



**Installation / Operation / Maintenance  
Manual**

**CHEMGUARD GenIII 110-  
410**

**Chemical Equipment**

**Manual Part Number: 477441**

**Edition: Rev-11 12/01/2020**

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## Revision Control Summary

Chapter	Revision	File Name
<b>Chapter 1 – Delivery and Inspection</b>		
<ul style="list-style-type: none"> <li>• Initial Release</li> </ul>	Rev-0	MNL000494.doc
<b>Chapter 2 – Site Preparation</b>		
<ul style="list-style-type: none"> <li>• Added 8x outlet manifold</li> </ul>	Rev-6	MNL000495.doc
<b>Chapter 3 – Installation</b>		
<ul style="list-style-type: none"> <li>• Updated DO connection points for 8x outlets</li> </ul>	Rev-5	MNL000496.doc
<b>Chapter 4 – Changing Reservoir Container</b>		
<ul style="list-style-type: none"> <li>• Initial Release</li> </ul>	Rev-0	MNL000497.doc
<b>Chapter 5 – Features and Components</b>		
<ul style="list-style-type: none"> <li>• Updated spill funnel model types</li> </ul>	Rev-5	MNL000498.doc
<b>Chapter 6 – System Operation</b>		
<ul style="list-style-type: none"> <li>• Initial Release</li> </ul>	Rev-0	MNL000499.doc
<b>Chapter 7 – Maintenance and Calibration Procedure</b>		
<ul style="list-style-type: none"> <li>• Removed CG410NT reference.</li> </ul>	Rev-2	MNL000500.doc
<b>Appendix G – Models SS2 &amp; SS4 Fire Detector</b>		
<ul style="list-style-type: none"> <li>• Initial Release</li> </ul>	Rev-3	MNL000115.doc
<b>Appendix H – Smoke Detector</b>		
<ul style="list-style-type: none"> <li>• Initial Release</li> </ul>	Rev-3	MNL000116.doc
<b>Addendum D – High Flow Degasser</b>		
<ul style="list-style-type: none"> <li>• Initial Release</li> </ul>	Rev-4	MNL000187.doc
<b>Addendum F – CG Bulk Container Fit-up Envelope</b>		
	Rev-4	MNL000292.doc

- Removed CG410NT reference.

**Addendum Y – UVIR Detector**

Rev-6

MNL000114.doc

- Initial Release

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# Chapter 1

## Delivery and Inspection

**Section 1      Delivery**

**Section 2      Inspection**

## 1.1 Delivery

The ChemGuard® Gen III may be shipped in multiple packing boxes. The packing slip on the outside of one of the cartons indicates the number of items in the order. A separate Shipping Identification Sheet (SIS), or packing checklist, included with the manuals, identifies all components in the shipment. Before unpacking, make sure your order includes the correct number of packages.

This shipment does not include an empty reservoir container. You will need to order a container or containers containing chemical. The contents of the packing boxes are:

- The ChemGuard® Gen III Cabinet
- Start-up kit (See Packing Checklist included with shipment)
- Shipping Identification Sheet (packing checklist)
- ChemGuard® Gen III Quality Inspection Records

**NOTE:** Save all cartons (along with foam supports and padding) for re-use in case unit must be returned to Versum Materials, Inc.

## **1.2 Inspection**

Be sure each item on the packing checklist is included in the shipment. Notify Versum Materials, Inc. within 30 days if anything is missing. After 30 days, it is the customer's responsibility to purchase missing or damaged parts.

1. Verify that the part numbers on the items are the same as specified on the Shipping Identification Sheet (SIS).
2. Keep the packing checklist for use in any future communication with Versum Materials, Inc. Customer Service.

# Chapter 2

## Site Preparation

- Section 1      Facility Preparation**
- Section 2      Facility Requirements**
- Section 3      Tag and Lockout Routine**
- Section 4      Spill Cleanup Routine**

This chapter describes the space and clearances required to install ChemGuard® systems along with specifications for power, gas, vacuum, cabinet exhaust, reservoir vent and chemical delivery line.

Before the ChemGuard® unit can be installed, the customer must prepare the location site as detailed in the following section to provide sufficient space and clearance around the unit. Ensure the AC power, vacuum and gas sources are available in close proximity to the unit. Please read the information in this chapter carefully to avoid problems later.

The user of this product is responsible for compliance with all applicable environmental laws and regulations including local governing agencies and state/local laws (i.e., Clean Water Act, Clean Air Act, and Hazardous Waste Laws).

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ChemGuard® hazard location groups include Class I, Division II Groups B, C, D (United States) and Group 2, Category 3 ATEX (Europe).

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

## 2.1 Facility Preparation

Determine a suitable location for ChemGuard<sup>®</sup> cabinet. Versum Materials, Inc. recommends installing the cabinet in close proximity to:

- Your AC power source
- Your vacuum supply
- Your helium push gas and nitrogen purge gas supplies

Ensure that there is ample space to allow the cabinet doors to open completely and that there is proper clearance around the unit. (See Table 2-1 for required cabinet clearances.) If an optional fire extinguisher is installed, additional clearance may be required.

**Table 2-1: Cabinet Clearances**

PLACEMENT	CLEARANCES
Height	87 in. (2.209 meters)
Width	18 in. (457 mm)
Depth	Door open: 37 in. (940 mm) Door closed: 21 in. (533 mm)

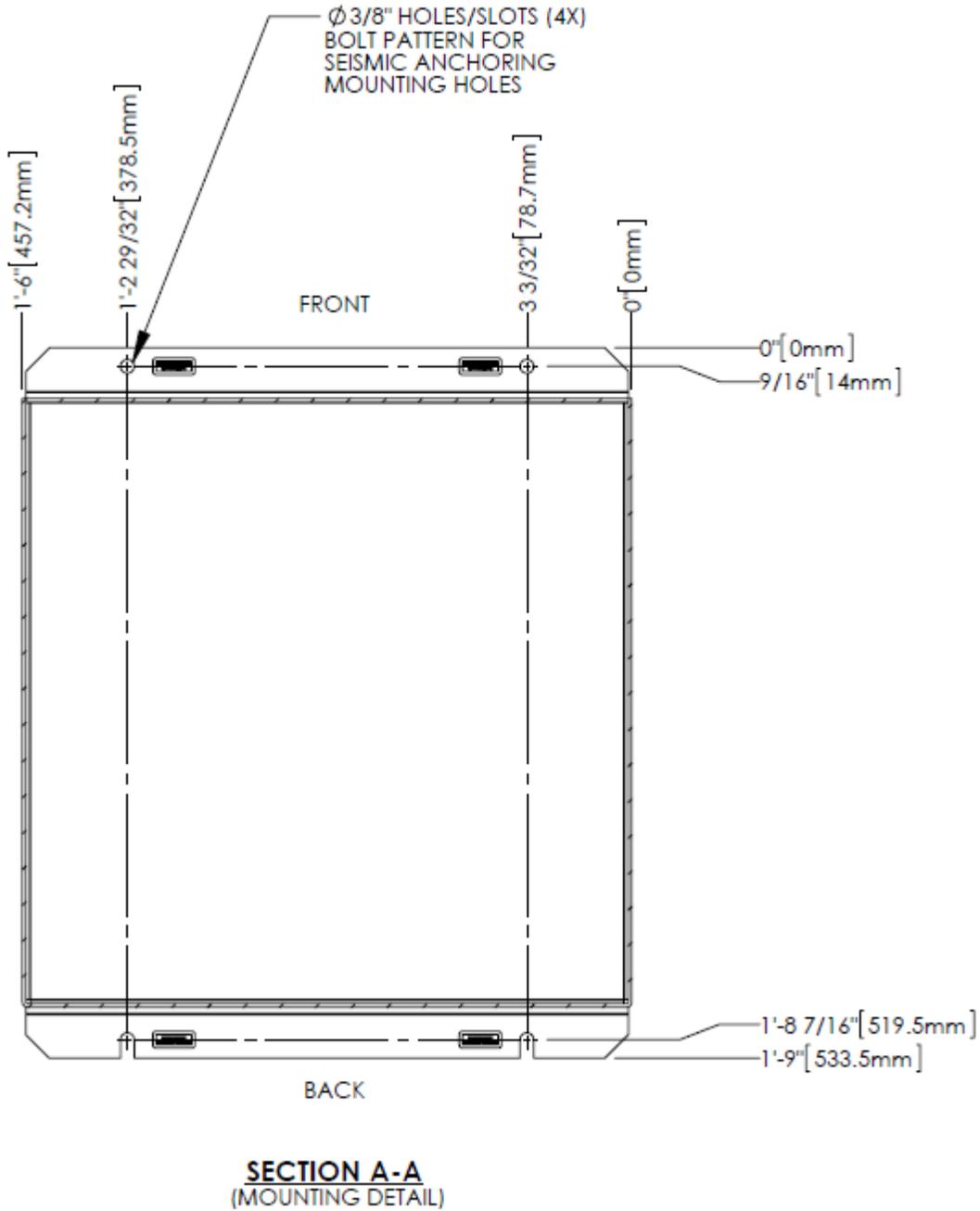
### 2.1.1 Bolt-Down and Ground Cabinet Requirements

Set the ChemGuard<sup>®</sup> cabinet over the bolt-down points and attach securely. Verify ChemGuard<sup>®</sup> is in a level location where it can be serviced easily, and is out of the main thoroughfare.

Per current United States UBC and SEMI S2-STANDARD requirements, floor bolts must be at least Grade 5 (metric Grade 8.8), at a recommended minimum length of 2.5 in. (6.35 cm).

1. Place the cabinet at the designated location.
2. Verify that there is enough room around the cabinet to fully open the door, or perform maintenance tasks.
3. The ChemGuard<sup>®</sup> must be grounded in accordance with Article 250 - Grounding, The National Electrical Code 2003. Refer to Figure 2-1 for the location of the grounding lug. Versum Materials, Inc. recommends a ground resistance of <1.0 Ohms.

**Figure 2-1: Earthquake Bolt-Down Pattern**



## 2.2 Facility Requirements

When selecting a location for the unit, ensure that the following facilities are available to make connections on top of the cabinet.

- Environmental
- Electrical
- Supply gases
- Vacuum
- Exhaust and Vent
- Chemical Delivery Line
- Bulk Chemical Refill Line (Optional)
- Outlet Manifold

Figure 2-2: CHEMGUARD® GEN III Cabinet Connections, Top View

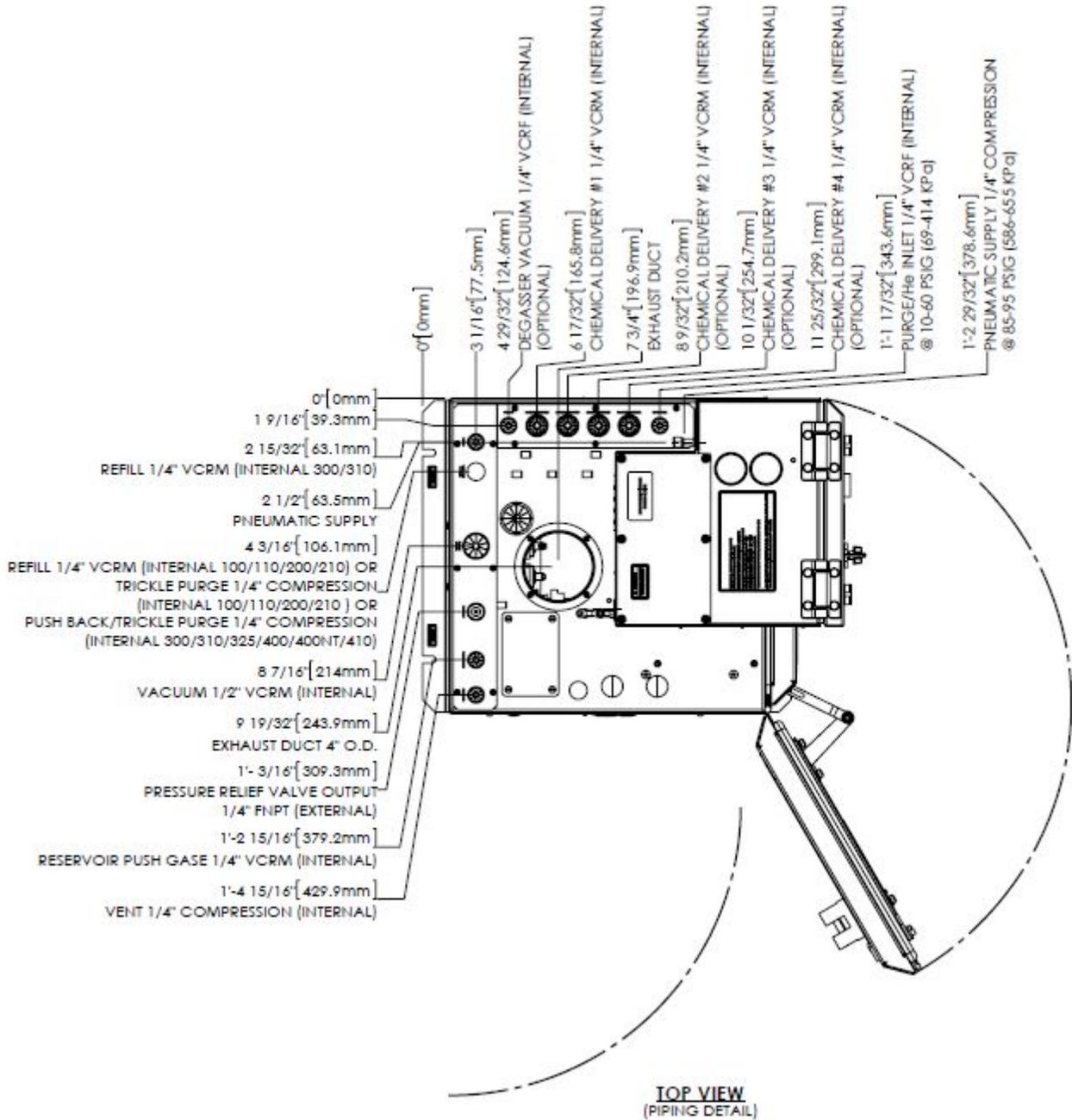
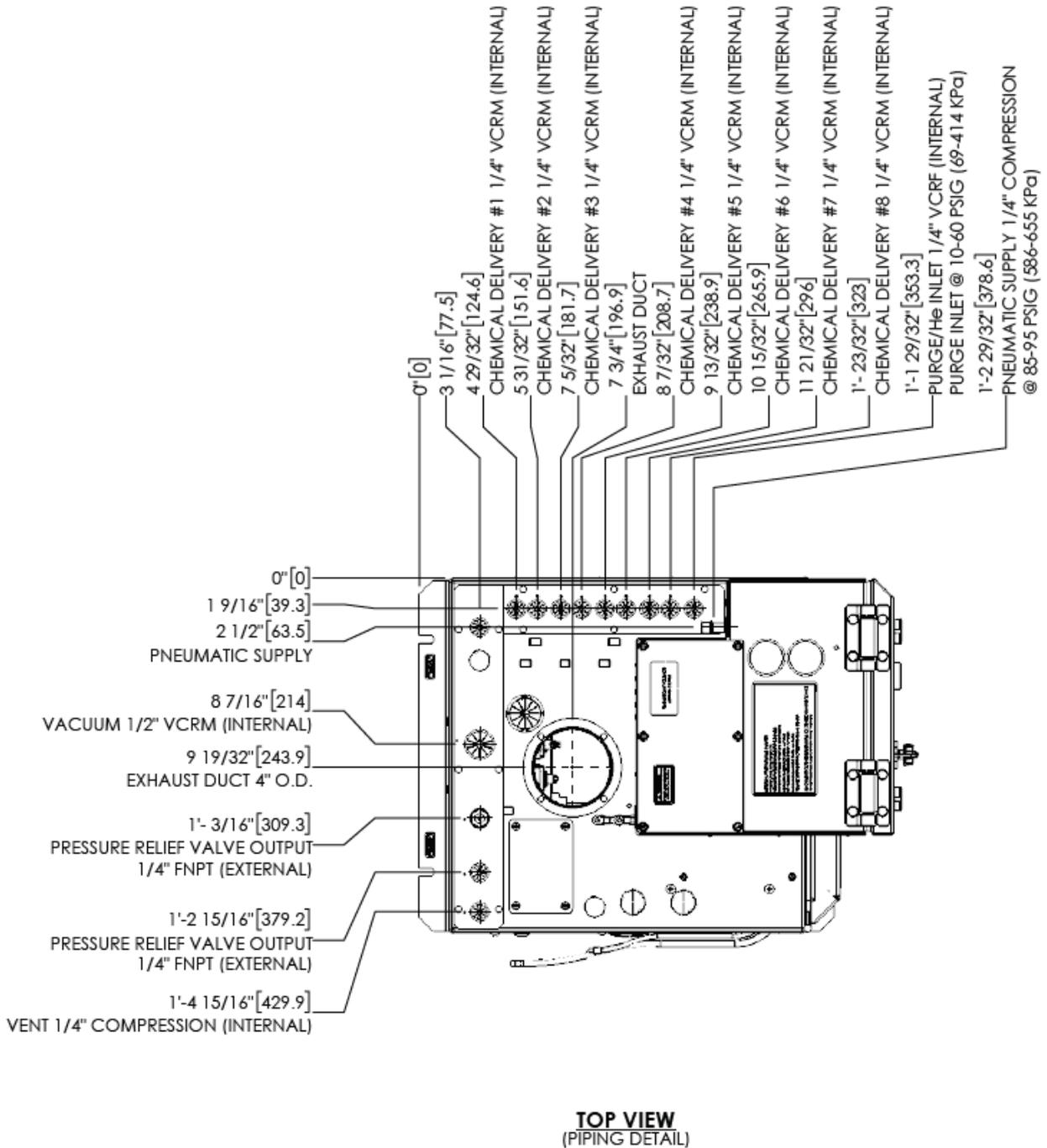
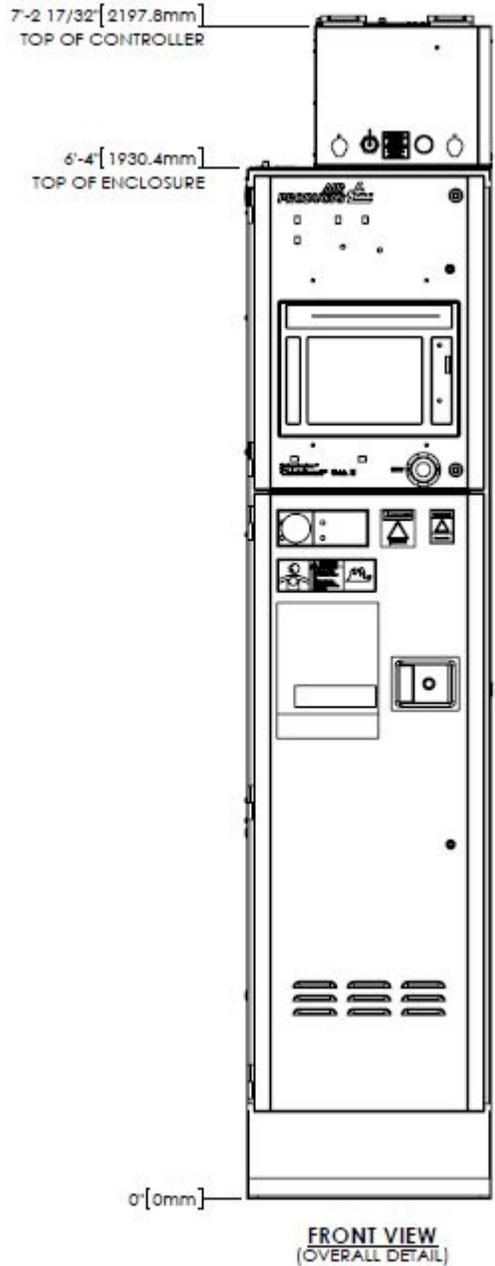


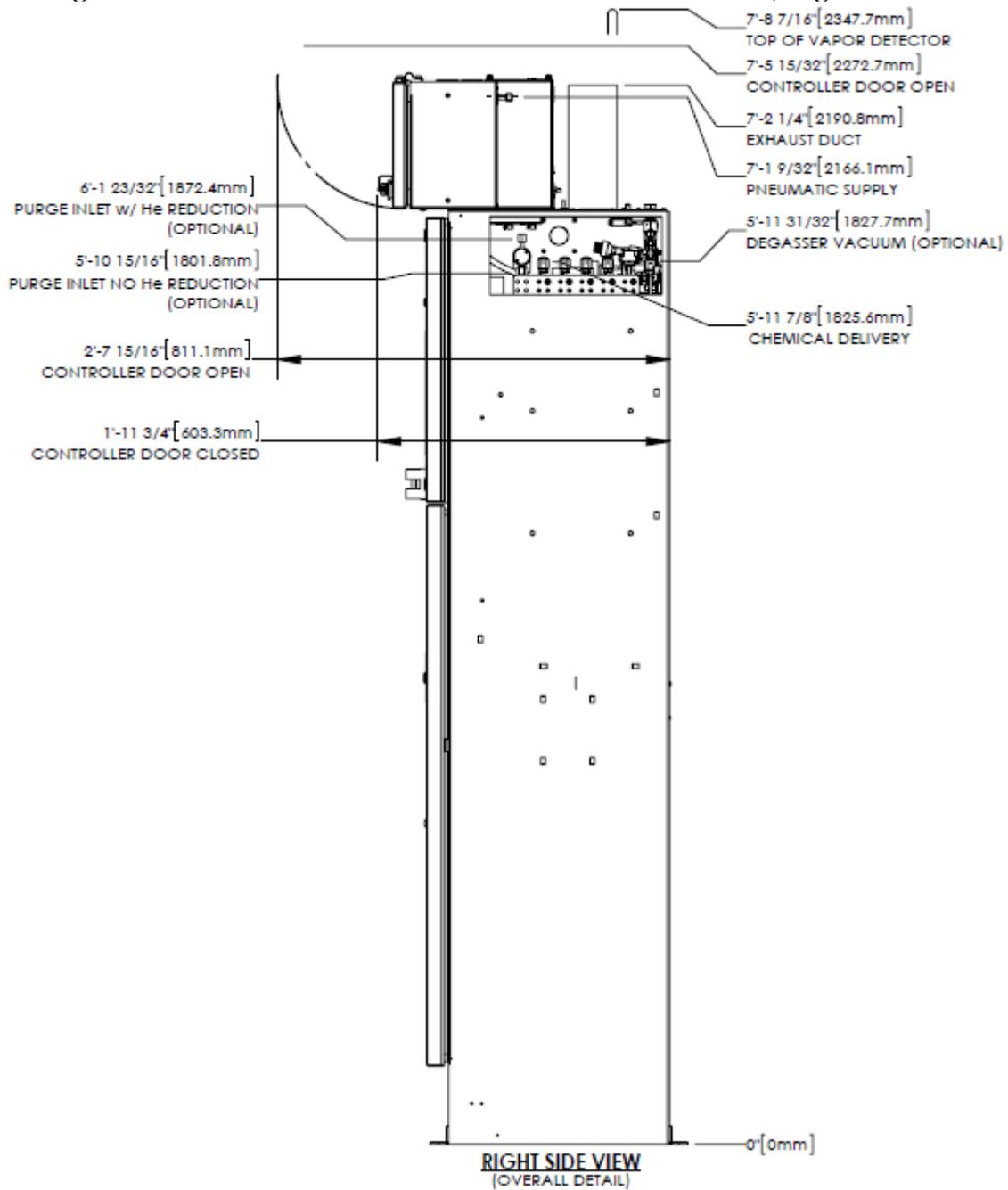
Figure 2-3: CHEM GUARD® GEN III Cabinet Connections with 8x outlets, Top View



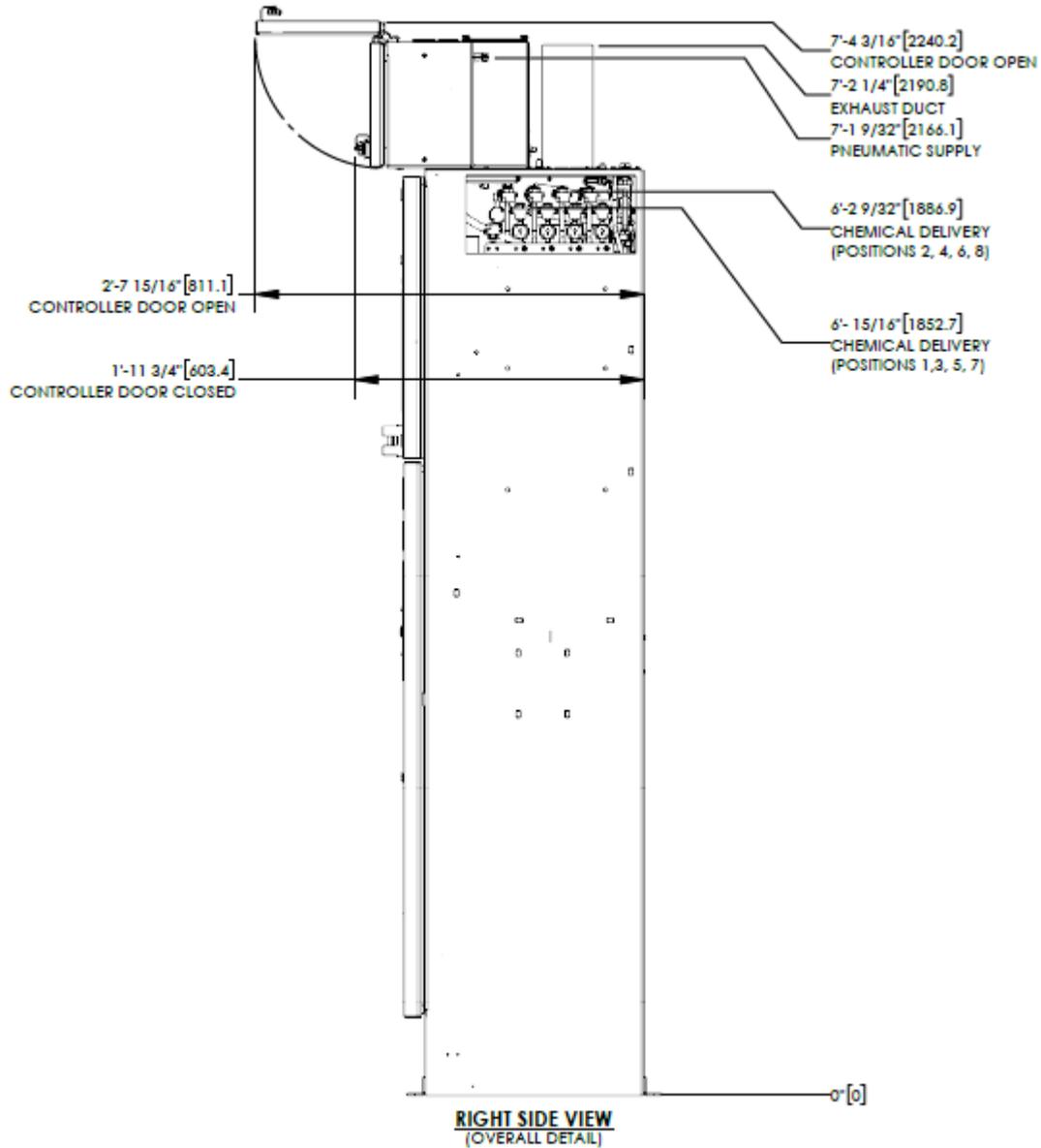
**Figure 2-4: CHEMGuard® GEN III Cabinet Connections, Front view**



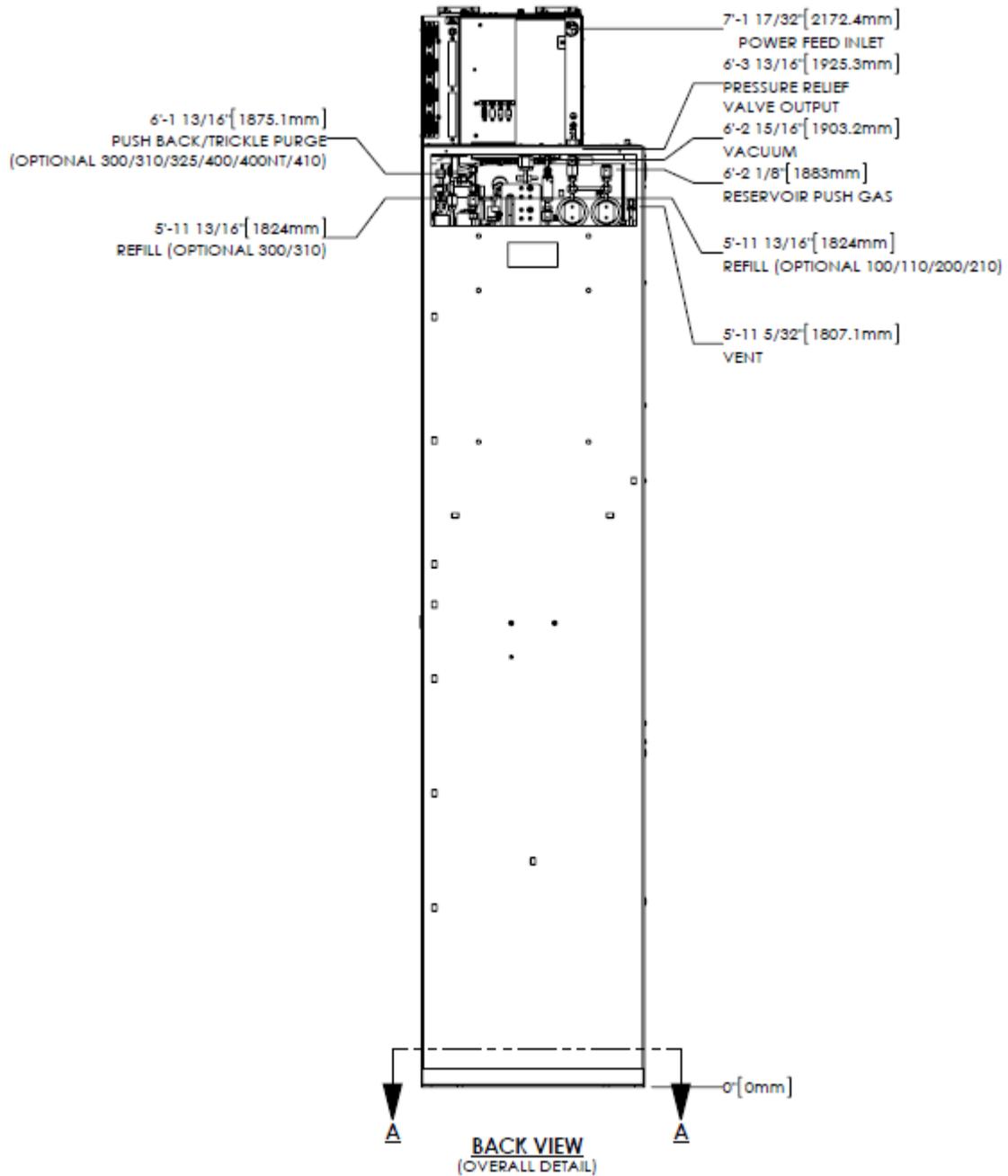
**Figure 2-5: CHEM GUARD® GEN III Cabinet Connections, Right Side view**



**Figure 2-6: CHEMGUARD® GEN III Cabinet Connections, Right Side view for 8x outlets**



**Figure 2-7: CHEMGUARD® GEN III Cabinet Connections, Back view**



### 2.2.1 Environmental Requirements

The customer is responsible for compliance with applicable environmental laws and regulations, including local governing agencies and state/local laws (i.e. Clean Water Act, Clean Air Act, Hazardous Waste Laws).

**Table 2-2: Environmental Requirements**

CONDITION	RANGE
Environmental	Operating Temperature: 0°C to 40°C Humidity: 5% to 95% RH, non-condensing Temperature must be compatible with chemical used.
Lighting	Minimum of 300 lux of illumination

### 2.2.2 Electrical Requirements

Versum Materials, Inc. recommends connection to an Uninterrupted Power Supply (UPS) and a Ground-Fault Circuit Interrupter (GFCI). Versum Materials, Inc. recommends that customer electrically ground the CHEMGUARD® cabinet and plumbing.

SEMI S2 requires a lockout type circuit breaker setup for the AC power. OSHA standards require customer to install lockout-type, 10K interrupt current (AIC) circuit breaker for AC power. Recommend placement of breaker 1 – 10 meters (3 – 32 ft.) from BCD.

Per SEMI S2 requirements, all electrical work for CHEMGUARD® GEN III is Type 1 and Type 2.

Type 1 = Equipment fully de-energized

Type 2 = Equipment is energized

S2 requires a lockout type circuit breaker setup for the AC power.



**Live circuits are covered and/or insulated, Lockout / Tagout is required while work is performed at a remote location to preclude accidental shock.**

**Table 2-3: Electrical Requirements**

CONDITION	RANGE
AC Power	100 - 240 VAC, 100 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded  125 VAC, 1000 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded, with Degasser Vacuum Pump option.

### 2.2.3 Process Tool Interface and Life Safety Interconnect

The external interface cable hookup between ChemGuard® product line and OEM Tool or Site Area Monitor System is customer responsibility. It is recommended to use multi-conductors shield cable with twisted pairs, 22-20 AWG, 7x30 stranded, rated 300-600V RMS, minimum 7-10 pairs (14-20 conductors) per interface.

**Table 2-4: Digital I/O**

DIGITAL INPUTS		DIGITAL OUTPUTS	
Input current, On	4.07 mA min.5.3 mA max.	Resistive Load	1.0 A @ 30 VDC, 0.5 A @ 120 VDC
Input voltage, On	24.0 VDC ±20%	Switching Power	30 W max.
Input current, Off	100 µA max.	Contact material	Silver alloy, gold-etched clad
Input voltage, Off	1.0 VDC max.		
Protection	36V Zener		

### 2.2.4 Supply Gases

The customer is required to supply all gases, filters, check-valves, and regulators. Ensure that the required gases are available in close proximity to the ChemGuard® installation site. (see Chapter 3 for further details). Ensure the push gas regulator selected is properly sized for a safety relief valve with flow coefficient CV=0.37, relieving at 110psig, located within the ChemGuard cabinet. Ensure there are shutoff valves and filters for gas lines feeding the ChemGuard®. Ensure the correct gases are used for the process chemical and the properties of the gas are correct for the process chemical (i.e. dry N2). (See Table 2-5).

To reduce the potential of flow fluctuations, the end-user must properly design the facilities for the ChemGuard®, i.e. incoming gas supplies and chemical delivery line layouts with adequate line size, vertical rise, horizontal length between the ChemGuard® and the process tool(s).

To avoid potential process failures here are some guidelines the end users should consider when facilitate ChemGuard® cabinets at central location.

- ChemGuard® cabinets centrally located and within close proximity to the process tool(s) to minimize the vertical and horizontal length of the chemical delivery lines.
- The incoming main gas supply to multiple ChemGuard® cabinets should be properly sized to provide adequate pressure and flow before branching out to multiple ChemGuard® cabinet connection points.
- After the main gas supply has been branched off to the individual ChemGuard® cabinets, Individual gas supply lines are equipped with individual regulators, check valves and isolation valves which have been properly sized to meet the pressure and flow requirements of the process tool(s).

A gas filter is required on the houseline supplying the ChemGuard® push gas. Failure to install a filter will void regulator and valve warranty if failed component found to have particles embedded on the seat.

Minimum filter specifications:

- Filter = 0.003 micron.
- Flow = 50 slpm.
- Material = Electropolished 316L Stainless Steel.
- Membrane = 316L Stainless Steel or PTFE.
- Leak Tested = 100% Helium leak tested to  $5 \times 10^{-9}$  atm cc/sec ( $3.8 \times 10^{-9}$  Torr L/sec).



**DO NOT deliver process/purge gases from a high pressure gas cylinder source. The supply gases must be delivered from the house line gas source regulated to no more than 120 psig with flow not greater than 250 slpm.**

A pneumatic supply of inert gas without oxygen is recommended for the controller. **It is strongly advised to not use clean dry air for pneumatic supply.** The pneumatic supply may be shared in the controller between the pneumatic solenoids and the enclosure inerting/pressurizing service (Z-purge). Based on results from DC power harness testing, clean dry air may promote the corrosion of electrical connectors for interconnecting power cables. The presence of oxygen enhances the corrosion effect and may result in deterioration of controller performance.

**Table 2-5: Supply Gases**

<p><b>PROCESS GAS</b></p>	<p>Helium gas is Ultra High Pure semiconductor-grade recommended. Water content &lt; 10 ppb and O2 content &lt; 2ppm.</p> <p>Recommended to use Inert Gas Purifier model # SS2500KFI4RR or equivalent.</p> <p>Required to install a 0.003 micron gas filter.</p> <p>Regulated to 620 ± 70 kPa (90 ± 10 psig) with regulator appropriately sized for a safety relief valve with flow coefficient CV=0.37, relieving at 110psig, located within the ChemGuard cabinet.</p> <p>Inline Filter 0.003 micron Cabinet 6.35 mm (¼ in.) male VCR connection Connects to CABINET He IN port with .003 micron filter (See Figure 2-2)</p> <p><b>For moisture sensitive chemicals, gas requirements are as follows:</b> Recommended the Water content &lt; 10 ppb and O2 content &lt; 2ppm.</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p> <p><b>WARNING: DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.</b></p>
<p><b>TRICKLE PURGE VENT (IF CG310, CG410)</b></p> <p><b>TRICKLE PURGE BULK PIGTAIL (Option)</b></p>	<p>Nitrogen gas is Pure semiconductor-grade or better recommended. Water and O2 content minimal.</p> <p>Required to install a 0.003 micron gas filter.</p> <p>Regulated to 550 ± 70 kPa (80 ± 10 psig) with check-valve and 100 psig PRV Inline Filter 0.003 micron Cabinet 6.35 mm (¼ in.) Swagelok connection</p>

	<p>Connects to CABINET N2 IN port with .003 micron filter (See Figure 2-2)</p> <p><b>For moisture sensitive chemicals, gas requirements are as follows:</b> Recommended the Water content &lt; 10 ppb and O2 content &lt; 2ppm.</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p> <p><b>WARNING: DO NOT</b> connect high pressure gas cylinder directly to the cabinet process/purge gas ports.</p>
<p><b>PURGE GAS (IF OPTIONAL PURGE OUTLET MANIFOLD IS INSTALLED)</b></p>	<p>Nitrogen gas is Ultra Pure semiconductor-grade or better is recommended. Water content &lt;10 ppb and O2 content &lt;2 ppm.</p> <p>Recommended to use Inert Gas Purifier model # SS2500KFI4RR or equivalent.</p> <p>Required to install a 0.003 micron gas filter.</p> <p>Regulated to 140-275 kPa (20-40 psig) with check-valve and 70 psig PRV Inline Filter 0.003 micron Cabinet 6.35 mm (¼ in.) female VCR connection Connects to CABINET N2 IN port with .003 micron filter (See Figure 2-2)</p> <p><b>For moisture sensitive chemicals, gas requirements are as follows:</b> Recommended the Water content &lt; 10 ppb and O2 content &lt; 2ppm.</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p> <p><b>WARNING: DO NOT</b> connect high pressure gas cylinder directly to the cabinet process/purge gas ports.</p>
<p><b>PNEUMATIC</b></p>	<p>Nitrogen gas is semiconductor-grade or better is recommended.</p> <p>Regulated to 620 ± 70 kPa (90 ± 10 psig) Cabinet 6.35 mm (¼ in.) Swagelok connection Connects to PNEUMATIC port, coarse filter recommended (See Figure 2-2)</p> <p>A pneumatic supply of inert gas without oxygen is recommended for our controllers. <b>It is strongly advised to not use clean dry air for pneumatic supply.</b> The pneumatic supply may be shared in the controller between the pneumatic solenoids and the enclosure inerting/pressurizing service (Z-purge). Based on results from DC power harness testing, clean dry air may promote the corrosion of electrical connectors for interconnecting power cables. The presence of oxygen enhances the corrosion effect and may result in deterioration of controller performance.</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p>

### 2.2.5 Vacuum Requirements

The customer is required to provide a vacuum source to ensure complete removal of vapors and atmospheric gases that invariably enter the ChemGuard® lines during reservoir change operation.

The pump should provide a vacuum pressure of less than 15 mTorr if chemical vapor pressure is < 500 mTorr at 20°C or < 50 mTorr if chemical vapor pressure is > 500 mTorr at 20°C, either by way of the Process Tool vacuum pump or through the use of a stand-alone vacuum pump.

If a stand-alone vacuum is used, Versum Materials, Inc. recommends a dry-vacuum pump. Connect it to the Vacuum IN port on the top of the cabinet. See Figure 2-2.

If Cabinet is sharing vacuum pump with Process Tool, then provide an isolation valve in-line between Cabinet and Tool and/or interlock to allow for maintenance and prevent cross contamination.

Multiple ChemGuard® units can be connected to a shared single vacuum pump only when using compatible chemicals. Include isolation valves in-line between ChemGuard® cabinets to allow for maintenance and prevent cross contamination.

When multiple cabinets share a common pump, use the vacuum status outputs and bulk/process vacuum interlock inputs on the AP1614 Tool I/O PCB to prevent multiple ChemGuard® units from using the vacuum pump at same time preventing cross contamination during container change out.

**Table 2-6: Vacuum Requirements**

<b>VACUUM</b>	<p>Recommended customer to evaluate a dry vacuum pump requirement with the pump manufacturer in selection a compatible, adequate and suitable of handling the process chemical and/or solvent liquid as well as vapor.</p> <p>&lt; 15 mTorr pressure for chemicals with a vapor pressure &lt; 500 mTorr at 20°C &lt; 50 mTorr pressure for chemicals with a vapor pressure &gt; 500 mTorr at 20°C</p> <p>Minimum 19.05 mm (3/4 in.) Vacuum line or larger recommended. Connection is 12.70 mm (1/2 in.) male VCR, connects to cabinet VACUUM connection (See Figure 2-2) Isolation valve is recommended.</p> <p>Recommended vacuum line tube size versus distance:</p> <ul style="list-style-type: none"> <li>• 19.05mm (3/4 in) for distance &lt; 5 meters (15 feet).</li> <li>• 25.40 mm (1.0 in.) for distance &lt; 10 meters (32 feet).</li> <li>• 50.80 mm (2.0 in) for distance &lt; 20 meters (65 feet).</li> <li>• 102.00 mm (4.0 in) for distance &lt; 50 meters (164 feet).</li> </ul> <p><b>NOTE:</b> Venturi vacuum sources are not recommended for chemicals with a vapor pressure less than 100 Torr at 20°C <b>NOTE:</b> A separate vacuum source is required for supplying the degasser and process panel of the ChemGuard unit. The process panel and degasser cannot share the same vacuum source.</p>
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WARNING: Pump exhaust contains      WARNUNG: Die Abgase der Pumpe      AVERTISSEMENT: Le tuyau

chemical vapor. Pump exhaust must be connected to the appropriate abatement system for chemical used.

enthalten chemische Dämpfe. Pumpenabgase müssen über ein für das jeweilig Chemikal geeignetes Abgassystem abgeführt werden.

d'échappement de la pompe contient des vapeurs chimiques. Le tuyau d'échappement doit être connecté à un système de réduction adéquat au produit chimique utilisé.



**WARNING:** Excess push gas from the Reservoir Container will be saturated with chemical vapor. Secure the vent line to the exhaust, and test to prevent vapors from escaping to the environment.

**WARNUNG:** Überschüssiges Treibgas vom Vorratsbehälter ist mit chemischen Dämpfen gesättigt. Um ein Austreten dieser Dämpfe in die Umgebung zu vermeiden, muß daher die Entlüftungsleitung an einen Abscheider angeschlossen und getestet werden.

**AVERTISSEMENT:** L'excès des gaz de poussée venant de la caisse du réservoir se trouve saturé de vapeurs chimiques. La conduite d'évent des gaz doit être installée solidement au scrubber afin d'empêcher ces gaz de s'échapper dans l'environnement.

### 2.2.6 Vacuum Pump IS Off and Interlock Signals

The vacuum pump is off signal allows ChemGuard® to monitor a health status signal from the vacuum pump. A closed relay contact, or a 24 VDC signal connected to AP1614 indicates the proper operation of the vacuum pump connected to ChemGuard®, Refer to Chapter 3 for signal location.

If the contact is opened or the voltage input is below 0 VDC when beginning a vacuum operation, the cabinet detects a vacuum alarm condition and prevents the vacuum operation to start and A VACUUM PUMP NOT AVAILBLE Alarm text message is displayed on the screen.

The vacuum interlock signal indicates the system is in an operation by another cabinet. An open relay contact, or the voltage input is below 0 VDC to the AP1614 prevents starting a vacuum operation. A Vacuum Pump In-Use Alarm text message is displayed on the screen, Refer to Chapter 3 for signal location.

### 2.2.7 Exhaust and Vent Requirements

**NOTE:** Vent line can be installed to the facility exhaust if exhaust is connected to the appropriate abatement system for the chemical used. Versum Materials, Inc. recommends facility exhaust controls/abatement in lieu of on-board (localized) controls/abatement system.

The reservoir vent function allows removal of pressure from the Reservoir Container. The vent should be connected to the appropriate abatement system for chemical used. Ventilation measurements should be made at a distance of four (4) duct diameters from the cabinet.

Versum Materials, Inc. recommends that ducting be made from zinc-plated steel, with operation at static pressure of 0.7 in. of water.

For chemicals authorized for use in ChemGuard® Refer to document V-TSA060, ChemGuard® Chemical Fill Matrix or contact Versum Materials for detail.

**NOTE:** If your installation has the combustible, lower explosion limit (LEL) vapor-detector option, see facilities requirements.

**Table 2-7: Exhaust and Vent Requirements**

<b>EXHAUST</b>	<p>101.6 mm (4 in.) diameter circular duct Cabinet Exhaust Flow/Pressure Set Point: 850 Liter/minute (30 CFM) minimum recommended Connect to the appropriate abatement system for chemical used.</p> <p><b>It is recommended to install the Exhaust line perpendicular and/or above the main abatement duct. DO NOT ENTER BELOW THE MAIN ABATEMENT DUCT TO AVOID LIQUID TRAP (See Below).</b></p>
<b>VENT</b>	<p>Connect to the appropriate abatement system for chemical used. Cabinet 6.35 mm (¼ in.) Swagelok connection. Connects to VENT port (See Figure 2-2)</p> <p><b>Vent line is to be connected directly to the main abatement duct and not the ChemGuard® exhaust duct.</b></p> <p><b>It is recommended to install the Vent line perpendicular and/or above the main abatement duct. DO NOT ENTER BELOW THE MAIN ABATEMENT DUCT TO AVOID LIQUID TRAP (See Below).</b></p> <p><b>NOTE:</b> Certain chemicals, having high vapor pressures and low ignition energies could potentially ignite in the vent header downstream from the ChemGuard® cabinet when exposed to atmospheric Oxygen. For such chemicals either the exhaust must be routed to a burn box or the deluge trickle flow option must be specified. Contact Versum Materials, Inc. for detail.</p>

### 2.2.8 Chemical Delivery Line Requirements

The end user must have knowledge of process flow requirements, prepare flow calculations for sufficient flow and have a carefully designed layout plan for the installation of the ChemGuard® cabinet – preferably at a central location where the facilities will meet the process tool requirements. Proper facilitation and installation will reduce and avoid potential failures, tool downtime and rework costs.

Chemical delivery line to each process tool(s) should be designed and install with minimum distance in vertical rise (height) and horizontal length between ChemGuard® cabinet and the process tool(s) to meet process operating pressure and flow rate required of the process tool(s). Refer to Chemical Delivery Line Requirements Position Paper DOC000140.

**NOTE:** All chemical delivery line requirements are the customer’s responsibility. Versum Materials, Inc. recommends installing coaxial Chemical Delivery Lines. Versum Materials, Inc. recommends customer install a lockable shutoff valve on the chemical delivery line, to comply with OSHA lockout/tagout requirements.

The customer provides the chemical delivery line. All bends should meet SEMATECH standards for bend radius.

The chemical line should be helium leak-checked, purged, cleaned and certified prior to installing and chemical introduction.

The chemical delivery line is connected to the chemical output manifold and is then directed to the Process Tool's chemical input manifold.

**Table 2-8: Chemical Delivery Line Requirements**

<b>CHEMICAL DELIVERY LINE</b>	6.35 mm (¼ in.) male VCR connection 316L stainless steel, electro-polished line. Connects to Chem Delivery 1-8 (See Figure 2-2 and Figure 2-3)  Bends should meet SEMATECH standards for bend radius. Versum Materials, Inc. recommends inside electro-polish rating 10RA maximum.  Chemical Line should be Helium leak-checked, purged, and cleaned before installing ChemGuard.  Optional Outer Coaxial Line (if required by customer or local regulations): 12.7 mm (½ in.) stainless steel.
<b>Optional Outer Coaxial Line</b>	Optional Outer Coaxial Line (if required by customer or local regulations): 12.7 mm (½ in.) stainless steel.  Bends should meet SEMATECH standards for bend radius.

### 2.2.9 Installing the Optional Coaxial Chemical Delivery Lines

The Optional Coaxial Chemical Delivery Lines comprised of:

- Outer line, 12.7 mm (1/2 in.) stainless steel line.
- Inner line, 6.35 mm (1/4 in.) stainless steel line.

#### Specification for outer lines

- Stainless steel line
- The line should be welded
- Sharp edges should be removed and de-burred at breaks in the line to prevent stainless steel inner line from being scratched or torn when routing through the outer line.

### 2.2.10 Chemical Bulk Refill Line (Optional)

The chemical refill line is an additional line, routed on top of the ChemGuard®. It allows the BULK reservoir container to be filled from an external source (i.e., ChemGuard® BCD100 cabinet).

**Table 2-9: Chemical Bulk Refill Line Requirements**

<b>CHEMICAL Bulk Refill LINE</b>	6.35 mm (¼ in.) male VCR connection 316L stainless steel, electro-polished line. Connects to External Refill Line (See Figure 2-2 and Figure 2-3)  Bends should meet SEMATECH standards for bend radius. Versum Materials, Inc. recommends inside electro-polish rating 10RA maximum.  Chemical Refill Line should be Helium leak-checked, purged, and cleaned before installing
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	<p>ChemGuard.</p> <p>Optional Outer Coaxial Line (if required by customer or local regulations): 12.7 mm (½ in.) stainless steel.</p>
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### 2.2.11 Output Manifold

The Output Manifold option allows the ChemGuard® to feed chemical up to four (4) tools simultaneously. Manual purge and dual isolation of the house lines are also available. A variety of manifolds are available, connected by 6.35 mm (¼ in.) VCR fittings. Consult your Versum Materials, Inc. sales representative for further details.

Note: Manual purge of the house lines **IS NOT** available on CG 410.

### 2.3 Tag and Lockout Routine

When performing certain maintenance procedures described in this manual, electrical power to the ChemGuard® must be de-energized, using site lockout/tag out procedures.

Consult your company's safety procedures for tagging and lockout instructions to be followed when performing such maintenance.

It is the customer's responsibility to ensure compliance with local electrical regulations external to the equipment.

#### Sequence of Lockout or Tagout System Procedure

1. Notify all affected employees that a lockout or tagout system is going to be utilized and the reason therefore. The authorized employee shall know the type and magnitude of energy that the machine or equipment utilizes and shall understand the hazards thereof.
2. If the machine or equipment is operating, shut it down by the normal stopping procedure (depress stop button, open toggle switch, etc.).
3. Operate the switch, valve, or other energy isolating device(s) so that the equipment is isolated from its energy source(s). Stored energy (such as that in springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down, etc. (Type(s) of stored energy methods to dissipate or restrain).
4. Lockout and/or tagout the energy isolating devices with assigned individual lock(s) or tag(s) (Method(s) selected, i.e., locks, tags, additional safety measures, etc.)
5. After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate (Type(s) of equipment checked to ensure disconnections).



**Return operating control(s) to neutral or off position after the test.**

6. The equipment is now locked or tagged out.

## 2.4 Spill Cleanup Routine

In dealing with chemical spills/mitigating releases, always use proper personal protective equipment, including gloves, face and eye protection, respirators, and protective clothing. Due to various factors in each spill incident, it has been determined unsafe to provide generic spill instructions for each type of chemical delivered by ChemGuard® cabinets. For example, two spills of the same type of chemical could have two different spill procedures. Therefore, in the event of a spill, we recommend immediately contacting Versum Materials, Inc. EH&S department at **1-866-624-7677** (Chemical Emergency Option) or **1-760-931-9555** for specific chemical spill recommendations and environmental regulatory information. It is the responsibility of the customer to follow their EH&S procedures for hazardous material cleanup.

SDS (MSDS) for all Versum Materials, Inc. chemicals are available from Versum Materials, Inc. EH&S department.

In addition, consult your company's environmental hazard/safety procedures for specific instructions to be followed in the event of a chemical spill from ChemGuard® GEN III.

# Chapter 3

## Installation

<b>Section 1</b>	<b>Introduction</b>
<b>Section 2</b>	<b>Reference Documents</b>
<b>Section 3</b>	<b>Installation</b>
<b>Section 4</b>	<b>Installing the ChemGuard® Cabinet</b>
<b>Section 5</b>	<b>Connecting ChemGuard® Gas Lines</b>
<b>Section 6</b>	<b>Installing ChemGuard® Bulk Scale</b>
<b>Section 7</b>	<b>ChemGuard® Communications</b>
<b>Section 8</b>	<b>ChemGuard® Start-up and Initialization</b>
<b>Section 9</b>	<b>ChemGuard® System Configuration</b>
<b>Section 10</b>	<b>Manual Mode</b>
<b>Section 11</b>	<b>Pressure Regulator Adjustment</b>
<b>Section 12</b>	<b>System Leak Check</b>

- Section 13      System Leak Check – External Refill Option**
- Section 14      System Leak Check – AMAT Degasser Option**
- Section 15      Installing Optional Refillable Bulk Container**
- Section 16      Finishing the ChemGuard® Installation**

**NOTE:** Maintenance personnel shall make use of a step stool or small ladder to safely access the ChemGuard® GEN III controller. Operating personnel shall make use of a step stool to access the touch screen monitor as required.

### 3.1. Introduction

This chapter describes the installation of ChemGuard® GEN III cabinet.

Because each customer application may vary, these instructions are provided as a guideline and should not be considered as comprehensive. Please do not begin installing the ChemGuard® unless trained individuals are present.

The ChemGuard® comes pre-calibrated and cabinet-tested. The ChemGuard® Bulk Scale, dual float spill detector, banner sensor (degasser option), combustible vapor detector (option), and UVIR (option) are setup prior to leaving the factory. These items should not require calibration during installation. Please contact Versum Materials, Inc. if any of these components do not function properly.

**NOTE:** When highly flammable chemicals are used and present within the equipment you must:

- Ensure the all connections made to the cabinet are leak tight.
- Use an inert gas purge to dilute the concentration of highly flammable vapors in the exhaust header to which the vent piping is connected.
- Use an inert gas purge to the vacuum pump gas ballast connection.

### 3.2. Reference Documents

For facilities inspection, pre-startup and commissioning procedure and check-off/sign-off lists refer to:

- **SW017055**\_Installation Drawing
- **DOC000191**\_for the ChemGuard® GEN III P&ID Drawing
- **V-TSA049**\_CG100-400NT GEN III Installation, Startup, Commissioning Procedure and Check List
- **V-TSA050**\_CG100-400NT GEN III Commissioning Check List
- **V-TSA060**\_Chemical Maximum Fill Value Table

### 3.3. Installation

#### 3.3.1. Pre-installation

This chapter describes items that should be identified and resolved prior to installing ChemGuard®.

The end user must have knowledge of process flow requirements, prepare flow calculations for sufficient flow and have a carefully designed layout plan for the installation of the ChemGuard® cabinet – preferably at a central location where the facilities will meet the process tool requirements. Proper facilitation and installation will reduce and avoid potential failures, tool downtime and rework costs.

Chemical delivery line to each process tool(s) should be designed and install with minimum distance in vertical rise (height) and horizontal length between ChemGuard® cabinet and the process tool(s) to meet process operating pressure and flow rate required of the process tool(s).

- The maximum range that a standard ChemGuard® can deliver chemical is dependent on the chemical and the pressure of the push gas. Contact Versum Materials, Inc. for any specific delivery requirements beyond 250 meters of horizontal run and 10 meters of vertical run. These distances could be increased contingent on bends and valve count in the system.
- Install ChemGuard® using the earthquake bolt down points. Verify that the location has the stability and strength to permit the installation of support bolts.
- Verify AC power is available for ChemGuard®. (Power requirements are described in Chapter 2)
- Verify all required gases are delivered to an area near the final position of ChemGuard®. (Refer to Chapter 2)

**NOTE:** All chemical delivery line requirements are the customer's responsibility.

- Gases required for ChemGuard® cabinet operation are described in Chapter 2.
- The ChemGuard® requires vacuum in order to ensure complete removal of chemical vapors or atmospheric gases from the lines during a reservoir change operation.

**NOTE:** The customer must provide the vacuum source which is a requirement to operate the cabinet.

- The ChemGuard® requires an exhaust flow of 30 CFM. In addition to cabinet exhaust, ChemGuard® contains a reservoir vent function that permits the removal of pressure from the reservoir container. This vent should be connected to the appropriate abatement system for the chemical used.
- Coaxial chemical delivery lines are recommended for all process chemicals. In the event that a leak or rupture occurs in the main delivery lines, the liquid will be contained and be prevented from entering the environment.
- The liquid from any leak will be contained in the ChemGuard® cabinet and be detected by the spill detector, and container then relieved to prevent any further spillage.

#### 3.3.2. Available Configurations

The number and type of Process Tools installed limit the setup configuration of ChemGuard®. Before mixing Process Tool-types within one ChemGuard® cabinet, contact Versum Materials, Inc.

### **3.4. Installing the ChemGuard® Cabinet**

Verify that the cabinet is in a level location with enough clearance around it so that its doors can be fully opened and so that it can be serviced easily.

Set the ChemGuard® cabinet over the bolt-down points and attach securely.

Per current United States UBC and SEMI requirements, floor bolts must be at least Grade 5 (metric Grade 8.8), at a recommended minimum length of 2.5 in. (6.35 cm).

The ChemGuard® must be grounded in accordance with Article 250 - Grounding, The National Electrical Code 1993. See Chapter 2 for the location of the grounding lug. Versum Materials, Inc. recommends a ground resistance of <1 Ohms.

#### **3.4.1. Electrical Connections**

Versum Materials, Inc. recommends that the customer electrically ground ChemGuard® cabinet and plumbing. OSHA standards require customer to install lockout-type circuit breaker for AC power. Per SEMI S2-93A requirements, all electrical work for ChemGuard® GEN III is Type 1 and Type 2.

- Type 1 = Equipment fully de-energized.
- Type 2 = Equipment is energized.

Live circuits are covered or insulated. Work is performed at a remote location to preclude accidental shock.

#### **3.4.2. Electrical Requirements**

AC POWER:

100 - 240 VAC, 100 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded, without optional degasser pump.

125 VAC, 1000 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded, with optional degasser pump. Short circuit current rating (SCCR) is 10kA.

OSHA standards require customer to install lockout-type circuit breaker for AC power. Versum Materials, Inc. recommends an over current protection of 10,000 Ampere Interrupt Capacity (AIC) be provided in close proximity to the unit.



**WARNING:** Electrical connections should be made by a qualified electrician. AC power junction box requires Lock-out Tag-out ON/OFF capability. ½' AC power conduit hole exits top of cabinet.

**WARNUNG:** Elektrische Anschlüsse sollten nur durch qualifizierte Elektriker hergestellt werden. Wechselstrom-Verteilerkästen müssen einen EIN/AUS-Schalter zur Verriegelung bzw. Isolierung besitzen. Oben am Schrank wird ein ca. 15 cm (0,5 Fuß) langes flexibles Schutzrohr für Wechselstromleitungen herausgeführt.

**AVERTISSEMENT:** Les connexions électriques doivent être réalisées par un électricien qualifié. La boîte de dérivation de courant alternatif requiert une capacité de connexion et déconnexion "ON/OFF". 15 cm (0,5 pieds) du tube souple de courant alternatif ressort du haut de la boîte.



**WARNING:** Failure to follow the procedure for connecting the AC line voltage could result in injury to operator and damage to the ChemGuard unit.

**WARNUNG:** Nichteinhalten des Verfahrens zum Anschluß der Wechselstromspannung kann zu Verletzungen des Bedienpersonals und Beschädigung der ChemGuard -Einheit führen.

**AVERTISSEMENT:** Ne pas se conformer aux procédés pour le raccord de la conduite de voltage CA peut causer un danger pour l'opérateur et des dégâts à l'appareil ChemGuard.



**WARNING:** To prevent electrical shock, the ChemGuard cabinet must be earth-grounded. Electrical connections should be made only by a qualified electrician.

**WARNUNG:** Um elektrische Schläge zu vermeiden, muß der Schrank des ChemGuard geerdet werden. Elektrische Anschlüsse sollten nur durch qualifizierte Elektriker hergestellt werden.

**AVERTISSEMENT:** Pour éviter tout choc électrique, la boîte ChemGuard doit être reliée à la masse. Les raccords électriques doivent être seulement exécutés par.

### 3.4.3. Connecting Line AC Power



WARNING: Do not connect AC power to live line voltage until all electrical connections have been made and protective covers installed.

WARNUNG: Die Wechselstromleitung erst nach Erstellung aller elektrischen Anschlüsse und Einbau der Schutzabdeckungen an das Netz anschließen.

AVERTISSEMENT: Ne pas raccorder le cordon secteur à une tension d'une ligne active jusqu'à ce que tous les raccordements électriques aient été accomplis et tous les couvercles protecteurs installés.

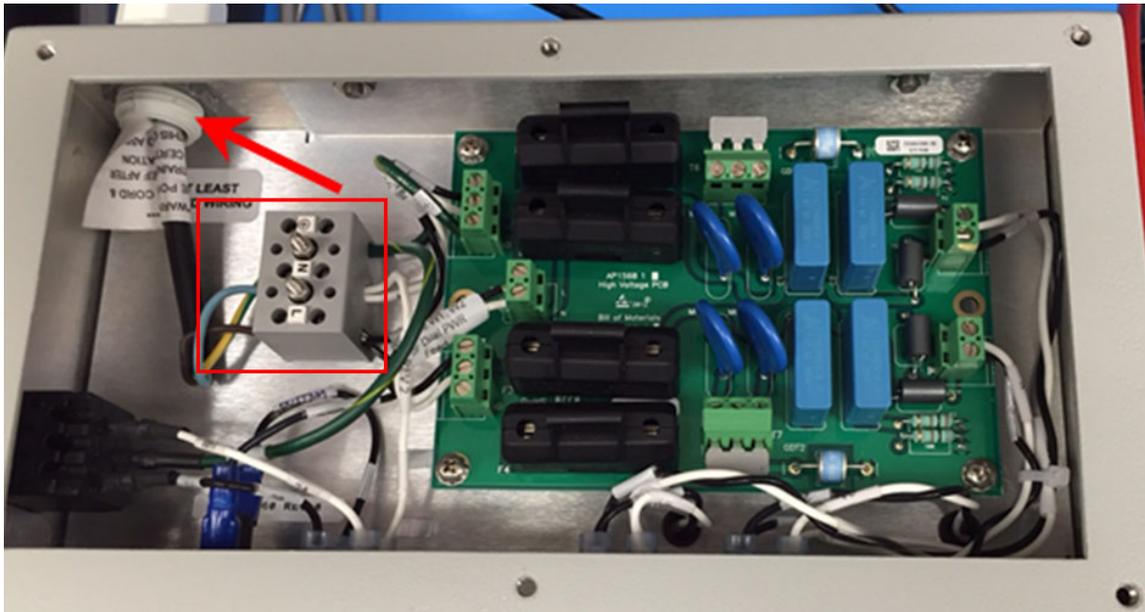
**Figure 3-1: Rear view of Conduit Power Entrance**



**ELECTRICAL HAZARD**

A 3/4" conduit hole is supplied for connecting the 100-240 VAC AC line to the cabinet. The conduit hole is located on the upper back wall of the controller enclosure, red arrow. The power input must be wired to the terminals shown below, in red box.

**Figure 3-2: Single Power Feed / Dual Supply Terminal Connection**



**NOTE:** For dual incoming AC power feed systems, two (2) din rail terminal blocks will be installed. Two separate power inputs will route thru the conduit hole and connect to the individual terminal blocks.

Use at least 75C rated wiring for the mains supply.

In NEC Class I, Division 2 areas (only in the U.S.A.), a conduit seal ("pour fitting") or equivalent must be installed between each electrical connection point on the cabinet and the electrical source. Liquid tight flexible conduit can be installed between the ChemGuard® connectors and the conduit seals to facilitate these connections.

A maximum length of 18" (457 mm) is allowed between the last pour fitting and the cabinet connector. All conduits shall be sealed in accordance to Sections 501-5, 502-5 or 504-70 of the National Electric Code.

**NOTE:** For Systems approved for installation and use in Explosive Atmospheres (Europe), refer to Chapter 4 for additional instructions.



**In classified hazardous areas – Do not separate electrical terminations or connectors while energized due to risk of electrical arc or spark which can ignite potentially flammable atmospheres.**

External cabling that runs between the ChemGuard® and other pieces of customer equipment must be shielded. The shield must be single point grounded at the customer end of the cable. If the cable is over 10m in length, it must be routed in grounded metallic conduit.

Replaceable fuses - F1, F2, F3, and F4 located on the power board are 4A super quick acting fuses. Also, when a degasser pump is present, a Schurter, PN 7022.0700 10A/ 500VAC Super Quick Action fuse is located on the inside of the controller.

#### **3.4.4. Connecting Degasser Vacuum Pump (Degasser option)**

When degasser option with vacuum pump is ordered, the ChemGuard® cabinet comes with a degasser vacuum pump. The degasser vacuum pump only runs on 115 VAC, 50/60 Hz. Power to the ChemGuard® can only be 125 VAC, 1000 W @ 50 or 60 Hz; Single-Phase.

**NOTE:** Refer to the Pfeiffer DUO 3 / DUO 3M Rotary Vain Pump Operating Instructions manual provided with the pump, Installation Chapter 5.

1. Remove vacuum pump from the shipping package.
2. Remove bottle of operating fluid from shipping package and fill vacuum pump to the prescribed level, refer to Chapter 5.
3. Confirm the gas ballast valve is set for one (1) open position.
4. Mount the pump oil tray, provided to the bottom of the pump and place on top of the ChemGuard® cabinet just to the left of the controller. Mount in place with mounting bolts.
5. Remove locking caps from vacuum and exhaust flange before connecting.
6. Pay attention to the cone strainer and o-ring in the intake port. Connect the inlet spool using the flange connection to the intake port.
7. Connect the outlet spool to the exhaust port using the flange connection.

**NOTE:** Do not insert the Centering ring/Centering ring with nozzle as manual instructs. This will build up back pressure and make vacuum pressure to the degasser non-functional.

8. Confirm inlet and outlet spools to/from vacuum pump are connected properly at the ChemGuard® cabinet.
9. Plug the power cord from the pump into the AC outlet on left side of controller.

**NOTE:** Refer to Appendix A for degasser testing procedures.

#### **3.4.5. USP Port Blocker**

ChemGuard® controller software files may need to be modified to customize the system or add optional features.

When loading new software files onto the ChemGuard® a USB thumb drive is required to do so. A USB port is located on the face of the controller. The USB port allows a USB connection to be made without having to open the controller door. Electrical devices should never be operated, connected to, or disconnected from the USB port unless the area surrounding the equipment is known to be free of

flammable material. The USB port on the face of the controller will also have a warning label, Figure 3-3 for operation in a flammable area.

Each USB connector type is 2.0 format. 4ea USB ports available inside the controller, with one of the ports extended externally to the controller door.

Safety standards require that the front-panel USB port be tool accessible. To meet the standard, a Lindy USB Port Blocker, Figure 3-4 will be factory installed on all controllers. In order to use the USB port, the USB Port Blocker plug must be removed using a Lindy key. Remember, electrical devices should never be operated, connected to, or disconnected from the USB port unless the area surrounding the equipment is known to be free of flammable material. When finished using the USB port, the USB Port Blocker plug must be reinstalled along with the USB cover.

**Figure 3-3: Electrical Warning Label**



**Figure 3-4: Lindy USB Port Blocker and Key**



### 3.5. Connecting ChemGuard® Gas Lines

The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier. (See Chapter 2 for further details.)

Ensure there are shutoff valves and filters for gas lines feeding the ChemGuard® cabinet.



**WARNING:** System pressures above 120 psig exceed the rating of Versum Materials, Inc. chemical containers.

**WARNUNG:** Bei Systemdrücken über 120 psig werden die Nennwerte für die Chemikalienbehälter der Fa. Versum Materials, Inc. überschritten.

**AVERTISSEMENT:** Les pressions du système dépassent l'échelle des récipients Versum Materials, Inc. au delà de 120 psig (827,76 kg/cm<sup>2</sup>).



**CAUTION:** Use of a dry vacuum pump is strongly recommended. If an oil pump is used, provide trapping mechanism to minimize chemical vapor mixing with pump oil and molecular flow of oil back into mechanism.

**VORSICHT:** Der Einsatz einer Trockenvakuumpumpe wird unbedingt empfohlen. Wird jedoch eine Ölpumpe eingesetzt, so muß eine Scheidevorrichtung angebracht werden, um das Vermischen der chemischen Dämpfe mit dem Pumpenöl und eine Molekularströmung des Öls zurück zum Abscheider so gering wie möglich zu halten.

**ATTENTION:** Il est fortement recommandé d'utiliser une pompe à vide à air sec. Si une pompe à huile est utilisée, prévoir un mécanisme de rétention pour réduire au minimum tout mélange de vapeurs chimiques avec l'huile de la pompe et tout reflux moléculaire de l'huile au mécanisme de rétention.



**CAUTION:** Only one (1) ChemGuard should be open to the vacuum source at a time. Do not operate in any mode that requires using the vacuum concurrently in multiple ChemGuards. Possible cross-contamination could result.

**VORSICHT:** Es sollte nur jeweils eine (1) ChemGuard -Einheit zu einer Unterdruckquelle offen sein. Der Betrieb darf nicht in einem Modus stattfinden, der Saugdruck in mehreren ChemGuard -Einheiten gleichzeitig erfordert, da dies zu gegenseitiger Kontamination führen kann.

**ATTENTION:** Seulement un (1) ChemGuard doit s'ouvrir à la source d'aspiration à un moment donné. Ne pas l'opérer sous aucun mode qui exige l'utilisation simultanée d'aspiration dans des ChemGuard multiples. Une contamination croisée peut en résulter.

### 3.5.1. Chemical Delivery Line Requirements

**NOTE:** All chemical delivery line requirements are the customer's responsibility.

**Table 3-1: Chemical Delivery Line Connections**

CHEMICAL DELIVERY LINE	CONNECTS TO VALVE	VALVE CONTROL
Chemical Delivery Line #1	Valve V11	Electrically controlled by Process Tool. Table 3-5/6
Chemical Delivery Line #2	Valve V12	Electrically controlled by Process Tool. Table 3-5/6
Chemical Delivery Line #3	Valve V13	Electrically controlled by Process Tool. Table 3-5/6
Chemical Delivery Line #4	Valve V14	Electrically controlled by Process Tool. Table 3-5/6
Chemical Delivery Line #5	Valve V21	Electrically controlled by Process Tool. Table 3-5/6
Chemical Delivery Line #6	Valve V22	Electrically controlled by Process Tool. Table 3-5/6
Chemical Delivery Line #7	Valve V23	Electrically controlled by Process Tool. Table 3-5/6
Chemical Delivery Line #8	Valve V24	Electrically controlled by Process Tool. Table 3-5/6

**Table 3-2: Purge Valve on Chemical Delivery Lines**

INDIVIDUAL PURGE CHEMICAL DELIVERY LINE	CONNECTS TO VALVE	VALVE CONTROL
Chemical Delivery Line #1	MV15	Manually operate.
Chemical Delivery Line #2	MV16	Manually operate.
Chemical Delivery Line #3	MV17	Manually operate.
Chemical Delivery Line #4	MV18	Manually operate.
Chemical Delivery Line #5	MV25	Manually operate.
Chemical Delivery Line #6	MV26	Manually operate.
Chemical Delivery Line #7	MV27	Manually operate.
Chemical Delivery Line #8	MV28	Manually operate.
COMMON PURGE CHEMICAL DELIVERY LINE	CONNECTS TO VALVE	VALVE CONTROL
Common Purge Line 1-4	MV10(A) & MV19	Manually operate.
Common Purge Line 5-8	MV10B & MV20	Manually operate.

**NOTE:** These valves are normally closed during normal flow of chemical to the Tools.

**Table 3-3 Dual Isolation on Chemical Delivery Lines (Option)**

CHEMICAL DELIVERY LINE	CONNECTS TO VALVE	VALVE CONTROL
------------------------	-------------------	---------------

Chemical Delivery Line #1	MV11	Manually operate.
Chemical Delivery Line #2	MV12	Manually operate.
Chemical Delivery Line #3	MV13	Manually operate.
Chemical Delivery Line #4	MV14	Manually operate.
Chemical Delivery Line #5	MV21	Manually operate.
Chemical Delivery Line #6	MV22	Manually operate.
Chemical Delivery Line #7	MV23	Manually operate.
Chemical Delivery Line #8	MV24	Manually operate.

### 3.5.2. Bulk Reservoir Refill (Option)

The Bulk Reservoir Refill option is an additional line connected to the refill port on top of the ChemGuard® cabinet. This allows the Bulk reservoir container to be filled from an external source, CG100-300 or CGBCD.

**NOTE:** The Primary valve to operate Remote Refill mode is V8A.

### 3.5.3. Bulk Trickle Purge Pigtail (Option)

The Bulk Trickle Purge Pigtail option provides flow of N2 purge gas to the Bulk Inlet / Outlet pigtails when disconnecting the Bulk container during Change Bulk operation. The trickle purge can be operated manually to purge pigtails at any time prior to installing a fresh Bulk container.

The Bulk Trickle Purge Pigtail option cannot be utilized in conjunction with the Bulk Remote Refill option. A ChemGuard® unit cannot have both the Bulk Trickle Purge Pigtail and Bulk Remote Refill options installed simultaneously.

**NOTE:** The primary valve to operate Trickle Purge Pigtail mode is V15.

### 3.5.4. Vacuum Requirements

The customer must provide a vacuum source to ensure complete removal of chemical vapors and atmospheric gases that invariably enter the ChemGuard® lines during the Change operation.

Connect a vacuum line from the vacuum pump to the Vacuum connection port on top of the ChemGuard® cabinet.



Warning: Pump exhaust contains chemical vapor. Pump exhaust must be

WARNUNG: Die Abgase der Pumpe enthalten chemische Dämpfe.

AVERTISSEMENT: Le tuyau d'échappement de la pompe contient

connected to the appropriate abatement system for chemical used.

Pumpenabgase müssen über ein für das jeweilig Chemikal geeignetes Abgassystem abgeführt werden.

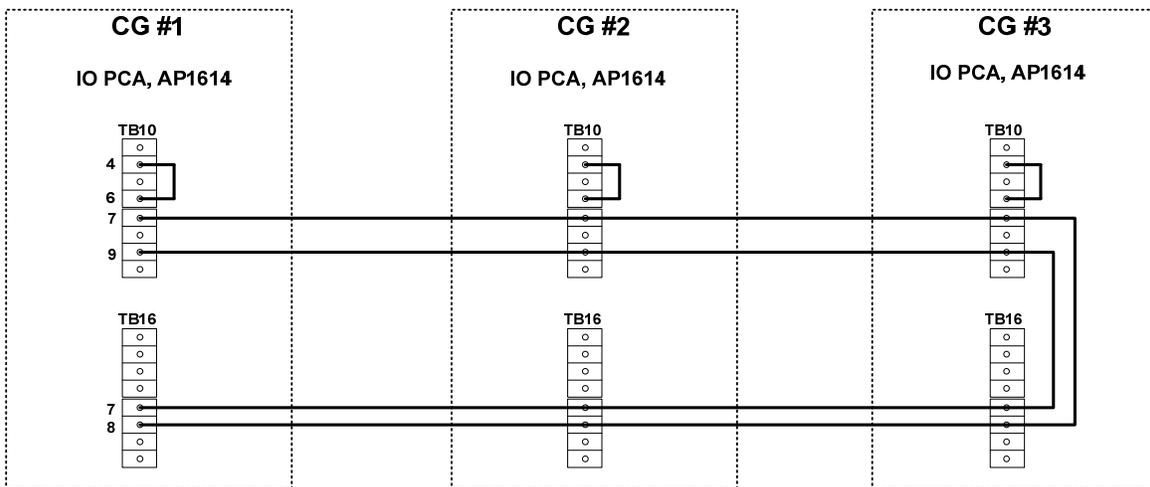
des vapeurs chimiques. Le tuyau d'échappement doit être connecté à un système de réduction adéquat au produit chimique utilisé.

### 3.5.5. Multiple ChemGuard®s Connected To A Single Vacuum Pump

Multiple ChemGuard®s can be connected to a shared single vacuum pump only when using compatible chemicals.

To use this feature, the “VACUUM INTERLOCK” output of each ChemGuard® must be connected to the “VACUUM INTERLOCK” input on all the other ChemGuard® units.

**Figure 3-5: Vacuum Pump Interface**



### 3.5.6. Exhaust and Vent Requirements

For Exhaust and Vent installation requirements refer to Chapter 2.

### 3.5.7. Connecting ChemGuard® Exhaust

1. Connect Exhaust line to the 101.6 mm (4 in.) Exhaust port on ChemGuard® cabinet (see Chapter 2).
2. The ChemGuard® cabinet also requires exhaust for venting of the reservoir container. During system operation the reservoir container will relieve excess push-gas to the vent connection on ChemGuard®.

### 3.5.8. Hazardous Gas/Vapor Leak Detection System

A gas/vapor leak detection system must be installed by the customer for all toxic gases used in the ChemGuard® Gen III cabinet. The detection points must include the interior of the chemical cabinet. If a leak is detected, the system must provide signals that will shut down the chemical cabinet.

### 3.5.9. ChemGuard® Z-Purge

According to NFPA 497 and SEMI S6, if adequate reduction of flammable gas cannot be achieved, special electrical designs or purging may be used to address potential ignition sources.

The ChemGuard® GEN III cabinet was evaluated and the 1) Controller; 2) VGA LED display panel; 3) CG IO Interface Module was identified as the only components with a potential spark source. Provided that these components are purged and pressurized at a flow of 25 scfh, the risk of spark is eliminated.

Every ChemGuard® shipped has Z-purge enabled and can be installed in hazardous areas.

### **3.5.10. Z-Purge Setup**

A Z-Purge flow valve is located on the right rear of the controller and can be adjusted via the penetration into the ChemGuard® cabinet between the pneumatic control bulkheads.

The flow valve controls the flow of the house nitrogen to the controller interior. Its use may be required in certain areas (i.e. Class I, Division II designated areas in the U.S.A. or Group II, Category 3 areas in the European Community).

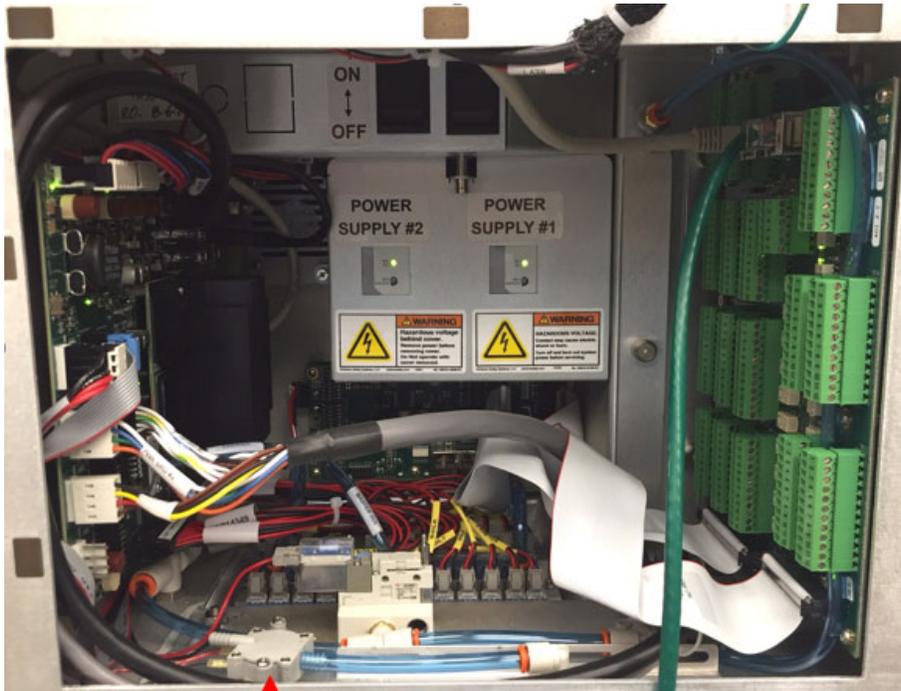
There are three pressure switches located within the cabinet. There is one switch in the controller housing, one in the upper cabinet door and one in the interface box to ensure adequate pressure (0.1" H<sub>2</sub>O) during the Z-purging. Low Z-purge alarms will be triggered if pressure falls below the pressure adjustment in the pressure switches. The nitrogen flow must be increased until the alarms can be reset.

The Z purge pressure is controlled by a needle valve at the base of the controller. After opening the controller in a suspected hazardous area it is necessary to use the following procedure to re-establish the Z-purge before operating the controller:

1. Close the controller front and tighten both latches completely.
2. Open the needle valve 4 to 5 turns (counter-clockwise). Allow the controller to purge for 30 minutes.
3. Adjust needle valve to satisfy all three of the "Z-Purge" alarm (approximately 2 total turns open).

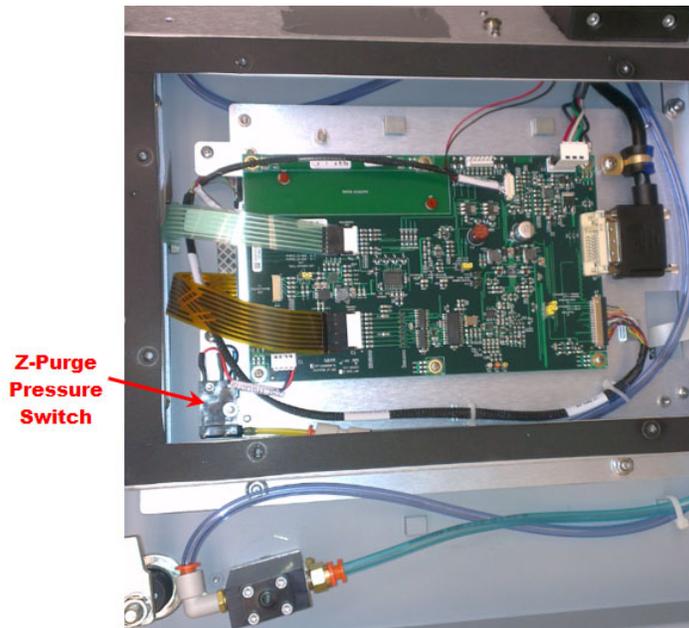
Flow requirements to operate the solenoid valves are very small, less than 1 LPM (2 CFH). If Type Z purge is required, a minimum flow rate of 5.5 SLPM will be needed, depending on the tightness of the individual controller and the installation.

**Figure 3-6: Controller Z-Purge Pressure Switch**



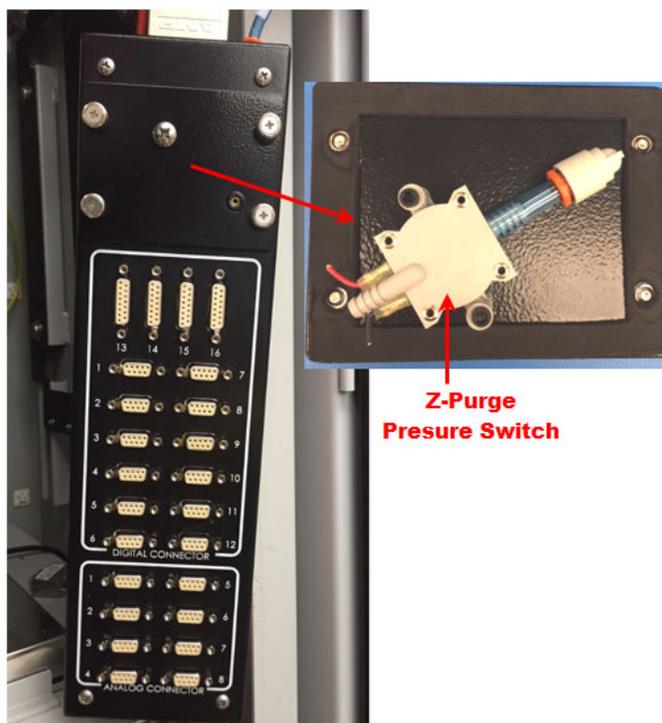
**Z-Purge Pressure Switch**

**Figure 3-7: Display Panel Z-Purge Pressure Switch**



**Z-Purge Pressure Switch**

**Figure 3-8: Interface Module Z-Purge Pressure Switch**



### 3.6. Installing ChemGuard® Bulk Scale

One reservoir scale is shipped with the ChemGuard® cabinet and installed inside the cabinet for the Bulk container.

**NOTE:** For the Bulk scale and Process scale calibration procedures, refer to Chapter 7.

#### 3.6.1. Bulk Scale Installation

Carefully remove the optional ChemGuard® Bulk reservoir scale assembly from its shipping carton. This is a precision instrument that can be damaged if mishandled.



CAUTION: Do not drop ChemGuard Reservoir Scale while installing. This may cause damage.

VORSICHT: Die Waage beim Einsetzen nicht aufschlagen lassen da sie dadurch beschädigt werden kann.

ATTENTION: Ne pas faire tomber la balance lors de son installation. Cela pourrait causer des dommages.



CAUTION: Do not connect or disconnect scale with power ON.

VORSICHT: Die Waage nicht bei eingeschaltetem Strom anschließen.

ATTENTION: Ne pas raccorder la balance lorsque qu'elle est sous tension.

1. Turn the reservoir scale so that the scale connector is facing toward the back of the cabinet.
2. Ensure the scale assembly is centered on the shelf, and not touching the side walls of the cabinet.
3. Adjust the scale brackets as necessary as to not affect scale reading. Brackets should not clamp the scale. A single sheet of paper should be able to slide between the scale and each bracket.
4. Press and turn to attach the scale connector to the socket inside the cabinet under the shelf. The scale connector has been designed so that it can only be installed one way.
5. Perform scale calibration per Chapter 7.

**NOTE:** The Bulk scale top plate is an optional item. It is only included with the 38L sump spill kit option when order, it is simply place on top of the Bulk scale without a need of bolt down.

**NOTE:** If customer desires to upgrade ChemGuard® cabinet from no scale option to scale option, then customer must order new software conversion kit as well to operate the scale.

### 3.7. ChemGuard® Communications

#### 3.7.1. Connecting Inputs/Outputs

The Process Tool Interface Connection enables the Process Tool to automatically control the main functions of ChemGuard®. It also provides alarms used by the Process Tool to automate the interface with ChemGuard®.

For all field terminations on the DB25 or DB9 customer connections, connectors that require a tool for connection and disconnection are required. Also, the customer must ensure that the outputs are energy limited to meet US and CE requirements.

Use the following tables to connect customer Inputs and Outputs.

#### 3.7.2. Connecting Digital Inputs

**Table 3-4: Life Safety Shutdown Input**

Digital Input #	Input Label	AP1614	
		TB11	CONFIGURATION
36	* Life Safety Shutdown	10	Dry Contact
		12	
	* Jumper must be installed or Customer Supplied Input required to satisfy Life Safety Shutdown condition	11 - GNDD	Sourcing max. 1A @ 24vdc ±2.4
		12 - +24vdc	

**Table 3-5: Tool Input - Valve Control, Dry Contact**

Digital Input #	Input Label	AP1614		DB25 Bulkhead Connector
		TB5-TB7	CONFIGURATION	
22	V11 Control	TB5; 11&12	Dry Contact J1 to A position J1 pin 1&2	J1; 12&13
23	V12 Control	TB6; 11&12	Dry Contact J2 to A position J2 pin 1&2	J2; 12&13
24	V13 Control	TB7; 11&12	Dry Contact J3 to A position J3 pin 1&2	J3; 12&13
25	V14 Control	TB8; 11&12	Dry Contact J4 to A position J4 pin 1&2	J4; 12&13

26	V21 Control	TB9; 4&6	Dry Contact	N/A
27	V22 Control	TB9; 7&9	Dry Contact	N/A
28	V23 Control	TB9; 10&12	Dry Contact	N/A
29	V24 Control	TB10; 1&3	Dry Contact	N/A

**Table 3-6: Tool Input - Valve Control, Sinking Inputs**

Digital Input #	Input Label	AP1614		DB25 Bulkhead Connector
		TB1-TB4	CONFIGURATION	
22	V11 Control	TB1; 11&12	Sinking	J1; 12&13
23	V12 Control	TB2; 11&12	Sinking	J2; 12&13
24	V13 Control	TB3; 11&12	Sinking	J3; 12&13
25	V14 Control	TB4; 11&12	Sinking	J4; 12&13

**NOTE:** For an 8x outlet manifold configuration, all valve control inputs are dry contact configuration.

**Table 3-7: Tool Input – Chem On**

Digital Input #	Input Label	AP1614		DB25 Bulkhead Connector
		TB1-TB4	CONFIGURATION	
37	Chem On – Tool 1 (V11)	TB1; 1&2	Dry Contact	J1; 20&22
38	Chem On- Tool 5 (V21)	TB1; 3&4	Dry Contact	J1; 23&25
39	Chem On – Tool 2 (V12)	TB2; 1&2	Dry Contact	J2; 20&22
40	Chem On – Tool 6 (V22)	TB2; 3&4	Dry Contact	J2; 23&25
41	Chem On – Tool 3 (V13)	TB3; 1&2	Dry Contact	J3; 20&22

42	Chem On – Tool 7 (V23)	TB3; 2&4	Dry Contact	J3; 23&25
43	Chem On – Tool 4 (V14)	TB4; 1&2	Dry Contact	J4; 20&22

**NOTE:** 1 of the 4 inputs must be closed in order to enable Chem On operation. If not “No Tools Active” alarm will be generated and prevent Chem On.

**NOTE:** Digitals 38, 40, 42, 44 are designated as Chem On only when the 8x outlet manifold option is selected.

**Table 3-8: Vacuum Interlock**

Digital Input #	Input Label	AP1614	
		TB10	CONFIGURATION
30	* Vacuum Pump Is Off	4	Dry Contact
	* Jumper must be installed or Customer Supplied Input required to start Change Bulk operation	6	
31	* Vacuum Interlock	7	Dry Contact
	* Input must be open to start Change Bulk Operation	9	

**Table 3-9: External Bulk Refill**

Digital Input #	Input Label	AP1614	
		TB10	CONFIGURATION
29	* XFILL OFF – from BCD100/200 * Input must be closed to enable/start XFILL operation to refill Bulk container	1	Dry Contact

### 3.7.3. Connecting Digital Outputs (Outputs: max. 1A @ 24vdc)

**Table 3-10: Life Safety Outputs**

Digital Output #	Output Label	AP1614	
		TB15	CONFIGURATION
9	Exhaust	1	N/O
		2	Common
		3	N/C
10	Cabinet Spill – Dual Floats	4	N/O
		5	Common

	(Not provided in CG410)	6	N/C
11	FIRE (Option in CG110-310. Standard in CG410) <ul style="list-style-type: none"> <li>• Heat ROR</li> <li>• UVIR</li> <li>• Smoke Detect</li> </ul>	7	N/O
		8	Common
		9	N/C
12	Door Open (Xfill Request for 8x configuration)	10	N/O
		11	Common
		12	N/C

**Table 3-11: Life Safety Outputs (Cont.)**

Digital Output #	Output Label	AP1614	
		TB13	CONFIGURATION
13	UVIR Fault (non-8x configurations only)	1	N/O
		2	Common
		3	N/C
14	Degasser (non-8x configurations only)	4	N/O
		5	Common
		6	N/C
15	Liquid in Vacuum	7	N/O
		8	Common
		9	N/C
16	Vapor Detect	10	N/O
		11	Common
		12	N/C

**Table 3-12: Output Valve Acknowledgement**

Digital Output #	Output Label	AP1614	
		TB14	CONFIGURATION
21	Chem On – Tool 1 (V11) (non-8x configurations only)	1	N/O
		2	Common
		3	N/C
22	Chem On – Tool 2 (V12) (non-8x configurations only)	4	N/O
		5	Common
		6	N/C
23	Chem On – Tool 3 (V13) (non-8x configurations only)	7	N/O
		8	Common
		9	N/C

24	Chem On – Tool 4 (V14) (non-8x configurations only)	10	N/O
		11	Common
		12	N/C

**Table 3-13: Alarm Outputs when 4x Manifold Option selected - Tool 1**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB5	CONFIGURATION	
25	Shutdown Alarm	1&2	Dry Contact	J1; 8&15
26	Fault Alarm	3&4	Dry Contact	J1; 10&16
27	Chem On (Process in Fill)	5&6	Dry Contact	J1; 9&17
28	Bulk Empty	7&8	Dry Contact	J1; 6&18

**Table 3-14: Alarm Outputs when 4x Manifold Option selected - Tool 2**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB6	CONFIGURATION	
25	Shutdown Alarm	1&2	Dry Contact	J2; 8&15
26	Fault Alarm	3&4	Dry Contact	J2; 10&16
27	Chem On (Process in Fill)	5&6	Dry Contact	J2; 9&17
28	Bulk Empty	7&8	Dry Contact	J2; 6&18

**Table 3-15: Alarm Outputs when 4x Manifold Option selected - Tool 3**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB7	CONFIGURATION	
25	Shutdown Alarm	1&2	Dry Contact	J3; 8&15
26	Fault Alarm	3&4	Dry Contact	J3; 10&16
27	Chem On (Process in Fill)	5&6	Dry Contact	J3; 9&17
28	Bulk Empty	7&8	Dry Contact	J3; 6&18

**Table 3-16: Alarm Outputs when 4x Manifold Option selected - Tool 4**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB8	CONFIGURATION	
25	Shutdown Alarm	1&2	Dry Contact	J4; 8&15
26	Fault Alarm	3&4	Dry Contact	J4; 10&16
27	Chem On (Process in Fill)	5&6	Dry Contact	J4; 9&17
28	Bulk Empty	7&8	Dry Contact	J4; 6&18

**Table 3-17: Alarm Outputs when 8x Manifold Option selected - Tool 1**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB14	CONFIGURATION	
21	Chem On (Process in Fill)	1&2	Dry Contact	N/A
25	Shutdown Alarm	<b>TB5</b>	<b>CONFIGURATION</b>	J1; 8&15
		1&2	Dry Contact	
26	Bulk Empty	3&4	Dry Contact	J1; 10&16

**Table 3-18: Alarm Outputs when 8x Manifold Option selected - Tool 2**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB14	CONFIGURATION	
22	Chem On <b>(Process in Fill)</b>	4&5	Dry Contact	N/A
25	Shutdown Alarm	<b>TB6</b>	<b>CONFIGURATION</b>	J2; 8&15
		1&2	Dry Contact	
26	Bulk Empty	3&4	Dry Contact	J2; 10&16

**Table 3-19: Alarm Outputs when 8x Manifold Option selected - Tool 3**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB14	CONFIGURATION	
23	Chem On <b>(Process in Fill)</b>	7&8	Dry Contact	N/A

25	Shutdown Alarm	<b>TB7</b>	<b>CONFIGURATION</b>	J3; 8&15
		1&2	Dry Contact	
26	Bulk Empty	3&4	Dry Contact	J3; 10&16

**Table 3-20: Alarm Outputs when 8x Manifold Option selected - Tool 4**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB14	CONFIGURATION	
24	Chem On (Process in Fill)	10&11	Dry Contact	N/A
25	Shutdown Alarm	<b>TB8</b>	<b>CONFIGURATION</b>	J4; 8&15
		1&2	Dry Contact	
26	Bulk Empty	3&4	Dry Contact	J4; 10&16

**Table 3-21: Alarm Outputs when 8x Manifold Option selected – Tool 5**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB13	CONFIGURATION	
13	Chem On (Process in Fill)	1&2	Dry Contact	N/A
27	Shutdown Alarm	<b>TB5</b>	<b>CONFIGURATION</b>	J1; 9&17
		5&6	Dry Contact	
28	Bulk Empty	7&8	Dry Contact	J1; 6&18

**Table 3-22: Alarm Outputs when 8x Manifold Option selected – Tool 6**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB13	CONFIGURATION	

14	Chem On (Process in Fill)	4&5	Dry Contact	N/A
27	Shutdown Alarm	<b>TB6</b>	<b>CONFIGURATION</b>	J2; 9&17
		5&6	Dry Contact	
28	Bulk Empty	7&8	Dry Contact	J2; 6&18

**Table 3-23: Alarm Outputs when 8x Manifold Option selected – Tool 7**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB16	CONFIGURATION	
17	Chem On (Process in Fill)	1&2	Dry Contact	N/A
27	Shutdown Alarm	<b>TB7</b>	<b>CONFIGURATION</b>	J3; 9&17
		5&6	Dry Contact	
28	Bulk Empty	7&8	Dry Contact	J3; 6&18

**Table 3-24: Alarm Outputs when 8x Manifold Option selected – Tool 8**

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB16	CONFIGURATION	
18	Chem On (Process in Fill)	4&5	Dry Contact	N/A
27	Shutdown Alarm	<b>TB8</b>	<b>CONFIGURATION</b>	J4; 9&17
		5&6	Dry Contact	
28	Bulk Empty	7&8	Dry Contact	J4; 6&18

**Table 3-25: PLIS Alarm Outputs**

Digital Output #	Output Label	PLIS1 / PLIS2 / PLIS3 / PLIS4	CONFIGURATION

27	Chem On (Bulk in Fill)	1&2	Dry Contact
26	Fault Alarm	3&4	Dry Contact
28	Bulk Empty	5&6	Dry Contact
14	Degasser Out	7&8	Dry Contact

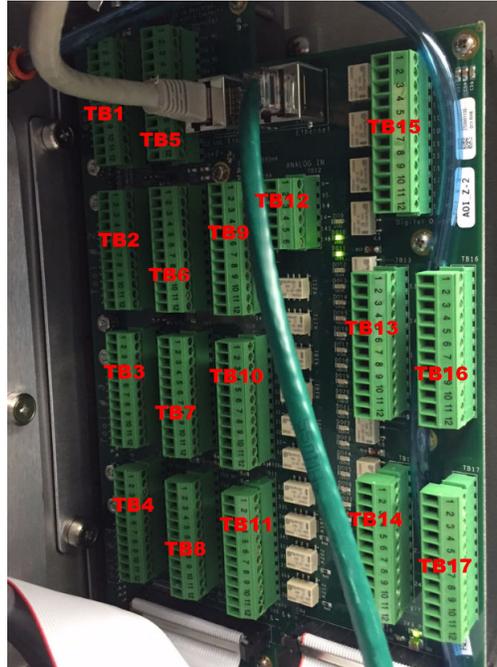
**Table 3-26: X-Fill and Vacuum Outputs**

Digital Output #	Output Label	AP1614	
		TB16	CONFIGURATION
17	Fill Active (non-8x configurations only)	1	N/O
		2	Common
		3	N/C
18	X-Fill Request (non-8x configurations only)	4	N/O
		5	Common
		6	N/C
19	* Vacuum Interlock * Interfaced to multiple CGs when sharing single vacuum pump	* 7	N/O
		* 8	Common
		9	N/C
20	Vacuum Pump Off	10	N/O
		11	Common
		12	N/C

### 3.7.4. Connecting ChemGuard® to Monitoring System

ChemGuard® can be connected to a Global Communication System (GCS) that provides continuous, 24-hour, on-line monitoring of the status of the cabinet. The connection should be made with a 10BaseT Ethernet cable.

**Figure 3-9: Tool I/O Board (AP1614)**



**Figure 3-10: Tool 1-4 DB25 Connectors**



**Figure 3-11: PLIS1-4 DB9 Connectors**



PLIS1/PLIS2/PLIS3/PLIS4	
Pin	Output (Dry Contact)
1	Chem On
2	
3	Fault
4	
5	Bulk Empty
6	
7	Degasser Out
8	
9	Not Used

### 3.8. ChemGuard® Start-up and Initialization

#### 3.8.1. Turing On System Power

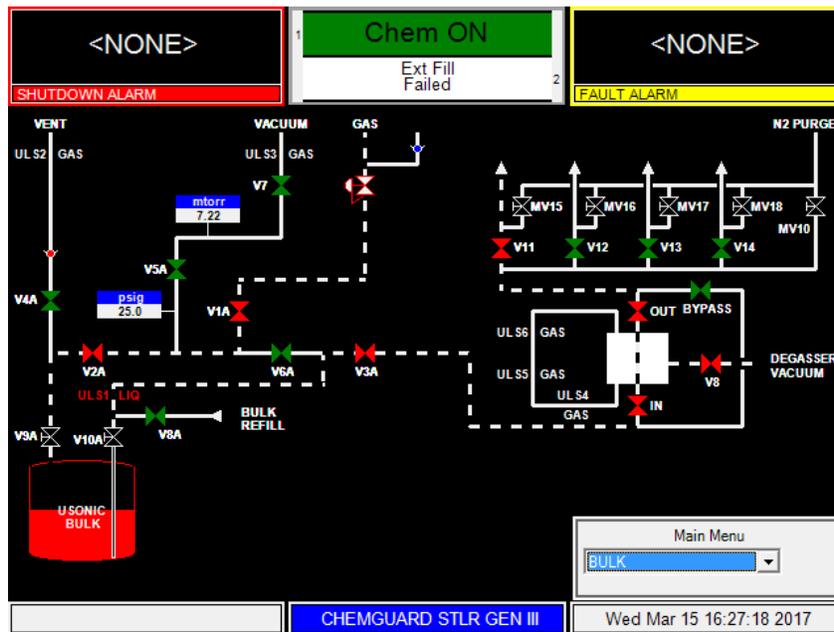
1. Apply AC power to the Controller.
2. Place power switch, (1) for single power supply or (2) for dual power supply located above power supplies inside controller to the ON position. Verify power LED lit, refer to Figure 3-2.
3. Verify power is on to the CG. The CG Display will light and go to boot-up display.
4. Acknowledge any alarms and log into the main menu to verify the display is working properly.

#### 3.8.2. ChemGuard® Display

The ChemGuard® GENIII has a color VGA LED screen on the front face of the cabinet that shows a graphical display of the Bulk and Process reservoir, shutdown and fault alarm boxes. The system screen allows the operator to easily understand the operation and to quickly identify operating status. The chemical flow path is indicated by an animated dashed line and controller status is displayed in the middle of the top of the screen. Conforming to ISA standards, open valves are shown in red and closed valves are shown in green, refer to Figure 3-12.

**NOTE:** A legend for the color code is on the side of the LCD for reference.

**Figure 3-12: ChemGuard® Controller VGA Display Screen**



#### 3.8.3. System Status LEDs

System Status LEDs displaying ChemGuard® alarm conditions, Process Fill enable and ARS ready signal are located to the right of the VGA display. The table below describes these LEDs and their functions.

**Figure 3-13: Controller LEDs**



**Table 3-23: Controller LEDs**

LED	FUNCTION
SHUTDOWN ALARM	This LED flashes red on Shutdown alarm. Once acknowledged, the LED stops flashing but remains red until it is reset.
FAULT ALARM	This LED flashes yellow on Fault alarm. Once acknowledged, the LED stops flashing but remains yellow until it is reset.
CHEMICAL FLOWING	This LED lights green when Process Fill is enabled and tool inputs are satisfied.
ARS – Auto-Restart	This blue LED lit and in steady state indicates Auto-Restart option enabled and monitoring system status. LED flashing blue indicates Auto-Restart was activated.
POWER	This LED indicates that there is +5 VDC power to the unit.

### 3.8.4. Password Log-in

A password is required to access the main menu display. There are 4 levels of password protection in the ChemGuard® GEN III Controller.

Each password level allows a user more access to the features and operation of the controller.

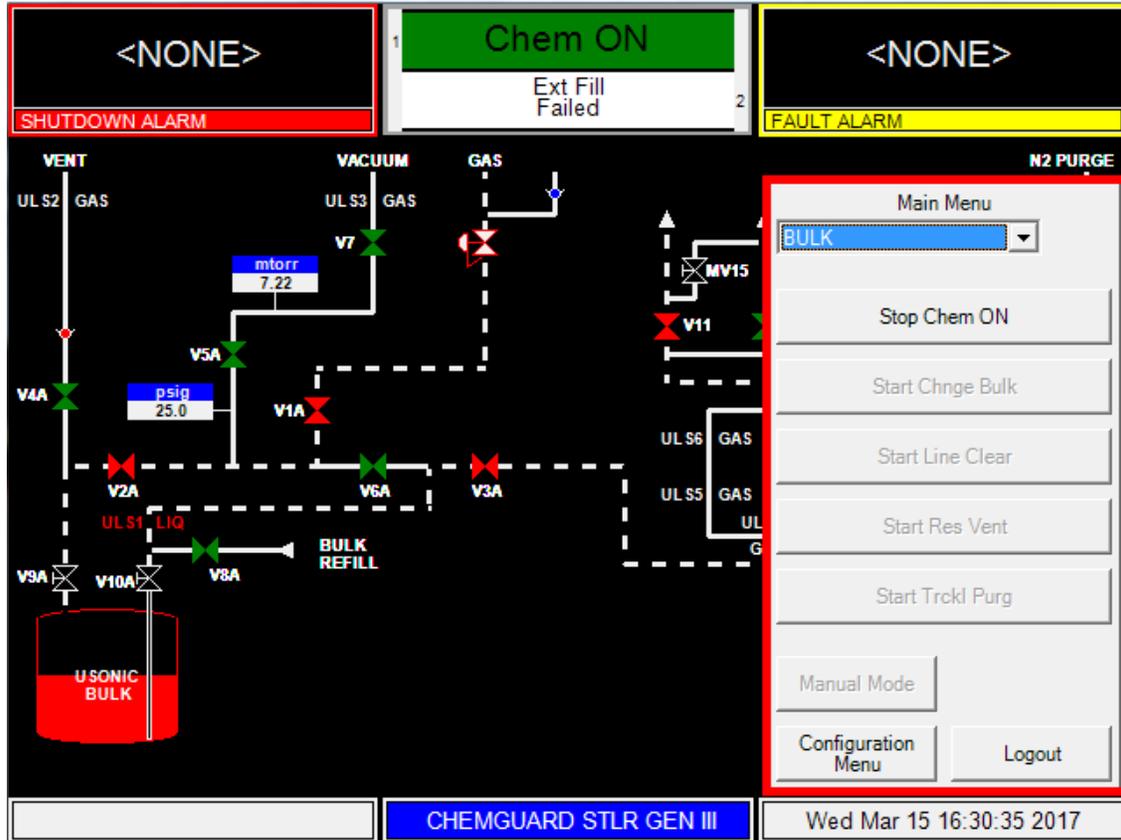
From the Main Menu, enter Config Menu ->

- 1st Security List > default **11234**
- 2nd Security List > default **25678**
- 3rd Security List > default **39999**

### 3.8.5. Main Menu and Configuration Selection Window

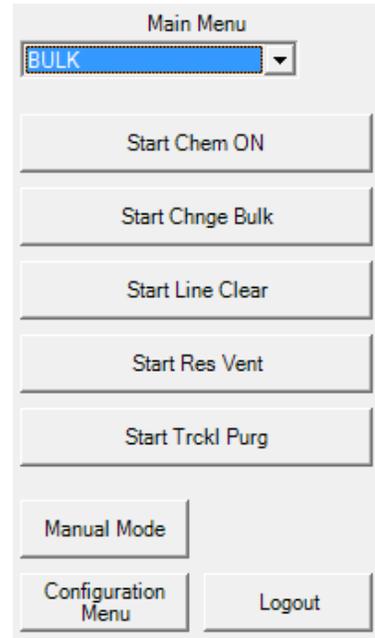
Once a password is successfully entered, the selection window will display on the right side of the screen to show prompts and menu selections. It will remain displayed for a configurable amount of time or until the “LOGOUT” key is pressed.

Figure 3-14: ChemGuard® Main Menu Display Screen

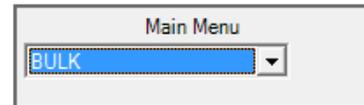


### 3.8.6. ChemGuard® Controller Main Menu

To view the Main Menu in full screen mode, touch the words “Main Menu” at the top of the window.



To return the Main Menu to its normal size, simply touch the words, “Main Menu,” again.



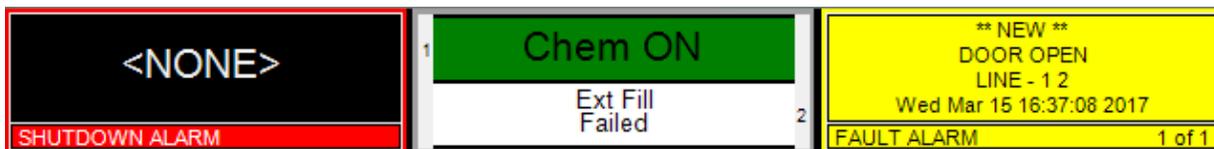
### 3.8.7. Alarm and Controller Status Boxes

Shutdown alarms will appear on the SHUTDOWN ALARM box, located in the top left hand corner of the screen. Fault alarms will appear on the FAULT ALARM box, located in the top right hand corner of the screen. A time stamp of when the alarm occurred will be displayed with each alarm.

**NOTE:** If <NONE> is displayed, no alarm conditions are present.

Controller Status Box, in upper middle field displays green when Chem On or Ext-Fill is enabled.

**Figure 3-15: Alarm and Controller Status Box**



### 3.8.8. Screen Saver

When the programmed amount of time has elapsed since the operator’s last keypad action, the screen saver blanks the display screen and a randomly-moving mode indicator box appears. This occurs during the following states: idle, Chem On and External Fill (in systems with a Bulk refill option).

The screen saver will de-activate if a new alarm appears.

To manually de-activate the screen saver, touch anywhere on the display screen.

The screen saver function will not be active while a fault or shutdown alarm is present, an active prompt is displayed, or during any mode/sequence other than idle and Chem On (Chem On or External Fill, if Bulk refill optional is available).

### 3.9. ChemGuard® System Configuration

#### 3.9.1. User Setpoints – Process Scale (Analog)

Configuring Process analog scale “Fill”, “External Fill” & alarm setpoints.

From the Main Menu, enter Config Menu -> User Setpoints -> Bulk Scale. Note, values shown are recommended.

**Table 3-27: User Setpoints > Bulk Scale**

Num	Alarm Label	Percent
1	BULK RES Overfull	105% (85% when Ext Fill Enabled)
2	BULK RES Low	5%
3	BULK RES Empty	0%
4	BULK HI Refill (External Refill option only)	70%
7	BULK LOW Refill (External Refill option only)	50%

**NOTE:** If the cabinet has an external fill option, the external fill operation will start when the Bulk level reaches Bulk Low Refill Level setpoint.

#### 3.9.2. User Setpoints – Bulk Push (Digital)

Configuring Bulk Push PT1 “Pressure Alarm” setpoints.

From the Main Menu, enter Config Menu -> User Setpoints -> Bulk Push. Note, values shown are recommended.

**Table 3-28: User Setpoints > Bulk Push**

Num	Alarm Label	Setpoint
1	LOW PUSH PRES BK	5 psig below R1 setting
2	HI PUSH PRES BK	59 psig
3	LOW PUSH PRES BK	5 psig below R1 setting
5	N2 VENT FAIL	5 psig
8	GROSS LEAK PT1	10 psig

#### 3.9.3. User Setpoints – Vacuum (Analog)

Configuring Vacuum PTV Change Bulk and Change Process base vacuum setpoints.

From the Main Menu, enter Config Menu -> User Setpoints -> Vacuum. Note, values shown are recommended.

**Table 3-29: User Setpoints > Vacuum**

Num	Alarm Label	Setpoint
1	VACUUM GUAGE FAIL	300 mtorr

2	BASE VAC TIMEOUT	+10 mtorr above vacuum base reading
3	PMPDWN TIMEOUT	300 mtorr

### 3.9.4. Fill Timers (System Setup)

Configuring Fill Timer for External Refill.

From the Main Menu, enter Config Menu -> System Setup -> Fill Timers.

**Table 3-30: System Setup > Fill Timers**

Num	Label	Timer
16	Ext Fill	60 sec

**NOTE:** Do not enter fill timer for Chem On. Chem On remains in Fill Enable indefinitely.

### 3.10. Manual Mode



**Only experienced operators should operate the ChemGuard® in manual mode. Operating valves out of their proper sequence could potentially cause damage to the product by interrupting or providing insufficient gas flow. Manual operation should not be used for normal, daily operation.**

Manual mode provides a means of flowing purge gas through the purge and process gas panels during cabinet installation and pre-start-up procedures. It also provides a means of flowing purge gas while maintenance or repairs are being performed or when performing leak checks, Vacuum “Rate of Rise” or Pressure Decay tests.

#### 3.10.1. How to Operate Manual Mode



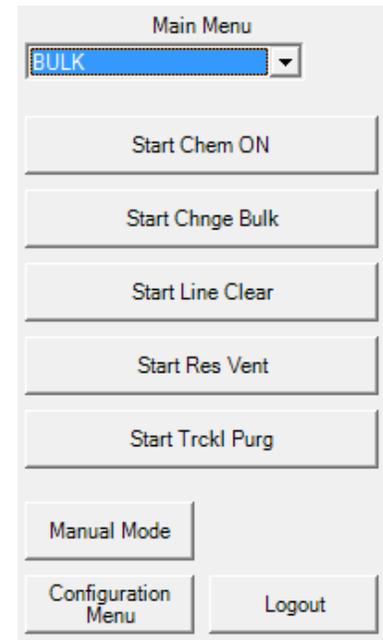
**Operating in Manual Mode could cause the following hazards which can result in Personal Injury or damage to the Equipment.**

- **Opening valves when liquid chemical is present at the valve.**
- **Liquid chemical could be vented or released.**
- **Opening valves when container pigtails are not connected and sealed.**

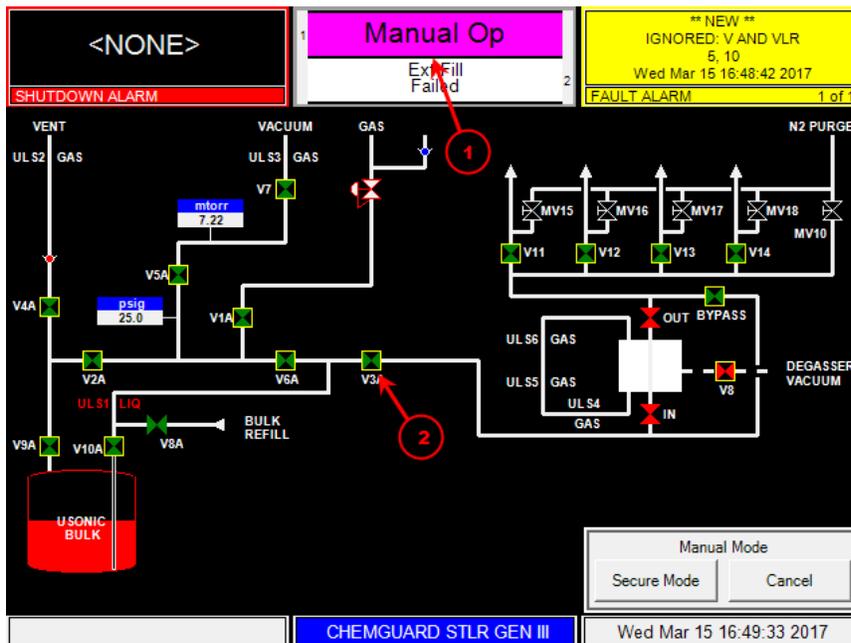
**NOTE:** Due to the potential hazards listed above, Manual Mode operation requires a second level security code.

### 3.10.2. Selecting Manual Mode

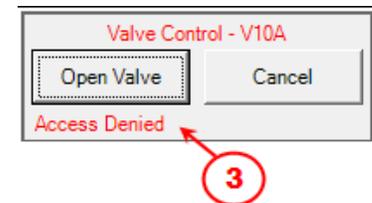
1. Select anywhere on the Color Touch;
2. Display to bring up Main Menu screen and enter the password;
3. Press "OK";
4. From the Main Menu screen, select "MANUAL MODE";
5. The MANUAL MODE window will display, refer to Figure 3-16.



**Figure 3-16: ChemGuard® Manual Mode Display**



1. Controller Status box changes to Violet for operation selected, Bulk or Ext Fill
2. Yellow box around valves that can be controlled via Manual Mode
3. Valve lock for a valve that cannot be open in Manual Mode



### 3.10.3. How to Open Valve in Manual Mode

To open a valve:

1. Select by touching the valve. The valves that can be manually operated from the display will be highlighted with a yellow box.

- The valve confirmation window will appear, asking you to confirm that you want to open the valve by pressing “OPEN VALVE”. Pressing “CANCEL” will close the window, leaving valve closed, refer to Figure 3-16.

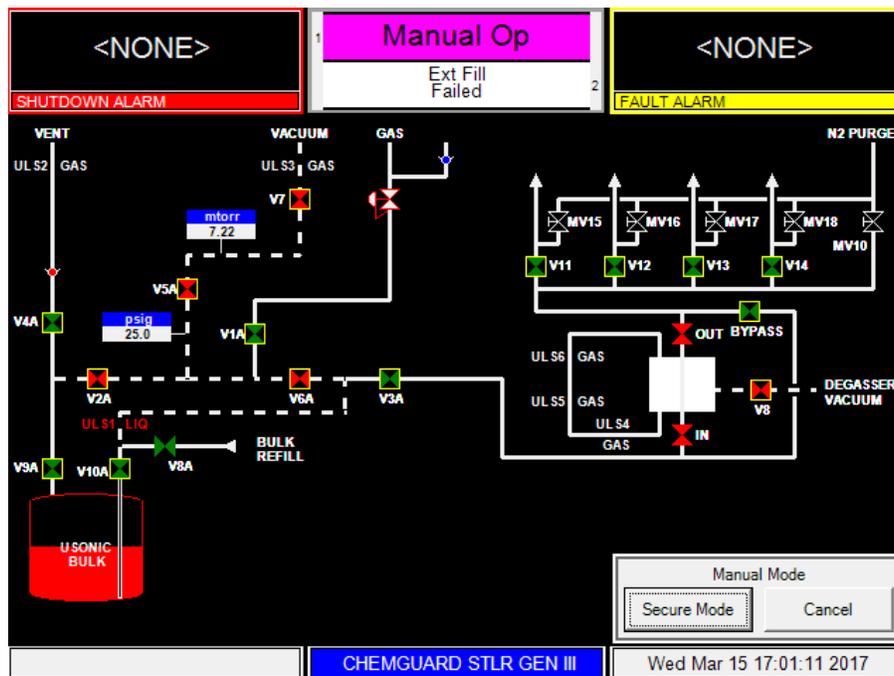


### 3.10.4. How to Close Valve in Manual Mode

To close a valve:

- Touch the valve you want to close by selecting the valve on the display.

**Figure 3-17: ChemGuard® in Manual Mode**



### 3.10.5. To SECURE Manual Mode

The Secure option allows the operator to exit the Manual Mode menu while remaining in manual mode with valves open. (The Secure option will not be selectable if no valves are open) When the operator chooses Secure Mode from the Manual Mode window it allows the operator to go to other menu screens. Any open valve will remain open, and the Mode Status Box will continue to indicate manual mode. Manual mode will remain active or ‘secured’ until an operator re-enters the Manual Mode window. While manual mode is ‘secured’, Manual Mode will be the only selectable option on the Main Menu.



**ChemGuard® must not be left unattended in Manual Mode, as access to the system in Manual Mode is open to anyone.**

**NOTE:** Pressing “CANCEL” will automatically close any valves which were left open unless the secure mode feature is used as seen below.

### 3.11. Pressure Regulator Adjustment

#### 3.11.1. Bulk PT1 and R1 Test and Adjustment

**NOTE:** Test Bulk PT and Regulator R1 together at same time.

1. Slowly open regulator R1 by turning R1 fully clockwise
2. Step to Bulk Menu
3. Step to Manual Mode and open V1A. Verify valve indicator switches from green to red
4. Turn main supply gas off to the CG, 0 psig
5. Vent off pressure to PT1 by opening V2A and V4A
6. Confirm PT1 pressure drops to 0 psig. Close V2A and V4A
7. Set main supply gas pressure to 10 psig. Verify PT1 reads  $10.0 \pm 0.5$  psig
8. Set main supply gas pressure to 25, 35 & 55 psig. At each setting verify PT1 reads setting  $\pm 0.5$  psig
9. Return main gas supply pressure to original setting, 60-90 psig
10. Slowly close regulator R1 by turning R1 fully counterclockwise
11. Close V1A and open V2A and V4A. Confirm PT1 pressure drops to 0 psig. Close V2A and V4A
12. Open V1A
13. Slowly open regulator R1 by turning R1 clockwise to user selected pressure setting, typically 35 psig
14. Close V1A

**NOTE:** Regulators are not self venting. If the desired push pressure is exceeded the flow path must be vented in manual mode, then the pressure regulator adjustment repeated.

#### 3.11.2. Bulk Regulator Creep Test

1. After PT1 tested and R1 set to user selected pressure setting, wait 5mins for pressure to stabilize
2. Document PT1 pressure reading = \_\_\_\_\_ psig
3. Let CG sit for 4 hours = \_\_\_\_\_ Start \_\_\_\_\_ Stop
4. The pressure reading should not drift by more than  $\pm 2$  psig
5. Record final reading = \_\_\_\_\_ psig



**3.12.3. Leak Check-Bulk, Vent Line**

**Confirm Bulk Inlet and Outlet pigtails are securely capped.**

1. At Main Display, step to Bulk Menu and enter Manual Mode. Select and open valve V1A, V2A and V4A.  
Note: If Helium gas is used Helium gas will flow to vent. If Helium gas is in short supply to prevent high consumption only keep V1A open for short duration or skip step one and perform visual check, step 2 only.
2. Visually check ¼" VCR connection at outlet of V4A and ¼" Swagelok connection at inlet and outlet of Check Valve, CV1. Confirm connections are secure and no presence of gas can be detected.
3. Optional, if push gas being supplied to the CG is Helium; obtain a suitable Helium Leak Detector. Using outboard leak detection method, sniff connections of V4A and CV1. Confirm no Helium gas is detected at connections.  
Note: If Helium gas is detected, remake connections at V4A and CV1
4. Cancel out of Manual mode.



12. Return to System Test -> Test Analog In. Compare Vacuum reading from values recorded in step 6. Confirm change in vacuum is less than 10mtorr, 0.25vdc.

\_\_\_\_\_ mTOR \_\_\_\_\_ VDC

Note: if vacuum ROR is greater than specified, troubleshoot until vacuum ROR meets this specification.

13. Cancel out of Ext Fill and Bulk Manual modes.

### 3.14. System Leak Check – AMAT Degasser Option

**Note:** Leak Check of the High Flow Degasser, refer to Addendum A.

#### 3.14.1. Leak Check-Degasser, Pressure Decay-Chemical Path Confirm Bulk Inlet and Outlet pigtails are securely capped.

1. At Main Display, step to Bulk Menu and enter Manual Mode. Select and open valve V1A.
2. Increase R1, Bulk Pressure to 45psig.
3. Wait for 1 minutes. Place Manual Mode in Secure Mode.
4. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Bulk Push pressures, Gross and Raw.

\_\_\_\_\_ PSIG \_\_\_\_\_ mA

5. Enter Manual mode, close V1A.
6. Return to System Test -> Test Analog In. Verify Bulk Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.2mA.
7. Enter Manual mode, open V1A, V6A, and V3A. Confirm Degasser Vacuum valve, V8 is open.
8. Wait 15 minutes and then close V1A.
9. Wait for 15 minutes. Place Manual Mode in Secure Mode.
10. Return to System Test -> Test Analog In. Compare Bulk Push pressure from values recorded in step 4. Confirm change in pressure (Pressure decay) is less than 3psig, 0.5mA.

\_\_\_\_\_ PSIG \_\_\_\_\_ mA

**Note:** if pressure drop is greater than specified, troubleshoot until pressure decay meets this specification.

11. Cancel out of Manual mode.

#### 3.14.2. Leak Check-Degasser, Pressure Decay-Bypass Confirm Bulk Inlet and Outlet pigtails are securely capped.

1. At Main Display, step to Bulk Menu and enter Manual Mode.
2. Select and open valve V1A. Increase R1 Bulk Pressure to 45psig.
3. Wait for 1 minutes. Place Manual Mode in Secure Mode.
4. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Bulk Push pressures, Gross and Raw.

\_\_\_\_\_ PSIG \_\_\_\_\_ mA

5. Enter Manual mode, close V1A.
6. Return to System Test -> Test Analog In. Verify Bulk Push values. Confirm change in pressure (Pressure Decay) is less than 1psig, 0.2mA.
7. If Degasser option configured with Degasser Vacuum Switch, disconnect Vacuum Switch from P5 cable.
8. Confirm Degasser switches to the Bypass mode on Main Menu and Vacuum Switch Fail alarm activates Yellow for a Fault Alarm. Proceed to step 11.
9. If Degasser option not configured with the Vacuum Switch at Degasser Pneumatic Switching valve, remove 4 air lines.



Note: if pressure drop is greater than specified, troubleshoot until pressure decay meets this specification.

15. Cancel out of Manual mode.

16. Reconnect Vacuum Switch to P5 cable or return 4 air lines removed in previous test, step 8 to their original position on the adapter fittings.



1. V3A is interlocked and cannot be opened in Manual Mode. Remove pneumatic air line from V3A then remove a pneumatic air line from an unused output valve, V12, V13, V14, or V21-V24 (if applicable) and connect to V3A.
2. Open/confirm manual shutoff valve on vacuum line from vacuum pump to CG, V7 is open.
3. At Main Display, step to Bulk Menu and enter Manual Mode. Select and open V7, V2A, V5A, V6A, V9A and output valves V11 thru V14 and V21-V24 (if applicable) where a Chemical Delivery lines is connected, (confirm chemical delivery lines connected and valve closed at tool end).
4. Open the unused output valve where the pneumatic air line was connected to V3A. V3A is now open.
5. Place Manual Mode in Secure Mode.
6. At Main Display, step to External Fill Menu (if option available) and enter Manual Mode. Select and open V8A, (confirm chemical refill line connected and valve closed at CGBCD end).
7. Place Manual Mode in Secure Mode.
8. Place in System Vacuum Purge overnight, or for 4-12hrs.  

	Start Time		End Time
--	------------	--	----------
9. Cancel out of Bulk and External Fill Manual modes.
10. Remove pneumatic air line connected to V3A and re-connected to the unused output valve, V12, V13, V14, or V21-V24 (if applicable) then re-connect pneumatic air line to V3A.

### 3.15.3. Setting Up Net Product Weight – Refillable Bulk Container

Configuring Refillable Bulk Container Chemical Level

**NOTE:** Only enter value when Bulk Container is **EMPTY**

- Net Liquid Weight – 100% Full Level of Bulk Container
  - Value entered is the 100% level of a full container.
  - Using V-TSA060\_Chemical Maximum Fill Value Table, select the value for the model/size Bulk container, i.e. 19 liter and the chemical being used in this ChemGuard®, i.e. TEOS
  - Enter value in kilograms (17.4)
- Current Liquid Weight – 0% Actual level of Bulk container
  - Enter 00.0 kilograms

Figure 3-18: Example using Chemical Maximum Fill Value Table

**Net Liquid Weight**

- Determine Process Container Model/Size
- Chemical Being Used
- Enter Liquid Weight – in kilograms

CONTAINER		BK4000SW	BK6280ST	BK11000SU	BK18900ST	BK38000SY
ACTUAL VOLUME	ChemGuard	4098cc	6450cc	11128cc	19645cc	39800cc
STYLE	Model	4 Liter	6.2 Liter	11 Liter	19 Liter	38 Liter
OMCTS	100	4200	9900	10025	17000	N/A
Pyridine	325	3900	5650	9700	N/A	N/A
R-H <sub>2</sub> O	100	N/A	N/A	N/A	N/A	N/A
SiCL <sub>4</sub>	300	6500	9000	15600	20000	N/A
TEOS	100	3200	5600	11200	17400	34800
TMA	100	3700	6000	11200	18000	N/A
TiCl <sub>4</sub>	300	7250	10300	17800	31350	62200
TMA	400	3050	4340	7525	13250	N/A
TMB	100	3150	5250	9300	16700	N/A
TMCTS	100	4450	6100	10600	18000	N/A

Figure 3-19: Selecting Net Product - Bulk Scale

**Select Net Product**

- Select Bulk Scale

The screenshot shows the ChemGuard control interface. At the top, there are status indicators for '<NONE>', 'Power Up', and '<NONE>'. Below these are 'SHUTDOWN ALARM' and 'FAULT ALARM' indicators. The main interface displays various process parameters like VENT, VENT PURGE, VACUUM, GAS, and N2 PURGE. A 'Configuration Menu' is overlaid, with 'Net Product' selected. A 'Net Product' dialog box is open in the foreground, showing 'Device: BULK SCALE', 'Gross Wgt: 0.00', 'Net Liquid Wgt: 17.4', and 'Current Liquid Wgt:'. The dialog has numeric keypad buttons and 'OK', 'Cancel', and 'Apply' buttons. The background configuration menu includes options like 'Valve Counts', 'Analog Scaling', 'Alarm Sequences', 'User Setpoints', 'Container Chng Counts', 'Analog Units', 'Relay Defaults', '3rd Security Access', 'Subcycle Parameters', 'Operation Sequences', 'Fixed Setpoints', 'Helium Leak Check', 'System Setup', 'Leak Test Parameters', 'Sequence Flow Options', 'Alarm Conditions', '1st Security List', 'Config Transfer', 'System Test', 'Prompt List', 'Alarm Delays', '2nd Security List', 'Memory Management', 'Valve Setup', 'Set Time/Date', 'Alarm Types', and '3rd Security List'. At the bottom, it shows 'Configuration File Description: CHEMGUARD110', 'Configuration File Name: 468850\_CG310\_Rev-1.GCF', 'Configuration File Revision: 2.0', 'Configuration File Date: Thu Mar 3 15:10:04 2017', and a 'Close' button. The status bar at the bottom indicates 'CHEMGUARD STLR GEN III' and 'Fri Mar 17 15:13:52 2017'.

**Figure 3-20: Entering Weight of Empty Bulk Container**

**Bulk Scale:**

**Note:** Only enter value when an empty Process container installed

1. Enter 100% Full Level (From V-TSA060 ChemGuard® Chemical Fill Matrix)
2. Enter 00.0 for Current Level (Empty Container)
3. Select Apply

Net Product

Device: BULK SCALE

Gross Wgt: 0.00

Net Liquid Wgt: 17.4

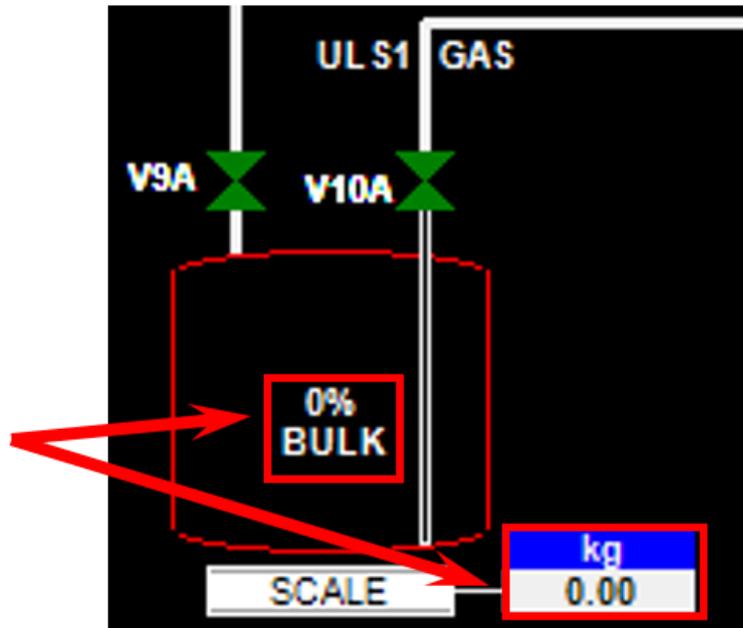
Current Liquid Wgt: [ ]

Buttons: 7, 8, 9, 4, 5, 6, 1, 2, 3, ., 0, -, Backspace, OK, Cancel, Apply

**Figure 3-21: Net Product Weight of Empty Bulk Container**

Current weight of the Bulk Container is shown on the Main Display in Kilograms and %.

This window is an example of a Bulk Container that is empty



### 3.16. Finishing the ChemGuard® Installation

#### 3.16.1. Installation of the standard Bulk Container

Refer to Chapter 4 for the installation of the standard Bulk Container.

#### 3.16.2. Chemical Delivery Line Certification

Verify and confirm the Chemical Delivery Lines have been completed and certified, i.e. leak check and vacuum purged for a minimum of eight (8) hours to remove any atmospheric moisture before starting the chemical fill.

To perform system vacuum purge, refer to 3.15.2.

**NOTE:** It is the end user's responsibility to evacuate the delivery line from the ChemGuard® cabinet's output manifold to the Process Tool.

#### 3.16.3. Chem On (Bulk Fill) Operation

Confirm with the end user that the ChemGuard® is ready to be placed system in Chem On and process tool(s) ready to receive chemical.

1. To place the Bulk container into fill operation, from the main menu, select BULK.
2. Select "Start Chem On". The Controller status box for Bulk will change from white to green indicating Chem On is enabled and is a Bulk fill, Bulk valves are on, in red and dash line activated showing chemical flow.
3. Chem On terminates either by operator selecting "Stop Chem On" or a life safety shutdown alarm terminates Bulk Fill.

#### 3.16.4. Chemical Fill Out to Tool

**NOTE:** Verify the end user has completed the evacuate of the chemical delivery line from the ChemGuard® cabinet's output manifold to the Process Tool.

Recommend the Process Tool(s) controls the Chemical Output Valves V11, V12, V13, V14, and V21-V24 (if applicable) enabling the input signals on the AP1614 Tool Interface PCB, refer to Table 3-5 and Table 3-6.

# Chapter 4

## Changing Reservoir Container

- Section 1      Safety Notes**
- Section 2      Removing and Replacing the Reservoir Containers**
- Section 3      Change BULK Container Operation**

The Change Bulk operation is an automated procedure that guides the operator through the steps required to change out the Bulk containers.

**NOTE:** This warranty is expressly conditioned on compliance with Versum Materials, Inc. operating instructions and the use of the equipment only for authorized chemicals. Operation of the equipment other than as set forth in Versum Materials, Inc. operating instructions or the use of the equipment for unauthorized chemicals shall void all of Versum Materials, Inc. warranties hereunder.

**NOTE:** The remove-and-replace procedure described in Section 4.2 and 4.3 applies to the Bulk container except as noted. The appearance of your Bulk container may vary slightly from those shown in the illustrations in this chapter.

**NOTE:** Ensure the product in the Bulk container is at room temperature prior to installation and startup of the ChemGuard®. Some chemicals have relatively high freezing points.



**WARNING:** Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should follow procedures in the Safety Data Sheet (MSDS) on chemical being used. Secondary containment and cleanup material should be available in the event of chemical spill. Proper personal protective equipment must be used.

**WARNUNG:** Vor dem Umgang mit Chemikalien die in Ihrem Unternehmen geltenden Sicherheitsbestimmungen und betriebsinternen Sicherheitsverfahren revidieren. Alle mit Chemikalien umgehenden Personen sollten mit den in den Sicherheitsdatenblättern (MSDS) aufgeführten Verfahren über die jeweils verwendete Chemikalie vertraut sein. Ein Zweitbehälter und Reinigungsmittel sollten bereitstehen, falls Chemikalien verschüttet werden.

**AVERTISSEMENT:** Réexaminer les règles de sécurité instituées à votre entreprise et les procédés de sécurité en force avant la manipulation de tous produits chimiques. Tout utilisateur d'un produit chimique doit suivre les procédés prescrits dans les feuilles de normes pour matières (MSDS) concernant les produits chimiques en usage. Un récipient secondaire et du matériel de nettoyage doivent être disponibles au cas où le produit chimique se renverse.

#### 4.1. Safety Notes

Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should be familiar with the SDS (MSDS) and chemical being used.

For caution, all appropriate personal safety protection equipment should be used. Secondary containment and clean-up material should be available in the event of chemical spill or breakage of the container.

When lifting fully filled chemical containers, Versum Materials, Inc. recommends that two (2) persons perform the lifting.

## 4.2. Removing and Replacing the Reservoir Containers



**WARNING:** Be sure the manual valves on the container are closed before disconnecting the lines.

If pneumatic valves are used on the container, disconnect the pneumatic tubes prior to disconnecting the container connections.

**WARNUNG:** Vor dem Trennen der Leitungen sicherstellen, daß die handbetätigten Ventile am Vorratsbehälter geschlossen sind.

Werden am Vorratsbehälter Druckluftventile verwendet, müssen zuerst die Druckluftleitungen getrennt werden, bevor die Anschlüsse am Behälter entfernt werden.

**AVERTISSEMENT:** Avant de débrancher la ligne, s'assurer que les soupapes de manoeuvre se trouvant sur le réservoir soient fermées.

Si les valves pneumatiques sont utilisées sur le réservoir, alors déconnecter les tubes pneumatiques avant de débrancher les connexions du récipient.



**CAUTION:** Do not allow valves on container to rotate.

Damage to VCR faces may result in leaks, preventing proper system operation.

**VORSICHT:** Die Ventile am Behälter dürfen sich nicht drehen.

Eine Beschädigung der VCR-Berührungsflächen kann zu Leckage führen, die den ordnungsgemäßen Betrieb des Systems beeinträchtigen.

**ATTENTION:** Ne pas laisser tourner les soupapes sur la boîte métallique.

Tout dégât aux surfaces des pièces en VCR peut causer des fuites et, donc, empêcher le fonctionnement propre du système.



### **TO PREVENT BACK INJURY, USE PROPER LIFTING TECHNIQUE WHEN HANDLING CONTAINERS.**

1. Have the following equipment ready:
  - a) New container containing desire (correct) chemical
  - b) Wrenches (5/8 in., 11/16 in. and 3/4 in. open end)
  - c) 6.35mm (1/4 in.) stainless steel, VCR gaskets
  - d) Proper personal protective equipment (PPE)
2. Put on personal protective equipment.

### 4.3. Change BULK Container Operation



**WARNING:** Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should follow procedures in the Safety Data Sheet (MSDS) on chemical being used. Secondary containment and cleanup material should be available in the event of chemical spill. Proper personal protective equipment must be used.

**WARNUNG:** Vor dem Umgang mit Chemikalien die in Ihrem Unternehmen geltenden Sicherheitsbestimmungen und betriebsinternen Sicherheitsverfahren revidieren. Alle mit Chemikalien umgehenden Personen sollten mit den in den Material-Sicherheitsdatenblättern (MSDS) aufgeführten Verfahren über die jeweils verwendete Chemikalie vertraut sein. Ein Zweitbehälter und Reinigungsmittel sollten bereitstehen, falls Chemikalien verschüttet werden.

**AVERTISSEMENT:** Réexaminer les règles de sécurité instituées à votre entreprise et les procédés de sécurité en force avant la manipulation de tous produits chimiques. Tout utilisateur d'un produit chimique doit suivre les procédés prescrits dans les feuilles de normes pour matières (MSDS) concernant les produits chimiques en usage. Un récipient secondaire et du matériel de nettoyage doivent être disponibles au cas où le produit chimique se renverse.

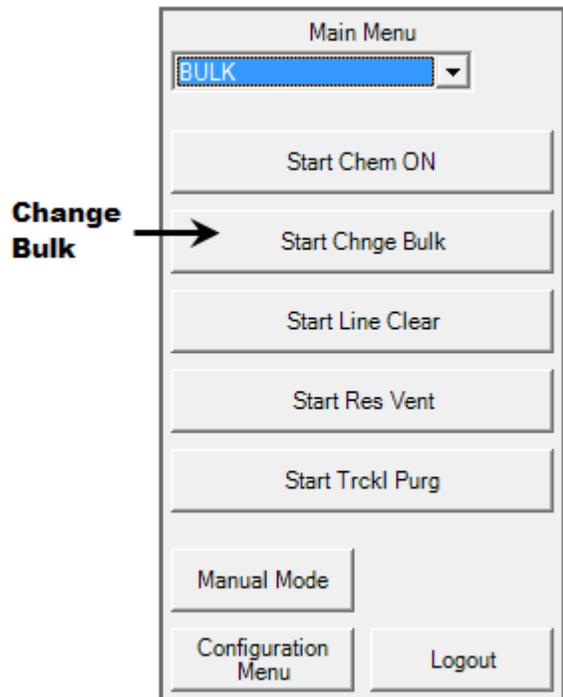
#### 4.3.1. Changing the BULK Container

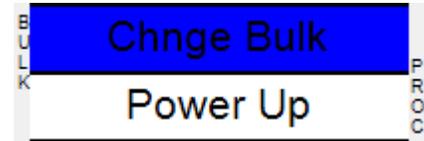
This option guides the operator through steps to remove and replace Bulk container. Change Bulk operation must be performed any time to remove or install Bulk container.

##### To start Change Bulk operation:

- Select Main Menu – Bulk
- Select Start Chnge Bulk
- Controller status box for Bulk will change from white to blue and display Chnge Bulk
- Click on Stop Chnge Bulk button to stop change bulk operation

**NOTE:** Chem On and External Fill must first be disabled before Change Bulk can start.





Change Bulk operation will not proceed if any of the following conditions exists:

- A Life Safety or Change Bulk Shutdown alarm is activated.
- Operator terminates operation by selecting Stop Chnge Bulk from Bulk menu.
- The Vacuum pump is not turned on.

**NOTE:** For any reason if Change Bulk operation is terminated before its completion Chem On cannot be enabled. Successful completion of the Change Bulk operation is required to place ChemGuard® into the Chem On mode.

#### 4.3.2. Detail Description of the Change Bulk Operation

1. When selecting the main screen, “Password” window displays. Enter a valid password and select “OK”.
2. Select “Bulk” from the pull-down menu. If Chem On operation is enabled, select STOP CHEM ON to disable Bulk fill operation.
3. Select Bulk from the pull-down menu and select either START Chnge Bulk to start the Change Bulk operation.
4. The controller status box will change from white to blue and indicate, Chnge Bulk.
5. At any time, the operator can terminate the Change Bulk operation by selecting STOP Chnge Bulk.

**NOTE:** If Bulk change operation is stopped before its completion Chem On cannot be enabled. Successful completion of the Change Bulk operation is required to place ChemGuard® into a Chem On Mode.

6. The Bulk change operation continues to run until either one of the following occurs
  - a) A Life Safety or Change Bulk Shutdown alarm is activated
  - b) Technician/Operator terminates the operation by selecting **Stop Chnge Bulk**
7. During the Change Bulk operation, the system first performs a LINE CLEAR function, pushing liquid chemical from the Bulk outlet pigtail back into the Bulk container.
8. The operator/technician is then prompted to close the Bulk container manual valves, if configured for a manual valve container.
9. The Change Bulk operation then performs a series of Vacuum Cycle steps to ensure chemical/residue has been completely removed and dried from the Bulk inlet and outlet pigtails.
10. A leak test, vacuum rate of rise test will be performed before the Bulk container is removed. This ensures all chemical/residue has been completely removed and dried from the Bulk inlet and outlet pigtails and to ensure there is no across the valve seat leak of either the valves on the Bulk container or ChemGuard® valves.
11. The system will prompt the operator to remove the spent Bulk container and then verify/perform scale calibration.

**NOTE:** Scale Calibration requires verification of the 4-20mA analog reading which is displayed at this step. This allows for the verification/calibration of the bulk scale without having to terminate Change Bulk operation, refer to Figure 4-1 and scale calibration procedure in Chapter 7.

12. Disconnect the pneumatic quick-disconnect fittings, if the container has pneumatic valves.
13. Disconnect the two (2) VCR connections connecting the Bulk pigtailed to Bulk container valves. Take special care to account for the 2 used VCR gaskets ensuring they are not left attached to the Bulk pigtail connections.



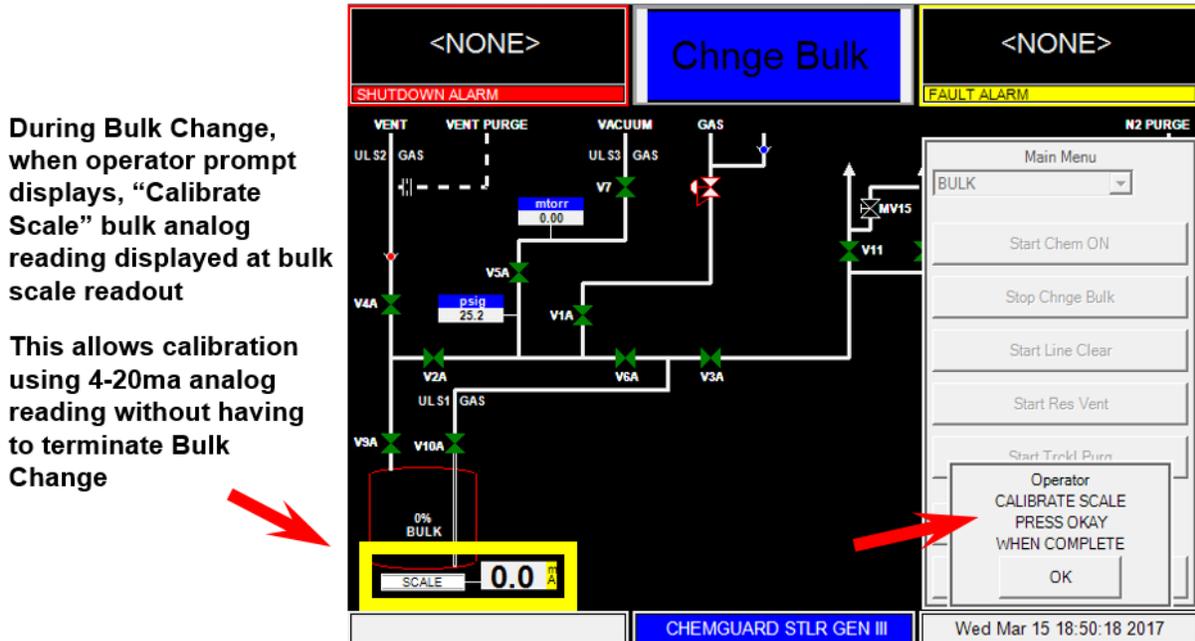
**DO NOT loosen the VCR connection of the inlet and outlet valves where they connect to the body of the Bulk Container**

14. The operator will now be prompted to install the new Bulk container. **DO NOT** press OK until Bulk container has been installed and connected to the Bulk pigtailed.
15. Replace with two (2) new VCR gaskets and connect the Bulk pigtailed to the Bulk container valves.

**NOTE:** Ensure the pigtailed closely aligned with the VCR fittings on the Bulk container valves ensuring there is no strain or stress applied to the Bulk container when the pigtailed are connected. This can cause an incorrect reading of the Bulk Scale.

16. If there is a barcode option, the software will prompt to ENTER OR SCAN THE BARCODE ON THE NEW BULK CAN. Following this there will be a prompt which says INSTALL NEW CAN (this prompt will appear regardless of whether the system has a barcode option or not). At this point install the new Bulk can and press the OKAY button on the screen.
17. Reconnect the pneumatic quick-disconnect fittings, if the container has pneumatic valves.
18. The operator will now be prompted to enter a numeric entry for the valve type of the Bulk container, 2 for manual bulk valves or 3 for pneumatic bulk valves.
19. The Change Bulk operation will now continue with the post container change and perform a “Gross” leak pressure decay test followed by several vacuum cycle purge steps and finally a leak test, vacuum rate of rise test. This ensures all moisture/air has been completely removed and dried from the Bulk inlet and outlet pigtailed before Chem On commences.
20. The operation will now be prompted to enter the chemical liquid weight, which is printed on the label on front of the Bulk container.
21. If Bulk container configured with manual valves the operator will be prompted to open the manual valves.
22. Change Bulk operation is now completed and the controller status box will change from blue to white and indicate, ChngBlk Completed.

Figure 4-1: Change Bulk Scale Calibration "Prompt"



### 4.3.3. Change Bulk Diagnostics



WARNING: Do NOT disconnect any fittings until all chemical has been removed.

WARNUNG: KEINE Verschraubungen lösen, bis nicht alle Chemikalien entfernt worden sind.

AVERTISSEMENT: NE PAS détacher les raccords de tuyauterie avant que tout produit chimique no soit extrait.

The following are alarm errors that could occur during the Change Bulk operation and possible causes and corrective actions to take:

Table 4-1: Change Bulk Alarm Errors

ALARM ERROR	POSSIBLE CAUSES	CORRECTIVE ACTION
PMPDWN TIMEOUT alarm BASE VAC TIMEOUT alarm LOW VACUUM TIMEOUT alarm	<ul style="list-style-type: none"> <li>- Vacuum Pump failure</li> <li>- PMPDWN / BASE VAC setpoint set too low</li> <li>- Change Bulk cycles incorrectly set</li> </ul>	<ul style="list-style-type: none"> <li>- Check vacuum pump for correct operation, check for leaks</li> <li>- Check base pressure reading of pump</li> <li>- Check vacuum setpoints</li> <li>- Check Change Bulk sub-cycle setting</li> </ul>

LOW PUSH PRES BLK alarm HIGH PUSH PRES BLK alarm	<ul style="list-style-type: none"> <li>- PT1 Pressure Transducer fail</li> <li>- Supply gas problem, incoming gas supply</li> <li>- R1 regulator fail – reg creep</li> <li>- R1 reg adjustment issue</li> </ul>	<ul style="list-style-type: none"> <li>- Check function of PT1</li> <li>- Check incoming gas supply, main regulator setting</li> <li>- Check R1 regulator, test for reg creep</li> <li>- Re-adjust R1 to setpoint</li> </ul>
Bulk Vent Failed alarm	<ul style="list-style-type: none"> <li>- PT1 Pressure Transducer fail</li> <li>- Vent valve fail</li> <li>- Bulk check valve, CV1 fail</li> </ul>	<ul style="list-style-type: none"> <li>- Check function of PT1</li> <li>- Check V2A and V4A valves</li> <li>- Check CV1 check valve for blockage, check valve plugged</li> <li>- Check vent line to exhaust for blockage</li> </ul>
PIGTAIL NOT EMPTY alarm	<ul style="list-style-type: none"> <li>- V6A valve fail</li> <li>- UltraSonic Sensor ULS1 on Bulk Pigtail fail</li> </ul>	<ul style="list-style-type: none"> <li>- Check V6A valve</li> <li>- Check pneumatic air pressure to V6A</li> <li>- Check function and placement of ULS1 Bulk Pigtail sensor</li> </ul>
VAC GAUGE FAIL alarm	<ul style="list-style-type: none"> <li>- PTV Vacuum Gauge fail</li> </ul>	<ul style="list-style-type: none"> <li>- Check function of PTV Vacuum Gauge</li> </ul>
LEAK TEST FAILURE alarm GROSS LEAK PT1	<ul style="list-style-type: none"> <li>- Valve leak, leak across valve seat</li> <li>- Loose VCR connection</li> <li>- Change Bulk cycles incorrectly set</li> </ul>	<ul style="list-style-type: none"> <li>- Perform valve seat leak check, leak test across valve seat</li> <li>- Check VCR connections</li> <li>- Check Change Bulk sub-cycle setting</li> </ul>

# Chapter 5

## Features and Components

<b>Section 1</b>	<b>Overview</b>
<b>Section 2</b>	<b>Component Description</b>
<b>Section 3</b>	<b>Available Options</b>

## 5.1. Overview

**NOTE:** Only spare parts that meet the manufacturer's specifications should be used in the ChemGuard® GenIII product line.

### 5.1.1. Operational Features

The ChemGuard® GenIII 110-410 is a single tank (STLR) automated chemical delivery system which will control and monitoring all major system operations, including;

- Continuously delivers uninterrupted supply of chemical from the Bulk container to a process tool.
- External Refill Bulk container (option) maintained at a constant level supplied by the BCD100/200.
- Automated Bulk Change Operation.
- Display shows all operating parameters, current status of Bulk container, chemical levels of each container, and system setup information.
- All purge, process gas lines, exhaust line and pneumatic lines can be monitored continuously for pressure.
- Programmable container change operation, Leak Rate & Cycle Purge parameters.
- Purge procedures that monitors the removal of all chemical from container connections.
- Automatic leak check detects leaks which safeguards against chemical exposure.
- Patented UltraSonic Empty Sensor allows 100% Utilization of Chemical from Bulk Container.
- All alarms are displayed on the LED HMI color touch display.
- System alarm displayed for ease of troubleshooting and include Life Safety, system pressure, system level, system status, vacuum status and degasser alarms, if degasser option is ordered.

**NOTE:** CG410 includes a Smoke detector and UVIR sensor.

**NOTE:** CG310 includes a UVIR sensor option.

### 5.1.2. Purity Control Features

- Process gas lines welded, electro-polished 316L stainless steel.
- All wetted surfaces constructed of 316L stainless steel, the valve seats made of KEL-F on certain model, other valve seat materials are available on certain models as well.
- All orbital TIG welded plumbing using VCR fittings to maximize leak integrity.
- Reservoir container constructed of 316L stainless steel.
- Cycle Purge and Leak Checks automated to prevent atmospheric contamination of the chemical during reservoir change out.

### 5.1.3. Safety and Security Features

- No spark sources in chemical storage area of cabinet for inherently safe design.
- Built-in seismic safety bolts down points per S2 Standard. Refer to Chapter 3 for bolt down dimensions.
- Specially designed scale for accurate weight detection of the Bulk containers,  $\pm 150$  grams,  $\pm 0.1\%$  of full scale.
- Pull-out tray to simplify Bulk container replacement.
- 110% primary spill containment is standard on ChemGuard® Cabinets.

- Redundant overfill protection of the Bulk containers, including ultrasonic liquid sensors mounted on the vent and vacuum lines.
- Latching cabinet front door with key lock.
- Redundant dual liquid spill detection standard in all cabinets.
- Bulk container ASME-certified for pressure, rated to 120 PSIG.
- Pressure-relief is built in to prevent over-pressure of the Bulk containers. Pressure-relief valve set for 110 PSIG.
- Designed using SEMI S2, CE Heavy Industry and U.L. safety specifications as guidelines.
- Optional lower explosion limit (LEL) combustible vapor detection sensor is available. Consult your Versum Materials, Inc. Sales Representative.
- Optional fire (temperature rate of rise) detection sensor is available. Consult your Versum Materials, Inc. Sales Representative.
- Optional Fire Suppression System is available. Consult your Versum Materials, Inc. Sales Representative.

#### **5.1.4. Installation in Classified Locations**

The ChemGuard® is approved for use in NEC (National Electric Code) Class I, Division 2 (U.S.A) and ATEX Zone (Group) 2, Category 3 (Europe) classified locations provided that the controller Type Z purge is enabled.

The Type Z purge is required to maintain a positive pressure of Nitrogen at or above 0.10 in. W.C. as dictated by the National Fire Protection Agency (NFPA) and European directives (ATEX). In applications where Type Z purge is required, the controller will be equipped with a pressure switch to monitor the presence of purge gas. The Type Z purge will require a flow rate of approximately 5.5 LPM.

#### **5.1.5. Z-Purge Setup and Procedure**

The Z purge pressure is controlled by a needle valve at rear of controller. After opening the controller in a suspected hazardous area it is necessary to use the following procedure to re-establish the Z-purge before operating the controller:

1. Close the controller door and secure latch completely.
2. Open the needle valve 4 to 5 turns (counter-clockwise). Allow the controller to purge for 30 minutes at 5.5 SLPM flowrate.
3. Flow requirements to operate the solenoid valves are very small, less than 1 LPM (2 CFH). If Type Z purge is required, a flow rate of 5.5 LPM will be needed, depending on the tightness of the individual controller and the installation.

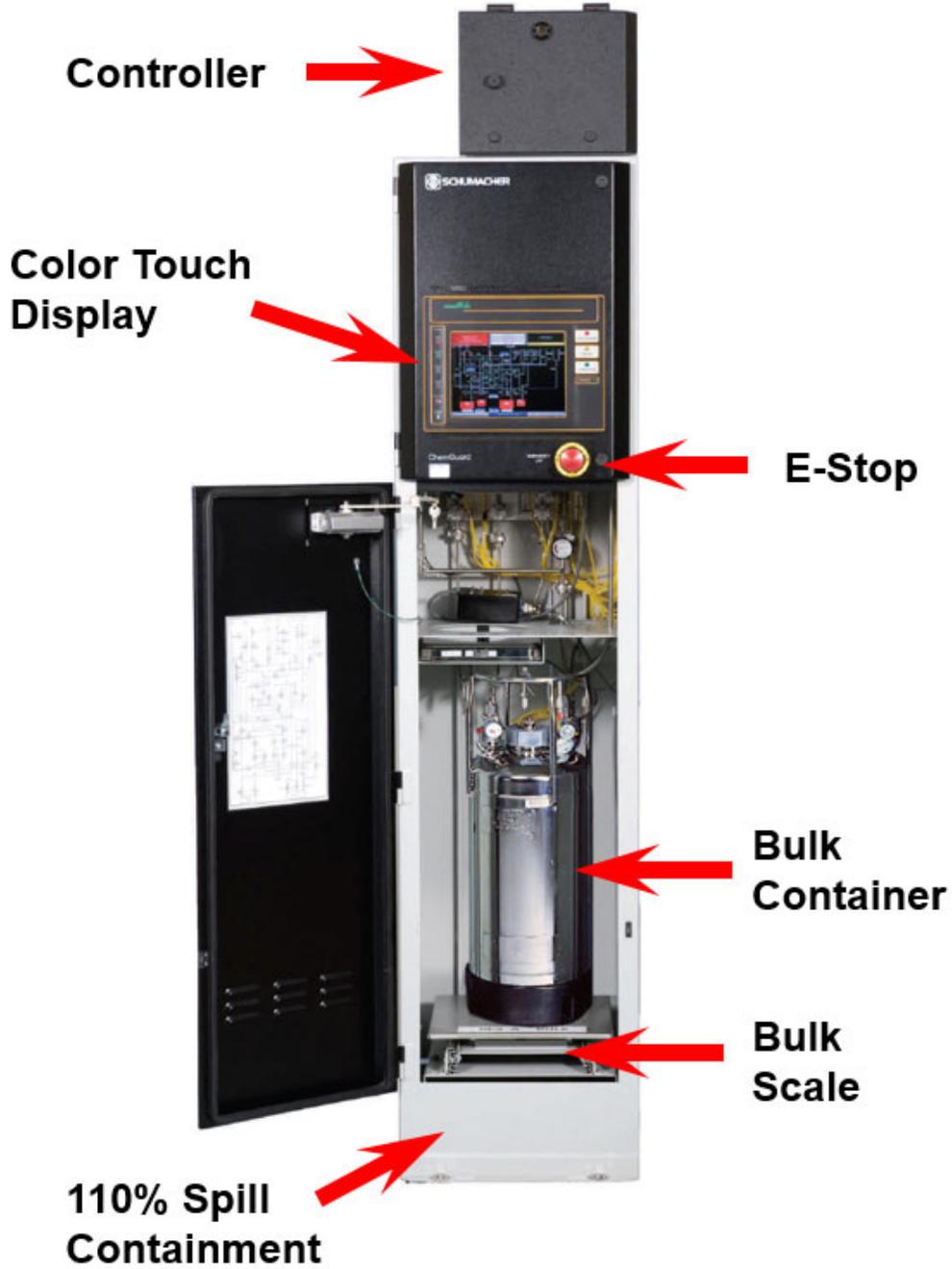
## 5.2. Component Description

The ChemGuard® GenIII consists of these major subassemblies:

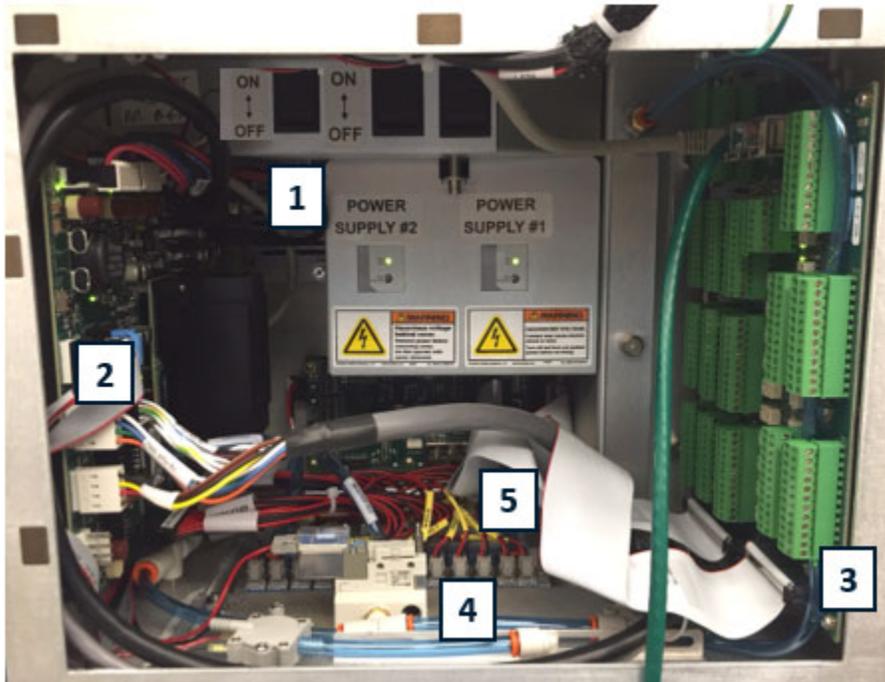
- Chemical Cabinet
- Controller Electronics Enclosure
- Emergency Manual Stop (E-Stop)
- LED VGA Color Touch Display Screen

**NOTE:** The Bulk container not included with the ChemGuard® cabinet unless the External Bulk Refill option is ordered which includes the refillable Bulk container. Consult your Versum Materials, Inc. representative for more details.

Figure 5-1: ChemGuard® GenIII



**Figure 5-2: ChemGuard® Electronic Enclosure**



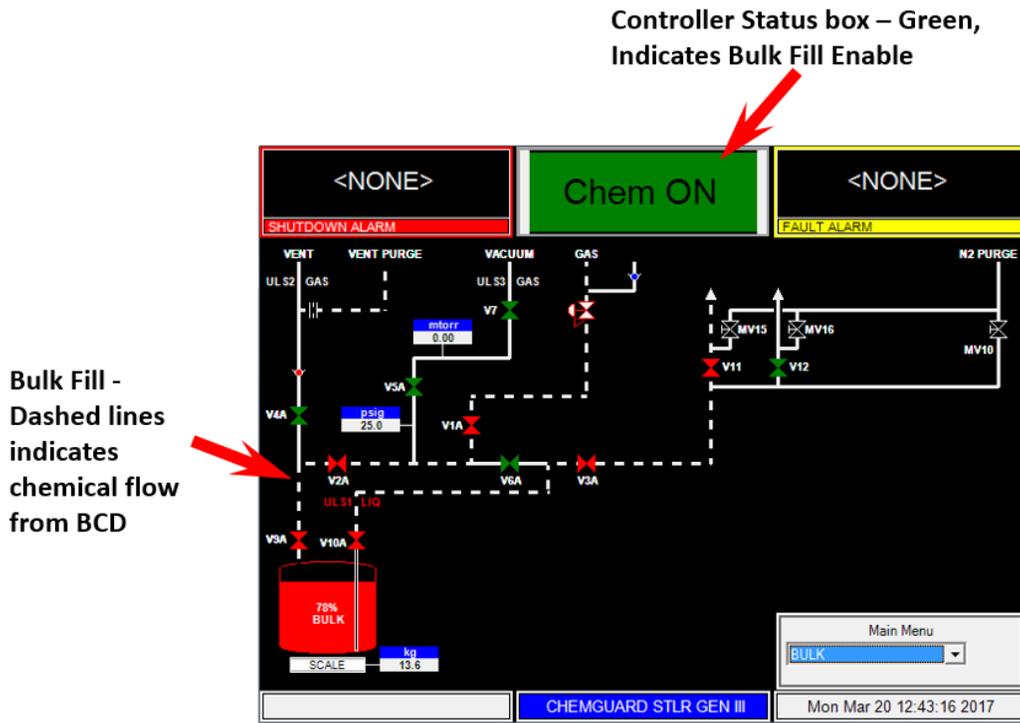
ITEM#	ITEM	FUNCTION
1	Power Supply	Single or dual, redundant power supply with On-Off switch and power indicator
2	Carrier board, AP1565	Main controller board with on-board microprocessor and redundant ARS (automated restart) microprocessor
3	Tool IO board, AP1614	Cabinet IO Interface with Life Safety and Process Tools
4	Master Solenoid	Controls main pneumatic air supply to ChemGuard® cabinet. Closes to isolate pneumatic supply (hardware interlock) in a life safety alarm condition
5	Solenoid Manifold	Main manifold for all pneumatic control valves in the ChemGuard® cabinet

**5.2.1. Emergency Manual Off (E-Stop)**

The Emergency Manual Off (E-Stop) circuit provides for emergency shutdown of ChemGuard® cabinet. The E-Stop switch is located on the upper door, immediately on the lower right of the upper door. When pressed, it will cutoff the pneumatic air pressure to the master solenoid and all valves will return to their normally de-activated condition.

**NOTE:** System power will remain on to the ChemGuard® allowing continual monitoring of system conditions.

**Figure 5-3: Color Touch Display Screen**



**NOTE:** The above figure is a typical display screen of the ChemGuard® Gen III, depending on system configuration and options ordered.

**5.2.2. Bulk Container**

The bulk container stores and supply the process chemical used in customer applications.

Many bulk container-types are available for use with ChemGuard®. Depending on customer requirements, containers of different capacities may be used in one ChemGuard® installation.

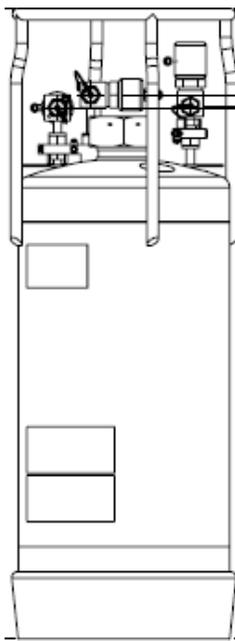
**Standard Bulk Pigtail Connections:**

- Inlet Pigtail has 1/4 inch female VCR (1/4" FVCR) connection to container valve on headspace (gas) side.
- Outlet Pigtail has 1/4 inch male VCR (1/4" MVCR) connection to container valve on diptube (liquid) side.

**NOTE:** The Bulk container not included with the ChemGuard® cabinet unless the External Bulk Refill option is ordered which includes the refillable Bulk container. Consult your Versum Materials, Inc. representative for more details.

Bulk Container installation is described in Chapter 4.

**Figure 5-4: Bulk Container**



### 5.2.3. Chemicals Authorized for Use in ChemGuard®

Please contact an Versum Materials, Inc. service representative for complete list of authorized chemistries to be used in the ChemGuard® and the model ChemGuard® required.

For chemicals authorized for use in ChemGuard® Refer to document V-TSA060, ChemGuard® Chemical Fill Matrix or contact Versum Materials for detail.

Some of these chemicals require specially-configured ChemGuard® cabinets. For physical hazards and hazard thresholds associated with these chemicals, contact Versum Materials, Inc. for SDS information for each chemical-type.

It is the customer's responsibility to comply with OSHA Hazard-Communication Standards regarding chemical container-labeling and cabinet-labeling. Versum Materials, Inc. advises the customer to affix a label outside the ChemGuard® cabinet, identifying the chemical therein.

Use of chemicals in ChemGuard® may fall under the guidelines of specific government agencies. It is the customer's responsibility to determine and comply with appropriate guidelines for specific chemicals used. For further information, contact Versum Materials, Inc.

Versum Materials, Inc. recommends that exhaust connection to the ChemGuard® be a facility-based control.

### 5.3. Available Options

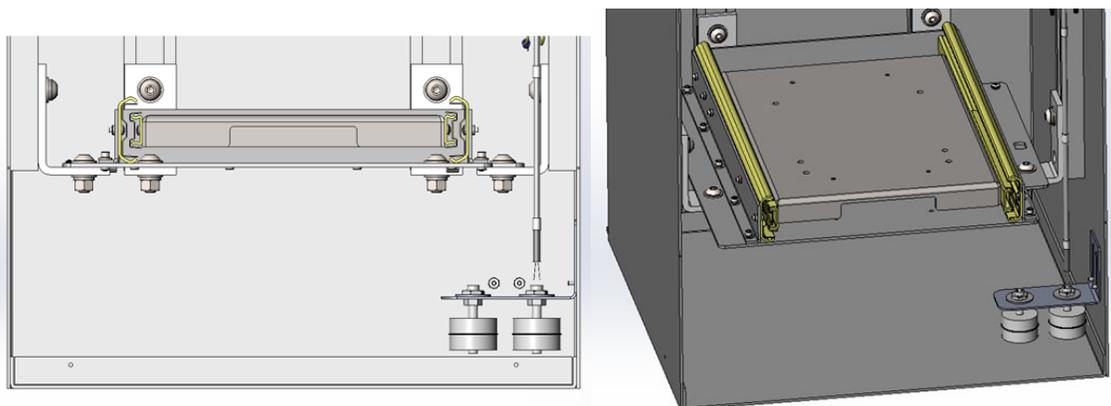
#### 5.3.1. Cabinet Spill Detection

##### Sump Spill (Dual Float Sensors)

The ChemGuard® is equipped with dual float switches as standard offering for spill detection. When a single float detects a spill, a fault alarm is displayed. If both float switches detect a spill, a shutdown alarm will be generated and will terminate all operations and return the cabinet to IDLE state.

**NOTE:** The Dual Float Sensors (SUMP SPILL) does not require any calibration, it is recommended to verify the floats move freely by lifting each one up and it should free fall down. Verify no build-up on the Float and Stem which can cause hang-up. Please refer to Chapter 7 for more detail test on the Sump Spill (Dual Float Sensors).

**Figure 5-5: Sump Spill (Dual Float Sensors)**



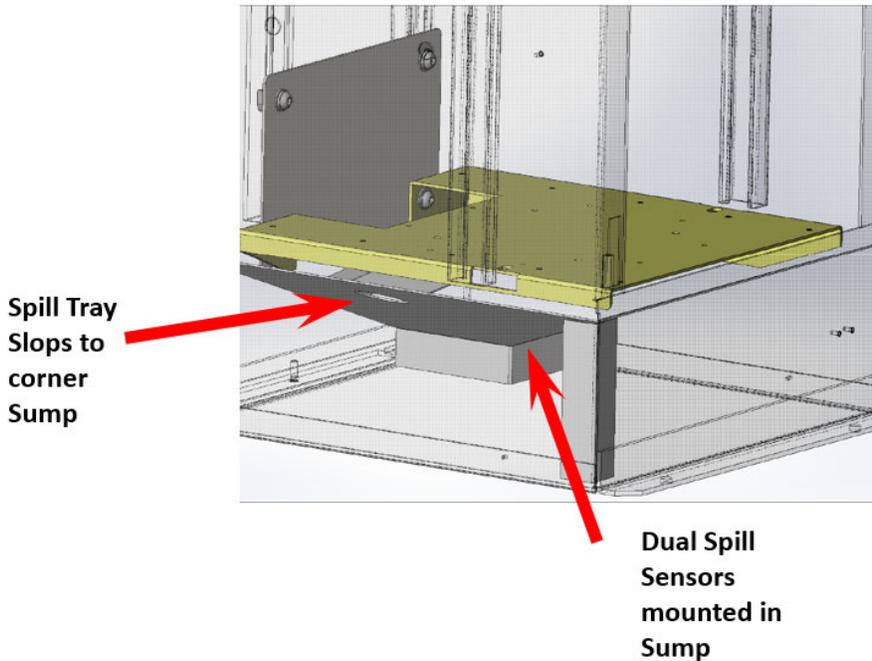
##### Sump Spill Funnel Option

The ChemGuard® sump spill funnel is a unique cabinet design for use with highly flammable chemicals and solvents like OCTANE, HEXANE and Z4MS. When the minimum exhaust flow of 30 CFM cannot keep the concentration of vapors below LEL should there be a spill, the ChemGuard® cabinet is equipped with spill tray that slopes toward one corner of the cabinet where the dual float switches are installed, Refer to Figure 5-6. Certain CG310 chemistries require this option.

When a liquid leak occurs, the chemical is funneled to the corner sump where the float switches will detect a spill, minimizing the volume of chemical released from the spill and allowing for the vapors to remain below the LEL of the chemical.

**NOTE:** Approximately 0.4 liters of chemical will spill into the sump compared to 4 liters in a standard ChemGuard®.

**Figure 5-6: Sump Spill Funnel Option**



### 5.3.2. Vermiculite Pillows

ChemGuard® CG410 is specifically designed for Pyrophoric liquids which burn upon contact with air. As an engineering control vermiculite pillows are placed in bottom of the cabinet to absorb the liquid and help to extinguish a fire.

**NOTE:** Do not open the vermiculite pillows to pour the vermiculite into the bottom of the cabinet. The cabinet exhaust air will kick up the vermiculite dust and will get dust throughout the cabinet.

**NOTE:** The primary leak detector in the ChemGuard® CG410 is the smoke detector and UVIR. Upon contact with air Pyrophoric liquid will ignite resulting in a flame and smoke.

### 5.3.3. Smoke Detector

The ChemGuard® CG410 comes standard with a Smoke Detector. The smoke detector is used to respond to a leak condition. Upon contact with air Pyrophoric liquid will ignite resulting in a flame and smoke. This will provide an early indication of a fire inside the ChemGuard® cabinet.

When smoke is detected by the smoke detector, a “SMOKE DETECT” alarm will be generated and returning the cabinet to IDLE state.

Refer to Appendix H for calibration and maintenance of the Smoke Detector.

### 5.3.4. Ultraviolet Infrared (UVIR) Detector (optional for CG310)

The ChemGuard® CG410 comes standard with an Ultraviolet Infrared (UVIR) Detector. The UVIR combines a UV and an IR flame detector in one device to respond to a flame condition. This will provide an early indication of a fire inside the ChemGuard® CG410 or CG310 (if option selected) cabinet.

When a fire is detected by the UVIR a “UVIR DETECT” alarm will be generated and returning the cabinet to IDLE state.

Refer to Addendum Y for calibration and maintenance of the UV/IR.

### 5.3.5. High Temperature Detection Switch (optional)

A temperature switch mounted on the exhaust sensor assembly will alarm if temperature inside the ChemGuard® cabinet rises above 45-52°C. A High Temp alarm will be generated and will terminate all operations and return the cabinet to IDLE state. Refer to Chapter 7 for testing of the sensor.

### 5.3.6. System Combustible Vapor Detection (optional)

An optional combustible vapor detector is located near the exhaust flow stream of the ChemGuard®. When combustible chemical vapors come from the inner ChemGuard® cabinet, a VAPOR Alarm is activated.

This alarm will terminate any operation in progress, and will return all valves to their safe (deactivated) condition to prevent further chemical flow.

The vapor pressures of many process chemicals used in the ChemGuard® are too low to be detected by the vapor detector, and also are too low to be in their flammable/combustible ranges. However, most are air-sensitive chemicals that will develop byproducts detectable by the combustible vapor detection system.

**NOTE:** The combustible vapor detection system is not designed for use in detecting Threshold Limit Value (TLV) concentrations of process chemical. The customer is responsible for determining whether such protection is required and for providing this equipment. Refer to Chapter 7 for vapor detector calibration and maintenance.

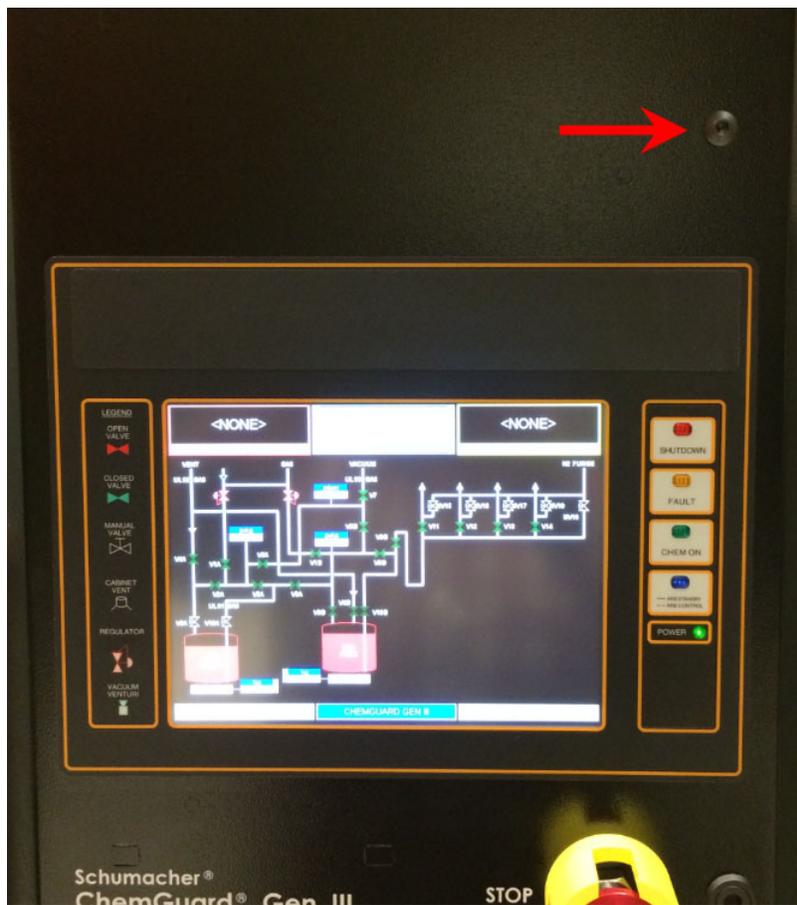
### 5.3.7. Hazardous Vapor Sniffer Port

There is a sniffer port located on the display door of the cabinet enclosure as shown in the below figure. In an event where the chemical containment is in question or the internal cabinet atmosphere needs to be verified, removal of the sniffer port screw can allow access for a customer approved gas detector to be inserted.



**Always wear proper PPE for hazardous atmosphere when the cabinet internal atmosphere is in question or unknown. THIS PORT IS NOT TO BE USED WHEN FLAMMABLE OR TOXIC ATMOSPHERE IS KNOWN TO EXIST INSIDE CABINET.**

**Figure 5-7: Sniffer Port Location**



### 5.3.8. Fire Suppression System (optional)

The Fire Suppression System is an independent system, equipped with a rate of rise detection sensor. The sensor will trigger an alarm if a rise of temperature in the cabinet exceeds 40°F in a period of less than one (1) minute. The Fire Suppression System will then be activated and CO<sub>2</sub> released into the ChemGuard® cabinet extinguishing a fire within the cabinet. It will also send a signal to the ChemGuard® generating a shutdown alarm and returning the cabinet to IDLE state.

As the fire suppression option is an independent system, authorized personnel should always review the manufacturers operation manual prior to install or service.



**WARNING**

**The system must be independently powered down and locked out at the circuit breaker prior to any work.**



**WARNING**

**Hazardous energy present includes stored pressurized CO<sub>2</sub>. Always wear proper PPE and follow manufacturer's instruction manual.**

**NOTE:** The CG Fire option is an external and independent Fire Detection and Suppression System. The CG Fire option installs directly onto ChemGuard® cabinet to minimize space requirements and piping connections. While the CG Fire option is not certified to meet CE Standard, it does meet the minimum safety requirements outlined in the manufacturer's operating manual.

Refer to Appendix G for calibration and maintenance of the Fire Detection and Suppression System.

**5.3.9. Degasser (optional)**

The degasser is an optional component to be installed prior to the Outlet plumbing manifold. It can be installed on most ChemGuard® models. The degasser removes dissolved Helium push gas from the chemical delivery stream when vacuum is applied to the internal semi-permeable membrane coil. Contact Versum Materials, Inc. Delivery Systems for more detail.

Refer to Addendum D for information on the Versum Materials, Inc High Flow Degasser module.

**5.3.10. Degasser Vacuum Pump (optional)**

An oil-sealed, rotary vane vacuum pump is offered as standard with the degasser option. If desired, the owner may employ an alternative vacuum pump provided that it can reach a base vacuum of at least 50 mTorr. Only Versum Materials, Inc. approved pumps may be used with the outlet on the side of the controller.

**NOTE:** The primary vacuum valve to operate Chemical Degasser mode is V8.

**NOTE:** A separate vacuum source is required for supplying the degasser and process panel of the ChemGuard unit. The process panel and degasser cannot share the same vacuum source.

# Chapter 6

## System Operation

- Section 1**      **Theory of Operation**
- Section 2**      **Description of Menus and Operations**
- Section 3**      **Operating Menu**
- Section 4**      **Alarm Types**

**NOTE:** Maintenance personnel shall make use of a step stool or small ladder to safely access the ChemGuard® GEN III controller. Operating personnel shall make use of a step stool to access the touch screen monitor as required.

**NOTE:** The ChemGuard® GEN III cabinet must remain locked during normal operation. The operating personnel shall only unlock and open the lower cabinet door while performing canister changes or prescribed preventative maintenance procedures and the area is known to be free of flammables.

## 6.1. Theory of Operation

### 6.1.1. Overview

The ChemGuard® is designed to deliver liquid chemical (from 1, 2, or 4 chemical output lines) directly to external refill equipment, i.e. Liquid VMB, ChemGuard® and process tool(s).

All Versum Materials Inc. chemical is supplied in bulk stainless steel reservoir containers (refer to Chapter 5).

Using pressurized inert gas, Nitrogen, Helium or Argon, the ChemGuard® pushes chemical from the bulk container to the external refill equipment upon a fill request or when the refill equipment opens its controlling refill valve. Fill continues until the refill equipment reaches the refill level and either terminates the request or closes its controlling refill valve.

In a Direct Liquid Injection (DLI) process Helium gas must be controlled in a process fluid in order to prevent damage or improper operation of the liquid MFC. This is accomplished by keeping the chemical level constant at all times in the Bulk container and by the use of an optional degasser module.

**NOTE:** The use of a particular degasser is specified by the OEM tool manufacturer.

**NOTE:** Applications that require the use of a degasser module are typically limited to research and development sites. When used in a high-volume manufacturing environment, the CG100-400NT should be specified.

The bulk chemical can be supplied in either a 11-, 19- or 38-Liter container or the Bulk container can remain captive and be bulk filled from the Versum Materials, Inc. ChemGuard® BCD system.

The ChemGuard® is a Windows CE operation system which monitors all key parameters that control the operations. The controller automatically performs most maintenance functions. For example, the Cycle Purge and Leak Check operations are automated functions designed into the Change Bulk operation. This automation reduces the time and effort involved in performing common maintenance tasks.

An automated Change Bulk operation ensures the ability to change the chemical container without contaminating the chemical or causing exposure to the user or the environment. The plumbing lines to the bulk container are designed with flexibility to help while installing the container. Pressure relief is provided to prevent over-pressurization of the bulk container.

The Emergency Manual Off (EMO) circuit provides an emergency stop to shutdown the Pneumatic supply source to the cabinet.

A remote life safety input can be hooked up directly to the ChemGuard® controller to place system in a safe, idle condition. Contact Versum Materials Inc. for details.

Password protection prevents unauthorized personnel from attempting key tasks. Operating modes are displayed to simplify operation.

The ChemGuard® has been designed to meet or exceed industry environmental / safety regulations and specifications. The cabinet is steel, and contains 110% spill containment. All power sources capable of providing shocks or sparks have been isolated and contained completely outside of the chemical cabinet.

Communication to the Process Tool is provided via the input/outputs from the Tool IO board, AP1614, refer to Chapter 3.

**NOTE:** The exact configuration required depends on the Process Tools in use. Please contact Versum Materials, Inc. service or marketing to determine the best setup for your application.

## 6.2. Description of Menus and Operations

3 Primary Operations performed by the ChemGuard®:

- Chem On
- Bulk Change
- External Fill (option)

### 6.2.1. Chem On (Bulk Fill)

External refill equipment sends request to have their onboard supply ampoules replenished without affecting chemical delivery or chemical pressure to the process tool.

Chemical will be pressurized from the Bulk container through valve V3 to the output manifold valves V11-V14. To fill chemical from the ChemGuard® to the refill equipment, valves V11-V14 must be activated by applying input signal to the CHEM ON VALVE input.

### 6.2.2. Change BULK Operation

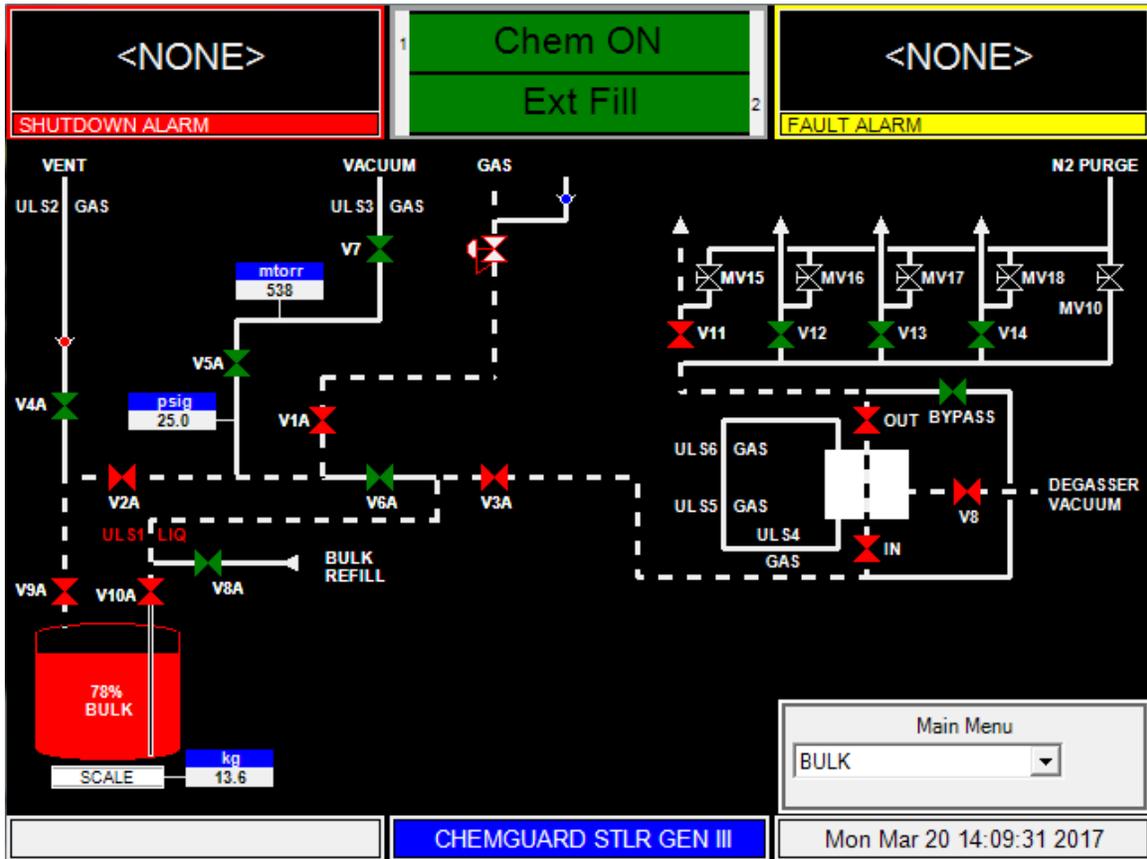
- Automated Bulk Change operation.
- Does not affect chemical delivery to the process tool
- Ultrasonic empty sensor generates bulk empty alarm once 100% of chemical has been utilized
- Optional bulk scale will monitor chemical level of Bulk container
- Operator prompts to perform user tasks- i.e. “Change Bulk”
- Purge and leak test operations automatically performed
- Bulk container weight updated when optional bulk scale installed
- Chem On “locked out” until successful completion of Change Bulk operation

### 6.3. Operating Menu

#### 6.3.1. Display Screen

Located on the front face of the controller, the display screen is an LED color touch display that contains a graphical display of the Bulk and Process container, shutdown and fault alarm boxes, a controller status box and selection window. The LED display provides a lighted display, and visual indication of pneumatic valve positions. Open valves are shown in red and closed valves are shown in green. The valve condition colors conform to ISA standards.

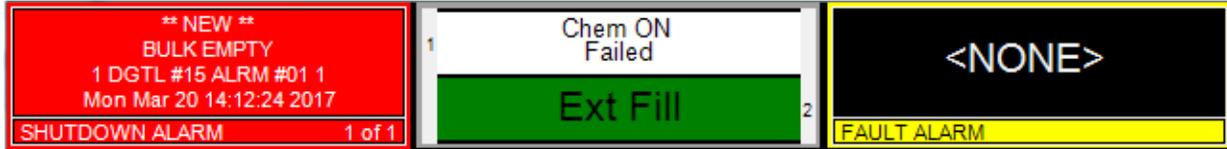
**Figure 6-1: ChemGuard GENIII Display Screen**



#### 6.3.2. Alarm and Controller Status Boxes

Shutdown alarms in the cabinet appear on the SHUTDOWN ALARM box, located in the top left hand corner of the screen. Fault alarms appear on the FAULT ALARM box, located in the top right hand corner of the screen. If <NONE> is displayed, no alarm conditions are present in the cabinet. A time stamp of when the alarm occurred will be displayed with each alarm. Alarms can be acknowledged and the alarm buzzer can be muted by clicking once anywhere on the alarm box. Double clicking on the alarm text box will clear the alarm.

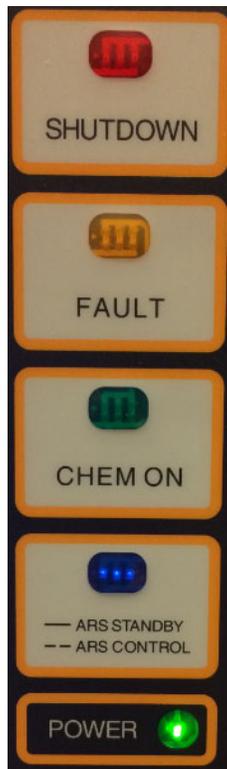
**Figure 6-2: Alarm and Controller Status Box**



**6.3.3. System Status LEDs**

Additionally, LEDs that display ChemGuard® functions are located to the right of the LCD display. The table below describes these LEDs and their functions. The fault alarms are indicated by a yellow color and the shutdown alarm is identified by red.

**Figure 6-3: System Status LEDs**



**Table 6-1: System Status LEDs Description**

LED	FUNCTION
SHUTDOWN ALARM	This LED flashes red on Shutdown alarm. Once acknowledged, the LED stops flashing but remains red until it is reset.
FAULT ALARM	This LED flashes yellow on Fault alarm. Once acknowledged, the LED stops flashing but remains yellow until it is reset.
CHEMICAL FLOWING	This LED lights green when Process Fill is enabled and tool inputs are satisfied.
ARS – Auto-Restart	This blue LED lit and in steady state indicates Auto-Restart option enabled and monitoring system status. LED flashing blue indicates Auto-Restart was activated.

POWER	This LED indicates that there is +5 VDC power to the unit.
-------	--

### 6.3.4. Main Menu

The selection window, which is shown as a Main Menu, is located on the right side of the screen after a password has been successfully entered. This menu will remain displayed for a configurable amount of time or until the “LOGOUT” key is pressed.

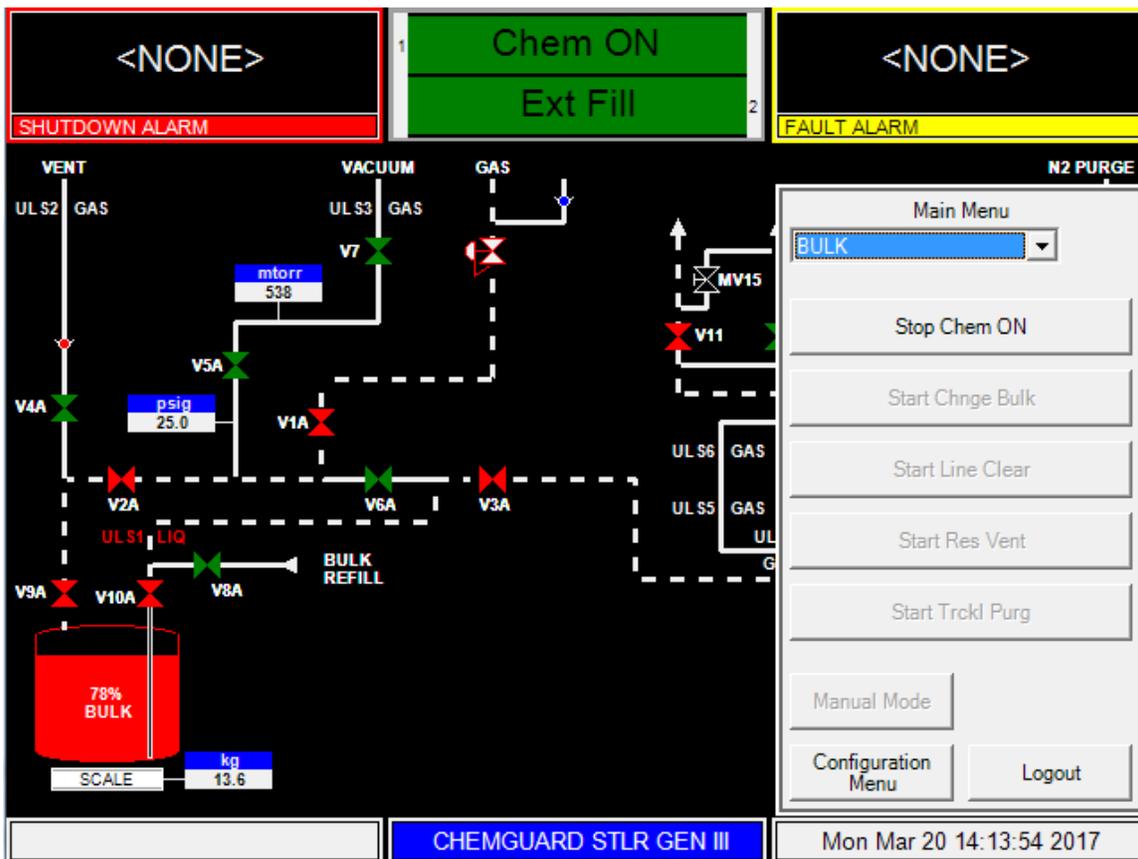
The Main Menu has a pull-down window with two options: BULK, and EXT FILL. Any operation associated with the Bulk container should be selected by choosing Bulk from the pull-down menu, also referred to as the Bulk Main Menu.

It is possible to resize the Main Menu to get a full view of screen. To resize the Main Menu, touch the label, “Main Menu,” at the top of the window.

The Main Menu will appear like the illustration to the right.

To return the Main Menu to its full size, simply touch the words, “Main Menu,” at the top of the window again.

**Figure 6-4: ChemGuard® Main Menu Display Screen**



### 6.3.5. Screen Saver

The screen saver function becomes active during idle or process on states, after the programmed amount of time has elapsed since the last operator keypad action. The screen saver blanks the screen and displays a randomly-moving mode indicator box.

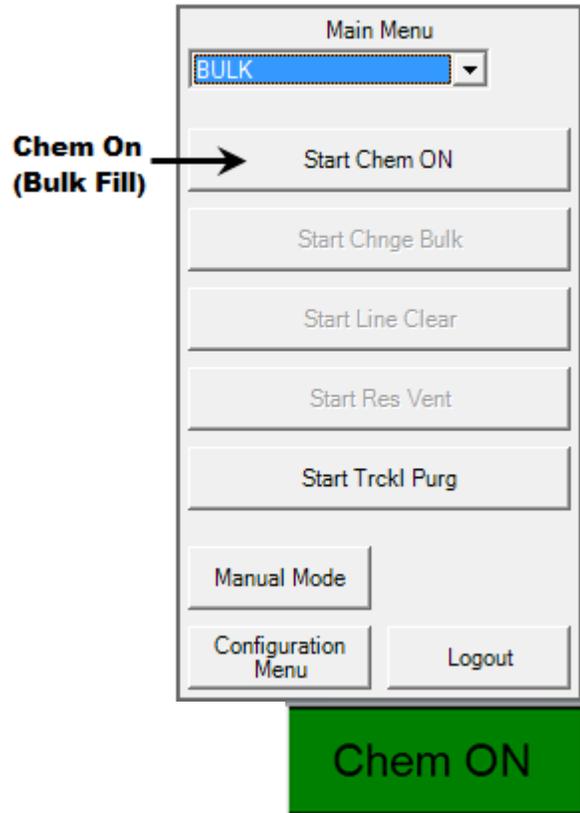
If the operator presses any key or a new alarm appears while the screen saver is active, the screen saver function will become inactive and the key pressed will be ignored. The screen saver function will not be active while a fault or shutdown alarm is present, an active prompt is displayed, or during any mode/sequence other than idle and Chem On.

### 6.3.6. Bulk Main Menu Options

#### Chem On (Start Bulk Fill)

This operation allows chemical to fill from the Bulk container to the External Refill equipment via the outputs valves V11 thru V14. From the pull-down menu of the Main Menu, select Bulk (if not selected) to gain access to the Bulk Main Menu. Click **START Chem ON**.

- In this option: Select **Start Chem ON** to enable Bulk fill
- Bulk fill enable requires either Memory Management > Variables, 77-80 to be set for 0.00 (factory default) or a Bulk fill signal input at TB1-4 on the Tool IO board, refer to Chapter 3
- Controller status box changes from Chem ON Stopped, white to Chem ON, green
- Menu option **Stop Chem ON** will be enabled once **Start Chem ON** is selected. Clicking on **Stop Chem ON** option stops, disables Bulk fill



The cabinet remains in Chem ON status until one of the following conditions occurs:

- Chemical level in the Bulk container reaches empty
- Operator terminates the operation by selecting Stop Chem ON
- A shutdown alarm occurs

#### Change Bulk operation (START CHNGE BULK)

This option guides the operator through steps to remove and replace Bulk container. Change Bulk operation must be performed any time to remove or install Bulk container.



Refer to Chapter 4 for detail information.



**WARNING:** Review corporate safety policy and in-house safety procedures before handling any chemical. The chemical handler should follow procedures in the Material Safety Data Sheet (MSDS) on chemical being used. Secondary containment and cleanup material should be available in the event of chemical spill. Proper personal protective equipment must be used.

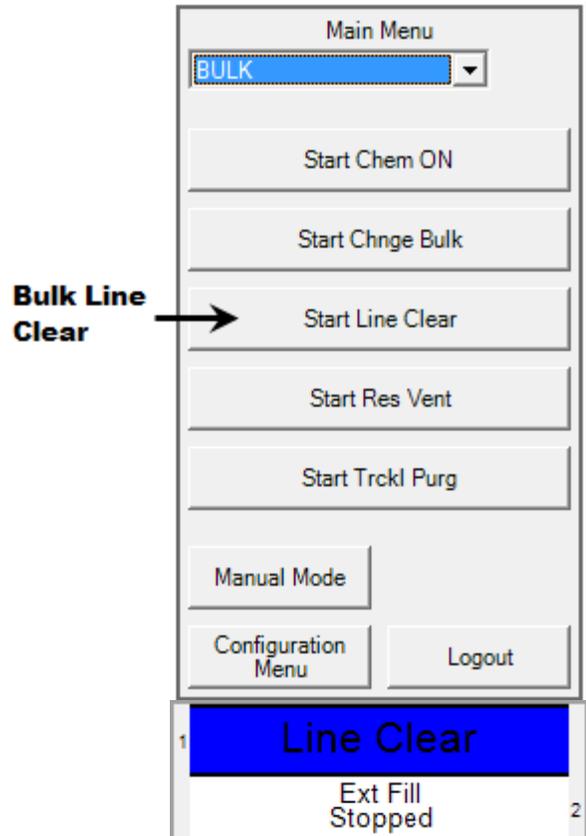
**WARNUNG:** Vor dem Umgang mit Chemikalien die in Ihrem Unternehmen geltenden Sicherheitsbestimmungen und betriebsinternen Sicherheitsverfahren revidieren. Alle mit Chemikalien umgehenden Personen sollten mit den in den Material-Sicherheitsdatenblättern (MSDS) aufgeführten Verfahren über die jeweils verwendete Chemikalie vertraut sein. Ein Zweitbehälter und Reinigungsmittel sollten bereitstehen, falls Chemikalien verschüttet werden.

**AVERTISSEMENT:** Réexaminer les règles de sécurité instituées à votre entreprise et les procédés de sécurité en force avant la manipulation de tous produits chimiques. Tout utilisateur d'un produit chimique doit suivre les procédés prescrits dans les feuilles de normes pour matières (MSDS) concernant les produits chimiques en usage. Un récipient secondaire et du matériel de nettoyage doivent être disponibles au cas où le produit chimique se renverse.

**Bulk Line Clear Operation (START LINE CLEAR)**

Bulk line clear operation pushed chemical from the Bulk outlet pigtail back into the Bulk container. It will continue until Bulk Empty sensor, ULS1 no longer detects liquid but detects gas.

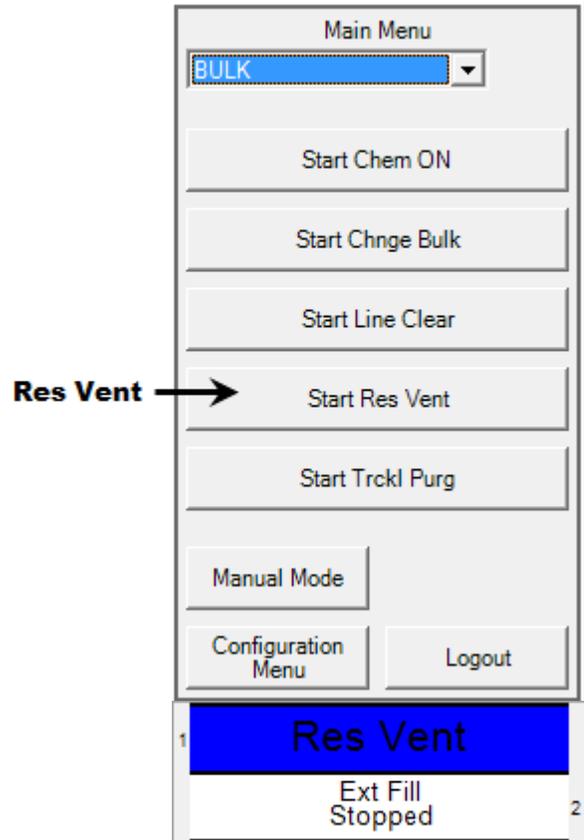
- To start the Bulk line clear operation, click on **START LINE CLEAR** from the Bulk Main Menu
- The Controller status box for Bulk will display “Line Clear” and the STOP LINE CLEAR option will be enabled on the Main Menu
- Select **STOP LINE CLEAR** to stop line clear operation at any time
- Bulk Line Clear operation will continue until Bulk Empty sensor, ULS1 no longer detects liquid
- Bulk line clear operation can be started if there are no shutdown alarms in the cabinet



**Bulk Reservoir Vent Operation (START RES VENT)**

Bulk reservoir vent operation will vent off head pressure of the Bulk container to scrubbed exhaust. When selected the inlet, headspace valve, V9A of the Bulk container is opened to vent. Used in maintenance mode.

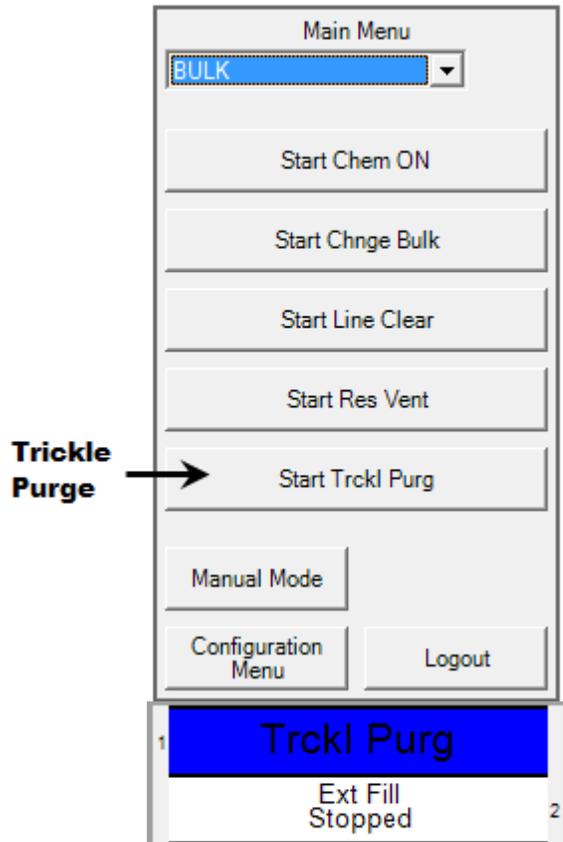
- To start Res Vent operation, click **START RES VENT** on the Bulk Main Menu
- The Controller status box for Bulk displays “Res Vent”
- Res Vent will stop once vent operation completed
- Res Vent operation can be started if there are no shutdown alarms in the cabinet



**Bulk Trickle Purge Operation (START TRCKL PURG) “only available if trickle purge option is ordered”**

Bulk trickle purge operation is an optional feature. The START TRCKL PURG option will be enabled if the trickle purge feature is available in this particular ChemGuard®. When selected purge gas open to Bulk inlet and outlet pigtails. Used in maintenance mode where the bulk container is removed and the pigtails open to atmosphere.

- To start the Bulk trickle purge operation, click **START TRCKL PURG** on the Bulk Main Menu and follow prompted information on the screen
- The Controller status box for Bulk displays “Trickl Purg” and the STOP TRCKL PURG option will be enabled on the Bulk Main Menu
- Select **STOP TRCKL PURG** to stop trickle purge operation at any time
- Bulk trickle purge operation can be started if there are no shutdown alarms in the cabinet



**Bulk Manual Mode Operation (START Manual Mode)**

The Bulk Manual Mode operation is a function to operate individual valve during startup or maintenance mode as well as for troubleshooting, refer to Figure 6-5.

- To start Bulk Manual Mode operation, select **MANUAL MODE** from the Bulk Main Menu.
- Select desired valve on touch screen to be actuated and confirm by pressing “OK”.
- For desired valves to remain actuated, then select the “SECURE” box before changing to different screen.
- At anytime all valves can return to normal state by pressing the “CANCEL” box.

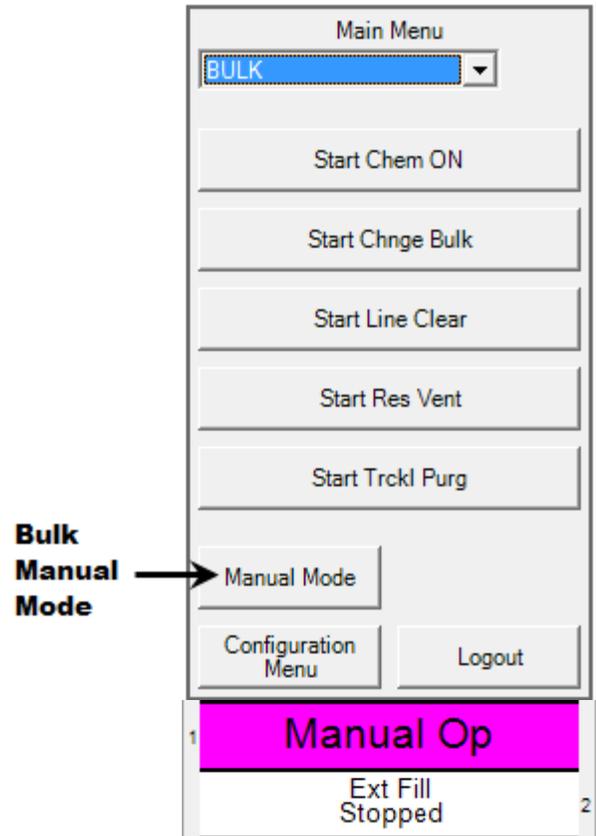
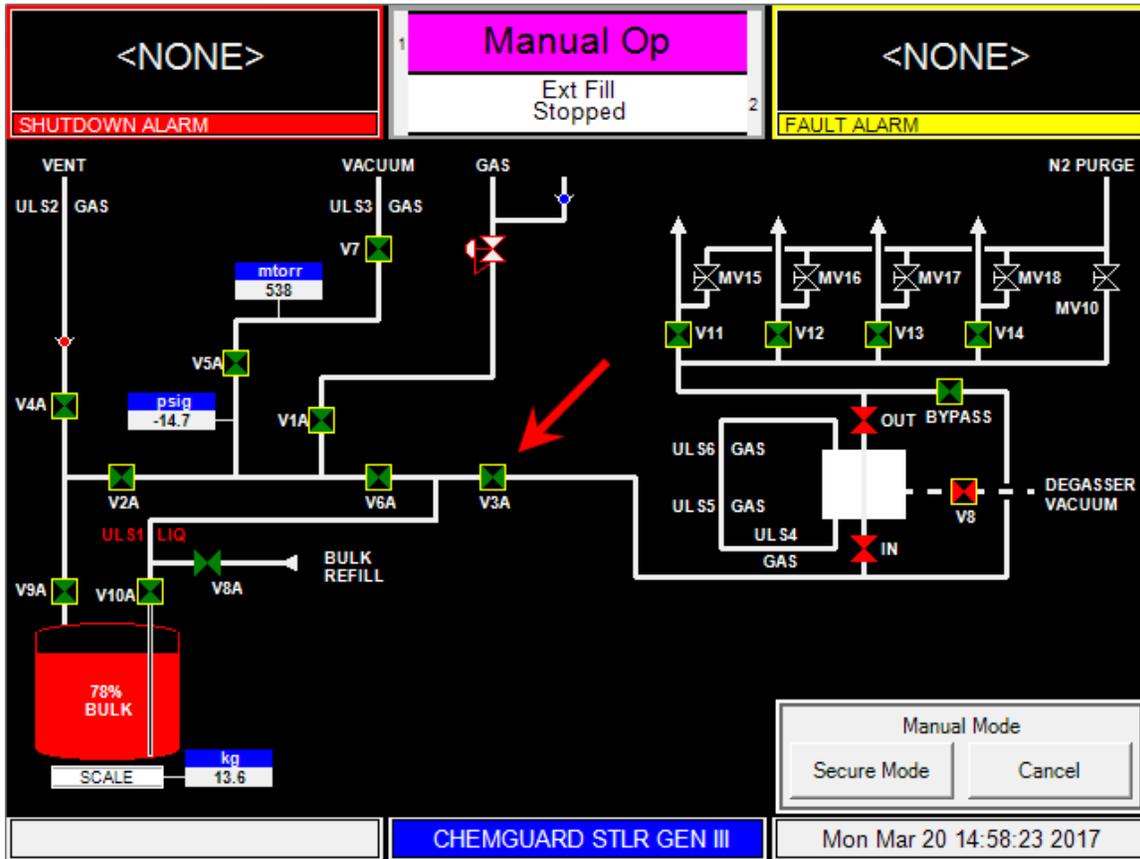


Figure 6-5: CHEMGUARD® Main Menu Display Screen



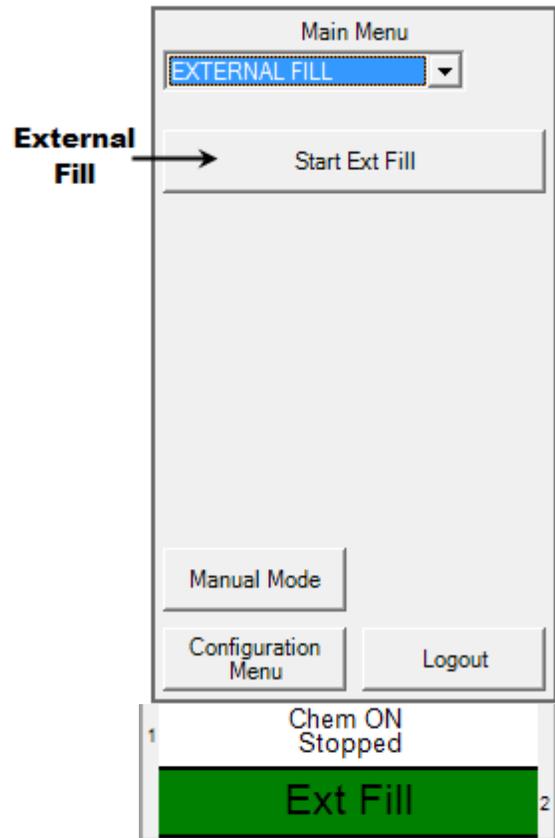
**NOTE:** Yellow box symbol  around all valves allowed to be controller in manual mode.

### 6.3.7. External Fill Main Menu (optional)

This option allows the Bulk container to be refilled from an external source, i.e. BCD100. A REFILL manifold is added to the existing BULK container plumbing, allowing connection of an external FILL line, which controls the REFILL of chemical to the Bulk container. External Fill is an optional feature in ChemGuard® product line, refer to Figure 6-6.

From the pull-down menu of the Main Menu, select EXTERNAL FILL to gain access to this option.

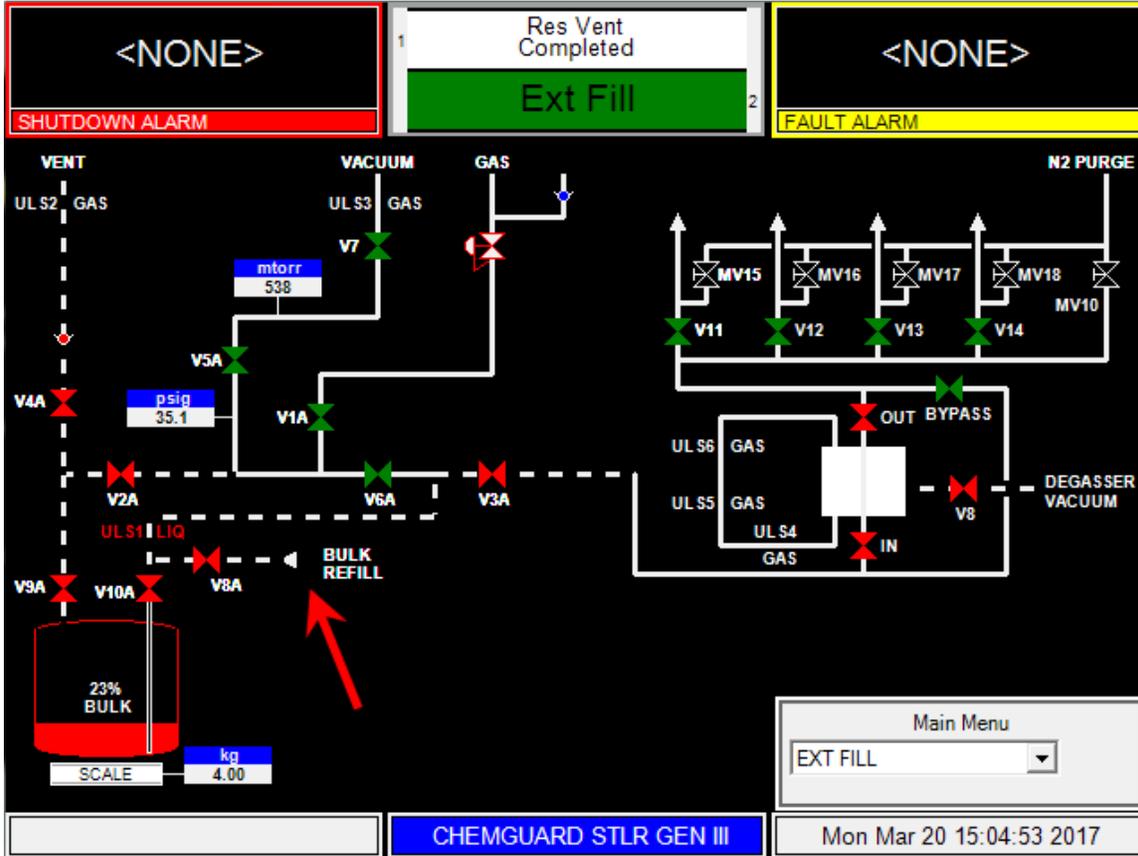
- To start external fill operation, select EXTERNAL FILL from the pull-down menu of Main Menu and click START EXT FILL. Note: **START EXT FILL** will be disabled if BULK REFILL LEVEL setpoint percent in User SETPOINTS of Configuration menu is set to zero
- When START EXT FILL is selected, the controller status box for Bulk container (middle box) will display **EXTERNAL FILL ON**
- Also, the menu option STOP EXTERNAL FILL will be enabled. Selecting **STOP EXTERNAL FILL** allows the operator to disable external fill operation.



The external fill operation will start when all of the following conditions are met:

- The XFILL ENABLE input signal is present at T10 pins 10 and 12 on the Tool IO board, AP1614
- Chemical level in the Bulk container falls below the START XFILL LEVEL set-point defined in User Setpoints of Configuration Menu
- There are no shutdown alarms that prohibit external fill operation

Figure 6-6: External Fill Display Screen



## 6.4. Alarm Types

The alarms in the ChemGuard® cabinet can be classified either as SHUTDOWN alarms or FAULT alarms. Shutdown alarms appear on the SHUTDOWN ALARM box, in RED, located in the top left hand corner of the screen. Fault alarms appear on the FAULT ALARM box, in YELLOW, located in the top right hand corner of the screen. If <NONE> is displayed, no alarm conditions are present. A time stamp of when the alarm occurred will be displayed with each alarm.

Any alarm that occurs in ChemGuard® is displayed along with date and time stamp indicating date and time of alarm occurrence. In addition, independent output signals for shutdown and fault alarm are sent to all the available IO connections in ChemGuard®.

A SHUTDOWN alarms sets off a buzzer, which continues to sound until the alarm has been cleared. A shutdown alarm LED flashes red when an un-acknowledged shutdown alarm is present. The Alarm can be acknowledged by clicking anywhere on the alarm text box. Double-clicking anywhere on the alarm text box will clear the alarm. Once acknowledged, the LED stops flashing, but remains red until it is reset.

A FAULT alarm LED flashes yellow when a fault alarm is present. Once acknowledged, the LED stops flashing, but remains yellow until it is reset. If a light bar tower is available in the system, a red section of light bar flashes when an un-acknowledged shutdown alarm is present. Once acknowledged, the LED stops flashing, but remains red until it is reset. A yellow section of light bar flashes yellow when a fault alarm is present. Once acknowledged, the LED stops flashing, but remains yellow until it is reset.

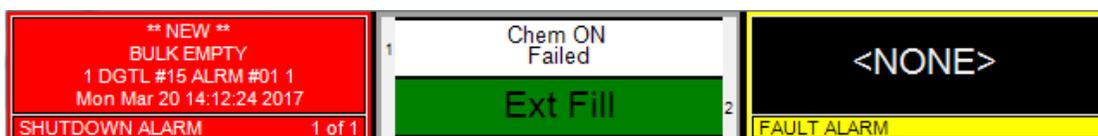
If multiple alarms are present, alarms will scroll in the alarm box with an index and number of alarms present in the cabinet at that time. The ChemGuard® can be configured so that, when the power at the ChemGuard® is turned off, all alarms are activated at the I/O, which in turn, alerts the process tool of a loss of power on the ChemGuard®.

Unacknowledged alarms are marked with keyword “\*\*NEW\*\*”. Even after an alarm is cleared (by double clicking anywhere on alarm text box), if alarm condition exists in the cabinet, the alarm will come back.

### 6.4.1. SHUTDOWN Alarms

When a shutdown alarm occurs, all operations are stopped and all valves return to normal stage. In addition, alarm text message will be displayed, shutdown alarm LED will flash and relay output is sent to all active IO connections so that signal can be sent to the process tool. If there is a light bar in the cabinet, a red section of the light bar will flash if shutdown alarm is un-acknowledged and will remain solid red after the alarm is acknowledged.

**Figure 6-7: Shutdown Alarm Displayed**



### 6.4.2. FAULT Alarms

When a fault alarm occurs, alarm text message will be displayed, fault alarm LED will flash and relay output is sent to all active IO connections so that signal can be sent to the process tool. If there is a light bar in the system, a yellow section of the light bar will flash if the fault alarm is un-acknowledged and will remain solid yellow after the alarm is acknowledged.

**Figure 6-8: Fault Alarm Displayed**

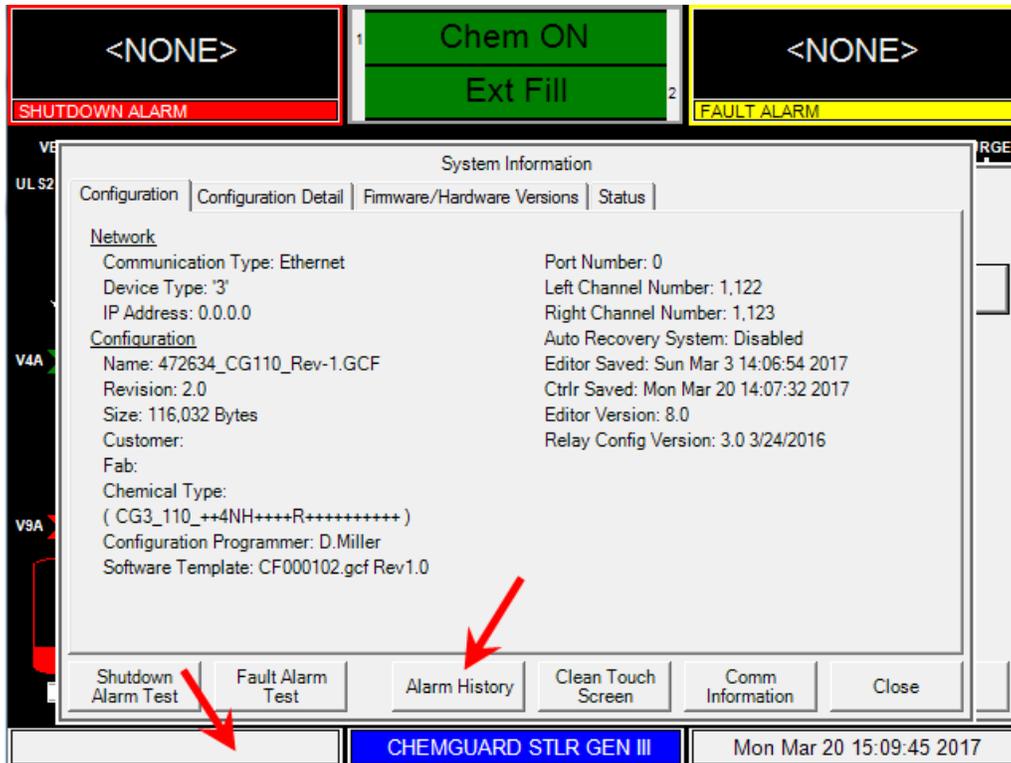


### 6.4.3. Alarm History Menu

A time stamp of when the alarm occurred will be displayed with each alarm. Hundreds of alarms and user log in/out times can be reviewed in System Information > Alarm History Menu, refer to Figure 6-9.

1. Tab anywhere on the lower task bar. System Information menu will be displayed
2. Select Alarm History tab
3. Alarm History (Read Only) menu will be displayed
4. Using scroll bar on right, Alarm History alarm list can be reviewed, refer to Figure 6-10

**Figure 6-9: Accessing Alarm History Menu**



**Figure 6-10: Alarm History Menu**

SHUTDOWN ALARM

1 Chem ON  
Ext Fill 2

FAULT ALARM

Alarm History

Sort By:  
 Date/Time  
 Shutdown Alarm  
 Fault Alarm

Date/Time	Type	Description
03/20/2017 15:09:40	Reset	Alarm(s) Reset by Local User
03/20/2017 15:09:39	Ack	Alarm(s) Acknowledged by Local User
03/20/2017 15:09:32	Fault	DOOR OPEN, DGTL 11, LINE 1,2
03/20/2017 15:09:32	Reset	Alarm(s) Reset by Local User
03/20/2017 15:09:31	Ack	Alarm(s) Acknowledged by Local User
03/20/2017 15:08:33	Fault	DOOR OPEN, DGTL 11, LINE 1,2
03/20/2017 15:08:33	Reset	Alarm(s) Reset by Local User
03/20/2017 15:08:32	Ack	Alarm(s) Acknowledged by Local User
03/20/2017 15:07:46	Fault	DOOR OPEN, DGTL 11, LINE 1,2
03/20/2017 15:07:19	Reset	Alarm(s) Reset by Local User
03/20/2017 15:07:19	Ack	Alarm(s) Acknowledged by Local User
03/20/2017 15:05:27	Shutdown	HIGH PUSH PRES BLK, ANLG 4-2, LINE 1,2
03/20/2017 15:03:36	Reset	Alarm(s) Reset by Local User
03/20/2017 15:03:36	Ack	Alarm(s) Acknowledged by Local User

Alarm Detail Refresh Cancel

CHEMGUARD STLR GEN III Mon Mar 20 15:10:56 2017

# Chapter 7

## Maintenance and Calibration

**Section 1**      **Introduction**

**Section 2**      **Calibration and Testing**

**NOTE:** Maintenance personnel shall make use of a step stool or small ladder to safely access the ChemGuard® GEN III controller. Operating personnel shall make use of a step stool to access the touch screen monitor as required.

## 7.1. Introduction

The ChemGuard® is designed to have minimal maintenance activity associated with its electronics. Proper Lockout-Tagout procedures should be followed to ensure that power is disconnected from the electronic enclosure before any work is performed on this equipment.

## 7.2. Calibration and Testing

Calibration and testing, and any resulting maintenance, should be performed at regular intervals. Refer to Table 7-1.

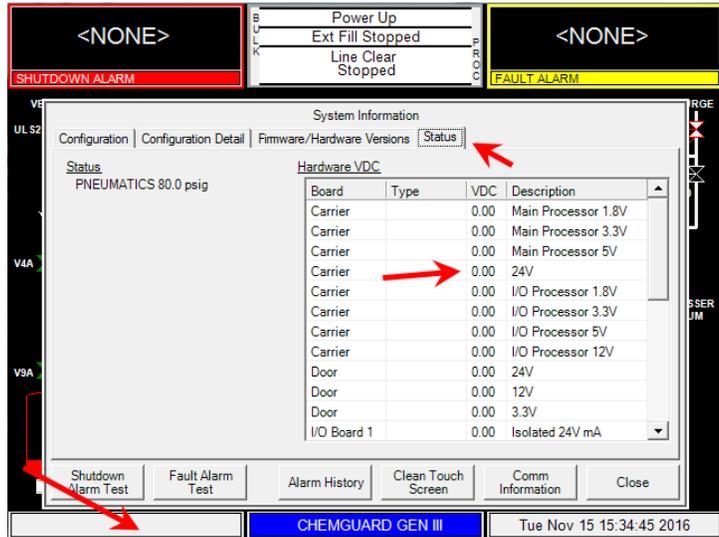
Only qualified personnel trained on the Operation and Maintenance of the ChemGuard® GEN III should attempt to perform maintenance and calibration of the System.

**Table 7-1: Inspection Schedule**

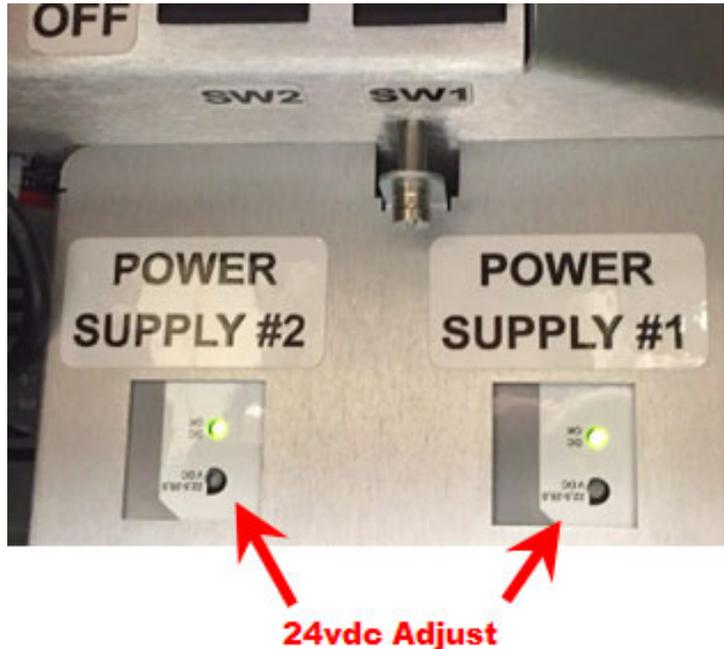
<b>Periodic Inspection</b>	<b>Frequency</b>
Power Supply Verification	12 Months
Scales Verify/Calibration	24 Months or When replaced
Sump Spill Sensor Verification	24 Months
R1 Regulator Verification – refer to Chapter 3	12 Months
PT1 Verification – refer to Chapter 3	12 Months
Vacuum Thermal Couple / Vacuum Baratron	12 Months or When replaced
Ultrasonic Sensor Verification	12 Months
Ultrasonic Sensors Maintenance	24 Months
Vapor Detector Verify/Calibration	12 Months
High Temp Sensor Verification	12 Months

**7.2.1. Power Supply Verification**

1. Select the lower task bar at bottom of the display screen
2. System information screen will be displayed. Select the top tab on the far right labeled "Status"
3. While monitoring Carrier > 24V, adjust Power Supply 1 or 2 for 24V ± .2 vdc



4. When Dual Power Supply option used turn power off at Power Supply 2 to adjust Power Supply 1
5. Turn power off at Power Supply 1 to adjust Power Supply 2
6. Turn both Power Supply's on



**7.2.2. Scale Calibration**

This procedure is used to set the accuracy of the Bulk scale. Calibrated weights are typically used to calibrate the scale but if calibrated weights are not available the weight of the Bulk container can be used.

The container weight will be referenced on the label, both tare weight of the empty container and the total weight of the empty container and chemical fill weight.

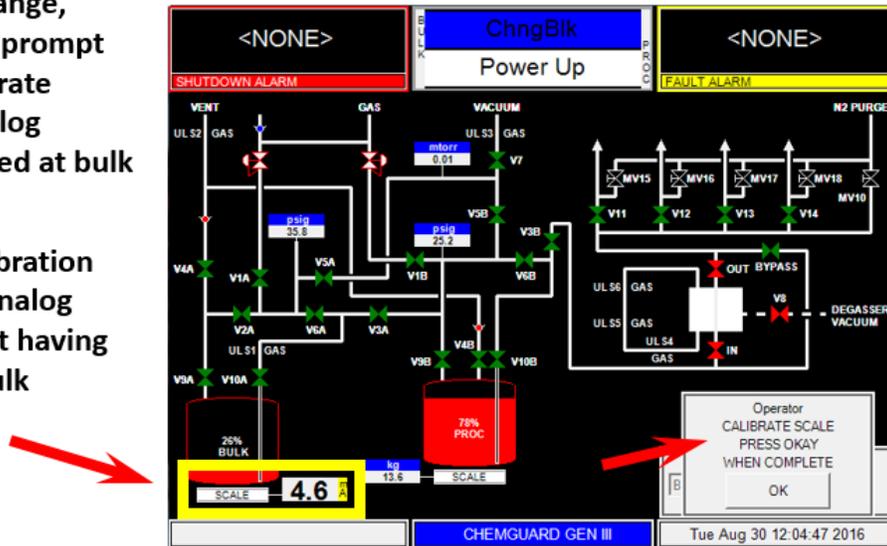
When calibrating the scale use the total weight referenced on the label of a full container and then calibrate before completing the Change Bulk operation and before any chemical is removed from the Bulk container.

Perform Bulk Scale calibration during Change Bulk when user interface prompts operator to Calibrate Scale.

1. Perform Change Bulk operation to remove Bulk container from scale

**During Bulk Change, when operator prompt displays, “Calibrate Scale” bulk analog reading displayed at bulk scale readout**

**This allows calibration using 4-20ma analog reading without having to terminate Bulk Change**



2. Step to Configuration Menu and then select System Test and then TEST ANALOG IN
3. Adjust the zero pot (left side) on front edge of scale as required so the current reads 4.0 mA  $\pm 0.01$ mA on the TEST ANALOG IN display, Label – Bulk Scale. The reading should be at 0 gram

Test Analog In						
Input	Label	Net	Gross	Raw	Hardwire	Connection Point
1	PROCESS SCALE		0.05 kg	4.01 mA	N/A	IF Box - A1
2	BULK SCALE		0.05 kg	4.01 mA	N/A	IF Box - A2
3	PROCESS PUSH		22.7 psig	10.0 mA	N/A	IF Box - A3
4	BULK PUSH		-0.00 psig	6.36 mA	N/A	IF Box - A4
5	VACUUM		3.79 mtorr	3.77 VDC	N/A	IF Box - A5
6	Varian-		3.79 mtorr	0.01 VDC	N/A	IF Box - A6
7	DG VACUUM				N/A	IF Box - A7
8	Analog 8				N/A	IF Box - A8
9	Analog 9				N/A	Tool - TB12 - 1,2,3
10	Tool #1		50.0 psig	12.0 mA	N/A	Tool - TB1,CN5
11	Tool #2		0.00 psig	4.00 mA	N/A	Tool - TB2,CN6
12	Tool #3		0.00 psig	4.00 mA	N/A	Tool - TB3,CN7
13	Tool #4		0.00 psig	4.00 mA	N/A	Tool - TB4,CN8
14	Analog 14				N/A	Tool - TB12 - 4,5,6
15	Analog 15				N/A	N/A
16	Analog 16				N/A	N/A

4. Place calibrated weight(s) on scale surface and verify the weight reading against the actual gram value of the calibrated weight
5. Adjust the span (right side) pot on front edge of scale as required so the weight is within  $\pm 50$  grams of the actual calibrated weight
6. Remove weight(s) and verify zero grams  $\pm 20$  grams. Adjust the zero pot (left side) on front edge of scale as required so NET weight is within  $\pm 20$  grams
7. Repeat until no adjustment is required and measurements are within specifications
8. If calibrating during Change Bulk, select OK prompt to continue on with change

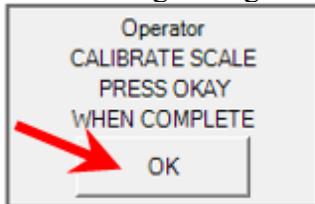
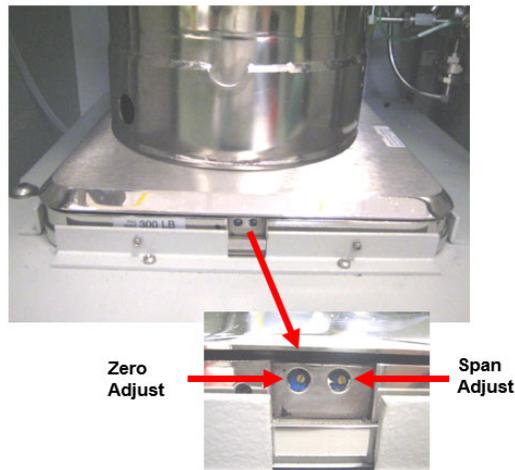


Figure 1: Bulk Scale Zero and Span Adjust



### 7.2.3. Sump Dual Spill Sensors Verification

The Dual Spill Sensor(s) consist of hermetically sealed reed switches actuated by magnetic floats. As the floats rise and fall with the liquid level, the magnetic field passing the switch causes the switch to either open or close.

The ChemGuard® uses Dual Float Sensors which are closed in the normally dry condition and open when wet to generate Fault and/or Shutdown alarms depending on the operation mode.

This procedure should be performed during a CHANGE BULK RESERVOIR Operation, as the Bulk Reservoir must be removed to perform sensor verification.

During the Dual Float Sensors verification, the ChemGuard® should be in an idle condition, it will not deliver chemical to the OEM tools.

**NOTE:** The Dual Float Sensors do not require calibration. It is recommended to verify the floats move freely by lifting each one up and it should freely fall down. Verify there is no build-up of debris on the float and stem which could cause hang-up. The assembly can be cleaned using isopropyl alcohol.

1. The Dual Float Sensors are mounted in the lower portion of the cabinet, mounted to front right side below the bulk container shelf. Reach in and gently lift up one float at a time. The test result should be a SPILL DETECTED or SPILL DETECTED 2 fault alarm.
2. Clear alarm and test other float.
3. Verify each float sensor movement several times to ensure the floats are free falling.
4. Gently lift up both floats at once. The test result should be a DUAL SPILL DETECT shutdown alarm.
5. Verify that the DUAL SPILL DETECT alarm can be cleared

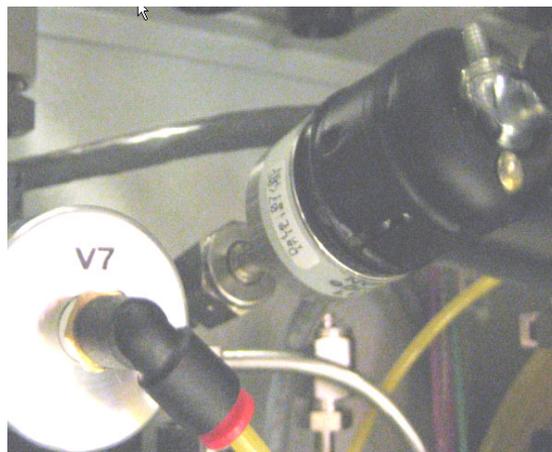
#### 7.2.4. Thermocouple Gauge Verification (CG110/210)

Calibration is not required.

1. Connect a calibrated vacuum reference to the vacuum pump.
2. Apply vacuum to the vacuum port on the ChemGuard®.
3. Enter Manual Mode and open V7. Wait for the vacuum reading on the “Analog Test-In” display of the ChemGuard® to stabilize, 5-10 minutes.
4. The cabinet vacuum base pressure should read approximately 10-50 mTorr. This may be higher than the calibrated vacuum reference.
5. Switch V7 off and remove the vacuum reference.

**NOTE:** Document base pressure reading for this cabinet. This reading will be used for Change Bulk operation and when conducting leak checks of the system.

**Figure 7-2: CG100/210 Thermocouple Gauge**



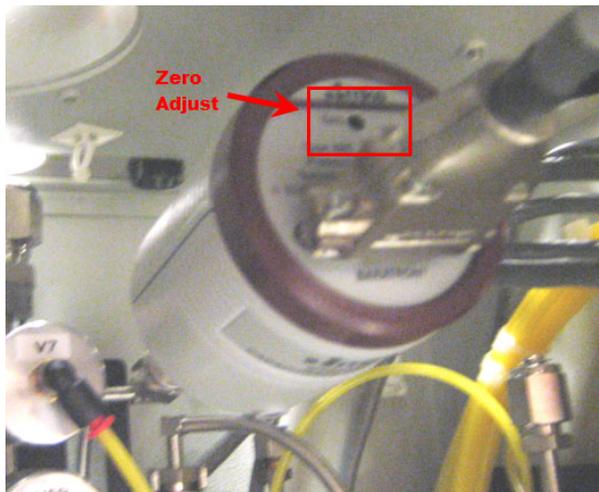
### 7.2.5. Vacuum Transducer Calibration (Baratron model 626A) (CG310/410)

This procedure is used to set the zero adjust of the vacuum Baratron.

1. Connect a calibrated vacuum reference to the vacuum pump.
2. Apply vacuum to the vacuum port on the ChemGuard®.
3. Enter Manual Mode and open V7. Wait for the vacuum reading on the “Analog Test-In” display of the ChemGuard® CG400 to stabilize, 5-10 minutes.
4. Verify / Adjust the Zero potentiometer on the baratron until the vacuum reading on the display matches the calibrated vacuum reference on the vacuum source.
5. Switch V7 off and remove the vacuum reference.
6. Calibration is now complete.

**NOTE:** Document base pressure reading for this cabinet. This reading will be used for Change Bulk operation and when conducting leak checks of the system.

**Figure 7-3: Vacuum Baratron**



### 7.2.6. Ultrasonic Clamp-On Sensor Verification

This procedure is used to verify that the Ultrasonic clamp-on sensors operate at the appropriate alarm conditions. The clamps are removed one at a time and then monitored at the System Test menu under Digital Input.

1. Locate the 3 Ultrasonic sensors mounted at their respective locations and note the mounting location for each
  - Bulk Empty Sensor – Blue – Bulk Liquid Pigtail – ULS1
  - Res Overfull – Yellow – Vent Line, Above V4 – ULS2
  - Liquid in Vac Line – Black – Vacuum Source, Above V7 – ULS3
2. To verify the alarm activates for each, remove each sensor one at a time to verify the alarms appear on Main Display and changes states;
  - Sensor wet shown as LIQ in red
  - Sensor dry shown as GAS in white
3. Carefully replaced sensor and press the alarm field on the Main Display to verify the alarm clears from the Main Display to reset alarm. Do not over tighten knurled thumbscrew as this can crack and damage sensor

**NOTE:** All three sensors will cause an additional Ultrasonic Failure alarm

4. Verify the Bulk Empty sensor by entering Configuration Menu and then selecting SYSTEM TEST and then TEST DIGITAL IN
5. Find Input labeled BULK EMPTY. The Input displayed will show the corresponding state of the input (closed or open). When the empty sensor is removed from the tubing, the status will change from closed to open
6. Reinstall the Bulk Empty sensor and verify the status returns to the closed
7. Repeat for other 2 sensors, Inputs labeled RES OVERFULL and LIQ IN VAC LINE

Figure 7-4: Ultrasonic Sensor Test

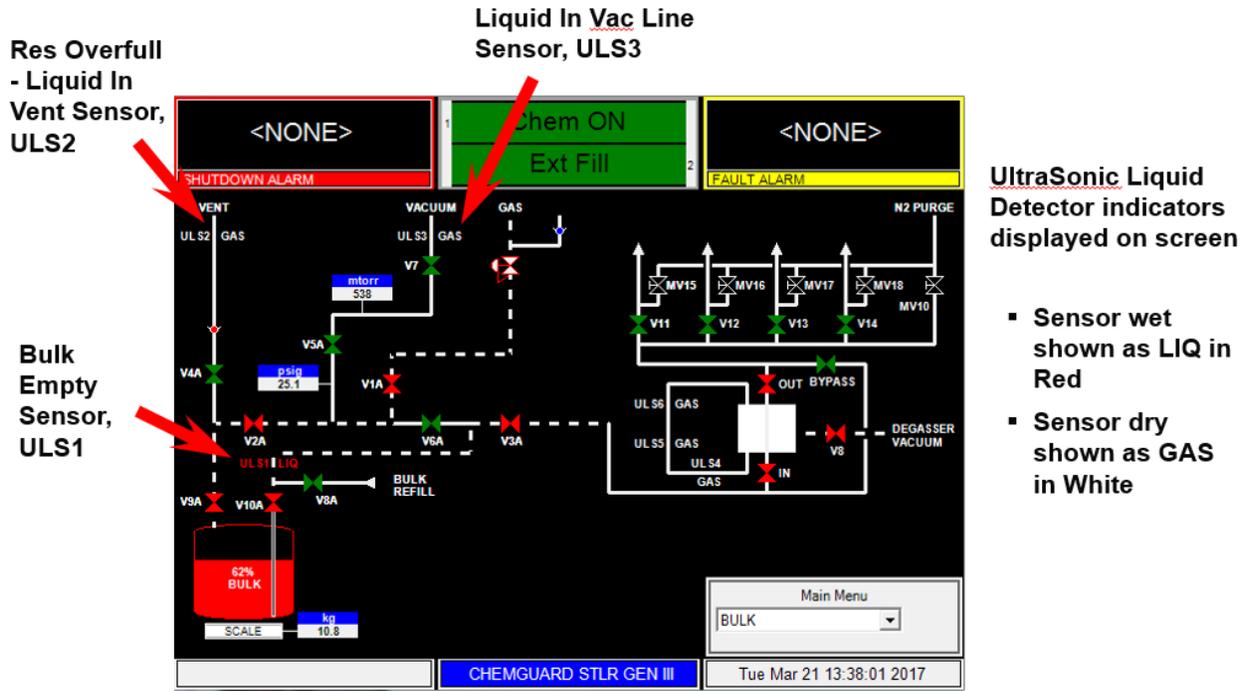
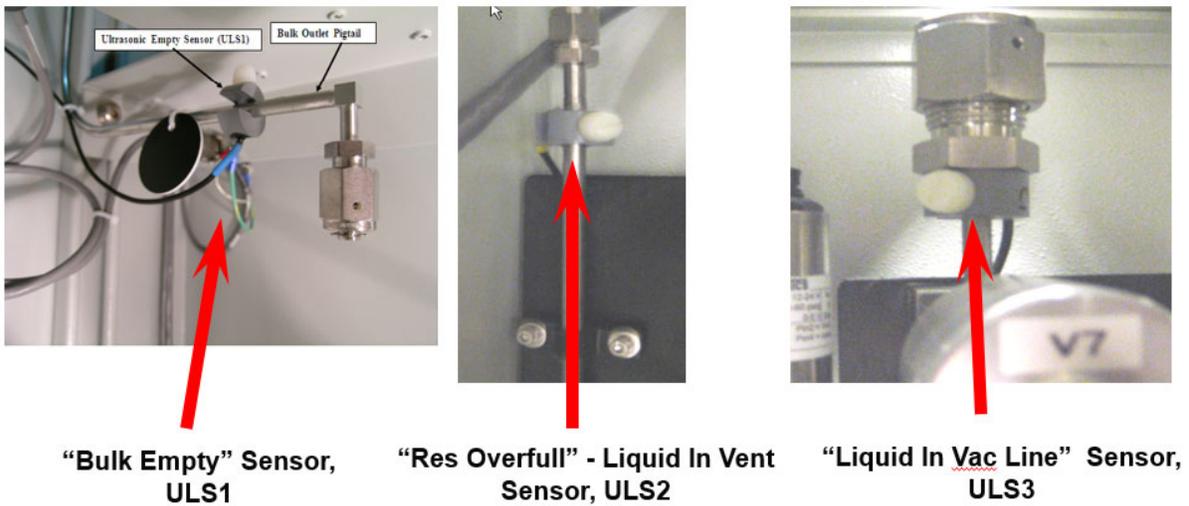


Figure 7-5: Ultrasonic Sensor Locations



**7.2.7. Ultrasonic Clamp-On Sensor Maintenance**

1. Turn off all fill operations (bulk to process, process fill, and external refill)
2. Open the cabinet door
3. Remove the ultrasonic sensors one at a time to avoid mounting them in the wrong location
4. Use a clean wipe to remove the vacuum grease from the stainless tubing. Make sure all sides of the tubing are clean
5. Clean the grease from the ultrasonic sensor
6. Cut a ¼” by 1” strip of gel tape – PN 164016



**Scotch® Clear Mounting Tape 4010, 1 in x 60 in**

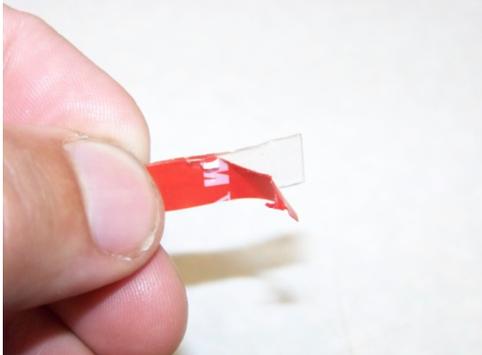


This virtually invisible, professional-quality tape is designed for attaching items up to two pounds to virtually any smooth wall or surface. It is perfect for discretely mounting items on glass, tile or mirrors. 1 in x 60 in.

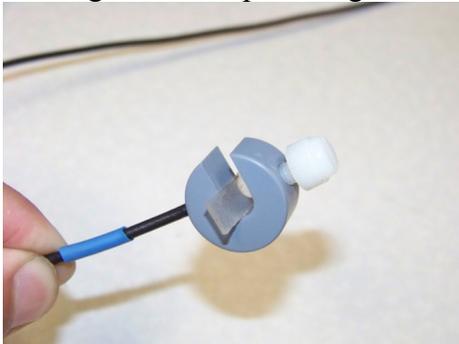
3M Id : 70-0708-8163-9  
Buyer's Part Number : 76272  
GTIN(UPC/EAN) : 0 00 51131 76272 5

**3M – Scotch Clear  
Mounting Tape  
3M PN 76272**

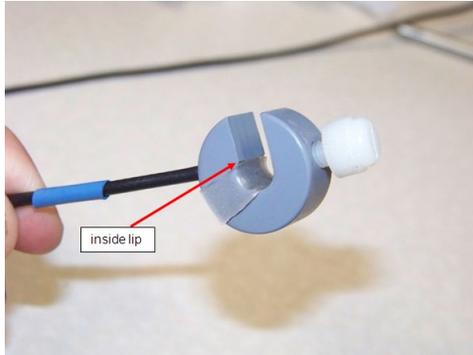
7. Remove the red backing from the tape



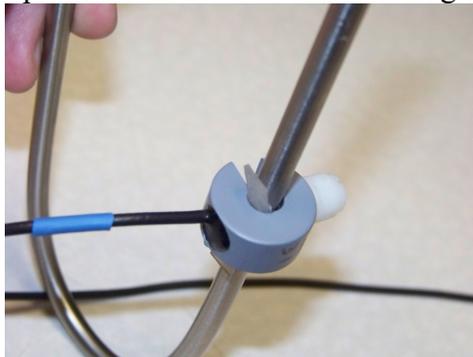
8. Lay the tape inside the sensor, over top of the sensor wire (the side of tape which had the red backing should be placed against the sensor)



9. Bend the overlap of the tape, down onto the sensor and grasp either side of overlap with the thumb and forefinger to hold the tape in place (be careful not to stretch the gel tape)



10. Attach the sensor to the piping (be sure that the front edge of the gel tape is behind the “inside lip” of the sensor to avoid doubling-over of the gel tape as the sensor is pushed onto the piping)



11. Tighten the set screw by hand. The sensor should be snugly mounted on the piping
12. Make sure the tape is sitting in place correctly and did not shift
13. Repeat steps 2-12 for each sensor
14. Check for any ultrasonic alarms. If any alarms are present, replace the gel tape on the applicable sensor
15. Log into the controller. Check the status of all of the ultrasonic sensors on the Main Display, refer to UltraSonic Liquid Detector test in this section.

**NOTE:** If the signal toggles from OPEN to CLOSED, even briefly, the gel tape should be replaced on the applicable sensor. The digital inputs must be watched for 10 minutes or longer (if the gel tape is not mounted correctly, the sensor may not fail immediately)

16. Reset alarms

**NOTE:** If applicable, can use Dow Corning High Vacuum Grease, Dow Corning PN 976HVG and apply to the inner wall of the clamp on sensor in lieu of the Gel Tape.

### 7.2.8. Smoke Detector Verification

This test requires canned smoke to perform the verification.

1. Apply smoke to the face of the detector.
2. An alarm message “Smoke Detect” will display within 10-20 seconds.
3. Remove can of smoke from detector and let smoke clear from face of the detector.
4. Verify that the alarm message self-clears from display.

**NOTE:** To test per the manufactures procedure and for maintenance of the Smoke Detector refer to Appendix H, D263/D273 Photoelectric Smote Detector Series Installation manual.

### 7.2.9. Sierra Vapor Detector Verification / Calibration (System Option)

This procedure is used to verify/calibrate the detection limit of the optional Sierra Vapor Detector. Failure to perform this calibration may fail to detect sensor drift over time, resulting in inaccurate response of the Vapor Detector. This inaccuracy can manifest itself as over-sensitivity (causing the alarm to be triggered when no vapors are present), or as insensitivity (causing no alarm when vapors are present). Drift is not predictable and may vary in direction and magnitude from system to system and may change as the Vapor Detectors age.

The optional Vapor Detector should be verified / calibrated every twelve (12) months, or when exhaust flow over an interval changes. The user should be familiar with the operation and calibration of the Vapor Detector prior to servicing the detector.

**NOTE:** Before conducting this procedure, any Remote Alarm interfaced to Life Safety control or monitoring station should be tagged out to avoid a false alarm to the site.

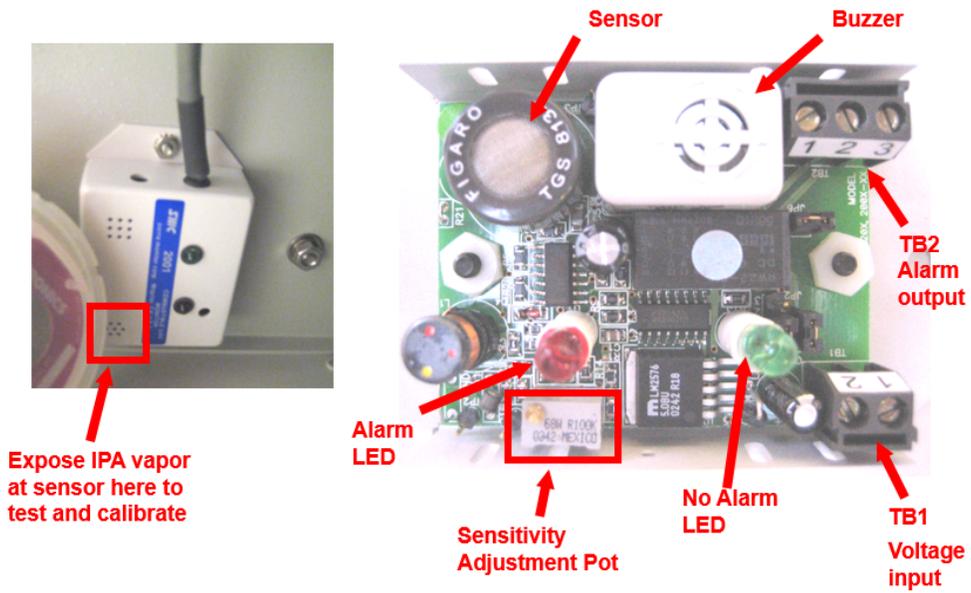
This optional vapor detector is a Sierra Monitor Corporation Gas Sensor Module, Model 2001-00.

1. Test Vapor Detector by using Isopropyl Alcohol, IPA with air mixture, by placing small amount of IPA onto a clean room wipe
2. Hold clean room wipe directly to the sensor area for a maximum of 60 seconds allowing for IPA vapor to be detected by sensor, refer to following slide for sensor location. **DO NOT USE LIQUID**
3. The detector should trip and the red LED will be on
4. A Combust Vapor Detect alarm will be displayed on the Shutdown (RED) Alarm Field on the Main Display
5. Verify the Bulk and Process Container valves are open to vent. Vents head pressure of containers
6. If the detector does not trip after 60 seconds place additional IPA on the clean room wipe and test for another 60 seconds
7. If detector still fails to trip, adjust the potentiometer counter-clockwise until the alarm turns on
8. Remove clean room wipe from detector
9. Verify that the alarm turns off after the gas is removed from the sensor. Usually takes 2 to 3 minutes

**NOTE:** The cabinet may have to be ventilated for a few minutes, by holding door open if the alarm does not deactivate

10. If the alarm fails to turn off after ventilating the cabinet, adjust the potentiometer clockwise until the alarm turns off
11. Repeat the test again to verify sensor is operating without further adjustment

Figure 7-6: Sierra Vapor Detector (optional)



**7.2.10. High Temperature Sensor Verification**

This test can be used on the exhaust high temp sensor assembly.

**NOTE:** Do not point the heat gun at anything other than the high temp sensor.

1. Using Heat Gun apply heat directly to the sensor, but not more than 1 minute.
2. An alarm message “Fire Detected” will display within 10-20 seconds.
3. Remove the heat gun and wait until the temp sensor cools down.
4. Verify that the alarm message self-clears from display.

### 7.2.11. Other Tests

Other tests that should be performed on a periodic basis include:

- Triggering the E-Stop switch on front door of cabinet to verify system shutdown
- Verification of cabinet exhaust
- Verification of all system parameters
- Test of the UVIR sensor if option is installed refer to Addendum Y
- Test of the Auto-Pulse 542R Fire Control panel refer to Appendix G
- Test of the High Flow Degasser refer to Addendum D

## Appendix G

# Multi-Spectrum Digital, Electro-Optical Radiant Energy Models SS2 & SS4 Fire Detectors

**NOTE:** Versum Materials, Inc. recommends customer always review and reference to the device manual shipped along with the ChemGuard equipment package, it is an indication a device in-use has accurate information such as operation, specification, calibration and maintenance schedule.



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*Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions*

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**Fire Sentry Corporation**

**Multi-Spectrum  
Digital, Electro-Optical  
Radiant Energy**

**Models SS2 & SS4  
Fire Detectors**

*Frequently  
asked  
Questions*



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*Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions*

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*Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions*

## Question

*What is an Electro-Optical Radiant Energy Fire Detector?*

*What is meant by the Detector's Field of View?*

*What is an Ultraviolet (UV) only Flame Detector?*

*What is an Infrared (IR) Only Narrow Band Flame Detector?*

## Answer

An Electro-Optical Radiant Energy Fire Detector senses the electro-optical radiant energy emitted by a fire. The radiant energy comprises Ultraviolet (UV), Infrared (IR) and Visible (VIS) light spectra. (Fire Sentry uses visible light to provide additional rejection of false alarm sources). Nothing known travels faster than electromagnetic radiant energy (about 300,000,000 meters per second or about 186,000 miles per second), therefore, an Electro-Optical Radiant Energy Fire Detector is truly an early warning device for the rapid detection of a flaming fire.

The Field-of-View describes the actual area the Fire Detector is capable of seeing with its sensor "eyes". For example, if the Detector has a 120-degree Field of View, the coverage is 60 degrees to either side of the axis of the Fire Detector like a conical funnel. The SS2 and SS4 cover a volumetric area approximately four (4) times that of conventional flame detectors with 90 degrees field-of-view.

A UV Flame Detector, which uses a Geiger-Mueller gas filled tube, detects radiant energy in the 185-250 nanometer (0.185 to .25 micron) UV region of the electro-optical spectrum. Solar radiation in this ultraviolet band is absorbed by the atmospheric ozone layer before reaching the earth's surface. Although "solar blind" UV Fire Detectors are sensitive to fires, they also have a propensity to false alarm to many non-fire sources of UV radiation, such as arc welding, quartz halogen lamps, lightning, sparks, X-rays, etc.

An IR only Narrow Band Flame Detector is a device that senses "flickering" radiant energy in the 4.3-micron narrow band IR (CO<sub>2</sub> emission band) region of the electro-optical spectrum. Conventional Fire Detectors utilize *pyroelectric* or *thermopile* thermal IR sensors. These IR sensors function by detecting the absorption of IR energy (heat) on their substrate, but many non-fire IR sources (sunlight, hot manifolds, etc.) can fool these devices. To reduce false alarms, with *pyroelectric* or *thermopile* IR sensors manufacturers use narrow band optical filters in order to selectively focus on the unreliable and unpredictable carbon dioxide (CO<sub>2</sub>) emission band. This region of the IR spectrum, known as the "CO<sub>2</sub> spike", is located at approximately 4.3 microns and is characteristic of well oxygenated, hydrocarbon fires.



*Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions*

*What are some of the numerous Inadequacies and Shortcomings of Narrow Band Single, Dual and Triple-IR Band 4.3 micron IR Flame Detectors?*

The inadequacies and shortcomings of using IR only Narrow Band (or "spike band") for flame detection are numerous. These shortcomings are the same whether or not one or two (Dual IR and "Triple IR") guard bands are used for false alarm rejection purposes:

1. Only fires that have carbon are detectable, and therefore they can only detect hydrocarbon fires. While it is true that most fires are hydrocarbon, many are not and are classified as non-hydrocarbon fires.
2. The narrow CO<sub>2</sub> band IR flame detectors are susceptible to blindness due to water absorption in any form (ice, snow, rain, dew, fog, condensation, water mist suppression, etc.) whether on its window lens or in the path between itself and the fire.
3. They can be blinded by CO<sub>2</sub> gas (which is used as a suppression agent) itself since Kirchoff's Law states a good emitter is also a good absorber."
4. If the fire is not well oxygenated, the output tends to shift out of the 4.3-micron band because more carbon monoxide (CO) is produced instead of carbon dioxide (CO<sub>2</sub>).
5. There are also limitations associated with the use of narrow band optical filters. The physical characteristics of these interference type filters means that the maximum sensitivity to radiant energy is on axis. As the off axis angle increases, sensitivity diminishes considerably. The optical filter selected is the narrow band CO<sub>2</sub> emission spike that means that there is very little signal to detect in real world "dirty fires". The result is a flame detector with low sensitivity and narrow field of view.

*What is a UV/IR Fire Detector?*

Conventional UV/IR Flame Detectors use narrow band IR sensor in conjunction with Geiger-Mueller type UV tube for detection of fires in an attempt to reduce the numerous false alarms. While this was an improvement, these devices still had a low sensitivity, narrow Fields of View and false alarm to non-fire sources. They are limited to detecting only well oxygenated, hydrocarbon based fires and could not detect non-hydrocarbon fires such as Hydrogen and Silane.

*What is a Multi-Spectrum Radiant Energy Fire Detector?*

A Multi-Spectrum Radiant Energy Fire Detector senses radiant energy over a large region of the electro-optical spectrum. The Fire Sentry Models SS2 and SS4 Fire Detectors detect Ultraviolet, Wide Band Infrared and Visible light spectrums. Coupled with microcomputer intelligence and advanced digital signal processing software algorithms, this makes Fire Sentry Fire Detectors superior to conventional Electro-Optical Fire Detector currently available.



*Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions*

**What is the Difference between a Flame Detector and a Radiant Energy Fire Detector?**

The difference between a "flame" and "fire" detector is a flame detector senses primarily the molecular spike emission of flames. The cleaner and purer the flame, the better these type of detectors perform. The most common molecular flame emitter is the 4.3 micron narrow band generated by combustible carbon dioxide (CO<sub>2</sub>) molecules. A true radiant energy fire detector, on the other hand, senses all the radiant energy a fire produces, not just the flames itself, but also the hot Planckian blackbody particulate radiators that real-world "dirty fires" generate. To accomplish this, Quantum type WideBand IR sensors are used. The primary reason most manufacturers use the 4.3 micron band for sensing the flame component of fires, is the fact that detector requires no actual signal processing. Without sophisticated signal process algorithms to process the WideBand IR™ signals, the detector would generate an unacceptable level of false alarms. The Models SS2 and SS4 series Fire Detectors utilize sophisticated signal processing algorithms as well as the UV and visible spectral bands to provide the highest level of false alarm immunity in the industry and this has been proven in thousands of successful installations worldwide since 1990.

**Why are the Models SS2 and SS4 Multi-Spectrum Fire Detectors superior to the conventional Narrow Band UV/IR Fire Detectors?**

The conventional combination of UV and IR sensors slightly improved the performance of older Fire Detectors, but the use of *pyroelectric* or *thermopile* thermal type IR sensors greatly limits their response to real world fires. The type of IR sensor used by Fire Sentry Corporation in its SS2 and SS4 Detectors is a lead sulfide (PbS) *quantum* type that detects WideBand IR™ radiant energy in the 0.7 to 3.5 micron range. The Wide Band *quantum* IR sensor directly captures incident IR photons, giving it a much faster response. This type of sensor is *many* times more sensitive and responsive than *pyroelectric* or *thermopile* IR sensors used by other manufacturers. This Wide Band IR™ technology enables Fire Sentry's Electro-Optical Radiant Energy Detectors to detect in excess of 88% of a fire's total radiated energy, compared to less than 1% seen by older type *pyroelectric* or *thermopile* IR sensors with narrow band optical filters. PbS IR sensors are used by NASA, the Department of Defense and all branches of the military for many different sensing applications.

**Why do the SS2 and SS4 detect all fires?**

Since the Fire Sentry Models SS2 and 4 Fire Detectors do not rely on the unpredictable and unreliable narrow 4.3 micron band CO<sub>2</sub> emission spike, the SS2 and SS4 are able to detect all types of hydrocarbon and non-hydrocarbon fires, whether or not water in any form (such as ice on the lens) is present or carbon dioxide gas is present as a suppression release.

**Why do the SS2 and SS4 use a Visible sensor?**

The use of the Visible light spectrum enhances fire detection capability while increasing non-fire source rejection. The information from the multi-spectrum sensor array (UV, Visible, Wide Band IR™) is processed by solid-state, digital microprocessor technology, which utilize sophisticated digital signal processing software algorithms. (fires emit very little or no significant Visible band radiant light)



***Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions***

***Do the SS2 and SS4 have Built-In Self-Test?***

The SS4 Detector has automatic built-in "through the lens" self-test which checks the window cleanliness, checks the sensor response and carries out an electronics diagnostic test. The SS2 Detector does not have built-in "through the lens" self-test, although it does have internal self-checking tests.

***How are SS2 & SS4 Detectors UV sensor tubes different from other manufacturers?***

One of the largest costs of ownership for UV/IR Detectors is the short life expectancy of UV tubes. Older type UV tubes are prone to early failure and are expensive to replace. Fire Sentry's UV tubes are manufactured to the highest quality standards. Anodes and cathodes are fabricated from steel and the large area of glass sealing the anode and cathode wires ensures no leakage or cracking during vibration and stress. This makes Fire Sentry SS2 & SS4 Fire Detectors extremely rugged and suitable for use in high vibration areas. Other manufacturers have to replace their UV tubes periodically, but Fire Sentry UV tubes have been rated for a service life in excess of ten years.

***Do the SS2 and SS4 require a dedicated Controller?***

The Model SS2 & SS4 Fire Detectors can be used as stand alone, unitized devices that do not require a Controller. Integral Fire and Fault dry contact relays can be connected to a conventional fire alarm panel or a PLC. Each Fire Detector requires regulated 24 VDC power. An optional 4-20mA output is available if required with the Model SS4 series.

***What is the SS2 and SS4 power consumption?***

For the SS2 Detector, the power consumption is a low 56mA in quiescent state and 75mA in alarm. For the SS4 the power consumption is a low 68mA in quiescent state and 75mA in alarm. Fewer backup batteries are required for 24-hour backup, which means smaller, lower cost fire control panels are required.

***When would it be useful to use a Controller?***

When the end-user requires a fully intelligent, addressable system, the Model CM1-A™ Controller is the best choice. The proven Model CM1-A wall-mount Controller monitors up to 30 Model SS4 or SS2 Fire Detectors and is a fully addressable and intelligent system using Fire Sentry FireBusI™ RS-485 (4) wire loop communication. The CM series Controller has many advanced features. It functions as the system manager, provides power to the Fire Detectors and continuously monitors all devices on a 4-wire RS-485 loop. Fire and Fault history files, Tri-Mode Plot™ and FirePic™ are stored in non-volatile, solid-state memory, and can be accessed via the RS-232 port, using a PC computer and Fire Sentry's UC2000™ software. System status is shown on a backlit LCD display and there is a built-in audible alarm and battery back-up system.



*Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions*

*What are the outputs from the CM1-A™ Controller?*

The Fire Sentry CM1-A™ Controller has six (6) each 10 amp SPDT relays for Fire Alarm outputs. One relay is the Common (Master) Fire Alarm relay and the remaining four Fire Alarm relays can be configured by zone or voting preference. One 10-amp SPDT relay is available for Fault annunciation. An RS-232 port is also available for interfacing with a PC or Laptop computer operating Fire Sentry's UC2000™ software.

*What are the wiring requirements between the SS2 and SS4 and the CM1-A™ Controller?*

Four conductor shielded cable is required. Fire Sentry recommends a minimum of 18 AWG solid wire. Two conductors are for 24 VDC power and two conductors are for RS-485 communications, using FireBusI™ protocol. Using the RS-485 loop requires far less wiring than traditional "home run" installations and therefore saves on wiring and installation costs.

*What is the power consumption of the CM1-A™ Controller?*

Low power consumption: 115mA in quiescent state; 312mA in alarm. Battery backup is provided. Less battery backup is required for 24-hour backup that means less costly fire control panels.

*What is FirePic™?*

Fire Sentry's FirePic™ is the capability of the SS2 and SS4 Fire Detectors to record the electro-optical data immediately prior to the fire alarm being declared. This data is stored in non-volatile solid-state memory and can be downloaded using Fire Sentry PC software and Interface Box, or via a CM1-A Controller and PC software. This is essential information to have when postulating the cause of a fire, especially if a fire event was not immediately apparent.

*What is SnapShot™?*

With SnapShot™, both the SS2 and SS4 Detectors have the ability to record the real-time spectral energy response of the UV, visible and IR sensor array against test fires and false alarm sources. To do this, use the Fire Sentry Interface Box, the Fire Sentry PC Software, and a laptop or desktop PC computer. The resultant data can be plotted and analyzed using a graphing program such Microsoft Excel®. The ability to record real-time data is invaluable when optimizing the SS2 and SS4 Detectors against new, untested combustible materials and unusual false alarm stimuli.

*What is Tri-Mode Plot™?*

Fire Sentry's Tri-Mode Plot™ is the capability of the Fire Detectors to see real-time the UV, IR and Visible electro-optical data in the Field of View. Tri-Mode Plot can be used as a diagnostic tool to "view" the local environment and to ensure that the Fire Detector is not detecting a potential source of "friendly fire", such as a flare stack. It can also be used as a preventive maintenance tool for regular checking of the normal operation of the Fire Detector.



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*Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions*

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*Can the SS2 and SS4 Interface with PLC and DCS systems?*

The SS2 and SS4 Detector can interface with a variety of third party systems, such as rack-mounted controllers, PLC and DCS systems via dry relay contacts. The SS4 Detector can be supplied with an optional 4-20mA output module for interfacing with PLC or DCS systems.

*Is there a swivel mount for the SS2 and SS4?*

A swivel mount, Model SM4, is available for aiming the Detector. This is a fully adjustable, calibrated 316 Stainless Steel mounting bracket.

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# Appendix H

## Smoke Detector

**NOTE:** Versum Materials, Inc. recommends customer always review and reference to the device manual shipped along with the ChemGuard equipment package, it is an indication a device in-use has accurate information such as operation, specification, calibration and maintenance schedule.

**DS280 Series Photoelectric  
Smoke Detectors**



The DS280 Series are low profile, photoelectric system type smoke detectors. The patented chamber design provides superior immunity to false alarms caused by dust. ChamberCheck self-diagnostics allow the sensitivity to be verified by simply looking at the detector LED. Several different models are available, offering a wide variety of features and outputs.

■ **Series Features**

- Direct wire design with removable terminal strip
- Diagnostic/sensitivity test features
- ChamberCheck self-diagnostics
- Easy cleaning
- Sensitivity voltage output
- 12VDC or 24VDC operation

■ **Series Basic Functions**

Test features

LED automatically flashes to indicate a calibration trouble and latches on alarm. Sensitivity can be verified by using visual check, magnet test, or digital voltmeter.

ChamberCheck

This feature provides an indication if the detector is outside the factory calibrated specifications. It reduces service costs because the installer can easily determine which detectors require attention. This feature also reduces false alarms by alerting the end-user that the detector is dirty long before the possibility of producing a false alarm. A visual indication is provided in all DS smoke detectors. The DS284THR and DS284THSR include a trouble relay, allowing this indication to send a report to the central station.

Patented chamber design

The detection chamber includes computer-designed chamber walls and lenses to optimize internal light scattering and dust hiding capabilities. This provides for industry leading dust immunity without sacrificing detection. The detection chamber can be easily removed should it require cleaning.

Sounder

An 85-dB sounder (at 10 ft. (3 m)) activates on detector alarm or reverse polarity. The sounder is available on detectors with S in the model number (eg. DS282THS).

Trouble relay

Indicates ChamberCheck trouble condition or loss of power (DS284THR and DS284THSR only).

■ **Series Approvals**

UL Standards	UL268, Smoke Detectors for Fire Alarm Signaling Systems
ULC Standards	ULC529, Smoke - Automatic Fire Detectors Certified for Canada
Approvals	CSRM 12.12-1062:108 Hong Kong Fire Services Department New York City MEA 274-93-E (Vol. VII)

Security you can rely on



■ Series Technical Specifications

<b>Enclosure Design</b>	
Dimensions (HxW):	2 in. x 5 in. (5 cm x 12.7 cm)
Material:	High impact fire retardant ABS plastic enclosure and separate twistlock mounting plate.
Mounting:	Separate mounting plate mounts directly to 4 in. (10.2 cm) octagonal electrical box, single gang box and wireold surface box #5728. A removable terminal strip allows for quick installation.
<b>Environmental Considerations</b>	
Relative Humidity:	0% to 95% non-condensing
Temperature (Operating):	+32°F to +120°F (0°C to +49°C)
<b>Outputs</b>	
Alarm:	One Form "A" (NO) contact rated at 0.5 A, 200 V
<b>Power Requirements</b>	
Current (Startup):	0.12 mA maximum
Current (Standby):	0.08 mA @ 12 VDC; 0.09 mA @ 24VDC; 0.1 mA @ 30 VDC
Power-up Time:	22 s maximum
RMS Ripple (maximum):	2% of DC input
Voltage (Standby):	2-wire: 9.5 VDC to 33.0 VDC 4-wire: 10.0 VDC to 30.0 VDC
Radio Frequency Interference (RFI) Immunity:	No alarm or setup on critical frequencies in the range from 26 MHz to 950 MHz at 50 v/m.

■ Series Hardware Options

**DT-1 Test Tool**



Provides a means of accessing the detector for testing without the use of a ladder by connecting to 1/2 in. (1.27 cm) EMT.

**EOL200 End-Of-Line Module**



Intended for use as a line supervision device in 4-wire fire detection circuits, the EOL200 is designed for installation at the end of the circuit run using an end-of-line (EOL) resistor as specified by the control panel manufacturer.

**SMK-RA5 Remote Alarm Indicator**



Provides remote annunciation of alarms for fire detectors. Requires 5 VDC, 10 mA @ 5 V. Measures (HxWxD) 4.8 in. x 3.1 in. x 0.25 in. (12.3 cm x 78 cm x 0.63 cm).

**SMK-TM Test Magnet**

Used to trigger the detector during Fire Walk Testing.

**TC2000 Test Cable**



Connects a digital voltmeter to the detector's calibration pin for verifying that the detector is within its calibration range.

**TP280 Trim Plate**



For retrofit and remodeling purposes; 6 in. (15.2 cm) diameter. Used to increase base diameter.

### DS282 2-Wire Smoke Detector

Prod ID DS282

The DS282 is a basic photoelectric 2-wire smoke detector. For control panel compatibility information, see Technical Service Note (P/N: 26979).

#### ■ Technical Specifications

Current Draw	
Alarm:	Determined by control panel
Standby:	0.09 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum

### DS282TH 2-Wire Smoke/Heat Detector

Prod ID DS282TH

The DS282TH is a basic photoelectric 2-wire smoke detector with a built-in +135°F (+57°C) heat sensor. For control panel compatibility information, see Technical Service Note (P/N: 26979).

#### ■ Technical Specifications

Current Draw	
Alarm:	Determined by control panel
Standby:	0.09 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum

### DS282THC 2-Wire Smoke/Heat Detector with Trouble Relay

Prod ID DS282THC

The DS282THC is a basic photoelectric 2-wire smoke detector with a built-in +135°F (+57°C) heat sensor and a Form "C" trouble relay. For control panel compatibility information, see Technical Service Note (P/N: 26979).

#### ■ Technical Specifications

Current Draw	
Alarm:	Determined by control panel.
Standby:	0.09 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum
Outputs	
Auxiliary:	One Form "C" (NO/C/NC) contact rated at 1 A, 220 VDC; 250 VAC

### DS282THS 2-Wire Smoke/Heat Detector with Sounder

Prod ID DS282THS

The DS282THS is a basic photoelectric 2-wire smoke detector with a built-in +135°F (+57°C) heat sensor and an 85 dB [at 10 ft (3 m)] sounder. For control panel compatibility information, see Technical Service Note (P/N: 26979).

#### ■ Technical Specifications

Current Draw	
Alarm:	Determined by control panel.
Standby:	0.09 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum

### DS284 4-Wire Smoke Detector

Prod. ID DS284

The DS284 is a basic photoelectric 4-wire smoke detector. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Standby:	0.08 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum

### DS284ES 4-Wire Smoke Detector with Sounder and EOL Relay

Prod. ID DS284ES

The DS284ES is a basic photoelectric 4-wire smoke detector with an 85 dB [at 10 ft. (3 m)] sounder and an EOL relay. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	79 mA±10 mA max. @ 30 VDC
Standby:	0.08 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum

### DS284IS 4-Wire Smoke/Heat Detector with Sounder

Prod. ID DS284IS

The DS284IS is a basic photoelectric 4-wire smoke detector with a built-in isolated +135°F (+57°C) heat sensor and an 85 dB [at 10 ft. (3 m)] sounder. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	100 (±10) mA max. @ 30 VDC
Standby:	0.08 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum

### DS284TH 4-Wire Smoke/Heat Detector

Prod. ID DS284TH

The DS284TH is a basic photoelectric 4-wire smoke detector with a built-in +135°F (+57°C) heat sensor. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	19 (±5) mA max. @ 30 VDC
Standby:	0.08 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum

### DS284THC 4-Wire Smoke/Heat Detector with Auxiliary Relay

Prod. ID DS284THC

The DS284THC is a basic photoelectric 4-wire smoke detector with a built-in +135°F (+57°C) heat sensor and a Form "C" trouble relay. Compatible with all UL listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	32 (±10) mA @ 30 VDC
Standby:	0.08 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum
Outputs	
Auxiliary:	One Form "C" (NO/C/NC) contact rated at 1 A, 220 VDC; 250 VAC

### DS284THCS 4-Wire Smoke/Heat Detector with Auxiliary Relay and Sounder

Prod ID DS284THCS

The DS284THCS is a basic photoelectric 4-wire smoke detector with a built-in +135°F (+57°C) heat sensor, a Form "C" trouble relay, and an 85 dB [at 10 ft. (3m)] sounder. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	96 (±10) mA @ 20 VDC
Standby:	0.08 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum
Outputs	
Auxiliary:	One Form "C" (NO/C/NC) contact rated at 1 A, 220 VDC, 250 VAC

### DS284THE 4-Wire Smoke/Heat Detector with EOL Relay

Prod ID DS284THE

The DS284THE is a basic photoelectric 4-wire smoke detector with a built-in +135°F (+57°C) heat sensor and an EOL relay. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	96 (±5) mA @ 20 VDC
Standby:	15 mA
Trouble:	15 (±2) mA maximum @ 12 VDC

### DS284THES 4-Wire Smoke/Heat Detector with EOL Relay and Sounder

Prod ID DS284THES

The DS284THES is a basic photoelectric 4-wire smoke detector with a built-in +135°F (+57°C) heat sensor, an EOL relay, and an 85 dB [at 10 ft. (3m)] sounder. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	96 (±10) mA @ 20 VDC
Standby:	15 mA
Trouble:	15 (±2) mA maximum @ 12 VDC

### DS284THR 4-Wire Smoke/Heat Detector with Trouble Relay

Prod ID DS284R

The DS284THR is a basic photoelectric 4-wire smoke detector with a built-in +135°F (+57°C) heat sensor and a Form "C" trouble relay. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	18 (±5) mA @ 20 VDC
Standby:	18 mA maximum @ 20 VDC
Trouble:	0.1 mA maximum
Outputs	
Trouble:	One Form "A" (NO) contact rated at 0.5 A, 200 V

### DS284THS 4-Wire Smoke/Heat Detector with Sounder

Prod. ID DS284THS

The DS284THS is a basic photoelectric 4-wire smoke detector with a built-in +135°F (+57°C) heat sensor and an 85 dB [at 10 ft. (3 m)] sounder. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	78 (±10) mA @ 30 VDC
Standby:	0.08 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum

### DS284THSR 4-Wire Smoke/Heat Detector with Sounder and Trouble Relay

Prod. ID DS284THSR

The DS284THSR is a basic photoelectric 4-wire smoke detector with a built-in +135°F (+57°C) heat sensor, a Form "C" trouble relay, and an 85 dB [at 10 ft. (3 m)] sounder. Compatible with all UL Listed 4-wire control panels. Refer to the control panel's Installation Instructions for EOL resistor selection.

#### ■ Technical Specifications

Current Draw	
Alarm:	96 (±5) mA @ 30 VDC
Standby:	18 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum
Outputs	
Auxiliary:	One Form "C" (NO/C/NC) contact rated at 1 A, 220 VDC, 250 VAC

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# Addendum D

## High Flow Degasser

### OVERVIEW

The Degasser Assembly consists of an outer Housing, inner Coil, Inlet, Outlet, and Bypass valves, and Ultrasonic liquid leak detector. The four (4) ports on the Degasser Housing are chemical inlet, chemical outlet, vacuum source, and leak detect (refer to Figure 1). The Degasser functions to remove essentially 100% of Helium push gas from the chemical delivery stream when continuous vacuum is applied to the inner, semi-permeable coil.

The procedures described in this addendum are directed to those persons servicing and maintaining the system. In the event of a leak within the Degasser Assembly, the ChemGuard will shut down and return all valves to a safe state thereby limiting the leak to within the Degasser Assembly. **Replacement of the Degasser Assembly is recommended in the unlikely event of a leak.**

To service and maintain the optional Degasser Vacuum Pump, refer to the service manual from the **Manufacturer Vacuum Pump Operating Instructions** (shipped with the vacuum pump). The pump oil has a potential for contamination in the form of chemical residue exposure. Therefore it should be considered a hazardous material and treated as such. Consult the pump manual, site Environmental Health and Safety EH&S (and Versum Materials, Inc. EH&S), local governing agencies and state/local laws (i.e. Clean Water Act, Clean Air Act, Hazardous Waste Laws).

**NOTE:** During startup of new systems and following any maintenance or service to the Degasser and surrounding plumbing, perform an inboard Helium leak check of the VCR connections on the Degasser Inlet and Outlet valves. If a Helium Leak Checker is not available, perform Pressure Decay Test of Degasser Housing (described below) to check for leaks around the Degasser Housing and VCR connections.

**The NOTES are applied to all test sections below:**

- NOTE:** Each section of the procedures (below) should only be performed when the inner coil is void of liquid chemistry. If the degasser is charged with liquid chemistry, perform Process Line Purge operation as described in Chapter 6 of the ChemGuard® Installation and Operation Manual. In order to purge the inner coil and chemical delivery lines completely dry, the operator must manually perform the Line Purge operation to push liquid back from the Process Tool(s) into the Process Reservoir and follow with several Line Clear and Vacuum Cycle Purge.
- NOTE:** Do not attempt to perform Process Line Purge if a Degasser Leak is confirmed (Degasser Leak alarm is active). Rather, have a qualified person perform Degasser Replacement as described below.
- NOTE:** The following test assumes the customer has an oil sealed, rotary vane vacuum pump with functional anti-suction valve. If the customer has a dry vacuum pump, the test can be performed by isolating the vacuum source before the atmosphere pressure switch, it installed externally on the Degasser vacuum tubing immediately above the ChemGuard cabinet.
- NOTE:** Under no circumstance should the degasser housing be taken apart to access the inner coil.
- NOTE:** Maximum pressure rating for the inner coil is 145psig.
- NOTE:** The alarm is triggered when spill condition or atmosphere switch read higher than (above) 75 Torr, then valve V8 will turn off (close) as Degasser Inlet and Outlet valves turn off (closed) and Degasser Bypass valve turn on (open). Or this can easily accomplished by removing the DB15 connector cable from the Ultrasonic module to simulate a spill condition - variable 68 must be set to 0 for the bypass to be operational. The system will display a fault alarm "degasser leak".
- To verify by pulling the pneumatic lines on the degasser inlet/outlet, the lines should have pneumatic air flow when the sensors are dry. When any combination of two sensors are detected wet condition then inlet/outlet valves should turn off (close) and the bypass valve should turn on (open), then pulling the pneumatic lines to verify pressure.
- NOTE:** Proper PPE should be worn when removing the Degasser assembly.

**1. PRESSURE DECAY CHECK OF INNER COIL TUBING**

- 1.1 Read, understand and make reference to all notes indicated at the front of this document when perform the test operation.

- 1.2 The inner coil of the High Flow Degasser is so permeable to Helium push gas that a pressure decay test will invariably give results that suggest a gross leak. Refer to Rate of Rise Check of Inner Coil Tubing test section below.

**Figure 1: High Flow Degasser Assembly**

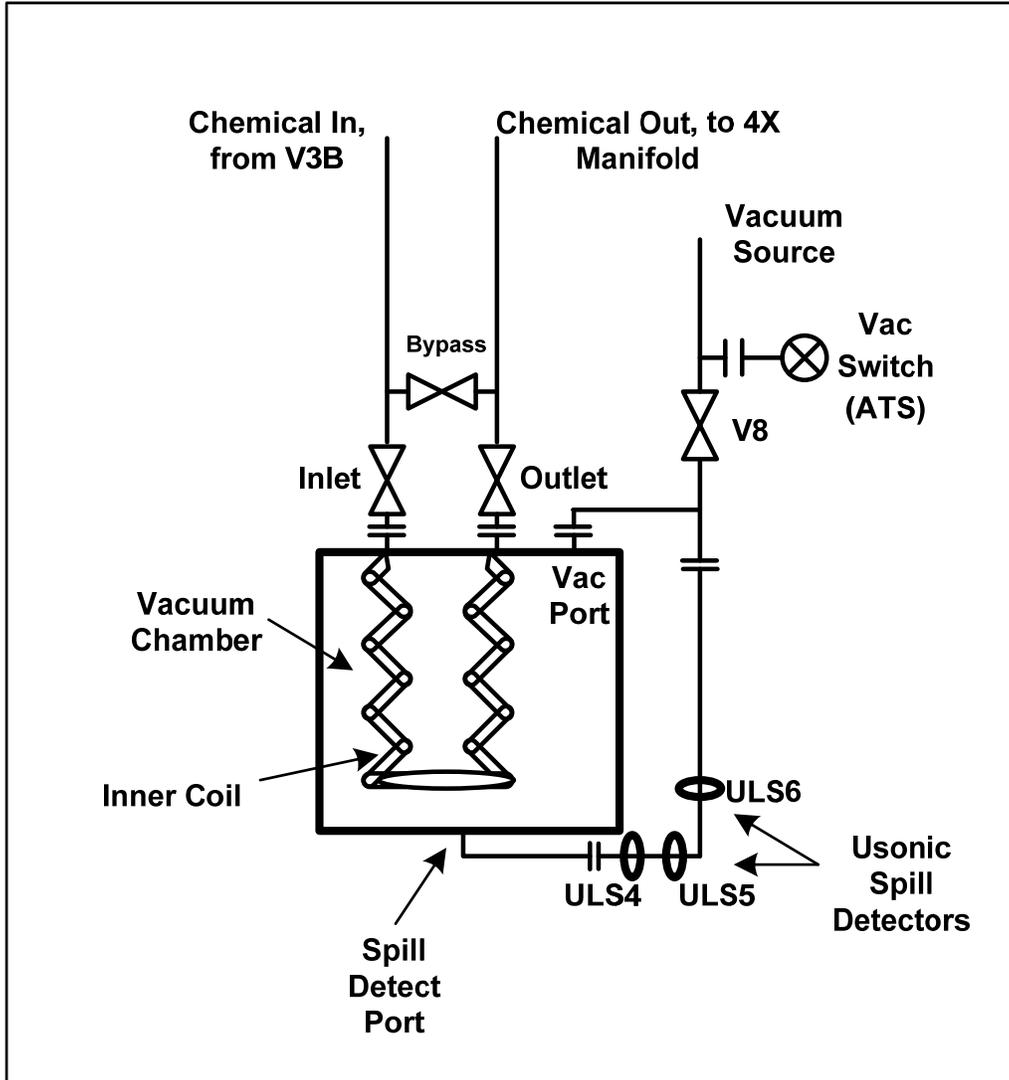
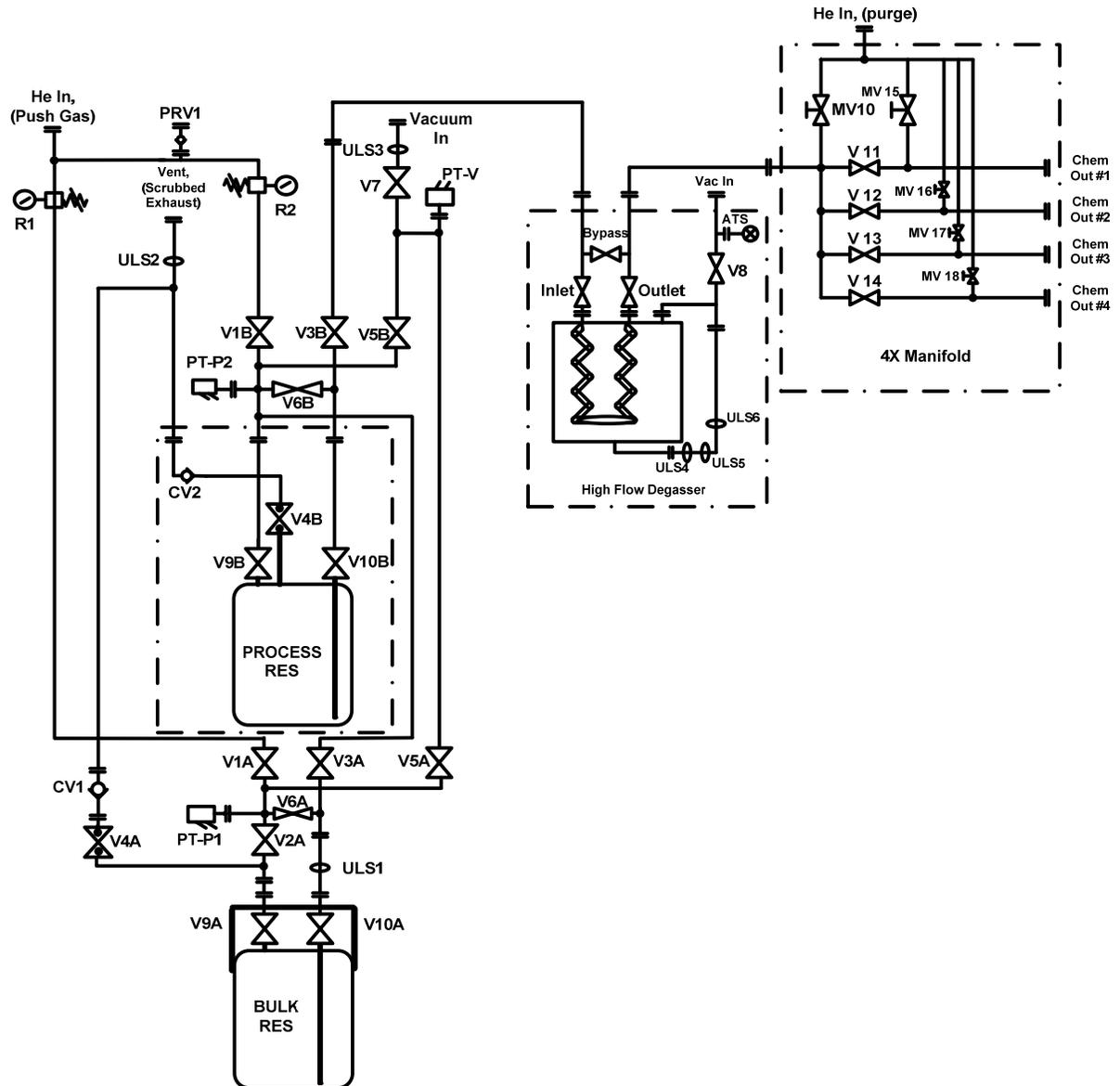


Figure 2: ChemGuard with High Flow Degasser Assembly



- 2. PRESSURE DECAY TEST OF DEGASSER HOUSING** (required if an inboard Helium Leak Check cannot be conducted)
- 2.1 Read, understand and make reference to all notes indicated at the front of this document when perform the test operation.
  - 2.2 Power up the ChemGuard cabinet and place in standby mode if not already powered up.
  - 2.3 Confirm the main manifold flow path have been leak tested, if not then refer to Chapter 3 of the ChemGuard® Installation and Operation Manual to perform leak test first. Because testing degasser housing will utilize same flow path and pressure transducer to monitor pressure decay test on degasser housing.
  - 2.4 Ensure all plumbing lines lead to the Degasser Inlet and Outlet valves are leak tight.
  - 2.5 Ensure chemical outlet valves manifold are closed.
  - 2.6 Ensure all valve on Nitrogen purge manifold are closed.
  - 2.7 Ensure degasser vacuum pump is off and valve V8 is closed.
- NOTE:** Carefully NOT to open valves V5B or V5A, the high pressure push gas will damage the vacuum transducer.
- 2.8 In manual mode, open valves V1B, V6B, adjust regulator R2 Helium push gas to 55 psig reading at pressure transducer PT2, wait 5 minutes and open V3B.
- NOTE:** CG110-310 will use valves V1A, V6A, V3A, regulator R1, and pressure transducer PT1.
- 2.9 Verify and open Degasser Inlet/Outlet valves.
  - 2.10 Select secure mode to ensure valves stay open in manual mode.
  - 2.11 Allow 12-16 hours (overnight) as Helium push gas will permeable through Teflon tubes and eventually pressurize the Degasser Housing with same pressure applied to inner coil Teflon tubes.
  - 2.12 Verify the pressure transducer PT2 is stabled overtime.
  - 2.13 In manual mode, close valve V1B, wait 5 minutes.
  - 2.14 Verify V6B and V3B are still open, and Degasser Inlet / Outlet valves open as well.
  - 2.15 Record initial reading from pressure transducer PT2 and starting test time.
  - 2.16 Select secure mode to ensure valves stay open in manual mode.
  - 2.17 At end of 2 hours test time, record final reading from pressure transducer PT2.

- 2.18 Calculate delta pressure and compare, if pressure drops less than 0.5 psig in 2 hours, there is no leak in the degasser housing.
- 2.19 If failed the first time, then retest second time to re-confirm before replacing the degasser unit.

**NOTE:** If there is leakage, the problem is most likely at the degasser housing assembly or at VCR connections.

- 2.20 Decrease regulator R2 to near close position.
- 2.21 Open valve V1B.
- 2.22 Verify V6B and V3B are still open.
- 2.23 Vent pressure by manually opening V4A, V2A, V6A, and V3A.
- 2.24 Return all valves to normal operation.
- 2.25 Re-adjust push gas regulator R2 to desired pressure.
- 2.26 If all test completed then turn on Degasser Vacuum Pump.
- 2.27 If all tests are completed then return cabinet to normal operation. Otherwise continue below.

### **3. RATE OF RISE PRESSURE CHECK OF DEGASSER INNER COIL TUBING**

- 3.1 Read, understand and make reference to all notes indicated at the front of this document when perform the test operation.
- 3.2 Power up the ChemGuard cabinet and place in standby mode if not already powered up.
- 3.3 Confirm the main manifold flow path have been leak tested, if not then refer to Chapter 3 of the ChemGuard® Installation and Operation Manual to perform leak test first. Because testing degasser inner coil tubing will utilize same flow path to apply pressure to the inner coil tubing while monitoring the pressure rise by the atmosphere pressure switch at the degasser vacuum piping.
- 3.4 Ensure all plumbing lines lead to the Degasser Inlet and Outlet valves are leak tight.
- 3.5 Ensure chemical outlet valves manifold are closed.
- 3.6 Ensure all valve on Nitrogen purge manifold are closed.
- 3.7 Ensure degasser vacuum pump is off and valve V8 is closed.
- 3.8 In manual mode, open valves V3B, V5B, V6B leading to the vacuum transducer PT-V on the main manifold.

**NOTE:** CG110-310 will use valves V3A, V5A, V6A, and pressure transducer PT-V.

- 3.9 Select secure mode to ensure valves stay open in manual mode.

- 3.10 Now turn on degasser vacuum pump and allow pumping.
- 3.11 Verify and open Degasser Inlet/Outlet valves.
- 3.12 Verify valve V8 is open when the atmosphere pressure switch drop below 75 Torr.
- 3.13 Monitoring the vacuum transducer PT-V on the main manifold, it should start to read vacuum pressure (dropping) as the degasser vacuum pump is pumping on the degasser housing where gas get pull through the inner coil tubing.
- 3.14 The vacuum transducer PT-V should be able to read pressure drop below 500mTorr. This could take few hours if there was any push gas present inside the Teflon Inner Coil Tubing.
- 3.15 In manual mode, close valves V3B, V5B, V6B.
- 3.16 In manual mode, open valve V1B, adjust regulator R2 Helium push gas to 25 psig reading at pressure transducer PT2.
- NOTE:** CG110-310 will use valves V1A, V3A, V6A, regulator R1 and pressure transducer PT1.
- 3.17 In manual mode, now open valve V6B, allow pressure transducer to read 25 psig.
- 3.18 Observe the degasser vacuum pump is still run normally, and valve V8 is still open as the atmosphere pressure switch still stay below 75 Torr.
- NOTE:** CG110-310 will use valves V1A, V3A, V6A, regulator R1 and pressure transducer PT1.
- 3.19 Select secure mode to ensure valves stay open in manual mode.
- 3.20 Verify valves V1B, V6B are still open, wait 10 minutes.
- 3.21 In manual mode, now open valve V3B.
- 3.22 Verify and observe the conditions below, if these conditions occurred immediately within approximate about five (5) minutes, then this is indication the degasser inner coil tubing has leaked.
- Atmosphere pressure switch immediately goes above 75 Torr and fail alarm.
  - Valve V8 close.
  - Degasser vacuum pump motor increase winding (louder) sound than normal.
  - Push gas pressure transducer rapidly dropping.
- 3.23 If failed the first time, then retest second time to re-confirm before replacing the degasser unit.
- 3.24 But if it take longer than 30 minutes up to few hours and the Atmosphere pressure switch to even rise to 75 Torr, or caused valve V8 to close, and the degasser vacuum pump motor winding sound still normal. This is indication the degasser inner coil tubing free of leaks.
- 3.25 In manual mode, close valve V1B, V3B, V6B.

- 3.26 Observe the degasser vacuum pump will eventually pump down as the atmosphere pressure switch drop below 75 Torr, valve V8 is open again and the degasser inner coil tubing will be pump down normally.
- 3.27 Return all valves to normal operation.
- 3.28 Re-adjust push gas regulator R2 to desired pressure.
- 3.29 Keep the Degasser Vacuum Pump turn on.
- 3.30 If all tests are completed then return cabinet to normal operation. Otherwise continue below.

#### 4. PRESSURE DECAY TEST OF BYPASS TUBING

- 4.1 Read, understand and make reference to all notes indicated at the front of this document when perform the test operation.
- 4.2 Stop all processes on the ChemGuard (Bulk to Process, Process Fill, Bulk External Fill, etc).
- 4.3 Confirm the main manifold flow path have been leak tested, if not then refer to Chapter 3 of the ChemGuard® Installation and Operation Manual to perform leak test first. Because testing degasser housing will utilize same flow path and pressure transducer to monitor pressure decay test on degasser housing.
- 4.4 Ensure all plumbing lines lead to the Degasser Inlet and Outlet valves are leak tight.
- 4.5 Ensure chemical outlet valves manifold are closed.
- 4.6 Ensure all valve on Nitrogen purge manifold are closed.
- 4.7 Ensure Degasser Vacuum Pump is turn off.
- 4.8 Manually close valve V8 or by removing pneumatic tubing from valve actuator and pinch pneumatic line.
- 4.9 Or disconnect the DB15 cable from the Ultrasonic module to simulate a spill condition, thereby opening the Degasser Bypass valve and closing the Degasser Inlet and Outlet Valves (variable 68 must be set to 0 for the bypass to be operational).
- 4.10 In manual mode, open valves V1B, V6B, adjust regulator R2 Helium push gas to 55 psig reading at pressure transducer PT2, and open V3B to apply pressure to Degasser Bypass valve and piping.

**NOTE:** CG110-310 will use valves V1A, V6A, V3A, regulator R1, and pressure transducer PT1.

- 4.11 Select secure mode to ensure valves stay open in manual mode.
- 4.12 Allow 30 minutes for push pressure to stable at pressure transducer PT2 reading.
- 4.13 In manual mode, close valve V1B, wait 5 minutes.

- 4.14 Verify V6B and V3B are still open, and the Degasser Bypass valve is opened.
- 4.15 Select secure mode to ensure valves stay open in manual mode.
- 4.16 Record initial reading from pressure transducer PT2, and starting test time.
- 4.17 At end of 30 minutes test time, record final reading from pressure transducer PT2.
- 4.18 Calculate delta pressure and compare, if pressure drops less than 1.0 psig in 30 minutes, there is no leak at the degasser bypass valve and piping.
- 4.19 If failed the first time, then retest second time to re-confirm before replacing the degasser valve assembly.

**NOTE:** If there is leakage, the problem is most likely at VCR connections or across the valve seats.

- 4.20 Decrease regulator R2 to near close position.
- 4.21 Open valve V1B.
- 4.22 Verify V6B and V3B are still open.
- 4.23 Vent pressure by manually opening V4A, V2A, V6A, and V3A.
- 4.24 Return all valves to normal operation.
- 4.25 Re-adjust push gas regulator R2 to desired pressure.
- 4.26 If all tests are completed then return cabinet to normal operation. Otherwise continue below.

## **5. VACUUM LEAK CHECK OF BYPASS TUBING**

- 5.1 Read, understand and make reference to all notes indicated at the front of this document when perform the test operation.
- 5.2 Stop all processes on the ChemGuard (Bulk to Process, Process Fill, Bulk External Fill, etc).
- 5.3 Confirm the main manifold flow path have been leak tested, if not then refer to Chapter 3 of the ChemGuard® Installation and Operation Manual to perform leak test first. Because testing degasser housing will utilize same flow path and pressure transducer to monitor pressure decay test on degasser housing.
- 5.4 Ensure all plumbing lines lead to the Degasser Inlet and Outlet valves are leak tight.
- 5.5 Ensure chemical outlet valves manifold are closed.
- 5.6 Ensure all valve on Nitrogen purge manifold are closed.
- 5.7 Ensure Degasser Vacuum Pump is turn off.
- 5.8 Manually close valve V8 or by removing pneumatic tubing from valve actuator and pinch pneumatic line.

- 5.9 Or disconnect the DB15 cable from the Ultrasonic module to simulate a spill condition, thereby opening the Degasser Bypass valve and closing the Degasser Inlet and Outlet Valves (variable 68 must be set to 0 for the bypass to be operational).
- 5.10 In manual mode, open valves V7, V5B, V6B, and V3B to apply vacuum to Degasser Bypass valve and piping.

**NOTE:** CG110-310 will use valves V3A, V5A, V6A, and pressure transducer PT-V.

- 5.11 Select secure mode to ensure valves stay open in manual mode.
  - 5.12 Allow the bypass tubing to pump down to base pressure.
  - 5.13 Close valve V7.
  - 5.14 Record the starting vacuum pressure PT-V from the Analog Inputs menu.
  - 5.15 If the pressure starts to rise immediately (greater than 5 mTorr/min) during the first five (5) minutes, there is a problem which must be addressed prior to proceeding.
- NOTE:** If there is leakage, the problem is most likely at VCR connections or across the valve seats.
- 5.16 Allow the test to continue for a minimum of thirty (30) minutes. After thirty (30) minutes record the ending vacuum pressure PT-V from the Analog Inputs menu.
  - 5.17 Calculate the change of ending pressure from starting pressure.
  - 5.18 If pressure change divided by elapsed time (30 minutes) is greater than 5 mTorr/min, then continue the steps below. Otherwise, troubleshoot problem, fix as appropriate, and test again. Please contact Versum Materials, Inc. for troubleshooting support.
  - 5.19 Turn on Degasser Vacuum Pump.
  - 5.20 Manually open valve V8 by replacing pneumatic tubing to valve actuator.
  - 5.21 Allow Degasser Vacuum Pump to run for 15 minutes.
  - 5.22 Connect the DB15 cable to the Ultrasonic module to close the Degasser Bypass valve and open the Degasser Inlet and Outlet Valves.
  - 5.23 If all tests are completed then return cabinet to normal operation. Otherwise continue below.

## **6. ULTRASONIC SPILL SENSOR VERIFICATION**

- 6.1 Read, understand and make reference to all notes indicated at the front of this document when perform the test operation.
- 6.2 There are three (3) clamp-on Ultrasonic leak detect sensors located in series on the vacuum tubing of the High Flow Degasser. Each one should be removed, one at a time, to trigger a FAULT alarm (Degasser Leak 1, Degasser Leak 2, and Degasser Leak 3). The sensors are removed by loosening the plastic thumbscrew.

- 6.3 After each alarm is verified, replace the gel tape before re-install sensor and tighten the thumbscrew  $\frac{1}{4}$  turn past finger tight (approximately 40 in-oz torque). Verify that the alarm can be cleared from the Main Menu then test the next sensor.
- 6.4 Each combination of two sensors should be removed to verify the display screen indicate SHUTDOWN alarm appears (Dual Spill Detect), replace the gel tape before re-install sensors and tighten the thumbscrew  $\frac{1}{4}$  turn past finger tight (approximately 40 in-oz torque). Verify the alarm can be cleared from the Main Menu before testing the next combination of two sensors.

**Troubleshooting Aid:** Degasser Leak 1, Degasser Leak 2, and Degasser Leak 3 alarms can be removed by installing gel tape (SAP p/n 164016) on the inner diameter (cable-side) of the ultrasonic sensors. If adjustment is required, re-apply gel tape and mount on a surface of tubing that is free of welds. The knurled thumbscrew should be tightened  $\frac{1}{4}$  turn past finger-tight or 40 in-oz torque. If the alarm will not clear, move the sensor vertically (up or down) approximately 0.25" to avoid mounting on rough surface.

## **7. REMOVING / REPLACING HIGH FLOW DEGASSER**

**WARNING:** The Degasser Housing might retain high pressure from process push gas due to inner coil tubing had been ruptured, take caution when loosen VCR fittings. Possible liquid is spraying as VCR fitting disconnect.

**NOTE:** Proper PPE should be worn when removing the Degasser assembly.

- 7.1 Read, understand and make reference to all notes indicated at the front of this document when perform the test operation.
- 7.2 Stop all processes on the ChemGuard (Bulk to Process, Process Fill, Bulk External Fill, etc).
- 7.3 Ensure chemical outlet valves manifold are closed.
- 7.4 Ensure all valve on Nitrogen purge manifold are closed.
- 7.5 Ensure degasser vacuum is off and valve V8 is closed.
- 7.6 Ensure chemical has been removed and tubing has been purged between V3B and chemical outlet manifold upstream of valve V11-V14 (toward V3B valve and the Reservoir container).
- 7.7 Disconnect pneumatic tubing to Degasser Inlet, Outlet, and Bypass valves. (Pinch pneumatic tubing as required to stop air flow).
- 7.8 Remove three (3) ultrasonic clamp-on sensors.
- 7.9 Break VCR connections on Degasser Leak Port toward (below) the valve V8 connection. Cap and plug VCR connections

- 7.10 Break VCR connections above Degasser Inlet and Outlet valves. Cap and plug VCR connections. **Under no circumstance should the VCR connections directly on top of the Degasser be broken.**
- 7.11 Remove the entire Degasser Assembly with Degasser Inlet, Outlet, and Bypass valves attached.
- 7.12 Install new Degasser Assembly and ensure all VCR connections are properly made.
- 7.13 Re-install the three (3) ultrasonic clamp-on sensors.
- 7.14 Perform Pressure Decay Test of Degasser Housing by following the above procedure steps.
- 7.15 Perform Rate of Rise Pressure Check of Degasser Inner Coil Tubing by following the above procedure steps.
- 7.16 Perform Ultrasonic Spill Sensor Verification by following the above procedure steps.
- 7.17 Perform or replace vacuum pump or change out pump oil per manufacturer operation manual.
- 7.18 Verify all activities are completed before returning ChemGuard cabinet to normal operation.

## **8. CHECK PUMP OIL LEVEL AND MAINTENANCE**

- 8.1 Read, understand and make reference to all notes indicated at the front of this document when perform the test operation.
- 8.2 Please refer to the OEM vacuum pump operation manual for proper oil level and maintenance schedule.



# Addendum F

## ChemGuard Bulk Container Fit-up

**Section 1      Overview**

**Section 2      Cabinet Pigtails and Containers Reference**

## 1.0 Overview:

The ChemGuard® cabinet is designed to hold up to a 19 liter Process container (only VERSUM MATERIALS, INC. container at process location) and up to a 38 liter container size at the bulk location as referenced in Figure-1.

VERSUM MATERIALS, INC. Bulk containers are designed to fit into the ChemGuard cabinet. The ChemGuard bulk pigtailed are designed to match up with the VERSUM MATERIALS, INC. bulk container inlet and outlet valves as seen in Figure-3 and Figure-4.

When a non VERSUM MATERIALS, INC. Bulk container is used, it is the customer(s) responsibility to validate if the Bulk container will fit into the ChemGuard cabinet and that the bulk pigtailed will match up with the container valves. Refer to Table-1 for ChemGuard pigtail options.

The information below provides guidelines to help customer(s) with Bulk container fit-up into the ChemGuard cabinet when a non VERSUM MATERIALS, INC. Bulk container is used.

- The Bulk container shelf can be adjusted upward or downward in the ChemGuard cabinet. If the shelf is adjusted upward too high, depending on weight of the bulk container, it may require two people to lift bulk container onto the shelf.
- The Bulk container shelf can be adjusted downward by approximately 3.0in (72mm) to accommodate overall Bulk container height of 30.80in (782mm).
- For a non VERSUM MATERIALS, INC. Bulk container, it is critical to ensure the chosen Bulk container meets the criteria below:
  - The container chime-ring must not interfere with the Process container shelf.
  - The container valve port fittings must align with the ChemGuard cabinet inlet and outlet pigtailed without interfering with the container chime-ring and Process container shelf.
  - ChemGuard cabinet inlet and outlet pigtail gender must match the Bulk container valve ports. Refer to Table-1 for pigtail options currently available. If there are no matching pigtailed available, contact your local VERSUM MATERIALS, INC. commercial representative for ordering information on custom pigtailed.
- The ChemGuard cabinet is designed for 110% spill protection, which equates to 32 liters of total liquid chemical in the Process and Bulk containers. A non VERSUM MATERIALS, INC. Bulk container filled in excess of 20 liters will require the 38 liter Spill Kit, PN 162251.
- For non VERSUM MATERIALS, INC. Bulk containers with a base diameter in excess of 10.25in (260mm), the 38 liter Spill Kit, PN 162251, is required. Note that a bulk scale adaptor plate is included in the 38 liter Spill Kit.

## 2.0 Cabinet Pigtails and Containers Reference:

### ChemGuard Cabinet CG100-400,426 Models:

The CG100-400,426 models can accommodate overall Bulk container height of 30.80in (782mm). Refer to Figure-1 for detail outline of Bulk container.

### ChemGuard Cabinet CG100-400,426 Pigtail Options:

The table below contains the ChemGuard pigtail options currently available.

**Table – 1: ChemGuard Pigtail Options**

<b>CG100-325,326 Pigtail Options</b>		
<b>Inlet Pigtail</b>	<b>Outlet Pigtail</b>	<b>Selection Pigtail Options</b>
¼" FVCR	¼" MVCR	<b>P</b>
¼" MVCR	¼" FVCR	<b>C</b>
½" MVCR	¼" MVCR	<b>PB</b>
½" FVCR	¼" MVCR	<b>PP</b>
½" FVCR	¼" FVCR	<b>L2</b>

<b>CG400/CG426 Pigtail Options</b>		
<b>Inlet Pigtail</b>	<b>Outlet Pigtail</b>	<b>Selection Pigtail Options</b>
½" FVCR	¼" MVCR	<b>P / PR2 / NPB</b>

<b>CG110-410 Pigtail Options</b>		
<b>Inlet Pigtail</b>	<b>Outlet Pigtail</b>	<b>Selection Pigtail Options</b>
¼" FVCR	¼" MVCR	<b>P</b>
¼" MVCR	¼" FVCR	<b>C</b>
½" MVCR	¼" MVCR	<b>PB</b>
½" FVCR	¼" MVCR	<b>PP</b>

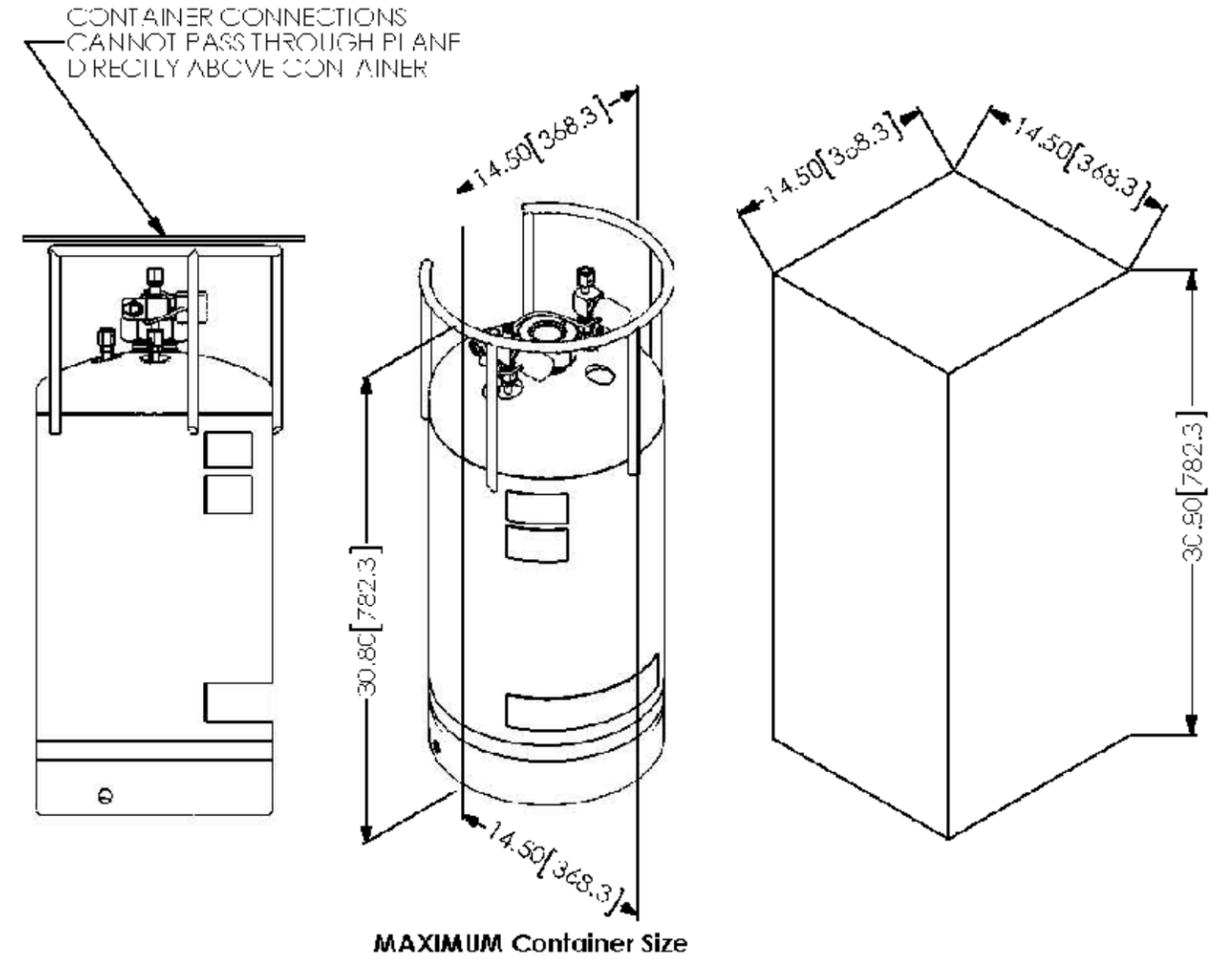
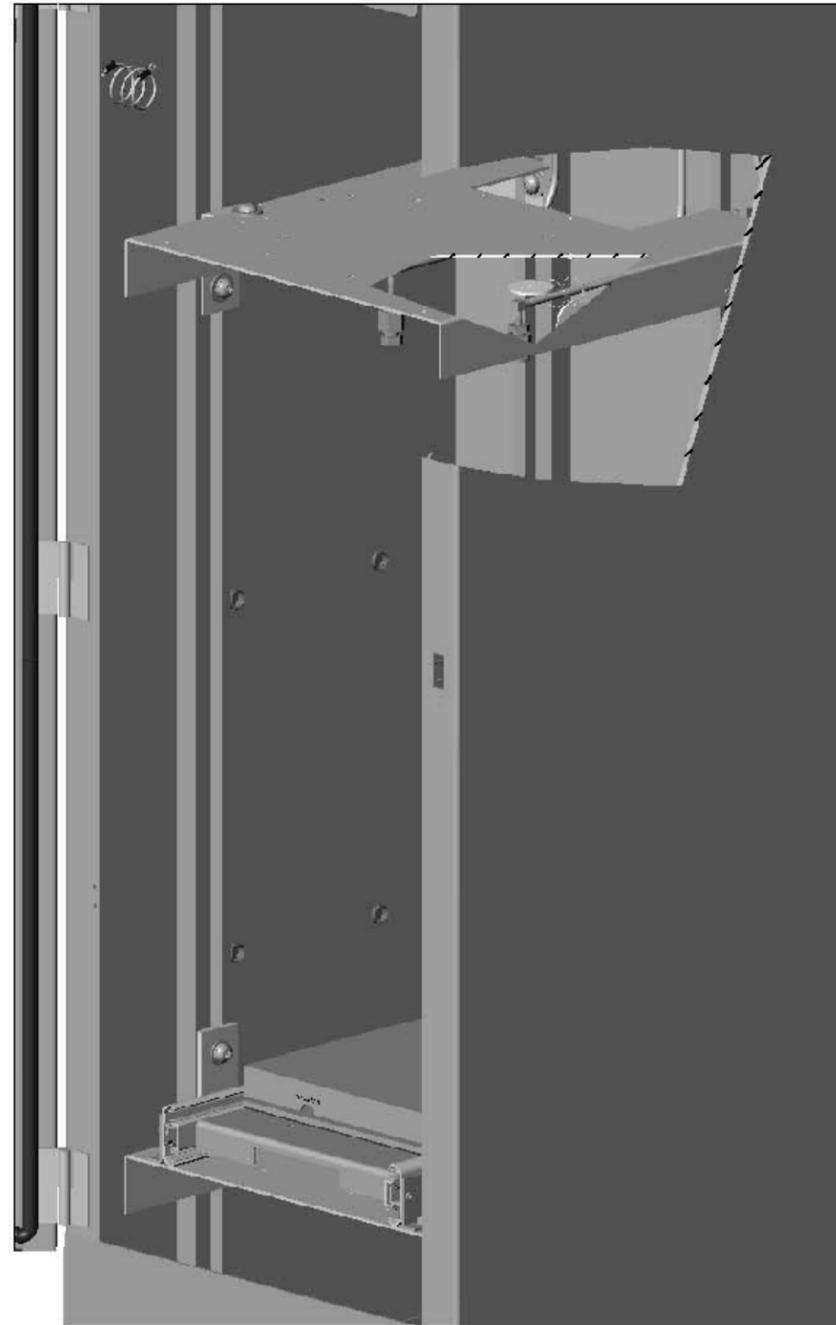
1/2" FVCR	1/4" FVCR	L2
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**ChemGuard Cabinet CG110-410 Models:**

The CG110-410 models utilize the same bulk cabinet spacing and pigtail requirements accommodating the same size Bulk container described for the CG100-400,426.

The CG110-410 models does have some flexibility to accommodate a slightly taller Bulk container as there is no Process container or Process container shelf, as shown in Figure-2.

Figure – 1: Reference CG100-400,426 Cabinet with allowable Bulk Container Dimensions.



ECR # / ECH#	REV.	DESCRIPTION	DATE	DRW	CHKD	APP'D	DATE
	0						

UNLESS OTHERWISE SPECIFIED:	APPROVALS	DATE
DESIGN	<i>W. J. Blawie</i>	01/19/2015
CHECKED	<i>T. J. Duce</i>	01/21/2015
IN CHARGE		
APPROVED	<i>K. A. Kistner</i>	03/09/2019

<p>Enc_LCG Bulk Container Fit Up</p>		
SCALE: 1:10	REF.	SI ECT 1 OF 2

SW014764.slcdlrv  
**B** **0**

Figure – 2: Reference CG110-410 Cabinet with allowable Bulk Container Dimensions.

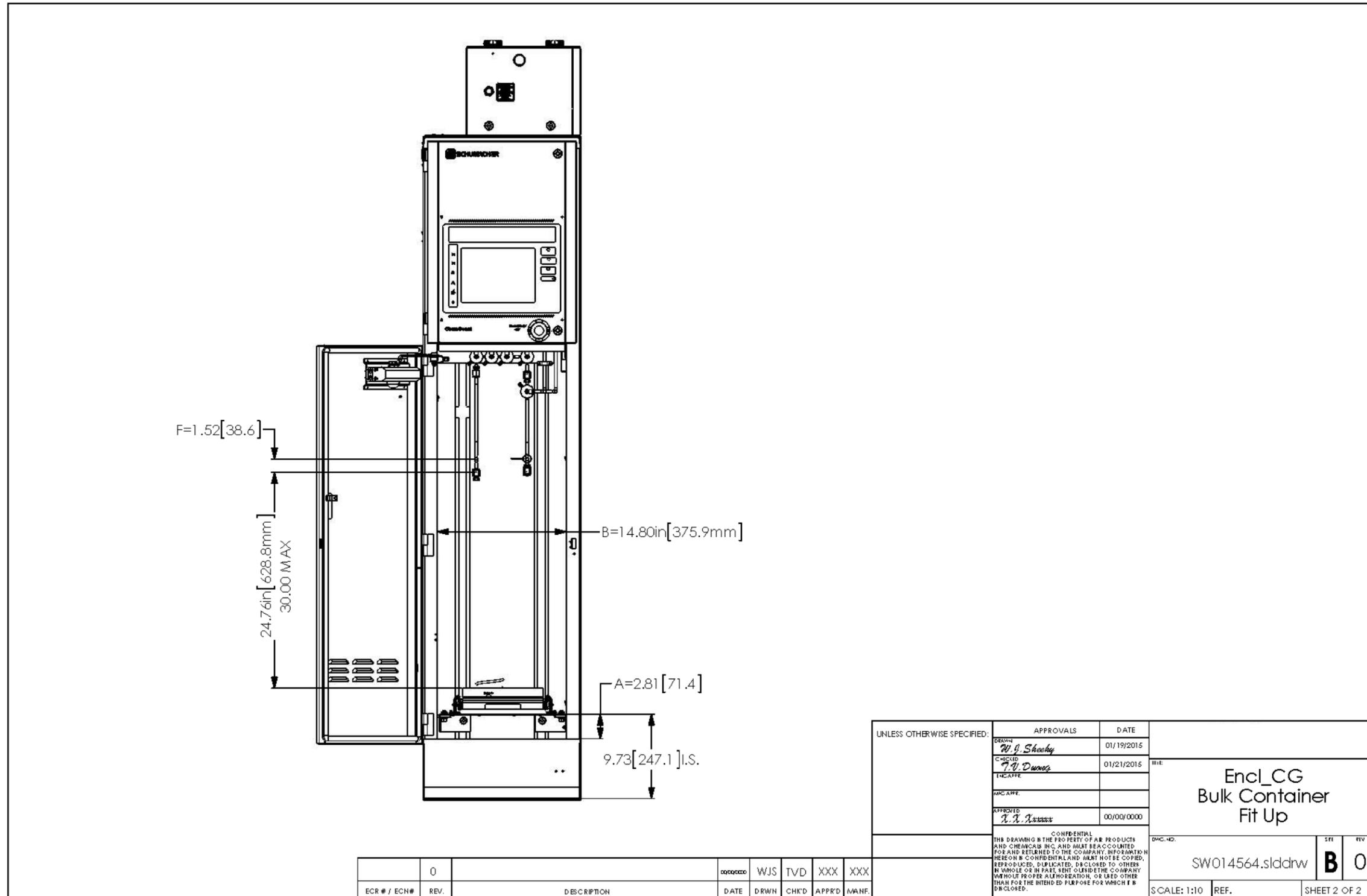


Figure – 3: Reference VERSUM MATERIALS, INC. 19 Liter Bulk Container.

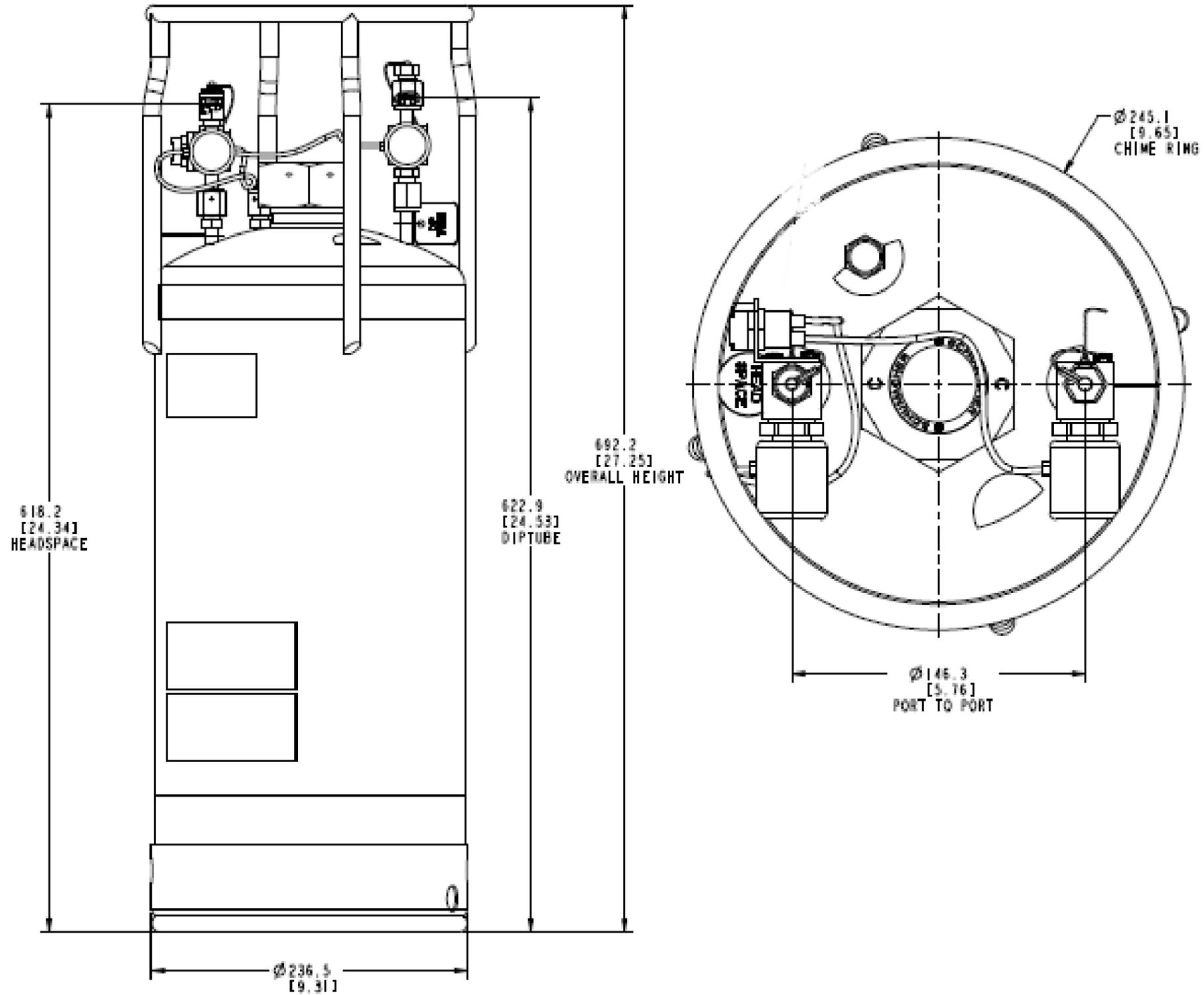
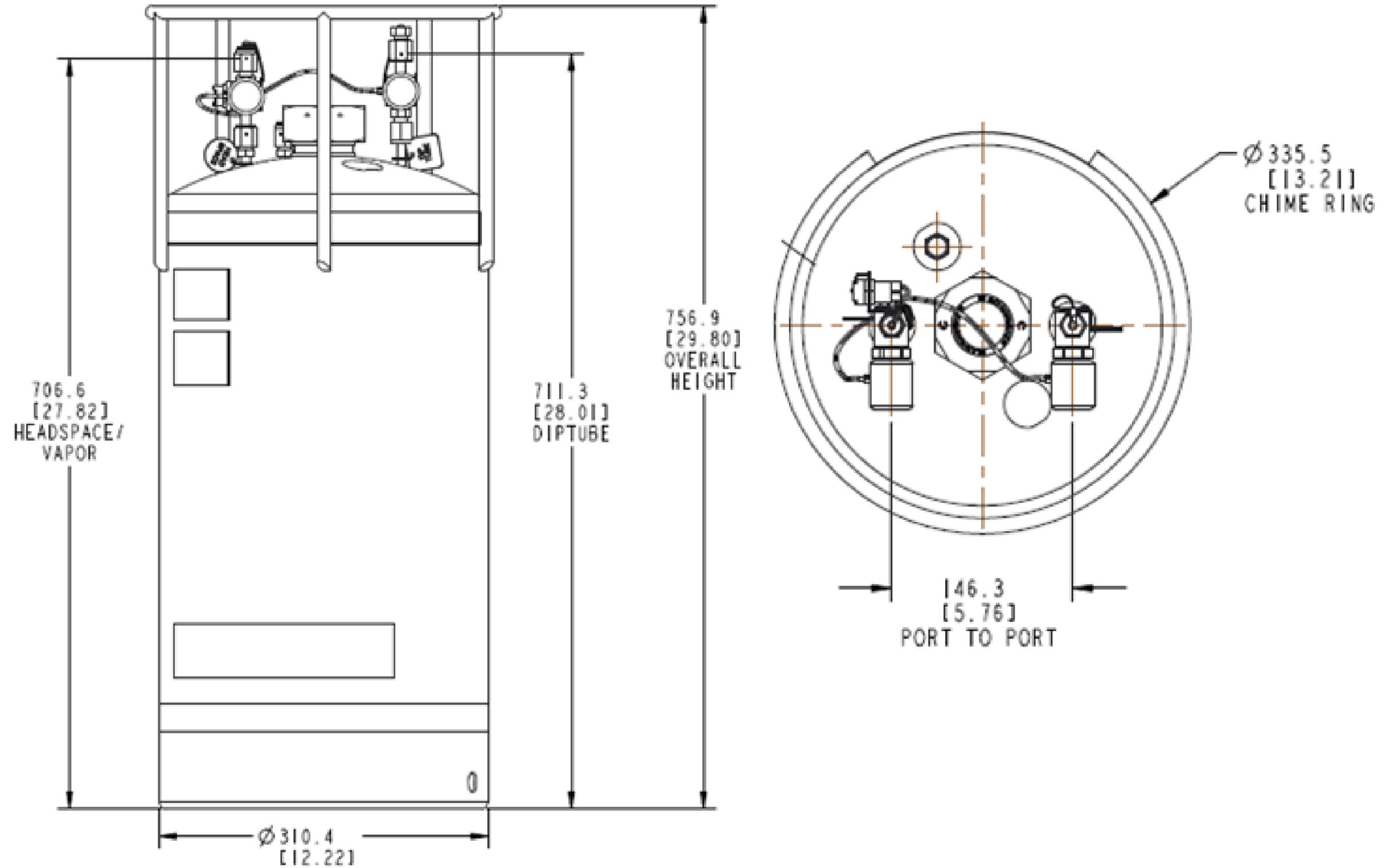


Figure – 4: Reference VERSUM MATERIALS, INC. 38 Liter Bulk Container.



# Addendum Y

## UVIR Detector

### **VERSUM MATERIALS, INC.' RECOMMENDATIONS FOR FLAME DETECTION**

**NOTE:** Versum Materials, Inc. recommends that the customer review and refer to the UVIR device manual shipped along with the system. The manual provides accurate information regarding operation, specification, calibration and maintenance of the UVIR.

- 1.1** For flame detection, Versum Materials, Inc. uses a Fire Sentry/Honeywell SS4-A or SS4-A2 UV/IR in GG500, APx, TEx, and ChemGuard cabinets, racks, wall-mounts, VMBs, VMPs, HFS, VHFS, and BSGS. Versum Materials, Inc. strongly recommends the use of a UV/IR detector over any other type of flame detection device.
  - 1.1.1** The Model No. SS4-A/-A2 Detector is a microprocessor based Electro-Optical Fire/Flame Detector that “sees” the ultraviolet (UV), visible and wide band infrared (IR) spectral bands of optical spectra. This fast-acting, digital, configurable Fire Detector will alarm to Type A, B, and C fires (Table 1).

**Table 1: Fire Types**

Class of Fire	Fuel Source
A	Ordinary combustibles (i.e., trash, wood, paper, cloth)
B	Flammable Liquids (i.e., oils, grease, tar, gasoline, paint, thinners)
C	Electricity (i.e., live electrical equipment)

**1.1.2** “The Fire Sentry UV/IR model SS4-A features algorithms that process multiple spectrums to determine if a fire exists while also rejecting false alarm signals. UV/IR monitors are tuned to respond to both UV and IR emissions (as well as other variables such as visible light, flicker frequency, etc) that algorithms use to declare a flame or reject as a false alarm. The SS4-A detector analyzes ultraviolet (UV), visible (VIS), and wideband infrared (IR) energy before declaring a fire. Generally, flames have little VIS but significant UV and IR allowing the VIS signal to assist in false alarm rejection logic. In the case of non-hydrocarbon fires, and Silane fires in particular, the spectrum that is emitted results from the interaction of oxygen and hydrogen that forms water vapor (H<sub>2</sub>O) as well as oxygen-hydrogen (OH) radicals. OH emits strongly in the 306 nanometer UV spectral band and additional emission peaks within the UV spectral band between 180 – 240 nanometers. It also emits IR radiant energy in the Near IR band with several peaks within the 1 – 3 micron spectral IR band. Water (H<sub>2</sub>O) emits mainly in the near IR band with a strong peak at 2.7 microns. Detecting the emitted radiation from a Silane flame simultaneously at both these spectral bands (UV and IR) enables fast and reliable Electro-Optical fire detection with high immunity to false alarms. Note that this Silane flame detection does not rely on IR absorbance associated with CO<sub>2</sub> (4.3 microns) evolution from hydrocarbon fires.” (Excerpt from Matthew H. MacConnell’s “UVIR Flame Detection”, Rev 1, 30 May 03)

**1.2 Field of View:** The UVIR can detect a fire within a 120 degree cone. The detector is pointed at the largest fire threat area for the fastest response times to the smallest size fire. In Versum Materials, Inc.’ equipment the UVIR will be positioned to see all VCR connections.

**1.3 Certifications:**

Class I, Div. 1 & 2, Groups B, C, & D

Class II, Div. 1 & 2, Groups E, F, G

Class III

#### 1.4 Versum Materials, Inc. Configuration Settings

The configuration of the SS4-A/-A2 UV/IR Detector is set using DIP switches located on the middle circuit board of the detector. Configuration options and Versum Materials, Inc. settings are discussed below.

**1.4.1 Verification Time:** The verification time is the amount of time the detector will wait until it declares a fire. If a fire is detected, the detector will use the specified amount of time to confirm the existence of a fire. If at the end of the time period the detector no longer detects a flame, the detector will not alarm. If at the end of the time period the detector still detects a flame, the detector will alarm. Verification time helps in reducing the number of false detections. Versum Materials, Inc. sets the verification time to 5 seconds and the verification time is always enabled. Therefore, if the detector detects a flame for 5 continuous seconds, the detector will declare a Fire Verify. Verification time is controlled by the settings of dip switches 1, 2, and 3.

**1.4.2 Latching:** In the SS4-A/-A2 Latching mode, the Fire or Verify Relay will energize and Red LEDs will remain illuminated until the detector power is cycled (power is turned off and on). If Verify is enabled when the Verify Relay energizes it will remain energized until the detector is reset. Latching is determined through the setting of dip switch 4.

**1.4.3 IR-Only Enable:** The IR-only setting allows the detector to declare a fire in situations where UV is not present or is obscured. For Silane systems, the detector must detect both UV and IR to declare a fire. This is done to reduce false detections, since silane systems are sometimes sited outdoors. These detectors are labeled with "Configured for Silane". For all other gas systems, the detector will declare a fire if UV and IR are present, but can declare a fire with only the presence of IR. False detections have not occurred on systems using the IR only mode. When the detector detects only IR in this IR only mode, it begins a UV self test. During this test, the internal UV source is turned on, UV reflects off the metal lens guard, and should be sensed by the UV sensor. If the detector does not sense the internally generated UV, it assumes that the lens is blocked, and will declare a fire based only on IR. If the internally generated UV is sensed, the detector assumes that it is working properly, and that IR is present without UV (and therefore, no fire exists). The detector will not declare a fire in this condition. IR-Only Enable is controlled by the dip switch 5 setting.

**1.4.4 Test Cycle:** Testing of the UV sensor occurs every 30 minutes. The detector has an internal UV source and performs a self-test every 30 minutes. During the self-test, the UV source is turned on, and UV is reflected off of the metal lens guard. The UV should

be sensed by the UV sensor. If the detector does not sense the UV, a fault alarm will be set off. The test cycle frequency is controlled by the dip switch 6 setting.

**1.4.5 Fire Range/Sensitivity:** The fire range/sensitivity setting is measured by the distance between the sensor and the fire (15, 30, 45, or 60 ft). The sensitivity setting refers to the distance that the detector is guaranteed to detect a burning 1 square foot puddle of gasoline. Versum Materials, Inc. sets the UV/IR so it will detect a 1 square foot gasoline fire at a distance of 60 feet. Since a leaking low pressure VCR connection would produce a significantly smaller flame than a puddle of gasoline, the sensitivity is set to a much higher distance than the actual distance of the potential leak. The fire range/sensitivity is controlled by the dip switches 7 and 8 settings.

#### 1.4.6 Dip Switch Settings (GG500, APx, TEx, ChemGuard)

The SS4-A/-A2 is configured at the Versum Materials, Inc. Factory as listed in Table 2.

**Table 2: Versum Materials, Inc.' SS4-A/-A2 Dip Switch Setting**

Switch	State	Description
1	Closed	Verify is enabled and the verify time is 5 seconds
2	Open	
3	Open	
4	Closed	Latching mode (LEDs stay on until reset)
5	Open	Used for silane only. UVIR must detect both UV and IR to declare a fire. This is done to reduce false detections, since Silane systems are sited outdoors. These detectors are labeled with "Configured for Silane".
5	Closed	Used for all other gases. The detector will declare a fire if UV and IR are present, but can declare a fire with only the presence of IR.
6	Open	Testing of the UV sensor occurs every 30 minutes.
7	Closed	The UVIR is set to detect a 1 square foot gasoline fire at a distance of 60 feet.
8	Closed	

## 1.5 SS4-A/-A2 Detector System Relays

**1.5.1 Fault Relay:** The fault relay checks for normal operation of the UV/IR Detector. The detector issues a fault condition by de-energizing its Fault Relay and the controller will show a UV/IR Fault alarm on its screen. If there is a fault, the detector will illuminate one LED to visually indicate the fault. The list of Detector Faults include temperature fault, excessive input voltage fault, no power fault, detector fault, relay fault, self-checking fault, and analog '0' current. The LED will not light if the fault is "no power". If the fault condition is eliminated, the detector will return to normal operation and the LEDs will return to blinking every 10 seconds. Faults requiring factory recertification will be indicated with the LEDs rapidly blinking.

*Temperature Fault:* The detector will fault due to temperature if during operation the internal temperature rises about 85°C or falls below -40°C. This will cause both LEDs to blink rapidly. The corrective action for this type of fault is to return the UV/IR for factory re-certification.

*Excessive Input Voltage Fault:* The detector will fault due to excessive input voltage if the input voltage becomes greater than 45 Volts. This will also cause both LEDs to blink rapidly, and the corrective action requires returning the detector for factory re-certification.

*Low Input Voltage Fault:* The detector will fault due to low input voltage if the input voltage becomes too low. In this cause, one LED is illuminated until the fault is corrected.

*No Power Fault:* The detector will fault if there is no power and/or the input voltage is interrupted or turned off. The LEDs will not be lit in this case.

*Detector Fault:* The detector will fault if the Optical Sensors fail the automatic built-in lens test. In this case one LED is on until the fault is corrected. The user should clean the inside and outside of the lens, then the exposed surface of the UV sensors, and the protective grill mounted on the outside of the housing cover. Testing of the UV sensor (automatic built-in lens test) occurs every 30 minutes (Versum Materials, Inc. setting) and the testing frequency is controlled by dip switch 6.

*Relay Fault:* The detector will fault if one of its relay circuits fails. This fault will be indicated by one LED being lit continuously.

*Self-Checking Fault:* The detector will fault if its internal microprocessor finds a failure during its self-check of the hardware and software. One LED will be lit until the fault is corrected.

*Analog "0" Current:* All of the faults described will produce an output current loss with the 4- 20 mA module option.

**1.5.2 Fire Relay:** If the detector senses a fire, the fire relay will energize and the detector will fault. The detector fault will cause the controller to issue a shutdown alarm. The detector will monitor the same x/y coordinates for a specified duration of time to verify the existence of a fire. Versum Materials, Inc. specifies the verification time to be 5 seconds. The fire relay and verification time is enabled by dip switches 1, 2, and 3.

**1.5.3 Verify Relay:** The verify relay signals the existence of a fire. For Versum Materials, Inc. applications, the Fire Verify Relay is always enabled. In the case of a fire, the Verify Relay will energize and the Fire Relay will de-energize if the fire conditions are still present at the end of the Verify Time period of five seconds. Therefore, if the sensor detects a fire (through the use of the fire relay), the Fire Verify Relay will energize and if it continues to detect a fire in the exact x/y coordinates for five seconds, the detector will declare a fire in the cabinet. The verify relay is controlled by dip switches 1, 2, and 3.

## **1.6 Controller Alarms Associated with the SS4-A/-A2 UV/IR Detector**

**1.6.1 UV/IR Fault** – If the detector's fault relay deenergizes, the controller's UV/IR fault alarm will be initialized. The UV/IR Fault alarm is a fault alarm and indicates that the UV/IR detector is not functioning properly (possible detector faults are described in section 1.5.1).

**1.6.2 Flame Detect** – If the detector's fire relay energizes, the controller's flame detect alarm will be initialized. The flame detect alarm is a shutdown alarm and will close all the valves on the side of the system that detected a fire. On VMBs, this alarm is a hardwire alarm

**1.6.3 Flame Verify** – If the detector's verify relay energizes, the controller's flame verify alarm will be initialized. The flames verify alarm is a shutdown alarm, and the alarm will close all valves throughout the system and stop the flow of gas. Power will also be turned off to the UV/IR detector. This alarm is initiated when the detector senses a steady flame or fire for five seconds. Flame verify is a hardwire alarm. The alarm is not used on VMBs since only two inputs are used, UV/IR Fault and Flame Detect (which is hardwired).

## 1.7 Operation of the Fire Sentry SS4-A UV/IR (excerpt taken from PTB071, Jan 22, 2004)

There are two LEDs on the SS4-A UV/IR that indicate the state of the detector. During normal operation without an alarm condition, the LED's on the face of the UV/IR will blink every 10 seconds. Every 30 minutes, as defined by switch 6, the detector performs a self-test. The detector tests itself by turning on a UV source inside the housing. This UV is transmitted through the lens, reflects off the metal lens guard, and is detected by the UV sensor. If the detector fails to sense the self generated UV, it will go into fault, and the controller will declare a UV/IR fault.

If the UV/IR detects a fire during testing or operation, both LED's will remain on continuously. The controller will alarm with UV/IR Flame Detect (a shutdown alarm), closing all valves on the side that detected the fire if two UV/IRs are used, or all valves if only one detector is used. If the detector continues to detect a flame for 5 continuous seconds, as defined by switches 1 through 3, the detector will declare a Fire Verify. The controller will alarm with the hardwired shutdown UV/IR Flame Verify, closing all system valves. If the system is an Automatic Backup System (ABS) Primary, it will also signal the ABS Backup to Shutdown. The fire alarm LEDs will remain on until power is cycled to the unit (power turned on and off).

The controller turns off UV/IR power when the UV/IR Flame Verify occurs. Power is restored to the UV/IR when the operator presses the controller's reset button. This causes the UV/IR to reset and un-latch. Since this Flame Verify would interrupt process gas, alternate methods can be used to manually reset the detector without interrupting process gas.

## 1.8 Version SS4-A2: "The operation of this unit is identical to the SS4-A, except the fire alarm LEDs turn off once the fire threat is eliminated, without power cycling of the device." Excerpt from Installation and Operating Manual, Model SS4-A/-A2, Rev A, July 2014.

Since Versum Materials, Inc. controllers use the relay outputs not the LEDs for detection, the SS4-A and SS4-A2 are considered identical and interchangeable in Versum Materials, Inc. equipment.

## 1.9 Testing/Maintenance of the SS4-A/-A2 Flame Detector

### 1.9.1 The SS4-A/-A2 can be manually tested to verify proper operation and should be done at least yearly. Testing the SS4-A/-A2 will require a shutdown of the equipment. A UV/IR Fault can be simulated by placing a non-reflective surface (i.e. black paper) in front of

the UV/IR metal lens protector for at least 30 minutes. This causes the UV/IR to fail its self-test, and generate a fault.

A UV/IR Flame Detect can be simulated by generating UV and IR in front of the lens. This can be done with an actual flame (NOTE: This method is dependent upon the hazard location of the UV/IR and should not be done in an area considered to be hazardous), or with a UVIR test source. It must be done continuously for at least 5 seconds. Any interruption in the UV/IR source during the 5 seconds will cause the UV/IR to restart the 5 second period.

- 1.9.2** Automatic testing of the detector is performed during detector operation. Versum Materials, Inc. specifies that the detector will self test every 30 minutes. A red LED on the detector will remain illuminated to indicate contamination of the window lens, missing the protective self-test grill, or when removing the enclosure.
- 1.8.3** The housing glass or lens should be cleaned at least every 6 months if the device is located indoors. If located outdoors, the lens should be cleaned at least monthly. To clean the housing glass, a blast of an air hose or an oil-free cloth (oil degrades the performance of UV detectors) can be used. The use of a solvent, such as alcohol, is acceptable in some cases.

## **2.0 RELATED DOCUMENTS**

- 2.1** Visit [honeywellanalytics.com](http://honeywellanalytics.com) for Product Description, Specifications, Data Sheets, and FAQs.
- 2.2** See attached Fire Sentry SS4-A/-A2 Operating Manual.

END