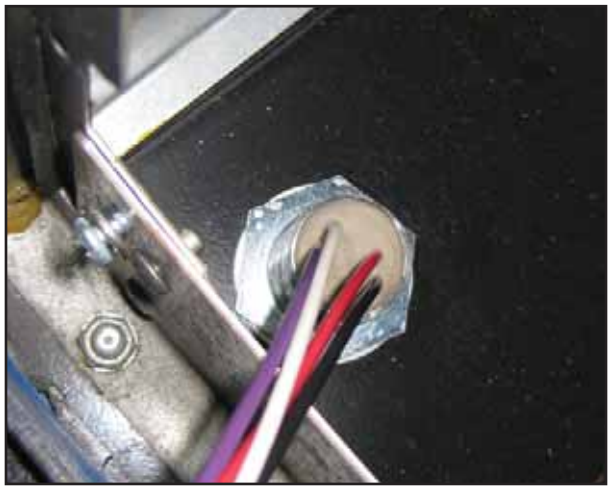

Figure 5: Potted Nipple Installed

12. Find reducer from IS conduit kit, 020-1513. From electrical enclosure, pull wires from the potted nipple assembly through ¾” opening of reducer and attach reducer to the top of the nipple assembly.

13. From electrical enclosure, pull wires from the potted nipple assembly through opening of straight conduit. Attach straight conduit f tting onto reducer.

Figure 6: Straight Conduit Installed

14. Find TS-DTU/P kit and remove brackets, DTU, and hardware from box.
15. Remove cover from DTU.
16. Install mounting bracket to DTU with two screws, nuts and washers from hardware provided with DTU, as described in the General Information Section. Make sure that bracket is installed on correct side as shown in Figure 7.

Figure 7: Mounting Bracket on DTU

17. Remove two screws from IS wiring cover inside the DTU and remove cover. Keep cover and screws for reassembly.
18. Find 90-degree f tting in IS conduit kit, 020-1513. Remove nut from 90-degree f tting. Attach f tting to opening nearest IS wiring terminal block of DTU using nut previously removed.

Note: The installation of the DTU in the dispenser will occur after all connections have been made to the DTU.

Figure 8: 90-Degree Fitting Installed

19. Find power harness kit part number 600-0166. Find the Wayne power harness and ground wire with ring terminal as shown in f gure 4 of the Parts List. Remove tie-wraps and uncoil.
20. Push wiring harness end with crimp connector through opening in DTU nearest power terminal block J1. Attach white lead to terminal block position labeled NEUTRAL and black lead to terminal block position labeled L1 on terminal block J1 of DTU. Attach ground wire to terminal block position labeled GND of J2 on DTU.

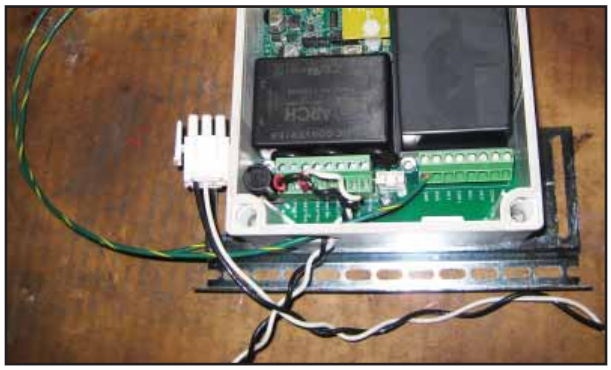

Figure 9: DTU Wiring

21. Cut both connectors off the Wayne power harness kit. Strip wire insulation 3/8” from the end of the wire.
22. Pull wire underneath bracket, along bottom of dispenser and through wire bushing in display assembly.

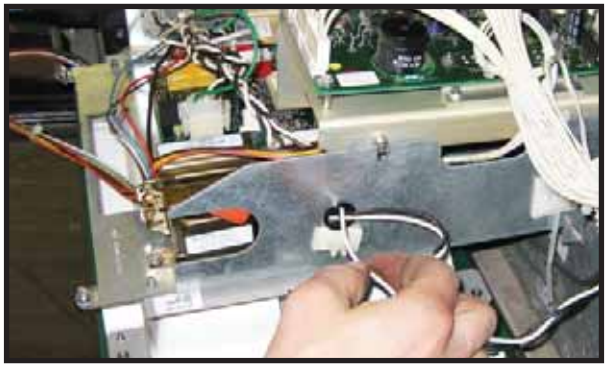

Figure 10: Power Harness Wiring

23. Dispenser supply power wires from the potted nipple. Cut wires 6 to 12 inches away from the potted nipple, forming four leads and uncoil. Strip wire insulation 3/8” from the end of each wire.

24. Using wire nuts provided, connect the incoming power, one end of the wire with the ferrite, and a wire for the DTU power.

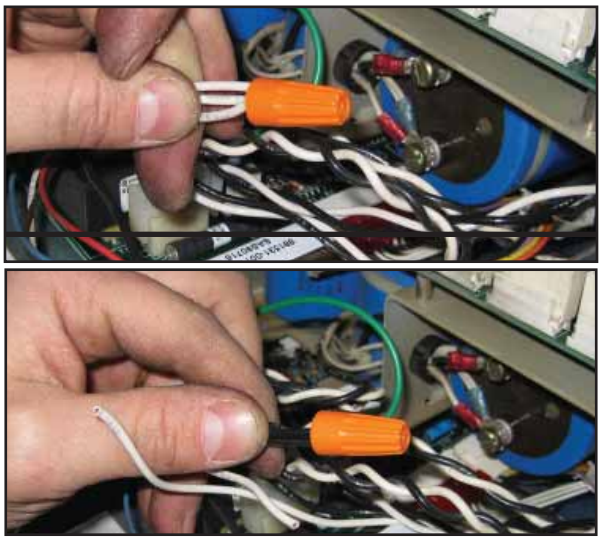

Figure 11: Connect Wires

25. Use tie-wrap to attach connections together.

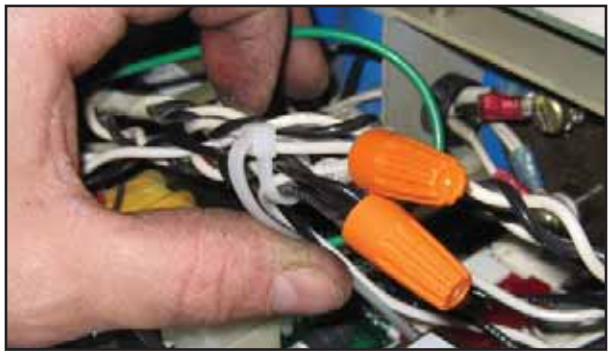

Figure 12: Wrap Wires

26. Attach wiring from power wiring harness to the side of the display assembly using adhesive backed anchor and wire tie.

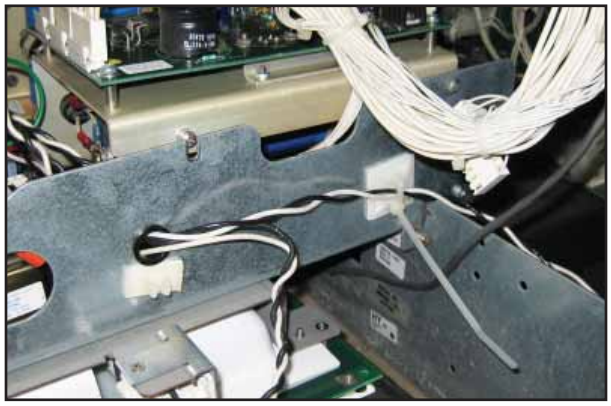

Figure 13: Attach Power Wiring Harness

27. Close display assembly and f rmly attach using two screws. Ensure that all wiring is free of sharp edges and pinching when doors close. If sharp edges or pinching is observes, use additional tie wraps and anchors to reroute wiring as necessary.

28. Attach ring terminal of ground wire to dispenser bracket using screw and nut as shown. Wind excess wiring and f rmly attach with tie wraps to ensure that it does not interfere with door closing.

29. Find straight conduit f tting and f exible conduit from IS conduit kit, 020-1513. Remove nut and bushing from straight conduit f tting. Push bushing on one end of f exible conduit. Pull wires from nipple assembly through bushing / f exible conduit and attach f exible conduit to straight conduit f tting using nut.

Figure 14: Attach Flexible Conduit

30. Remove nut and bushing from the 90-degree conduit f tting and feed f exible conduit through nut. Put bushing on unattached end of f exible conduit. Pull wires from f exible conduit through the 90-degree conduit f tting and pull excess wire into DTU. Use nut to attach f exible conduit to 90-degree f tting.

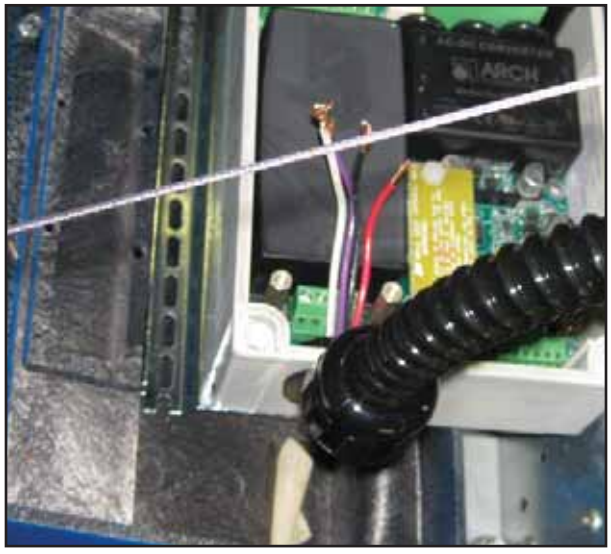

Figure 15: Flexible Conduit DTU Connection

31. Cut excess wire inside DTU allowing a length of 2” for terminal block wiring. Strip wire insulation 3/8” from the end of the wire.

32. Attach wires to DTU terminal block as follows

Figure 16: Wires Connected to DTU

33. Reinstall barrier cover using screws that were removed in step 20.
34. Replace DTU cover.
35. Install the DTU assembly on the horizontal cross bracket as shown in Figure 17. Use the two screws, washers, and nuts as supplied in the TS-DTU/P hardware kit. Make sure the f exible conduit does not interfere with electronics inside dispenser.

Figure 17: DTU Installed with Cover On

Note: Moving the 90-degree conduit f tting on DTU slightly away from the dispenser PCB board will aid in separating the conduit from the that board.

36. Find cable assembly extending from TS-VFM vapor meter in dispenser hydraulics enclosure.
37. Find wiring from previously installed potted nipple assembly inside hydraulics enclosure.
38. Find two wire splice connector kits. Inside hydraulics enclosure, connect black wire from potted nipple assembly to black wire from TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
39. Inside the hydraulics enclosure, connect red wire from the potted nipple assemble to red wire from the TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
40. Locate cable extending from TS-VPS inside hydraulics enclosure. Cut yellow and blue leads from end of cable.
41. Find purple and white wires from potted nipple assembly in hydraulics enclosure. Strip wire insulation 3/8” from the end of the wire.
42. Using wire nuts provided with kit, attach purple wire from potted nipple assembly to black wire of TS-VPS. Attach white wire from potted nipple assembly to white wire of the TS-VPS.
43. Reinstall lower hydraulic door using key-lock
44. Close upper dispenser door on each side by tightening two screws, refer to f gure 1.

Wayne Vista 3

This section illustrates the basic components needed to retrof t a TS-DTU module into an existing dispenser. This system can be installed in any “Non-Vapor or Vapor Ready” dispenser including dispensers with existing “Balance” or “VacAssist” piping.

1. Open upper dispenser door on both sides by loosening two screws on each door.

Figure 1: Open Door

2. Find the location where the DTU will be installed. (The DTU will not be installed until step 21). Examine the bottom of the electrical enclosure to determine location of unused hole plugs and choose the appropriate side of dispenser.

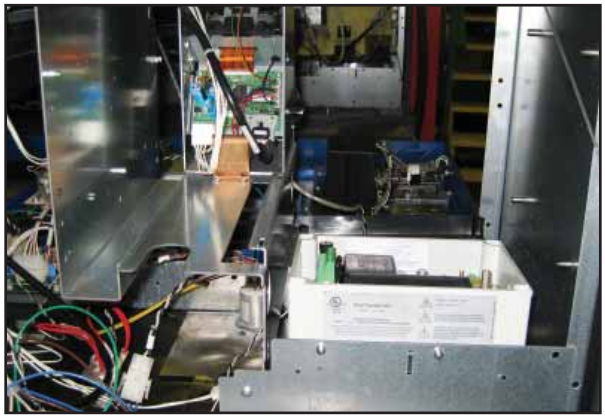

Figure 2: DTU Location

Note: Hole plugs beneath plastic catch pans cannot be used as there is not signif cant clearance to install conduit f ttings.

3. Remove lower dispenser door using key lock closest to the hole plug chosen in step 2.

Figure 3: Unlock Lower Door

4. Using two wrenches, remove nut from hole plug located at the bottom of the electrical enclosure. Remove bolt, nut, and washers and dispose of them.

Figure 4: Removing Hole Plug

Note: Opening created in the bottom of the electrical enclosure may be ½” or ¾”. If hole is ½”, it will need to be increased in ¾” in step 5. For openings that are ¾”, skip to Step 6.

5. Using ¾” conduit hole punch, increase size of ½” hole to ¾”.
6. Find and remove potted nipple assembly, 131610.
7. Remove wire ties and unwind wiring.
8. Remove and dispose of rubber washer from assembly.
9. Remove top nut from potted nipple and remove nut and one washer by pulling over wire leads. Keep nut and washer for future use.
10. Pull top wires of potted nipple assembly from the hydraulics enclosure to the electrical enclosure. Ensure that wiring is not damaged by sharp edges.
11. Pull top of potted nipple assembly through opening in electrical enclosure. Pull wires inside electrical enclosure through washer and nut retained in step 8. Firmly attach potted nipple assembly by tightening nut.

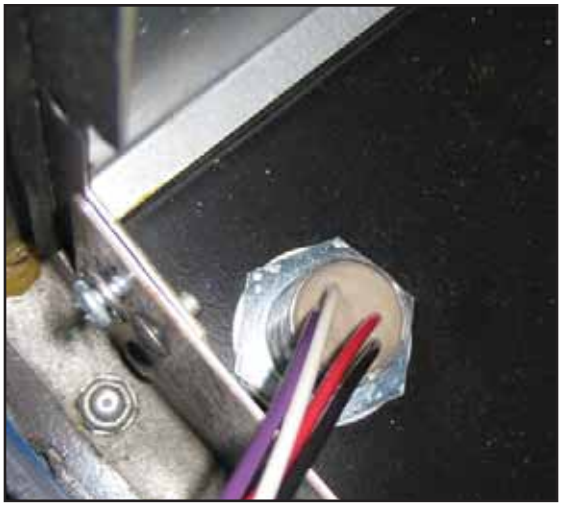

Figure 5: Potted Conduit Installed

12. Find reducer from IS conduit kit PN 020-1513. From electrical enclosure, pull wires from the potted nipple assembly through ¾" opening of reducer and thread reducer to the top of the nipple assembly.
13. Find straight conduit f tting from IS conduit kit 020-1513. From electrical enclosure, pull wires from the potted nipple f tting through opening of straight conduit f tting. Turn straight conduit f tting clockwise onto reducer.

Figure 6: Straight Conduit Installed

14. Find TS-DTU/P from kit and remove brackets, DTU, and hardware from box.
15. Remove cover from DTU.
16. Install mounting bracket to DTU with two screws, nuts and washers from hardware provided with DTU as described in the general Information Section. Ensure that bracket is installed on correct side as shown.

Figure 7: DTU Mounting Bracket Installed

17. Remove two screws from IS wiring cover inside the DTU and remove cover. Keep cover and screws for future reassembly.
18. Find 90-degree f tting from IS wiring kit. Remove nut from 90-degree f tting. Attach f tting to opening nearest IS wiring terminal block of DTU using nut previously removed.

Figure 8: 90-Degree Fitting Installed

Note: The installation of the DTU in the dispenser will occur after all connections have been made to the DTU.

19. Find power harness kit part number 600-0166. Find the Wayne power harness and ground wire with ring terminal as shown in f gure 4 of the Parts List. Remove tie-wraps and uncoil.
20. Push wiring harness end with crimp connector through opening in DTU nearest power terminal block J1. Attach white lead to terminal block position labeled NEUTRAL and black lead to terminal block position labeled L1 on terminal block J1 of DTU. Attach ground wire to terminal block position labeled GND of J2 on DTU.

21. Find the incoming power connection on the dispenser power supply board shown in Figure 9

Figure 9: Attach White Connector

22. Attach the new Wayne power extension cable between the incoming power connector and the power supply board.

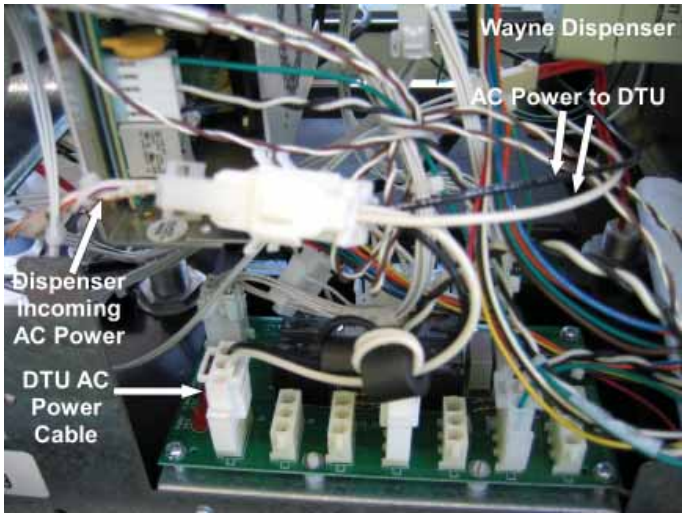

Figure 10: Attache Power Cable

23. Find straight conduit f tting and f exible conduit from IS conduit kit, 020-1513. Remove nut and bushing from straight conduit f tting. Put bushing on one end of f exible conduit.
24. Determine length of f exible conduit needed and cut to f t.
25. Push wires from nipple assembly through bushing / f exible conduit and attach f exible conduit to straight conduit f tting using nut.

Figure 11: Flexible Conduit Installation

26. Remove nut and bushing from 90-degree conduit f tting and push f exible conduit through nut. Push bushing on unattached end of f exible conduit. Pull wires from f exible conduit through the 90-degree conduit f tting and pull excess wire into DTU. Attach f exible conduit to 90-degree f tting with nut.

Figure 12: 90-Degree Fitting Installed

27. Cut excess wire inside DTU allowing a length of 2” for terminal block wiring. Strip wire insulation 3/8” from end of wire. Attach wires to DTU terminal block as follows.

Figure 13: Wires attached to DTU

28. Reinstall barrier cover using screws set aside in step 17.
29. Replace DTU cover.

30. Install the DTU assembly on the horizontal cross bracket as shown in Figure 14. Use the two screws, washers, and nuts as supplied in the TS-DTU/P hardware kit.

Figure 14: DTU Mounted

31. Attach ring terminal of ground wire to dispenser bracket using screw and nut as shown. Coil excess wiring and f rmly attach with tie wraps to ensure that it does not interfere with door closing.

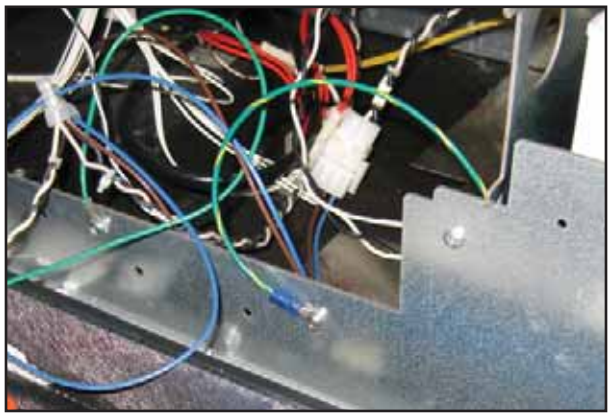

Figure 15: Ground Wire Connected

32. Find cable assembly extending from TS-VFM vapor meter in dispenser hydraulics enclosure.
33. Find wiring from previously installed potted nipple assembly inside hydraulics enclosure.
34. Find two wire splice connector kits. Inside hydraulics enclosure, connect black wire from potted nipple assembly to black wire from TS-VFM f ow meter by putting each lead into an opening in the wire splice connector and push f tting closed to lock.
35. Inside the hydraulics enclosure, connect red wire from the potted nipple assemble to red wire from the TS-VFM f ow meter by placing each lead into an opening in the wire splice connector and push f tting closed to lock.
36. Find cable from TS-VPS inside hydraulics enclosure. Clip yellow and blue leads from end of cable.
37. Find purple and white wires from potted nipple assembly in hydraulics enclosure. Strip wiring insulation 3/8” from end of wire.
38. Using wire nuts provided with kit connect purple wire from potted nipple assembly to black wire of TS-VPS. Connect white wire from potted nipple assembly to white wire of the TS-VPS.
39. Reinstall lower hydraulic door using key-lock.
40. Close dispenser doors on each side of the unit and f rmly attach with two screws located in each door.

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INCON®

Franklin Fueling Systems

Thermal Printer

Model TSSP-TMPTR

Retrofit / Installation Instructions

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Printer Installation

The following instructions are for the addition of an internal printer or replacement of an existing printer in a T5 Series Fuel Management System.

Note: The thermal printer requires controller module firmware rev 1.5 or higher.

Included with Printer:

- Plastic Bezel
- Thermal Printer on PCB (Printed Circuit Board)
- Hardware includes:
  - (2) stand-offs
  - Mounting screws (Quantity, size and use shown in chart)

Note: Use only the provided hardware to mount the printer.

		
(4) #6	**(2) #8**	**(2) #10**
For lower 4 holes in the PCB	For top of PCB, in stand-offs	For Plastic Bezel

Installation Procedure

Warning **Disconnect power before opening the console cover.**

1. Open the Tank Gauge front door.
2. Remove the front door's inside cover plate by unscrewing the screws located on the plate. (Number of screws vary by model).

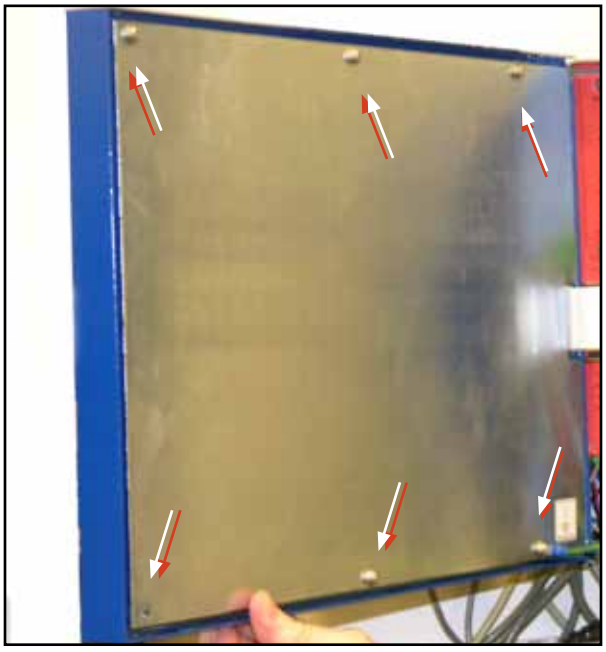


Figure 1: Remove Inside Cover Screws

To Retrofit a Printer in a Console Without One

a. Remove the 4 nuts that secure the blank-off plate.
b. Remove the plate (blank-off plate may stick to the overlay).
c. Carefully cut out the part of the overlay that covers the printer opening using a sharp knife.

Go to step 9.

3. Disconnect the cable that connects the impact printer to the interface board in the front door.

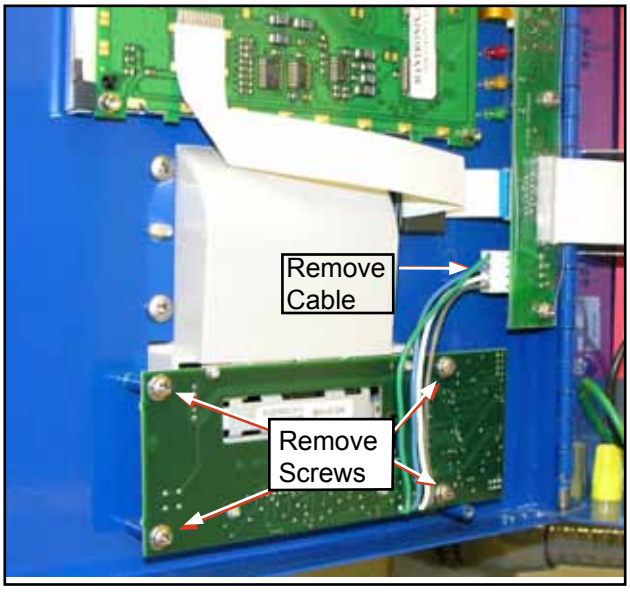


Figure 2: Disconnect Old Printer

4. Remove the roll of paper from the printer.
5. Remove the 4 screws that hold the impact printer to the front door.

Note: Be careful not to damage the ribbon cable.

6. Pull the printer gently and slowly a couple of inches away from the door. Completely remove the impact printer board.
7. Remove the 4 screws that hold the printer's plastic cover printer to the front door.

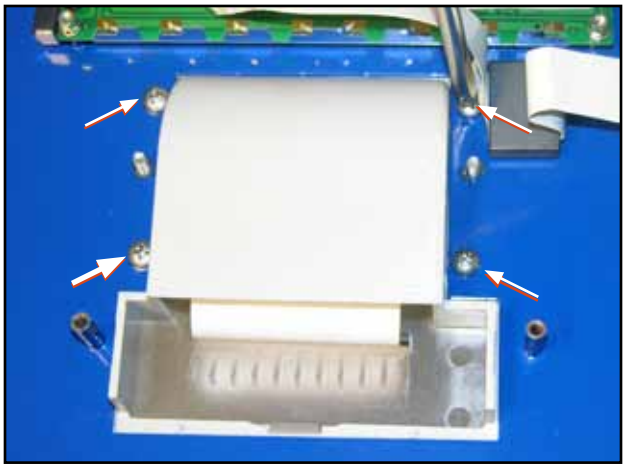


Figure 3: Remove Plastic Cover

8. Remove the plastic cover.
9. Place the new plastic bezel over the cutout in the front door. Fasten the bezel to the enclosure using the two #10 self-tapping screws supplied Start the screws in the lower two mounting holes. Do not tighten screws all the way at this time. These screws will be tightened after installing the printer assembly.
10. Install the 2 stand-offs on the studs located next to the printer opening (Figure 4).

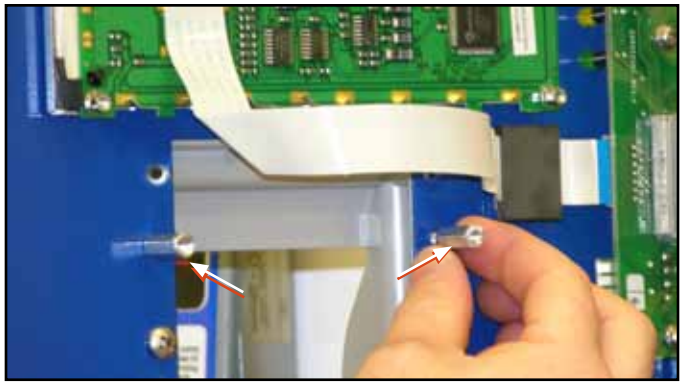


Figure 4: Install Stand-offs

11. Mount the printer so that the clear printer cover faces outward of the front door.

Figure 5: Mount Printer in Door

12. Attach the 6 screws for the thermal printer board to the front door (Figure 6). Refer to the screw chart on the previous page.

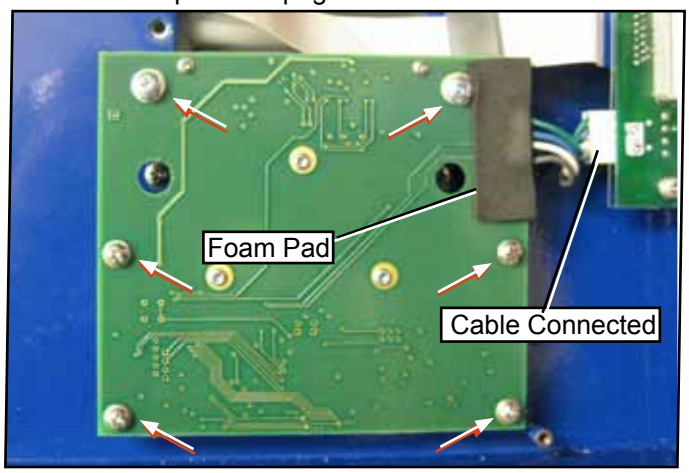


Figure 6: Printer Circuit Board Installed

13. Connect the cable from the thermal printer board to the interface board of the front door (Figure 6).
14. Tighten the two screws that hold the plastic bezel by inserting a screwdriver through the access holes in the circuit board.
15. Check to make sure the foam pad covers the corner of the circuit board where the power cables connect.
16. Replace the metal inside cover plate on the front door and fasten the screws. Make sure to reattach the ground connector to the plate.
17. Lift up on the green panel to open the printer and load paper (Figures 7-9). Make sure the roll is oriented as shown.

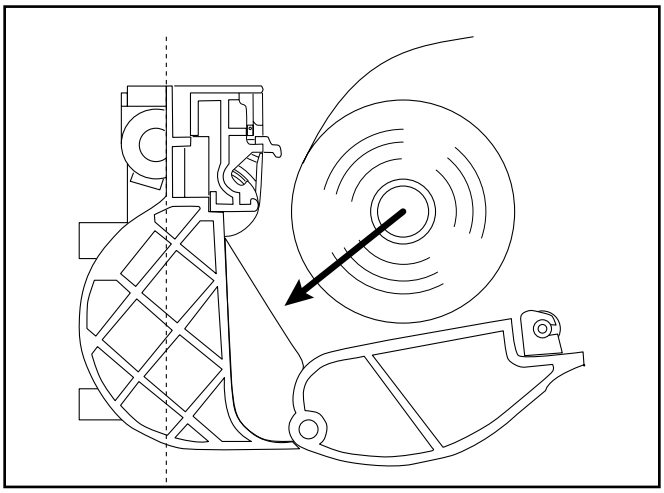


Figure 7: Load Paper

Figure 8: Do NOT load paper from door, Do NOT have paper wound loosely

Figure 9: Paper Loaded Correctly

18. Close the printer door.
19. Restore power to the tank gauge.

Paper Specifications
Type: Thermal Printer Paper
Width: 58 mm (2.28")
FFS part #: TS-TP2 (box of 5 rolls)
TS-TP2C (Carton of 20 boxes = 100 rolls)

To print a test page

1. Once the tank gauge is on, press the Main Menu key on the LCD with the figure of a table (Figure 10).

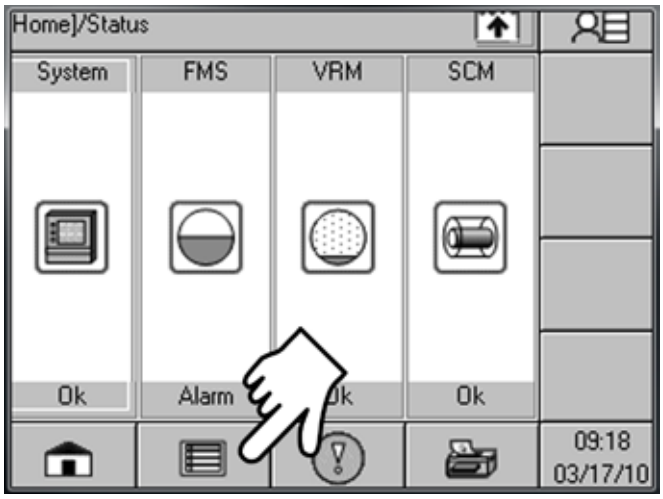


Figure 10: Select Main Menu

2. Press the arrow on the right side bar once.

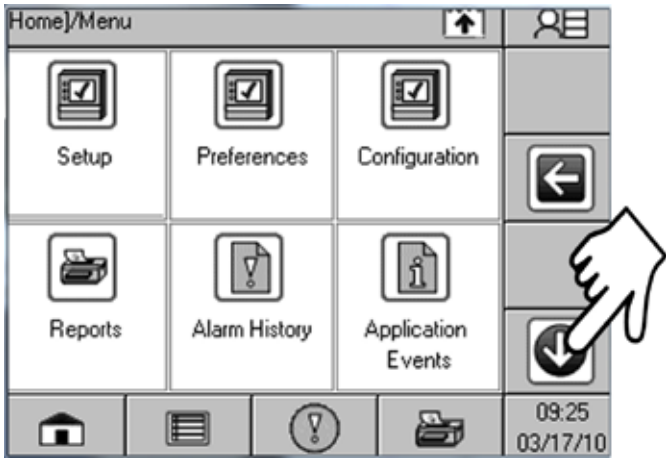


Figure 11: Select Arrow Down

3. Press ***Diagnostics***.

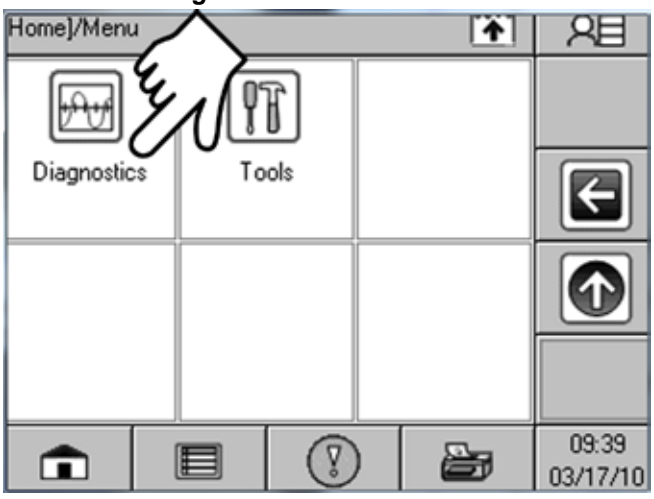


Figure 12: Select Diagnostics

4. Press ***Print Test Page***.

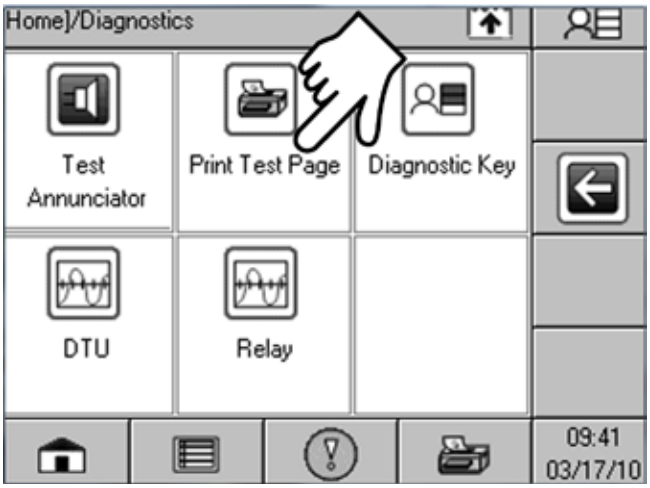


Figure 13: Print Test Page

Printer Operation Notes

- On rare occasions, when printing excessively long reports at high ambient temperature, the printer may need to pause momentarily. Printing will resume automatically after a few seconds.
- An open printer door or no-paper will generate an out-of-paper alarm.
- If you are trying to print and the paper is spooling but no text is printing, check paper roll orientation per Figure 7.
- The paper tear-bar is located at the top. Tear the paper with a lifting motion (Figure 14).

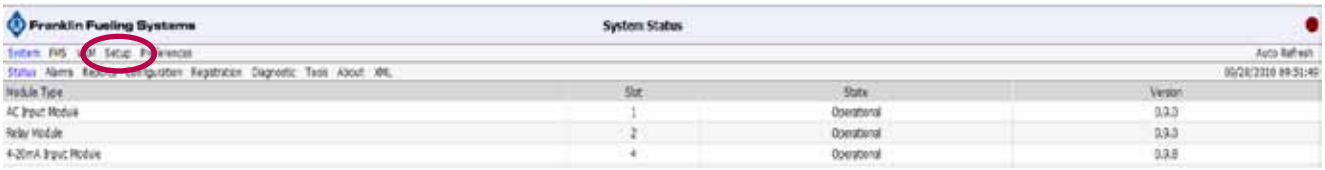
Figure 14: Tear Paper with Lifting Motion

To Setup a New Printer on a Console That Had No Printer

To physically install the printer, follow Printer Installation steps starting with step 9 on page 2.

The following steps illustrate how to program the T5 system through the computer connection when adding an internal printer. Log on to the console using a web browser interface (Refer to FMS Operator's Guide for further information).

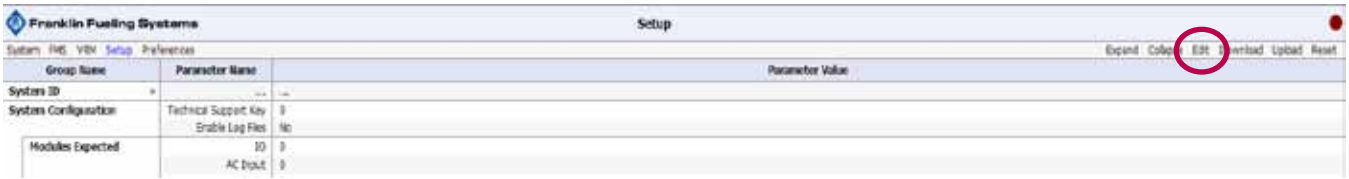
From the System Screen, click on Setup



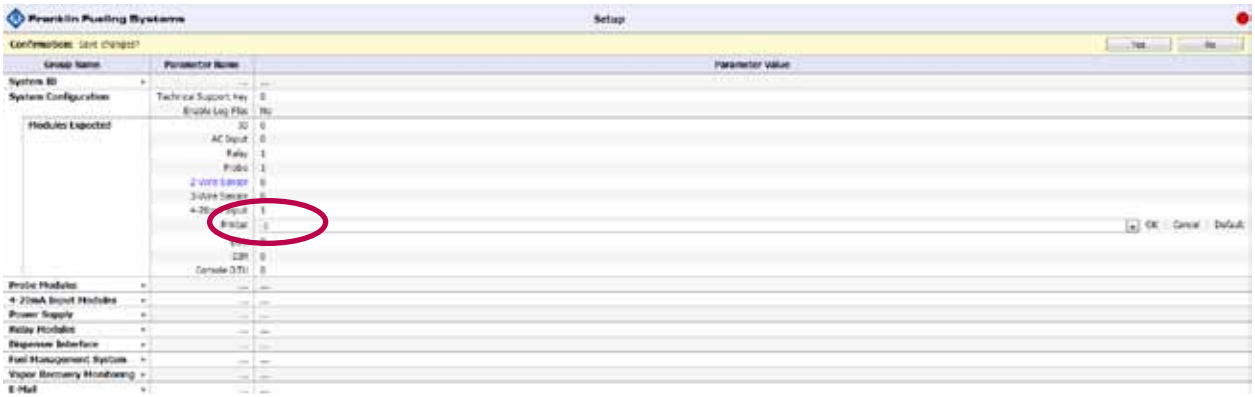
Select System Configuration

Select Modules Expected

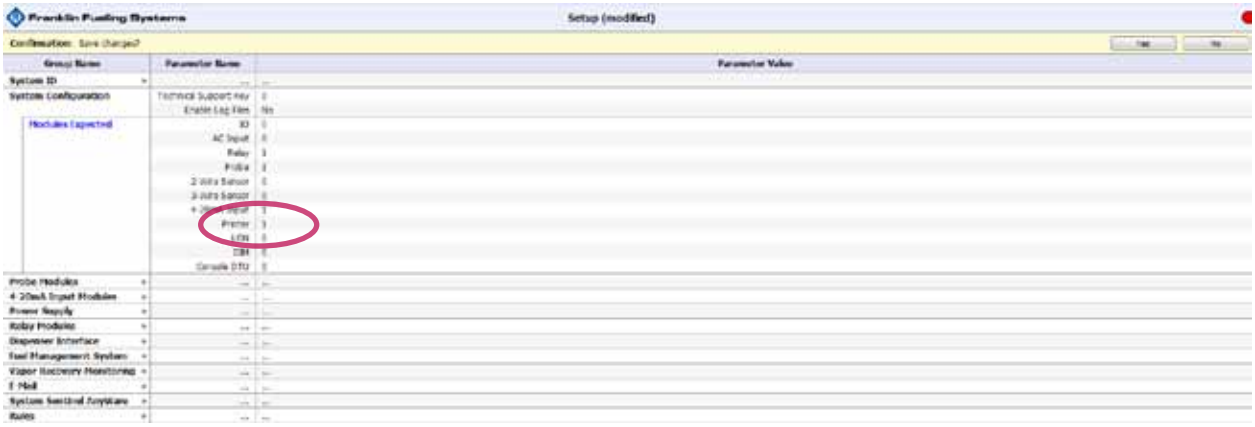
A list of all potential modules will be displayed. The number next to the module represents the number of modules that should be installed. When adding any module to the system, you must increase that module number by 1.



Click on the 0 next to Printer.

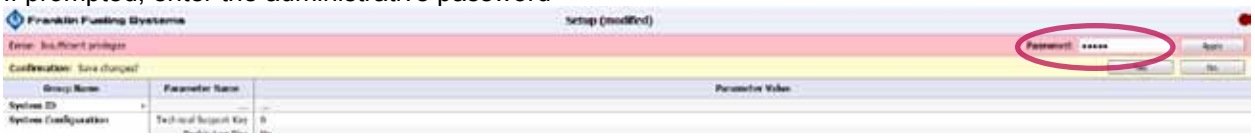


Change the 0 to a 1

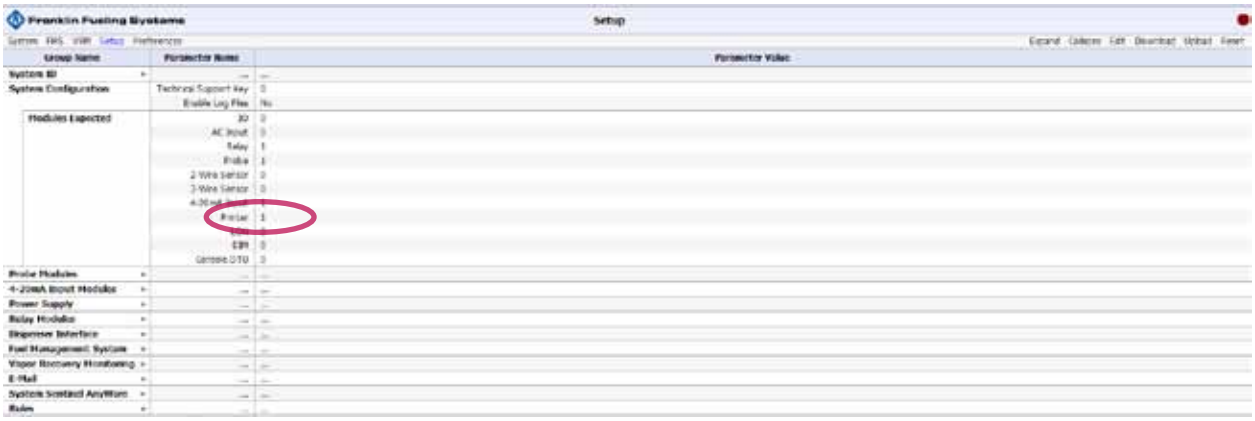


Click Yes to Save Changes

If prompted, enter the administrative password



Confirm that the Printer number is now 1. The system will now “look” for an internal printer



To Replace an Existing Thermal Printer

Warning **Disconnect power before opening the console cover.**

1. Remove the back panel shown in Figure 1.
2. Remove the 6 screws as shown in Figure 6.
3. Remove the cable connection.
4. If the existing plastic bezel will still be used, follow installation instructions starting with step 12 on page 3.
5. Print a test page to verify operation.

Franklin Fueling Systems

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Vapor Pressure Sensor for Vent Stacks

Installation Guide

VEEDER-ROOT

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DAMAGE CLAIMS / LOST EQUIPMENT

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

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

1. Contact Veeder-Root Customer Service at 800-873-3313 with the specific part numbers and quantities that were missing or received damaged.
2. Fax signed Bill of Lading (BOL) to Veeder-Root Customer Service at 800-234-5350.
3. Veeder-Root will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

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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.
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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.

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) 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).

Figures

Tables

Introduction

A Vapor Pressure Sensor monitors the pressure in a vapor containment system located at a product fueling site. The purpose of this sensor is to detect pressure leakage as well as overpressure conditions that are both considered vapor containment faults. To accomplish this, the pressure sensor is installed the vapor vent stack.

Reference Figure 1 and Figure 2 in this manual. Each Vapor Vent Line must have an enclosure with the Vapor Pressure Sensor mounted inside. Additional customer supplied hardware is required to complete this type of vapor monitoring installation.

Contractor Certification Requirements

Veeder-Root Contractor Certification Requirements	Installer Certification[6]	ATG Technician Certification[7]	VR Vapor Products Certification[8]
Install[1] ISD	X	X	X
Install PMC	X	X	X
Install CCVP	X	X	X
Install Wireless ISD/PMC	X	X	X
Installation Checkout[2]		X	X
ATG Startup[3] / Training[4] / Service[5]		X	X
ISD Startup / Training / Service			X
PMC Startup / Training / Service			X
CCVP Startup / Training / Service			X
Wireless ISD/PMC Startup / Training / Service			X
Install Pressure Sensor (ATG)	X	X	X
Maintain Pressure Sensor (ATG)		X	X
Calibrate Pressure Sensor (ATG)		X	X
Clear ATG Pressure Sensor Alarm (ATG)		X	X
Clear ISD/PMC Alarms (ISD/PMC)			X

[1]Perform wiring and conduit touting; equipment mounting
[2]Inspect wiring and conduit routing; equipment mounting
[3]Turn power on, program and test the systems
[4]Provide supervised field experience in service techniques and operations
[5]Troubleshoot and provide routing maintenance
[6]UST Monitoring Systems – Installer (Level 1)
[7]Certified UST Monitoring Technician
[8]VR Vapor Products

Warranty Registrations may only be submitted by selected Distributors. Certified installers are required to provide the GDF operator with the completed Equipment Warranty Notice, form 577013-868, for their records.

Product Marking Information

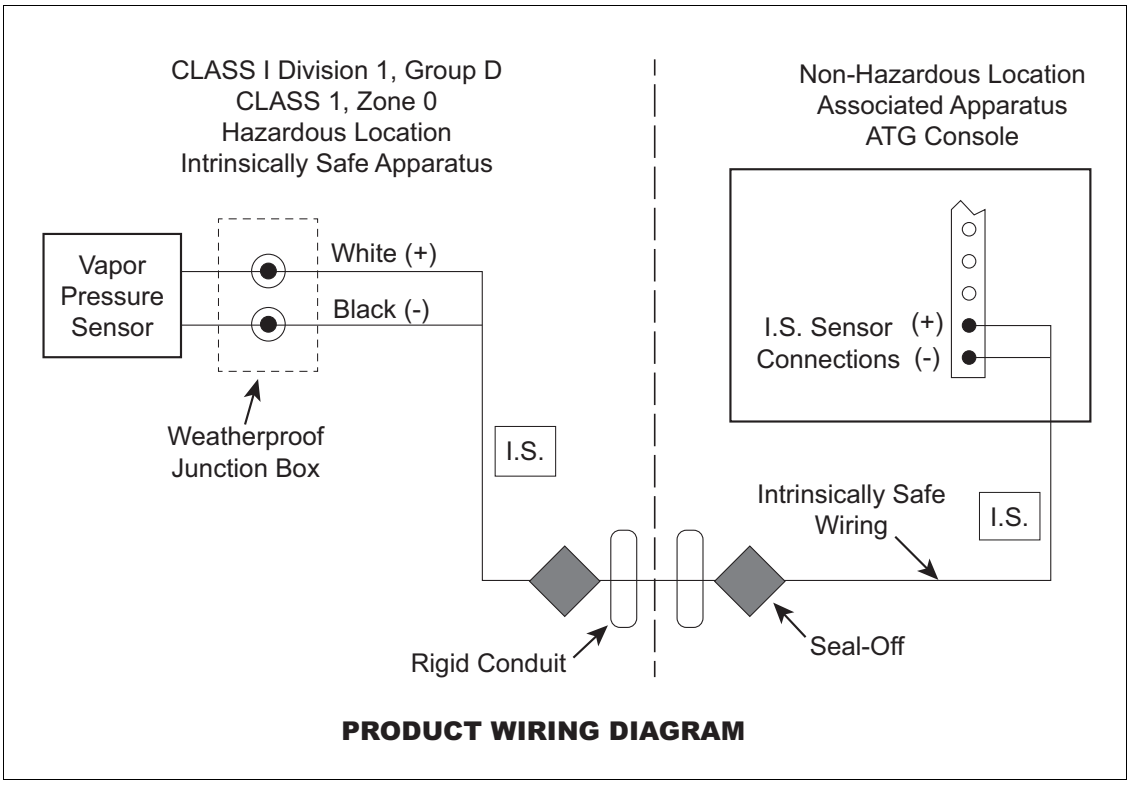
RELATED DOCUMENTS

Documents Required to Install Equipment

This intrinsically safe apparatus is only for use as part of a Veeder-Root Automatic Tank Gauging System (ATG Console with probes and sensors). To install intrinsically safe apparatus, use the specific control drawing that appears on the nameplate of the applicable associated apparatus (ATG Console):

Associated Apparatus	UL/cUL Control Drawing Number
TLS-350, TLS-350R	331940-011

The control drawings contain information related to the correct installation of the overall intrinsically Safe System. This includes information such as maximum number of apparatus, specific apparatus allowed in the system, maximum cable lengths, references to codes, proper grounding and so on. Control drawings can be found on the accompanying Compact Disk (TECH DOCS CD) or on the internet at veeder.com under SUPPORT; VR TECHNICAL DOCUMENTS; DRAWINGS.



PRODUCT WIRING DIAGRAM

Product Label Contents

VEEDER-ROOT™

I.S. CIRCUIT FOR HAZLOC SENSOR
F/N 86119X-XXX
S/N XXXXXX

CL I, DIV. 1, GP.D
CL I, ZONE 0
AEx ia IIA
Ex ia IIA
TC=T4

-40°C ≤ Ta ≤ +60°C

MANUAL NO. 577014-019

24G6
c UL us
LISTED

SECURITE INTRINSEQUE

Safety Warnings

To protect yourself and your equipment, observe the following warnings and important information:

⚠ WARNING

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

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

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

NOTE ***Failure to install this product in accordance with its instructions and warnings will result in voiding of all warranties with this product.***

Safety Symbols

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

EXPLOSIVE
Fuels and their vapors are extremely explosive if ignited.

FLAMMABLE
Fuels and their vapors are extremely flammable.

ELECTRICITY
High voltage exists in, and is supplied to, the device. A potential shock hazard exists.

TURN POWER OFF
Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.

 **WARNING** Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.	 **USE SAFETY BARRICADES** Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.
 **WEAR EYE PROTECTION** Wear eye protection when working with pressurized fuel lines or epoxy sealant to avoid possible eye injury.	 **INJURY** Careless or improper handling of materials can result in bodily injury
 **GLOVES** Wear gloves to protect hands from irritation or injury	 **READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.

Related Manuals

IOM19 VR-203 and VR-204	TLS RF Wireless 2 System (W2) Installation and Maintenance Guide
576013-879	TLS-3XX Site Prep Manual

Before You Begin

- Review and comply with all the health and safety warnings in the installation manuals and any other national or local requirements.
- When direct wiring to a TLS console, a 2-conductor, 18 AWG, or equivalent, 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. The Tygon tubing connecting the vapor pressure sensor to the drying tube must be attached to the down port of the drying tube. **The 'up' port must be left open to atmosphere.**
- For all connections requiring sealant, use only UL classified yellow Gas/TFE Teflon tape.
- Customer supplied pipe and pipe fittings shall be standard full-weight (ASTM Schedule 40, or equivalent) 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, or equivalent.

Veeder-Root Parts

Table 1. Pressure Sensor Installation Kit Form Number 861190-00X for UL/cUL approved pressure sensor

Item	Qty.	Description	P/N
1	1	Pressure sensor assembly	8611X0-X0X
2	1	Warranty registration form	576047-146
3	1	Warranty card	577013-868
4	1	Union 62CA-4, brass 1/4” tube size	514100-431
5	1	Sealing pack	514100-304
6	2	Wire nut	576008-461
7	2	Tie wrap	510901-337
8	1	Shim	332061-001
9	1	Installation manual	577014-019
10	1	Kit - vapor pressure sensor drying tube	330020-717

Table 2. Kit - Pressure Sensor Drying Tube (P/N 330020-717)

Item	Qty.	Description	P/N
1	1	Drying tube - non-indicating desiccant	514100-424
2	36”	Tubing - Tygon fuel and lube	514110-425
3	4	Tie wrap	510901-337
4	2	Self-adhesive mount - tie wrap	576008-437

Table 3. Kit - Vapor Pressure Sensor Site Start-Up Install ISD (P/N 330020-715)

Item	Qty.	Description	P/N
1	4	Male connector 68CA-4-4, brass 1/4" tube to 1/4" pipe	514100-430
2	1	Plug 59CA-4, brass 1/4" tube size	514100-432
3	1	Universal Mount Kit (assorted screws, clamps, brackets, bolts, washers and nuts)	330020-012
4	1	Cord grip	331028-001
5	1	Ball valve, 3-way, 1/4”	576008-649
6	36”	Tube - soft copper, 1/4” OD	332151-001

Table 3. Kit - Vapor Pressure Sensor Site Start-Up Install ISD (P/N 330020-715)

Item	Qty.	Description	P/N
7	2	Male elbow 169CA-4-4, brass 1/4" tube to 1/4" pipe	579066-001
8	1	Bulkhead union 62CABH-4, brass 1/4” tube size	514100-476
9	2	Washer, 0.469 x 1.125 x 0.063”, zinc	510904-573
10	1	Tube - copper, 1/4” OD, short S bend	333006-001

Table 4. Kit - Universal Enclosure (P/N 330020-716)

Item	Qty.	Description	P/N
1	1	Enclosure, NEMA 4X-modified	333004-001
2	1	Vent plug, porous, flanged, 0.17 x 0.42”	514100-477
3	1	Label - Veeder-Root	333042-001
4	1	Label - eVRgreen	333041-001
5	1	Panel, composite, modified	333005-001
6	1	Cord grip bushing	330787-004
7	2	Conduit clamp, 3”, steel, std duty	514100-482
8	1	Conduit hub	576010-715
9	2	Hex bolt - steel, 1/4-20 x 0.75”	026-620-1
10	2	Washer, flat, 1/4”, zinc	514100-374
11	2	Hex nut w/lock washer, 1/4-20	511000-251
12	2	Conduit clamp, 2”, steel - std duty	514100-478
13	1	Fitting, cap plug	027-213-1
14	1	Mounting bracket, Receiver	332315-001
15	1	Mounting bracket, Battery	332295-002
16	1	Panel nut, 7/8-16 x 1/4 thick	514100-475
17	6	Screw, #10-32 x 1/2 Taptite	510500-400
18	1	Label - universal enclosure kit	333263-001
19	1	Group - cord grip, 1/2” NPT	331028-001
20	1	Cord grip bushing	330787-002

Tools Required

1. Wrenches suitable for tightening tubing/pipe fittings.
2. Necessary pipe fitter's equipment (including tube bending and threading equipment as needed) and a non-hazardous work space suitable to modify the vapor vent stack for Vapor Pressure Sensor installation.
3. Torx bit for tamper-resistant screws (V-R P/N 330020-635).

   NOTE: this bit is required to open and close the enclosure door.

Vapor Vent Stack Installation

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.
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 1).
4. Install the vapor pressure sensor (item 1 in Table 1) vertically onto the center of the composite panel (item 5 in Table 4). Insert the sensor in the 2-inch conduit clamp using necessary bolts, nuts, and washers included in the universal mounting kit (item 3 of Table 3). Be sure the top symbol on the panel is facing upwards (see Figure 2). Wrap the rubber shim (item 8 in Table 3) 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 two169CA-4-4 male elbows (item 7 in Table 3) into each end of the 3-way calibration valve (item 5 in Table 3) as shown (see Figure 2).
6. Install one 68CA-4-4 male connector (item 1 in Table 3) into the center port of the 3-way calibration valve, and then directly attach it to the vapor pressure sensor inlet port (center) (see Figure 2).
7. Screw the 59CA-4 plug (item 2 in Table 3) onto the left port's male elbow (see Figure 2).
8. Install the two plastic enclosure mounting plates to the back of the enclosure. Use the four short flat-head screws included in the enclosure hardware bag.
9. Install the composite panel into the enclosure (item 5 in Table 4) 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 2 in Table 4) is still securely installed into the hole in the bottom of the enclosure (see Figure 2).
11. Insert the S-bend ¼" OD copper tube (item 10 in Table 3) into the right-side male elbow of the 3-way calibration valve, but do not fully tighten the compression nut (see Figure 2).
12. Locate the 62CABH-4 bulkhead union (item 8 in Table 3) and remove the compression nut and the adjustable nut then place a large washer (item 9 in Table 3) 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 2).

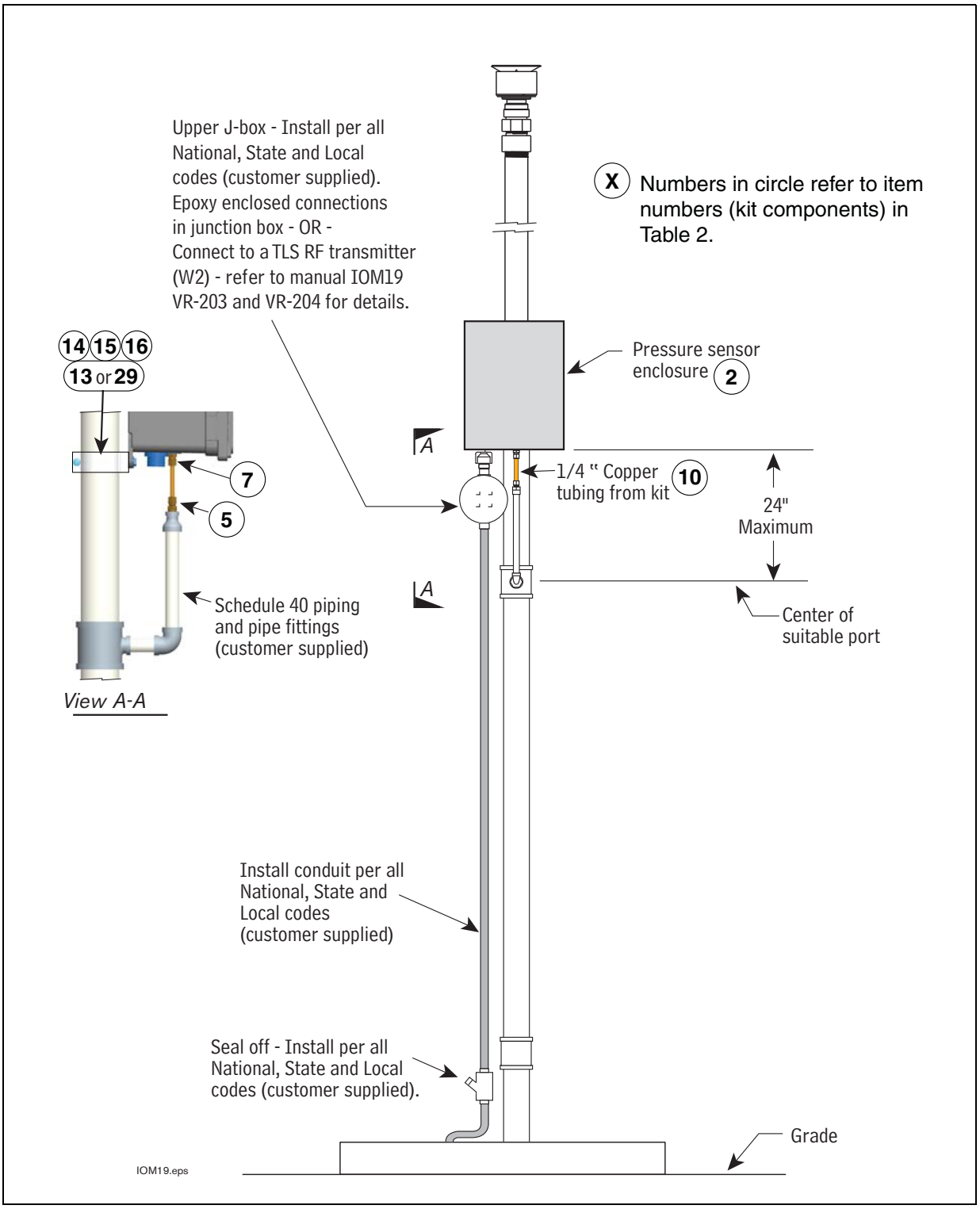


Figure 1. Locating Pressure Sensor Enclosure in Vapor Vent Stack

16. Get the contents of the pressure sensor drying tube kit (Table 2). Thread a tie wrap (item 3) through the slots in each of the self-adhesive mounts (item 4). Place the top mount against the large cap on one end of the tube and tighten the tie wrap until it is against the tube cap but you can still rotate the tube. Place the second mount against the other end cap of the tube, again pulling the tie wrap through the mount until it is against the tube cap but you can still rotate the tube.

    Remove the two soft plastic seals from each end port of the drying tube. Get the Tygon tubing (item 2) from the kit and attach one end of the tubing to one end of the drying tube. Slide the tubing onto the drying tube as far as you can (snug). Referring to Figure 2, position the drying tube vertically in the enclosure with the open port of the tube up, and estimate the length needed to loop from the bottom of the drying tube up to the vent port (off center) of the Vapor Pressure Sensor. Cut the Tygon tubing at the estimated length (approximately a foot or so). Remove the paper cover from the self-adhesive base of the two tie wrap mounts and stick the drying tube to the inside of the enclosure as shown in Figure 2. Pull each of the tie wraps snug and cut off the excess. Attach the other end of the Tygon tubing to the vent port (off center) of the Vapor Pressure Sensor. NOTE: the upper port of the drying tube must remain open and be oriented up as shown in Figure 2.

17. 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 1).

18. 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.

19. Install one 68CA-4-4 male connector (item 1 in Table 3) onto the top of the new pipe (see View A-A, Figure 1).

20. Measure, fabricate, and install ¼" OD copper tubing (item 6 in Table 3) 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.

21. 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 ¼" vertical per 12" horizontal to eliminate any potential liquid traps.

22. Make sure the valve's handle is set to connect the sensor to the vapor vent stack as shown in Figure 2 and not to the capped (vent) port.

23. 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.

24. 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 1). For wireless installations, using the TLS RF, Steps 24 - 27 are not required.

25. 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 1).

26. Seal wire nuts in epoxy sealant following the instructions in Figure 4.

27. Push the epoxy sealed bag into the junction box. Replace and tighten the junction box cover.

28. Terminate field wiring into TLS 350R console and connect to a Smart Sensor Module. Note: observe polarity! The cable length between the console and sensor must not exceed the distance stated in the applicable console's Site Prep manual.

29. 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.
30. Close the enclosure door and secure by threading the tamper-resistant screws into the enclosure body using a Torx bit for tamper-resistant screws.
31. Affix the eVRgreen label (item 4 in Table 4) to the enclosure door as desired.

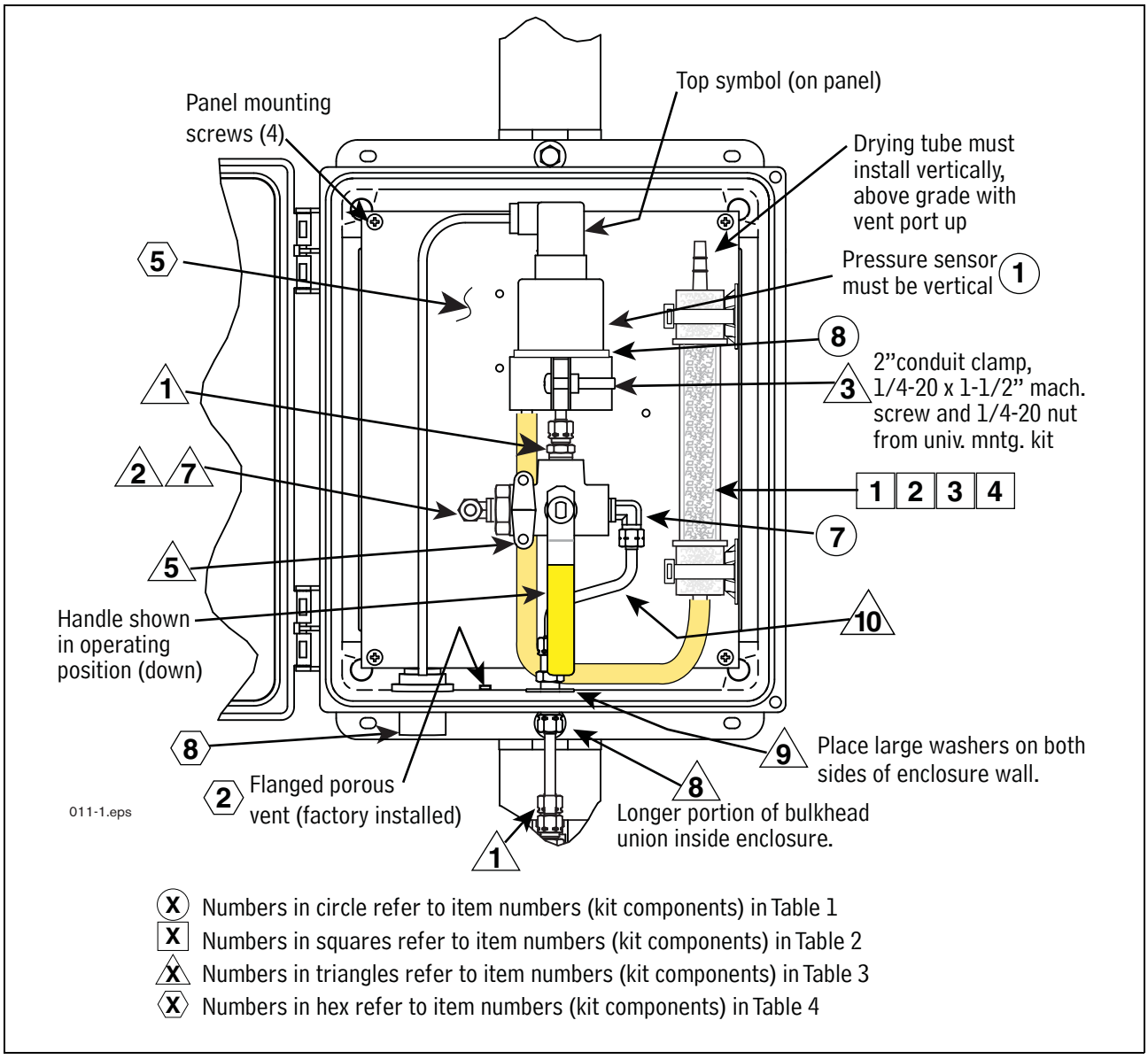


Figure 2. Mounting Pressure Sensor Assembly onto Composite Panel

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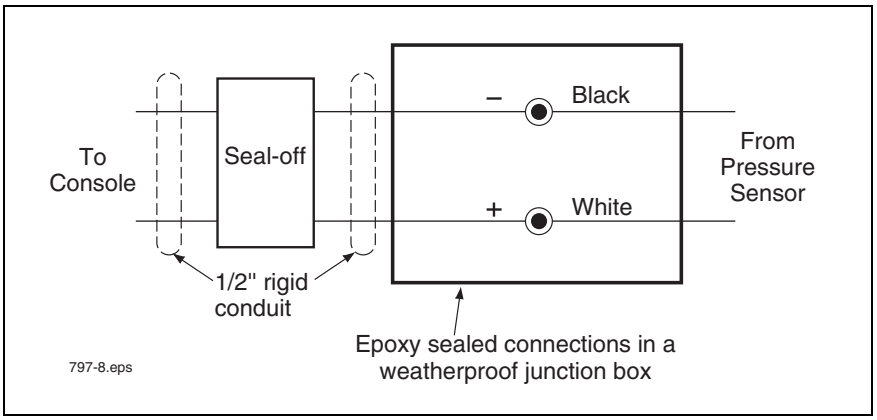
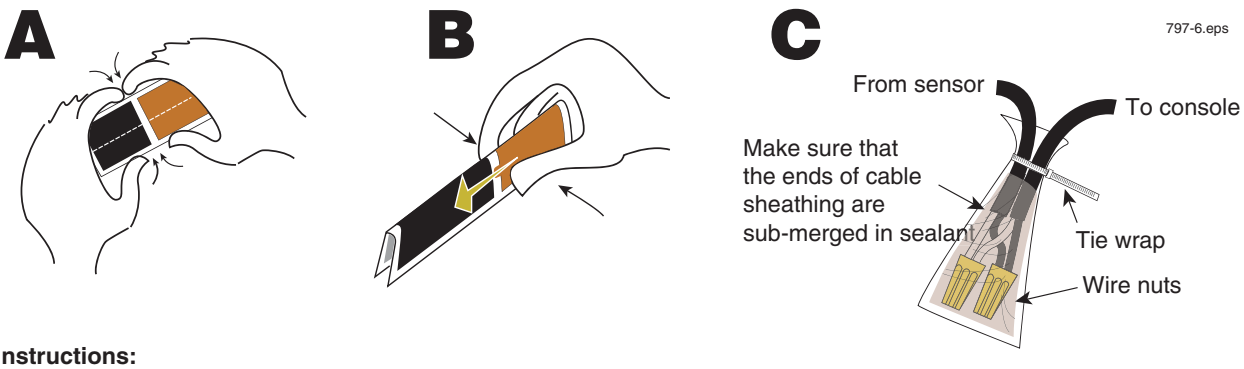


Figure 3. Field wiring Pressure Sensor - Observe Polarity



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 epoxycarboxylate.

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 4. Epoxy sealing field wiring

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