



Installation / Operation / Maintenance Manual

CHEMGUARD GenIII 050

Chemical Equipment

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Edition: Rev-0

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Revision Control Summary

Chapter	Revision	File Name
Chapter 1 – Delivery and Inspection		
• Initial Release.	Rev-0	MNL000622.doc
Chapter 2 – Site Preparation		
• Initial Release.	Rev-0	MNL000623.doc
Chapter 3 – Installation		
• Initial Release.	Rev-0	MNL000624.doc
Chapter 4 – 38 Liter Bubbler Installation		
• Initial Release.	Rev-0	MNL000625.doc
Chapter 5 – Features and Components		
• Initial Release.	Rev-0	MNL000626.doc
Chapter 6 – System Operation		
• Initial Release.	Rev-0	MNL000627.doc
Chapter 7 – Maintenance and Calibration Procedure		
• Initial Release.	Rev-0	MNL000628.doc
Addendum A – LPE 14 Liter Bubbler Change Procedure		
• Initial Release.	Rev-0	MNL000629.doc
Addendum B – Gas Filter Setup		
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Appendix F – Gas Sensor Instruction		
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Chapter 1

Delivery and Inspection

Section 1	Delivery
Section 2	Inspection

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 bubbler chemical 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 bubbler chemical 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

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

Chapter 2: Site Preparation

This chapter describes the space and clearances required to install ChemGuard® CG050 systems along with specifications for power, gas, vacuum, cabinet exhaust, reservoir vent and chemical delivery line.

Before the ChemGuard® CG050 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® CG050 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® CG050 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)

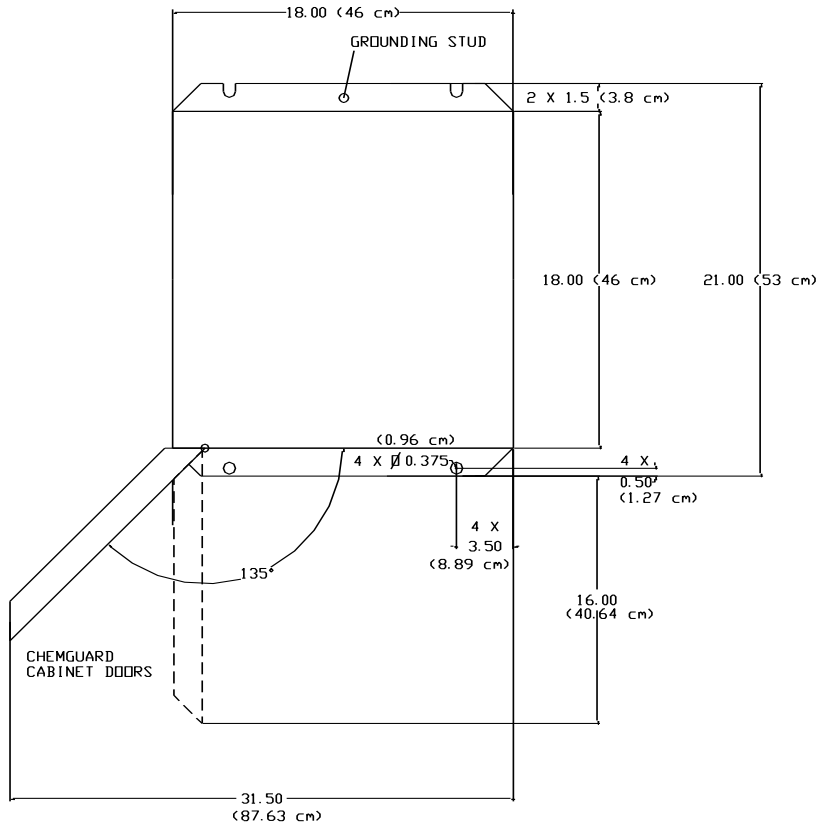
2.1.1 Bolt-Down and Ground Cabinet Requirements

Set the ChemGuard® CG050 cabinet over the bolt-down points and attach securely. Verify ChemGuard® CG050 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® CG050 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
- Venturi Vacuum Supply
- Exhaust and Vent
- Chemical Delivery Line
- Bulk Chemical Refill Line (from BCD200, CG010 or CG310)
- Chemical Outlet

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Revision 0

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Chemical Equipment

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Figure 2-2:

CG050 GEN III Cabinet Connections, Top View

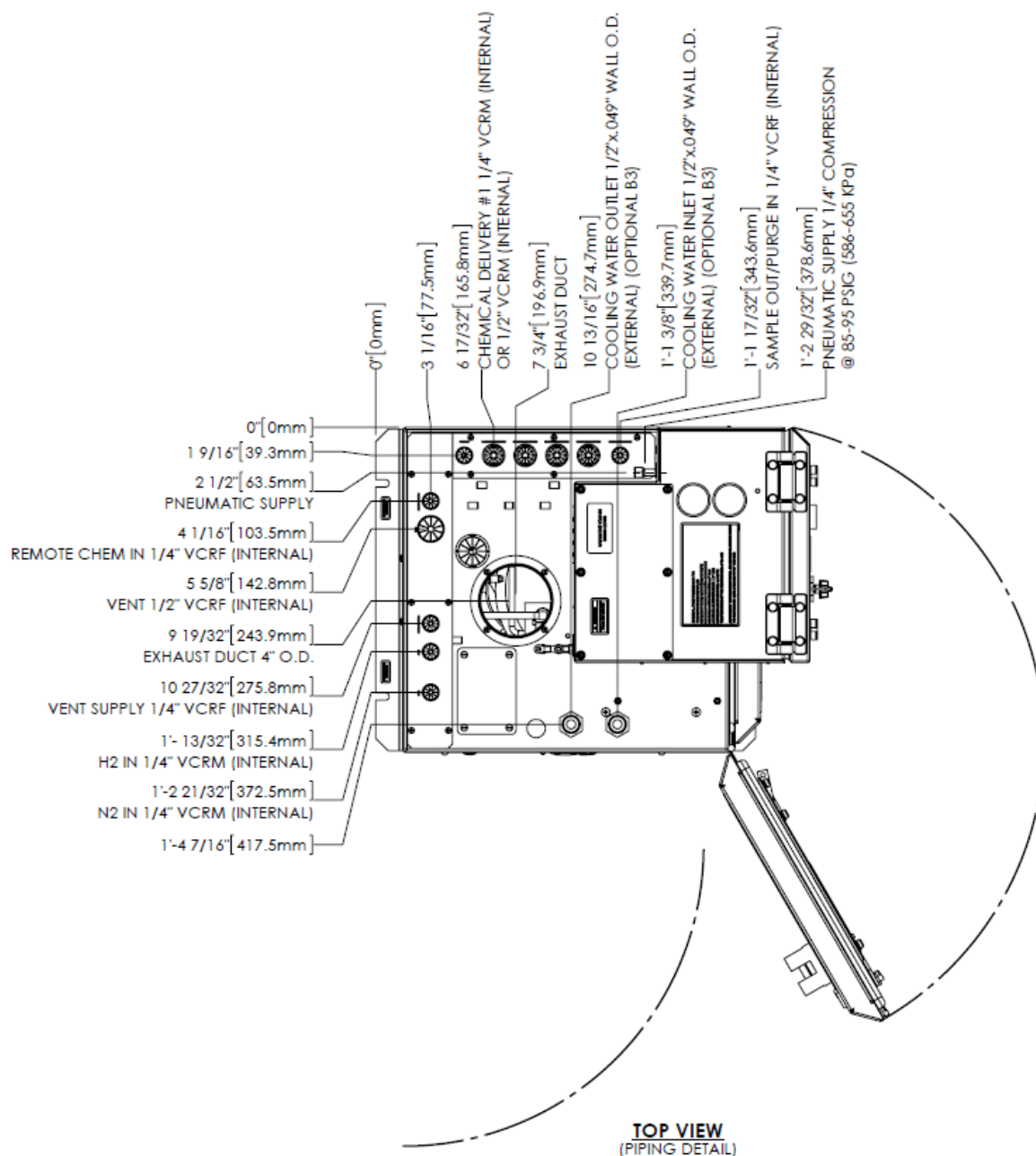


Figure 2-3:

CG050 GEN III Cabinet Connections, Right Side View

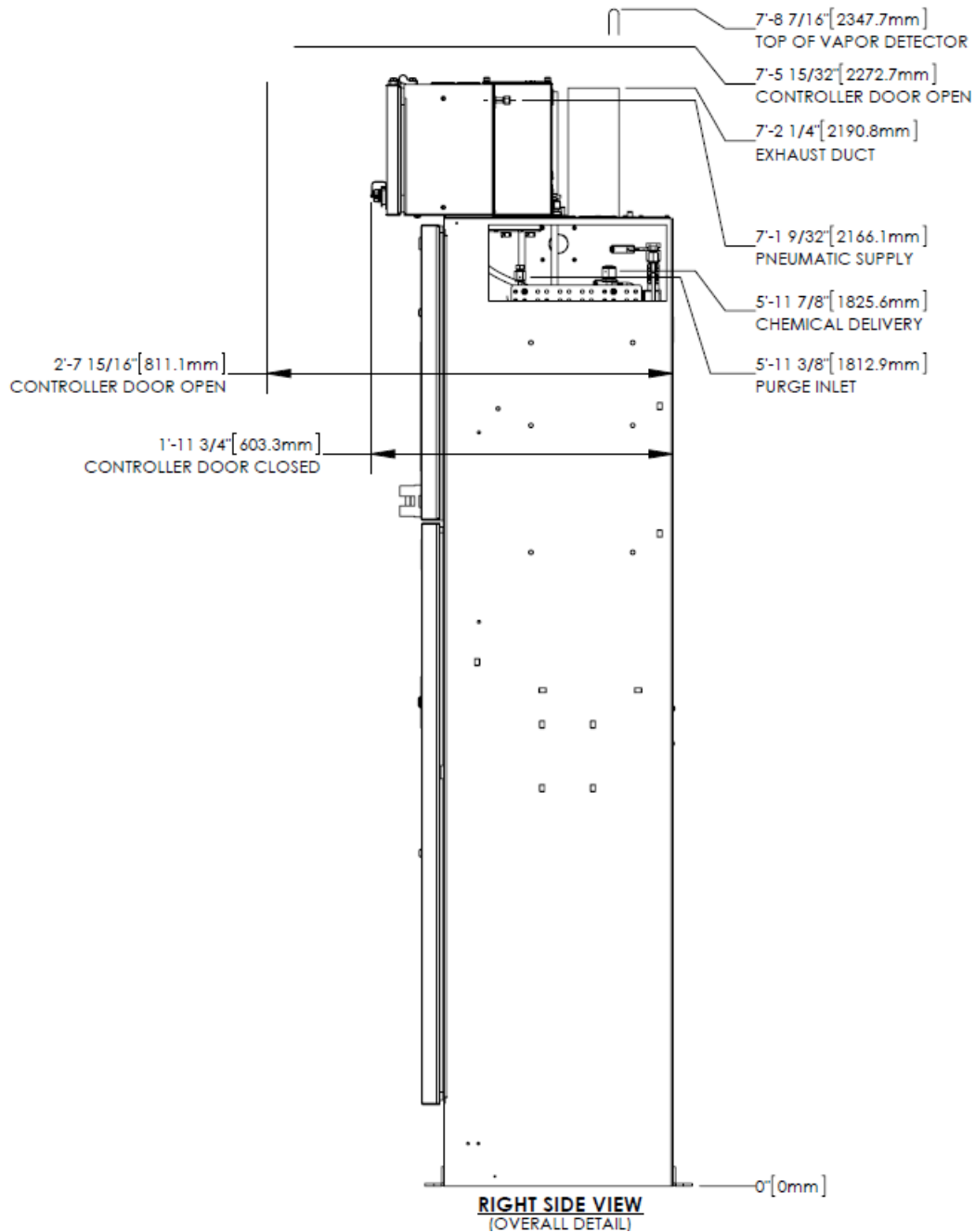
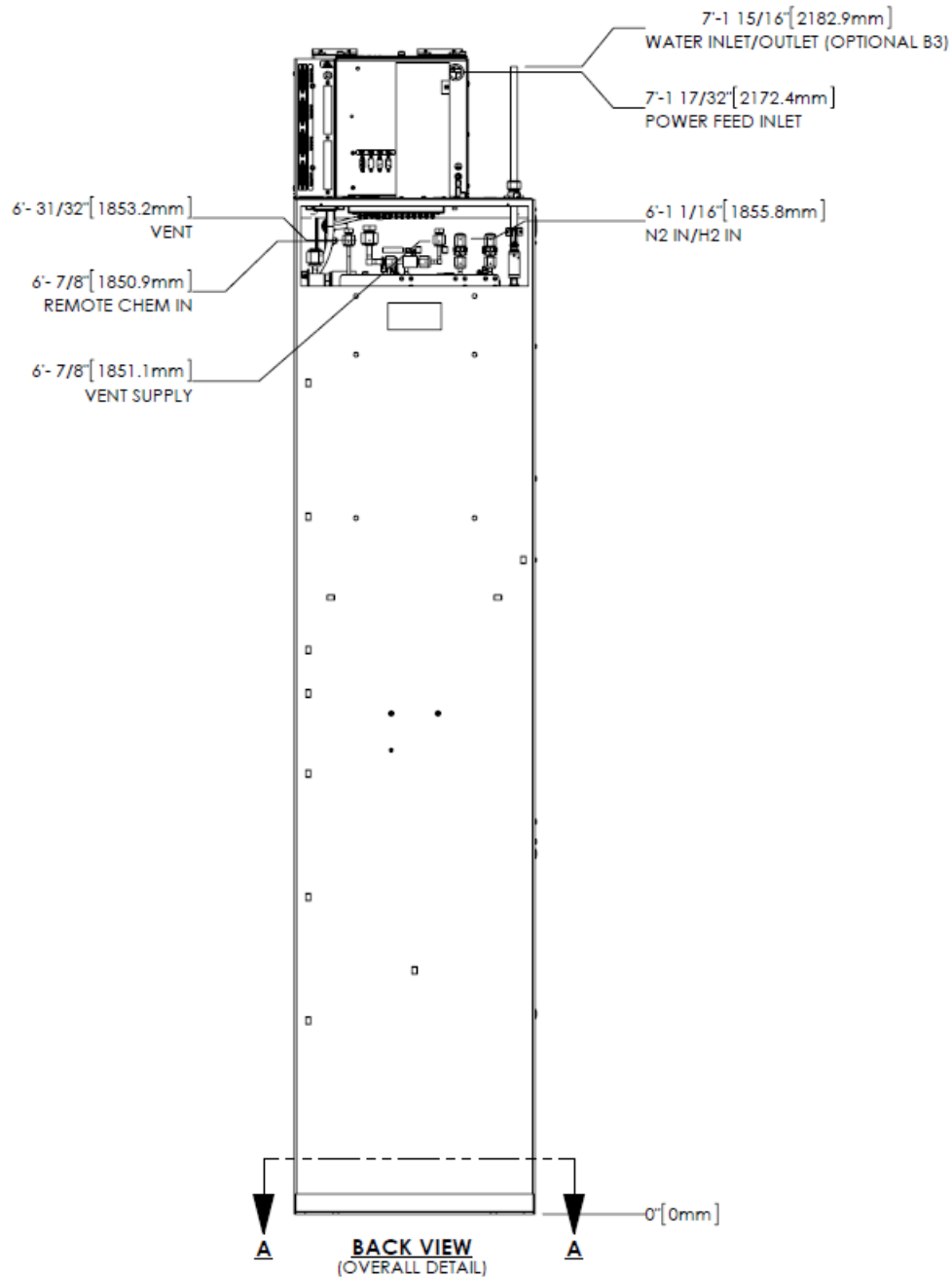


Figure 2-4:

CG050 GEN III Cabinet Connections, Back View



2.2.1 Environmental Requirements

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

Table 2-2: Environmental Requirements

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

2.2.2 Electrical Requirements

Versum Materials, Inc. recommends connection to an Uninterrupted Power Supply (UPS) and a Ground-Fault circuit Interrupter (GFCI). Versum Materials, Inc. recommends that customer electrically ground the ChemGuard® CG050 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® CG050 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® CG050 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® CG050 installation site. (see Chapter 3 for further details).

Ensure there are shutoff valves and filters for gas lines feeding the ChemGuard® CG050. 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® CG050, i.e. incoming gas supplies and chemical delivery line layouts with adequate line size, vertical rise, horizontal length between the ChemGuard® CG050 and the process tool(s).

To avoid potential process failures here are some guidelines the end users should consider when facilitate ChemGuard® CG050 cabinets at central location.

- ChemGuard® CG050 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® CG050 cabinets should be properly sized to provide adequate pressure and flow before branching out to multiple ChemGuard® CG050 cabinet connection points.
- After the main gas supply has been branched off to the individual ChemGuard® CG050 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® CG050 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 5×10^{-9} atm cc/sec (3.8×10^{-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

H2 IN: Process Supply Gas	<p>Hydrogen gas is Ultra High Pure semiconductor-grade recommended. Water content < 10 ppb and O2 content < 2ppm.</p> <p>Recommended to use Inert Gas Purifier model # SS2500KF14RR or equivalent.</p> <p>Required to install a 0.003 micron gas filter.</p> <p>Regulated to 620 ± 70 kPa (90 ± 10 psig, 105 psiA)</p> <p>Cabinet 6.35 mm (¼ in.) male VCR connection</p> <p>Connects to H2 IN port (See Figure 2-2)</p> <p>For moisture sensitive chemicals, gas requirements are as follows:</p> <p>Recommended the Water content < 10 ppb and O2 content < 2ppm.</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p> <p>WARNING: DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.</p>
N2 IN: Process Purge Supply Gas	<p>Nitrogen gas is Ultra High Pure semiconductor-grade recommended. Water content < 10 ppb and O2 content < 2ppm.</p> <p>Recommended to use Inert Gas Purifier model # SS2500KF14RR or equivalent.</p> <p>Required to install a 0.003 micron gas filter.</p> <p>Install regulator at N2 IN supply port and regulate to 620 ± 70 kPa (90 ± 10 psig, 105 psiA)</p> <p>Cabinet 6.35 mm (¼ in.) male VCR connection</p> <p>Connects to N2 IN port (See Figure 2-2)</p> <p>For moisture sensitive chemicals, gas requirements are as follows:</p> <p>Recommended the Water content < 10 ppb and O2 content < 2ppm.</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p> <p>WARNING: DO NOT connect high pressure gas cylinder directly to the cabinet process/purge gas ports.</p>
80 PSI 60 SLPM: Venturi Vacuum Supply Gas	<p>Recommended teeing off the N2 Process Purge Gas Supply, see specifications above</p> <p>Install regulator at 80 PSI 60 SLPM supply port and regulate to 551 kPa (80 psig, 95 psiA) at 60 liters per minute</p> <p>Cabinet 6.35 mm (¼ in.) female VCR connection</p> <p>Connect to 80 PSI 60 SLPM port (See Figure 2-2)</p> <p>NOTE: N₂ @ 551 kPa results in 100 Torr vacuum with a, minimum 9.4 mm</p>

	<p>(3/8 in.) vent line</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p>
<p>SAMPLE OUT/PURGE IN:</p> <p>Purge Gas for Outlet Manifold</p>	<p>Recommended teeing off the N2 Process Purge Gas Supply, see specifications above</p> <p>Install regulator at SAMPLE OUT/PURGE IN port and regulate to 140-275 kPa (20-40 psig)</p> <p>Cabinet 6.35 mm (1/4 in.) female VCR connection</p> <p>Connects to SAMPLE OUT/PURGE IN port (See Figure 2-2)</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p> <p>NOTE: The Output Manifold allows the cabinet to feed the gas mixture to the process tool as well as a sample/purge IN port simultaneously. Manual sample/purge port is also available. The house line can be plumb and ready to use by opening either of the manual valves</p>
<p>PNEUMATIC SUPPLY</p>	<p>Nitrogen gas is semiconductor-grade or better is recommended.</p> <p>Regulated to 620 ± 70 kPa (90 ± 10 psig)</p> <p>Cabinet 6.35 mm (1/4 in.) Swagelok connection</p> <p>Connects to PNEUMATIC port, coarse filter recommended (See Figure 3-2)</p> <p>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.</p> <p>The customer is required to supply all gases with shut-off valves, regulators, check-valves, filters and/or gas purifier in-line feeding the ChemGuard. Ensure the required gases are available in close proximity to the ChemGuard installation site.</p>

2.2.5 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.

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



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

WARNUNG: Die Abgase 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 utilisé.

Table 2-6: 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
VENT: Venturi Vacuum Exhaust	Connect to the appropriate abatement system for chemical used Cabinet 12.70 mm (½ in.) female VCR connection Connects to VENT port (See Figure 2-2) 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

2.2.6 Chemical Vapor 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® CG050 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® CG050 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 2-7: Chemical Delivery Line Requirements

CHEMICAL DELIVERY #1: Vapor Flow out to Tool	6.35 mm (¼ in.) male VCR connection 316L stainless steel, electro-polished line. Connects to Chem Delivery #1 port (See Figure 2-2) 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 <ul style="list-style-type: none"> • 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.

2.2.7 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.

2.2.8 Chemical Bulk Refill Line (from BCD200, CG010 or CG310)

The chemical refill line is an additional line, routed on top of the ChemGuard® CG050. It allows the BULK reservoir container to be filled from an external source (i.e., ChemGuard® BCD200, CG010 or CG310 cabinet).

Table 2-8: Chemical Bulk Refill Line Requirements

REMOTE CHEM IN: Chemical Bulk Refill Line from the BCD200, CG010 or CG310	6.35 mm (¼ in.) female VCR connection 316L stainless steel, electro-polished line Connects to REMOTE CHEM IN port (See Figure 2-2) 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.
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2.2.9 Sample/Purge Output Manifold

The Output Manifold allows the cabinet to feed the gas mixture to the process tool as well as a sample/purge port simultaneously. Manual sample/purge port is also available. The house line can be plumb and ready to use by opening either of the manual valves.

2.2.10 Coolant Supply/Return (optional)

The ChemGuard® CG050 is configured with a standard coolant supply and return lines with overpressure protection, shutoff, and drain capability built into the cabinet. The temperature of the bubbler is typically maintained at 18° C.

Table 2-9: Coolant Supply/Return Requirements

COOLANT SUPPLY / RETURN	Cabinet 12.70 mm (1/2 in.) Female NPT connection (See Figure 2-2) Flow: 7.6 liters per minute (2 US gpm) Pressure: Up to 2.75 barg (40 psig)
--	--

2.3 Tag and Lockout Routine

When performing certain maintenance procedures described in this manual, electrical power to the ChemGuard® CG050 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® CG050 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 your chemical provider 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.

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® CG050 GEN III.

Chapter 3

Installation

Section 1	Introduction
Section 2	Reference Documents
Section 3	Installation
Section 4	Installing the ChemGuard® CG050 Cabinet
Section 5	Connecting ChemGuard® Gas Lines
Section 6	Chemical Delivery Line Requirements
Section 7	Installing ChemGuard® Bulk Scale
Section 8	Communications
Section 9	Start-Up and Initialization
Section 10	System Configuration
Section 11	Manual Mode
Section 12	Regulator Adjustment
Section 13	Finishing the ChemGuard® Installation

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

3.1 Introduction

This chapter describes the installation of ChemGuard® CG050 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® CG050 comes pre-calibrated and cabinet-tested. The ChemGuard® Bulk Scale, dual float spill detector, combustible vapor detector (option) and UVIR (option) are setup prior to leaving the factory. These items should not require calibration during installation. Please contact Versum Materials, Inc. if any of these components do not function properly.

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

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

3.2 Reference Documents

For Installation and P&ID system drawings, facilities inspection, pre-startup and commissioning procedure and check-off/sign-off lists refer to;

- SW017054_Installation Drawing
- DOC000191 for the ChemGuard® CG050 GEN III P&ID Drawings
- V-TSA060_ChemGuard® Chemical Fill Matrix

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® CG050 GEN III cabinet uses venturi vacuum as the vacuum source so no vacuum pump is required. The vapor pressure of the chemical used in the ChemGuard® CG050 GEN III cabinet is high enough

for the venturi vacuum to completely remove all chemical vapors from the lines during maintenance operations.

- 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 line, 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 ChemGuard® CG050 GEN III cabinet is used in an epitaxial process. Hydrogen gas is “bubbled” thru an onboard container typically containing Trichlorosilane, (TCS) and vapor is then delivered to a Process Tool. This application is limited to one ChemGuard® per tool or chamber.

3.4 Installing the ChemGuard® CG050 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 Figure 2-1 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.

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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: Electrical connections should be made by a qualified electrician. AC power junction box requires Lock-out Tag-out ON/OFF capability. 1/2" AC power conduit hole exits top of cabinet.

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

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



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

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

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



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

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

AVERTISSEMENT: Pour éviter tout 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: 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.

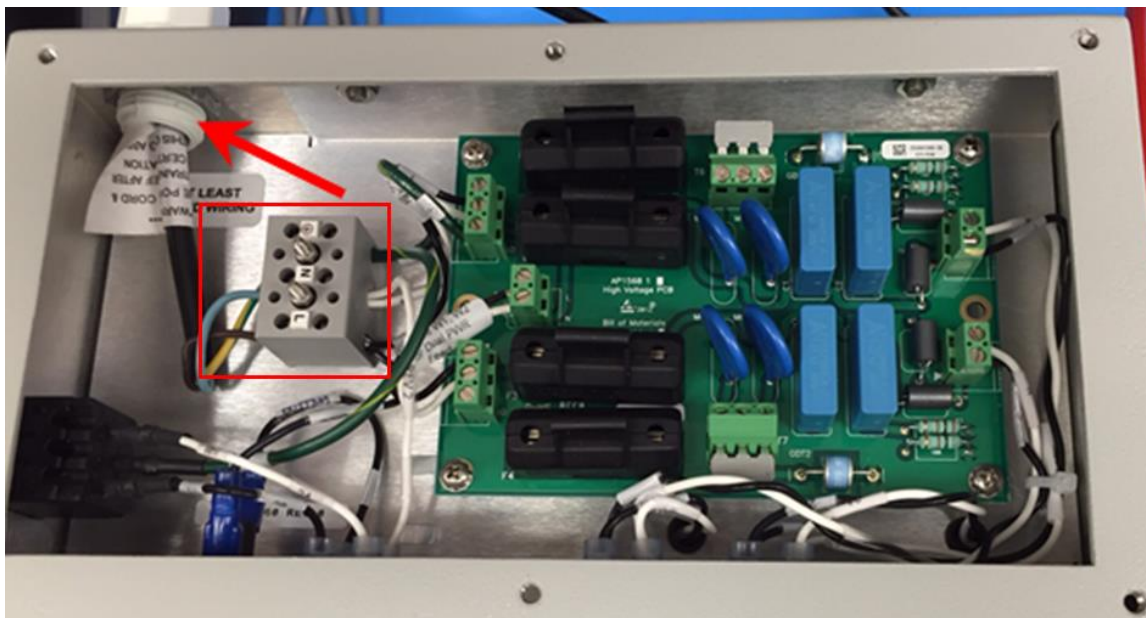
Figure 3-1: Rear view of conduit power entrance



WARNING
WARNING: ELECTRICAL HAZARD

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

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



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

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

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

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

NOTE: For Systems approved for installation and use in Explosive Atmospheres (Europe), refer to section 4.7 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.

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 USP Port Blocker

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

When loading new software files onto the ChemGuard® a USB thumb drive is required to do so. A USB port is located on the face of the controller. The USB port allows a USB connection to be made without having to open the controller door. Electrical devices should never be operated, connected to, or disconnected from the USB port unless the area surrounding the equipment is known to be free of flammable material. The USB port on the face of the controller will also have a warning label, Figure 3-3 for operation in a flammable area.

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

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

Figure 3-3: Electrical Warning Label



Figure 3-4: Lindy USB Port Blocker and Key



3.5 Connecting ChemGuard® Gas Lines

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

Ensure there are shutoff valves and filters for gas lines feeding the ChemGuard® cabinet. See Figure 2-2 for ChemGuard® cabinet connections.



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).

3.6 Chemical Delivery Line Requirements

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

3.6.1 Chemical Vapor Delivery Line

The Output Manifold allows the ChemGuard® cabinet to deliver the process vapor and gas mixture to the process tool through pneumatic valve V11.

NOTE: Only with the 38L Bubbler option can CHEM ON operate simultaneously while in Refill enable (from the BCD200, CG010 or CG310 cabinet).

Table 3-1: Chemical Vapor Delivery Line Connection

VAPOR DELIVERY LINE	CONNECTS TO VALVE	VALVE CONTROL
Chemical Delivery #1	Valve V11	Electrically controlled by Process Tool. Table 3-4/5

3.6.2 Sample/Purge Port

The Output Manifold allows the cabinet to feed the gas mixture to the process tool as well as a sample/purge port simultaneously. Manual sample/purge port is also available. The house line can be plumb and ready to use by opening either of the

manual valves.

Table 3-2: Sample Out/Purge In on Chemical Delivery Line

NOTE: This valve is normally closed during normal vapor flow of chemical to the Tool.

SAMPLE OUT/PURGE IN	CONNECTS TO VALVE	VALVE CONTROL
Sample Purge Port	MV10	Manually operate.

3.6.3 Remote Chem IN Line (from BCD200, CG010 or CG310)

The Remote Chem IN line is the bubbler refill line, routed on top of the ChemGuard® CG050. It allows the bubbler to be filled from an external source (i.e., ChemGuard® BCD200, CG010 or CG310 cabinet).

NOTE: The Primary valve to operate External Fill is V8.

3.6.4 Exhaust and Vent Requirements

For Exhaust and Vent installation requirements refer to chapter 2.

3.6.5 Connecting ChemGuard® Exhaust

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

3.6.6 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® 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.

3.6.7 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® cabinet was evaluated and the 1) Controller, 2) VGA LED display panel 3) CG IO Interface Module was identified as the only components

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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.

3.6.8 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 " H₂O) 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 3-4: Controller Z-Purge Pressure Switch

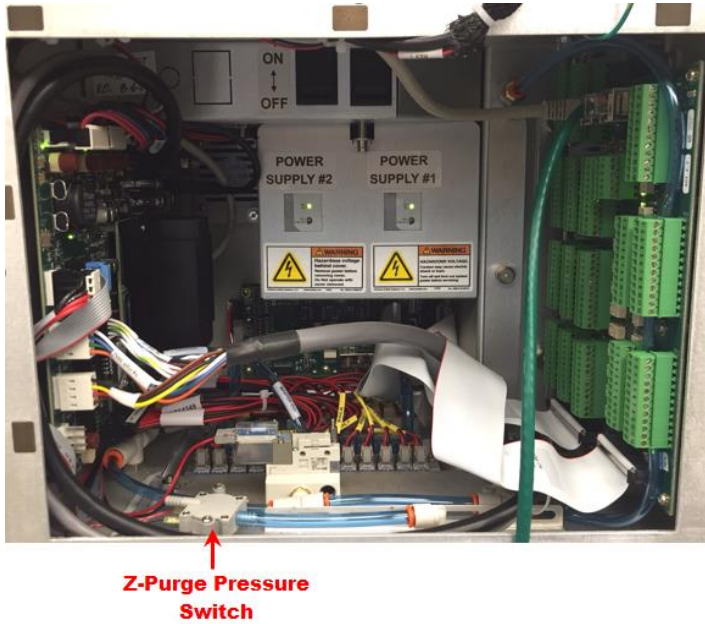
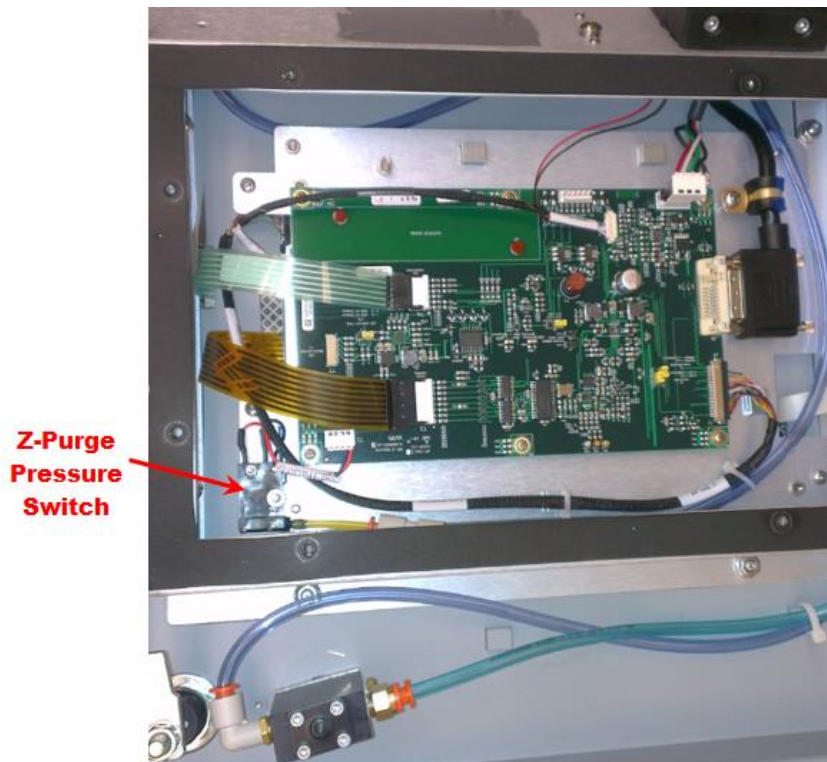


Figure 3-5: Display Panel Z-Purge Pressure Switch



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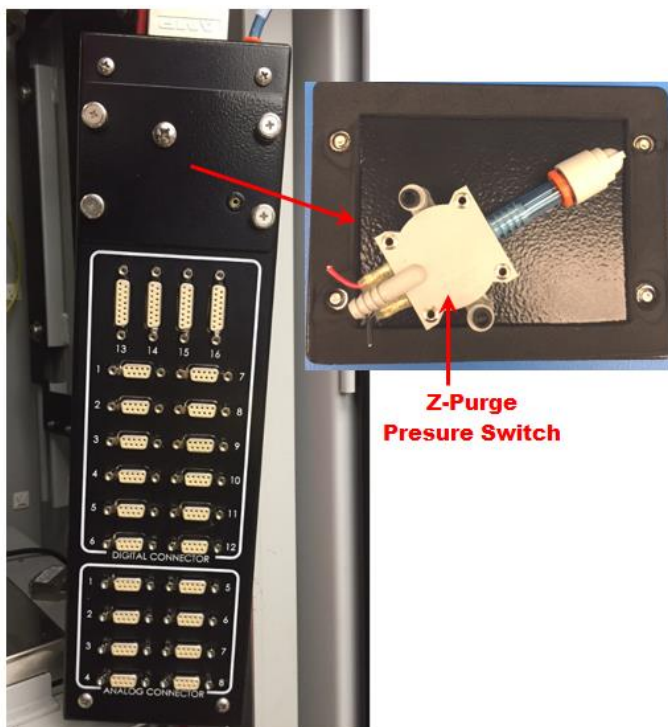
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3.6.9 Figure 3-6: Interface Module Z-Purge Pressure Switch



3.7 Installing ChemGuard® Bulk Scale

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

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

3.7.1 Bulk Scale Installation

Carefully remove the bulk 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 beschädigt werden kann.

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

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. 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.
4. Set scale top plate onto scale. There is no bolt down for this..
5. Perform scale calibration per chapter 7.

3.8 Communications

3.8.1 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 Table 3-2 for connector and signal identification.). Refer to Chapter 2 for general cable specification.

For all field terminations on the DB25 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.

3.8.2 Connecting Digital Inputs

Table 3-3: Life Safety Shutdown Input

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

Table 3-4: 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
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Table 3-5: 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

Table 3-6: Tool Input – Chem On

Digital Input #	Input Label	AP1614		DB25 Bulkhead Connector
		TB1-TB4	CONFIGURATION	
37	Process Tool – (V11) Chemical Vapor Flow enable	TB1; 1&2	Dry Contact	J1; 20&22

NOTE: Input 37 must be closed in order to enable Process Tool, Chemical Vapor Flow enable. If input not present “Waiting On Tool Signal” prompt will be generated and prevent Process Flow

Table 3-7: External Refill

Digital Input #	Input Label	AP1614	
		TB1	CONFIGURATION
38	XFILL ON – from BCD200, CG010 or CG310 Input must be closed to enable/start XFILL operation to refill Bubbler or a “WAITING ON X_FILL SIGNAL” prompt will be displayed	TB1; 3&4	Dry Contact

3.8.3 Connecting Digital Outputs Outputs; max. 1A @ 24vdc

Table 3-8: Life Safety Outputs

Digital Output #	Output Label	AP1614	
		TB15	CONFIGURATION
9	Exhaust	1	N/O
		2	Common
		3	N/C
10	Cabinet Spill – Dual Floats	4	N/O
		5	Common
		6	N/C
11	FIRE • Heat ROR • UVIR (option)	7	N/O
		8	Common
		9	N/C
12	Door Open	10	N/O
		11	Common
		12	N/C

Life Safety Outputs - continue

Digital Output #	Output Label	AP1614	
		TB13	CONFIGURATION
16	Vapor Detect	10	N/O
		11	Common
		12	N/C

Table 3-9: Output Valve Acknowledgement

Digital Output #	Output Label	AP1614	
		TB14	CONFIGURATION
21	V11 Chem On	1	N/O
		2	Common
		3	N/C

Table 3-10: Bulk Refill Request Output

Digital Output #	Output Label	AP1614	
		TB16	CONFIGURATION
18	XFill Request	4	N/O
		5	Common
		6	N/C

Table 3-11: Alarm Outputs

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

Table 3-12: 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 3-7: Tool IO Board (AP1614)

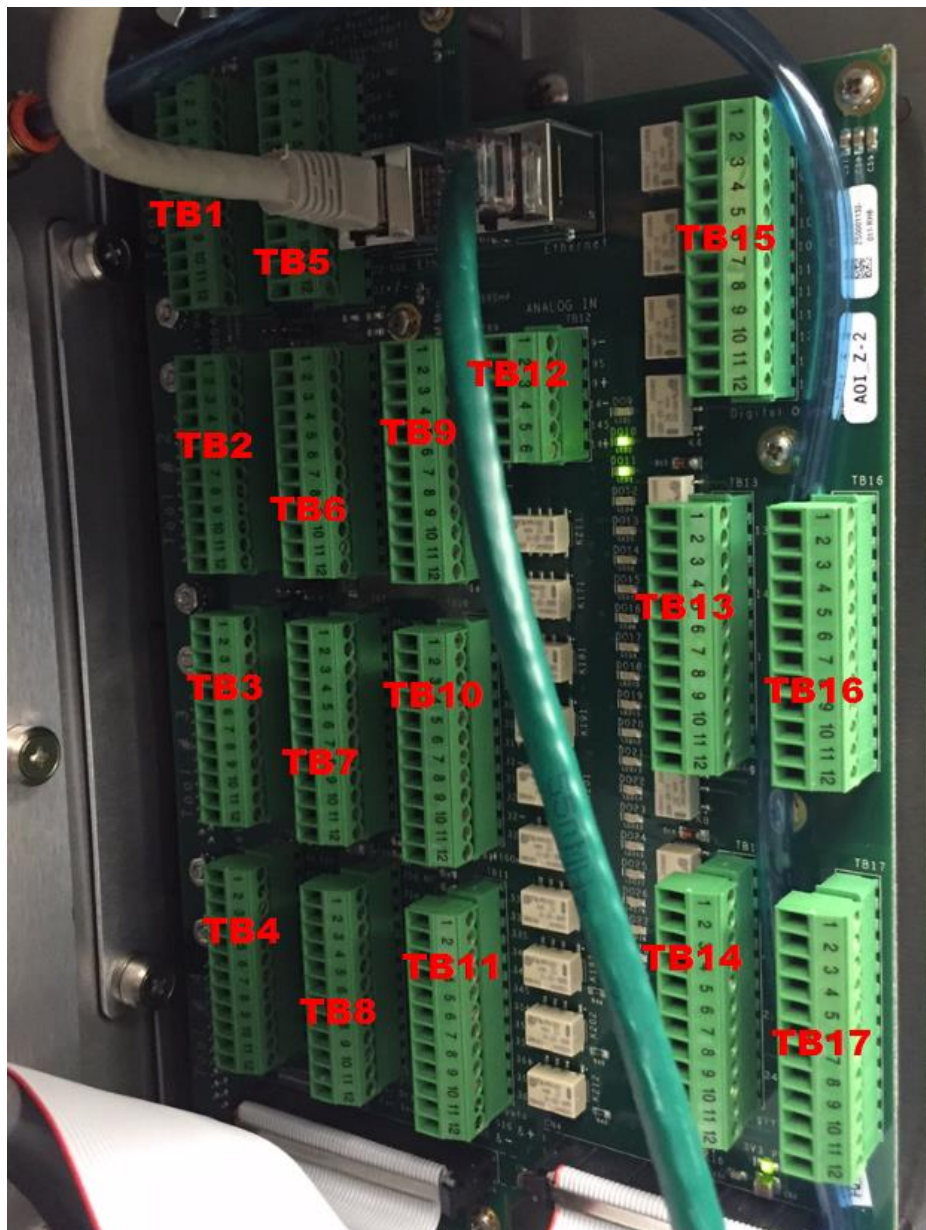


Figure 3-8: Tool 1- 4 DB25 Connectors

3.9 Start-up and Initialization

3.9.1 Turing On System Power

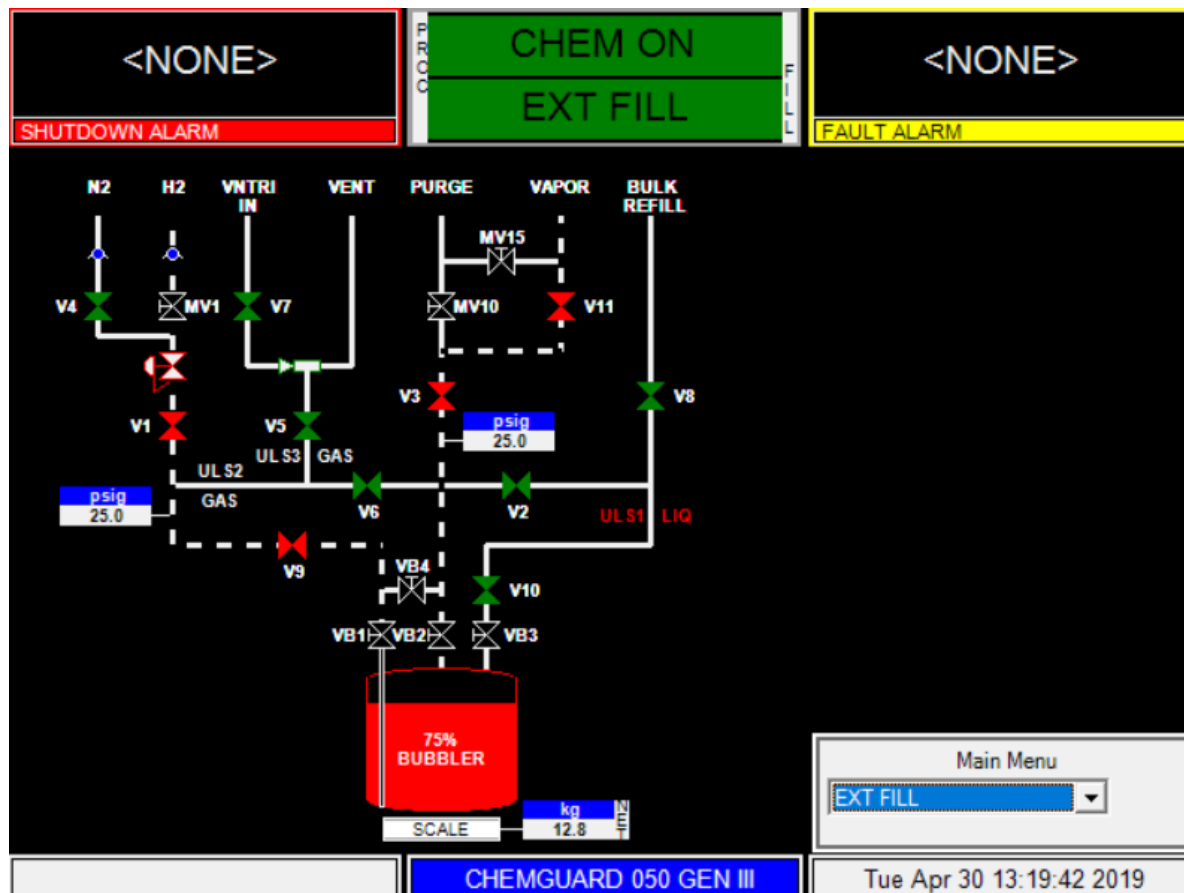
1. Apply AC power to the Controller.
2. Place power switch, (1) for single power supply or (2) for dual power supply located above power supplies inside controller to the ON position. Verify power LED lit, Refer to Figure 3-4.
3. Verify power is on to the CG. The CG Display will light and go to boot-up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

3.9.2 ChemGuard® Display

The ChemGuard® 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 3-10.

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

Figure 3-10: ChemGuard® CG050 Controller VGA Display Screen



3.9.3 System Status LEDs

System Status LEDs displaying ChemGuard® alarm conditions, CHEM ON and ARS standby control signal are located to the right of the VGA display. The table below describes these LEDs and their functions.

Table 3-13: 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.
CHEM ON	This LED lights green when Chem On is enabled and tool inputs are satisfied.
ARS – Auto-Restart	This blue LED lit and in steady state indicates Auto-Restart option enabled and monitoring system status. LED flashing blue indicates Auto-Restart was activated.
POWER	This LED indicates that there is +5 VDC power to the unit.

3.9.4 Password Log-in

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

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

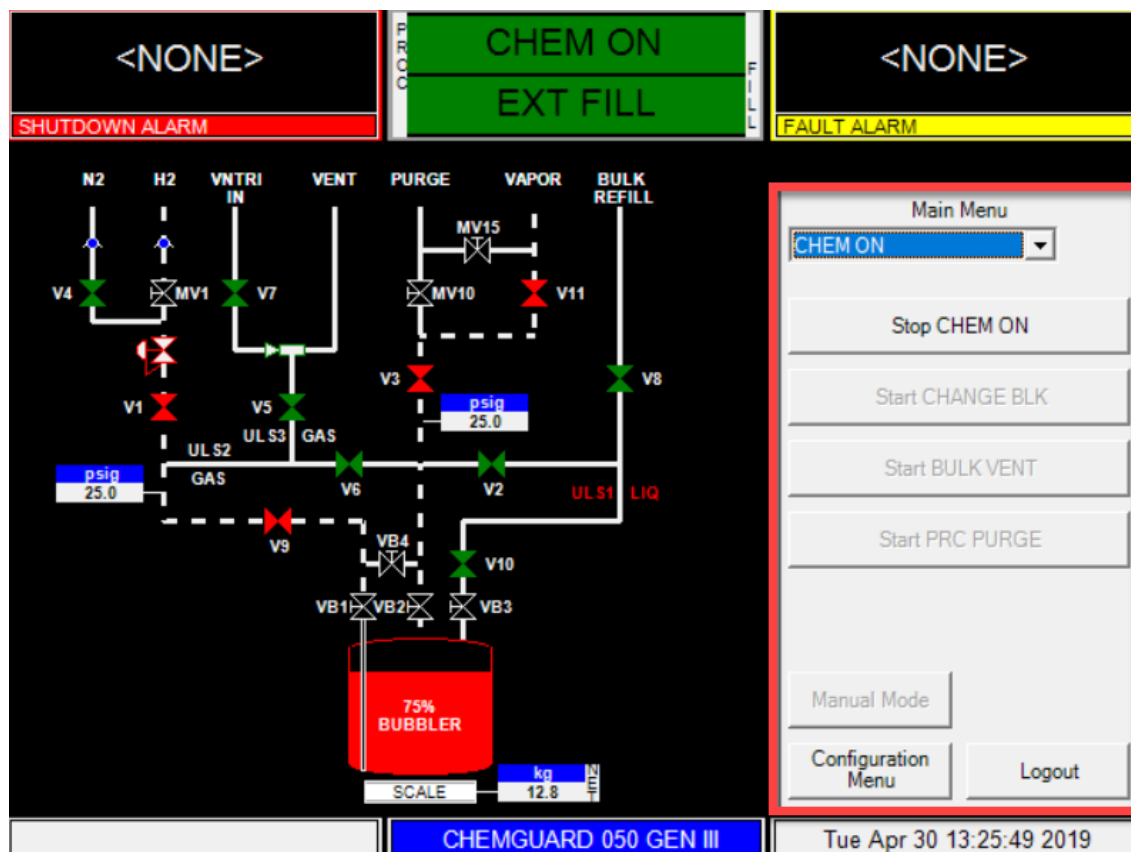
From the Main Menu, enter Config Menu ->

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

3.9.5 Main Menu and Configuration Selection Window

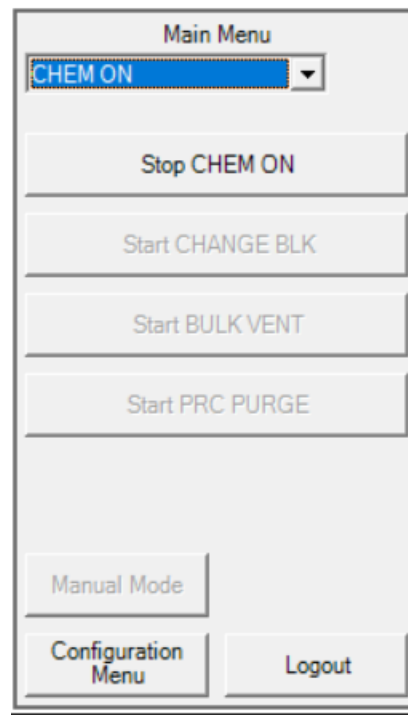
Once a password is successfully entered, the selection window will display on the right side of the screen to show prompts and menu selections. It will remain displayed for a configurable amount of time or until the “LOGOUT” key is pressed.

Figure 3-11: Main Menu Display Screen

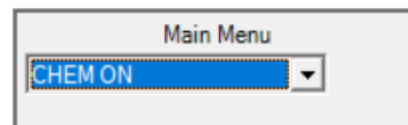


3.9.6 Controller Main Menu

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.



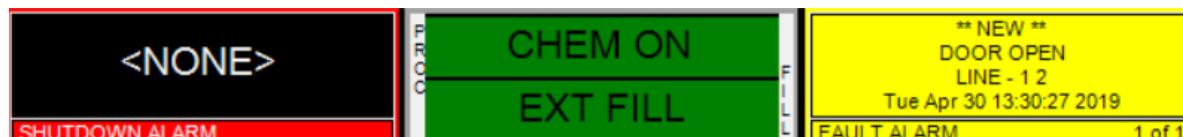
3.9.7 Alarm and Controller Status Boxes

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

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

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

Figure 3-12: Alarm and Controller Status Box



3.9.8 Screen Saver

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

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

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

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

3.10 System Configuration

3.10.1 User Setpoints – Bulk Scale (Analog)

Configuring Bulk analog scale External Fill & alarm setpoints

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

Table 3-14: User Setpoints > Bulk Scale

Num	Alarm Label	Percent
1	BULK RES OVERFULL	85%
2	BULK RES LOW	15%
3	BULK RES EMPTY	10%
4	BUBLR STOP LEVEL	70%
5	BUBLR START LEVEL	68%

3.10.2 User Setpoints – PT1 and PT2

Configuring Bulk Push PT1 and PT2 “Pressure Alarm” setpoints

From the Main Menu, enter Config Menu -> User Setpoints -> PT1. Note, values shown are recommended.

Table 3-15: User Setpoints > PT1

Num	Alarm Label	Setpoint
1	LOW PUSH PRESSURE	22
2	HI PUSH PRES PRESSURE	45
3	LOW PUSH PRESSURE	22
4	BULK VENT FAILED	22
5	PUMPDOWN CHECK	10
6	BASE VAC CHECK	5
7	GROSS LEAK PT1	22
8	PT1 HP VENT	28

From the Main Menu, enter Config Menu -> User Setpoints -> PT2. Note, values shown are recommended.

Table 3-16: User Setpoints > PT2

Num	Alarm Label	Setpoint
1	LOW PUSH PRESSURE	22
2	HI PUSH PRES PRESSURE	45
3	PT1 HP VENT	28
4	HH PUSH PRESSURE	45

3.11 Manual Mode



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

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

3.11.1 How to Operate Manual Mode



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

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

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

3.11.2 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 be displayed, refer to Figure 3-12

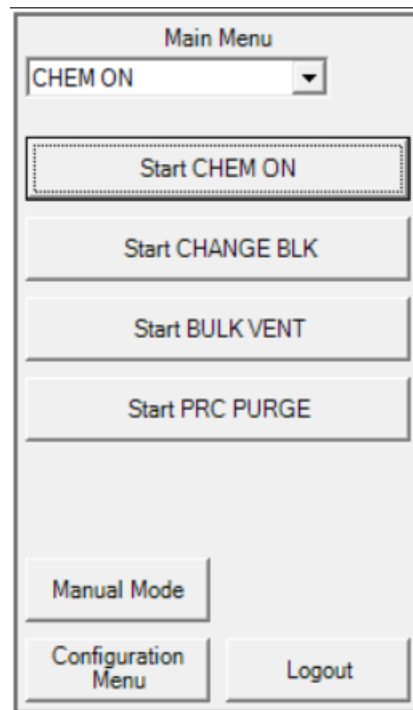
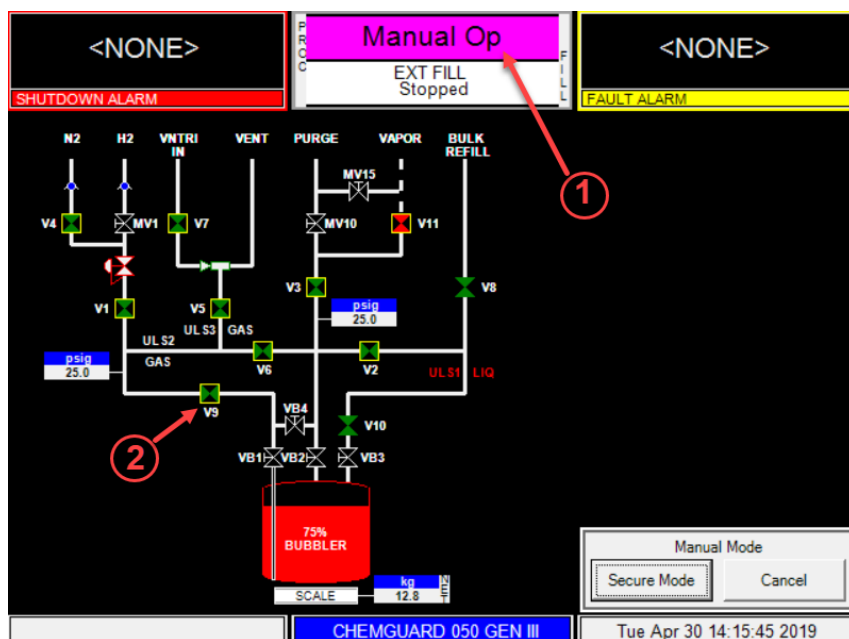
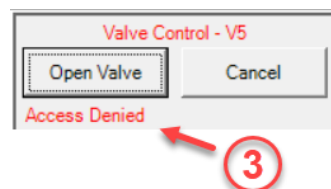


Figure 3-12: Manual Mode Display



1. Controller Status box changes to Violet for operation selected, CHEM ON, 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



3.11.3 How to Open Valve in Manual Mode

To open a valve:

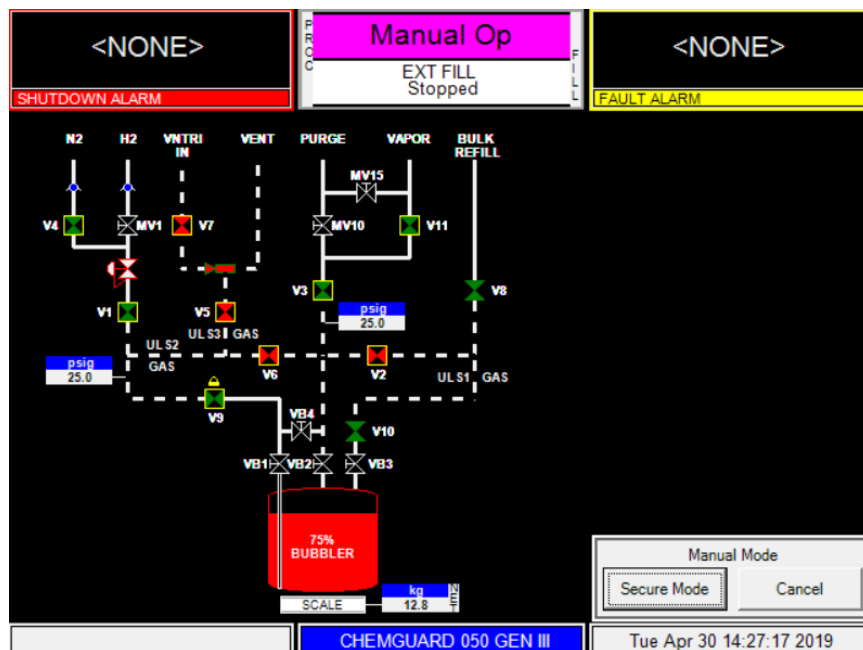
1. Select by touching the valve. The valves that can be manually operated from the display will be highlighted with a yellow box
2. The valve confirmation window will appear, asking you to confirm that you want to open the valve by pressing "OPEN VALVE". Pressing "CANCEL" will close the window, leaving valve closed, refer to Figure 3-13



3.11.4 How to Close Valve in Manual Mode

1. To close a valve:
2. Touch the valve you want to close by selecting the valve on the display

Figure 3-13: Manual Mode



3.11.5 To SECURE Manual Mode

The Secure option allows the operator to exit the Manual Mode menu while remaining in manual mode with valves open. (The Secure option will not be selectable if no valves are open.) When the operator chooses Secure Mode from the Manual Mode window it allows the

operator to go to other menu screens. Any open valve will remain open, and the Mode Status Box will continue to indicate manual mode. Manual mode will remain active or 'secured' until an operator re-enters the Manual Mode window. While manual mode is 'secured', Manual Mode will be the only selectable option on the Main Menu.



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

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

3.12 Regulator Adjustment

3.12.1 Bubbler PT1/PT2 and R1 Test and Adjustment

Test Bubbler PT1 and PT2 while adjusting Regulator R1 together at same time

1. Turn main supply gas off to the CG050, 0psig
2. Slowly open regulator R1 by turning R1 fully clockwise
3. Step to CHEM ON Menu
4. Step to Manual Mode and open V4, V1 and V6. Verify valve indicator switches from green to red
5. Vent off pressure to PT1 by opening V5
6. Confirm PT1/PT2 pressure drops to 0psig. Close V5
7. Set main supply gas pressure to 10psig. Verify PT1/PT2 reads 10.0 ± 00.5 psig
8. Set main supply gas pressure to 25, 35 & 55 psig. At each setting verify PT1/PT2 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 V1 and open V5 (V4 and V6 open). Confirm PT1/PT2 pressure drops to 0 psig. Close V5
12. Open V1
13. Slowly open regulator R1 by turning R1 clockwise to user selected pressure setting, typically 25 psig at both PT1/PT2
14. Close V1, V4 and V6

NOTE: Regulator is 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.

3.12.2 Bubbler Regulator Creep Test

1. After PT1/PT2 tested and R1 set to user selected pressure setting, open V4 and V1. Wait 5 mins for pressure to stabilize
2. Document PT1 pressure reading = _____ psig
3. Let CG sit for 1 hours = _____ start time _____ stop time
4. The pressure reading should not drift by more than +/-2 psig
5. Record final reading = _____ psig

3.13 Finishing the ChemGuard® Installation

Refer to chapter 4 for the installation and leak test of the 38 Liter bubbler and pigtails.

Refer to addendum A for the installation and Change BLK of the 14 Liter LPE bubbler

3.13.1 Chemical Delivery Line Certification

1. 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.
2. To perform system vacuum purge, refer to chapter 4

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

3.13.2 Chem On (Bulk Fill) Operation

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

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

3.13.3 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 and V14 enabling the input signals on the AP1614 Tool Interface PCB, refer to Table 3-4 and 3-5.

Chapter 4

38 Liter Bubbler Installation

Section 1	38 Liter Bubbler Installation
Section 2	Bubbler Valves
Section 3	Installation of the Bubbler and Valves
Section 4	Bubbler and System Leak test - Setup
Section 5	Leak Test – main Manifold -> Pressure Decay
Section 6	Leak Test – Vapor Out -> Pressure Decay
Section 7	Leak Test – Sample Out/Purge Line -> Pressure Decay
Section 8	Leak Test – 38L Bubbler/Outer Cooling Jacket ->
Pressure Decay	
Section 9	Leak Test – External Refill Line -> Pressure Decay
Section 10	System Purge
Section 11	Install Bubbler Chiller Connections
Section 12	Entering Bubbler Liquid Weight

4.1 38 Liter Bubbler Installation

Confirm the 38 Liter Bubbler is available along with the 3 valve pigtail spools, VB1, VB2 and VB3. Once the Bubbler is installed it will remain in the cabinet unless removed for maintenance or system de-commission.

NOTE: The Change BLK operation is not available for the 38 Liter Bubbler option. The 38 Liter Bubbler is not designed for routine removal. Should the 38 Liter Bubbler require removal for maintenance purposes, contact your Versum Materials representative for instructions.

4.2 Bubbler Valves

NOTE: Before installing the 38 Liter Bubbler the Technician should be familiar with the Bubbler valves prior to opening and closing the manual valves and during software prompts.

Software prompts to OPEN and/or CLOSE during operation.

38 Liter Bubbler Valves	
VB1	Manual Inlet Valve on Dip-tube/Bubbling port
VB2	Manual Outlet Valve on Headspace/Vapor Out port
VB3	Manual external Refill Valve on non Dip-tube port

NOTE: The 38 Liter Bubbler does not have valves installed onto the Bubbler prior to shipment. These valves are integrated as part of the pigtails and ship separately with the CG050 cabinet.

4.3 Installation of the Bubbler and Valves

1. Inspect bubbler and valve pigtails for signs of physical damage. Ensure all parts are present including the UltraSonic overfull probe.
2. If the Ultrasonic probe did not come installed, install to the $\frac{3}{4}$ " FVCR port using the provided $\frac{3}{4}$ " gasket, refer to figures 4-1 and 4-2. are
3. Carefully place the bubbler on the bulk scale. Secure the bubbler using the cylinder strap provided on the back bracket.
4. Attached the 3 valve pigtail assemblies, VB1, VB2 and VB3 to the appropriate port on the bubbler using new $\frac{1}{4}$ " VCR gaskets. Finger tighten only at this time.
5. Connect the opposite end of each pigtail assembly to the main manifold using new 1.4" VCR gaskets.
6. Position bubbler on the scale and align so the valve pigtail assemblies are not putting stress on the scale.
7. Once seated on scale properly tighten the 3 VCR connections at the main manifold to spec.
8. Tighten the 3 VCR connections at the bubbler to spec.
9. Connect the Coolant in and out lines to the side of the bubbler using the quick connect fitting.
10. Connect the UltraSonic probe to the cable connected to the ChemGuard interface box.

Figure 4-1: 38 Liter Bubbler

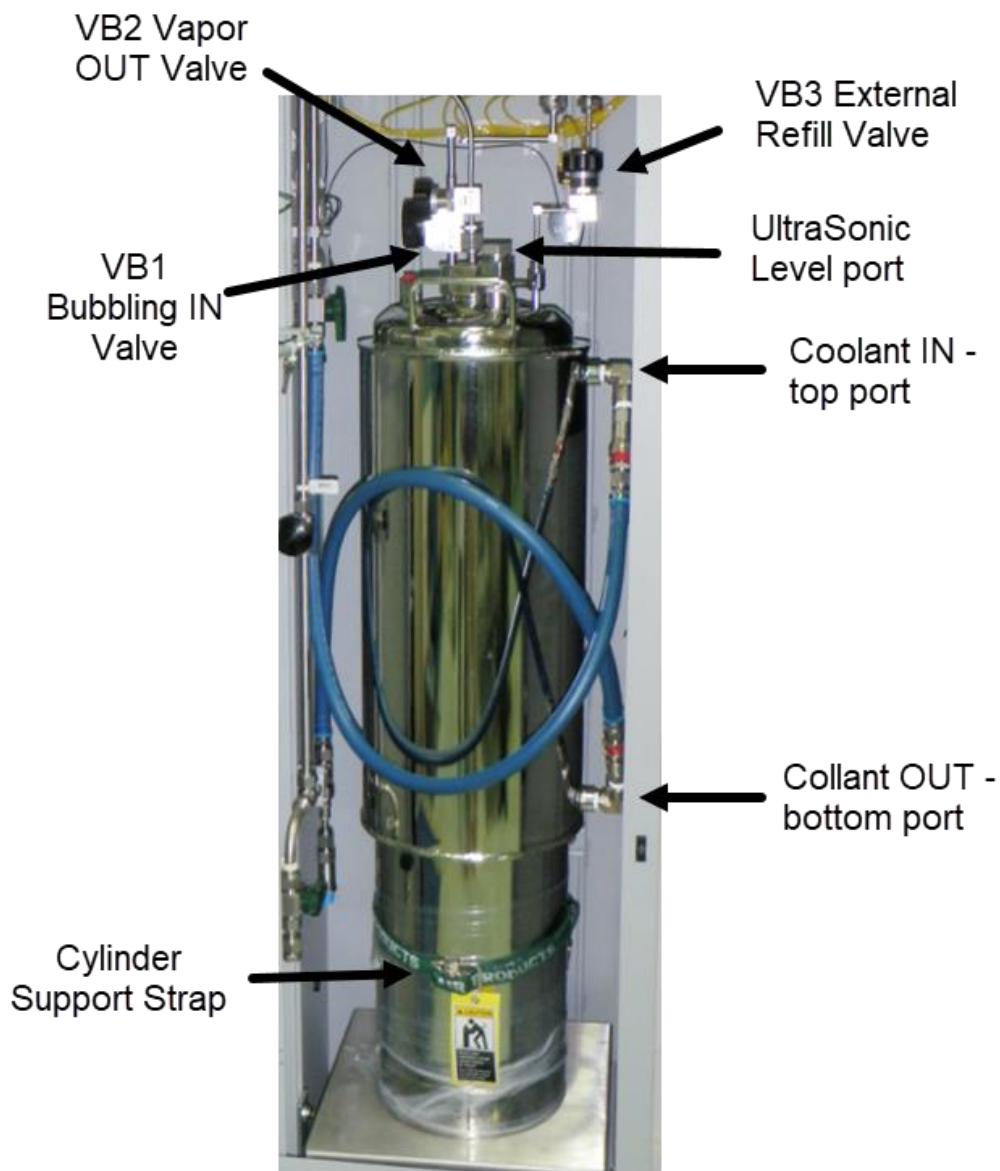
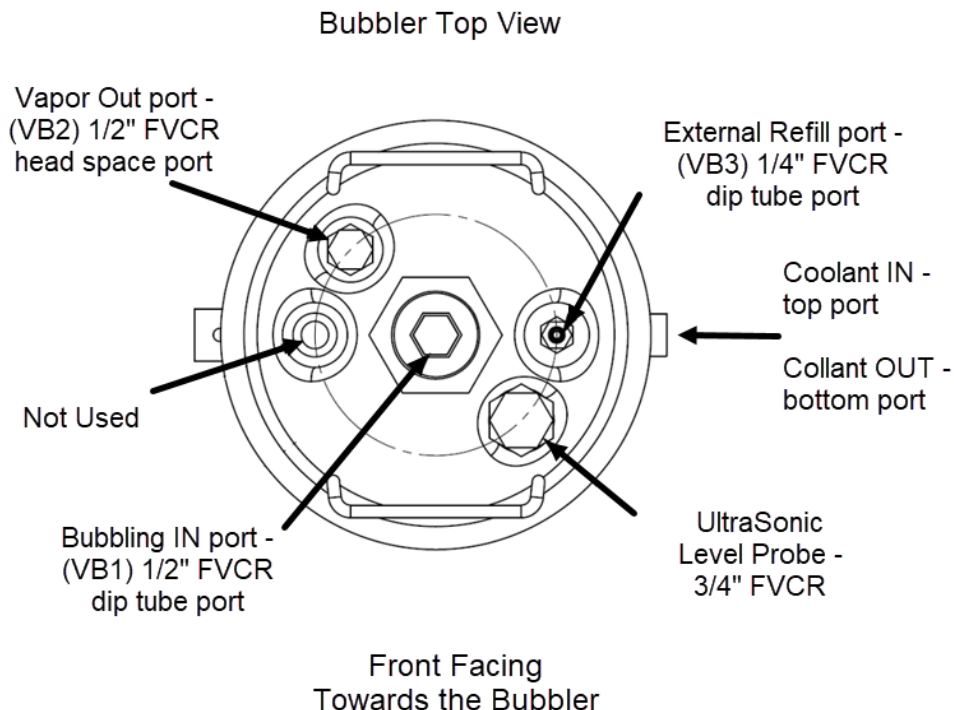


Figure 4-2: 38 Liter Bubbler Top View



4.4 Bubbler and System Leak Test – Setup

Use following to establish pressure decay base reading for all Leak Check test steps below. Record pressure decay base reading below.

1. At the Main Menu, enter Config Menu -> System Setup -> and select Disable Valve Locks
2. At Main Display, step to CHEM ON Menu and enter Manual Mode. Select and open valve V4 and V1.
3. Set R1 to maximum setting ~ 60-80 psig. Refer to BUBBLER PT1 AND R1 TEST/SETUP in above section.
4. Set PTI High Push Pressure Setpoint to 85
5. Wait for 5 minutes. Place Manual Mode in Secure Mode.
6. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of PT1, Gross and Raw.
 _____ PSIG _____ mA
7. Enter Manual Mode, close V1.
8. Wait 5 minutes.

9. Return to System Test -> Test Analog In. Compare PT1 pressure from values recorded in step 5. Confirm change in pressure (Pressure decay) is less than 1psig, 0.2mA.

_____PSIG _____mA

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

10. Cancel out of Manual Mode.

_____PSIG _____mA (record values for test steps below)

4.5 Leak Test – Main Manifold -> Pressure Decay

1. Confirm/Close MV1, MV10, MV15.
2. Go to Main Menu -> CHEM On and select Manual Mode.
3. Open V5 and V6. At Bubbler, open VB2.
4. Wait 15 minutes.
5. Close V5, V6 and Bubbler valve VB2.
6. Open V4, V1, V9, V6, V2 and V3 (V11 closed).
7. Place Manual Mode in Secure Mode.
8. Go to Main Menu -> EXT Fill and select Manual Mode.
9. Open V10.
10. Place Manual Mode in Secure Mode.
11. Wait 5 minutes.
12. Go to Main Menu -> CHEM On and select Manual Mode.
13. Close V1.
14. Place Manual Mode in Secure Mode.
15. Wait 15 minutes.
16. Return to System Test -> Test Analog In. Compare PT1 pressure from values recorded in Leak Check Setup, above. Confirm change in pressure (Pressure decay) is less than 1psig, 0.2mA.

_____PSIG _____mA

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

4.6 Leak Test – Vapor Out -> Pressure Decay

1. Confirm/Close MV1, MV10, MV15.
2. Enter Manual Mode, open V4, V1, V6, V3 and V11.

Note: Confirm vapor output line from V11 is connected and is closed at tool.

3. Wait 15 minutes and then close V1.
4. Place Manual Mode in Secure Mode.
5. Wait 30 minutes.
6. Return to System Test -> Test Analog In. Compare PT1 pressure from values recorded in Leak Check Setup, above. Confirm change in pressure (Pressure decay) is less than 1psig, 0.2mA.

_____ PSIG _____ mA

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

7. Cancel out of Manual Mode.

4.7 Leak Test – Sample Out/Purge Line -> Pressure Decay

1. Confirm/Close MV1, MV15.
2. Open MV10.
3. Enter Manual Mode, open V4, V1, V6 and V3.

Note: Confirm Sample Out/Purge line from MV10 is connected and is closed at tool.

4. Wait 15 minutes and then close V1.
5. Place Manual Mode in Secure Mode.
6. Wait 30 minutes.
7. Return to System Test -> Test Analog In. Compare PT1 pressure from values recorded in Leak Check Setup, above. Confirm change in pressure (Pressure decay) is less than 1psig, 0.2mA.

_____ PSIG _____ mA

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

8. Cancel out of Manual Mode.

4.8 Leak Test – 38 Liter Bubbler/Outer Cooling Jacket -> Pressure Decay

Note, Chiller Connections to the outer coolant jacket not installed at this time

1. Confirm Chiller Connections to the outer coolant jacket not connected and ports open to atmosphere
2. From the Main Menu, enter Config Menu -> System Setup -> and select Disable Valve Locks.
3. Confirm/Close MV1, MV10, MV15.

4. Open Bubbler valve VB1 and VB2.
5. Go to Main Menu -> CHEM On and select Manual Mode.
6. Open V4, V1, V9, V6, and V2.
7. Wait 30 minutes.
8. From the Main Menu, enter Config Menu -> System Test -> Test Analog In. Record values of PT1, Gross and Raw.

_____ PSIG _____

9. Close V1.
10. Place Manual Mode in Secure Mode.
11. Wait 2 hours.
12. Return to System Test -> Test Analog In. Compare PT1 pressure from values recorded in step 8 above. Confirm change in pressure (Pressure decay) is less than 1psig, 0.2mA.

_____ PSIG _____ mA

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

13. Cancel out of Manual Mode.

4.9 Leak Test – External Refill Line -> Pressure Decay

1. Confirm/Close MV1, MV10, MV15.
2. Confirm External Refill line is connected to a BCD-200/CG310 and has been leak tested and certified.
3. V2 is locked out in manual mode so connect pneumatic airline from V3. Remove airline from V3 and insert to pneumatic fitting of V2.
4. Go to Main Menu -> EXT Fill and select Manual Mode.
5. Open V8, V10.
6. Place Manual Mode in Secure Mode.
7. Go to Main Menu -> CHEM On and select Manual Mode.
8. Open V4, V1, V6 and V3 (which now opens V2).
9. Place Manual Mode in Secure Mode.
10. Wait 15 minutes and then close V1.
11. Place Manual Mode in Secure Mode.
12. Wait 15 minutes.

13. Return to System Test -> Test Analog In. Compare PT1 pressure from values recorded in Leak Check Setup, above. Confirm change in pressure (Pressure decay) is less than 1psig, 0.2mA.

_____ PSIG _____ mA

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

14. Cancel out of Manual Mode.
15. Return pneumatic airline to V3. Remove airline from V2 and insert back to pneumatic fitting of V3. Insert airline of V2 back to pneumatic fitting of V2.

4.10 System Purge

Confirm Bubbler installed and cooling water off

Note, Do not purge while cooling water is on

1. Open/confirm manual shutoff valve on venture vacuum gas supply line to V7 is open.
2. At Main Display, step to CHEM ON Menu and enter Manual Mode.
3. Select and open V7 and V5.
4. Confirm pressure readout of PT1 begins to decrease. Once pressure stabilizes and is no longer decreasing, Record value
_____ PSIG.
5. Confirm value entered in User Setpoints -> PT1, #6-BASE VAC CHECK is +2 greater than value recorded in step 4.
6. Open V6, V3, and Vapor Output Valve V11, (confirm vapor output line is connected and is closed at tool)
7. Place Manual Mode in Secure Mode.
8. At Main Display, step to EXTERNAL FILL Menu and enter Manual Mode. Select and open V8, V10.
9. Place Manual Mode in Secure Mode.
10. Open Bubbler valves, VB1, VB2 and VB3.
11. Place in System Venturi Vacuum Purge overnight, or for 4-12 hrs.
_____ Start Time _____ End Time
12. Cancel out of CHEM ON and EXTERNAL FILL Manual Modes.
13. Close Bubbler valves, VB1, VB2 and VB3.

4.11 Install Bubbler Chiller Connections

1. Connect Chiller Connections to the outer coolant jacket

2. Verify Coolant Drain Valve, MV55 is closed and end cap installed
3. Turn coolant water on
4. Verify with facilities that coolant water is circulating
5. Visually inspect all coolant water connections at CG cabinet and chiller connections at outer coolant jacket of bubbler is leak free, no water leak observed
6. Once Bubbler installed and coolant water on and circulating enter Bubbler Net and Current liquid weight.

4.12 Entering Bubbler Liquid Weight

From the Main Menu, enter Config Menu -> Net Product -> Bulk Scale.

Enter the following values;

Net Liquid: 43.4kg (100% chemical level of 38 Liter Bubbler)

Current Liquid Wgt: 00.0kg (Initial installation of the Bubbler, the current liquid weight will be 0%)

Figure 4-3: Bubbler Net Product Menu

Chapter 5

Features and Components

Section 1	Overview
Section 2	Component Description
Section 3	Available Options

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® CG050 GEN III is used in an epitaxial process. Hydrogen gas is “bubbled” thru an onboard container typically containing Trichlorosilane, (TCS) and vapor is then delivered to a Process Tool. This application is limited to one ChemGuard® per tool or chamber.

The ChemGuard® CG050 GEN III uses is a high-volume bubbler with auto-refillable capability and is capable of saturated vapor gas flow rates of 20-30 CFM with correct chiller / remote refill system.

- Continuously delivers uninterrupted supply of chemical vapor from the onboard bubbler to a process tool.
- The bubbler maintained at a constant level supplied by the remote refill from an external source (i.e., ChemGuard® BCD200, CG010 or CG310 cabinet).
- Display shows all operating parameters, current status of bubbler, chemical level and system setup information.
- All purge, process gas lines, exhaust line and pneumatic lines can be monitored continuously for pressure.
- Programmable bubbler refill level and pressure alarm parameters.
- 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 and venturi vacuum status.

NOTE: Change Bulk operation is not available when using the standard Versum Materials 38 liter bubbler. In order to remove/replace the 38 liter bubbler a manual procedure is used. Contact Versum Materials Technical Support for additional information.

NOTE: Refer to addendum A for instructions on performing Change Bulk operation when a customer provided 14 liter LPE bubbler is used

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.
- All orbital TIG welded plumbing using VCR fittings to maximize leak integrity.
- Versum Material 38 liter bubbler constructed of 316L stainless steel.
- The ChemGuard® CG050 is configured with a standard coolant supply and return lines with overpressure protection, shutoff, and drain capability built into the cabinet.
- The temperature of the bubbler is typically maintained at 18° Ct.

NOTE: Water Chiller is the end users responsibility and is not included with the system.

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 2 for bolt down dimensions.
- Specially designed scale for accurate weight detection of the bubbler, ± 150 grams, $\pm 0.1\%$ of full scale.
- 110% primary spill containment is standard on ChemGuard® Cabinets.
- Redundant overfill protection of the bubbler, including ultrasonic liquid sensors mounted on the vent and vacuum venturi lines.
- Latching cabinet front door with key lock.
- Redundant dual liquid spill detection standard in all cabinets.
- Bubbler ASME-certified for pressure, rated to 120 PSIG.
- Pressure-relief is built in to prevent over-pressure of the bubbler. Pressure-relief valve set for 110 PSIG.
- Designed using SEMI S2, CE Heavy Industry and U.L. safety specifications as guidelines.
- Optional fire (temperature rate of rise) detection is available. Consult your Versum Materials, Inc. Sales Representative.
- Optional Fire Suppression System is available. Consult your Versum Materials, Inc. Sales Representative.

5.1.4 Installation in Classified Locations

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

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

5.1.5 Z-Purge Setup and Procedure

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

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

5.2 Component Description

The ChemGuard® GenIII consists of these major subassemblies:

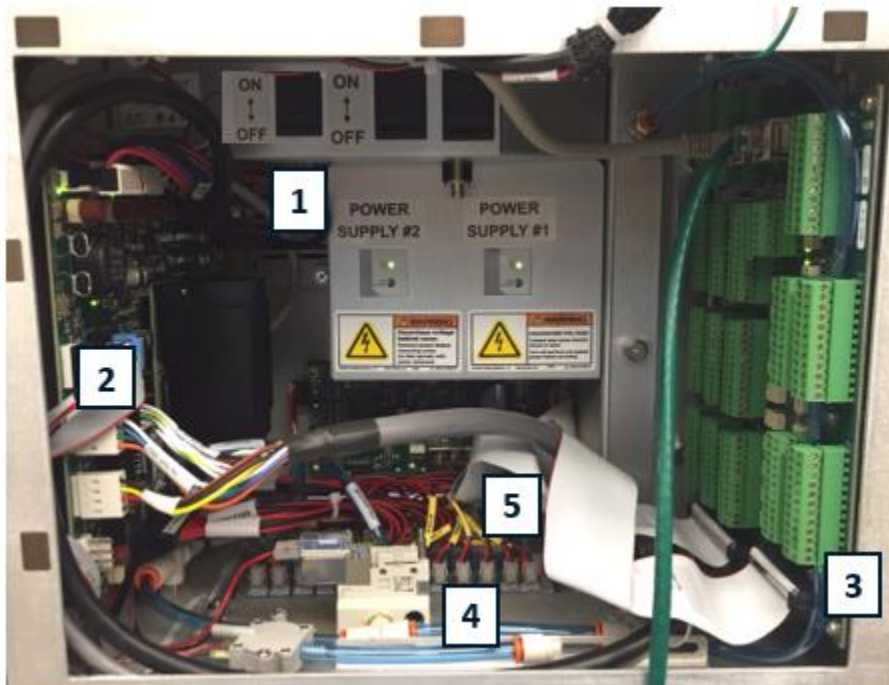
- Chemical Cabinet
- Controller Electronics Enclosure
- Emergency Manual Stop (E-Stop)
- LED VGA Color Touch Display Screen
- Optional Versum Material 38 liter bubbler with built in coolant jacket

NOTE: If a customer provided LPE 14 liter bubbler is used the customer is responsible to provide this bubbler. It is not available from Versum Materials.

Figure 5-1: ChemGuard® CG050 GenIII



Figure 5-2: ChemGuard Electronic Enclosure



ITEM KEY

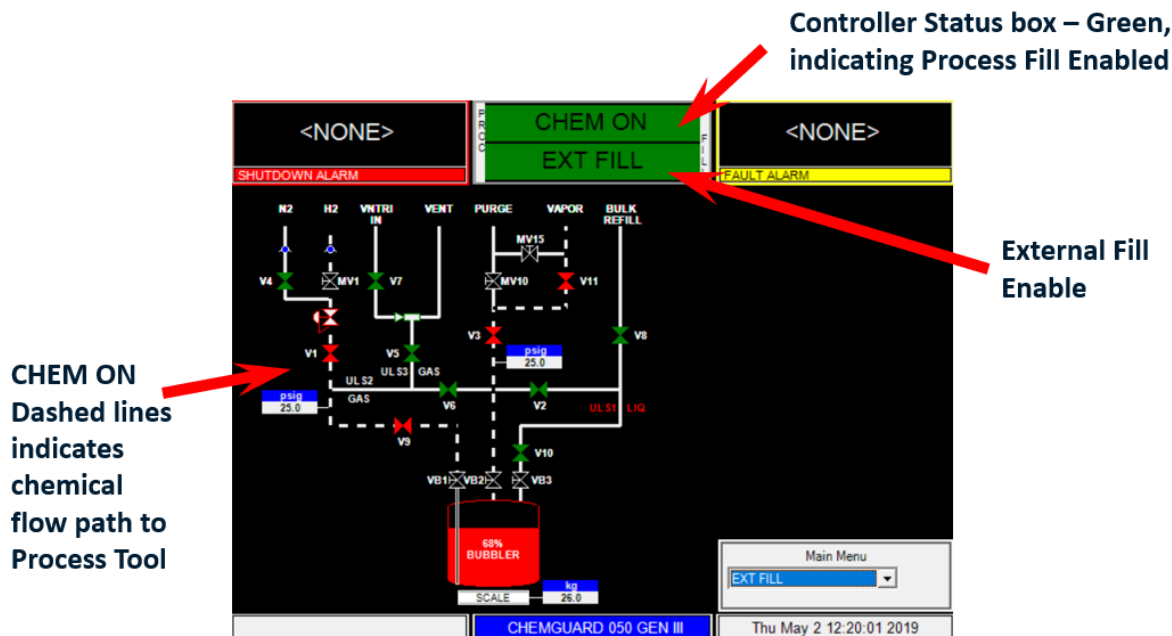
ITEM#	ITEM	FUNCTION
1	Power Supply	Single or dual, redundant power supply with On-Off switch and power indicator
2	Carrier board, AP1565	Main controller board with on-board microprocessor and redundant ARS (automated restart) microprocessor
3	Tool IO board, AP1614	Cabinet IO Interface with Life Safety 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 cutoff the pneumatic air pressure to the master solenoid and all valves will return to their normally de-activated condition.

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

Figure 5-3: Color Touch Display Screen



NOTE: The above figure is a typical display screen of the ChemGuard® CG050 Gen III with a 38 liter bubbler

5.2.2 Liquid Bubbler

The two liquid bubblers are available for use with the CG050:

- Versum Material's 38 liter bubbler, PN 477700
The 38 liter bubbler is 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. bubbler scale or the failure of the external fill operation
- LPE 14 liter bubbler, customer provided

Table 5-1: ChemGuard® CG050 Stainless Steel Reservoir Container Specifications

MODEL	38 LITER (~10.0 GALLONS) – PN 477700 Chemistry -specific Containers BULK Container: (manual valves)
	14 LITER - Third Party Bulk Container (manual valves)

5.2.3 38 liter Bubbler (Installation is described in Chapter 4)

Bubbler Valve Connections:

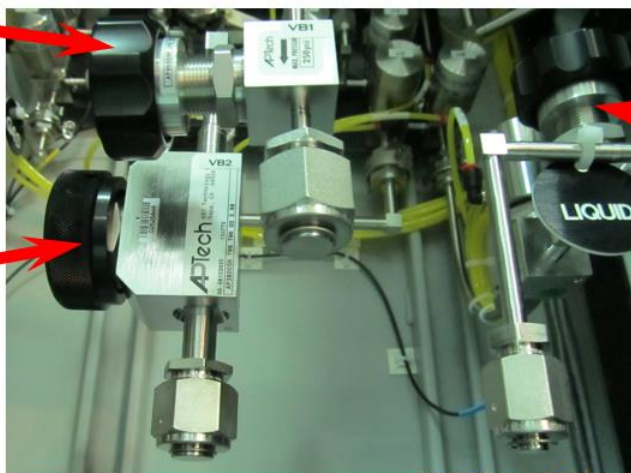
- **VB1 Carrier Gas IN Valve Assembly, PN 239613** has ½ inch male VCR connection. Connects to bubbler carrier gas IN port on dip tube port side of bubbler.
- **VB2 Vapor OUT Valve Assembly, PN 239614** has ½ inch male VCR connection. Connects to bubbler vapor OUT port on headspace side of bubbler.
- **VB3 Refill IN Valve Assembly, PN 239615** has ½ inch male VCR connection. Connects to the bubbler refill IN port on dip tube port side of bubbler.

NOTE: Refill IN port connects to a dip tube in the bubbler that goes to bottom of the bubbler. This allows for manual back fill of the chemical from the bubbler to the external refill system should the bubbler need to be maintenance or removed.

Figure 5-4: Bubbler Valve Assembly Connections

**VB1 Carrier
Gas IN Valve
Assembly
PN 239613**

**VB2 Vapor
OUT Valve
Assembly
PN 239614**



**VB3 Refill IN
Valve
Assembly
PN 239615**

Figure 5-5: 38 liter Bubbler with Coolant Plumbing Connections

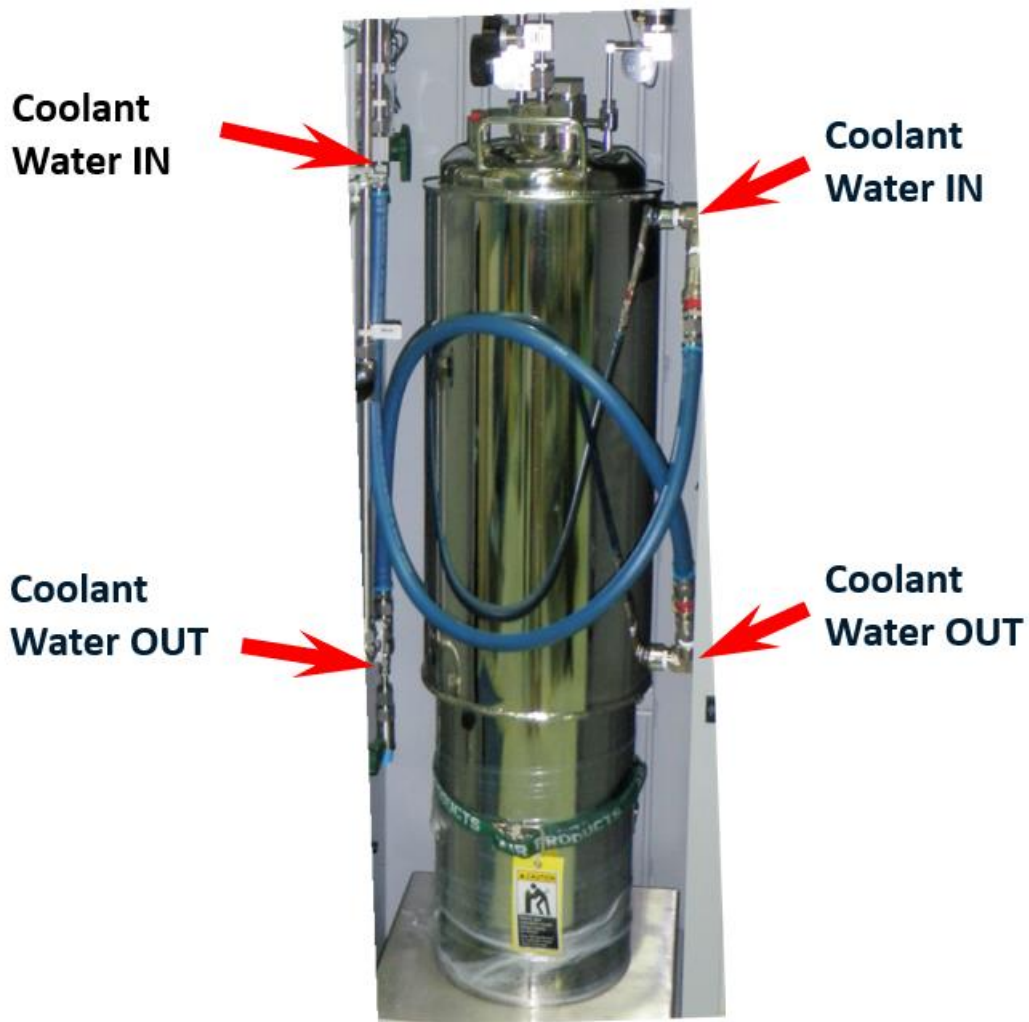
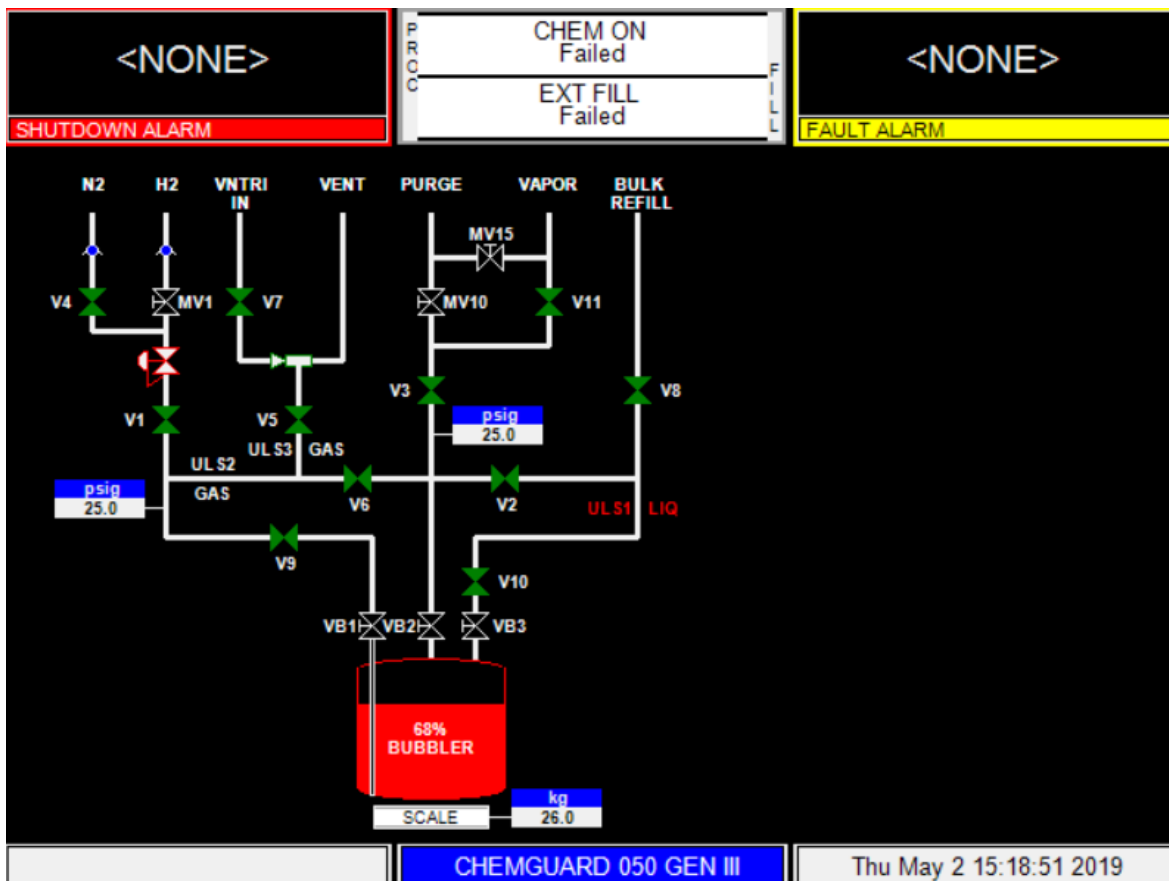


Figure 5-6: CG050 Display with a 38 liter Bubbler



5.2.4 LPE 14 liter Bubbler (Installation is described in Chapter 4)

Bubbler Valve Connections:

- Carrier Gas IN pigtail has ¼ inch male VCR connection. Connects to bubbler carrier gas IN valve, VB1 on dip tube port side of bubbler.
- Vapor OUT pigtail has ¼ inch female VCR connection. Connects to bubbler vapor OUT valve, VB2 on the headspace side of bubbler.
- Refill IN pigtail has ¼ female VCR connection. Connects to the bubbler refill IN valve, VBBL on the headspace side of bubbler.

NOTE: Refill IN port connects to the headspace side of the bubbler without a dip tube which does not allow for backfilling of the bubbler. When ordering a CG050 for use with the LPE 14 liter bubbler the software is configure with a Change Bulk option. Refer to addendum A for the Change Bulk operation.

Figure 5-7: LPE 14 liter Bubbler



Figure 5-8: LPE 14 liter Bubbler Drawing

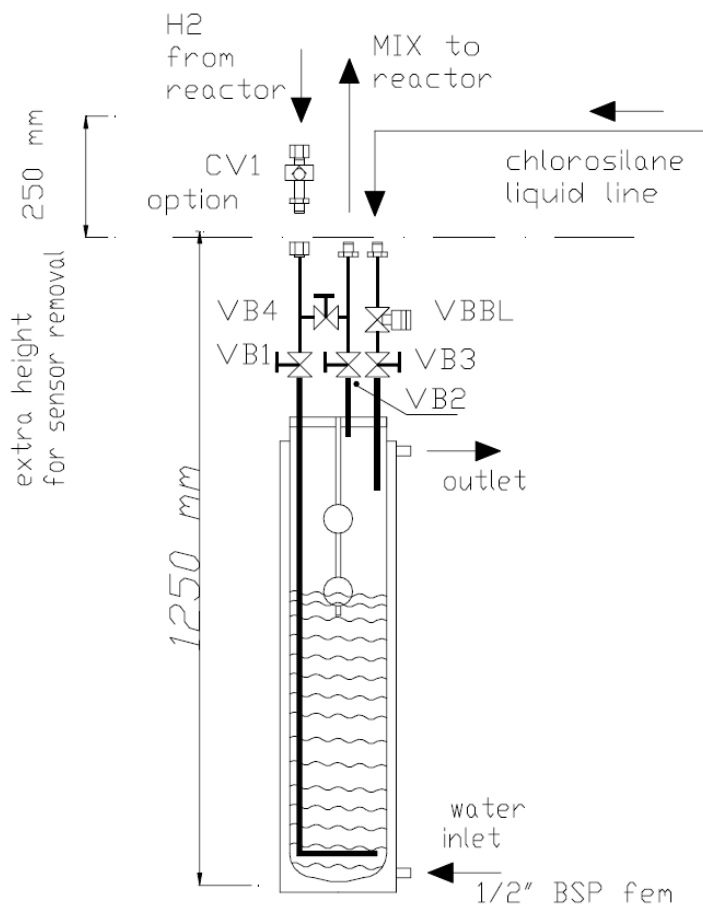
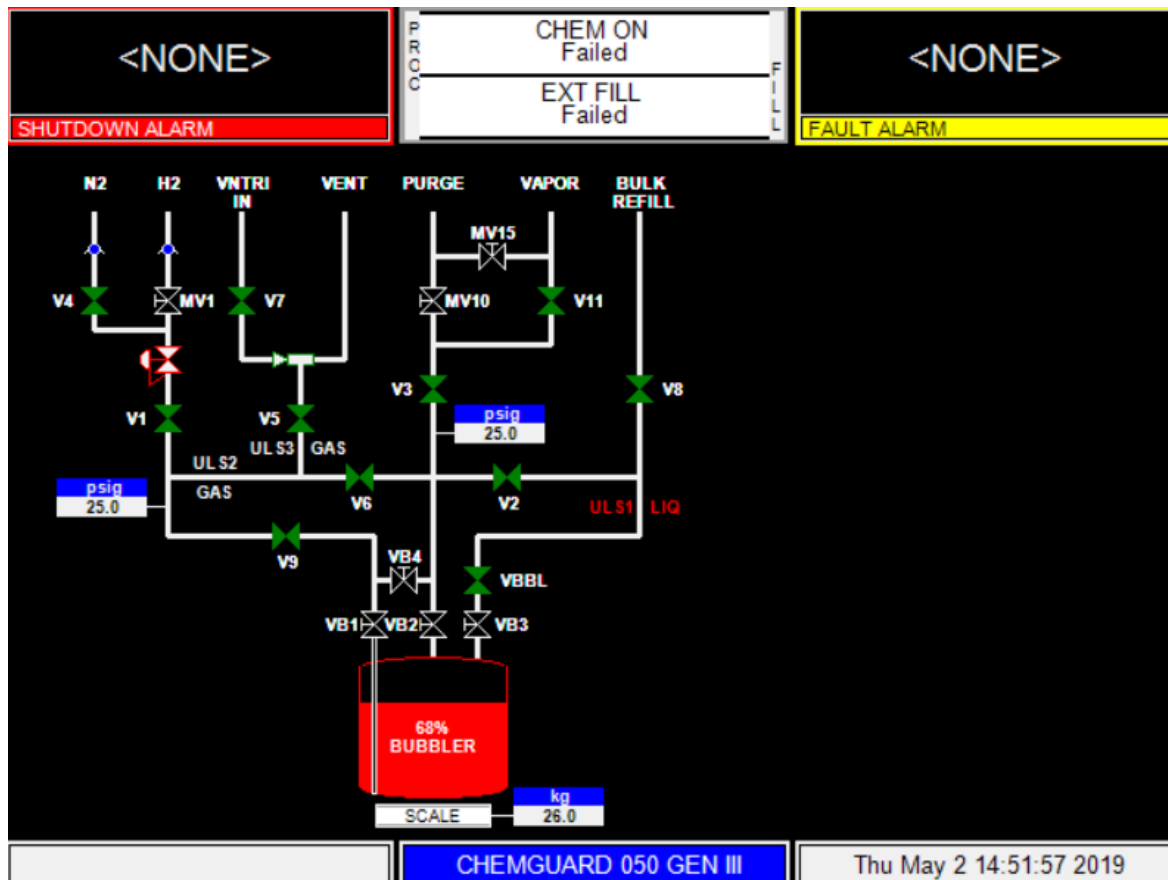


Figure 5-9: CG050 Display with a LPE 14 liter Bubbler



5.2.5 Chemicals Authorized for Use in the ChemGuard® CG050

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

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.

Table 5-2: Chemical Use and Chemical Maximum-Fill Values

ABBREVIATION	CHEMICAL NAME	MAX FILL VALUE 38 LITER	MAX FILL VALUE 14 LITER
TCS	Trichlorosilane	43.4kg	15.4kg

5.3 Available Options

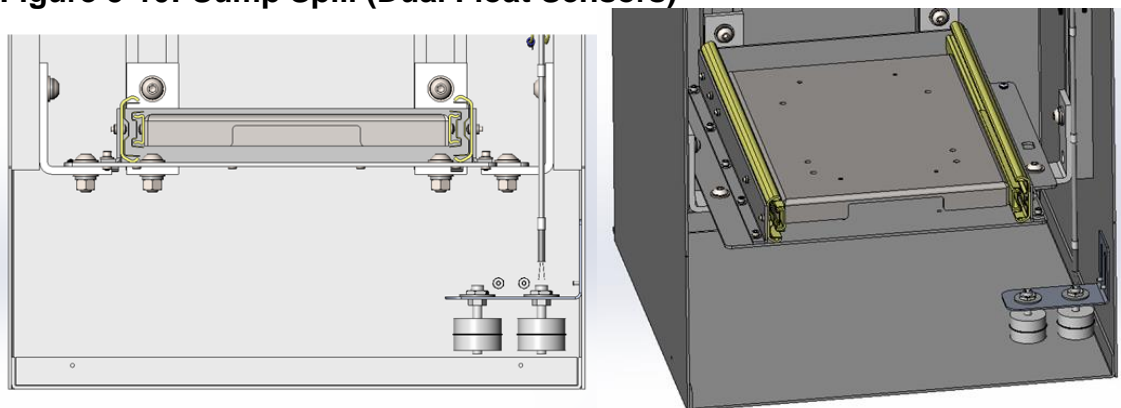
5.3.1 Cabinet Spill Detection

Sump Spill (Dual Float Sensors)

The ChemGuard® CG050 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 5-10: Sump Spill (Dual Float Sensors)



5.3.2 System Combustible Vapor Detection (Required)

A 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.

5.3.3 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.

Sniffer port location



5.3.4 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.

5.3.5 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°C in a period of less than one (1) minute. The Fire Suppression System will then

be activated and CO₂ 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 manufacturer's 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.

Chapter 6

System Operation

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

6.1 Theory of Operation

6.1.1 Overview

The ChemGuard® CG050 is designed to deliver vapor mixture from the Bulk bubbler to the OEM Process Tool by means of bubbling through chemical with process gas, typically Hydrogen gas. It provides a constant outlet pressure and a constant flow of mixture without the downtime.

The chemical gas mixture is supplied in either a 14 L third party bubbler (not available thru Versum Materials) or a Versum materials 38 Liter Bubbler. It is installed in the area designated Bulk reservoir.

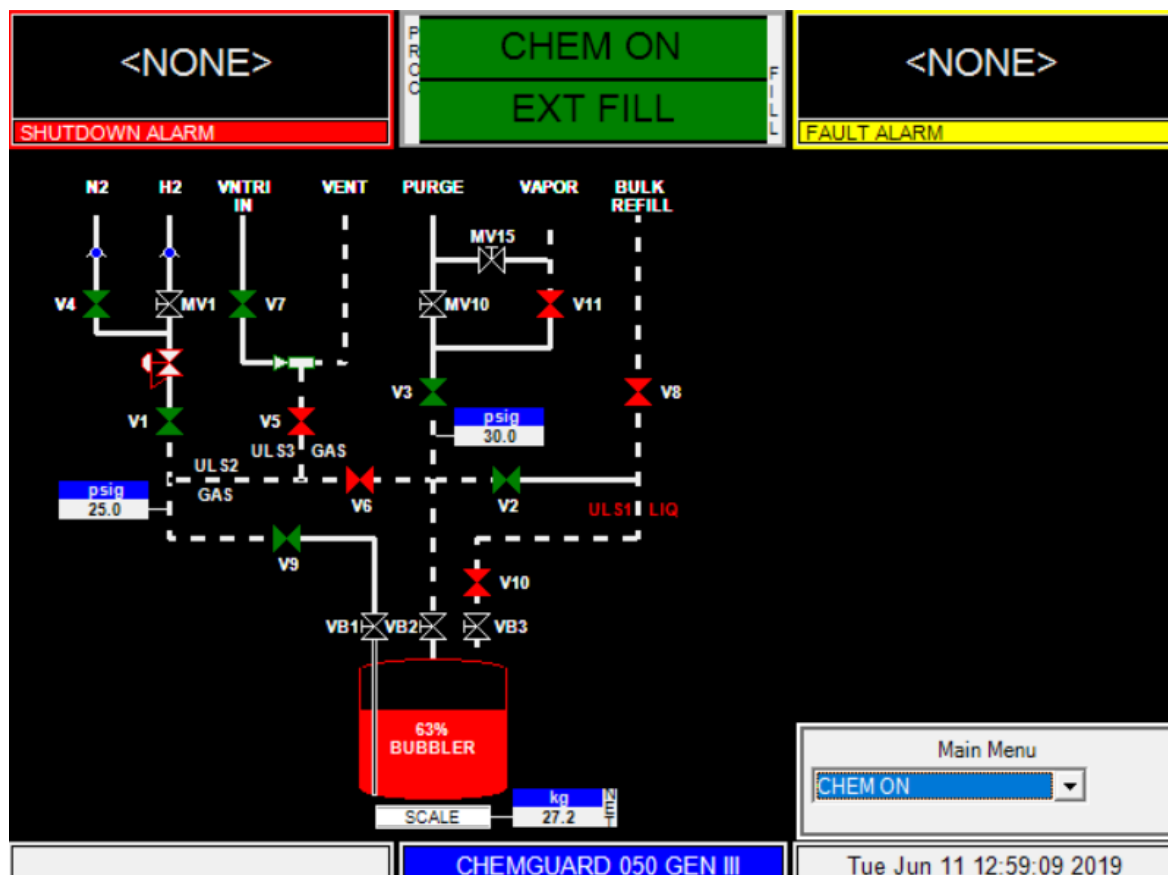
To form the gaseous mixture, gas is introduced through a dip tube to the bottom of the Bubbler. At the end of the dip tube, a sparger nozzle creates a fine dispersion of gas bubbles. The Bubbler enhances liquid evaporation by increasing the contact surface area between the liquid and the gas. The evaporation process depletes the liquid inventory in the Bubbler which is then automatically refilled.

When the liquid level in the Bubbler goes low the Bubbler is externally refilled from a Bulk Chemical Delivery System, BCD200, CG010 or CG310. When the liquid level in the bubbler drops below the Bubbler Start Refill Level which is found in “User Setpoints” of the Configuration Menu external refill starts and continues until the Bubbler liquid level reaches Bubbler Stop Refill Level set-point.

While flowing the vapor mixture from the Bubbler to the process tool a constant outlet pressure must be provided. This is accomplished by the adjustment of regulator R1. Input pressure is monitored by PT1 and the vapor outlet mixture is monitored by PT2. When the outlet pressure exceeds the PT2 HP Vent setpoint found in “User Setpoints” of the Configuration Menu a “Vent Pulse” routine will be activated.

A constant pressure must be maintained, to within 5psig of R1 regulator setpoint. When in the external refill mode the refill pressure from the BCD200, CG010 or CG310 will exceed the PT2 HP Vent setpoint and will “Vent Pulse”, refer to figure 6-1.

Figure 6-1: CG050 “Vent Pulsing” during External Refill Mode



The ChemGuard® CG050 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 Bubbler Refill functions are incorporated, providing 100% uptime preventing interruption to the process tool.

NOTE: The Bulk Reservoir Change operation is not available for the 38 Liter Bubbler option. The 38 Liter Bubbler is not designed for routine removal. Should the 38 Liter Bubbler require removal for maintenance purposes, contact your Versum Materials representative for support.

The ChemGuard® CG050 has been designed to meet or exceed industry environmental / safety regulations and specifications. The cabinet is made from 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.

The main system power supply is 100 - 240VAC, auto-switched, for use in all countries.

The Emergency Manual Off (EMO) circuit provides emergency shutdown, including standard red emergency OFF switch (see Chapter 5 section). If the EMERGENCY MANUAL OFF (EMO) switch is pressed, it will disrupt the pneumatic air pressure to the solenoids, which return the valve actuators to normal status.

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

6.2 Description of Menus and Operations

2 Operations performed by the ChemGuard® CG050

- **CHEM ON**
- **EXTERNAL FILL**

6.2.1 CHEM ON

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

- Bubbler gas regulator, R1 set to required vapor bubbling pressure, i.e. 25 psig
- High and Low PT1 Push Pressure alarm set for +/- 5 psig from R1 setpoint
- PT2 “Vent-Pulses” by momentarily opening the Venturi vacuum line when pressure from output of bubbler, monitored by PT2 increases above PT2 HP Vent setpoint found in “User Setpoints” of the Configuration Menu.

6.2.2 External Fill

Bubbler automatically calls for refill from a bulk refill system, BCD200, CG010 or CG310 without affecting vapor flow delivery or vapor flow pressure to the process tool.

- Bulk refill system remains in Idle mode until CG050 requests a refill

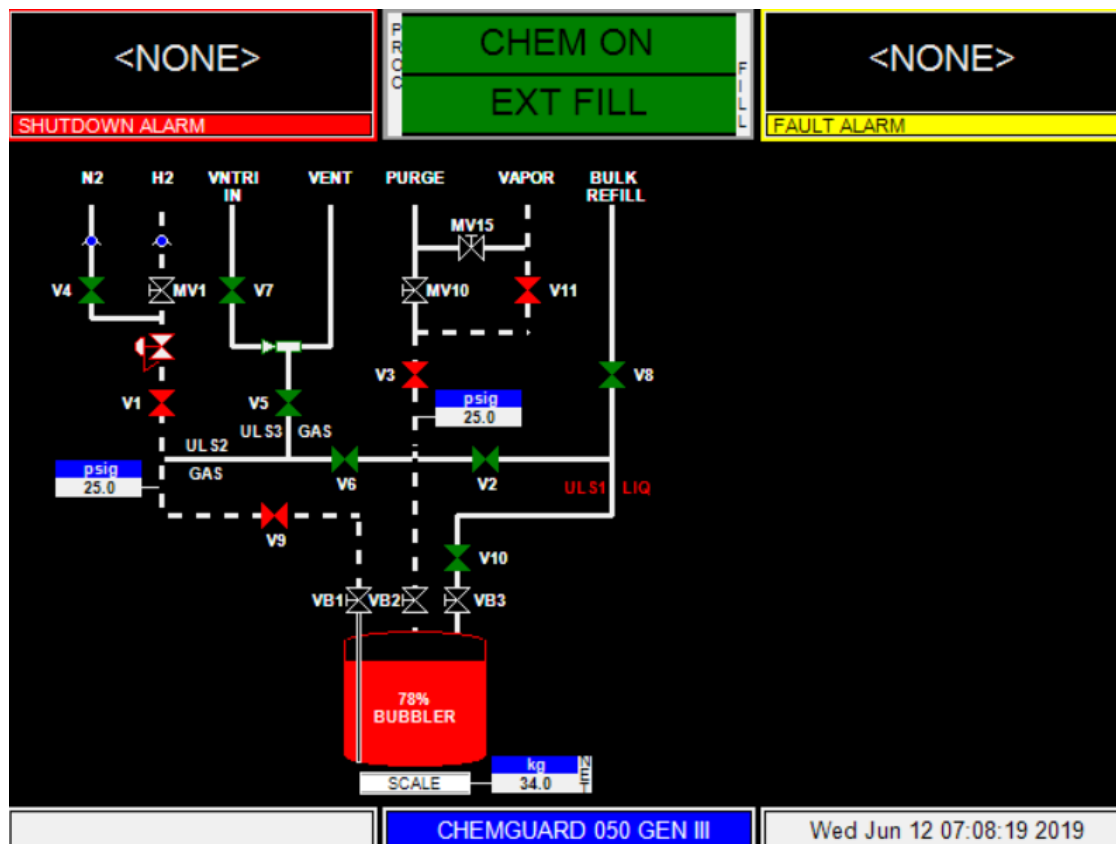
- As chemical vapor is removed from the Bubbler, weight on Bubbler scale decreases
- When weight decreases below Bubbler Start Refill setpoint, i.e. 65% found in “User Setpoints” of the Configuration Menu. The Bubbler will remain in an external refill mode until Bubbler level reaches Bubbler Stop Refill setpoint, 70%.

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 Bubbler and External Refill, 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® CG050 Bubbler and External Refill Screen



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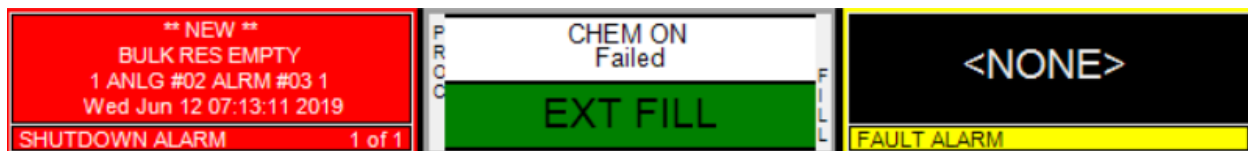
06/25/2019

Chemical Equipment

6.3.2 Alarm and Controller Status Boxes

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

Figure 6-2: Alarm and Controller Status Box



6.3.3 System Status LEDs

Additionally, LEDs that display ChemGuard® CG050 functions are located to the right of the LED display. The table below describes these LEDs and their functions. The fault alarms are indicated by a yellow color and the shutdown alarm is identified by red.

Figure 6-3: 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.

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Chemical Equipment

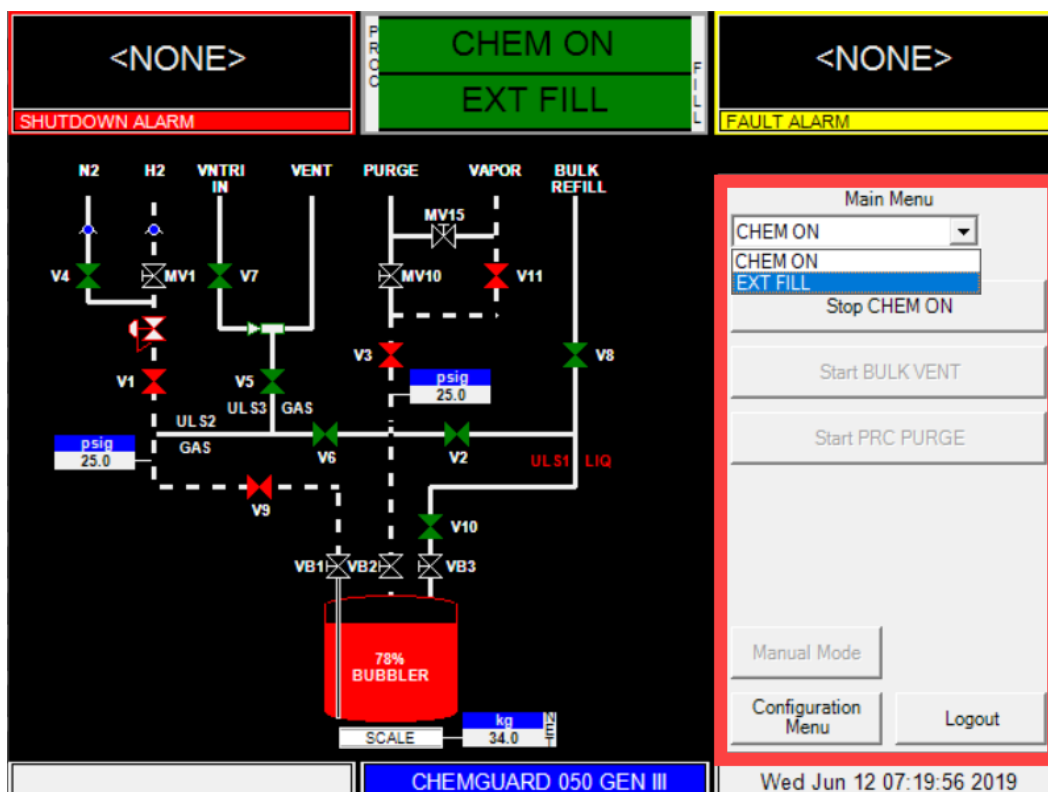
6.3.4 Main Menu

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: Chem On, and External Fill. Any operation associated with the Bubbler should be selected by choosing Chem On from the pull-down menu. To enable External refill select the Ext Fill from the pull-down menu.

It is possible to minimize the Main Menu without logging out. To minimize touch the top right corner of the Main Menu window. To open fully again touch the top right corner to open the Main Menu fully.

Figure 6-4: ChemGuard® Main Menu Display Screen



6.3.5 Screen Saver

The screen saver function becomes active during idle or Chem 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.

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06/25/2019

Chemical Equipment

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 Chem On Menu Options

Select Chem On from the pull-down menu of Main Menu to gain access to the Bubbler Main Menu.

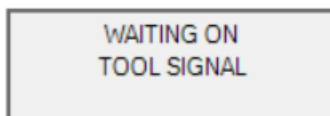
Start CHEM ON

This option allows vapor mixture to flow from the Bubbler to the process tool.

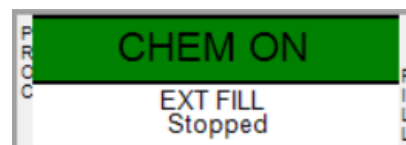
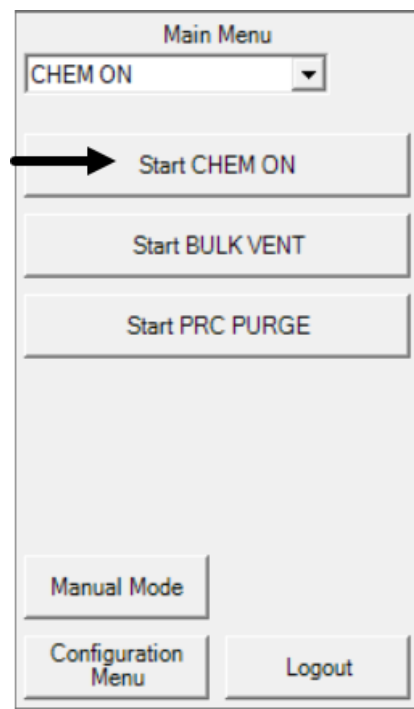
In this option:

- Select Start Chem On to enable the Bubbler's vapor flow. Then when the process tool provides the Process Tool flow signal bubbling gas will begin to flow from the Bubbler and vapor mixture will flow to the process tool
- Vapor flow from the Bubbler requires a Process Tool input signal on Digital Input 37

If Process Tool input not present a display prompt "Waiting On Tool Signal" will be displayed



- Once Start CHEM ON is selected, Stop CHEM ON will be displayed. The Controller status box will display CHEM ON, in green
- The Selection of Stop CHEM ON will allow the operator to stop vapor flow from the Bubbler to the process tool



CHEM ON operation remains enabled until one of the following occurs:

- The operator terminates the operation by selecting **Stop CHEM ON**
- A Life Safety or Process shutdown alarm occurs
- Process Tool input signal at Digital Input 37 is removed and the input goes open

Bubbler Vent Operation (Start BULK VENT)

The Bubbler Vent operation opens the bubbler head space to the Venturi vacuum. This allows for any head pressure to be vented from the Bubbler, refer to Figure 6-6.

To start Bubbler Vent operation:

1. Select CHEM ON from the pull-down menu of Main Menu and click **Start BULK VENT**. The Controller status box for Bubbler CHEM ON will change to BULK VENT, in blue
2. Once line clear operation is started, the Stop BULK VENT button will be enabled on the CHEM ON Main Menu. Click on **Stop BULK VENT** any time to stop Bubbler Vent operation
3. Bubbler Vent operation can be started unless there is a shutdown alarm present in the cabinet

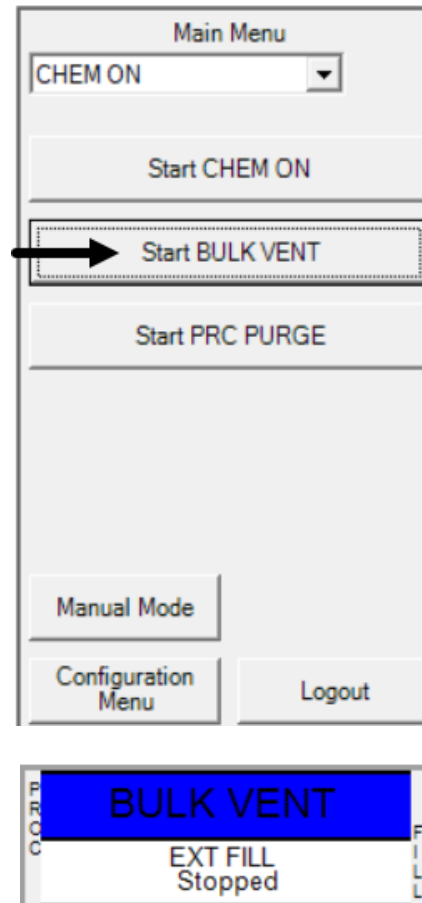
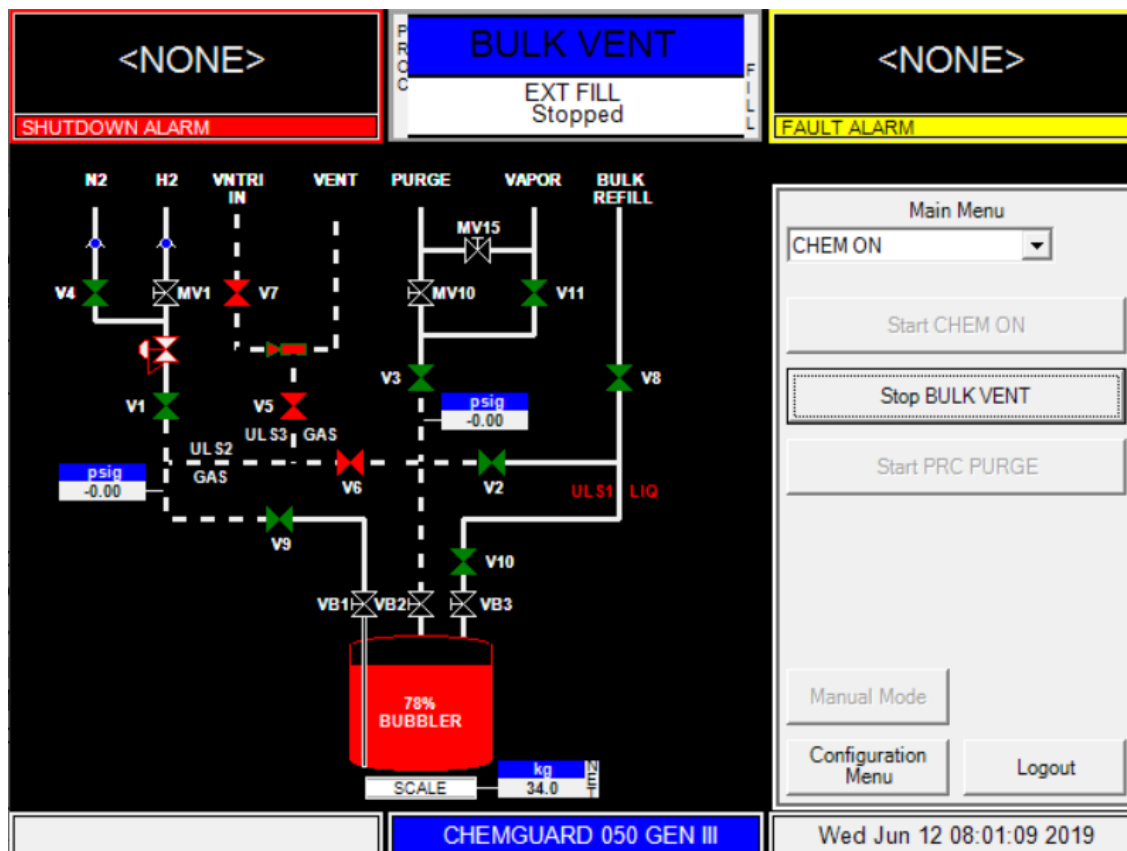


Figure 6-5: ChemGuard® CG050 Bulk Vent Mode



Bubbler Process Line Purge Operation (Start PRC PURGE)

Bubbler Process Line Purge operation removes chemical vapor from the CG050 main process panel and out thru the vapor output line to the process tool. This operation is primarily used during maintenance operation and should be done before the vapor output line is disconnected or when the 38 Liter Bubbler needs to be replaced, refer to Figure 6-7.

To start Bubbler Line Purge operation:

1. Select CHEM ON from the pull-down menu of the Main Menu and click **Start PRC PURGE**. The Controller status box for Bubbler CHEM ON will change to PRC PURGE, in blue
2. Once PRC PURGE operation is started, the Stop PRC PURGE button will be enabled on the CHEM ON Main Menu. Click Stop PRC PURGE at any time to Bubbler Line Purge operation
3. Bubbler Line Purge operation can be started unless there is a shutdown alarm present in the cabinet

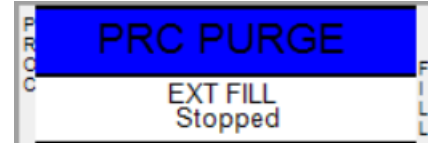
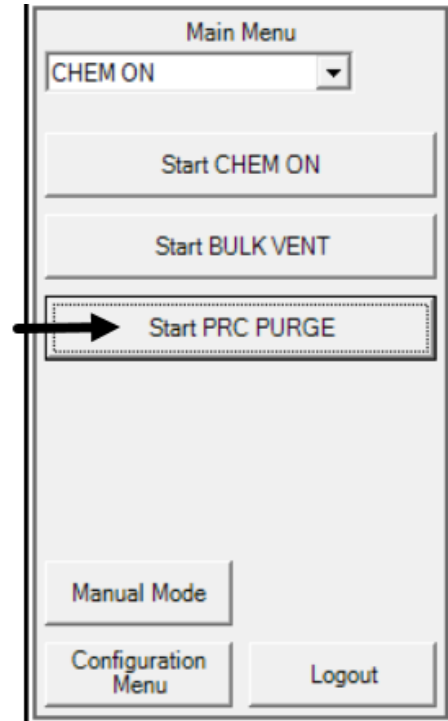
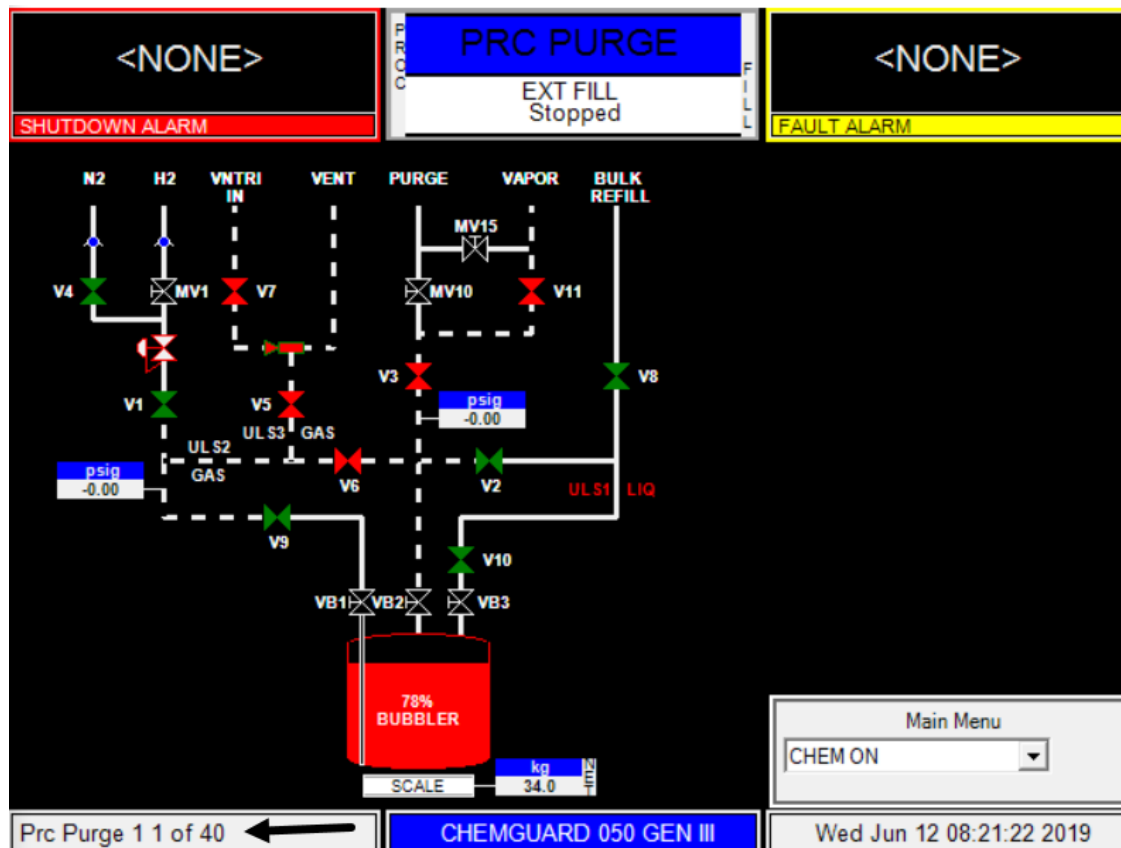


Figure 6-6: ChemGuard® CG050 PRC PURGE



Bubbler Manual Mode Operation (START Manual Mode)

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

NOTE: Only qualified operators and maintenance technicians should access and operate ChemGuard® CG050 in manual mode.

- To start Bubbler Manual Mode operation, select **MANUAL MODE** from the CHEM ON 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.

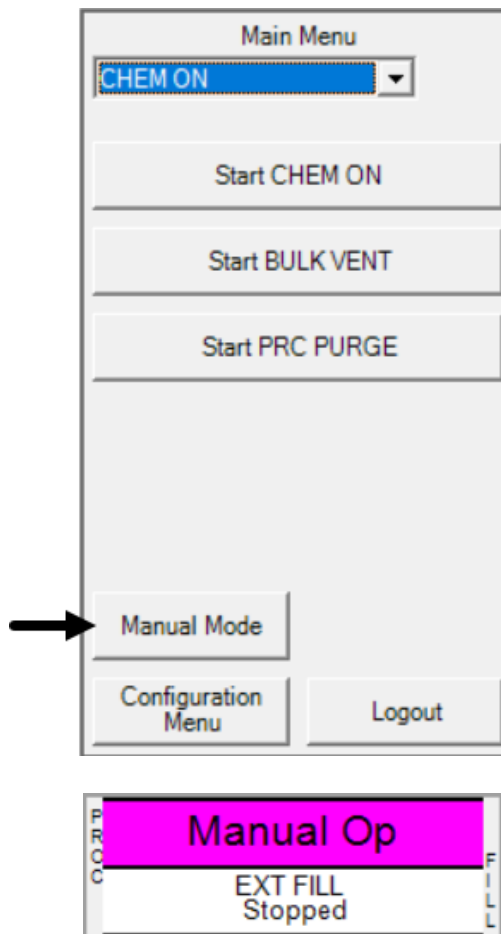
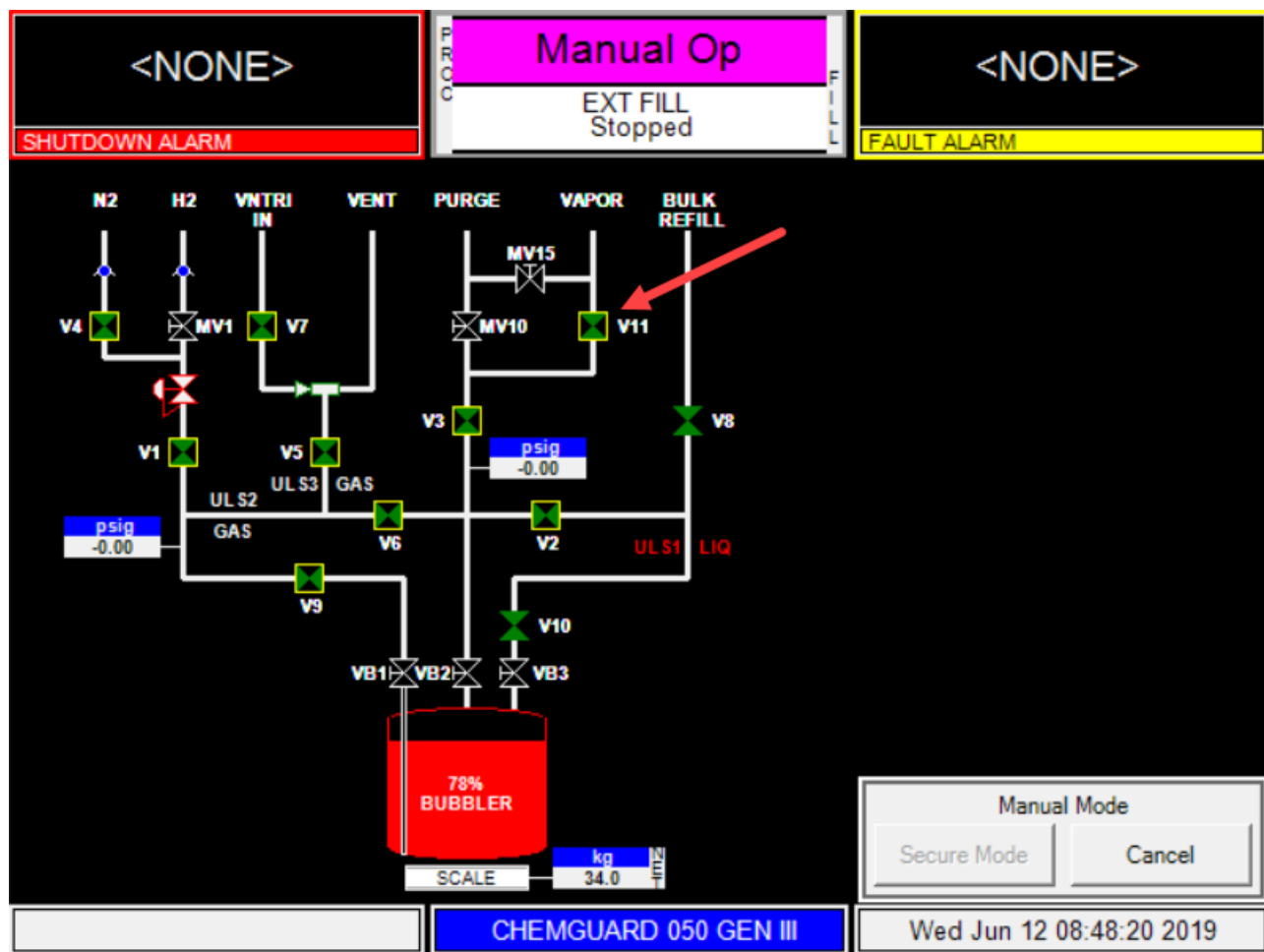


Figure 6-7: Manual Mode Display Screen



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

6.3.7 External Fill Main Menu

External Fill operation allows the Bubbler to be refilled from an external source, i.e. BCD200, CG010 or CG310. An external refill line connects to a dip tube valve on the 38 Liter Bubbler, allowing connection of an external refill line, refer to Figure 6-9.

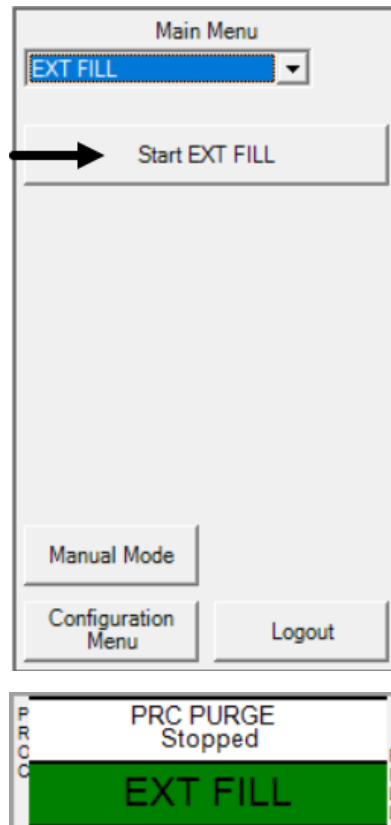
From the pull-down menu of the Main Menu, select EXT FILL to gain access to this operation.

To start external fill operation:

- Select EXT FILL from the pull-down menu of Main Menu and click **Start EXT FILL**. Then when the external refill system provides the X-FILL ON signal and the liquid level is below Bubbler Start Level the CG050 will be placed in an external refill mode
- EXT FILL requires an X-FILL ON input signal on Digital Input 38
If X-FILL ON input not present a display prompt “Waiting On X_Fill Signal” will be displayed

WAITING ON
X_FILL SIGNAL

- Once Start EXT FILL is selected, Stop EXT FILL will be displayed. The Controller status box will display EXT FILL, in green
- The Selection of **Stop EXT FILL** will allow the operator to stop external fill from the external refill system



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

- The X-FILL ON input signal is present at DI38, T1 pins 3 and 4 on the Tool IO board, AP1614
- Liquid level in the Bubbler falls below the BUBLR START LEVEL set-point defined in User Setpoints of Configuration Menu, as shown below

Note, Once liquid level in the Bubbler reaches the BUBLR STOP LEVEL set-point External fill will end and go back to the enable mode until liquid level again drops below the BUBLR START LEVEL set-point

- There are no shutdown alarms that prohibit external fill operation

User Setpoints

Analog Input:
Bulk Scale

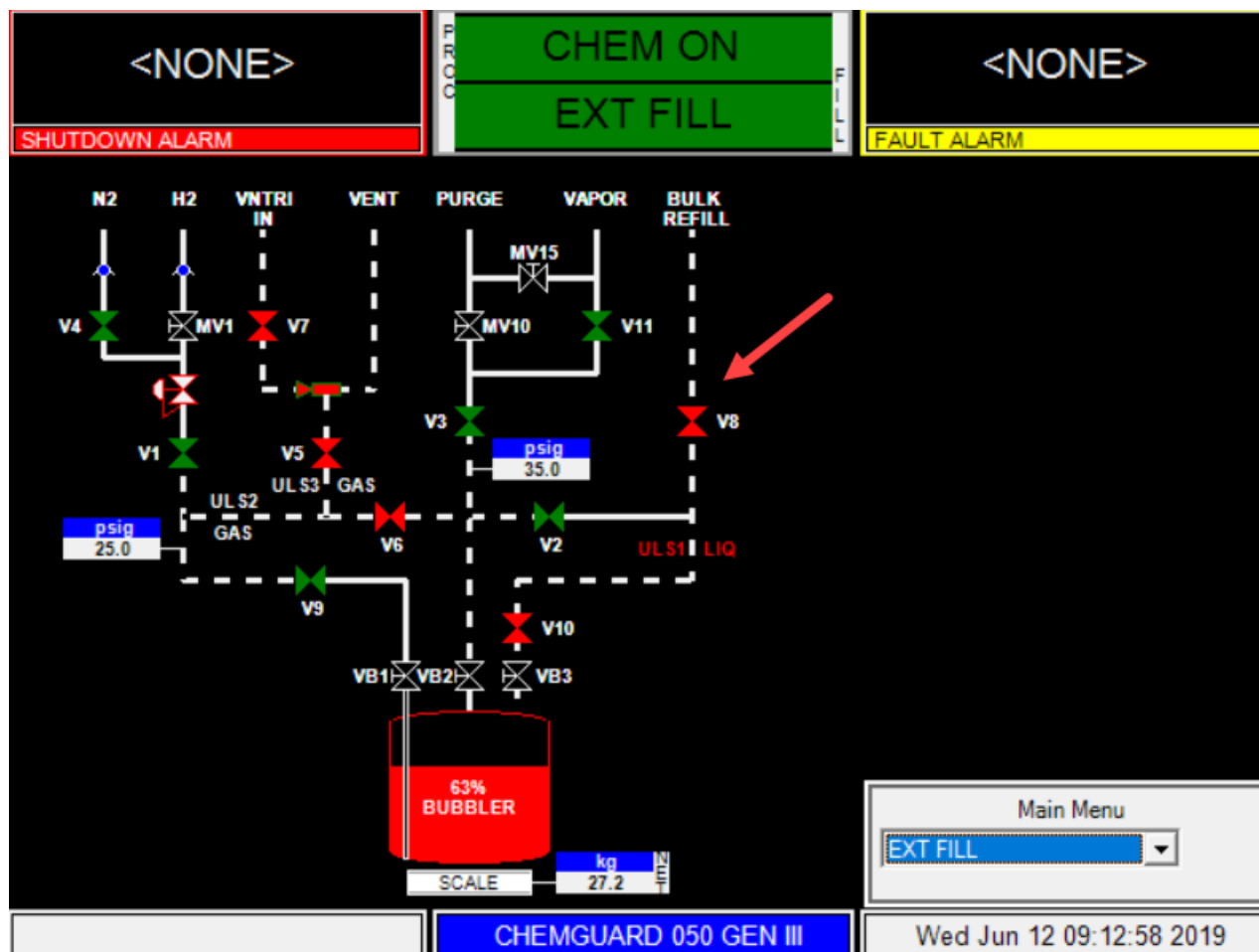
User Setpoints:

Num	Alarm Label	Setpoint	Percent	Type
1	BULK RES OVERFULL	36.9	85	User
2	BULK RES LOW	17.4	40	User
3	BULK RES EMPTY	13.0	30	User
4	BUBLR STOP LEVEL	30.4	70	User
5	BUBLR START LEVEL	28.2	65	User
6	AI #2 Alarm 6	0.00	0	Fixed
7	AI #2 Alarm 7	0.00	0	Fixed
8	AI #2 Alarm 8	0.00	0	Fixed

Setpoint: 0.06 Setpoint Percent: 30

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

Figure 6-8: 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® CG050 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 the available IO connections in controller.

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.

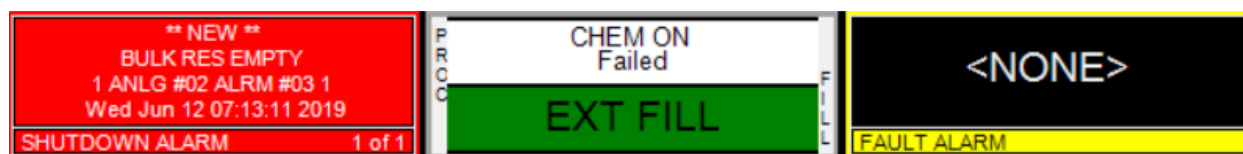
If multiple alarms are present, alarms will scroll in the alarm box with an index and number of alarms present in the cabinet at that time. The CG050 can be configured so that, when the power at the CG050 is powered off, all alarms are activated at the I/O, which in turn, alerts the process tool of a loss of power on the CG050.

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 state. In addition, alarm text message will be displayed, shutdown alarm LED will flash, and relay output is sent to the IO connections so that signal can be sent to the process tool.

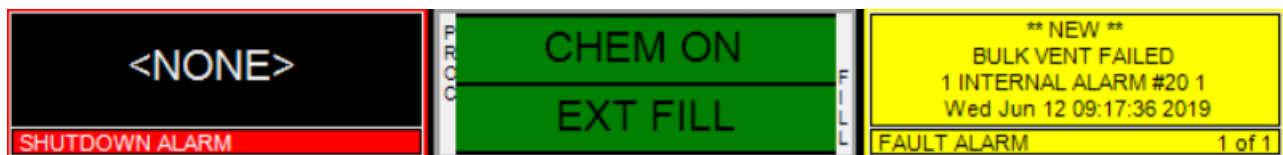
Figure 6-9: Shutdown Alarm Displayed



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 the IO connections so that signal can be sent to the process tool.

Figure 6-10: 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 6-12.

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 6-13

Figure 6-11: Accessing Alarm History Menu

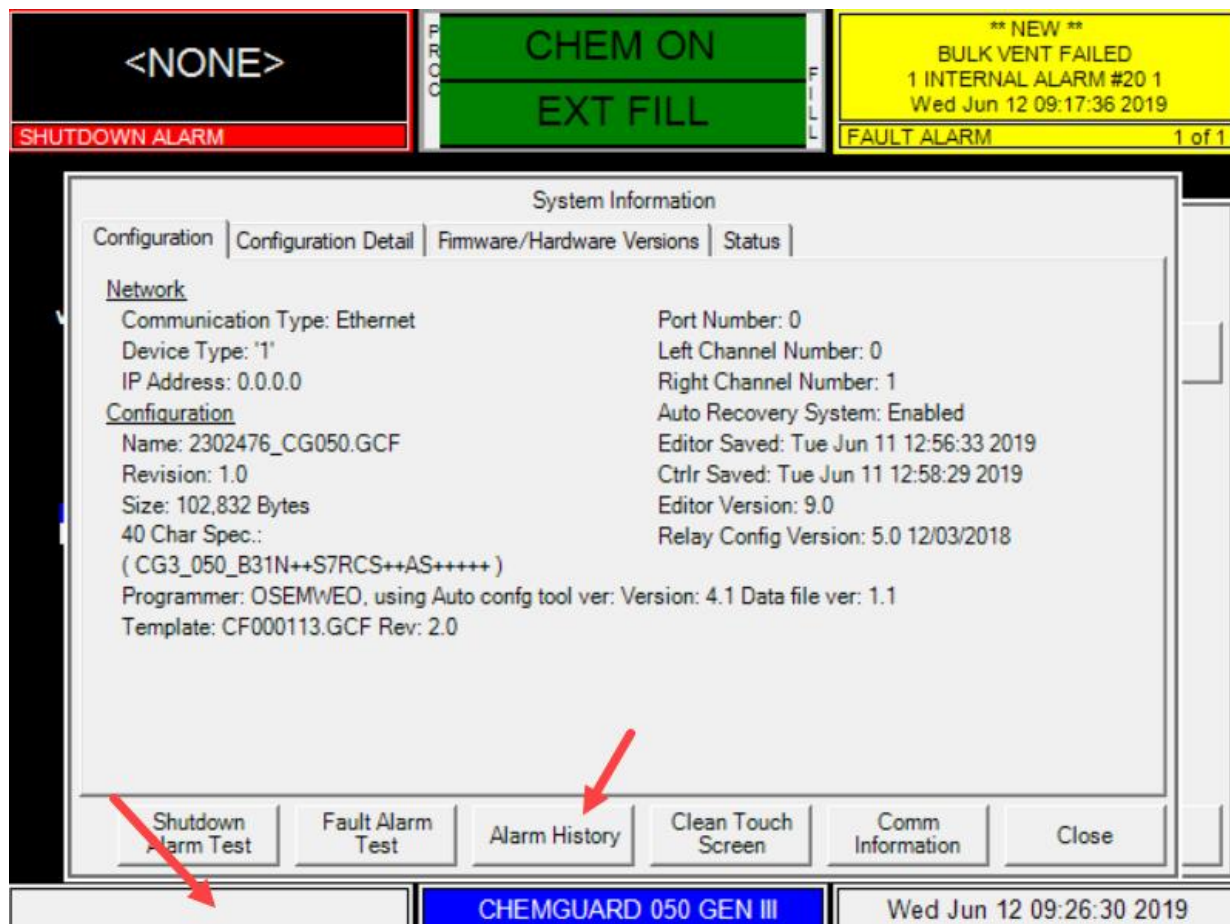


Figure 6-12: Accessing Alarm History Menu

<NONE>

SHUTDOWN ALARM

CHEM ON

EXT FILL

** NEW **

BULK VENT FAILED

1 INTERNAL ALARM #20 1

Wed Jun 12 09:17:36 2019

FAULT ALARM 1 of 1

Alarm History

Sort By: ☒ Date/Time ☐ Shutdown Alarm ☐ Fault Alarm

Date/Time	Type	Description
06/12/2019 09:17:36	Fault	BULK VENT FAILED, INTRNL ALRM 20, LINE 1
06/12/2019 08:53:10	Reset	Alarm(s) Reset by Local User
06/12/2019 08:53:09	Ack	Alarm(s) Acknowledged by Local User
06/12/2019 08:50:36	Fault	INGORED: V AND VLR 2, 8, INTRNL ALRM 15, LINE 2
06/12/2019 08:50:33	Reset	Alarm(s) Reset by Local User
06/12/2019 08:50:33	Ack	Alarm(s) Acknowledged by Local User
06/12/2019 08:50:28	Fault	INGORED: V AND VLR 2, 8, INTRNL ALRM 15, LINE 2
06/12/2019 08:50:25	Reset	Alarm(s) Reset by Local User
06/12/2019 08:50:25	Ack	Alarm(s) Acknowledged by Local User
06/12/2019 08:50:23	Fault	INGORED: V AND VLR 2, 8, INTRNL ALRM 15, LINE 2
06/12/2019 08:27:35	Reset	Alarm(s) Reset by Local User
06/12/2019 08:27:35	Ack	Alarm(s) Acknowledged by Local User
06/12/2019 08:27:21	Fault	LOW PUSH PRESSURE, ANLG 4-1, LINE 1
06/12/2019 07:18:36	Reset	Alarm(s) Reset by Local User

Clear All History
Export
More Options
Alarm Detail
Refresh
Cancel

CHEMGUARD 050 GEN III

Wed Jun 12 09:24:16 2019

Chapter 7

Maintenance and Calibration Procedures

Section 1 Introduction

Section 2 Calibration and Testing

NOTE: Maintenance personnel shall make use of a step stool or small ladder to safely access the ChemGuard® CG050 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® CG050 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.

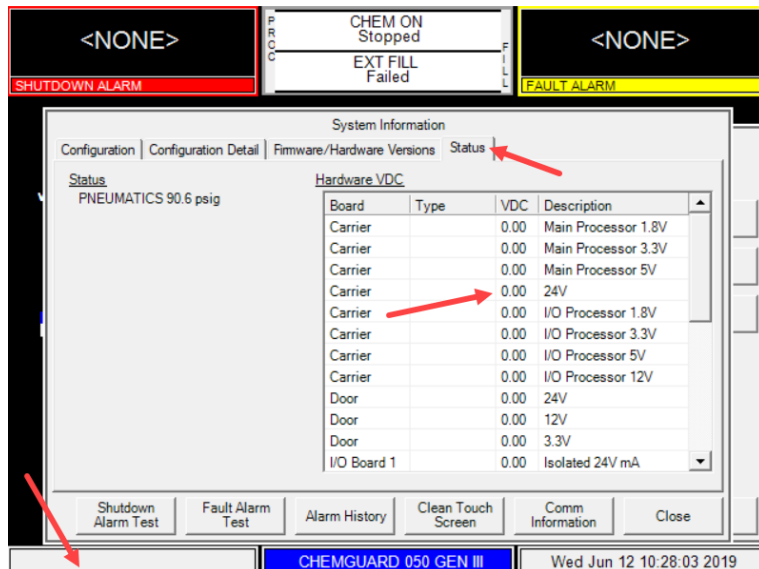
Only qualified personnel trained on the Operation and Maintenance of the ChemGuard® CG050 GEN III should attempt to perform maintenance and calibration of the System.

Table 7-1: Inspections Schedule

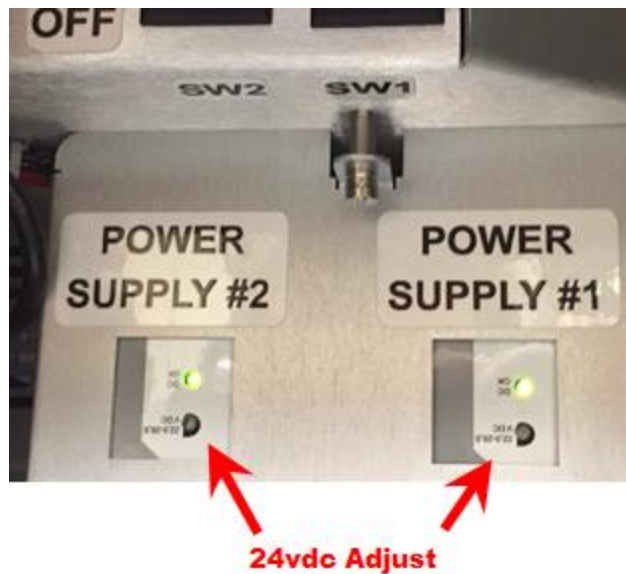
Periodic Inspection	Frequency
Power Supply Verification	12 Months
Bubbler Scale Verify/Calibration	24 Months or When replaced
Sump Spill Sensor Verification	24 Months
R1 and R2 Regulator Verification – refer to chapter 3, section 3-12	12 Months
PT1 and PT2 Verification – refer to chapter 3, section 3-12	12 Months
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 \pm .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 Bubbler scale. Once the 38 Liter Bubbler is installed and the scale calibrated, re-calibration is not required unless the scale or Bubbler is replaced.

Bubbler Scale:

Perform Bubbler Scale calibration when replacing the scale or 38 Liter Bubbler

1. Once 38 Liter Bubbler is removed step to the Net Product menu -> Bulk Scale in the Configuration Menu

1. Enter 0 for Current Liquid Weight

The screenshot shows a configuration menu for a 'Bulk Scale'. At the top, 'Net Product' is indicated with a red arrow. The menu displays the following fields and values:

- Device: Bulk Scale (dropdown menu)
- Gross Wgt: 79.2
- Net Liquid Wgt: 43.4
- Current Liquid Wgt: 0 (input field with a red arrow pointing to it)

On the right side, there is a numeric keypad with buttons for digits 0-9, a decimal point, and a minus sign. Below the keypad are buttons for 'Backspace', 'OK', 'Cancel', and 'Apply'.

2. Step to Configuration Menu and then select System Test and then TEST ANALOG IN
4. Adjust the zero pot (left side) on front edge of scale as required so the current reads 4.0 mA \pm 0.01mA on the TEST ANALOG IN display, Label – Bulk Scale. The reading should be at 0 kg, refer to figure 7-1

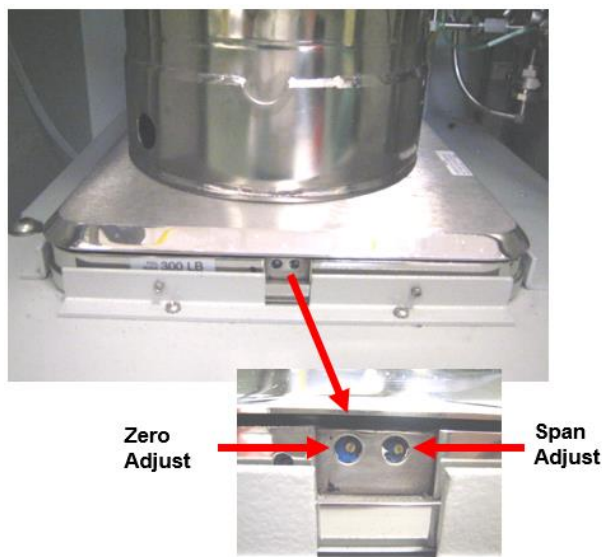
Figure 7-1: Bulk Scale Analog Reading

Input	Label	Net	Gross	Raw	Hardwire	Connection Point
1	Analog 1				N/A	IF Box - A1
2	Bulk Scale		0.00 kg	4.00 mA	N/A	IF Box - A2
3	Analog 3				N/A	IF Box - A3
4	PT1		-0.00 psig	6.36 mA	N/A	IF Box - A4
5	Analog 5				N/A	IF Box - A5
6	PT2		25.0 psig	10.4 mA	N/A	IF Box - A6
7	Analog 7				N/A	IF Box - A7
8	Analog 8				N/A	IF Box - A8
9	Analog 9				N/A	Tool - TB12 - 1,2,3
10	Analog 10				N/A	Tool - TB1,CN5
11	Analog 11				N/A	Tool - TB2,CN6
12	Analog 12				N/A	Tool - TB3,CN7
13	Analog 13				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

- Place calibrated weight(s) on scale surface and verify the weight reading against the actual gram value of the calibrated weight
Note, if calibrated weight not available use the empty 38 Liter Bubbler that will be installed, reference 11.5 kg.
- Adjust the span (right side) pot on front edge of scale as required so the weight is within ± 0.05 kg of the actual calibrated weight
- Remove weight(s) and verify zero, 4.00 mA, ± 0.02 . Adjust the zero pot (left side) on front edge of scale as required so NET weight is within 4.00 mA, ± 0.02
- Repeat until no adjustment is required and measurements are within specifications

Figure 7-2: Bubbler Scale Zero and Span Adjust



7.2.3 Sump Dual Spill Sensors Verification

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

The CG050 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.

During the Dual Float Sensors verification, the CG050 should be in an idle condition as a Bubbler shutdown will occur and stop delivering the vapor mixture to the process tool.

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 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 2 Ultrasonic sensors mounted at their respective locations and note the mounting location for each, refer to Figures 7-3, 7-4 and 7-5
 - Res Overfull – Yellow – Vent Line, Above V4 – ULS2
 - Liquid in Vac Line – Black – Vacuum Source, Above V7 – ULS3

NOTE: Bulk Empty Sensor, ULS1 mounted on the external refill line is not used
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: The sensors when removed will cause an additional Ultrasonic Failure alarm
4. Verify the Res Overfull sensor by entering Configuration Menu and then selecting SYSTEM TEST and then TEST DIGITAL IN
5. Find Input labeled RES OVERFULL, DI 13. The Input displayed will show the corresponding state of the input (closed or open). When the sensor is removed from the tubing, the status will change from closed to open
6. Reinstall the Res Overfull sensor and verify the status returns to the closed
7. Repeat for the Liquid In Vac Line sensor, DI 12.

Figure 7-3: Ultrasonic Sensor Test

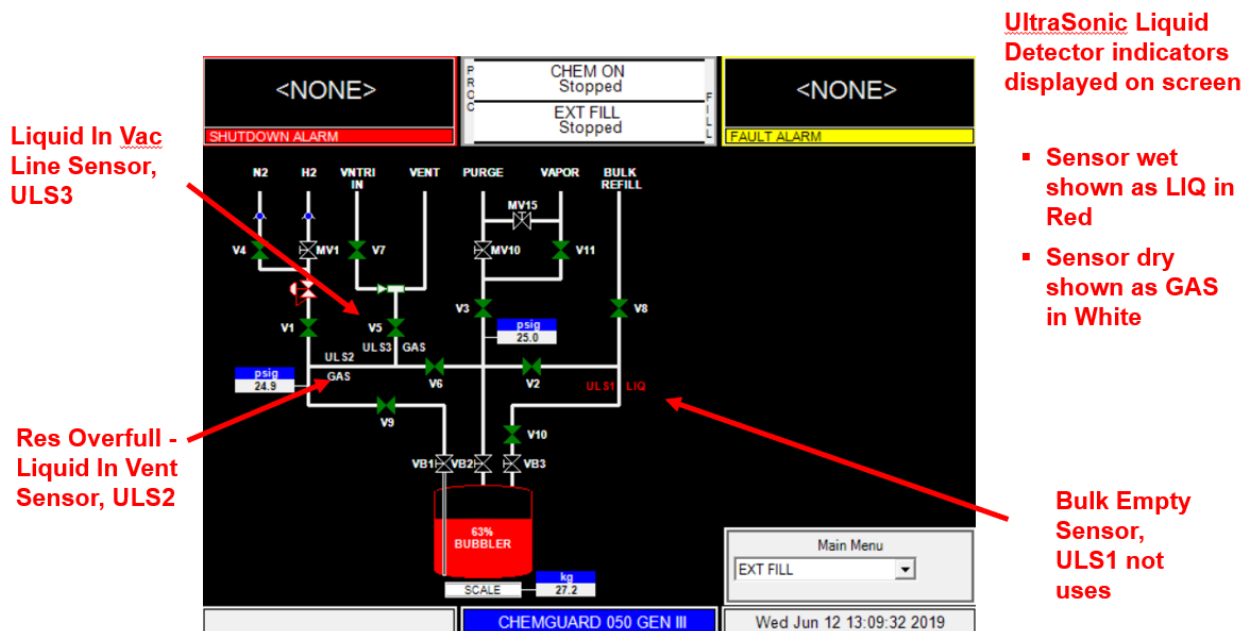


Figure 7-4: Ultrasonic Sensor Location, Res Overfull ULS2

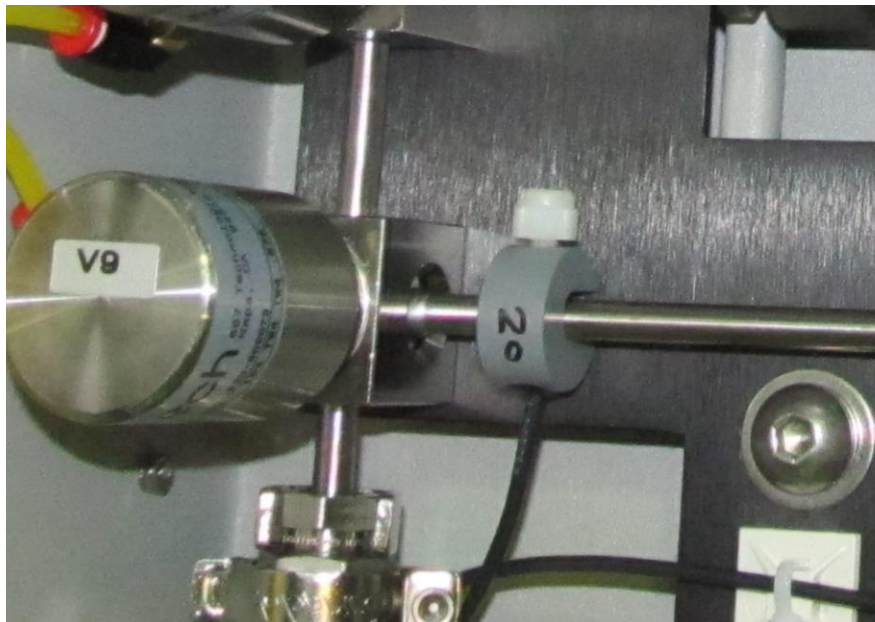
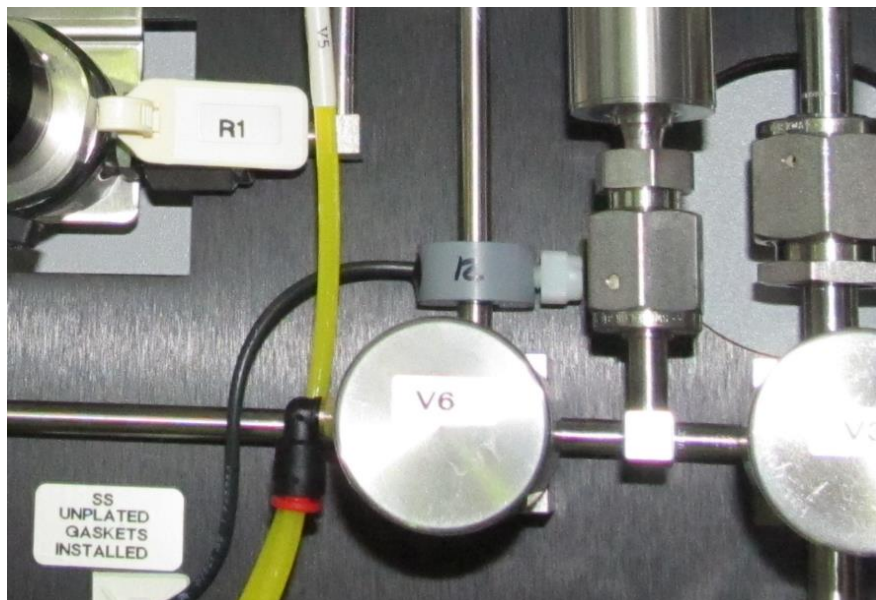
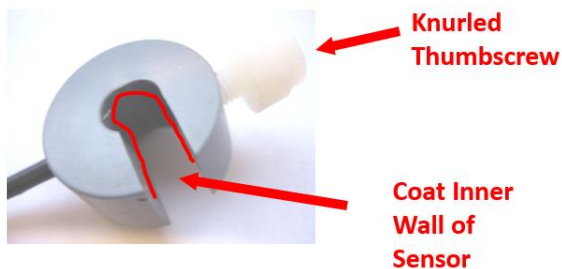


Figure 7-5: Ultrasonic Sensor Location, Liq In Vac Line, ULS3



7.2.5 Ultrasonic Clamp-On Sensor Maintenance

1. Turn off all operations (Chem On 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 any of the gel tape or vacuum grease from the stainless tubing. Make sure all sides of the tubing are clean
5. Clean the gel tape or vacuum grease from the inside ultrasonic sensor
6. Apply a pea size drop of vacuum grease to the inside of the sensor spread a thin coating (approximately 1-2 mm) of vacuum grease around inner wall of sensor



7. Ensuring only high temperature vacuum grease (Dow Corning) is used when mounting the sensors to their respective locations

**Dow Corning®
high-vacuum
silicone grease**



8. The sensor can be tightened with the knurled thumbscrew ¼ turn past finger tight. Do not over tighten knurled thumbscrew as this can crack and damage sensor
NOTE: If any sensor is damaged or not functioning the complete UltraSonic assembly must be replaced
9. If the alarm will not clear, move the sensor vertically (up or down) approximately ±0.5" on the stainless steel tubing to avoid being installed on rough surface. Retighten on a surface of the tubing that is free of all welds or bent surface
10. 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 vacuum grease should be replaced on the applicable sensor.

7.2.6 Sierra Vapor Detector Verification / Calibration (System Requirement)

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

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

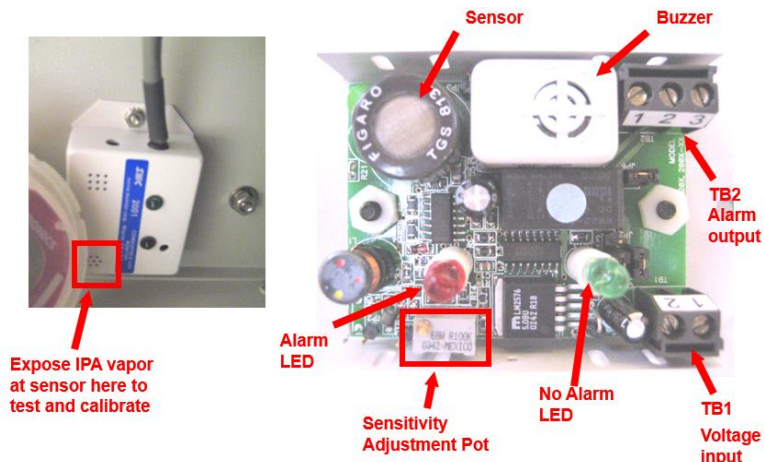
This vapor detector is a Sierra Monitor Corporation Gas Sensor Module, Model 2001-00, refer to Appendix F.

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



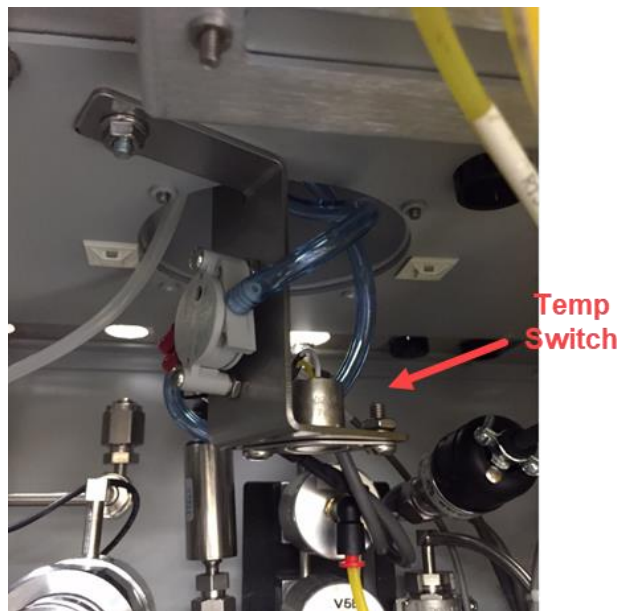
7.2.7 High Temperature Sensor Verification (System Option)

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.
Note, - Alarms when temp rises above 45-52°C
3. Remove the heat gun and wait until the temp sensor cools down.
4. Verify that the alarm message self-clears from display.

Figure 7-7: High Temp Sensor



7.2.8 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 ARS, Auto Restart

Addendum A

LPE 14 Liter Bubbler Change

Section 1	Safety Notes
Section 2	Removing and Replacing the Bubbler
Section 3	Change BULK Bubbler Operation

The change reservoir operation for a LPE 14 Liter Bubbler is an automated procedure that guides the operator through the steps required to change out the Bubbler.

NOTE: The Bubbler Change Bulk operation is not available for the 38L Bubbler option. The 38L Bubbler is not designed for routine removal. Should the 38L Bubbler require removal for maintenance purposes, contact your Versum Materials representative for instructions.



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 (SDS) 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 (SDS) 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 (SDS) 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.

1.1 Safety Notes

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

For precaution, 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 recommends that two (2) people perform the lifting.

NOTE: Use the strap(s) provided within the cabinet to tighten down and secure the Bubbler. **DO NOT** over tighten the Bubbler which can cause inaccurate scale reading and result in an under / overfull condition.

1.2 Removing and Replacing the Bubbler



WARNING

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

If pneumatic valves are used on the Bubbler, 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 Bubbler that has not been used and is empty

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Revision 0

06/25/2019

Chemical Equipment

- 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

2. Put on personal protective equipment.

1.3 Change BULK Bubbler Operation (not available for 38L Bubbler option)

Changing the Bubbler

This option guides the operator through steps to remove and replace 14 Liter LPE Bubbler. Change BLK operation must be performed any time to remove or install the Bubbler.

To start Change BLK operations:

- At Main Menu scroll to CHEM ON
- Select START CHANGE BLK button
- Confirm Sequence Start confirmation button will be displayed
- Select the Confirmation button to start Change Blk Operation

The screenshot shows a 'Main Menu' interface. At the top, there is a dropdown menu currently set to 'CHEM ON'. Below this are five buttons: 'Start CHEM ON', 'Start CHANGE BLK', 'Start BULK VENT', and 'Start PRC PURGE'. At the bottom of the menu are three buttons: 'Manual Mode', 'Configuration Menu', and 'Logout'. Below the main menu, a separate confirmation dialog is shown with the title 'Confirm Sequence Start' and two buttons: 'Confirm' and 'Cancel'.

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

- CHEM ON or External Fill is enabled
- The Vacuum Venturi is not turned on
- A Shutdown alarm is activated

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

- Operator terminates operation by selecting STOP CHANGE BLK from the CHEM ON menu
 - A shutdown alarm occurs
3. **NOTE: If a shutdown alarm occurs, all automatic operations are terminated. For any reason if Change Bubbler operation is terminated before its completion, the operator must restart the Change Bubbler operation to prevent exposure to chemical if not yet purged from pigtails.**

Start Change BLK

1. When tapping on the main screen, the “Password” window is displayed. Enter a valid password, level 2 or level 3 and click on “OK”.
 2. Select “CHEM ON” from the pull-down menu. If CHEM.ON or EXTERNAL FILL is enabled, select Stop CHEM ON and Stop EXT Fill operations.
 3. Select START CHANGE BLK to start the Bubbler change operation.
1. **NOTE:** At any time, the operation can be terminated by selecting STOP CHANGE BLK from the Main Menu. If the Bubbler change operation is stopped before its completion, it must be restarted and run thru completion before any of the other operations can be started, CHEM ON and External Fill.
4. First a supply pressure test and Venturi Vacuum test will be performed followed by an operator prompt to close the inlet valve of the Bubbler, VB1.
 5. Next a LINE CLEAR function is performed to pushing liquid chemical back into the Bubbler from the external refill line.
 6. The operator is then prompted to close the outlet valve and refill valve, VB2 and VB3 on the Bubbler, open the purge crossover valve, VB4 on the bubbler and close the H2 supply valve, MV1 on the main manifold.
 7. The system performs a series of Venturi vacuum purge cycles to ensure chemical is removed from the pigtail lines and valve connections.
 8. After completion of the purge cycles a Leak Check, Vacuum Rate of Rise test is performed. Once leak check passes the operator is prompted to close VB4 purge crossover valve.

9. The operator is now prompted to remove and replace the Bubbler. **DO NOT** press OK until the Bubbler is replaced.
10. Isolate the coolant system by closing the valves on the coolant lines.
11. Disconnect the coolant lines from the current Bubbler. Note there may be a small amount of coolant at disconnect, be prepared to use towel to dry.
12. Cap or plug any coolant ports.
13. Disconnect the VCR valve connections on top of the Bubbler.
14. Remove empty Bubbler.
15. Install new Bubbler and reconnect VCR fittings.
16. Connect the coolant lines to the new Bubbler.
17. The system will perform an automatic pressure decay leak test check.
18. Next post Venturi vacuum purge cycles will be performed followed by a Leak Check, Vacuum Rate of Rise test.
19. The operator is next prompted to open the valves closed in step 6.
20. The operator is then prompted to enter the chemical net liquid weight and current weight. Enter 15.4 for the 14 liter LPE bubbler. Then enter 0 for the current liquid weight, then select OK.

Net Product

Device: Bulk Scale
Gross Wgt: 6.79
Net Liquid Wgt: 15.4
Current Liquid Wgt: 0

7 8 9
4 5 6
1 2 3
. 0 -
Backspace
OK

21. Controller status box in Bulk section will display CHANGE BLK Completed.
22. The Change Bubbler operation is now complete.

Bubbler 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 ne soit
extrait.

Table 4-1: Bubbler Change Diagnostics

The following are errors that could occur during the Change Bubbler Operation:

ERROR	POSSIBLE CAUSES	REMEDY
Base Vac Timeout	Vacuum Venturi failure Loose VCR connection	Check N2 pressure Replace gaskets and re-tighten fittings
Leak Check Failure	Loose VCR fitting Failed valve	Replace gaskets and re-tighten fitting Replace container
Low Push Pres Blk High Push Pres Blk Bulk Vent Failed	Supply gas source problem Push Pressure Transducer fail	Check supply gas sources Adjust regulators Check Transducers