VERSUM MATERIALS

Installation / Operation / Maintenance Manual

GenIII 1000/2000

Chemical Equipment

Manual Part Number: 474102

Edition: Rev-4

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Chapter

Introduction ChemGuard GenIII 1000/2000

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Section 2	**Definition of Terms**
Section 3	**Safety Information**
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I.1 Introduction to the Manual

This manual covers the Versum Materials, Inc. ChemGuard™ CG1000-2000 Chemical Refill System.

This manual contains all the required information to install, operate and maintain the ChemGuard® cabinet. The information contained in this document should be read in its entirety to ensure safe operation and proper maintenance of this new offering of the ChemGuard® product line.

For the purpose of clarity, Versum Materials, Inc. is a brand of Versum Materials, Inc. "Versum Materials, Inc." will be used interchangeably with the Versum Materials, Inc. brand name throughout this manual.

Inspect all shipping containers that are delivered with your shipment to verify that all parts are available and to acquaint yourself with the system components.

This manual is written for personnel experienced in the analysis, troubleshooting, and maintenance of automated chemical delivery systems.

The manual contains the basic information needed to get the system unpacked, installed and operating. Individual chapters contain specialized information, such as the theory of operation, additional operations available, and diagnostics.

I.2 Definition of Terms

There is no industry-standard term for the source container used within each type of process tool to provide chemical directly to the process. The terms ampoule, bubbler, source container, and others are all used interchangeably in industry. To reduce confusion, in this manual the term Bubbler is used to identify the Versum Materials, Inc. quartz container (Teflon™ systems) or the stainless steel source container (stainless steel systems).

There are three (3) types of notes used in this manual. They are NOTE, CAUTION, and WARNING. For purposes of this manual, they are defined as:

NOTE

This is an example of a NOTE. A NOTE notifies the reader of an item that warrants special attention.

CAUTION

CAUTION: This is an example of a CAUTION. A CAUTION notifies the reader that a procedure must be performed as prescribed, or that a specific set of conditions must be maintained or avoided, in order to avert damage to equipment or the operating environment.

VORSICHT: Dieses VORSICHTS-Gebot dient als Beispiel. Ein VORSICHTS-Gebot weist den Leser darauf hin, daß ein Verfahren nach den gegebenen Vorschriften durchgeführt oder bestimmte Voraussetzungen erfüllt bzw. vermieden werden müssen, um eine Schädigung der Anlage oder der Arbeitsumgebung zu verhindern.

ATTENTION: Voici un exemple d'un ATTENTION à suivre. Un ATTENTION avertit le lecteur qu'un procédé doit être accompli selon les consignes prescrites ou qu'une série de conditions spécifiques doivent être maintenues ou evitées afin d'empêcher tout dégât à l'équipement ou à la zone d'opération.

WARNING

WARNING: This is an example of a WARNING. A WARNING notifies the reader that a procedure must be performed as prescribed, or that a specific set of conditions must be maintained or avoided, in order to avoid injury or death to personnel.

WARNUNG: Diese WARNUNG dient als Beispiel. Eine WARNUNG weist den Leser darauf hin, daß ein Verfahren nach den gegebenen Vorschriften durchgeführt oder bestimmte Voraussetzungen erfüllt bzw. vermieden werden müssen, um das Personal vor Körper- oder tödlichen Verletzungen zu schützen.

AVERTISSEMENT: Voici un exemple d'une "AVERTISSEMENT" à suivre. Une avertit le lecteur qu'un procédé doit être accompli selon les consignes prescrites ou qu'une série de conditions spécifiques doivent être maintenues ou évitées afin d' empêcher toute cause de blessure ou de décès du personnel.

Abbreviations

A	Amperes
AC	Alternating Current
AIC	Ampere Interrupt Capacity
CFM	Cubic Feet per Minute
CG1000-2000	ChemGuard® CG1000-2000
CGLVLCAP	Capacitive Level Probe
CGRVM	ChemGuard® Refill Valve Manifold
CGSCE	ChemGuard® Source Control Electronics
CGSCM	ChemGuard® Source Controller Module
CGVMB5	5X Valve Manifold Box
DC	Direct Current
EMO	Emergency Manual Off
ERR	Error
gr.	Gram
He	Helium
I.D.	Inner Diameter
ID	Identification
in.	Inch
kPa	KiloPascal, absolute pressure
lb.	Pound
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
LPM	Liters per minute
mA	Milli Amperes
mL	Milliliter
mm	Millimeter(s)
N2	Nitrogen
NC	Normally closed
NO	Normally open

O.D.	Outer Diameter
P/N	Part Number
POCl3	Phosphorus Oxychloride
psia	pounds per square inch, absolute pressure
psig	pounds per square inch, gauge pressure
PWR	Power
RAM	Random Access Memory
SRC	Source
POCl3	Phosphorus Oxychloride
TRANS-LC	Trans-1, 2-Dichloroethylene
UPS	Uninterrupted Power Supply
VAC	Volts, Alternating Current
VDC	Volts, Direct Current

I.3 Safety Information

WARNING

USE ONLY VERSUM MATERIALS, INC. APPROVED COMPONENTS INCLUDING CONTAINERS.

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 Material-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.

The chemicals that are qualified to be introduced into the ChemGuard® cabinet are flammable. Refer to the SDS of the chemical in use for their specific characteristics and hazards.

For risk reduction procedures relating to the chemical used in the system, all personnel shall read the corresponding SDS.

All personnel shall be aware of the associated hazards of the ChemGuard® cabinet.

All personnel operating and/or performing maintenance on the ChemGuard® cabinet shall be appropriately trained for their specific duties.

Versum Materials, Inc. cannot assume liability for any chemicals used in the ChemGuard® cabinet from another chemical supplier.

Do not exceed the pressure and temperature requirements of the ChemGuard® cabinet. All system requirements are outlined in Chapter 2.

NOTE

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

NOTE

When working with CG1000-2000 models with no glass in the cabinet door always don appropriate PPE before opening the cabinet door.

WARNING

The Chemicals are highly flammable. Keep away from heat and sources of ignition. Sparks may ignite liquid and vapor. Failure to heed this warning will result in product contamination, personnel injury or death.

NOTE

If necessary, maintenance personnel shall make use of a step stool or small ladder to safely access the controller. Operating personnel shall make use of a step stool to reach the Touch screen monitor as required.

I.4 Chemicals Authorized for use in the CG1000-2000

This version of the CG1000-2000 manual is intended for using Phosphorus Oxychloride (POCl3) and Trans-1, 2-Dichloroethylene (Trans LC). Consult with Versum Materials, Inc. for other chemicals.

I.5 Chemical Handling

Avoid contact with all chemicals and the associated vapors.

WARNING

RISK OF SERIOUS INJURY OR EVEN DEATH FROM CHEMICAL INHALATION

I.6 Tag and Lockout Routine

Wear the appropriate PPE for the chemical type and job.

Use secondary containment when transporting chemical containers.

The chemicals that are qualified to be introduced into the cabinet are flammable. Refer to the SDS of the chemical in use for their specific characteristics and hazards.

When performing certain maintenance procedures described in this manual, electrical power to the cabinet 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.

All potential energies (Pressurized N_2, Clean Dry Air, etc.) shall be secured and safeguarded in the case of accidental release.

I.7 Power loss and Accidental Release

In the case of equipment power loss, all valves will revert to a safe non-energized state. All operations will stop. The system(s) should not be re-started until the cause of the power loss is identified and rectified. The CG1000-2000 cabinet will power up in (IDLE) state, any shutdown or fault alarms will be displayed on the touch screen if they are existing.

An uncontrolled chemical release will be contained in the CG1000-2000 cabinet, the CGVMB, or the CGSCM if the correct installation requirements are met. Double contained chemical lines are necessary to contain chemical outside of the three aforementioned sub-systems.

If an emergency condition exists that warrants shutting down the CG1000-2000 cabinet. Depress the emergency manual off (EMO) button on the front of each controller. This action will remove the 24 VDC to the solenoids, putting all valves in a safe non-energized state. The power to the controllers will remain on and the local operator interface (LOI) will display the current system status.

Anytime there is possible chemical exposure appropriate PPE must be used.

Contact Versum Materials, Inc. EH&S department for information on chemical spill containment, PPE and material compatibility.

I.8 Interior Leak of CG1000-2000

Any chemical release within the CG1000-2000 cabinet will be fully contained by a fill sump rated to 110% of the total chemical volume.

Activation of the float spill sensor will occur when less than 1% of the chemical is detected on the system floor. This will in turn activate the life safety interlocks venting excess container pressure and putting all valves in their normally safe state.

I.9 Interior Leak of CGVMB (Valve Manifold Box)

Any chemical release into the CGVMB module will trigger a float sensor and close the upstream valve feeding the manifold. In addition, the cabinet will alarm for detection on the external fill sensor. Downstream valves associated with the CGVMB will also close.

I.10 Chemical Release Detected at the CGSCM (Source Controller Module)

Any chemical release at the CGSCM will trigger a float sensor and close the upstream valve of the CGVMB. The cabinet will annunciate an alarm for external spill detection.

NOTE

The customer must provide a spill containment tray capable of containing 110% of chemical volume to be used with the CGSCM. The containment tray must be made of a non-reactive material for the chemical used. Teflon™, Polypropylene, or High Density Polyethylene (HDPE) are the recommended materials.

On configurations where a CGVMB is not used and the CGSCM is plumbed directly to the cabinet, the liquid float sensor located at the CGSCM will detect a chemical spill; this signal will then be sent to the cabinet. The associated upstream chemical output valve at the cabinet will deactivate and the external spill alarm will annunciate.

I.11 Chemical Release external to the CG1000-2000

Chemical spills external to the CG1000-2000 shall be handled according to the guidelines set forth by the facility. Emergency response procedures should be tailored to the facilities particular needs.

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™ systems. 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 the Versum Materials, Inc. Emergency Information Line. In the U.S. and Canada call (Toll-Free) at **866-624-7677**. If calling from outside the U.S., use **610-481-7711**. SDS for all Versum Materials, Inc. chemicals are available by contacting Versum Materials, Inc.

Chapter 1

Delivery and Inspection

Section 1 **Delivery**

Section 2 **Inspection**

1.1 Delivery

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

This shipment does not include empty Bulk reservoir container. Customer will need to order a Bulk container filled chemical.

The contents of the packing boxes are:

- ChemGuard® Gen III Cabinet
- Reservoir scale (optional)
- Shipping Identification Sheet (packing checklist)
- ChemGuard® Cabinet 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..

NOTE: In some versions of Versum Materials, Inc. product literature for chemical processing and delivery systems, the term “canister” is used in place of the term “container”.

NOTE: In some versions of Versum Materials, Inc. product literature for chemical processing and delivery systems, the terms “bubbler” or “ampoule” or “source” are used interchangeably.

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.
3. There is a 30 limit upon receipt of order for reporting missing or damaged items for warrantee replacement.

CAUTION

CAUTION: Ensure valves are clear of packing material before lifting.

VORSICHT: Vor dem Herausheben sicherstellen, daß die Ventile aus dem Verpackungsmaterial befreit wurden.

ATTENTION: S'assurer que les valves SOIENT dégagées du matériel d'emballage avant dénlever l'équipement.

WARNING

WARNING: Inspect the shipping container at all stages of unpacking for any indication of leaking chemical. If a chemical leak is suspected, STOP! DO NOT PROCEED. Notify your safety authority, follow your safety procedures, and notify Versum Materials, Inc. for disposal guidelines.

Metal has sharp edges when cut.

Sides of crate fall outward. Clear area of personnel to avoid injury.

WARNUNG: Den Versandbehälter zu verschiedenen Zeitpunkten während des Auspackens auf Anzeichen ausgelaufener Chemikalien untersuchen. Wird Leckage festgestellt, sofort STOPPEN! NICHT FORTFAHREN! Die zuständige Sicherheitsstelle benachrichtigen, die vorgeschriebenen Sicherheitsverfahren durchführen und Richtlinien zur Entsorgung bei Versum Materials, Inc. anfordern.

AVERTISSEMENT: Durant chaque étape du déballage du conteneur, contrôler qu'il n'y ait aucun signe de fuite chimique. Si une fuite chimique est suspectée, STOP! NE PAS CONTINUER! Le signaler à votre chef de sécurité. Suivre les procédés de sécurité et contacter Versum Materials, Inc. afin d'obtenir des informations concernant la disposition de ce matériel.

Une fois coupé, le métal a des côtés tranchants. Les côtés de la boîte tombent vers l'extérieur. Eloigner le personnel pour éviter tout dange.

Chapter 2

Site Preparation

Section 1 **Overview**

Section 2 **Facility Preparation**

Section 3 **Facility Requirements**

Section 4 **Tag and Lockout Routine**

Section 5 **Spill Cleanup Routine**

2.1 Overview

This chapter describes the space and clearances required to install ChemGuard® systems along with specifications for power, gas, vacuum, cabinet exhaust, reservoir vent and chemical delivery line. Before the ChemGuard® unit can be installed, the customer must prepare the location site as detailed in the following section to provide sufficient space and clearance around the unit. Ensure the AC power, vacuum and gas sources are available in close proximity to the unit. Please read the information in this chapter carefully to avoid problems later.

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

The information and data contained herein are proprietary to Versum Materials, Inc. and are not to be copied, reproduced, duplicated, or disclosed to others, in whole or in part, without prior written consent of Versum Materials, Inc. The information and data should be available only to those with a need to know. Versum Materials, Inc. makes no representation that the information and data is appropriate for the recipient, and each recipient needs to independently evaluate the appropriateness of the information and data for its use. This information and data were originally written in English.

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

2.2 Facility Preparation

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

- AC power source
- Vacuum supply
- Nitrogen and Helium gas supply

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.

2.2.1 Cabinet Dimensions

Table 2-1: CHEMGUARD® GenIII Standard Cabinet Dimensions

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

2.2.2 Bolt-Down and Ground Cabinet Requirements

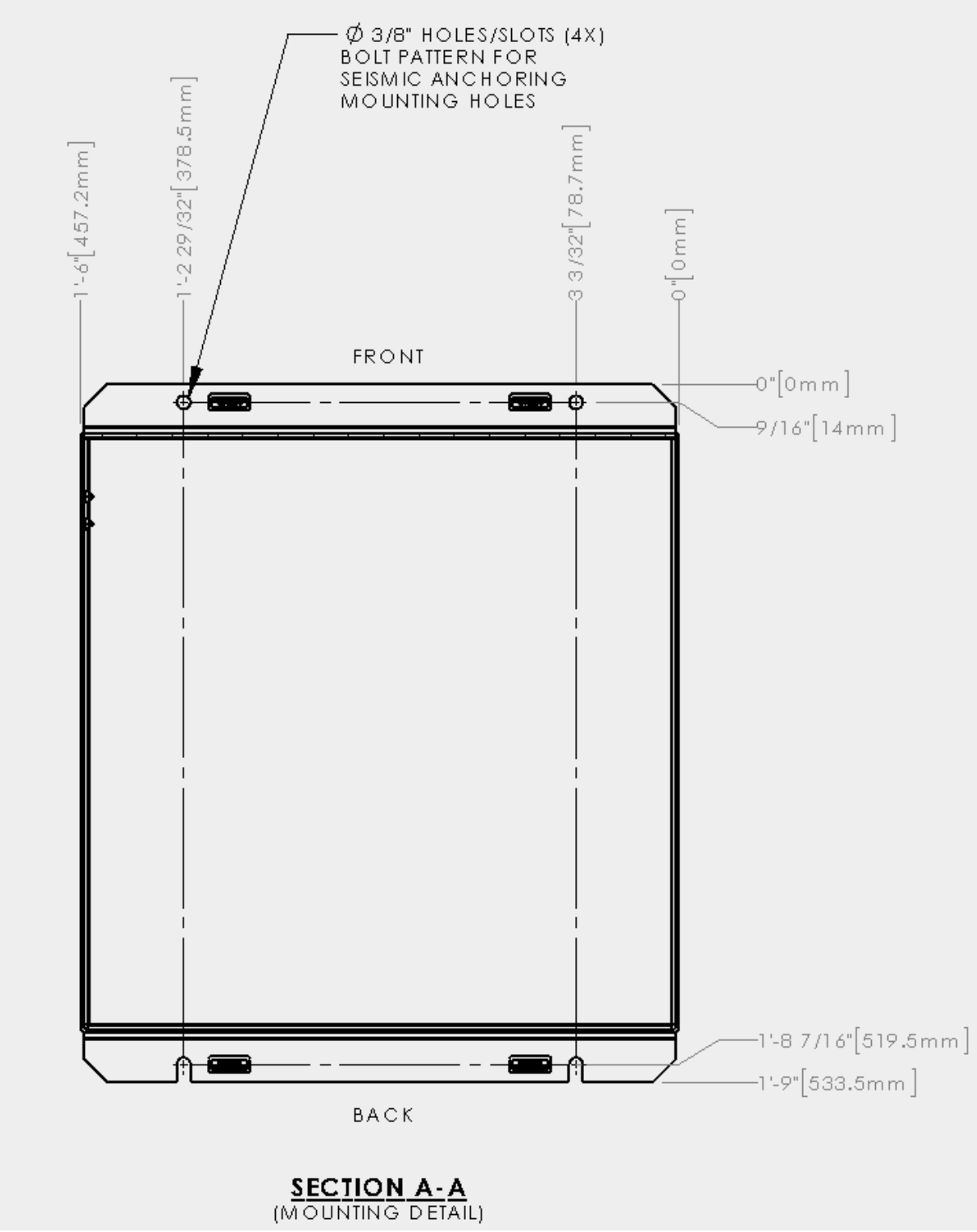
2.2.2.1 CHEMGUARD® GenIII Standard Cabinet Bolt-Down Pattern

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

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

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

Figure 2-1: CHEMGUARD® GenIII CG1000/2000 Cabinet Earthquake Bolt-Down Pattern



2.3 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	• Exhaust, Vent and PRV
• Electrical	• Chemical Delivery Line
• Coaxial Chemical Delivery Lines	• Supply gases
• Signals Input / Output Interface	• Outlet Manifold
• Life Safety Interface	• Signals Input / Output Interface

Figure 2-2: CHEMGUARD® GEN III CG1000/2000 Cabinet Connections, Top View

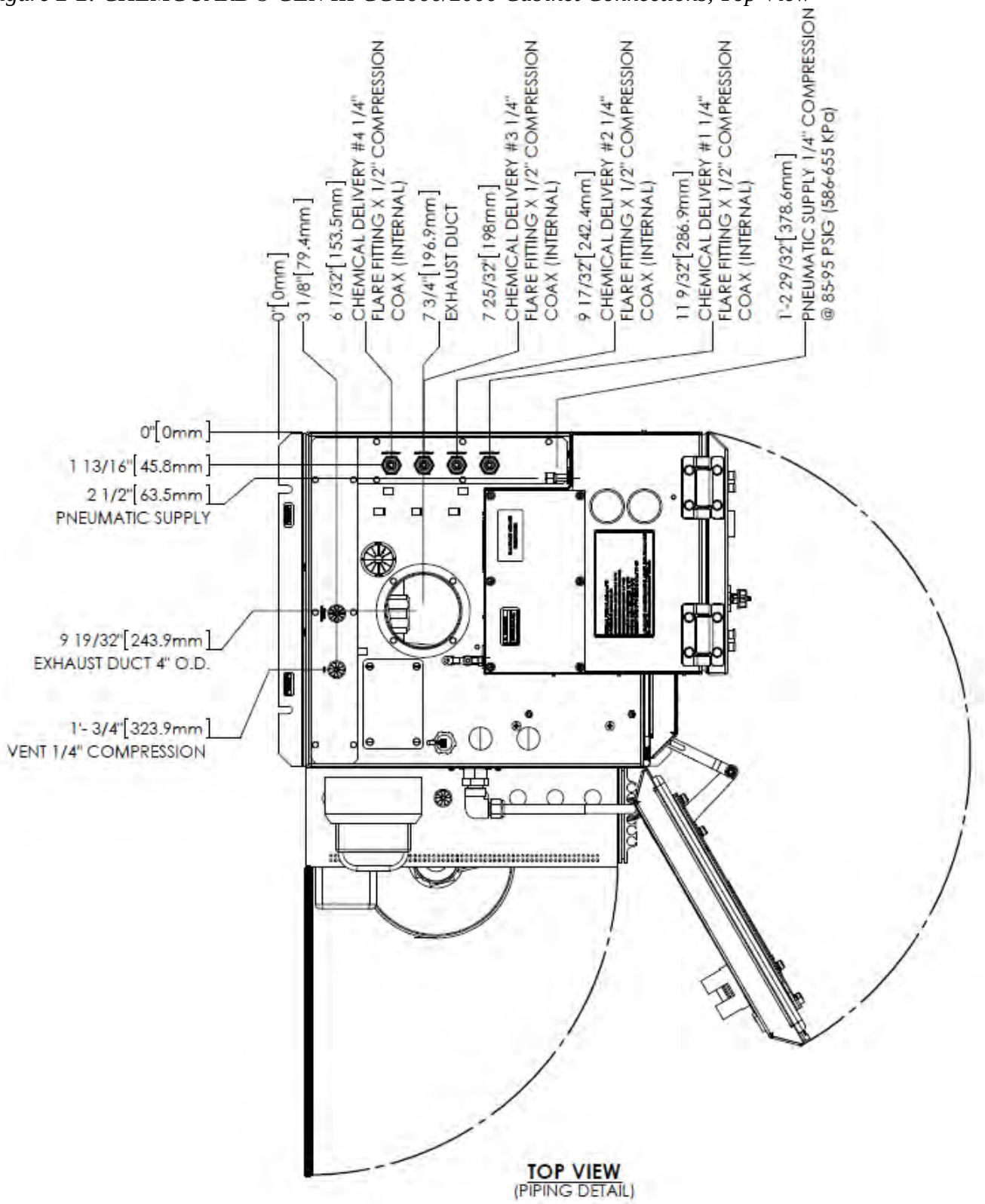


Figure 2-3: CHEMGUARD® GEN III CG1000/2000 Cabinet Connections, Front View

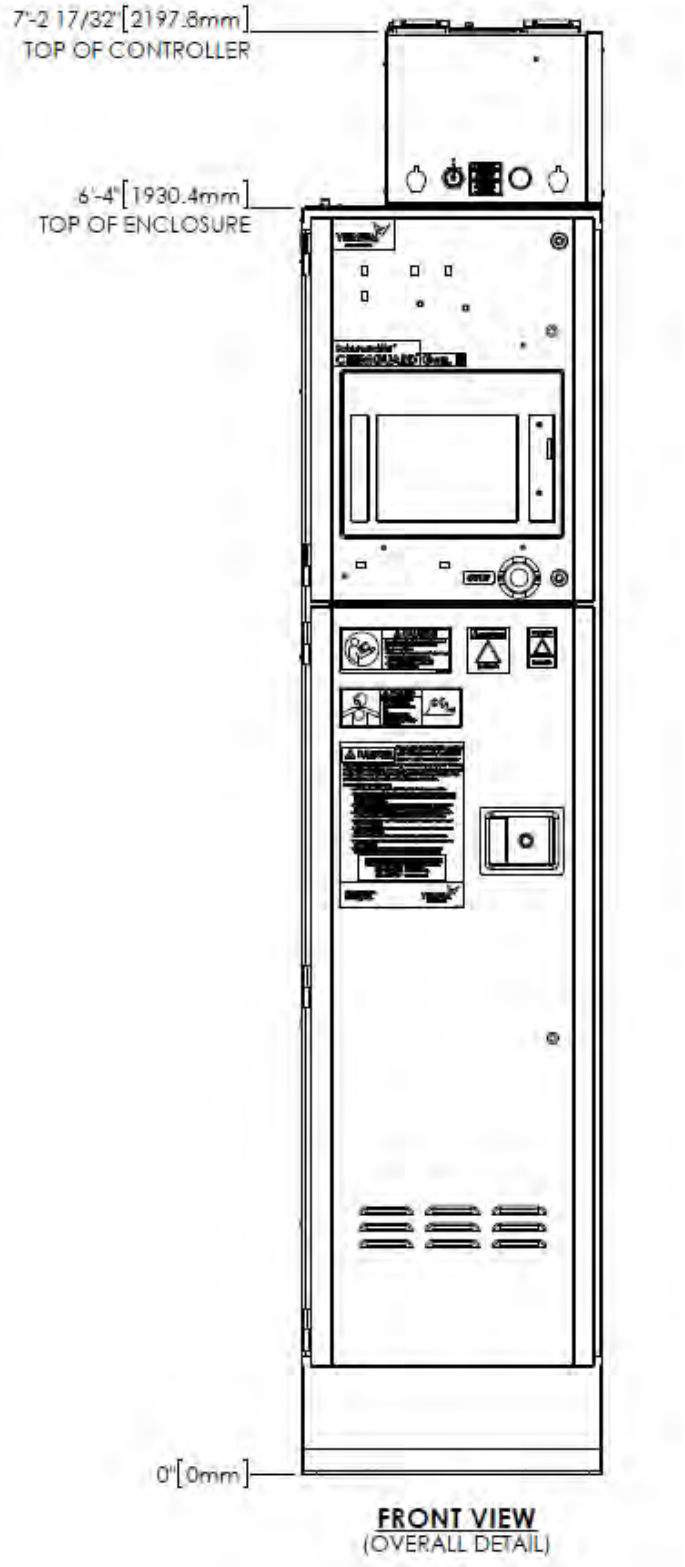


Figure 2-4: CHEMGUARD® GEN III CG1000/2000 Cabinet Connections, Right Side View

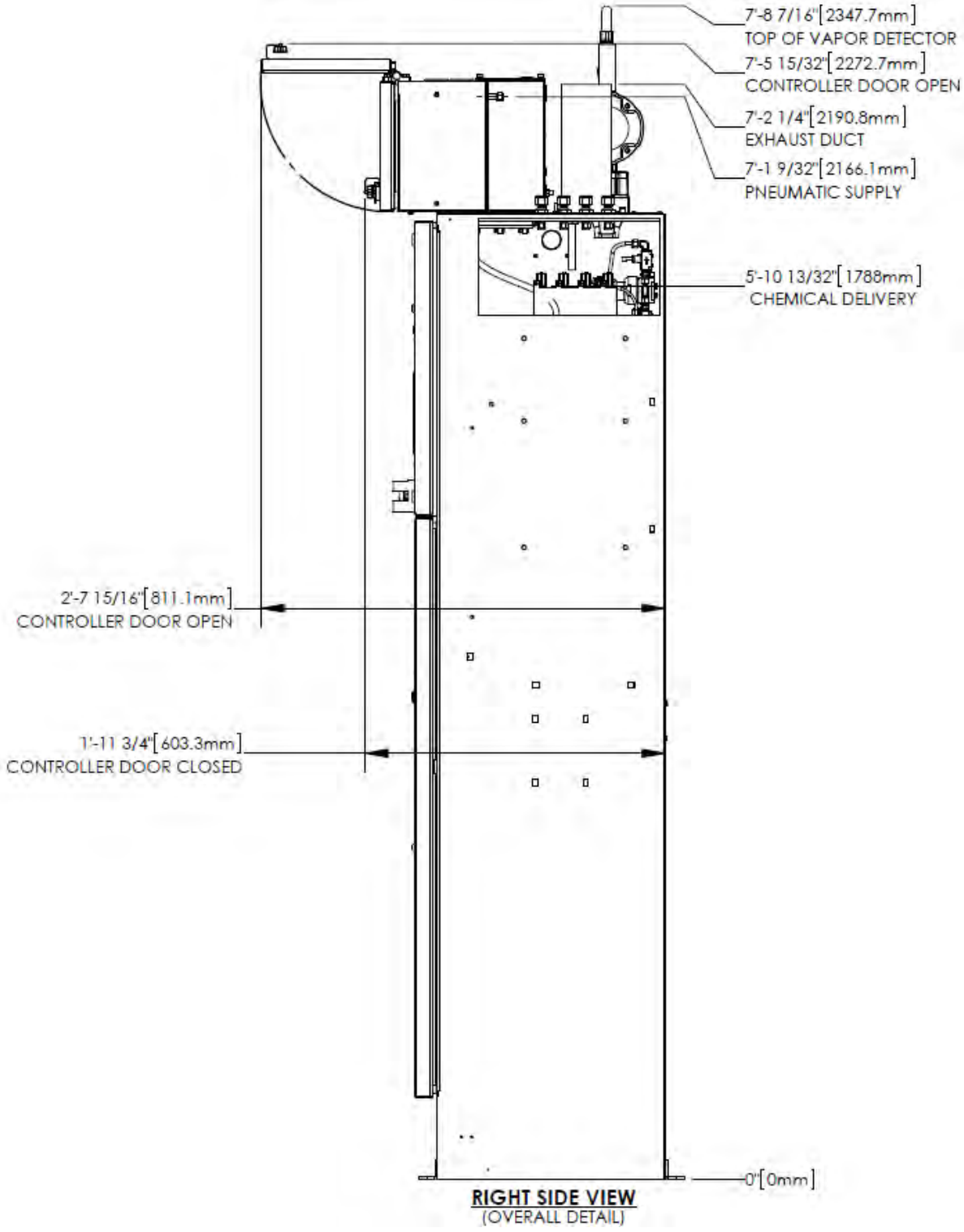
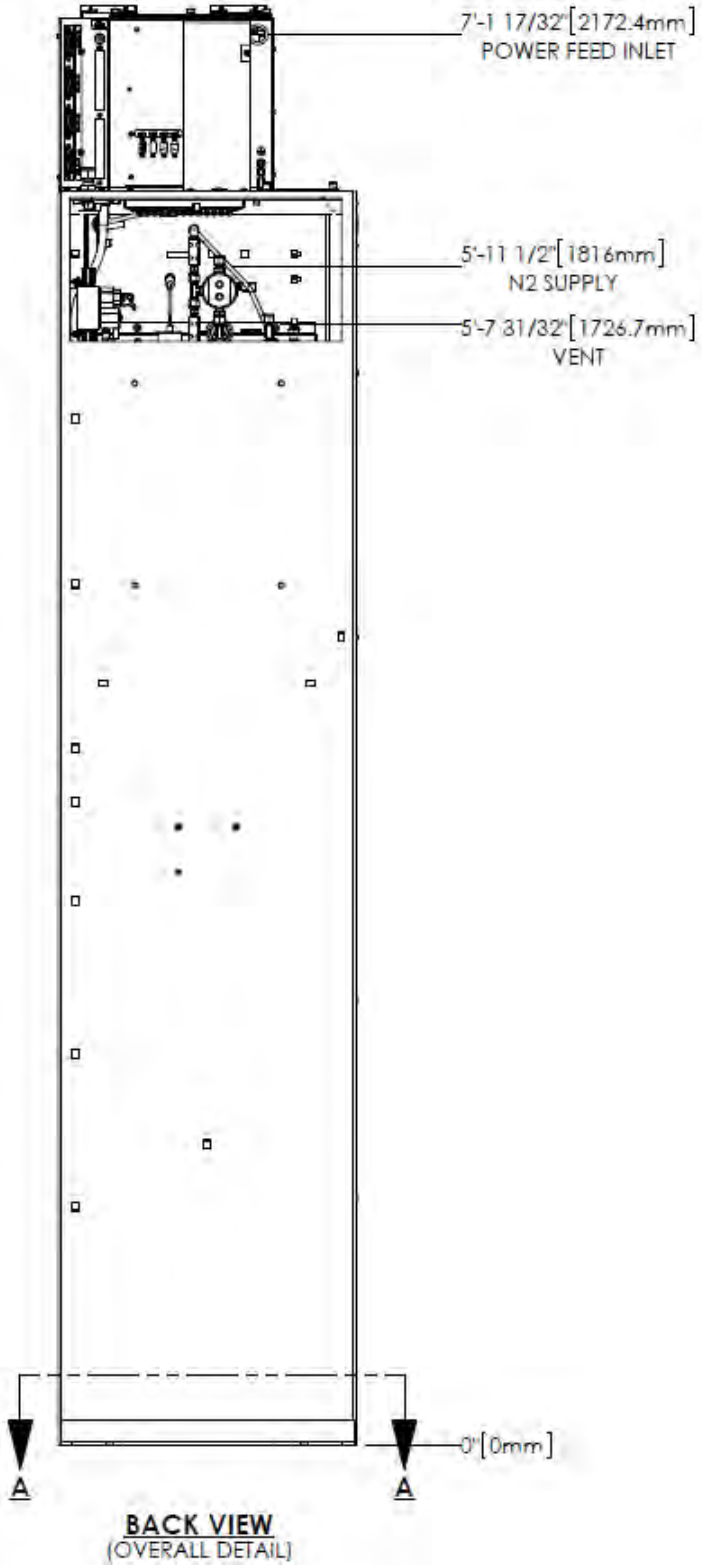


Figure 2-5: CHEMGUARD® GEN III CG1000/2000 Cabinet Connections, Back View



2.3.1 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, and Hazardous Waste Laws).

Table 2-2: Environmental Requirements

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

2.3.2 Electrical Requirements

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

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

Per SEMI S2 requirements, all electrical work for CHEMGUARD® GenIII is Type 1 and Type 2.
Type 1 = Equipment fully de-energized
Type 2 = Equipment is energized

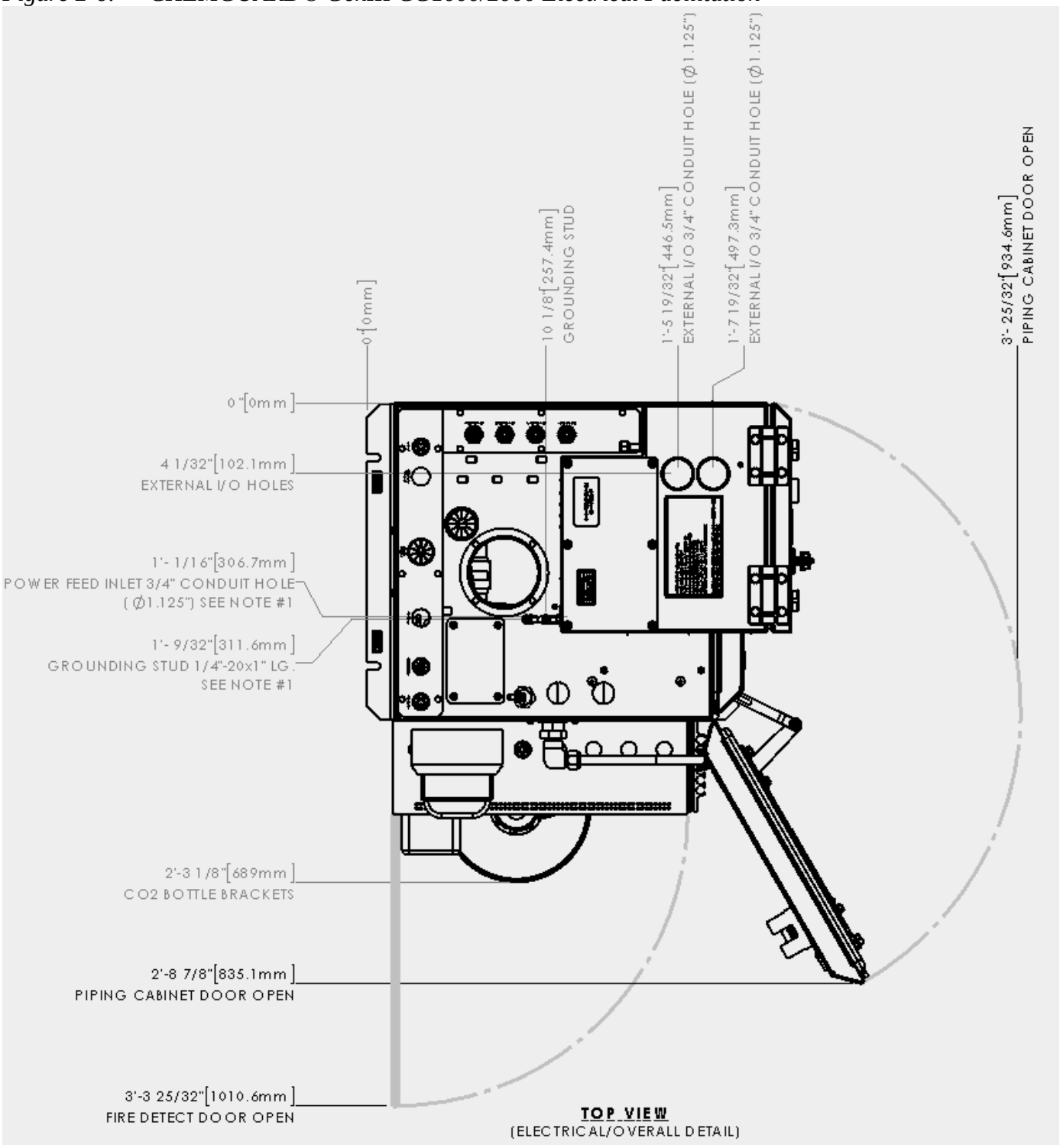
WARNING:

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	120 - 240 VAC, 125 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.

Figure 2-6: CHEMGUARD® GenIII CG1000/2000 Electrical Facilitation



2.3.3 Process Tool Interface and Life Safety Interconnect

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

Table 2-4: Digital I/O

DIGITAL INPUTS		DIGITAL OUTPUTS	
Input current, On	4.07 mA min.5.3 mA max.	Resistive Load	1.0 A @ 30 VDC, 0.5 A @ 120 VDC
Input voltage, On	3.0 VDC min.30.0 VDC max.	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		

2.3.4 Supply Gases

The customer is required to supply all gases, filters, check-valves, and regulators. Ensure that the required gases are available in close proximity to the ChemGuard® installation site (see Chapter 3 for further details). Ensure there are shutoff valves and filters for gas lines feeding the ChemGuard®. Ensure the correct gases are used for the process chemical and the properties of the gas are correct for the process chemical (i.e. dry N2).

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

Minimum filter specifications:

- Filter = 0.003 micron.
- Flow = 50 slpm.
- Material = Electropolished 316L Stainless Steel.
- Membrane = 316L Stainless Steel or PTFE.
- Leak Tested = 100% Helium leak tested to $5x10^{-9}$ atm cc/sec ($3.8x10^{-9}$ Torr L/sec).

WARNING:

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

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

WARNING:

For non Versum Materials, Inc. containers/bubblers it is the customer's responsibility to not exceed the maximum pressure rating of the container/bubbler.

Nitrogen (N_2) or other inert gas is recommended to actuate the Teflon™ valves. The incoming pressure shall be regulated. The pneumatic gas is also diverted inside the electronics enclosure to a pressure gauge with an integrated set-point adjustment and to the optional Z-purge inlet.

The cabinet requires a regulated source of N_2 or other inert gas for pneumatic actuation of the cabinet valves. A regulated source of either N_2 or other inert gas is also required for the actuation of each of the source controller's valves. Pneumatic pressure requirements are listed in this Chapter. The customer must meet the requirement outline in the tables below.

Table 2-5: Pneumatic Gas Requirements

PNUEMATIC GAS - CG1000/CG2000	Nitrogen or other inert gas recommended Regulated to 75-95 psig (gauge pressure) [619-757 kPa (absolute pressure). 6.35 mm (1/4 in.) Male SS Swagelok compression fitting The End-user supplies all gases with gas purifier, filters, shut-off valves, check-valves, and regulators in-line feeding the cabinet. Ensure the required gases are available in close proximity to the cabinet installation site. CAUTION CAUTION: Requires 100 psig PRV (Pressure Relief Valve). VORSICHT: Ein Rückschlag- und ein 100-psig-Überdruckventil sind erforderlich. ATTENTION: Requiert un clapet de retenue et une soupape de décharge de pression de 100 psig (gauge pressure) [791 kPa (absolute pressure).
PNEUMATIC GAS - SCM	Nitrogen or other inert gas recommended Regulated to 75-95 psig (gauge pressure) [619-757 kPa (absolute pressure). 6.35 mm (1/4 in.) Teflon quick-disconnected The End-user supplies all gases with gas purifier, filters, shut-off valves, check-valves, and regulators in-line feeding the CGSCM. Ensure the required gases are available in close proximity to the CGSCM installation site. CAUTION CAUTION: Requires 100 psig PRV (Pressure Relief Valve). VORSICHT: Ein Rückschlag- und ein 100-psig-Überdruckventil sind erforderlich. ATTENTION: Requiert un clapet de retenue et une soupape de décharge de pression de 100 psig (gauge pressure) [791 kPa (absolute pressure).

Table 2-6: CG1000-2000 Process Push Gas Requirements

PROCESS GAS - CG1000/2000	Nitrogen recommended Regulated to 170-205 kPa (10-15 psig; MAWP 50 psig) 6.35 mm (1/4 in.) Male SS Swagelok compression fitting Use .003m filter. Use Millipore part number WG2F 06WR1 or equivalent. For moisture sensitive chemicals: Nitrogen semiconductor-grade or better recommended. Water content < 10 ppb and O2 content < 2ppm. The End-user supplies all gases with gas purifier, filters, shut-off valves, check-valves, and regulators in-line feeding the cabinet. Ensure the required gases are available in close proximity to the cabinet installation site.  CAUTION CAUTION: Requires check valve. VORSICHT: Ein Rückschlagventil ist erforderlich. ATTENTION: Requiert un clapet de retenue.
PROCESS GAS - SCM	Nitrogen recommended Regulated to 10-15 psig (gauge pressure) [170-205 kPa (absolute pressure). 6.35 mm (1/4 in.) Male SS Swagelok compression fitting Use .003m filter. Use Millipore part number WG2F 06WR1 or equivalent. Note: Self venting regulators must not be used. For moisture sensitive chemicals: Nitrogen semiconductor-grade or better recommended. Water content < 10 ppb and O2 content < 2ppm. The End-user supplies all gases with gas purifier, filters, shut-off valves, check-valves, and regulators in-line feeding the CGSCM. Ensure the required gases are available in close proximity to the CGSCM installation site.  CAUTION CAUTION: Requires check valve. VORSICHT: Ein Rückschlagventil ist erforderlich. ATTENTION: Requiert un clapet de retenue.

WARNING

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

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

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

Table 2-7: CGSCM Process Push Gas Requirements

Process Gas	Nitrogen recommended Regulated to 10-15 psig (gauge pressure) [170-205 kPa (absolute pressure). 6.35 mm (1/4 in.) Male SS Swagelok compression fitting Use .003m filter. Use Millipore part number WG2F 06WR1 or equivalent. Note: Self venting regulators must not be used. Refer to Versum Materials, Inc. Bubbler Installation and Removal Safetygram. For moisture sensitive chemicals: Nitrogen semiconductor-grade or better recommended. Water content < 10 ppb and O2 content < 2ppm. The End-user supplies all gases with gas purifier, filters, shut-off valves, check-valves, and regulators in-line feeding the CGSCM. Ensure the required gases are available in close proximity to the CGSCM installation site.  CAUTION CAUTION: Requires check valve. VORSICHT: Ein Rückschlagventil ist erforderlich. ATTENTION: Requiert un clapet de retenue.

2.3.5 Exhaust, Vent and PRV Requirements

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

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

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

For chemicals authorized for use in ChemGuard®, and for exhaust flow requirements for specific process chemicals, Contact Versum Materials, Inc. EES Group for detail.

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

Table 2-8: Exhaust and Vent Requirements

EXHAUST	101.6 mm (4 in.) diameter circular duct Cabinet Exhaust Flow/Pressure Set Point: 850 Liter/minute (30 CFM) minimum recommended Connect to the appropriate abatement system for chemical used. It is recommended to install the Exhaust line perpendicular and/or above the main abatement duct. DO NOT ENTER BELOW THE MAIN ABATEMENT DUCT TO AVOID LIQUID TRAP (See Below).
VENT	0.5-2.0 in. water column to scrubbed exhaust 6.35 mm (1/4 in.) Male compression fitting and Teflon tube connection. Connect to the appropriate abatement system for chemical used. Connects to VENT port. 17 psig maximum pressure drop. Nitrogen Trickle flow 5 liter/minutes (10 SCFH).

2.3.6 Chemical Delivery Line Requirements

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

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

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.

The distance from the CG1000-2000 and the process tool it feeds can vary depending on the I.D. of the delivery line tubing, the number of bends, and the vertical distance. The maximum vertical distance from the cabinet to the process tool shall not exceed 26 feet (7.9 meters). If the user requires a greater range than factory standard, consult with Versum Materials, Inc.. The system was designed with a small enough foot print to be installed next to the process tool. The inner chemical lines shall be constructed with Teflon™ tubing.

NOTE

The wall thickness of the tubing must be .047". The connection points to the CG1000-2000, CGSCM and Source Containers are flared fittings therefore the right wall thickness is crucial in order to properly flare the tubing.

2.3.7 Outer Chemical Line Requirements

The chemical lines shall be enclosed within an outer line used for double containment of the chemical in the unlikely event of a chemical leak. This outer line shall have a constant N_2 purge flowing through it to help sweep all vapors from the CGSCM towards the cabinet.

The outer chemical lines shall be constructed of 12.7 mm (1/2 in.) O.D. Teflon™. The wall thickness shall be .062". The connection points to the CG1000-2000 and CGVMB is a 12.7 mm (1/2 in.) Stainless Steel Swagelok compression fitting. The terminating connection at the CGSCM is a 12.7 mm (1/2 in.) Teflon™ Swagelok compression fitting.

Table 2-9: Chemical Line Inner and Outer Lines Requirement

Chemical Delivery Inner Line	PFA Teflon tubing required with 1.19mm (.047 in.) wall thickness. 6.35 mm (1/4 in.) O.D. with Male Teflon Flare connection.
Chemical Delivery Outer Line	Coaxial Chemical Delivery (FILL) Line – un-terminated stainless steel connection fitting for outer coax line. 12.7 mm (1/2 in.) Teflon or stainless steel.

NOTE

The four (4) ½" Swagelok compression fittings used for double containment will be supplied by Versum Materials, Inc. and available for use during installation.

2.3.8 Coaxial Line Purge

The main process fill lines shall be enclosed within an outer line constructed of either Teflon™ or Stainless Steel, 12.7 mm (1/2") Stainless Steel or Teflon™. In the case of an inner wall breach, the liquid will be contained by the outer wall which has an N_2 purge regulated and flowing downstream from each individual CGSCE towards the CG1000-2000 cabinet. The minimum recommended flow rate for the coaxial purge is 0.2 to 0.5 SCFH (0.09 to 0.24 SLM). Higher coaxial flow rates can be used. The current software setup default is 17 SLM (36 SCFH). A setup value of 0 (zero) entered for a coaxial line will disable that Coaxial Purge Low alarm. Disabling the coaxial alarm is not recommended.

Table 2-10: Coaxial Line Purge Gas Requirement

Coaxial Line Purge Gas	Nitrogen recommended; Regulated to 2-15 psig (gauge pressure) [115-205 kPa (absolute pressure). 3.17 mm (1/8 in.) O.D. Teflon™ quick disconnect. Use .003m filter. Use Millipore part number WG2F 06WR1 or equivalent.

The customer is required to provide process push gas and coaxial purge gas as well at the Source ampoule or Bubbler, the process push gas is using to delivery liquid or vapor toward the wafer processing tool(s) and also can be use in maintenance or decommission of chemical delivery line. A 17 psig pressure relief valve is installed inside of the cabinet upstream of the pressure regulator. The facilities push gas pressure being supplied to the cabinet should never exceed 16 psig.
The Purge gas is using to purge any liquid or vapor leakage from the inner chemical delivery line to flow toward the ChemGuard cabinet.

Table 2-11 illustrate the capacity of the system, the values were estimated assuming a fixed vertical distance of 8 m and a delivery pressure to the bubbler of 0.3 psig.

Table 2-11: CG2000 System Refilling Times

Horizontal line length	Time to refill 337 g (fill command to full)	Time to fill line	Total refill time
(m)		(minutes)	
12.5	2.6	1.4	4
25.0	4.2	4.6	8.8
50.0	7.4	16.1	23.3
75.0	10.6	34.6	35.2
100.0	13.7	60.1	73.8

2.3.9 Output Manifold (Optional)

The Output Manifold options allow the ChemGuard® to feed chemical up to 20 tools with use of the LVMB. Consult your Versum Materials, Inc. sales representative for further details.

2.4 Tag and Lockout Routine

When performing certain maintenance procedures described in this manual, electrical power to the ChemGuard® must be de-energized, using site lockout/tag out procedures. This includes all power feeds to equipment including dual power and fire suppression options.
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 or open toggle switch. If there is a fire suppression system in place, ensure that the separate power feed is isolated prior to working on the equipment only if required.
3. Operate the valves, or other energy isolating device(s) so that the equipment is isolated from its energy source(s). Stored energy (such as electrical, pressurized air, push gas, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down, etc.
4. Lockout and/or tagout the appropriate energy isolating devices with assigned individual lock(s) or tag(s). In the event of pressurization of piping manifold, ensure that the system regulators are turned down and locked out prior to a venting.
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.
6. The equipment is now locked or tagged out.

CAUTION

Return operating control(s) to neutral or off position before returning system to operational state.

2.5 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® systems. For example, two spills of the same type of chemical could have two different spill procedures. Therefore, in the event of a spill, we recommend immediately contacting Versum Materials, Inc. EH&S department at **1-866-624-7677** (Chemical Emergency Option) or **760-931-9555** for specific chemical spill recommendations and environmental regulatory information. It is the responsibility of the customer to follow their EH&S procedures for hazardous material cleanup.

MSDS for all Versum Materials, Inc. chemicals are available from Versum Materials, Inc. EH&S department.
In addition, consult your company's environmental hazard/safety procedures for specific instructions to be followed in the event of a chemical spill from ChemGuard® Gen III.

Chapter 3

Installation

Section 1	Introduction
Section 2	Installation
Section 3	Cabinet Installation
Section 4	Electrical Connections
Section 5	Gas Line Connection
Section 6	Chemical Delivery Line Requirements
Section 7	Reservoir Scale Installation
Section 8	Process Tool Interface Connection
Section 9	Vacuum System Installation
Section 10	Exhaust and Vent Installation
Section 11	System Initialization
Section 12	System Features
Section 13	VMB Installation and Integration

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

3.1 Introduction

This chapter describes the installation of ChemGuard® Gen III cabinet. Because each customer application may vary, these instructions are provided as a guideline and should not be considered as comprehensive.

Please do not begin installing the ChemGuard® Gen III unless trained individuals are present.

The ChemGuard® Gen III comes pre-calibrated and cabinet-tested. The ChemGuard® Gen III reservoir scale(s), dual float spill detector, banner sensor (optional), and combustible vapor detector 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.

3.2 Installation

3.2.1 Pre-Installation

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

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).

- Install ChemGuard® Gen III 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® Gen III. (Power requirements are described in Chapter 2.)

- Verify all required gases are delivered to an area near the final position of ChemGuard® Gen III (Refer to Chapter 2).

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

- Gases required for ChemGuard® Gen III cabinet operation are described in Chapter 2.
- The ChemGuard® Gen III requires vacuum in order to ensure complete removal of chemical vapors or atmospheric gases from the lines during a reservoir change operation.
- The ChemGuard® Gen III requires an exhaust flow of 30 CFM. In addition to cabinet exhaust, ChemGuard® Gen III 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.
- The liquid from any leak will be contained in the reservoir cabinet and be detected by the spill detector, and container then relieved to prevent any further spillage.

3.3 Installing the ChemGuard® GenIII 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® Gen III 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® Gen III must be grounded in accordance with Article 250 - Grounding, The National Electrical Code 1993.

3.3.1 CGSCE Mounting Requirements

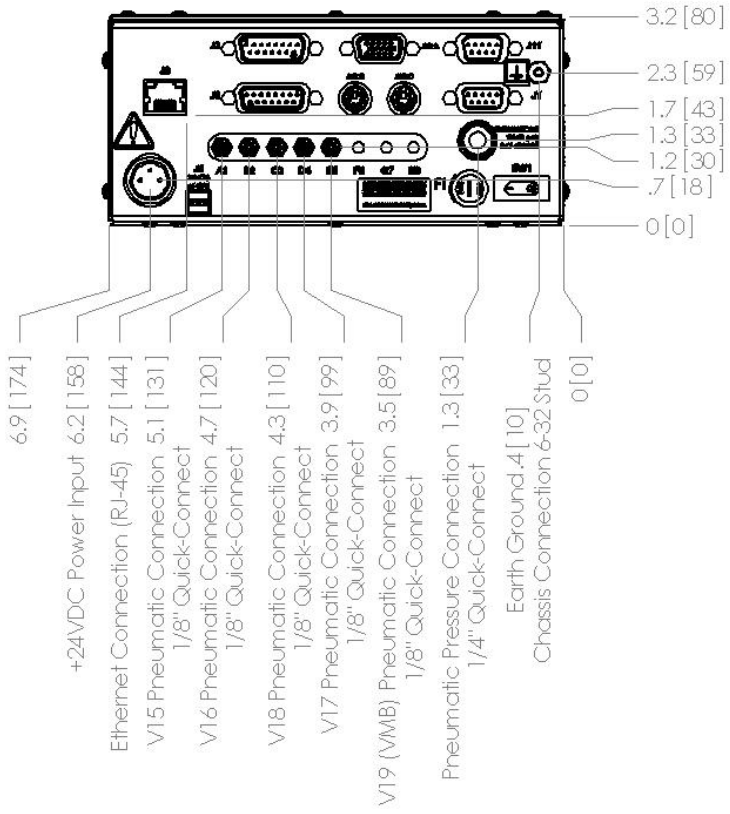
The CGSCE needs to be fixed to a stable flat surface. The unit has 4 mounting holes on its top side for this purpose. An optional bracket can be provided upon request. The CGSCE must be located within 5 feet from the VMB and 5 feet from the Quartz Source Container.

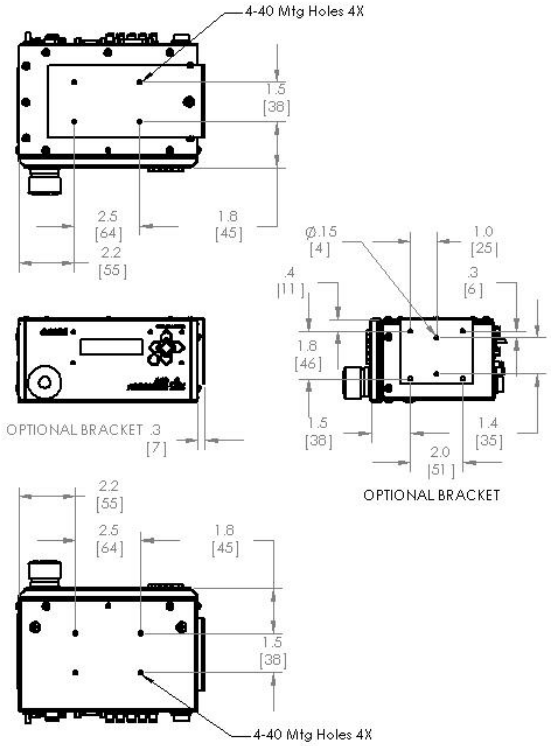
WARNING

The SCE (Source Control Electronic) unit is not classify for the Class I Division II environment, unit cannot be installed or placed in the classify area.

Refer to below figure for the location of the grounding lug for the cabinet. The CGSCE must be grounded using the Chassis Connection provided. The CGVMB requires no grounding. The CGSCE must be grounded in accordance with Article 250 - Grounding, The National Electrical Code 1993. Versum Materials, Inc. recommends a ground resistance of <1 Ohm.

Figure 3-1: CGSCE Mounting





Top - No clearance is needed on this side of the CGSCE. This side is normally used to fix the enclosure of the CGSCE.

- Bottom - No clearance is needed on this side.
- Front – Provide a clear path to view the CGSCE display and to access its key pad. A minimum clearance of 24 inches in this side is recommended to gain access and operate the keypad and stop button.
- Back – Requires a 6-inch clearance to gain access to all the connections and chassis grounding lug.
- Left - No clearance is needed on this side.
- Right - No clearance is needed on this side.

CGVMB:

- Top - Provide 12 inches clearance for installation and maintenance of connections on this side.
- Bottom - A 12 inches clearance for installation and maintenance of the spill detector is recommended on this side.
- Front - A 12 inches clearance is necessary in order to remove the cover and work inside the enclosure.
- Back – No clearance is needed on this side.
- Left - No clearance is needed on this side.
- Right - No clearance is needed on this side.

3.3.2 Installing the CGSCM (Source Controller Module)

Installing the SCM is accomplished in two parts. The first is the placement and facilities hook up to the CGSCE, Source Control Electronics.

The second is the installation and plumbing of the Source container. Contact Versum Materials, Inc. Service department for detail of "Versum Materials, Inc. Bubbler Installation and Removal Procedure" for recommended bubbler plumbing.

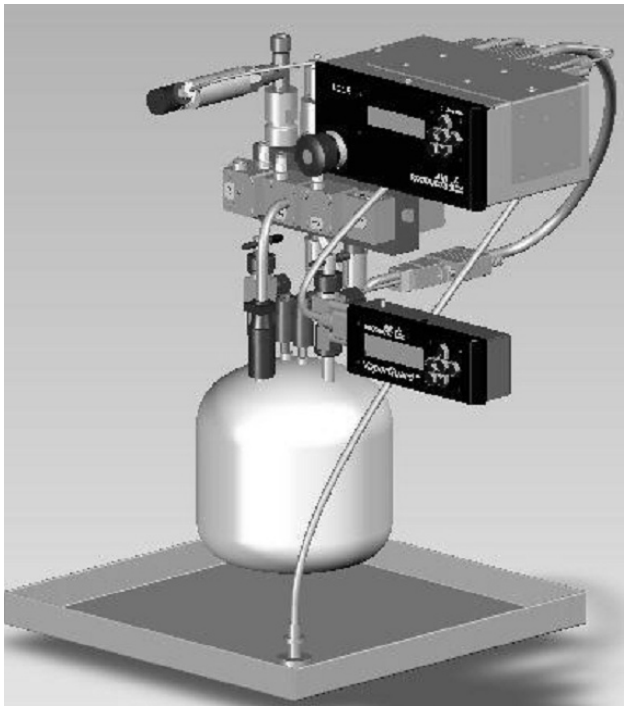
NOTE

The customer is responsible for all connections, components, and the necessary safety protocols between the N_2 input and vapor output of the Source container. Over pressurization, and the prevention of back flow are critical safety and process controls issues that must be addressed and resolved prior to CGSCM commissioning.

WARNING

It is the customer's responsibility to ensure over-pressurization of the Source Container does not occur. Hardware shall be put in place to relieve pressure in excess of 15 psig or catastrophic failure of the bubbler can occur.

Figure 3-2: CGSCM, with Source Container and RVM



3.3.3 CGSCM Components and Accessories

The CGSCM components and its accessories are listed below. The Source Controller Electronics (CGSCE) and all associated pneumatic tubing and electrical connections.

- The Level sense cable.
- Level sense probe, includes both optical and continuous level sensing.
- 6.35 mm (1/4 in.) OD Pneumatic input quick disconnect.
- Spill cable.
- Chemical input connection from CGVMB.
- Regulated facilities N_2 connection.
- Vent output to scrubbed exhaust.
- 24 VDC Power supply.
- N_2 input connection from process tool.
- Chemical vapor output to tool.
- Refill Valve Manifold (CGRVM).
- Quartz Source Container.
- Pressure Transducer.
- Port connector.
- Speed Controller (if applicable).
- Straight union (if applicable).
- Elbow union (if applicable).
- Rotameter (if applicable).
- Mounting Bracket (if applicable).

3.3.4 Placement of the CGSCM

The CGSCE should be installed within 1.5 meters (5 ft.) of the Source Container. The Source Container should be installed in a vented cabinet with sufficient exhaust flow. The CGSCE can be installed outside of the tool's source cabinet.

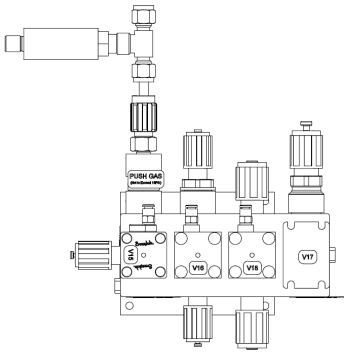
The Source Container is installed into an appropriate temperature control system. Contact Versum Materials, Inc. EES Technical Services at 866-624-7677 or 760-929-6268 for verification that the chemical being introduced to the Source Container is compatible with the temperature control system being used.
There are four recommended positions to install the Refill Valve Manifold (RVM), refer to Figure 3.8.

- Vertical
- Vertical Up Side Down
- Horizontal (flat on a horizontal surface)
- Horizontal Up Side Down (hanging from a horizontal surface)

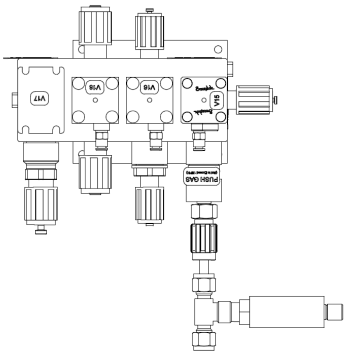
WARNING

Do not install the RVM in other positions different from the four recommended. Consult Versum Materials, Inc. if manifold needs to be installed in a different position.

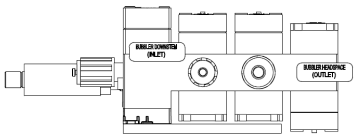
Figure 3-3: RVM Recommended Positions



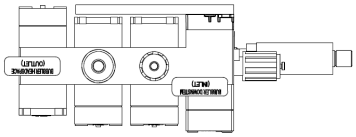
1) Vertical



2) Vertical Up Side Down



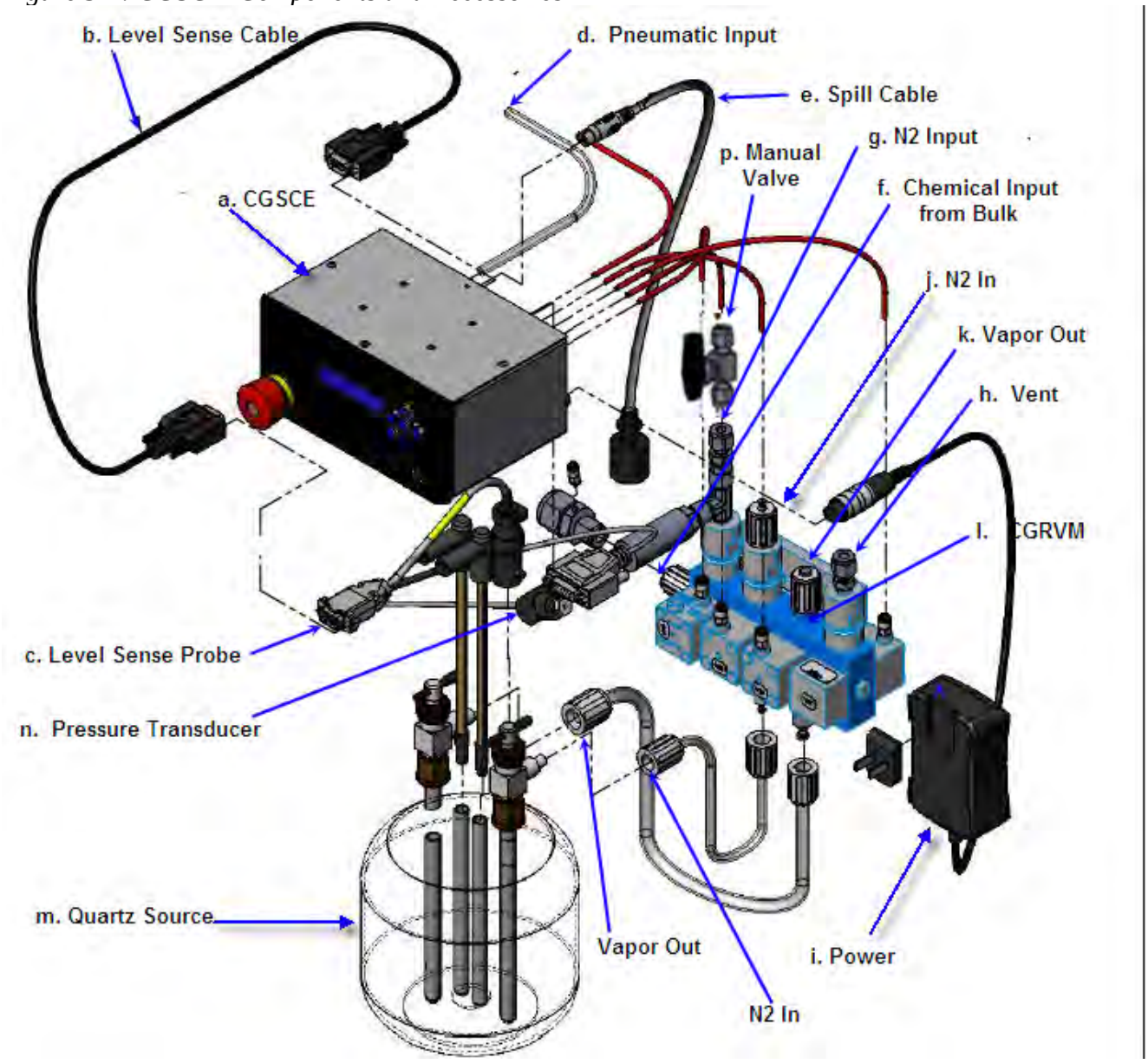
3) Horizontal



4) Horizontal Up Side Down

Verify there is sufficient room around the CGSCE, CGRVM and Source container to facilitate all plumbing and electrical requirements.

Figure 3-4: CGSCM Components and Accessories



3.4 Electrical Connections

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

Type 1 = Equipment fully de-energized.

Type 2 = Equipment is energized.

3.4.1 Electrical Requirements

AC POWER:

- 120 - 240 VAC, 125 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded without optional degasser and pump. Short circuit current rating (SCCR) is 10kA.
- 125 VAC, 1000 W @ 50 - 60 Hz; Single-Phase, 3 wires; Neutral solidly grounded with optional degasser and pump. Short circuit current rating (SCCR) is 10kA.

OSHA standards require customer to install lockout-type circuit breaker for AC power.

Versum Materials, Inc. recommends an over current protection of 10,000 Ampere Interrupt Capacity (AIC) be provided in close proximity to the unit.

WARNING

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

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

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

WARNING

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

WARNUNG: Nichteinhalten des Verfahrens zum Anschluß der Wechselstromspannung kann zu Verletzungen des Bedienpersonals und Beschädigung der ChemGuard® Gen III-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® Gen III.

WARNING

WARNING: To prevent electrical shock, the ChemGuard® Gen III 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® Gen III geerdet werden. Elektrische Anschlüsse sollten nur durch qualifizierte Elektriker hergestellt werden.

AVERTISSEMENT: Pour éviter tout choque électrique, la boîte ChemGuard® Gen III doit être reliée à la masse. Les raccords électriques doivent être seulement exécutés par un électricien qualifié.

3.4.2 Connecting Line AC Power

WARNING

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

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

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

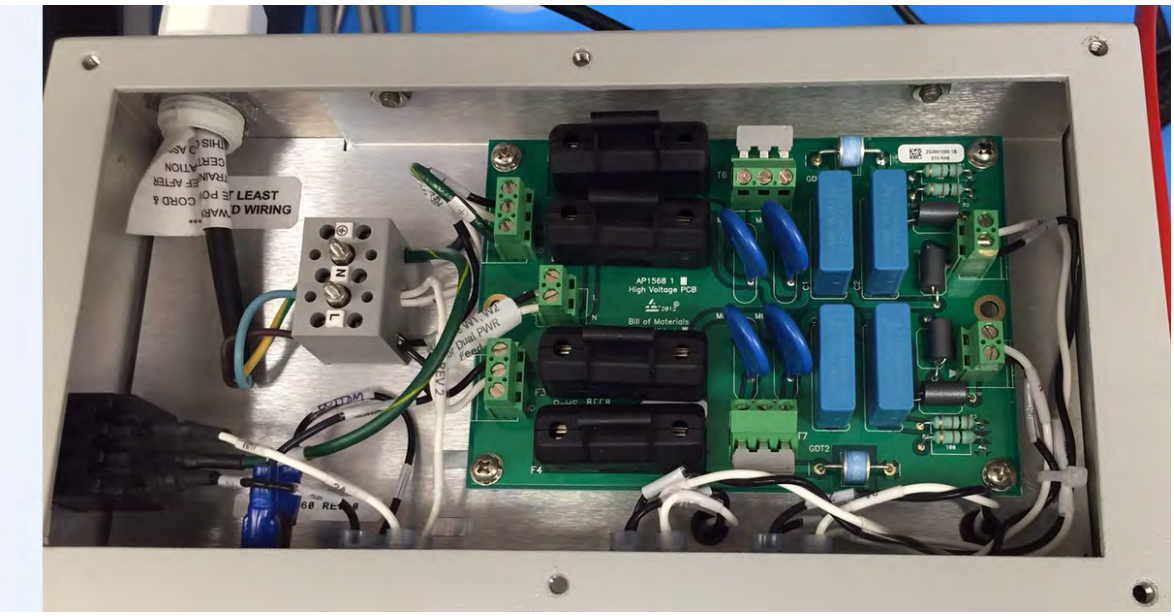
Figure 3-5: Rear view of conduit power entrance

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. The power input must be wired to the terminals shown below.

Figure 3-6: Dual Power Supply Terminal Connection



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 (p/n # 7022.0700) 10A/ 500VAC Super Quick Action fuse is located on the inside of the controller.

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® Gen III 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.

3.4.3 Connecting Inputs/Outputs

3.4.3.1 CG1000/2000 Inputs/Outputs

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

Table 3-1: Cabinet Connections

Digital Input #	Input Label	Connection Location
		Tool I/O Connector Board
29		
30		
31	Vacuum Interlock	TB10 (7+,8-,9S)
36	Life Safety Shutdown	TB11 (10+,11-,12S)

NOTE: ETO software configuration is required to detect code cable option.

Outputs max. 1A @ 24vdc

Digital Output #	Output Label	Connection Location
		Tool I/O Connector Board
9	Exhaust	TB15 (1,2,3)
10	Spill	TB15 (4,5,6)
11	Fire	TB15 (7,8,9)
12	Door Open	TB15 (10,11,12)
16	Vapor	TB13 (10,11,12)
		Tool I/O Connector Board
21	V11 Chem On	TB14 (1,2,3)
22	V12 Chem On	TB14 (4,5,6)
23	V13 Chem On	TB14 (7,8,9)
24	V14 Chem On	TB14 (10,11,12)

Table 3-2: Tool Interface – Terminal (AP1614) or DB-25

Outputs max. 1A @ 24vdc

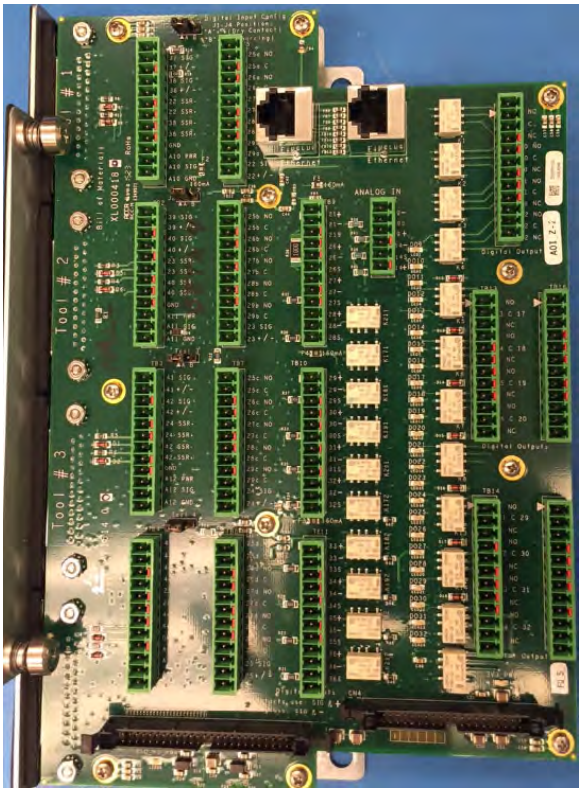
*Indicates an Isolated Input

Tool #1			
Digital Input #	Input Label	Tool I/O Connector Board	DB25 (S, -)
22	V11 VMB Spill	TB5 (11,12), TB1 (5,6)*	CN5(13,12)
37	V11 VMB Exhst Fail	TB1 (1,2)	CN5(20,22)
Digital Output #	Output Label	Tool I/O Connector Board	DB25 (NO, COM
25	Shutdown Alarm	TB5 (1,2)	CN5(8,15)
26	Fault Alarm	TB5 (3,4)	CN5(10,16)
27	Chem On	TB5 (5,6)	CN5(9,17)
28	Bulk Empty/Info	TB5 (7,8)	CN5(6,18)
Tool #2			
Digital Input #	Input Label	Tool I/O Connector Board	DB25 (S, -)
23	V12 VMB Spill	TB6 (11,12), TB2 (5,6)*	CN6(13,12)
39	V12 VMB Exhst Fail	TB2 (1,2)	CN6(20,22)
Output #	Output Label	Tool I/O Connector Board	DB25 (NO, COM
25	Shutdown Alarm	TB6 (1,2)	CN6(8,15)
26	Fault Alarm	TB6 (3,4)	CN6(10,16)
27	Chem On	TB6 (5,6)	CN6(9,17)
28	Bulk Empty/Info	TB6 (7,8)	CN6(6,18)

Tool #3			
Digital Input #	Input Label	Tool I/O Connector Board	DB25 (S, -)
24	V13 VMB Spill	TB7 (11,12), TB3 (5,6)*	CN7(13,12)
41	V13 VMB Exhst Fail	TB3(1,2)	CN7(20,22)
Output #	Output Label	Tool I/O Connector Board	DB25 (NO, COM
25	Shutdown Alarm	TB7 (1,2)	CN7(8,15)
26	Fault Alarm	TB7 (3,4)	CN7(10,16)
27	Chem On	TB7 (5,6)	CN7(9,17)
28	Bulk Empty/Info	TB7 (7,8)	CN7(6,18)
Tool #4			
Digital Input #	Input Label	Tool I/O Connector Board	DB25 (S, -)
25	V14 VMB Spill	TB8 (11,12), TB4 (5,6)*	CN8(13,12)
43	V14 VMB Exhst Fail	TB4(1,2)	CN8(20,22)
Output #	Output Label	Tool I/O Connector Board	DB25 (NO, COM
25	Shutdown Alarm	TB8 (1,2)	CN8(8,15)
26	Fault Alarm	TB8 (3,4)	CN8(10,16)
27	Chem On	TB8 (5,6)	CN8(9,17)
28	Bulk Empty/Info	TB8 (7,8)	CN8(6,18)

Figure 3-8: Tool 1-4 DB25 Connectors

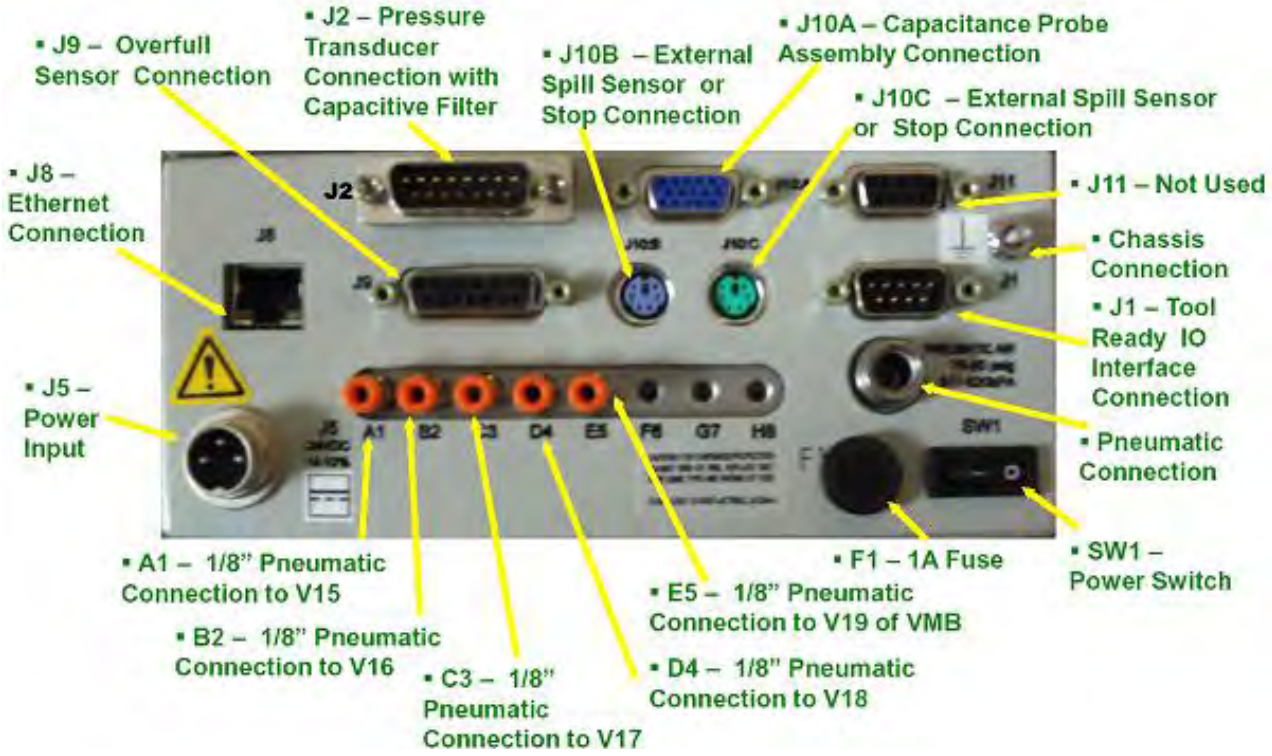
Figure 3-9: Tool I/O Board (AP1614)



3.4.3.2 SCE Inputs/Outputs

For all field terminations SCM customer connections the customer must ensure that the outputs are energy limited to meet US and CE requirements. Use the following diagrams and descriptions to connect customer Inputs and Outputs:

Figure 3-10: CGSCE Pneumatic and Electrical Connections



External Spill Sensor

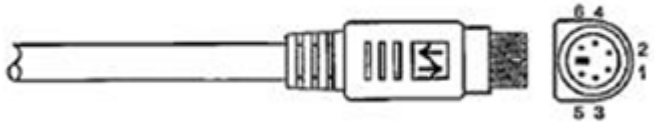
The connector for Spill can be J10B or J10C; the spill and stop connectors are Interchangeable. These connectors are type PS/2. Each cable handles two relay outputs.

Table 3-3: CGSCE J10B or J10C Connector

Pin no.	Pin Assignment	Color Code
1	STOP Normally Open	Red
2	STOP Common	Orange
3	Reserved	Black
4	SPILL Normally Open	Yellow
5	Reserved	Brown
6	SPILL Common	Green

Note: Newer versions of this cable may not match the color code shown above and will be labeled with their color code.

Figure 3-11: CGSCE J10B or J10C Connector



The CGSCE has a local spill detect input. This input signal is derived from the float sensor located in the overspill tray. Once a spill is detected at the Source Controller, all valves on the CGRVM and CGVMB will revert to a safe state.

If the CGSCM is upstream of a CGVMB, then the valve supplying chemical to that CGSCM and Source Container will also close.

Stop Connection

As in the case of the Spill connection, the connector for Stop can be J10B or J10C, the spill and stop connectors are Interchangeable, the connector is type PS/2, and the cable handles two relay outputs.

The Stop connection provides a Stop Output signal to the customer. The Stop signal is generated when the stop emergency manual off (EMO) button on the front of the CGSCE is pressed. When this happens, the Source Controller revert all valves on the CGRVM and CGVMB to a safe state.
Like in the case of spill detection, if the CGSCM is upstream of a CGVMB, then the valve supplying chemical to that CGSCM and Source Container will also close.

Connect the corresponding cable shielding of the stop connector (J10B or J10C) to the chassis tool ground.

Tool Ready IO Interface Connection

This is a Customer IO Connection. The CGSCE outputs to the tool, digital Fault and Shutdown alarms and a 4-20 mA output that corresponds to 0% to 120% chemical level in the Source Container.
The CGSCE requires a “Tool Ready” input signal from the tool in order to enable/disable the refill operation.

A Tool Ready signal is required to initiate any operation. A Tool Not Ready signal stops all operations except Source Change. Continuous “Tool Ready” status is required to perform and complete Source Change Operation. “Tool ready” signal should close a customer valve located in the line connecting the tool gas supply (tool carrier gas) to the bubbler. See customer requirements at the beginning of this chapter.

Versum Materials, Inc. supplies the interface cable which connects into connector J1 of the CGSCE and must be terminated by the customer at the tool. The cable shielding of J1 needs to be connected to the Tool chassis ground.

Table 3-4: CGSCE Tool IO, J1 Connector

Pin no.	Pin Assignment
1 (1)	**Tool Ready Input**
2 (1)	**Tool Ready Common**
3 (2)(4)	**4 to 20 mA Output – Chemical Level 0-120%**
4(4)	**4 to 20 mA Return**
5	**Ground**
6	**+ 24 VDC**
7 (3)	**Shutdown Alarm (output)**
8	**Alarm Common**
9 (3)	**Fault Alarm (output)**

Notes:

1. Tool Ready is recognized when both of the following conditions are met:
2. +24V connects to Tool Ready Input (J1-6 to J1-1)
3. Ground connects to Tool Ready Common (J1-5 to J1-2).
4. J1-pin3 was not evaluated or has not yet passed CE compliance.
5. See Chapter 2 for contact electrical specifications
6. The 4-20 mA output by default is sourced from the CGSCE. If the customer desires to sink this output with their own 4-20 mA, then the JP3 jumper will need to be repositioned. The cover of the CGSCE will need to be removed to gain access to this jumper.

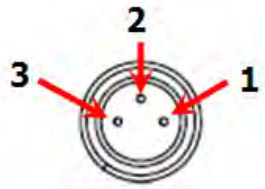
Power Input

The connector is a 3 pin Amphenol Tuchel type connector. The pin outs for the connector are listed in Table 5.1.3 and Figure 5.1.3.

Table 3-4: CGSCE Tool IO, J5 Connector

Connector J5	Description
Pin 1	**+24 VDC**
Pin 2	**Ground**
Pin 3	**Chassis Ground**

Figure 3-12: CGSCE Power Supply Pin Outs



Power Switch

Turns the CGSCE power On or Off.

Ethernet Connection

The CGSCE communicates with the cabinet though this connector. The Ethernet connector is a RJ45 type connection.

Overfull Sensor Connection

Connects the optical liquid sensor to the CGSCE. This is a DB15 Female connector.

Pressure Transducer Connection

Connects the Pressure Transducer to the CGSCE. This is a DB15 Male connector. This connection is protected with a capacitive filter installed on the Pressure Transducer cable.

Capacitance Probe Assembly Connection

The level sense probe connector includes both the optical and the continuous level sensing of chemical. This connector is a DB HD 15 (High Density) Female connector.

Chassis Connection

Provides connection to earth ground the CGSCE. This connector is a 6-32 threaded stud.

Fuse

The CGSCE is protected from over current by a 1A fuse. The connection is for a 5X20 mm fuse. The part number is 0217001.HXP from Littlefuse.

J11 Connector

Connector J11 is not used. Do not connect anything to this connector.

CGSCE Electrical requirements

The CGSCE, Source Controller Electronics is power by 24VDC adaptor.

NOTE

A cable is also supplied for direct connection to a facility 24VDC power supply. However, the facility supplied 24VDC power was not evaluated or has not yet passed CE.

3.5 Connecting ChemGuard® GenIII 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 3-3 and 3-4 for ChemGuard® Gen III cabinet connections.

WARNING

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

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

AVERTISSEMENT: Les pressions du système dépassent l'échelle des récipients Versum Materials, Inc. au delà de 120 psig (827,76 kg/cm2).

WARNING

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

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

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

CAUTION

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

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

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

3.5.1 Coaxial Purge

A Coaxial Chemical Delivery Line is required for all process chemicals. In the event that a leak or rupture occurs in the inner delivery line, the liquid will be contained and be prevented from entering the environment.

In addition, liquid from any leak will be contained in the ChemGuard cabinet containment tray and be detected by the spill detector, and pressure then relieved to prevent any further spillage.

The outer Coaxial Chemical Delivery Line can be purged with N_2 by use of a coaxial purge fitting. The coaxial purge fitting is installed closest to the CGSCM where the Chemical Delivery Line enters the source cabinet.

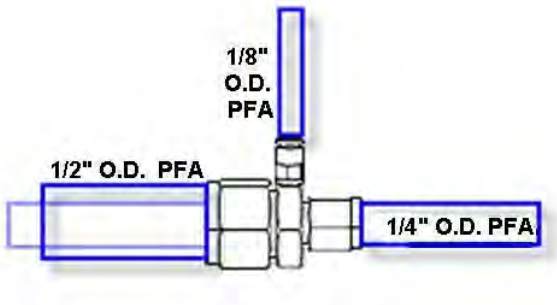
The outer Chemical Delivery Line connects to a 12.7 mm (1/2 in.) O.D Stainless Steel Swagelok compression fitting at one end of the coaxial purge fitting.

The inner Chemical Delivery Line passes thru the coaxial purge fitting where a 6.35 mm (1/4 in.) O.D Stainless Steel compression fitting is tightened and seals the end of the outer Chemical Delivery Line.

CAUTION
DO NOT OVER-TIGHTEN THE COMPRESSION FITTING, THE FERRAL MIGHT CUT THROUGH THE TEFLON LINE.

The coaxial flow rate must be regulated with a needle valve, refer to Chapter 2 for setting and measuring. The output line of the needle valve connects to the rotameter and the output of the rotameter connects to the 3.17 mm (1/8 in.) O.D. Stainless Steel Swagelok compression fitting where N_2 purge will flow back through the outer Chemical Delivery Line and back the ChemGuard.

Figure 3-13: Coaxial Purge Fitting



3.5.2 CGSCM Chemical and Coaxial Line Installation

1. Install 12.7 mm (1/2 in.) OD Stainless Steel or Teflon™ tubing at the ChemGuard chemical output Swagelok connector and to the coaxial purge fitting located at the CGSCM.

NOTE

The coaxial purge fitting should terminate in an exhausted enclosure and be positioned above the horizontal plane of maximum chemical containment of the spill tray.

2. Install 6.35 mm (1/4 in.) OD Teflon™ tubing between the ChemGuard chemical output manifolds flare connection, thru the coaxial purge fitting and terminates at the CGRVM at the chemical input flare connection.

NOTE

Place the Teflon™ screw caps on the ¼" OD lines prior to flaring Teflon™ tubing.

3. Connect the N_2 purge line to the needle valve, the output of the needle valve to the rotameter, and then the output of the rotameter to the 3.17 mm (1/8 in.) quick disconnect fitting located on the coaxial fitting. Terminate the other end of the purge line to the tool's regulated N_2 source.

3.5.3 Source Supply Gas Installation

The ChemGuard cabinet comes equip to handle various automated operations for ease of use. In order to facilitate some of the operations, Nitrogen supply gas must be installed at the CGSCM.

1. Install 6.35 mm (1/4 in.) Teflon™ tubing at the CGRVM push gas connection. The termination is a 6.35 mm (1/4 in.) Teflon™ compression fitting
2. Terminate the other end at the tool's regulated N_2 source.

3.5.4 Vent Line Installation

1. Install 6.35 mm (1/4 in.) Teflon™ tubing at the CGSCM vent connection. The termination is a 6.35 mm (1/4 in.) Teflon™ flared fitting.
2. Route the other end of the Teflon™ tubing to the appropriate abatement system.

3.5.5 Pneumatic Line Installation

Nitrogen or other inert gas is required to actuate the valves of the CGSCM. The gas should come from a regulated source at the tool and will terminate at the CGSCE's pneumatic input connection. The connection is a quick disconnect type that accommodates 6.35 mm (1/4 in.) OD Polyurethane or Teflon™ tubing.

3.6 Chemical Delivery Line Requirements

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

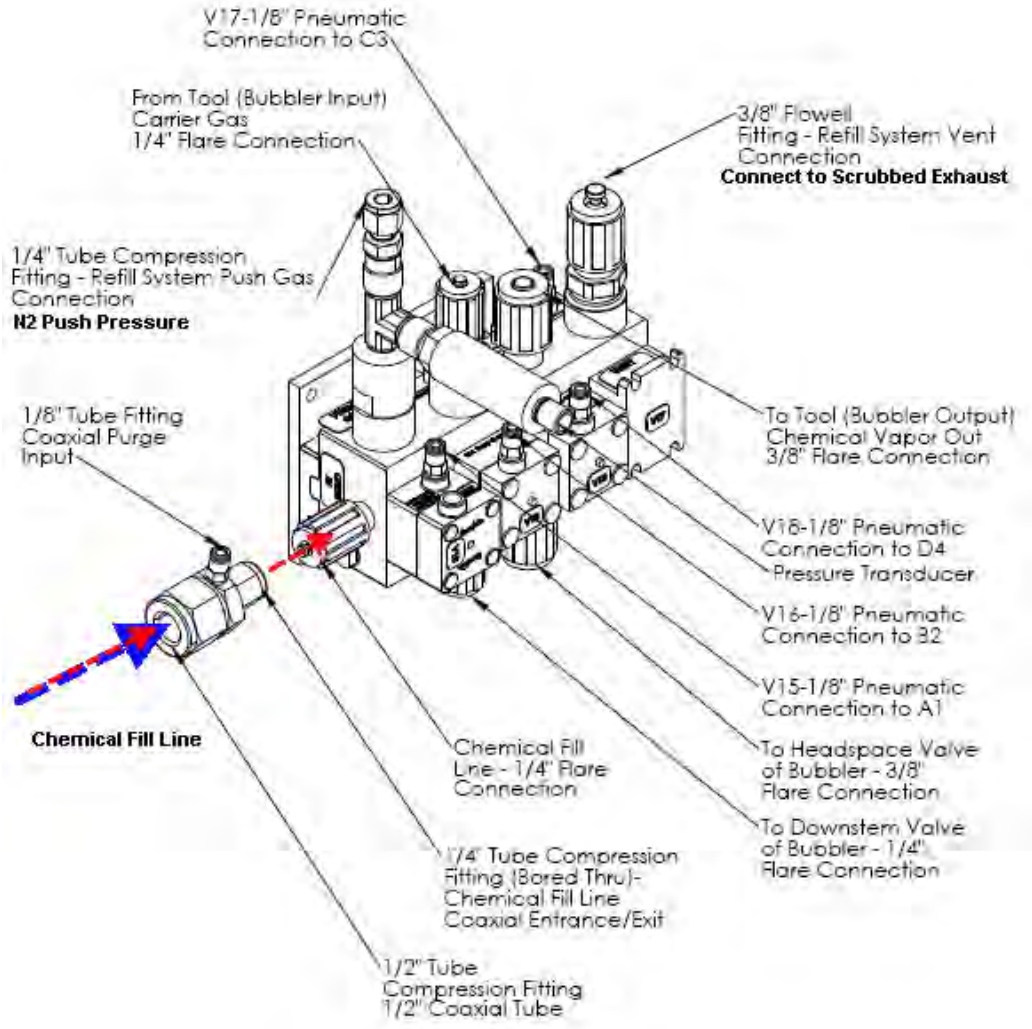
The Chemical Delivery Line is routed either directly from the ChemGuard cabinet to the source chemical input port on the CGRVM, Refill Valve Manifold, refer to Figure 3.10 or via the optional 4X or 5X CGVMB, Valve Manifold Box Double contained coaxial lines are recommended by Versum Materials, Inc.

The connection at the CGRVM is flared 6.35 mm (1/4 in.) O.D PFA fitting. The tubing thickness must be .047" in order to make the flared connection. Ensure the treaded connector is in place prior to flaring the Teflon™ tubing.

NOTE

All tubing and all associated components used to deliver chemical to the CGSCM are supplied by the customer.

Figure 3-14: CGRVM Connections



3.6.1 Pneumatic Connection for SCE

Pneumatics to the CGSCE: The CGSCE requires regulated Nitrogen (N_2) or other inert gas delivered via 6.35 mm (1/4 in.) O.D. compression fitting. Polyurethane or Teflon™ tubing can be used with the ability to withstand pressures in excess of 145 psig. A 1/8'' Pneumatic Connections to V15, V16, V17, V18, & V19 is required.

Pneumatics to the CGSCE: The CGSCE delivers pneumatic pressure for valve control of the CGRVM and one optional CGVMB. The terminations of the 3.17 mm (1/8 in.) O.D. pneumatic lines are quick disconnect compression fittings.

3.7 Installing ChemGuard® Gen III Reservoir Scale

One (1) scale is shipped with the ChemGuard® cabinet and installed inside the cabinet for the Process reservoir. As an option a second scale may be obtained for use with the Bulk reservoir. Please contact your Versum Materials, Inc. representative for further details. (For the Bulk scale and Process scale calibration procedures please refer to Chapter 7.).

3.7.1 Bulk Scale Installation

If ordered for your installation, carefully remove the optional ChemGuard® Bulk reservoir scale assembly from its shipping carton. This is a precision instrument that can be damaged if mishandled.

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

CAUTION

CAUTION: Do not connect or disconnect scale with power ON.	VORSICHT: Die Waage nicht bei eingeschaltetem Strom anschließen.	ATTENTION: Ne pas raccorder la balance lorsque qu'elle est sous tension.

NOTE: These steps apply to installation of optional scale (BULK Reservoir).

1. Remove the existing SCALE TOP PLATE [5] assembly from the CABINET [6].
2. Invert the SCALE TOP PLATE [5] assembly and remove the ChemGuard® Gen III NO-SCALE [2] by removing the existing SCREWS [4]. Retain the SCREWS [4] for installation of the RESERVOIR SCALE [1]. Discard the ChemGuard® Gen III NO-SCALE [2].
3. Turn the RESERVOIR SCALE [1] so that the SCALE CONNECTOR [3] points are facing toward the back of the CABINET [6]
4. While the SCALE TOP PLATE [5] is upside down, install RESERVOIR SCALE [1] into the SCALE TOP PLATE [5] using the existing SCREWS [4] removed in Step 2.
5. Flip the new SCALE TOP PLATE [5] assembly right-side up and gently set it onto the reservoir shelf inside the CABINET [6]. Ensure the new SCALE TOP PLATE [5] assembly is centered on the shelf, and not touching the side walls of the CABINET [6] at any point.

NOTE: When the SCALE TOP PLATE [5] assembly is turned right-side up, the old style RESERVOIR SCALE [1] will be upside down.

NOTE: Adjust the scale brackets as necessary as to not affect scale reading. Brackets should not clamp the scale. A single sheet of paper should be able to slide between the scale and each bracket.

6. Press and turn to attach the SCALE CONNECTOR [3] to the socket inside the CABINET [6] under the shelf. The SCALE CONNECTOR [3] has been designed so that it can only be installed one way.
7. Perform scale calibration per chapter 7.

3.8 Process Tool Interface Connection

3.8.1 Ethernet Network Installation

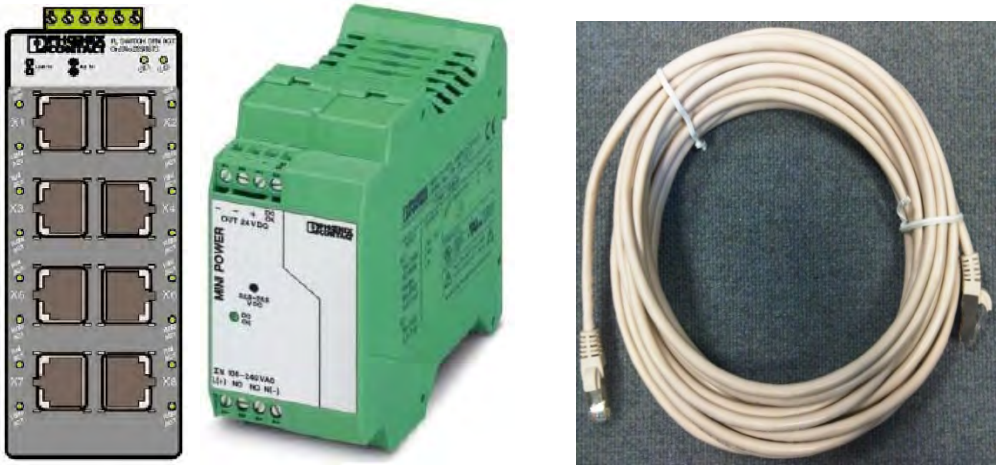
NOTE

The CGSCE and ChemGuard cabinet are capable of communicating via an Ethernet network. For this feature the customer must have the infrastructure in place.

Each CGSCE is connected to the ChemGuard through an Ethernet communications protocol. When using Ethernet communication, each CGSCE and ChemGuard must have a dedicated 10BaseT line connected to either a switch or router. Each unit must have a unique IP address assigned for proper communication.

Versum Materials, Inc. can provide an Ethernet kit. Refer to Figure 5.1.4.
1. Ethernet Switch (Ethernet 8 Port, Standard Function).
2. Power Supply (100-240AC to 24VDC, Din Rail, Narrow Design).
3. Cable Assembly (Ethernet 75 feet).

Figure 3-15: Ethernet Kit



Ethernet Switch Power Supply Cable Assembly

1. Mount Ethernet switch and power supply inside the tool in an electrical panel where there is available DIN rail space.
2. Connect DC power from the power supply to the Ethernet switch, reference drawing SW005302.
3. Connect AC power to the Power supply, reference in this Chapter.

3.9 Installing System Vacuum

There is no vacuum requirement for this system.

3.10 Installing System Exhaust and Vent

3.10.1 Exhaust and Vent Requirements

For Exhaust and Vent installation requirements please refer to Chapter 2.

3.10.2 Connecting ChemGuard® Gen III Exhaust

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

Table 3-5: Connection Verification Checklist

CONNECTION	Complete
Installing the cabinet	
Electrical connections	
Supply gas	
Vacuum	
Exhaust and vent	
Chemical delivery lines 1 – 4	
Optional outer coaxial line	
Optional Bulk scale	
Optional Bulk refill line	
Optional Bulk Trickle Purge Pigtail	

3.10.3 Hazardous Gas/Vapor Leak Detection System

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

3.10.4 Connecting ChemGuard® Gen III to Monitoring System

ChemGuard® Gen III 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.

3.10.5 Vent Line RVM

The Source Vent line is routed from the RVM vent port to the appropriate abatement system via an exhaust line.

The connection is flared 6.35 mm (1/4 in.) O.D. PFA fitting. The tubing thickness shall be 0.047” in order to make the flared connection. Ensure the treaded connector is in place prior to flaring the Teflon™ tubing.

3.11 Initializing the System

3.11.1 System Setup

The ChemGuard® Gen III cabinet have an LCD on the front face of the cabinet that shows a graphical display of the Bulk and Process reservoir, shutdown and fault alarm boxes, a controller status box and the selection window.

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. Any alarm that requires the system to be shutdown is displayed in the SHUTDOWN ALARM box in the top left hand corner of the screen. Any alarm that requires operator attention is displayed in the FAULT ALARM box in the top right hand corner of the screen.

3.11.1.1 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.

ChemGuard® Gen III Controller Main Menu

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

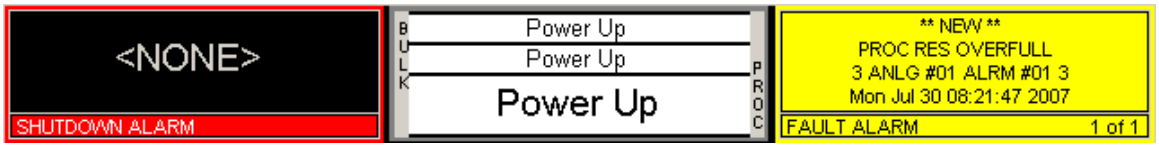
To return the Main Menu to its normal size, simply touch the words, “Main Menu,” again.

3.11.1.2 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.

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

Alarm and Controller Status Boxes



3.11.1.3 Display

The display, located on the door of the ChemGuard® Gen III controller or in the controller housing depending on model, provides visual indication of pneumatic valve positions. Conforming to ISA standards, open valves are shown in red and closed valves are shown in green. A legend for the color code is on the side of the screen for reference.

3.11.1.4 Display LEDs

LEDs displaying ChemGuard® Gen III functions are located to the right of the LCD display. The table below describes these LEDs and their functions.

3.11.1.5 Controller LEDs

Table 3-6: LED Matrix

LED	FUNCTION
SHUTDOWN ALARM	This LED flashes red on power up and for an un-acknowledged shutdown alarm. Once acknowledged, the LED stops flashing but remains red until it is reset.
FAULT ALARM	This LED flashes yellow on power-up and for a 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.
POWER	This LED indicates that there is +5 VDC power to the unit.
ARS (Option)	This LED lights blue; steady on when ARS is enabled, flashing when ARS is active

3.11.1.6 Screen Saver

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

The screen saver will de-activate if a new alarm appears. To manually de-activate the screen saver, touch the screen.

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

3.11.2 Source System Configuration

ChemGuard® Gen III controller files may be modified to customize the system operation for a particular installation or application using a second or third level security code. These modifications are referred to as the "source system configuration". Cabinet parameters for Bulk Reservoir, Process Reservoir, Bulk Change and Process Change must be defined and entered into the system memory. Select this item to set up the ChemGuard® Gen III cabinet operating parameters.

From the Main Menu, select the Configuration Menu to display some configurable parameters and change user configurable parameters.

For safety considerations, most configuration parameters may be changed only by Versum Materials, Inc. technical personnel. The following paragraphs describe the parameters that the operator may view and/or change.

ChemGuard® Gen III controller 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 4.10) 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 AP11 controller door as shown in Figure 4.11

Safety standards require that the AP11 front-panel USB port be tool accessible. To meet the standard, a Lindy USB Port Blocker (see Figure 4.11a) will be factory installed on all AP11 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 3-16: Electrical Warning Label

Figure 3-17: Lindy USB Port Blocker and Key

3.11.2.1 Net Product

You can enter the Net Liquid Weight and the Current Weight. For example, since all vessels are shipped from the factory with a fill weight, a typical 19L vessel has a full net weight of 17.4kg. Enter the Net weight in the NET window and the fill weight scribed on the vessel in the "Current Weight" window. Tap the OK button. This will generate the ratio of the Net and the Current weights as a percentage of full on the animated graphical screen. The gross value will display the normal analog reading with no adjustment.

3.11.2.2 User Set points

Choose an analog input device from a drop down menu. When the operator chooses an analog input device, the corresponding set points will be displayed and can be changed. The User Analog Set point window displays the customer/user-defined analog alarm data. The window displays the alarm number, alarm label, and current alarm set point for each user-defined alarm. A total of ten set points exist per analog input. The number of user set points will be equal to ten minus the number of VERSUM MATERIALS, INC. set points. This window allows the operator to enter a new set point value for one or more chosen alarms or exit the window without changes.

Enter parameters for each of the analog items, referring to the appropriate table for recommended parameters and settings for your specific installation.

NOTE: Numbers displayed in these illustrations are for theoretical purposes only. Refer to the information in the tables and to your own system requirements for actual parameter values.

To change a set point, first select the analog input device from the drop down menu. Then highlight the set point of your choice by touching the screen. Using the keypad, enter a numeric value into either the "Set point" or "Set point Percent" box. Press "APPLY" to accept the changes or "OK" to exit the window. Any change in the "Set point Percent" will change the value of the "Set point" and vice versa.

NOTE: To change Scale values, enter them in the "Set point Percent" box, but do not change the "Set point" box. For vacuum and push pressure values, change the "Set point" box, but do not change the "Set point Percent" box.

To setup Bulk reservoir parameters in ChemGuard® Gen III:

From the Main Menu, select CONFIGURATION MENU to display the Configuration Menu. From the Configuration Menu, select USER SETPOINTS.

Bulk Scale:

To set/change Bulk scale-related set point parameters, select BULK SCALE from the pull down menu in the USER SETPOINTS screen. Highlight the parameter to be changed and enter the value in the "Set point Percent" box. Click "APPLY" to accept the changes. Bulk scale parameters have to be entered in terms of percentage (%). Use the "Set point Percent" box to set/change any Bulk scale parameters.

Note that this will automatically change "Set point" parameters also.

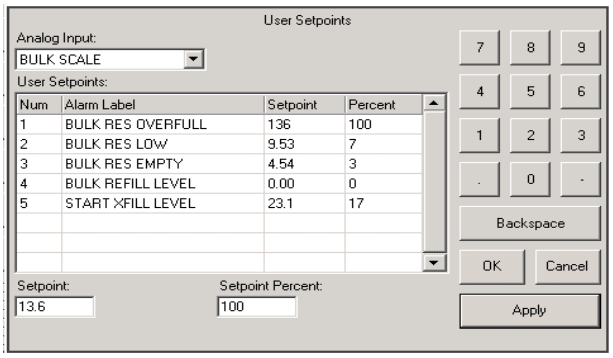
Bulk Res Overfull

Bulk Res Low

Bulk Res Empty

Bulk Refill Level

Start XFill Level



NOTE: If the cabinet has an external fill option, the external fill operation will start when the Bulk level reaches Start XFill Level set point.

NOTE: For Bulk scale parameter, do not enter a value in the “Set point” box. Enter only in the “Set point Percent” box.

Bulk Push Pressure:

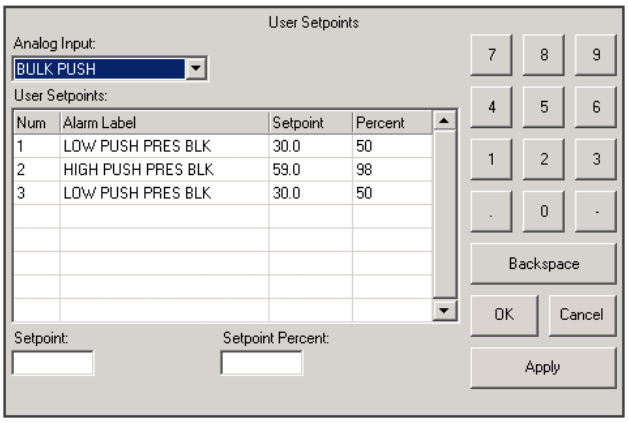
To set/change Bulk pressure-related set point parameters, select BULK PUSH from the pull-down menu in the USER SETPOINTS screen. Highlight the parameter to be changed and enter the value in the “Set point” box. Click “APPLY” to accept changes.

NOTE: Bulk push parameters are not used in terms of percentage, so use the set point box to enter new values.

Low Push Pres Blk

High Push Pres Blk

Low Push Pres Blk



Set point for Low Push Pres Blk should be set at both places in the above screen (Num 1 and Num 3). It is very important that these values are set to the same value since both set points are used to trigger the Low Push Pres Blk alarm.

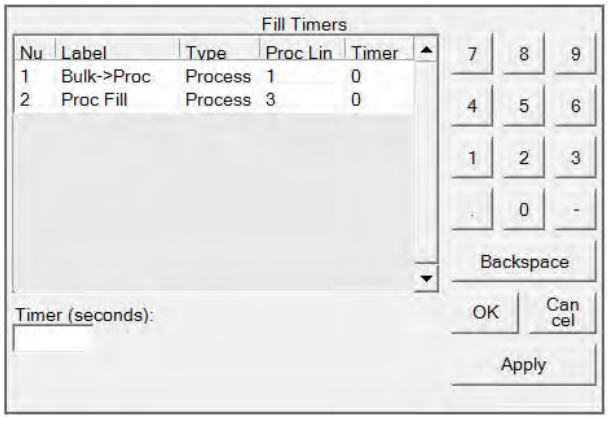
Fill Time:

To change/set fill timer values, from the Configuration Menu, select SYSTEM SETUP to display the System Menu. Select FILL TIMERS.

NOTE: A zero for any timer value means no timeout value will exist.

Bulk Fill Time:

To select the Bulk fill timer, select Bulk->Proc and key in a numeric value for the timer. Press “APPLY” to accept the changes. Press “OK” to exit the window.



Process Fill Time:

To select Process fill timer, select Proc Fill and key in the numeric value for timer. Press “APPLY” to accept the changes. Press the “OK” button to exit the window.

To set-up Process reservoir parameters in ChemGuard® Gen III:

From the Main Menu, select CONFIGURATION MENU to display the Configuration Menu. From the Configuration Menu, select USER SETPOINTS.

Sub Cycle Parameters

This option displays the current values for the purge parameters, which are primarily used during Bulk change and Process change operations. You may increase these values, but may not decrease them below their pre-programmed minimum.

NOTE: The maintenance routines are embedded into the change routines.

3.11.3 Flow Valve (Z-Purge)

The flow valve is located on the right rear of the controller and can be adjusted via the penetration into the gas 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.)

Pressure switches are installed inside the cabinet to ensure adequate pressure (≥ 0.1" H_2O) during the Z-purging. 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. A "low Z-purge" alarm will be triggered if pressure falls below the set point. The nitrogen flow must be increased until the alarm can be reset.

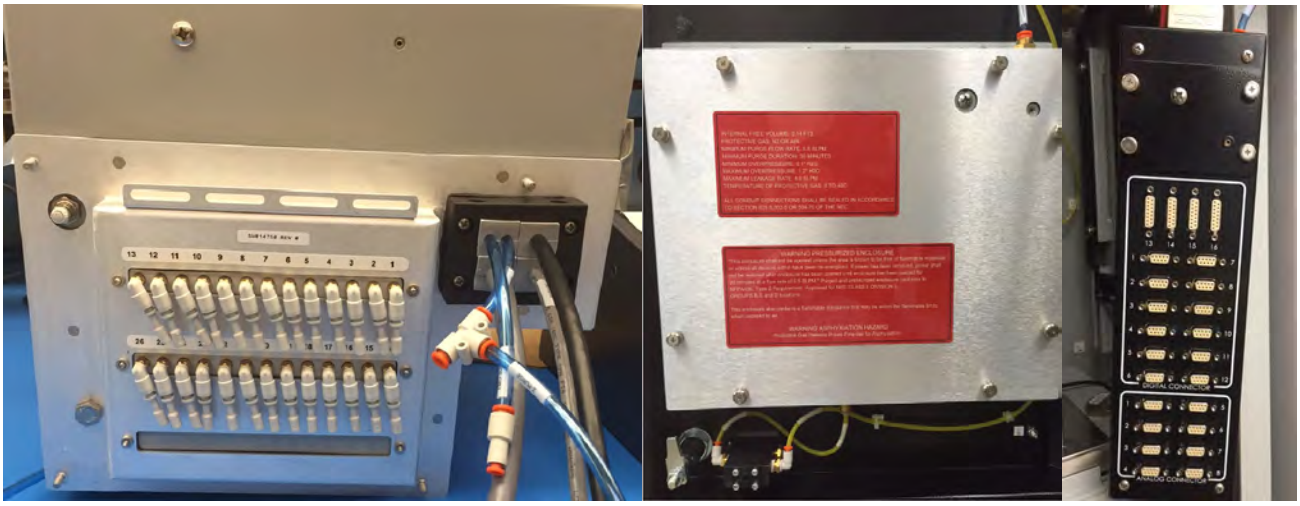
The Z purge pressure is controlled by a needle valve at the base of the controller. After opening the controller in a suspected hazardous area it is necessary to use the following procedure to re-establish the Z-purge before operating the controller:

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.



3.12 SYSTEM FEATURES

3.12.1 Manual Operation

CAUTION

Only experienced operators should operate the ChemGuard® Gen III 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.

How to Operate in Manual Mode

Operating in Manual Mode could cause the following hazards which can result in PERSONAL INJURY OR DEATH.

⚠WARNING

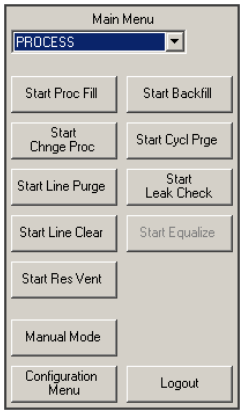
- **Opening valves when high pressure push gas is present.**
- **High pressure gas could be vented.**
- **Opening vent valves when high pressure gas is present.**

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

Select anywhere on the graphics portion of the screen and enter the password.

Press “OK”

From the Main Menu screen, click "MANUAL MODE".



The MANUAL MODE window will display

Operate valves referring to “How to Open and Close valves” section below.

To exit MANUAL MODE, press “CANCEL”.

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

How to Open and Close Valves

To open a valve:

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

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

To close a valve:

Touch the valve you want to close by selecting the valve on the touch screen.

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, the controller leaves the bank in manual and allows the operator to go to other screens. Any open valves will remain open, and the Mode Status Box will continue to indicate manual mode. Manual mode will remain active or ‘secured’ until an operator reenters the Manual Mode window. While manual mode is ‘secured’, Manual Mode will be the only selectable option on the Main Menu.

⚠CAUTION

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

3.12.2 System Test

Test Digital In

This option displays a list of the digital inputs and their current state. The state may be used to determine if the digital device is operating properly.

This file operates in a similar manner to manual operation as described in Section 3.13.1. It is the customer's responsibility to adhere to all operational warnings in Section 3.13.1 when performing the Digital Out Test.

Use the scroll bar to view all the digital input values.

Test Digital Out

This option displays a list of the digital outputs and their current values. Outputs may be forced "on" (energized) or "off" (de-energized) to determine if the output is operating properly.

Use the scroll bar to view all the digital output values.

⚠CAUTION

Extreme care must be taken when forcing a digital output either on or off as there is no confirmation in Digital Out Test, as a reminder, like that which is used in manual operation for critical valve operation.

Test Analog In

This option displays a list of the analog inputs, their current values (net or gross), and the raw signal input. The current value may be used to determine if the analog device is providing accurate output (controller input).

Use the scroll bar to view all the analog input values.

Test Internal Flag

The Test Internal Flags window will display the internal flag number, label, and state (Set or Clear) for all internal flags in the system. This window will allow the operator to exit the window or change one or more internal flag states to SET or CLEAR. To change an internal flag state, highlight the desired internal flag to change and select SET or CLEAR at the bottom of the window. Clicks APPLY. Upon exiting the Test Internal Flags window, any changes made to internal flag states will be ignored and the internal flag states will return to their original state.

⚠CAUTION

Extreme care must be taken when changing the state of an internal flag. The operator must fully understand the use of the flag prior to any edits.

Test Remote In

This option is not available in ChemGuard® Gen III cabinet.

3.12.3 Valve Setup

The Valve Setup window displays the solenoid number, valve label, and valve confirmation for each valve in the system. This window allows the operator to change the valve confirmation mode for one or more valves or exit the window without changes. The valve confirmation mode will be set to CONFIRM or NO CONFIRM.

3.12.4 Valve Counts

The Valve Counts window displays each valve in the system and the count for each valve. The valve count represents the number of times a pneumatic valve has cycled (opened and closed). This window allows the operator to change the valve count for one or more valves or exit the window. New valve counts are written to the NV Data File upon exiting and saving the Configuration Menu.

3.12.5 Operation Sequences

The Operation Sequences window displays a menu, listing the following for each operational sequence defined in the Configuration File: process line number, an indication of whether the sequence is a main

menu sequence, sequence type, sequence number, and sequence label. This menu allows the operator to exit the window or view an operational sequence by choosing the desired sequence. Changes to operational sequences are not allowed.

3.12.6 Sequence Flow Options

The Sequence Flow Options window displays a list of all Main Menu Sequences in the system. The operator is allowed to choose one of these sequences. When the operator chooses a sequence, a window appears with the sequence label as the title. The window displays the end, stop, and fail options lists defined in the Configuration File for the chosen sequence. The end, stop, and fail options lists contains the sequence label of each main menu sequence that is permitted to be selected from the main menu after an end, stop, or fail of the chosen sequence. Changes to sequence flow options are not allowed.

3.12.7 Prompt List

The Prompt List window displays the prompt number and prompt label for each of the prompts in the system. The window allows the operator to view the prompt list or exit the window. Changes to the prompt list are not allowed.

3.12.8 Set Time/Date

The Set Time/Date window displays the current time and date for the system. The window allows the operator to exit the window or enter a new time and/or date by selecting to the appropriate prompt.

3.12.9 Analog Scaling

The Analog Scaling window displays all the analogs used in the system. The operator can choose an analog or exit the window. After selecting an analog, the operator can change the maximum and minimum scaling values using the keypad. The Analog Scaling window displays the analog number, analog label, device type (milliamps or volts), minimum analog value, and maximum analog value for each analog point. This window allows the operator to exit the window or enter a new analog range minimum and/or analog range maximum for one or more analog points.

3.12.10 Set Points

The VERSUM MATERIALS, INC. Set Points window displays all analogs used in the system. The operator can choose an analog from the drop down menu and the corresponding set points for that analog will be displayed. The VERSUM MATERIALS, INC. Set Points window displays the VERSUM MATERIALS, INC.-defined analog alarm data. The window displays the alarm number, alarm label, and current alarm set point for each VERSUM MATERIALS, INC. alarm. A total of ten set points will exist per analog input. The number of VERSUM MATERIALS, INC. set points will be equal to ten minus the number of user set points. This window allows the operator to enter a new set point value for one or more chosen alarms or exit the window without changes. The VERSUM MATERIALS, INC. Set Points window will only be accessible with an VERSUM MATERIALS, INC. level password.

3.12.11 Alarm Conditions

The Alarm Conditions window displays the alarm input type, alarm number, alarm label, and alarm condition for each system alarm. This window allows the operator to change the alarm condition for digital alarms to closed, open, or not used and the alarm condition for analog alarms to high, low, or not used. The window allows the operator to change one or more alarms or to exit the window without changes.

3.12.12 Alarm Delays

The Alarm Delays window displays the alarm input type, alarm number, alarm label, and current alarm time delay (in seconds) for each alarm in the system. The window allows the operator to enter a new time delay value for one or more alarms or exit the window. A delay entry of ‘0’ equates to no delay. The range of values is from 0 to 255 seconds.

3.12.13 Alarm Types

The Alarm Types window displays the alarm input, alarm number, alarm label, and alarm type for each alarm in the system. The possible alarm types are Fault, Shutdown, Sequence controlled, and Non-Latching. The window allows the operator to exit the window or change the alarm type of one or more alarms. An alarm having an alarm type of “Sequence Controlled” cannot be changed to a different

type. All other alarm types can be changed; however, the alarm type cannot be changed to “Sequence Controlled.”

3.12.14 Alarm Sequences

The Alarm Sequences window displays the alarm number and alarm label for each alarm in the system. The window also displays the alarm response sequence and alarm response sequence label for those alarms that have an alarm response associated with them. The window allows the operator to exit the window or select one or more alarms to view the alarm response sequence. Changes to alarm response sequences are not allowed.

3.12.15 Relay Defaults

The Relay Defaults window displays the relay number, relay label, and relay default state for each relay in the system. The window allows the operator to exit the window or change the relay default state of one or more relays. Each relay default state will be set to No Default, Energize, or De-energize.

3.12.16 Helium Leak Check

This option is not applicable for ChemGuard® Gen III cabinet.

3.12.17 1st Security List

The 1st Security List window displays the password number and password for each first level password. The 1st level security list will be accessible to 2nd level security users and higher. This window allows the operator to exit the window or change, add, or delete one or more 1st level passwords. To delete a password, use the BACKSPACE button on the keypad. Only numeric characters are permitted in 1st level passwords and the first character will always be the number one.

3.12.18 2nd Security List

The 2nd Security List window displays the password number and password for each second level password. The 2nd level security list is accessible to 3rd level security users and higher. This window

allows the operator to change, add, or delete one or more 2nd level passwords or exit the window without changes. To delete a password, use the BACKSPACE button on the keypad. Only numeric characters are permitted in 2nd level passwords and the first character will always be the number two.

3.12.19 3rd Security List

The 3rd Security List window displays the password number and password for each third level password. The third level security list is accessible to 3rd level security users and higher. This window allows the operator to exit the window or change, add, or delete one or more third level passwords. To delete a password, use the BACKSPACE button on the keypad. Only numeric characters are permitted in 3rd level passwords and the first character will always be the number three.

3.12.20 2nd Security Access

The 2nd Security Access window displays all available user functions. For each function, the window displays the current operator's degree of access at the 2nd level of security. The degrees of access will be No Access, Read Only, or Write. The operator is allowed to view the access list or exit the window. Operators at 3rd level of security and higher that have Write access to the 2nd Security Access window are allowed to change one or more degrees of access. Changes to the degree of access cannot allow a 2nd level operator greater access than a higher level operator.

3.12.21 3rd Security Access

The 3rd Security Access window displays all available user functions. For each function, the window displays the current operator's degree of access at the 3rd level of security. The degrees of access will be No Access, Read Only, or Write. The operator is allowed to view the access list or exit the window. Only users with the VERSUM MATERIALS, INC. password are allowed to change the 3rd security access.

3.12.22 System Setup

The System Setup window allows the operator to change local or network options as well as the IP settings.

Local Setup

The Local Setup selection displays the Local Setup window. This window displays the menu timeout values. The window allows the operator to exit the window or change one of the following:

Change Exhaust Stack Size

This option is not used in ChemGuard® Gen III cabinet.

Password Protected Reset

The Password Protected Reset option allows the operator to toggle the password protected reset feature between ENABLED and DISABLED. When this feature is enabled, the operator will be required to enter a valid password when resetting alarms.

Screen Saver

The Screen Saver option allows the operator to change the screen saver time delay. The box will accept the values 0 or 31–99. A time delay of zero will disable the screen saver.

Key Press Feedback

Key Press Feedback is a toggle option that allows the operator to set whether a beep will sound as feedback when a menu option is enabled or an alarm is acknowledged.

Simulation

Simulation option allows the operator to toggle the simulation feature between ENABLED and DISABLED. This option should be set to DISABLED in the field.

Network Setup

The Network Setup option displays the Network Setup window, which displays the network port number, the network device type, the Network Control state the Ethernet channel numbers, and the network communication type. The window allows the operator to exit the window or change one or more of the network parameters.

Enable/Disable Network Control

The Enable/Disable option allows the operator to change the Network Control state to either Enable or Disable.

Ethernet Channel Number

The Ethernet change channel option allows the operator to change the left and right channel numbers within the range of 0 to 9999. Changes to the channel number will be written to the NV data file.

Network Comm Type

The network comm type can be set to Ethernet.

Peer to Peer IP Settings

This option is not applicable for ChemGuard® Gen III product line.

IP Settings

The IP settings option allows the user to modify the IP address, subnet mask, and default gateway.

Set Product Code

The set product code option allows the user to define the product code within the barcode string.

Calibrate Touch Screen

This option allows the User to Calibrate the Touch Screen.

Bar Codes

This feature allows the sequence to prompt for one or more barcodes during a change cylinder operation, provides a user interface window to view/modify the barcodes, and communicates the barcodes to the Network Monitor via the network protocol.

Alarm History

Alarms that appear in ChemGuard® cabinets are stored in the non-volatile memory of the controller and can be viewed via either the Alarm History button of the System Setup menu or the System Information window. Alarms can be stored overtime up to 200 alarm events, then FIFO (First In First Out).

In addition, alarms can be sorted by alarm type - fault, shutdown or in chronological order. Also there is ability to clear all history for either fault or shutdown and to dump the alarm history to a CSV file or similar on a USB memory device.

If the Alarm History window is opened from the System Information window, the Clear History buttons and the Export button will not be visible since the System Information window can be viewed by anyone without logging into the controller. If the Alarm History window is opened from the System Setup menu, the Clear History buttons and the Export button will be visible, but enabled per the operator's view/modify security permissions.

The Alarm History window will always open showing the most recent alarms to the least recent alarms in a multicolumn list. On top of the Alarm List will be the Sort by radio button selection list. The Sort by selections will be Date/Time, Shutdown Alarm and Fault Alarm. If a different Sort by criteria is selected, the Alarm List will refresh and update based on the Sort by selection. If the Shutdown Alarm Sort by is selected, fault alarms will not be shown, and if the Fault Alarm Sort by is selected, shutdown alarms will not be shown.

The Alarm List will have three columns: Date/Time, Type and Description. The Date/Time column will contain the date/time of the alarm event. The Type column will indicate the alarm event type being

Shutdown, Fault, Ack, Reset, Login, Logout and Power Up. The Alarm column will show the description of the alarm including the alarm input type, input number and alarm number, and will show the affected process lines.

Below the Alarm List are six buttons: Clear All History, Clear Shutdown History, Clear Fault History, Export, Refresh and Cancel. The Clear All History will clear all of the alarm history prior to the most recent alarm reset event. The Clear Shutdown History and Clear Fault History will clear just the selected shutdown or fault history. The Clear buttons will not clear any of the alarm events for active alarms.

The Export button exports the alarm history to a CSV text file in a selected directory on a USB memory device. The USB directory selection will be similar to the directory selection used when performing a firmware or configuration file transfer. The exported file will contain the following columns:

- Alarm Event Number – resorts the alarm events back to their original chronological order (most recent alarms to the least recent alarms starting at Alarm Event Number 1).
- Date/Time – alarm date and time string.
- Type – alarm event type being Shutdown, Fault, Ack, Reset, Login, Logout and Power Up.
- Description – event description string including the alarm input type, input number and alarm number, and affected process lines.
- PL1 through PL8 – a column for each process line that contains either a 0 or 1 to allow the alarm events to be sorted by process line.

The Refresh button refreshes the Alarm List with the latest alarm events. The Cancel button closes the Alarm History window.

The alarm history ring buffer will be completely cleared if the non-volatile memory is cleared via the memory management configuration menu.

Fill Timers

The fill timer option is used to set the timer value for Bulk to Process operation or Process Fill operation or External Fill operation. Refer 3.12.2 Source System Configuration section for details of how fill timers are used in ChemGuard® Gen III cabinets.

Tool Names

The tool names option is used in ChemGuard® Gen III product lines to set the tool name for each of the manifold lines (V11, V12, V13 and V14) that may be present in the system. On the screen, Num 1 and Num 2 correspond to tool name for V11. Num 3 and Num 4 correspond to tool name for V12, etc. Highlight any tool name to set/modify and using the keypad on the display type the tool names on the "Name" box. Click "Apply" to accept the changes. Click "OK" or "CANCEL" to exit out of this option.

Config Transfer

The Configuration Transfer window will display the Configuration File transfer options listed below. The operator will be allowed to choose an option or exit the window. All other controller operations will be suspended during a PC to Controller file transfer.

USB to Controller

The USB to controller transfer option will begin the file transfer of the configuration file from the source device connected to the controller USB port. This option will only be accessible by users with the VERSUM MATERIALS, INC. level password.

Controller to USB

The controller to USB transfer option will begin the file transfer of the Configuration File from the controller to the target device connected to the controller USB port.

3.12.24 Memory Management

The Memory Management window is not accessible to the customer. Only Versum Materials, Inc. authorized personnel has access. It will display the options listed below. The operator will be allowed to choose an option or exit the window.

USB to Controller Firmware

This option will begin the Firmware file transfer from the source device attached to the controller USB port. The identical transfer must be initiated by the user in the Transfer Program.

Controller to USB Memory Contents

This option will begin the file transfer of the firmware executable files, Configuration File, and NV Data File from the memory of the Controller to the attached PC. Once this option is selected, the following text “FILE TRANSFER IN PROGRESS - DISPLAY INFORMATION WILL NOT BE UPDATED DURING TRANSFER” will be displayed in bold at the bottom of the current selection window.

Delete Nonvolatile Data File and Reboot

The Delete Nonvolatile Data File option will delete the nonvolatile (NV) data file from the memory. The controller will reboot after completing deleting the NV data file from memory.

Return to Power Up Mode

The Return to Power Up Mode option returns the Controller to Power Up Mode.

Reboot

The Reboot option reboots the Controller.

Reboot to OS

The Reboot to OS option reboots the Controller to the Operating System.

Disable/Enable OS Access

The Disable/Enable OS Access option permits access to the Operating System Task Bar.

Variables

The Variables option allows the user to see the list of variables used in the sequence.

3.12.25 Source System Information

To access the Source System Information screen, touch the blue title button at the bottom of the screen. The Source System Information window displays the firmware, network, and configuration information and has options for testing the shutdown and/or fault alarms as well as cleaning the screen.

3.13 VMB Installation and Integration

If the maximum number of sources to be installed exceeds four (4) or if future expansion is expected, installation of CGVMB's will be required. Each VMB will house a five (5) stick output manifold. Each stick has a double isolated chemical shutoff with a manual and pneumatic valve. Four (4) CGVMB's can be connected to one (1) ChemGuard. This will considerably increase production to accommodate up to twenty (20) tool sets.

The CGVMB comes equip with the necessary hardware to facilitate double containment of the chemical lines from the ChemGuard and to each CGSCM.

NOTE

Versum Materials, Inc. does not provide a termination point for the doubled contained lines at the source cabinet because of the various tool configurations.

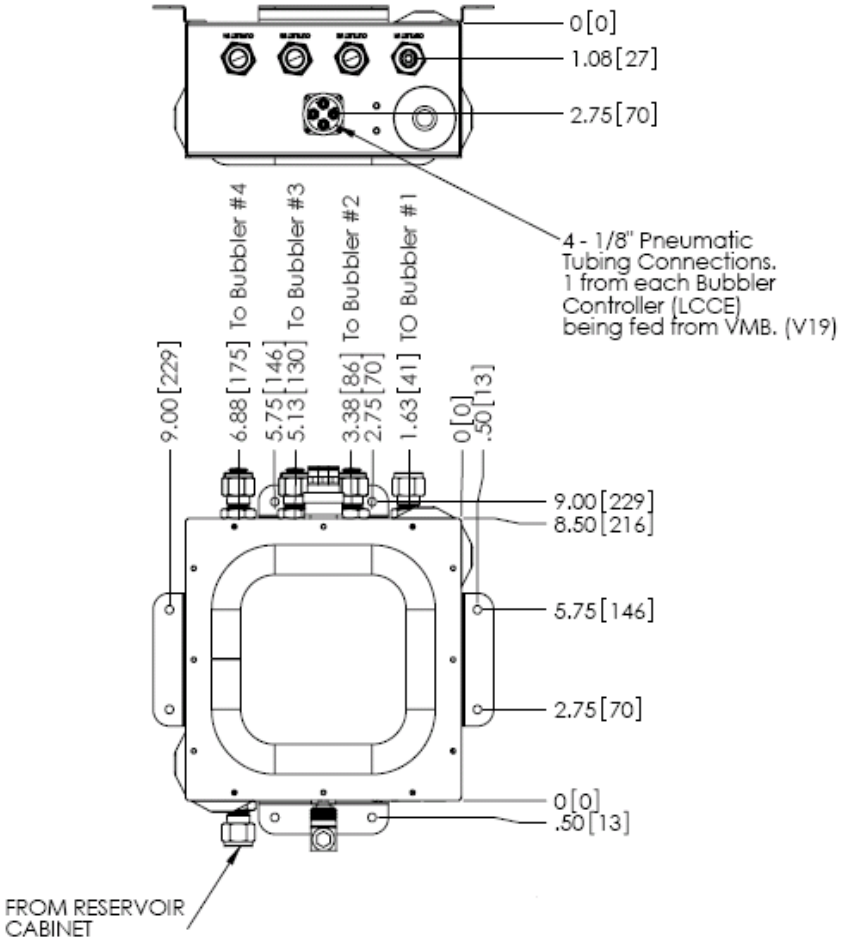
Figure 4.3.1 CGVMB, Valve Manifold Box

3.13.1 CGVMB Installation

The CGVMB has internal spill circuitry that will automatically shut off the chemical supply feeding it, as well as annunciate the alarm on the ChemGuard. To facilitate this arrangement installation of the following services is required. Refer to Figure 3.17.

1. Two conductor cable from each CGVMB to the ChemGuard Controller.
2. 3.17 mm (1/8 in.) pneumatic tubing from the CGVMB to each connected CGSCM.
3. 12.7 mm (1/2 in.) Stainless Steel or Teflon™ tubing from the ChemGuard Cabinet output manifold to the input Swagelok connector on the CGVMB.
4. 12.7 mm (1/2 in.) Stainless Steel or Teflon™ tubing from CGVMB output Swagelok fitting to the source cabinet where the CGSCM is located.
5. 6.35 mm (1/4 in.) Teflon™ tubing to accommodate all chemical fill lines.
6. The float can be mounted in five different planes to accommodate various positions of the CGVMBs during installation. In any case, the orientation of the float sensor must be vertical in relation to the CGVMB's mounted plane. The float signal output is connected to the Chemical Output Valve input of the ChemGuard controller.

Figure 3-18: CGVMB Connection Points



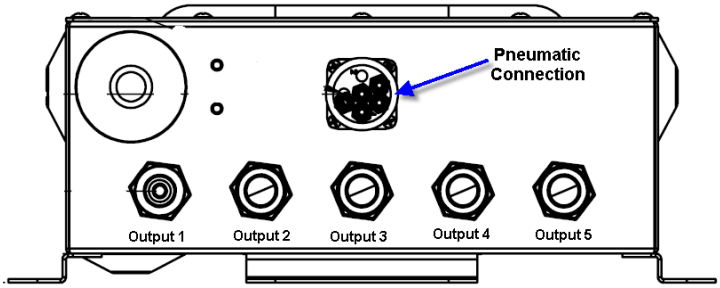
3.13.2 Chemical and Coaxial Line Installation

1. Install 12.7 mm (1/2 in.) OD Stainless Steel or Teflon™ tubing between the ChemGuard Cabinet output manifold Swagelok connector and the 12.7 mm (1/2 in.) Swagelok fitting "In-Line" with the "Chemical-In" port of the CGVMB.
2. Install 6.35 mm (1/4 in.) OD Teflon™ tubing between the ChemGuard chemical output manifolds flare connection via the coaxial purge fitting and terminate at the CGVMB chemical input flare connection.
3. Install 12.7 mm (1/2 in.) OD Stainless Steel or Teflon™ tubing between the CGVMB output and the CGRVM chemical input valve. Ensure the termination point at the CGRVM is inside an exhausted enclosure.
4. Install 6.35 mm (1/4 in.) OD Teflon™ line between the chemical output valve flare connection of the CGVMB to the CGRVM chemical input valve flare connection via the 12.7 mm (1/2 in.) coaxial line.

3.13.3 CGVMB Pneumatic Installation

Each pneumatic valve of the CGVMB is controlled by one CGSCE. This controlled valve will behave as an extension of the CGRVM

Figure 3-19: 5X CGVMB Pneumatic Connection Points



Chapter 4

Changing Reservoir Container

Section 1 **Bulk Change Operation**

Section 2 **Source Change Operation**

4.1 Bulk Change Operation (CG1000-2000)

The ChemGuard® CG1000-2000 Bulk Change operation will be the most commonly used operation, besides auto fill, that operators will be performing.

The automated Bulk Change operation will safely and completely remove chemical from the inlet and outlet pigtails, facilitating easy container installation and removal. Minimal operator interaction is needed to perform this function.

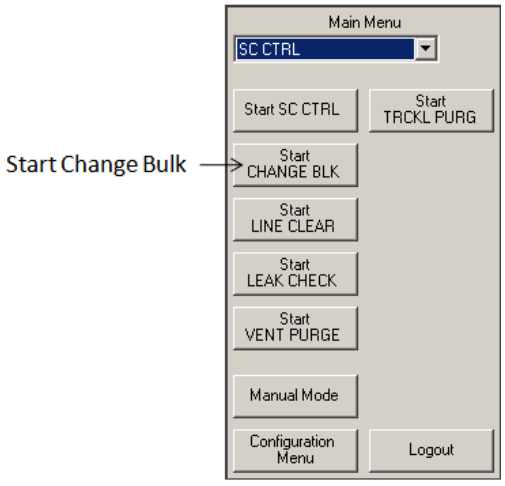
Because of the high vapor pressure of the chemicals used in the CG1000-2000 cabinet, no vacuum is needed to remove chemical and associated vapors from the internal piping and pigtails. This is accomplished mainly by flow purging using Nitrogen (N_2) gas and combination of operational steps embedded in the Bulk Change operation routine.

Soon after Operator selects Start Change Bulk operation, the cabinet software begins the cabinet pressure test to check for push gas and vent condition by using the pressure transducer to read and monitor change in pressure. Once the internal diagnostic checks complete, the software begins to clear liquid chemical at outlet pigtail back into Bulk container. Following the user prompts on the screen will allow for closing the bulk container valves. The cabinet software will begin cycle purge sub-route to remove chemical vapor from pigtails before allowing Operator to disconnect and replace container.

After a new Bulk container installed, the software resumes Bulk Change operation to leak check pigtails connections and then cycle purge to prepare for new container back online.

In order to start the change Bulk operation, log onto the CG1000-2000 cabinet with valid password. Select the Start CHANGE BLK button from the main menu as shown in Figure 4.1, the cabinet will automatically start the change Bulk operation. The controller status box will display the text "CHANGE BLK" indicating the change Bulk operation is in progress as Stop Change Bulk button will be displayed. Select the Stop Change Bulk button any time if you would like to stop the change Bulk operation.

Figure 4.1 Start Change Bulk



Once the change Bulk operation is initiated by selecting the Start Change Bulk button in the Main Menu, follow all the system prompts to complete the operation successfully. The change Bulk operation consists of several steps. The following section describes the steps involved in the change Bulk operation.

WARNING

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

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

WARNUNG: Vor dem Trennen der Leitungen sicherstellen, daβ Die handbetātigten Ventile am Vorratsbehālter geschlossen sind.

Werden am Vorratsbehālter Drucklufventile verwendet, műssen zuerst die Drucklufleitungen getrennt werden, bevor die Anschlűsse am Behālter entfernt warden.

Avertissement: Avant de dèbrancher la ligne, s'assurer que les soupapes de manoeuvre Se trouvant sur le rèservior soient femèes.

Si les valves pneumatiques sont utilsèes sur le reservoir, alors dèconnecter les tubes pneumatiques avant de Dèbrancher les connexions du Recipient.

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 Behālter dűfen sich nicht drehen.

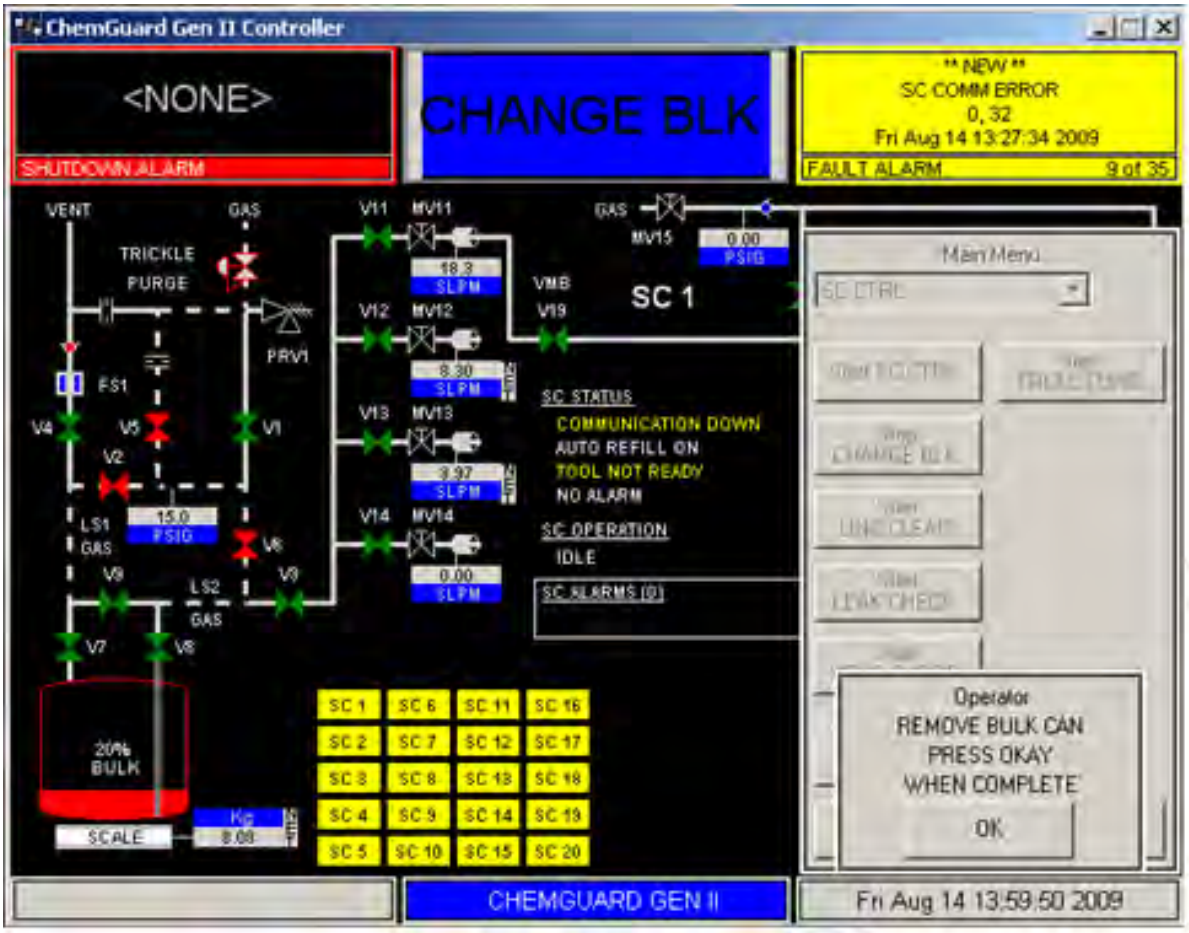
Eine Beschādigung der VCR-Berűhrungsflāchen kann zu Leckage fűhren, die den ordnngsgemāβen Betrieb des Systems beeintrāchtigen.

ATTENTION: Ne pas laisser toumer les soupapes sur la boite mètallique.
Tout dègát aux surfaces des pieces en VCR peut causer des fuites et, done, empècher le fonctionement proper du System.

WARNING

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

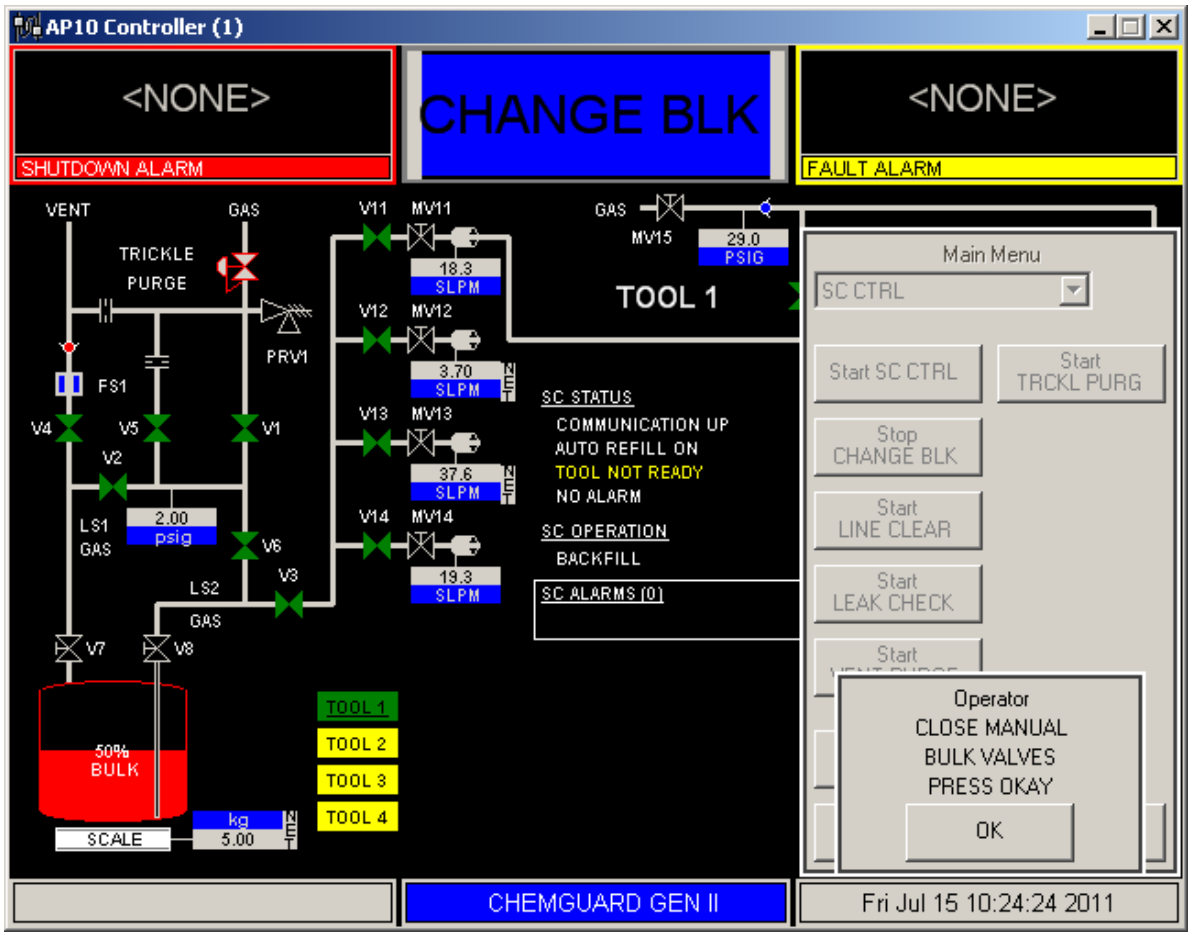
1. Select Start CHANGE BULK button.
2. Cabinet software begins Bulk Change operation.
3. To stop Bulk Change operation by selecting Stop CHANGE BULK button. Once the Bulk Change operation is started, it is strongly recommended to avoid an unsafe condition when disconnecting the pigtails from container.
4. The cabinet software line clear operation will clear liquid from pigtail back into Bulk container. After this operation is completed, the software will prompt Operator to close container valve.
   a. CG1000 cabinet software will display screen as shown container with three valves. Operator must follow software prompt to perform the task accordingly.



NOTE

The Bulk container has three valves setup

b. CG2000 cabinet software will display screen as shown container with two valves. Operator must follow software prompt to perform the task accordingly.



NOTE

The Bulk container has two valves setup

5. After Operator has performed the task of closing valves and confirmed, the cabinet software begins cycle purge routine to prepare pigtails for disconnection from Bulk container.
6. Software will check trickle purge pigtail pressure and then prompt Operator to disconnect and replace the Bulk container.

NOTE

When working with CG2000 models with no glass in the cabinet door always don appropriate PPE before opening the cabinet door.

NOTE

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

NOTE

The appearance of your Bulk Canister may vary slightly from those shown in the illustrations in this chapter.

NOTE

Ensure the product in the Bulk Canister is at room temperature prior to installation and startup of the CG2000. Some chemicals have relatively high freezing points.

WARNING

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

WARNUNG: Vor dem Umgangmit Chemikalien die in Ihrem Unternehmen geltenden Sickerheitsbestimmunge n und betriebsintemen Sicherheitsverfahren revidieren. All emit Chemikalien Umgehenden Personen solten mit den in den Material-Sicherheitsdatenblättern (MSDS) aufgeführten Verhahren űber die jeweils verwendete Chemikalie vertraut sein. Ein Zweitbehälter und Reinigungsmittel sollten bereitshehen, falls Chemikalien verschűttet werden.

AVERTISSEMENT: Rèex aminer les règles de sècuritè instituées à votre enterprise et les procèdès de sècuritè en force avant la manipulation de tous produits chimiques. Tout utilisateur d'un produit chimique doit suivre les procèdès prescrits dans les feuilles de norms pour matières (MSDS) concernant les produits chimiques en usage. Un recipient secondaire et du Materiel de nettoyage doivent ètre disponibles au cas où le produit chimique se renverse.

NOTE

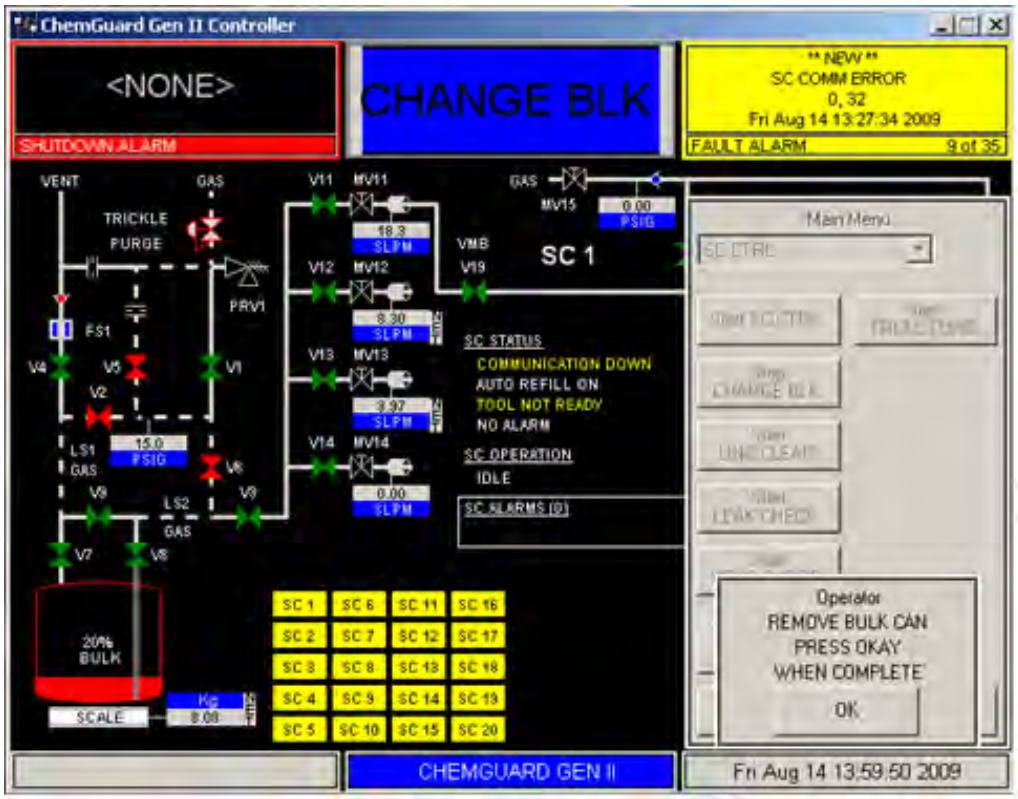
In the case of exhaust failure, chemical spill or leakage, SCBA (self-contained breathing apparatus) is required. Do not open the equipment door if either of the above conditions exists without SCBA.

7. Once the spent Bulk container has been removed and replaced with new Bulk container, the Operator must confirm the prompt to allow software route to resume.

NOTE

Although all appropriate engineering controls are in place, once the prompt is displayed to "change the spent chemical container", as little time as possible should be taken to perform the action.

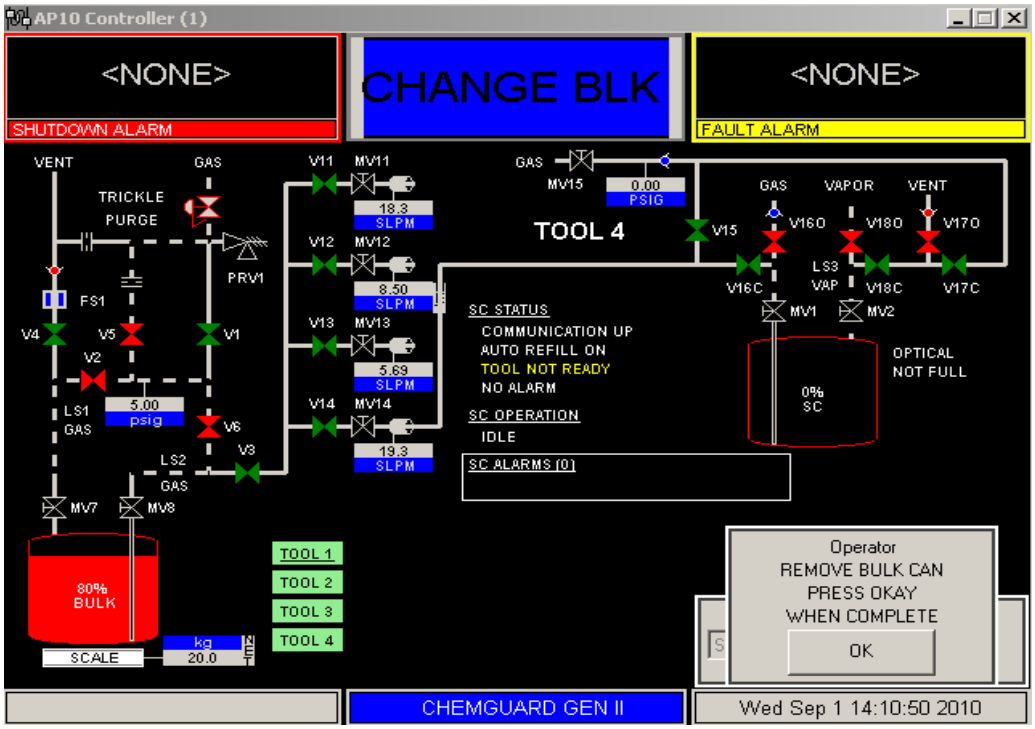
a. CG1000 cabinet software will display screen as shown container with three valves. Operator must follow software prompt to perform the task accordingly.



NOTE

The Bulk container has three valves setup

b. CG2000 cabinet software will display screen as shown container with two valves. Operator must follow software prompt to perform the task accordingly.



NOTE

The Bulk container has two valves setup

8. To remove and replace the container follow the steps below:

   a. Put on the Personal Protective Equipment.

   b. Open the door and inspect pigtails again for any signs of chemical droplets. If any droplets are present, close the door and repeat the change container procedure from the beginning.

   c. Disconnect inlet pigtail at N_2 IN container valve connector.

   d. Disconnect outlet pigtail at CHEM OUT container valve connector.

   e. The exposed pigtails will have a trickle flow of Nitrogen during the time they are disconnected to halt the introduction of moisture from the surrounding air and possible contaminate from entering the lines.

   f. Temporally plug both inlet and outlet pigtails using clean male flared Teflon™ plugs or caps.

   g. Cap the inlet and outlet valves connections on the spent Bulk container.

h. Slide out spent container and remove from scale and the replace with full container. Be aware of proper orientation, ensure container is centered on the scale and not touching any sidewalls nor obstructing door closure.

NOTE

Inspect new container for damage, evidence of chemical leakage, proper configuration and chemical type before installing.

i. Slide new container into the cabinet, then remove plugs or cap at inlet and outlet pigtails. And then re-connect inlet and outlet pigtails to container valves connectors.

j. Verify Bulk container placement and pigtails connection are properly made.

k. Close cabinet door and press the "OK" button that appears on your screen as shown.

NOTE

A series of prompts will appear on the touch screen display to guide the operator in removing the spent container and placing a full container of chemical into the system. DO NOT acknowledge the prompt until after you have completed the displayed request.

9. A post flow purge operation is then initiated to ensure line cleanliness. Finally, a pressure test, gross leak check and leak check are performed to ensure the leak integrity of the new connections.

10. If the leak check did not pass, a prompt will appear informing the operator that the leak check failed.

11. If the leak check pass, Software will prompt the operator to open container inlet/outlet valves.

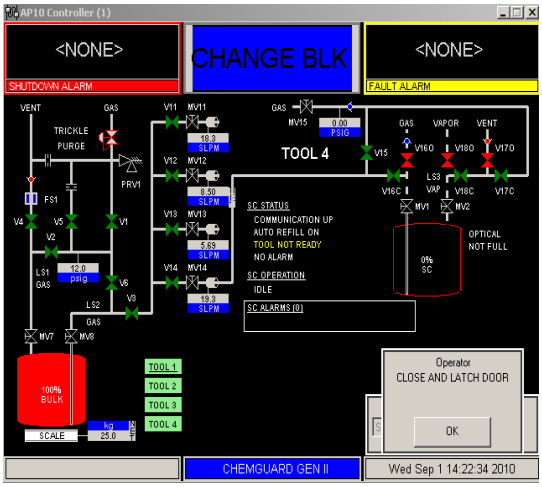
12. The final step in the Bulk Change routine is entering the new chemical weight. A pop up box will be displayed giving the operator the opportunity to enter the New Liquid Weight and Current Liquid Weight as shown in Figure below. The Bulk Change operation has now been completed and a screen indicating to latch and close the door as shown in Figure below will appear. Please latch the door and close the same.

NOTE

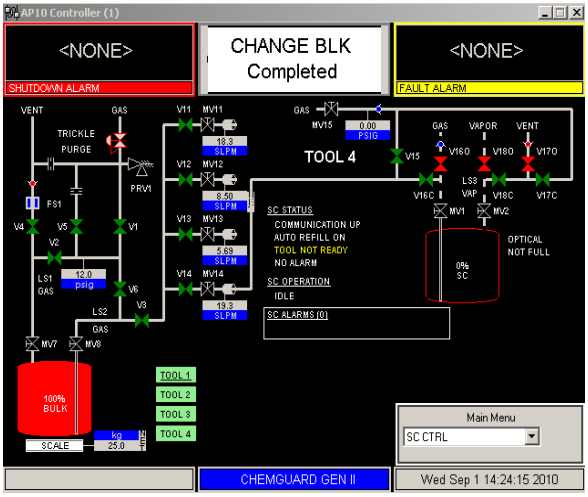
Ensure that the net weight displayed on the screen is stable before continuing.

Enter Chemical Weight

Prompt to Latch and close door



Change Bulk Complete



4.2 Source Change Operation (from CGSCE)

The Source Change operation is an automated solution to safely remove the Source Bubbler and if required, installation of a new Source Bubbler.

NOTE

To perform a Source Change operation, it is absolutely necessary to commit the tool to have a "tool ready" status during the entire time of the operation. If "tool ready" changes to "tool not ready" the software will not stop the operation.

After initiating Source Change operation, unlike any other CGSCE operation, the software will not stop if "tool ready" changes to "tool not ready". This feature is necessary to safely and successfully complete the operation. A Shutdown alarm will be generated by the CGSCE after the Source Change is started. The Alarm is send to the tool and displayed in the CG1000-2000 display window for the Source being changed.

Source Change operation can be performed even if there is chemical remaining in the Source Bubbler. This feature is useful to remove contaminated chemical in the system without sending it back to the Bulk Canister.

NOTE

It is strongly recommended to perform a Source Change operation only when the level of chemical in the bubbler is below 65%. If Source Change is performed when the level of chemical is above 65%, a Bubbler Overfull Shutdown Alarm may be generated.

If contamination of the chemical is not suspected in the system, then a complete backfill operation of the Source Bubbler is always recommended before performing Source Change operation.

After confirming the start of a Source Change operation, the flow purge operation will commence to dry the lines of chemical and associated vapors. The length of time the flow purge runs can be adjusted by the operator.

- Source Change is a maintenance semi-automated operation.
- Follow the prompts displayed by the CGSCE. As series of operation steps will run to safely remove liquid and vapor chemical from inlet and outlet valves on Source Bubbler before removing.
- Once a new Source Bubbler is installed, then series of operation steps will run to pressure decay leak check and remove atmosphere pressure at inlet and outlet valves on Source Bubbler before allowing to refill with chemical.
- Upon successfully passing the leak check the CGSCE will display the "Source Change Completed" prompt.

NOTE

To perform a Source Change operation, it is absolutely necessary to commit the tool to have a "Tool Ready" status during the entire time of the operation. If "Tool Ready" changes to "Tool Not Ready" the software will not stop the operation.

Maintenance of "Tool Ready" status during the entire time of the operation is required to safely perform and successfully complete Source Change Operation.

Follow the next steps to perform a Source Change operation.

NOTE

It is strongly recommended to perform a Source Change operation only when the bubbler is empty and after a Backfill operation has been performed. Unless Source Bubbler has contaminated.

Consult with VERSUM MATERIALS, INC. if a Source Change needs to be done with a non-empty bubbler.

1. Select the Source Bubbler for replacement. Verify all other sources connected to this CG1000-2000 cabinet are off-line and will not be used during change out.
2. During this procedure push gas supply will be used. Backfill and Line Purge, hence Refill operations may be affected. It is recommended not to perform these operations during this procedure. Notify the Process Engineer that the CG1000-2000 system will not deliver chemical for approximately four (4) hours.
3. Turn power off to the temperature controller containing this Source Bubbler.
4. Verify that Sources are "On" at the CG1000-2000 Operation menu, and then from the CGSCE Remote Operation menu, select "Source Change" operation.
5. A series of operation steps will run to safely remove liquid and vapor chemical from inlet and outlet valves on Source Bubbler to a safe level before allowing to remove Source Bubbler.
6. After the Line Purge operation is completed, the software will prompt click to continue and then to adjust the pressure to a safe level to open the lines during trickle purging ($2 < P > 4$ psig). Push Gas flows through the bubbler up to the vent line to allow the adjustment of the pressure. Locate the Push Gas regulator upstream MV15 and turn it counter-clockwise to lower the pressure.
7. After adjusting the pressure, the software prompts to close the manual valves on the Source Bubbler SCMV1 and SCMV2 (Refer to Chapter 3 for P&ID, and then to verify that manual valve MV15 is open. MV15 is the valve through which Nitrogen for trickle purge is provided.
8. The software then prompts to remove the Source Bubbler and install a new one.
9. Remove insulation and covers from the top of the Source Bubbler, the temperature probe from the thermowell, and the level probe assembly. Set all parts aside.
10. At the Source Bubbler carefully disconnect each of the lines to manual valves SCMV1 and SCMV2. The lines will have a trickle flow at this time. Cap the lines using male flare plugs. Cap also the valves of the bubbler being removed.
11. Remove the Source Bubbler from the temperature controller cup. Fill the thermowell of the new Source Bubbler with 5 to 10 drops of mineral oil. Insert the new Source Bubbler into the temperature controller cup.

12. Insert and connect the level probe assembly, insert the temperature probe, and replace the insulation and covers if applicable. Turn on the temperature control unit.
13. Carefully re-install the Teflon™ lines to manual valves SCMV1 and SCMV2. When you are done, press “Continue” on the CGSCE to continue the Source Change operation.
14. The software will prompt to confirm the can change. After confirming, the software will prompt to open the manual valves on the Source Bubbler SCMV1 and SCMV2.
15. After opening the manual valves, adjust the pressure back to a push process level. Turn the regulator clockwise to increase the pressure to the required pressure and then press enter.
16. The system will start now a series of steps to first inert, then leak check the installed Source Bubbler. Follow the prompts to perform the leak check.
17. If the leak checks fail, you have the option to repeat the check (continue) or terminate. If the leak checks fail, check the connections of the lines that were disconnected and re-connected. If the leak checks fail for a third time abort the operation, troubleshoot, isolate and fix the leak. Then repeat the operation.
18. When the Leak Check operation has completed successfully, the software will prompt to open MV15. Open MV15 and press “continue”. Can change will be confirmed with the prompt “Source Change Complete”.
19. Prepare the old Source Bubbler for return to Versum Materials, Inc. for cleaning, using the normal returns (RGA) procedure.
20. Perform a Source Level Calibration procedure to fill the Source Bubbler to the 70% level.
21. The procedure is now complete. A test run of the process tool should be completed to verify the new source installation.

Chapter 5

Features and Components

Section 1 **CG1000-2000 Component Assemblies**

Section 2 **CGSCM Component Assemblies**

Section 3 **CG1000-2000 Options**

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

5.1 CG1000-2000 Component Assemblies

This chapter describes the module specifications for the CG1000-2000 cabinet. All equipment described in this manual are for Versum Materials, Inc. containers. All customer containers used with this product should consult with Versum Materials, Inc. prior to use.

The CG1000-2000 cabinet supplies chemicals on demand to meet the needs of the semiconductor and various other industry requirements. It is a modular system consisting of:

- CG1000-2000, Bulk Cabinet assembly houses the electrical controller assembly, Color Touch Display interface, chemical delivery manifolds and chemical containment.
- The cabinet is designed with integral earthquake bolt down points.
- The main system power is from 100-240 VAC for use in all countries.
- The System "Stop" switch is located on the front of each cabinet. This is used to remove the +24 VDC power to the solenoid valves.
- The cabinet has been designed with numerous sensors and detectors to monitor all operations. These sensors and detectors are monitored approximately once per second to verify that all parameters are within specified ranges.
- All pneumatic, purge, exhaust, and process gas pressures are monitored with flow sensors or pressure transducers.
- System operation is continuously monitored with the use of a hardware watchdog circuit. All RAM is backed by a Super capacitor to prevent loss of memory in the event of an EMO or power failure.
- An automated Bulk Canister Change operation is provided allowing users the ability to change the bulk chemical container without contaminating the chemical or causing chemical exposure to the operator or the environment.
- Operator cues, Flow Purges and Leak Checks are all incorporated into the Bulk Change operation in order to provide a simple method for replacing the bulk container. All automatic functions are available in manual modes as well.
- The software control on the cabinet provides for a simple, menu-driven and user-friendly operator interface. The operator uses the touch screen to point to the desired selection. In the event further action or information is required, the software will inform the operator of what is required.
- A graphical user interface provides visual information on current system status, including valve conditions, current fill levels, alarms, historical data, and other data.

- All major parameters are programmable. These include items such as the Cycle Purge and Leak Check parameters, and system setup details. All user interaction with the cabinet is performed within the framework of the main operating system.
- The cabinet designed with 110% spill containment.
- Vapor concentration is controlled inside the cabinet by the use of high flow exhaust of no less than 30 SCFM.
- The cabinet plumbing is a single block design to maximize flexibility while minimizing potential sources of contamination. Dead space has been minimized, for ease in purging and cleaning.
- The cabinet is designed with flexibility pigtails connection to help while installing or disconnecting the Bulk Canister. Pressure relief is built in to prevent over pressurization of the container.
- Communication to the process tool is provided via the CGSCE's I/O. The exact configuration required will depend on the process tools in use. Contact Versum Materials, Inc. to determine the best setup for your application.
- The total number of Source Bubblers that can be directly filled from one CG1000-2000 cabinet is four (4).
- CGVMB, 4X or 5X Valve Manifold box used for mass chemical distribution.
- However, if using the optional CGVMB the total number of Source Bubblers that can be filled from one CG1000-2000 cabinet increases from four (4) to twenty (20).

5.2 CGSCM Component Assemblies

The CGSCM (Source Controller Module) used for chemical point of use, refilling the Source Bubbler located at each tool.

- Each CGSCM module is connected to the CG1000-2000 cabinet through an Ethernet communications link. There is a steady stream of data flowing through the network verifying that all modules are on-line, that no errors or alarms have occurred, and providing commands for each module.
- CGSCE is Source Controller Electronics.
- The power for the individual CGSCE modules is set at +24 VDC in order to reduce or eliminate spark or shock potentials.
- The CGSCE is protected by a 1A fuse that can be replaced from the back of the unit.
- Each CGSCE also has a "Stop" switch located on the front of each module.
- The LAN link can be extended up to 100 meters with a CAT5 cable to provide remote operation of modules. As a result, there is no requirement that the modules remain in close proximity to one another.

- CGRVM (Refill Valve manifold) is Source Manifold.
- CGLVLCAP is Capacitive Level Probe detection.
- The 1.5-liter quartz Source Bubbler.
- External spill detection.

5.3 CG1000-2000 Options

5.3.1 High Temperature Detection Switch

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.

5.3.2 Fire Suppression System

The Fire Suppression System is an independent system, equipped with a rate of rise detection sensor. The sensor will trigger an alarm if a rise of temperature in the cabinet exceeds 40°F in a period of less than one (1) minute. The Fire Suppression System will then be activated and C02 released into the ChemGuard® cabinet extinguishing a fire within the cabinet. It will also send a signal to the ChemGuard® generating a shutdown alarm and returning the cabinet to IDLE state.

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

WARNING

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

WARNING

Hazardous energy present includes stored pressurized CO2. Always wear proper PPE and follow manufacturer's instruction manual.

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

Refer to Chapter 7 for calibration and maintenance of the Fire Detection and Suppression System.

Chapter 6

System Operation

Section 1	**System Overview**
Section 2	**CG1000-2000 Operational Modes**
Section 3	**CGSCE Operational Modes**
Section 4	**CG1000-2000 System Setup**
Section 5	**Manual Operation**
Section 6	**Networking and Communication**
Section 7	**IP Setting**
Section 8	**Calibrate Touch Screen**
Section 9	**Alarm History**
Section 10	**Configuration Transfer**
Section 11	**Memory Management**
Section 12	**SCE Setting**
Section 13	**Automated Operation**
Section 14	**ChemGuard System Alarms**

Section 15 **ChemGuard Alarms Descriptions**

Section 16 **System Input / Output**

Section 17 **CGSCE Source Display**

Section 18 **Source Controller Overview Display**

Section 19 **CGSCE Source Display Details**

Section 20 **Source Configuration Menu**

Section 21 **CGSCM Manual Valve Control Mode**

Section 22 **Configure Capacitance Level**

Section 23 **CGSCE Source Alarms**

Section 24 **CGSCE Alarm Descriptions**

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

6.1 System Overview

The ChemGuard® CG1000-2000 cabinet operates as a distributed network controlled by electronic controller with a Local Operator Interface touch screen incorporated on the cabinet controller, while the CGSCE (Source Controller Electronic) is located near the wafer process tool. The CG1000-2000 cabinet controller is communicating with the CGSCE controller to share the operation and task, where the CGSCE controls all functions and operations native to the onboard Source Bubbler located in or near the OEM tool, while the CG1000-2000 cabinet HMI controls the functions and operations native to the cabinet chemical delivery. Operations that invoke transferring chemical to and from the Bulk container via the onboard Source Bubbler are controlled exclusively by the CGSCE.

The OEM has priority in system operation. The tool set sends an output to the CGSCE to let the ChemGuard cabinet know that the Source Bubbler is in use by the OEM and all other CGSCE functions are disabled during this time. For further OEM control, the push gas input valve and chemical output valve of the Source Bubbler are normally open to the tools gas jungle allowing the same chemical access as a standalone bubbler.

The ChemGuard cabinet houses the 20-liter Bulk Chemical Canister. Chemical can then be distributed to up to twenty (20) 1.5-liter Refillable Source Bubblers. Filling the Source Bubblers is accomplished automatically once the OEM tool sends out signal to the CGSCEs' (Tool Ready) input.

Filling the Source Bubbler is terminated automatically as:

1) Once chemical level reaches the "Fill Point" level detected by the Optical Probe installed into the Source Bubbler.
2) The Tool Ready signal is removed.
3) A Shutdown alarm has occurred.

The ChemGuard cabinet has many automated functions which minimize operator intervention and possibly error by performing operations manually. These automated operations are, but not limited to.

The Local Operator Interface is a touch screen powered and operated by a proprietary, multi-tasking operating system. Communication between the cabinet and each CGSCE's is accomplished by 10baseT local area network (LAN) Ethernet protocol, working at speeds up to 10 Mbps. The touch screen controller is very intuitive with color animation highlighting valve actuation, chemical and gas flows, and alarms.

NOTE

If necessary, operating personnel shall make use of a step ladder or step stool to access the touch screen monitor as required.

6.2 CG1000-2000 Operational Modes

There are two types of operational modes in the ChemGuard cabinet.

- Touch screen interface Automatic mode.
  - Auto Fill operation to Source Bubbler.
  - Maintenance operation.
- Touch screen interface Manual mode.
  - Manual Valve Open / Close operation.

6.2.1 Touch Screen Interface Automatic Mode

This mode is used to perform the automated functions exclusively for the ChemGuard cabinet. The operations that can be performed in this mode are:

- Start SC CTRL Operation.
- Change Bulk Operation.
- Bulk Line Clear Operation.
- Bulk Leak Check Operation.
- Bulk Vent Operation.
- Bulk Trickle Purge Operation.

Access to all of the automated operations may not be permissible at some customer locations. With the exception to “Change Bulk”, all other operations are nested under the Maintenance menu, which requires a higher level security password. This is to discourage unauthorized personnel from performing an operation that could prove detrimental to equipment or process. Refer to Chapter 4 for detail Change Bulk operation, refer to this Chapter for details of other operations.

6.2.2 Touch Screen Interface Manual Mode

This mode of operation should only be used by qualified well trained personnel in the correct operation of the ChemGuard. This operation is also nested under the Maintenance menu. This mode of operation will open all pneumatically operated valves in the ChemGuard.

- Manual Valve Actuation.

6.3 CGSCE Operational Modes

There are two types of operational modes to the CGSCE.

- CGSCE Interface Automatic Fill Mode.
- CGSCE Interface Manual Mode.

6.3.1 CGSCE Interface Automatic Fill Mode

This mode is used to perform the automated fill operation associated exclusively with the CGSCE and CGRVM. This is the operation that will be exclusively used during normal operations.

- Source Auto-Refill Mode.

6.3.2 CGSCE Interface Manual Mode

This mode is used to access all other automated source sequences. The term “Manual Mode” in this menu window has the meaning that the CGSCE IS NOT in auto fill mode. All other automated operations that reference the CGSCE will be available. Those operations are:

- Manual Refill Operation.
- Source Backfill Operation.
- Source Line Purge Operation.
- Source Vent Operation.
- Source Change Operation.
- Source Manual Valve Actuation.

Refer to Chapter 4 for detail Source Change operation, refer to this Chapter for details of other operations.

NOTE

If any of the above operations is terminated prior to their completion, then the ChemGuard cabinet controller “Source Control” radio button must be deactivated and re-started.

There is a true manual operation mode to open and close every valve on the CGRVM. This will also be discussed later in the chapter.

6.4 CG1000-2000 System Setup

On the front face of the cabinet there is an LCD display that contains a graphical interface displaying the P&ID of the cabinet controller and the operator selected Source Controller. Toggling different Source Controllers can be performed by touching any one of up to twenty source boxes located near the bottom center of the screen. When a different Source Controller is toggled, the previous source P&ID is replaced by the newly selected Source P&ID displaying current valve status and physical connection to the cabinet Controller.

Color coded shutdown and fault alarm boxes, a controller status box and the selected Source status are also displayed in the graphical user interface (GUI) window as shown in Figure 6.1.

The system screen allows the operator to easily understand the operation and to quickly identify the 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. Any alarm that requires the system to be shutdown is displayed in the SHUTDOWN ALARM box in the top left hand corner of the screen. A FAULT ALARM is displayed in the upper right hand corner of the touch screen. A Fault alarm does not shut down the system but still requires operator intervention and is an indicator that some parameter is out of specification and should be corrected.

Figure 6-1a: CG1000 Display Screen

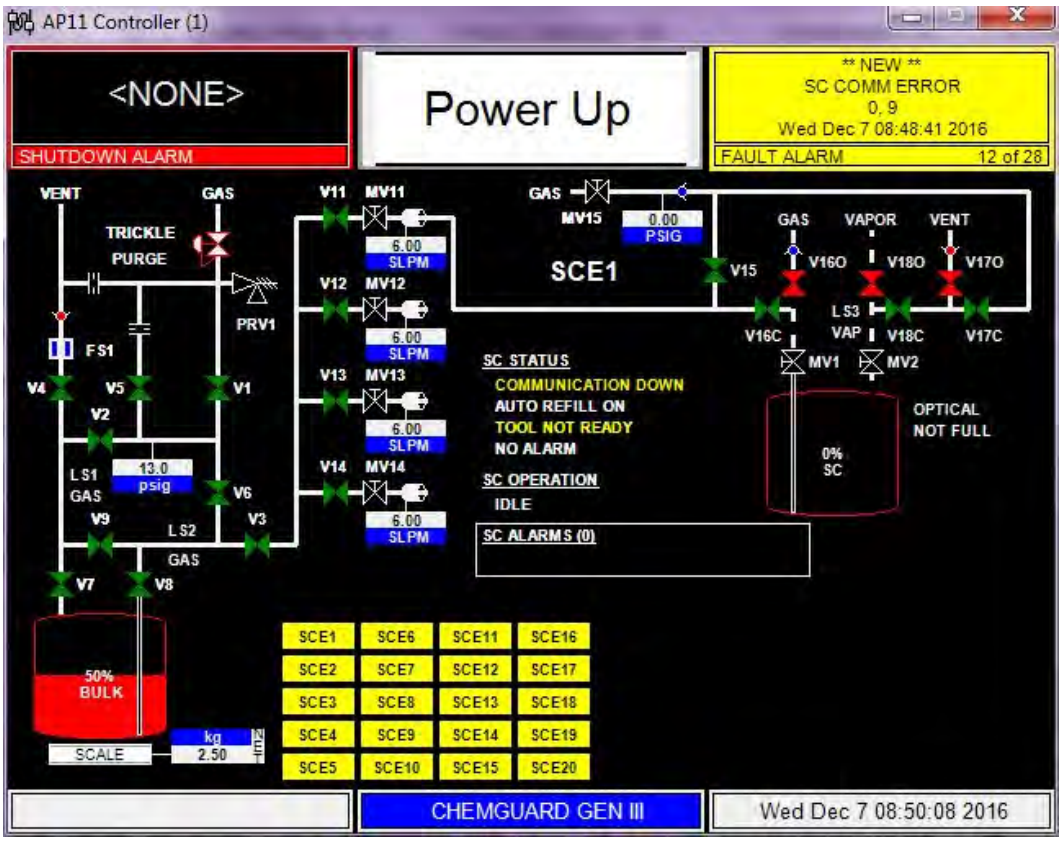
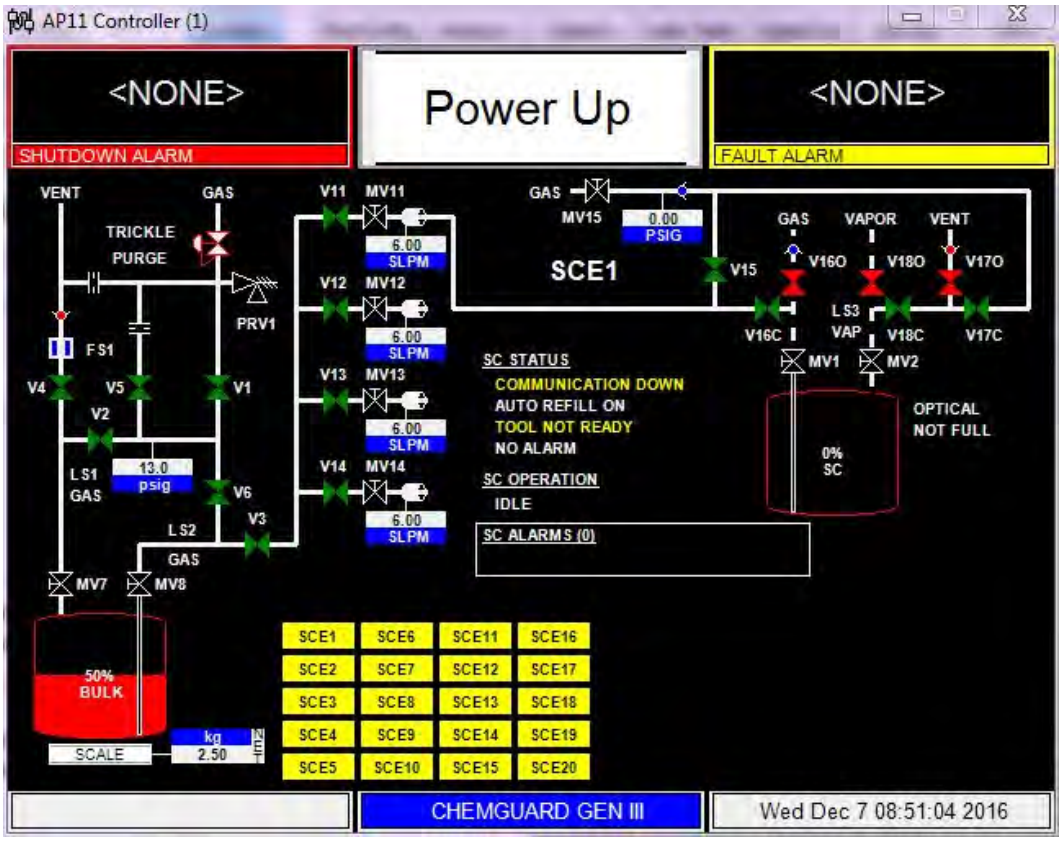


Figure 6-1b: CG2000 Display Screen

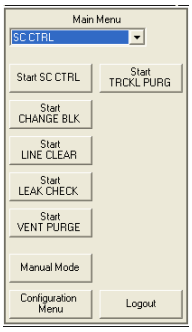


The screen that is displayed when the cabinet is powered up on a ChemGuard cabinet is shown in the picture above, Figure 6.1a and 6.1b.

6.4.1 Main Menu and Configuration Selection Window

The menu selection window is accessed by touching the touch screen anywhere inside the bordered area. The password screen and each subsequent screen will be located on right side of the screen. After successfully entering the password, the main menu will be displayed presenting prompts and menu selections to various automated operations. The Main Menu is shown in Figure 6-2.

Figure 6-2: ChemGuard Main Menu Screen



The Main Menu will remain displayed until a sub-menu item radio button is depressed, the screen saver timer times out, or of until the "LOGOUT" key is pressed.

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

The Main Menu will appear as in the illustration shown at the right.

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

6.4.2 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. If <NONE> is displayed, no alarm conditions are present. A time stamp of when the alarm occurred will be displayed with each alarm. Figure 6-3 below shows the alarm and controller status boxes in a ChemGuard cabinet.

Figure 6-3: ChemGuard Alarms and Status Display Screen

6.4.3 Screen Saver

The screen saver will blank the screen and a randomly moving mode indicator box will appear on the screen. When the programmed amount of time has elapsed since the last operator keypad action the screen saver will become active. If the operator touches the screen or a new alarm appears while the screen saver is active, the screen saver function will become inactive. The screen saver function will not be active while a fault or shutdown alarm is present or an active prompt is displayed.

6.4.4 Display Status LEDs

Additionally, LEDs which display Gen II ChemGuard functions are located to the right of the LCD display. The table below describes these LEDs and their functions.

Table 6-1: Front Panel LED Function

LED	FUNCTION
SHUTDOWN ALARM	This LED flashes red on power up and for an un-acknowledged shutdown alarm. Once acknowledged, the LED stops flashing but remains red until it is reset.
FAULT ALARM	This LED flashes yellow on power-up and for a 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..
POWER	This LED indicates that there is +6 VDC power to the unit.

6.4.5 System Configuration

ChemGuard controller files may be modified to customize ChemGuard operation for a particular installation or application, using a second or third level security code. System parameters necessary for proper cabinet operations must be defined and entered into the system memory. Select this item to set up the ChemGuard cabinet operating parameters.

The [System Configuration] may be accessed from the CONFIGURATION MENU option on the Main Menu. From the CONFIGURATION MENU, you may display some configurable parameters and change user configurable parameters. For safety considerations, most configuration parameters may be changed only by Versum Materials, Inc. technical personnel. The following paragraphs describe the parameters that you may view and/or change.

6.4.5.1 Net Product

This option allows the operator to enter Net Liquid Weight and the Current Weight. For example, a typical 20L vessel has a full net weight of 22.5kg. Each vessel is shipped from the factory with a fill weight.

Here are steps to input data:

- Select the device for which you would like to enter the data. Example: Bulk scale
- Enter the Net weight in the “Net Liquid Wt” window.
- Enter the fill weight specified on the vessel in the “Current Liquid Wt” window.

- Tap the OK button. This will generate the ratio of the Net weight and the Current weight as a percentage of full on the animated graphical screen.
- The gross value will display the normal analog reading with no adjustment.

6.4.5.2 User Setpoints

This option allows the operator to choose an analog input device from a drop down menu or exit the window. When the operator chooses an analog input device, the corresponding Setpoints will be displayed. The operator has the ability to select and change any of the Setpoints.

The User Setpoints window displays the customer/user defined analog alarm data. The window will display the alarm number, alarm label, current alarm Setpoints and current percent Setpoints for each user defined alarm. A total of ten (10) Setpoints will exist per analog input. The number of user Setpoints will be equal to ten minus the number of VERSUM MATERIALS, INC. Setpoints. This window will allow the operator to enter a new Setpoint value for one or more chosen alarms or exit the window without changes. These Setpoints may include one or more of the following:

Enter parameters for each of the analog items. Please note the numbers displayed in these illustrations are for theoretical purposes only.

Here are the steps to change a Setpoint:

- First select the analog input device from the drop down menu.
- Highlight the set point of your choice, by touching the screen.
- Using keypad numeric value can be keyed in either at “Setpoint” or “Setpoint Percent” box.
- Press “APPLY” to accept changes.
- Press “OK” pushbutton to exit window. Any change in “Setpoint Percent” will change value of “Setpoint” and vice versa.

NOTE

To change Scale values, enter the values in “Setpoint Percent” box and do not change “Setpoint” box.

To change Push Pressure values or COAX values change “Setpoint” box and do not change “Setpoint Percent” box.

The following section describes all the Bulk canister setup parameters and how to set them in the ChemGuard controller.

6.4.5.3 Setup Bulk Canister Parameters

Here are the steps to change a Setpoint:

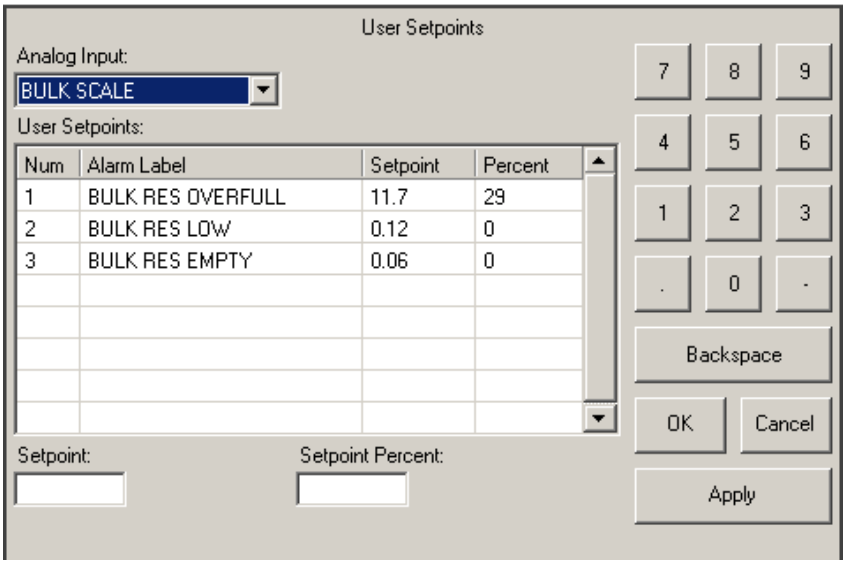
- Select CONFIGURATION MENU pushbutton, Configuration menu will appear.

- Select USER SETPOINTS pushbutton.

Bulk Scale: To set/change Bulk scale related Setpoints parameters from Configuration Menu.

- Select BULK SCALE from the pull-down menu in USER SETPOINTS screen as in Figure 6.4
- Highlight the parameter to be changed.
- Enter value in “Setpoint Percent” box.
- Click “APPLY” to accept changes. Bulk scale parameters have to be entered in terms of percentage (%).

Figure 6-4: Bulk Scale User Setpoints



NOTE

Please use the “Setpoint Percent” box to set/change any Bulk scale parameters. This will also automatically change “Setpoint” parameters.

Perform the above steps to set/change the following Bulk related parameters.

- Bulk Res Overfull, which defaults to 107%.
- Bulk Res Low, which defaults to 30%.
- Bulk Res Empty, which defaults to 2%.

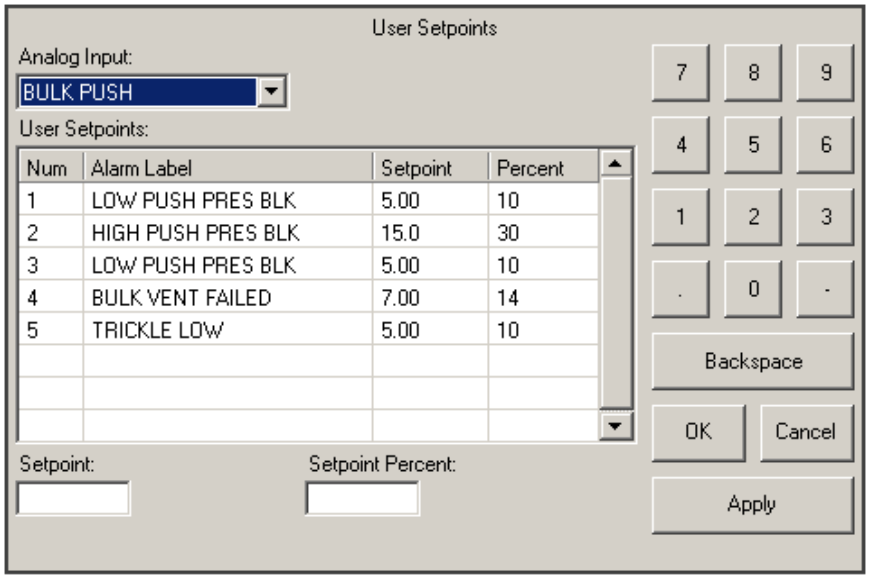
NOTE

For Bulk scale parameter, do not enter value in “Setpoint” box. Enter only in “Setpoint Percent” box.

Bulk Push Pressure: To set/change Bulk pressure related Setpoints parameters, from Configuration Menu.

- Select BULK PUSH from the pull-down menu in USER SETPOINTS screen as in Figure 6.5.
- Highlight the parameter to be changed.
- Enter value in “Setpoint” box.
- Click “APPLY” to accept changes. Bulk push parameters are not used in terms of percentage, so use Setpoint box to enter new values.
- Perform the above steps to set/change Bulk pressure related parameters.

Figure 6-5: Bulk Push User Setpoints



- Low Push Pres Blk, which defaults to 5 psig.
- High Push Pres Blk, which defaults to 15 psig.
- Low Push Pres Blk, which defaults to 5 psig.
- Bulk Vent Failed, which defaults to 5 psig.
- Trickle Low, which defaults to 5 psig.

NOTE

The field Setpoint for Low Push Pres Bulk should be set at both places in the above screen (Num 1 and Num 3). It is very important that these values are set to the same value since both Setpoints are used to trigger Low Push Pres Bulk alarm.

6.4.5.4 Leak Test Parameters

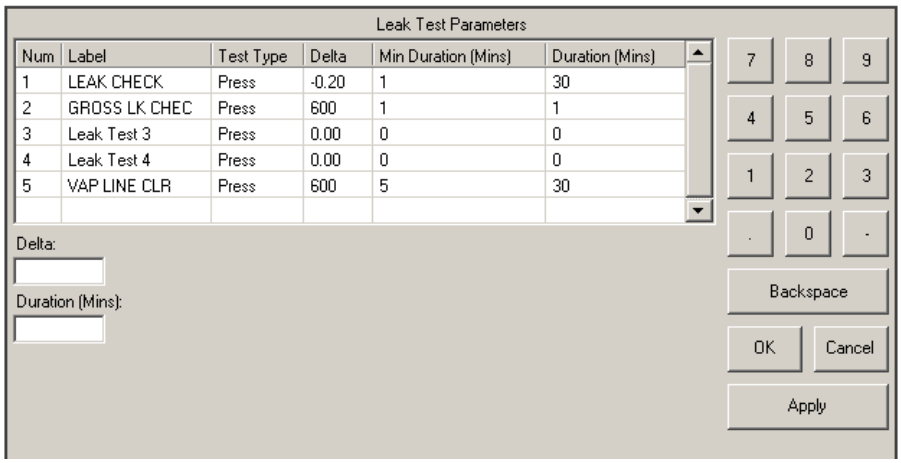
This option displays the current values for the leak parameters. Operator may increase these values, but may not decrease them. Shown below are the pre-programmed minimums.

The leak parameters minimum values follow:

Leak Test: Minutes of Testing = 1 Pressure Difference = -0.20 psig

Highlight parameter to change and using numeric keypad enter value for Delta or Duration. Press "APPLY" to accept the changes. Press the "OK" or "CANCEL" pushbutton to exit the window.

Figure 6-6: Leak Test Parameters



NOTE

In the above figure the VAP LINE CLR is used as timer values, not as leak test parameters.

6.5 System Feature

6.5.1 Manual Valve Operation

CAUTION

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

Manual mode provides a means of flowing purge gas through the purge and process gas panels during cabinet installation and pre-start-up procedures. It also provides a means of flowing purge gas while maintenance or repairs are being performed.

6.5.1.1 How to Operate in Manual Mode

WARNING

Operating in Manual Mode could cause the following hazards which can result in PERSONAL INJURY OR DEATH.

- Opening valves when high pressure push gas is present.
- High pressure gas could be vented.
- Opening vent valves when high pressure gas is present.

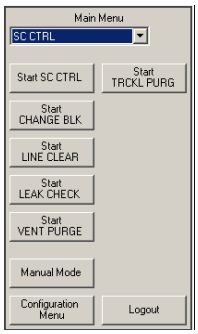
NOTE

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

Select anywhere on the graphics portion of the screen and enter the password.

1. Press “OK”
2. From the Main Menu screen, press the "MANUAL MODE" pushbutton.
3. The MANUAL MODE window will display.
4. Operate valves referring to “How to Open and Close valves” section below.
5. To exit MANUAL MODE, press “CANCEL”.

Figure 6-7: Main Menu



NOTE

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

How to Open and Close Valves

To open a valve:

1. Select the valve by touching the screen. The valves that can be operated from the screen 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 the valve closed.

To close a valve:

1. Select the valve by touching the screen.
2. The valve confirmation window will appear, asking to confirm that you want to open the valve by pressing "CLOSE VALVE". Pressing "CANCEL" will close the window, leaving the valve opened.

6.5.1.2 How to Secure Manual Mode

The Secure option will allow an 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, the controller will leave the bank in manual and allow the operator to go to other screens. Any open valves will remain open, and the Mode Status Box will continue to indicate manual mode. Manual mode will remain active or 'secured' until an operator reenters the Manual Mode window. While manual mode is 'secured', Manual Mode will be the only selectable option on the Main Menu.

CAUTION

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

6.5.2 System Test

6.5.2.1 Test Digital In

This option displays a list of the digital inputs and their current state. The state may be used to determine if the digital device is operating properly.

Use the scroll bar to view all the digital input values.

6.5.2.2 Test Digital Out

This option displays a list of the digital outputs and their current values. Outputs may be forced "on" (energized) or "off" (de-energized) to determine if the output is operating properly.

This operates in a similar manner to manual operation as described in this chapter. It is the customer's responsibility to adhere to all operational warnings in this chapter when performing the Digital Out Test. Use the scroll bar to view all the digital output values.

6.5.2.3 Test Analog In

This option displays a list of the analog inputs, their current values (net or gross), and the raw signal input. The current value may be used to determine if the analog device is providing accurate output (controller input).

Use the scroll bar to view all the analog input values.

6.5.2.4 Test Internal Flag

The Test Internal Flags window will display the internal flag number, label, and state (Set or Clear) for all internal flags in the system. This window will allow the operator to exit the window or change one or more internal flag states to SET or CLEAR. To change an internal flag state, highlight the desired internal flag to change and select SET or CLEAR at the bottom of the window. Then press the APPLY pushbutton. Upon exiting the Test Internal Flags window, any changes made to internal flag states will be ignored and the internal flag states will return to their original state.

CAUTION

Extreme care must be taken when changing the state of an internal flag. The operator must fully understand the use of the flag prior to any edits.

6.5.2.5 Test Remote In

This option is not available in ChemGuard cabinet.

6.5.2.6 Checklist (Versum Materials, Inc. Factory set. DO NOT alter)

6.5.3 Valve Setup (Versum Materials, Inc. Factory set. DO NOT alter)

6.5.4 Valve Counts

The Valve Counts window will display each valve in the system and the count for each valve. The valve count will represent the number of times a pneumatic valve has cycled (opened and closed). This window will allow the operator to change the valve count for one or more valves or exit the window. New valve counts will be written to the NV Data File upon exiting and saving the Configuration Menu.

6.5.5 Container Change Counts

This window provides a count of the number of times a Change Bulk operation was done.

6.5.6 Operation Sequences

6.5.7 Sequence Flow Options (Versum Materials, Inc. Factory set. DO NOT alter)

6.5.8 Prompt List

The Prompt List window will display the prompt number and prompt label for each of the prompts in the system. The window will allow the operator to view the prompt list or exit the window. Changes to the prompt list will not be allowed.

6.5.9 Set Time/Date

The Set Time/Date window will display the current time and date for the system. The window will allow the operator to exit the window or enter a new time and/or date by selecting to the appropriate prompt.

6.5.10 Analog Scaling (Versum Materials, Inc. Factory set. DO NOT alter)

6.5.11 Analog Units (Versum Materials, Inc. Factory set. DO NOT alter)

6.5.12 VERSUM MATERIALS, INC. Setpoints (Versum Materials, Inc. Factory set. DO NOT alter)

NOTE

VERSUM MATERIALS, INC. Setpoints are safety determined that altering these will have a detrimental impact on the safe operation of the ChemGuard cabinet.

6.5.13 Alarm Conditions

The Alarm Conditions window will display the alarm input type, alarm number, alarm label, and alarm condition for each system alarm. This window will allow the operator to change the alarm condition for digital alarms to closed, open, or not used and the alarm condition for analog alarms to high, low, or not used. The window will allow the operator to change one or more alarms or to exit the window without changes.

6.5.14 Alarm Delays

The Alarm Delays window will display the alarm input type, alarm number, alarm label, and current alarm time delay (in seconds) for each alarm in the system. The window will allow the operator to enter a new time delay value for one or more alarms or exit the window. A delay entry of '0' equates to no delay. The range of values is from 0 to 255 seconds.

6.5.15 Alarm Types

The Alarm Types window will display the alarm input, alarm number, alarm label, and alarm type for each alarm in the system. The possible alarm types are Fault, Shutdown, Sequence controlled, and Non-Latching. The window will allow the operator to exit the window or change the alarm type of one or more alarms. An alarm having an alarm type of Sequence Controlled cannot be changed to a different type. All other alarm types can be changed; however, the alarm type cannot be changed to Sequence Controlled.

6.5.16 Alarm Sequences

The Alarm Sequences window will display the alarm number and alarm label for each alarm in the system. The window will also display the alarm response sequence and alarm response sequence label for those alarms that have an alarm response associated with them. The window will allow the operator to exit the window or select one or more alarms to view the alarm response sequence. Changes to alarm response sequences will not be allowed.

6.5.16.1 Relay Defaults

The Relay Defaults window will display the relay number, relay label, and relay default state for each relay in the system. The window will allow the operator to exit the window or change the relay default state of one or more relays. Each relay default state will be set to No Default, Energize, or De-energize.

6.5.16.2 Helium Leak Check

This option is not applicable for ChemGuard cabinet.

6.5.16.3 1st Security List

The 1st Security List window will display the password number and password for each first level password. The 1st level security list will be accessible to 2nd level security users and higher. This window will allow the operator to exit the window or change, add, or delete one or more 1st level passwords. To delete a password, use the BACKSPACE button on the keypad. Only numeric characters are permitted in 1st level passwords and the first character will always be the number 1.

6.5.16.4 2nd Security List

The 2nd Security List window will display the password number and password for each second level password. The 2nd level security list will be accessible to 3rd level security users and higher. This window will allow the operator to change, add, or delete one or more 2nd level passwords or exit the window without changes. To delete a password, use the BACKSPACE button on the keypad. Only numeric characters are permitted in 2nd level passwords and the first character will always be the number 2.

6.5.16.5 3rd Security List

The 3rd Security List window will display the password number and password for each third level password. The third level security list will be accessible to 3rd level security users and higher. This window will allow the operator to exit the window or change, add, or delete one or more third level passwords. To delete a password, use the BACKSPACE button on the keypad. Only numeric characters are permitted in 3rd level passwords and the first character will always be the number 3.

6.5.16.6 2nd Security Access

The 2nd Security Access window will display all available user functions. For each function, the window will display the current operator's degree of access at the 2nd level of security. The degrees of access will be No Access, Read Only, or Write. The operator will be allowed to view the access list or exit the window. Operators at 3rd level of security and higher that have Write access to the 2nd Security Access window will be allowed to change one or more degrees of access. Changes to the degree of access cannot allow a 2nd level operator greater access than a higher level operator.

6.5.16.7 3rd Security Access

The 3rd Security Access window will display all available user functions. For each function, the window will display the current operator's degree of access at the 3rd level of security. The degrees of access will be No Access, Read Only, or Write. The operator will be allowed to view the access list or exit the window. Only users with the VERSUM MATERIALS, INC. password will be allowed to change the 3rd security access.

6.5.16.8 System Setup (Menu Option)

The System Setup window will display the option to change either local or network options. It also allows the change of the IP settings.

6.5.16.9 Local Setup

The Local Setup selection will display the Local Setup window. This window will display the menu timeout values. The window will allow the operator to exit the window or change one of the setup.

6.5.16.10 Change Exhaust Stack Size

This option is not used in ChemGuard cabinet.

6.5.16.11 Password Protected Reset

The Password Protected Reset option will allow the operator to toggle the password protected reset feature between ENABLED and DISABLED. When this feature is enabled, the operator will be required to enter a valid password when resetting alarms.

6.5.16.12 Screen Saver

The Screen Saver option will allow the operator to change the screen saver time delay. The box will accept the values 0 or 31–99. A time delay of zero will disable the screen saver.

6.5.16.13 Key Press Feedback

Key Press Feedback option will allow the operator to toggle key press feedback feature between ENABLED and DISABLED. When this option is enabled, anytime a menu option is selected or an alarm is acknowledged a beep will be made as a feedback for the key press.

6.5.16.14 Simulation

Simulation option will allow the operator to toggle simulation feature between ENABLED and DISABLED. This option should be set to DISABLED in the field.

6.6 Networking and Communication

The Network Setup option will display the Network Setup window. The Network Setup window will display the network port number, the network device type, the Network Control state, the RS-485 channel numbers, the Ethernet channel numbers, and the network comm type. The window will allow the operator to exit the window or change one or more of the network parameters.

6.6.1 Enable/Disable Network Control

The Enable/Disable option will allow the operator to change the Network Control state to either Enable or Disable.

6.6.2 RS-485 Channel Number

The RS-485 Channel Number will allow the operator to change the left and right RS-485 channel number. The numbers may be changed within the range of 0 to 63. Changes to the channel number will be written to the NV data file.

6.6.3 Ethernet Channel Number

The Ethernet change channel option will allow the operator to change the left and right channel numbers. The numbers may be changed within the range of 0 to 9999. Changes to the channel number will be written to the NV data file.

6.6.4 Network Comm Type

The network comm type can be set to either RS-485 or Ethernet.

NOTE

The communication type for the ChemGuard “shall always be set to “Ethernet”.

6.7 IP Settings

The IP settings option allows the user to modify the IP address, subnet mask, and default gateway.

6.8 Calibrate Touch Screen

NOTE

Use extreme caution when performing touch screen calibration. Improper calibration may make the touch screen unresponsive.

This option allows the User to Calibrate the Touch Screen.

6.9 Alarm History

Alarms that appear in a ChemGuard system are stored in the non-volatile memory of the controller. These alarms can be viewed via either the Alarm History button of the System Setup menu or System Information window. Alarms can be stored for either 30 days maximum or 200 alarm events, whichever comes first.

In addition, alarms can be sorted by alarm type - fault, shutdown or in chronological order. Also there is ability to clear all history for either fault or shutdown and to dump the alarm history to a CSV file or similar on a USB memory device.

If the Alarm History window is opened from the System Information window, the Clear History buttons and the Export button will not be visible since the System Information window can be viewed by anyone without logging into the controller. If the Alarm History window is opened from the System Setup menu, the Clear History buttons and the Export button will be visible, but enabled per the operator's view/modify security permissions.

The Alarm History window will always be opened showing the most recent alarms to the least recent alarms in a multicolumn list. On top of the Alarm List will be the Sort By radio button selection list. The Sort By selections will be Date/Time, Shutdown Alarm and Fault Alarm. If a different Sort By criteria is selected, the Alarm List will refresh and update based on the Sort By selection. If the Shutdown Alarm Sort By is selected, fault alarms will not be shown, and if the Fault Alarm Sort By is selected, shutdown alarms will not be shown.

The Alarm List will have three columns: Date/Time, Type and Description. The Date/Time column will contain the date/time of the alarm event. The Type column will indicate the alarm event type being Shutdown, Fault, Ack, Reset, Login, Logout and Power Up. The Alarm column will show the description of the alarm including the alarm input type, input number and alarm number, and will show the affected process lines.

Below the Alarm List are six buttons: Clear All History, Clear Shutdown History, Clear Fault History, Export, Refresh and Cancel. The Clear All History will clear all of the alarm history prior to the most recent alarm reset event. The Clear Shutdown History and Clear Fault History will clear just the selected shutdown or fault history. The Clear buttons will not clear any of the alarm events for active alarms.

The Export button will export the alarm history to a CSV text file in a selected directory on a USB memory device. The USB directory selection will be similar to the directory selection used when performing a firmware or configuration file transfer. The exported file will contain the following columns:

- **Alarm Event Number** – used to resort the alarm events back to their original chronological order (most recent alarms to the least recent alarms starting at Alarm Event Number 1).

- **Date/Time** – alarm date and time string.
- **Type** – alarm event type being Shutdown, Fault, Ack, Reset, Login, Logout and Power Up.
- **Description** – event description string including the alarm input type, input number and alarm number, and affected process lines.
- **PL1 through PL8** – there will be one column for each process line that contains either a 0 or 1 to allow the alarm events to be sorted by process line.

The Refresh button will refresh the Alarm List with the latest alarm events, and the Cancel button will close the Alarm History window.

The alarm history ring buffer will be completely cleared if the non-volatile memory is cleared via the memory management configuration menu.

6.10 Configuration Transfer

The Configuration Transfer window will display the Configuration File transfer options listed below. The operator will be allowed to choose an option or exit the window. All other controller operations will be suspended during a USB to Controller file transfer.

- Controller to USB

The controller to USB transfer option will begin the file transfer of the Configuration File from the controller to the target device connected to the controller USB port.

- USB to Controller Transfer

The USB to controller transfer option will begin the file transfer of the configuration file from the source device connected to the controller USB port. This option will only be accessible by users with the VERSUM MATERIALS, INC. level password.

6.11 Memory Management

The Memory Management window will display the options listed below. The operator will be allowed to choose an option or exit the window. All other controller operations will be suspended during a PC to Controller Memory Contents file transfer.

6.11.1 USB to Controller Firmware

This option will begin the Firmware file transfer from the source device attached to the controller USB port. The identical transfer must be initiated by the user in the Transfer Program.

6.11.2 Controller to USB Memory Contents

This option will begin the file transfer of the firmware executable files, Configuration File, and NV Data File from the memory of the Controller to the attached PC. Once this option is selected, the following text “FILE TRANSFER IN PROGRESS - DISPLAY INFORMATION WILL NOT BE UPDATED DURING TRANSFER” will be displayed in bold at the bottom of the current selection window.

6.11.3 Delete Nonvolatile Data File and Reboot

The Delete Nonvolatile Data File option will delete the nonvolatile (NV) data file from the memory. Then reboot the controller after completing delete operation of the NV data file from memory.

6.11.4 Return to Power Up Mode

This option returns the Controller to Power Up Mode.

6.11.5 Reboot

This option reboots the Controller.

6.11.6 Reboot to OS

This option reboots the Controller to the Operating System.

6.11.7 Disable/Enable OS Access

Permits Access to the Operating System Task Bar.

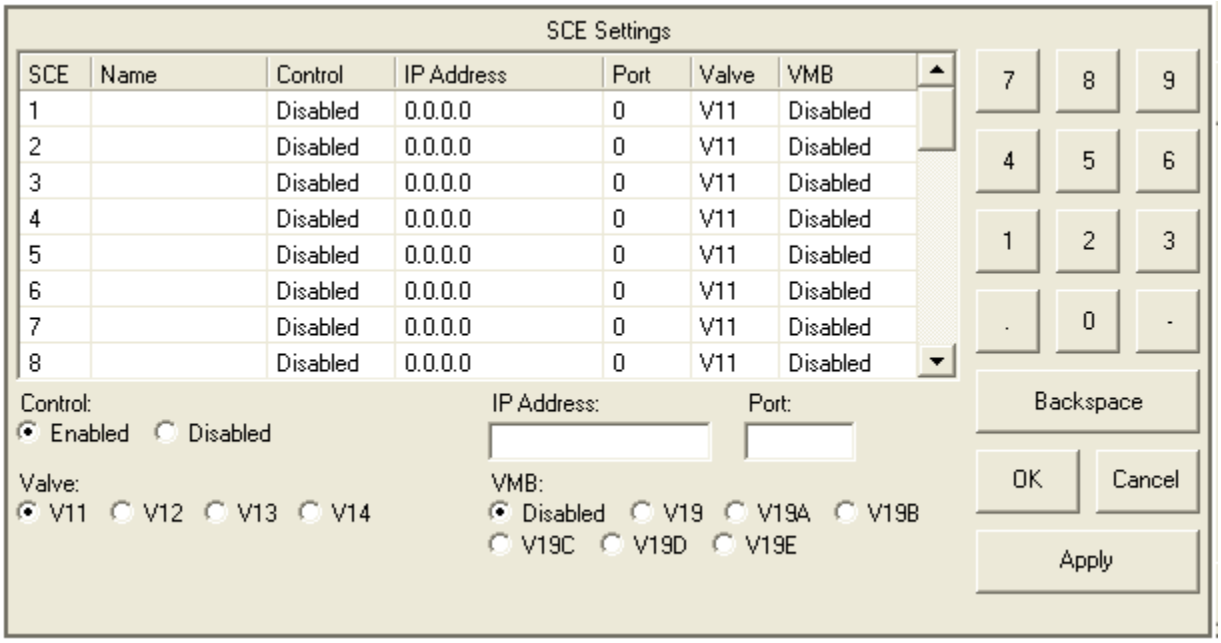
6.11.8 Variables

This option allows the user to see the list of variables used in the sequence.

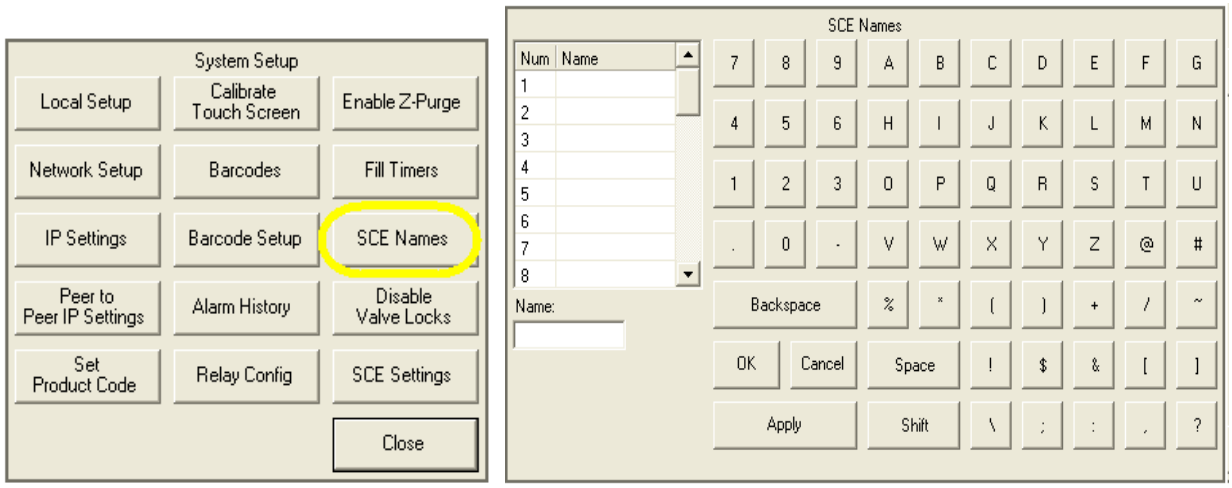
6.12 SCE Settings

The SCE Settings Window, accessible via the System Setup Menu of the Configuration Menu allows the enable/disable state, valve, enable/disable VMB, IP address, and port number of each SCE to be configured, and will appear as shown in Figure 6.8

Figure 6-8: SCE Settings



The SCE enable/disable control enables or disables the control state between the cabinet and the SCE. The SCE valve selection helps to configure which cabinet Controller outlet valve is connected to the SCE. The SCE enable/disable VMB enables or disables whether the SCE is connected via a ChemGuard VMB (valve manifold box). The SCE IP addresses and port number fields define the IP communication parameters to the SCE. A particular name can be identified here according to the specific SCE. The SCE Names menu allows naming the individual SCE with a specific Tool ID or name.



6.13 Automated Operations

Only one automated operation can be initiated at any time on the ChemGuard touch screen controller. This is also true of the CGSCE. Handshaking will occur in operations involving chemical flow between the ChemGuard cabinet and the CGSCE, such as auto fill or bulk change. This handshaking is necessary to disable the others operations. The OEM tool takes precedence over this entire procedure.

No source (CGSCE) operation can occur, without the tools output of a “Tool Ready” command to the CGSCE. This is to ensure the ChemGuard cabinet does not impact process chemical flow to the tool during process.

6.13.1 CG1000-2000 Operations Not Requiring a “Tool Ready” Command

The following operations do not require a Tool Ready command. They are initiated from the CGRCM only.

- Start SC CTRL Operation.
- Change Bulk Operation.
- Bulk Line Clear Operation.
- Bulk Leak Check Operation.
- Bulk Vent Operation.
- Bulk Trickle Purge Operation.
- Manual cabinet Valve Actuation.

6.13.1.1 Start SC CTRL Operation

The Bulk Change operation will be the most commonly used operation, besides auto fill, that operators will be performing.

6.13.1.2 Bulk Change Operation

The Bulk Change operation will be the most commonly used operation, besides auto fill, that operators will be performing.

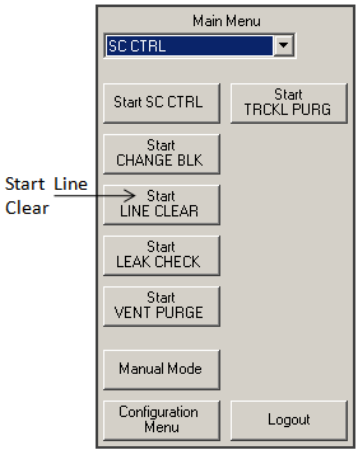
The automated Bulk Change operation will safely and completely remove chemical from the input and output pigtails, facilitating easy container installation and removal. Minimal operator interaction is needed to perform this function.

Because of the high vapor pressure of the chemicals used in the ChemGuard cabinet, no vacuum is needed to remove chemical and associated vapors from the internal piping. This is accomplished mainly by flow purging using N_2 gas and a combination of operational steps embedded in the Bulk Change sub-routine.

Refer to Chapter 4 for details operation to start Bulk Change.

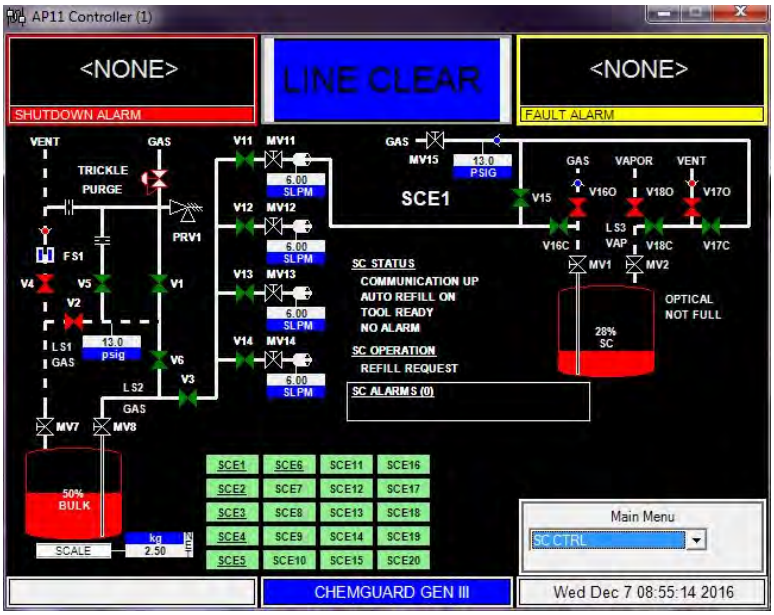
6.13.1.3 Bulk Line Clear Operation

The Bulk Line Clear operation can be started by selecting Start Line Clear button from the Main Menu as shown in Figure 6.9. Selecting this button will enable the Stop Line Clear button on the Main Menu, which can be used to stop the line clear operation before its completion. Also the controller status box will display the text LINE CLEAR indicating the line clear operation is in progress.



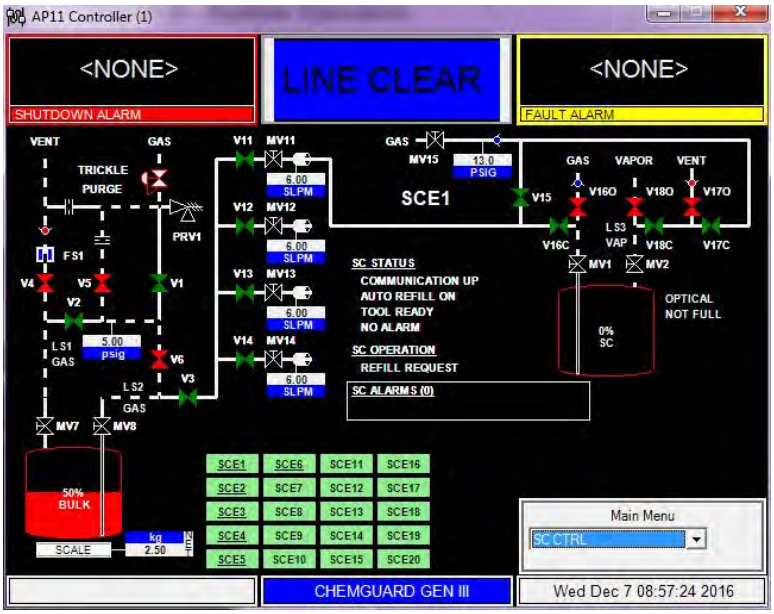
Line clear is a two-step process. First, Nitrogen pressure is vented from the pressure gauge area of the manifold to test the unrestricted flow to the vent by monitoring the gauge pressure. Valves V2 and V4 are open at this time as in Figure 6.9a.

Figure 6-9a: Pre Vent Test



The next step of the Line Clear operation is to push any chemical from the wetted lines of the ChemGuard manifold back into the bulk canister by opening valves V5, V6, and V4, refer to Figure 6.9b.

Figure 6-9b: Line Clear Liquid



6.13.1.4 Bulk Leak Check Operation

The Leak Check operation can be started by selecting the Start Leak Check button from the Main Menu as shown in Figure 6.10. This will change the controller status box to LEAK CHECK indicating that the leak check operation is in progress. Also this will enable the Stop Leak Check button which can be used to stop the leak check operation before its completion.

The Leak Check operation uses the pressure decay method for determining the leak integrity of the Teflon™ line and subsequent connections. The leak rate is programmable by the operator.

Before the pressure decay test can occur, line purging of chemicals and associated vapors must be accomplished. The leak check routine will perform these operations automatically once the leak check function is selected.

Figure 6-10: Bulk Leak Check

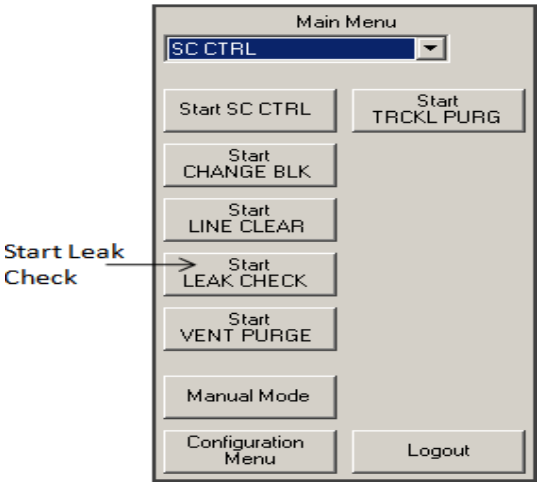
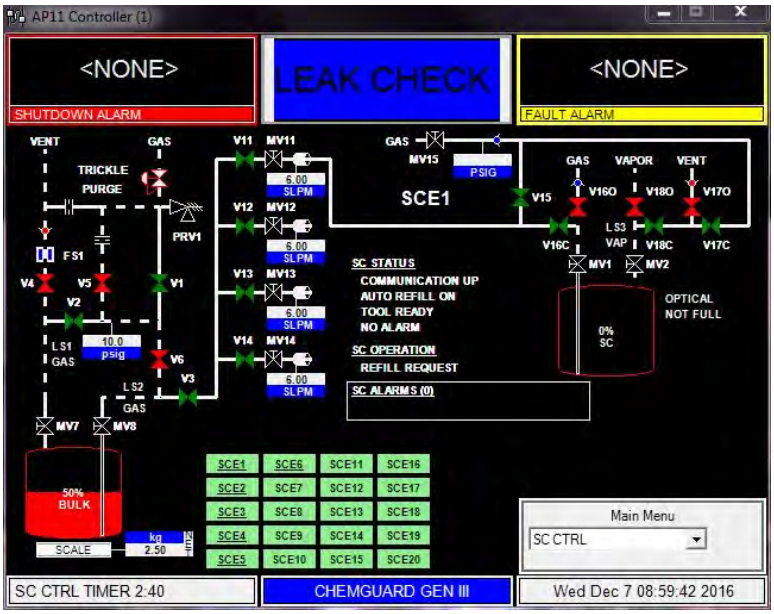


Figure 6-10a: Leak Check



6.13.1.5 Bulk Vent Purge Operation

The Vent Purge operation can be started by selecting the Start Vent Purge button from the Main Menu as shown in Figure 6.11. The controller status box will change to VENT PURGE indicating the vent purge operation is in progress and also the Stop Vent Purge button will be visible in the Main Menu. Select the Stop Vent Purge button, if you need to stop the vent purge operation.

The Vent Purge operation, removes chemical vapor from the vent line, pushing vapors towards scrubbed exhaust. This is accomplished by the system automatically by opening valves V1, V2, and V4. The vent purge time is configured in the software.

Figure 6-11: Bulk Vent Purge

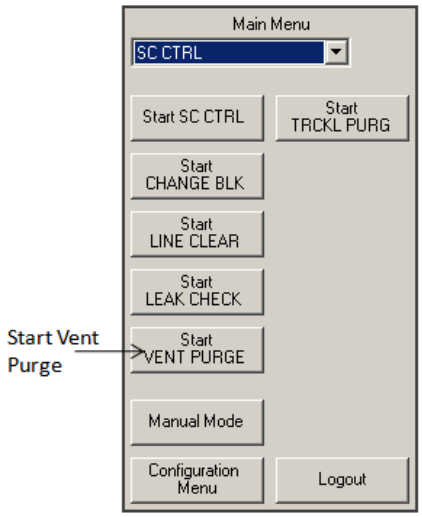
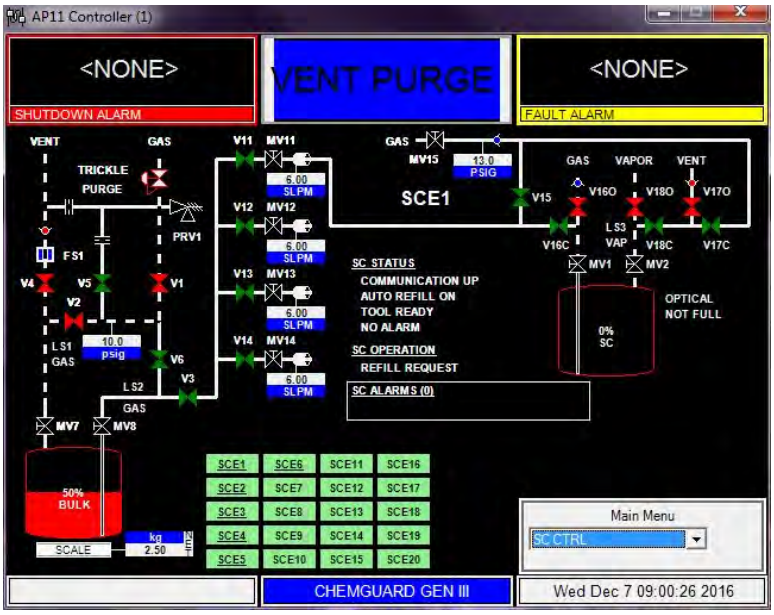


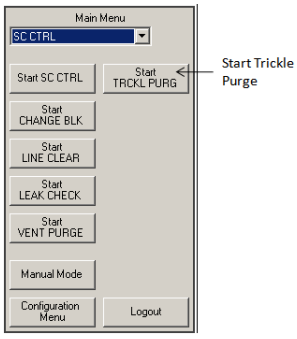
Figure 6-11a: Vent Purge



6.13.1.6 Bulk Trickle Purge Operation

The Trickle Purge operation can be started by selecting the Start TRCKL PURG button from the Main Menu as shown in Figure 6.12. Selecting this button will start the trickle purge operation and the controller status box will display the text TRCKL PURG indicating the trickle purge operation is in progress. Also the Stop TRCKL PURG button will be enabled on the Main Menu. Use this button if you want to stop the trickle purge operation.

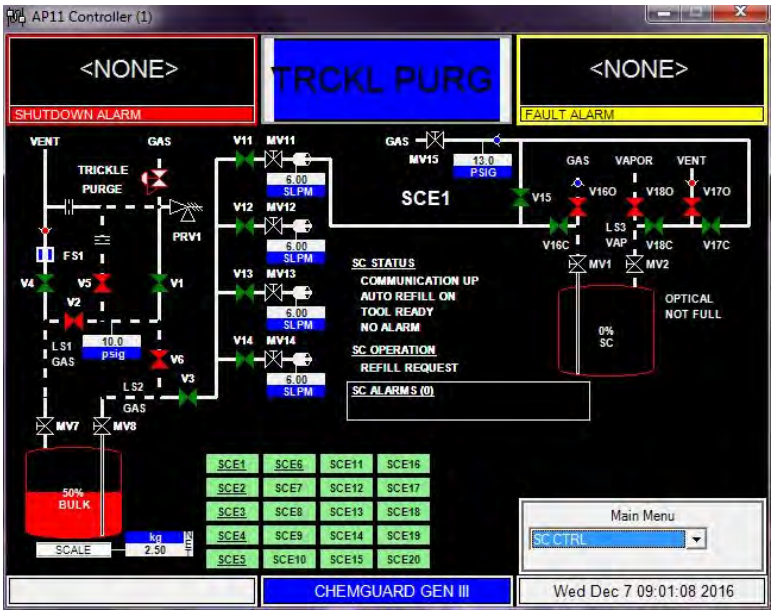
Figure 6-12: Start Trickle Purge



The Trickle Purge operation should be used anytime the pigtails are to be exposed to atmosphere. During trickle purge, Nitrogen flows thru restrictor (FR2) and out via valves V5, V6 and V2 as shown in Figure 6.28.

The Trickle Purge operation is used to keep positive pressure and flow in the pigtails when they are exposed to atmosphere. This, along with the flow purge routine prevents the introduction of contamination into the system and lessens the buildup of residue from exposing un-purged piping to atmosphere

Fig 6-12a: Trickle Purge



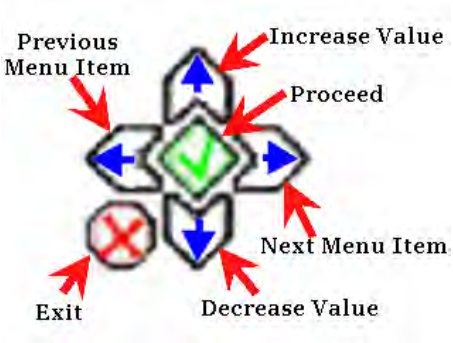
6.13.2 CGSCE Operations Are Requiring a "Tool Ready" Command

The majority of operations are controlled by the CGSCE. Navigating the menu options of the CGSCE is accomplished by a 6 button keypad, refer to Figure 6.13.

The following operations require a Tool Ready command from the OEM tool set.

- Auto Refill Operation.
- Manual Refill Operation.
- Source Backfill Operation.
- Source Line Purge Operation.
- Source Vent Operation.
- Source Change Operation.
- Source Manual Valve Actuation.

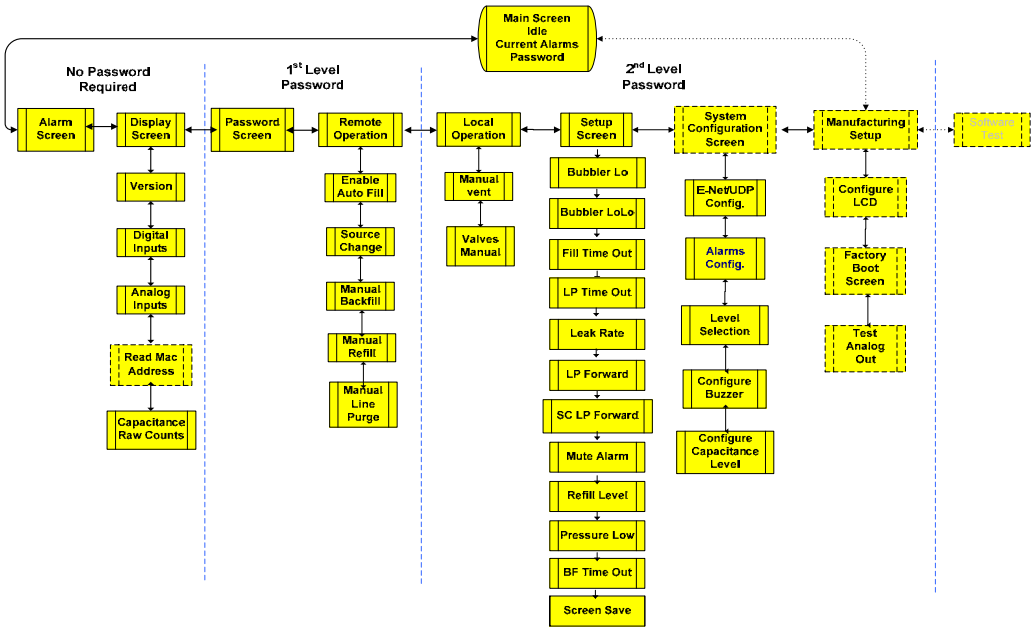
Figure 6-13: CGSCE Keypad



6.13.2.1 CGSCE Password Level

The CGSCE, like the ChemGuard, has password protection. Some of the higher level programming features are not available to the user and reserved for software modification only, refer to Figure 6.14.

Figure 6-14: CGSCE Menu and Password Levels



NOTE

Remote and Local Operations require the CGSCE Auto Refill to be disabled.

6.13.2.2 Source Auto-Refill

When auto fill is enabled, the bubbler is refilled automatically when the following conditions exist:

- The Tool Ready input to the CGSCE is satisfied.
- The chemical level in the ampoule is below the configured refill level point.
- No shutdown alarms exist at the CGSCE or ChemGuard.
- Sources are On-Line.

Once all of the conditions listed above are satisfied, the auto fill sequence will begin. The steps involved in the auto refill operation are:

1. The normally open valves V16 and V18 of the Source Bubbler will close to the tool. Valve V19 will open.
2. The ChemGuard cabinet will begin to pressurize the bulk container by opening valves V1, V2, V3, and the associated output manifold valve (V11, V12, V13, or V14).
3. Chemical will begin to flow from the ChemGuard to the Source Bubbler.
4. Chemical flow will continue until one, or more, of the following situations occurs:

(a) Until the stop fill point is reached.

(b) Until the tool ready input is removed.

(c) Until a shutdown alarm occurs.

Only one source can be refilled at a time. If multiple sources are requesting a fill within the same time frame, these sources will be queued on a first in (first to get a tool ready command) first fill basis. Once the source in the queue is filled, it will move on to the next source and so on. A tool ready input must remain present while the sources are queued. If the tool ready command is removed during queue, that source will be removed from the list and the other queued sources will shift and occupy that vacated space. If that particular source receives a tool ready command again, it will now occupy the space at the end of the queue.

A provision exists in the configuration menu to automatically clear the fill line of chemical by pushing the remainder of the chemical left in the piping back to the ChemGuard bulk container after the Source Bubbler is filled. This is done to prevent standing pressurized chemical to remain in the fill line. This requirement is desirable and sometimes necessary in certain fabrication environments and customer sites.

In the event that the tool ready command is removed before the line purge is completed during a refill operation, the part of the fill line from the bubbler to the ChemGuard will still be automatically cleared. This operation does not interfere with the tool use of the bubbler since valves V16 and V18 will revert to its normally open state for the tool. However, in the case of power lost or emergency stop during a refill operation the lines will not be cleared automatically, for those cases refer to the appropriate recovery procedure explained in chapter one of this manual.

6.13.2.3 Source Manual Refill

The Source Manual Refill operation can only be started directly from the CGSCE, in what is considered to be manual mode. All of the requirements necessary to manually start a Source Refill operation are the same as starting an auto fill operation, with one addition. The operator will need to press the start refill button from the CGSCE display.

The Source Refill operation will continue until the optical sensor detects chemical presence, the refill operation is terminated, or a fault alarm occurs.

Fill time out alarms are latched and must be cleared in order to re-start the fill procedure. A low N_2 push pressure is the major cause of re-fill time out alarms. A N_2 pressure reading at the CGSCE of less than <4 psig will not allow the customer to refill an empty Source Bubbler using the default fill time.

A N_2 pressure reading at the CGSCE of less than (<3 psig) will cause the ChemGuard to display [Scale Fault] alarm. This alarm is a failsafe which monitors the scale readings during chemical transfer.

6.13.2.4 Source Backfill Operation

The Source Backfill operation pushes chemical from the Source Bubbler towards the Bulk Canister of the ChemGuard. This operation is mainly used for maintenance purposes, i.e. removing Source Bubbler, adjusting level sense, etc.

The Source Backfill operation requires a Tool Ready command in order to run. The Tool Ready signal must be present at all times during the operation. Once Tool Ready is removed, all valves will close on the CGRVM and the CGSCE will be in idle mode.

The Source Backfill operation will also stop if:

- A major alarm occurs,
- The pre-programmed time has expired,
- The liquid sensor located on the chemical output line, LS2 senses a dry condition. (This is the most desired outcome)

The pre-programmed time that the Backfill operation takes to complete is configurable by the operator. If the time it takes to complete the operation exceeds the pre-programmed time, a time out alarm will be generated. This alarm must be reset at the CGSCE in order to complete the operation. The alarm will be displayed as “Backfill Alarm” on the CGSCE.

An additional timer is nested in the beginning of the Backfill operation. This is the pre-programmed “pre-backfill-time-out”. This is basically the time it takes the dry LS2 sensor to detect liquid. If the state change of the LS2 sensor exceeds the pre-programmed “Pre-backfill time out” then the backfill operation will stop and the CGSCE will display “Backfill Alarm”. The ChemGuard controller will display the alarm “Pre-Backfill Expired”.

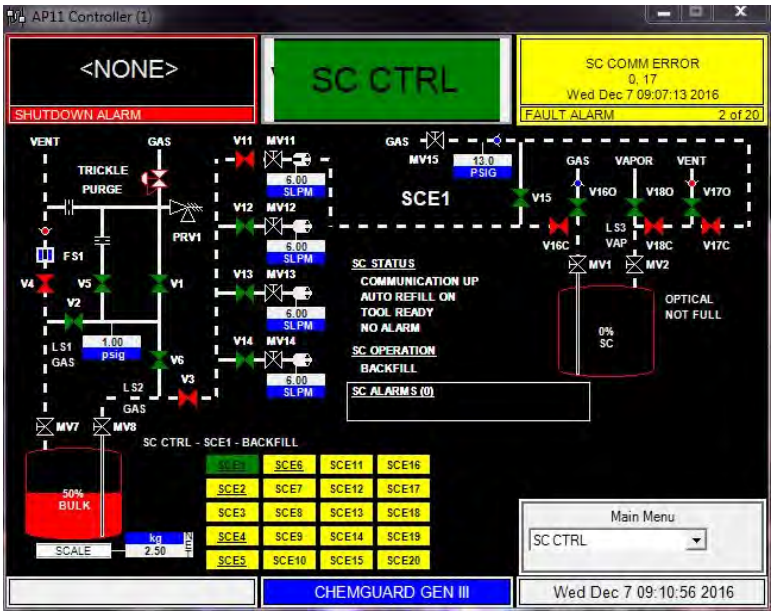
NOTE

Always visually inspect the Source Bubbler and chemical lines to ensure all chemical is removed after the Backfill operation completes.

During the “Backfill” operation, the state of sensor LS2 will change from the initial state of “Dry” to “Wet” and back to “Dry”, indicating the line is clear of liquid. A pre-programmed time delay is nested at the end of the Backfill operation called “LP Wait” (Line Purge Wait). This is used to ensure that the line is indeed, free of chemical by monitoring the LS2 sensor during the total delay time. If this delay time is too short, the Backfill operation would stop prematurely because of bubble detection.

After successful completion of the Backfill operation, the CGSCE will display “Backfill Done”.

Figure 6-15: Source Backfill Operation



6.13.2.5 Source Line Purge Operation

The source line purge operation is very similar to the back fill operation with one exception. The chemical remains in the bubbler but is removed from the fill lines between the Source Bubbler and the bulk supply.

The source line purge operation can be selected by the operator to automatically run after the auto fill sequence or manual fill sequence. This is desirable if the customer request that no chemical is to remain in the fill lines after refill. The line purge time required to totally clear the lines of liquid depends on the configuration of the lines in each installation. This time is programmable by the operator.

Source Line purge is composed of two basic steps; Line Purge Forward and Line Purge Backwards. The first step, Line Purge Forward, clears the lines between the CGRVM and the bubbler, the second step, Line Purge Backwards, clears the line between the CGRVM and the ChemGuard. In the event that the tool ready command is removed before the line purge is completed, the part of the fill line from the CGRVM to the ChemGuard will still be automatically cleared. However, in the case of power lost or emergency stop during a Line Purge operation the lines will not be cleared automatically, for those cases refer to the appropriate recovery procedure explained in chapter one of this manual.

6.13.2.6 Source Vent Operation

The Source Vent operation relieves Nitrogen pressure in the Source Bubbler. This operation is started at the CGSCE. The time the Source Vent operation will run is set in software. The source pressure must be below the vent set point, which is also set in software before the timer expires or a “Vent Fail”

alarm will be generated. Note: Source Vent operation does not display on the ChemGuard touch screen controller.

6.13.2.7 Source Change Operation

The Source Change operation is an automated solution to safely remove the Source Bubbler and if required, installation of a new Source Bubbler.

NOTE

To perform a Source Change operation, it is absolutely necessary to commit the tool to have a "tool ready" status during the entire time of the operation. If "tool ready" changes to "tool not ready" the software will not stop the operation.

Refer to Chapter 4 for details operation.

6.13.2.8 Source Manual Valve Actuation

All activated (open) valves will be displayed in green. All deactivated valves will be colored in red. When any operation is initiated on the touch screen HMI a graphical display of the ChemGuard P&ID will be shown.

The symbol for an activated valve (open) is represented by a solid green triangle. When the valve is closed or placed in the non-energized condition, the valve symbol will be red.

All valves controlled directly by the ChemGuard (V1 to V6 and V11 to V14) are normally closed two-way valves. When an operation is initiated, pneumatic gas is applied and the valves open.

In the ChemGuard Manual Valve mode, the operator can open any of the valves controlled by the ChemGuard. This mode is accessible at ChemGuard password level 2. Reference this chapter for details about this operation mode.

In the CGSCE Manual Valve mode, the operator can open any of the valves controlled by the CGSCE (V15 to V19). This mode is accessible at CGSCE password level 2. Reference this chapter for details about this operation mode.

6.14 ChemGuard System Alarms

An alarm condition is shown by the word ALARM followed by a numeric or alphanumeric code. Refer to alarm descriptions for the alarms and codes listed at the end of this paragraph. Scroll to ALARM on the MAIN Menu.

NOTE

When a shutdown alarm occurs, the system aborts any operation that is initiated. All valves are deactivated and placed in a safe condition.

The ChemGuard will constantly monitor its status and will provide visual and audio annunciation when any condition exists outside of the expected programmed norm. In addition, the alarm is time and date stamped then saved in Alarm History. The Alarm History screen will hold approximately 200 lines of alarm data. When alarm number 201 comes in, the first 100 alarms will be deleted and saved as a txt file into a USB memory stick if one is connected to the ChemGuard at that time. Each alarm that's displayed on the main screen of the ChemGuard is in either of one of two boxes. The box on the right will have a yellow background. This is where the fault alarms are displayed. The box on the left has a red background when displaying shutdown alarms.

Any alarm that requires the system to be shutdown is displayed in the Shutdown Alarm box in the top left hand corner of the screen. Any alarm that requires operator attention is displayed in the Fault Alarm box in the top right hand corner of the screen.

When a new alarm occurs, either shutdown or fault, the caption above the alarm will display (***NEW***). Below the displayed alarm will be the time and date the alarm occurs. If multiple alarms exist at that time, it will add the new alarm to the total number of alarms and display where in the sequence of alarms the new alarm occurred. Example: 5 of 5.

In addition to being displayed on the touch screen, the corresponding LED, either yellow for fault, or red for shutdown will begin to blink. If an optional light bar is connected to the ChemGuard, the light bar will mimic the operation of the LEDs. The alarm buzzer will sound.

To acknowledge an alarm, touch the corresponding block once where the new alarm is displayed (either fault or shutdown). The blinking of the LED and light bar will cease and become solid. The alarm buzzer will silence and the caption above the displayed alarm will change from (***NEW***) to (***ACKNOWLEDGED***).

If the alarm condition still exists and you touch the block again, the caption will revert back to ***NEW*** alarm. If the alarm condition does not exist when the block is touched the alarm is cleared and removed from the main menu display.

The conditions that generate either a fault or shutdown alarms are outlined in the following table.

Table 6-2: ChemGuard System Alarms

CG2000 Cabinet Alarm Table. Sofware: CG2000 REV: CF000004_REV1.60BETA																	
					With Source						Without Source						
							X = Interlock the Function										
Serial Number	Alarm Name (Text in display)	AlarmType (always back to Default)	DealyTime (Default can be updated) (Second)	Notes	C-L Calibration	AutoRefill	Refill	Line Purge with Source	Back Fill	Source Change	Res. Change	Vent Purge	Trickle Purge	Leak Check	Line Clear (No Source)	Manual Control
1	VAPOR DETECT	Shutdown	15	Hardwire Selectable	X	X	X	X	X	X	X	X	X	X	X	X
2	SPILL DETECTED	Shutdown	0	Hardwired	X	X	X	X	X	X	X	X	X	X	X	X
3	LOW EXHAUST	Shutdown	30	Hardwire Selectable	X	X	X	X	X	X	X	X	X	X	X	X
4	LOW PNEUMATICS	Shutdown	5	Hardwire Selectable (Emergency)	X	X	X	X	X	X	X	X	X	X	X	X
5	LIQ IN VENT LINE	Shutdown	1	LS1 is wet	X	X	X	X	X	X	X	X	X	X	X	X
6	DOOR OPEN	Fault	3	Hardwire Selectable	X	X	X	X	X	X	X	X		X	X	X
7	EMERGENCY STOP	Shutdown	0		X	X	X	X	X	X	X	X	X	X	X	X
6	FIRE DETECTED	Shutdown	15	Trans-LC	X	X	X	X	X	X	X	X	X	X	X	X
9	REMOTE SHTDWN	Shutdown	0		X	X	X	X	X	X	X	X	X	X	X	X
10	LIFE SAFETY (spare)	Shutdown	0	Keep disabled	X	X	X	X	X	X	X	X	X	X	X	X
11	TRICKLE LOW	Fault	1													
12	TRICKLE HIGH	Fault	1													
13	HP CAB SHUTDOWN	Shutdown	0	Software Compatibility. POCI3 Only	X	X	X	X	X	X	X	X	X	X	X	X
14	HIGH PUSH PRESS BLK	Shutdown	2	M. Cont. not locked if alarm is ack.	X	X	X	X	X	X	X	X	X	X	X	X
15	LOW PUSH PRESS BLK	Fault	20													
16	LOW Z-PURGE	Fault	5	Trans-LC												
17	SC OP TIMEOUT	Fault	0	Source Operation Timeout	X	X	X	X	X	X	X	X	X	X	X	X
18	LEAK CHECK FAILURE	Fault	0													
19	GROSS LEAK	Fault	1													
20	PREBCKFILL EXPIRED	Shutdown	2		X	X	X	X	X	X	X	X	X	X	X	X
21	CHNGE BLK NOT DONE	Fault	1	Unavailable bit set	X	X	X	X	X	X						
22	BULK RES OVERFULL	Fault	10	Level > 107%	X			X	X	X						
23	BULK RES LOW	Fault	10	Level < Low Set Point												
24	BULK RES EMPTY	Fault	10	Level < Empty Set Point	X	X	X									
25	BULK VENT FAILED	Fault	10													
26	VF SWITCH FAIL	Shutdown			X	X	X	X	X	X	X	X	X	X	X	X
27	V11 VMB SPILL	Shutdown	1		X	X	X	X	X	X	X	X	X	X	X	X
28	V12 VMB SPILL	Shutdown	1		X	X	X	X	X	X	X	X	X	X	X	X
29	V13 VMB SPILL	Shutdown	1		X	X	X	X	X	X	X	X	X	X	X	X
30	V14 VMB SPILL	Shutdown	1		X	X	X	X	X	X	X	X	X	X	X	X
31	MAN VLV TEST FAIL	Shutdown	0		X	X	X	X	X	X	X	X	X	X	X	X
32	SC COMM ERROR	Fault	60		X	X	X	X	X	X						
33	COAX 1 LOW FLOW	Fault	5													
34	COAX 2 LOW FLOW	Fault	5													
35	COAX 3 LOW FLOW	Fault	5													
36	COAX 4 LOW FLOW	Fault	5													
37	V11 VMB EXHST FAIL	Fault	0													
38	V12 VMB EXHST FAIL	Fault	0													
39	V13 VMB EXHST FAIL	Fault	0													
40	V14 VMB EXHST FAIL	Fault	0													
41	LINE CLEAR FAILED	Fault	0													
42	BULK EMPTY	Shutdown	5		X	X	X	X	X	X	X	X	X	X	X	X
43	CABINET OFFLINE	Fault	0													

6.15 ChemGuard Alarm Descriptions

The following conditions will cause the above annunciations.

1. VAPOR DETECT

The concentration of chemical vapor inside the ChemGuard cabinet is above the allowable limit.

2. SPILL DETECTED

The float sensor in the bottom of the ChemGuard cabinet has changed states.

3. LOW EXHAUST

The exhaust flow is below the allowable pre-set limit.

4. LOW PNEUMATICS

Incoming pneumatic pressure is below the default Setpoint pressure.

5. LIQ IN VENT LINE

Liquid is detected optical sensor LS1.

6. DOOR OPEN

The door to the chemical containment area is ajar.

7. EMERGENCY STOP

The emergency manual off button is depressed, the remote stop circuit is open, or a life safety alarm has occurred.

8. FIRE DETECTED

Rate of Rise temperature sensor detects a sharp increase in temperature.

9. REMOTE SHUT DOWN

The cabinet has been stopped by the customer through the cabinet remote stop connection.

10. LIFE SAFETY (spare)

A shutdown Alarm will be generated if this alarm is enabled. This alarm is not used in ChemGuard cabinet. Keep this alarm disabled.

11. TRICKLE LOW

The flow of the purge gas needs to be adjusted by adjusting its pressure during the Bulk Change routine to provide adequate trickle purge. If the pressure is not enough, this alarm is generated.

12. TRICKLE HIGH

The flow of the purge gas needs to be adjusted by adjusting its pressure during the Bulk Change routine to provide adequate trickle purge. If the pressure is too high, this alarm is generated.

13. HP CAB SHUTDOWN

A shutdown alarm will be generated if there is incompatibility between the cabinet and the SCE software. ChemGuard ($POCl_3$) cabinet only.

14. HIGH PUSH PRESSURE BULK

N_2 push pressure is above Setpoint. In the event that this alarm is generated all operations will be interlocked, refer to Appendix H for a recovery procedure.

15. LOW PUSH PRESSURE BULK

N_2 push pressure is below Setpoint.

16. LOW Z-PURGE

This alarm is generated when the pressure inside of the electronics enclosure is below the adjustable Z-Purge setting. This alarm will annunciate when the electronics controller door is opened. In Class 1 Division II environments, the electronics box door shall never be opened when AC power is applied to the cabinet. In addition, power cannot be restored to the cabinet until after at least ten (10) volume exchanges have taken place.

17. SC OP TIMEOUT

Source operation timeout. The time set to complete Refill, Backfill or Line Purge expired without completing the operation.

18. LEAK CHECK FAILURE

The system checks for leaks in the plumbing after the bulk has been replaced during a Bulk Change operation or as part of the Leak Check operation by comparing the pressure before and after a long period of time. This alarm is generated when the leak test does not meet the criteria to pass set in the configuration menu.

19. GROSS LEAK

Before performing a long leak test as described above, the system checks first for leaks within a short period of time. This short test is performed only for Bulk Change operations. The alarm is generated when the leak test does not meet the criteria to pass set in the configuration menu.

20. PREBCKFILL EXPIRED

This alarm is generated if chemical is not detected at the LS2 optical sensor in the ChemGuard when the Pre-Backfill timer expires. Once a Backfill operation has started, chemical is expected to reach LS2 within the time set. The timer is set in the cabinet configuration menu (Alarm Delays).

21. CHNGE BLK NOT DONE

When a Bulk Change is initiated, a bit is set in software to put the bulk container offline. This bit is only cleared after the successful completion of the leak check at the end of the container change routine. If this operation is not successfully completed the bit will not be cleared and the alarm is generated.

22. BULK RES OVERFULL

This alarm is generated when the percentage of chemical displayed on the touch screen is above the Setpoint value entered in the set-up page.

23. BULK RES LOW

The chemical percentage displayed on the touch screen is below the low Setpoint value entered in the set-up page.

24. BULK RES EMPTY

The chemical percentage displayed on the touch screen is below the empty set point value entered in the set-up page.

25. BULK VENT FAILED

Bulk Canister pressure is monitored during routines which involve vent operations. If during the vent routine the pressure does not reach the minimum pressure specified in the Setpoints, a fail alarm will be generated.

26. VF SWITCH FAIL

Vent flow switch (VF) is tested during routines which involve vent operations. If the switch does not detect enough N_2 flow during the vent routine, or if the switch does not change states, a switch fail alarm will be generated.

27. VMB # SPILL

CGVMB's 1 thru 4 has integrated float spill detectors mounted inside of the VMB enclosures. When the float sensors changes state, from closed (no spill) to open (spill detected), this open will be detected on the ChemGuard I/O card, pins 12 and 13. VMB 1 will be tied to I/O 1, VMB 2 to I/O 2, VMB 3 to I/O 3, and VMB 4 to I/O 4.

28. MAN VLV TEST FAIL

After software prompts to close manual valves during a Bulk Change operation, the system performs series of steps to verify that the valves have been indeed closed. This alarm will be generated if software detects that the valves has not been closed.

29. COAXIAL # LOW FLOW

The flow through the coaxial line is below the selected Setpoint.

30. SC COMM ERROR

The ChemGuard system can communicate with 20 CGSCE's via Ethernet network. If communication is lost, disconnected 10 Base T line, an alarm will annunciate displaying the source number of the disconnected CGSCE**.**

31. SC COMM ERROR (SHUTDOWN ALARM)

Depending on the architecture of wired network, network problems exist with either the Ethernet connection to the ChemGuard cabinet or the central hub.

32. VMB # EXHST FAIL

The VMB's enclosure exhausts are monitored. When the exhaust flow in one of the VMB's is below the Setpoint a fail alarm is triggered.

33. LINE CLEAR FAILED

This alarm is generated if chemical is still detected at the LS2 optical sensor in the ChemGuard after a line clear step.

34. BULK EMPTY

During normal refill operations liquid chemical flows through the optical sensor, LS2, located at the outlet pigtail of the Bulk canister. If liquid chemical is not detected by LS2 during the refill operation, the Bulk Empty alarm is triggered.

35. CABINET OFFLINE

This alarm is generated when the sources are taken offline either by pressing on the "Stop SC CTRL" box on the main menu or by any cabinet shutdown alarm.

6.16 System Input / Output

All setup parameters, I/O and user Setpoints must be properly configured according to the system configuration and customer requirements.

The input required from the customer is the "Tool Ready" command. When this command is present, all operations that were noted in the previous section can be performed. When the tool does not output this command, this indicates that the bubbler is in use by the tool and no other operations can be performed. The input command can be either a closed contact or a 3 to 30 VDC signal.

The next input command opens and closes the chemical output valve of the 4XCGVMB or 5XCGVMB. If a CGVMB is to be used, this input will be controlled via the CGVMB's spill output. Once a spill is detected in the CGVMB, the downstream chemical output valve will de-activate stopping chemical flow to the CGVMB. The ChemGuard will receive the alarm, "VMB Spill" alarm and all ChemGuard valves will deactivate and revert to a safe condition. The ChemGuard will communicate to all CGRVM that a spill condition exists and all CGRVM valves will also deactivate and revert to a safe state.

If a CGVMB is not connected to the ChemGuard cabinet, then the Chemical Output Valve is controlled directly from the CGSCE's spill detect output.

The ChemGuard cabinet outputs the fault and shutdown alarm from the system I/O. These alarms are configured as a normally open (NO) contact.

6.17 CGSCE Source Display

The CGSCE must be configured to properly communicate and carry out functions to and from the bulk supply as well as the customer tool set and facilities life safety systems.

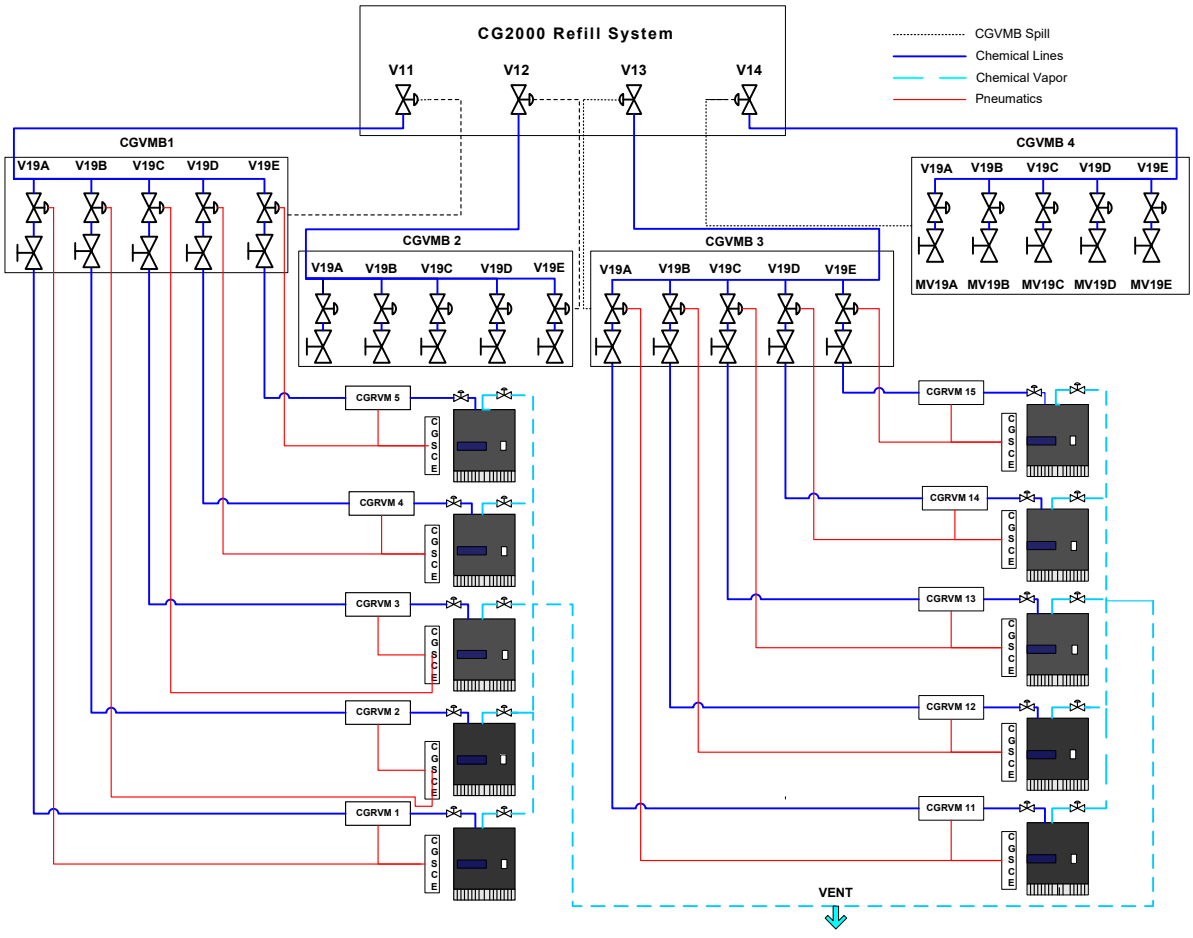
Understanding the menu mapping of the CGSCE and the information that's displayed on the screen is necessary to navigate from screen to screen.

6.18 Source Controller Overview Display

The Source Controller Overview display, found on the ChemGuard Touch Screen, displays a comprehensive overview of the status of all of the Sources connected to the ChemGuard cabinet.

Up to five (5) CGSCM Source Bubblers can be connected to one (1) CGVMB. The ChemGuard cabinet can interface with four (4) CGVMB's, for a total of 20 CGSCMs. If no CGVMB's are used, the CGSCM can be directly interfaced with the ChemGuard cabinet by connecting to the 4X Output Valve Manifold of the ChemGuard. Combinations of these two methods are also permissible, refer to Figure 6.35.

Figure 6-35: Typical Arrangement, Shown with 10 CGSCM Installed



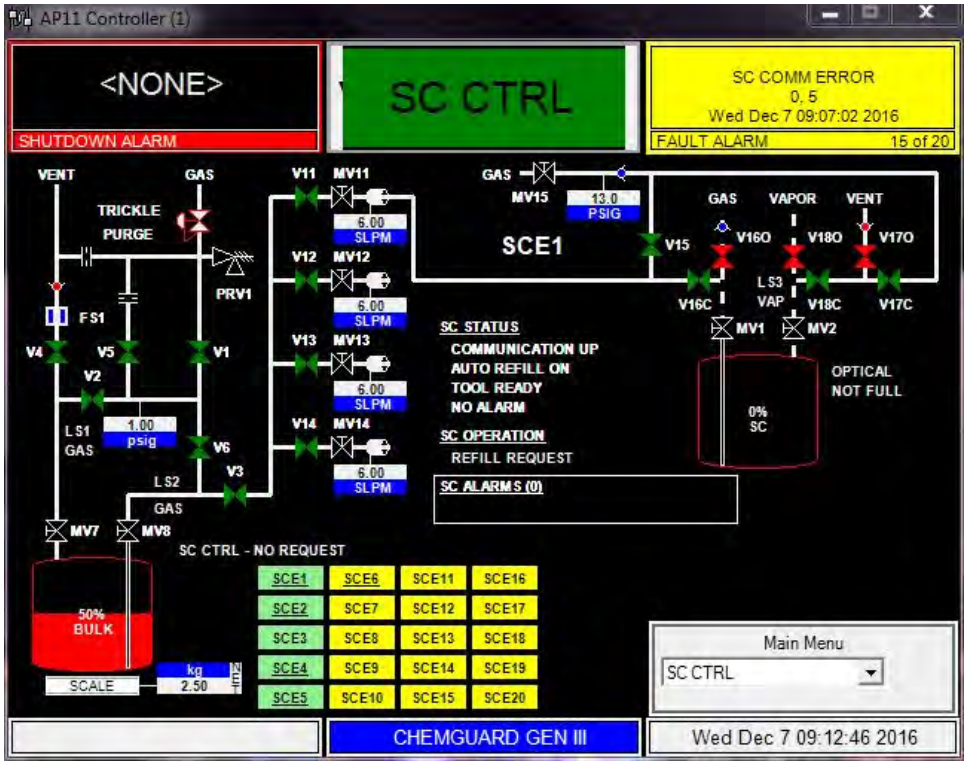
Each box on the touch screen represents a CGSCM. The boxes are color coded, indicating the status and alarm state of each CGSCM, refer to Figure 6.36.

Green - Indicates the CGSCM is on-line, and no alarms exist on that particular CGSCM.

Yellow – Indicates a fault alarm exist at the CGSCM

Red – Indicates the CGSCM is in shutdown status.

Figure 6-36: Source Controller Overview



6.19 CGSCE Source Display Details

By touching the radio button of any displayed CGSCE, a detailed status screen of that source will be shown, refer to Figure 6.37. The information displayed is as follows:

- P&ID of the bubbler showing the color coded valve states and the physical connection to the associated CGVMB. If the bubbler has a direct connection to the ChemGuard, the graphical display will show the physical connection made to the appropriate ChemGuard output valve.
- Capacitance (Analog) level and graphical display of the chemical level in the bubbler in percent (%).

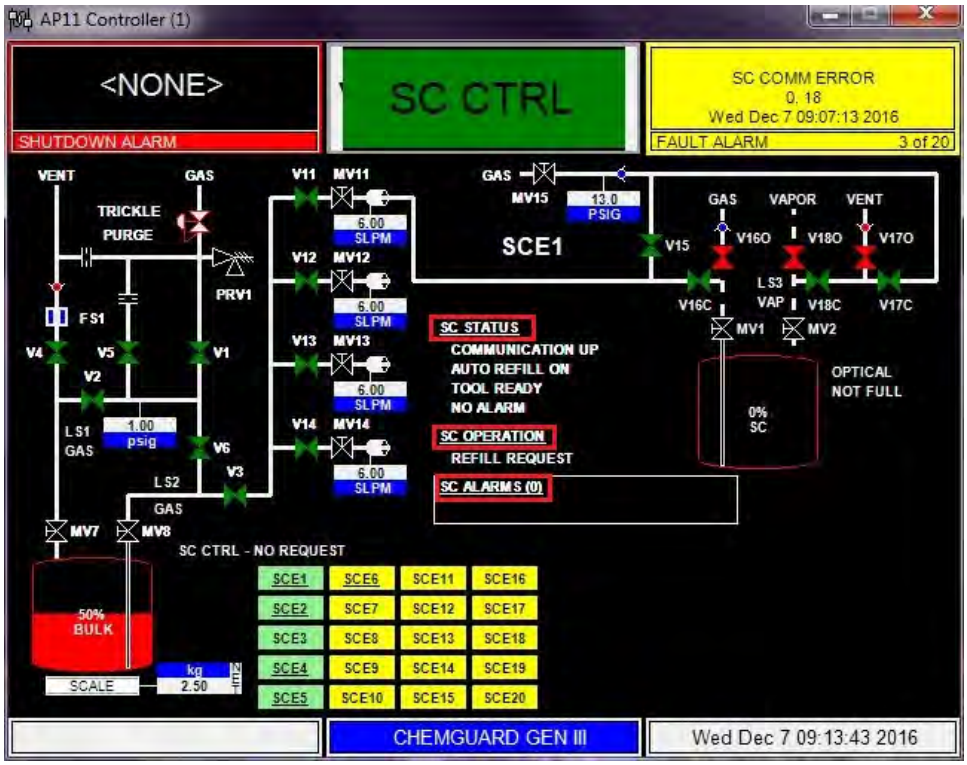
- Digital output reading displaying if the chemical level has reached the optical “stop fill” point.
- The analog reading of the N_2 push pressure at the bubbler, displayed as PSIG.
- The Source Controller status, which includes:

Communication State

  - If the CGSCE “Auto Refill” command is enabled or disabled.
  - If the input command, (Tool Ready) is active from the tool.
  - If any alarms exist on the CGSCE.
- Source Controller Operational State
  - Idle
  - Fill
- Source Controller Alarms

Any CGSCE alarm displayed at the SCE will also be displayed on the ChemGuard at the CGSCE detail window. Reference this chapter for CGSCE alarms descriptions.

Figure 6-37: Source Controller Display Details



6.20 Source Configuration Menu

Each CGSCM must be configured and setup individually using the CGSCE. Like the ChemGuard, the configuration of the CGSCE must be established first. Referencing the CGSCE Menu Function map, Figure 6.33, use the 2nd level login password to access the configuration and setup menu. All other menu items necessary to complete the CGSCE setup can be conducted from this level.

- Bubbler Lo. Default setup 10%.
- Bubbler LoLo. Default setup 5%.
- Fill Time out. Default setup 160 seconds.
- Line Purge Time out. Default setup 20 seconds.
- Leak Rate. Default setup 0.2 psig/h.
- Line Purge Forward. Default setup 60 seconds.
- SC LP Forward (Source Change). Default setup 300 seconds.
- Mute Alarm. Default setup 3600 seconds.
- Refill Level. Default setup 50%.
- Push Pressure Low. Default setup 1.2 psig.
- Backfill Time out. Default setup 160 seconds.
- Screen Saver Time out. Default setup 5 seconds.

6.20.1 CGSCE Network Setup

Prior to the CGSCE communicating with the ChemGuard cabinet, network addressing and protocol must be established. All the following configuration parameters, except for the MAC address, can be changed by navigating to the CGSCE System Configuration Menu and then selecting the parameter to be changed, refer to Figure 6.33.

6.20.2 Read Mac Address

The MAC address displayed on the CGSCE display screen must match the MAC address stamped on the label placed on the CGSCE. The MAC address cannot be changed.

6.20.3 Change IP Address in the CGSCE

Each CGSCE must have a valid and unique IP address in order to successfully communicate over the LAN. IP address must be provided by the facility IT department. Communication is not established between the ChemGuard and the CGSCE until the correct IP address is entered.

6.20.4 Change IP Address in the ChemGuard

The IP address must also be entered on the ChemGuard Source Controller Overview Display.

6.20.5 Change Subnet Mask

The Subnet Mask is to be assigned by customer IT personnel and must match at the SCSCE and the ChemGuard.

6.20.6 Change Default Gateway

The DF Gateway is to be assigned by customer IT personnel and must match at the SCSCE and the ChemGuard.

6.20.7 Change UD Port

The UDP port is to be assigned by customer IT personnel and must match at the SCSCE and the ChemGuard.

6.20.8 CGSCE Alarm configuration

Default is all alarms enabled.

6.20.9 CGSCE Level Selection

Presently, continuous level sensing is done using dual capacitance probes. This will be the default selection.

6.20.10 Configuration of Buzzer

This turns the audio buzzer of the CGSCE off and on.

WARNING

Disabling the cabinet Audio Buzzer is not recommended. The default setting for this function should be enabled. Some alarms will not display if certain menus are accessed. All alarms will display on the main menu display. All alarms will be annunciated when the Audio Buzzer "ON" is selected.

6.21 CGSCM Manual Valve Control Mode

Manual valve control is accomplished from this menu. Pneumatic actuated valves V15 thru V19 can be operated using the Manual Control mode.

Valves V15 and V19 are normally closed two-way valves. When either valve is selected in this mode, pneumatic gas is applied and the valves open.

Valves V16, V17, and V18 are three-way valves with a Common (C-Open) port, a Normally Open (NO) port, and a Normally Closed (NC) port. When one of these valves is selected in this mode, high-pressure pneumatic gas is applied, the Normally Open port closes and the Normally Closed port opens.

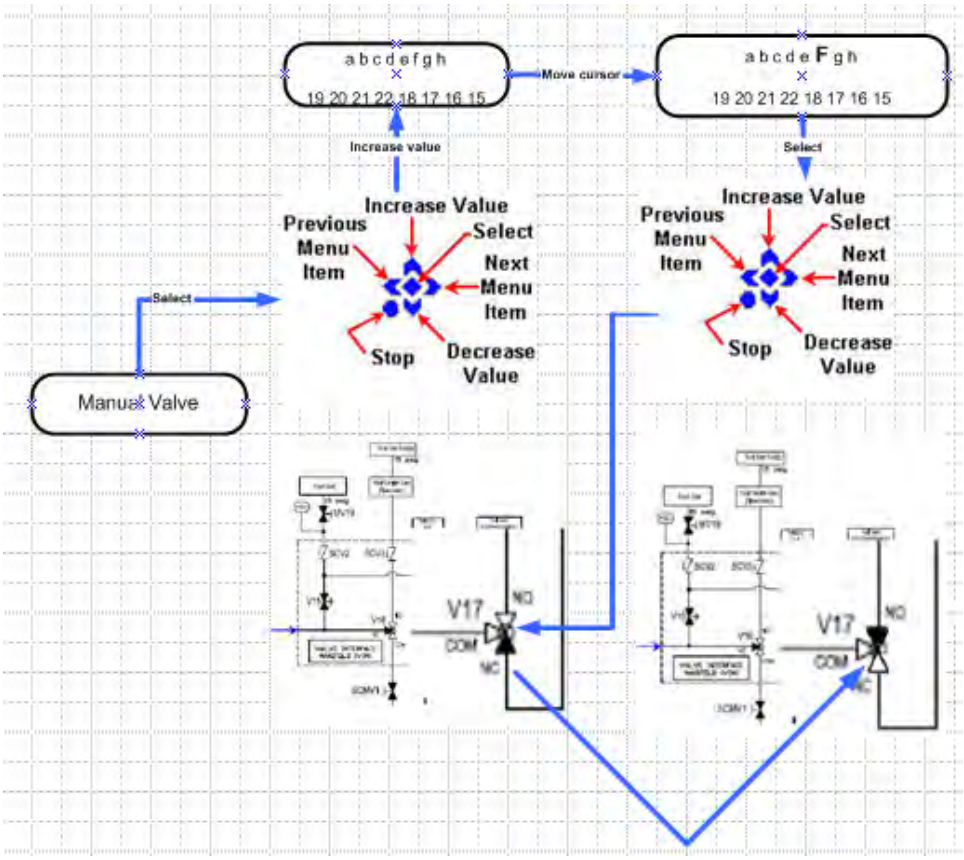
⚠WARNING

Operating in Manual Mode could cause the following hazards which can result in PERSONAL INJURY OR DEATH.

- ***Opening valves when high pressure push gas is present.***
- ***High pressure gas could be vented.***
- ***Opening vent valves when high pressure gas is present.***

Move cursor to select a valve and then press the "√" center key to open that valve, refer to Figure 6.38.

Figure 6-38: CGSCE Manual Valve Control Mode



NOTE

When manual valve operation is terminated by a source overfull alarm, the alarm will not be displayed until after the operator has exited the manual activation screen. Versum Materials, Inc. recommends, not disabling the alarm buzzer function, which will annunciate during the above noted condition.

6.22 Configure Capacitance Level

The Capacitance Level Probe calibration must be performed on each CGSCM prior to filling the Source Bubbler the first time. Note: The Capacitance Overfill alarm is disabled during level calibration. Refer to section 7.2.1 for Source Level Calibration.

6.23 CGSCE Source Alarms

The CGSCE will constantly monitor its status and will provide visual and audio annunciation when any condition exists outside of the expected programmed norm. In addition, the alarm is displayed on the ChemGuard at the CGSCE detail window.

When an alarm occurs, it will be either a shutdown or a fault alarm. The alarm will be displayed on the main display menu. If multiple alarms exist at that time, it will add the new alarm to the total number of alarms and display where in the sequence of alarms the new alarm occurred. Refer to Table 6.3.

Table 6-3: CGSCE Alarm Matrix

CG 1000 Source Controller Alarm Table. Firmware: CG1000 Rev 2.45 and 2.45HP 8/18/09																	
								Interlock Function X = Interlock I = Inhibit									
Serial Number	Alarm Name	Life Safety Relay (Hard wired)	Fault Relay	Shutdown Relay	Alarm Status (Default)	Alarm Inhibit Auto Refill (Switch to Manual)	Delay Time (Default)	C-L Calibration	Auto Refill	Refill	Line Purge	Backfill	Source Change	Manual Vent	Manual Control	Notes
1	SCE Manual Stop	X			Enabled	X	0	X	X	X	X	X	X	X	X	
2	External Spill	X		X	Enabled	X	0	X	X	X	X	X	X	X	X	
3	Bubbler Overfull			X	Enabled	X	5		X	X			X			Capacitance Level > 80%, Fixed
4	Bubbler Low Low			X	Enabled		5									Capacitance Level < 5, Variable
5	Overfull	X		X	Enabled	X	2	X	X	X	X	X	X	X	X	
6	Pneumatic Low				Enabled		5	X	X	X	X	X	X	X	X	< 65 PSI, Fixed
7	Pressure High				Enabled		0	X	X	X	X	X	X	X	X	> 17 PSI for Low Press; >28 for HP
8	Pressure Low				Enabled			X			X	X				Variable
9	E-net/UDP Failed				Enabled		60	X	X	X	X	X	X		X	
10	Refill Timeout				Enabled				X	X						Variable. Displayed as "Refill Alarm!"
11	Backfill timeout				Enabled							X				Variable. Displayed as "Backfill Alarm!"
12	Line Purge timeout				Enabled			X		X	X	X	X			Variable. LN P. interlocked at Autorefill. Displayed as "Line Purge Alarm!"
13	Bubbler Low		X		Enabled		5									Capacitance Level < 10, Variable
14	Change Not Done				Enabled		1	X	X	X	X	X				
15	Ultrasonic Low				Enabled		2									Not used.
16	Auto Refill Off				Enabled		0									
17	Pneumatic High				Enabled		5									Fixed (96 PSIG)
18	C-L Not Configed				Enabled		0									
	Source Change		X	X												(Fail safe)
	Tool Not Ready							X	X	X	X	X	I	X	X	

6.24 CGSCE Alarms Descriptions

The following conditions will cause the above annunciation.

1. SCE Manual STOP

Displayed as SCE Manual Stop, this is the Source STOP input from Life Safety or Tool to shut down “STOP” the operation being performed at that CGSCM.

2. External Spill

Chemical spill detected by the CGSCM’s Spill Detect cable mounted in the tool’s containment tray.

3. Bubbler Overfull

Capacitance Level Prove Overfull. The chemical detected by the Capacitance Level Probe, displayed on the CGSCE is above the Overfill Setpoint value entered in the set-up menu.

4. Bubbler Low-Low

Capacitance Level Prove Empty. The chemical detected by the Capacitance Level Probe, displayed on the CGSCE is below the Empty Setpoint value entered in the set-up menu.

5. Overfull

Liquid detected in the Vapor to Tool line by the optical probe, LS3.

6. Pneumatic Low

Incoming pneumatic pressure is below the default low Setpoint pressure.

7. Pressure High

N_2 push pressure is above Setpoint.

8. Pressure Low

N_2 push pressure is below Setpoint.

9. E-net/UDP Failed (Ethernet/UDP Failed)

Lost Ethernet. Communication loss between the CGSCE and ChemGuard.

10. Refill Timeout

Displayed as “Refill Alarm!”. This is the time set in the CGSCE setup menu to complete a Source Fill operation. If chemical does not reach the optical stop in this predetermined time span, a refill time out alarm is generated and the fill process stops.

11. Backfill Timeout

Displayed as “Backfill Alarm!”. This is the time set in the CGSCE setup menu to complete a Source Backfill operation. If during a Backfill operation, Sensor LS2 in the ChemGuard continues to detect chemical present in this predetermined time span, a Backfill Timeout alarm is generated and the Backfill operation will stop.

12. Line Purge Timeout

Displayed as “Line Purge Alarm!”. This is the time set in the CGSCE setup menu to complete a Source Line Purge operation. If during a Line Purge operation, Sensor LS2 in the ChemGuard continues to

detect chemical present in this predetermined time span, a Line Purge Timeout alarm is generated and the Line Purge operation will stop.

13. Bubbler Low

The chemical detected by the Capacitance Level Probe, displayed on the CGSCE is below the Low Setpoint value entered in the set-up menu.

14. Change Not Done

When a Source Change is initiated, a bit is set in software to put the Source offline. This bit is only cleared after the successful completion of the leak check at the end of the container routine. If this operation is not successfully completed the bit will not be cleared and the alarm is generated. The bit will be cleared after successful completion of a Source Change operation. Only local source operations can be performed at this time.

CAUTION

Ensure the Source Change process operation is successfully completed before attempting any other operations or maintenance. Chemical residue or TRANS-LC vapors above the TLV may be present in the lines.

In order to clear the “Change Not Done” alarm you must first reset the unavailable bit. First navigate to “Remote Operation” on the CGSCM. There will be a prompt to “Clear Unavailable”. Press the [Enter] key to clear the bit. Navigate to the [Current Alarm] screen and clear the “Change Not Done” alarm.

15. Auto Refill Off

The Auto-Refill function is disabled.

16. Pneumatic High

Incoming pneumatic pressure is above the default Setpoint pressure.

17. C-L Not Configured

Capacitance Level Prove Not Configured**.** The Capacitance Level Probe has not been calibrated.

In addition to the previous alarms, the CGSCE will display the following alarm messages when a ChemGuard Shutdown alarm condition exists.

- *System Unavailable Alarm(s) Active*

Alarm generated when the ChemGuard cabinet shuts down due a ChemGuard Shutdown alarm condition and a remote operation is attempted at the CGSCE. All remote operations are interlocked.

- *Refill Alarm! (Manual Operation)*

Alarm generated when the Refill operation stops due to a ChemGuard Shutdown alarm condition. The Refill and all other CGSCE Operations are interlocked.

- *Backfill Alarm! (Manual Operation)*

Alarm generated when the Backfill operation stops due to a ChemGuard Shutdown alarm condition. The Backfill and all other CGSCE operations are interlocked.

- *Line Purge Alarm! (Manual Operation)*

Alarm generated when the “Line Purge” operation stops to a ChemGuard Shutdown alarm condition. The Line Purge and all other CGSCE operations are interlocked.

- *Tool Not Ready*

The Tool Not Ready has been received from the tool. This condition interlocks any operation. Any operation, except Source Change, stops if this signal is received.

- *Source System Busy*

The system is busy with another SC operation.

- *Alarm Inhibited*

  A local operation is requested during a shutdown condition.

Chapter 7

Maintenance and Calibration Procedure

Section 1	**Introduction**
Section 2	**Calibration and Testing**
Section 3	**Source Level Calibration**
Section 4	**Source Cleaning and Replacement**
Section 5	**Scale Accuracy Test**
Section 6	**Flow Restrictor 1, Vent Purge Adjustment (FR1)**
Section 7	**Flow Restrictor 2, Trickle Purge Adjustment (FR2)**
Section 8	**Spill Sensor Calibration**
Section 9	**Touch Screen Calibration**
Section 10	**Miscellaneous Tests**
Section 11	**High Temperature Sensor Verification**

7.1 Introduction

The CG2000 system is designed to have minimal maintenance activity associated with its electronics. Proper Lockout-Tag-out procedures should be followed to ensure that power is disconnected from the electronic enclosure before any work is performed on this equipment.

7.2 Calibration and Testing

Calibration and testing, and any resulting maintenance, should be performed at regular intervals. Refer to Table 7.1.

Table 7.1 Maintenance and Inspection Schedule

Periodic Inspection	Frequency
Source Level Calibration	6 Months
Spill Sensor Calibration	12 Months
Scales Verification, Calibration	24 Months or when replaced
FR1 and FR2 Verification, Calibration	12 Months
Check Valve Change-Out	12 Months
Touch Screen Calibration	6 Months
Miscellaneous Test	12 Months
High Temp Sensor Verification	12 Months

CAUTION

A "Source Overfill" condition will occur if the optical probe is exposed to a light source. Under no circumstances should the Source container run without the protective cover installed. Do not shine a flash light beam onto the quartz container, especially when the refill operation is in progress.

NOTE

If necessary, maintenance personnel shall make use of a step ladder or step stool to access the electronics controller section or to perform maintenance operations near the cabinet top.

7.3 Source Level Calibration

This procedure should be performed during a new source installation, source cleaning and replacement or if it is suspected that the source level detect is out of specification.

The Source Level calibration is an automated procedure that allows one to set the gain of the capacitance level sense. To perform Source Level Calibration, follow the next steps.

1. Ensure no tool operations are being performed and the Tool Ready signal is present at the Source you are performing a calibration on.
2. Using the keypad of the CGSCE, disable the "Auto-fill" command and go to [System Configuration] > [Configure Capacitance Level].
   - You will be prompted with an inquiry "Is the container full or empty?"
3. If the Source container is full, a backfill operation will be prompted and start automatically after confirming the backfill operation. Ensure there is enough volume in the bulk container to accept the chemical. The Backfill operation will continue until:
   - The Backfill timer expires
   - A Shutdown alarm occurs
   - Sensor LS2 detects no chemical present
4. If the Source container is empty, you will be prompted to "Make Full'. A Fill operation will start automatically after confirming the Fill operation. When chemical is detected at the optical sensor, an OPTO FULL signal will be generated and the fill will stop. After the source is "made full" the fill lines will be automatically cleared of liquid. The CGSCE will display a message to wait for Line Purge to complete.
5. When Line Purge is done and the calibration is successful you will be prompted to enter the level. Set the chemical level to the 65% or 70% and press enter. The calibration is then completed.

7.4 Source Cleaning and Replacement

As time progresses and chemical is repeatedly filled to the Source Bubbler, impurities can build up. These impurities come from the slow concentration of sub-ppb levels of impurities that are present in the chemical.

Replacement and cleaning of each Source Bubbler should be performed on a regular basis to prevent any long term buildup of these impurities.

Reference Chapter 4 of this manual for details of Source Bubbler change out operation.

7.5 Scale Accuracy Test

This procedure should be performed during a Change Bulk Operation as the Bulk Container must be removed to perform the scale accuracy test.

This procedure is used to test the accuracy of the Scale. Failure to perform this calibration may permit a build-up of "Strain Gage Drift" resulting in inaccurate readings.

If the unit is operational, the Bulk Container is required to be removed to perform this calibration. It is recommended that this calibration be coordinated with a normal Bulk change out event.

Follow the next steps to perform a Scale Accuracy Test.

1. Notify the Process Engineer that the CG1000-2000 cabinet will not deliver chemical for approximately four (4) hours.
2. Document both fields of the NET and CURRENT weight of the CG1000-2000 BULK can, then perform CHANGE BULK operation.
3. Ensure the CG1000-2000 screen saver function is disabled during this operation. Refer to Parameter Setup Menu paragraph in this chapter.
4. From the Display screen, go to Analog Input and scroll down to scale, (analog I/O 10), to view the raw data output reading and the associated weight reading in grams.
5. Start the CHANGE BULK function, refer to Chapter 4 for details operation.
6. When the software prompts with a text message stating "CHANGE CAN?", refer to Chapter 4 for detail before the technician/operator should remove the BULK container. After the removal of the container, the pigtails should be capped.
7. Slide the scale assembly out and turn the scale assembly upside down (the scale is now right side-up and the adaptor plate is under the scale).
8. The gram reading should read between 0 and 20 grams. Adjust the zero pot, (Left side in relation to the scale in the upright position) on front edge of scale as required.
9. Adjust the Span pot (right side in relation to the scale in the upright position) as required.
10. Remove calibrated weights and verify that the scale returns to between 0 and 20 grams.
11. Repeat steps 8 -11 until no adjustments are required.
12. Place one calibrated weight on the scale and verify the Bulk weight displayed in the "Analog Test In" screen equals the actual grams value of calibrated weight within ±50 grams.
13. Remove the weight and turn the Bulk scale assembly right side-up (the scale is now upside down and the adaptor plate is on top of the scale).
14. At this point the technician/operator should remove the caps from the pigtails and re-install/install the new full BULK container.
15. Press ENTER to allow the software to continue with the change function. Exit the Analog display screen up to the main screen and then follow software prompts to complete the BULK CHANGE Operation. Refer to Chapter 4 for details on the last steps of the Bulk Change operation.

7.6 Flow Restrictor 1, Vent Purge Adjustment (FR1)

Follow the next steps to adjust the Vent Purge.

1. Fully close FR1 and FR2 by turning the adjustment knob fully counter-clock wise (CCW).
2. Disconnect ¼" Swage connector from FR1
3. Connect an 18" piece of ¼" Tygon tubing to the FR1 Swage connector.
4. Connect the other end of the Tygon tubing to Coax flow sensor quick disconnect.
5. Manually activate valve V1 and adjust the pressure of regulator R1 to 14 psig read on the display screen.
6. Close V1.
7. Adjust Vent Purge FR1 by turning the adjustment knob on FR1 clockwise (CW) to 4.7 SLPM as read on the touch screen display of the ChemGuard.

   NOTE: Make allowance for zero offset.
8. Tighten locknut and reconnect Swage connector to FR1.

7.7 Flow Restrictor 2, Trickle Purge Adjustment (FR2)

Follow the next steps to adjust the Trickle Purge.

1. Ensure FR1 has been adjusted according to the preceding procedure.
2. Fully close FR2 by turning the adjustment knob fully counter-clock wise (CCW).
3. Disconnect ¼" Swage connector from FR2.
4. Connect an 18" piece of ¼" Tygon tubing to the FR2 Swage connector.
5. Connect the other end of the Tygon tubing to Coax flow sensor quick disconnect.
6. Manually activate valve V1 and adjust the pressure of regulator R1 to 14 psig read on the display screen.
7. Close V1.
8. Adjust FR2 by turning clockwise to 4.7 SLPM as read on the touch screen display of the ChemGuard.

   NOTE: Make allowance for zero offset.
9. Tighten locknut and reconnect Swage connector to FR2.

7.8 Spill Sensor Calibration

The Spill Sensor requires no calibration. Semi-annual check of the spill sensor circuitry should be performed to ensure no degradation of the circuit has occurred.

Follow the next steps to perform a functional check of the spill sensor.

1. Lift the float assembly located in the left, rear, bottom, corner of the cabinet.
2. Ensure a shutdown alarm occurs and 24 VDC is removed from the solenoid bank.
3. Let the float sensor drop freely; verify the shutdown alarm can be cleared.

7.9 Touch Screen Calibration

The resistive touch screen may on occasion require calibration. Calibration is an automated procedure which can be initiated from the "configuration" screen.

Follow the next steps to calibrate the Touch screen.

1. Using level three (3) password, log onto the CG2000 display menu.
2. Go to Configuration Menu > System Setup > Calibrate Touch Screen.
3. A set of crosshairs will appear on the screen. You will also have the option at this point to "Cancel" the operation or "Re-calibrate" during this time.

NOTE
DO NOT SELECT CANCEL, DO NOT RE-CALIBRATE AT THIS TIME.

4. Continue with the screen calibration routine by carefully touching the exact three points displayed on the screen.
5. When the third point is touched, the "Save" radio button will be highlighted.
6. At this point either select "Save", "Cancel" or "Re-calibrate".
7. If Recalibrate is selected, repeat the operation starting from step three (3).

7.10 Miscellaneous Tests

The following tests should be performed when the system is first installed and then at regular intervals. Refer to Table 7.1.

- Verify the operation of the EMO by pressing the EMO button. System power and Touch Screen display should stay on. The 24 VDC to drive the solenoids should be off and all of the solenoids should be in a safe de-energized state. The Emergency Stop alarm should be annunciated.
- Verify all Pressure Transducers are fully operational.
- Ensure system Exhaust is operational.
- Verify the Spill detection circuitry on all CGVMB's is operational.

7.11 High Temperature Sensor Verification (System Option)

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

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

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

Appendix A

UHP Tubing and Fitting Specification

The Appendix contains the SEMC-QAF030 "UHP Tubing and Fitting Specification". Compressed Gas Association Technical Bulletins TB-9-1993 “Guidelines for the Proper Handling and use of the CGA 630/710 Series “Ultra High Integrity Service” Connections” and TB-4-1999 “Torque Guidelines for Sealing CGA Outlet Connections” are also included.

*S*emiconductor *E*quipment *M*anufacturing *C*enter

Quality Assurance Work Instruction:	Document No.: **QAF030**
UHP Tubing and Fitting Specification	Revision: **A**
Responsible Department:	Revision Date: **24 FEB 97**
Quality	Page **1** of **6**

1.0 Purpose:

To establish the minimum requirements for materials, dimensional tolerances, surface finishing, cleaning, testing, inspection, certification, and packaging for stainless steel tube and fittings used in ultra high purity applications.

2.0 Scope:

This specification shall apply to all tubing and fittings purchased for use in all ultra high purity piping installations for the electronics industry.

3.0 Responsibility:

3.1 The Materials Management group of SEMC is responsible for communicating this requirement to its vendors and ensuring their full compliance.

3.2 The vendor shall review and respond to this specification on a line by line basis confirming acceptance or exceptions to each requirement.

3.3 The vendor shall provide any additional steps above and beyond the requirements of this specification for review.

4.0 Definitions: (None)

5.0 References:

5.1 Electronics Engineering Worldwide Standard EES 005, 0.250" and 0.375' UHP and HP Tubing and Fittings.

5.2 ASTM A269 - Specification for seamless and welded austenitic stainless steel tubes for general service.

5.3 ASTM A479 - Specification for general requirements for carbon, ferritic alloy, and austenitic alloy steel bar.

5.4 ASTM A632 - Specification for seamless and welded austenitic stainless steel tubing (small diameter for general service).

5.5 ANSI/ASME B46.1 - 1985 - Specification for surface texture-surface roughness, waviness, and lay.

6.0 Procedure:

6.1 General Requirements

6.1.1 All tube and bar stock shall be produced from ASTM grade TP316L raw material unless specified in the purchase order. Tubing sized smaller than 3" shall be seamless and larger than 3" may be welded.

6.1.2 Stainless steel tubing shall be bright annealed at the producing mill in a dry hydrogen atmosphere (dewpoint <-40°C) or vacuum annealed (10 micron Hg) to a Rockwell Rb 90 maximum hardness.

6.1.3 The sulfur content of fittings and tubing shall be in the range of 0.005-0.017 percent; type 316L VAR and VIM\VAR a maximum of 0.005%. VAR or VIM/VAR will be specified in the purchase order. This range is an actual range and does not allow for rounding of numbers as set forth in ASTM A269.

6.1.4 Tubing shall conform to the requirements of ASTM A269 for sizes one-half inch diameter and larger and ASTM A632 for sizes smaller than one-half inch, except where specified differently within this specification.

6.1.5 Bar stock shall conform to the requirements of ASTM A479, except where specified differently within this specification.

6.2 Dimensional Tolerance Requirements:

6.2.1 End connections on tubing and fittings shall be faced and squared to plus or minus one-half degree for sizes 1/4" through 3/4" inclusive. Squareness of 1" and larger shall be +.006". All ends shall be fully prepped and suitable for installation with automatic orbital welding equipment.

6.2.2 Acceptable dimensional tolerances shall not exceed the limits listed below:

Dimension	Component	Tolerance
Linear	Fittings	+- .015"
Angular	Fittings	+- 1/2 degree
Wall Thickness	Tube and Fittings (including saddle area of tees)	+- 10%

Outside Diameter; Tube and Fittings

1/4" up to not including 1/2", +0.004"/-0.000";
1/2" to not including 1-1/2", +- 0.005";
1-1/2" up to not including 3-1/2", +- 0.010";
3-1/2" up to and including 4"; +- 0.015"

6.3 Interior Surface Finish Requirements:

6.3.1 The interior surface of each tube and fitting shall be electropolished to a microinch surface roughness standard of 7 Ra microinch average (10 Ra maximum).

6.4 Gases and Deionized Water for Drying, Cleaning, Testing:

6.4.1 Argon or nitrogen used for drying and packaging shall be supplied from a liquid source and have the following point of use quality:

Minimum purity:	99.998 percent
Moisture:	Less than 1 ppm
Oxygen:	Less than 3 ppm
Total Hydrocarbons:	Less than 1 ppm

Filtered to no more than 10 particles per scf larger than 0.02 microns at point of use.

6.4.2 Deionized water used for cleaning shall have the following minimum point of use requirements and be verified on a monthly basis by an independent laboratory:

Resistivity: 18 megohm centimeters @ 25°C minimum
Total Organic Carbon: Less than 50 ppb
Viable Bacteria Colonies: Less than or equal to ten/100 milliliters
Filtered to: 0.1 microns at point of use

DI water purity shall conform to the guidelines set forth be SEMI.

6.5 Tube Cleaning:

6.5.1 After electropolishing, tubing shall be final cleaned with deionized water as a final cleaning agent and dried with filtered nitrogen. Freon shall not be used as a cleaning agent.

6.5.2 Final cleaning of tubing shall be performed under Class 100 clean room conditions.

6.5.3 Tube washing shall utilize heated DI water (60^{O}C, minimum). The tube shall be flushed with heated DI water until the resistivity of the effluent measures at least 17.5 Megohm-cm for diameters less than 3 inches and 17.0 megohm-cm for diameters greater than or equal to 3 inches.

6.5.4 The tube shall be blown dry with heated nitrogen gas

6.6 Fittings Cleaning

6.6.1 Final cleaning of fittings shall be performed under Class 100 environment.

6.6.2 Fittings shall be flushed with heated DI water (60^{o}C) minimum.

6.6.3 Fittings shall be blown dry with heated nitrogen gas

6.7 Packaging:

6.7.1 Tubing ends shall be sealed with polyethylene caps pressed over polyamide nylon squares (1.75 mil) after being purged with nitrogen. Polyethylene bags (6 mil) shall then be placed over each end and taped to the tube a minimum of 3" from the end of the tube, using clean room tape. The entire tube shall then be closed in a 6 mil polyethylene bag and heat sealed at both ends.

6.7.2 Fitting ends shall be packaged in a heat sealed nylon bag with a heat sealed polyethylene bag over the nylon bag in a Class 100 environment.

6.7.3 Pack and ship to prevent damage to double bagging, tubing, and fittings.

6.7.4 Finished components shall be mill and heat traceable and permanently marked for correspondence to the applicable mill test reports.

6.8 Inspection and Testing:

6.8.1 All tests and inspections required in this section shall be performed for each order unless otherwise stated in the purchase order. The vendor shall provide a detailed procedure for each test required in Sections 6.9.1.2 - 6.9.1.10 for VERSUM MATERIALS, INC. review and acceptance.

6.8.2 One hundred percent (100%) of components shall be visually inspected to assure that interior surfaces exhibit no macroscopic pitting, staining, or discoloration as can be detected with the unaided eye.

6.8.3 A statistically valid sample of tubes and fittings shall be measured with calipers and/or micrometers or by other repeatable methods to verify conformance to the critical dimensional requirements and monitor process control. Critical dimensions will be identified in the purchase order. Statistical procedures must be submitted to VERSUM MATERIALS, INC. for review and approval prior to receipt of material.

6.8.4 All welded fittings shall be inboard helium leak tested to a 1 x 10^{-9} atm cc/sec gaseous helium with a mass spectrometer leak detector.

6.8.5 Finished tube and fittings in each lot shall be measured for interior surface finish with a stylus type measuring device in accordance with ASME B46.1 - 1985. Surface roughness shall be measured at three locations for each piece tested. Sample quantity for tubing shall be 10% of tube ends and 1% of middle sections. Sample quantity for fittings shall be 10% of fitting ends. The average of the readings shall not exceed 7 microinch Ra with no single reading above 10 microinch Ra. Sampling length cutoff shall be 0.030" and traverse length will be 0.150".

6.8.6 Scanning electron microscopy (SEM) photographs of finished component surfaces shall be analyzed for each machining, honing, polishing, or electropolishing process change or supply of material other than stainless steel. SEM analysis shall verify that no more than 40 defects shall be distinguishable in a 3600X field of view. A sample shall be taken from the middle of the tube or fitting. The test method shall conform to SEMATECH standard 90120401A-STD.

6.8.7 Chemistry analysis (ESCA) of electropolished surfaces shall be performed for each electropolishing process change to verify surface elemental composition. Elemental composition shall be expressed in atomic percent units and shall verify chromium to iron ratio of 1.5:1 and a minimum chromium oxide to iron oxide ratio of 3:1 for stainless steel.

6.8.8 Moisture testing shall be performed on one length of cleaned and packaged tube from each heat for each size (O.D. and nominal wall thickness). Testing shall verify the addition of less than 1 ppm moisture to nitrogen gas as described in Section 8.1 of this specification while flowing N_2 gas at a flow not to exceed 10ÿSCFH/IN2.

6.8.9 Particle testing shall be performed on one length of cleaned and packaged tube from each size (O.D. and nominal wall thickness). Testing shall verify that particle counts be no more than 10 per cubic foot of size greater than or equal to 0.1 microns and zero particles of size 0.3 microns or larger while flowing nitrogen gas at a velocity of 133 ft/sec.

6.8.10 A weld test shall be performed for each heat and lot number of material that is used. Weld tests on fittings can be avoided by completing this requirement on the tube that will be used to make the fitting. The test welds shall be made per Semiconductor Equipment Manufacturer Center specification, QAF020. Weld test shall be deemed acceptable if no internal discoloration of the weld is visible. Samples can be developed between VERSUM MATERIALS, INC. and the tube vendor to judge acceptable welds.

6.8.11 A Rockwell hardness test shall be performed on each mill heat of material to assure a Rockwell Rb 90 maximum hardness. This test shall be performed for each size after "pulling".

6.8.12 VERSUM MATERIALS, INC. reserves the right to source inspect all tubing and fittings and inspect the manufacturer’s facilities upon request.

6.9 Reports and Certifications:

6.9.1 The vendor shall supply the following reports and certifications as follows:

6.9.1.1 One set of reports shall be sent to SEMC QA prior to receipt of material at SEMC. The components will be cross referenced to the received reports for acceptable vendor traceability numbers.

6.9.1.2 Mill Test Reports

6.9.1.3 Certificate of compliance to the specifications within this document. Reference to pre-approved exceptions to this Work Instruction.

Appendix B

N2 MSDS

This Appendix contains the Nitrogen (N2) Material Safety Data Sheet.

Safety Data Sheet

Version 1.10 SDS Number 300000000099

Revision Date 01/26/2015 Print Date 06/24/2016

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	
Chemical formula	:	N2
Synonyms	:	Nitrogen, Nitrogen gas, Gaseous Nitrogen, GAN
Product Use Description	:	General Industrial
Manufacturer/Importer/Distributor	:	IDES Holding AG , Postfach 16 05 29, D-60070 Frankfurt/M &ULINE(35)&
Telephone	:	
Emergency telephone number (24h)	:	1-800-424-9300 (CHEMTREC) and (+1) 703-741-5970 (CHEMTREC)

2. HAZARDS IDENTIFICATION

GHS classification

Gases under pressure - Compressed gas.
Simple Asphyxiant

GHS label elements

Hazard pictograms/symbols

Signal Word: Warning

Hazard Statements:

H280:Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary Statements:

Storage : P410+P403:Protect from sunlight. Store in a well-ventilated place.

Hazards not otherwise classified

High pressure gas.
Can cause rapid suffocation.
Self contained breathing apparatus (SCBA) may be required.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Concentration (Volume)
Nitrogen	7727-37-9	100 %

Concentration is nominal. For the exact product composition, please refer to technical specifications.

4. FIRST AID MEASURES

General advice : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

Eye contact : Not applicable.

Skin contact : Not applicable.

Ingestion : Ingestion is not considered a potential route of exposure.

Inhalation : Remove to fresh air. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. In case of shortness of breath, give oxygen.

Most important symptoms/effects - acuate and delayed : Exposure to oxygen deficient atmosphere may cause the following symptoms: Dizziness. Salivation. Nausea. Vomiting. Loss of mobility/consciousness.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : All known extinguishing media can be used.

Specific hazards : Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Product is nonflammable and does not support combustion. Move away from container and cool with water from a protected position. Keep containers and surroundings cool with water spray. Most cylinders are designed to vent contents when exposed to elevated temperatures.

Special protective equipment : Wear self contained breathing apparatus for fire fighting if necessary.

for fire-fighters

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures	:	Evacuate personnel to safe areas. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Monitor oxygen level. Ventilate the area.
Environmental precautions	:	Do not discharge into any place where its accumulation could be dangerous. Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	:	Ventilate the area.
Additional advice	:	If possible, stop flow of product. Increase ventilation to the release area and monitor oxygen level. If leak is from cylinder or cylinder valve, call the Air Products emergency telephone number. If the leak is in the user's system, close the cylinder valve and safely vent the pressure before attempting repairs.

7. HANDLING AND STORAGE

Handling

Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Only experienced and properly instructed persons should handle compressed gases/cryogenic liquids. Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shock. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F).

Storage

Open/close valve slowly. Close when not in use. Wear Safety Eye Protection. Check Safety Data Sheet before

use. Use a back flow preventative device in the piping. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Read and follow the Safety Data Sheet (SDS) before use. Full containers should be stored so that oldest s tock is used first. Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Stored containers should be periodically checked for general condition and leakage. Observe all regulations and local requirements regarding storage of containers. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Keep containers tightly closed in a cool, well-ventilated place. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Return empty containers in a timely manner.

Technical measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance whit local regulations. Keep away from combustible material.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Provide natural or mechanical ventilation to prevent oxygen deficient atmospheres below 19.5% oxygen.

Personal protective equipment

Respiratory protection	:	Self contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmosphere. Air purifying respirators will not provide protection. Users of breathing apparatus must be trained.
Hand protection	:	Wear working gloves when handling gas containers. Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Safety glasses recommended when handling cylinders.
Skin and body protection	:	Safety shoes are recommended when handling cylinders.
Special instructions for protection and hygiene	:	Ensure adequate ventilation, especially in confined areas.
Remarks	:	Simple asphyxiant.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Compressed gas. Colorless gas
Odor	:	No odor warning properties.
Odor threshold	:	No data available.
pH	:	Not applicable.
Melting point/range	:	-346 °F (-210 °C)
Boiling point/range	:	-321 °F (-196 °C)
Flash point	:	Not applicable.
Evaporation rate	:	Not applicable.
Flammability (solid, gas)	:	Refer to product classification in Section 2
Upper/lower explosion/flammability limit	:	No data available.
Vapor pressure	:	Not applicable.
Water solubility	:	0.02 g/l
Relative vapor density	:	0.97 (air = 1) Lighter or similar to air.
Relative density	:	No data available.
Partition coefficient (n-octanol/water)	:	Not applicable.
Auto-ignition temperature	:	No data available.
Decomposition temperature	:	No data available.
Viscosity	:	Not applicable.
Molecular Weight	:	28 g/mol
Density	:	0.075 lb/ft3 (0.0012 g/cm3) at 70 °F (21 °C) Note: (as vapor)
Specific Volume	:	13.80 ft3/lb (0.8615 m3/kg) at 70 °F (21 °C)

10. STABILITY AND REACTIVITY

Chemical Stability	:	Stable under normal conditions.
Conditions to avoid	:	No data available.
Materials to avoid	:	No data available.
Hazardous decomposition products	:	No data available.
Possibility of hazardous Reactions/Reactivity	:	No data available.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Likely routes of exposure

Effects on Eye	:	No adverse effect.
Effects on Skin	:	No adverse effect.
Inhalation Effects	:	In high concentrations may cause asphyxiation. Asphyxiation may bring about unconsciousness without warning and so rapidly that victim may be unable to protect themselves.
Ingestion Effects	:	Ingestion is not considered a potential route of exposure.
Symptoms	:	Exposure to oxygen deficient atmosphere may cause the following symptoms: Dizziness. Salivation. Nausea. Vomiting. Loss of mobility/consciousness.

Acute toxicity

Acute Oral Toxicity	:	No data is available on the product itself.
Inhalation	:	No data is available on the product itself.
Acute Dermal Toxicity	:	No data is available on the product itself.
Skin corrosion/irritation	:	No data available.
Serious eye damage/eye irritation	:	No data available.
Sensitization.	:	No data available.

Chronic toxicity or effects from long term exposures

Carcinogenicity	:	No data available.
Reproductive toxicity	:	No data is available on the product itself.

Germ cell mutagenicity	:	No data is available on the product itself.
Specific target organ systemic toxicity (single exposure)	:	No data available.
Specific target organ systemic toxicity (repeated exposure)	:	No data available.
Aspiration hazard	:	No data available.

Delayed and Immediate Effects and Chronic Effects from Short and Long Term Exposure

Not applicable.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity	:	No data is available on the product itself.
Toxicity to other organisms	:	No data available.

Persistence and degradability

Biodegradability	:	No data is available on the product itself.
Mobility	:	No data available.
Bioaccumulation	:	No data is available on the product itself.

Further information

No ecological damage caused by this product.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products	:	Contact supplier if guidance is required. Return unused product in original cylinder to supplier.
Contaminated packaging	:	Return cylinder to supplier.

14. TRANSPORT INFORMATION

DOT

UN/ID No.	:	UN1066
Proper shipping name	:	Nitrogen, compressed

Class or Division	:	2.2
Label(s)	:	2.2
Marine Pollutant	:	No

IATA

UN/ID No.	:	UN1066
Proper shipping name	:	Nitrogen, compressed
Class or Division	:	2.2
Label(s)	:	2.2
Marine Pollutant	:	No

IMDG

UN/ID No.	:	UN1066
Proper shipping name	:	NITROGEN, COMPRESSED
Class or Division	:	2.2
Label(s)	:	2.2
Marine Pollutant	:	No

TDG

UN/ID No.	:	UN1066
Proper shipping name	:	NITROGEN, COMPRESSED
Class or Division	:	2.2
Label(s)	:	2.2
Marine Pollutant	:	No

Further Information

Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact a Versum Materials customer service representative.

15. REGULATORY INFORMATION

Toxic Substance Control Act (TSCA) 12(b) Component(s):

None.

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on Inventory.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.
Japan	ENCS	Included on Inventory.

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification
Sudden Release of Pressure Hazard.

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)
This product does not contain any chemicals known to State of California to cause cancer, birth defects or any other harm.