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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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

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

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

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)

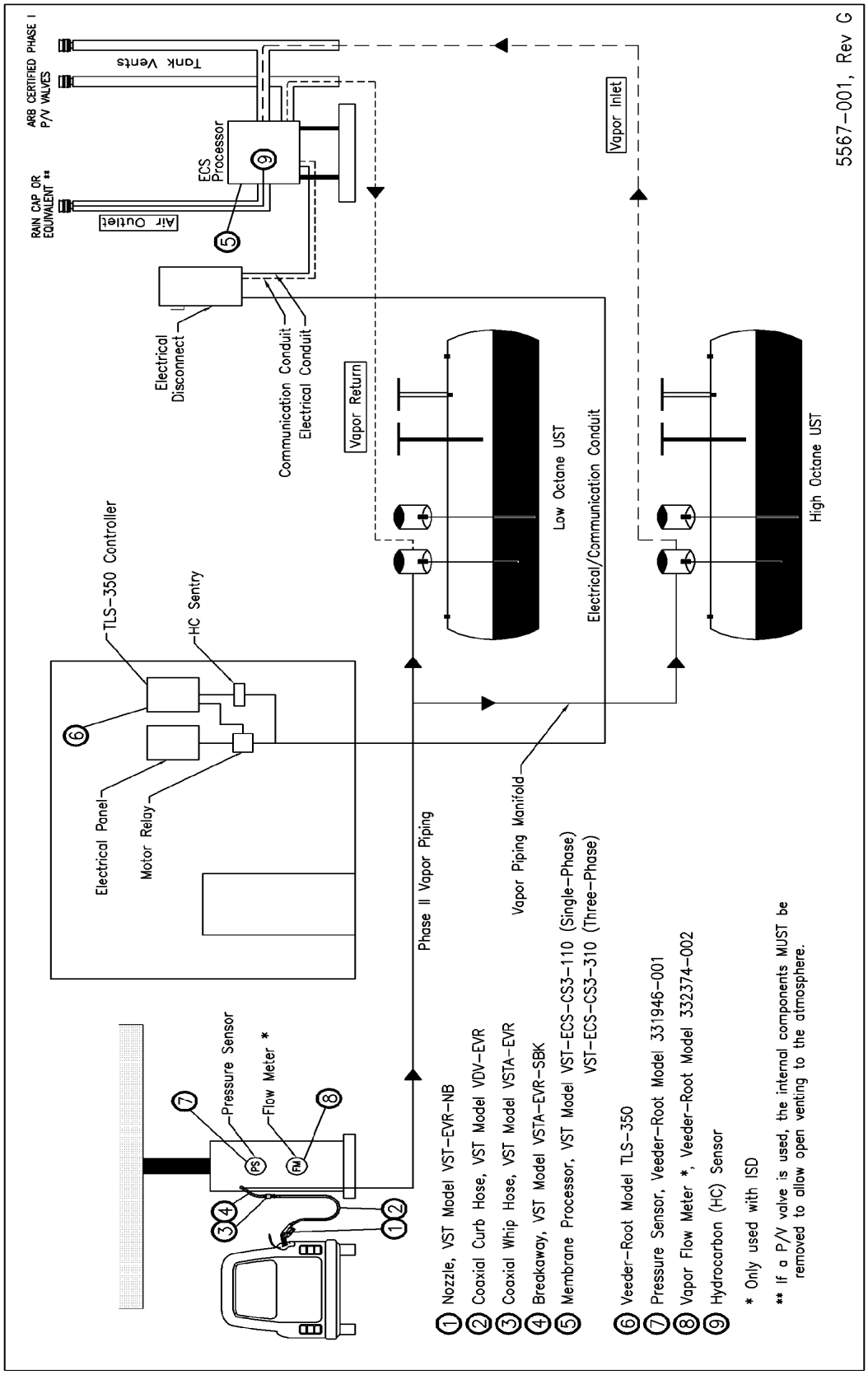


Figure 1: How the Processor fits into the GDF layout

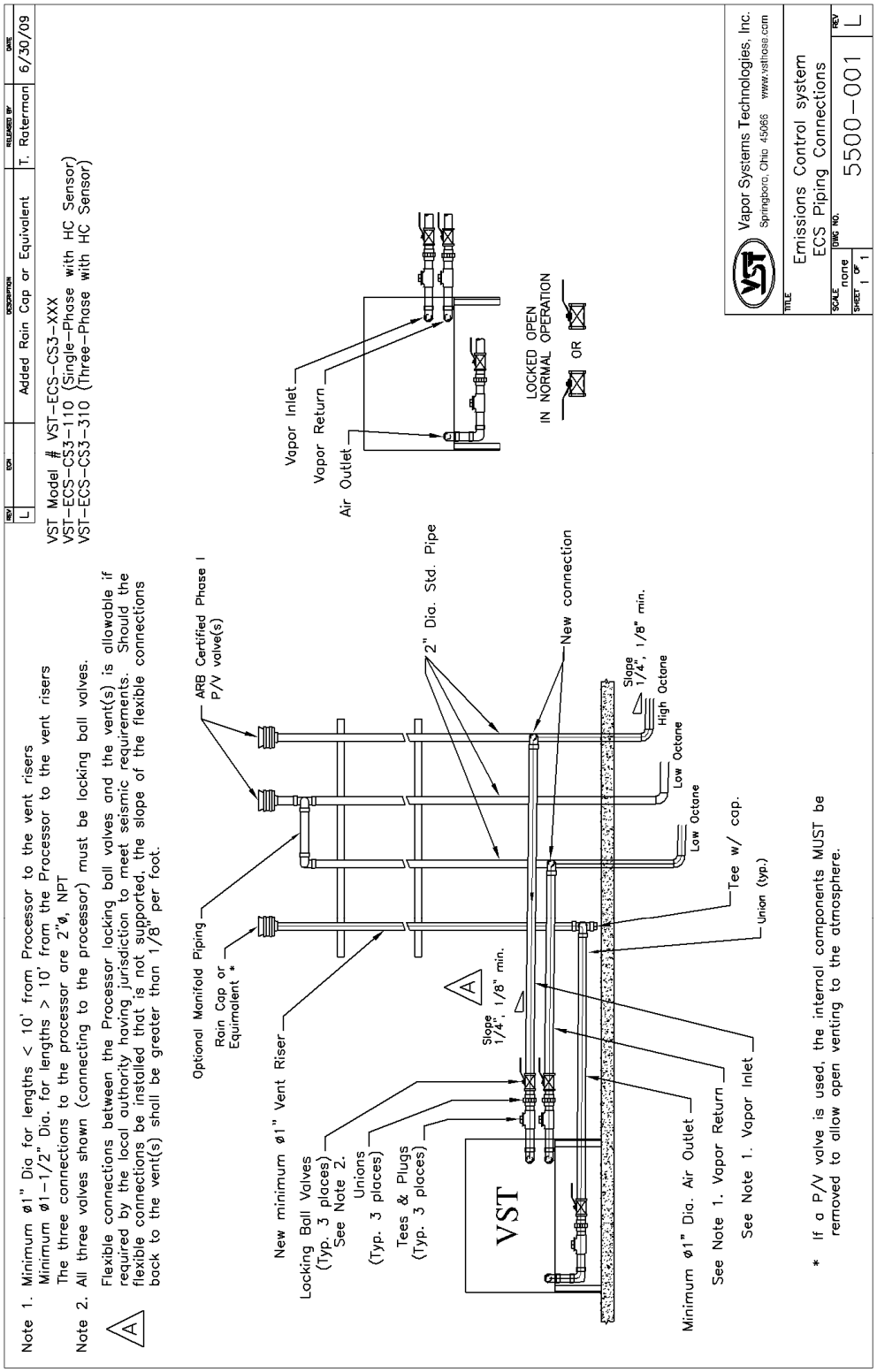


Figure 2: Processor Piping Diagram

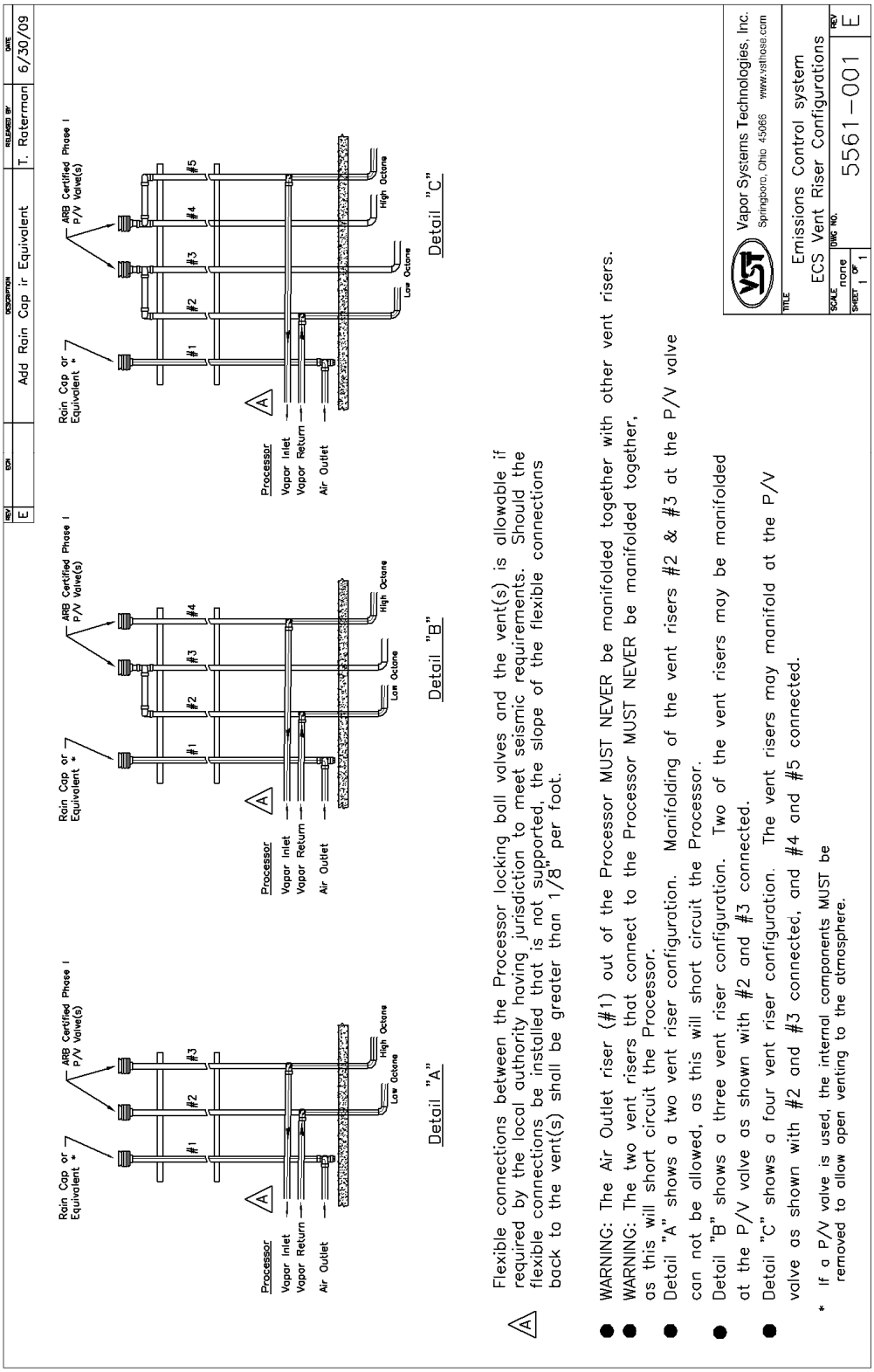


Figure 3: ECS Vent Configurations

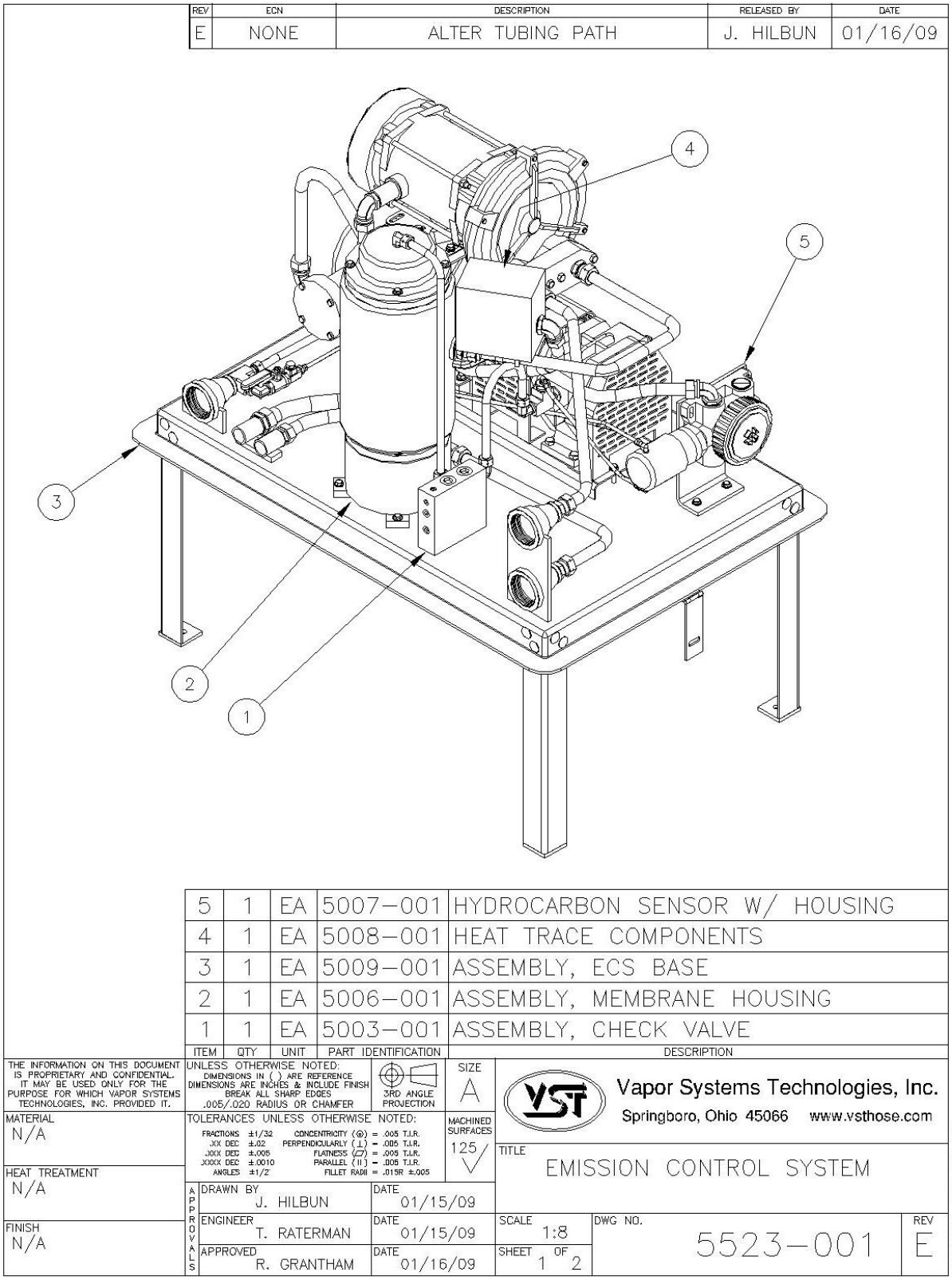


Figure 4: Processor Isometric Drawing (1 of 2)

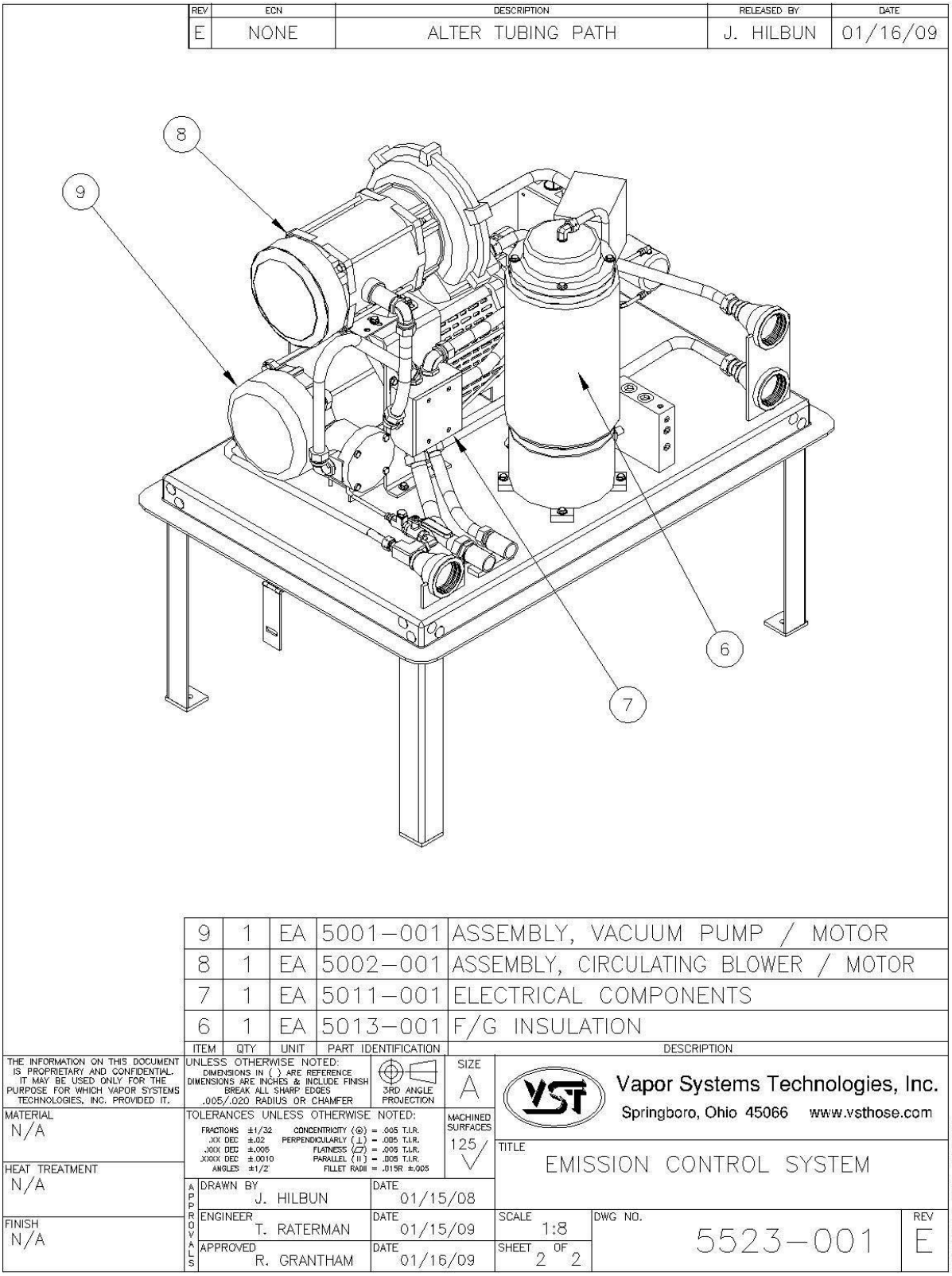


Figure 5: Processor Isometric Drawing (2 of 2)

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

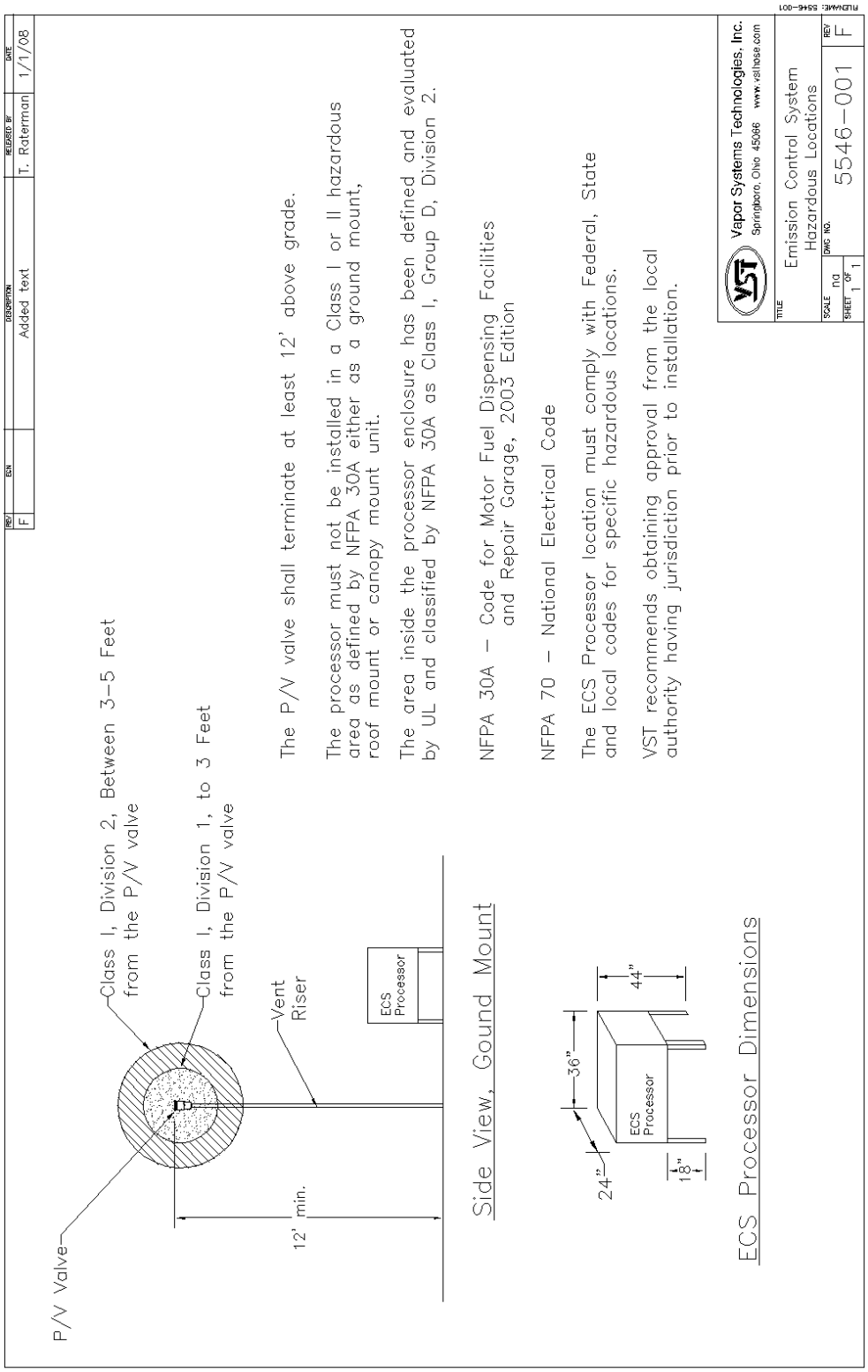


Figure 8: ECS Membrane Processor Hazardous Locations

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.

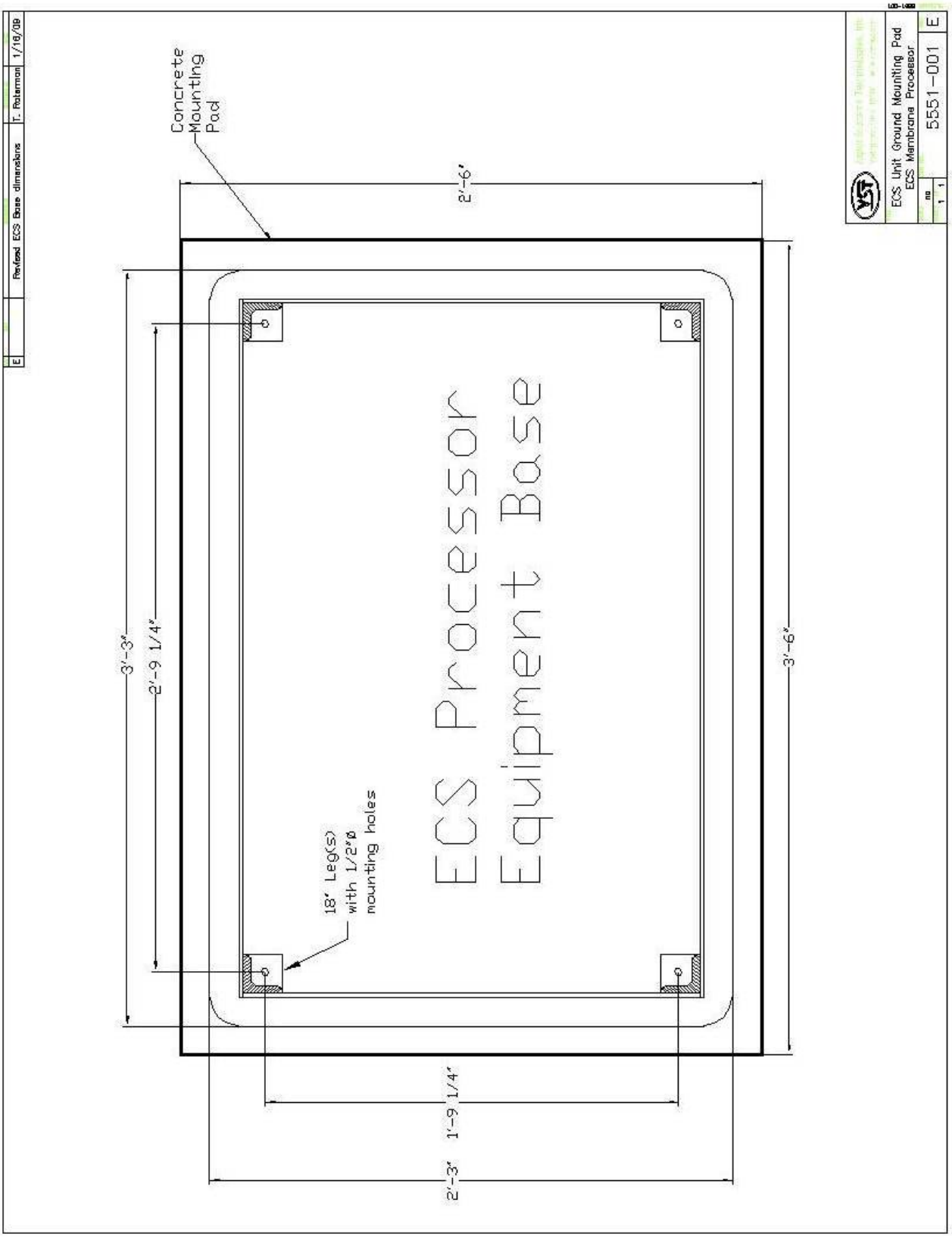


Figure 9: Concrete Mounting Pad Dimensions

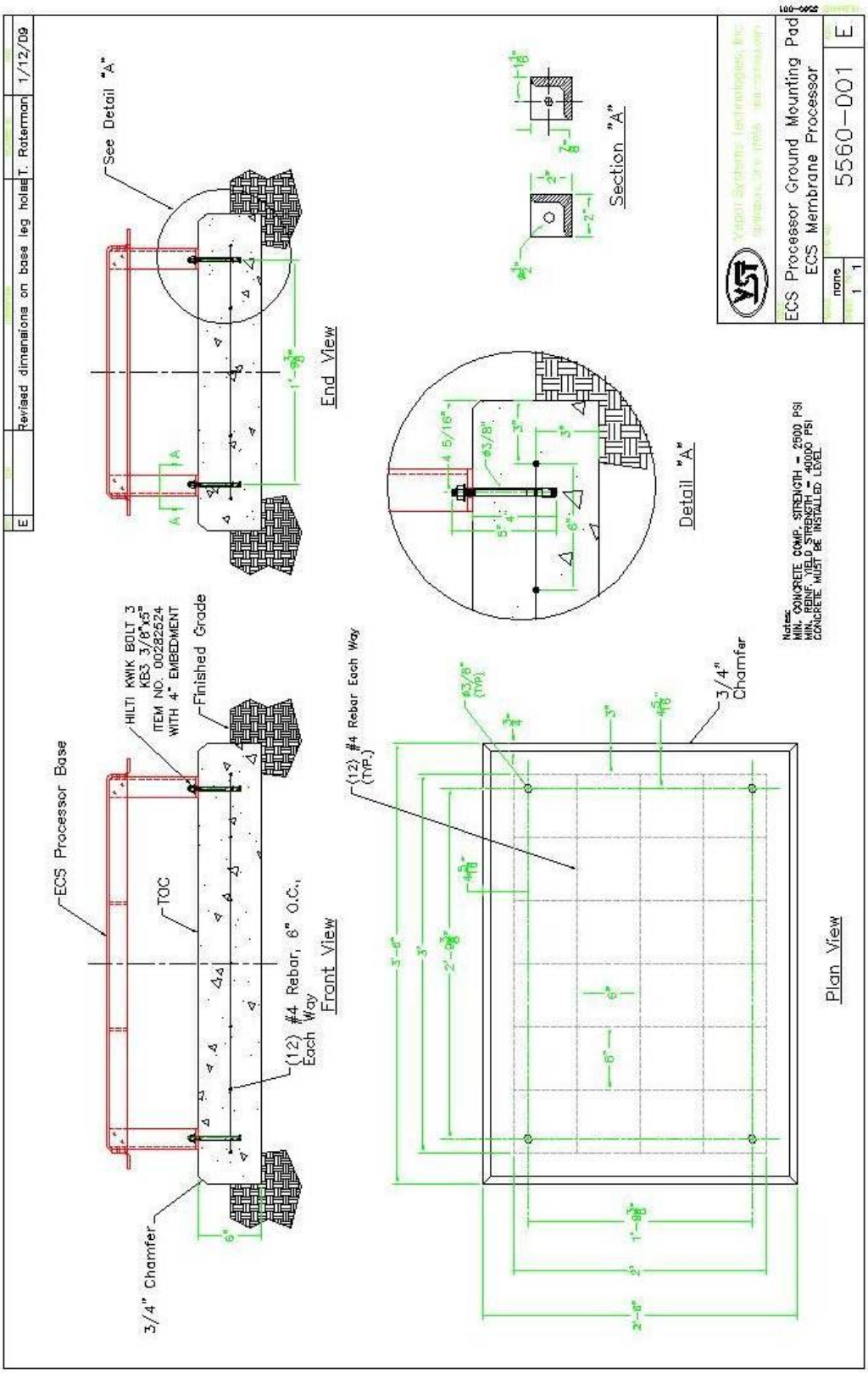


Figure 10: Processor Ground Mounting Pad

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

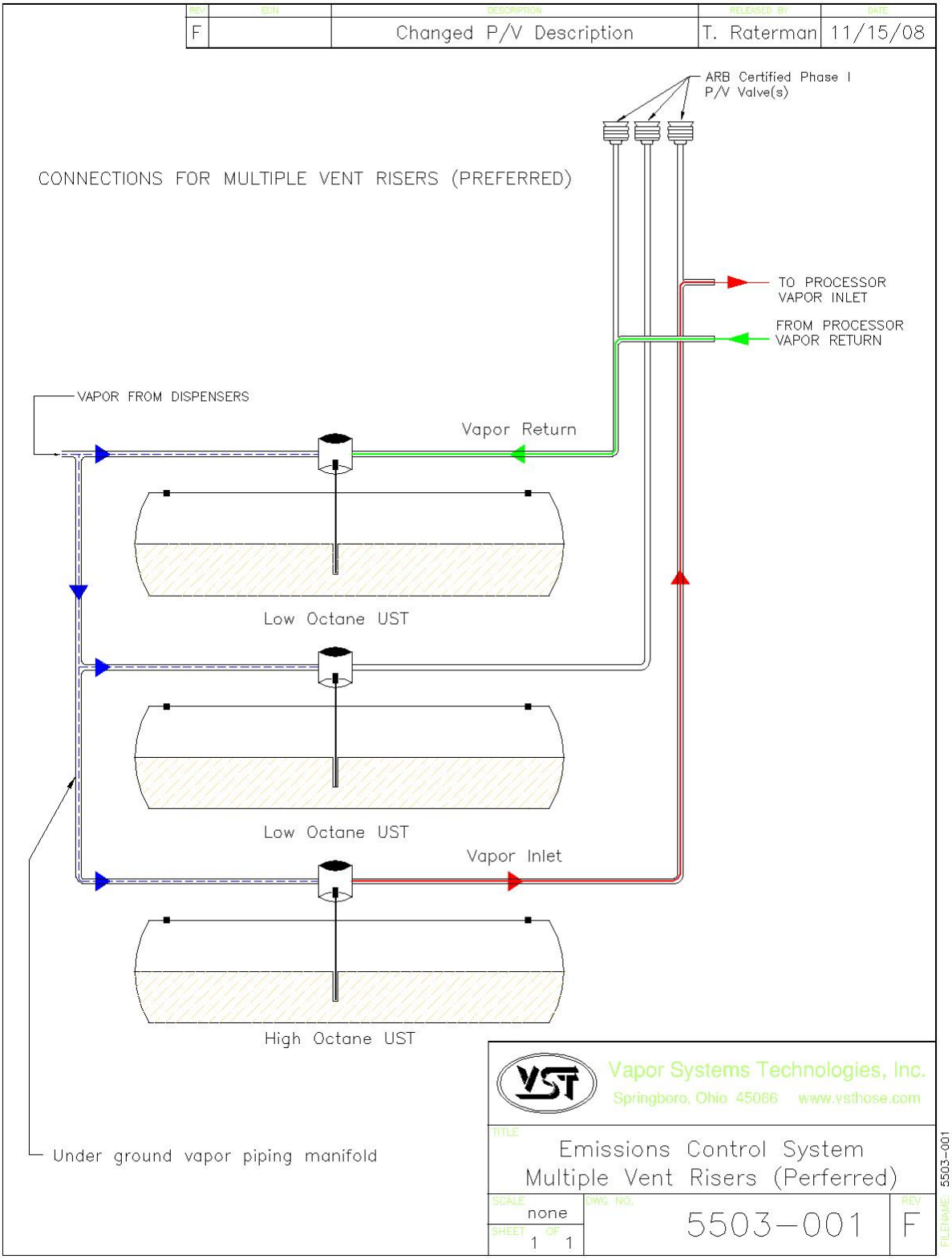


Figure 11: Processor Connections with Multiple Vent Risers

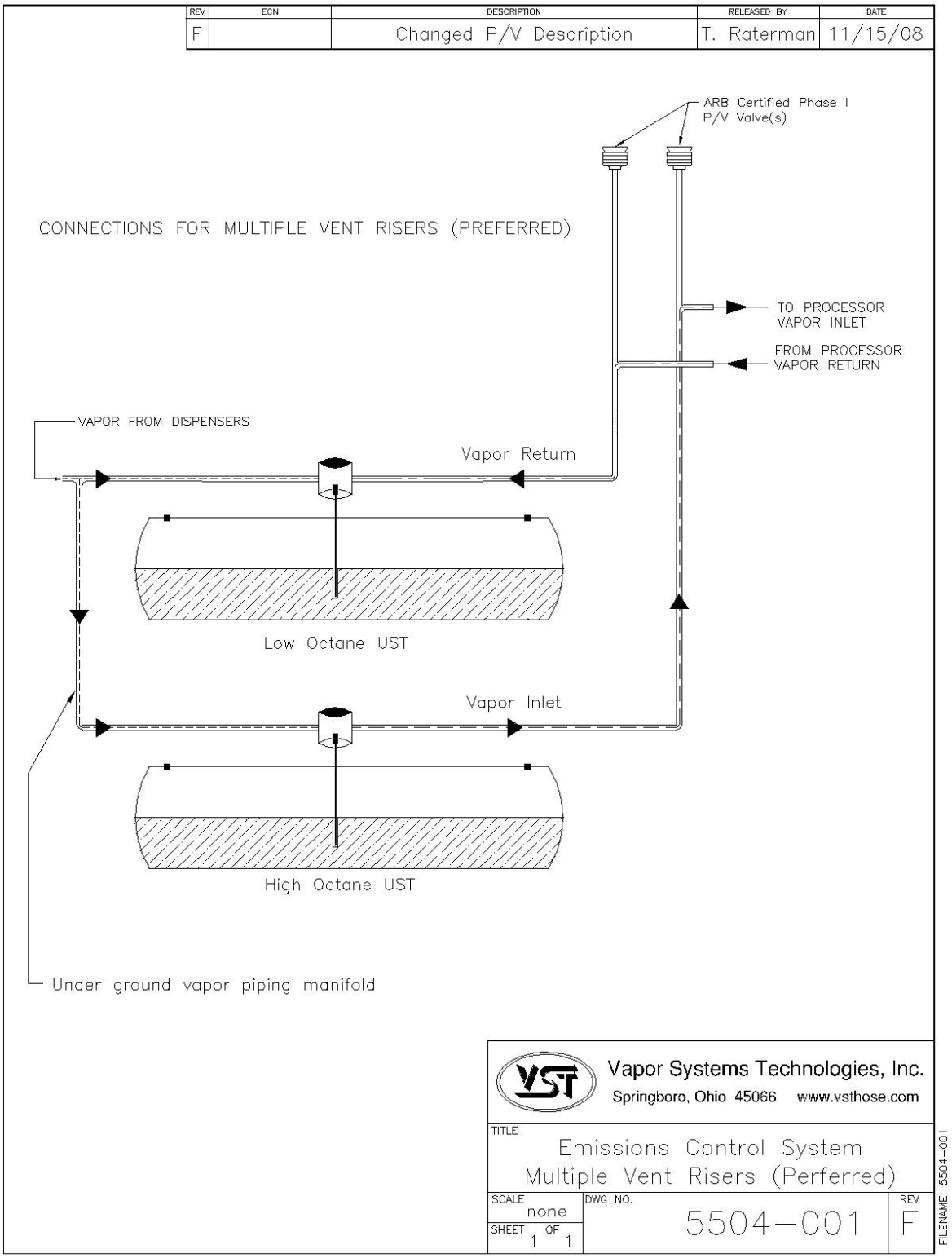


Figure 12: Processor Connections with 2 Vent Risers

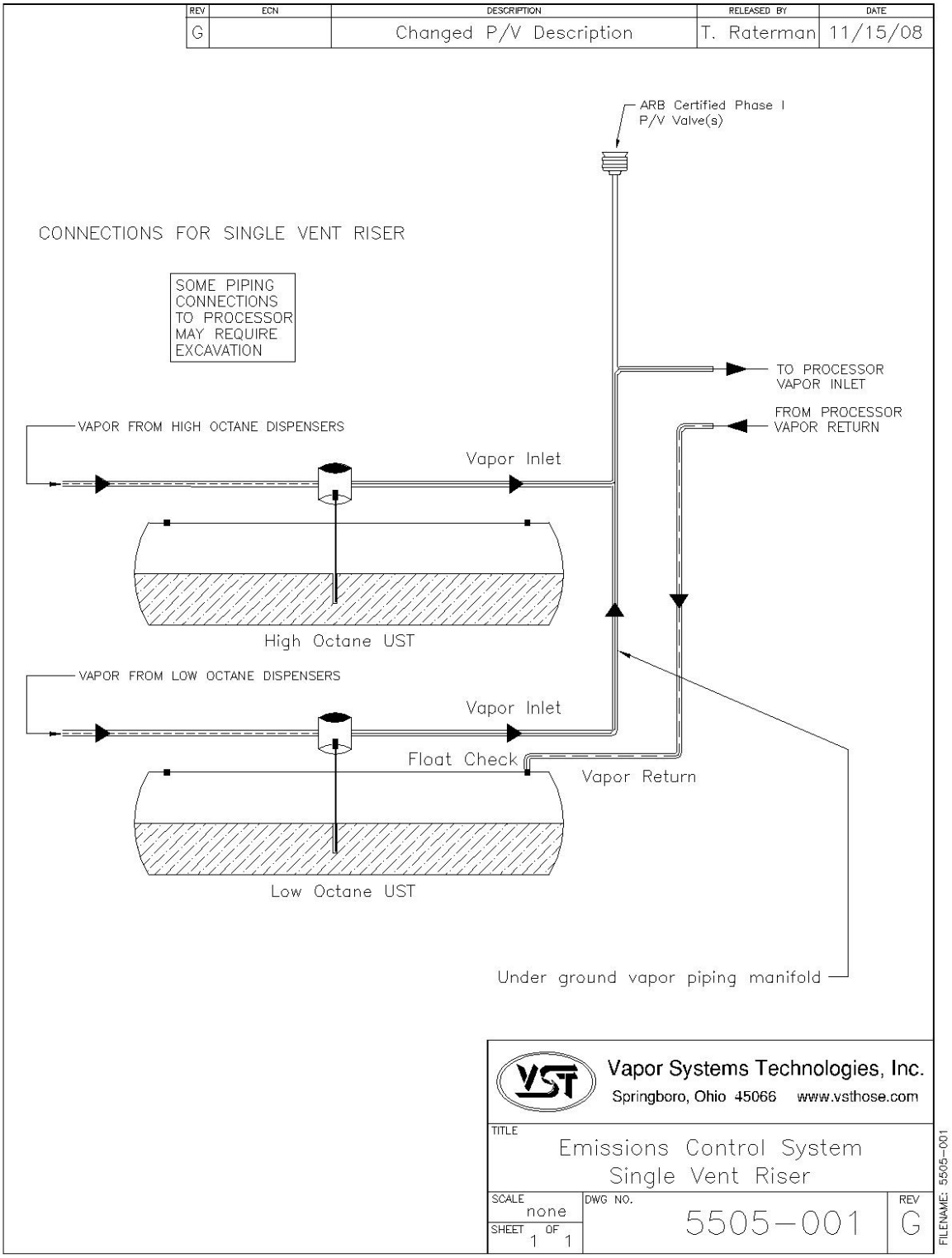


Figure 13: Processor Connections with Single Vent Riser

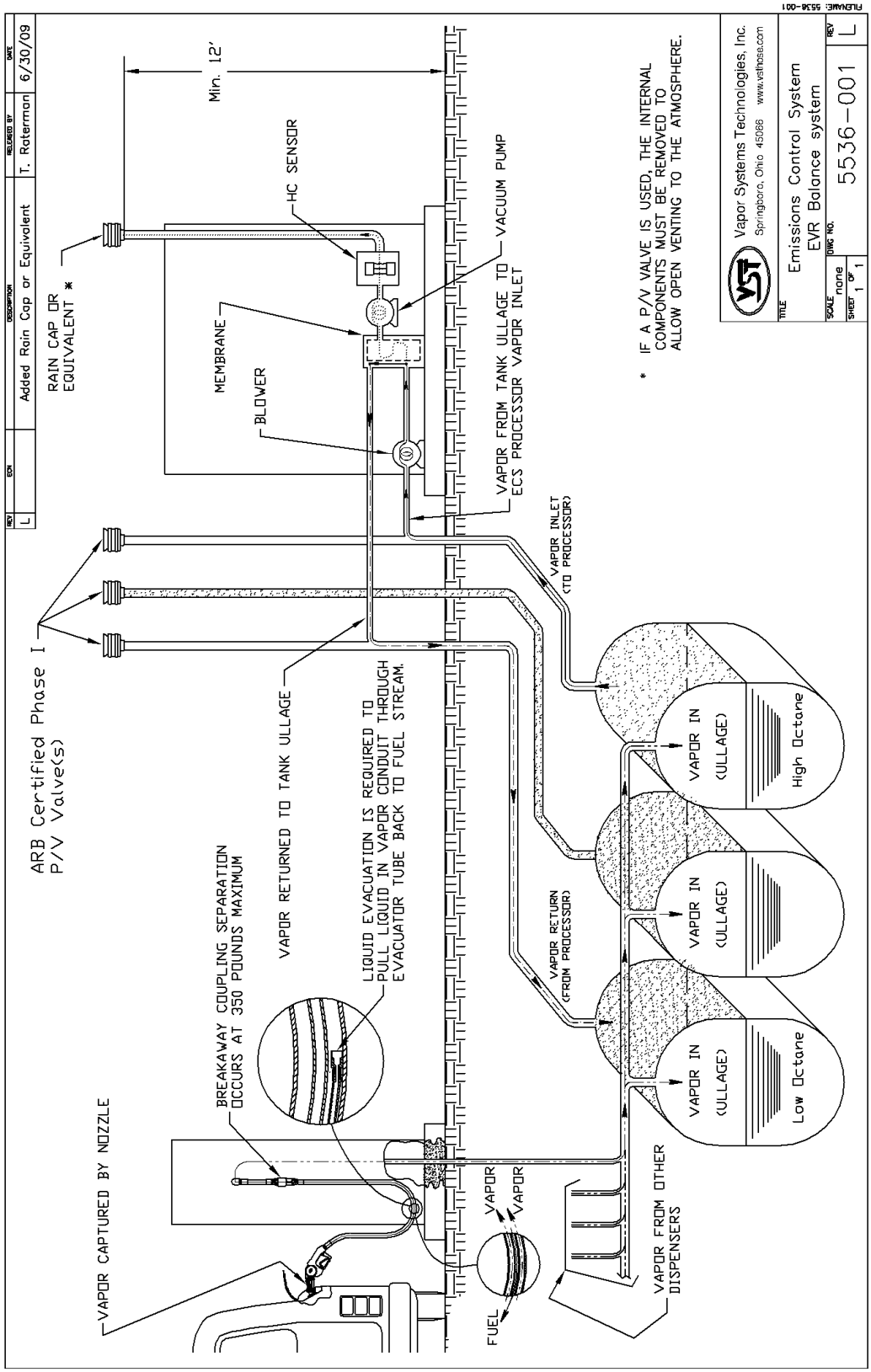


Figure 14: Typical GDF Vapor Piping Diagram for Processor

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.

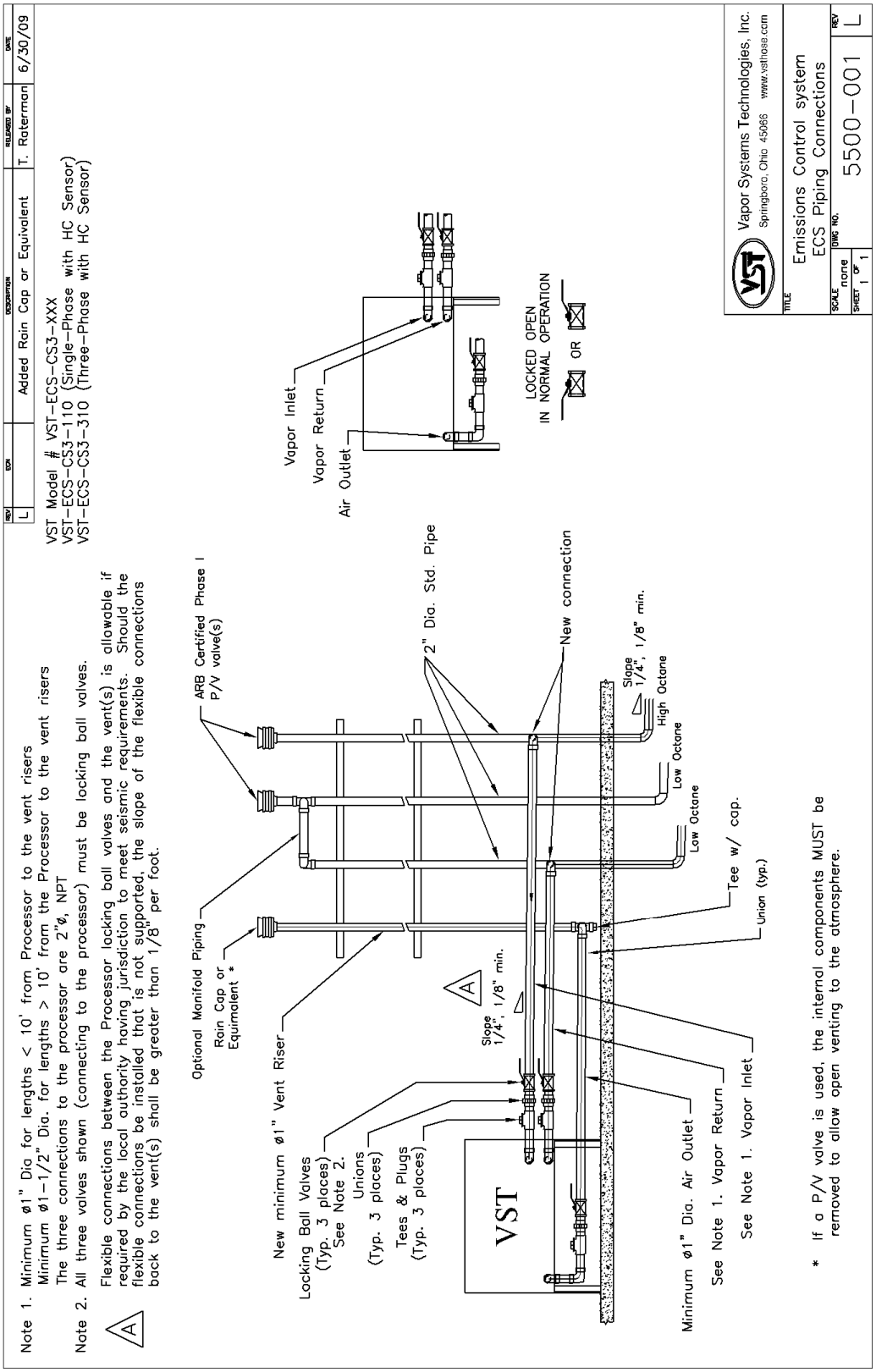


Figure 15: ECS Processor Piping Diagram

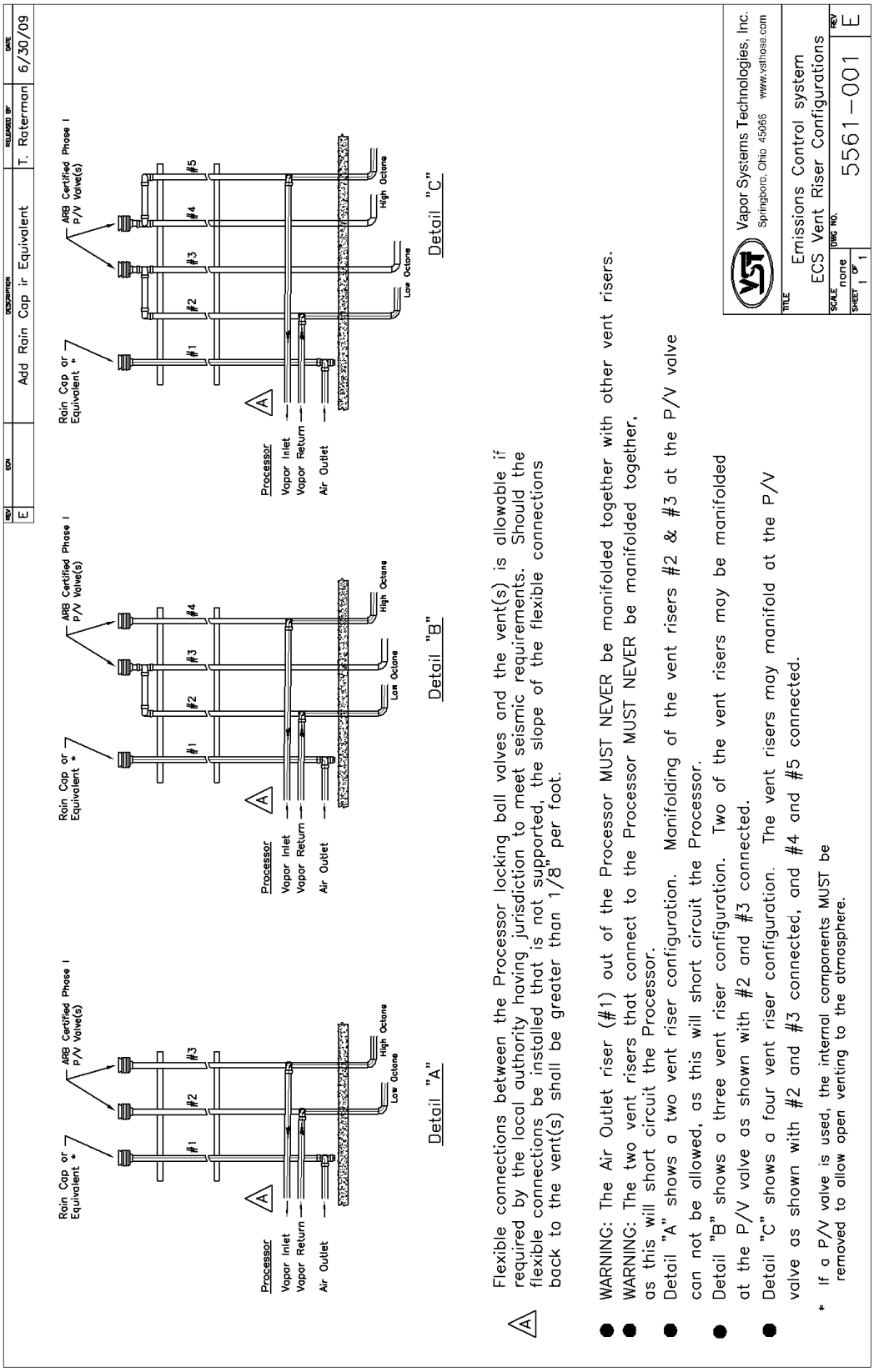


Figure 16: ECS Vent Configuration

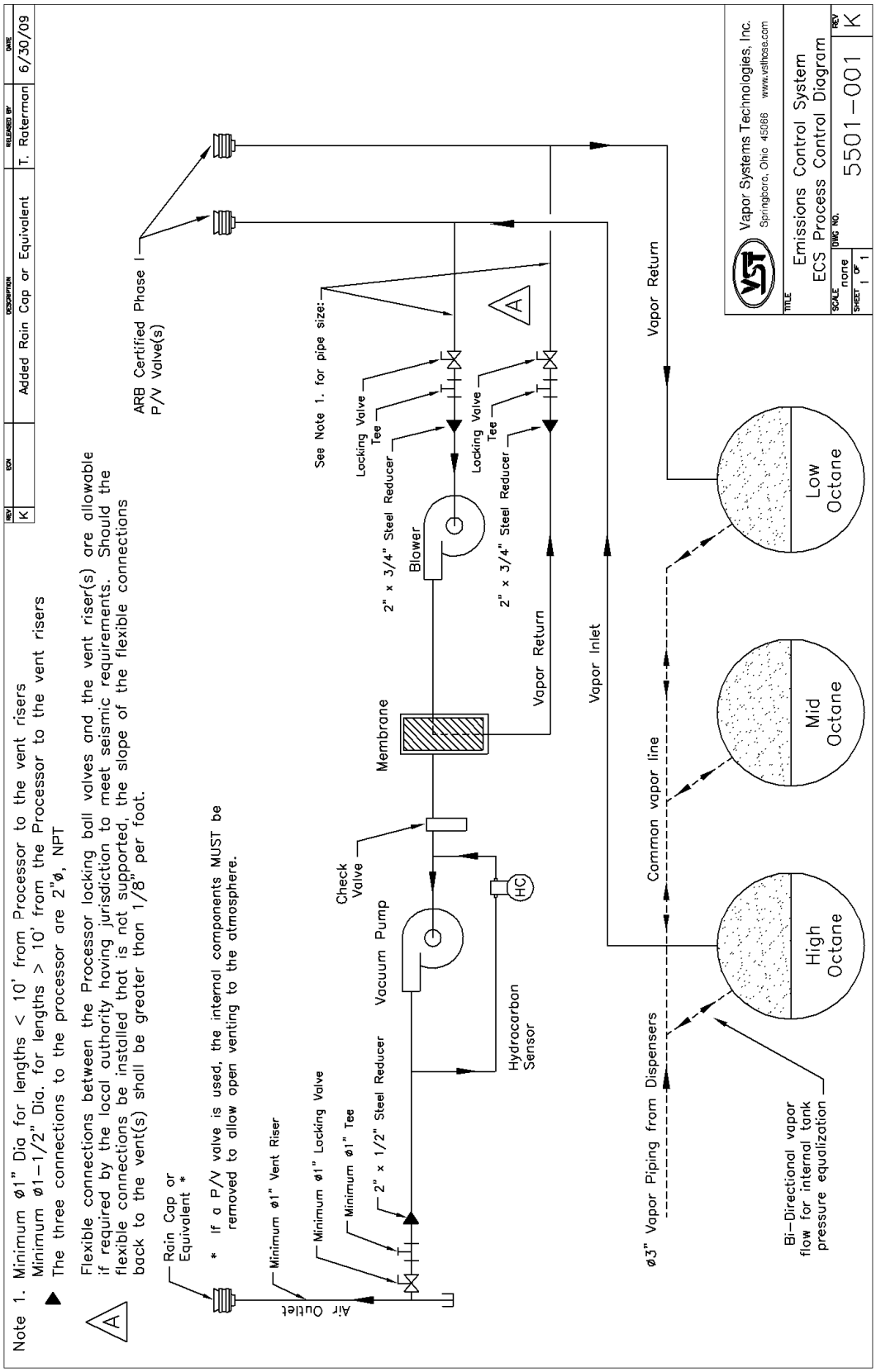


Figure 17: Processor Piping Connections

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.

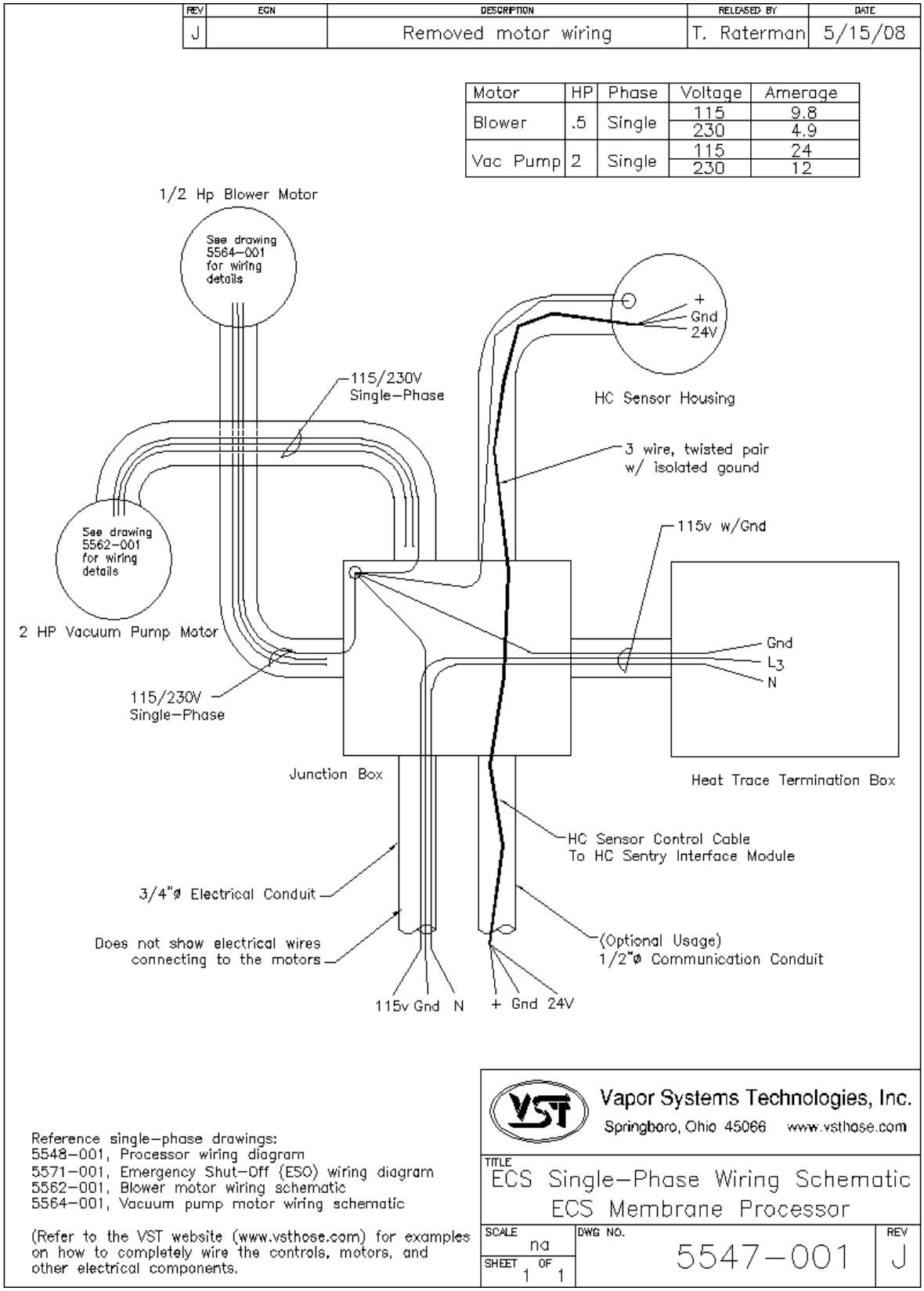


Figure 18: Single-Phase Wiring Schematic

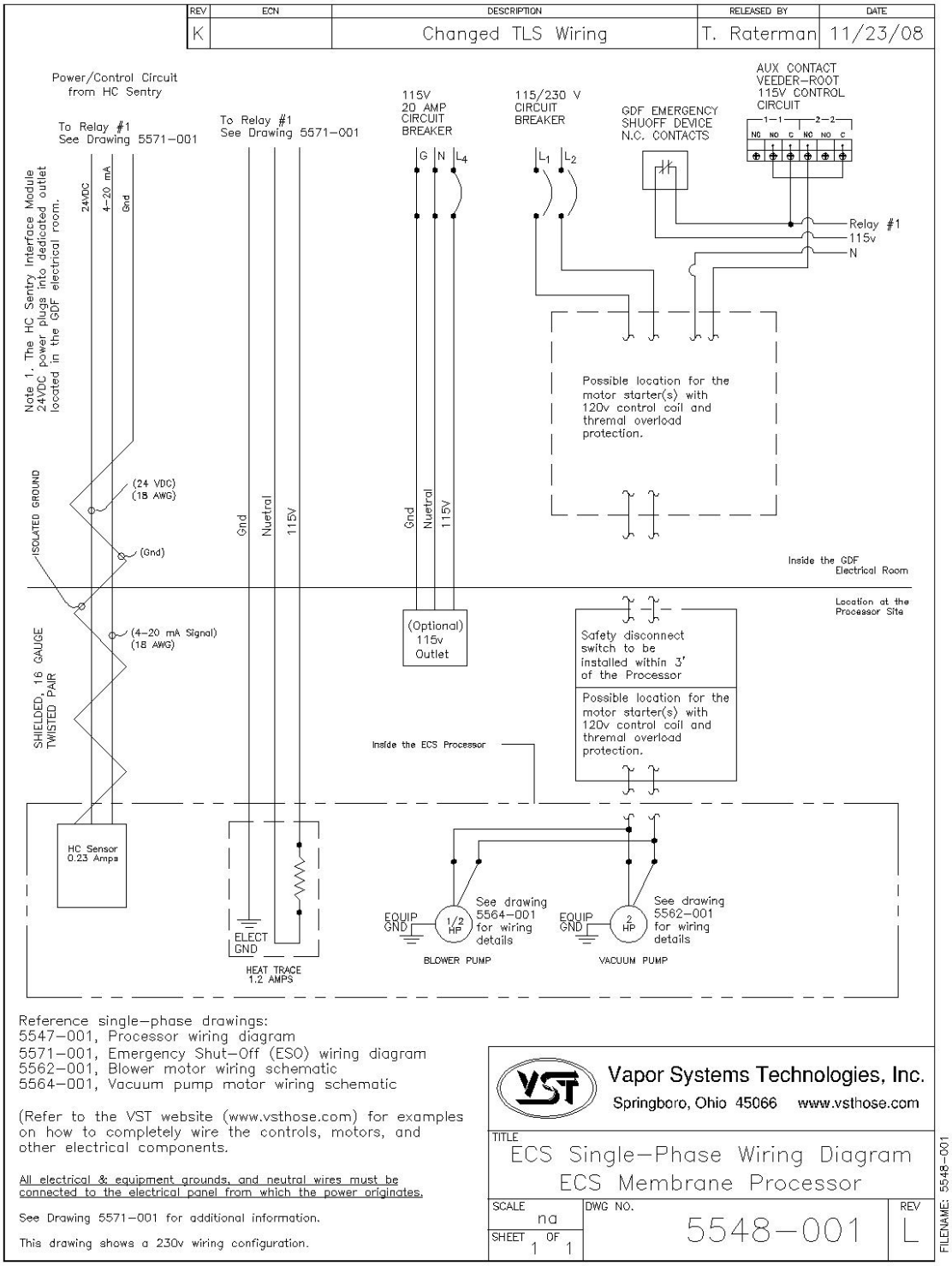


Figure 19: Processor Single-Phase Wiring Diagram

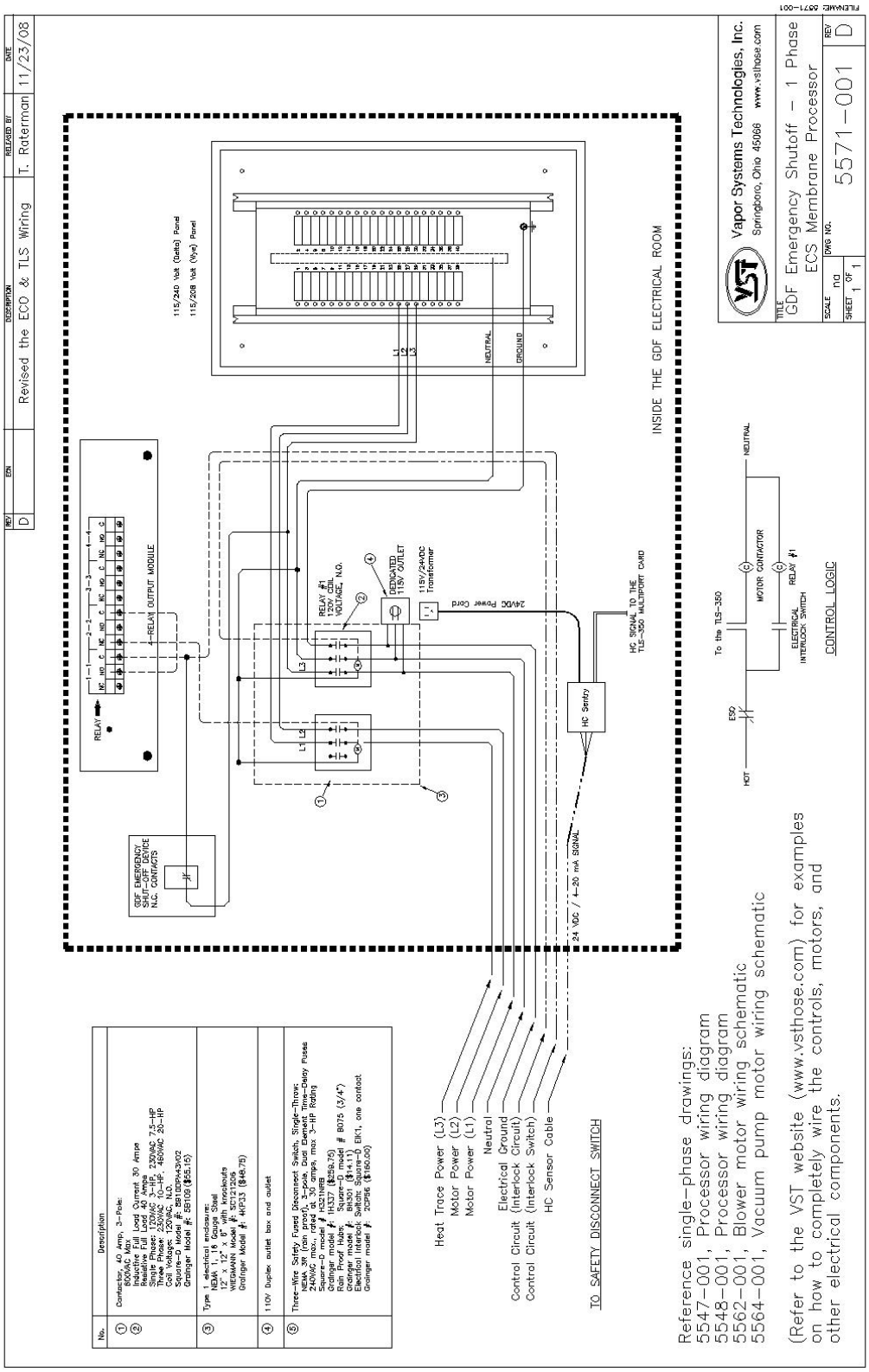


Figure 20: Processor Single-Phase ESO Wiring Diagram

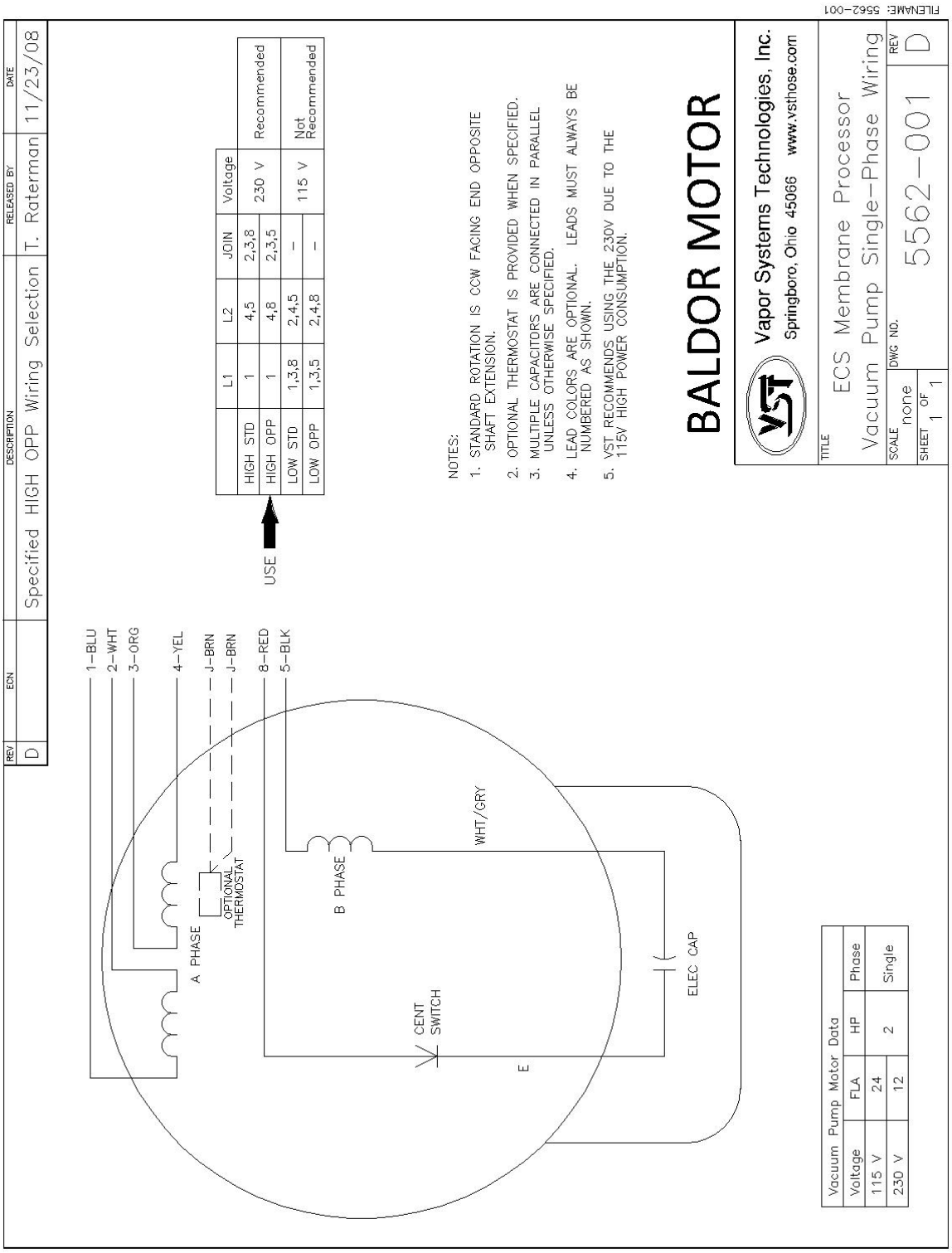


Figure 21: Vacuum Pump: Single-Phase Motor Wiring Diagram

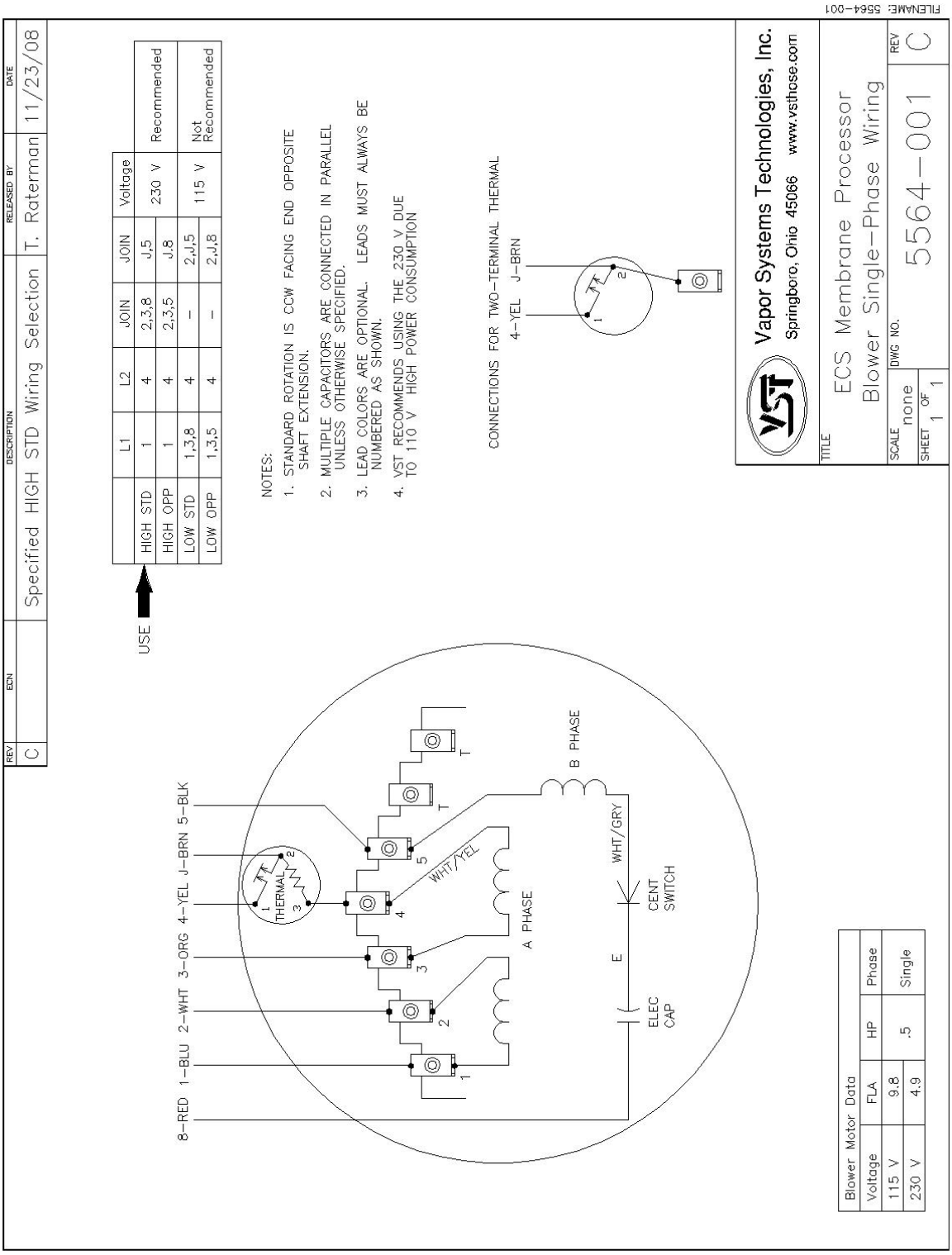


Figure 22: Blower: Single-Phase Motor Wiring Diagram

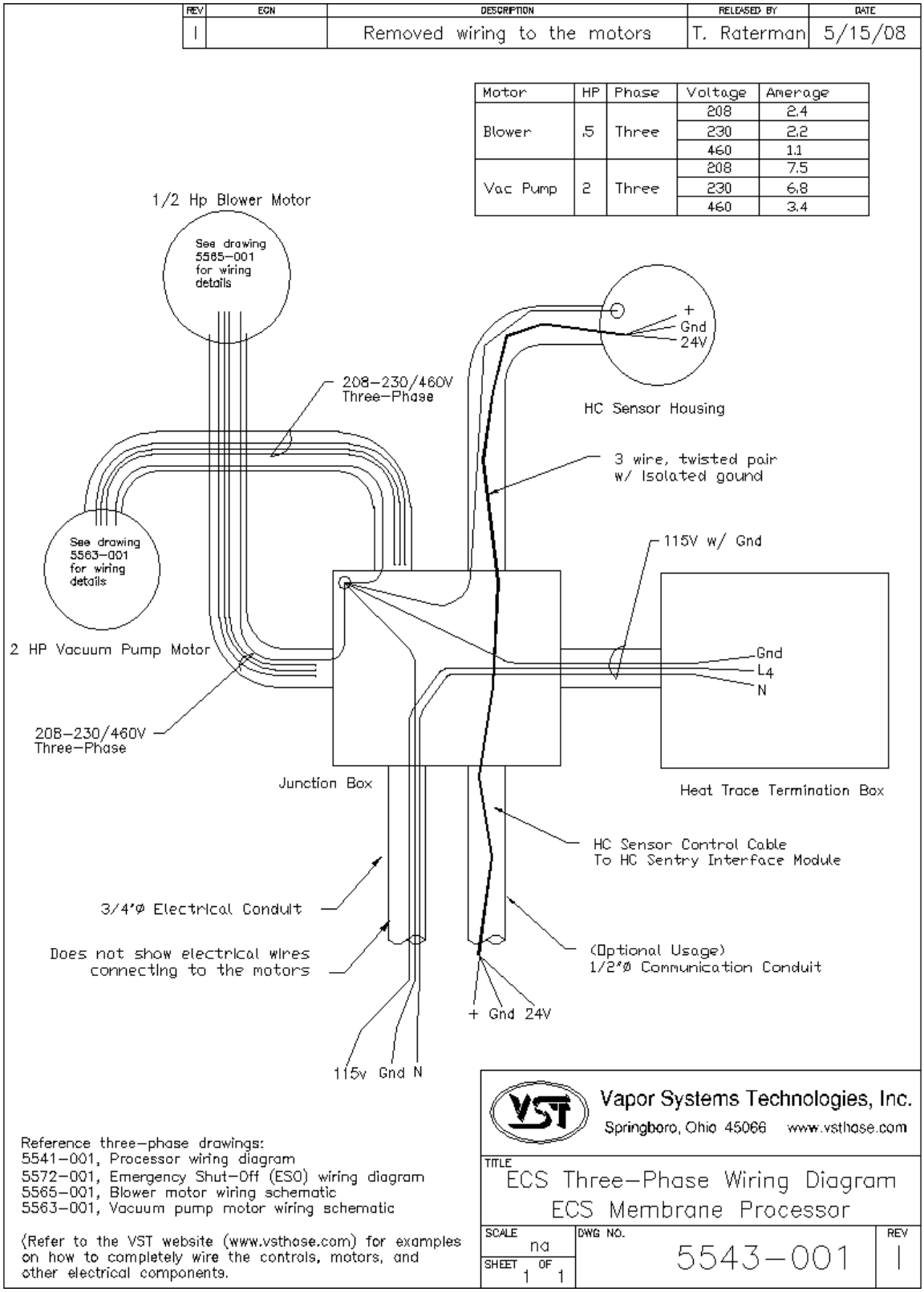


Figure 23: Processor Three-Phase Wiring Schematic

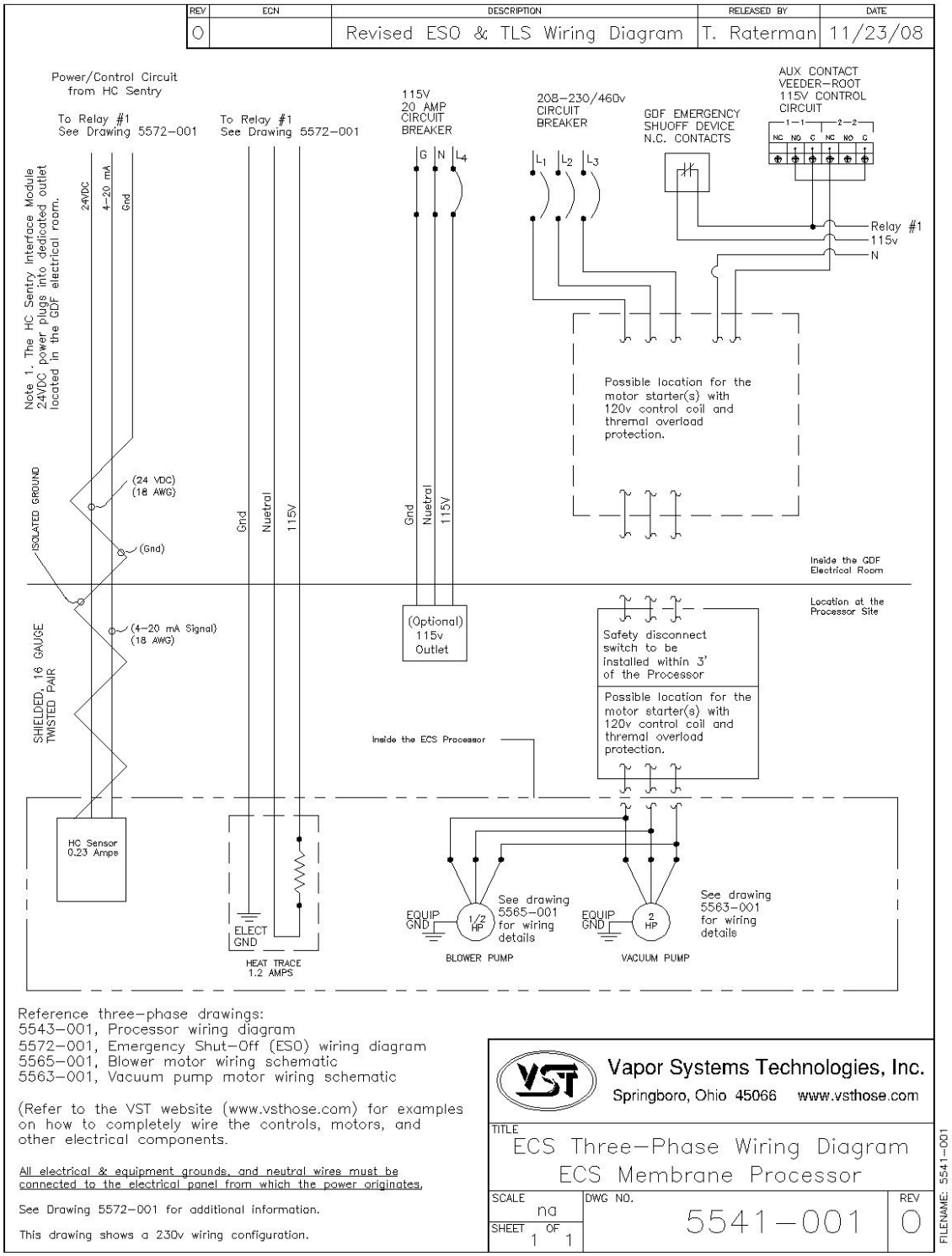


Figure 24: Processor Three-Phase Wiring Schematic

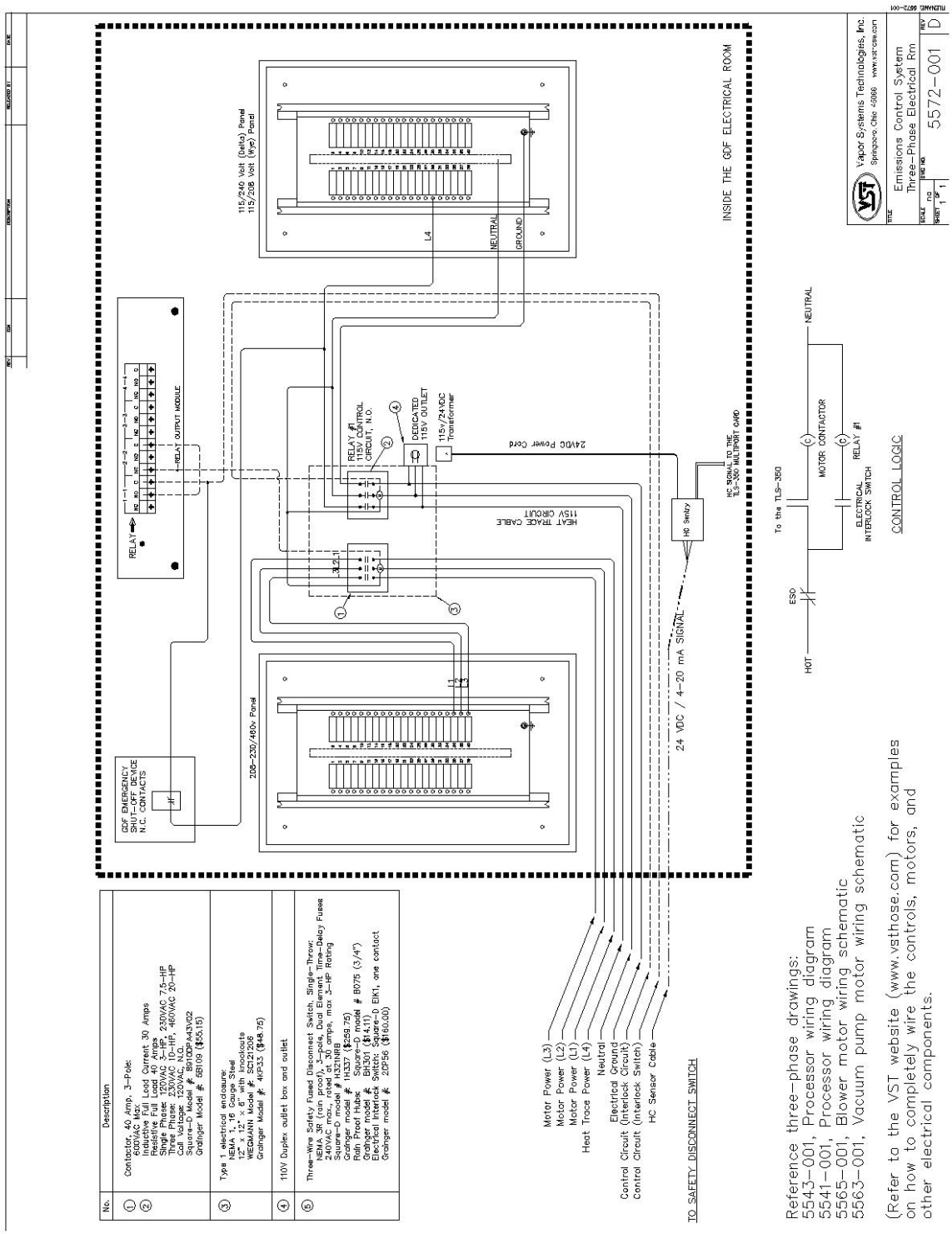


Figure 25: Processor Three-Phase ESO Wiring Diagram

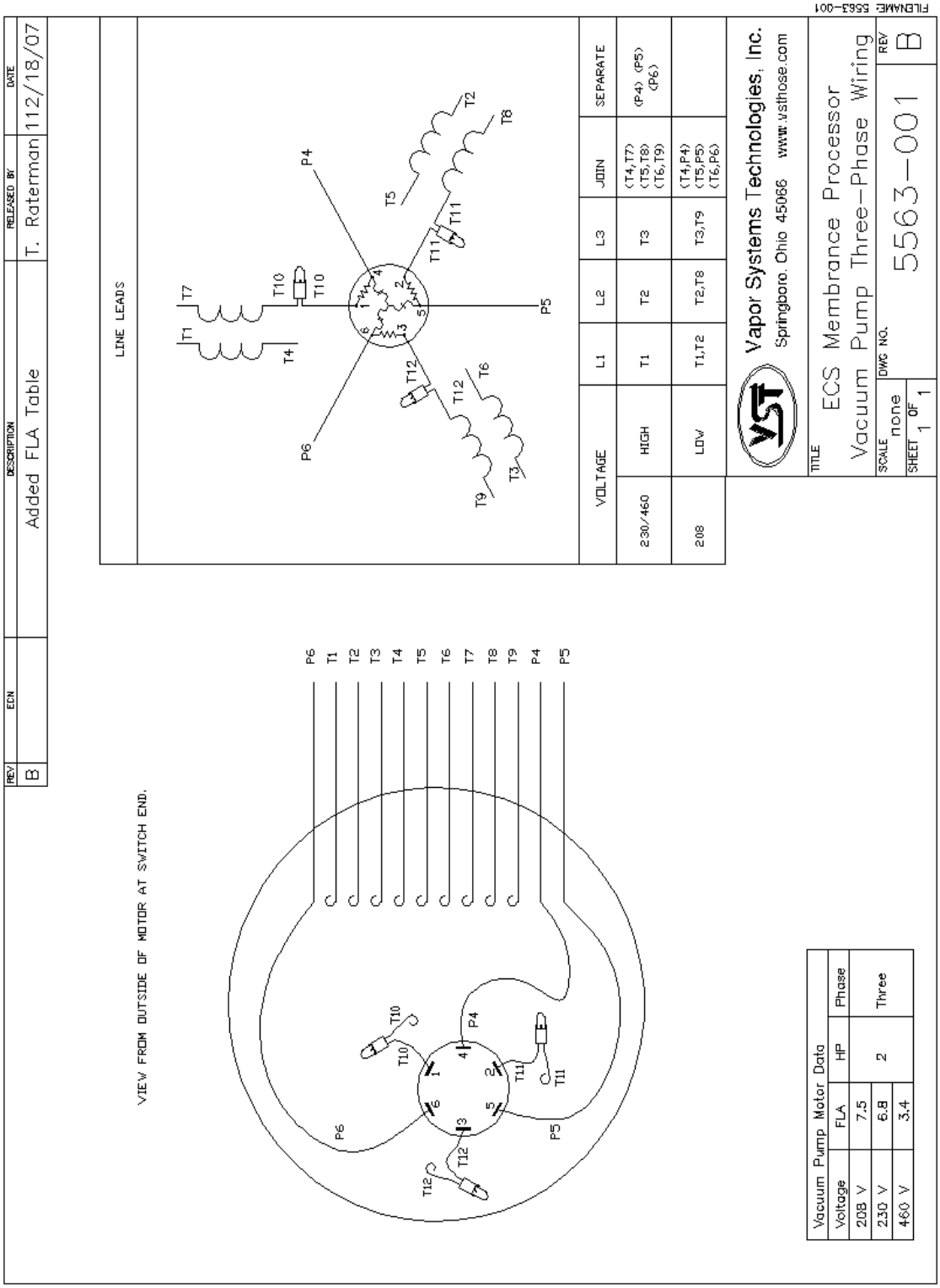


Figure 26: Vacuum Pump: Three-Phase Motor Wiring Diagram

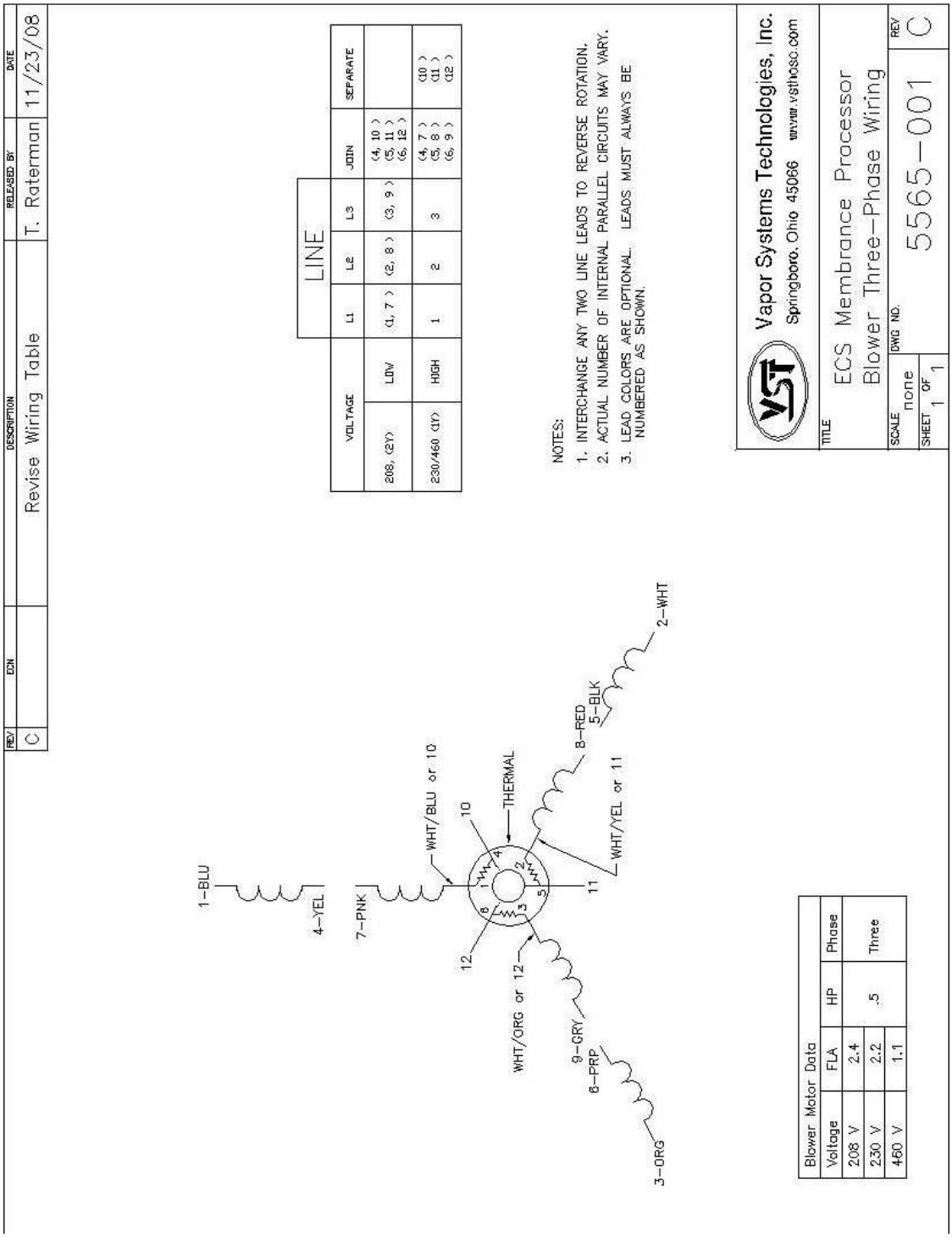


Figure 27: Blower: Three-Phase Motor Wiring Diagram

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.

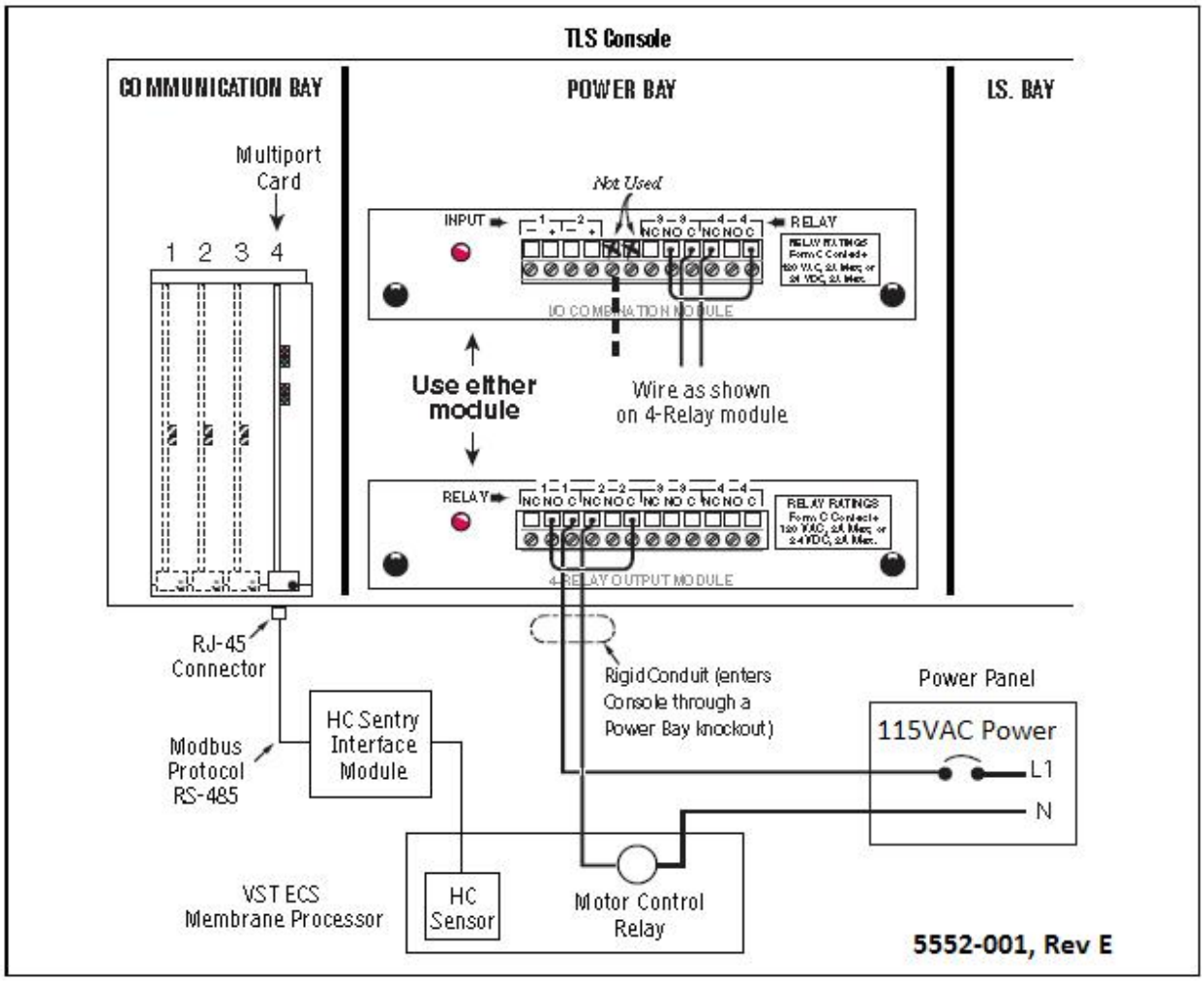
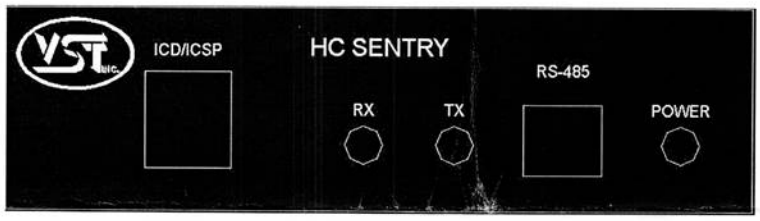


Figure 28: VR TLS Multi-Port Card Connection to HC Sentry Module

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.



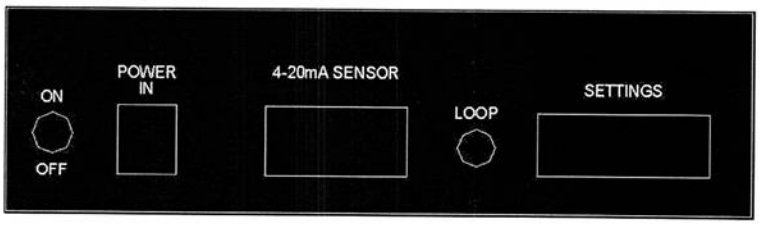
ICD/ICSP: This connector provides a means for performing in-circuit-debug and in-circuit-serial-programming utilizing the programming and debugging tools from the processor manufacturer. This connector will typically be used in production to perform initial programming, and could be used as a simple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

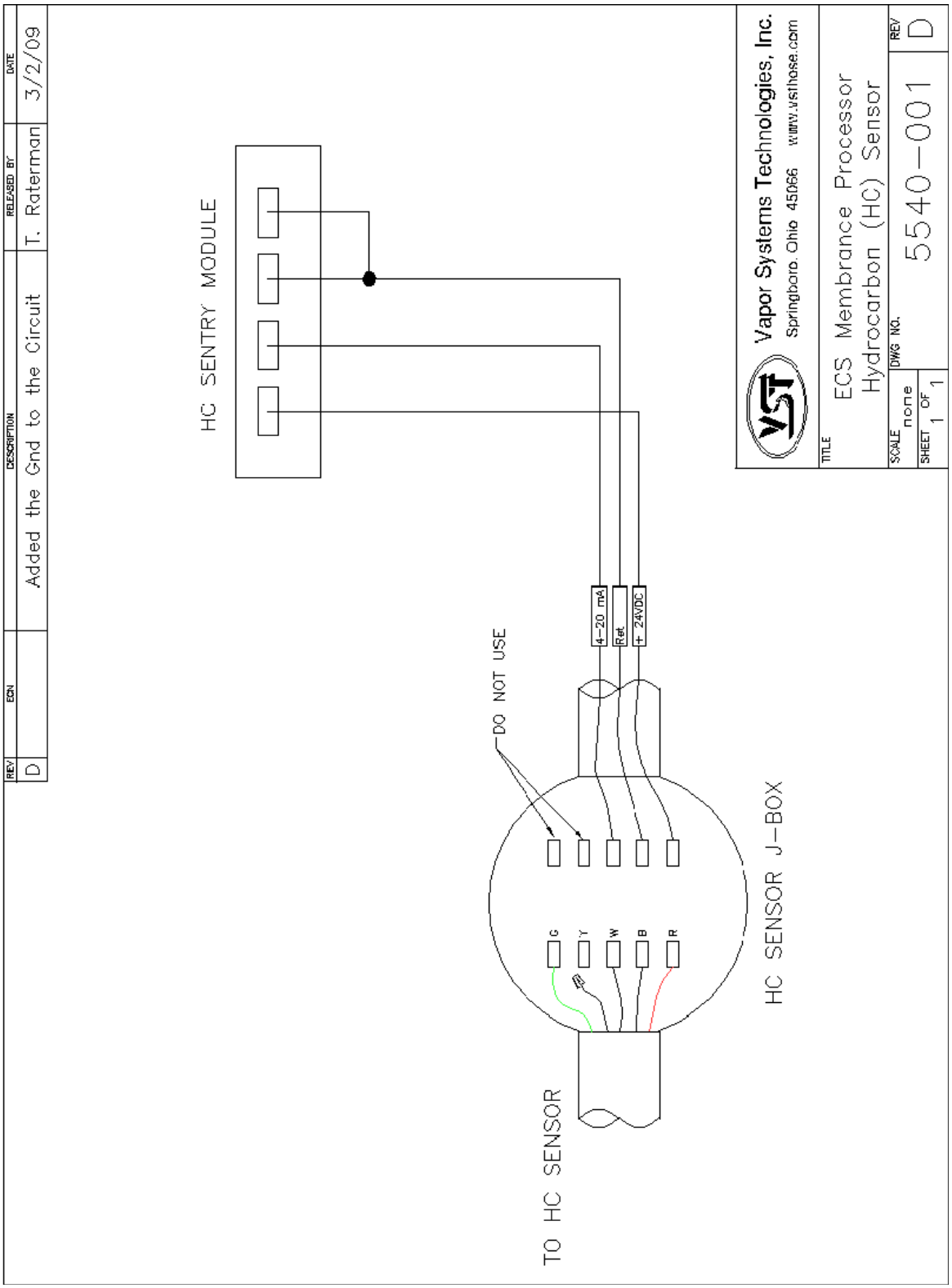
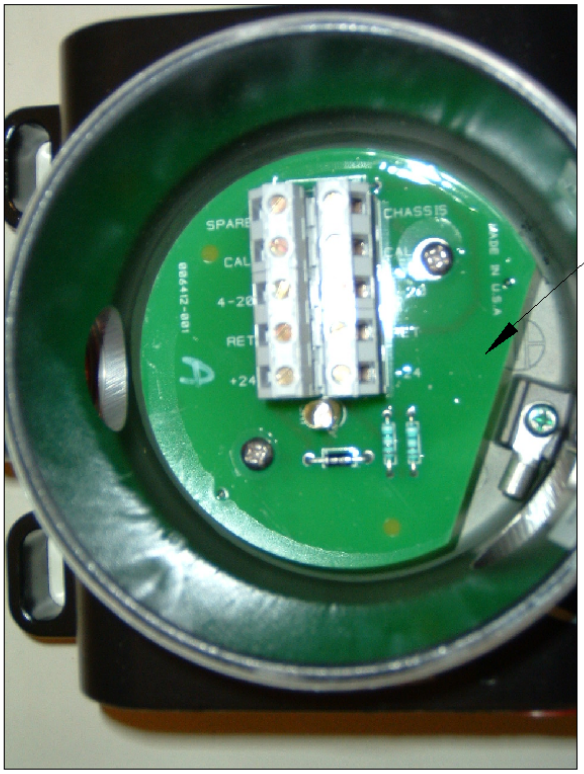


Figure 30: HC Sentry and HC Sensor Wiring Diagram

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.

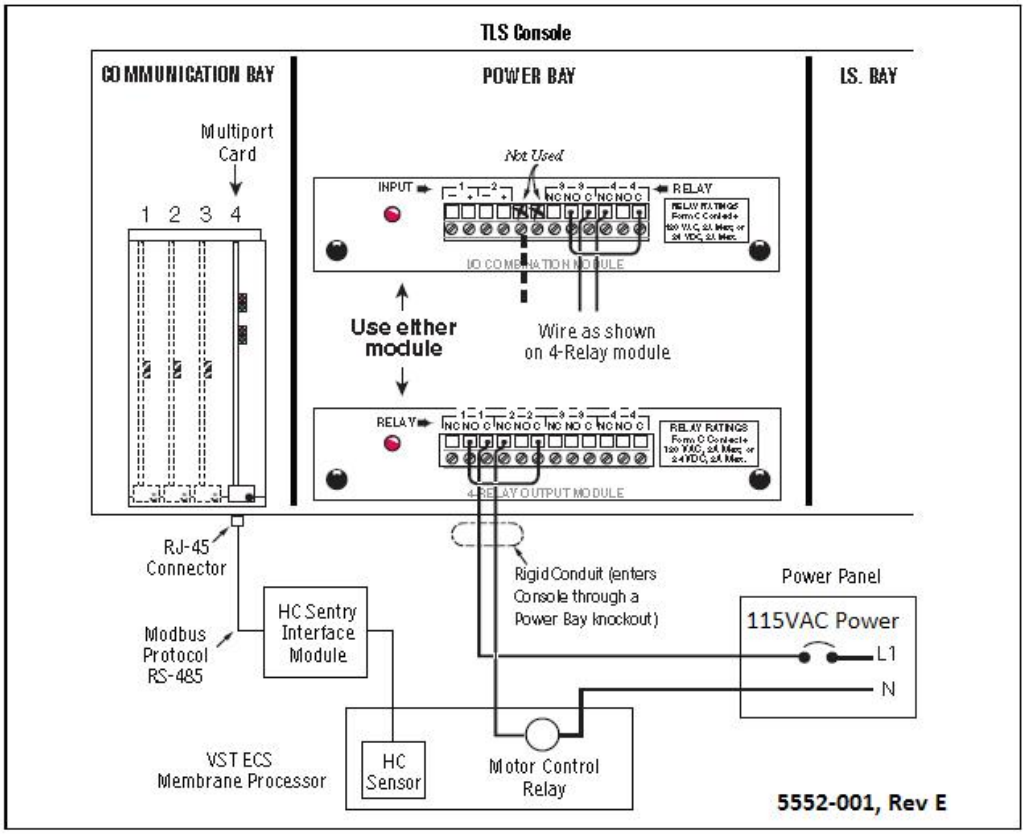


Figure 32: VR TLS Multi-Port Card Connection to the HC Sentry Module

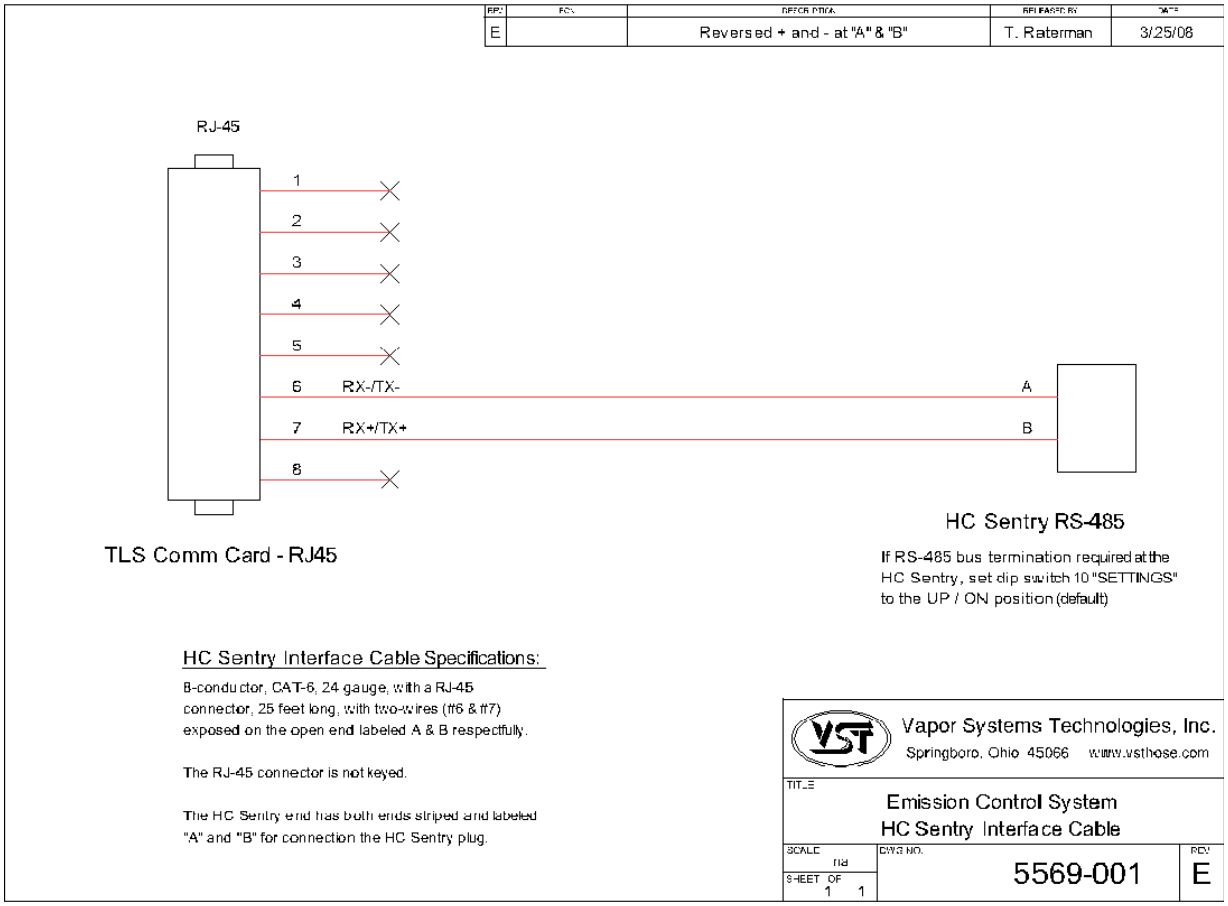


Figure 33: HC Sentry RS-485 Cable Wiring Diagram

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.

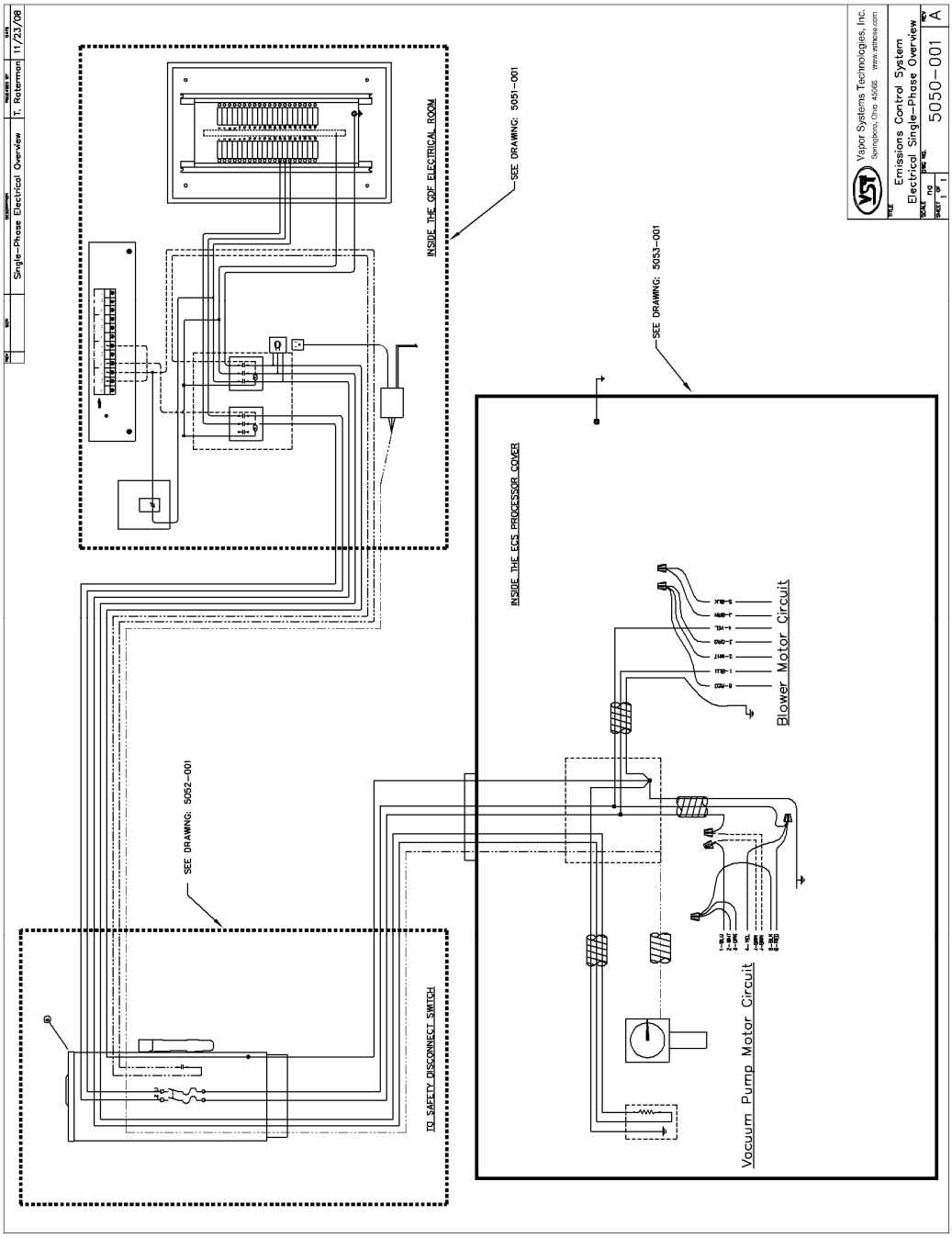


Figure 35: Single phase electrical overview

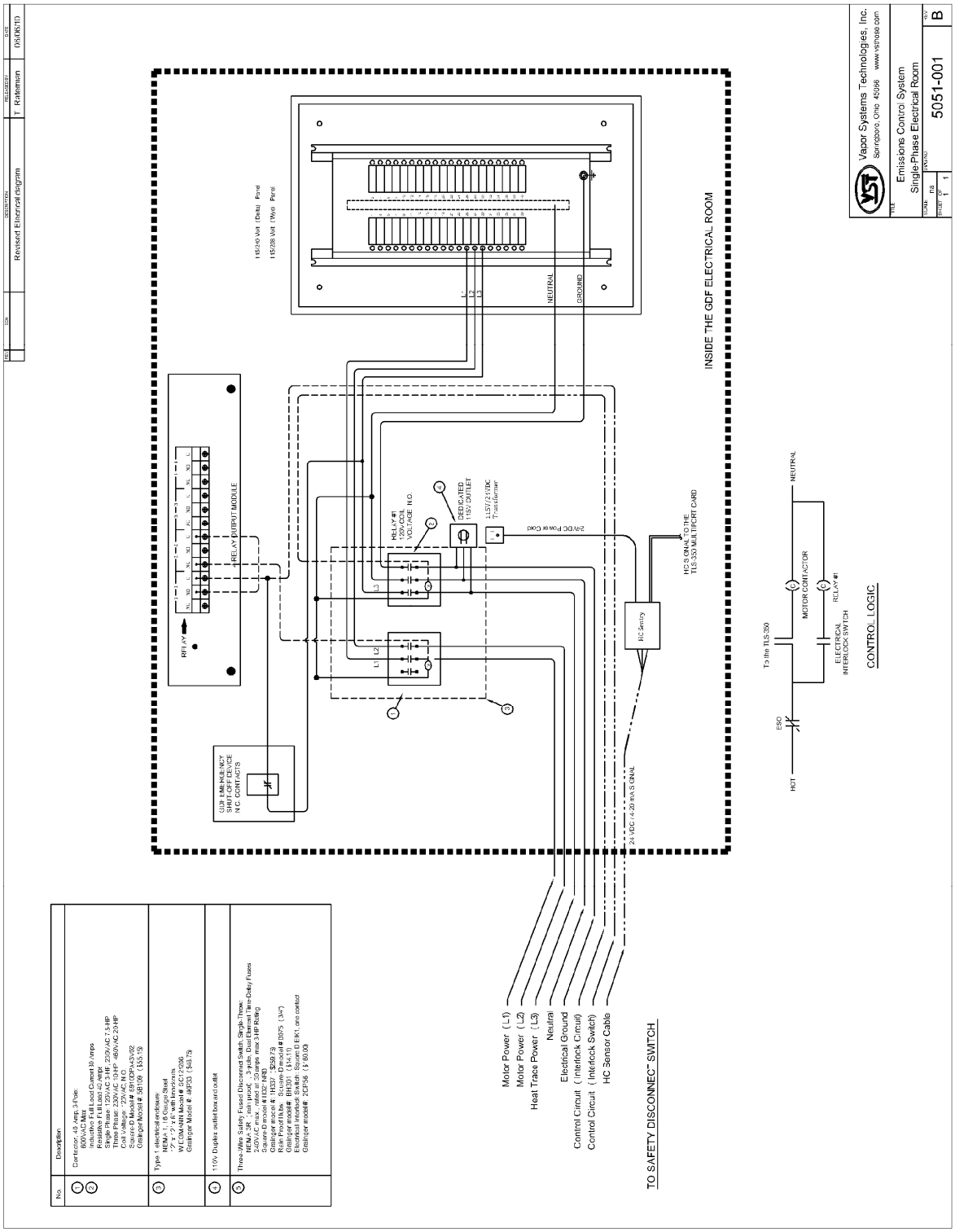
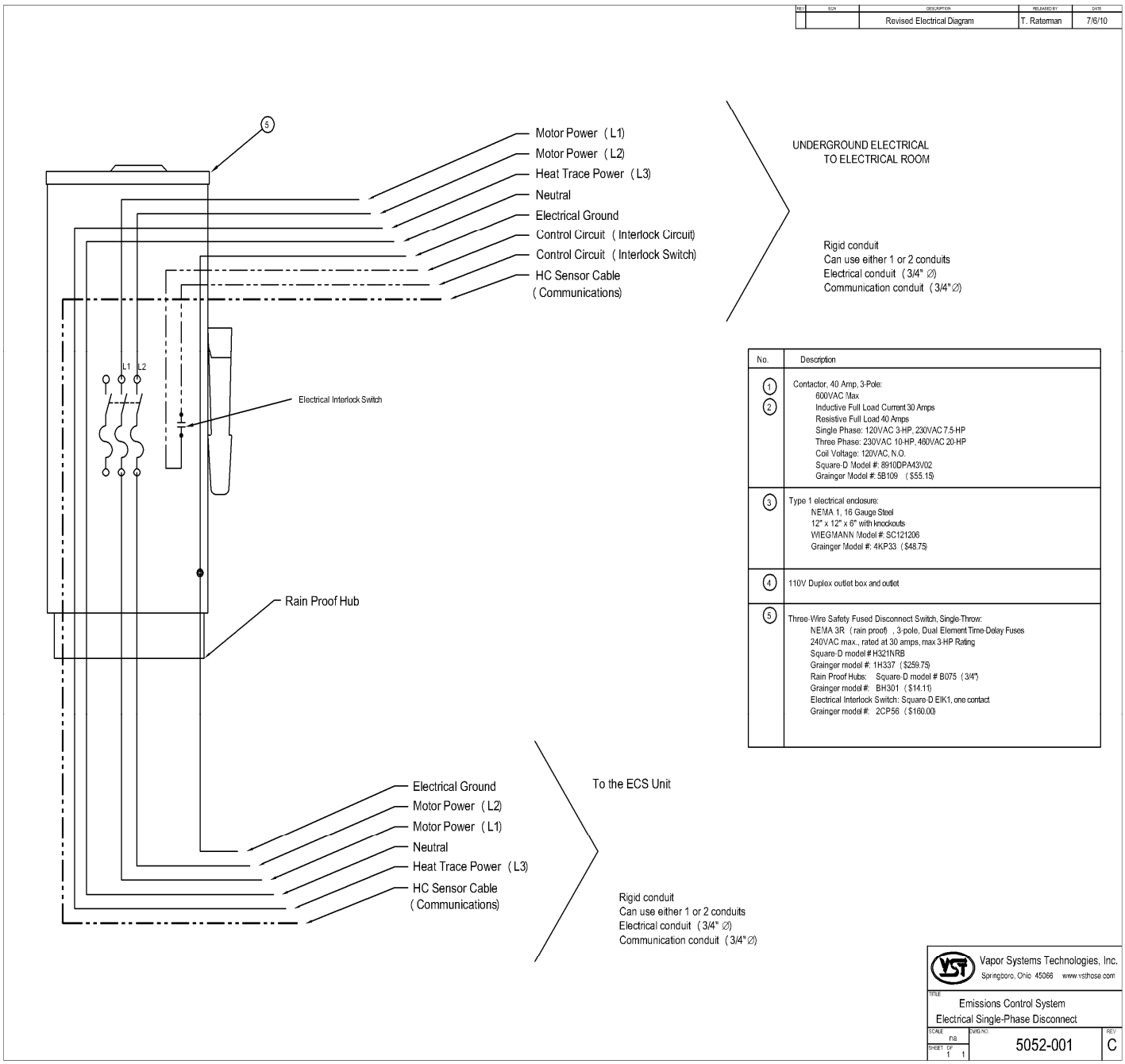


Figure 36: Single phase electrical room



No.	Description
1 2	Contactor, 40 Amp, 3-Pole: 600VAC Max Inductive Full Load Current 30 Amps Resistive Full Load 40 Amps Single Phase: 120VAC 3-HP, 230VAC 7.5-HP Three Phase: 230VAC 10-HP, 460VAC 20-HP Coil Voltage: 120VAC, N.O. Square-D Model #: 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 #: SC121206 Grainger Model #: 4KP33 ($48.75)
4	110V Duplex outlet box and outlet
5	Three-Wire Safety Fused Disconnect Switch, Single-Throw: NEMA 3R (rain proof), 3-pole, Dual Element Time-Delay Fuses 240VAC max., rated at 30 amps, max 3-HP Rating Square-D model # H321NRB Grainger model #: 1H337 ($259.75) Rain Proof Hubs: Square-D model # B075 (3/4") Grainger model #: BH301 ($14.11) Electrical Interlock Switch: Square-D EIK1, one contact Grainger model #: 2CP56 ($160.00)

Figure 37: Single phase electrical disconnect

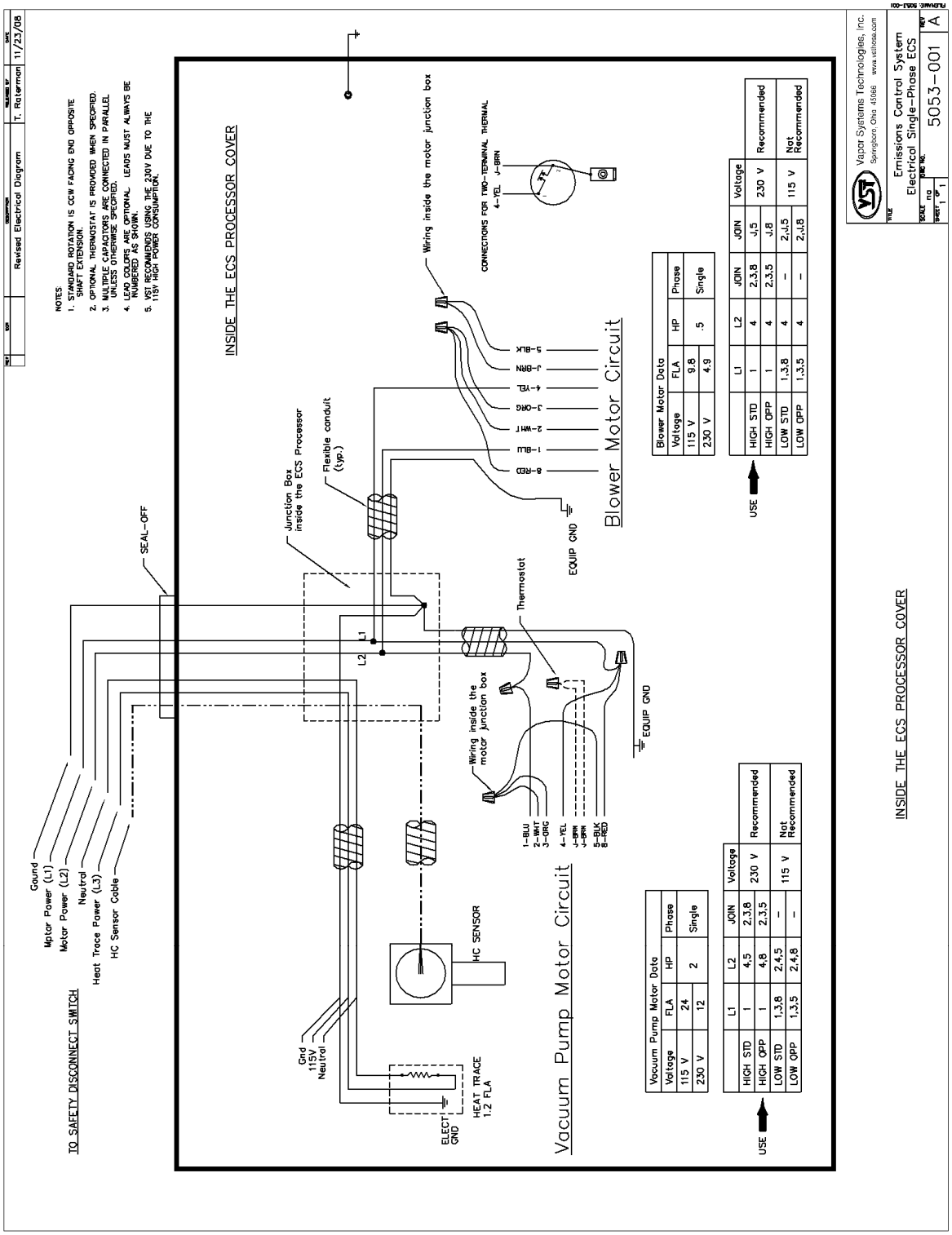


Figure 38: Single phase elec. inside the ECS

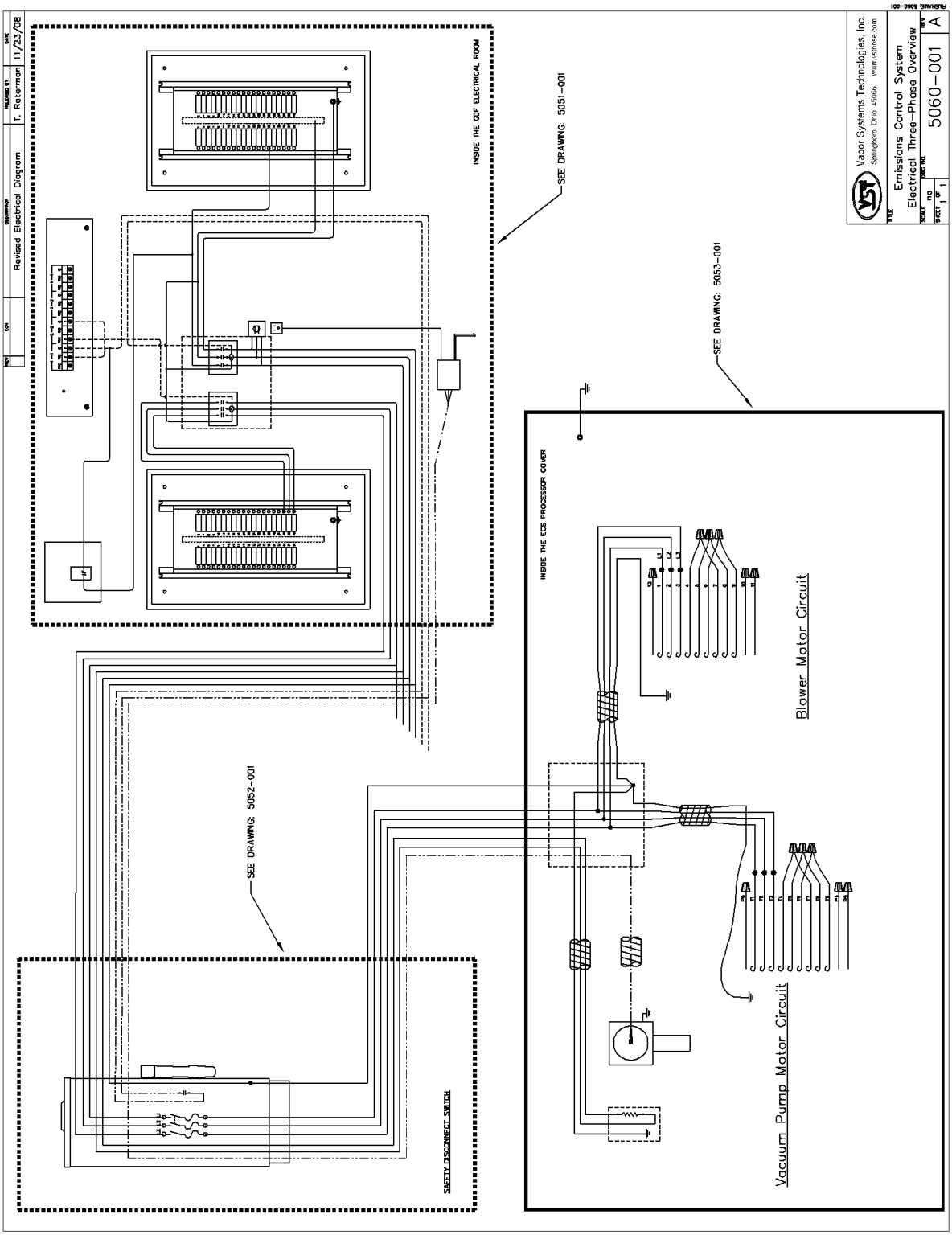


Figure 39: 3-phase electrical overview

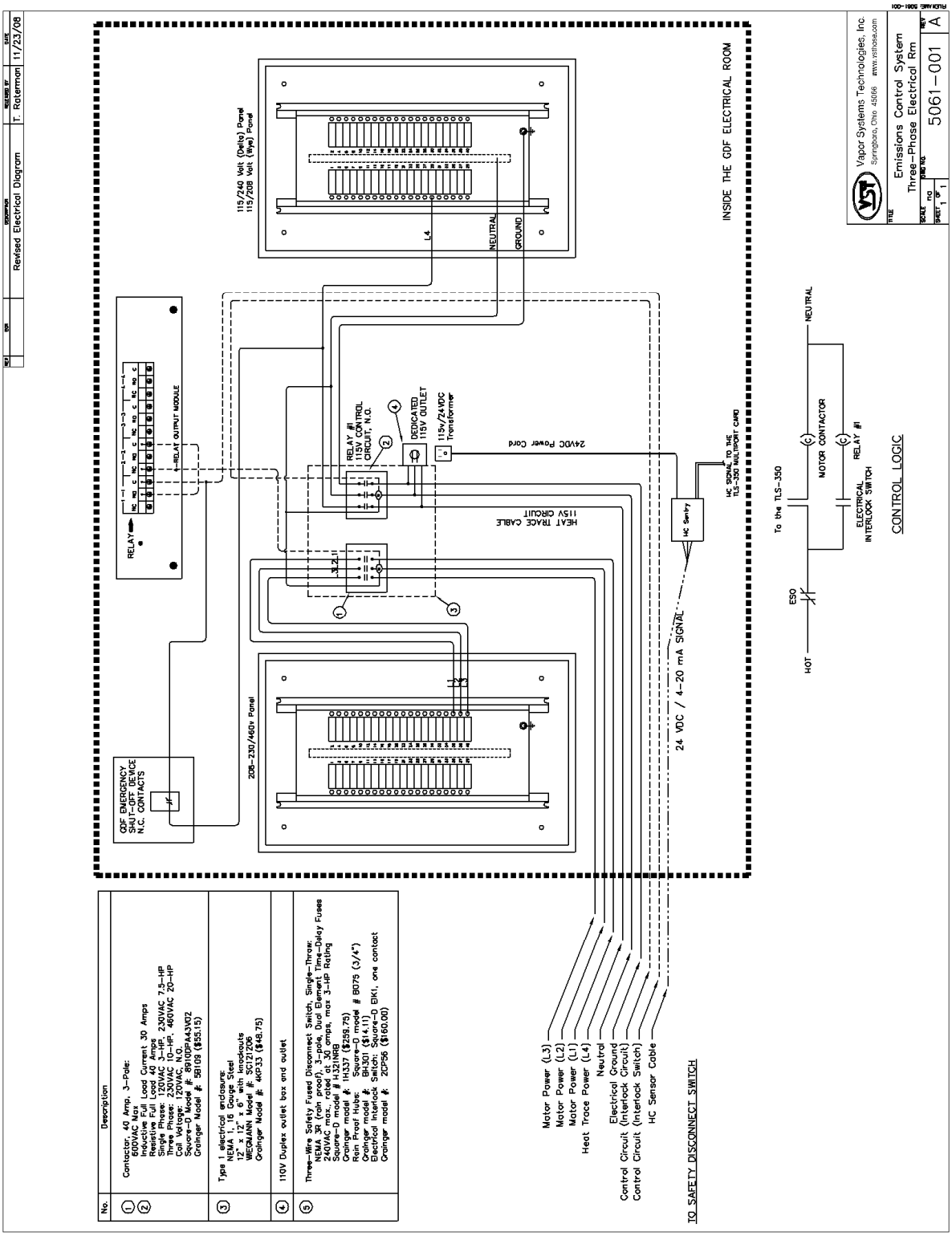


Figure 40: 3-phase electrical room

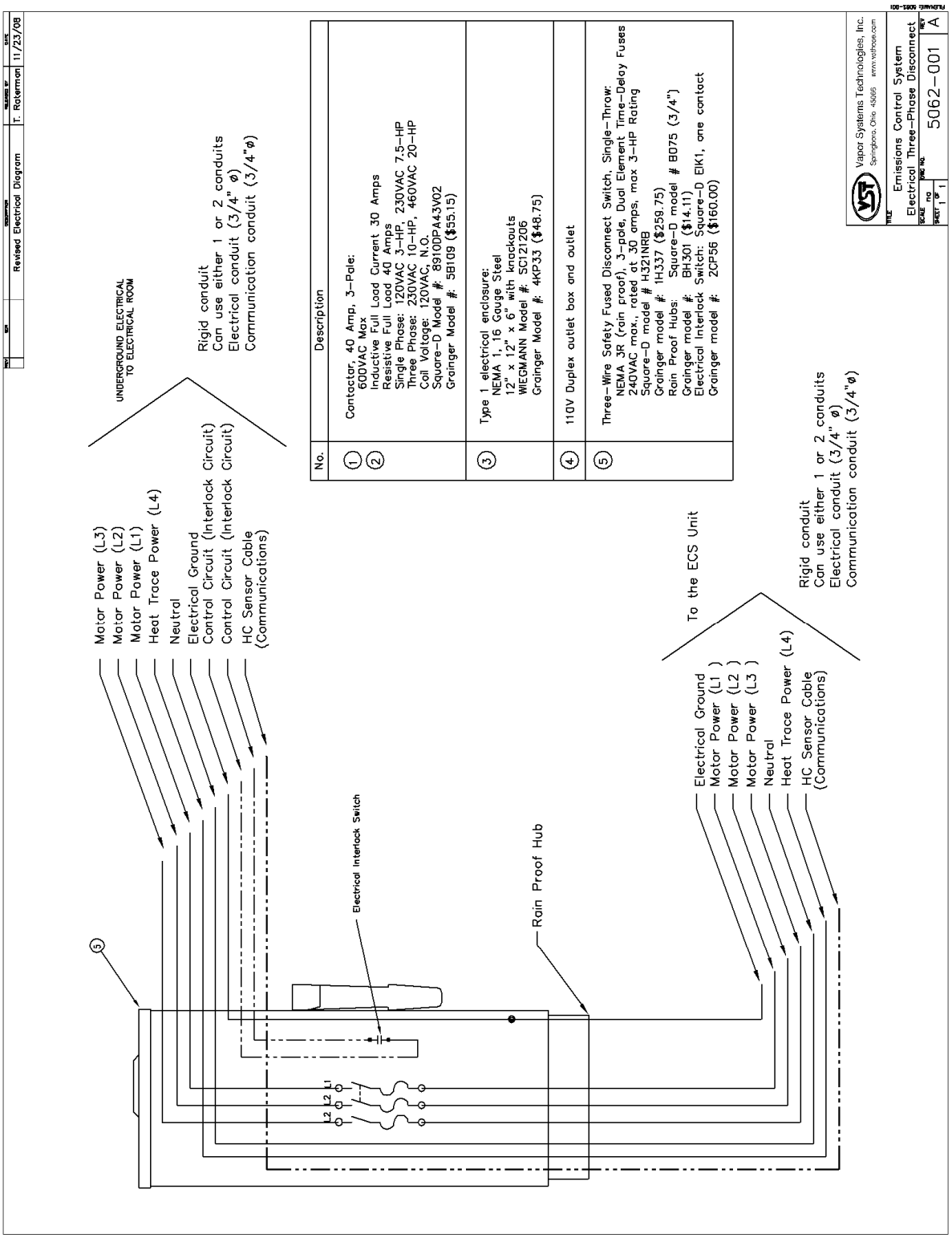


Figure 41: 3-phase electrical disconnect

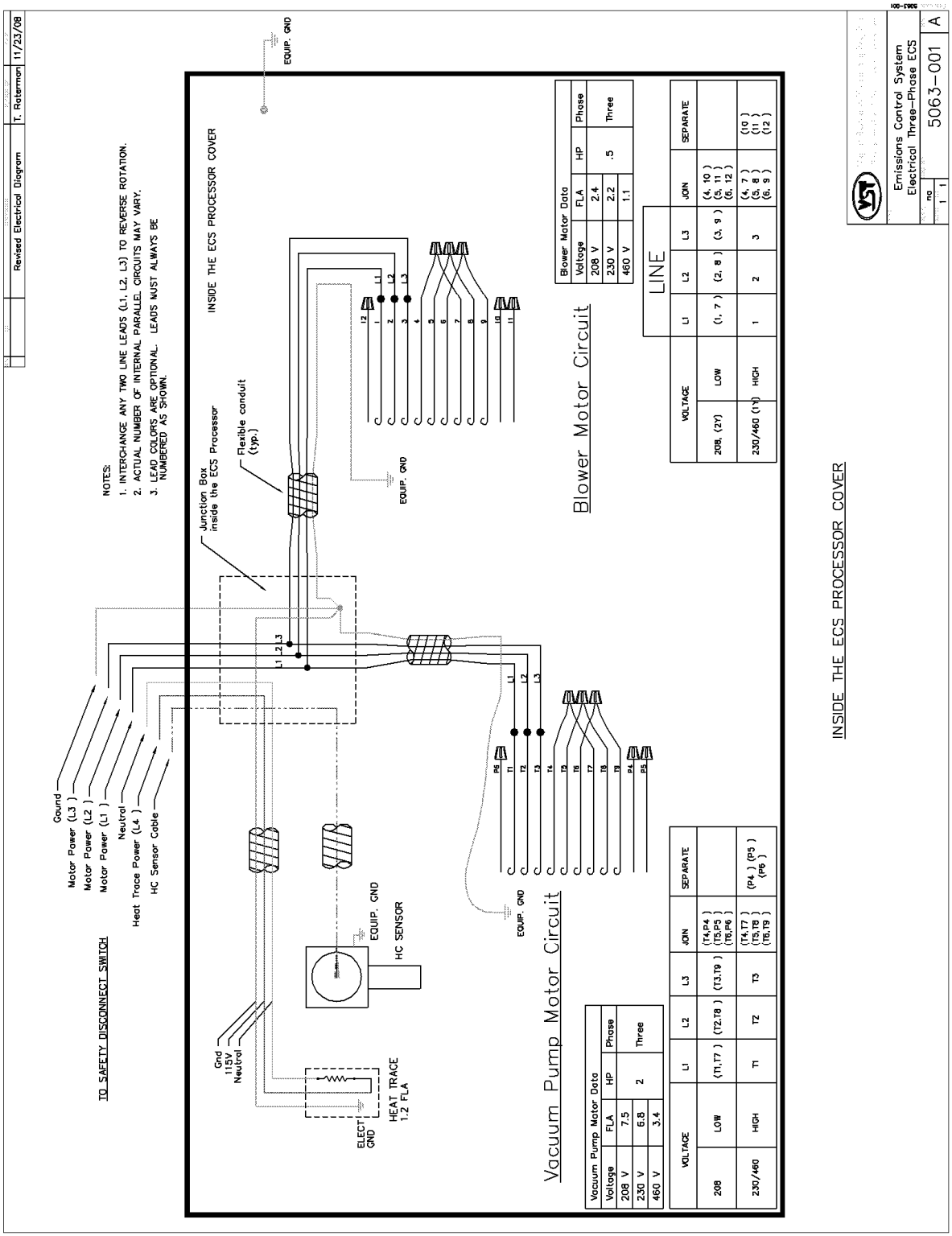


Figure 42: 3-phase elec. inside ECS

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