Air Liquide	**Operating Instructions** Pressure Reducers for pure gases in cylinders	**OP 150** **Version : 1.1** **Date : February 2022** Owner : NEC Language : EN

Operating Instructions
Pressure reducers for cylinders used with pure gases or specialty gases

Pressure reducers single stage	Pressure reducers double stage
HD300 - HD CO - HD.S	HBS - HBSI - HBS.V
LH, IH	HBD.S
AHL	HBD.S T Purge
BS-A, BS-GL, BS.V-GL	
BSI-GL	
DLM, DLM-CO, DLM-BA	
DHP - DHPS	
DIM, DIM-GLC	
DIM T Purge	
DIM GLC T Purge	
HD.S, HD.S T Purge	
BD.S-GLC	
Hepal 12 Food	

Warning

To preserve the quality of our product throughout its usage in the best safety conditions, please read this manual carefully and strictly follow the instructions that it contains. Non- compliance with these instructions or modification of the product many results in serious accidents or bodily injuries. Air Liquide shall not be held responsible in case of non approved usage of the product.
Air Liquide reserves the right to make all necessary modifications to the specifications described hereafter without notice.

CONTENTS

1. FIELD OF USAGE AND CHARACTERISTICS

1.1 Functions

The pressure regulators are used:

- to reduce a high-pressure conditioned gas (200 or 300 bar at 15°C) in cylinder
- to regulate and maintain stability of outlet pressure.
- to preserve the gas purity.

The regulators are designed for implementation of pure gases and mixtures with purity < N60 thus ALPHAGAZ™ 1 and 2.

Vacuum treatment possible for occasional purge.

WARNING! These regulators should not be used as shut-off valves

1.2 Technical characteristics

Operating temperature: - 20°C to + 50°C.
Leakage rate (Internal/External): ≤ 3 x 10-7 mbar.l/ s helium.

1.3 Gas compatibility table

IMPERATIVE : check the gases compatibility of this equipment by referring to the "Gas Compatibility Table.

See in “APPENDIX”.

2. AIR LIQUIDE COMMITMENTS

2.1 Conformity

AIR LIQUIDE certifies that the equipment is manufactured, tested and controlled, in accordance with state of the art and AIR LIQUIDE rules.

It is the responsibility of the end user to ensure that such equipment is installed and used in accordance with the current regulations.

Directive 2014/68/EC: Pressurized equipment (PED)

Technical requirements of Article 4§3 indicates that Pressure equipment and assemblies below or equal to the limits set out in points (a), (b) and (c) of paragraph 1 and in paragraph 2 respectively shall be designed and manufactured in accordance with the sound engineering practice of a Member State in order to ensure safe use.

Without prejudice to other applicable Union harmonisation legislation providing for its affixing, such equipment or assemblies shall not bear the CE marking referred to in Article 18.
By design, these equipment may integrate pressure relief valves or burst disks. In this case, those ones shall neither be CE marked according to paragraph 2 of annex II.
In all other cases, pressure relief valves and burst disks shall be CE marked.

Directive 2014/34/UE ATEX :

The equipment is not in the scope defined in points a), b) et c) of the article of the ATEX Directive ; consequently, they shall not bear the CE marking.
The equipment are not capable of causing an explosion through their own potential sources of ignition: then, they can be installed in ATEX zone 1 or 2, as far as respecting up to date regulations, rules, operating instructions, in accordance with the sound engineering practice are followed during installation and use.
Reminder: it belongs to the end user to define the ATEX zone.

REACH regulation (EC) n°1907/2006 :

The pressure reducers are made of brass parts, essentially the body, which is a copper alloy with a lead content between 1% and 4% w/w.
As requested by art.33 of REACH Regulation (Registration, Evaluation and Authorisation of Chemicals) and with reference to current list of SVHC (substances of very high concern) available on ECHA website, we inform that lead may be present in a concentration above 0,1% w/w in our products made of brass.
Lead inclusion in the SVHC list in June 2018 does not modify the use conditions described in operating instructions.
Lead will not be released to the surrounding environment or the gas used during normal use.
After product end of life, the pressure reducers must be scrapped by an authorized metal recycler.

2.2 Cleaning

Each equipment is subject to a grease removal and a high quality cleaning to preserve the purity of gas in the equipment as well as for use with oxygen for compatible equipment.
A suitable packaging protects the equipment against exterior pollutants during storage and transport.
Take care to avoid polluting the equipment during installation.

2.3 Inspections

Equipment is inspected and has undergone a certified helium leak test prior to packing and dispatch.

2.4 Warranty

The warranty period for equipment supplied by AIR LIQUIDE is one year, covering faulty material or workmanship during manufacture. The warranty does not cover packing and return transport costs.
Excluded from warranty: seals and relief valves. These components are submitted to a natural wear.

Warranty is not valid on deterioration resulting from incorrect or improper use, use of spare parts which are not recommended by AIR LIQUIDE or from the none respect of this operating instruction.

For more information, refer to the general sales conditions of AIR LIQUIDE.

3. ASSEMBLY-ACTIVATION

3.1 Safety

First of all, it is ESSENTIAL to read and respect the safety instructions described in the document “General Safety Instructions” delivered with the product.

NEVER dismantle a component of the regulator in the High Pressure part, especially the cylinder inlet fitting.

3.2 Precautions before assembly

After opening the packaging, check that the equipment is not damaged and that the contents correspond to the accompanying delivery notes.

- During assembly, it is important to take extreme care to ensure cleanliness and avoid contamination.
- The regulators are designed to be directly mounted on high pressure gas cylinders. Ensure that the gas cylinders are installed on a smooth and level surface and that the cylinders are attached to their racks. This will prevent risk of falling.
- To install the equipment, select a ventilated area, protected from the effects of bad weather.

3.3 Assembly

3.3.1 Cylinder set up

- Check that the high-pressure inlet connection (4) is compatible with the cylinder valve connection. It must be clean and in perfect state.
- Screw in the fitting nut all the way
    - hand tightening in case of fitting with overmolded or knurled nut with O-ring seal
    - Fitting by wrench in case of other fitting types.

In case of combustible gases, the fitting must be generally tightened counter-clockwise. (Circular mark on the nut).

3.3.2 Pipe work set up

Outlet fitting (5) assembly on the regulator outlet port:

- Make sure that the supplied outlet fitting matches the application.
- Put in place the seal.
- Screw the outlet fitting on the regulator outlet port (tighten to 35 Nm with a wrench).
- Connect the pipe network and strongly fix it to avoid risks of flapping.

Collect of relief valve (6) :

- Original mounted relief valve are collectable (except the AHL regulator). During the setup of the equipment, it is recommended to connect the relief valve to an event (Compression fitting 6mm) in the following cases:
- Risk of anoxia (restricted space) with neutral gases,
- Risk of explosion (restricted space) with hydrogen,

3.3.3 Tee purge with corrosive gases

Tee purge systems are implemented on specific reducers DIM or HBD.S for use with corrosive gases or toxic gases.
Functions of tee purge system :

- allow the operator to handle safely the reducer during the cylinder change.
- maintain the quality of the gas during the use,
- increase the lifetime of the reduccers by reducing corrosive damages on materials.

To increase the lifetime of the equipment, an installation with corrosive gases shall :
1- be free of any trace of moisture (H_2O content<5 ppm) ; it means purge operation must be done before each use of corrosive gas and after each cylinder change.
2- Perfectly gastight (1 to 3 x 10-9 atm.cm3/s helium), that means a very high care on the installation .
Main corrosive gases used: HF, SO_2, NH_3, HBr, Cl_2, HCl, SiH_2Cl_2, BCl_3, SiF_4, BF3, F2, NO_2.
Purge gas to be used: nitrogen, argon very dry (H_2O content<5 ppm).

It is highly recommended to install the cylinder+pressure reducer in a chemical box for the very high toxic gases.

Tee purge use :
The tee purge is connected to the high pressure chamber of the reducer to allow a sweeping of the internal parts and downstream line with an pure inert gas. The corrosive and/or toxic gas is removed either by a long flowing or by several pressurizing/depressurizing cycles.

Tee pure mounting :
The tee purge is fitted with a valve to open the inert gas flow and the check-valve to avoid the reactive gas to flow back to the inert gas cylinder.
→ always check the gas compatibility with the materials inside the equipment wetted by reactive gas.

Recommendation for the upstream protection of the pipe network :

- Install a shut-off valve on the pipe upstream of the point of use.
- Install a relief valve suited to the application on the pipe (besides the relief valve of the equipment).
- The equipment relief valve is not designed to protect the application.
- The application owner is responsible for the safety relief valve (CE marked) to be installed for its application protection.
- If flow adjustment is needed, install a metering valve.

3.4 Assembly of a compression fitting

Check dimensions and respect material compatibility between connection and pipe: Connection and pipe must always be made from the same material, example: Stainless steel connection for stainless steel pipe <Rockwell hardness B90 (exception : brass connection with copper pipe).

Connector pre-assembled by hand

- After cutting, deburring and blowing on the tube (use preferably a tube cutter), pre-assemble the nut and the ferrules, following the order and the direction indicated in the figure.
- Introduce the tube inside the connector up to the stop limit on the body.
- Clamp the nut completely by hand
- Complete the clamping using a wrench by turning the nut a 1-1/4 turn.

3.5 Activation

Even if the tightness of each regulator is tested in a factory, it is necessary to ensure there is no leakage on the connections made during the assembly. Before carrying out this check, make sure that the downstream circuit is closed (towards the application).

Never stand directly in front of the cylinder valve outlet while opening it.

3.5.1 Checking of leakage on the upstream circuit

- Check that the regulator handwheel (3) is loose (counterclockwise)
- Open the cylinder valve
- Verify that the value indicated on the high pressure gauge (1) does not vary over a sufficiently long period
- If necessary, check the leakage on the upstream circuit (Inlet fitting and gauge) by using an AIR LIQUIDE leaks detector.

In case of leakage:

- Close the cylinder valve.
- Purge the regulator
- Check the seal and, if necessary, change it.
- Retighten the inlet connection. In case of compression fitting, make sure that the tube is fully inserted in the fitting. Check the ferrules, if necessary, change them.
- Retighten the compression fitting nut.

3.5.2 Checking of leakage on the downstream circuit

- Make sure that the valve on the outlet circuit is closed.
- Open the cylinder valve.
- Turn the handwheel clockwise to read the pressure on the outlet pressure gauge (2).
- Verify that the value indicated on the high pressure gauge does not vary over a sufficiently long period.

- If necessary, check the leakage on the downstream circuit (outlet fitting and gauge) by using an AIR LIQUIDE leaks detector.

In case of leakage:

- Close the cylinder valve.
- Purge the regulator.
- Turn the handwheel counterclockwise.
- Make sure that the tube is fully inserted in the fitting.
- Check the ferrules, if necessary, change them.
- Retighten the compression fitting nut.

Always turn valves GRADUALLY. NEVER retighten a fitting under gas pressure.

4. USAGE

4.1 Use

- Verify that the regulator handwheel (3) is loose (counterclockwise) and the valve upstream circuit is closed.
- Open the cylinder valve
- Read the pressure on the high pressure gauge (1).
- Turn the handwheel clockwise until you start feeling resistance. Then continue until you reach the required working pressure.
- Now the regulator is ready to regulate the working pressure.
- Read the outlet pressure on the low pressure gauge (2).
- Open the outlet valve.
- Adjust the outlet pressure if necessary.
- To stop the gas flow, close the cylinder valve or the valve upstream of the regulator.

4.2 After use

When the regulator is no longer used.

- Close the cylinder valve.
- Lower the pressure by the outlet.
- Loosen the handwheel (3) of the regulator.
- Close the upstream valve of the regulator.
- **Dismantle the regulator and store it safely from dust and moisture.**

5. MAINTENANCE

5.1 Troubleshooting

Default	Cause	Remedy
Mounting impossible	Connections cannot be mount	Verify the compatibility of gases, inlet and outlet
	Damaged connections	Replace the regulator
Insufficient flow rate	Cross section of passage limited by a valve	Open the valve
	Insufficiently filled or empty cylinder	Change the cylinder
	Valve not operating	Change the cylinder
	Under-dimensional equipment	Contact Air Liquide
	Downstream device not operational	Change the device
Gas leak	Tightness default	Close the cylinder valve and replace the safety valve
Gas comes out of the relief valve	Leakage at the poppet or damaged relief valve	
Rise of the outlet pressure	Leakage at the poppet	
Unstable outlet pressure or frosting	Working temperature too low	Close the cylinder valve. Bring back the equipment temperature above 0 °C
	Gas used is (Ar), carbon dioxide (CO_2) or nitrous oxide (N_2O)	Use a heater at the inlet
	Flow rate to high	Respect the max. flow rate of the regulator. Limit the flow by a valve or a calibrated orifice
Vibrations	low rate to high	Limit the flow by a valve or a calibrated orifice
	Presence of valve with quick opening on the downstream pipe	

5.2 Maintenance

Even though the equipment is reliable, it must be checked periodically. Since this task requires some precautions, it must be done exclusively by a qualified technician.

The periodicity of this verification depends essentially on the usage of the equipment (intensive, moderate, occasional).

In case of operating accident (insufficient output, leakage, opening of the relief valve or accidental damage) : replace the equipment.

Defective reassembly may cause bursting, malfunctioning and/or an increasing output pressure, which is dangerous for your safety.

6. APPENDIX: Gas compatibility tables

6.1 Chromed-brass HP Reducers

Reducer	P max	N_2	CO_2	CO	Air*	O_2	N_2O	H_2	C_2H_2	C_3H_8	C_3H_6	C_2H_4	CH_4
HBS	**200 bar**	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N
HD300	**200 bar**	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N
LH, IH	**200 bar**	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N
AHL	**200 bar**	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N
DLM*	**200 bar**	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N
DHP 200-50-10	**200 bar**	Y	N	N	Y	Y	Y	N	N	N	N	N	N
DHP 200-200-30	**200 bar**	Y	N	N	Y	N	N	N	N	N	N	N	N
DHPS 200-200-30	**200 bar**	Y	N	N	Y	N	N	Y	N	N	N	N	N

* **DLM-BA** shall be used only for **breathable air** applications.

6.2 Brass HP Reducers for CO

Reducer	P max	N_2	CO_2	CO	Air*	O_2	N_2O	H_2	C_2H_2	C_3H_8	C_3H_6	C_2H_4	CH_4
HD CO	**200 bar**	N	N	Y	N	N	N	N	N	N	N	N	N
DLM-CO	**200 bar**	Y	N	Y	N	N	N	N	N	N	N	N	N

6.3 Chrome-Brass LP Reducers used for liquified product or low pressure gas

Reducer	P max	CO_2	C_3H_6	C_3H_8	C_2H_4	C_2H_2	Corrosive liquid	Low pressure mixed gas
BS-A	**25 bar**	N	N	N	N	Y	N	N
BS-GL	**25 bar**	Y	N	N	N	N	N	Y*
BS.V-GL	**50 bar**	N	Y	Y	Y	N	N	Y*

Y*: check the pressure of the mixed gas cylinder and all components compatibility

6.4 SS HP Reducers

Reducer	Material	N_2	CO_2	CO	Air *	O_2	N_2O	H_2	C_2H_2	C_3H_8	C_3H_6	C_2H_4	CH_4
HBSI	stainless steel	Y	Y	Y	Y	N	N	Y	N	N	N	N	N
DIM- DIM T Purge	stainless steel	Y	N	N	Y	N	N	Y	N	N	N	N	Y
HD.S - HD.S T Purge	stainless steel	Y	N	N	Y	N	N	Y	N	N	N	Y	Y
HBD.S - HBD.S-T purge	stainless steel	Y	N	N	Y	N	N	Y	N	N	N	Y	Y

* Air: compressed air not breathable
In case of use with corrosive gas, check the compatibility between the equipment and the gas used.

6.5 SS reducers for corrosive liquified gases or low pressure mixed gas

Reducer	P max	C_3H_8	C_3H_6	C_2H_4	CH_4	Corrosive liquid	Low pressure mixed gas
DIM-GLC	**25 bar**	Y	Y	Y	Y	Y*	Y*
	70 bar	Y	Y	Y	Y	Y*	Y*
BD.S-GLC	**27 bar**	Y	Y	N	N	Y*	Y*

Y*: check the pressure of the mixed gas cylinder and seals compatibility with Air Liquide
**BD.S can be used with ammonia (NH_3)

For others corrosive liquified gas, make a request to Air Liquide.

6.6 HEPAL 12 FOOD

The HEPAL12 FOOD regulator is reserved exclusively for use with ALIGAL™ type food gases.

Models	P_1 max	P_2 max	N_2 /Ar	CO_2	CO	Air *	B.A	O_2	N_2O	H_2	C_2H_2	C_3H_8 (10 bar)	C_3H_6 (10 bar)	C_2H_4 (70 bar)	CH_4 (200 bar)
HEPAL12 FOOD 200-8-15	200	16	Y	Y	N	N	N	N	N	N	N	N	N	N	Y
HEPAL12 FOOD 200-16-25	200	16	Y	Y	N	N	N	N	N	N	N	N	N	N	Y

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