VERSUM MATERIALS

Installation / Operation / Maintenance Manual

CHEMGUARD GenIII 100-325,326

Chemical Equipment

Manual Part Number: 477439

Edition: Rev-9

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Revision Control Summary

Chapter	Revision	File Name
Chapter 1 – Delivery and Inspection	Rev-3	MNL000307.doc
• Reformatted to become CG100-400NT		
Chapter 2 – Site Preparation	Rev-8	MNL000308.doc
• Added 8x outlet manifold option		
Chapter 3 – Installation	Rev-8	MNL000309.doc
• Added 8x outlet manifold option		
Chapter 4 – Changing Reservoir Container	Rev-4	MNL000310.doc
• Removed CG400NT references.		
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Chapter 7 – Maintenance and Calibration Procedure	Rev-4	MNL000314.doc
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• Initial Release		
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Addendum F – CG Bulk Container Fit-up Envelope

Rev-4 MNL000292.doc

- Removed CG400NT references.

Addendum Y – UVIR Detector

Rev-6 MNL000114.doc

- Initial Release

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Chapter 1: Delivery and 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 includes one empty Process 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
- One (1) Empty Process Reservoir Container
- 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

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® 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)

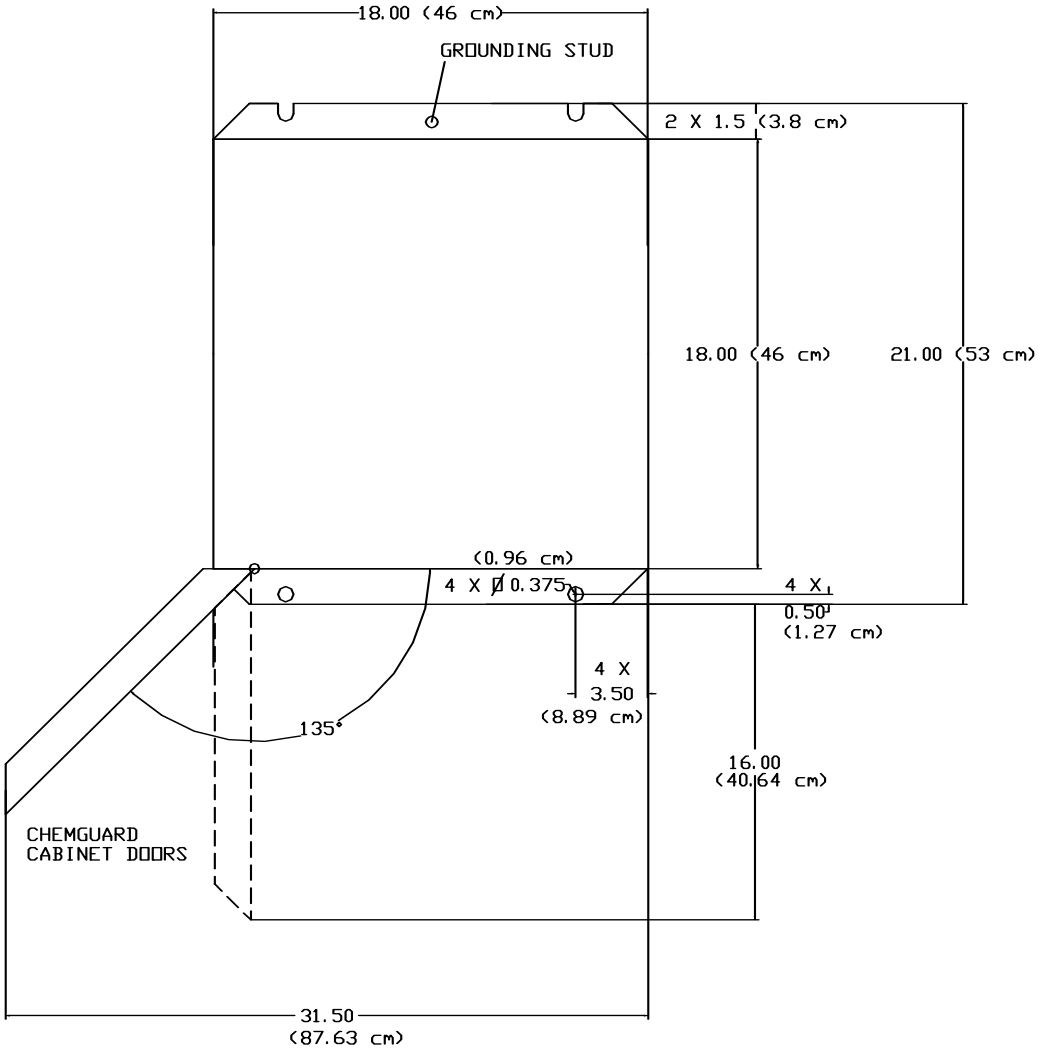
2.1.1 Bolt-Down and Ground Cabinet Requirements

Set the ChemGuard® cabinet over the bolt-down points and attach securely. Verify ChemGuard® 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® 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 with Front Door Clearances



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

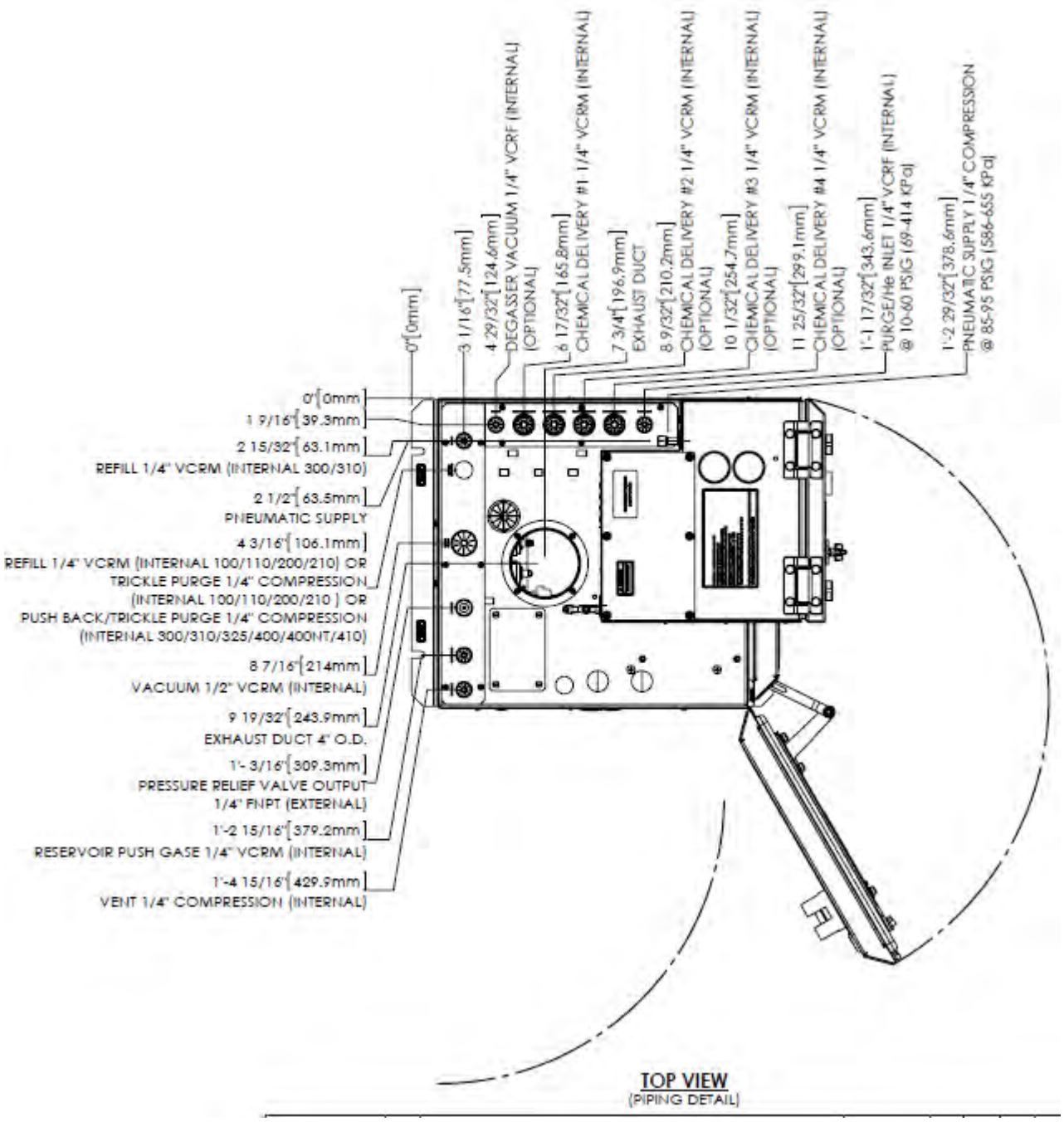
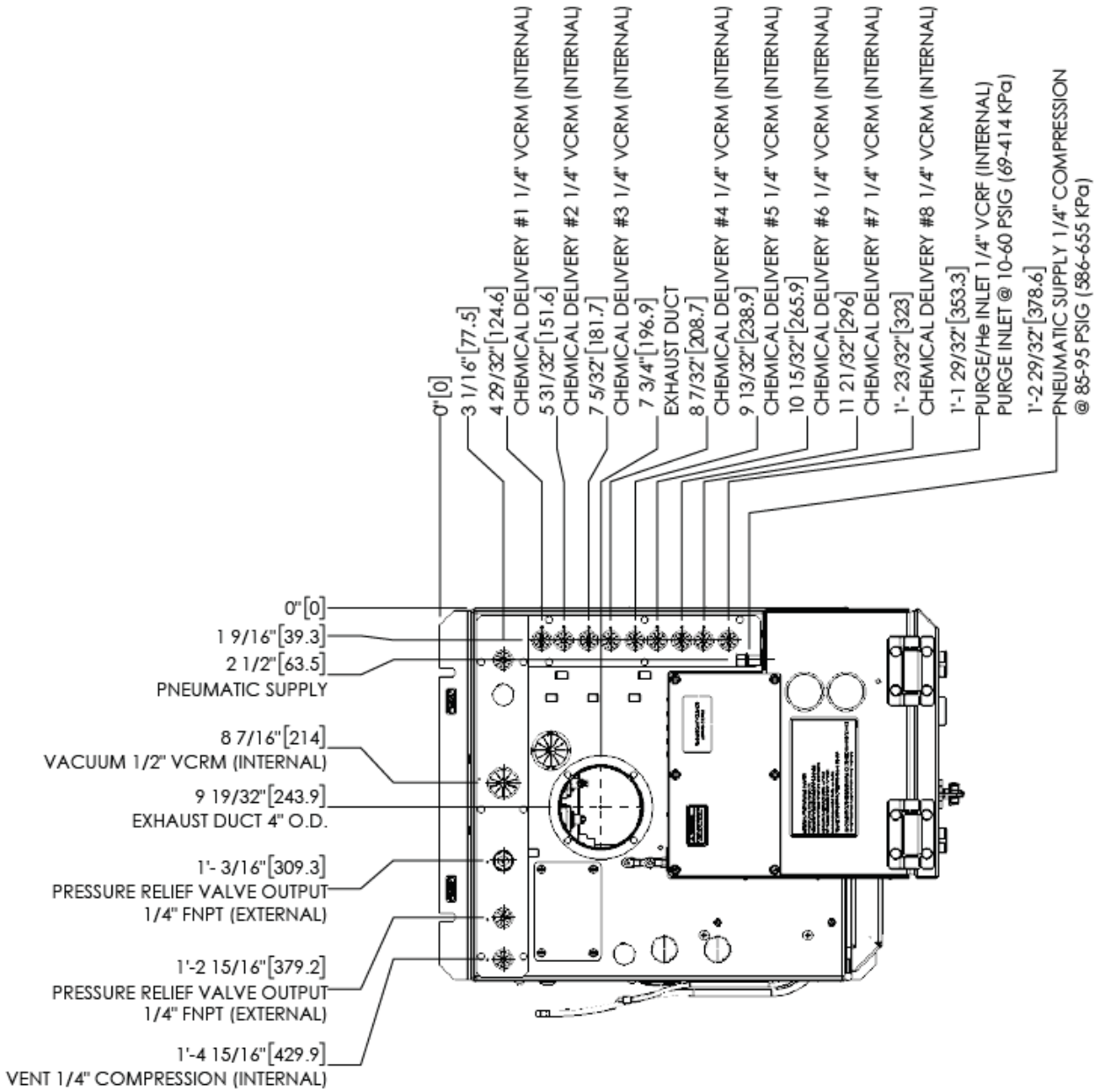


Figure 2-3: CHEMGUARD® GEN III Cabinet Connections with 8x outlets, Top View



TOP VIEW
(PIPING DETAIL)

Figure 2-4: CHEMGUARD® GEN III Cabinet Connections, Front Cabinet View

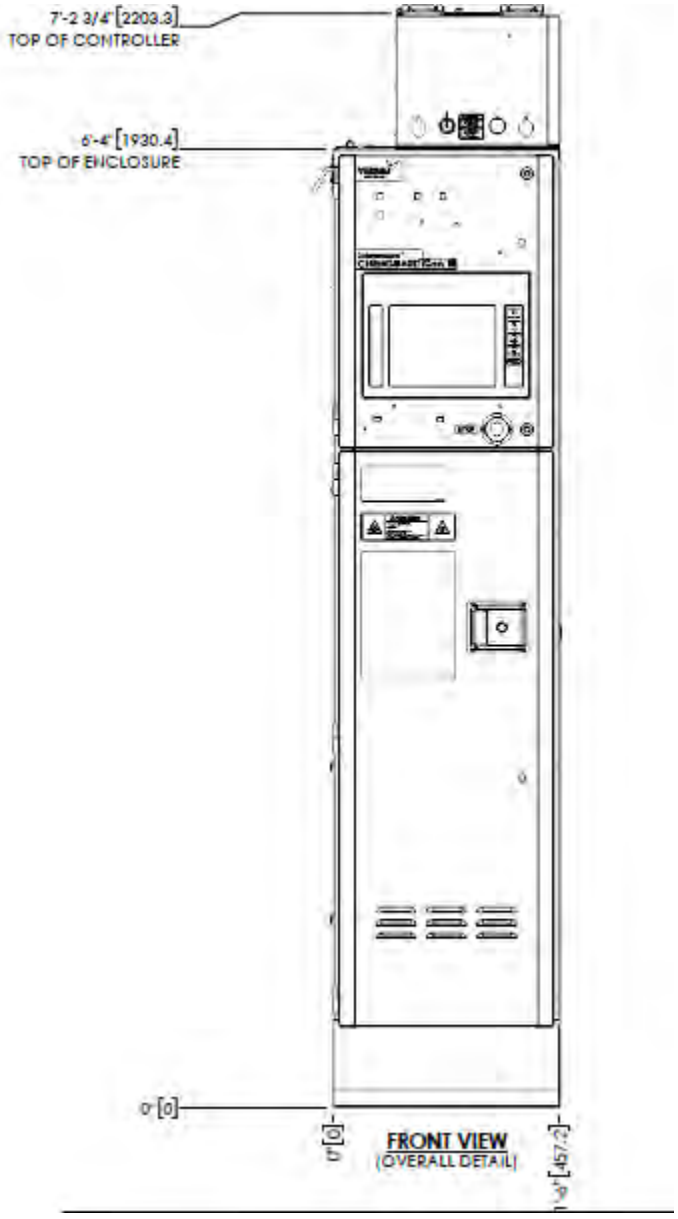


Figure 2-5: CHEMGUARD® GEN III Cabinet Connections, Right Side Cabinet View

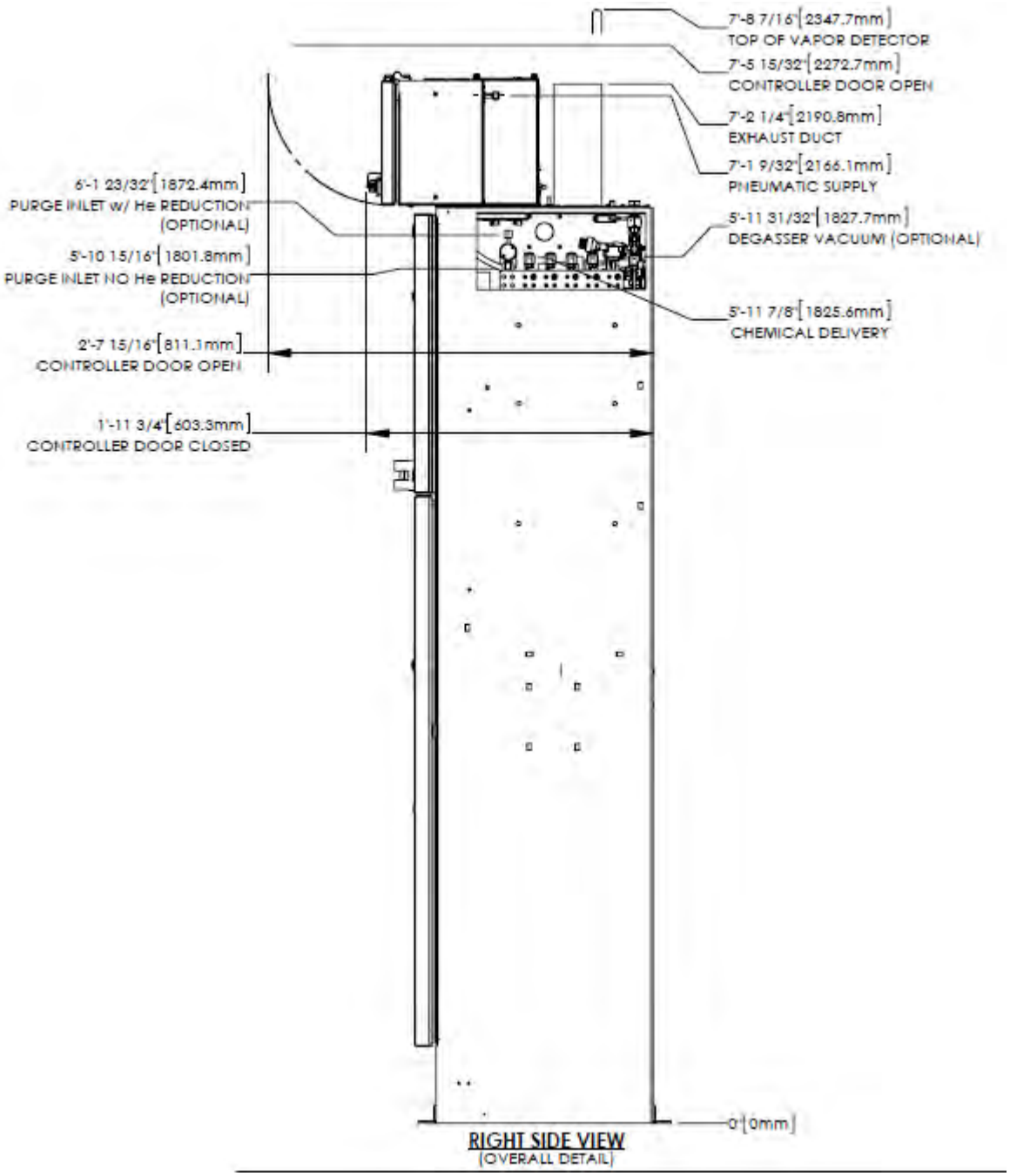


Figure 2-6: CHEMGUARD® GEN III Cabinet Connections, Right Side Cabinet View for 8x outlets

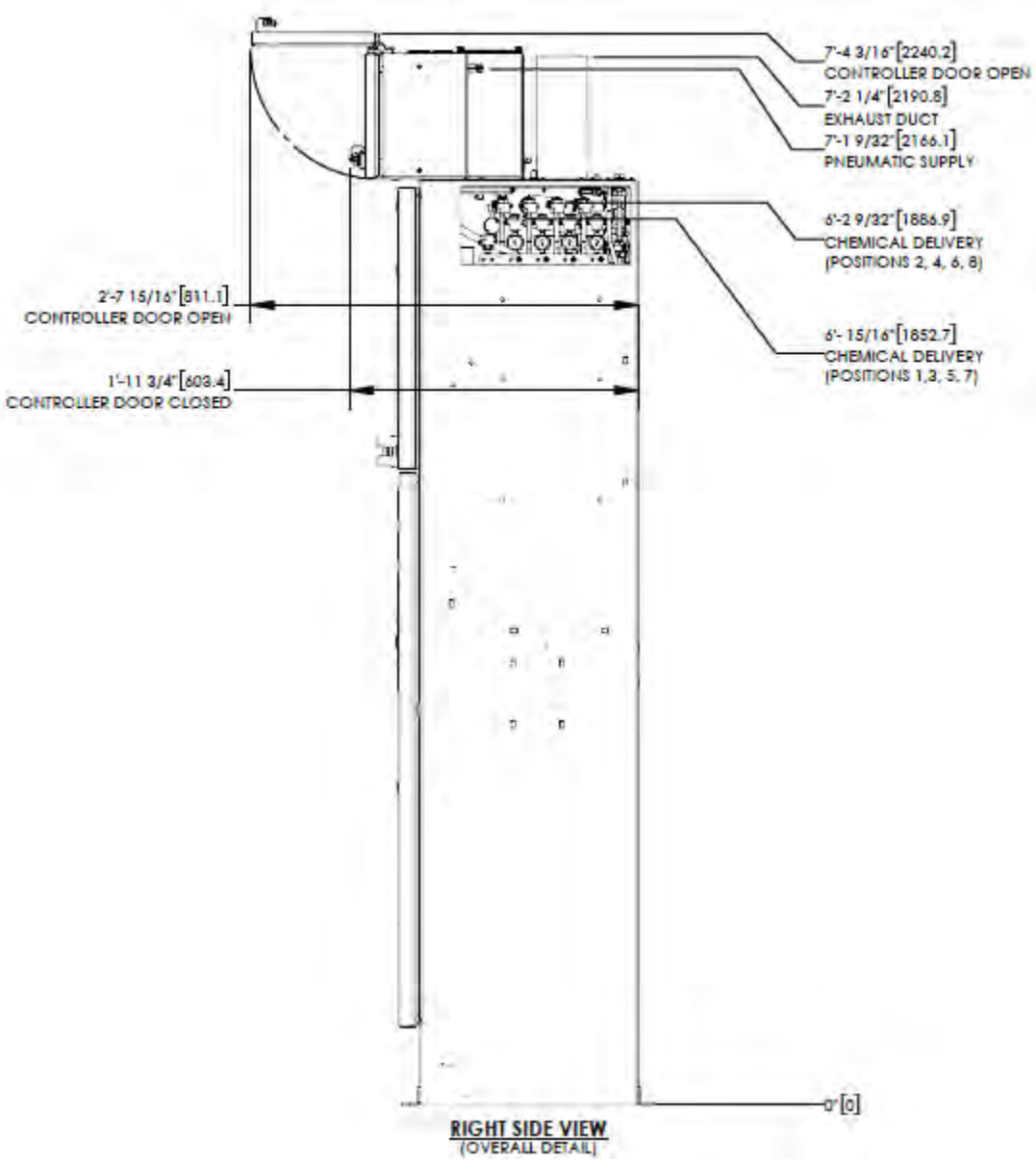
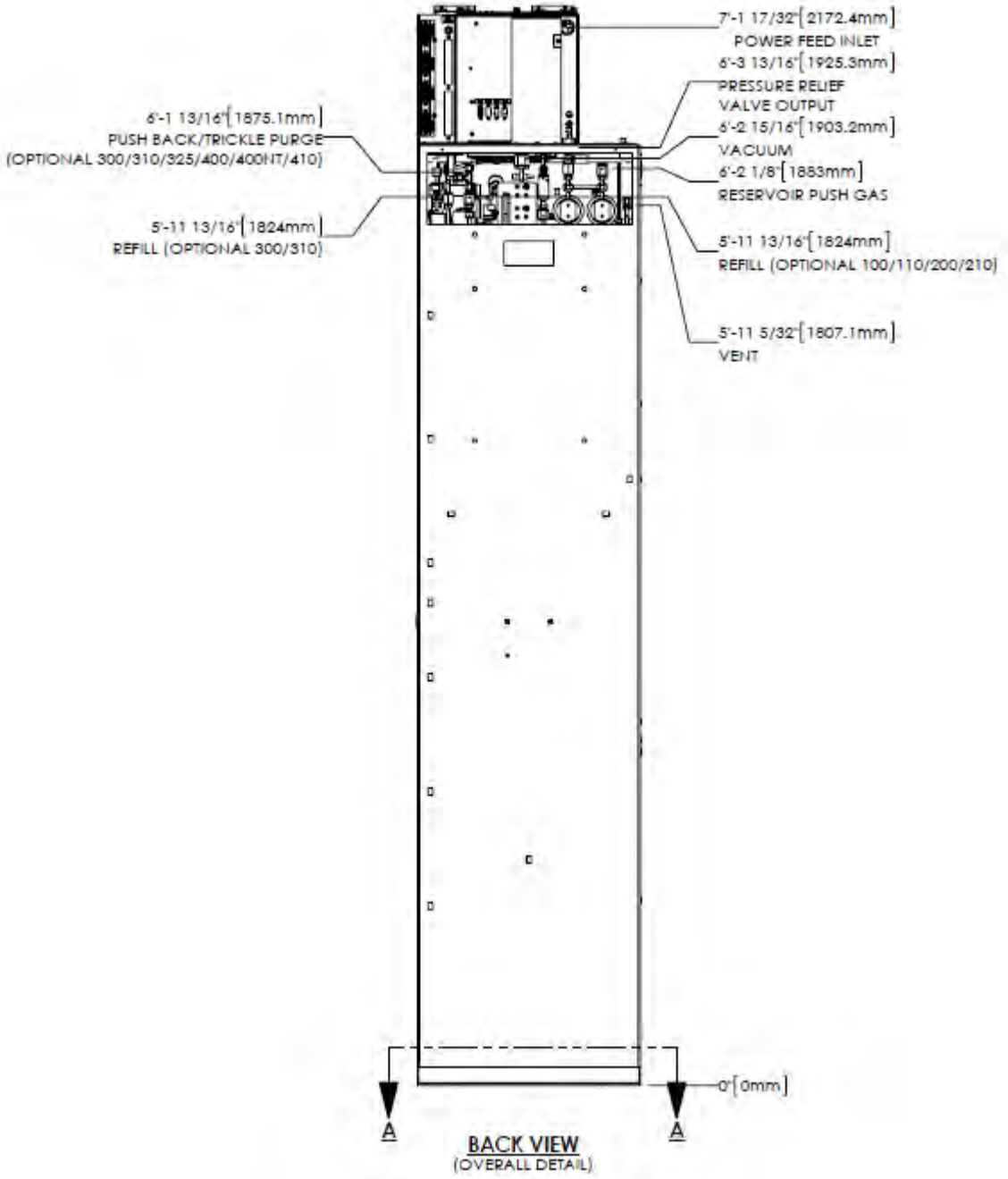


Figure 2-7: CHEMGUARD® GEN III Cabinet Connections, Back Cabinet View



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: 0ºC to 40ºC 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.

WARNING

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 there are shutoff valves and filters for gas lines feeding the ChemGuard®. 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 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. See Addendum B for recommended setup.

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 $5x10^{-9}$ atm cc/sec ($3.8x10^{-9}$ Torr L/sec).

WARNING

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

PROCESS GAS	Helium gas is Ultra High Pure semiconductor-grade recommended. Water content < 10 ppb and O2 content < 2ppm. Recommended to use Inert Gas Purifier model # SS2500KFI4RR or equivalent. Required to install a 0.003 micron gas filter.

	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. 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 and Figure 2-3) **For moisture sensitive chemicals, gas requirements are as follows:** Recommended the Water content < 10 ppb and O2 content < 2ppm. 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. **WARNING:** DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.
TRICKLE PURGE VENT (IF CG300, CG325) **TRICKLE PURGE BULK PIGTAIL (Option)**	Nitrogen gas is Pure semiconductor-grade or better recommended. Water and O2 content minimal. Required to install a 0.003 micron gas filter. 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 Connects to CABINET N2 IN port with .003 micron filter (See Figure 2-2 and Figure 2-3) **For moisture sensitive chemicals, gas requirements are as follows:** Recommended the Water content < 10 ppb and O2 content < 2ppm. 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. **WARNING:** DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.
PURGE GAS (IF OPTIONAL PURGE OUTLET MANIFOLD IS INSTALLED AND HELIUM REDUCTION OPTION)	Nitrogen gas is Ultra Pure semiconductor-grade or better is recommended. Water content <10 ppb and O2 content <2 ppm. **Note: For Helium reduction option use Nitrogen gas only, do not use Helium gas.** Recommended to use Inert Gas Purifier model # SS2500KFI4RR or equivalent. Required to install a 0.003 micron gas filter. 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 and Figure 2-3) **For moisture sensitive chemicals, gas requirements are as follows:** Recommended the Water content < 10 ppb and O2 content < 2ppm. 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.

	WARNING: DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.
PNEUMATIC	Nitrogen gas is semiconductor-grade or better is recommended. 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 and Figure 2-3) A pneumatic supply of inert gas without oxygen is recommended for our controllers. **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. 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.

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 and Figure 2-3.

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

VACUUM	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. < 15 mTorr pressure for chemicals with a vapor pressure < 500 mTorr at 20°C < 50 mTorr pressure for chemicals with a vapor pressure > 500 mTorr at 20°C 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 and Figure 2-3) Isolation valve is recommended. Recommended vacuum line tube size versus distance: • 19.05mm (3/4 in) for distance < 5 meters (15 feet). • 25.40 mm (1.0 in.) for distance < 10 meters (32 feet). • 50.80 mm (2.0 in) for distance < 20 meters (65 feet). • 102.00 mm (4.0 in) for distance < 50 meters (164 feet). **NOTE:** Venturi vacuum sources are not recommended for chemicals with a vapor pressure less than 100 Torr at 20°C **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.

WARNING

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

WARNUNG: Die Abgase der Pumpe enthalten chemische Dämpfe. Pumpenabgase müssen über ein für das jeweilig Chemikal geeignetes Abgassystem abgeführt werden.

AVERTISSEMENT: Le tuyau 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 utilize.

WARNING

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 and Appendix F.

Table 2-7: Exhaust and Vent Requirements

EXHAUST	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. **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).**
VENT	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 and Figure 2-3. **Vent line is to be connected directly to the main abatement duct and not the ChemGuard exhaust duct.** **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).** NOTE: 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 for detail.

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

CHEMICAL DELIVERY LINE	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.
Optional Outer Coaxial Line	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. **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.

2.2.9 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® BCD cabinet).

Table 2-9: Chemical Bulk Refill Line Requirements

CHEMICAL Bulk Refill LINE	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 ChemGuard. Optional Outer Coaxial Line (if required by customer or local regulations): 12.7 mm (½ in.) stainless steel.

2.2.11 Output Manifold

The Output Manifold option allows the ChemGuard® to feed chemical up to eight (8) 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.

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).

CAUTION

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

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® Reservoir Scale(s), 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.
- Use an inert gas purge to the vacuum pump gas ballast connection.

3.2 Reference Documents

For Installation and P&ID system drawings, 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 Drawings**
- **V-TSA060_ChemGuard® Chemical Fill Matrix**
- **V-TSA049_CG100-400NT GEN III Installation, Startup, Commissioning Procedure and Check List**
- **V-TSA050_CG100-400NT GEN III Commissioning Check List**

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 and pump.

125 VAC,1000 W @ 50 or 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

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 déconnection "ON/OFF". 15 cm (0,5 pieds) du tube souple de courant alternatif ressort du haut de la boîte.

WARNING

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

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 choque électrique, la boîte ChemGuard doit être reliée à la masse. Les raccords électriques doivent être seulement exécutés par un électricien qualifié.

3.4.3 Connecting Line AC Power

WARNING

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.

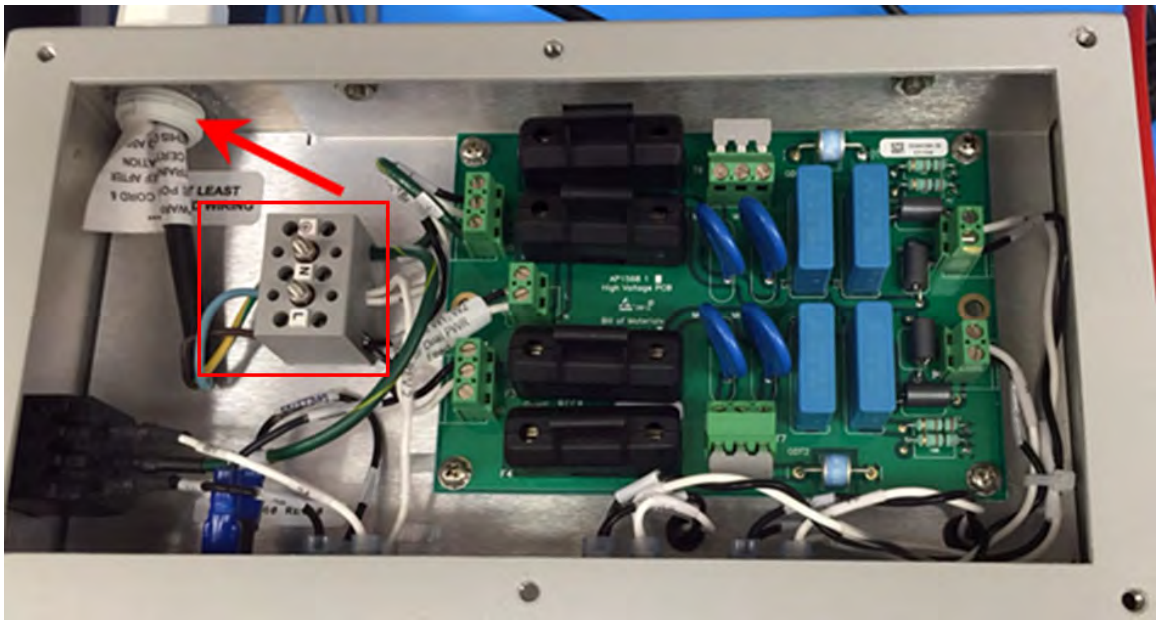
Figure 3-1: Rear View of Conduit Power Entrance

WARNING

ELECTRICAL HAZARD

A ¾" 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.

WARNING

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, section 5.2 of 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.

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

WARNING

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/cm2).

WARNING

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

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, BCD or CG 10 series.

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. The trickle purge.

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

3.5.4 Change Bulk Helium Reduction (Option)

The Change Bulk Helium Reduction option provides N2 purge gas to the Bulk Inlet/Outlet pigtails when conducting a Change Bulk operation. N2 purge spool connects into the Helium line with an isolation valve, V18 which opens during several Change Bulk purge steps reducing Helium supply gas.

The Change Bulk Helium Reduction spool connects to the N2 inlet port of the 4XN2 manifold. Purge gas to the manifold must be N2, refer to Chapter 2.

NOTE: The primary valve to operate Change Bulk Helium Reduction mode is V18.

3.5.5 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 Bulk and Change Process operation.

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

WARNING

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

WARNUNG: Die Abgase der Pumpe enthalten chemische Dämpfe. Pumpenabgase müssen über ein für das jeweilig Chemikal geeignetes Abgassystem abgeführt warden.

AVERTISSEMENT: Le tuyau 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.

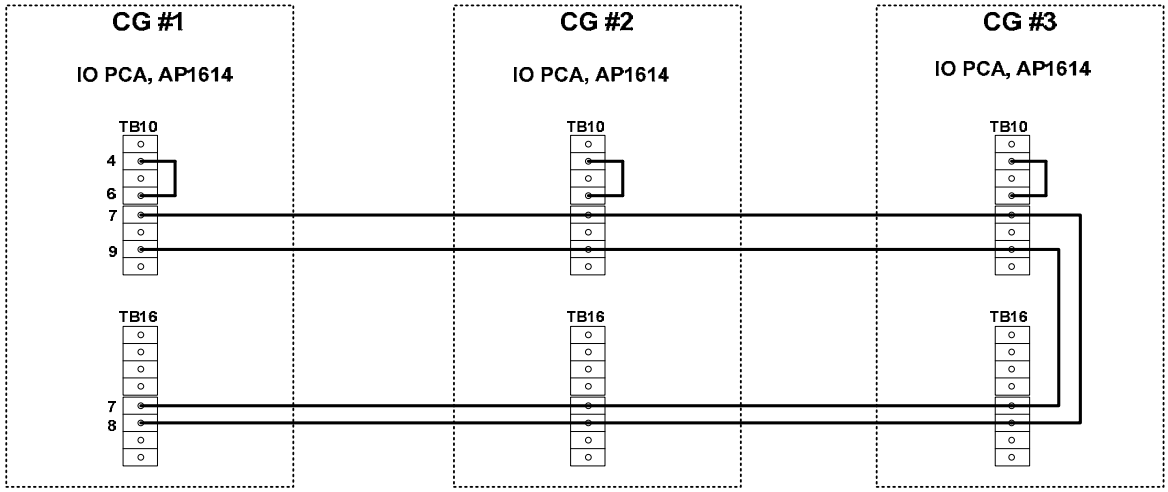
3.5.6 Multiple ChemGuard®'s Connected to A Single Vacuum Pump

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.

Vacuum Interlock wiring for multiple CGs sharing the same vacuum pump.

Figure 3-5: Vacuum Pump Interface



3.5.7 Exhaust and Vent Requirements

For Exhaust and Vent installation requirements refer to Chapter 2.

3.5.8 Connecting ChemGuard® Exhaust

1. Connect Exhaust line to the 101.6 mm (4 in.) Exhaust port on ChemGuard® cabinet.
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®.

3.5.9 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.

3.5.10 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.

3.5.11 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_2O) 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

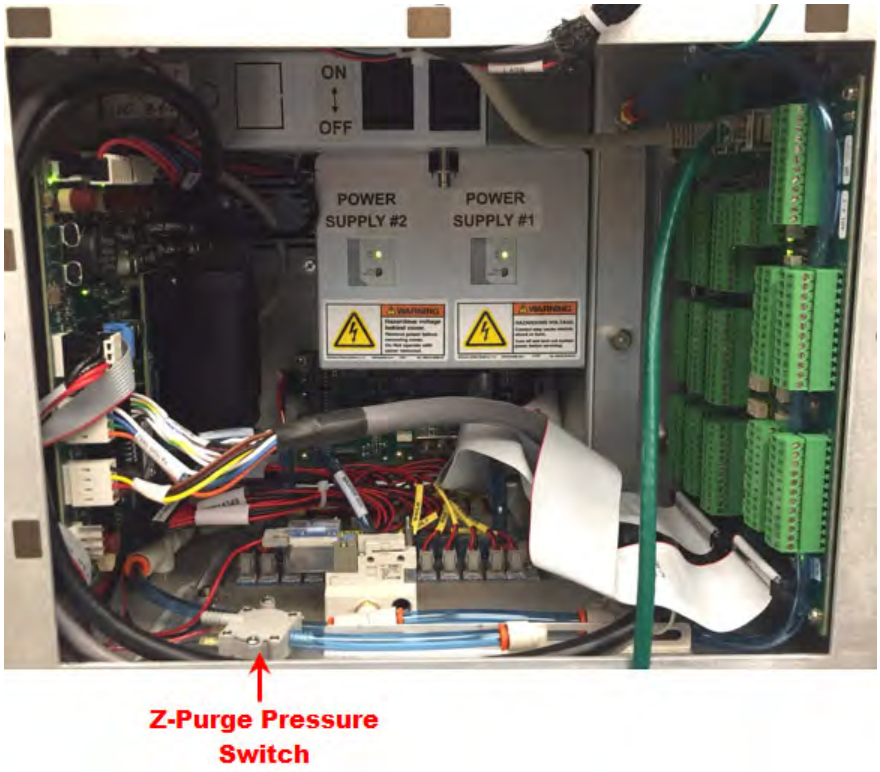


Figure 3-7: Display Panel Z-Purge Pressure Switch

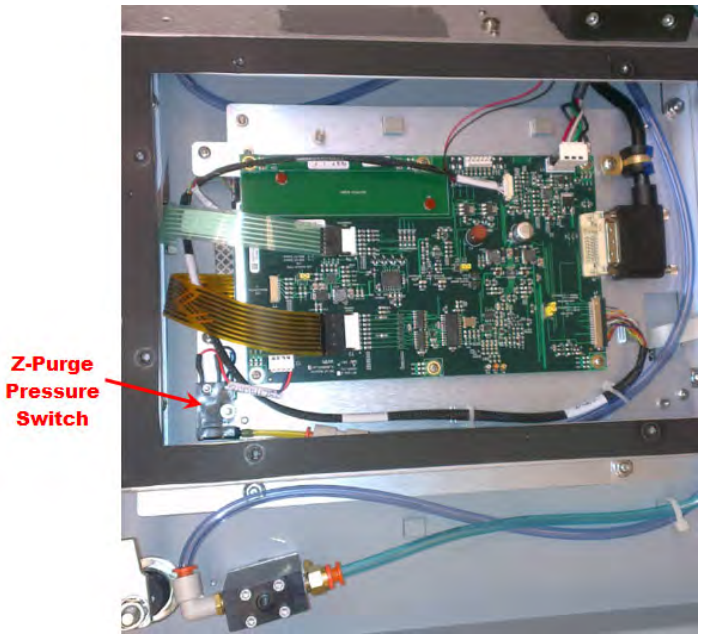
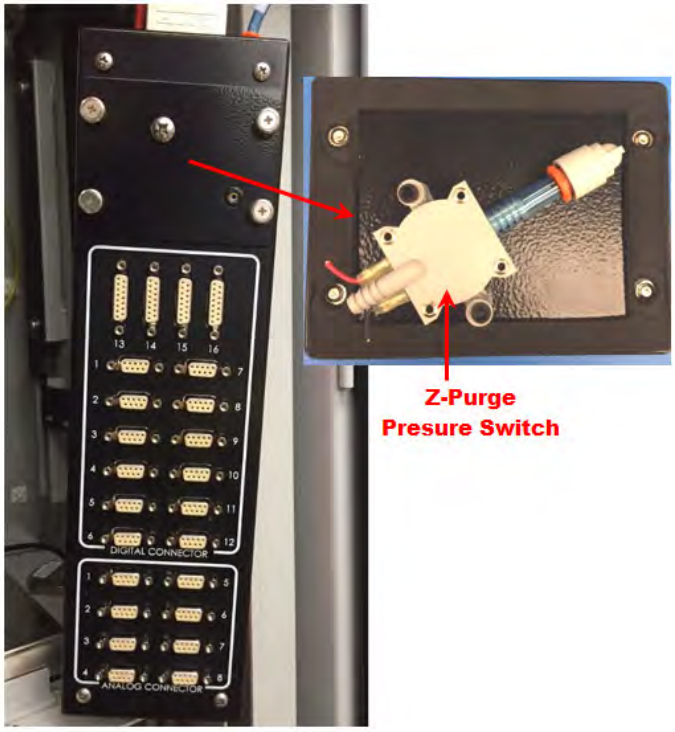


Figure 3-8: Interface Module Z-Purge Pressure Switch



3.6 Installing ChemGuard® Reservoir Scale(s)

One reservoir scale is shipped with the ChemGuard® cabinet and installed inside the cabinet for the Process reservoir. As an option a second scale can be obtained for use with the Bulk reservoir. Please contact your Versum Materials, Inc. representative for further details.

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

3.6.1 Bulk Scale Installation

If ordered for your 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

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

VORSICHT: Die Waage beim Einsetzen nicht aufschlagen lassen da sie dadurch baschadigt warden kann.

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

CAUTION

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.

NOTE: These steps apply to installation of the optional Bulk Scale.

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®. (See below tables for connector and signal identification.). Refer to Chapter 2 for general cable specification.

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

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 - Process Fill Enable

Digital Input #	Input Label	AP1614		DB25 Bulkhead Connector
		TB1-TB4	CONFIGURATION	
37	Process Fill Enable – Tool 1 (V11)	TB1; 1&2	Dry Contact	J1; 20&22
38	Process Fill Enable – Tool 5 (V21)	TB1; 3&4	Dry Contact	J1; 23&25
39	Process Fill Enable – Tool 2 (V12)	TB2; 1&2	Dry Contact	J2; 20&22
40	Process Fill Enable – Tool 6 (V22)	TB2; 3&4	Dry Contact	J2; 23&25
41	Process Fill Enable – Tool 3 (V13)	TB3; 1&2	Dry Contact	J3; 20&22
42	Process Fill Enable – Tool 7 (V23)	TB3; 2&4	Dry Contact	J3; 23&25
43	Process Fill Enable – Tool 4 (V14)	TB4; 1&2	Dry Contact	J4; 20&22

44	Process Fill Enable – Tool 8 (V24)	TB4; 3&4	Dry Contact	J4; 23&25

NOTE: 1 of the 4 inputs must be closed in order to enable Process Fill. If not "No Tools Active" alarm will be generated and prevent process fill mode.

Note: Digitals 38, 40, 42, 44 are designated as Process Fill Enable only when the 8x outlet manifold option is selected.

Table 3-8: Tool Input - Bulk > Process Enable

Digital Input #	Input Label	AP1614		DB25 Bulkhead Connector
		TB1-TB4	CONFIGURATION	
38	Bulk>Process Fill Enable – Tool 1	TB1; 3&4	Dry Contact	J1; 23&25
40	Bulk>Process Fill Enable – Tool 2	TB2; 3&4	Dry Contact	J2; 23&25
42	Bulk>Process Fill Enable – Tool 3	TB3; 3&4	Dry Contact	J3; 23&25
44	Bulk>Process Fill Enable – Tool 4	TB4; 3&4	Dry Contact	J4; 23&25

NOTE: If Variables; Bulk>Process Fill select is enabled; all 4 inputs must be closed or jumper installed in order to enable Bulk>Process Fill. If not "Action Required" alarm will be generated along with a display prompt preventing Bulk>Process Fill enable.

NOTE: These digital inputs are only designated in this manner if the 8x outlet manifold option is not selected.

Table 3-9: Vacuum Interlock

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

Table 3-10: External Bulk Refill

Digital Input #	Input Label	AP1614	
		TB10	CONFIGURATION
29	* XFILL OFF – from CG BCD / CG 10 Series	1	Dry Contact

	* Input must be closed to enable/start XFILL operation to refill Bulk container		

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

Table 3-11: Life Safety Outputs/External Fill Request

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
		6	N/C
11	FIRE - (Option) • Heat ROR • UVIR • Smoke Detect	7	N/O
		8	Common
		9	N/C
12	Door Open (Xfill Request for 8x configuration)	10	N/O
		11	Common
		12	N/C
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 – V11 (non-8x configurations only)	1	N/O
		2	Common
		3	N/C
22	Chem On – V12 (non-8x configurations only)	4	N/O
		5	Common
		6	N/C
23	Chem On – V13 (non-8x configurations only)	7	N/O
		8	Common
		9	N/C
24	Chem On – V14 (non-8x configurations only)	10	N/O
		11	Common
		12	N/C

Table 3-13: Alarm Outputs - 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 (Bulk Empty*)	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&8

NOTE: Bulk Empty DO26 alarm is for 8x configuration only

NOTE: Bulk Empty DO28 alarm is not associated to Tool 1 for 8x configuration

Table 3-14: Alarm Outputs - 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 (Bulk Empty*)	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&8

NOTE: Bulk Empty DO26 alarm is for 8x configuration only

NOTE: Bulk Empty DO28 alarm is not associated to Tool 1 for 8x configuration

Table 3-15: Alarm Outputs - 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 (Bulk Empty*)	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&8

NOTE: Bulk Empty DO26 alarm is for 8x configuration only

NOTE: Bulk Empty DO28 alarm is not associated to Tool 1 for 8x configuration

Table 3-16: Alarm Outputs - 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 (Bulk Empty*)	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&8

NOTE: Bulk Empty DO26 alarm is for 8x configuration only

NOTE: Bulk Empty DO28 alarm is not associated to Tool 1 for 8x configuration

Table 3-17: Alarm Outputs – Tool 5

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB13	CONFIGURATION	
13	Shutdown Alarm	1&2	Dry Contact	N/A
		TB14	**CONFIGURATION**	**DB25 Bulkhead Connector**
21	Chem On (Process in Fill)	5&6	Dry Contact	N/A
		TB5-8	**CONFIGURATION**	**DB25 Bulkhead Connector**
28	Bulk Empty	7&8	Dry Contact	N/A

NOTE: Table 3-17 alarms are for 8x configuration only.

Table 3-18: Alarm Outputs – Tool 6

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB13	CONFIGURATION	
14	Shutdown Alarm	4&5	Dry Contact	N/A
		TB14	CONFIGURATION	DB25 Bulkhead Connector
22	Chem On (Process in Fill)	5&6	Dry Contact	N/A
		TB5-8	CONFIGURATION	DB25 Bulkhead Connector
28	Bulk Empty	7&8	Dry Contact	N/A

NOTE: Table 3-18 alarms are for 8x configuration only.

Table 3-19: Alarm Outputs – Tool 7

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB16	CONFIGURATION	
17	Shutdown Alarm	1&2	Dry Contact	N/A
		TB14	CONFIGURATION	DB25 Bulkhead Connector
23	Chem On (Process in Fill)	5&6	Dry Contact	N/A
		TB5-8	CONFIGURATION	DB25 Bulkhead Connector
28	Bulk Empty	7&8	Dry Contact	N/A

NOTE: Table 3-19 alarms are for 8x configuration only.

Table 3-20: Alarm Outputs – Tool 8

Digital Output #	Output Label	AP1614		DB25 Bulkhead Connector
		TB16	CONFIGURATION	
18	Shutdown Alarm	4&5	Dry Contact	N/A
		TB14	CONFIGURATION	DB25 Bulkhead Connector
24	Chem On	5&6	Dry Contact	N/A

	(Process in Fill)			
		TB5-8	**CONFIGURATION**	**DB25 Bulkhead Connector**
28	Bulk Empty	7&8	Dry Contact	N/A

NOTE: Table 3-20 alarms are for 8x configuration only.

Table 3-21: PLIS Alarm Outputs

Digital Output #	Output Label	PLIS1 / PLIS2 / PLIS3 / PLIS4	CONFIGURATION
27	Chem On (Process 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 3-22: 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® cabinets can be connected to a Global Communication System (GCS) that provides continuous, 24-hour, on-line monitoring of the status of all connected ChemGuard® cabinet. The connection should be made with a 10BaseT Ethernet cable.

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

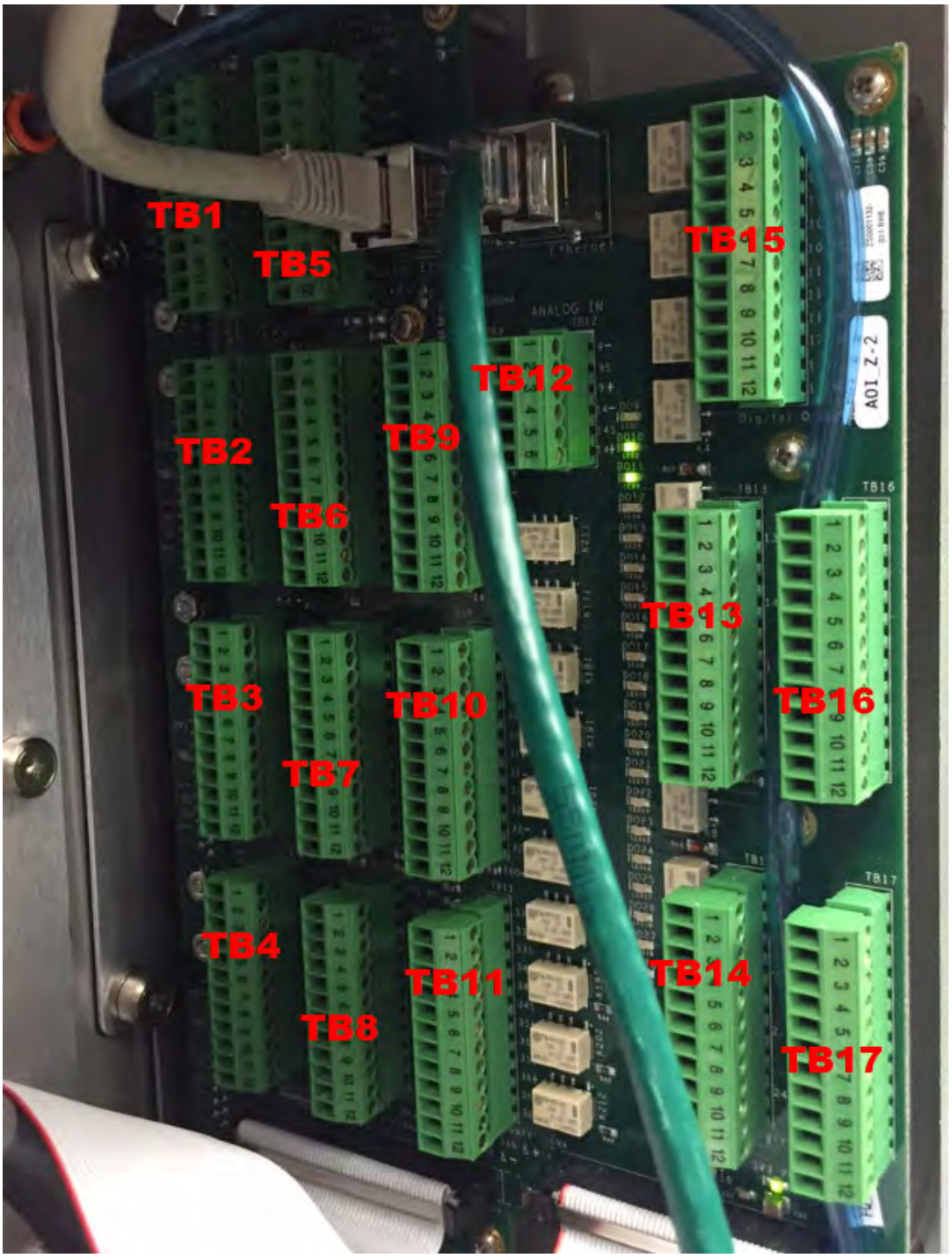


Figure 3-10: Tool 1-4 DB25 Connectors

Figure 3-11: PLIS 1-4 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

Apply AC power to the Controller.

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 3-13.

Verify power is on to the CG. The CG Display will light and go to boot-up display.

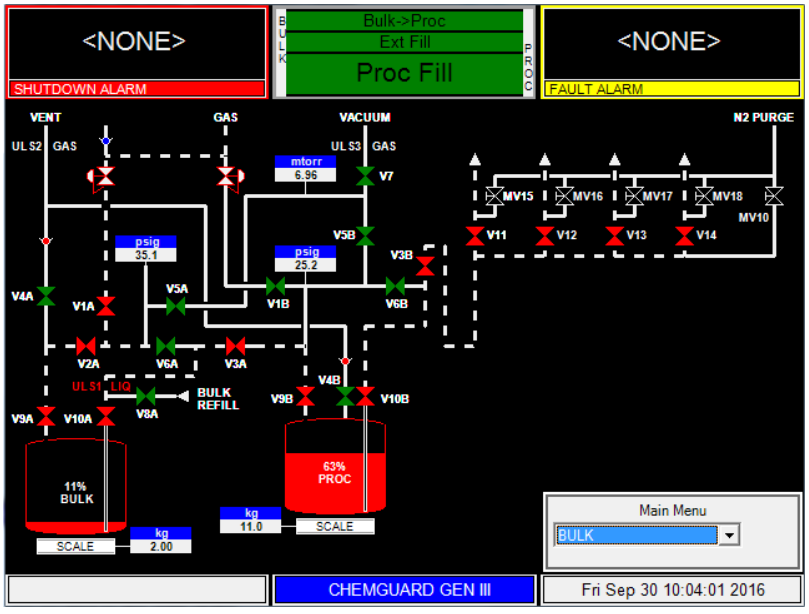
Acknowledge any alarms and log into the main menu to verify the Display is working properly.

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



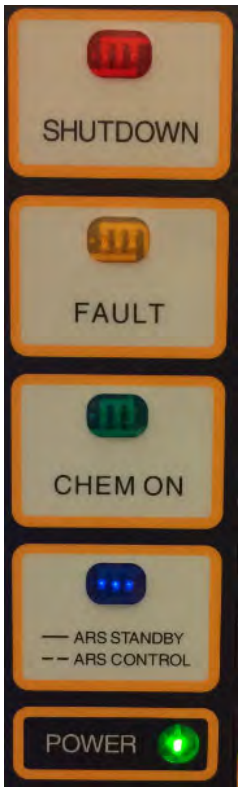
3.8.3 System Status LEDs

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.

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.

Figure 3-13: Controller LEDs



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.

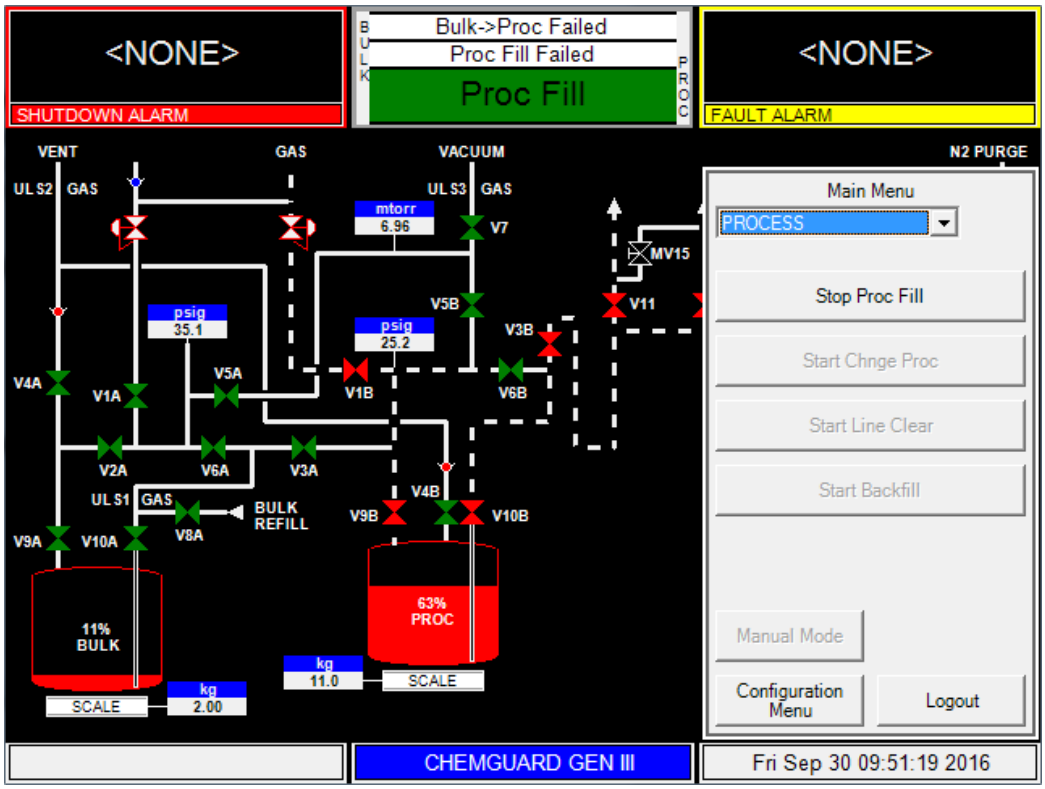
From the Main Menu, enter Config Menu ->

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

3.8.5 Main Menu and Configuration Selection Window

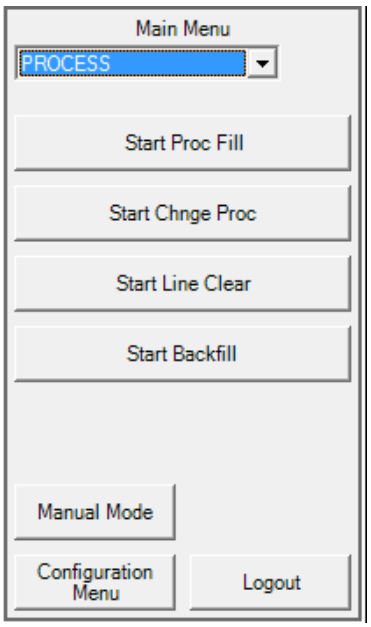
Once a password is successfully entered, the selection window will display on the right side of the screen to show prompts and menu selections. It will remain displayed for a configurable amount of time or until the “LOGOUT” key is pressed.

Figure 3-14: CHEMGUARD® Main Menu Display Screen

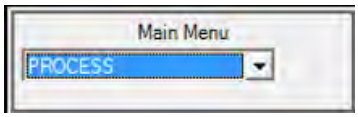


3.8.6 ChemGuard® Controller Main Menu

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.



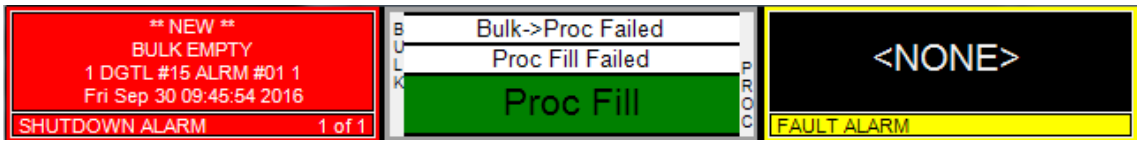
3.8.7 Alarm and Controller Status Boxes

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 Process Fill, Bulk>Process Fill 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, Process Fill, Bulk->Proc Fill 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 Process on (Process Fill, Bulk->Proc Fill or External Fill, if Bulk refill option is available).

3.9 ChemGuard® System Configuration

3.9.1 User Setpoints – Process Scale (Analog)

Configuring Process analog scale “Fill” & alarm setpoints.

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

Table 3-24: User Setpoints > Process Scale

Num	Alarm Label	Percent
1	PROC RES Overfull	85%
2	PROC RES Low	65%
3	PROC RES Empty	50%
4	PROC HI Refill	70%
7	PROC LOW Refill	68%

3.9.2 User Setpoints – Process Push (Digital)

Configuring Process Push PT2 “Pressure Alarm” setpoints.

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

Table 3-18: User Setpoints > Process Push

Num	Alarm Label	Setpoint
1	LOW PUSH PRES PR	5 psig below R2 setting
2	HI PUSH PRES PR	5 psig above R2 setting
3	LOW PUSH PRES PR	5 psig below R2 setting
5	PROC PULSE VENT	3 psig above R2 setting
8	GROSS LEAK PT2	10 psig

3.9.3 User Setpoints – Bulk Scale (Analog)

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

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

Table 3-26: User Setpoints > Bulk Scale

Num	Alarm Label	Percent
1	BULK RES Overfull	105%
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.

3.9.4 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 3-27: 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

3.9.5 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 3-28: 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

3.9.6 Fill Timers (System Setup)

Configuring Fill Timer for Bulk and External Refill.

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

Table 3-29: System Setup > Fill Timers

Num	Label	Timer
1	Bulk>Process	20 sec
16	Ext Fill	60 sec

NOTE: Do not enter fill timer for Process Fill. Process Fill remains in Fill Enable indefinitely.

3.10 Manual Mode

CAUTION

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

WARNING

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.

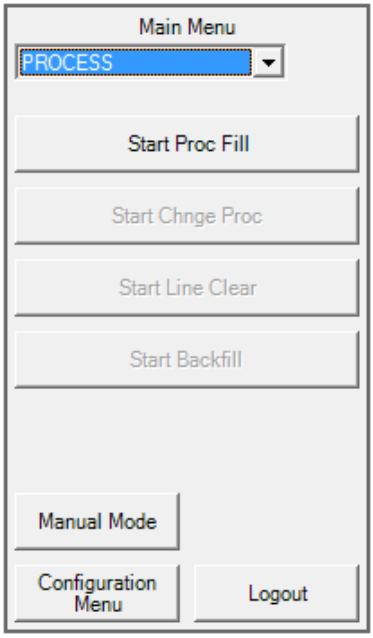
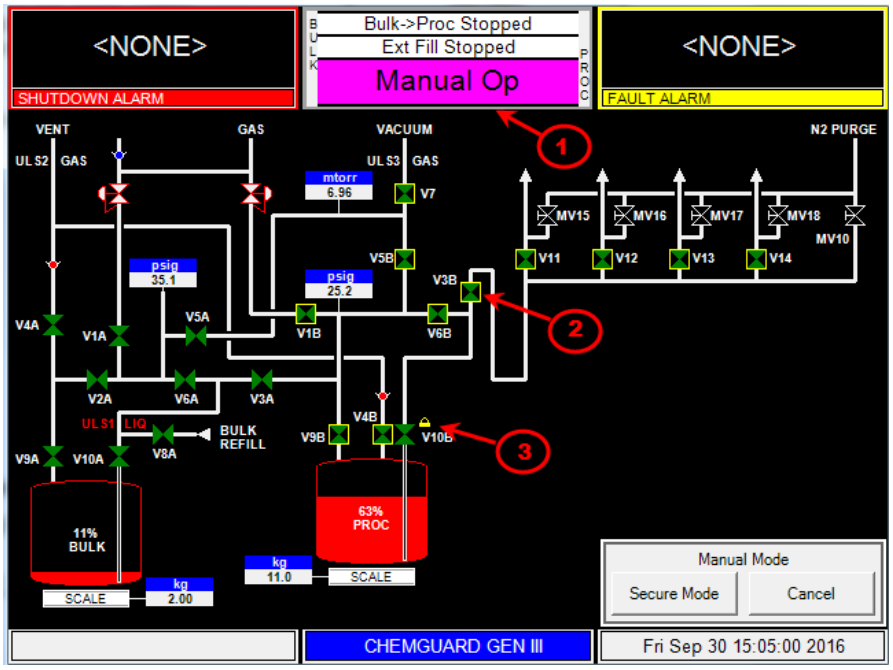


Figure 3-16: CHEMGUARD® Manual Mode Display



1. Controller Status box changes to Violet for operation selected, Bulk, Process 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

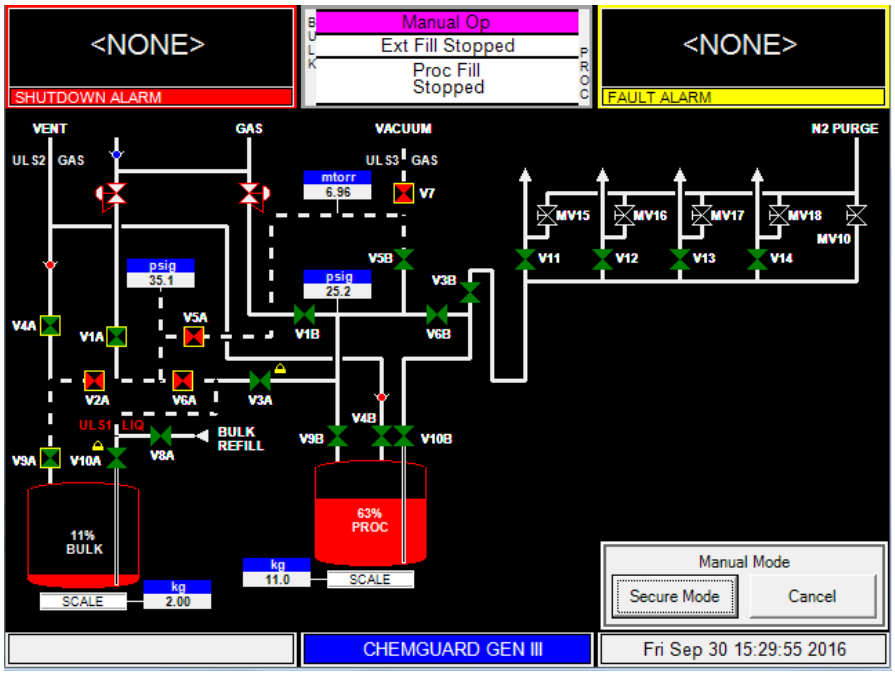
2. The valve confirmation window will appear, asking you to confirm that you want to open the valve by pressing “OPEN VALVE”. Pressing “CANCEL” will close the window, leaving valve closed, refer to **Error! Reference source not found.**.

3.10.4 How to Close Valve in Manual Mode

To close a valve:

1. 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.

⚠CAUTION

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 Process PT2 and R2 Test and Adjustment

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

1. Slowly open regulator R2 by turning R2 fully clockwise
2. Step to Process Menu
3. Step to Manual Mode and open V1B. Verify valve indicator switches from green to red
4. Turn main supply gas off to the CG, 0 psig
5. Vent off pressure to PT2 by opening V5B and V7. Note, verify vacuum pump is running and any manual isolation valve on vacuum line to CG is open
6. Confirm PT2 pressure drops to 0 psig. Close V5B and V7
7. Set main supply gas pressure to10 psig. Verify PT2 reads 10.0 ± 00.5 psig
8. Set main supply gas pressure to 25, 35 & 55 psig. At each setting verify PT2 reads setting ± 00.5 psig
9. Return main supply gas pressure to original setting, 60-90 psig
10. Slowly close regulator R2 by turning R2 fully counterclockwise
11. Close V1B and open V5B and V7. Confirm PT2 pressure drops to 0 psig. Close V5B and V7
12. Open V1B
13. Slowly open regulator R2 by turning R2 clockwise to user selected pressure setting, typically 25 psig
14. Close V1B

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 Process Regulator Creep Test

1. After PT2 tested and R2 set to user selected pressure setting, wait 5mins for pressure to stabilize.

2. Document PT2 pressure reading = _____ psig
3. Let CG sit for 4 hours = _____Start_____ Stop
4. The pressure reading should not drift by more than +/-2 psig

3.11.3 Bulk PT1 and R1 Test and Adjustment

NOTE: Test Process PT and Regulator 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 to10psig. Verify PT1 reads 10.0 ± 00.5 psig
8. Set main supply gas pressure to 25, 35 & 55 psig. At each setting verify PT1 reads setting ± 00.5 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.

3.11.4 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 +/-2 psig
5. Record final reading = _____ psig

3.12 System Leak Check

3.12.1 Leak Check-Bulk, Pressure Decay

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. Wait for 1 minute. Place Manual Mode in Secure Mode.
3. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Bulk Push pressures, Gross and Raw.

   _____PSIG _____VDC
4. Enter Manual mode, close V1A.
5. Return to System Test -> Test Analog In. Verify Bulk Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.
6. Close/confirm manual shutoff valve on vacuum line from vacuum pump to CG, V7 is closed.
7. Enter Manual mode, open V1A, V2A, V6A, V5A and V7.
8. Wait 5 minutes and then close V1A.
9. Wait for 5 minutes. Place Manual Mode in Secure Mode.
10. Return to System Test -> Test Analog In. Compare Bulk Push pressure from values recorded in step 3. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

    _____PSIG _____VDC

    Note, if pressure drop is greater than specified, troubleshoot until pressure decay meets this specification.
11. Cancel out of Manual mode.

3.12.2 Leak Check-Bulk, Vacuum ROR (Rate of Rise)

Confirm Bulk Inlet and Outlet pigtails are securely capped.

1. Open/confirm manual shutoff valve on vacuum line from vacuum pump to CG, V7 is open.

2. At Main Display, step to Bulk Menu and enter Manual Mode. Select and open valve V7.

3. Wait for 5 minute. Place Manual Mode in Secure Mode.

4. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Vacuum, Gross and Raw.

   _____mTOR _____VDC

5. Enter Manual mode, close V7.

6. Return to System Test -> Test Analog In. Verify Vacuum values. Confirm change in vacuum (Rate of Rise) is less than 10mtorr, 0.25vdc.

7. Enter Manual mode, open V2A, V6A, V5A and V7.

8. Wait 5 minutes and then close V7.

9. Wait for 5 minutes. Place Manual Mode in Secure Mode.

10. Return to System Test -> Test Analog In. Compare Vacuum reading from values recorded in step 4. 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.

11. Cancel out of Manual mode.

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.

2. 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.

3. 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.

4. 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

5. Cancel out of Manual mode.

3.12.4 Leak Check-Bulk External Fill (option), Pressure Decay

Confirm Bulk Inlet and Outlet pigtails are securely capped.

1. Confirm External Refill Line from CG's V8A is connected to one of the BCD's Output Valves, V11, V12, V13 or V14 and these valves closed
2. From the Main Menu, enter Config Menu -> System Setup and select Disable Valve Locks button. Display will change to Enable Valve Locks. This allows for manual operation of V8.
3. Select and open valve V8A. Place External Fill Manual Mode in Secure Mode.
4. At Main Display, step to Bulk Menu and enter Manual Mode. Select and open valve V1A. Wait for 1 minute. Place Manual Mode in Secure Mode.
5. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Bulk Push pressures, Gross and Raw.

   _____PSIG _____VDC

6. Enter Manual mode, close V1A.
7. Return to System Test -> Test Analog In. Verify Bulk Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.
8. Enter Manual mode, open V1A and V6A.
9. Wait 15 minutes and then close V1A.
10. Wait for 15 minutes. Place Manual Mode in Secure Mode.
11. Return to System Test -> Test Analog In. Compare Bulk Push pressure from values recorded in step 3. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

    _____PSIG _____VDC

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

12. Cancel out of External Fill and Bulk Manual modes.

3.12.5 Leak Check-Bulk External Fill (option), Vacuum ROR

Confirm Bulk Inlet and Outlet pigtails are securely capped.

1. From the Main Menu, enter Config Menu -> System Setup and select Disable Valve Locks button. Display will change to Enable Valve Locks. This allows for manual operation of V8
2. At Main Display, step to External Fill Menu and enter Manual Mode.
3. Select and open valve V8A. Place External Fill Manual Mode in Secure Mode.
4. Open/confirm manual shutoff valve on vacuum line from vacuum pump to CG, V7 is open.
5. At Main Display, step to Bulk Menu and enter Manual Mode. Select and open valve V7.
6. Wait for 5 minute. Place Manual Mode in Secure Mode.
7. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Vacuum, Gross and Raw.

   _____mTOR _____VDC

8. Enter Manual mode, close V7.
9. Return to System Test -> Test Analog In. Verify Vacuum values. Confirm change in vacuum (Rate of Rise) is less than 10mtorr, 0.25vdc.
10. Enter Manual mode, open V6A, V5A and V7.
11. Wait 15 minutes and then close V7.
12. Wait for 15 minutes. Place Manual Mode in Secure Mode.
13. Return to System Test -> Test Analog In. Compare Vacuum reading from values recorded in step 4. 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.

14. Cancel out of External Fill and Bulk Manual modes.

3.12.6 Leak Check-Process, Pressure Decay

Non-Degasser Systems only. Confirm Process Inlet, Outlet and Vent Line pigtails are securely capped.

1. At Main Display, step to Process Menu and enter Manual Mode. Select and open valve V1B.
2. Wait for 1 minute. Place Manual Mode in Secure Mode.
3. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Process Push pressures, Gross and Raw.

   _____PSIG _____VDC

4. Enter Manual mode, close V1B.
5. Return to System Test -> Test Analog In. Verify Process Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.
6. Close/confirm manual shutoff valve on vacuum line from vacuum pump to CG, V7 is closed.
7. Enter Manual mode, open V1B, V6B, V5B and V7.
8. Wait 5 minutes and then close V1B.
9. Wait for 5 minutes. Place Manual Mode in Secure Mode.
10. Return to System Test -> Test Analog In. Compare Process pressure from values recorded in step 3. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

    _____PSIG _____VDC

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

11. Cancel out of Manual mode.

3.12.7 Leak Check-Process, Vacuum ROR

Confirm Process Inlet, Outlet and Vent Line pigtails are securely capped.

1. Open/confirm manual shutoff valve on vacuum line from vacuum pump to CG, V7 is open.
2. At Main Display, step to Process Menu and enter Manual Mode. Select and open valve V7.
3. Wait for 5 minute. Place Manual Mode in Secure Mode.
4. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Vacuum, Gross and Raw.

   _____mTOR _____VDC
5. Enter Manual mode, close V7.
6. Return to System Test -> Test Analog In. Verify Vacuum values. Confirm change in vacuum (Rate of Rise) is less than 10mtorr, 0.25vdc.
7. Enter Manual mode, open V6B, V5B and V7.
8. Wait 15 minutes and then close V7.
9. Wait for 15 minutes. Place Manual Mode in Secure Mode.
10. Return to System Test -> Test Analog In. Compare Vacuum reading from values recorded in step 4. 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.
11. Cancel out of Manual mode.

3.12.8 Leak Check-Output Manifold, Pressure Decay

Non-Degasser Systems only. Confirm Process Inlet, Outlet and Vent Line pigtails are securely capped.

1. At Main Display, step to Process Menu and enter Manual Mode. Select and open valve V1B.
2. Wait for 1 minute. Place Manual Mode in Secure Mode.

3. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Process Push pressures, Gross and Raw.

   _____PSIG _____VDC

4. Enter Manual mode, close V1B.

5. Return to System Test -> Test Analog In. Verify Process Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

6. Enter Manual mode, open V1B, V6B, V3B, V11, V12, V13, V14, and V21-24 (if applicable). Confirm output valves, V11 thru V14 and V21-V24 (if applicable) chemical delivery lines connected and have valve closed at tool end.

7. Wait 15 minutes and then close V1B.

8. Wait for 15 minutes. Place Manual Mode in Secure Mode.

9. Return to System Test -> Test Analog In. Compare Process pressure from values recorded in step 3. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

   _____PSIG _____VDC

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

10. Cancel out of Manual mode.

3.12.9 Leak Check-Degasser, Pressure Decay-Chemical Path

Non-High Flow Degasser Systems only. Confirm Process Inlet, Outlet and Vent Line pigtails are securely capped.

NOTE: Leak Check of the High Flow Degasser refer to Addendum A in this manual.

1. At Main Display, step to Process Menu and enter Manual Mode. Select and open valve V1B.

2. Increase R2, Process Pressure to 45psig.

3. Wait for 1 minute. Place Manual Mode in Secure Mode.

4. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Process Push pressures, Gross and Raw.

   _____PSIG _____VDC

5. Enter Manual mode, close V1B.
6. Return to System Test -> Test Analog In. Verify Process Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.
7. Enter Manual mode, open V1B, V6B and V3B. Confirm Degasser Vacuum valve, V8 is open.
8. Wait 15 minutes and then close V1B.
9. Wait for 15 minutes. Place Manual Mode in Secure Mode.
10. Return to System Test -> Test Analog In. Compare Process pressure from values recorded in step 3. Confirm change in pressure (Pressure decay) is less than 3psig, 0.25vdc.

    _____PSIG _____VDC

    Note, if pressure drop is greater than specified, troubleshoot until pressure decay meets this specification.
11. Cancel out of Manual mode.

3.12.10 Leak Check-Degasser, Pressure Decay-Bypass

Non-High Flow Degasser Systems only. Confirm Process Inlet, Outlet and Vent Line pigtails are securely capped.

1. At Main Display, step to Process Menu and enter Manual Mode. Select and open valve V1B. Increase R2, Process Pressure to 45psig.
2. Wait for 1 minute. Place Manual Mode in Secure Mode.
3. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Process Push pressures, Gross and Raw.

    _____PSIG _____VDC
4. Enter Manual mode, close V1B.
5. Return to System Test -> Test Analog In. Verify Process Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.
6. If Degasser option configured with the Degasser Vacuum Switch, disconnect Vacuum Switch from P5 cable.

7. Confirm Degasser switches to the Bypass mode on Main Menu and Vacuum Switch Fail alarm activates Yellow for a Fault Alarm. Proceed to step 10.

8. If Degasser option not configured with the Vacuum Switch at Degasser Pneumatic Switching valve, remove 4 air lines.

9. Install air in/out lines to Bypass in/out adapter fitting. Confirm pneumatic air to Degasser Bypass valves, refer to Figure 9-20.

10. Enter Manual mode, open V1B, V6B and V3B.

11. Wait 5 minutes and then close V1B.

12. Wait for 5 minutes. Place Manual Mode in Secure Mode.

13. Return to System Test -> Test Analog In. Compare Process pressure from values recorded in step 3. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

    _____PSIG _____VDC

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

14. Cancel out of Manual mode.

    Before reconnecting Vacuum Switch to P5 or replacing Degasser Pneumatic Switching valve air lines, perform next check.

3.12.11 Leak Check-Output Manifold, Pressure Decay-thru Degasser Bypass

Non-High Flow Degasser Systems only. Confirm Process Inlet, Outlet and Vent Line pigtails are securely capped.

1. At Main Display, step to Process Menu and enter Manual Mode. Select and open valve V1B. Increase R2, Process Pressure to 45psig.

2. Wait for 1 minute. Place Manual Mode in Secure Mode.

3. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Process Push pressures, Gross and Raw.

    _____PSIG _____VDC

4. Enter Manual mode, close V1B.

5. Return to System Test -> Test Analog In. Verify Process Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

6. If Degasser option configured with the Degasser Vacuum Switch, disconnect Vacuum Switch from P5 cable.

7. Confirm Degasser switches to the Bypass mode on Main Menu and Vacuum Switch Fail alarm activates Yellow for a Fault Alarm. Proceed to step 10.

8. If Degasser option not configured with the Vacuum Switch at Degasser Pneumatic Switching valve, remove 4 air lines.

9. Install air in/out lines to Bypass in/out adapter fitting. Confirm pneumatic air to Degasser Bypass valves, refer to Figure 9-20.

10. Enter Manual mode, open V1B, V6B, V3B, V11, V12, V13, V14, and V21-V24 (if applicable). Confirm output valves, V11 thru V14 and V21-V24 (if applicable) chemical delivery lines connected and have valve closed at tool end.

11. Wait 15 minutes and then close V1B.

12. Wait for 15 minutes. Place Manual Mode in Secure Mode.

13. Return to System Test -> Test Analog In. Compare Process pressure from values recorded in step 3. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

    _____PSIG _____VDC

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

14. Cancel out of Manual mode.

15. 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, refer to Figure 9-20.

3.12.12 Leak Check-Process Container, Pressure Decay

Install Process Container, refer to chapter 4 of this manual.

1. From the Main Menu, enter Config Menu -> System Setup and select Disable Valve Locks button. Display will change to Enable Valve Locks. This allows for manual operation of V10B.

2. At Main Display, step to Process Menu and enter Manual Mode. Select and open valve V1B. Increase R2, Process Pressure to 45psig.
3. Wait for 1 minute. Place Manual Mode in Secure Mode.
4. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Process Push pressures, Gross and Raw.

   _____PSIG _____VDC

5. Enter Manual mode, close V1B.
6. Return to System Test -> Test Analog In. Verify Process Push values. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.
7. Enter Manual mode, open V1B, V6B, V9B and V10B.
8. Wait 15 minutes and then close V1B.
9. Wait for 15 minutes. Place Manual Mode in Secure Mode.
10. Return to System Test -> Test Analog In. Compare Process pressure from values recorded in step 3. Confirm change in pressure (Pressure decay) is less than 1psig, 0.08vdc.

    _____PSIG _____VDC

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

11. Cancel out of Manual mode.

3.12.13 Leak Check-Process Container, Vacuum ROR

1. Open/confirm manual shutoff valve on vacuum line from vacuum pump to CG, V7 is open.
2. At Main Display, step to Process Menu and enter Manual Mode. Select and open valve V7.
3. Wait for 5 minute. Place Manual Mode in Secure Mode.
4. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of Vacuum, Gross and Raw.

   _____mTOR _____VDC

5. Enter Manual mode, close V7.
6. Return to System Test -> Test Analog In. Verify Vacuum values. Confirm change in vacuum (Rate of Rise) is less than 10mtorr, 0.25vdc.
7. Enter Manual mode, open V5B, V6B, V7 and V9B.
8. Wait 30-60 minutes and then close V7.
9. Wait for 15 minutes. Place Manual Mode in Secure Mode.
10. Return to System Test -> Test Analog In. Compare Vacuum reading from values recorded in step 4. 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.
11. Cancel out of Manual mode.

3.13 Installing Reservoir Containers

At this point in the installation procedure, the Process container should be installed in the upper shelf of the ChemGuard® cabinet. Refer to Chapter 4 for detailed Reservoir Container procedures.

If the ChemGuard® includes the External Refill option and comes with the Bulk refillable container, install the Bulk container.

The Process and Bulk container will remain in the cabinet unless removed for maintenance or shutdown procedures. The non-refillable Bulk container is changed as required.

3.13.1 Initial Installation of PROCESS Reservoir Container

- Install Process container.
- Perform manual leak check by pressure decay test and then vacuum rate of rise at Inlet, Outlet and Vent VCR connections.
- If Empty Process container installed then perform manual leak check by pressure decay test and then vacuum rate of rise at Inlet, Outlet and Vent VCR connections throughout the container.
- If Empty Process container installed, then pump down to base vacuum pressure for a minimum of eight (8) hours to remove any atmospheric moisture from the container before filling the containers.

NOTE: The Process container requires installation only once with replacement for cleaning, as necessary based on the shelf-life of the chemical and residency time in the container based on flow rates / tool usage.

NOTE: The CG325 Process container comes equipped with an ultrasonic level detection probe. The probe is interfaced to the ChemGuard® cabinet to prevent an overfill condition which could occur during a Bulk>Process fill operation.

NOTE: The Bulk>Process fill operation stops when Process level reaches “Process Hi Refill” setpoint set in USER SETPOINTS>PROCESS SCALE.

3.13.2 Setting Up Net Product Weight – Process Container

Configuring Process Container Chemical Level

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

- ❑ Net Liquid Weight – 100% Full Level of Process 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 Process container, i.e. 19 liter and the chemical being used in this ChemGuard®, i.e. TEOS, refer to following page
- Enter value in kilograms (17.4)

❑ Current Liquid Weight – 0% Actual level of Process 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	17[illegible]00	N/A
Pyridine	325	3900	5650	9700	N/A	N/A
R-H_2O	100	N/A	N/A	N/A	1[illegible]00	N/A
SiCL	300	6500	9000	15600	2[illegible]00	N/A
TEB	100	3000	5165	8900	16[illegible]00	N/A
TEOS	100	3200	5600	[illegible]	17400	34600
[illegible]	100	3700	6000	11200	[illegible]	N/A
TiCl4	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 - Process Scale

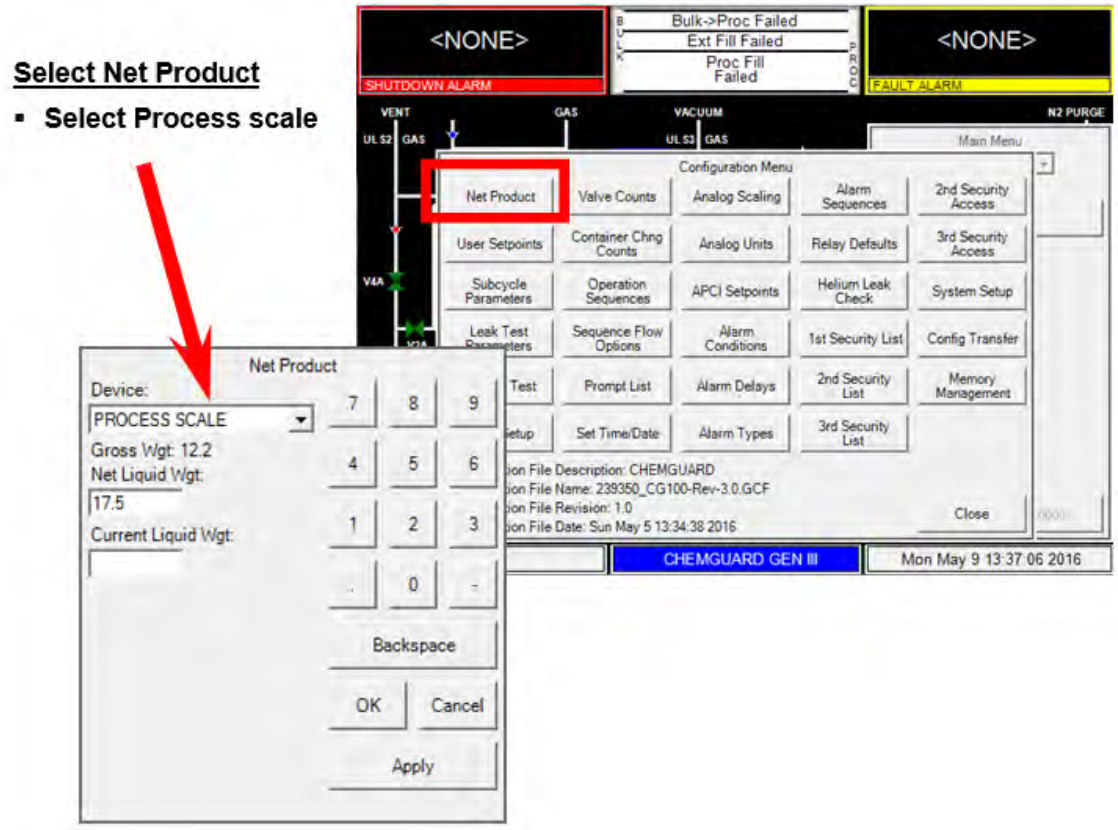


Figure 3-20: Entering Weight of Empty Process Container

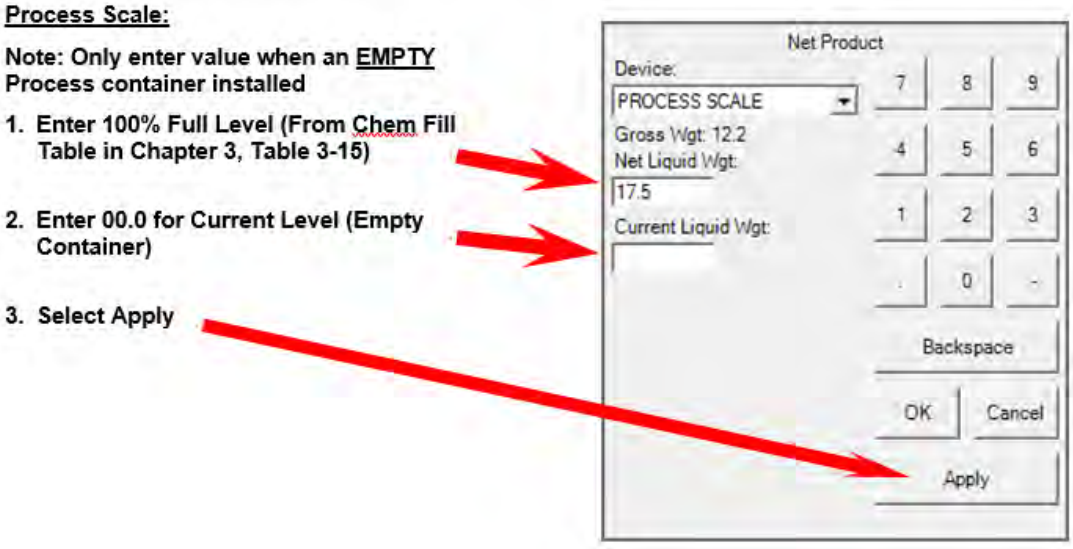
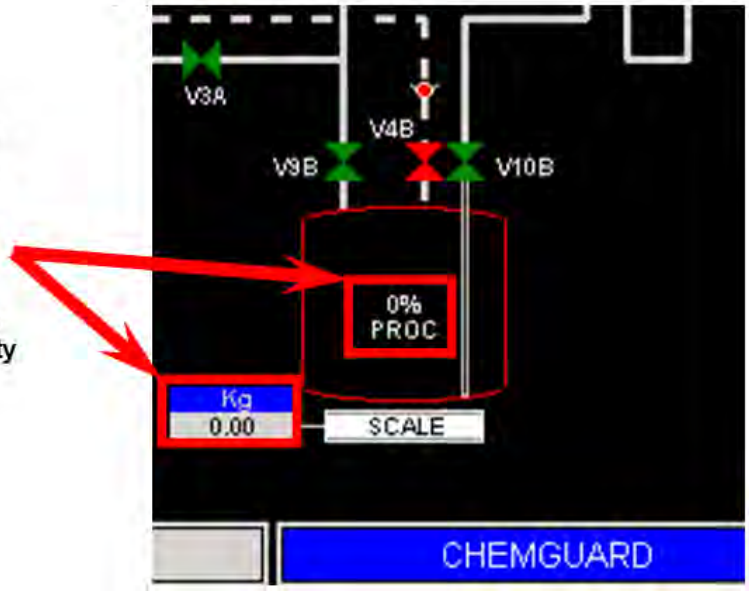


Figure 3-21: Net Product Weight of Empty Process Container



3.13.3 Optional Refillable Bulk Container, Initial Installation

- Install refillable Bulk container.
- Perform manual leak check by pressure decay test and then vacuum rate of rise at Inlet and Outlet VCR connections.
- If refillable Bulk container installed, then perform manual leak check by pressure decay test and then vacuum rate of rise at Inlet and Outlet VCR connections throughout the container.
- If refillable Bulk container installed, then pump down to base vacuum pressure for a minimum of eight (8) hours to remove any atmospheric moisture from the container before filling the containers.

NOTE: Refillable Bulk container requires installation only once with replacement for cleaning as necessary based on the shelf-life of the chemical and residency time in the container based on flow rates / tool usage.

NOTE: The external fill operation stops when Bulk level reaches “Bulk Refill Level” setpoint set in USER SETPOINTS>BULK SCALE

3.13.4 Setting Up Net Product Weight – Refillable Bulk Container

Configuring Bulk Container Chemical Level. Refer to Setting Up Net Product Weight – Process Container on previous page.

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 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

3.13.5 Installation of the non-refillable Bulk Container

Refer to Chapter 4

3.14 Finishing the ChemGuard® Installation

3.14.1 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.

3.14.2 Vacuum Purge Chemical Delivery Line

1. Manually open valves V7, V5B, V6B and V3B.
2. If the chemical delivery line(s) has not yet been charged with chemistry, open V11–V14 and V21-V24 (if applicable) and vacuum purge to the first isolation valve(s) at the Process Tool(s).
3. Monitor the vacuum pressure confirming vacuum reading goes to base vacuum, value recorded in the Leak Check step
4. Close V11 – V14 and V21-V24 (if applicable) if opened.
5. Manually Close V7, V5B, V6B and V3B.

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

3.14.3 Bulk>Process Fill Operation

1. To enable the Bulk>Process Fill operation, from the main menu, select BULK.
2. Select "Start Bulk->Proc." The Controller status box for Bulk will change from white to green indicating Bulk>Process fill operation is enabled.
3. When chemical in the Process container drops below "Process Low Refill" setpoint set in USER SETPOINT>PROCESS SCALE Bulk>Process fill will commence.
4. Bulk>Process fill operation stops when Process level reaches "Process Hi Refill" setpoint set in USER SETPOINTS>PROCESS SCALES.
5. Bulk>Process Fill terminates either by operator selecting "Stop Bulk>Proc" or a life safety shutdown alarm terminates Bulk>Process Fill.

3.14.4 Process Fill Operation

Confirm with the end user that the ChemGuard® is ready to be placed in Process Fill and process tool(s) ready to receive chemical

1. To place the Process container into fill operation, from the main menu, select PROCESS.

2. Select “Start Proc Fill.” The Controller status box for Process will change from white to green indicating Process is enabled and is a Process fill, Process valves are on, in red and dash line activated showing chemical flow.

3. Process Fill terminates either by operator selecting “Stop Proc Fill” or a life safety shutdown alarm terminates Process Fill.

3.14.5 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 Containers

The change reservoir operation is an automated procedure that guides the operator through the steps required to change out the reservoir 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 4.1 and 4.2 applies to both the Process reservoir container and the Bulk reservoir container except as noted. The appearance of your reservoir container(s) 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.

NOTE: The Process container requires installation only once with periodic replacement for cleaning. The refillable Bulk container also is only installed once with periodic replacement and cleaning.

NOTE: The CG325, CG326, CG400, and CG426 Process container is equipped with an ultrasonic level probe. The ultrasonic probe is interfaced to the cabinet controller to prevent an overfill condition due to the result of the Bulk>Process Fill operation.

WARNING

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

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

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.

WARNING

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 (¼ in.) stainless steel, VCR gaskets

d) Proper personal protective equipment (PPE)

2. Put on personal protective equipment.

4.3 Change BULK Container Operation

WARNING

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.

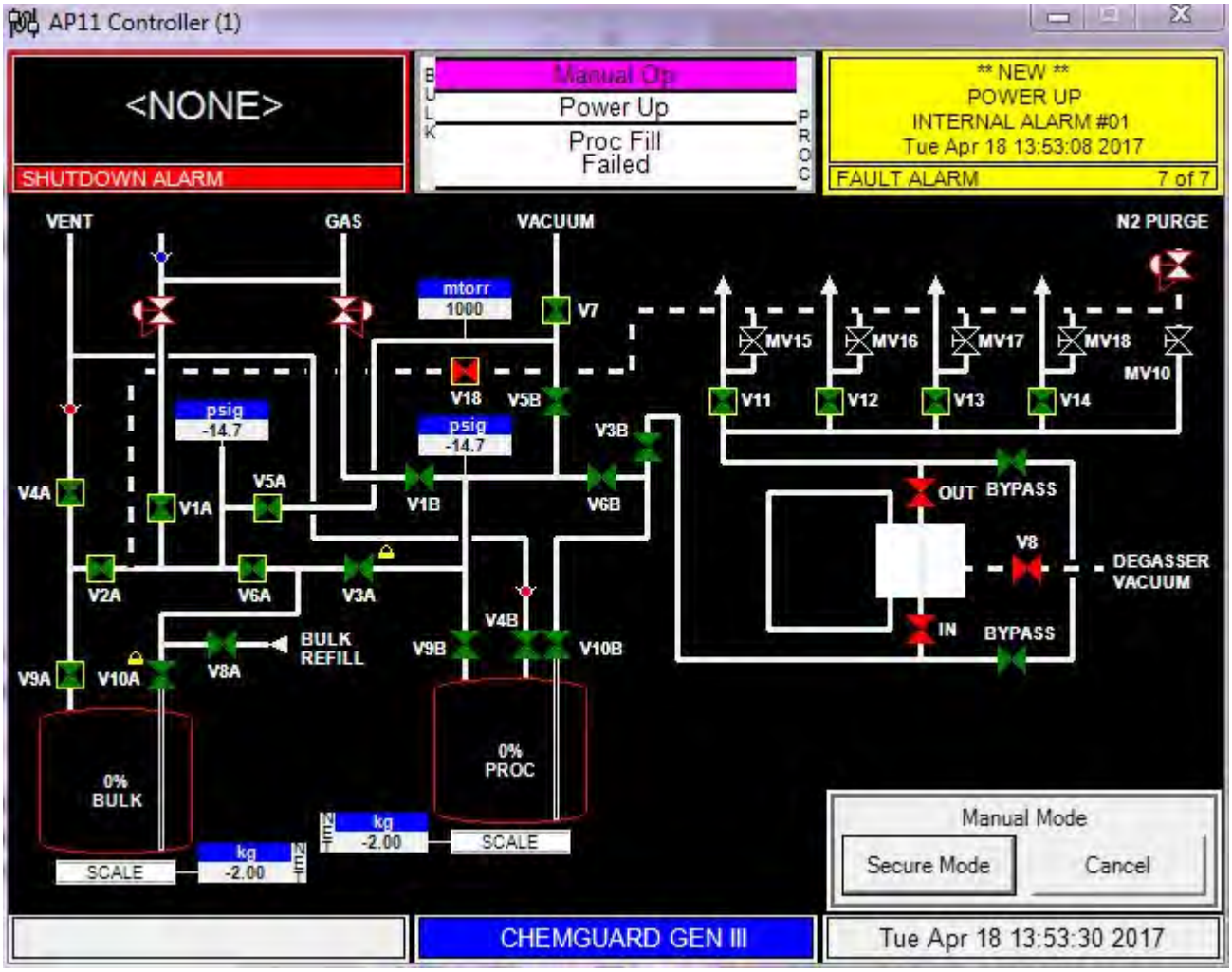
4.3.1 Changing the BULK Container

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.

NOTE: There will be two (2) “Start Change Bulk” selections on the main menu display if ChemGuard® ordered with the Helium Reduction option, addition of the V18 N2 spool.

- Start ChngBlk is the standard selection which uses Helium gas and is available for both non-Helium Reduction and Helium Reduction ChemGuard®.
- Start Start ChngBlkN2 is only available when the Helium Reduction option is ordered and uses N2 gas when performing Change Bulk operation.

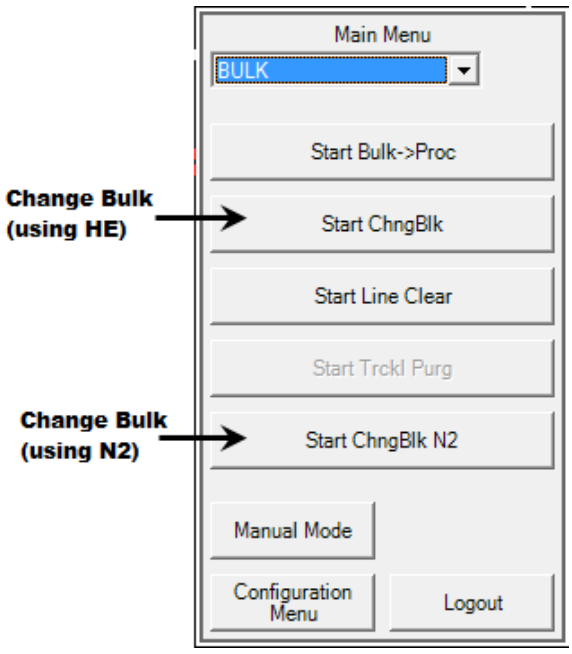
Figure 4-1: CHEMGUARD with Helium Reduction Option, V18



To start Change Bulk operation:

- Select Main Menu – Bulk
- Select Start ChngBlk –
  (Select when configured with the Helium Reduction option and when Helium required for Change Bulk operation)
- Controller status box for Bulk will change from white to blue and display ChngBlk
- Click on Stop ChngBlk button to stop change bulk operation
- Select Start ChngBlk N2 –
  (Select when configured with the Helium Reduction option and when N2 required for Change Bulk operation)

  NOTE: Bulk>Process Fill 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 ChngBlk from Bulk menu.
- The Vacuum pump is not turned on.

NOTE: For any reason if Change Bulk operation is terminated before its completion Bulk>Process Fill cannot be enabled. Successful completion of the Change Bulk operation is required to place ChemGuard® into a Bulk>Process Fill.

4.3.2 Detail Description of the Change Bulk Operation

NOTE: Refer to these steps when replacing refillable Bulk container when used with the External Refill option.

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 Bulk>Process fill operation is enabled, select STOP BULK->PROC to disable Bulk to Process fill operation.

3. If External Refill option is available in the ChemGuard®, select EXTERNAL FILL from the pull-down menu. If External Fill operation is enabled, select STOP EXT FILL to disable the External Fill operation.

4. Select Bulk from the pull-down menu and select either START ChngBlk or START ChngBlk N2 (if Helium Reduction option available) to start the Change Bulk operation.

5. The controller status box will change from white to blue and indicate, ChngBlk.

6. At any time, the operator can terminate the Change Bulk operation by selecting STOP ChngBlk or STOP ChngBlk N2 from the Bulk Menu.

   NOTE: If Bulk change operation is stopped before its completion Bulk>Process Fill cannot be enabled. Successful completion of the Change Bulk operation is required to place ChemGuard® into a Bulk>Process Fill.

7. 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 ChngBlk**

8. 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.

9. The operator/technician is then prompted to close the Bulk container manual valves, if configured for a manual valve container.

10. 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.

11. 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.

12. 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 4-1and scale calibration procedure in Chapter 7.

13. Disconnect the pneumatic quick-disconnect fittings, if the container has pneumatic valves.

14. Disconnect the two (2) VCR connections connecting the Bulk pigtails 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.

CAUTION

<u>DO NOT</u> loosen the VCR connection of the inlet and outlet valves where they connect to the body of the Bulk Container

15. Remove the spent container and install the shipping caps to the VCR connections on the valves.

16. 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 pigtails.

17. Replace with two (2) new VCR gaskets and connect the Bulk pigtails to the Bulk container valves.

    NOTE: Ensure the pigtails 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 pigtails are connected. This can cause an incorrect reading of the Bulk Scale.

18. 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.

19. Reconnect the pneumatic quick-disconnect fittings, if the container has pneumatic valves.

20. 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.

21. The Change Bulk operation will now continue with the post container change and perform a “Gross” leak test 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 pigtails before Bulk>Process fill commences.

22. The operation will now be prompted to enter the chemical liquid weight, which is printed on the label on front of the Bulk container.

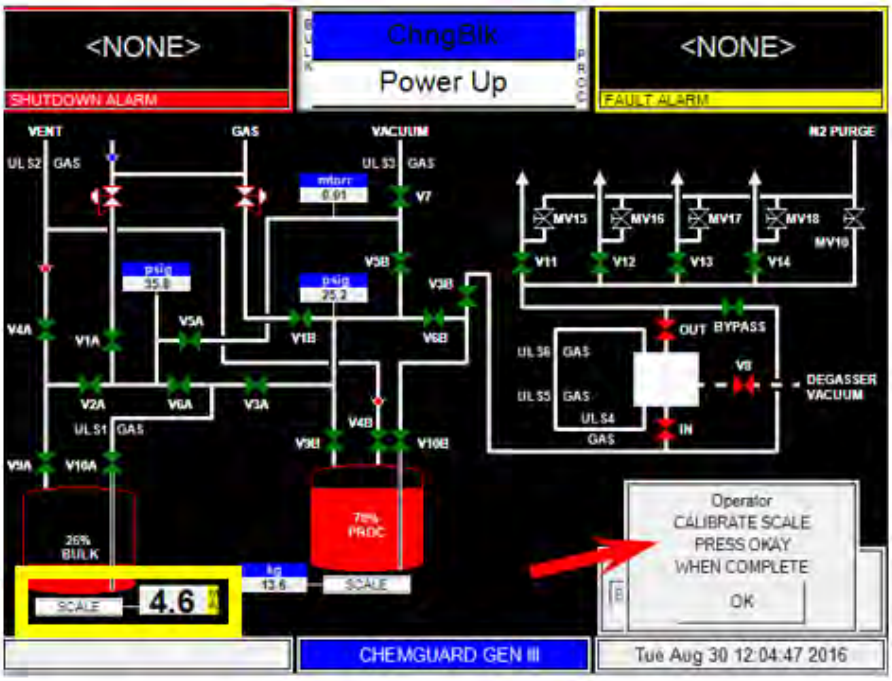
23. If Bulk container configured with manual valves the operator will be prompted to open the manual valves.

24. Change Bulk operation is now completed and the controller status box will change from blue to white and indicate, ChngBlk Completed.

Figure 4-2: Change Bulk Scale Calibration "Prompt"

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



4.3.3 Change Bulk Diagnostics

WARNING

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	- Vacuum Pump failure - PPMPDWN / BASE VAC setpoint set too low - Change Bulk cycles incorrectly set	- Check vacuum pump for correct operation, check for leaks - Check base pressure reading of pump - Check vacuum setpoints - Check Change Bulk sub-cycle setting
LOW PUSH PRES BLK alarm HIGH PUSH PRES BLK alarm	- PT1 Pressure Transducer fail - Supply gas problem, incoming gas supply - R1 regulator fail – reg creep - R1 reg adjustment issue	- Check function of PT1 - Check incoming gas supply, main regulator setting - Check R1 regulator, test for reg creep - Re-adjust R1 to setpoint
Bulk Vent Failed alarm	- PT1 Pressure Transducer fail - Vent valve fail - Bulk check valve, CV1 fail	- Check function of PT1 - Check V2A and V4A valves - Check CV1 check valve for blockage, check valve plugged - Check vent line to exhaust for blockage
PIGTAIL NOT EMPTY alarm	- V6A valve fail - UltraSonic Sensor ULS1 on Bulk Pigtail fail	- Check V6A valve - Check pneumatic air pressure to V6A - Check function and placement of ULS1 Bulk Pigtail sensor
VAC GAUGE FAIL alarm	- PTV Vacuum Gauge fail	- Check function of PTV Vacuum Gauge
LEAK TEST FAILURE alarm GROSS LEAK PT1	- Valve leak, leak across valve seat - Loose VCR connection	- Perform valve seat leak check, leak test across valve seat - Check VCR connections

	- Change Bulk cycles incorrectly set	- Check Change Bulk sub-cycle setting

4.4 Change PROCESS Reservoir Operation

WARNING

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.

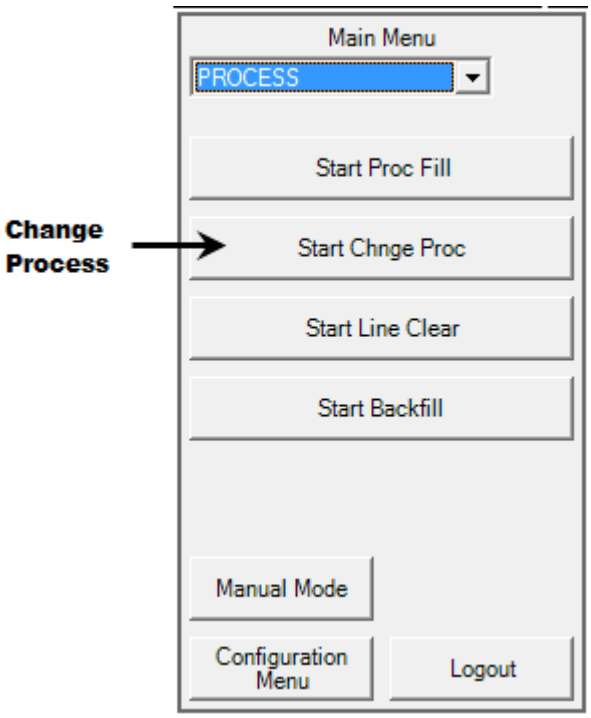
4.4.1 Changing The PROCESS Reservoir Container

This option guides the operator through steps to remove and replace the Process reservoir. When the Process reservoir is to be removed or installed, the automated change Process reservoir operation must be performed.

To start Change Process operation:

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

  NOTE: Bulk>Process Fill and External Fill must first be disabled before Change Process can start



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

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

NOTE: For any reason if Change Process operation is terminated before its completion Process Fill, Bulk>Process Fill and External Fill cannot be enabled. Successful completion of the Change Process operation is required to place ChemGuard® into any fill operation.

4.4.2 Detail Description of the Change Process Operation

1. When selecting the main screen, ”Password” window displays. Enter a valid password and select “OK”.
2. Select “Process” from the pull-down menu. If Bulk>Process fill operation is enabled, select STOP BULK->PROC to disable Bulk to Process fill operation.
3. If External Refill option is available in the ChemGuard®, select EXTERNAL FILL from the pull-down menu. If External Fill operation is enabled, select STOP EXT FILL to disable the External Fill operation.

4. Select Process from the pull-down menu and select Start Chnge Proc to start the Change Process operation.

5. The controller status box will change from white to blue and indicate, Chnge Proc.

6. At any time, the operator can terminate the Change Process operation by selecting STOP Chnge Proc from the Bulk Menu.

   NOTE: If Process change operation is stopped before its completion Process Fill, Bulk>Process Fill and External Fill cannot be enabled. Successful completion of the Change Process operation is required to place ChemGuard® into any Fill operation.

7. The Process change operation continues to run until either one of the following occurs

   a) A Life Safety or Change Process Shutdown alarm is activated

   b) Technician/Operator terminates the operation by selecting **Stop Chnge Proc**

8. During the Change Process operation, the system first performs a LINE CLEAR function, pushing liquid chemical from the Process outlet pigtail back into the Process container.

9. The Change Process operation then performs a series of Vacuum Cycle steps to ensure chemical/residue has been completely removed and dried from the Process inlet and outlet pigtails.

10. A leak test, vacuum rate of rise test will be performed before the Process container is removed. This ensures all chemical/residue has been completely removed and dried from the Process inlet and outlet pigtails and to ensure there is no across the valve seat leak of either the valves on the Process container or ChemGuard® valves.

    NOTE: Process container vent line, V4B is closed and not vacuum purged.

11. The system will prompt the operator to remove the spent Process container and then verify/perform scale calibration.

12. Disconnect the pneumatic lines from the Process container quick-disconnect fittings, V9B, V10B. Do not disconnect airline to V4B.

    NOTE: When removing Process container keep pneumatic airline connected to Process container vent valve, V4B. Confirm vent valve V4B is closed, (normally open valve so solenoid valve should be activated and LED lit red).

When Process container vent line pigtail disconnected, cap V4B valve before disconnecting pneumatic airline so V4B won't open and expose chemical inside Process container to air.

13. Disconnect the three (3) VCR connections on the container valves. Take special care to account for the 3 used VCR gaskets ensuring they are not left attached to the Process pigtail connections.

CAUTION

<u>DO NOT</u> loosen the VCR connection of the inlet, outlet and valves where they connect to the body of the Process Container.

14. Remove the spent container and install the shipping caps to the VCR connections on the valves.

15. The operator will now be prompted to install the new Process container. **DO NOT** press OK until Process container has been installed and connected to the Process pigtails.

16. Replace with three (3) new VCR gaskets and connect the Process pigtails to the Process container valves.

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

17. Reconnect the pneumatic lines to the quick-disconnect fittings on the Process container.

18. The Change Process operation will now continue with the post container change and perform a "Gross" leak test 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 Process inlet and outlet pigtails before Process>Process fill commences.

19. The operation will now be prompted to enter the chemical liquid weight, which will be 0 kgs as the Process container will be empty. Refer to section 3.13.1 in Chapter 3, Setting Up Net Product Weight.

20. Change Process operation is now completed and the controller status box will change from blue to white and indicate, Chnge Proc Completed.

4.4.3 Change Process Diagnostics

WARNING

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 4-2: Change Process Alarm Errors

ALARM ERROR	POSSIBLE CAUSES	CORRECTIVE ACTION
PMPDWN TIMEOUT alarm BASE VAC TIMEOUT alarm LOW VACUUM TIMEOUT alarm	- Vacuum Pump failure - PPMPDWN / BASE VAC setpoint set too low - Change Process cycles incorrectly set	- Check vacuum pump for correct operation, check for leaks - Check base pressure reading of pump - Check vacuum setpoints - Check Change Process sub-cycle setting
LOW PUSH PRES PR alarm HIGH PUSH PRES PR alarm	- PT2 Pressure Transducer fail - Supply gas problem, incoming gas supply - R2 regulator fail – reg creep - R2 reg adjustment issue	- Check function of PT2 - Check incoming gas supply, main regulator setting - Check R2 regulator, test for reg creep - Re-adjust R2 to setpoint
Process Vent Failed alarm	- PT2 Pressure Transducer fail - Vent valve fail - Process check valve, CV2 fail	- Check function of PT2 - Check V9B and V4B valves - Check CV2 check valve for blockage, check valve plugged - Check vent line to exhaust for blockage
VAC GAUGE FAIL alarm	- PTV Vacuum Gauge fail	- Check function of PTV Vacuum Gauge
LEAK TEST FAILURE alarm GROSS LEAK PT2	- Valve leak, leak across valve seat - Loose VCR connection - Change Process cycles incorrectly set	- Perform valve seat leak check, leak test across valve seat - Check VCR connections - Check Change Process sub-cycle setting

Chapter 5: ChemGuard® GEN III Features and Components

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 is a dual tank (DTLR) automated chemical delivery system which will control and monitoring all major system operations, including;

- Continuously delivers uninterrupted supply of chemical from the Process container to a process tool.
- Process container maintained at a constant level supplied by the Bulk container.
- Automated Bulk Change Operation without interruption to the Process container and chemical delivery to the process tool.
- Display shows all operating parameters, current status of Process and Bulk containers, 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: A UVIR sensor is optional on CG325 and CG326 model types.

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 both the Process and Bulk containers, ± 150 grams, ± 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 Process and 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 and Process containers ASME-certified for pressure, rated to 120 PSIG.
- Pressure-relief is built in to prevent over-pressure of the Process and 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 in 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
- Process Container

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

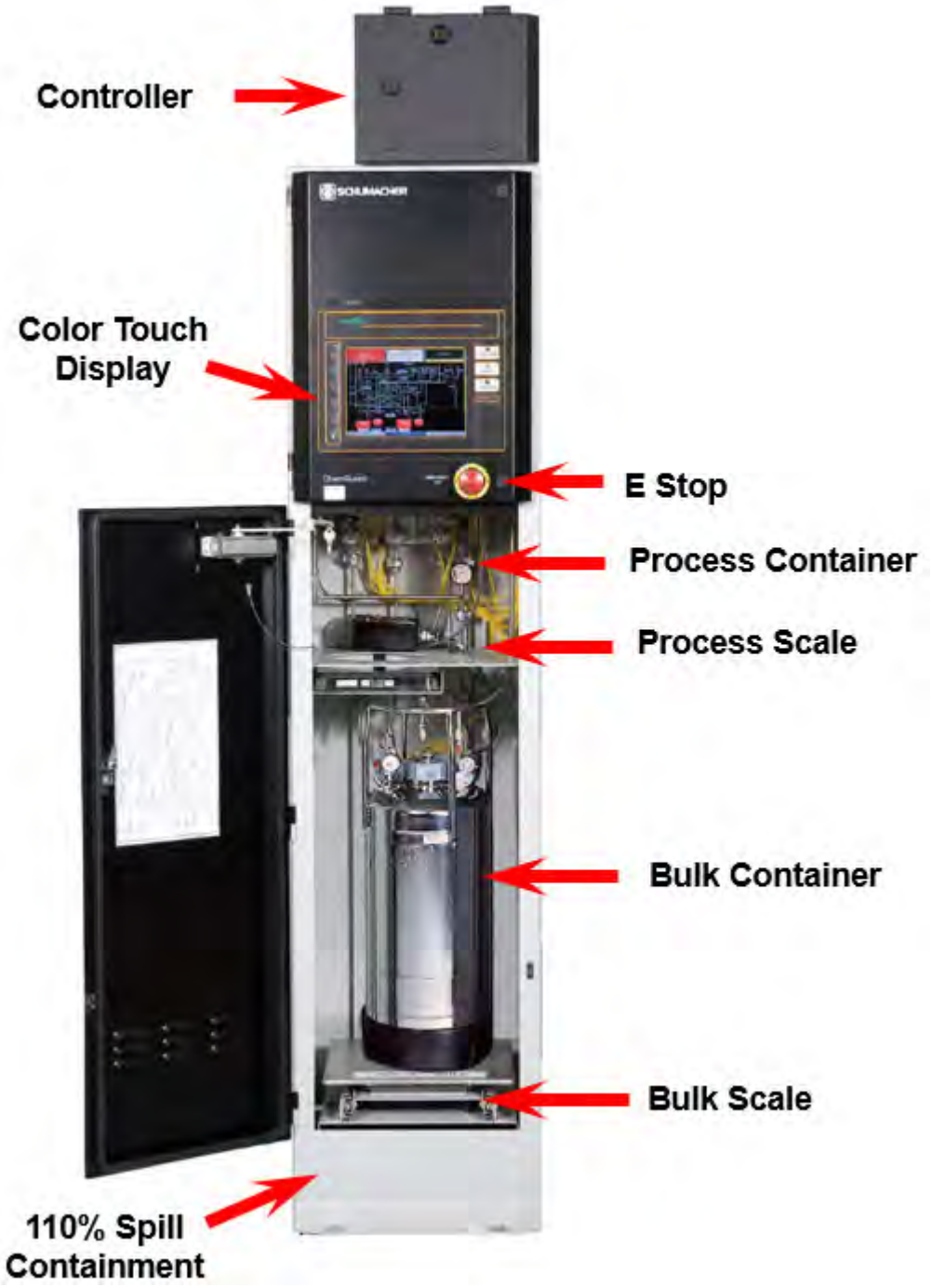


Figure 5-2: CHEMGUARD® Electronic Enclosure

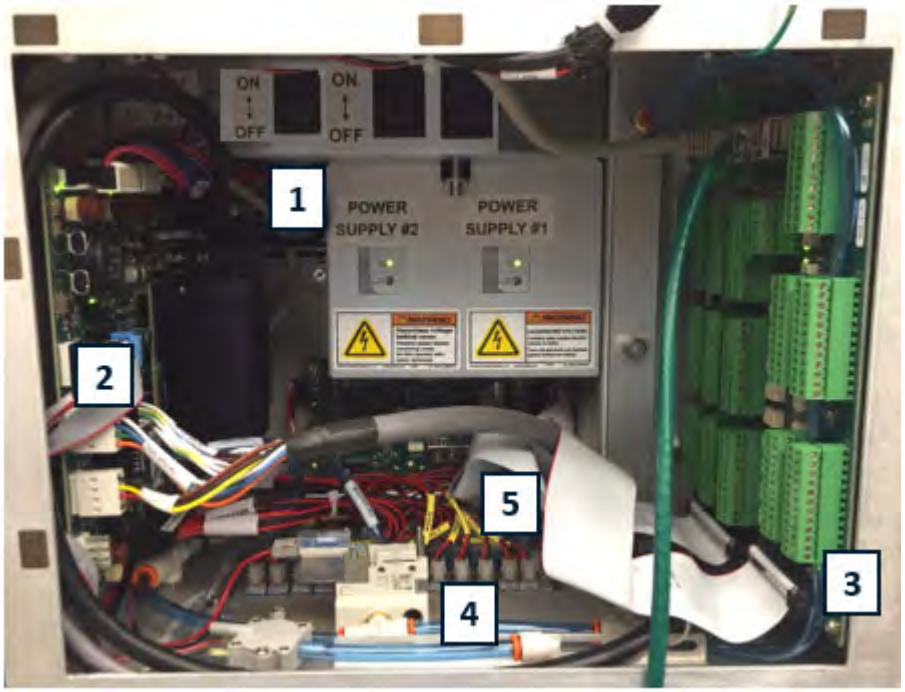


Table 5-1: Item Key

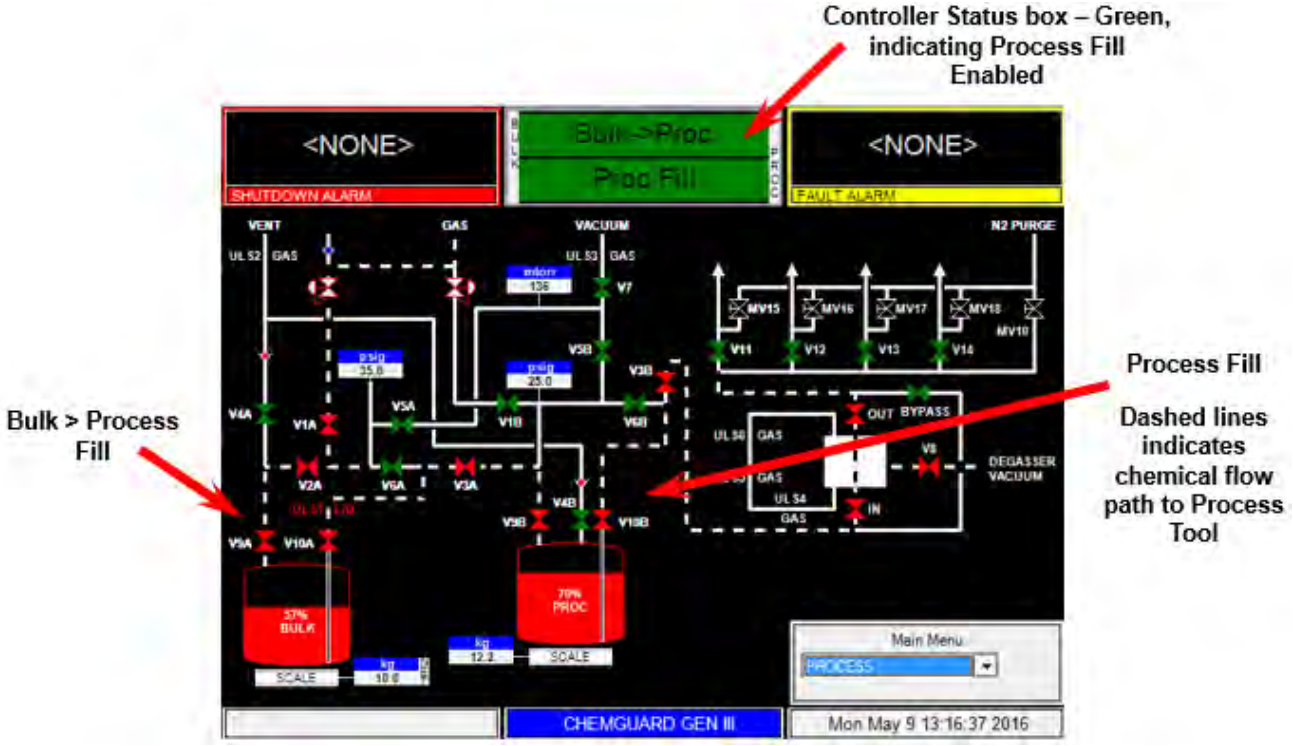
ITEM#	ITEM	FUNCTION
1	Power Supply	Single or dual, redundant power supply with On-Off switch and power indicator
2	Carrier board, AP1565	Main controller board with on-board microprocessor and redundant ARS (automated restart) microprocessor
3	Tool IO board, AP1614	Cabinet IO Interface with Life Safety 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 cut off 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 Reservoir Containers

The two (2) Reservoir containers store and supply the process chemical used in customer applications:

- BULK Reservoir container (bottom container).
- PROCESS Reservoir container (top container).

The CG325, CG326, CG400, and CG426 Process containers are equipped with a level overfill probe. The overfill probe is interfaced to the cabinet controller to prevent an overfill condition due to the result of a component failure, i.e. Process scale or the failure of the Bulk>Process fill operation.

NOTE: In some related ChemGuard® documentation, such as interconnect and plumbing diagrams, the Process container may be designated as RES B, and the Bulk container designated as RES A.

At any given time, depending on the operation performed, one or both containers may be full, partially full, or empty. These operations are described in later chapters in this manual.

Several Reservoir Container-types are available for use with ChemGuard®. They are described in Table 5-2. 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: It is the customer's responsibility to determine container requirements based on their processes and chemical usage needs.

NOTE: It is the customer's responsibility to determine container requirements based on their processes and chemical usage needs.

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.

Reservoir Container installation is described in Chapter 4.

Figure 5-4: Process Container

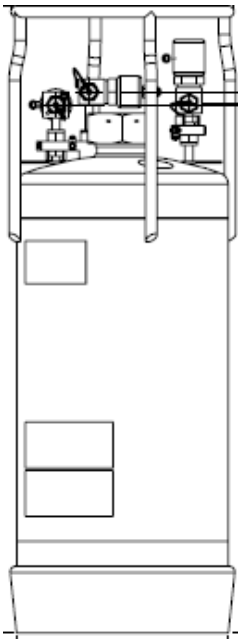


Table 5-2: CHEMGUARD Process and Bulk Refill Container

MODEL	**11 LITER (~2.9 GALLONS)** PROCESS Container: PN 19094 – CG200 PN 19096 – CG100/CG300 **PN 165349 – CG325/CG400** **PN 2303754 – CG326/CG426**
	18.9 LITER (~4.9 GALLONS) PROCESS Container: PN 19119 – CG200 PN 19124 – CG100/CG300
	18.9 LITER (~4.9 GALLONS) BULK REFILL Container: PN 19123 – CG100/CG300

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

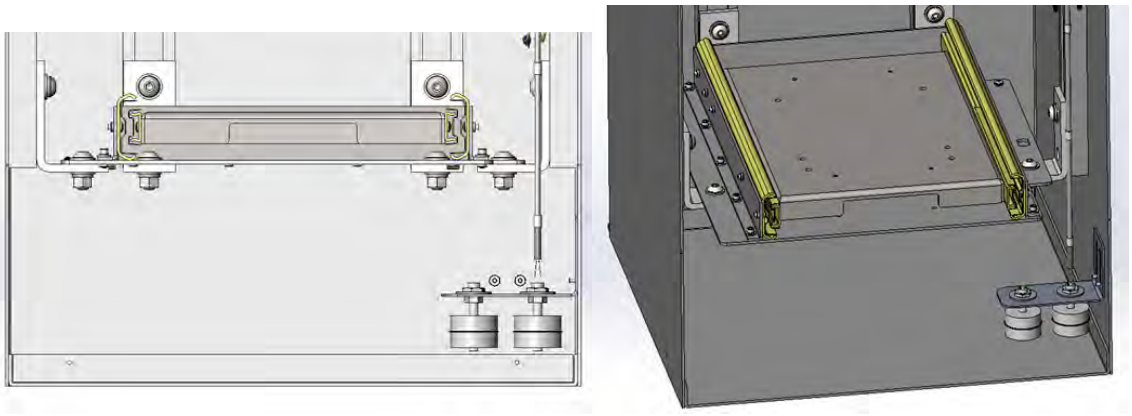
5.3.1 Cabinet Spill Detection

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 IDEL 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)



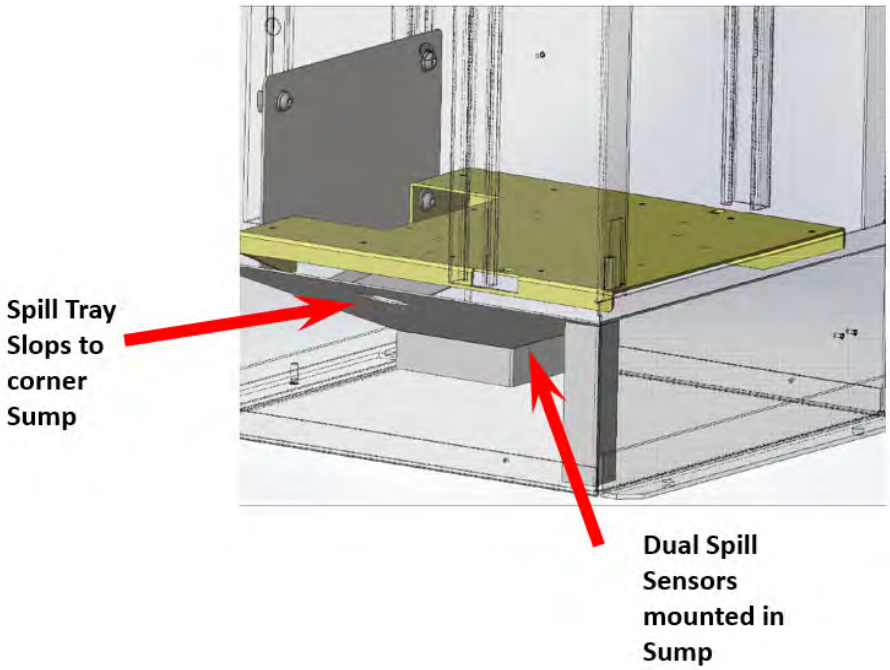
5.3.2 Sump Spill Funnel (optional)

The ChemGuard® sump spill funnel is a unique cabinet design for use with highly flammable chemicals and solvents like OCTANE, HEXANE and Z4MS. This sump spill funnel is required for certain chemistries. 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 slops toward one corner of the cabinet where the dual float switches are installed, Refer to Figure 5-6.

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



5.3.3 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.

5.3.4 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.

WARNING

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

5.3.5 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 IDEL state. Refer to Chapter 7 for testing of the sensor.

5.3.6 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 $C0_2$ 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 CO2. 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 Addendum F for calibration and maintenance of the Fire Detection and Suppression System.

5.3.7 Ultraviolet Infrared (UVIR) Detector (optional)

The ChemGuard® CG325/CG326 includes an optional Ultraviolet Infrared (UVIR) Detector (Required for certain chemistries). 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® 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.

5.3.8 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 details.

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

5.3.9 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

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

The ChemGuard® is designed to deliver liquid chemical from the Process container to the OEM process Tool through the use of an inert gas, Helium, Nitrogen or Argon. It provides a constant outlet pressure and a constant flow of chemical without the downtime associated due to container replacement.

Using Helium, or other inert gas, the cabinet pushes the chemical from the Process container to the process tool without any interruptions or down time.

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 Process container and by the use of an optional degasser module.

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

At the same time the Bulk container refills the Process container whenever the Process level drops below the PROCESS LOW REFILL set-point, in USER SETPOINTS of the CONFIGURATION MENU. The Bulk>Process Fill continues until the Process level reaches PROCESS HI REFILL set-point, in USER SETPOINTS of CONFIGURATION MENU.

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 microprocessor-based system that monitors all key parameters that control operations. The controller automatically performs most maintenance functions. For example, the CYCLE PURGE and LEAK CHECK operations are automated functions designed into the CHANGE CONTAINER operation. This automation reduces the time and effort involved in performing common maintenance tasks. The ChemGuard® also provides zero downtime for normal operations as it permits replacement of Bulk container while the Process container is filling to the tool.

The ChemGuard® is designed to ensure maximum purity of process chemicals used in normal operations while reducing the cost of ownership through improved efficiencies (footprint, exhaust, MTBF, MTBR).

Automated CHANGE CONTAINER functions are incorporated, providing customers with the ability to change chemical Bulk containers without contaminating chemical lines or causing harm to the Technician/Operator or environment.

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

Three Primary Operations performed by the ChemGuard®:

- Process Fill
- Bulk > Process Fill
- Bulk Change

Table 6-1: CHEMGUARD® Operating Parameters

ChemGuard® Designed to	WHY
Continuously delivers uninterrupted supply of liquid chemical from the Process container to the tool	Thin film process is single wafer and can run continuously non-stop 24/7
Keeps the Process container in a continuous fill mode	To deliver chemical uninterrupted to the tool
Keeps constant supply of push pressure to the Process container	The LFM requires constant liquid pressure, ±5psig
Bulk container replenishes the chemical in the Process container, keeping chemical at a specific level without interrupting process pressure	Keep process can full, allowing for the process can to deliver chemical uninterrupted to the tool, 24/7
“Vent Pulses” the head pressure of the Process container to keep the operating pressure within spec, ±5psig	Bulk can pressure set +5-10psig higher than process in order to fill process. To maintain ±5psig pressure spec the process container must be vented to relieve small amount of head pressure
Allows for the Bulk container to be changed out when it goes empty without interruption to the Process container fill mode	So process can remain in a fill mode while changing out the bulk can
Optional Degassers available to “de-gas” liquid chemical being delivered to DLI process tools configured with a liquid flow controller	LFCs requires “de-gassed” liquid chemical

6.2.1 Process Fill

Chemical pressure accurately maintained within in +/- 5 psig. This is accomplished by the following;

- Process Regulator, R2 set to required Process Push Pressure
- High and Low Process Push Pressure alarm set for +/- 5 psig from R2 setpoint
- V4B Vent Valve, “Vent-Pulses” by momentarily opening when pressure in Process Container, (monitored by PT2) increases to 2 psig below High Push Pressure alarm

6.2.2 BULK>Process Fill

Process container automatically calls for refill from Bulk container without affecting chemical delivery or chemical pressure to the process tool.

- Bulk remains in Idle mode until Process requests fill
- As chemical is removed from the Process container to Process Tool, weight on Process Scale decreases
- When weight decreases 2% from 70% to 68% (Process Refill Level setpoint), Process container is refilled back to 70%

6.2.3 Change BULK Operation

- Automated Bulk Change operation.
- Does not affect process fill or 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
- Bulk > Process Fill “locked out” until successful completion of Change Bulk operation

Table 6-2: CHEMGUARD Vacuum verse Venturi

VACUUM	VENTURI
Vacuum pressure can reach 2-3mtorr dependent on pump	Venturi pressure can only reach 25-30 torr dependent on construction, N2 flow/pressure
Vacuum can outgas chemical residue from CG plumbing for chemicals with vapor pressures as low as 50 mtorr	Venturi can only outgas liquid chemical residue for chemicals with vapor pressures as low as 80 torr
Vacuum cycle purging and leak check rate of rise test can be performed to ensure all chemical residue removed before breaking of VCR fittings	Venturi purging can be performed but leak check cannot be performed to ensure all chemical residue has been removed before breaking of VCR fittings
Container change can be completed in 2-3 hours – TEOS at 1.2 torr	Container change takes approximately 6-8 hours to complete – TCS at 400 torr
Dry vacuum pump required and typically expensive	Venturi inexpensive and only requires N2 to perform
Typical chemicals that can be purged using vacuum – TEOS, TiCL4, TMAL, BTBAS, LTO520, TMB, TMPI, many others	Typical chemicals that can be purged using venturi – TCS, SiLC4, 4MS

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 Process and Bulk>Process Fill Screen

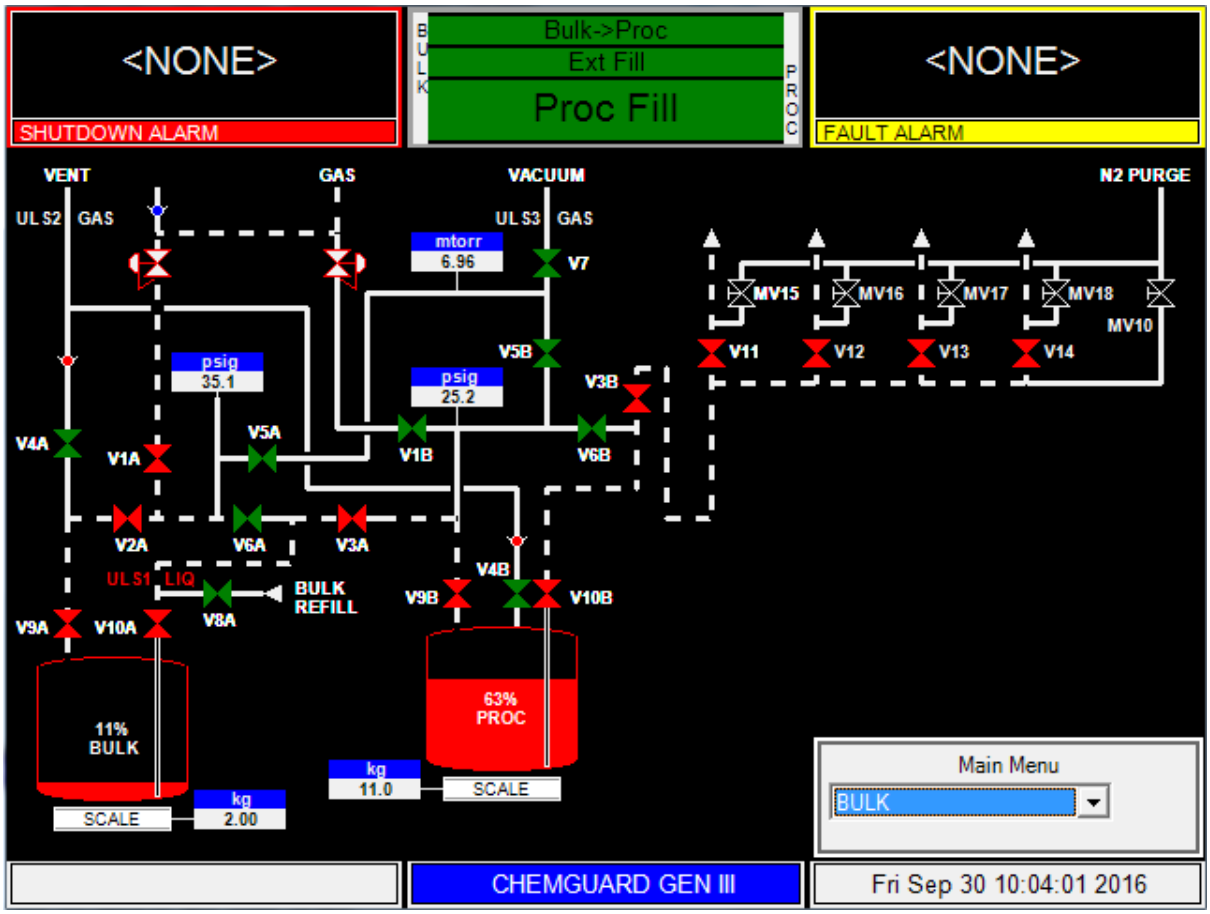
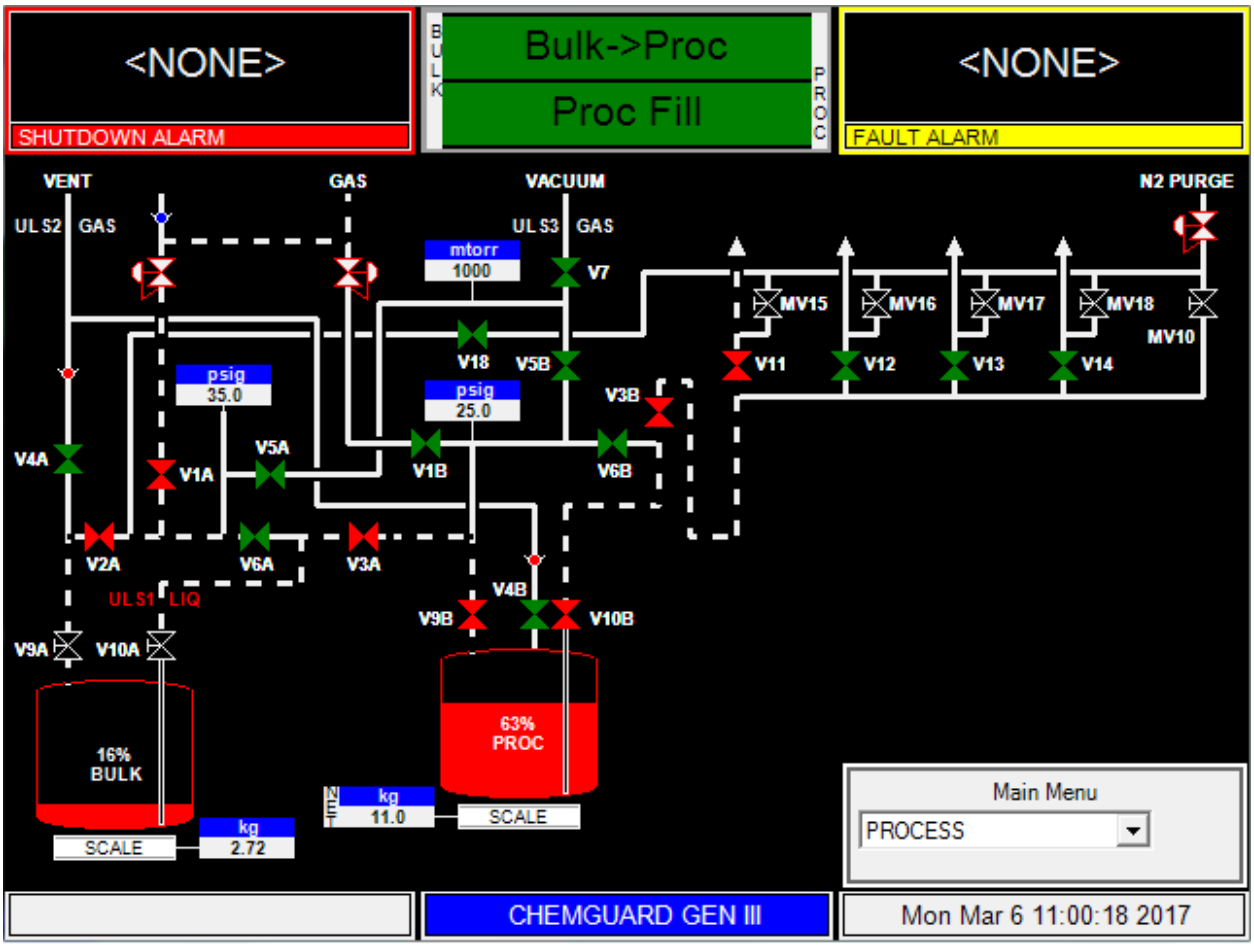


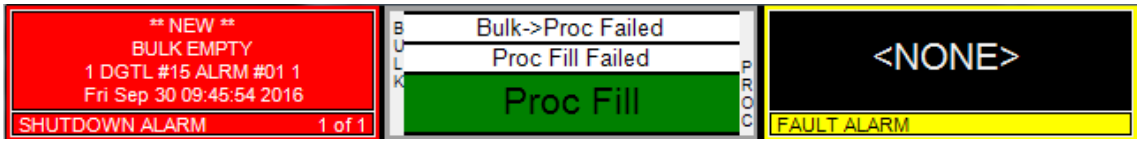
Figure 6-2: CHEMGUARD GenIII Process and Bulk>Process Fill Screen with V18 Helium Reduction Option



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.

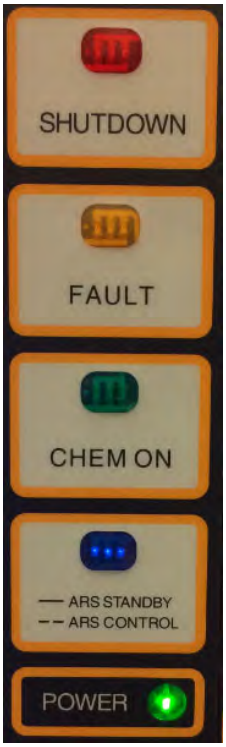
Figure 6-3: Alarm and Controller Status Box



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 6-4: Alarm and Controller Status Box



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 Process. (If the cabinet has the Bulk refill option, the Main Menu pull down window will have three options: Bulk, Process and External 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.

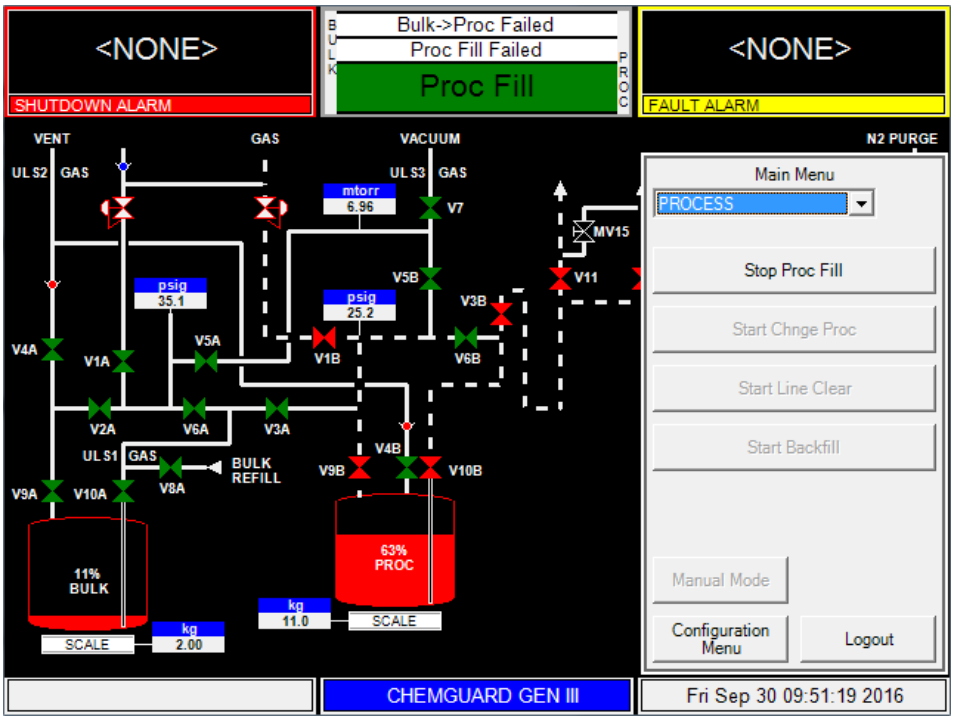
Process container-related operations can be chosen by selecting the Process pull-down menu, also known as the Process Main Menu. If the cabinet is configured for the refill option, then External refill operation can be selected by selecting the External Refill option from the pull-down menu.

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 6-5: 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 process on.

6.3.6 Process Main Menu Options

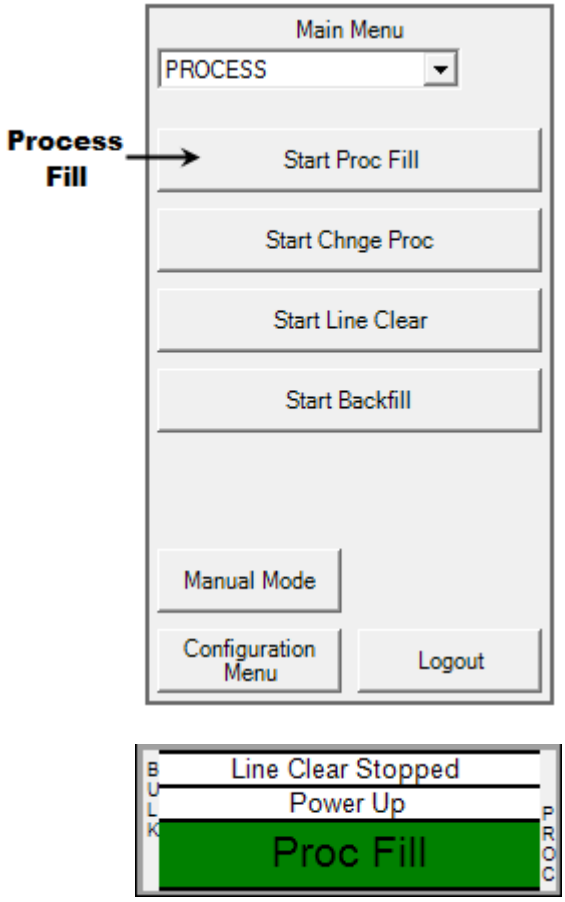
Select Process from the pull-down menu of Main Menu to gain access to the Process Main Menu.

START PROC FILL

This option allows chemical to flow from the Process container to the process tool.

In this option:

- Select **START PROC FILL** to enable the Process container to start fill operation to process the tool when requested.
- Process fill operation requires FILL B input signal on any one of the Tool I/Os to be satisfied.
- Once START PROC FILL is selected, STOP PROC FILL will be enabled. The Controller status box for the Process container will display **PROC FILL**
- The Selection of **STOP PROC FILL** will allow the operator to stop the Process container filling process tool.



The Process fill operation remains enabled until one of the following occurs:

- The operator terminates the operation by selecting **STOP PROC FILL**
- A Life Safety or Process shutdown alarm occurs
- FILL B input signal is not available in all IO connections present in the cabinet

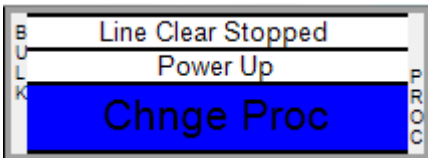
Change Process Container Operation (START CHNGE PROC)

This option guides the operator through steps to remove and replace the Process container. When the Process container is to be removed or installed, the automated Change Process container operation must be performed.

NOTE: Change Process operation cannot be started if the vacuum pump is not turned on, a shutdown alarm is present, or all automatic operations are terminated. If, for any reason, the Change Process operation is terminated before its completion, the operator must re-start the Change Process container operation to prevent any contamination.

- Stop **Bulk external fill** if an external source is filling Bulk container, controller status box for Bulk (middle one) will indicate EXT FILL. To stop external fill select EXTERNAL FILL from the pull-down menu of Main Menu and choose **STOP EXT FILL** pushbutton. Note: External fill is an option and may not be available in all ChemGuard® products
- Select Process from the pull-down menu of Main Menu. Choose **START CHNGE PROC** pushbutton to start change Process routine

At any time, the operator can terminate the operation by selecting **STOP CHNGE PROC** from the Main Menu.



WARNING

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.

NOTE: The Change Process operation continues to run until one of the following conditions occurs:

- The Technician/Operator terminates the Change Process operation by selecting **STOP CHNGE PROC**
- A Life Safety or Process shutdown alarm occurs

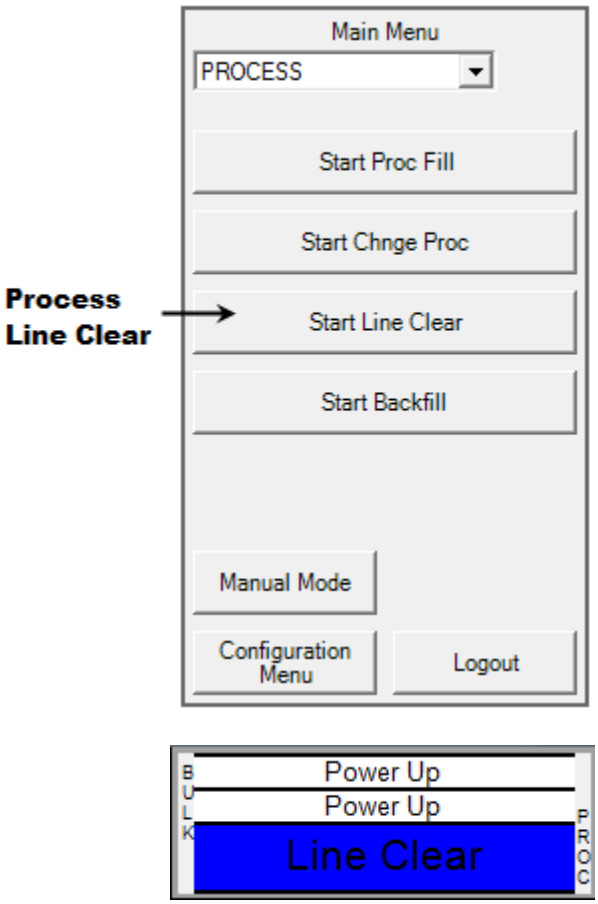
Refer to Chapter 4 for detail on the Change Process operation.

Process Line Clear Operation (START LINE CLEAR)

The Process Line Clear operation removes chemical from internal lines and pushes it back to Process container. It also pushes chemical from the fill inlet line to the Process container back to the Bulk container. This operation should be used when the cabinet is to be shut down for an extended period or during maintenance operations.

To start Process Line Clear operation:

1. Select Process from the pull-down menu of Main Menu and click **START LINE CLEAR**. The Controller status box for Process will display LINE CLEAR
2. Once line clear operation is started, the STOP LINE CLEAR button will be enabled on the Process Main Menu. Click on **STOP LINE CLEAR** at any time to stop line clear operation
3. Process line clear operation can be started unless there is a shutdown alarm present in the cabinet



Process Backfill Operation (START BACKFILL)

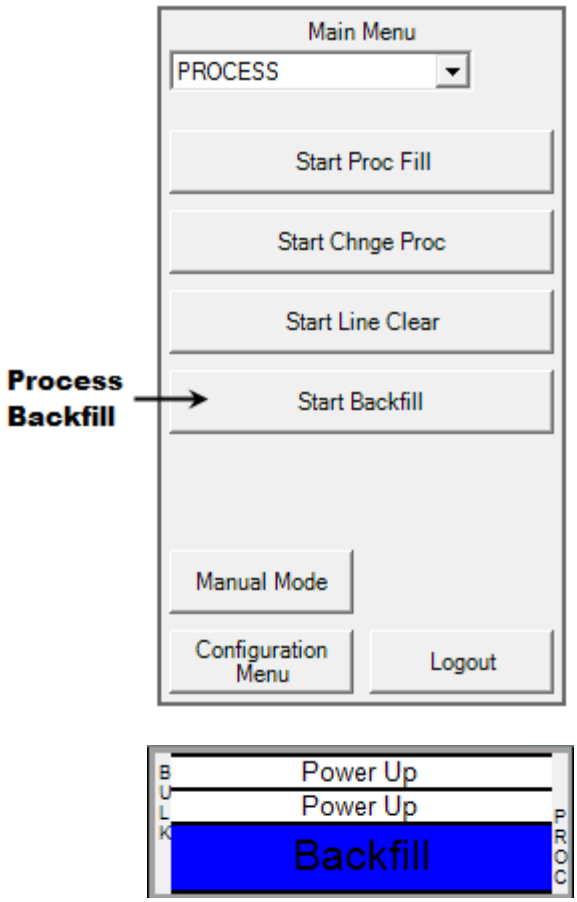
Process Backfill operation removes chemical from the Process container and transfers it to the Bulk container. This operation is primarily used during maintenance operation and should be done before a Change Process operation.

Before performing this operation, verify that the Bulk container can hold the amount of chemical from the Process container, (to prevent any OVERFILL condition during the backfill operation.) Otherwise, perform change Bulk operation and install empty Bulk container before proceeding with backfill operation.

To start backfill operation:

1. Select Process from the pull-down menu of the Main Menu and click START BACKFILL. The Controller status box for Process will appear as Backfill
2. Once Process backfill operation is started, the STOP BACKFILL button will be enabled on the Process Main Menu. Click STOP BACKFILL at any time to stop backfill operation
3. Backfill operation can be started unless there is a shutdown alarm present in the cabinet

NOTE: To confirm Process container is empty, monitor Process scale level to confirm readout no longer changes. Process Backfill may need to be run 2 or 3 times



Process Manual Mode Operation (START Manual Mode)

The Process Manual Mode operation is a function to operate individual valve during startup or maintenance mode as well as for troubleshooting.

NOTE: Only qualified operators and maintenance technicians should access and operate ChemGuard® in manual mode.

- To start Process Manual Mode operation, select **MANUAL MODE** from the Process 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 any time, all valves can return to normal state by pressing the “CANCEL” box.

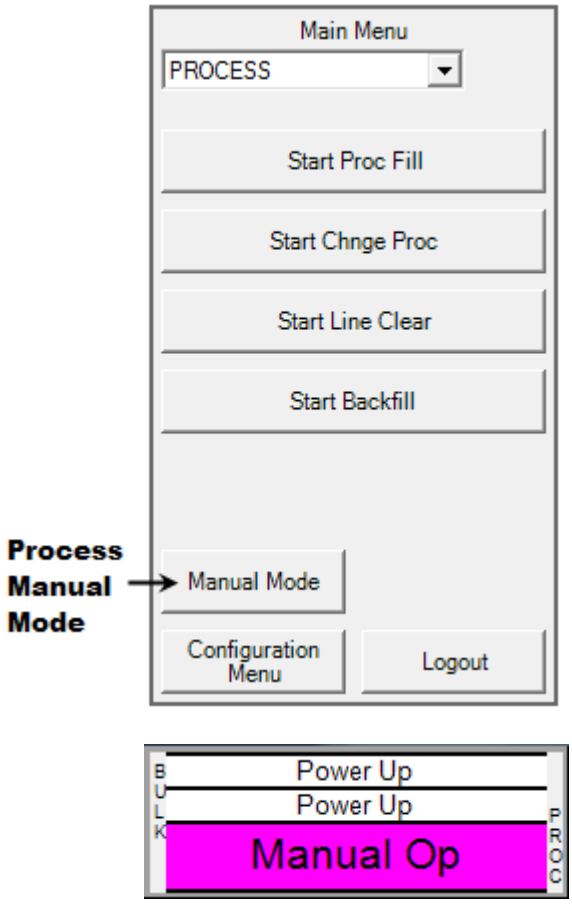
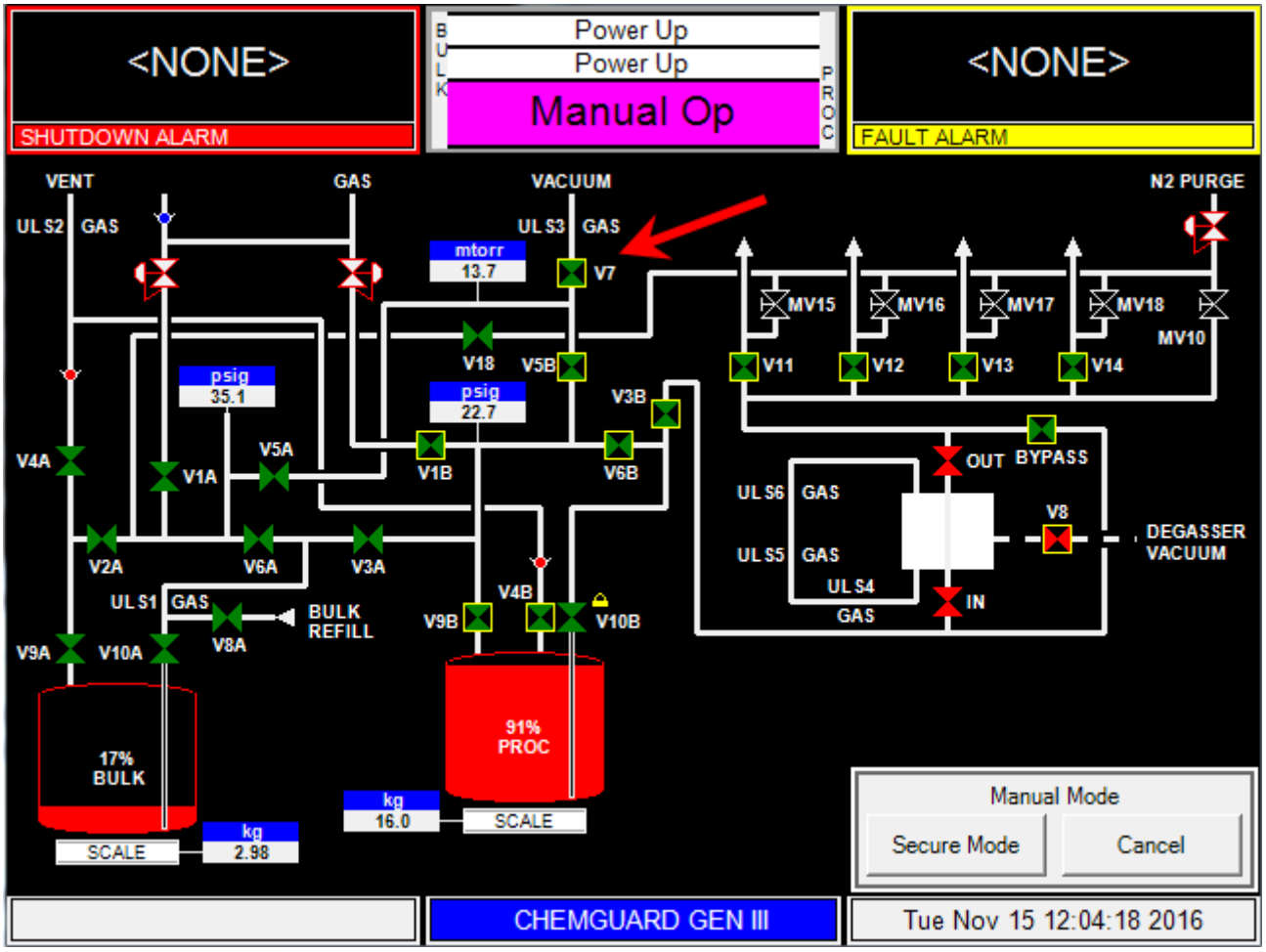


Figure 6-6: Manual Mode Display Screen



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

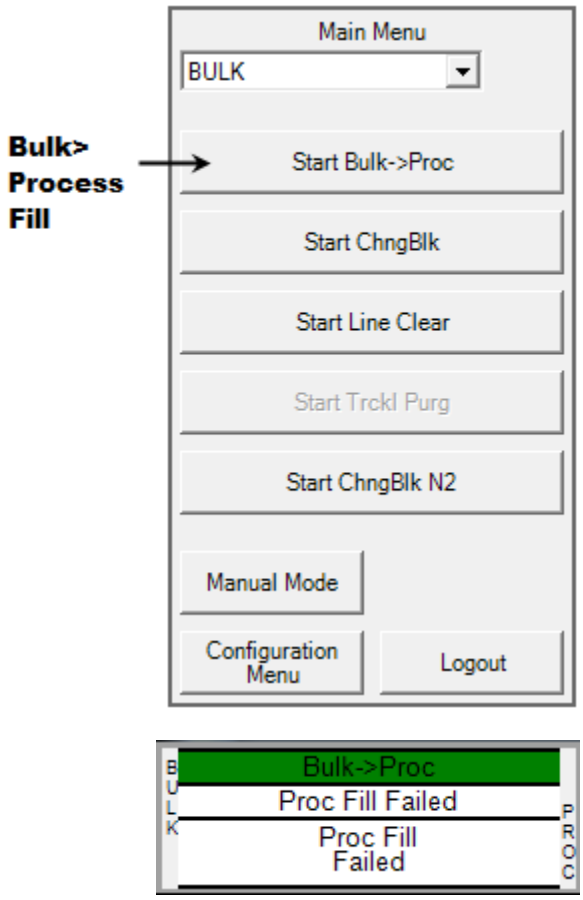
NOTE: Yellow lock symbol next to valve will not allow that valve to be open in manual mode. This is a software interlock that prevents valve to be manually opened which could lead to unsafe condition.

6.3.7 Bulk Main Menu Options

Bulk to Process Fill (START BULK->PROC)

This operation allows chemical to fill from the Bulk container to the Process container. From the pull-down menu of the Main Menu, select Bulk (if not selected) to gain access to the Bulk Main Menu. Click **START BULK->PROC** to enable Bulk->Process Fill. Bulk fill starts when chemical level of Process container reaches Process Low Refill setpoint, i.e. 68% set in User Setpoint > Process Scale > Process Low Refill.

- In this option: Select **START BULK->PROC** to enable the Bulk container to refill the Process container
- 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 Bulk->Proc Stopped, white to Bulk>Proc, green
- Menu option STOP BULK->PROC will be enabled once START BULK->PROC is selected. Clicking on STOP BULK->PROC option stops, disables Bulk fill
- Bulk fill starts when chemical level of Process container reaches Process Low Refill setpoint, i.e. 68% set in User Setpoint > Process Scale > Process Low Refill.
- Bulk fill stops when chemical level of Process container reaches Process Hi Refill setpoint, i.e. 70% set in User Setpoint > Process Scale > Process Hi Refill



The cabinet remains in Bulk->Proc status until one of the following conditions occurs:

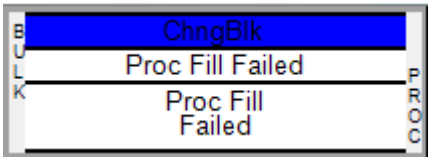
- Chemical level in Process container reaches PROCESS HI REFIL set-point value, set in USER SETPOINTS of CONFIGURATION MENU
- Chemical level in the Bulk container reaches empty
- Operator terminates the operation by selecting STOP BULK->PROC
- A shutdown alarm occurs

Change Bulk operation (START CHNGE BULK)

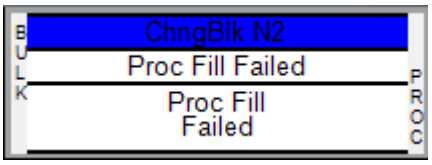
This option guides the operator through steps to remove and replace Bulk container. Change Bulk operation must be performed any time to remove or install Bulk container.

NOTE: There will be two (2) “Start Change Bulk” selections on the main menu display if ChemGuard® ordered with the Helium Reduction option, addition of the V18 N2 spool.

- **Start ChngBlk** is the standard selection which uses Helium gas and is available for both non-Helium Reduction and Helium Reduction ChemGuard®.



- **Start Start ChngBlkN2** is only available when the Helium Reduction option is ordered and uses N2 gas when performing Change Bulk operation.

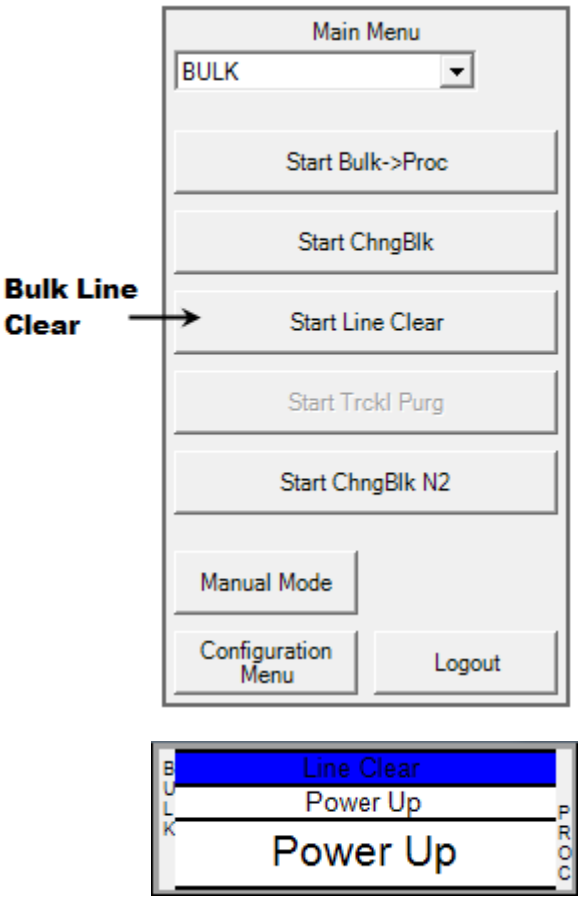


Refer to Chapter 4 for detail information.

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.

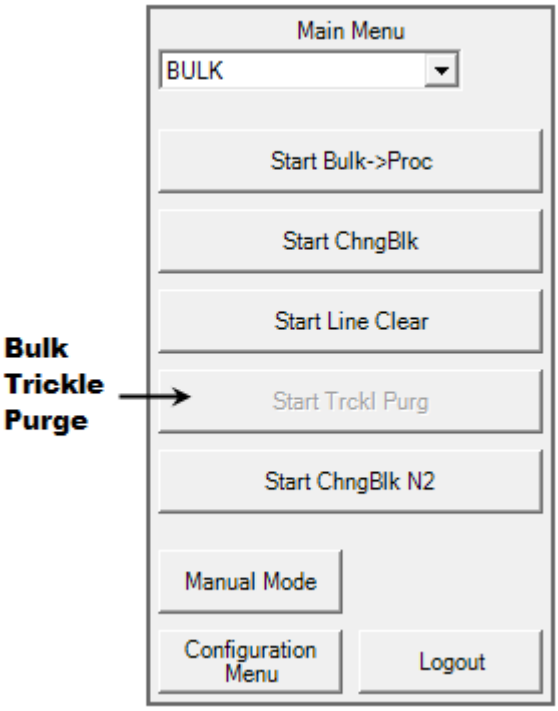
- To start the Bulk line clear operation, click on **START LINE CLEAR** from the Bulk Main Menu
- The Controller status box for Bulk will display “Line Clear” and the STOP LINE CLEAR option will be enabled on the Main Menu
- Select **STOP LINE CLEAR** to stop line clear operation at any time
- Bulk Line 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 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.

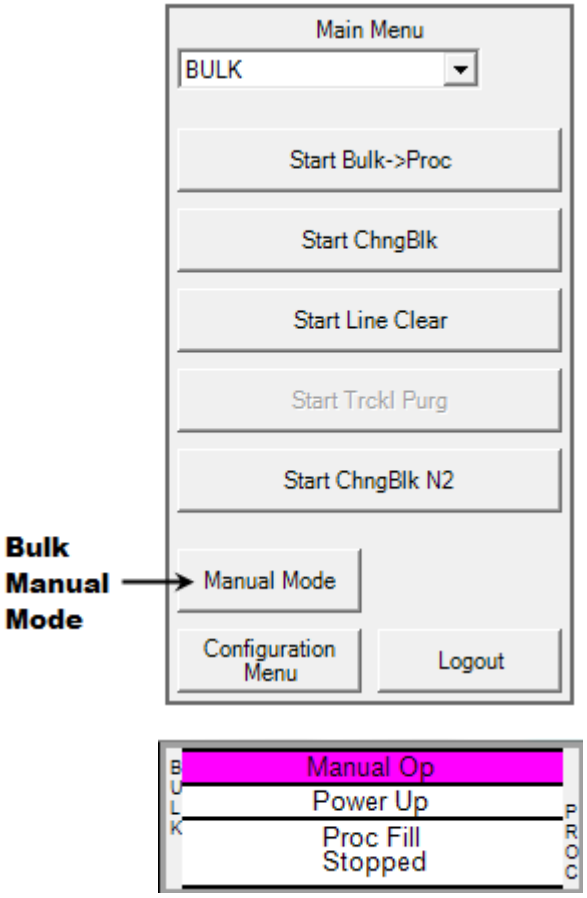
- To start the Bulk trickle purge operation, click **START TRCKL PURG** on the Bulk Main Menu and follow prompted information on the screen
- The Controller status box for Bulk displays "Trickl Purg" and the STOP TRCKL PURG option will be enabled on the Bulk Main Menu
- Select **STOP TRCKL PURG** to 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.



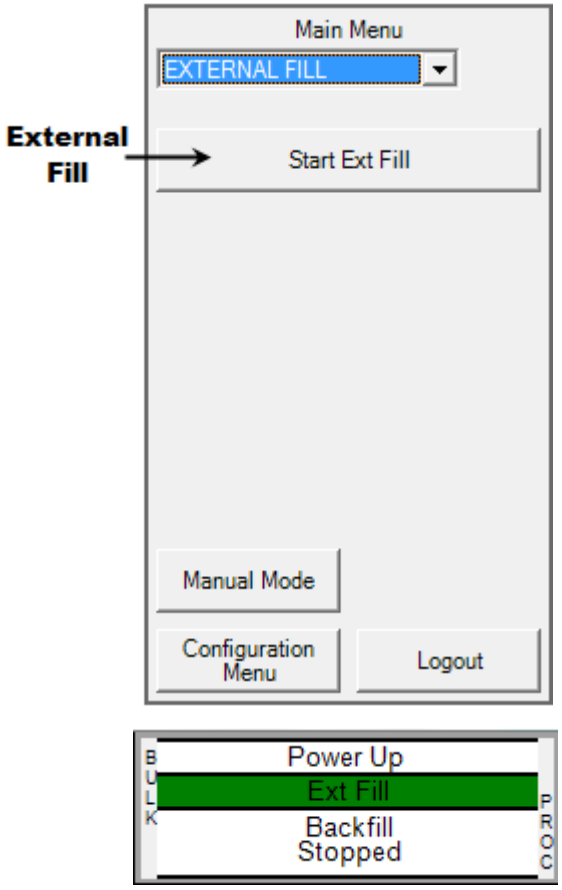
6.3.8 External Fill Main Menu (optional)

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:

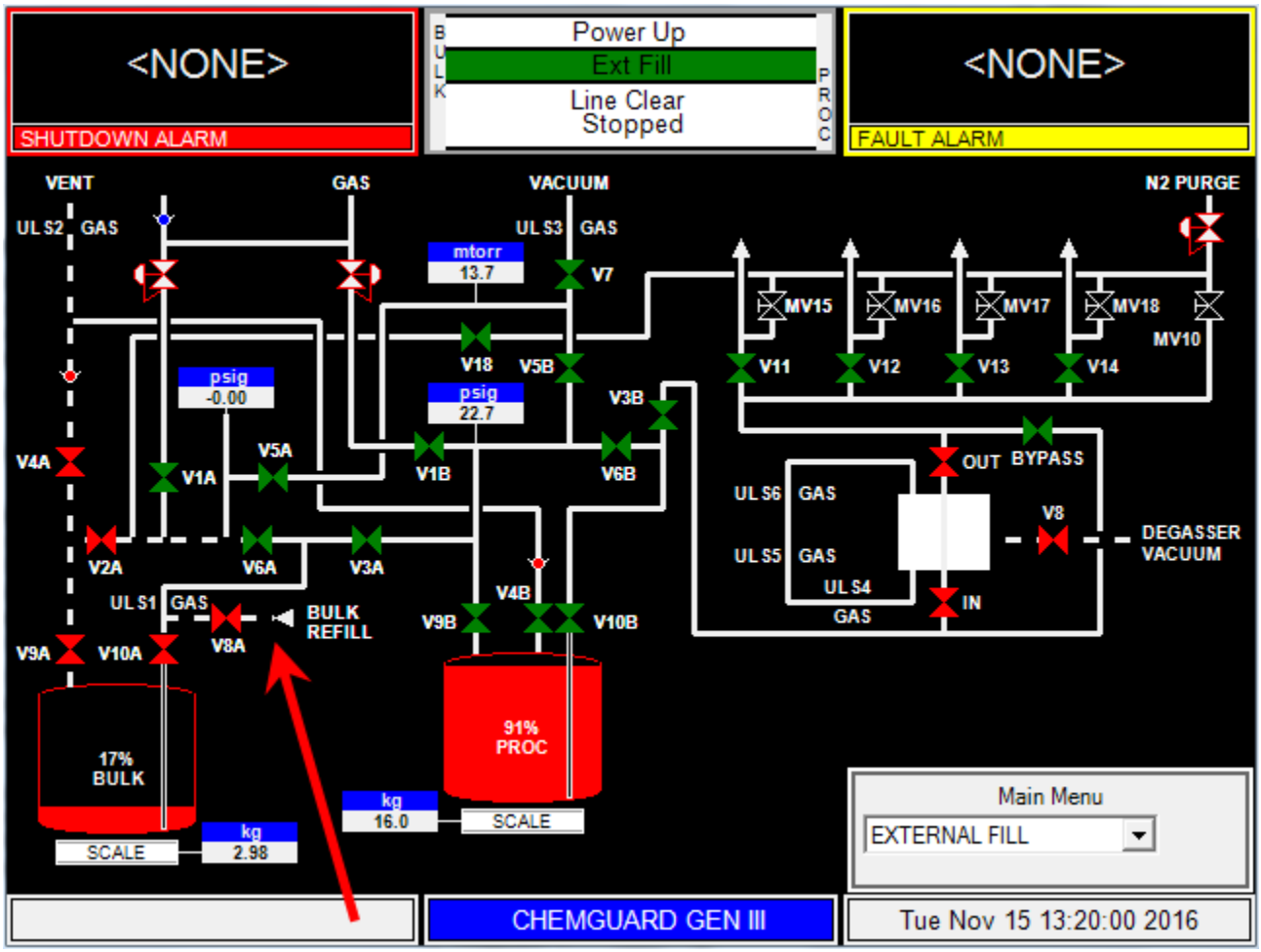
- Select EXTERNAL FILL from the pull-down menu of Main Menu and click **START EXT FILL**. Note: START EXT FILL will be disabled if BULK REFILL LEVEL setpoint percent in User SETPOINTS of Configuration menu is set to zero
- When START EXT FILL is selected, the controller status box for Bulk container (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
- The Bulk container is not refilling the Process container
- There are no shutdown alarms that prohibit external fill operation

Figure 6-7: 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.

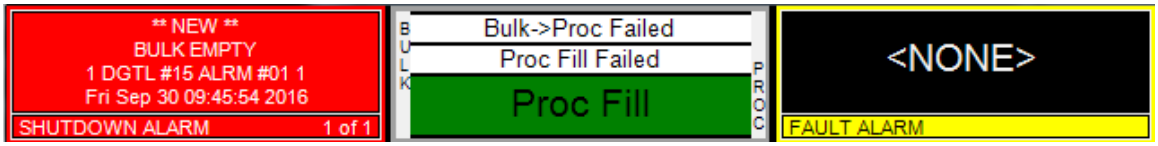
If multiple alarms are present, alarms will scroll in the alarm box with an index and number of alarms present in the cabinet at that time. The ChemGuard® can be configured so that, when the power at the ChemGuard® is turned off, all alarms are activated at the I/O, which in turn, alerts the process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

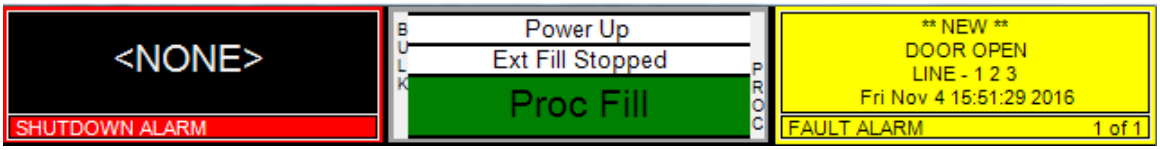
Figure 6-8: Shutdown Alarm Displayed



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 6-9: 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 6-10.

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 6-11

Figure 6-10: Accessing Alarm History Menu

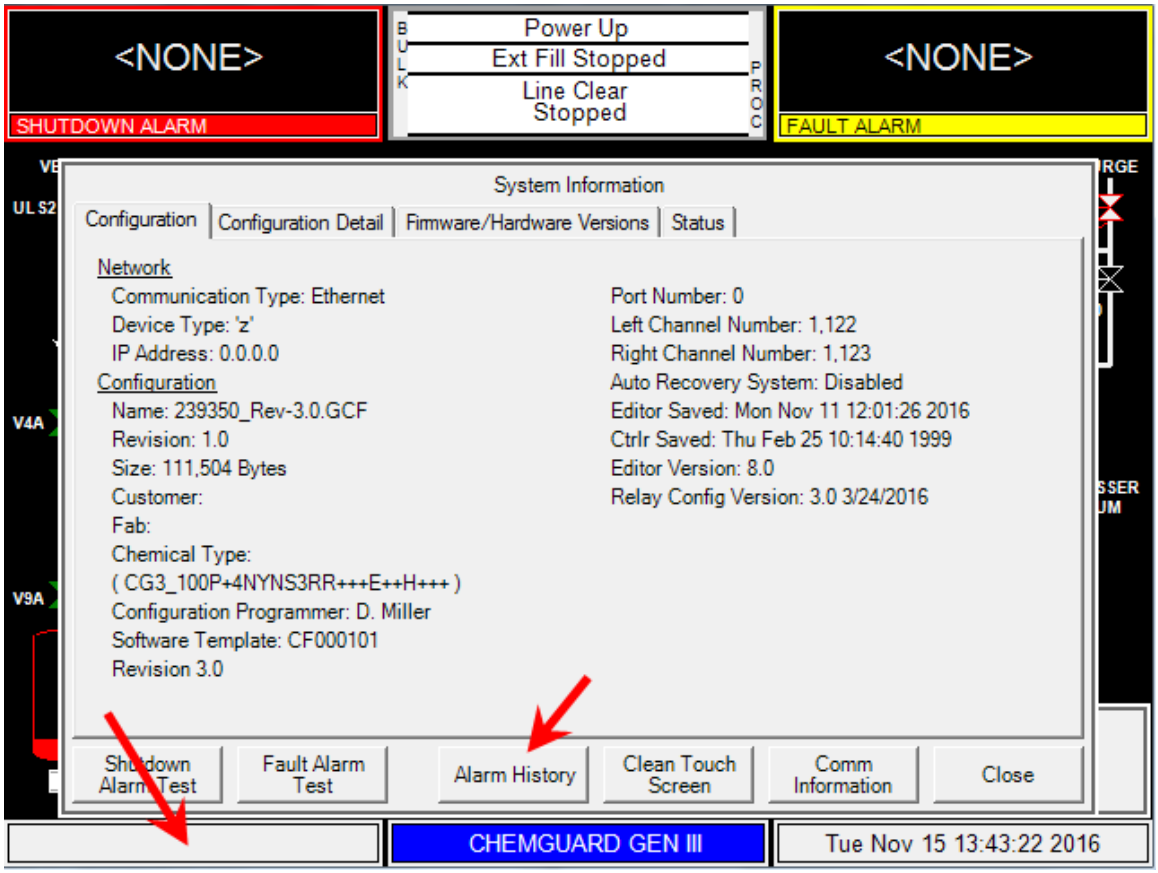
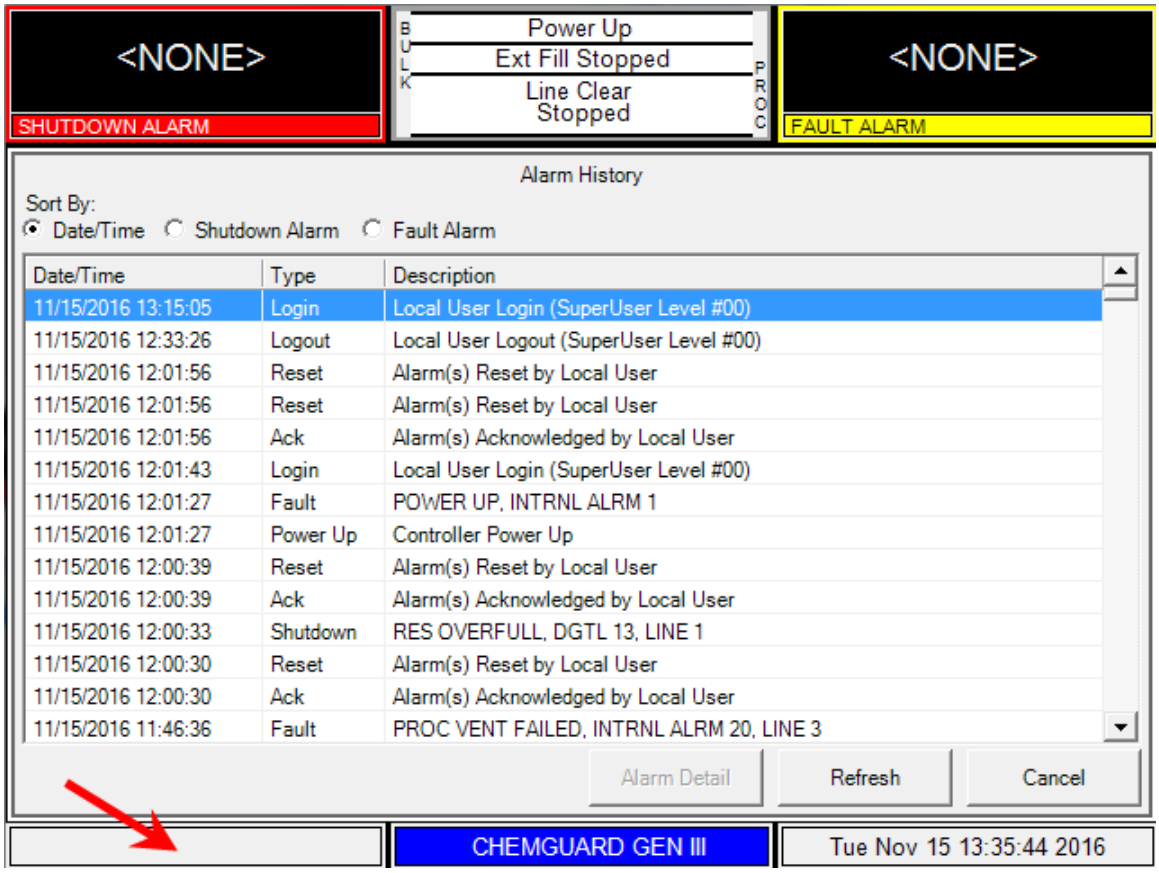


Figure 6-11: Accessing Alarm History Menu



Chapter 7: Maintenance & Calibration Procedures

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 recommended inspection table below.

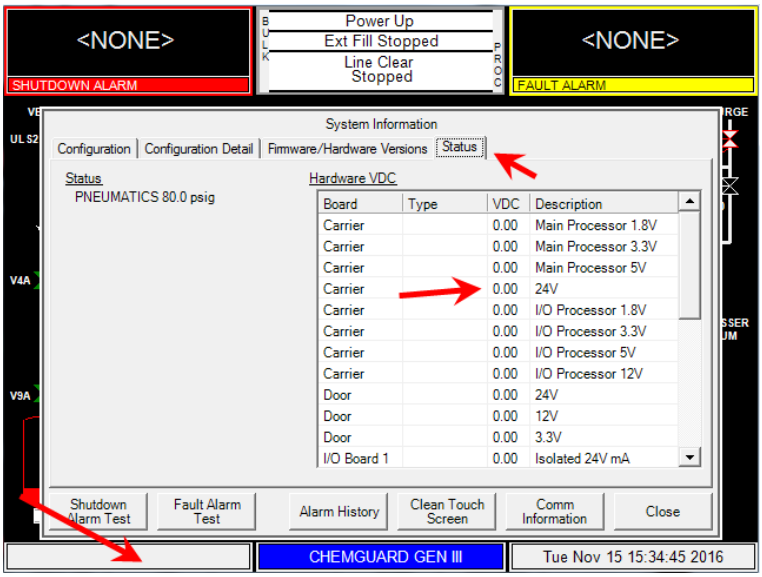
Only qualified personnel trained on the Operation and Maintenance of the ChemGuard® GEN III should attempt to perform maintenance and calibration of the System.

Table 7-1: Inspections Schedule

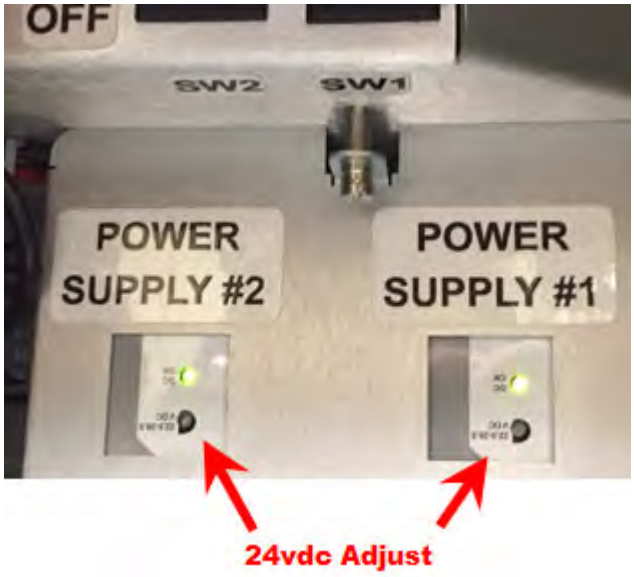
Periodic Inspection	Frequency
Power Supply Verification	12 Months
Scales Verify/Calibration	24 Months or When replaced
Sump Spill Sensor Verification	24 Months
R1 and R2 Regulator Verification – refer to chapter 3, section 3-11	12 Months
PT1 and PT2 Verification – refer to chapter 3, section 3-11	12 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

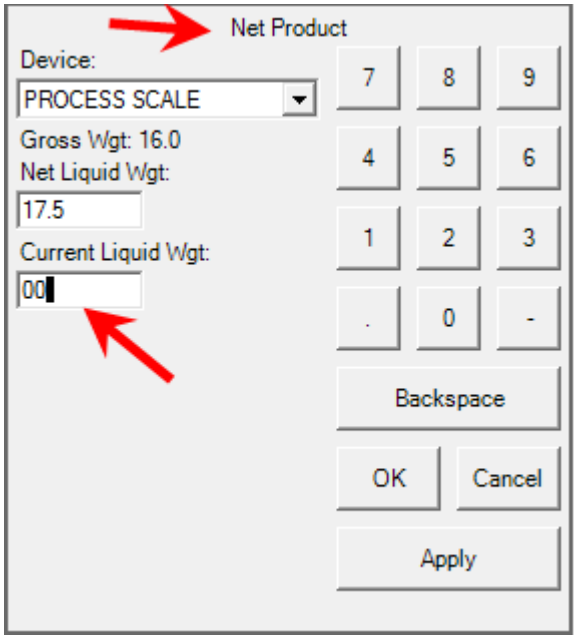
This procedure is used to set the accuracy of the Bulk and Process scales. Failure to perform this calibration may permit a buildup of “strain gage drift” resulting in inaccurate readings. If the PROCESS scale were to read the container weight lower than real weight, the PROCESS container could potentially be overfilled, causing a Shutdown alarm and a shutdown of the Bulk>Process fill, which may result in unscheduled down time.

Process Scale:

Perform Process Scale calibration when replacing the Process container

1. Perform Process Backfill operation to empty Process container
2. Perform Change Process operation to remove Process container from scale

3. Zero out all net values by entering Configuration Menu
4. Selecting Net Product > Process Scale
5. Enter 0 for Current Liquid Weight



6. Step to Configuration Menu and then select System Test and then TEST ANALOG IN
7. Adjust the zero pot (left side) on front edge of scale as required so the current reads 4.0 mA ±0.01mA on the TEST ANALOG IN display, Label - Process Scale. The reading should be at 0 gram, refer to Figure 7-1.

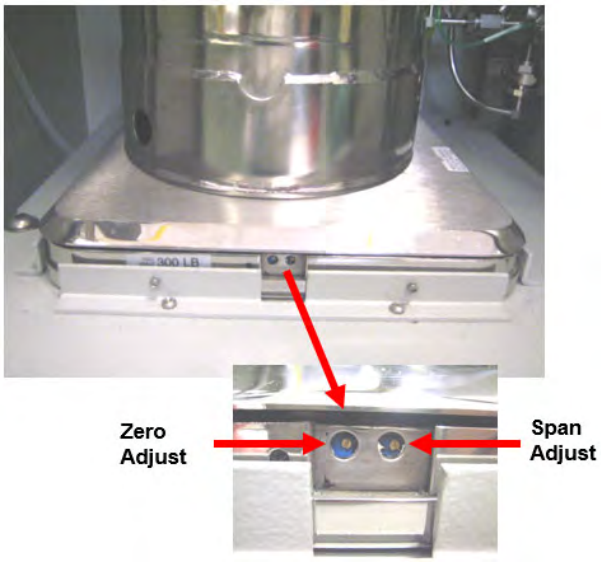
Test Analog In

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		2.98 kg	4.35 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

Close

8. Place calibrated weight(s) on scale surface and verify the weight reading against the actual gram value of the calibrated weight
9. Adjust the span (right side) pot on front edge of scale as required so the weight is within ±50 grams of the actual calibrated weight
10. Remove weight(s) and verify zero grams ±20 grams. Adjust the zero pot (left side) on front edge of scale as required so NET weight is within ±20 grams
11. Repeat until no adjustment is required and measurements are within specifications

Figure 7-1: Bulk and Process Scale Zero and Span Adjust



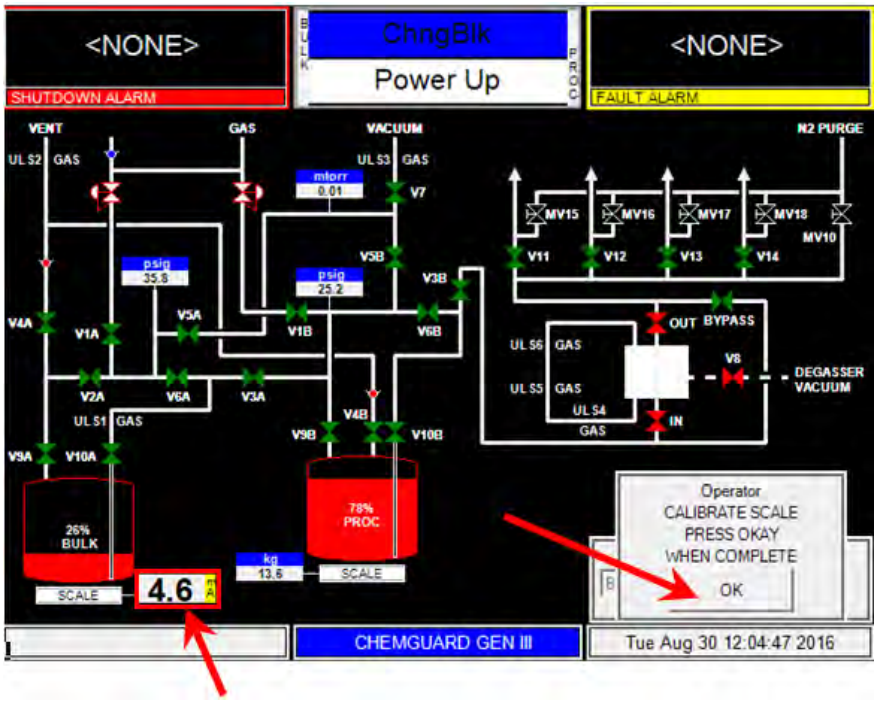
Bulk Scale:

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 Change Bulk, 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 Change Bulk operation



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 ±0.01mA on the TEST ANALOG IN display, Label – Bulk Scale. The reading should be at 0 gram, refer to Figure 7-1.

Test Analog In

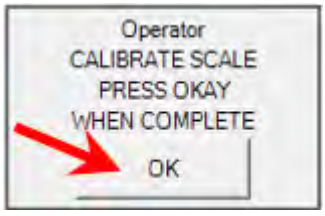
Input	Label	Net	Gross	Raw	Hardwire	Connection Point
1	PROCESS SCALE		0.05 kg	4.01 mA	N/A	IF Box - A1
2	BULK SCALE		0.05 kg	4.01 mA	N/A	IF Box - A2
3	PROCESS PUSH		22.7 psig	10.0 mA	N/A	IF Box - A3
4	BULK PUSH		-0.00 psig	6.36 mA	N/A	IF Box - A4
5	VACUUM		3.79 mtorr	3.77 VDC	N/A	IF Box - A5
6	Varian-		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

Close

4. Adjust the zero pot (left side) on front edge of scale as required so the current reads 4.0 mA ±0.01mA on the TEST ANALOG IN display, Label – Bulk Scale. The reading should be at 0 gram

   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 ±50 grams of the actual calibrated weight
6. Remove weight(s) and verify zero grams ±20 grams. Adjust the zero pot (left side) on front edge of scale as required so NET weight is within ±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



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.

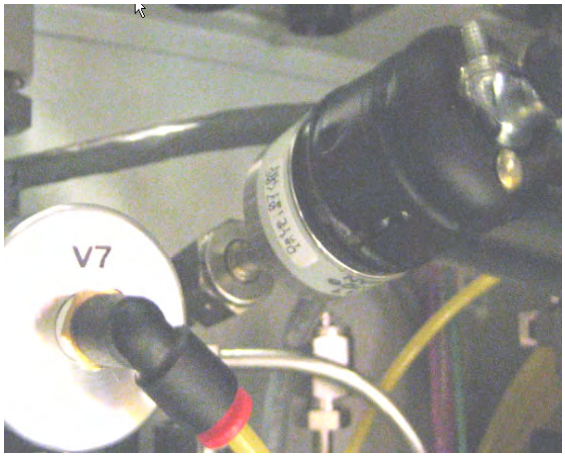
7.2.4 Thermocouple Gauge Verification

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: CG100/200 Thermocouple Gauge



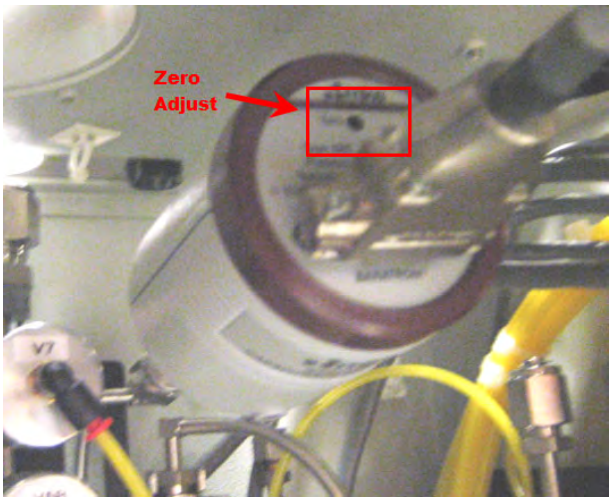
7.2.5 Vacuum Transducer Calibration (Baratron model 626A)

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® 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: CG300/325/326/400/426 Vacuum Baratron



Reference Model via Vacuum Gauge:

Vacuum Gauge	CG100--200	CG300—325, CG326, CG400, CG426
Thermocouple	X	
Baratron		X

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

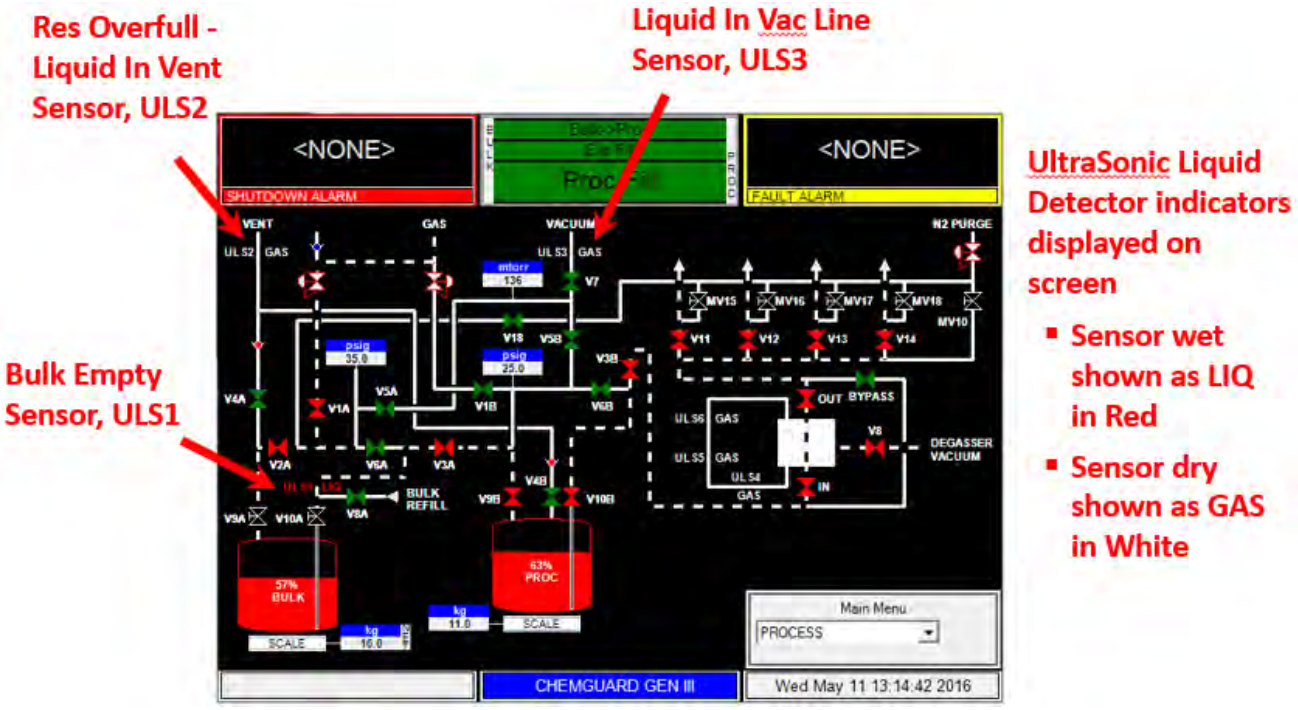
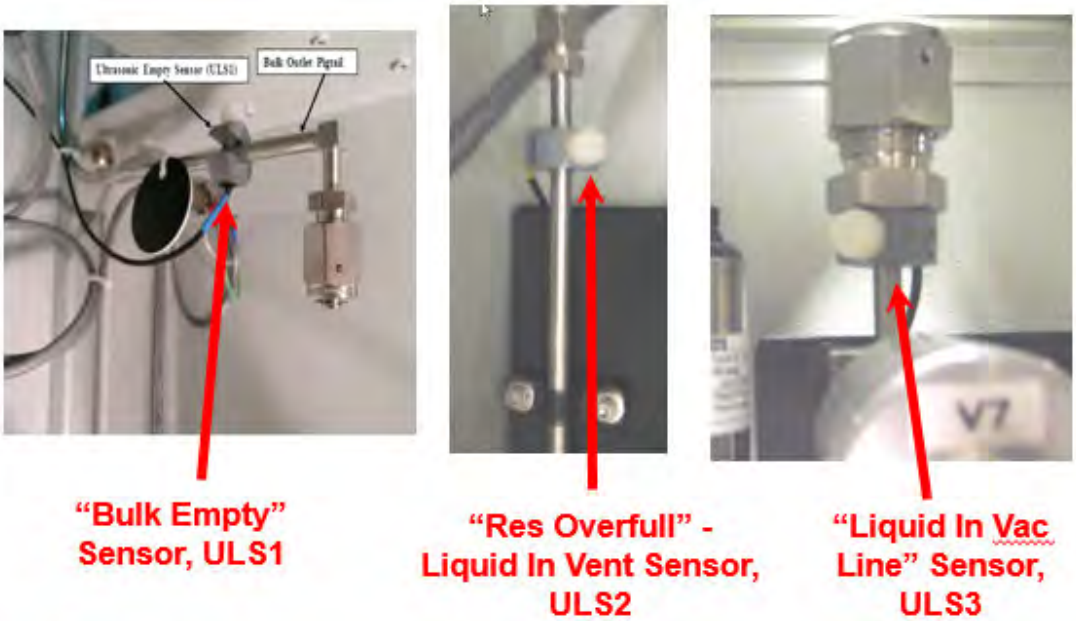
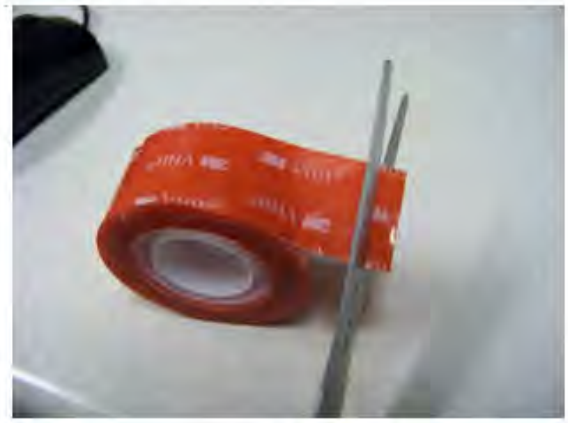


Figure 7-5: Ultrasonic Sensor Location

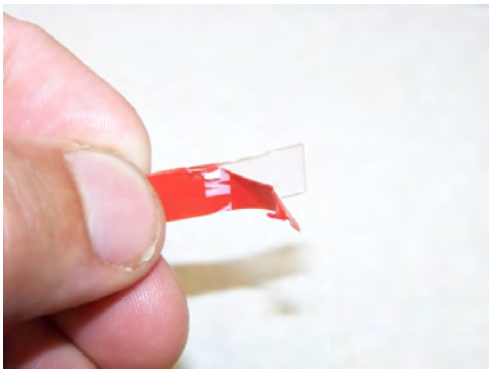


7.2.7 Ultrasonic Clamp-On Sensor Maintenance

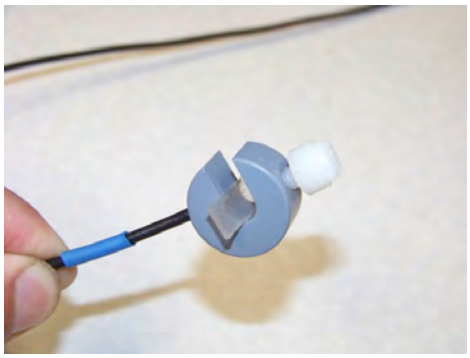
1. Turn off all fill operations (bulk to process, process fill, and external refill)
2. Open the cabinet door
3. Remove the ultrasonic sensors one at a time to avoid mounting them in the wrong location
4. Use a clean wipe to remove the vacuum grease from the stainless tubing. Make sure all sides of the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



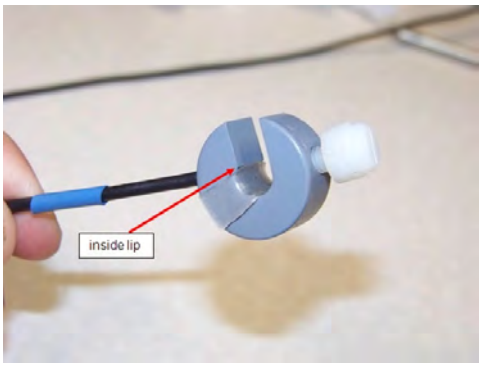
7. Remove the red backing from the tape



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 snuggly 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 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.

For calibration of the Dräger gas detector refer to chapter 5 of the Dräger Polytron 8700/8720 instruction manual.

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

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

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

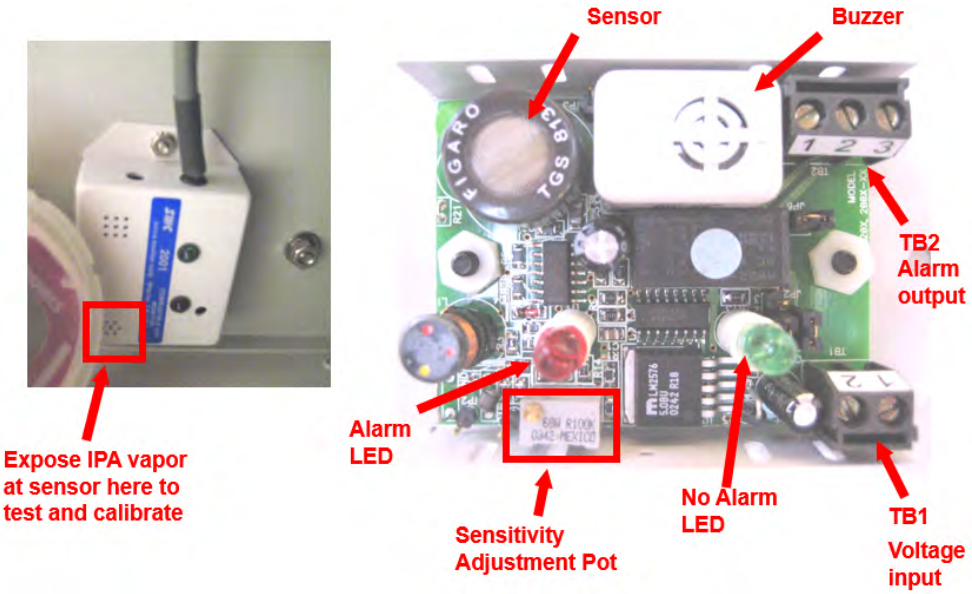
9. Verify that the alarm turns off after the gas is removed from the sensor. Usually takes 2 to 3 minutes

   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)



7.2.9 High Temperature Sensor Verification (System Option)

This test can be used on both the exhaust high temp sensor assembly or the Rate of Rise temp sensor installed when the fire suppression system is ordered.

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.

7.2.10 Other Tests

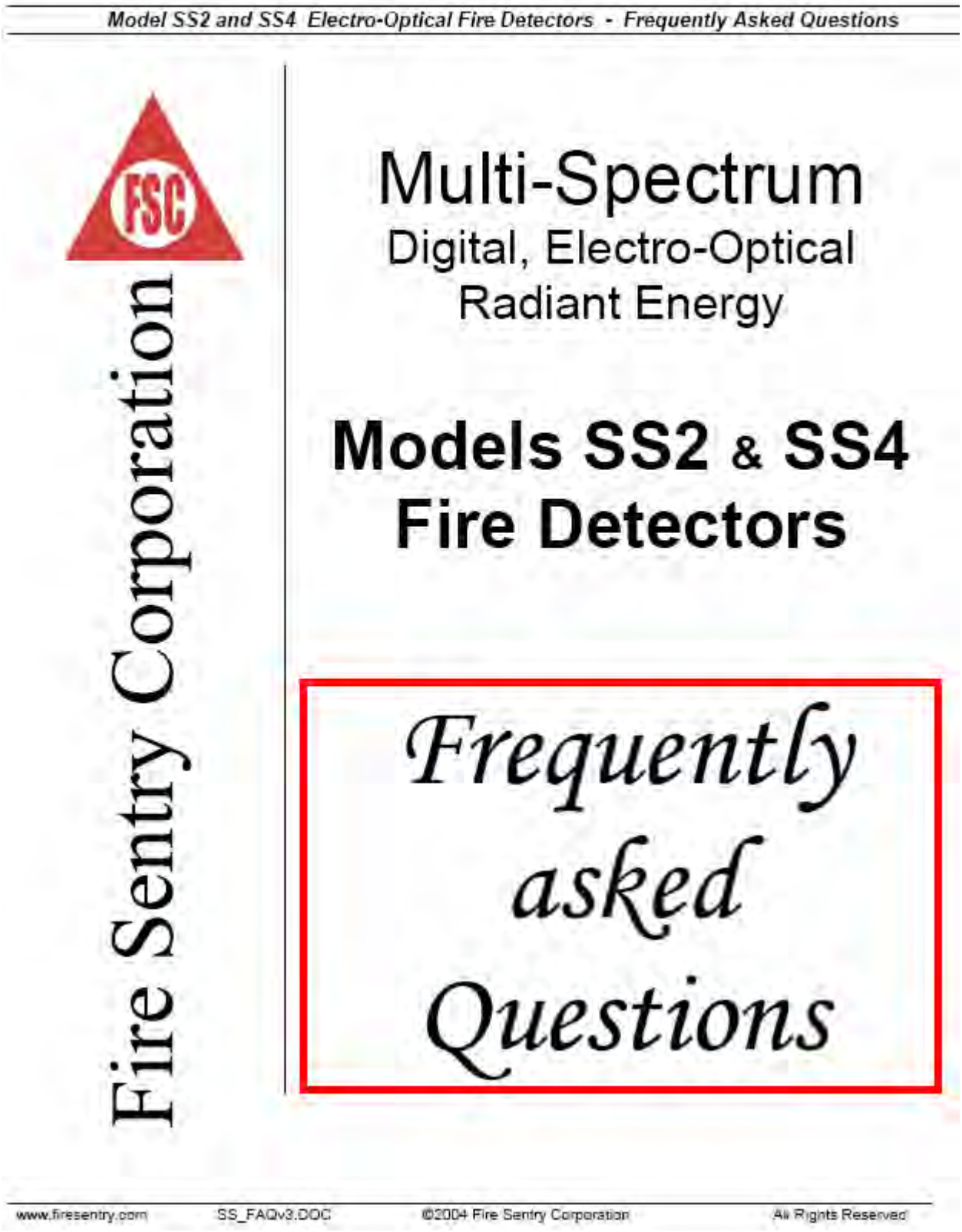
Other tests that should be performed on a periodic basis include:

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



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	Answer
What is an Electro-Optical Radiant Energy Fire Detector?	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.
What is meant by the Detector's Field of View?	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.
What is an Ultraviolet (UV) only Flame Detector?	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.
What is an Infrared (IR) Only Narrow Band Flame Detector?	An IR only Narrow Band Flame Detector is a device that senses "flickering" radiant energy in the 4.3-micron narrow band IR (CO_2 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_2) emission band. This region of the IR spectrum, known as the "CO_2 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_2 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_2 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_2).

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_2 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 (CO2) 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_2 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.

Model SS2 and SS4 Electro-Optical Fire Detectors - Frequently Asked Questions	
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
- 12 VDC or 24 VDC 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	CSFM 7272-1062:109
	Hong Kong Fire Services Department
	New York City MEA 274-93-E (Vol. VII)

Security you can rely on.

BOSCH

Series Technical Specifications

Enclosure Design	
Dimensions (HxØ):	2 in. x 5 in. (5 cm x 12.7 cm)
Material:	High impact fire retardant ABS plastic enclosure and separate twist-lock mounting plate.
Mounting:	Separate mounting plate mounts directly to 4 in. (10.2 cm) octagonal electrical box, single gang box and wiremold surface box #5739. A removable terminal strip allows for quick installation.
Environmental Considerations	
Relative Humidity:	0% to 95% non-condensing
Temperature (Operating):	+32°F to +120°F (0°C to +49°C)
Outputs	
Alarm:	One Form "A" (NO) contact rated at: 0.5 A, 200 V
Power Requirements	
Current (Start-up):	0.12 mA maximum
Current (Standby):	0.09 mA @ 12 VDC; 0.09 mA @ 24 VDC; 0.1 mA @ 30 VDC
Power-up Time:	22 s maximum
RMS Ripple (maximum):	25% of DC input
Voltage (Standby):	2-wire: 8.5 VDC to 32.0 VDC 4-wire: 10.0 VDC to 30.0 VDC
Radio Frequency Interference (RFI) Immunity:	No alarm or set up on critical frequencies in the range from 25 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 7.9 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:	0.09 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. @ 20 VDC
Standby:	0.09 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. @ 20 VDC
Standby:	0.09 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. @ 20 VDC
Standby:	0.09 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:	33 (±10) mA @ 20 VDC
Standby:	0.09 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum
Outputs:	
Auxiliary:	One Form "C" (NC/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. (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 (±10) mA @ 30 VDC
Standby:	0.09 mA @ 12 VDC; 0.1 mA maximum
Trouble:	0.1 mA maximum
Outputs	
Auxiliary:	One Form "C" (NC/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 @ 30 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. (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 (±10) mA @ 30 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 @ 30 VDC
Standby:	18 mA maximum @ 30 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:	0.09 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 trigged 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

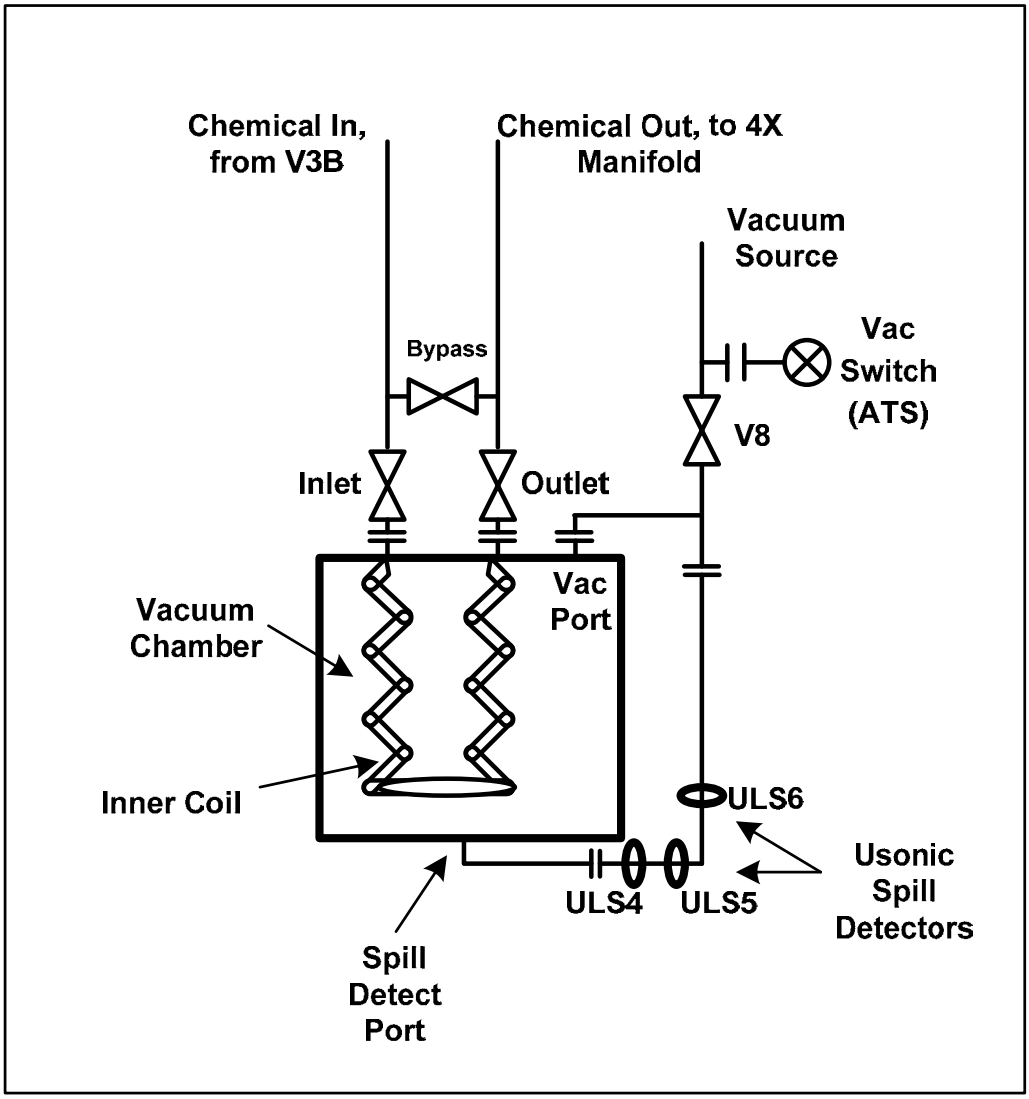
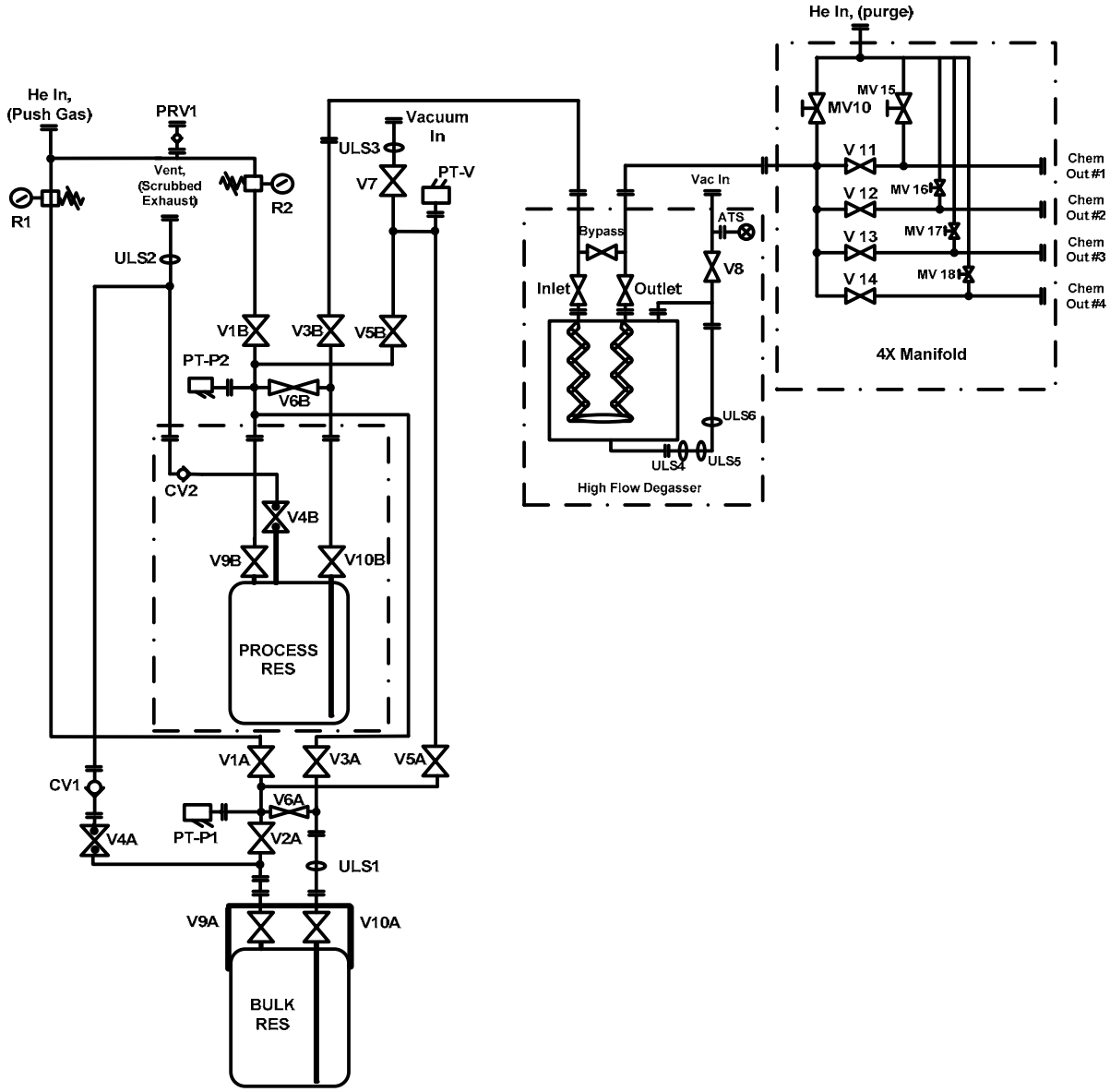


Figure 2: ChemGuard with High Flow Degasser Assembly



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.

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 ¼ 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 ¼ 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 ¼ 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

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 pigtails 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 pigtails 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 pigtails 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 pigtails available, contact your local VERSUM MATERIALS, INC. commercial representative for ordering information on custom pigtails.
- 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

CG100-325,326 Pigtail Options		
Inlet Pigtail	**Outlet Pigtail**	**Selection Pigtail Options**
¼" FVCR	¼" MVCR	**P**
¼" MVCR	¼" FVCR	**C**
½" MVCR	¼" MVCR	**PB**
½" FVCR	¼" MVCR	**PP**
½" FVCR	¼" FVCR	**L2**

CG400/CG426 Pigtail Options		
Inlet Pigtail	**Outlet Pigtail**	**Selection Pigtail Options**
½" FVCR	¼" MVCR	**P / PR2 / NPB**

CG110-410 Pigtail Options		
Inlet Pigtail	**Outlet Pigtail**	**Selection Pigtail Options**
¼" FVCR	¼" MVCR	**P**
¼" MVCR	¼" FVCR	**C**
½" MVCR	¼" MVCR	**PB**
½" FVCR	¼" MVCR	**PP**

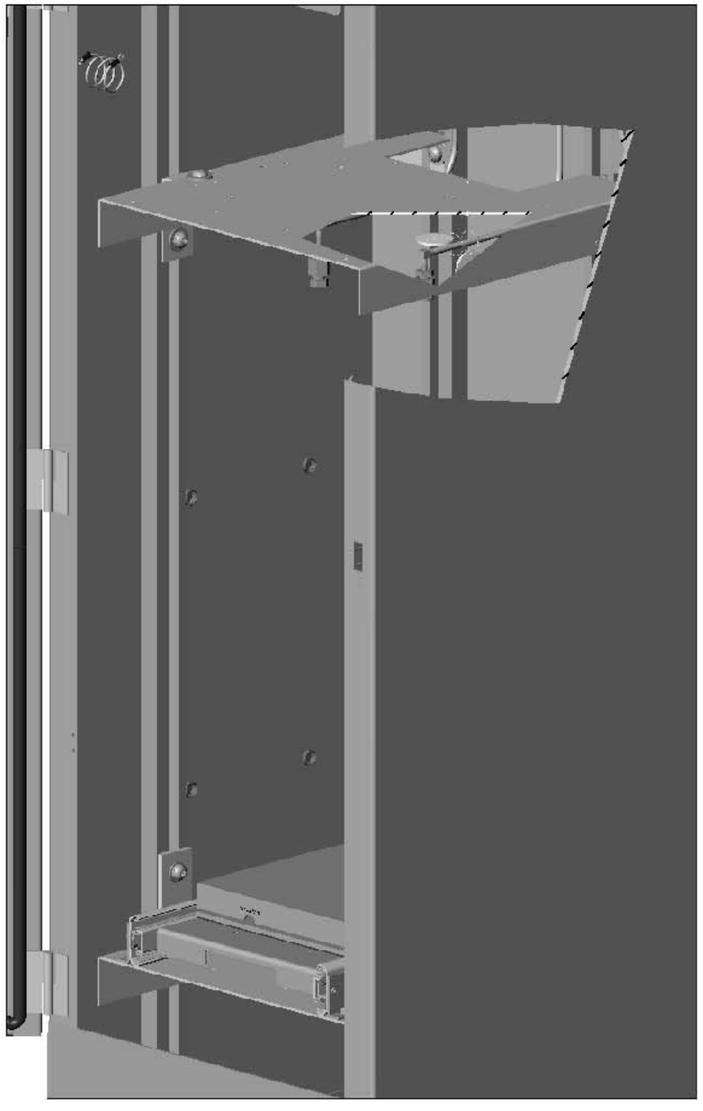
½” FVCR	¼” FVCR	**L2**

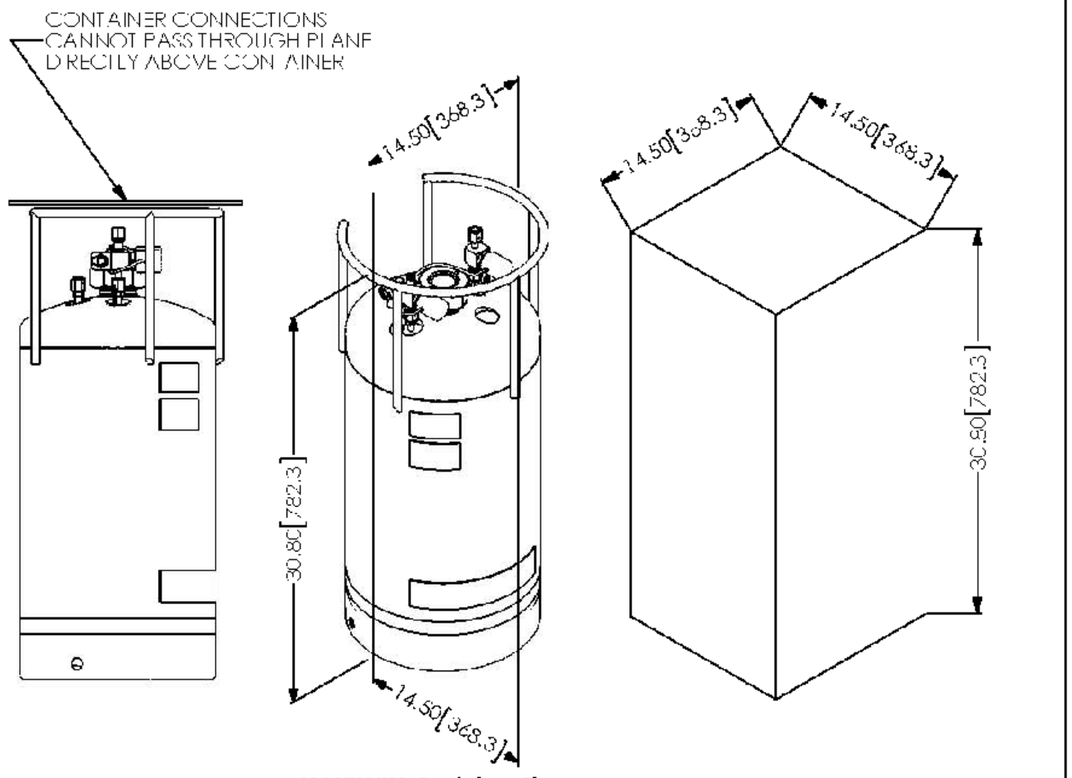
ChemGuard Cabinet CG110-410 Models:

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.





MAXIMUM Container Size

	0		WJS	TVD	XXX	XXX	
ECR # / ECN#	REV.	DESCRIPTION	DATE	DRWN	CHKD	APPRD	MATRF

UNLESS OTHERWISE SPECIFIED:

APPROVALS	DATE
DRAWN W. J. Sheehy	01/19/2015
CHECKED T.V. Duross	01/21/2015
ENG APPR.	
MFG APPR.	
APPROVED K.K. Kirton	00/00/0000

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TITLE: Encl_CG Bulk Container Fit Up

DWG. NO. SW0 4564.slddrw | SIZE B | REV 0

SCALE: 1:10 | WT. | SHEET 1 OF 2

Figure – 2: Reference CG110-410 Cabinet with allowable Bulk Container Dimensions.

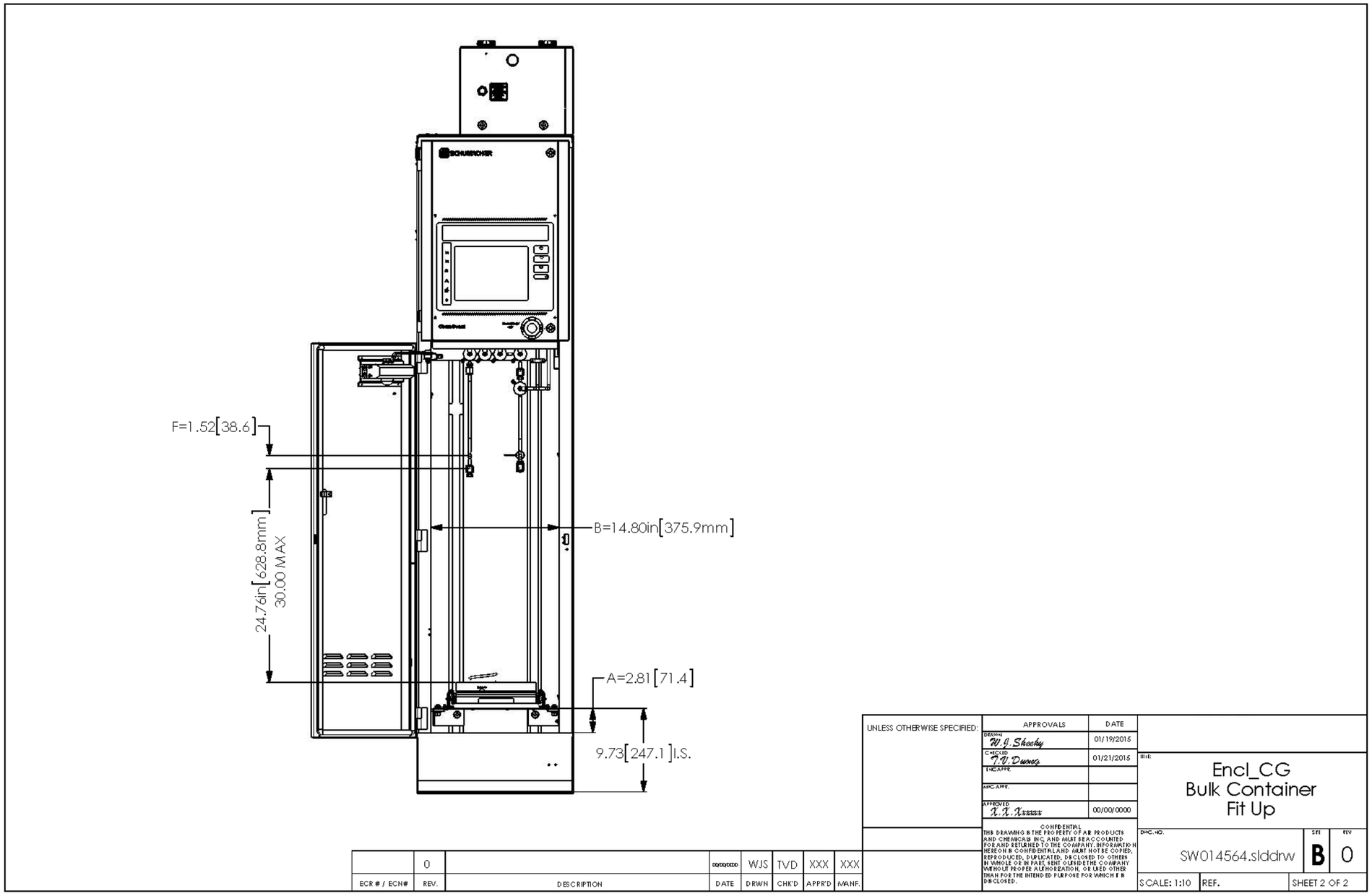


Figure – 3: Reference VERSUM MATERIALS, INC. 19 Liter Bulk Container.

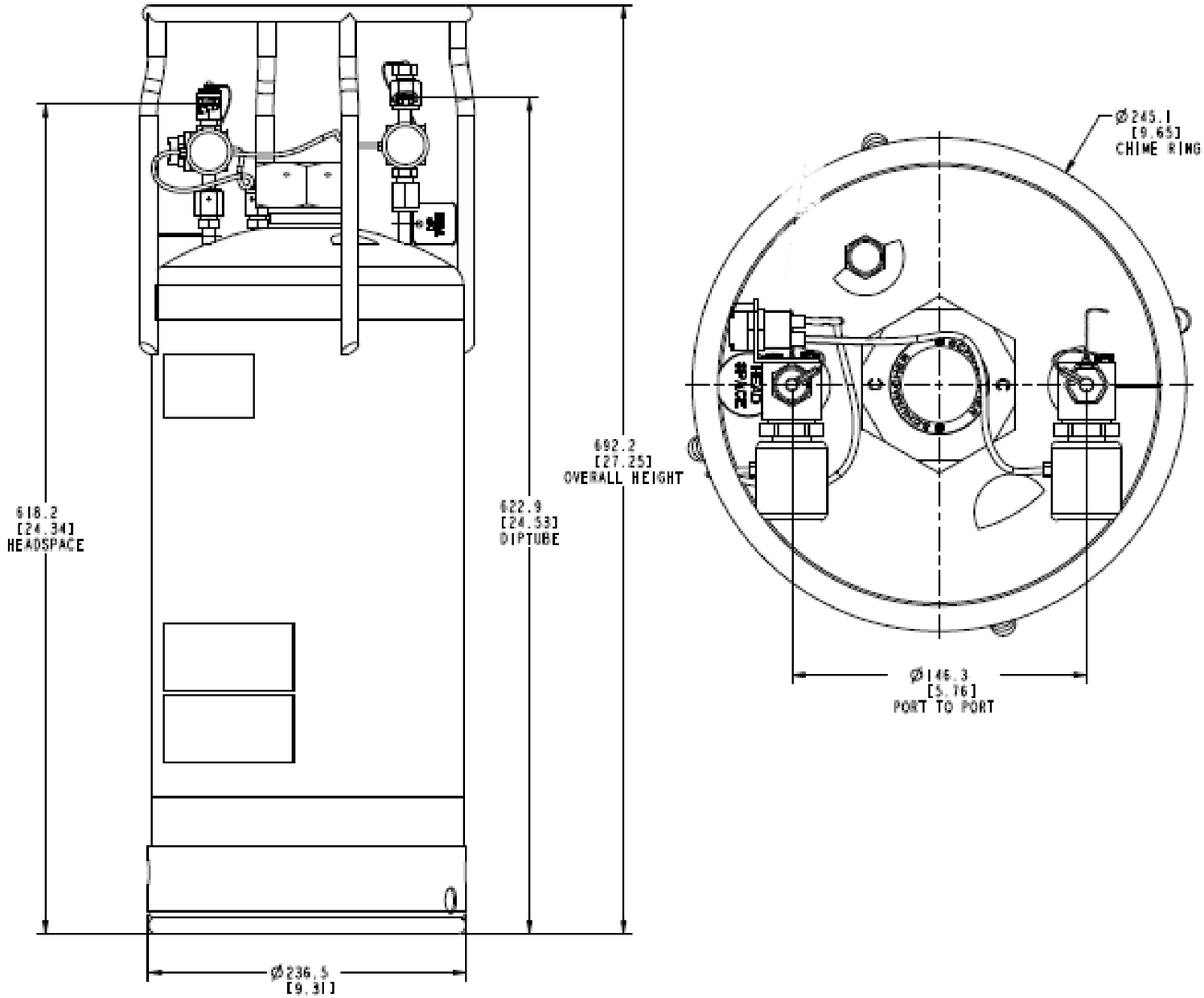
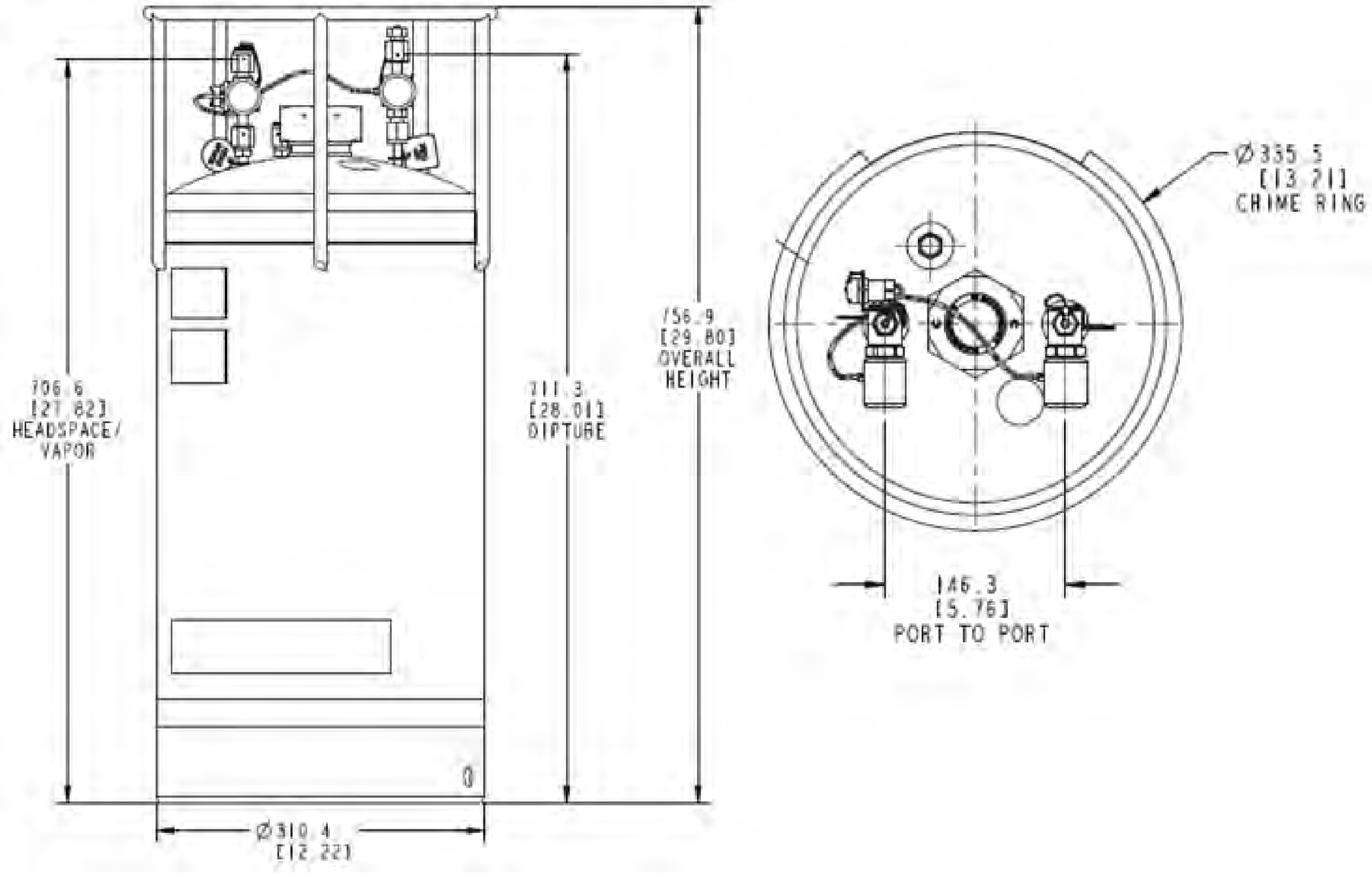


Figure – 4: Reference VERSUM MATERIALS, INC. 38 Liter Bulk Container.



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_20) 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_20) 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_2 (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 for Product Description, Specifications, Data Sheets, and FAQs.

2.2 See attached Fire Sentry SS4-A/-A2 Operating Manual.

END