Section #14

Installation Manual

ECS Membrane Processor with ISD

<table>
<thead>
<tr>
<th>Part</th>
<th>VST-ECS-CS3-110</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VST-ECS-CS3-310</td>
</tr>
<tr>
<td>E.O.</td>
<td>VR-204</td>
</tr>
</tbody>
</table>

Vapor Systems Technologies, Inc.
650 Pleasant Valley Drive
Springboro, Ohio  45066
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FX: 937-704-9443
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UL Declaration Notice

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

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

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

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

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

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

Notice

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

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

- The warranty is conditional on whether the Processor was installed by a VST ASC Level B or a VST Level C.

- 12-month warranty becomes effective at the time of installation. If this card is not returned, the warranty becomes effective from the date of shipment 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 customer.

- Warranty status will be determined within 30 days of the return of suspected items.

- VST provides for a warranty program in conjunction with VST’s exclusive serial number tracking system.

- Each VST product carries a unique serial number and warranty tracking card.


- This warranty does not cover any components exposed to contact with fuels more than 5% menthol, 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.vsttools.com

**Figure 1: VST Registration Card**

**Figure 2: ECS Membrane Processor Sticker**
## Components and Warranties

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Component</th>
<th>Authorized Tasks</th>
<th>Training Pre-Requisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Hanging Hardware</td>
<td>Functional Testing Installation Maintenance Repair</td>
<td>No pre-requisite</td>
</tr>
<tr>
<td>A/B</td>
<td>Hanging Hardware</td>
<td>Functional Testing Installation Maintenance Repair</td>
<td>No pre-requisite</td>
</tr>
<tr>
<td></td>
<td>Membrane Processor</td>
<td>Installation</td>
<td>Veeder-Root Level 1, 2/3, or 4 ASC certification</td>
</tr>
<tr>
<td>C</td>
<td>Membrane Processor</td>
<td>Annual Testing Component Replacement Maintenance Operation Post-Installation Power-Up Testing Start-Up Testing Troubleshooting</td>
<td>Veeder-Root Level 2/3, or 4 ASC with PMC / ISD certification VST level “A/B”</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Veeder-Root Level 1</th>
<th>Contractors holding valid Level 1 Certification are approved to perform wiring and conduit routing, equipment mounting, probe and sensor installation, tank and line preparation, and line leak detector installation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veeder-Root Level 2/3 or 4</td>
<td>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.</td>
</tr>
<tr>
<td>PMC / ISD</td>
<td>This course of training includes In-Stations Diagnostics/Pressure Management Control (ISD/PMC) installation checkout, startup, programming, and operations training. It also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current level 2/3 or 4 certification is a prerequisite for the ISD/PMC course. After successful completion of this course the contractor will receive a certificate as well as a Veeder-Root ISD/PMC contractor certification card.</td>
</tr>
</tbody>
</table>

**Warranty Registrations may only be submitted by selected distributors.**
## Safety Icons

<table>
<thead>
<tr>
<th>Icon</th>
<th>ELECTRICITY</th>
<th>TURN POWER OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>A potential shock hazard exists. High voltage is supplied to and exists in this device.</td>
<td>Turn power off to the device and its accessories when installing and servicing the unit. Live power creates a potential spark hazard.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Icon</th>
<th>EXPLOSIVE</th>
<th>NO POWER TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Gasoline and its vapors are extremely explosive if ignited.</td>
<td>Sparks from electric power tools can ignite gasoline and its vapors.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Icon</th>
<th>FLAMMABLE</th>
<th>NO PEOPLE IN THE AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Gasoline and its vapors are extremely flammable.</td>
<td>Unauthorized people in the work area during installation and service of the device create a potential for personal injury.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Icon</th>
<th>NO SMOKING</th>
<th>READ ALL RELATED MATERIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Gasoline and its vapors can be ignited by sparks and embers of burning cigarettes.</td>
<td>Read, understand, and follow all instructions, warnings, and requirements before you begin work.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Icon</th>
<th>NO OPEN FLAMES</th>
<th>USE SAFETY BARRICADES</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Open flames from sources like lighters and matches can ignite gasoline and its vapors.</td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Icon</th>
<th>PINCH RISK</th>
<th>ROTATING MACHINERY</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Stay clear. Keeps hands and tools away from rotating machinery and moving parts.</td>
<td>Stay clear. Keep hands and tools away from rotating machinery.</td>
</tr>
</tbody>
</table>
# Table of Terms and Abbreviations

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

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>When the UST system pressure rises above +0.2&quot;WC, the Processor turns ON.</td>
</tr>
<tr>
<td>2.</td>
<td>Through the vapor inlet pipe connection at the Processor, the VOC vapor is drawn into the suction side of the blower.</td>
</tr>
<tr>
<td>3.</td>
<td>The blower discharges the VOC vapor into the membrane housing.</td>
</tr>
<tr>
<td>4.</td>
<td>Inside the membrane housing, the VOC vapor is separated into two air streams:</td>
</tr>
<tr>
<td></td>
<td>1. VOC depleted air (referred to as “air”)</td>
</tr>
<tr>
<td></td>
<td>2. Concentrated VOC vapor</td>
</tr>
<tr>
<td></td>
<td>The membrane is designed specifically for separating air from gasoline VOC vapor.</td>
</tr>
<tr>
<td>5.</td>
<td>A vacuum pump draws the air from the membrane housing through a check valve.</td>
</tr>
<tr>
<td>6.</td>
<td>A sample of the air flows through a hydrocarbon sensor to check the percent hydrocarbons.</td>
</tr>
<tr>
<td>7.</td>
<td>From the vacuum pump, the air is vented to atmosphere via the air return.</td>
</tr>
<tr>
<td>8.</td>
<td>The concentrated VOC vapor returns to the UST system via the vapor return.</td>
</tr>
<tr>
<td>9.</td>
<td>When the UST system pressure drops below -0.2”WC, the Processor turns OFF.</td>
</tr>
</tbody>
</table>
### 1.3 Processor Dimensions and Weight

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Unit</th>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>VST-ECS-CS3-110</td>
<td>Single-Phase</td>
<td>L-39” x W-27” x H-43”</td>
<td>385 lbs.</td>
</tr>
<tr>
<td>VST-ECS-CS3-310</td>
<td>Three-Phase</td>
<td>L-39” x W-27” x H-43”</td>
<td>350 lbs.</td>
</tr>
</tbody>
</table>

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

### 1.4 Processor Components

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

<table>
<thead>
<tr>
<th>PART #</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5015-001</td>
<td>HC Sentry Interface Module w/24VDC power supply</td>
</tr>
</tbody>
</table>

### 1.6 Processor Manuals and Warranty

<table>
<thead>
<tr>
<th>MANUAL #</th>
<th>MANUAL NAME</th>
<th>SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9520-001</td>
<td>ECS Membrane Processor with ISD: Installation Manual</td>
<td>14</td>
</tr>
<tr>
<td>9520-002</td>
<td>ECS Membrane Processor with ISD: Operation / Maintenance Manual</td>
<td>15</td>
</tr>
<tr>
<td>9514-003</td>
<td>ECS Membrane Processor: Troubleshooting Guide</td>
<td><a href="http://www.vsthose.com">www.vsthose.com</a></td>
</tr>
<tr>
<td>9514-004</td>
<td>ECS Membrane Processor: Pre-Installation Site Survey</td>
<td><a href="http://www.vsthose.com">www.vsthose.com</a></td>
</tr>
<tr>
<td>9522-001</td>
<td>IOM: VST EVR Balance Total System Solution</td>
<td>5</td>
</tr>
<tr>
<td>9998-001</td>
<td>Warranty Paperwork</td>
<td><a href="http://www.vsthose.com">www.vsthose.com</a></td>
</tr>
</tbody>
</table>
Figure 3: How the Processor fits into the GDF Layout

1. Nozzle, VST Model VST-105-NS
2. Cockpit Desk, VST Model VST-105-NS
3. Cockpit Seat, VST Model VST-105-NS
4. Cockpit Monitor, VST Model VST-105-NS
5. Membrane Processor, VST Model VST-105-SSS (Single-Phase)
   VST-105-SSS-313 (Three-Phase)
6. Vessel-Food Grade TST-350
7. Pressure Sensor, Vessel-Food Grade 3316-25-03
8. Flow Meter, Vessel-Food Grade 3312-25-02

Oct/01, REV A
Figure 4: ECS Process Control Diagram

Note 1. Minimum 1" Dia. for lengths < 10' from Processor to the vent risers
Minimum #1-1/2" Dia. for lengths > 10' from the Processor to the vent risers
The three connections to the processor are 2", NPT
Note 2. All three valves shown (connecting to the processor) must be locking ball valves.

VST Model #: VST-ECS-CS3-XXX
VST-ECS-CS3-110 (Single-Phase with HC Sensor)
VST-ECS-CS3-310 (Three-Phase with HC Sensor)
Figure 5: ECS Vent Riser Configurations

- 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 cannot be allowed, as this will short circuit the Processor.
- Detail "B" shows a three vent riser configuration. Two of the vent risers may be manifolded at the P/V valve as shown with #2 and #3 connected.
- Detail "C" shows a four vent riser configuration. The vent risers may manifold at the P/V valve as shown with #2 and #3 connected, and #4 and #5 connected.
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

<table>
<thead>
<tr>
<th>Local Air Pollution Control District</th>
<th>Canopy-Mount Location</th>
<th>Vent Risers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GDF must contact the local air pollution control district for specific local vapor-recovery requirements.</td>
<td>• The local jurisdiction must allow the Processor to be placed on the canopy.</td>
<td>• 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.)</td>
</tr>
<tr>
<td><strong>Ground-Mount Location</strong></td>
<td>• Structure must be strong enough to hold the weight of the Processor:</td>
<td>• The maximum distance the Processor can be from the vent risers is 100-feet.</td>
</tr>
<tr>
<td>• The Processor must be protected from damage.</td>
<td>• Three-phase 350 lbs.</td>
<td>• Any type of trap, regardless of the Processor location, is not permitted in any vapor lines connected to the Processor.</td>
</tr>
<tr>
<td>• Processor must be located at least 10’ from the property line.</td>
<td>• Single-phase 385 lbs.</td>
<td>• To install the Processor, there must be two vent risers connected at different locations to the UST’s or to the underground vapor piping.</td>
</tr>
<tr>
<td>• Processor must be within 100’ of the vent risers.</td>
<td>• Must be a 36” perimeter around the Processor for maintenance and testing.</td>
<td>• 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.</td>
</tr>
<tr>
<td><strong>Roof-Mount Location</strong></td>
<td>• All safety and code concerns have been addressed.</td>
<td>• A 5’ radius around the vent riser P/V valve is a Class I, Div. 2 hazardous area as defined in NFPA 70.</td>
</tr>
<tr>
<td>• Structure must be strong enough to hold the weight of the Processor:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Three-phase 350 lbs.</td>
<td>• 3 empty breaker spaces 208/230-460v panel for blower and vacuum pump motors</td>
<td></td>
</tr>
<tr>
<td>• Single-phase 385 lbs.</td>
<td>• (1) 115v breaker for the heat-trace cable</td>
<td></td>
</tr>
<tr>
<td>• Must be a 36” perimeter around the Processor for maintenance and testing.</td>
<td>• (1) 115v outlet for the HC sentry</td>
<td></td>
</tr>
<tr>
<td>• The height of the Processor must be above the building parapet to allow for the proper vapor-piping slope.</td>
<td>• GFCI protected, weatherproof 115v convenience outlet located at the Processor is optional</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 2-hp vacuum pump / ½-hp blower</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Three Phase Electric</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 2 empty 115v breaker spaces in the panel for the blower and vacuum pump motors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• (1) 115v breaker for the heat trace cable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• (1) 115v outlet for the HC sentry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• GFCI protected, weatherproof 115v convenience outlet located at the Processor is optional</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 2-hp vacuum pump / ½-hp blower</td>
<td></td>
</tr>
</tbody>
</table>
### UST Manifolding
- UST's must be manifolded below ground.
- There must be at least two separate vent lines, which are not manifolded together.

### Dispenser
- 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 ISD installed

### CARB Requirements
- VR-204 (VST Executive Order)
4 Ground Installation

4.1 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.

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
Figure 8: ECS Membrane Processor Hazardous Locations

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 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 prior to installation.
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 32

- 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, 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: Section 14 / Page 33 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](http://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.
Figure 9: Concrete Mounting Pad Dimensions
Figure 10: Processor Ground Mounting Pad
5 Roof-Top Installation

5.1 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.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Unit</th>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>VST-ECS-CS3-110</td>
<td>Single-Phase</td>
<td>L-39” x W-27” x D-43”</td>
<td>385 lbs.</td>
</tr>
<tr>
<td>VST-ECS-CS3-310</td>
<td>Three-Phase</td>
<td>L-39” x W-27” x D-43”</td>
<td>350 lbs.</td>
</tr>
</tbody>
</table>

*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
• 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.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Unit</th>
<th>Dimensions</th>
<th>Weight</th>
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<td>Single-Phase</td>
<td>L-39” x W-27” x D-43”</td>
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<td>Three-Phase</td>
<td>L-39” x W-27” x D-43”</td>
<td>350 lbs.</td>
</tr>
</tbody>
</table>

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.

- 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.

- 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 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 Piping Connection Material

- All connections to the Processor must be 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
7.3.1 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.
7.4 Underground Vapor Piping Instructions

- From the dispenser to the UST:
  - A minimum of 2” ID is acceptable unless the dispenser lines are manifolled 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.
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.

- See Figure 15: Section 14 / Page 47 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. Valve (sized for the pipe diameter)
  4. Union (sized for the pipe diameter)
  5. Vent Riser

- 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. Union (sized for the pipe diameter)
  5. Vent Riser

- 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 P/V valve must be installed on the air outlet vent riser to shield against rain and reduce noise.

- 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 and 5 feet in all directions of the vent opening.

- The new vent riser may be installed next to the existing vent risers.
Note 1. Minimum #1” Dia for lengths < 10’ from Processor to the vent risers.
Minimum #1-1/2” Dia. for lengths > 10’ from the Processor to the vent risers.
The three connections to the processor are 2”, NPT.
Note 2. All three valves shown (connecting to the processor) must be locking ball valves.

VST Model #: VST-ECS-CS3--XXX
VST-ECS-CS3--110 (Single-Phase with HC Sensor)
VST-ECS-CS3--310 (Three-Phase with HC Sensor)
WARNING: The Air Outlet riser (#1) out of the Processor MUST NEVER be manifolded together with other vent risers.

WARNING: The two vent risers that connect to the Processor MUST NEVER be manifolded together, as this will short circuit the Processor.

Detail "A" shows a two vent riser configuration. Manifolding of the vent risers #2 & #3 at the P/V valve can not be allowed, as this will short circuit the Processor.

Detail "B" shows a three vent riser configuration. Two of the vent risers may be manifolded at the P/V valve as shown with #2 and #3 connected.

Detail "C" shows a four vent riser configuration. The vent risers may manifold at the P/V valve as shown with #2 and #3 connected, and #4 and #5 connected.
Note 1. Minimum #1" Dia for lengths < 10' from Processor to the vent risers
Minimum #1-1/2" Dia. for lengths > 10' from the Processor to the vent risers
The three connections to the processor are 2" x, NPT
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 below ground.

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 air outlet) is part of the Phase I system, and therefore must be a CARB-certified component.

**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
9 Electrical Controls

9.1 Electrical Controls 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.

9.2 Single-Phase Processor

- A circuit disconnect device is not included with the Processor.
  - NEC code requires that a readily accessible disconnect device be installed within site of the Processor.
- At the main breaker, size the motor panel breaker according to the table below. Make sure the total amperage includes both motors.

<table>
<thead>
<tr>
<th>Motor</th>
<th>HP</th>
<th>Phase</th>
<th>Voltage</th>
<th>Amperage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blower</td>
<td>.5</td>
<td>Single</td>
<td>115</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>230</td>
<td>4.9</td>
</tr>
<tr>
<td>Vacuum Pump</td>
<td>2</td>
<td>Single</td>
<td>115</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>230</td>
<td>12</td>
</tr>
</tbody>
</table>

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).
- VST recommends that the Processor’s main power be controlled by the facility’s main Emergency Shut-Off System.

The contractor shall supply a 115v fused motor starter with a 115V relay coil to start/stop the single-phase motors.

**9.2.1 Power Requirements for Single-Phase Electrical Service**

- 115v, single-phase, 60Hz (blower and vacuum pump motors).  
  - See Table 1 / Section 14 / Page 51 for the motor amperage.
- 115v breaker (heat-trace cable power)  
  - 115v, 2-amp service to power the heat trace
- 115v, 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 disconnect device be installed with the installation wiring for the Processor.
- At the main breaker use a 208/230-460v, 3-phase, 60Hz electric service.  
  - See Table 2 / Section 14 / Page 53 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).
  - VST recommends that the Processor’s main power be controlled by the facility’s main Emergency Shut-Off System.
- The contractor shall supply a 208/230-460v fused motor starter with a 115V relay coil to start / stop the three-phase motors.
9.3.1 Power Requirements for Three-Phase Electrical Service

- **See Table 2: Section 14 / Page 53 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.

<table>
<thead>
<tr>
<th>Motor</th>
<th>HP</th>
<th>Phase</th>
<th>Voltage</th>
<th>Amperage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blower</strong></td>
<td>.5</td>
<td>Three</td>
<td>208</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>230</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>460</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Vacuum Pump</strong></td>
<td>2</td>
<td>Three</td>
<td>208</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>6.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>460</td>
<td>3.4</td>
</tr>
</tbody>
</table>

*Table 2: Three Phase Motor Power Requirements*

- 115v breaker (heat-trace cable power)
  - 115v, 2-amp service to power the heat trace

- 115v, 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.
  - 115V, 2 amp service to power the motor-starter relay coil.

- The ECS motor-starter relay is located inside the GDF.
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 115v, single-phase power the two electric motors in the Processor.
  - This breaker should be a delayed-trip motor starting type.
  - See Figure 18: Section 14 / Page 60.
  - See Figure 19: Section 14 / Page 61.

- Single-phase motors wiring diagrams:
  - See Figure 20: Section 14 / Page 62 for the vacuum pump single-phase motor wiring diagram
  - See Figure 21: Section 14 / Page 63 for the blower single-phase motor wiring diagram

9.5.2 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 22: Section 14 / Page 64.
  - See Figure 23: Section 14 / Page 65.

- Three-phase motors wiring diagrams:
  - See Figure 24: Section 14 / Page 66 for the vacuum pump three-phase motor wiring diagram
  - See Figure 25: Section 14 / Page 67 for the blower three-phase motor wiring diagram

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

- 115v, 2-amp 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

- 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.

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
9.8 Power for the Motor Starter Relay Coil

- 115V circuit provides power to the relay coil.

9.9 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.
10 Electrical Installation

10.1 Electrical Controls Safety

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

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 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.

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 208/230-460v 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.
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:
    - 208/203-460v motors (vacuum pump & blower)
    - 115v heat trace
    - Optional 115v 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 (208/203-460 VAC and 24 VDC) to be TFFN or THHN with 600 V insulation.

  ▶ All wiring must be gasoline and oil resistant.

- VST provides the 24 VDC power supply for the HC Sentry module.
  
  ▶ The 24VDC power-supply plugs into a standard 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: Vacuum Pump: Single-Phase Motor Wiring Diagram

<table>
<thead>
<tr>
<th>Voltage</th>
<th>FLA</th>
<th>HP</th>
<th>Phase</th>
</tr>
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<tbody>
<tr>
<td>115 V</td>
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<td>230 V</td>
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<td></td>
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**NOTES:**
1. STANDARD ROTATION IS CW FACING END OPPOSITE SHAFT EXTENSION.
2. OPTIONAL THERMOSTAT IS PROVIDED WHEN SPECIFIED.
3. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.
5. VST RECOMMENDS USING THE 230 V DUE TO 110 V HIGH POWER CONSUMPTION.
Figure 21: Blower Single-Phase Motor Wiring Diagram

### Blower Motor Data

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### Table of Wiring Diagrams

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<td>2.3 B</td>
<td>J 5</td>
<td>230 V Recommended</td>
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<tr>
<td>HIGH 115 V</td>
<td>1</td>
<td>4</td>
<td>2.3 B</td>
<td>J 8</td>
<td>115 V Not Recommended</td>
</tr>
</tbody>
</table>

**NOTES:**

1. STANDARD ROTATION IS CWX FACING END OPPOSITE SHAFT EXTENSION.
2. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.
3. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.
4. VST RECOMMENDS USING THE 230 V DUE TO 110 V HIGH POWER CONSUMPTION.

**Connections for Two-Terminal Thermostat**

110 V J-BRN
Figure 22: Processor Three-Phase Wiring Schematic
Figure 23: Processor Three-Phase Wiring Schematic
Figure 24: Vacuum Pump: Three-Phase Motor Wiring Diagram

<table>
<thead>
<tr>
<th>Voltage</th>
<th>FLA</th>
<th>HP</th>
<th>Phase</th>
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</thead>
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<tr>
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<tr>
<td>230 V</td>
<td>6.8</td>
<td>2</td>
<td>Three</td>
</tr>
<tr>
<td>460 V</td>
<td>3.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

ECS Membrane Processor
Vacuum Pump Three-Phase Wiring

VST
VST EVR Total Balance System Solution
Figure 25: Blower: Three-Phase Motor Wiring Diagram

<table>
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<tr>
<th>Voltage</th>
<th>FLA</th>
<th>HP</th>
<th>Phase</th>
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<td>.5</td>
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</tr>
<tr>
<td>230 V</td>
<td>2.2</td>
<td>.5</td>
<td>Three</td>
</tr>
<tr>
<td>460 V</td>
<td>1.1</td>
<td>.5</td>
<td>Three</td>
</tr>
</tbody>
</table>

**Notes:**
1. Interchange any two line leads to reverse rotation.
2. Actual number of internal parallel circuits may vary.
3. Lead colors are optional. Leads must always be numbered as shown.
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, or 2/3, or 4 certification.

- The 115VAC control voltage for the motor control contactors coil comes from the TLS-350 controller.

- The 115V control voltage for the motor control contactor is from the 115V electrical panel.

- 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 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).

- 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 26: Section 14 / Page 69
  - See Figure 27: Section 14 / Page 70
  - See Figure 28: Section 14 / Page 71
Figure 26: VR TLS Multi-Port Card Connection to HC Sentry Module
Figure 27: Processor Single-Phase TLS Wiring
208–230/460 VAC 3-Phase Breaker

Single Throw triple pole contactor, 115 VAC control voltage

Motor Starter Relay

TLS-350

RS–485/RS–232 COMMUNICATION
2 WIRE PAIR INTO RJ 45 CONNECTOR
HC SENSOR SIGNAL TO MULT–PORT CARD

Figure 28: Processor Three-Phase Wiring
10.5 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 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.

![HC Sentry Diagram]

**Figure 29: HC Sentry Front and Back Views**
Figure 30: HC Sentry and HC Sensor Wiring Diagrams
Figure 31: 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 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 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.

- **See Figure 33: Section 14 / Page 76 TLS – HC Sentry RS-485 Cable for the wiring diagram. VST does not provide this cable or the RJ-45 connector to the Multiport card in the TLS communication bay.**

![Figure 32: VR TLS Multi-Port Card Connection to HC Sentry Module](image-url)
If RS-485 bus termination required at the HC Sentry, set dip switch 10 "SETTINGS" to the UP / ON position (default).

TLS Jumper J5 to 2-wire position (default)
10.7 Veeder-Root TLS 350 with ISD

- The Processor is controlled by a Veeder-Root (VR) TLS-350 with a ISD 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 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 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 34: VR TLS 350](image-url)
# Post-Installation Checklist

<table>
<thead>
<tr>
<th>Post-Installation Checklist</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ASC #:</td>
<td>Date:</td>
</tr>
<tr>
<td>ASC Name:</td>
<td></td>
</tr>
<tr>
<td>VST-ASC Certification Level</td>
<td>☐A  ☐B  ☐C</td>
</tr>
<tr>
<td>ASC Company:</td>
<td></td>
</tr>
<tr>
<td>GDF Name:</td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
</tr>
<tr>
<td>City:</td>
<td>State:</td>
</tr>
<tr>
<td>GDF Contact Person Name:</td>
<td></td>
</tr>
<tr>
<td>GDF Contact Person Title:</td>
<td></td>
</tr>
<tr>
<td>GDF Contact Person Phone:</td>
<td></td>
</tr>
<tr>
<td>GDF Contact Person E-mail:</td>
<td></td>
</tr>
</tbody>
</table>

## 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.

ASC Signature
<table>
<thead>
<tr>
<th>Site Components</th>
<th>Yes</th>
<th>No</th>
<th>Unknown</th>
<th>If “NO” or “Unknown” explain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure sensor installed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TLS-350 with ISD software installed</td>
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<tr>
<td>HC sentry connected to the TLS and checked</td>
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<tr>
<td>Motor-starter control relay connected to the TLS and checked</td>
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<tr>
<td>All vapor piping sloped away from the Processor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All vapor piping line size meets CP-201 requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All vapor piping slope meets CP-201 requirements</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>All warranty information has been filled out and sent to VST</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>All connections from the Processor to the UST’s are correct</td>
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</tr>
<tr>
<td>The Processor has not been installed in a Class I, Div. 1 or Class I, Div. 2 area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The electrical installation meets NEC, federal, state, and local standards</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Processor installation meets CP-201 requirements</td>
<td></td>
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</tr>
<tr>
<td>The ECS Processor has been installed per installation instructions</td>
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</tr>
</tbody>
</table>