Section #14

Installation Manual

ECS Membrane Processor with PMC

Part:	VST-ECS-CS3-110 VST-ECS-CS3-310

NOTE:
The single-phase Processor (VST Model VST-ECS-CS3-110) has not been certified. VST anticipates certification of the single-phase Processor soon.

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

www.vsthose.com

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UL Declaration Notice

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

- NOTE: All peripheral equipment required to activate / control these units is not covered under the UL Listing of this ECS Membrane Processor.

    - They should be UL Listed, have the appropriate communications protocol, not installed over or in a hazardous location, and are determined to be acceptable to the authority having jurisdiction with regards to suitability and overall installation.

About VST

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

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

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

VST's product offering includes; curb pump and vapor recovery hoses, safety breakaways, nozzles, and emission-control system *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

Warranty

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

Warranty Cards

Vapor Systems Technologies, Inc.

Phone: (937)-704-9333 • Fax: (937)-704-9443
www.vsthose.com

IMPORTANT
PRODUCT WARRANTY
REGISTRATION CARD

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

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

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

SERIAL NUMBER:

INSTALLATION DATE:

INSTALLATION SITE:

CITY/STATE/ZIP:

DISTRIBUTOR NAME:

PRODUCT STYLE:

☐ HOSE ☐ SAFETY BREAKAWAY
☐ NOZZLE ☐ ECS PROCESSOR

Figure 1: VST Registration Card

NOTICE: THIS TAG MUST NOT BE REMOVED FOR ANY REASON

ECS MEMBRANE PROCESSOR UNIT

Serial Number: _____

Date Installed: _____

This device was factory tested and met all applicable performance standards and specifications to which it was certified.

Manufactured By: Vapor Systems Technologies, Inc.
650 Pleasant Valley Dr., Springboro, Ohio 45066
Phone: (937) 704-9333, Fax: (937) 704-9443

Figure 2: ECS Membrane Processor Sticker

Components and Warranties

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

VST Contractor Requirements

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

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

- ASC's must be able to show proof of certification if asked. Carry the wallet card or have a copy of your certification on file with the GDF.

- The ASC must record his or her certification number on the applicable paperwork for all warranties to be deemed valid.

- Contractors should **ALWAYS** verify the training and certification requirements with the air-district staff **BEFORE** beginning installation of EVR systems.

Veeder-Root Contractor Requirements

Veeder-Root Level 1	Contractors holding valid Level 1 certification are approved to perform: • Wiring and Conduit Routing • Equipment Mounting • Probe and Sensor Installation • Tank and Line Preparation • The Line Leak Detector Installation
Veeder-Root Level 2/3 or 4	Contractors holding valid Level 2, 3, or 4 certifications are approved to perform: • Installation • Checkout • Startup • Programming and Operations Training • Troubleshooting And Servicing For All Veeder-Root Tank Monitoring Systems, Including Line Leak Detection And Associated Accessories.
PMC / ISD	This course of training includes PMC/ISD installation checkout, startup, programming, and operations training. It also includes troubleshooting and service techniques for the PMC/ISD diagnostics system. A current level 2/3 or 4 certification is a pre-requisite for the PMC/ISD course. After successful completion of this course, the contactor will receive a certificate as well as a Veeder-Root PMC/ISD Contractor Certification card.
Warranty Registrations may only be submitted by selected distributers.	

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 and Abbreviations

ASC:	Authorized Service Contractor
AQMD:	Air Quality Management Districts
ATG:	Automatic Tank Gauge on a TLS
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
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
VRPS:	Manufacturer of the TLS-350
VST:	Vapor Systems Technologies, Inc. - manufacturer of the ECS Membrane *Processor*
WC:	Water Column

1 VST ENVIRO-LOC Balance System ECS Membrane Processor

- 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 system.

- 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, the 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, the permeate will contain less than 3.0% hydrocarbons. The result of this activity includes, fresh air vented to atmosphere, saturated 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 transport across the membrane. These are the only moving parts in the system.

  A low-temperature self-regulating heating coil is incorporated around the membrane housing to keep the membrane free from condensate.

1.1 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 PMC 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: 1. VOC depleted air (referred to as “air”) 2. Concentrated 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 concentrated 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.

1.2 Processor Dimensions and Weight

Part Number	Unit	Dimensions	Weight
VST-ECS-CS3-110	Single-Phase	L-39” x W-27” x H-43”	385 lbs.
VST-ECS-CS3-310	Three-Phase	L-39” x W-27” x H-43”	350 lbs.
Note: Cover weight is 24lbs. and is included in the overall weight of the *Processor*.			

1.3 *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*
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5003-001	Check-Valve Assembly
5005-001	Membrane
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5006-011	O-Ring (2) Vertical Tube
5006-012	O-Ring (2) Base Insert
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5007-001	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

1.4 Auxiliary Components

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

1.5 Manuals and Warranty

MANUAL #	MANUAL NAME	SECTION
9514-001	ECS Membrane *Processor* with PMC: Installation Manual	14
9514-002	ECS Membrane *Processor* with PMC: Operation / Maintenance Manual	15
9514-003	ECS Membrane *Processor*: Troubleshooting Guide	www.vsthose.com
9514-004	ECS Membrane *Processor*: Pre-Installation Checklist	www.vsthose.com
9522-001	IOM: VST EVR Balance Total System Solution	5
9998-001	Warranty Paperwork	www.vsthose.com

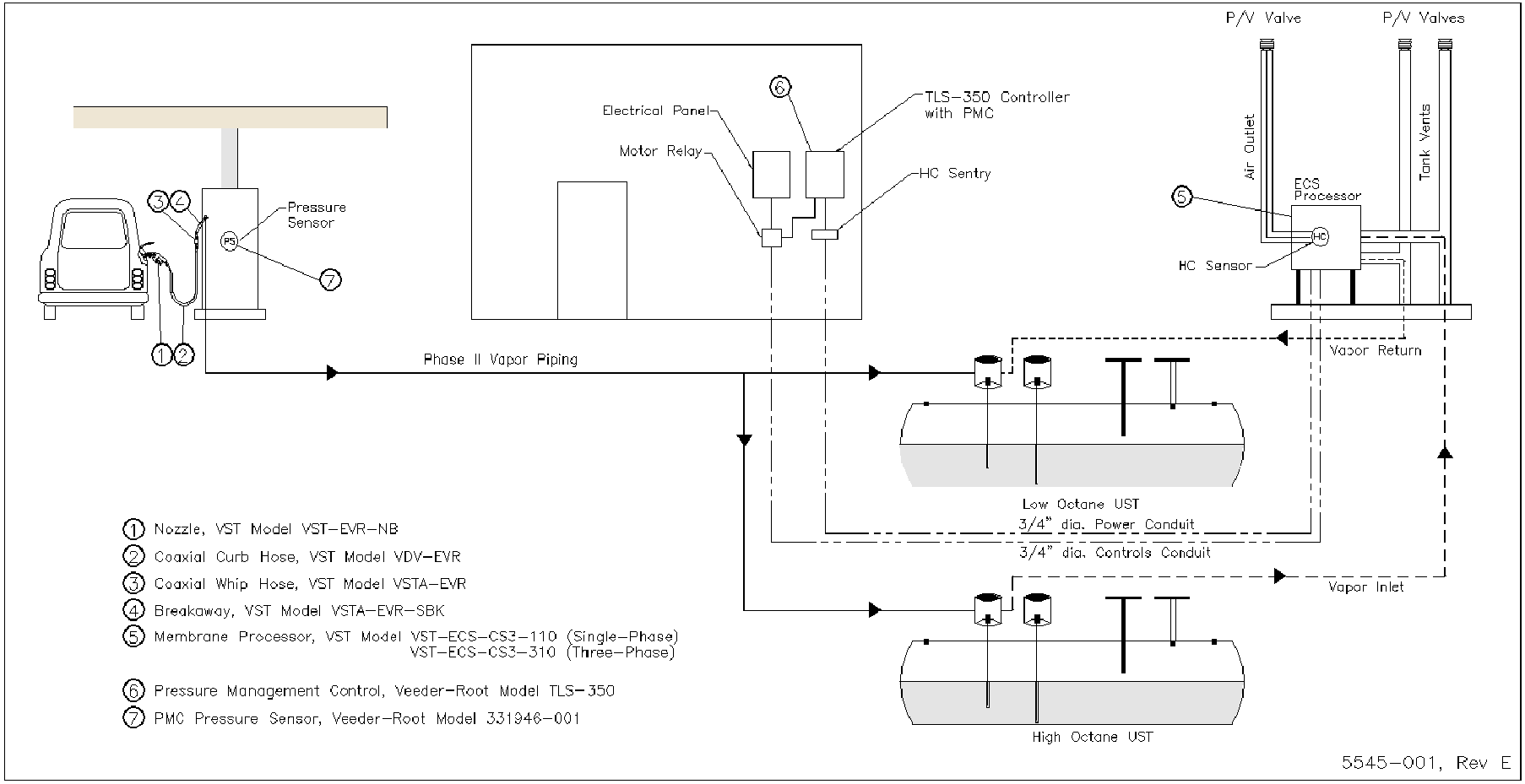


Figure 3: How the Processor fits into the GDF layout

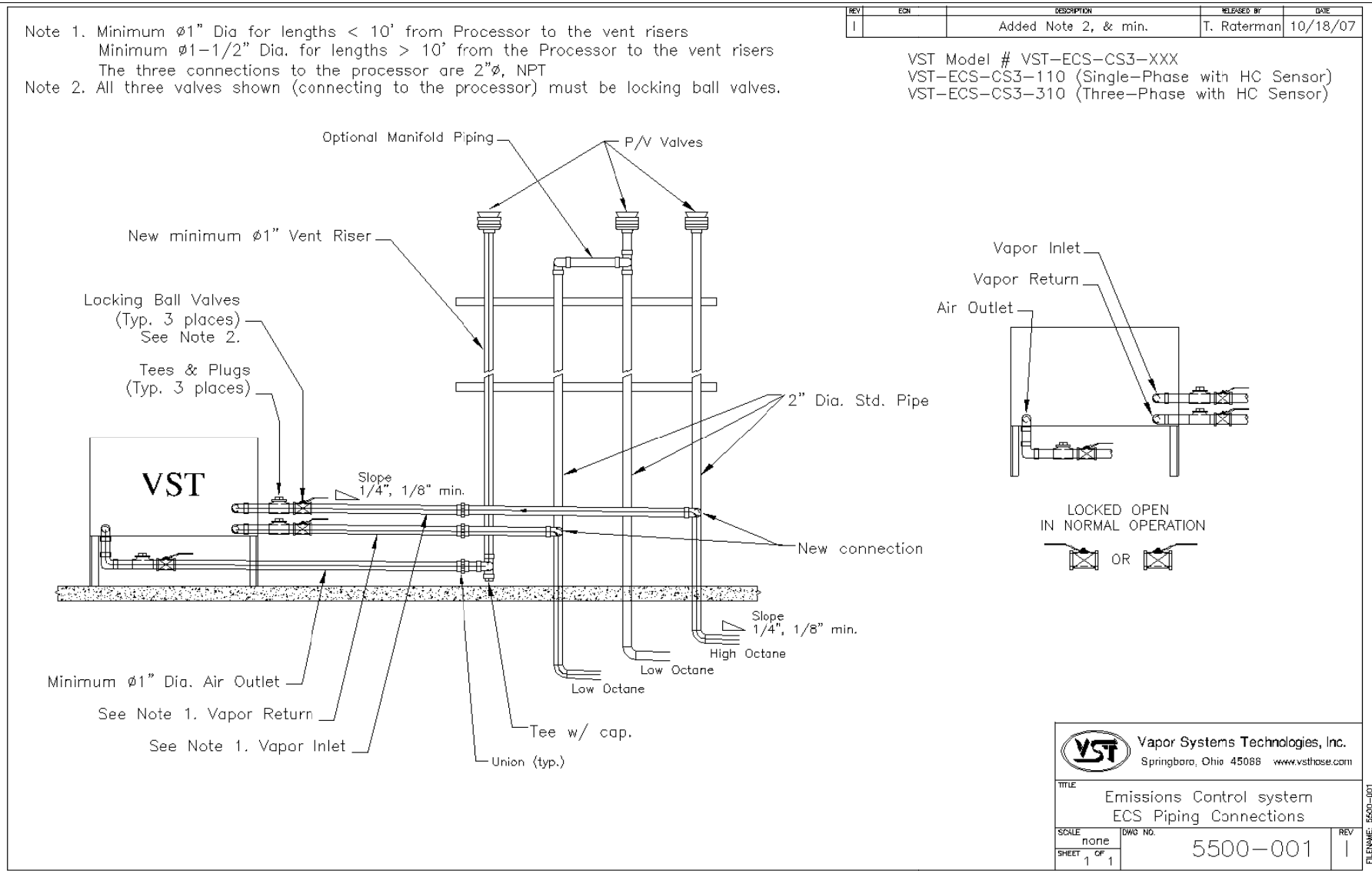
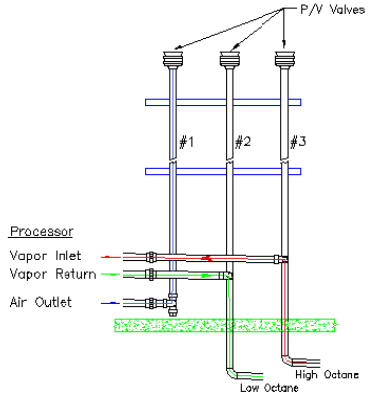
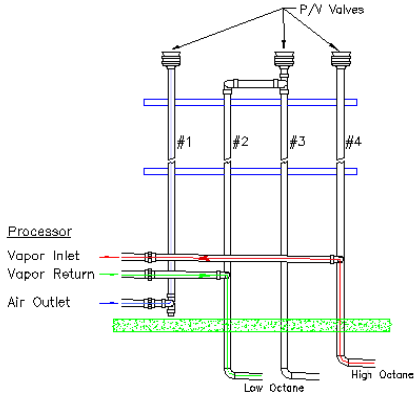


Figure 4: ECS Process Control Diagram

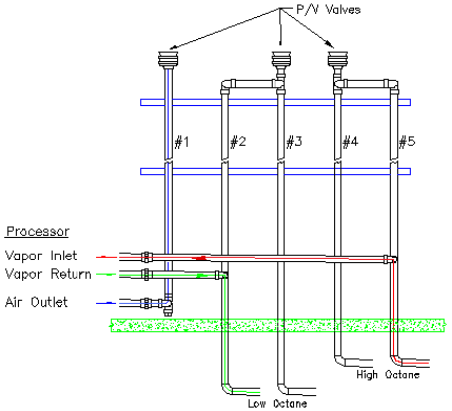
REV	ECN	DESCRIPTION	RELEASED BY	DATE
A			T. Raterman	10/17/07



Detail "A"



Detail "B"



Detail "C"

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

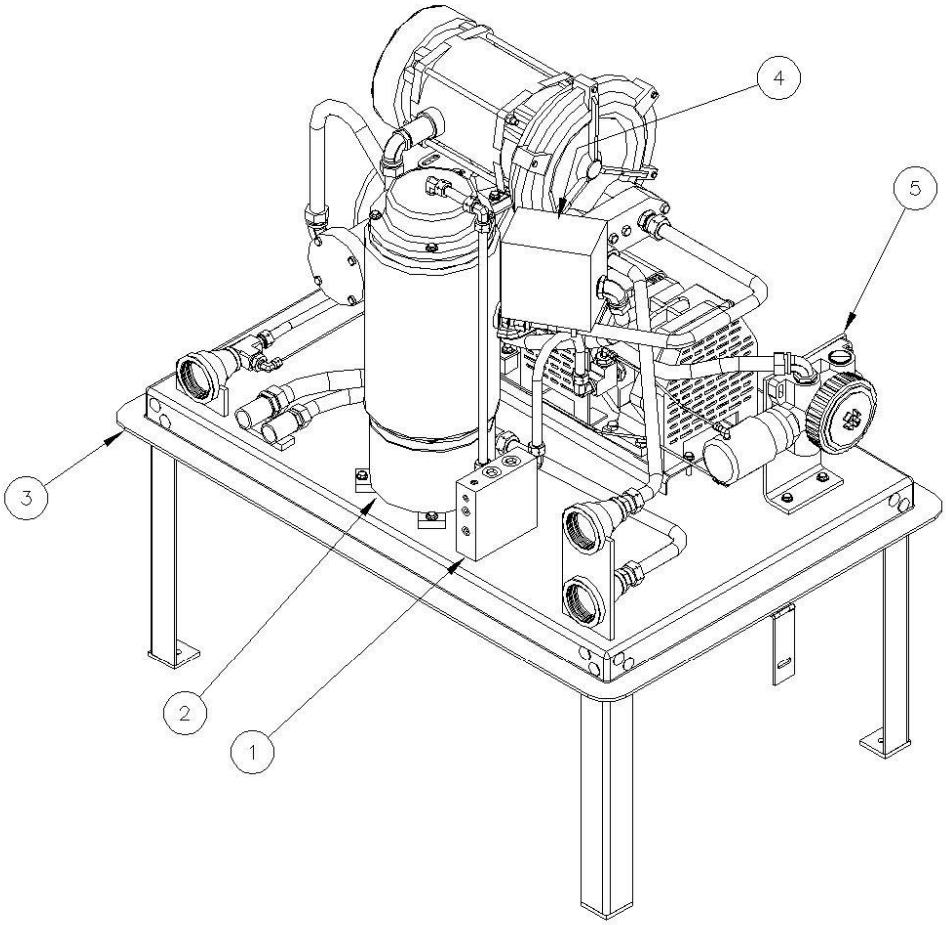
Vapor Systems Technologies, Inc.
Springboro, Ohio 45066 www.vsthose.com

TITLE: Emissions Control system
ECS Vent Riser Configurations

SCALE	DWG NO.	REV
none	5561-001	A
SHEET 1 OF 1		

Figure 5: ECS Vent Riser Configurations

REV	ECN	DESCRIPTION	RELEASED BY	DATE
C	NONE	CHANGED DRAWING FORMAT	C. SPENCER	09/11/07



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

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

MATERIAL 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

TITLE: EMISSION CONTROL SYSTEM

HEAT TREATMENT N/A

FINISH N/A

APPROVALS

DRAWN BY: C. SPENCER	DATE: 09/10/07	
ENGINEER: T. RATERMAN	DATE: 09/11/07	SCALE: 1:8
APPROVED: G. WALKER	DATE: 09/11/07	SHEET 1 OF 2

DWG NO. 5523–001 REV C

FILENAME: 5523–001.DWG

Figure 6: Processor Isometric Drawing (1 of 2)

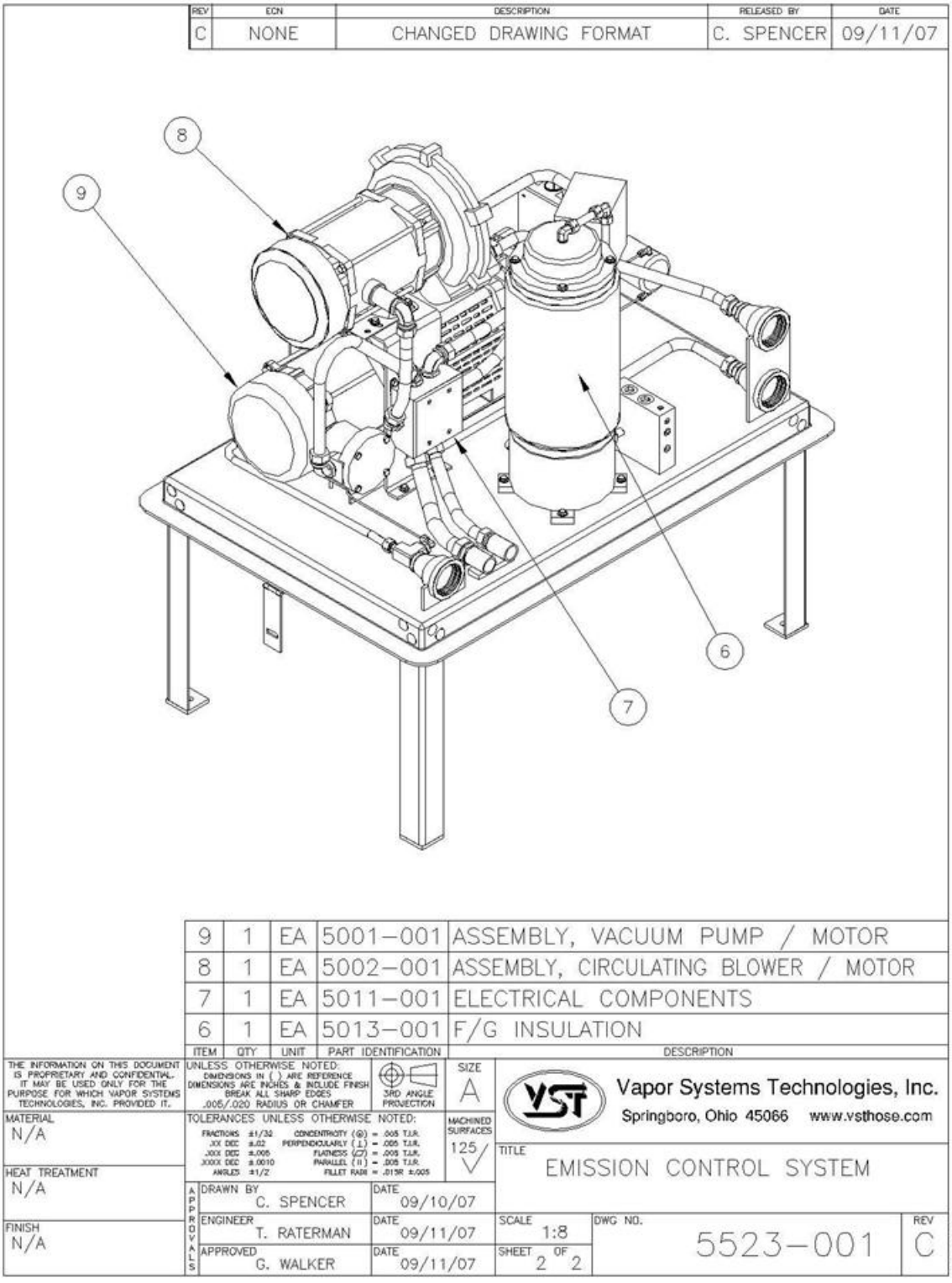


Figure 7: Processor Isometric Drawing (2 of 2)

2 Pre-Installation Site Survey

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

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

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

3 Site Requirements

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

3.1 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 Marshall**
- **Water Board**
- **Local Air Pollution District**
- **ICC**
- **NEC**
- **NFPA 30 and 30A**
- **UL**
- **Any other applicable federal, state, and local codes**

3.2 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 *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

- Structure must be strong enough to hold the weight of the *Processor:*
  - Three-phase 350 lbs.
  - Single-phase 385 lbs.
- Must be a 36" 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.
  - Single-phase 385 lbs.
- Must be a 36" perimeter around the *Processor* for maintenance and testing.
- All safety and code concerns have been addressed.

Three Phase Electric

- 3 empty breaker spaces 208/230-480v panel
- 208/230-480v, 3-phase, 60Hz service, 20-amp
- (1) 110v breaker
- (1) 110v outlet
- GFCI protected, weatherproof 110v convenience outlet located at the *Processor* is optional
- 2-hp vacuum pump / ½-hp blower

Single Phase Electric

- (2) empty 110v breaker spaces in the panel
- (1) 110v breaker, single-phase, 60Hz service, 40-amp
- (1) 110v breaker
- (1) 110v outlet
- GFCI protected, weatherproof 110v 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. • There must be at least two separate vent lines, which are not manifolded together.	• Must be a Balance dispenser. • Phase II vapor riser must be greater than or equal to 1" ID. • The *Processor* may not be installed in a Class 1, Division 1 or a Class 1, Division 2 hazardous location. **Veeder-Root Controls** • Must have TLS-350 with PMC installed	• VR-203 (VST Executive Order)

4 Ground Installation

4.1 Ground Installation Safety



- The *Processo*r 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.

4.2 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 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 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.

4.3 Ground-Mount Location

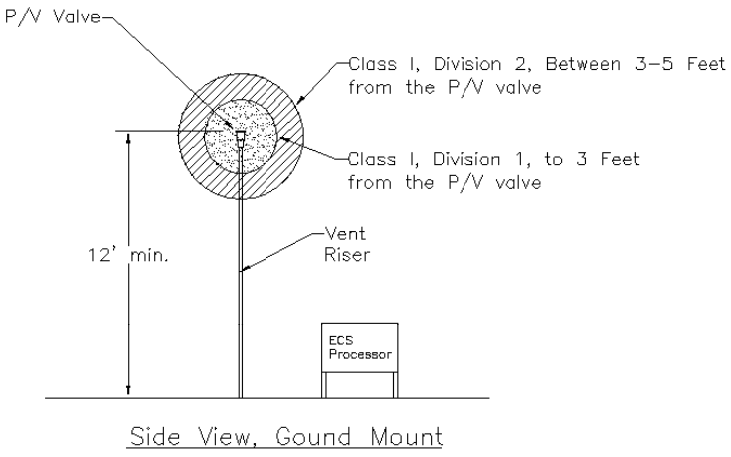
- Location to property line: according to NFPA 30A, Section 10.1.7.1
  ". . . in no case shall the vapor-processing equipment so protected be located within 3m (10-feet) of adjacent property lines that can be built upon."

    - Local authorities may grant reduced distance depending on the specific circumstances

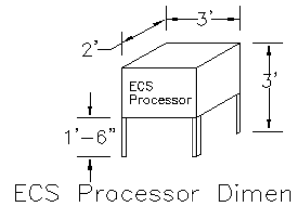
- To minimize the installation cost and to maximize operating efficiency, locate the *Processor* adjacent to the existing vent risers.

- **See figure 4: Section 14 / Page 19**

REV	ECN	DESCRIPTION	RELEASED BY	DATE
D		Changed P/V Valve	T. Raterman	9/11/2007



Side View, Gound Mount



ECS Processor Dimensions

The P/V valve shall terminate at least 12' above grade.

The processor must not be installed in a Class I or II hazardous area as defined by NFPA 30A either as a ground mount, roof mount or canopy mount unit.

The area inside the processor enclosure has been defined and evaluated by UL and classified by NFPA 30A as Class I, Group D, Division 2.

NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garage, 2003 Edition

NFPA 70 – National Electrical Code

The ECS Processor location must comply with Federal, State and local codes for specific hazardous locations.

VST recommends obtaining approval from the local authority having jurisdiction.

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

TITLE: Emission Control System Hazardous Locations

SCALE: na | SHEET 1 OF 1 | DWG NO. 5546–001 | REV D

FILENAME: 5546–001

Figure 8: ECS Membrane Processor Hazardous Locations

4.4 Setting the Concrete Pad

- The *Processor* must be installed on a concrete pad, on grade, and permanently anchored to the concrete pad.
    - VST does not provide any hardware to install the *Processor* on the pad.

- Be sure to allow the minimum clearances listed below for maintenance and service:
    - Back: 36”
    - Front: 36”
    - Left: 36”
    - Right: 36”

- Concrete pad minimum dimensions:
    - 3’6” long x 2’6” wide
    - 6” thick (minimum)
    - **See figure 9: Section 14 / Page 31**

- 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

4.5 Installing the Processor on the Concrete Pad

1. After the concrete has properly cured, position the *Processor* onto the anchor bolts in the cement slab.

2. Bolt the *Processor* into place with the 3/8” galvanized lock washers and bolts.

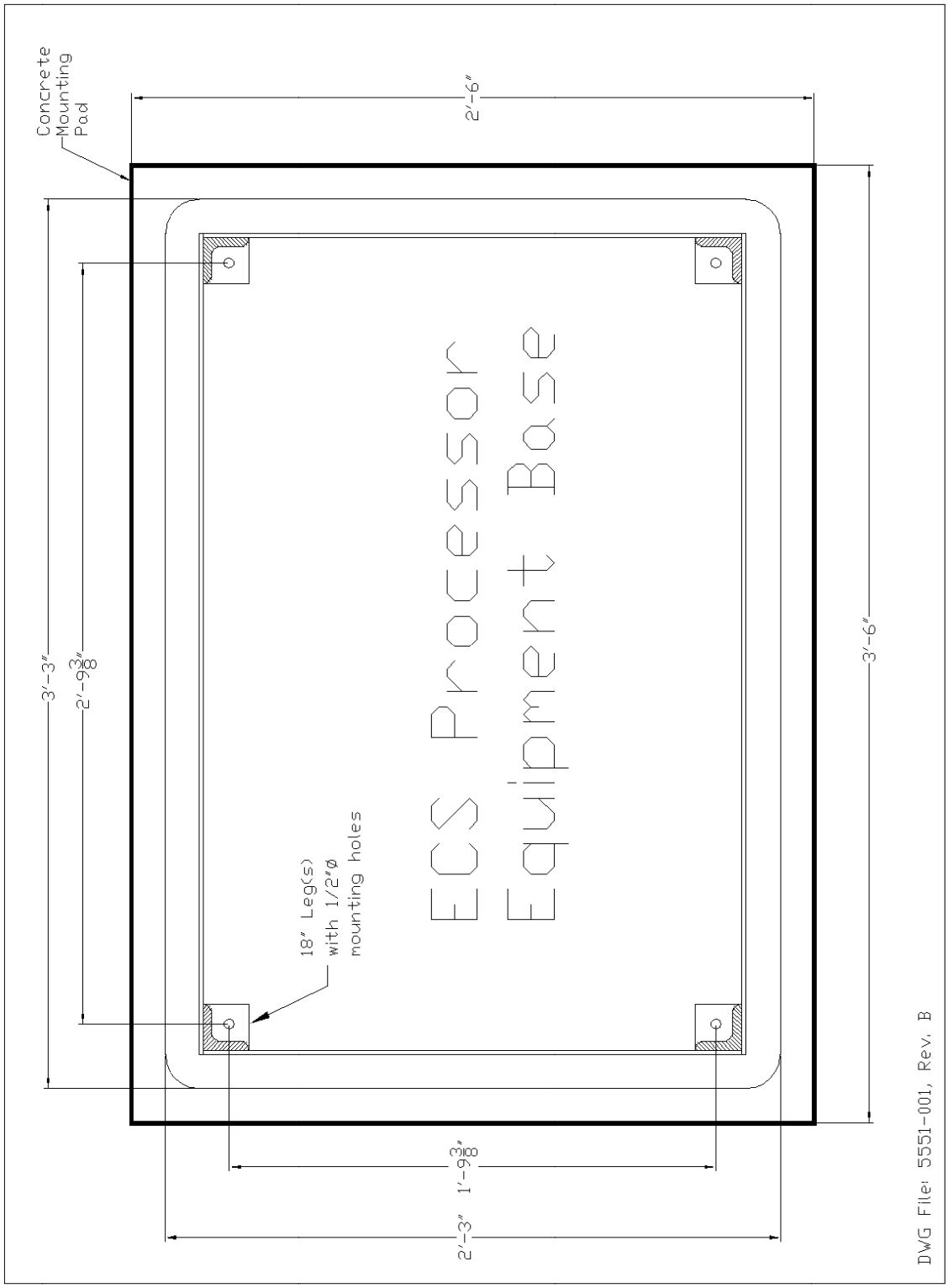


Figure 9: Concrete Mounting Pad Dimensions

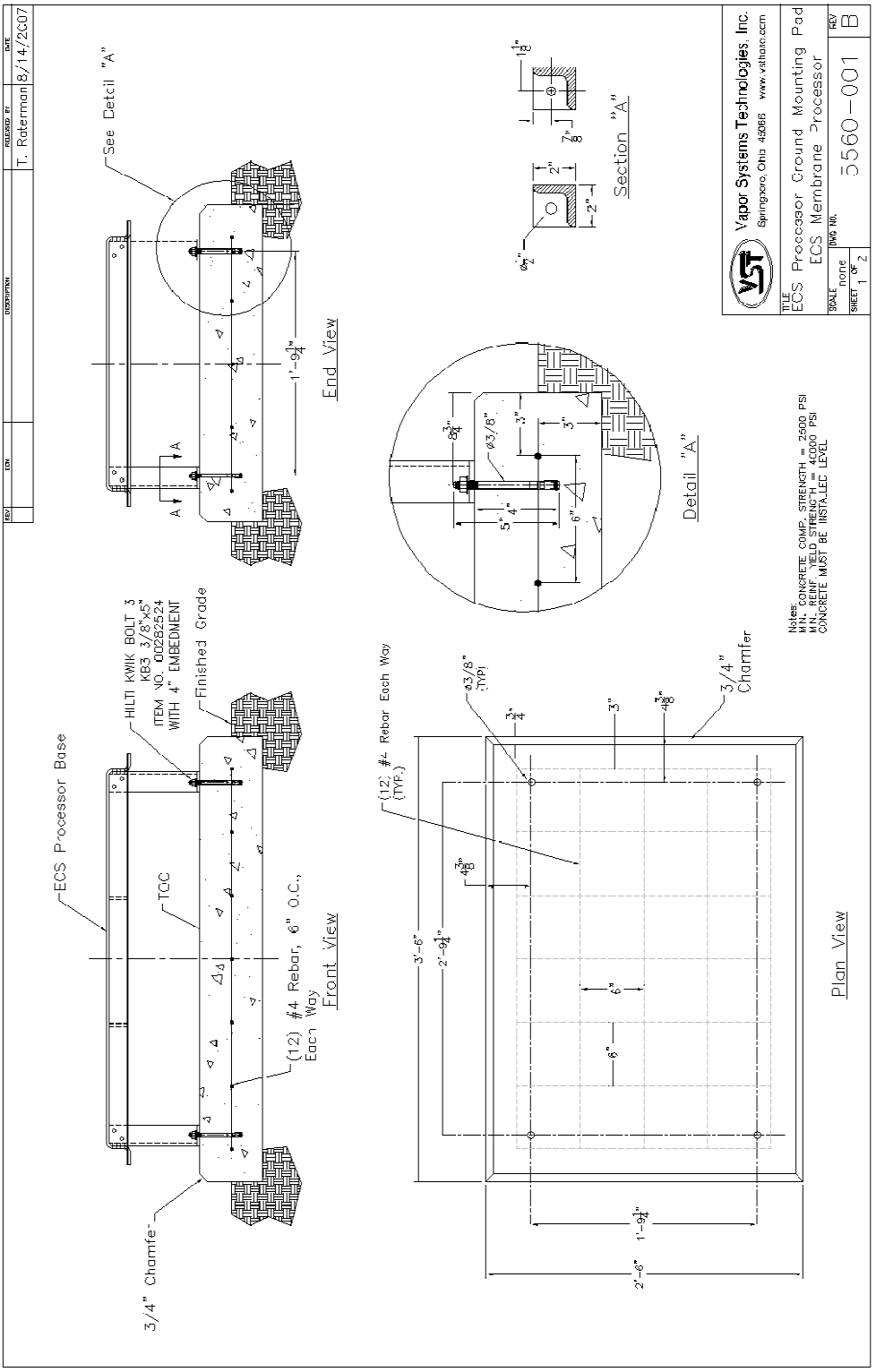


Figure 10: Processor Ground Mounting Pad

5 Roof-Top Installation

5.1 Roof-Top Installation Safety

- The *Processo*r 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"	385 lbs.
VST-ECS-CS3-310	Three-Phase	L-39" x W-27" x D-43"	350 lbs.

Note: Cover weight is 24lbs. and is included in the overall weight of the *Processor*.

- Location to property line: according to 2003 Edition of NFPA 30A, Section 10.1.6, Page 23: Vapor-processing equipment shall be located "At least 3m (10 ft) from adjacent property lines that can be built upon."
  - Local authorities may grant reduced distance depending on the specific circumstances.

- The *Processor* must not be installed within 5' of a vent riser P / V valve.

- A 5' radius around the vent riser P/V valve is a Class I, Div. 2 hazardous area as defined in NFPA 70.

- All vapor-piping connecting to the *Processor* must be sloped away from the *Processor*. VST recommends 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.

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 Marshall**
- **Water Board**
- **Local Air Pollution District**
- **ICC**
- **NEC**
- **NFPA 30 and 30A**
- **UL**
- **Any other applicable federal, state, and local codes**

- 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 at least 36" 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 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.

6 *Canopy Top Installation*

6.1 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"	385 lbs.
VST-ECS-CS3-310	Three-Phase	L-39" x W-27" x D-43"	350 lbs.

Note: Cover weight is 24lbs. and is included in the overall weight of the *Processor*.

- Location to property line: according to 2003 Edition of NFPA 30A, Section 10.1.6, Page 23: 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 Marshall**
- **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 at least 36” 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.

- 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* 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 roof top.

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

7 Vapor Piping

7.1 Vapor Piping Safety

- The *Processo*r 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 Piping Connection Material

- All connections to the *Processor* must be a minimum 1" galvanized pipe.

7.3 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 Marshall**
- **Water Board**
- **Local Air Pollution District**
- **ICC**
- **NEC**
- **NFPA 30 and 30A**
- **UL**
- **Any other applicable federal, state, and local codes**

- The *Processor* can be installed without any trenching to the UST's provided there are at least 2 vent risers connected to the UST's.
    - Connect the vent stack from the highest octane UST to the vapor inlet of the *Processor*.
    - Connect the vent stack from the lowest octane UST to the vapor outlet of 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.

7.4 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 Marshall**
- **Water Board**
- **Local Air Pollution District**
- **ICC**
- **NEC**
- **NFPA 30 and 30A**
- **UL**
- **Any other applicable federal, state, and local codes**

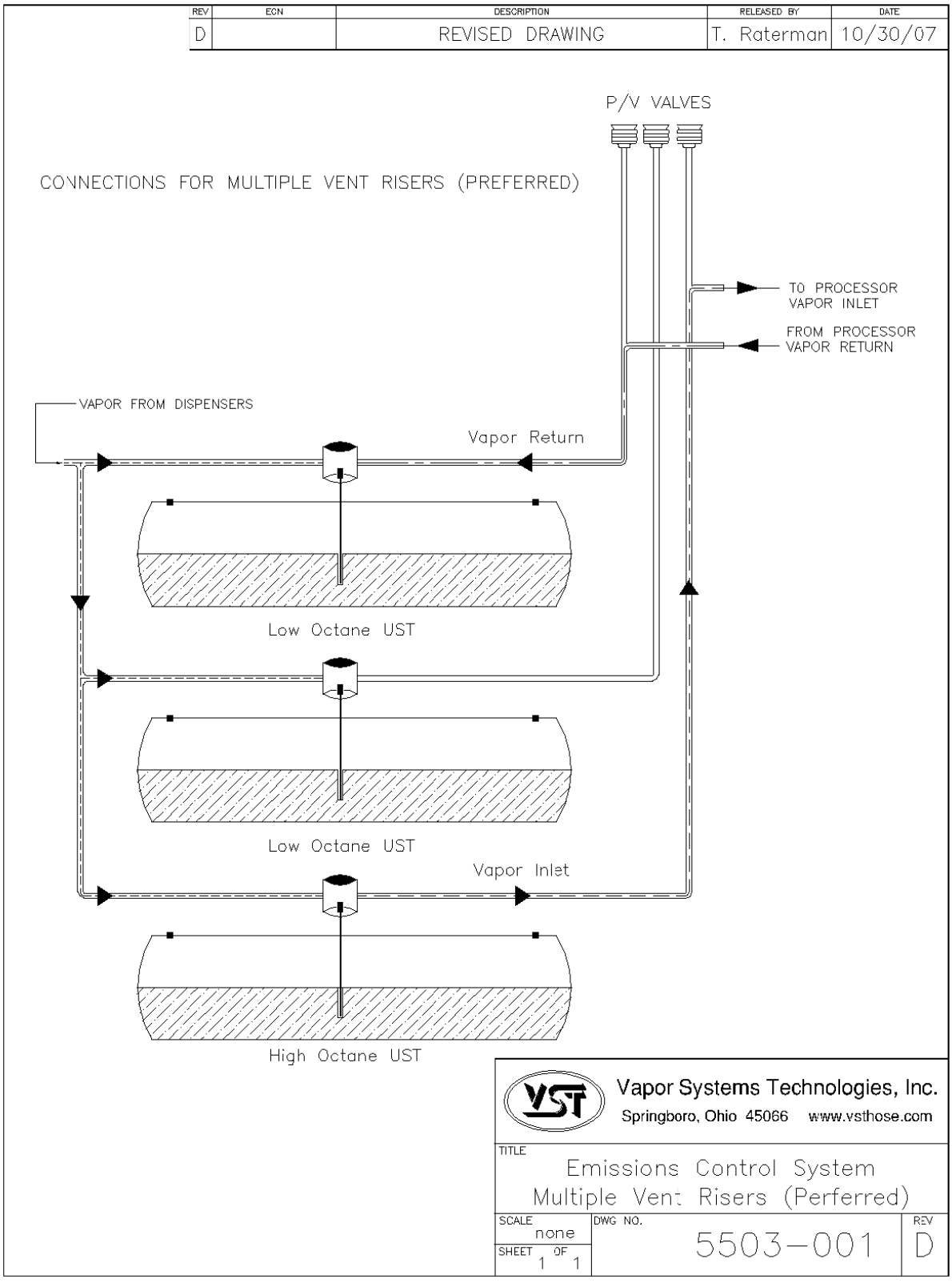


Figure 11: Processor Connections with Multiple Vent Risers

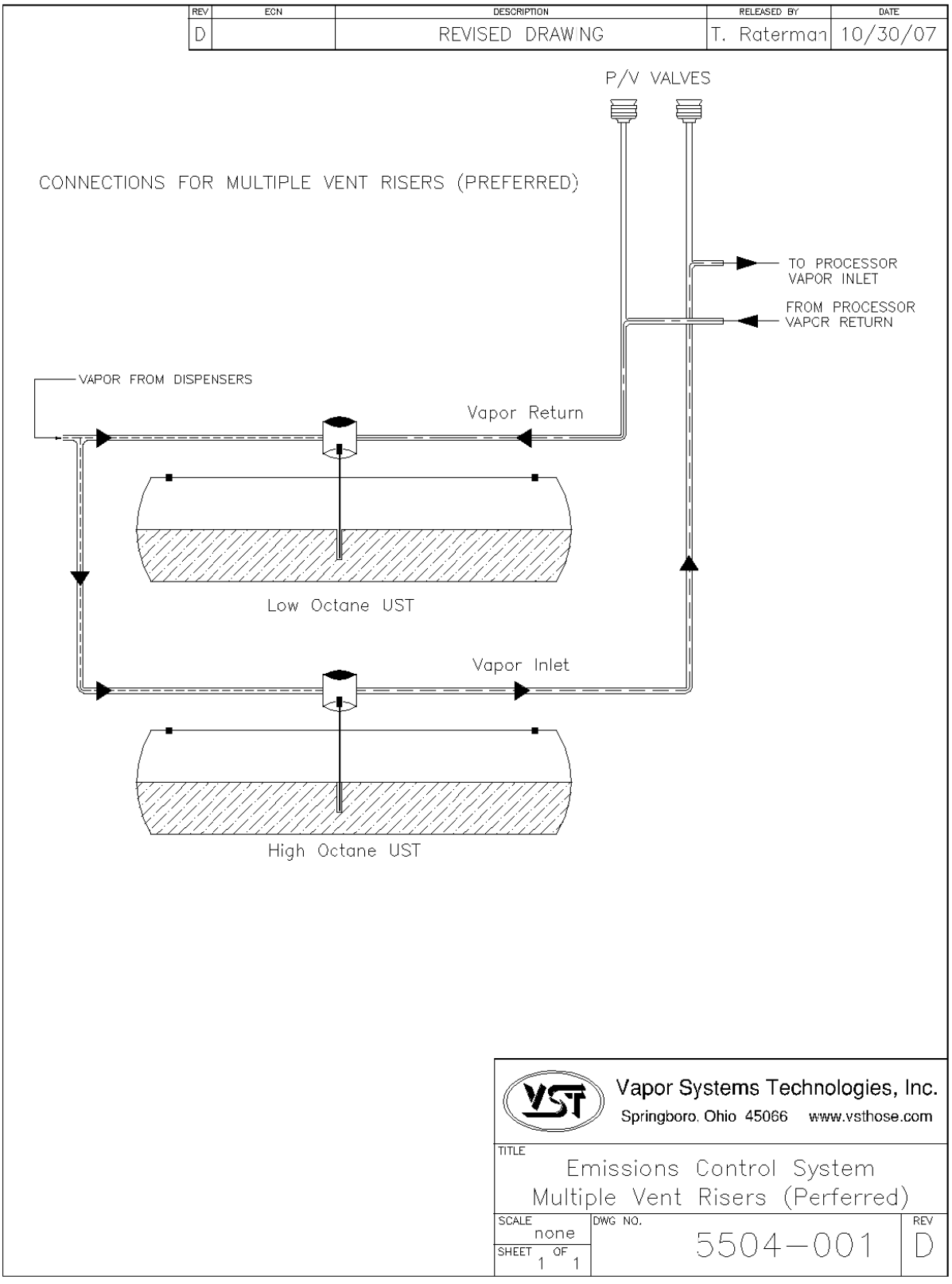


Figure 12: Processor Connections with 2 Vent Risers

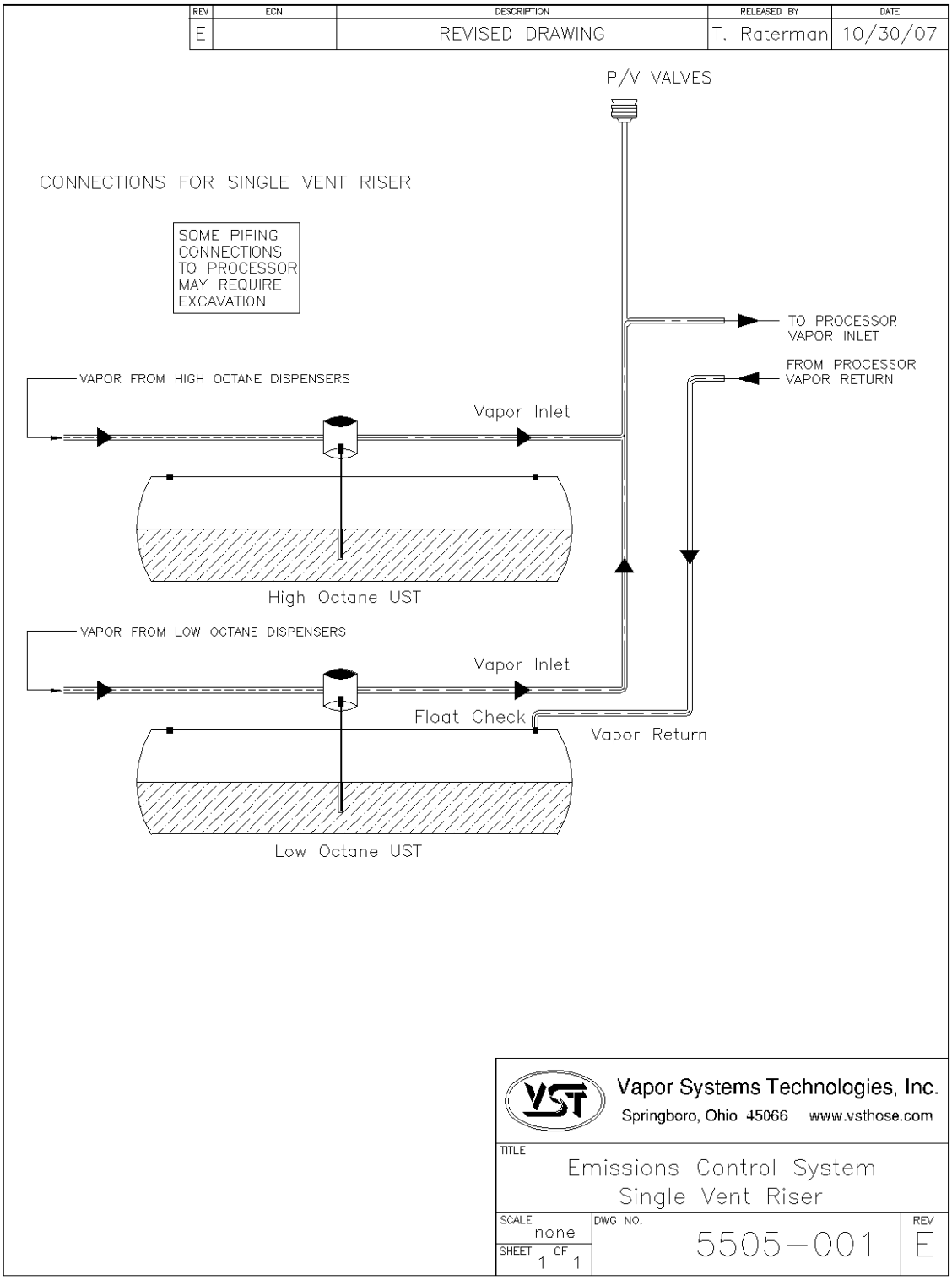


Figure 13: Processor Connections with Single-Vent Riser

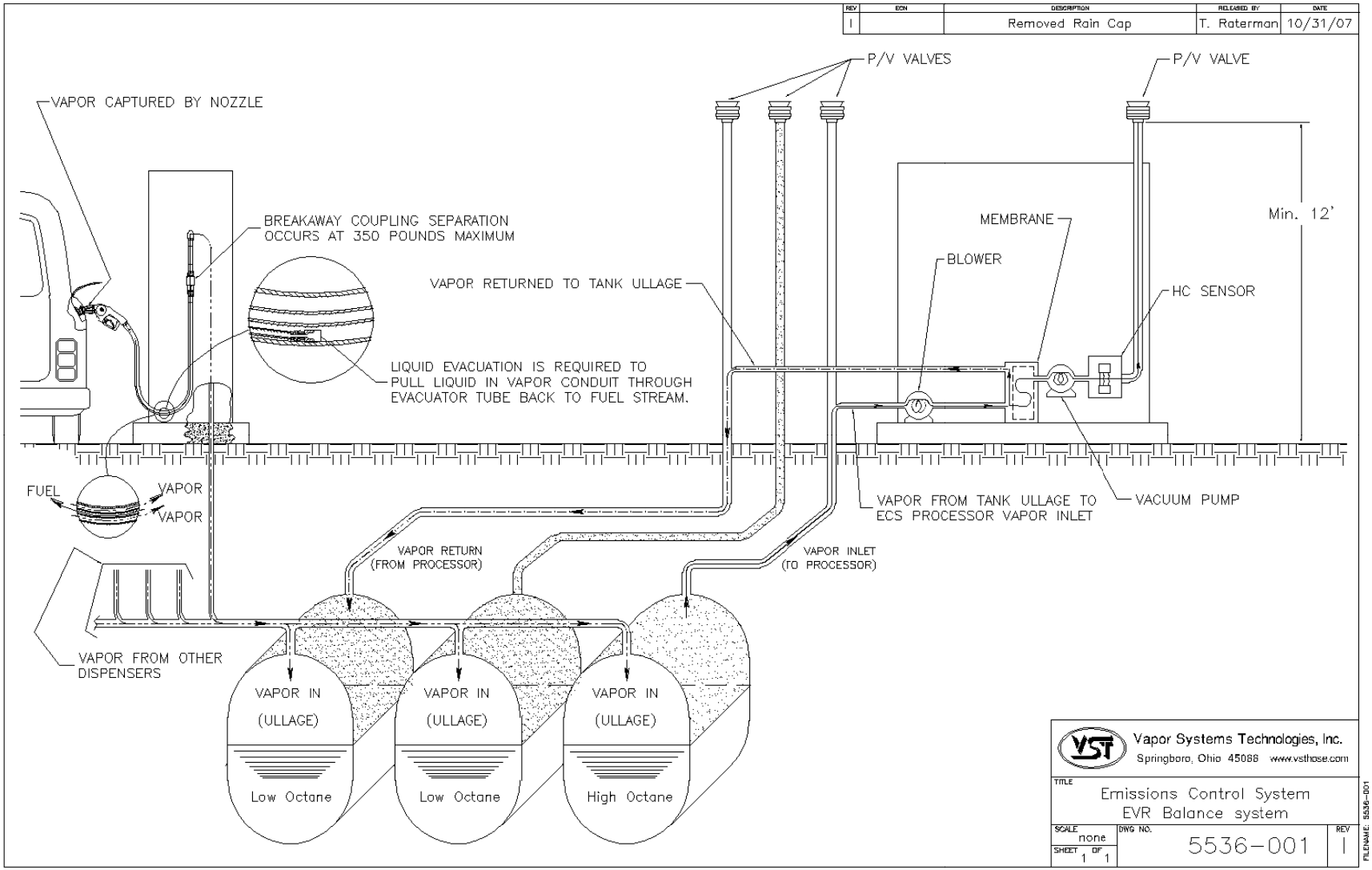


Figure 14: Typical GDF Vapor Piping Diagram for Processor

7.5 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.

- 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. Valve (sized for the pipe diameter)
    4. 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 15 / Section 14 / Page 46

- 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.

8 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. Valve (sized for the pipe diameter)
  4. Vent riser

See figure 15 / Section 14 / Page 46

- 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 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 P/V valve must be installed on the air outlet vent riser to shield against rain and reduce noise.
- The permeate 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 and 5 feet in all directions of the vent opening.
- The new vent riser may be installed next to the existing vent risers.

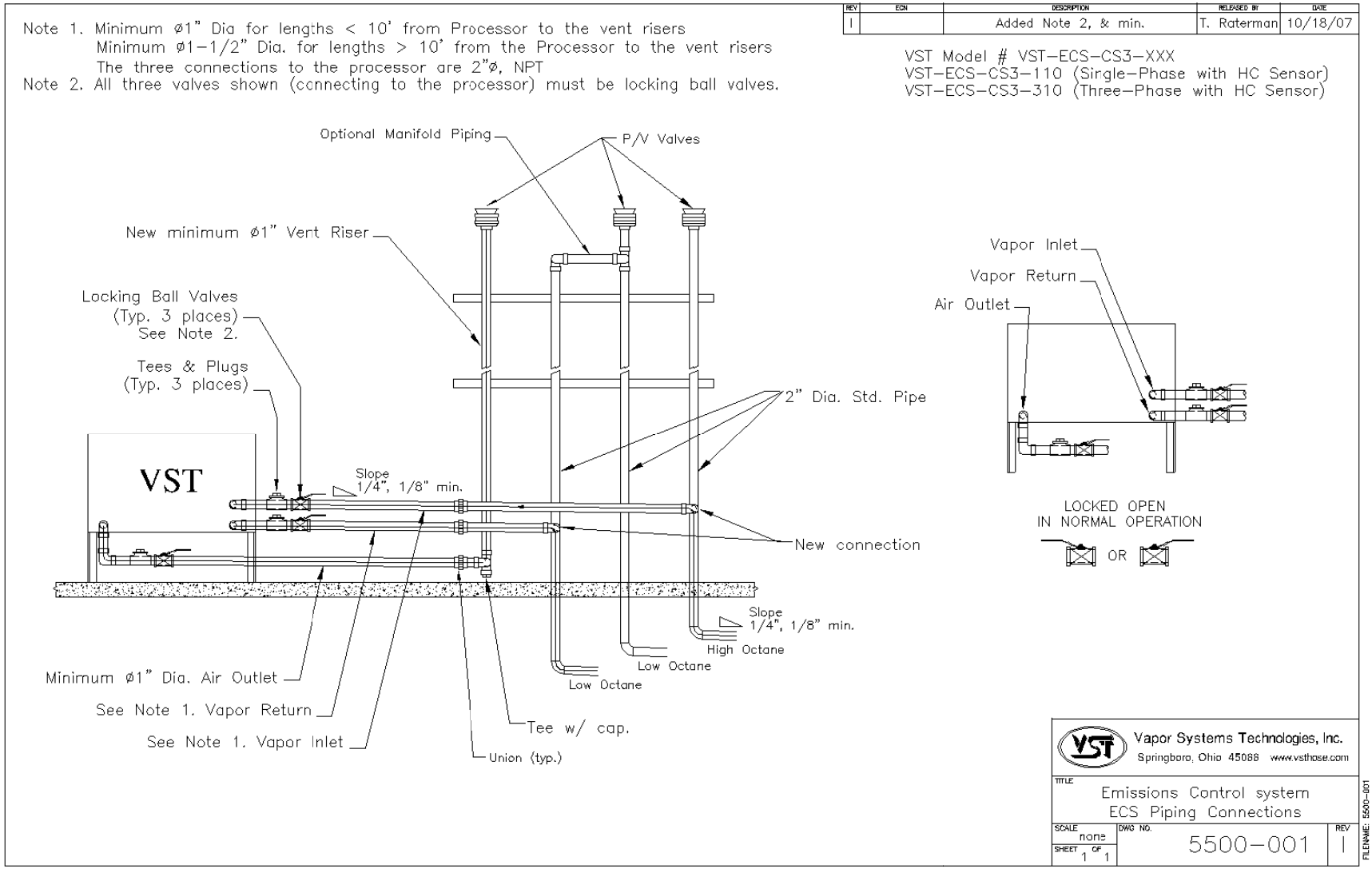


Figure 15: ECS Processor Control Diagram

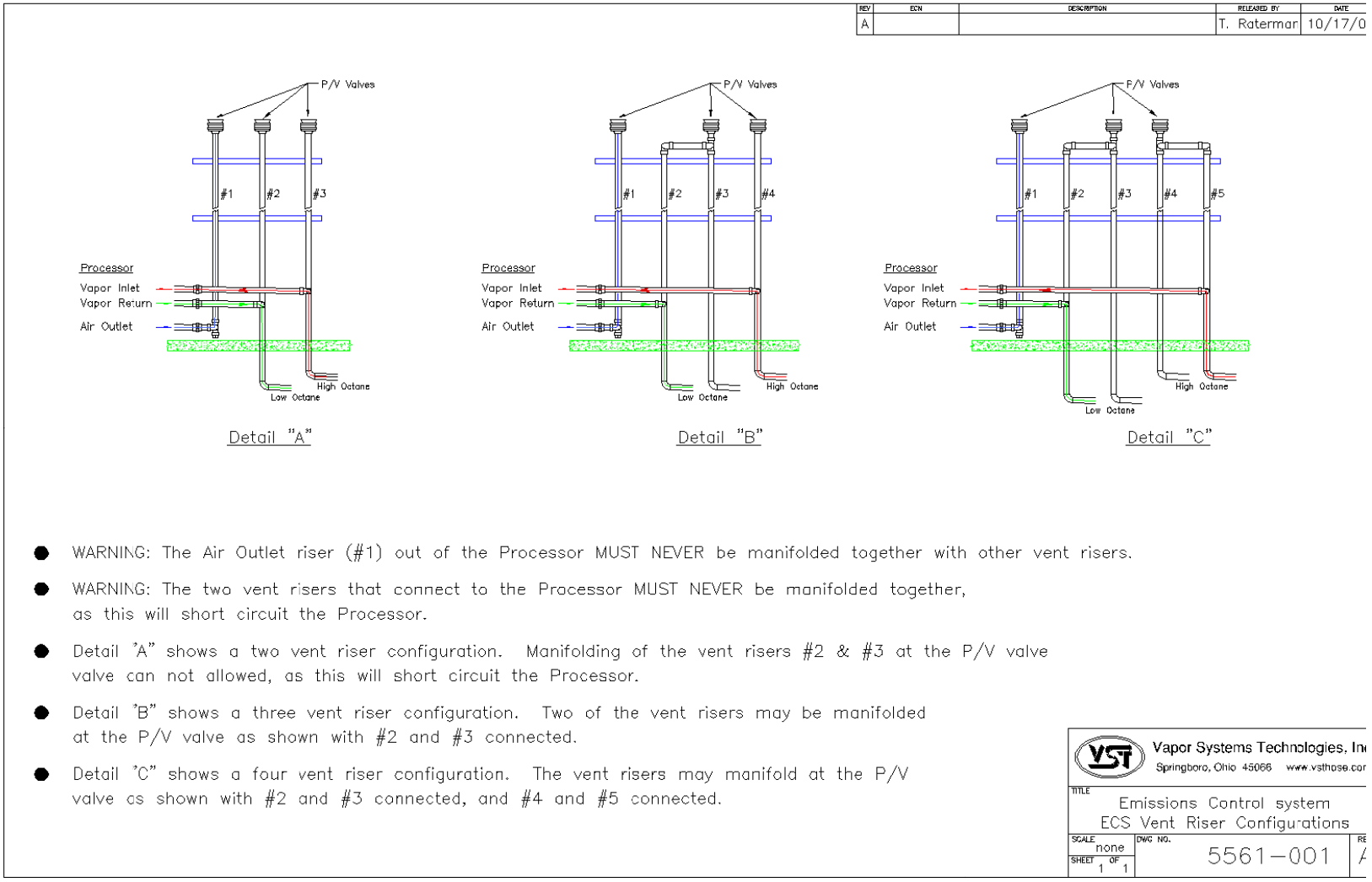


Figure 16: ECS Vent Riser Configuration

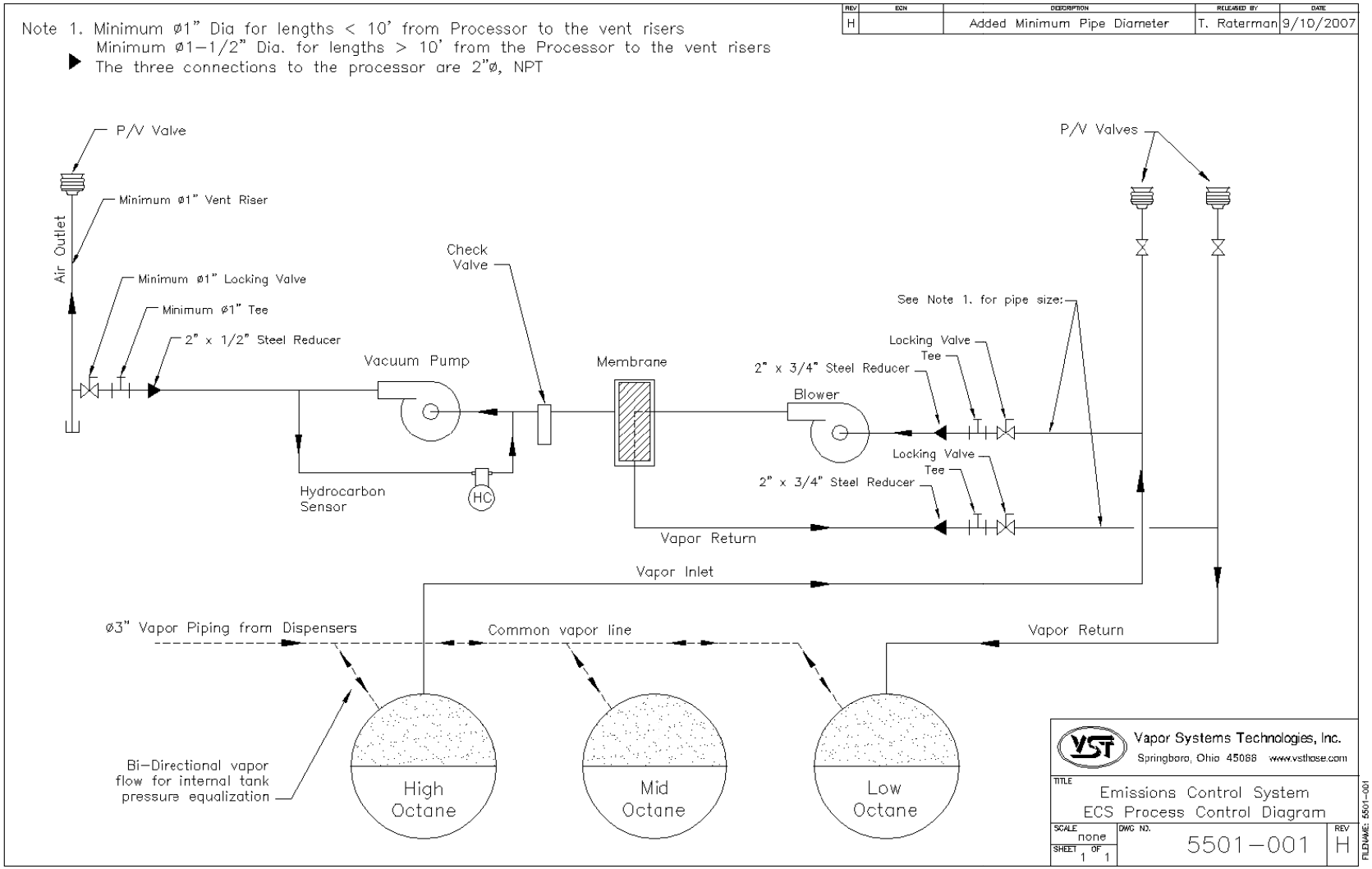


Figure 17: Processor Piping Connections

8.1 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.
- 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 VR-203, Exhibit 2.

8.2 Storage Tank Vapor Manifolds

- Storage tanks must be vapor manifolded.

8.3 P / V Valves

- All of the vent risers, including the additional vent risers for the *Processor* air outlet, must have a P/V valve installed.
- The air outlet P/V valve (functional or non-functional) is not regulated by CARB and does not need to be tested by AQMD's.
- The P/V valve for each vent riser (not including the *Processor* outlet) is part of the Phase 1 system, and therefore must be a CARB certified component.

C A U T I O N

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 Marshall**
- **Water Board**
- **Local Air Pollution District**
- **ICC**
- **NEC**
- **NFPA 30 and 30A**
- **UL**
- **Any other applicable federal, state, and local codes**

9 *Electrical Controls*

9.1 Electrical Controls Safety

- The *Processo*r 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.

9.2 Single-Phase Processor

- A circuit disconnect device is not included with the *Processor*.
    - NEC code requires that a readily accessible three-pole disconnect device be installed with the installation wiring for the *Processor*.
- At the main breaker, use a minimum of 110v, single-phase, and 40-amp electrical service.
- 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 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).
    - VST recommends that the *Processor's* main power be controlled by the facility's main Emergency Shut-Off System.

- The contractor shall supply a 110v fused motor starter with thermal overloads with a 110V relay coil to start / stop the:
    - 110v, 2-Hp, 24-amp, single-phase vacuum-pump motor
    - 110v, ½ Hp, 9.8 amp, single-phase blower motor

9.2.1 Power Requirements for Single-Phase Electrical Service

- 110v, single-phase, 60Hz, 40-amp service (blower and vacuum pump motors)
    - 110v, 2-hp, 24-amp, single phase vacuum-pump motor
    - 110v, ½ Hp, 9.8 amp, single-phase blower motor
- 110v breaker (heat-trace cable power)
    - 110v, 2-amp service to power the heat trace
- 110v, 2-amp service to power the 24VDC power supply for the HC sensor and the HC sentry
- The ECS motor-starter relay connects to the TLS.

9.3 Three-Phase Processor

- A circuit disconnect device is not included with the *Processor*.
    - NEC code requires that a readily accessible three-pole disconnect device be installed with the installation wiring for the *Processor*.
- At the main breaker use a 208/230-480v, 3-phase, 60Hz, 20-amp electric service.
- 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).
    - VST recommends that the *Processor's* main power be controlled by the facility's main Emergency Shut-Off System.
- The contractor shall supply a 208/230-480v fused motor starter with thermal overloads with a 110V relay coil to start / stop the:
    - 208/230-480v, 2-Hp, 7.5-amp, three-phase vacuum-pump motor
    - 208/230-480v, ½ Hp, 4.2 amp, three-phase blower motor

9.3.1 Power Requirements for Three-Phase Electrical Service

- 208/230-480v, 3-phase, 60Hz, 20-amp service (blower and vacuum pump motors)
    - 208/230-480v, 7.5-amp three-phase vacuum-pump motor
    - 208/230-480v, ½ Hp, 4.2 amp, three-phase blower motor
- 110v breaker (heat-trace cable power)
    - 110v, 2-amp service to power the heat trace
- 110v, 2-amp service to power the 24VDC power supply for the HC sensor and the HC sentry
- The ECS motor-starter relay is located inside the GDF.
- The ECS motor-starter relay connects to the TLS.

9.4 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 electrical motor starter and 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 that an electrical disconnect be installed. VST does not provide an outside electrical disconnect for the *Processor*. The NEC requires an electrical disconnect 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).

9.5 Power for the Motors

9.5.1 Single-Phase Processor

- Breakers rated at 110v, single-phase, and 40 amps power the two electric motors in the *Processor.*
  - This breaker should be a delayed-trip motor starting type.
  - **See Figure 18: Section 14 / Page 57.**
  - **See Figure 19: Section 14 / Page 58.**

9.5.2 Three-Phase Processor

- Breakers rated at 208/230-480v, three-phase, and 20 amperes power the two electric motors in the *Processor.*
  - This breaker should be a delayed-trip motor starting type.
  - **See Figure 20: Section 14 / Page 59.**
  - **See Figure 21: Section 14 / Page 60.**

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

- 110v, 2-am service to power the 24VDC power supply for the HC sensor and HC sentry.

9.7 Power for the Heat-Trace Cables in both Single-Phase and Three-Phase Processor

- 110v 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*.

9.8 Optional Convenience Outlet at the Processor

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

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 Marshall**
- **Water Board**
- **Local Air Pollution District**
- **ICC**
- **NEC**
- **NFPA 30 and 30A**
- **UL**
- **Any other applicable federal, state, and local codes**

10 Electrical Installation

10.1 Electical Controls Safety

- The *Processo*r 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.

10.2 Location and Mounting of the ECS Motor-Starter Relay and Conduit Layout

10.2.1 Single-Phase *Processor* Configuration

- Mount the ECS motor-starter relay inside the GDF's electrical room.
- Install two ¾" conduit from the *Processor* to the electrical room:
  - The first ¾" rigid conduit is for the 110v vacuum pump and blower motors. It is also for 110v power for the heat trace.
  - The second ¾" rigid conduit is for 24VDC and HC signal control wiring.

10.2.2 Three-Phase *Processor* Configuration

- Mount the ECS motor-starter relay inside the GDF's electrical room.
- Install two ¾" conduit from the *Processor* to the electrical room:
  - The first ¾" rigid conduit is for 208/230-480v and 110v power.
  - The second ¾" rigid conduit is for 24VDC and HC signal control wiring.

10.3 Wiring the Processor

- Size the system breaker(s) for the power load based on NEC requirements.
- Install two 3/4" rigid conduits from the *Processor* to the electrical room:
    - First 3/4" rigid conduit is for:
        - 208/203-480v motors (vacuum pump & blower)
        - 110v heat trace
        - Optional 110v convenience power outlet
- Second ¾" rigid conduit is for:
    - HC sensor 24VDC power
    - 4-20 mA HC signal control cable

Wiring between the *Processor* and components:

- All wiring (208/203-480 VAC and 24 VDC) to be TFFN or THHN with 600 V insulation.
- All wiring must be gasoline and oil resistant.

- VST provides the 24 VDC power supply for the HC Sentry module.
    - The 24VDC power-supply plugs into a standard 110v outlet.
    - The 110v 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 110V circuit. (Go to page 54 and page 56 of this section to see the electrical schematics.)

- 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 208/230-480v or 110v power for the motors is a minimum 12 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.

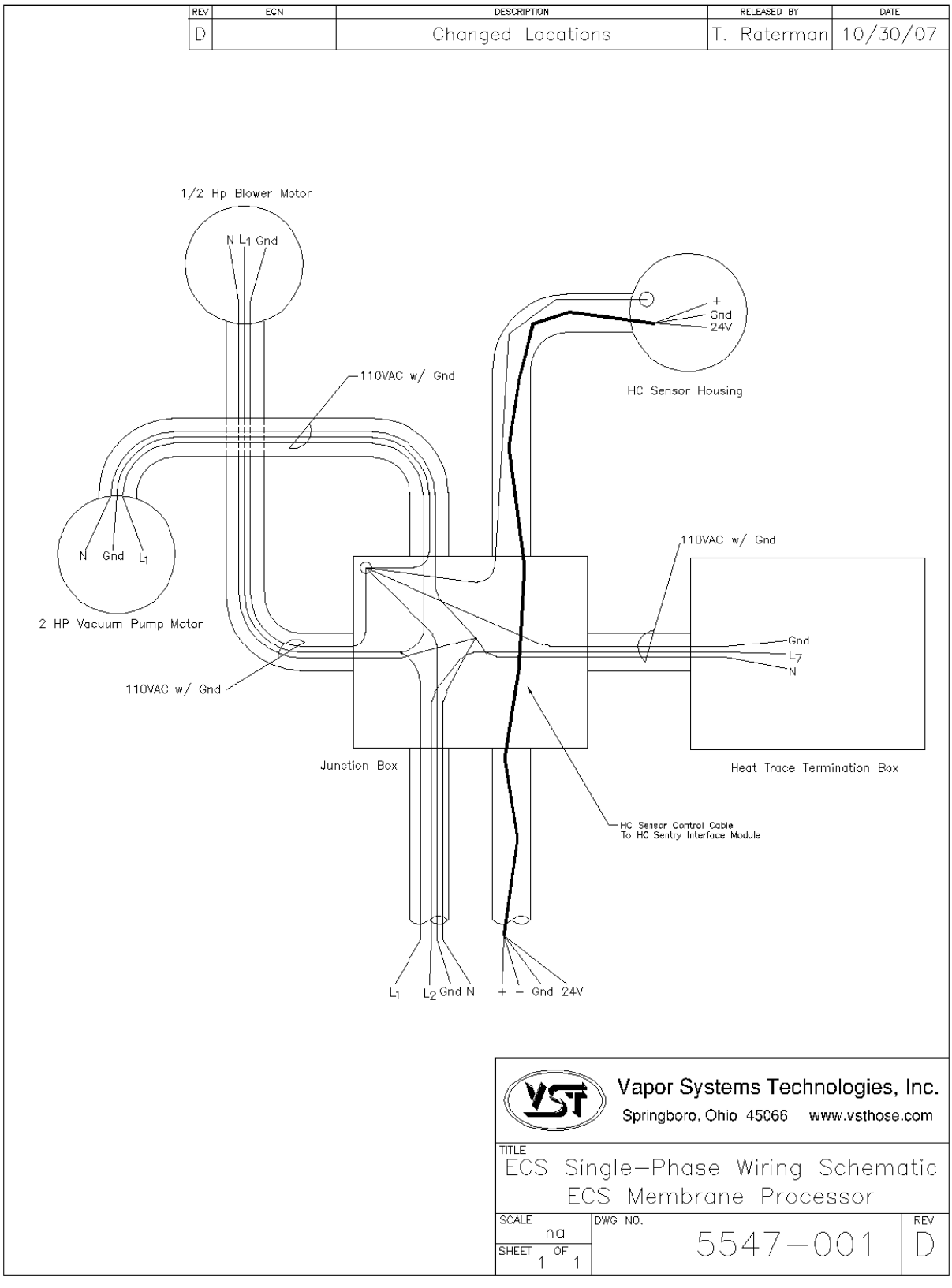


Figure 18: Single-Phase Wiring Schematic

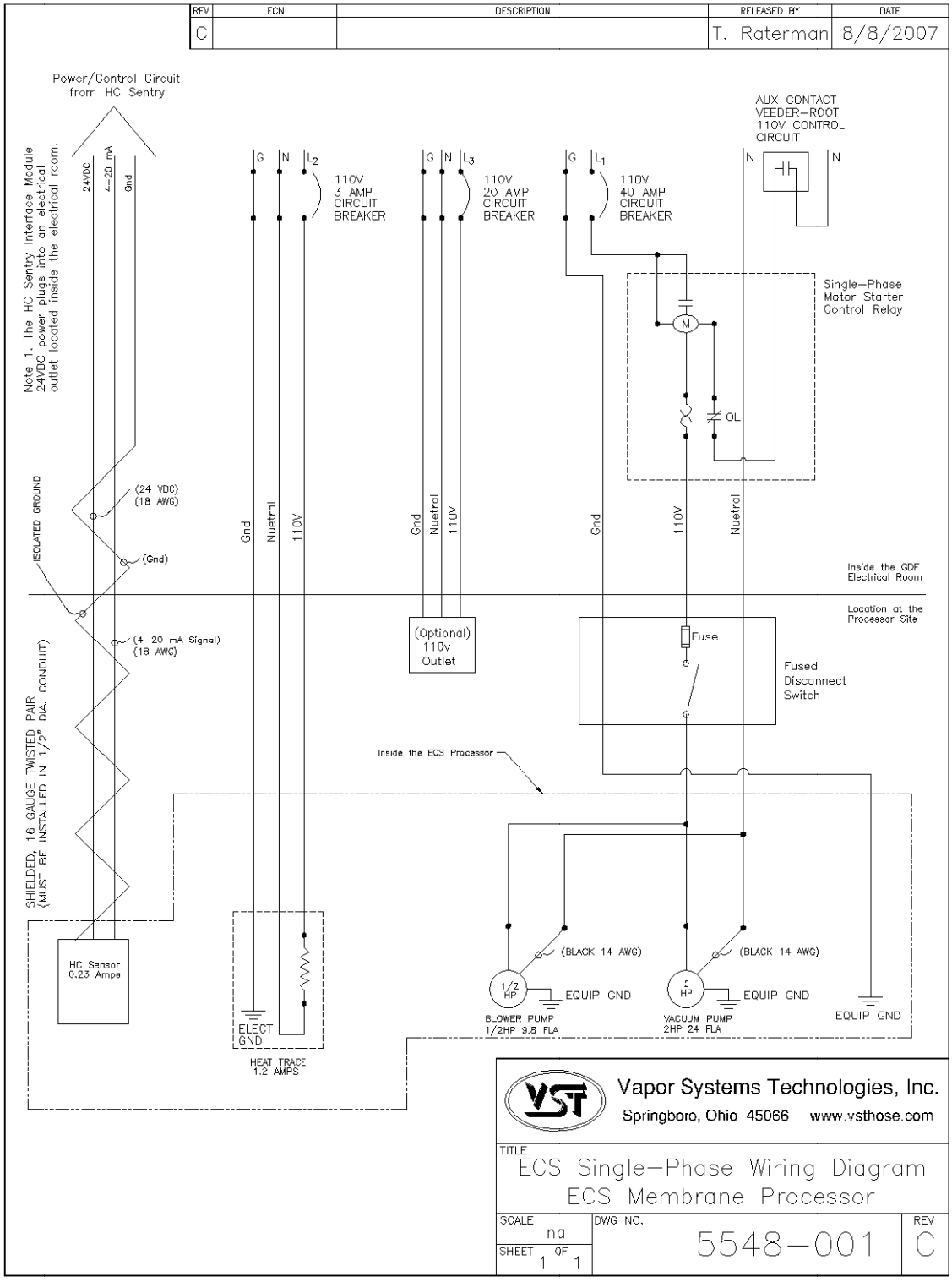


Figure 19: Processor Single-Phase Wiring Diagram

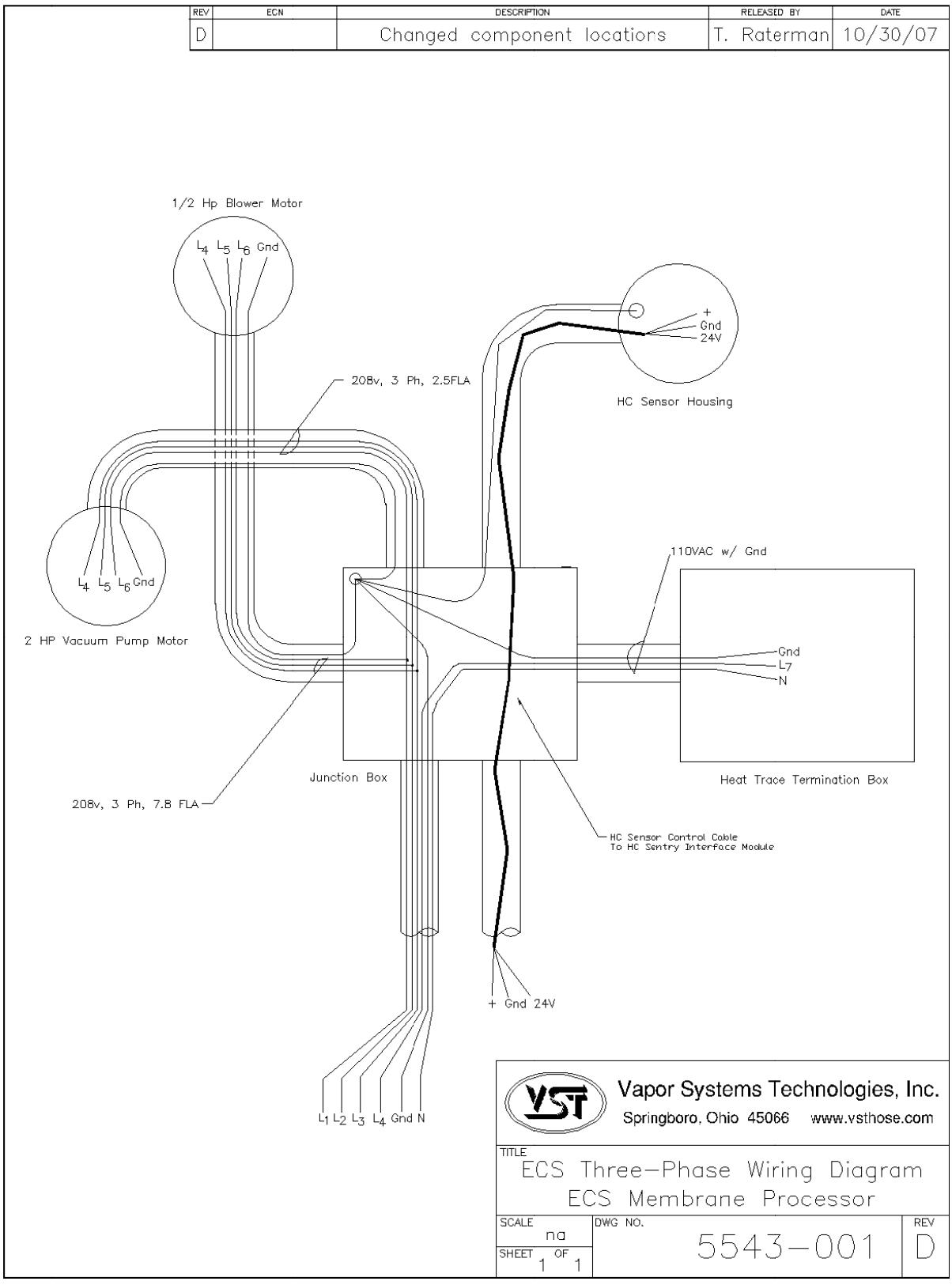


Figure 20: Processor Three-Phase Wiring Schematic

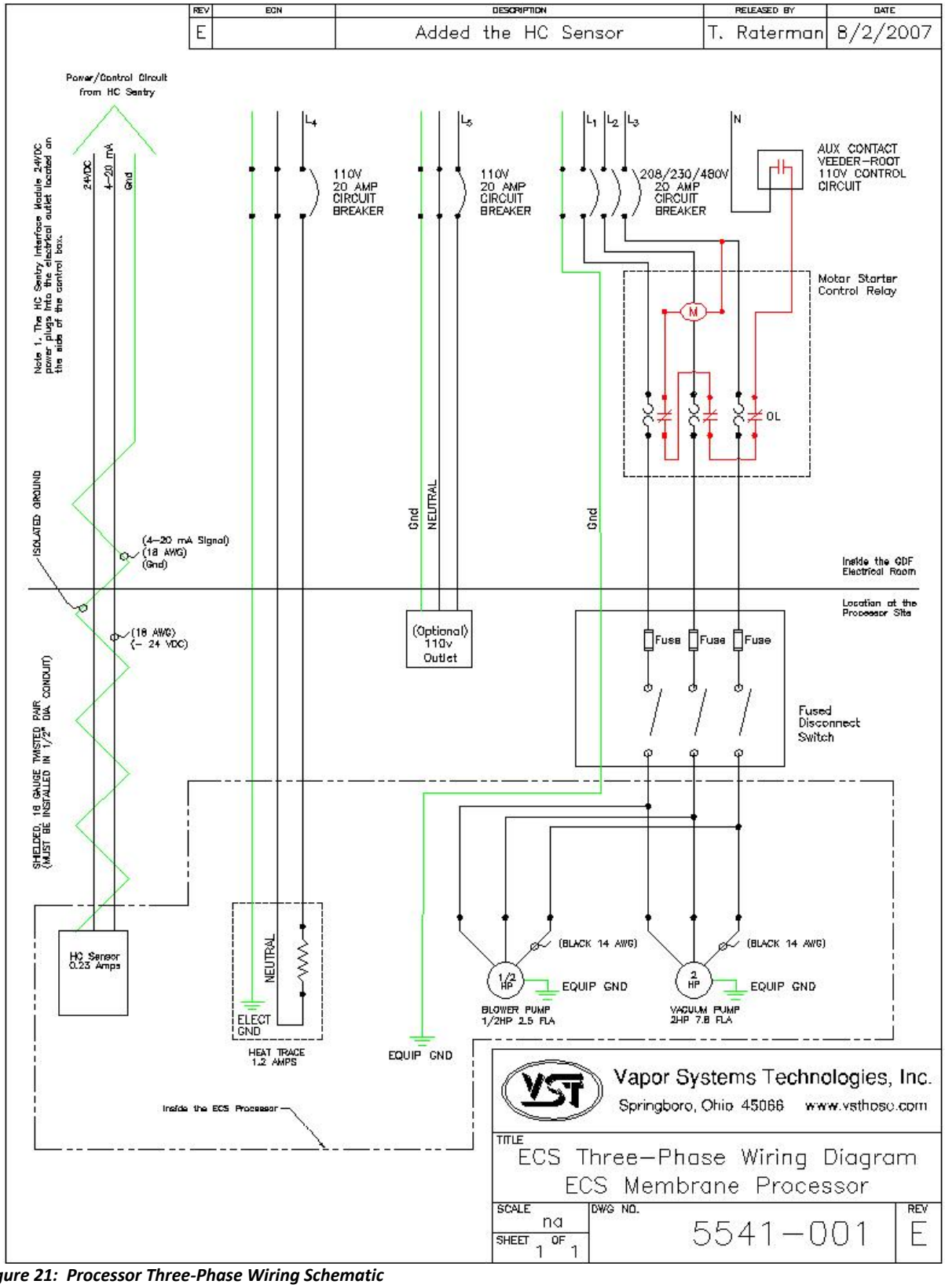


Figure 21: Processor Three-Phase Wiring Schematic

10.4 Auxiliary Output Relay

- Run two wires from motor relay contacts to the Veeder-Root TLS.
    - This action requires that the VST ASC (Level B) be a Veeder-Root Certified Contractor with a minimum of Veeder-Root level 1/2/3/4 certification.
- The 110VAC control voltage for the motor control contactors coil comes from the PMC TLS-350 controller.
- The user interface is equipped with an Auxiliary Output Relay for external monitoring of the *Processor*.
- This relay will typically be used when the *Processor* is installed with a PMC 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).
- When the *Processor* is either powered off 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.
    - **See Figure 22: Section 14 / Page 62**
    - **See Figure 23: Section 14 / Page 63**
    - **See Figure 24: Section 14 / Page 64**

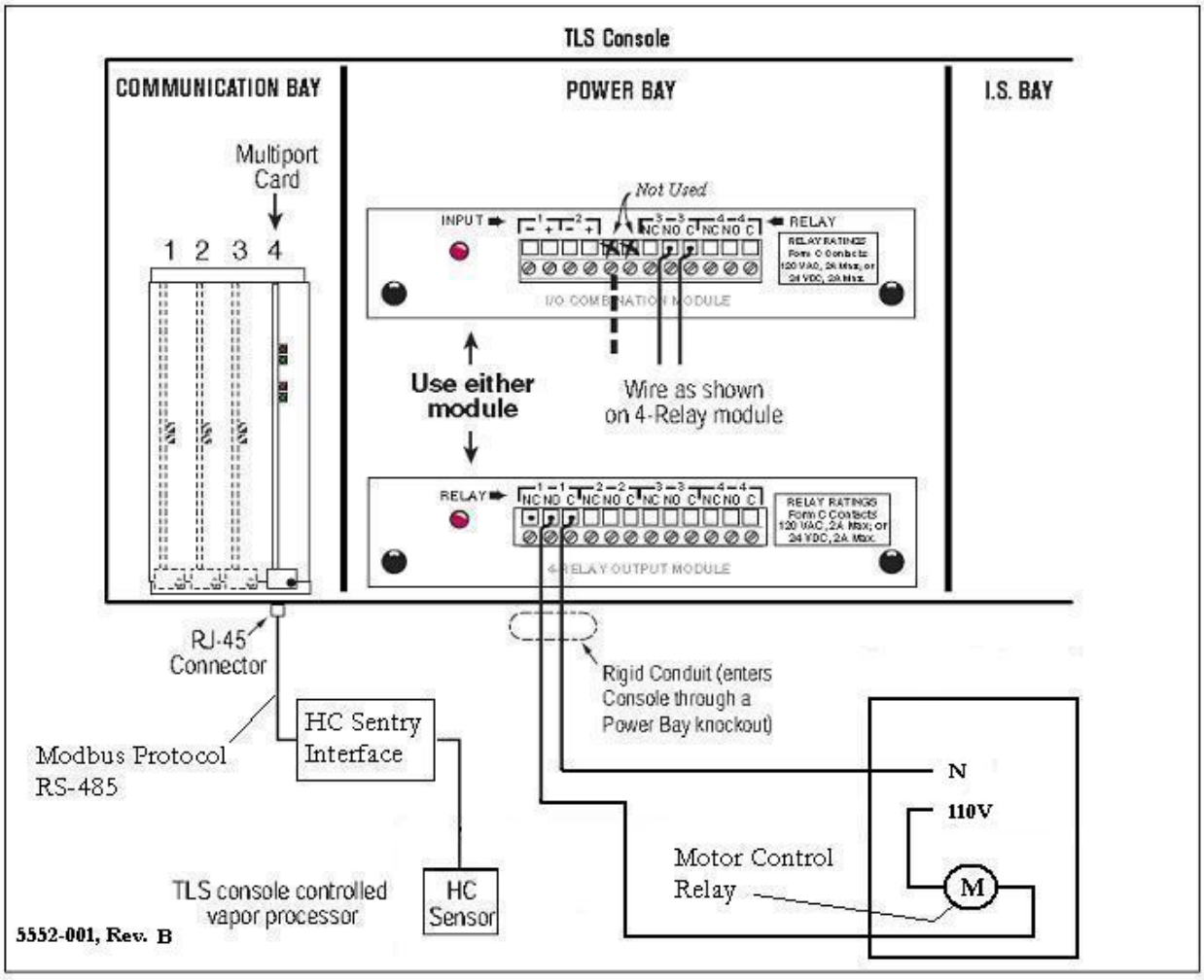


Figure 22: VR TLS Multi-Port Card Connection to HC Sentry Module

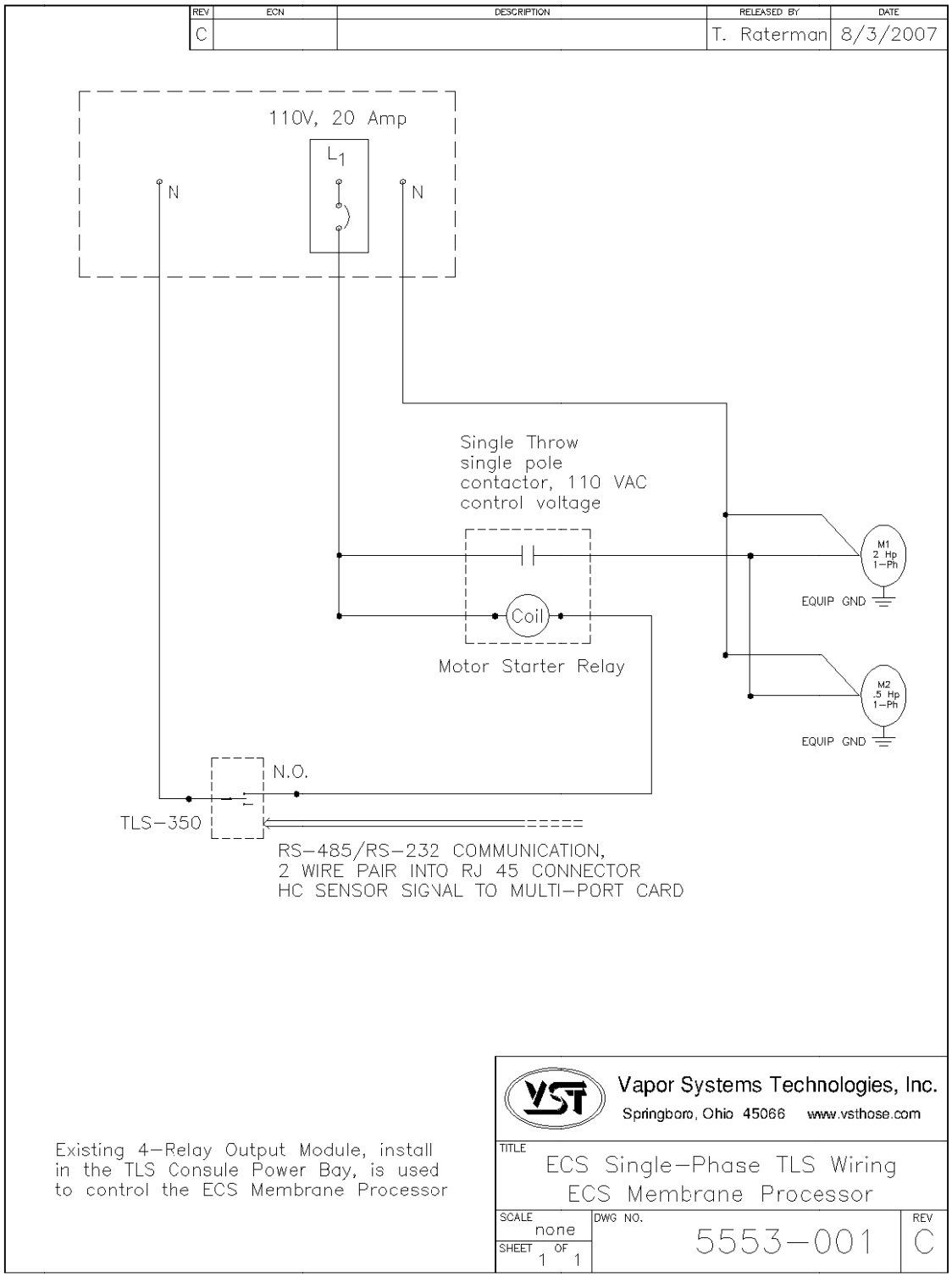


Figure 23: Processor Single-Phase TLS Wiring

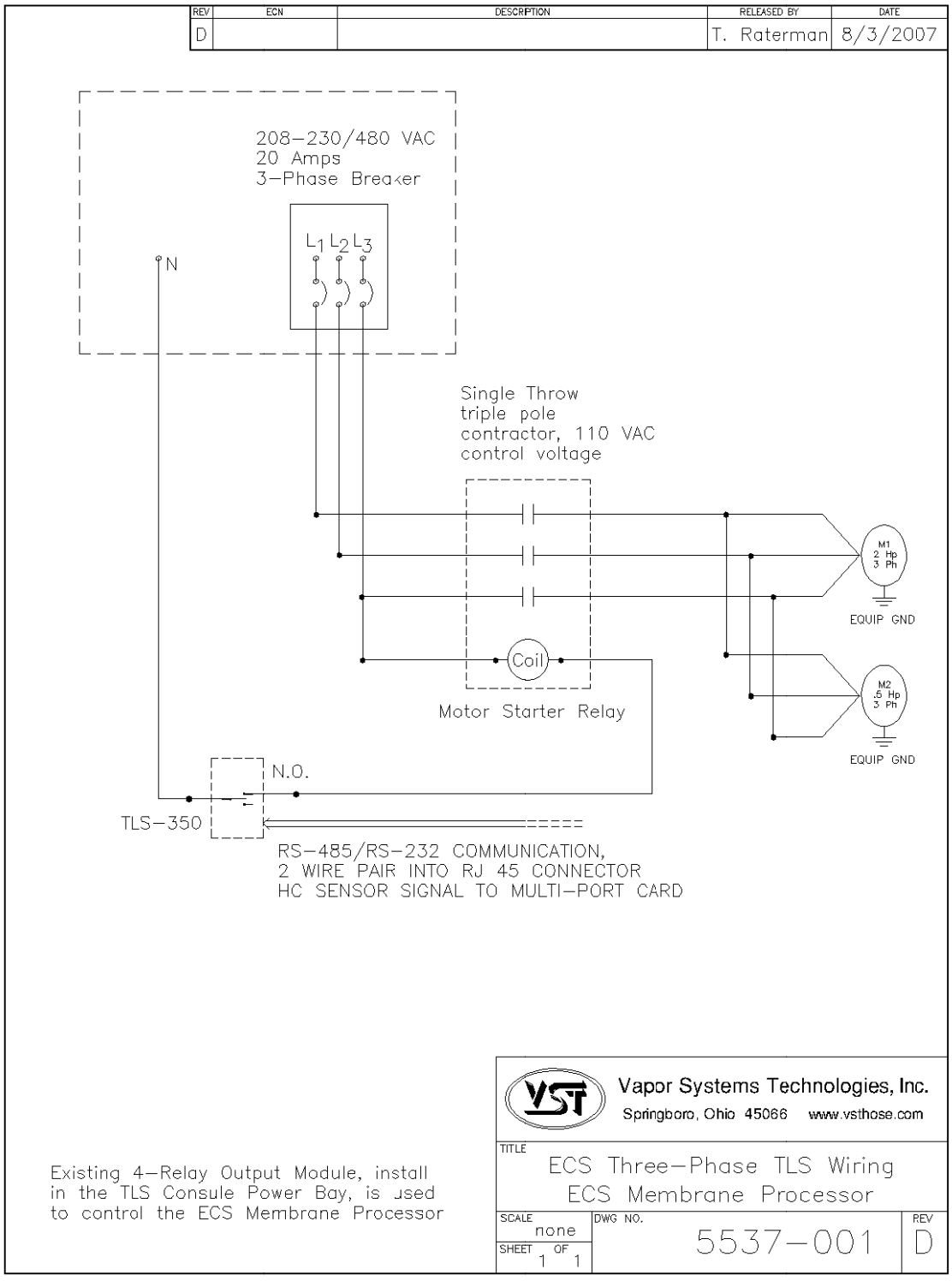
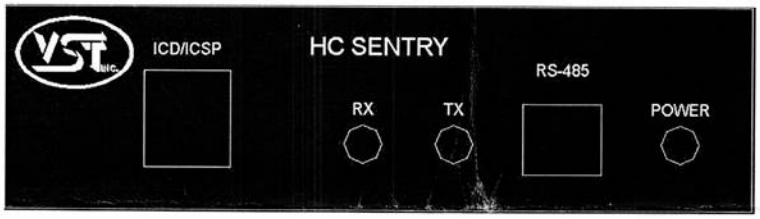


Figure 24: Processor Three-Phase TLS Wiring

10.5 HC Sensor / HC Sentry

- Using 24 VDC, the HC sentry provides power to the HC sensor.
- A 110V / 24 VDC converter from a 110V outlet powers the HC sentry.
- A 4-wire, 18 ga. 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.
- The wiring from the HC sensor is connected to the 2 twisted-pair wires inside the HC electrical housing.
- Install an equipment ground to the HC sensor housing.



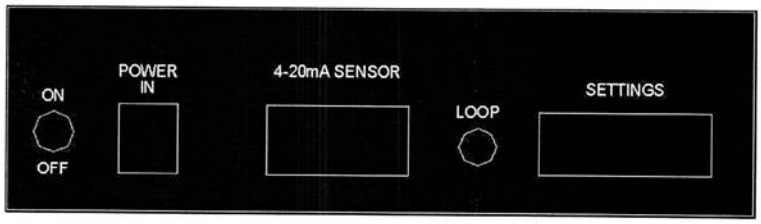
ICD/ICSP: This connector provides a means for performing in-circuit-debug and in-circuit-serial-programming utilizing the programming and debugging tools from the processor manufacturer. This connector will typically be used in production to perform initial programming, and could be used as a simple 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 25: HC Sentry Front and Back Views

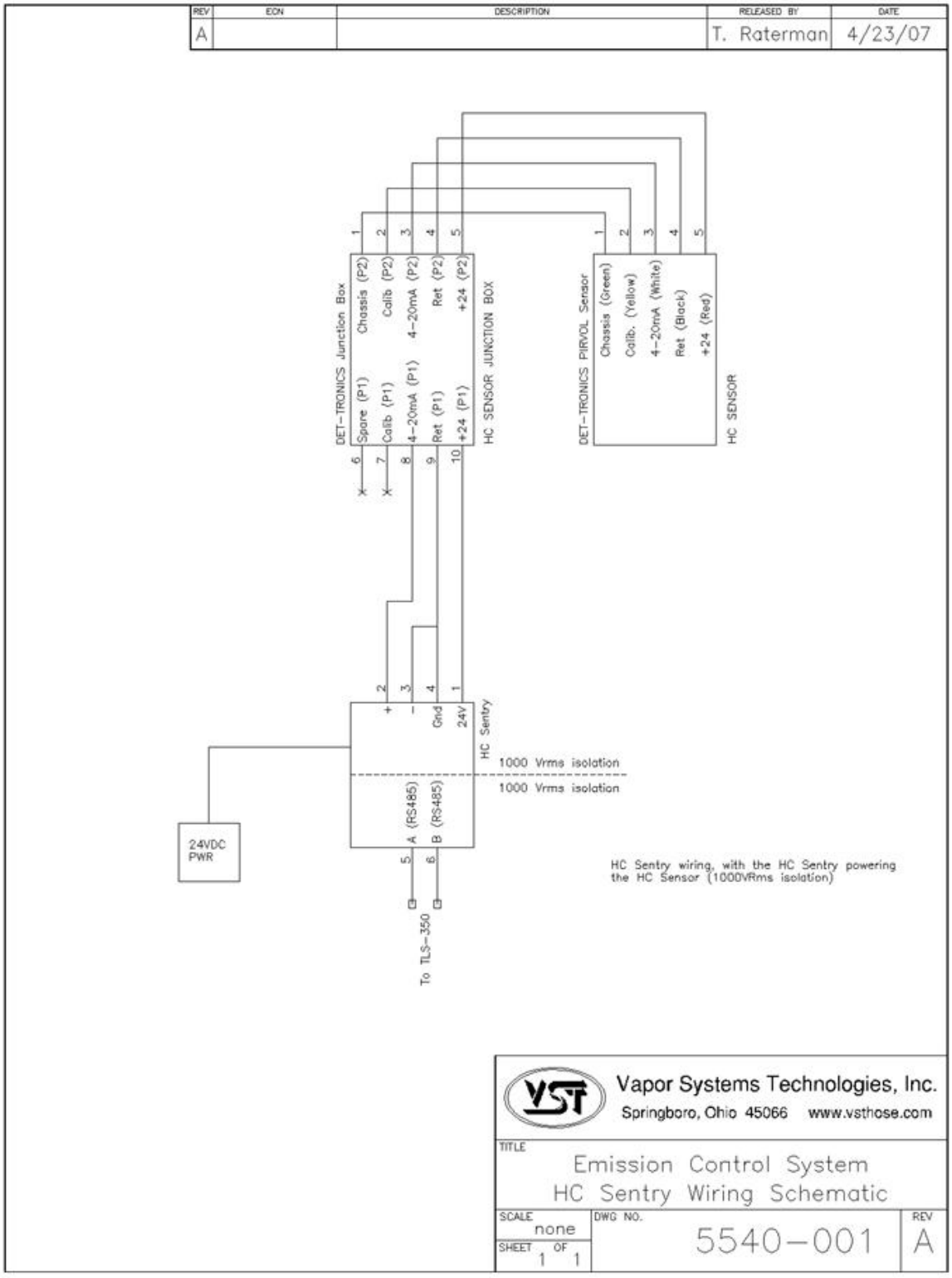
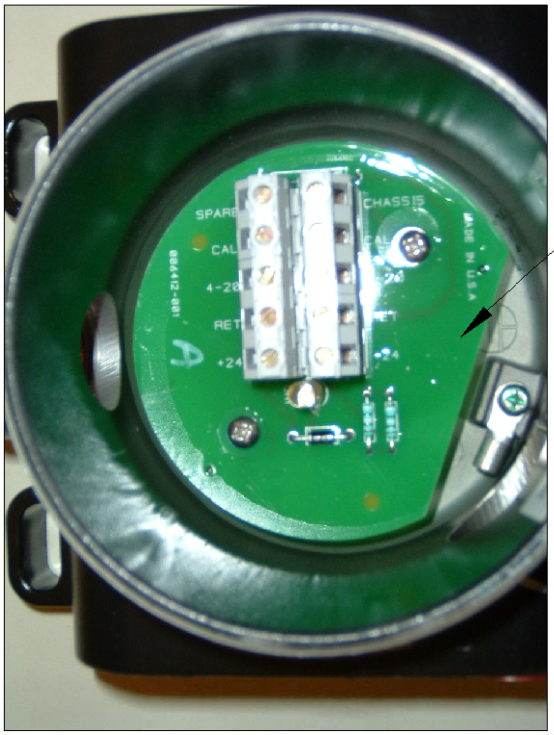


Figure 26: HC Sentry to HC Sensor Wiring Diagrams

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 27: HC Sensor and HC Sentry Pictures

10.6 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 2/3 training.
- 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 110VAC outlet.
- A four-wire, 18-gauge, 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.

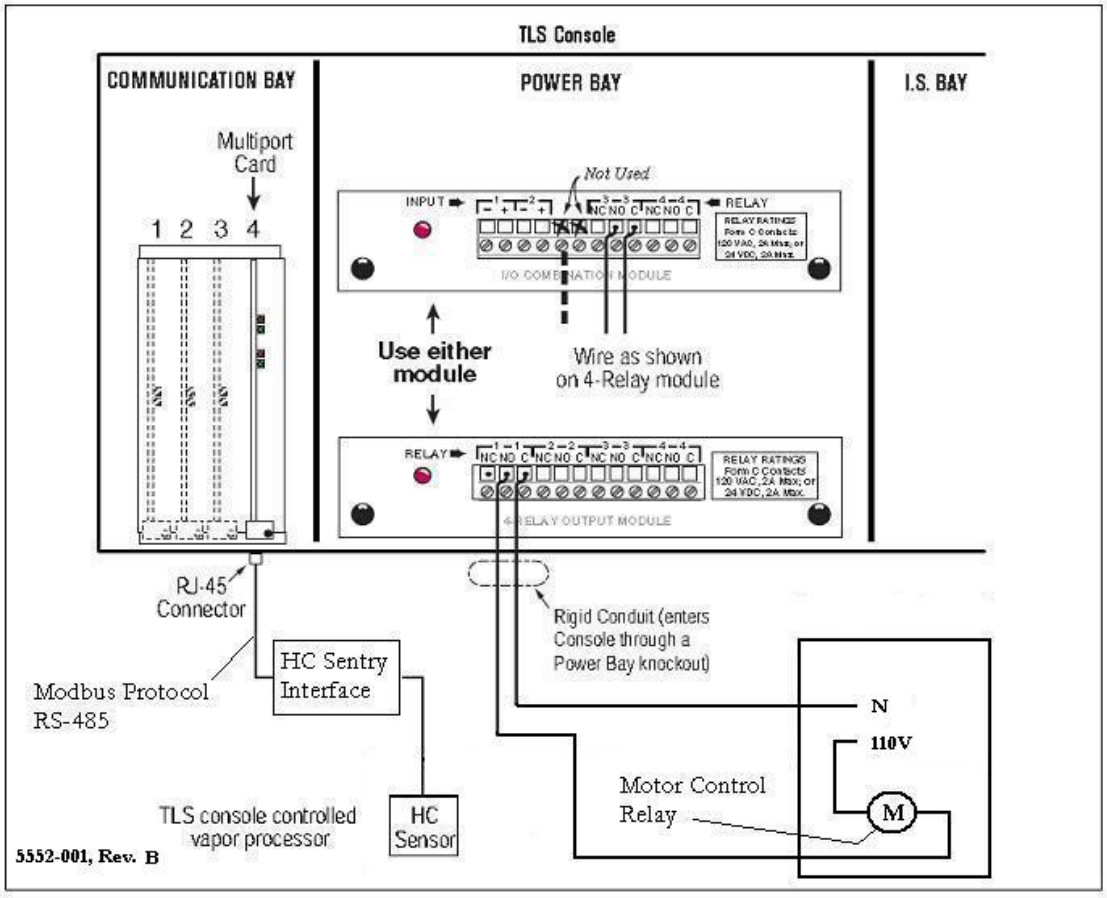


Figure 28: VR TLS Multi-Port Card Connection to HC Sentry Module

10.7 Veeder-Root TLS 350 with PMC

- The *Processor* is controlled by a Veeder-Root (VR) TLS-350 with a PMC 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 a PMC control package.
- VST will supply the HC Sentry Interface Module with 110VAC/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 does not provide the required items to interface the *Processor* with the TLS-350 controller.
- VST does not provide the TLS-350 controller or the software required by the TLS-350.

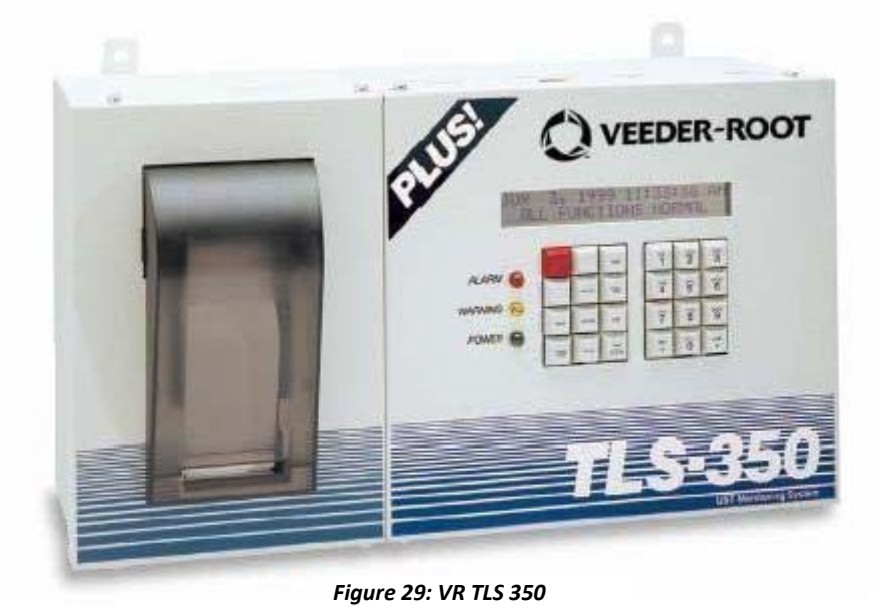


Figure 29: VR TLS 350

5554-001

11 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 outlet of the *Processor.*

Remove the plugs on the 3 tees located on the inlet and the outlet of the *Processor.*

11.1 Required Post-Installation Power-Up Tests

- Once you have properly prepared the *Processor* for testing, conduct the following 5 tests:

	Test	Section #	Page #
1.	Electrical Connection Check	14	73
2.	Processor Leak Test	14	73
3.	Motor Rotation Test	14	77
4.	Heat-Trace Temperature Test	14	78
5.	HC Sensor & HC Sentry 24 Power Test	14	78

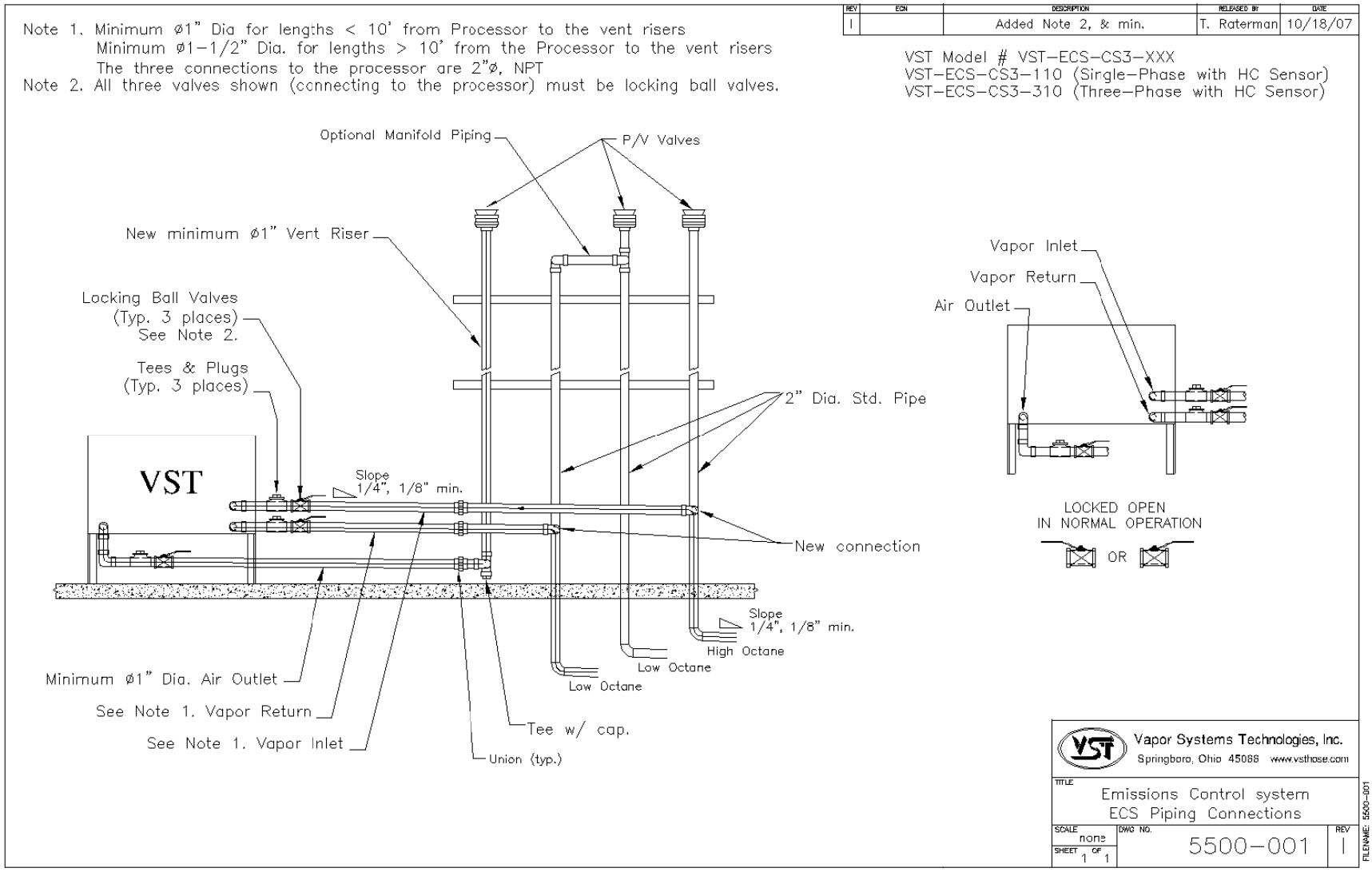


Figure 30: ECS Piping Configuration

11.2 TLS Manual Mode

- Follow the steps at the TLS console to put theTLS-350 in the Manual "**OFF**" Mode, as shown in the figure on this page.

- After the post-installation power-up tests are complete, put the *Processor* in the Manual "OFF" position.

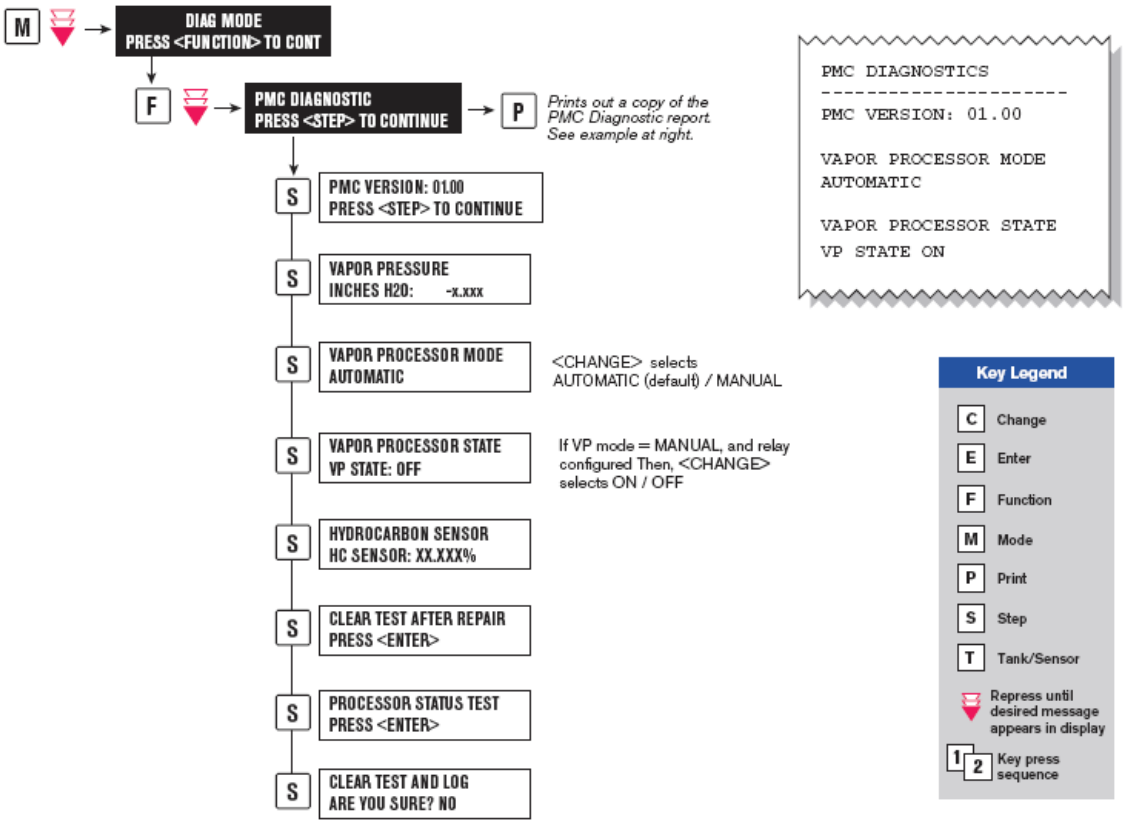


Figure 31: Diagnostic Menu

11.3 Electrical Connection Test

- With the TLS in the Manual "**OFF**" Mode as shown in **Figure 31: Section 14 / Page 72.**
- 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) / 110V power
        - Fused disconnects
        - Panel breaker wiring connections
        - Starter
        - TLS 4-relay module
        - TLS multi-port card
    - At the ECS:
        - 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 Marshall**
- **Water Board**
- **Local Air Pollution District**
- **ICC**
- **NEC**
- **NFPA 30 and 30A**
- **UL**
- **Any other applicable federal, state, and local codes**

11.4 Processor Leak Test

- The ASC must be a VST Level B or C.
- Conduct this test with the TLS in the Manual "**OFF**" Mode, as shown in **Figure 31: Section 14 / Page 72.**
- Physically check all fittings for tight connections.
- All tubing fittings are a special UL approved flare-fitting and designed for gasoline- vapor applications.
    - For a leak-proof connection, these fittings are made to be repeatedly disassembled and reassembled.

11.4.1 Tools needed to conduct the *Processor* Leak Test:

- NPT steel test plug (sized for the tee), drilled and tapped with a ¼" NPT hole, and centered in the plug.
- A pressure supply generating 2.0 ± 0.1 PSI.
- A pressure gauge, 0-5 PSI, ¼" NPT bottom connection, 2-1/2" face
  (NOSHOK, 25-200-5-PSI, ¼" NPT bottom, 2-1/2" face)
- Pressure regulator capable of an outlet pressure of 2.0 PSI, ¼" NPT connections
  (McMaster-Carr, 1888K1, 0-15 output pressure, 250 max. pressure, ¼" NPT)
- ¼" NPT 3-way isolation/line/relief valve
- ¼" NPT x 2" nipple (3-each)
- ¼" NPT tee
- ¼" NPT fitting to connect the compressed air supply
- **See figure 32: Section 14 / Page 76**

11.4.2 *Processor* Leak Test Steps

- With the TLS in the Manual "**OFF**" Mode, check all electrical connections, as shown in **Figure 31: Section 14 / Page 72**.

- Make sure the three valves at the *Processor* are closed.

- Install NPT plugs on the vapor return and the air outlet.
  - **See ECS Membrane *Processor* Piping Configuration: Figure 30: Section 14 / Page 71.**

- Install a NPT test-plug on the vapor inlet-tee and attach the:
  - 1st Nipple
  - Tee
  - 2nd Nipple
  - Pressure Gauge
  - Pressure Regulator
  - 3rd Nipple
  - Valve

- With the pressure-test equipment attached to the vapor inlet on the *Processor*, connect the compressed air to the test fixture.
  - Open the 3-way valve to allow the *Processor* to pressurize to 2.0 PSI.

- With the *Processor* pressurized to 2.0 PSI, spray a soapy solution on each fitting to check for bubbles.

  - If air bubbles do not appear, the connection is tight
  - If air bubbles do appear, tighten the leaking fitting 1/8" turn and re-check for leaks.

- Continue this process until all the internal tube fittings have been checked and found to be leak free.

- Remove the compressed air connection to the *Processor*.

  - Release the pressure from inside the Processor.
  - Remove the test fixture and test plug.

- If the fittings cannot be tightened so the connection is leak free, replace the tube/45° flare nuts assembly.

- **Once this test is complete, remove the NPT plugs on the vapor return and the air outlet.**

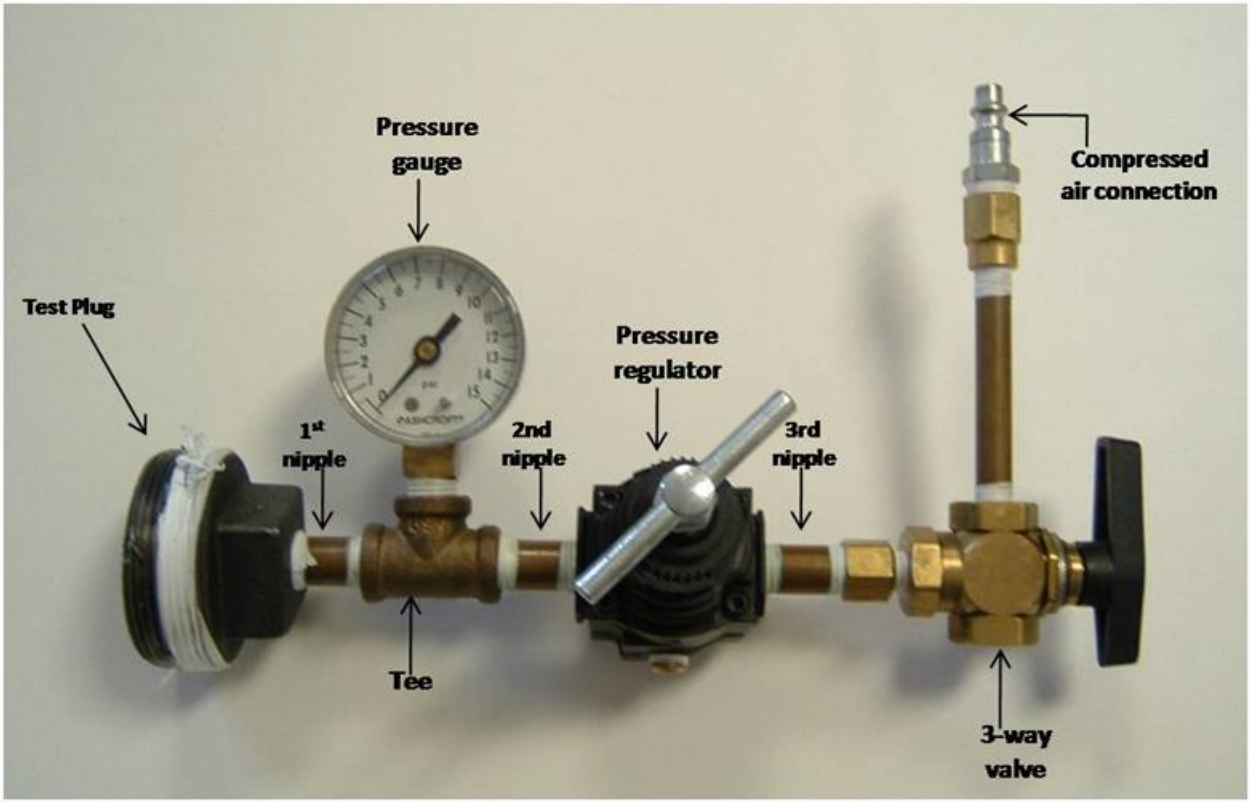


Figure 32: Leak Test Fixture

11.5 Motor-Rotation Test (Three-Phase Motors Only)

- The purpose of this test is to insure that the motors are rotating in the correct direction.
- Be sure the *Processor* is in the manual **ON** Mode at the TLS (as shown in **figure 31: Section 14 / Page 72)** and that the cover is off the *Processor*.
    - Visually check the motor rotation for the vacuum pump and blower motor 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.
- If the motors are rotating in the proper direction, put the TLS in the manual **OFF** mode, as shown in **figure 31: Section 14 / Page 72**
- If either of the motors are not rotating in the correct direction:
    - Put the *Processor* in the manual "OFF" Mode at the TLS.
    - Turn off and lock out power to the *Processor* at the main distribution panel.
    - Follow safety regulations regarding lock-out / tag-out procedures to insure power cannot be turned on to the *Processor*.
    - At the motor-starter relay or main distribution panel, switch any two of the three power circuits.
    - Remove the lock from the lock-out and apply power to the *Processor*.
    - Return the *Processor* to the manual **ON** Mode at the TLS.
    - Re-check the equipment for proper rotation.
    - If either motor will not run, **see the ECS Troubleshooting Guide: VST Manual 9514-003, found on the VST website at www.vsthose.com.**

11.6 Heat-Trace Temperature Test

- The purpose of this test is to insure that the electrical connection to the heat-trace cable is properly established and that the membrane housing has a temperature between 100°-150° F.

  (Note: An infrared temperature sensor may be used in place of the temperature probe.)

- With power on to the heat-trace cable, use a temperature probe to check the temperature inside the fiberglass insulation (you can also use an infrared temperature sensor).

  - Gently insert the probe tip 2”- 3” from the top between the membrane housing and the heat trace cable.
  - Leave the probe tip inside for two minutes for temperature stabilization.
  - The temperature should reach 100°-150°F in two minutes.
  - If the heat trace does not come up to temperature, **see the *Processor* Troubleshooting guide VST Manual 9514-003 at www.vsthose.com.**

11.7 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.

11.7.1 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.

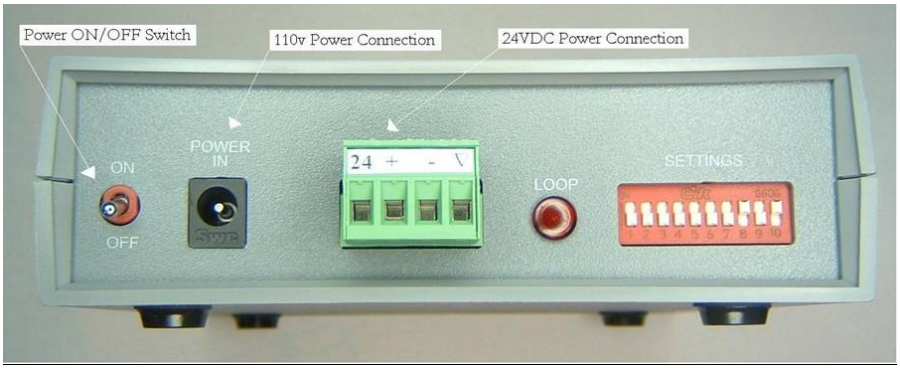


Figure 33: HC Sentry Interface Module Front View: Power and ON/OFF Switch

- If the unit does not function properly,
  see the ECS Troubleshooting Guide:
  VST Manual 9514-003, found on the VST website at www.vsthose.com.

11.7.2 Checking 24VDC Power to the HC Sentry Module

- The HC Sentry is powered from a 110V outlet and uses a 110v/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 110v power to the outlet.
    - Check the **ON** switch on the HC Sentry module.
    - Check that the 110v/24VDC power converter is functioning.
    - If the unit does not function properly, **see the ECS Troubleshooting Guide: VST Manual 9514-003, found on the VST website at www.vsthose.com.**

Figure 34: HC Sentry Interface Module Back View: Power "ON" Light

11.8 Preparing the Processor for Field Operation

- 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 31: Section 14 / Page 72.**

12Post-Installation Power-Up Checklist

Post-Installation Power-Up Checklist Form			
VST-ASC #:	Date:		
ASC Name:			
VST-ASC Certification Level:			
ASC Company Name:			
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 the post-installation.			

The following tests were performed in accordance with IOM found in the VST's Executive Order VR-203-A.

_____

ASC Signature

	ECS *PROCESSOR* COMPONENTS	Passed	Failed	Repaired	Replaced	Action Items if Required
	All electrical connections checked	☐	☐	☐	☐	
	Processor internal tubing leak checked	☐	☐	☐	☐	
	Blower motor rotation checked	☐	☐	☐	☐	
	Vacuum pump motor rotation checked	☐	☐	☐	☐	
	Heat-trace temperature checked	☐	☐	☐	☐	
	HC sentry power checked	☐	☐	☐	☐	
	HC sensor power checked	☐	☐	☐	☐	
	Site Components	**Yes**	**No**	**Unknown**	**If "NO" or "Unknown" explain**	
	Pressure sensor operational and checked	☐	☐	☐		
	TLS-350 operational and checked	☐	☐	☐		
	HC sentry connected to the TLS and checked	☐	☐	☐		
	Motor-starter control relay connected to the TLS and checked	☐	☐	☐		
	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	☐	☐	☐		

	Site Components	Yes	No	Unknown	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	☐	☐	☐	