Building the **GOLD standard** of service and quality
in cryogenic storage equipment.

Auguste Cryogenics
Operating Instructions

AC Liquid Cylinders
AC 70 – AC 240

Low Pressure Versions

with/without
Pressure Building Regulator

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Auguste Cryo

Auguste Cryogenics

Operating instructions –
please read carefully before use.

Do not attempt to use or maintain this unit until you read and understand these instructions. Do not permit untrained persons to use or maintain this equipment.

Refer to Auguste Cryogenics' Safety-First document (AC-202) for handling cryogenic material.

If you do not understand these instructions, contact your supplier for additional information.

Manufacturer:

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1. Contents

1. General Safety Instructions

Pressure Hazard

The containers covered by this literature contain liquefied gas under pressure. 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 repairs on these containers until all pressure is released, and the contents have been allowed to vaporize to ensure no pressure build up can occur.

Extreme Cold – Cover Eyes and Exposed Skin

Accidental contact of the skin or eyes with any cryogenic liquid or cold issuing gas may cause a freezing injury similar to frostbite. Protect your eyes and cover your skin when handling the container or transferring liquid, or in any instance where the possibility of contact with liquid, cold pipes, and cold gas may exist. Safety goggles or a face shield should be worn when withdrawing liquid or gas. Long-sleeved clothing and gloves that can be easily removed are recommended for skin protection. Cryogenic liquid is extremely cold and will be at temperatures below minus 184°C under normal atmospheric pressure.

Asphyxiation Hazard

Keep Equipment Well Ventilated – Although the gases used in these containers are non-toxic and non-flammable, 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 the 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.

Fire and Explosion Hazard

When vessel is in oxygen service, there is an increased risk of fire and explosion.

Prevent Contamination

Use only Auguste Cryogenics recommended spare parts. Keep used accessories clean. Please make sure that spare parts and accessory equipment are properly cleaned to prevent contamination. For information on cleaning, see ”ISO 23208 - Cryogenic vessels - Cleanliness for cryogenic service” or equivalent industrial cleaning specifications.

Install Section Relief Valves

Make sure to have relief valves installed on piping and/or fittings. To avoid trapping liquid between two potentially closed valves, a relief valve must be used in the section. Failure to do so may cause serious injury or even death.

NOTE:
For detailed information on the handling of cryogenic liquids, refer to the Compressed Gas Association (CGA) publication:

• P-12 ”Safe Handling of Cryogenic Liquids”
Available from the Compress Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202
and to
• Accident prevention rule VBG 17 - Pressure-Gas
• Accident prevention rule VBG 61 - Gas

Both publications are based on documents published by the associated occupational organisation and are available from the Carl Heymann publishing house, Köln/Berlin.

2. Product Description

Auguste Cryogenics (AC) containers are portable, vacuum-isolated pressure vessels designed for the storage of deep-cooled, liquefied gases such as nitrogen, oxygen, and argon. They have been designed following EN 1251 and Directives 2010/35/EU and 2008/68/EC. These are pressure devices up to 1000 L suitable for the transport of liquefied gases based on ADR / RID / GGVSE Annex A, Part II, Class 2. The most advanced production methods have been incorporated into the construction of these vessels, which guarantee quality, reliability, and safety while using.

AC containers are devices for supplying gases in a liquid state. The AC 70 to AC 240 series cylinders can provide continuous liquid withdrawal of up to 20 liters when operating with oxygen, nitrogen, or argon. The maximum operating pressure can be up to 10 bar, subject to approval. The automatically operating pressure building circuit ensures sufficient driving pressure for the liquid in the vessel.

Code and groups of gases:

- 3 A 1951 Argon (Ar), liquid, cryogenic
- 3 A 1977 Nitrogen (N_2), liquid, cryogenic
- 3 O 1073 Oxygen (O_2), liquid, cryogenic

Attention!
Storing, filling or using the products for other liquids, chemicals or gases is not allowed!

Generally, the liquid cylinders are available in sizes from 70 to 240 liters in low, mid and high pressure configurations. The high quality of our products is guaranteed, among others, by a quality assurance system per ISO 9001.

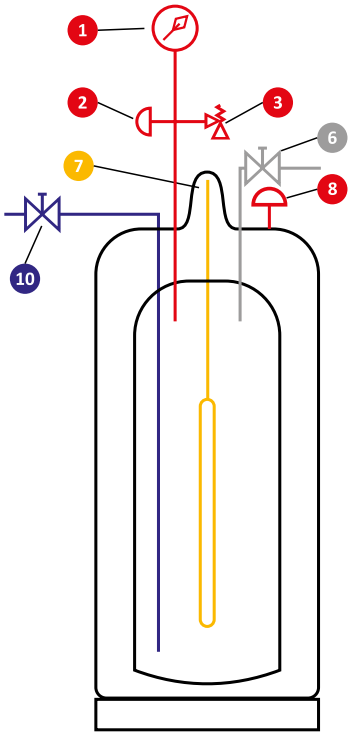
Type		AC 70 PB	AC 120	AC 120 PB	AC 160	AC 180	AC 180-26”	AC 180-26” PB	AC 240	AC 240 PB
Capacity (liters)	Gross	73	126	126	168	186	190	190	253	253
	Useable	70	120	120	160	180	180	180	240	240
Working pressure std. | max. (bar)		1.5 | 10	1.5 | 10	1.5 | 10	1.5 | 10	1.5 | 10	1.5 | 10	1.5 | 10	1.5 | 10	1.5 | 10
Nominal Evaporation Rate[2] (%)		3.5	2.3	2.4	1.5	1.3	1.3	1.3	1.4	1.4
Liquid Withdrawal Rate[3] (l/min)		6	6	6	6	6	15	15	20	20
Safety devices (bar)	Pressure Relief Valve	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Inner Container Bursting Disc	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
	Set Pressure Building[4]	1	1	1	1	1	1	1	1	1
Weight[1] (kg)	Empty	73	103	105	121	137	120	122	144	146
	Full (N_2)	129	200	202	250	282	265	267	338	340
Dimensions (mm)	Diameter	508	508	508	508	508	660	660	660	660
	Height	1080	1430	1430	1640	1780	1350	1350	1535	1535
Casters[5]		4	5	5	-	-	5	5	5	5
Pressure Building		set 1 bar	no	set 1 bar	no	no	no	set 1 bar	no	set 1 bar

[1] allow for a measurement inaccuracy of +/- 2%
[2] % vented NER based on useable liquid capacity per day
[3] at 1 bar in the container
[4] where applicable
[5] non-magnetic casters for MRT applications available on request

Specifications are subject to change without notice.

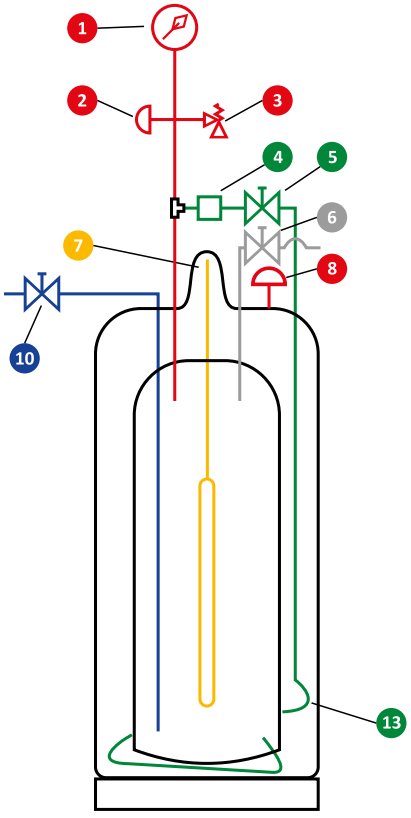
3. Functional Diagram

a) Liquid cylinder without pressure building system



1. Pressure gauge
2. Inner vessel bursting disc
3. Pressure relieve valve
6. Vent valve (VENT)
7. Liquid level gauge
8. Outer vessel bursting disc
10. Liquid fill and withdrawal valve (LIQUID)

b) Liquid cylinder with pressure building system



1. Pressure gauge
2. Inner vessel bursting disc
3. Pressure relieve valve
4. Pressure building regulator
5. Pressure building valve (PB)
6. Vent valve (VENT)
7. Liquid level gauge
8. Outer vessel bursting disc
10. Liquid fill and withdrawal valve (LIQUID)
13. Pressure building coil

4. Handling the Containers

Auguste Cryogenics AC Liquid Cylinders are generally quite rugged vessels. The space between the inner and outer vessel of all insulated by vacuum and super-insulation. Any accident (impact, tip-over, etc.) may affect the integrity of this container insulation system.

When filled, the liquid cylinder will contain up to 194 kg of medium (AC240 in nitrogen operation). While moving a full container, this means handling a total weight of up to 338 kg. Personnel should be aware of that and handle the load accordingly. AC Liquid Cylinders with castors can be carefully moved over flat and even surfaces by hand. The attachment points provided on AC Liquid Cylinders will allow you to use a hand truck, or lifting device, to handle these loads properly. Do not attempt to move these containers by any other means.

When handling an AC Liquid Cylinder, the following safety precautions should be observed:

1. Never place the container on its side. Always ship, operate and store the unit in a vertical, upright position on a solid, flat surface and secure the containers against tilting, falling and rolling away.
2. When moving the container on site or loading/unloading the container from a vehicle, use a lift gate, a crane, or a parallel loading dock. Never attempt to lift an AC Liquid Cylinder manually.
3. To move the container over rough surfaces or to lift the container, attach an appropriate sling to the lifting points and use a portable lifting device that will handle the weight of the container.
4. Make sure to protect vessel and equipment containing liquid cryogenic gases from excessive heating and mechanical damage. Do not place the vessel in the vicinity of heat sources like radiators or heating vents. Do not place the vessel in driveways or in places where they can be hit by falling objects (like e.g. under shelves).

Generally, liquid cylinders are not designed to be permanently mounted on a vehicle. Depending on the design of the fixation, the vibrations and resonances put high strain on the inner vessel supports so Auguste Cryogenics cannot uphold the warranty for the vacuum. Please ask Auguste Cryogenics for solution suggestions.

5. Safety Devices

Auguste Cryogenics storage containers are protected against exceeding the permissible operating pressure by the following safety features.

- Relief valve, set at 1.5 bar (options)
- Inner vessel bursting disc, set at 12.8 bar
- Outer vessel bursting disc, set at approximately 0.5 bar, protects the outer vessel against overpressure. This bursting disc is covered by a protection cap.

Replacing one type of relief valve for another should be performed only after consultation with Auguste Cryogenics Slovakia s.r.o., or an expert holding official certification.

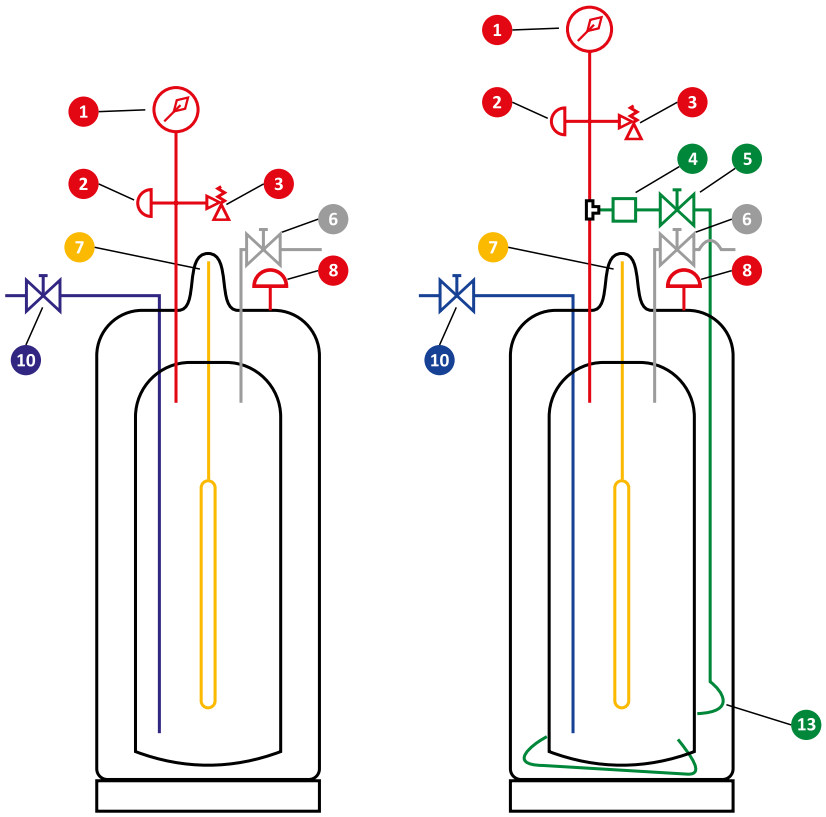
Note: It is necessary to check the faultless operation of the relief valves following the valid regulations at regular intervals.

6. Operation

These instructions are for operators experienced with cryogenic equipment. Before operating this product become familiar with the safety precautions in this manual and in reference publications. Study this manual thoroughly. Know the location and function of all components.

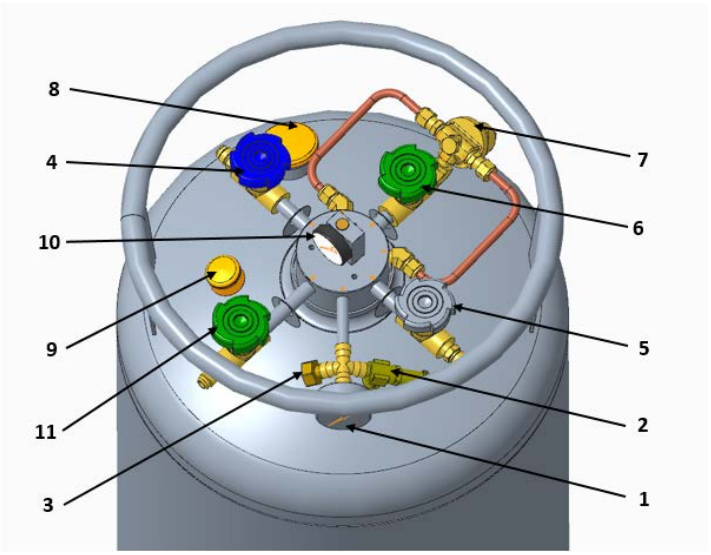
The model numbers of these units indicate their respective liquid storage capacities in liters. The containers are designed for liquid nitrogen, oxygen, or argon only. The following descriptions of components and accessories apply to these containers and should be read before operating the container. The components are identified in the illustration below.

Caution:
When changing the gas used to O_2 (Oxygen) it is absolutely important that the relevant regulations are strictly followed.



1. Pressure gauge
2. Inner vessel bursting disc
3. Pressure relieve valve
4. Pressure building regulator
5. Pressure building valve (PB)
6. Vent valve (VENT)
7. Liquid level gauge
8. Outer vessel bursting disc
10. Liquid fill and withdrawal valve (LIQUID)
13. Pressure building coil

7. Component Description



1 Pressure Gauge

The pressure gauge displays the internal container pressure in bar or PSI.

2 Relief Valve

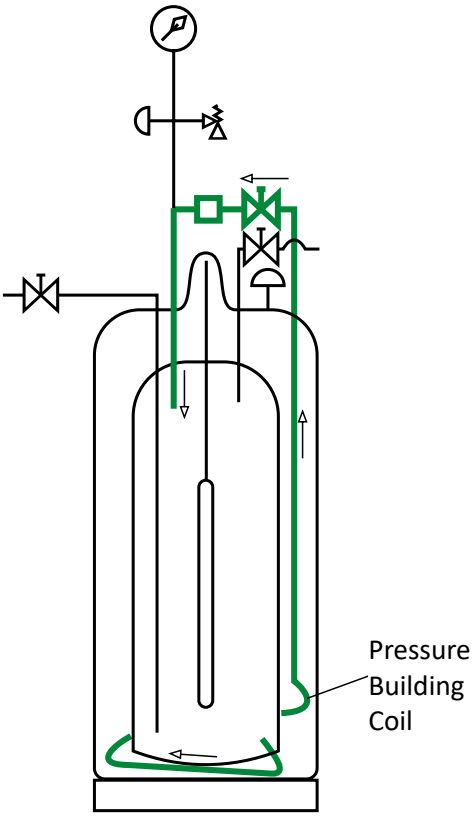
Pressure relief device. The AC cylinders have inner container relief valves set at 1.5 bar for the LP series. If the pressure in the inner vessel reaches the set pressure limit, the relief valve opens and blows off the excess pressure from the container.

3 Bursting Disc (Inner Vessel)

This bursting disc protects the inner vessel from overpressure, should the relief valve ever fail. It is set to 12.8 bar for LP vessels.

4 LIQUID Valve (blue handwheel)

Fill and withdrawal valve - liquid product is added to or withdrawn from the container through the connection controlled by this valve. It has the CGA fitting that is required for liquid connections. After connecting the transfer hose with compatible fittings, the valve is opened to fill or withdraw the liquid. The containers contain liquefied gas under pressure. The sudden release of this pressure may cause personal injury by issuing cryogenic gas or liquid, or by expelling parts during maintenance.



5 VENT Valve (grey handwheel)

This valve controls a line into the headspace of the container. It is used during the filling process. The VENT valve is opened to vent the headspace area while the liquid is entering the inner container during a liquid fill through the LIQUID valve. It also serves as a full trycock. When liquid is emitted from the VENT valve, stop filling immediately.

6 PB Valve (Pressure Building; green handwheel)

Selected vessels from the LP versions of the Auguste Cryogenics liquid cylinders are built with an automatic pressure building circuit. This circuit is used to provide sufficient driving pressure above the liquid in the container

during high withdrawal periods. The pressure building (PB) function is actuated by opening the PB hand valve to create a path for the liquid in the bottom of the container to the gas space at the top. When the PBU is active, the lower exterior of the container may show visible frost. This is a normal phenomenon.

7 Pressure Building Regulator

When the PB valve is open and the container pressure falls below the pressure regulator setting (1 bar), the liquid taken from the inner container is vaporized in an internal heat exchanger, situated between the inner and outer casing. The gas generated thereby is fed into the upper section of the inner container to build up pressure. As soon as the pressure in the container rises above the regulator setting, the regulator closes and the circuit is inoperative. The pressure building regulator automatically utilizes the pressure building circuit to maintain the pressure in the vessel at approximately 1 bar.

8 Bursting Disc (Outer Vessel)

This bursting disc protects the outer vessel from pressurization. it ruptures if the space between inner and outer vessel should ever get pressurized (e. g. due to product leaking into the space from the inner vessel or due to a failing vacuum). It is set to approximately 0.5 bar and covered with a protective cap.

9 Evacuation Seal Off Connection

This port seals the vacuum in the space between inner and outer vessel. It can be used to evaluate the state of the vacuum or to reevacuate the container. This should only be done by Auguste Cryogenics staff or experts commissioned by AC. If the seal is broken, the warranty for the vacuum is void.

10 Liquid Level Gauge

The container can be equipped with a digital or float level indicator. The digital level sensor indicates the liquid volume via a capacitive sensor and display. The float liquid level sensor indicates the volume of liquid in the container via a magnetic coupling with an indicator. This gauge is an indication of approximate container contents only and should not be used for filling. If the level indicator does not move when the container is filled, it may indicate that the magnetic field between the level indicator and the gauge has been uncoupled. The level indicator should recouple itself as the container is emptied.

8. Filling the Container

WARNING:
Filling operations should take place only in well-ventilated areas. Accumulations of gas can be very dangerous (refer to the safety precautions in these instructions). Maintain adequate ventilation at all times.

Make sure that personnel stays clear of the vicinity of the VENT valve and all sensitive equipment is removed from the area during filling. When the container is full, cryogenic liquid may be emitted from the VENT valve causing injury and damage.

A change of gas particularly to O_2 or N_2O may only be implemented in accordance with the relevant regulations. A change from CO_2 service to N_2O or O_2 service is not permissible, and in order to avoid later mistakes there should as well be no change from CO_2 to N_2 or Ar.

Notes:

Before filling the liquid cylinder with precious gases, especially with Argon (Ar), it is advisable that the vessel is cooled down with Nitrogen (N_2) to minimize gas loss.

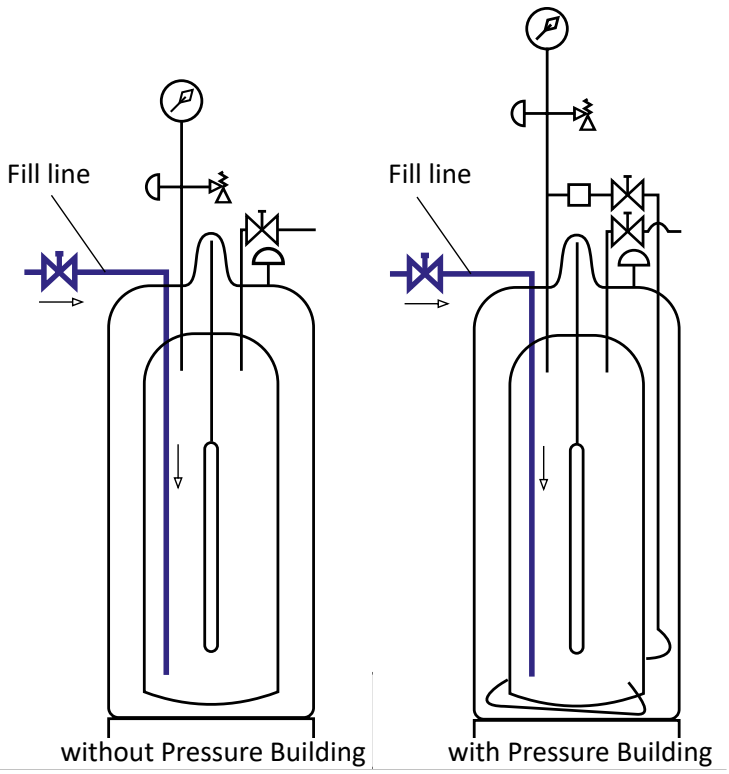
If the application requires a a certain purity, it may be advisable to purge the tank with the service gas before filling.

Please make sure you use an undamaged, clean and dry transfer hose that is free from condensed water.

Filling the Container by Pressure Transfer

1. Visually inspect the container. Do not attempt to fill containers that have broken or missing components.
2. Connect a transfer hose to the LIQUID valve from a low-pressure source of liquid, and close the Pressure Building Valve.
3. Open the supply valve. Then open the VENT and LIQUID valves on the AC container to start the filling process.
4. When the liquid begins to spit from the VENT valve, quickly close the supply valve and then the VENT valve – observe the sequence! Both valves must be closed before the container relief valve opens.
5. Close the LIQUID valve.
6. Disconnect the fill line from the container.

ATTENTION: To avoid contamination, close the LIQUID valve before disconnecting the transfer line.



Filling the Container by Weight of Contents

Determine the proper weight of each container that is to be filled first. The weight derived is then used in the filling procedure that follows.

1. Visually inspect the container. Do not attempt to fill containers that have damaged or missing components.
2. Move the container to a filling station scale and weigh 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 filling should be stopped, add the desired filling weight, the transfer line weight, and the Tare Weight from the container's data plate.
4. Once you have determined the proper fill weight for the container, connect a transfer hose to the LIQUID fitting to a low-pressure source of liquid.
5. Open the supply valve. Then open the VENT and LIQUID valves on the AC container to start the filling.
6. During filling, monitor the pressure in the container and keep the pressure between 0.7 - 1 bar by throttling the VENT valve.
7. When full weight is reached, close the supply valve, then both the LIQUID and the VENT valves – observe the sequence!
8. Disconnect the fill line from the liquid cylinder and remove the vessel from the scale.

ATTENTION: To avoid contamination, close the LIQUID valve before disconnecting the transfer line.

Table of the allowed net weights per medium in kilograms:

Medium	ADR Class 2	UN Code	AC 70 PB	AC 120	AC 120 PB	AC 160	AC 180	AC 180-26"	AC 180-26" PB	AC 240	AC 240 PB
Argon (Ar)	3A	UN 1951	97	167	167	222	250	250	250	334	334
Nitrogen (N_2)	3A	UN 1977	56	97	97	129	145	145	145	194	194
Oxygen (O_2)	30	UN 1073	80	137	137	182	205	205	205	273	273

NOTE:
The fill weight calculation includes the weight of residual liquid. The weights shown in the specifications are for liquids saturated at atmospheric pressure. The actual fill weight for your application depends on the saturation temperature of the liquid in your storage tank and may be determined by weighing.

9. Withdrawing Liquid from the Container

To use the container in liquid delivery service, attach a suitable transfer hose to the LIQUID connection and open the adjacent LIQUID valve. The pressure in the container will drive the liquid product out through the valve as long as the container pressure exceeds that of the receiver. The rate of liquid withdrawal from AC containers is variable depending on the container pressure and the saturation temperature of the liquid. With liquid saturated at 1 bar, a withdrawal rate of up to 10 liters/min can be obtained.

10. Maintenance

Read the safety instructions in the front of this manual before attempting any repairs on AC containers. Also, follow these additional safety instructions while performing container maintenance.

- **Work on the container may only be performed by a professionally qualified and trained person.**
- **Never work on a pressurized container.** Open the VENT valve during maintenance to prevent pressure build-up from the residual liquid in the container.
- **Use only spare parts that are "clean for oxygen service" for repairs.** Please make sure that your tools are free of oil and grease.
- **Use a good maintenance procedure** to help ensure that no dirt enters the interior of the container.
- **Perform leak tests after each repair.** Pressurize the container with a suitable inert gas for leak testing. Use only approved solutions for the leak test.
- **No smoking or open flame in the vicinity of O_2 equipment.** Observe the relevant regulations and distances according to ISO 21029-2.

Pressure Building Regulator

Cryogenic storage containers marked "PB" in the vessel type designation are equipped with a pressure building regulator. The pressure building regulator is set to 1 bar. The regulator should not be set above this value to avoid overlapping the range of the regulator and the relief valves.

Liquid Level Indicator

The contents of the containers are measured using a digital or float level indicator. Follow the appropriate instructions or manufacturer's manual when maintaining, calibrating, or replacing the batteries. It is essential to carry out maintenance, disassembly, and assembly of the level gauge while the container is positioned vertically. When reassembling the level indicator, make sure that the capacitive probe or float is correctly positioned in the guide ring inside the container.

Make sure to choose the correct scale of the liquid level gauge for the medium used:

- Disassemble the plastic cover.
- Replace the current scale for the desired one: for LIN/LOX/LAR (in liters/in cubic meters/in Nm^3/in percent).
- After replacing the scale reassemble the plastic cover.

11. Checking Container Performance

The cryogenic vessel AC consists of an outer and an inner vessel. The space between the containers serves as a highly efficient thermal barrier consisting of insulation and a vacuum. Each of these barriers is a very important part of the useful life of the container. The high technology insulation is very effective in preventing radiated heat or solid conduction from entering the container. The vacuum prevents heat convection from reaching the stored product. 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 gas molecules from the vacuum space. The vacuum maintenance system can perform its function for years but 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. When the container is filled with liquid, the outer casing will be much colder than normal.
2. The container may appear to ”sweat” if the air surrounding the container is hot and humid.
3. The relief valve will open continuously until the container is empty.
4. The container will hold pressure, but will not hold the liquid.

12. 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 after the vessel is allowed to stabilize is recommended to produce a Daily NER for each period.

1. Fill the container with liquid nitrogen up to half its volume.
2. Close the LIQUID valve, open the VENT valve and allow it to remain open during the test.
3. Allow the container to stabilize for 24 hours, and then weigh it. Record the weight, time, and date.
4. Reweigh after the recommended 48 hours. The test is most effective if the container is not moved during this period, and if conducted in an area where ambient temperatures are consistent. The following calculation will provide the actual Normal Evaporation Rate. Daily NER = [Weight Loss (Step 3- Step 4) / time elapsed (Hrs.)] x 24.

Compare the results of your test with the NER value ”as manufactured” in the SPECIFICATIONS section of this manual. A container in service should maintain a NER value less than twice the new specification. Any test result greater than twice the listed value is indicative of a failed, or failing, vacuum. If NER is found to be high, contact Auguste Cryogenics or your distributor.

13. Spare parts

The valves used are welded to the container. In case of leakages, we recommend replacing the internal parts of the valve by using a valve repair kit.

Mack Valve Repair Kit, Color Gray	Order number: 402212
Mack Valve Repair Kit, Color Green	Order number: 402213
Mack Valve Repair Kit, Color Blue	Order number: 402214

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

Other spare parts for AC 70 - AC 240

Relief valve 1.5 bar	Order number: 401423
Bursting disc 12 bar	Order number: 500049
Pressure gauge 0-4 bar	Order number: 414818
Connection CGA 295	Order number: 358342
PBU regulator set at 1 bar	Order number: 402693
Castor	Order number: 402074
Castor with the brake	Order number: 402078

14. Accessories

Trolley	Order number: Trolley
Withdrawal hose 1.2 m	Order number: 1700-9C65
Withdrawal hose 1.8 m	Order number: 1600-9C66
Phase separator, large	Order number: 1193-8C80
Square base	Order number: XL65-9C59

15. Cleaning, Taking Out Of Service

For cleaning and disinfection of the vessel suitable and approved solutions must be used. The selection of the right product is in the responsibility of the user due to the high number of applications and kinds of stored product. Auguste Cryogenics does not have the expertise to give a judgment about the effectivity of such solutions.

Spray the surfaces of the vessel with the selected solution. After 5 minutes the solution must be rinsed with 70% solution of alcohol and water. After 15 minutes all liquid must be removed from the container and the container must be wiped dry.

Discarded products have to be disposed of professionally. The vessel must be mechanically broken down into its individual parts. All necessary materials from stainless steel, aluminium and aluminium foil can be reused as recyclable materials. All plastics, epoxy tube, glass paper and the molecular sieve must be disposed of as industrial waste or incinerated. Electronic components (controller / control unit) must be supplied to the hazardous waste. Your local authority will give all disposal information.

Important:
If a vessel has to be returned to your supplier or to the manufacturer it must be cleaned and disinfected. A written statement must be confirmed by the sender (ask for ”Product Return Slip (AC 80001.00). If such document is missing the vessel will not be accepted and will be returned at the sender’s expense.

Continuity. Reliability. Quality.
We are **Auguste Cryogenics**.

AC SCS.1 Line
Vertikal Bulk Tanks

AC HSCS Line
Horizontal Bulk Tanks

AC SCS-LNG Line
Bulk Tanks

AC MBC/TCC Line
MicroBulk Tanks

AC Line
Liquid Cylinders

AC Medical Family
Aluminum Vessels

For more information about the Auguste Cryogenics product portfolio and our solutions for your cryogenic applications please contact our sales team!

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