Taylor-Wharton
Since 1742

Instruction Manual

XL-45HP, XL-50HP, XL-55HP, XL-60HP, XL-65HP, XL-70HP, XL-50VHP and XL-55VHP

Do not attempt to use or maintain this unit until you read and understand these instructions. Do not permit untrained personnels to use or maintain this unit. If you do not fully understand these instructions, contact your supplier for further information.

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Contents

1. Container Safety

WARNING
Following safety precautions are for your protection. Before performing installation, operating, or maintenance procedures read and follow all safety precautions in this section and in reference publications. Failure to observe all safety precautions can result in property damage, personal injury, or possible death. It is the responsibility of the purchaser of this equipment to adequately warn the user of the precautions and safe practices for the use of this equipment and the cryogenic fluid stored in it.

- **Pressure Hazard –** The containers covered by this literature may contain pressure up to 230 psig (16 bar/1586 kPa.) Sudden release of this pressure may cause personal injury by issuing cold gas or liquid, or by expelling parts during servicing. Do not attempt any repair on these containers until all pressure is released, and the contents have been allowed to vaporize to ensure no pressure build-up can occur. Before performing installation, operation, or maintenance procedures, read and follow all safety precautions in this section and in reference publications. Failure to observe all safety precautions can result in property damage, personal injury, or possible death. It is the responsibility of the purchaser of this equipment to adequately warn the user of the precautions and safe practices for use of this equipment and cryogenic fluid being used.

- **Extreme Cold – Cover Eyes and Exposed Skin –** Accidental contact of cryogenic liquid or cold issuing gas with the skin or eyes may cause a freezing injury like frostbite. Handle the liquid so that it won't splash or spill. Protect your eyes and cover the skin where the possibility of contact with the liquid, cold pipes and cold equipment, or the cold gas exists. Safety goggles or a face shield should be worn if liquid ejection or splashing may occur, or cold gas may be issued forcefully from equipment. Clean, insulated gloves that can be easily removed and long sleeves are recommended for arm protection. Cuffless trousers should be worn outside boots or over the shoes to shed spilled liquid. Cryogenic liquids are extremely cold and will be at temperatures below -300°F (-184°C) under normal atmospheric pressure.

- **Keep Equipment Well Ventilated –** Although the gases used in these containers are non-toxic and nonflammable, they can cause asphyxiation in a confined area without adequate ventilation. An atmosphere that does not contain enough oxygen for breathing can cause dizziness, unconsciousness, or even death. These gases cannot be detected by human senses and will be inhaled normally as if they were air. Ensure there is adequate ventilation where these gases are used and store liquid containers outdoors or only in a well-ventilated area.

- **Replacement Parts Must be 'Cleaned for Oxygen service' –** Some materials, especially nonmetallic gaskets and seals, can be a combustion hazard if used in oxygen or nitrous oxide service. Use only Taylor-Wharton recommended spare parts, and be certain parts used are properly cleaned to prevent contamination of stored products. For information on cleaning, consult

the Compressed Gas Association (CGA) pamphlet G-4.1, “Cleaning for Oxygen Service” or equivalent industrial cleaning specifications.

- **Install Relief Valves in Cryogenic Liquid Lines –** When installing piping or fill hose assemblies, make certain a suitable safety relief valves are installed in each section of plumbing between shut-off valves. Trapped liquefied gas will expand as it warms and may burst hoses or piping causing damage or personal injury.

NOTE: *For detail information on the handling of cryogenic liquids, refer to the Compressed Gas Association publication: P-12 “Safe Handling of Cryogenic Liquids.” Available from the Compress Gas Association, 8484 Westpark Drive, Suite 220, McLean VA 22202, USA. Please* ***pay attention to all laws, rules, and recommendations about handling of cryogenic liquefied gases and materials that are valid in your country.***

2. General Information

The XL-45HP, XL-50HP, XL-55HP, XL-60HP, XL-65HP, XL70HP, XL-50VHP and XL-55VHP are vacuum-insulated, stainless steel containers design to store and transport cryogenic liquid oxygen, nitrogen, argon, carbon dioxide, and nitrous oxide with continuous flow rates up to 150 ft3/h (3.9 m3/h) in carbon dioxide service up to 110 ft3/h (2.9 m3/h) in nitrous oxide service; up to 350 cfh (9.2 cu.m/h) in other gas service. The container is designed and constructed in accordance with DOT 4L standards and may be used for over-the-road transportation & as well as on-site storage and supply in a wide range of applications. The XL-45HP/50HP/55HP/60HP/65HP/70HP are designed to hold liquid with a relief valve setting of 350 psig (24 bar/2413 kPa) and the XL-50VHP and the 55VHP with relief valve setting of 500 psig (34 bar/3447 kPa), which provides greater holding times than lower pressure cryogenic containers.

Note: *The XL-50VHP/XL-55VHP is not designed to store or transport cryogenic liquid nitrous oxide.*

3. Handling of the Container

The HP/VHP Series containers are very rugged liquid cylinders. All Cryogenic liquid containers have an inner container and an outer container with an insulated vacuum space between them. Any abuse (dents, dropping, tip-over, etc.) can affect the integrity of the container’s insulation system.

Please refer to the specification table with regards to weight for each model respectively and you should treat the load accordingly. The attachment points provided on the XL-45HP/50HP/55HP/50VHP/55VHP will allow you to use a hand truck or a hoist to handle these loads properly. XL-60HP, XL-65HP and XL-70HP will allow you to use a caster wheel for movement. Do not attempt to move these cylinders by any other means.

When moving the cylinder, the following precautions should be observed:

- Never lay the container on its side. Always ship, operate, and store the unit in a vertical or upright position.

- **The liquid cylinders should only be moved by utilizing an appropriate cylinder cart, roller base or overhead crane over smooth, level and even floor surface.**

- Do not roll a liquid cylinder with the handling ring.

- When loading or unloading the container from a truck, use a lift gate, a crane, or a parallel loading dock. Never attempt to manually lift the unit.

- To move the container over rough surfaces or to lift the container, attach an appropriate sling to the lifting points cut into the welded support posts, and use a portable lifting device that will handle the weight of the container.

- Liquid cylinders are generally not designed to be permanently mounted on a truck. Depending on the design of the fixation, the permanent transversal vibrations and resonances put a high stress on the inner vessel supports, so that Taylor-Wharton cannot keep the warranty for the vacuum. Please seek advice from Taylor-Wharton to look for possible solutions.

A pull handle is provided on the OD 26" (OD 660mm) outer body of the cylinder with round base caster to move the cylinder around. Those pull handles should only be used to move cylinders over flat and smooth surface. The proper handing method is to hold the handrail ring and the pull handle on the shell with both hands at the same time when pulling the cylinder around. Do not use the handles to pull cylinders up or down inclines. Also, they should not be used to lift cylinders, with or without products in them.

The cylinder with caster wheel design is only used when frequent and short distances are required. Before utilizing this method of transportation, make sure the area over which the liquid cylinder is to be moved is flat and smooth.

Freight Damage Precautions. *Any freight damage claims are your responsibility. Cryogenic liquid containers are delivered to your carrier from Taylor-Wharton's dock in a new condition. When you receive our product, you may expect it to be in the same condition. For your own protection, take time to visually inspect each shipment in the presence of the carrier's agent before you accept delivery. If any damage is observed, make an appropriate note on the freight bill. Then, ask the driver to sign the notation before you receive the equipment. You should decline to accept containers that show damage which may affect serviceability.*

4. Specification

	XL-45HP	XL-50HP	XL-55HP	XL-50VHP
Dimensions				
Diameter, in (mm)	20 (508)	20 (508)	20 (508)	20 (508)
Height, in (mm)	60.0 (1525)	62.3 (1582)	65 (1650)	62.3 (1582)
Weight Empty (Nominal), lb (kg)	275 (125)	291 (132)	300 (136)	302 (137)
Capacity, Gross, Liters	176	188	208	188
Capacity, Useable Liquid, Liters	165	176	198	176
Weight of Contents Maximum lb.(kg) Based on DOT Rated Service Pressure				
Carbon Dioxide	387 (176)	414 (188)	458 (208)	381 (173)
Oxygen	360 (163)	385 (175)	426 (193)	364 (165)
Nitrogen	252 (114)	269 (122)	298 (135)	240 (109)
Argon	438 (199)	467 (212)	518 (235)	443 (201)
Nitrous Oxide	368 (167)	393 (178)	435 (197)	N/A
Normal Evaporation Rate* (% Capacity per Day)				
Carbon Dioxide	0.75%	0.75%	0.75%	0.8%
Oxygen / Argon	1.4%	1.2%	1.2%	1.5%
Nitrogen	2.2%	2.0%	1.9%	2.2%
Nitrous Oxide	0.75%	0.75%	0.75%	N/A
Gas Flow Rate @ NTP (STP)** cfh (cu. m/h)				
Carbon Dioxide	150 (3.9)	150 (3.9)	150 (3.9)	150 (3.9)
Oxygen, Nitrogen, Argon	350 (9.2)	350(9.2)	350 (9.2)	350(9.2)
Nitrous Oxide	110 (9.2)	110 (9.2)	110 (9.2)	N/A
Relief Valve Setting, psig (bar/kPa)	350 (24 / 2413)	350 (24 / 2413)	350 (24 / 2413)	500 (34 / 3447)
Inner Container Bursting Disc, Psig (bar / kPa)	525 (36 / 3620)	525 (36 / 3620)	525 (36 / 3620)	750 (52 / 5171)
Dual Pressure Building/ Economizer Regulator*** Psig (bar / kPa)				
Pressure Building Setting,	300 (20.7 / 2068)	300 (20.7 / 2068)	300 (20.7 / 2068)	400 (28 / 2578)
Economizer Setting	320 (22 / 2206)	320 (22 / 2206)	320 (22 / 2206)	420 (29 / 2896)
Design Specifications TC / DOT	4LM / 4L	4LM / 4L	4LM / 4L	4LM / 4L
Gaseous Capacity Based on DOT Rated Service Pressure @ NTP, ft^3. (STP, m^3)				
Carbon Dioxide	3383 (89)	3619 (95)	4003 (108)	3330 (88)
Oxygen	4350 (114)	4651 (122)	5146 (135)	4397 (116)
Nitrogen	3478 (91)	3712 (98)	4112 (108)	3312 (87)
Argon	4236 (111)	4516 (119)	5012 (132)	4285 (113)
Nitrous Oxide	3211 (84)	3429 (90)	3796 (106)	N/A

specification cont…

	XL-55VHP	XL-60HP	XL-65HP	XL-70HP
Dimensions				
Diameter, in (mm)	20 (508)	26 (660)	26 (660)	26 (660)
Height, in (mm)				
RND BASE	65 (1650)	56.10 (1425)	57.5 (1460)	61.5 (1562)
SQ. BASE	N/A	61.50 (1563)	58.0 (1473)	62.0 (1575)
Weight Empty (Nominal), lb (kg)				
RND BASE	317 (144)	376 (171)	385 (175)	416 (189)
SQ. BASE	N/A	440 (200)	418 (190)	449 (204)
Capacity, Gross, Liters	201	240	247	280
Capacity, Useable Liquid, Liters	190	230	240	265
Weight of Contents Maximum lb.(kg)				
Based on DOT Rated Service Pressure				
Carbon Dioxide	411 (187)	528 (240)	545 (247)	617 (280)
Oxygen	393 (178)	491 (223)	505 (229)	572 (259)
Nitrogen	259 (118)	343 (156)	353 (160)	400 (181)
Argon	478 (217)	596 (271)	614 (279)	695 (315)
Nitrous Oxide	N/A	502 (228)	518 (235)	586 (266)
Normal Evaporation Rate*				
(% Capacity per Day)				
Carbon Dioxide	0.8%	0.75%	0.75%	0.75%
Oxygen / Argon	1.5%	1.0%	1.0%	1.0%
Nitrogen	2.2%	1.6%	1.6%	1.6%
Nitrous Oxide	N/A	0.75%	0.75%	0.75%
Gas Flow Rate @ NTP (STP)**				
cfh (cu. m/h)				
Carbon Dioxide	150 (3.9)	150 (3.9)	150 (3.9)	150 (3.9)
Oxygen, Nitrogen, Argon	350(9.2)	350 (9.2)	350(9.2)	350 (9.2)
Nitrous Oxide	N/A	110 (9.2)	110 (9.2)	110 (9.2)
Relief Valve Setting, psig (bar/kPa)	500 (34 / 3447)	350 (24 / 2413)	350 (24 / 2413)	350 (24 / 2413)
Inner Container Bursting Disc,				
Psig (bar / kPa)	750 (52 / 5171)	525 (36 / 3620)	525 (36 / 3620)	525 (36 / 3620)
Dual Pressure Building/				
Economizer Regulator***				
Psig (bar / kPa)				
Pressure Building Setting,	400 (28 / 2578)	300 (20.7 /2068)	300(20.7 / 2068)	300(20.7 / 2068)
Economizer Setting	420 (29 / 2896)	320 (22 / 2206)	320 (22 / 2206)	320 (22 / 2206)
Design Specifications				
TC / DOT	4LM / 4L	4LM / 4L	4LM / 4L	4LM / 4L
Gaseous Capacity				
Based on DOT Rated Service Pressure				
@ NTP, ft^3. (STP, m^3)				
Carbon Dioxide	3560 (94)	4616 (122)	4511 (119)	5376 (152)
Oxygen	4701 (124)	5931 (156)	6100 (160)	6910 (196)
Nitrogen	3541 (93)	4733 (125)	4871 (128)	5520 (156)
Argon	4582 (121)	5767 (152)	5938 (156)	6725 (190)
Nitrous Oxide	N/A	4380 (115)	5419 (142)	5096 (144)

Specifications are subject to change without prior notice.

* *Vented NER based on Useable Liquid capacity.*

** *Container pressure at or above factory Dual Pressure Building/Economizer Regulator setting.*

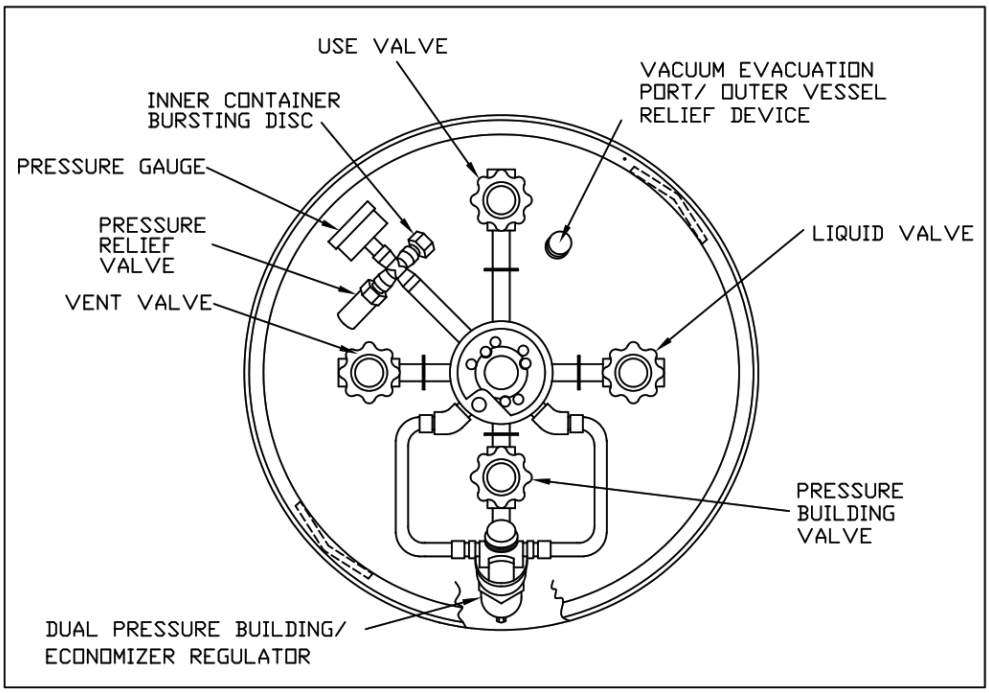
*** *Regulator has a pressure delta of 20 psig (1.4bar/138kPa)*

5. Operation

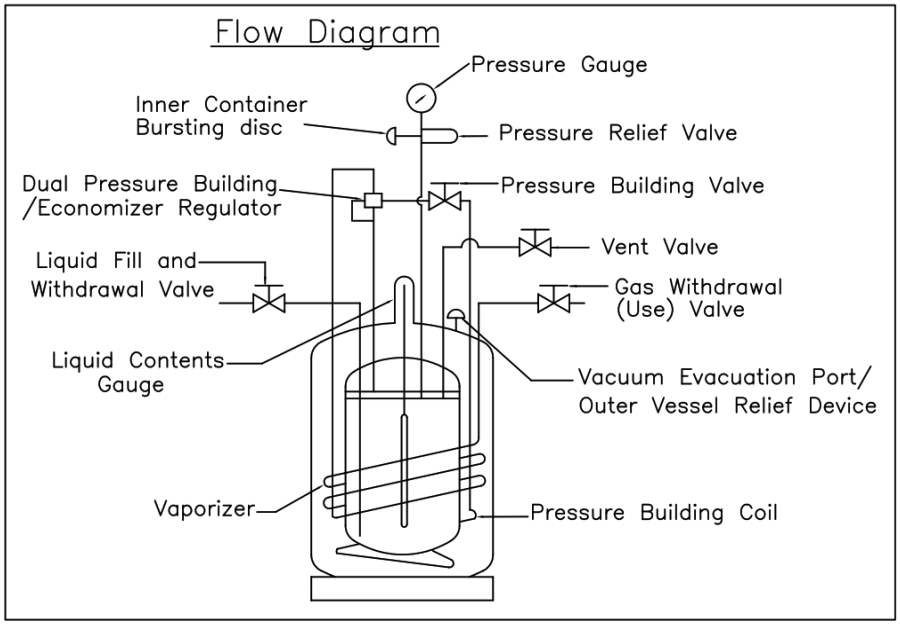
The XL-45HP will store up to 165 liters of product; the XL-50HP up to 176 liters, 198 liters for XL-55HP, 230 liters for XL-60HP, 240 liters for XL-65HP,176 liters for XL-50VHP,190 liters for XL-55VHP and 265 liters for XL-70HP. All these cylinders can deliver either liquid or gas. The following component and circuit descriptions are pertinent to the operation of all the containers and should be read before attempting operation. Components may be identified on the Component Location illustration.

The cylinders can be filled with liquid according to their net content. All these HP-Series vessels are suitable for liquid/gaseous nitrogen, oxygen, argon, carbon dioxide and nitrous oxide.

6. Component Description



Flow Diagram



- **Liquid Fill and Withdrawal Valve**
  Liquid product is filled into or withdrawn from the container through the connection controlled by this valve. It is equipped with a connection (CGA fitting) specifically required for the liquid service, for which the container is configured. If the liquid service changes, this connection must be changed as well. The valve is opened for liquid fill or liquid withdrawal after connecting a transfer hose with compatible fittings to the liquid line connection.

- **Vent Valve**
  This valve controls a line into the head space of the container. It is used during the fill process. The vent valve acts as fill point during the pump transfer or to vent the head space area while liquid is filling the inner container during a pressure transfer fill through the LIQUID valve. The vent line serves as full try cock of the inner container fill volume.

- **Gas Withdrawal (Use) Valve**
  This valve (also called USE Valve) controls the withdrawal of gas produced by the internal product vaporizer. The withdrawal line is equipped with a CGA connection specifically required for the gas service, for which the tank is configured. If the gas service changes, the connection must be changed also.

- **Pressure Building Valve**
  This valve isolates the liquid in the bottom of the container to the Dual Pressure Building/Economizer Regulator. This valve must be open to build pressure inside the container.

- **Pressure Gauge**
  The pressure gauge displays the internal container pressure in pound-per-square-inch or in kilo Pascal.

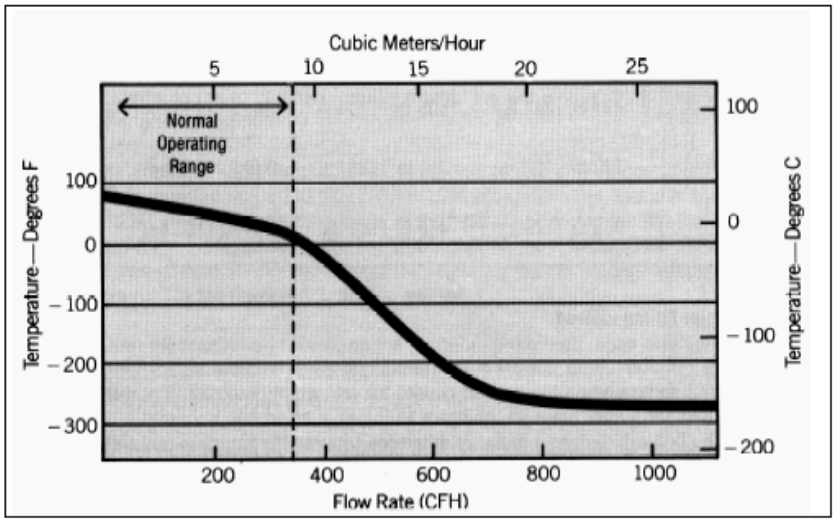
- **Liquid Content Gauge**
  The container liquid content gauge is a float type liquid level sensor that indicates container liquid content through a magnetic coupling to a yellow indicator band. This gauge is an indication of approximate container contents only and should not be used for filling; liquid cylinder should be filled by weight. If the level indicator does not move when container is filled, it may indicate that the magnetic field between the level indicator and the gauge has been uncoupled. The indicator should recouple itself as the container is empty.

- **Inner Container Relief Devices**
  These cylinders have a gas service relief valve and inner container bursting disc with setting of 350 psig (24 bar/2413 kPa) and 525 psig (36 bar/3620 kPa) respectively for the HP-Series; and 500 psig (34 bar/3447 kPa) and 750 psig (52 bar/5171 kPa) for the VHP-Series respectively. Relief valves of 230 psig (16 bar/1568 kPa) is available if medium pressure operation is desired. A 22 psig (1.5 bar/152 kPa) relief valve is available for liquid delivery applications. Alternate dual pressure building/economizer regulator setting are required if medium-pressure relief valves are installed.

- **Dual Pressure Building/Economizer Regulator**
  The combined pressure building/economizer regulator controls the withdrawal of gas from the gas space to reduce the pressure in the tank, if it is higher than the set pressure. The pressure reduction avoids the loss of products by blowing safety valves, if the withdrawal from the tank is low. If the pressure in the tank is below the set pressure, the regulator activates the pressure building system. If the pressure building valve is open, the pressure regulation operates automatically at the set pressure without any further care.

- **Vaporizer Coil (Internal)**
  A liquid container for gas service must have an internal heat exchanger that functions as a gas vaporizer coil to convert liquid product to gas continuously during withdrawal. The cylinder utilizes an internal heat exchanger that is inside the vacuum space attached to the container's outer casing. It provides a means of introducing heat from outside container's insulated jacket, to vaporize liquid as gaseous product is withdrawn. The capacity of this circuit is sufficient to vaporize product flow rates up to 350 cfh @ NTP (9.2 cu.m/h @STP). If greater continuous demand is put on the vaporizer, an external vaporizer should be added to properly warm the gas and avoid malfunction, or damage, to gas regulator, hoses, and other downstream components.

Vaporizer Performance Graph

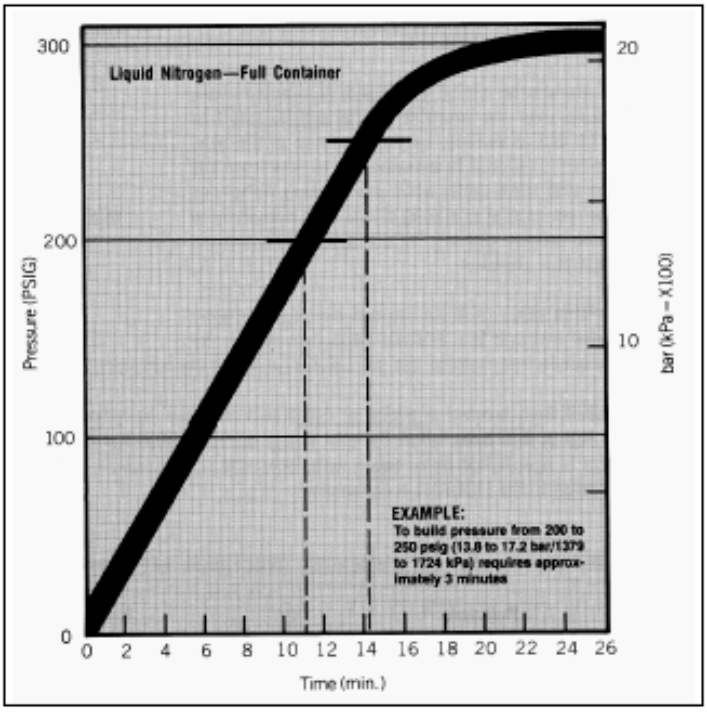


❖ **Pressure Building Coil**

A pressure building circuit is used to ensure sufficient driving pressure during high withdrawal periods. The function is actuated by opening the pressure building valve that creates a flow from the bottom of the container, through the pressure building coil, the regulator into the gas space in the top. When the pressure valve is open, and the container pressure is below the set pressure of the regulator, liquid taken from the bottom of the container is warmed up and vaporized in the pressure building coil as heat exchanger which is inside the outer casing. The expanding gas is fed into the upper section of the container to build up pressure. The resulting pressure will drive either the liquid or gas delivery system.

Pressure Building is not often required unless container pressure drops below the gas output pressure desired. But it allows a sufficient pressure in the tank, even if up to 9 m³ per hour are continuously withdrawn. If, for example, the container pressure gauge reads 250 psig (17.2 bar/1724kPa), and your gas pressure requirement is 270 psig (19 bar/1860 kPa), the pressure building valve may be opened to build container pressure to 300 psig (20.7 bar/2068 kPa). For many applications, where the container pressure is rising due to low withdrawal rates, it may make sense to deactivate the pressure building circuit by closing the pressure building valve.

Pressure Building Rate Graph



❖ **Economizer**

An economizer circuit withdraws gas preferentially from the head space over the liquid in the container-gas that otherwise lost to venting. Excess pressure in the head space of the container is relief by allowing gas to flow from this area directly to the gas withdrawal (use) valve outlet while gas is withdrawn from the container; yet normal operating pressure is preserved to ensure uninterrupted product delivery. The economizer is automatic and requires no operator's attention.

Note: The economizer and pressure building functions are controlled by a single dual action regulator. The pressure delta between the pressure building setpoint and the economizer setpoint is approximately 20 psig (1.4 bar/138 kPa). This delta cannot be altered.

Warning: ***Never use the Dual Pressure Building/Economizer Regulator or Relief Valve for the VHP Series on any other container.***

RELIEF VALVES AND RECOMMENDED REGULATOR SETTING

Relief Valve Setting	Pressure Building Setting	Economizer Setting	Normal Operating Range
22 psig 1.5 bar 152 kPa	N/A N/A N/A	N/A N/A N/A	0-22 psig 0-1.5 bar 0-152 kPa
230 psig 16 bar 1586 kPa	125 psig 8.6 bar 862 kPa	145 psig 10 bar 1000 kPa	75-175 psig 5-12 bar 517-1207 kPa
350 psig 24 bar 2413 kPa	300 psig 20.7 bar 2068 kPa	320 psig 22 bar 2206 kPa	200-350 psig 13.8-24 bar 1379-2413 kPa
500 psig 34 bar 3447 kPa	400 psig 28 bar 2758 kPa	420 psig 29 bar 2896 kPa	300-600 psig 20.7-41 bar 2068-4137kPa

7. Withdrawal Gas from the Container

To withdraw gas from these cylinders, connect a suitable pressure regulator to the USE connection, and the output of the regulator to your external equipment. Then open the USE and the PRESSURE BUILDING valves. When the container pressure reaches 300 psig (20.7 bar/2068 kPa) or 400 psig (28 bar/2758 kPa) if equipped with the higher valve Dual Pressure Building/Economizer regulator, set the pressure regulator for the desired delivery pressure.

Increasing Gas Supply Capacity –Two or more liquid containers may be manifolded together. Accessory manifolds are available for use in creating a higher capacity gas supply system. These cylinders can supply gas at flowrates up to 350 cfh @ NTP (9.2 cu. m/h @STP) using only its internal vaporizer. At low flowrates, the gas supplied will be at nearly ambient temperature. As the demand increases, the gas will become proportionately colder. If greater vaporizing capacity is required, an accessory external vaporizer is available. When an external vaporizer is used, it must be connected to the USE valve and the regulator moved to the output of the external vaporizer.

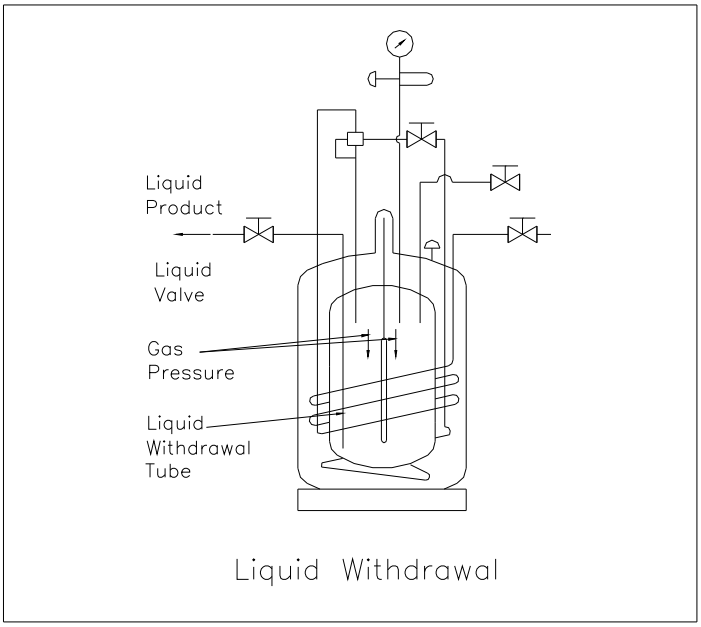
> ***Caution:*** *During high gas withdrawal rates above 9.2 m3 / hour the capacity of the internal vaporizer may be exceeded. If the capacity of a vaporizer is exceeded, the withdrawn gas may become very cold or even contain liquid gas. This can heavily damage the connected equipment, hoses, and components. An additional external vaporizer should be connected, if the withdrawal is made at a continuously higher rate to ensure the full evaporation of the withdrawn product and to warm it up to avoid frost damage.*

Caution: *Internal orifices in pressure regulators used with CO2 are subject to the formation of dry ice if excessively cold gas or high flow rates are used. If this condition occurs, an external vaporizer should be used to ensure the gas is warmed before it reaches the regulator.*

8. Withdrawal Liquid from the Container

To use the container in liquid delivery service, attach a transfer hose to the liquid fill/withdrawal connection and open the adjacent liquid/fill withdrawal valve. The pressure in the container will drive liquid product out through the valve if the container pressure exceeds that of the receiver.

The rate of liquid withdrawal from these containers is variable depending on the container pressure and the saturation temperature of the liquid.



Caution: *As a rule, always close the LIQUID valve before you disconnect the hose when the container is empty, to avoid contamination.*

9. Filling the Container

Cryogenic liquid containers must always be filled by weight to ensure there is enough gas head space (ullage) for liquid to expand as it warms. Using the procedure below, first determine the proper filled weight of each container. The weight derived is then used in either the Pump Transfer or Pressure Transfer filling procedures that follow.

WARNING: *Filling operations should take place only in well-ventilated areas. Accumulations of product gas can be very dangerous (refer to the safety precautions in the front of these instructions). Always maintain adequate ventilation.*

Determine Proper Fill Weight

1. Visually inspect the container. Do not attempt to fill containers with broken or missing components.

2. Move the container to a filling station scale and weight it both with, and without, the fill hose attached to determine the weight of the fill line assembly. The difference is the fill line weight.

3. To determine the weight at which the fill should be stopped, add the desired filling weight (from the table below), the transfer line weight, and the Tare Weight from the container's data plate.

NOTE: The weight calculation includes the weight of residual liquid and is applicable to both Pressure Transfer and Pump Transfer filling methods.

FILLING WEIGHTS

Fluid\Model	XL-45HP	XL-50HP	XL-55HP	XL-60HP	XL-65HP	XL-70HP	XL-50VHP	XL-55VHP
ARGON	438 lb. (199 kg)	467 lb. (222 kg)	518 lb. (235 kg)	596 lb (271 kg)	614 lb (279 kg)	695 lb (315 kg)	443 lb. (201 kg)	478 lb. (217 kg)
CARBON DIOXIDE	387 lb. (176 kg)	414 lb. (188 kg)	458 lb. (208 kg)	528 lb (240 kg)	545 lb (247 kg)	617 lb (280 kg)	381 lb. (173 kg)	411 lb. (187 kg)
NITROGEN	252 lb. (114 kg)	269 lb. (122 kg)	298 lb. (135 kg)	343 lb (156 kg)	353 lb (160 kg)	400 lb (181 kg)	240 lb. (109 kg)	259 lb. (118 kg)
NITROUS OXIDE	368 lb. (167 kg)	393 lb. (178 kg)	435 lb. (197 kg)	502 lb (228 kg)	518 lb (235 kg)	586 lb (266 kg)	N/A	N/A
OXYGEN	360 lb. (163 kg)	385 lb. (175 kg)	426 lb. (193 kg)	491 lb (223 kg)	505 lb (229 kg)	572 lb (259 kg)	364 lb. (165 kg)	393 lb. (178 kg)

Solid CO_2 (Dry Ice) Formation- Carbon dioxide may form into the solid phase (dry ice) if the saturated pressure of the liquid is allowed drop below 70 psig (4.8 bar/483 kPa). In carbon dioxide service the pressure in all these cylinders must be maintained above this pressure to ensure a solid block will not form inside the container. If the container is being filled with CO_2, it may be necessary to pressurize the container with gaseous CO_2 before beginning the fill.

NOTE: If the pressure in the container is somehow lost, the dry ice block that forms may be thawed by pressurizing the cylinder to 280 psig (19.3 bar/1931 kPa) with carbon dioxide liquid and gas from an external source and allowing several days at this pressure to thaw the cylinder.

Pressure Transfer Filling

Filling a liquid cylinder using the pressure transfer method is common for 22 psig (1.5 bar/152 kPa) service where the product is used for refrigerant purposes. This method may also be used for higher pressure cylinders to increase liquid holding time. A fill is accomplished by first establishing a pressure difference between the source vessel and these cylinders (higher pressure at the bulk vessel). The pressure differential will then push the liquid from the storage vessel to the container being filled. This method is employed when no transfer pump system is available or is a greater control over liquid temperature is desired.

Filling the container is accomplished through the LIQUID valve while the VENT valve is open or partially open to control product pressure. Careful control of pressure will control the amount of heat retained in the liquid. Lower pressure results in colder liquid transferred to the container and increases, or lengthens, product holding time.

Pressure Transfer Filling Procedure (Low Pressure Source)- Once you have determined the proper full weight for a container, connect a transfer hose to the LIQUID fitting from a low- pressure source of liquid.

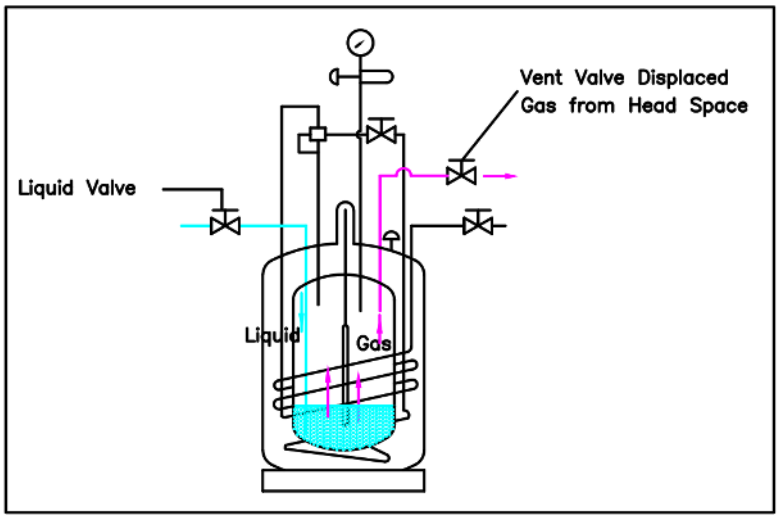
(1) Open the supply valve. Then, open the LIQUID and VENT valves of these cylinders to begin the fill.

(2) During the fill, monitor the container pressure and maintain a pressure of 10-15 psig (0.7-1 bar/69-103 kPa) by throttling the VENT valve.

(3) When full weight is reached, closed both the LIQUID and the VENT valves.

(4) Close the liquid supply valve and open the dump valve on fill line assembly.

(5) Disconnect the fill line from the container and remove the container from the scale.



Pressure Transfer Filling
From a Low Pressure Source

CAUTION:	***With carbon dioxide, pressure in the container being filled must be above 70 psig (4.8 bar/483 kPa) before the fill begins and at all times during the fill to prevent the product from freezing into dry ice.***

Pump Transfer Filling Method

When a pump is used for filling liquid containers, the fill may be accomplished through either the VENT valve or LIQUID valve. Filling through the VENT valve recondenses gas in the area over the liquid in the cylinder and reduces product loss during the filling. This method will also result in liquid near the saturation temperature of the supply vessel. Filling through the LIQUID valve may provide colder liquid and longer holding time before the liquid warms to the point where the venting begins; but will require more frequent venting and greater product loss.

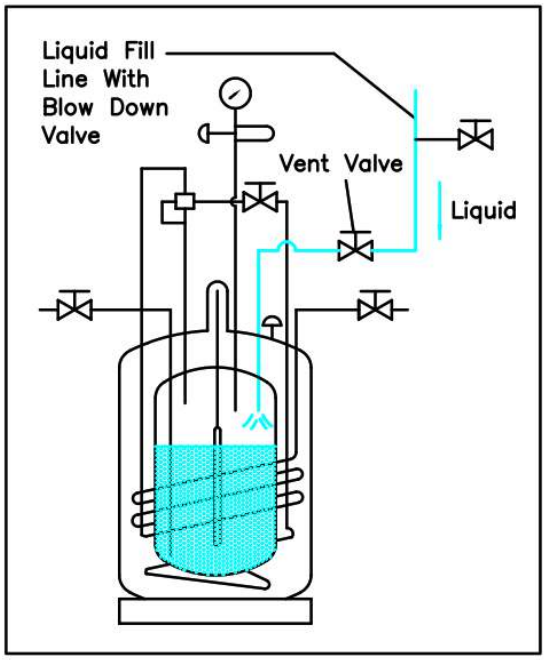
Pump Transfer Filling Procedure - This method applies only to containers in gas service that are equipped with a 230 psig (16 bar/1586 kPa), 350 psig (24 bar/2413 kPa) or 500 psig (34 bar/3447 kPa) relief valve. Liquid is admitted through the VENT valve and recondenses gas in the head space during the fill. The fill line is connected from the liquid supply to the VENT valve on the cylinder. Both the fill line and the container should be precooled prior to beginning the fill process. Proper full weight is determined by the previously explained method.

(1) Open the supply valve. Then, on the container being filled, open only the VENT valve to begin the fill. Start the pump at this time.

(2) Observe the container pressure closely. If the pressure approaches the relief valve setting (or the pump pressure rating) stop the fill process at the supply and open the fill line dump valve to vent excess pressure. As soon as the pressure has dropped to a level that will allow you to resume the fill, close the dump valve and restart the pump (or reopen the supply valve).

(3) When full weight is reached, close the VENT valve. Stop pump (where applicable), close liquid supply valve and open the dump valve on fill line assembly to vent trapped liquid.

(4) Disconnect the fill line from the container and remove the container from the scale.



Pump Transfer Liquid
Fill Rhrough Vent Valve

Fill Hose

Taylor-Wharton fill hose for these cylinders is designed to transfer specific liquefied gases to, or from, the containers. Cryogenic transfer hoses are constructed of stainless steel for the transfer of cryogenic liquids and are available in six feet (1.8 m) lengths with 3/8 in. NPT fitting one end and CGA service-specific female fittings on the other.

TRANSFER HOSE CHART

Description (Service/Hose Length)	Cylinder Connection(s)	End Fittings	Part Number
Inert (N2, Ar) Service 6 ft. (1.8m) Stainless Steel	LIQUID or VENT Valve	CGA 295 to 3/8in. NPT	1600-9C66
Oxygen Service 6 ft. (1.8m) Stainless Steel	LIQUID or VENT Valve	CGA 440 to 3/8in. NPT	GL50-8C53

*Taylor-Wharton offers metal hoses for filling and withdrawal as accessories.

10. Repair and Maintenance

Read the Safety Precautions in front of this manual before attempting any repairs or maintenance on these containers. Also, follow these additional safety guidelines while performing container maintenance:

- **Never work on a pressurized container.** Opening the vent valve as a standard practice during maintenance to guard against pressure build-up from residual liquid.

- **Containers that are in service for oxygen or nitrous oxide may contain residual oxygen.** Many materials and working practices together with oxygen can be a combustion hazard. For that reason, an oxygen or nitrous oxide container must be sufficiently emptied and rinsed with nitrogen for instance, to remove the oxygen or nitrous oxide from the container before repair and maintenance work can start.

- **Use only repair parts suitable for oxygen service. This basic rule is also valid for containers, which are at that time not in oxygen service, because they may be in the future.** Be certain your tools are free of oil and grease. This is good maintenance practice and helps ensure you do not introduce any contaminants to the plumbing of the container and do not create a combustion hazard when working on containers for oxygen or nitrous oxide service.

- **Leak test connections after every repair.** Pressurize the container with appropriate inert gas for leak testing. Use only leak test solutions and follow the manufacturer's recommendations. "Snoop" Liquid Detector is one approved solution.

WARNING: For O2 System User: Residue of leak detectors solutions can be flammable. All surfaces to which the leak detector solutions have been applied must be adequately rinsed with portable water to remove all traces of residue. Reference CGA G-4. Section 4.9.

CAUTION: Carbon Dioxide may form into the solid phase (dry ice) if the pressure of the liquid is allowed to drop below 70 psig (4.8 bar/483 kPa). Pressure in the container must be maintained above this value to ensure a solid block of CO_2 will not form inside the container. Before performing maintenance on an XL-45HP/50HP/55HP/50VHP/55VHP in CO_2 service, the contents must be transferred to another container so that container pressure can be released.

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11. Change of Gas Service

These cylinders may be converted from one service to another within the confines of the services for which the containers are designed if a change of gas service should be desired. For this conversion, the connection fittings on the pipes must be exchanged, further the scale on the liquid level gauge as well as product decals.

Container Modification

Empty the container and open the vent valve to allow residual liquid to evaporate and to prevent the container from building up pressure.

> ***Caution:*** *Always change the fittings, never use adapters if the service shall be changed. The following procedures address the physical changes to the container only. For detailed procedures on the decontamination of the container itself, refer CGA pamphlet C-10 "Changes of Service for Cylinders including Procedures for Inspection and Contamination Removal."*
> *Carbon Dioxide and Nitrous Oxide may contain contaminants such as hydrocarbon, which are not easily removed from cylinders, and associated components by conventional oxygen service cleaning procedure. Once a cylinder is replaced with CO2 or N2O gas service, it should never be converted to another gas service. See CGA pamphlet C-10 for proper procedure.*

(1) Unscrew the fittings of the connections to the vent (gas blow) line, the use (gas withdrawal) line and the liquid (fill/ withdrawal) line –one after the other-, with standard wrenches. Screw in the new fittings for the desired medium service. Seal with Teflon/ PTFE band or similar oxygen compatible thread sealant.

(2) Remove the protective cover over the liquid level gauge. Exchange the snap-on indicator on the liquid level gauge against the indicator for the new medium from the service change kit, then reinstall the protective cover.

(3) Carry out a leak test on all fittings that have been exchanged. Change the stickers or decals on the container for the gas service.

GAS SERVICE CHANGE CONNECTIONS

Gas Service	Valve Name	Connection Designation
Oxygen	LIQUID VENT USE	CGA 440 CGA 440 CGA 540
Nitrogen	LIQUID VENT USE	CGA 295 CGA 295 CGA 580
Argon	LIQUID VENT USE	CGA 295 CGA 295 CGA 580

Carbon Dioxide	LIQUID VENT USE	CGA 320 CGA 295 CGA 320
Nitrous Oxide	LIQUID VENT USE	CGA 326 CGA 295 CGA 326

12. Purge Procedure

After changing the cylinder gas service, determine the level of purity in the pressure vessel. If the pressure vessel contents purity is unacceptable, perform a purge procedure to reduce contaminants. The following procedure is recommended for the applications:

(1) Attach warm nitrogen, N2, source to the liquid fill/withdrawal valve. Approximately 20 psig pressure should be achieved. *The positive pressure must always be maintained in the cylinder during purge procedure to prevent drawing atmospheric contaminants back into the cylinder.*

(2) Closed all valves. Before venting into the atmosphere ensure that such a venting is allowed by all applicable site regulations and codes.

(3) Open vent and use valves. Vent the inner vessel to 5 psig (34kPa), as indicated on the pressure gauge. Close vent and use valves.

(4) At this low pressure 5 psig (0.35 bar), loosen the compression fitting connections on the pressure build regulator so that N2 vented through this connection. Then retighten the connections while the cylinder is still having positive pressure.

(5) Repeat purge procedure 1 through 3 until an acceptable product purity is achieved.

(6) After completion of cylinder purge, make sure that all valves are closed.

13. The Dual Stage Regulator Maintenance

A dual stage, spring loaded regulator is employed for the pressure building/ economizer circuit. This regulator can be adjusted on the container, or it can be replaced. It is also possible to check and adjust the regulator off the container in a readily fabricated bench adjustment fixture.

Please note: *One clockwise turn of the adjustment screw will raise the set point by approximately 30 psig (2 bar /207 kPa). See the chart below to determine the range of adjustments for the regulator. Do not attempt to set the regulator to pressure outside of its design range.*

Regulator Adjustment on Container

(1) Fill the container to approximately 2/3 with appropriate liquid product.

(2) Open the pressure building valve and allow the container to stabilize, until the pressure does not change any more, about half an hour. Note the point, when the pressure stabilizes, this is the set pressure of the dual pressure building/economizer regulator.

(3) Adjust the screw on the top of the regulator to raise or lower the pressure to the desired point. To increase the set pressure by clockwise turning the adjustment screw on the regulator. Watch the pressure in the container increase until it stabilizes. If you want to lower the set pressure, turn it anticlockwise, then close the pressure building valve, and vent the container to a pressure below the desired set pressure. Repeat step 2 in order to observe the change.

REGULATOR ADJUSTMENT RANGES

Part No.	Normal Setting`	Range	Delta
6999-9018	300 psig 20.7 bar 2068 kPa	150 to 350 psig 10.3 to 24.1 bar 1034 to 2413 kPa	20 psig 1.4 bar 138 kPa
8816-1060	400 psig 28.0 bar 2758 kPa	300 to 600 psig 20.7 to 41 bar 2068 to 4137 kPa	20 psig 1.4 bar 138 kPa

Regulator Removal or Replacement Procedure

(1) Close manual Pressure Building valve.

(2) Vent the container to atmospheric pressure. (For units in CO2 service, see caution for releasing pressure at the Maintenance Section.)

(3) Loosen and remove both the tube connections on the pressure building and economizer side of the regulator.

(4) Remove the regulator from the container by unscrewing the valve body and elbow from the output of the pressure building valve.

(5) Repair the regulator and readjust its setpoint using the bench test setup.

(6) To install a replacement or readjusted regulator, apply Teflon tape to the elbow on the container and thread the valve body onto the elbow.

(7) Reconnect the tube connections to the regulator and tighten.

(8) Pressurize the container and check it for leaks.

Regulator Adjustment - Bench Procedure

Assemble the regulator adjustment fixture, and the regulator to be adjusted, as shown in the accompanying illustration.

(1) Leak test joints between the high-pressure cylinder regulator and the dump valve. Joints must leak free before proceeding.

(2) Close the ON/OFF valve, and the dump valve.

(3) Slightly open the high-pressure cylinder valve.

(4) Set the high-pressure regulator above the desired set point for the Pressure Building setpoint.

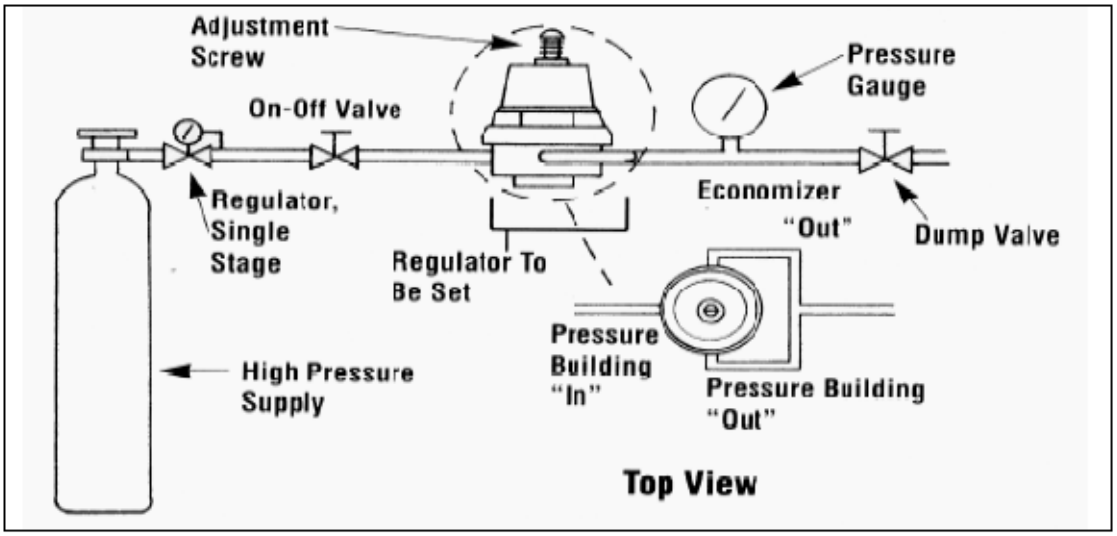
(5) Slowly open ON/OFF valve and observe the downstream pressure gauge.

(6) When the regulator under test closes, the P.B. set point may be read on the downstream pressure gauge.

(7) Close the ON/OFF valve and open the Dump valve.

(8) To reset the regulator, loosen the locknut on the adjusting screw. Raise the set point by turning the adjusting screw clockwise; lower the set point by turning the screw counterclockwise. After adjustment, repeat steps 5 and 6 to check the setting before reinstalling the regulator on the liquid container.

Note: *The regulator has directional gas flow. The arrow on the regulator body must point in the direction indicated in the Bench Adjustment Fixture illustration. The economizer portion of the regulator has already opened approximately 20 psig (1.4 bar/ 138 kPa) below the pressure building setpoint.*



Regulator Bench Adjustment Fixture

14. Checking Container Performance

The cryogenic container consists of two containers, one inside the other. The space between the containers acts as a highly efficient thermal barrier including high technology insulation, a vacuum, and a vacuum maintenance system. Each serves a very important part in the useful life of the container. The high technology insulation is very effective in preventing radiation reaching the inner container. Unfortunately, the perfect vacuum cannot be achieved since trace gas molecules begin to enter the vacuum space from the moment of manufacture. The vacuum maintenance system consists of materials which gather trace gas molecules from the vacuum space. The maintenance system can perform its function for years, but it has a limited capacity. When the vacuum maintenance system is saturated, it can no longer maintain the vacuum integrity of the container. The change will be very gradual and may go unnoticed for several years. When the vacuum in the insulation space is no longer effective, the following symptoms may appear:

(1) With liquid in the container and pressure building coil not in use, the outer casing will be much colder than comparative containers.

(2) Frost, indicating the liquid level, may be visible on the outer casing of the container.

(3) The container may appear to be 'sweat' if the air surrounding the container is hot and humid.

(4) The relief valve will open continuously until the container is empty.

(5) The container will hold pressure for several days but will not hold liquid.

Similar symptoms can be observed if the pressure building is activated or damaged. Pressure building valve and / or dual pressure building/economizer regulator may be defective or need to be re-adjusted / replaced. It can be observed by an iced or very cold regulator, valve, and pipes from a damaged vacuum.

15. Checking Normal Evaporation Rate (NER- Test)

If you have reason to suspect a loss of the vacuum integrity, you can check the container's Normal Evaporation Rate. Before you start testing, check first the integrity of the Vacuum Evacuation Port/ Outer Vessel Relief Device. If the Vacuum Evacuation Port/ Outer Vessel Relief Device is defective, there is no more need for the test. In that case the container would need to be re-evacuated after the reason for the vacuum loss was found. In case there is a vacuum leak, for instance by a crack in the outer or inner casing, on the neck tube, or on one of the pipes, a repair would make no more sense for economic reasons. Please contact your dealer.

If the Vacuum Evacuation Port/ Outer Vessel Relief Device is ok, carry out the NER-Test. The test measures the actual product loss over time.

Please note: *The Pressure Building Valve must remain closed during the test; otherwise, the pressure building process would increase the evaporation and distort the test result. It must be ensured that the Pressure Building Valve closes 100%.*

(1) Fill the container with about 150 pounds (68 kg) of liquid nitrogen.

(2) Close the liquid fill/withdrawal valve and open the vent valve and allow it to remain open during the test.

(3) The liquid nitrogen boils because it is pressurized. After 24 hours the saturation process should be finished, so that the evaporation from the container is stabilized. Then weigh it, and record the weight, time, and date.

(4) Repeat the weighting after 24 hours and again after 24 hours.

$$\text{Daily NER} = \frac{[\text{Weight (step3)} - \text{Weight (step 4)}]}{[\text{Time between Step 3 and Step 4 in hours}]} \times 24$$

(5) The results will be most reliable if the container is not moved during this time. The resulting weight loss over 24 hours is the daily evaporation rate. You can of course also measure weight and time at any time of the day to find the hourly evaporation and to calculate the daily evaporation rate. The measured values must be a linear function of time.

Compare the results of your test to the 'as manufactured' NER value in the specification sections of this manual. A container in service should maintain an NER value of less than two times the new specification. Any test results greater than two times the listed value is indicative of a failed or failing vacuum. If NER is found to be high, contact Taylor-Wharton or your distributor.

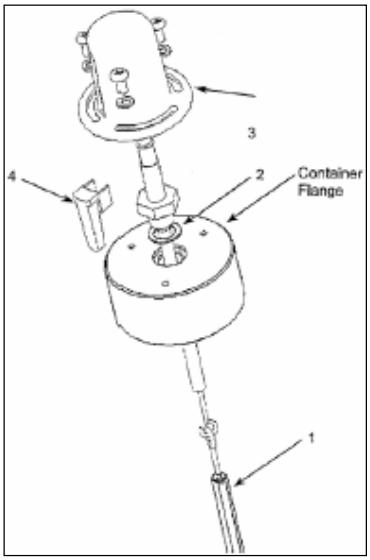
An increased evaporation rate is shown by fast pressure building, but it is not dangerous, because the container is protected by a pressure relief valve and an inner container bursting disc. There are no objections against a further operation of the container, if there is a continuous and enough withdrawal, at least until a blowing pressure relief valve shows that the evaporation rate of the container is too high and the vacuum to deteriorate for the present application.

16. Liquid Content Gauge

This device consists of the gauge assembly with a float rod beneath an indicator under a clear plastic protective cover. When the gauge is assembled, a level indicator ring is magnetically coupled to the top of a float rod and moves up or down with the changing liquid level in the container.

If the indicator ring stays in the bottom position, although there is still liquid in the container, this can be a sign for an interrupted magnetic coupling between the ring and the float rod. The indicator ring will be picked up again by the magnetic field

once the container is empty. You can also try to lift the ring in its position with a magnet from outside.



Components of the Contents Gauge:
1 - Float rod
2 - Sealing
3 - Cover
4 - Scale (Snap-on)

17. Replacement Instruction

Caution: Please refer to section "Repair and Maintenance" before doing the following replacement.

Liquid Content Gauge Replacement

a) Removing the Liquid Contents Gauge

(1) Vent all pressure from the container.

(2) Remove the protective cover by removing three bolts from the base of the cover.

(3) Unscrew the gauge body using a wrench on hex fitting at base of the liquid gauge.

(4) Lift the entire gauge assembly free of the container. The gauge assembly is long and may be very cold. Gloves should be used to protect your skin.

WARNING: Cold surfaces should never be handled with bare skin. Use gloves and other protective clothing when performing this procedure.

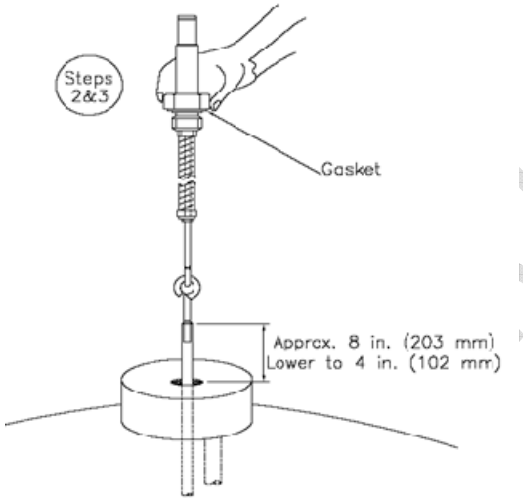
b) Liquid Content Gauge Installation

Before installing or repairing a new liquid content gauge, inspect the gasket seals. If any damage is apparent, replace the gasket.

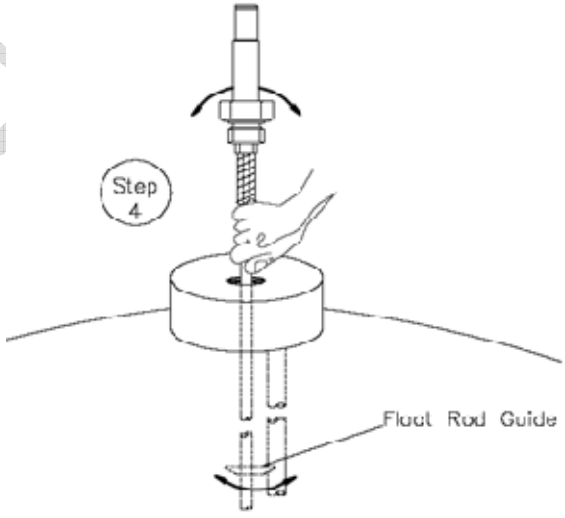
(1) When inserting the gauge assembly, lower the float rod through the gauge opening until about 8 inches (203 mm) of the float rod remains above the container.

(2) Grasp the clear cover portion of the gauge assembly with two fingers so that the assembly hangs free and “plumb.”

(3) Lower the assembly about 4 inches (102 mm) slowly and try to keep the rod in the center of the threaded entrance hole as you do. If you are careful during this portion of insertion, you will drop the float rod straight through the guide ring inside the cylinder.



(4) To confirm that the rod is correctly positioned in the cylinder, stop where you can still grasp the top of the rod and try to swing the lower end from side to side.



(5) To confirm that the rod is correctly positioned in the cylinder, stop where you can still grasp the top of the rod and try to swing the lower end from side to side.

(6) When the rod is engaged in the guide ring, the rod will be restricted to lower end movement of about ½" inches (12.7 mm); if you can feel greater movement, withdraw the rod to the point where its top is 8 inches (203 mm) above the gauge opening and try again.

(7) When you are satisfied that the float rod is correctly installed, lower the assembly the rest of the way into the container until the top portion threads can be engaged.

(8) Screw the gauge in place and hand torque to about 20 lbs-ft (2.8 kgf-m). Leak checks the connection of gauge to the flange.

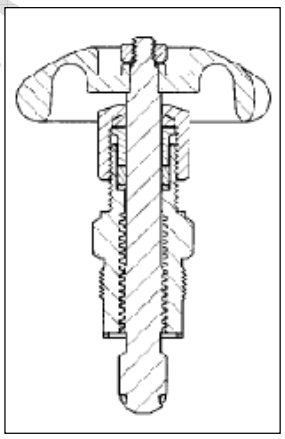
CAUTION:
When installing the gauge assembly, care must be taken to ensure that the float rod is inserted through "guide ring" located on the liquid withdrawal line inside the container. If the gauge does not engage this ring, the contents indication will be inaccurate, or the gauge may be damaged in use.

Hand Valve Replacement

Hand valves are an integral part of the container, and the valve bodies rarely need replacement. However, the handwheel and internal parts of the valves are renewable. The illustration below is a view of the valve replaceable part used on Taylor-Wharton liquid container.

Valve Repair Kit Assembly (P/N 1750-9C35)

➔ 3/8" Rego Globe



a) Valve Disassembly Instructions

(1) Open valve by turning Handwheel counterclockwise as far as it will go to release any trapped gas in the system.

(2) Using a large adjustable wrench to hold valve body, remove Bonnet by turning counterclockwise with a 15/16-inches socket wrench that capable of developing at least 80 lbs-ft (11 kgf-m) torque.

(3) Remove the handwheel assembly from the valve body and discard. Inspect the body and clean if necessary; be sure interior and seal areas are free from dirt, residue, and foreign particles.

CAUTION:
Do not apply force after the valve is fully open.
Do not scratch or mark the internal surface of valve.

b) Valve Replacement Instructions

(1) Thread handwheel assembly into valve body until properly seated.

(2) Turn the handwheel completely clockwise to close the valve. Re-pressurize container and leak check valve.

Pressure Relief Valve / Inner Container Bursting Disc / Pressure Gauge Replacement

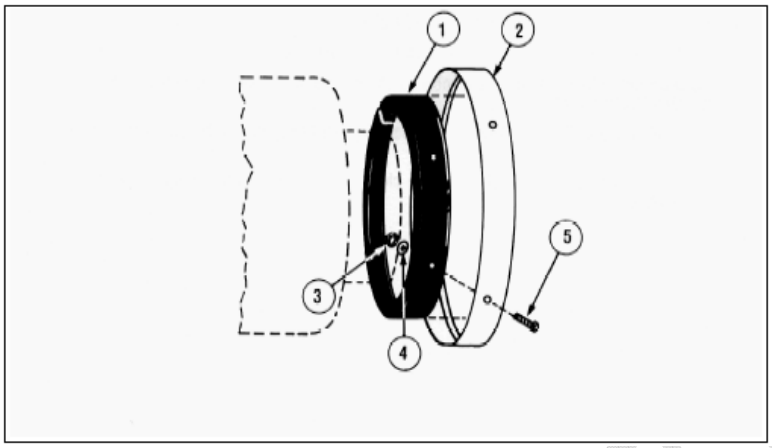
Unscrew the part to be removed by suitable socket wrench. Apply approved sealing tape to the thread of new parts to be installed. Using a suitable socket wrench, screw back the parts to its connection. Leak test connection after replacement (refer to section “Repair and Maintenance”).

Foot Ring Parts Replacement

COMPONENT FOR SHOCK MOUNT FOOT RING (XL-45HP/50HP/55HP/50VHP/55VHP)

Item No.	Description	Part No.	Qty.
1	Rubber Shock Ring	XL50-4C18	1
2	Foot Ring	XL50-4C19	1
3	Hex Nut	6311-1042	3
4	Washer	6430-0125	3
5	Carriage Bolt	6620-0401	3

Shock Mount Foot Ring- Exploded View



Replacement of Shock Mount Foot Ring

(1) Empty or transfer all contents of tank. Vent to atmospheric pressure.

(2) Gently lay the container on its side and unbolt the three (3) carriage bolts that attached the foot ring and rubber ring to the tank.

(3) Slide off the damaged foot ring and rubber shock ring.

(4) Assemble rubber shock ring into new foot ring and force over shock mount ring on container. Use a rubber hammer to drive the rubber shock ring into place.

(5) Using a ½ inch drill bit, drill holes through rubber so that the carriage bolt slides in smoothly.

(6) The holes in foot ring must be position in alignment with holes in shock mount ring. Using the 3 bolts, washers and nuts, fasten the new parts to the container.

(7) After securing the shock mount ring, gently lift the container to the upright position and inspect your work.

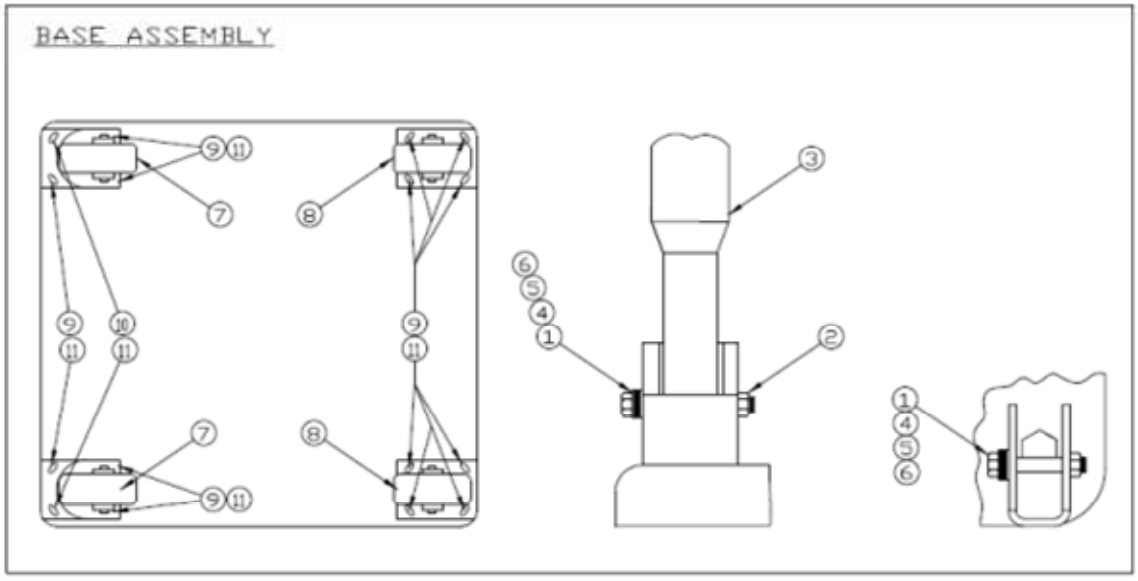
Note: If the original Shock Mount Ring is badly damaged, we recommend that an NER test is performed to ensure that no internal damage has resulted from the impact of the shock mount ring.

Square Base Parts Replacement

COMPONENT FOR SQUARE BASED ASSEMBLY

Item No.	Description	Part No.
1	Cap screw, Hex Head, ½”-13UNC, S.S.	6164-1753
2	Hex Nut, Nylon Insert	6331-1183
3	Handle Assembly	XL65-9C31

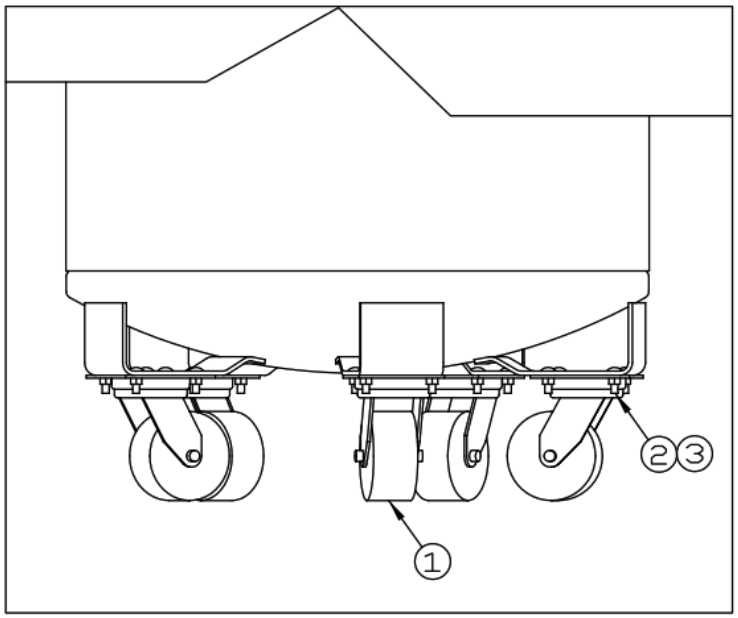
4	Flat Washer, S.S.	6460-9024
5	Spring Washer, S.S.	6460-9025
6	Flat Washer, Teflon	6160-9026
7	Caster, Swivel 4 in. Dia. Wheel	7300-9021
8	Caster, Rigid 4 in. Dia. Wheel	7300-9022
9	Carriage Bolt,3/8”-16UNC, 1 ¼” L, S.S.	6160-4766
10	Hex Head Cap screw,3/8”-16UNC, 1” L, S.S	6164-1133
11	Elastic Stop Nut, S.S.	6368-9110



Round Base Parts Replacement

COMPONENT FOR ROUND BASE ASSEMBLY

Item No.	Description	Part No.	Qty
1	Caster wheel, Swivel 4” Dia., Polyurethane	7300-9023	5
2	Carriage Bolt, M8 X 25MM Lg, Stn Stl	6160-4763	20
3	Elastic Stop Nut, M8, Stn Stl	6311-1044	24



18. Trouble Shooting Chart

The following chart is provided to give you some guidance in determining the probable cause and suggested corrective action for some problems that may occur with cryogenic liquid containers. This chart is specifically tailored to your XL-45HP, XL-50HP, XL-55HP, XL-60HP, XL-65HP, XL-70HP or XL-50VHP, XL-55VHP.

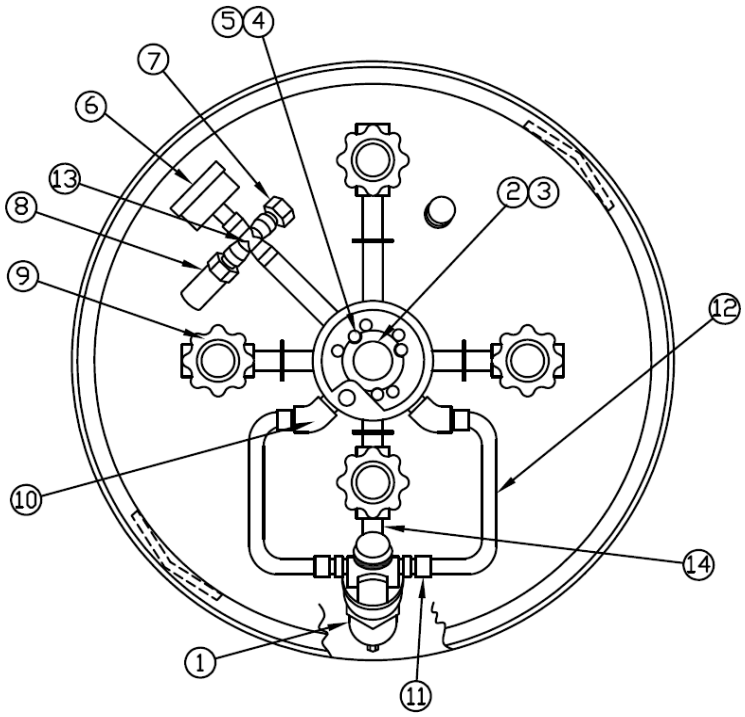
No	Symptom	Possible Cause	Corrective Action
1	Consistently low operating pressure.	(1) Relief valves open at low pressure. (2) Economizer side of P.B./Economizer Regulator stuck open. (3) Cold liquid.	(1) Remove and replace relief valve. (2) Remove and replace regulator (3) Open pressure building valve. With P.B. inoperative, the container will build pressure over time, or an external pressure source can be used to pressurize container.
2	No pressure shown on container pressure gauge.	(1) Bad container pressure gauge. (2) Open inner container bursting disc. (3) Leaks in valves or plumbing. (4) 4. Cold liquid.	(1) Remove and replace bad gauge. (2) Remove and replace bursting disc. Pressurize container and check relief valve operation. (3) Leak test and repair leaks. For valve repairs, see Maintenance section. (4) Open pressure building circuit.
3	No pressure showing but container is full by weight.	(1) Broken pressure gauge. (2) Vent valve open/P.B. valve closed. (3) Faulty relief valve.	(1) Replace pressure gauge. (2) Close vent valve, open P.B valve. (3) Replace relief valve.
4	Container full by weight and Liquid Level Gauge but very low pressure.	(1) Liquid too cold. (2) Possible leak in vent valve. (3) Faulty relief valve	(1) Open P.B. valve or allow to stand. (2) Rebuild valve. (3) Replace valve.
5	Container is cold and may have ice or frost on outer casing. Will not hold liquid overnight. Relief valve is venting gas.	(1) Vacuum loss. Check NER. (2) Defective	(1) Consult with Taylor-Wharton for course of action. Do not attempt to put additional liquid container. (2) Look for P.B coil

		P.B./Economizer regulator.	pattern in ice. Close P.B. valve. Replace or reset regulator.
6	Ice formation on bottom of container when P.B. valve is closed.	(1) Pressure building valve not closing properly. (2) Leak in pressure building system topworks.	(1) Replace or rebuild valve. (2) Leak test piping connections and tighten fitting if needed.
7	Container vents through relief valve when in use.	Pressure Building/ Economizer Regulator set above relief valve setting. Economizer side of regulator clogged or stuck open.	Remove and reset or replace regulator.
8	Container vents after fill but quits after a while.	This may be caused by residual heat vaporizing some liquid inside container and is a normal condition.	Symptom should go away once container reaches operating temperature, and the liquid reaches its saturation point at container operating pressure.
9	Container vent gas continuously through relief valve.	Heat leak may be too great.	Perform container performance evaluation test per Maintenance section to determine if container vacuum is adequate.
10	Level indicator stuck ½ full. Yellow indicator ring will not move.	Float rod stuck on or in float rod guide.	Reinstall. See Contents Gauge Installation section.
11	Level indicator at bottom of gauge. Container full of product.	Indicator disengaged from gauge rod. Caused by dropping the container.	Recouple indicator using re-engagement ring.

19. Replacement Parts

This replacement parts list includes a recommended inventory quantity which allows you to order parts on timely basis to keep all your HP/VHP-Series container in service. When placing orders, please use the nomenclature and part numbers in this section.

COMPONENT LOCATIONS



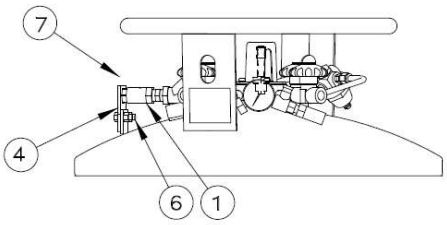
Index No.	Descriptions	Part No.	Recommended for 10 Units
1	Dual Regulator, Pressure Building/Economizer 400 psig (28 bar/2758 kPa)- for XL-50VHP/55VHP Only	8816-1060	2 Each
	Dual Regulator, Pressure Building/Economizer 300 psig (20.9 bar/2068 kPa)	6999-9018	2 Each
	**Dual Regulator, pressure Building/Economizer 125 psig (8.6 bar/862 kPa) – Not for CO_2 service	6999-9015	2 Each
2	*Gasket, Glass Filled Teflon, Contents Gauge	7701-0083	5 Each
3	Liquid Level Indicator Inert Spring W/ Float Rod: ▪ XL-45HP ▪ XL-50HP/VHP ▪ XL-55HP/VHP ▪ XL-60HP	 GL45-9C64 GL45-9C67 GL45-9C69 GL45-9C61	 1 Each 1 Each 1 Each 1 Each

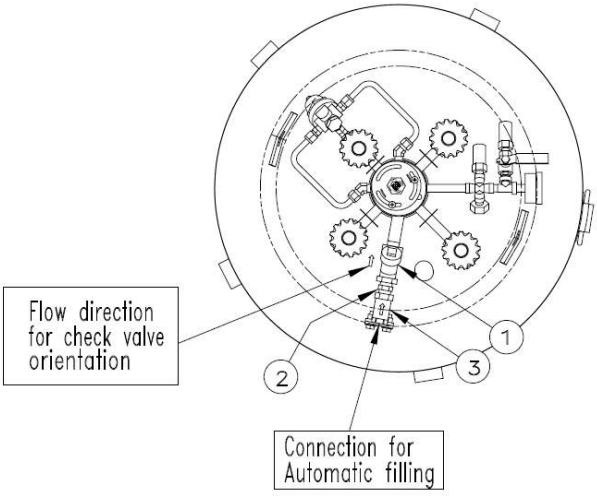
	▪ XL-65HP ▪ XL-70HP Nitrogen, indicator Scale Argon, indicator Scale Oxygen, indicator Scale Carbon Dioxide, indicator Scale	GL45-9C62 GL45-9C63 GL45-9C79 GL45-9C81 GL45-9C80 GL45-9C82	1 Each 1 Each 4 Each 4 Each 4 Each 4 Each
4	Screw, brass, 1/4inch-20 UNC x 5/8 inch	6114-1088	10 Each
5	Washer, Lock, ¼ inch, stainless steel	6460-2025	10 Each
6	Gauge, Pressure 0-600 psig (0-40 bar/0-4000 kPa)	1706-9C15	2 Each
7	Safety Head: ▪ 525 psig (36 bar/3620 kPa) ▪ 750 psig (52 bar/5171 kPa)- for XL-50VHP/55VHP Only	 1705-9C12 7815-3085	 2 Each 2 Each
8	Relief valve: ▪ 350 psig (24 bar/2413 kPa)-not for CO_2 or N_2O ▪ 350 psig (24 bar/2413 kPa)-for CO_2 or N_2O ▪ 500 psig (34 bar/3447 kPa)-not for CO_2-for XL-50VHP/55VHP Only ▪ **22 psig (1.5 bar/152 kPa)- Not for CO_2 or N_2O ▪ **230 psig (16 bar/1586kPa)- Not for CO_2 or N_2O	 ▪ 1705-9C39 (Rego) ▪ 6913-9071 (Generant) ▪ 1706-9C12 ▪ 6913-9072 (Generant) ▪ 1700-9069 (Rego) ▪ 6913-9069 (Generant) ▪ 1700-9C39 (Rego) ▪ 6913-9070 (Generant)	 5 Each 2 Each 5 Each 5 Each 5 Each
9	Valve Repair Kit	1750-9C35	3 Each
10	Elbow, Male, Brass, 45º, 3/8in. ODT-comp x ¼ in.	6814-9233	2 Each
11	Connector, Male, Brass, 3/8 in. ODT-comp x 1/4in. NPT-EXT	4570-1960	2 Each
12	Tube, P.B./Economizer Line	GL45-9C20	2 Each
13	Cross Assembly	GL55-9C29	2 Each
14	Elbow, Male, 45º, 3/8 in. NPT x ¼ in. NPT	6814-9241	2 Each
15	***End Fittings for Hand Valves** -USE (CGA 540)-oxygen -USE (CGA 580)-argon/nitrogen -USE (CGA 320)-carbon dioxide -USE (CGA 326)-nitrous oxide	 7114-0613 7114-0614 7114-0181	 5 Each 5 Each 5 Each

	-LIQUID (CGA 440)- oxygen	7114-0195	5 Each
	-LIQUID (CGA 295)-argon/nitrogen	6514-8992	5 Each
	-LIQUID (CGA 320)- carbon dioxide	7355-4712	5 Each
	-LIQUID (CGA 326)- nitrous oxide	7114-0181	5 Each
	-VENT (CGA 440)-oxygen	7114-0195	5 Each
	-VENT (CGA 295)-argon/nitrogen	7355-4712	5 Each
	-VENT (CGA 295)- carbon dioxide	7355-4712	5 Each
	-VENT (CGA 295)- nitrous oxide	7355-4712	5 Each
	*Decal, Warning	7355-4712	5 Each
	*Decal, Nitrogen service	1700-9C07	4 Each
	*Decal, Oxygen service	GL55-9C51	A/R
	*Decal, Argon service	GL55-9C52	A/R
	*Decal, Carbon Dioxide service	GL55-9C53	A/R
	*Decal, Nitrous Oxide service	GL55-9C54	A/R
		GL55-9C55	A/R

*Not illustrated
**Optional/Not illustrated

ADDITIONAL COMPONENT FOR EXPRESS-FILL VERSION





REPLACEMENT PARTS

Number	Description	Part Number
1	Check Valve, ½ NPT	6913-9365
2	Hex Nipple, ½ NPT	6719-9995
3	Check Valve, In-Line, ½ NPT	6913-9370
4	Check Valve Bracket	EZ65-9C92
5	Capscrew	6164-1133
6	Nuts	6310-0135
CGA Connections		
7	Oxygen	6514 – 8990
7	Nitrogen	7355 – 4698
7	Argon	7355 – 4698

THE EXPRESS-FILL VERSION NOTE

Please refer to those operating instructions for General Information and data related to Safety, Operation, Maintenance, Specifications, Troubleshooting, and Replacement Parts.

These cylinders are designed to be filled automatically using the Express Cryogenic Delivery System or by conventional means. Automatic filling eliminates product loses due to venting. The Express cylinders are designed to automatically stop the fill process when the liquid level in the cylinder reaches a set level. Refer to Express Truck manual (section 5.6) for automatic filling instruction. The automatic fill shut-off will operate only when filled by the Express Cryogenic Delivery System. The automatic fill shut-off will not function during conventional filling. When filling cylinder for transportation, maximum liquid weight should not be exceeded regardless of fill method. See "Filling the Container" for details. Before connecting the Express System-fill hose to the cylinder, visually check the CGA connection for cleanliness, and obstructions.

20. Accessories

Accessories available for use with Taylor-Wharton XL-Series containers are:

-Manifold, Automatic and Manual

-Container Hand Trucks

-Vaporizer adding up to 250 cfh (6.6 cu.m/h) each
- PN: VP50-7C10

-Transfer Hoses (O_2, N_2, and AR)
- PN: 1600-9C66 6 ft X CGA 295 X 3/8” NPT LIQUID / VENT N2/AR Service
- PN: GL50-8C53 6 ft X CGA 440 X 3/8” NPT LIQUID / VENT O2 Service

-Cryogenic Phase Separators
- PN: 1193-8C80 2 ¾” X 1 3/8” OD (3/8” NPT)

- PN: 1193-8C82 1 ¼” X 1” OD (3/8” NPT)
- PN: 1193-8C83 1 ¼” X 1/2” OD (1/8” NPT)

For additional information concerning the accessory of your choice, please consult the separate manuals on accessories or call Taylor-Wharton.

Disclaimer

Taylor-Wharton is not being liable for any consequential, special, or incidental damage or accidents resulting from the delivery, use, or maintenance of delivered XL-Series Cylinder (including loss of any liquid product or materials stored in liquid product), or from any cause whatsoever by accepting delivery of the products sold hereunder. Any claims regarding the containers must be reported immediately in written form to TW after receipt of the XL-Series Cylinder, or whenever damage becomes obvious. The XL- Series Cylinder may not be put in or kept in operation before clarification and repair of the damage, and it must be put out of any service and stored in a suitable form. The XL-Series Container may be put in service again only with the written consent of TW.

Furthermore, the 'Terms of Sales or Acknowledgement' of Taylor-Wharton apply.

QUALITY WARRANTY CERTIFICATES
TAYLOR-WHARTON
XL SERIES LIQUID CYLINDERS

Taylor-Wharton warrants to the original purchaser that the internal structural support system of each XL Series Liquid Cylinder shall be free of defects in materials and workmanship for the life of the product if it is used and maintained according to Taylor-Wharton's published instructions. Taylor-Wharton warrants to the original purchaser of the following:

1. Vacuum Deterioration: The Vacuum system employed on each XL Series Liquid Cylinders is warranted to maintain thermal performance or Net Evaporation Rate (NER) within 10% of Taylor-Wharton's published specifications for a period of five years from date of shipment to the initial purchaser if the product is used and maintained according to Taylor-Wharton's published instructions.
2. Plumbing and control Valves: All components supplied by Taylor-Wharton and used on this product are warranted to be free from defects in materials and workmanship, in the normal service for which the product was manufactured, for a period of one year from the date of shipment to the original purchaser.

To validate the warranty, the purchaser must abide to the following: 1) Immediate discontinue use of the product to further investigation. 2) Purchaser to confirm that defect is due to either of the above by written notice to Taylor-Wharton within 48 hours after confirmation of a claimed defect. Upon receiving official notice, Taylor-Wharton will act as follows: 1) Were the defect is due to vacuum deterioration, Taylor-Wharton will ask the purchaser to return such product freight prepaid to Taylor-Wharton for further evaluation to validate to warranty claim. If the claimed defect is confirmed by Taylor-Wharton's inspection will submit a report to customer, at its option and as the purchaser's sole remedy, repair or replace such product or any component part thereof or refund the original purchase price. If no defect is found or after correction of a confirmed defect, Taylor-Wharton will return the equipment at purchaser's expense. 2) If the defective is due to plumbing and control valves, Taylor-Wharton will require sending replacement parts to the purchaser for reinstallation by purchaser.

This warranty is voided by alterations or by repairs of others. Taylor-Wharton shall not be liable under this warranty, or otherwise, for defects caused by negligence, abuse or misuse of the product, corrosion, fire, heat, or the effects of normal wear. Any related components or other equipment manufactured by others which may be sold with Taylor-Wharton's products are not covered by this warranty.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE. TAYLOR-WHARTON SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES RESULTING FROM THE DELIVERY, USE OR FAILURE OF THE PRODUCT (INCLUDING LOSS OF ANY MATERIAL STORED IN THE PRODUCT), OR FROM ANY OTHER CAUSE WHATSOEVER BY ACCEPTING DELIVERY OF THE PRODUCT SOLD HEREUNDER, THE PURCHASER ACKNOWLEDGES THAT THIS LIMITATION OF REMEDIES IS REASONSABLE AND ENFORCEABLE. IN NO EVENT SHALL TAYLORWHARTON'S LIABILITY EXCEED THE PURCHASE PRICE FOR THE PRODUCT.

Taylor-Wharton
Since 1742

TAYLOR- WHARTON MALAYSIA SDN. BHD

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