



Taylor-Wharton
Since 1742

Instruction Manual

LSN-450



Do not attempt to use or maintain these units until you read and understand these instructions. Refer to the Taylor-Wharton's [Safety First](#) booklet (TW-202) for handling cryogenic material. Do not permit untrained persons to use or maintain this equipment. If you do not understand these instructions, contact your supplier for additional information.

Manual LSN450
T-W P/N# 7950-8095
Sept 06, 2018

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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 110 psig (7.6 bar/759 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 liquid nitrogen or cold issuing gas with the skin or eyes may cause a freezing injury similar to 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 issue 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 temperature below -320°F (-196°C) under normal atmospheric pressure.

Keep Equipment Area Well Ventilated

Although some of the gases used in these containers are non-toxic and non-flamable, they can cause asphyxiation in a confined area without adequate ventilation. Any atmosphere which does not contain enough oxygen for breathing can cause dizziness, unconsciousness or even death. These gases cannot be detected by the human senses and will be inhaled normally as if it were air. Ensure there is adequate ventilation where these gases are used and store liquid containers or only in a well-ventilated area.

Replacement Parts Must be "Cleaned for Oxygen Service"- Some materials, especially non-metallic gaskets and seals, can be a combustion hazard if used in oxygen or nitrous oxide service, although they may be acceptable for use with other cryogenic liquids. Use only Taylor-Wharton recommended spare parts, and be certain parts used on oxygen or nitrous oxide equipment are marked "clean for oxygen service." For information on cleaning, consult the Compressed Gas Association (CGA) pamphlet G-4.1, "Cleaning for Oxygen Service" or equivalent industrial cleaning specifications.

CAUTION: When installing field fabricated piping, make certain a suitable safety valve is installed in each section of piping between shut-off valves. Trapped liquefied gas will expand as it warms and may burst hoses or piping causing damage or personal injury.

For more detailed information concerning safety precautions and safe practices to be observed when handling cryogenic liquids consult CGA pamphlet P-12 'Handling Cryogenic Liquids' available from the Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly VA 20151-2923, phone: 703-788-2700, fax: 703-961-1831.

GENERAL INFORMATION

The LSN-450 is horizontal vacuum-insulated, stainless steel containers design to store and transport/distribution cryogenic liquid oxygen and nitrogen. The container is designed and constructed in according with DOT-4L standard and may be used for over the road transportation of O₂ & N₂ as well as on-site storage and supply in wide range of applications.

Handling the Container

The LSN-450 container is a 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.

When fully loaded, the LSN-450 oxygen service will contain up to 697 lb. (316 kg) of product. While moving a full container, you may be handling up to 1270 lb. (576 kg) and you should treat the load accordingly. The attachment points provided will allow you to use a hand truck or a hoist to handle these loads properly. Do not attempt to move these cylinders by any other means. While moving the cylinder, the following precautions should be observed:

- i. When loading or unloading the container from a truck, use a hand truck, lift gate, crane or parallel loading dock. Never attempt to manually lift the unit.
- ii. To move the container over rough surfaces, or lift the container, attach an appropriate sling to the lifting, and use a portable lifting device that will handle the weight of the container and its contents.

Freight Damage Precautions:

Any freight damage claims are your responsibility. Cryogenic liquid containers are delivered to your carrier from Taylor-Wharton's dock in 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 notation 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.

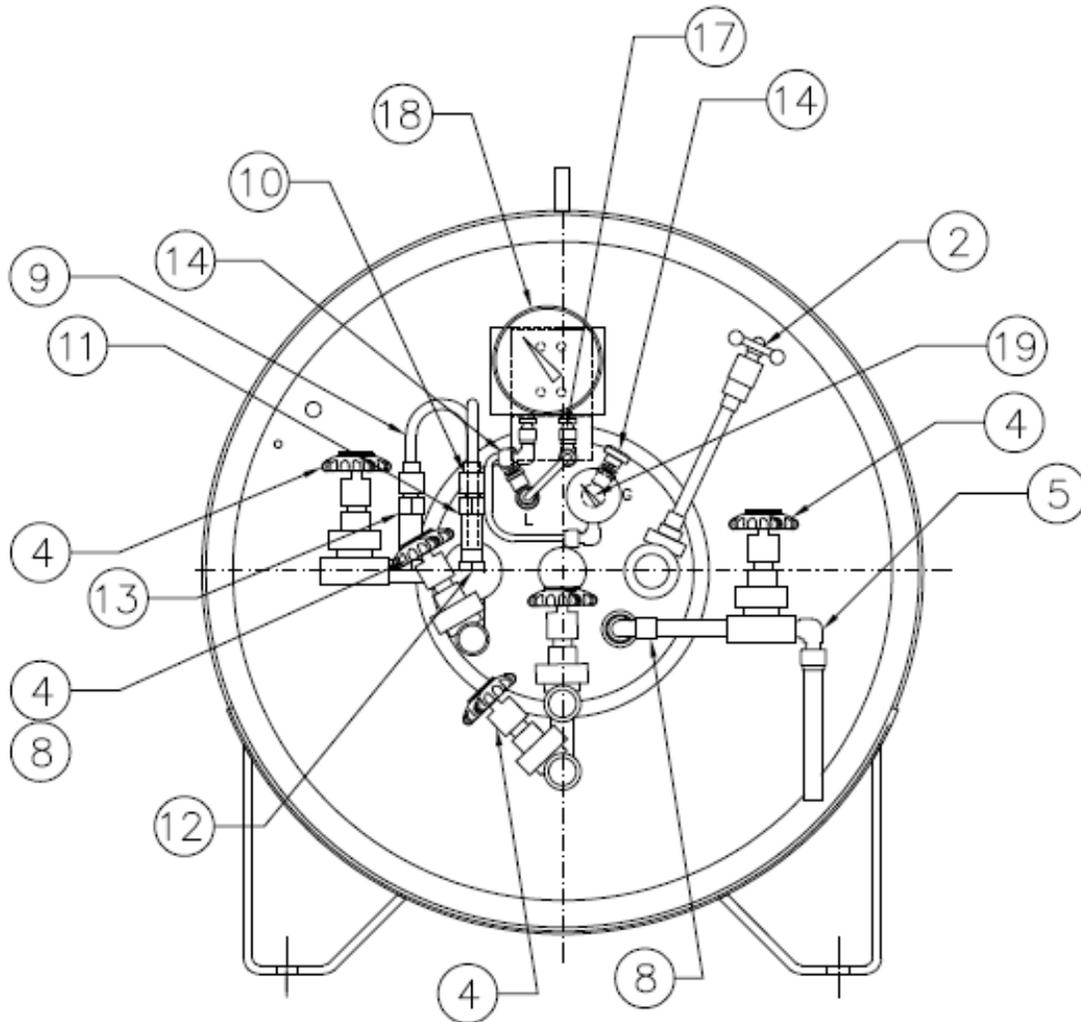
SPECIFICATIONS

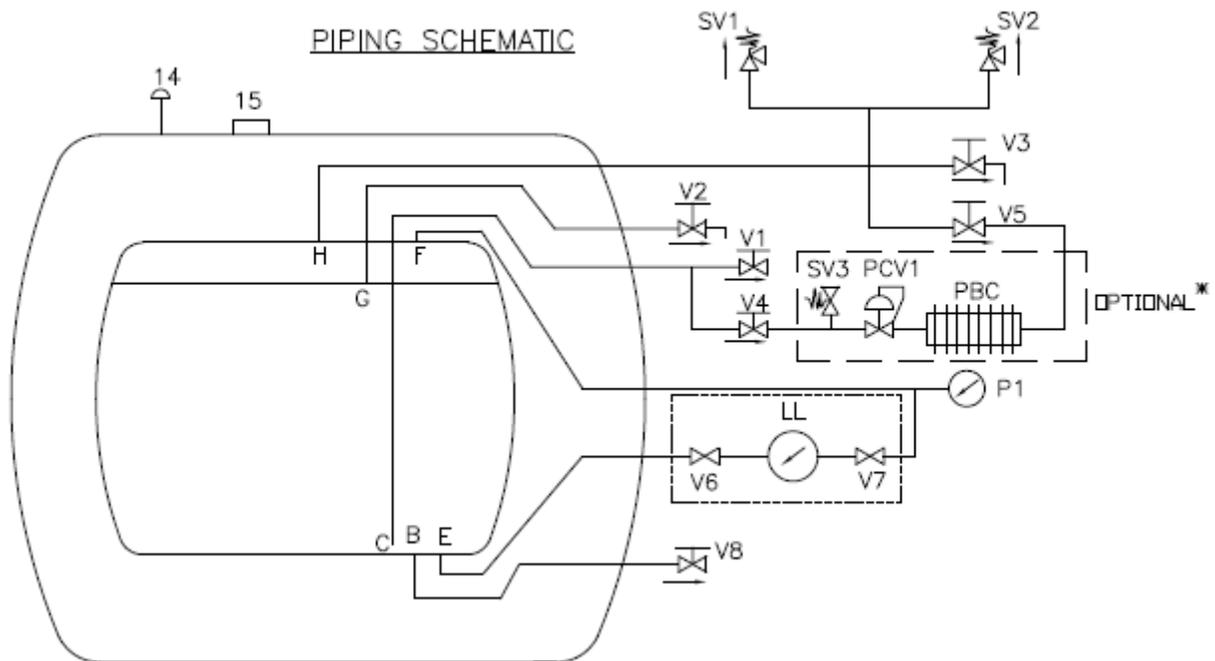
Dimensions Diameter, in (mm) Height, in (mm) Length, overall, in (mm) Weight Empty (Nominal), lb (kg)	26 (660) 27.75 (700) 81.82 (2256) 573 (260)
Capacity, Gross, Liters	490
Capacity, Useable Liquid, Liters	465
Weight of Contents Maximum Base on DOT Rated Service Pressure lb. (kg) Oxygen Nitrogen	389 (176) 274 (124)
Normal Evaporation Rate* (% Capacity per Day) Oxygen Nitrogen	1.0% 1.6%
Relief Valve Setting, psig (bar/kPa) Primary Secondary	110 (7.59 / 759) 200 (13.8 / 138)
Design Specifications	DOT-4L
Gaseous Capacity Base on DOT Rated Service Pressure @ NTP, cu.ft. (STP, cu.m) Oxygen Nitrogen	13243 (375) 10735 (304)

OPERATION

The LSN-450 will store up to 465 liters of product. The cylinder 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.

COMPONENT DESCRIPTIONS





Model with or without pressure building for option.

TAG. NO.	DESCRIPTION
V1	LIQUID WITHDRAWAL LINE
V2	FULL TRYCOCK VALVE
V3	VENT VALVE
V4	PRESSURE BUILDING INLET VALVE
V5	PRESSURE BUILDING OUTLET VALVE
V6 & V7	GAUGE ISOLATION VALVE
V8	LIQUID FILL VALVE
SV1	SAFETY VALVE
SV2	SAFETY VALVE
LL	LEVEL GAUGE
P1	PRESSURE GAUGE
PBC	PRESSURE BUILDING COIL
14	VACUUM BURSTING DISC
15	EVACUATION CONNECTION

P.B CIRCUIT (OPTIONAL)

TAG. NO	DESCRIPTION
PCV-1	P.B REGULATOR
PBC	PRESSURE BUILDING COIL
SV3	LINE RELIEF VALVE

The LIQUID FILL valve

Liquid product is fill to the container through the connection controlled by this valve. The valve, V8, is opened for filling after connecting a transfer hose with compatible fittings to the LIQUID line connection.

The LIQUID WITHDRAWAL valve

Liquid product is withdrawn from the container through the connection controlled by this valve. The valve, V1, is opened for liquid withdrawal after connecting a transfer hose.

The PRESSURE BUILDING INLET Valve

This valve, V4, isolates the liquid in the bottom of the container to the Pressure Building Circuit.

The PRESSURE BUILDING OUTLET Valve

This valve, V5, is the gas inlet to the top of the container for the Pressure Building Circuit.

The VENT Valve

This valve controls a line into the head space of the container. It is used during the fill process. The VENT valve act 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 Pressure Gauge

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

The Contents Gauge

The container contents gauge, LL1, indicates the amount of liquid in the tank. The Contents Gauge connected to the container through two ISOLATION VALVES, V6 & V7.

Relief Devices / Safety Valve

The cylinder equipped with a primary relief valve, SV1 and a secondary relief valve, SV2, with setting of 110 psig (7.59 bar/759 kPa) and 200 psig (13.8 bar/138 kPa) respectively.

The Full Trycock Valve

This valve, V2, is used during the fill process. The liquid will spurt from this valve indicates that the tank is full.

PURGE PROCEDURE

Before placing the container in service, determine the level of purity in the pressure vessel. If the pressure vesel contents purity is unacceptable, perform a product purge to reduce contaminants. The following procedure is recommended for the applications:

1. Attach the liquid purge product source to the LIQUID FILL VALVE. Approximately 40 psig product delivery pressure should be achieved. *The positive pressure must always be maintained in the container during purge procedure to prevent drawing atmospheric contaminants back into the container.*
2. Closed all valves. *Before venting to atmosphere ensure that such venting is allowed by all applicable site regulations and codes.*

3. Open VENT VALVE and vent the inner vessel to 5 psig (34kPa) as indicated on the PRESSURE GAUGE. Close VENT VALVE.
4. Open the LIQUID WITHDRAWAL VALVE slightly to allow the liquid to flow slowly into the bottom of the container. Flow must be gradual enough to allow the liquid to vaporize so that pressure build up in the inner container to flood the exposed section of line, then close valve.
5. When container PRESSURE GAUGE indicated maximum desire purge pressure, close the liquid supply source. When all product in the fill hose has vaporized close the LIQUID WITHDRAWAL VALVE. Then relief hose pressure by opening a hose drain valve on the supply vessel.
6. After 1 hour open the LIQUID VALVE then drain all the liquid from the container.
7. When only vapor exits, close all valves.
8. After all liquid has drained from the container, open VENT VALVE and vent for 2 minutes with cylinder pressure at 40 psig.
9. Repeat purge procedure 2 through 8 until an acceptable product purity is achieved.
10. After completion of container purge, make sure that all valves are closed.

WITHDRAWAL GAS FROM THE CONTAINER

The container pressure forced liquid through the dip tube line and the LIQUID VALVE, V8, through a transfer hose connected to the external vaporizer and to the output of the regulator of your external equipment.

WITHDRAWAL LIQUID FROM THE CONTAINER

Attach a transfer hose to the LIQUID WITHDRAWAL VALVE, V1, connection and open the adjacent LIQUID valve. The pressure in the container will drive liquid product out the valve as long as the container pressure exceeds that of the receiver.

The rate of liquid withdrawal from the container is variable depending on the gas phase pressure and the saturation of the liquid.

CAUTION: To avoid contamination, close the LIQUID valve on an empty container before disconnecting the transfer line.

FILLING THE CONTAINER

Cryogenic liquid containers must always be filled by weight to ensure there is enough gas head space (ulage) 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.

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.

FILLING WEIGHTS

	LSN-450
NITROGEN	274 lb. (124 kg)
OXYGEN	389 lb. (176 kg)

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 the LSN-450 (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 a greater control over liquid temperature is desired.

Filling the container is accomplished through the LIQUID FILL valve while the FULL TRYCOCK 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, on the LSN-450, open the LIQUID FILL and FULL TRYCOCK valves 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 FULL TRYCOCK valve.
3. When full weight is reached, closed both the LIQUID and the FULL TRYCOCOK 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.

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 FILL 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

FILL 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 - 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 container. 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.

MAINTENANCE PROCEDURE

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

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

Use only repair parts cleaned for oxygen service. Be certain your tools are free of oil and grease. This is a good maintenance practice and helps to ensure you do not create a combustion hazard when working on containers for oxygen.

Leak test connections after every repair. Pressurize the container with an appropriate inert gas for leak testing. Use only approved 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.

The need for maintenance usually becomes apparent from inspection of the container before filling, routine observation during and filling and indications of improper operation. Typical trouble indications would be unusually high or low tank pressure, leakage from valves or piping connections and excessive venting through relief valves. Prompt action to correct damage or malfunction is required to assure readings and repairs performed. Keep a permanent log of all inspections, vacuum readings, and repairs performed. Such a log can be valuable in evaluating tank performance and scheduling maintenance.

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/vaporizer coil not in use, the outer casing will be much colder than comparative container.
2. Frost, indicating the liquid level, may be visible on the outer casing of the container.
3. The container may appear to “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.

NER Testing

If a loss of vacuum integrity is suspected, the container’s Normal Evaporation Rate (NER) should be checked. The test measures the actual product lost over time, so you can compare the results obtained to the NER value in the SPECIFICATIONS table. A test period of 48 hours is recommended, after the container is allowed to stabilize; but the formula given produces a Daily NER over any time period.

1. Fill the container with 150 pounds (68 kg) of liquid nitrogen.
2. Close the all valves, leave the VENT valve open and allow it to remain open during test.
3. Allow the container to stabilize for 24 hours, then reweigh it. Record the weight, time, and date.
4. Reweigh 48 hours later. The test is most effective if container is not moved during this period. Record the second test date, time, and weight.

The following calculation will provide the actual Normal Evaporation Rate in pounds-per-day. Daily normal evaporation is simply half the loss over 48 hours.

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

Compare the results of your test to the “as manufactured” NER value in the SPECIFICATIONS section of this manual. A Container in service should maintain an NER value of less than two times the new specification. Any test result 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 Customer Service.

TROUBLESHOOTING

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.

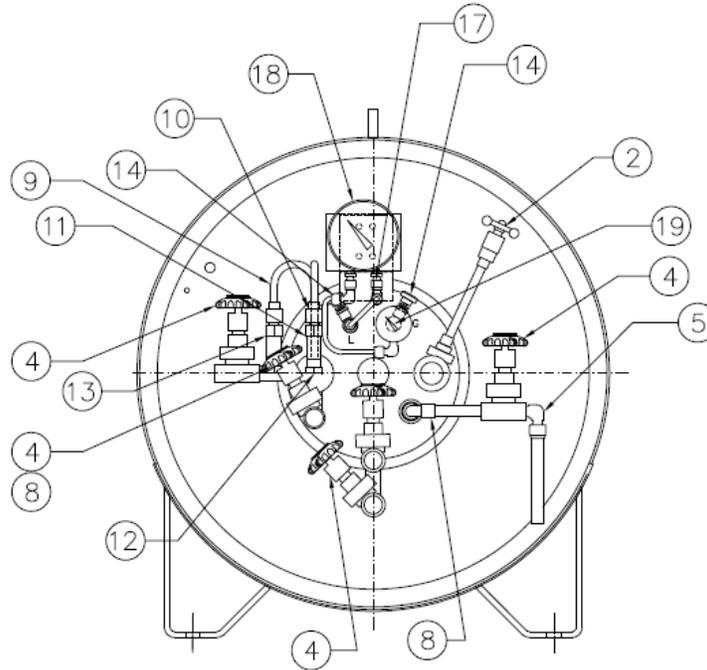
TROUBLESHOOTING CHART

Symptom	Possible Cause	Corrective Action
Consistently low operating pressure.	<ol style="list-style-type: none"> Relief valve open at low pressure. Cold liquid. 	<ol style="list-style-type: none"> Remove and replace relief valve. Use external pressure source to pressurize container.
No pressure shown on container pressure gauge.	<ol style="list-style-type: none"> Bad container pressure gauge. Leaks in valves or plumbing. 	<ol style="list-style-type: none"> Remove and replace bad gauge. Leak test and repair leaks.
No pressure showing but container is full by weight.	<ol style="list-style-type: none"> Broken pressure gauge. Vent valve open. Faulty relief valve. 	<ol style="list-style-type: none"> Replace pressure gauge. Close vent valve. Replace relief valve.
Container full by weight and Liquid Level Gauge but very low pressure.	<ol style="list-style-type: none"> Liquid too cold. Possible leak in vent valve. Faulty relief valve 	<ol style="list-style-type: none"> Allow container to stand. Replace valve. Replace valve.
Container is cold and may have ice or frost on outer casing. Will not hold liquid overnight. Relief valve is venting gas.	Vacuum loss. Check NER.	Consult with Taylor-Wharton for course of action. Do not attempt to put additional liquid container.
Container vents after fill but quits after awhile.	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.
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.

REPLACEMENT PARTS

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

COMPONENT LOCATIONS



NO	PART NUMBERS	DESCRIPTIONS	RECOMMENDED FOR 10 UNITS
2	4024-0220	Globe Valve, 3/4"FNPT, REGO# BK8406T, Brass	2
4	4024-0230	Globe Valve, 1/2"FNPT, REGO# ES8454, Brass	8
5	45251882	Male Elbow, 1/2"MNPT X 5/8"ODT, Brass	2
7	6816-9211	Street Tee, 1/2"MNPT X 1/2"FNPT X 1/2"FNPT	2
8	45255075	Street Elbow, 1/2", Brass	6
10	45027500	Female Connector, 1/4"FNPT X 3/8"OD socket, stn stl	4
11	6913-9055	Relief Valve, 1/4"NPT set @110psi , Brass	2
12	7114-9069	Silencer, Pop Stop(GPS), 1/4", Brass	4
13	6913-9056	Relief Valve, 1/4"NPT set @200psi, Brass	2
14	85443725	Needle Valve 1/4"MNPT, Brass	4
15	4570-1930	Female Connector,1/4"OD x 1/4"FNPT, Brass	4
17	4502-7028	Male Connector,1/4"MNPT x 1/4"FNPT, Brass	4
18	7702-6183	Differential Pressure Gauge (Liq. Level Gauge) 712.15.100 0-25"H2O	2
19	1700-9C13	Pressure Gauge, 1/4"NPT BMC, 50mmDIA>0-200psi,	2
20	4350-6420	Female Tee, 1/4"NPT, Brass	2
21	6814-9802	Male Elbow, 1/4" OD x 1/4" MNPT, Brass	6

**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 REASONABLE AND ENFORCEABLE. IN NO EVENT SHALL TAYLORWHARTON'S LIABILITY EXCEED THE PURCHASE PRICE FOR THE PRODUCT.



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