

**Operating manual
Phase separator
DC-PS-40**

Table of contents

I.	STRUCTURE OF THE MANUAL / CLARIFICATION	3
II.	SAFETY AND HEALTH CONCERNS	4
1	INTRODUCTION	5
1.1	Use of the phase separator	5
1.2	Operator working area	5
1.3	Transport and lifting	5
1.4	Mounting	5
1.5	Identification	6
2	INSTALLATION OF A PHASE SEPARATOR	7
3	FILLING A PHASE SEPARATOR	8
4	SAFETY OF A PHASE SEPARATOR.....	9
5	SETTING THE PRESSURE OF A PHASE SEPARATOR	10
5.1	General	10
5.2	Procedure for setting the opening pressure of the exhaust valve	10
6	ADJUSTING THE OPEN/CLOSE FILLING VALVE	11
7	ADJUSTING THE PROPORTIONAL FILLING VALVE	12
8	SURVEY SPARE PARTS.....	13
9	MAINTENANCE OF THE PHASE SEPARATOR.....	14
10	INTERVALS AND SCOPE OF INSPECTION OF SAFETY FACILITIES.....	14

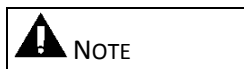
Operating Manual Phase Separator DC-PS-40

I. STRUCTURE OF THE MANUAL / CLARIFICATION

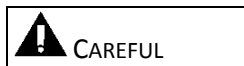
The various aspects of this manual are clearly listed here. Points of attention are marked throughout the entire manual in the following way (the interpretation is also given):



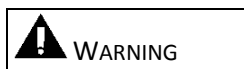
Offers suggestions/advice to the operator in order to perform certain tasks more easily.



Points out possible problems to the operator.



Indicates damage to the system or directly linked equipment when the operator does not carefully adhere to the procedures.



Warns the operator of possible injuries if the procedures are not adhered to properly.



The life of the operator is directly threatened.

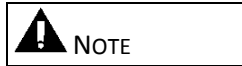
**Demaco Holland bv considers the operator to be:
the one who operates the machine or equipment supplied by Demaco Holland bv.**



The operator is responsible for the safety of any assisting employee. The operator must ensure, before starting the machine or application, that no dangerous situation can occur for the assisting employee.

Operating Manual Phase Separator DC-PS-40

II. SAFETY AND HEALTH CONCERNS



This user manual must be read by the operator as soon as possible in order for him to become familiar with the operation of this equipment.

From the point of view of injuries to the operator, specific attention is given to the dangers that can occur when using liquid nitrogen. On Demaco Holland bv equipment, where the operator may come into contact with liquid nitrogen, you can find the label as shown below. It warns the operator of the presence of coldness and it is indicated that safety glasses and gloves with wrist protection should be worn.



figure 1; *Safety label on Demaco Holland bv products*

This user manual should at least be available for consultation at the head of the department. We recommend that a copy is made of this manual, inserted in plastic folders, or bound, and is visibly presented alongside the control cabinet.

We also recommend to carefully read the Demaco safety instruction "Safety guidelines for working with cold media". Extensive information is provided in this manual about working with cryogenic media. A copy of the "safety instruction" is shipped with this delivery. Should you require more copies of this instruction in order to create a safe working environment for your operator(s), additional copies can be requested from Demaco Holland bv. Please contact our sales department.

Operating Manual Phase Separator DC-PS-40

1 INTRODUCTION

1.1 Use of the phase separator

The phase separator is designed to separate gaseous nitrogen from liquid nitrogen. The phase separator has the ability to reduce the pressure to a free adjustable and stable pressure. The phase separator has an internal storage capacity which allows to create a buffer in case of fluctuating consumptions. The Phase separator is available with an open/close filling valve control or optional with a proportional filling valve control. The phase separator is equipped with a level sensor which is connected to a level controller.

The phase separator interfaces:

Air supply	Quick connector Ø6, 6 barg
LN ₂ supply/outlet	Demaco Johnston Coupling DN25 (Ø28x1)
GN ₂ discharge	Demaco Johnston Coupling DN25 (Ø28x1)
Weight empty	appr. 75 kg

1.2 Operator working area

For safe operation of the phase separator the following points must be taken into consideration :

- Easy to access.
- Does not protrude passages or driveways.
- Adequate illumination level.
- Adequate space to operate and maintain the Phase separator.
- In case of direct blow-off a safe and ventilated area.

1.3 Transport and lifting

In case of transport or lifting of the phase separator the following points should be taken into consideration:

- Use a proper casing to protect the phase separator from damage.
- Only use the lifting lug attached to the phase separator for lifting.
- Only lift the phase separator when its empty.

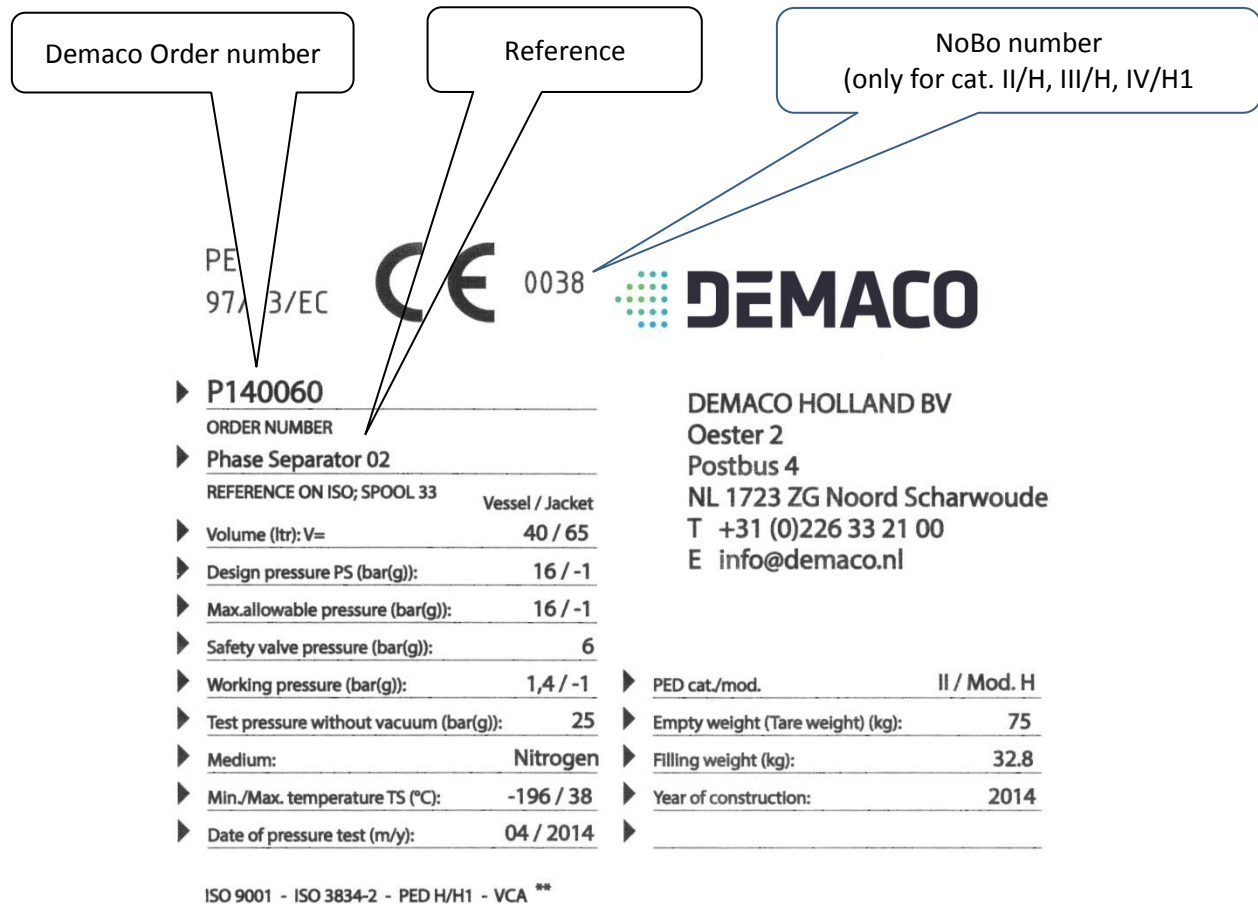
1.4 Mounting

- The phase separator must be attached firmly with the supplied support.
- The phase separator is designed for outside air temperature between 0°C and + 50°C.
- The phase separator must be protected from traffic loads or collisions using proper obstacles such as concrete poles or a steel frame.

Operating Manual Phase Separator DC-PS-40

1.5 Identification

Information about the phase separator is given on the dataplate which is affixed to it.




Demaco Order number

Reference

NoBo number
(only for cat. II/H, III/H, IV/H1)

PE
97/3/EC

CE 0038

 **DEMACO**

► **P140060**
ORDER NUMBER

► **Phase Separator 02**
REFERENCE ON ISO; SPOOL 33

	Vessel / Jacket
► Volume (ltr): V=	40 / 65
► Design pressure PS (bar(g)):	16 / -1
► Max.allowable pressure (bar(g)):	16 / -1
► Safety valve pressure (bar(g)):	6
► Working pressure (bar(g)):	1,4 / -1
► Test pressure without vacuum (bar(g)):	25
► Medium:	Nitrogen
► Min./Max. temperature TS (°C):	-196 / 38
► Date of pressure test (m/y):	04 / 2014

DEMACO HOLLAND BV
Oester 2
Postbus 4
NL 1723 ZG Noord Scharwoude
T +31 (0)226 33 21 00
E info@demaco.nl

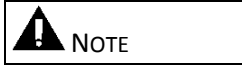
► PED cat./mod.	II / Mod. H
► Empty weight (Tare weight) (kg):	75
► Filling weight (kg):	32.8
► Year of construction:	2014

ISO 9001 - ISO 3834-2 - PED H/H1 - VCA **

figure 2; *Example of a dataplate*

Operating Manual Phase Separator DC-PS-40

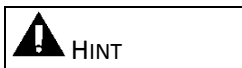
2 INSTALLATION OF A PHASE SEPARATOR



Inside Holland users of pressure equipment must perform an examination before bringing into use, Dutch term; “Keuring Voor Ingebruikname” (KVI), the user must select which equipment must have this examination. The rules are according the Dutch “Waren Wet Besluit Drukapparatuur” (WWBD).

During the installation of a phase separator, all required connections must be fitted by Demaco Holland bv personnel. All supply and discharge VIP piping is connected. The power supply for the level controller and the compressed air for the electrical/pneumatic filling is connected.

Filling of a Phase separator is assumed to be done from a storage tank already filled with liquid nitrogen.



When filling a phase separator with liquid nitrogen, one has to realise that the phase separator first has to be cooled down from room temperature to -196°C . This means that the first quantity of nitrogen will evaporate. Only after a period of time, depending on the contents of the phase separator, the phase separator will start filling with liquid nitrogen.

Verify, after the installation of the phase separator has been completed, that the level controller works properly. Refer to the instructions in the separate user manual of the level controller and the level sensor. By checking the LED on the electro-pneumatic on/off filling valve the functioning of the filling valve can be checked. By checking the display on the electro/pneumatic proportional filling valve the functioning of the filling valve can be checked. After this functional test the factory set values of the level settings can be adjusted when you want to use values different from the factory set values. Also refer to the separate manual of the level controller.

Operating Manual Phase Separator DC-PS-40

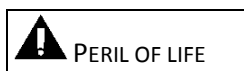
3 FILLING A PHASE SEPARATOR

Switch off the level controller. This will cause the filling valve to close.

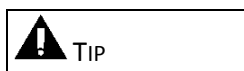
Open the manual valve at the main tank. It is most likely located outside, below the main tank.



When the system is supplied without exhaust piping connected to the exhaust valve, cold nitrogen gas will start flowing from the exhaust valve immediately after switching on the level controller. Ensure that persons or vulnerable equipment cannot be injured/damaged by this cold gas flow.



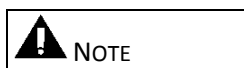
When the phase separator is installed in a confined space, danger of suffocation exists. This being, because the amount of nitrogen from the phase separator can displace the air (oxygen) from the space. In this case exhausting the gas to a safe remote atmosphere is necessary.



Immediately after switching on the level controller, nitrogen gas will flow from the exhaust valve. This will make some noise. Don't let this frighten you. As soon as the phase separator is cold, the gas flow will reduce, and the noise will cease.

Switch on the level controller. The phase separator will now start filling itself with the liquid nitrogen up to the "filling level". This level has been set by either Demaco Holland bv (see separate manual level controller) or by the user.

Once this level has been reached, the filling valve will close automatically. Now the set pressure in the phase separator will stabilise (to be read on the pressure gauge at the top of the phase separator), or in case of a non-pressurised phase separator (no pressure gauge), the pressure will stabilise at the atmospheric pressure.



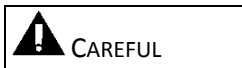
Some cold nitrogen gas will always escape as exhaust. This gas occurs as a result of the small heat leak into the inner vessel. Therefore this does not indicate leakage.

Now the phase separator is filled and ready to feed the application with pure liquid nitrogen.

4 SAFETY OF A PHASE SEPARATOR

Through the exhaust valve and exhaust piping each phase separator is connected with the environment. In case of a non-pressurised phase separator there is a direct (open) connection with the environment. In the case of a pressurised phase separator, an exhaust valve is positioned on top. The normally closed exhaust valve is directly operated by the pressure in the inner vessel of the phase separator (orange tubing). As soon as the pressure becomes too high, the exhaust valve is opened and the pressure is relieved up to the set value.

Apart from this possibility to relief the pressure, a safety valve has been fitted on each phase separator. Should the exhaust piping be blocked, the pressure build-up in the phase separator shall be relieved by the safety valve. Therefore a safe situation is always guaranteed.

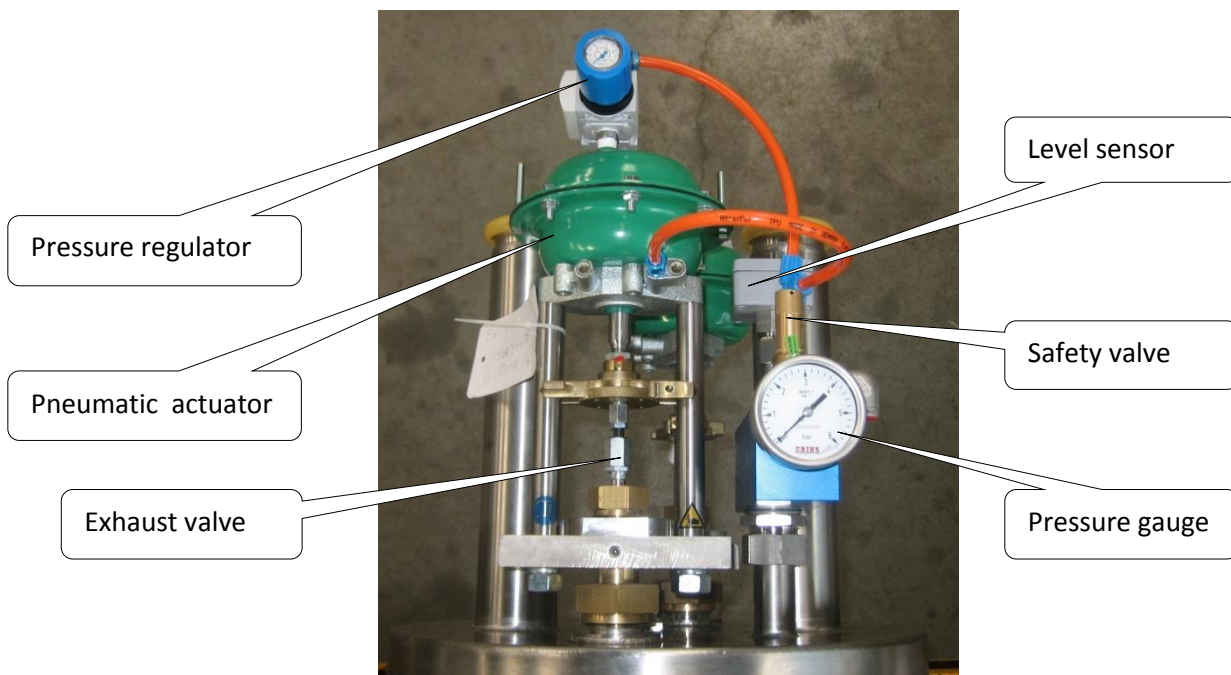


Once the safety valve has engaged, the system must be verified in order to determine the cause. Only after this problem has been solved, the phase separator can be filled again.

Operating Manual Phase Separator DC-PS-40

5 SETTING THE PRESSURE OF A PHASE SEPARATOR

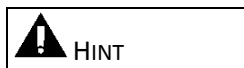
The phase separator can be supplied in two versions. The non-pressurised version of the phase separator does not need to be checked. The version with exhaust valve must be checked as described above. In case of a deviation of the set pressure, the procedure described below must be followed.



5.1 General

The opening pressure of the exhaust valve is determined as follows:

The pneumatic actuator on the exhaust valve is connected with the internal vessel of the phase separator and the pressure regulator (orange tubing). By varying the setting of the pressure regulator, the opening pressure of the exhaust valve can be set.



The opening pressure of the exhaust valve can only be adjusted when the phase separator is in operation (filled with liquid nitrogen).

5.2 Procedure for setting the opening pressure of the exhaust valve

1. Check the current pressure of the phase separator on the pressure gauge on top of the phase separator. When the indicated pressure is lower than the required pressure, the pressure on the pressure regulator will have to be increased. When the indicated pressure is higher than the required pressure, the pressure on the pressure regulator will have to be decreased.
2. After making the adjustment, wait about 15 minutes in order to give the phase separator time to adjust to the new set pressure.
3. Repeat adjustment of the pressure as many times as required to obtain the required pressure setting.

6 ADJUSTING THE OPEN/CLOSE FILLING VALVE

The normally closed filling valve of the phase separator is controlled by the level controller. The pneumatic actuator on the filling valve is air opens, spring returns.

The pneumatic valve is a normally closed solenoid valve with manual override.

By adjusting the pressure regulator, the travel way of the filling valve can be increased or decreased.

Adjusting may be necessary for quieter filling of the phase separator.

The minimum air pressure needs to be 2,2 bar(g).



Operating Manual Phase Separator DC-PS-40

7 ADJUSTING THE PROPORTIONAL FILLING VALVE

The proportional filling valve of the phase separator is controlled by the level controller. The pneumatic actuator is operated by a proportional pressure control valve. The inlet air pressure needs to be 6 bar(g), adjustable by the pressure regulator.

By adjusting the SPAN potentiometer, the travel way of the filling valve can be increased or decreased.

Adjusting may be necessary for quitter filling of the phase separator.

This potentiometer is accessible by peeling open the rubber dust cover.

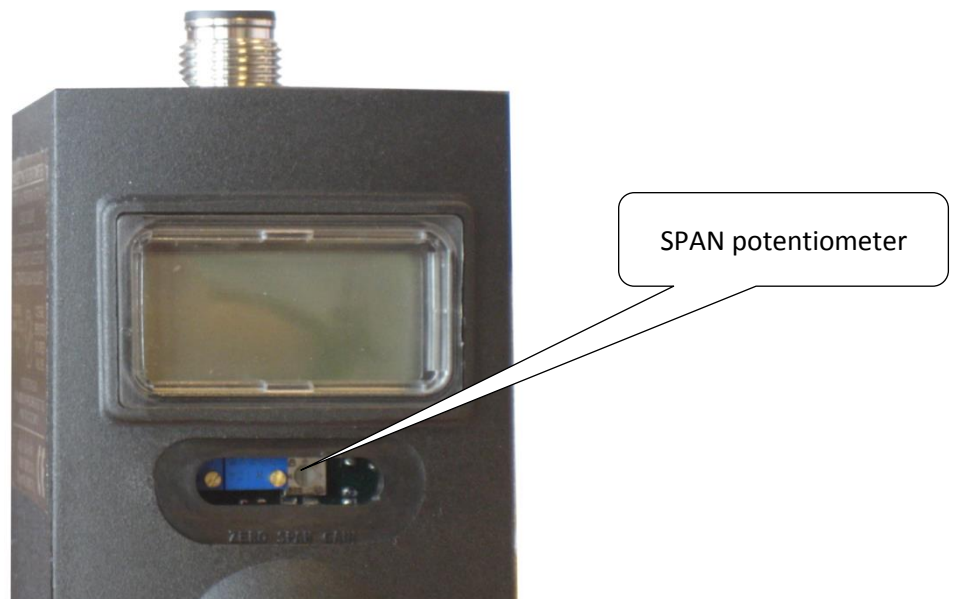


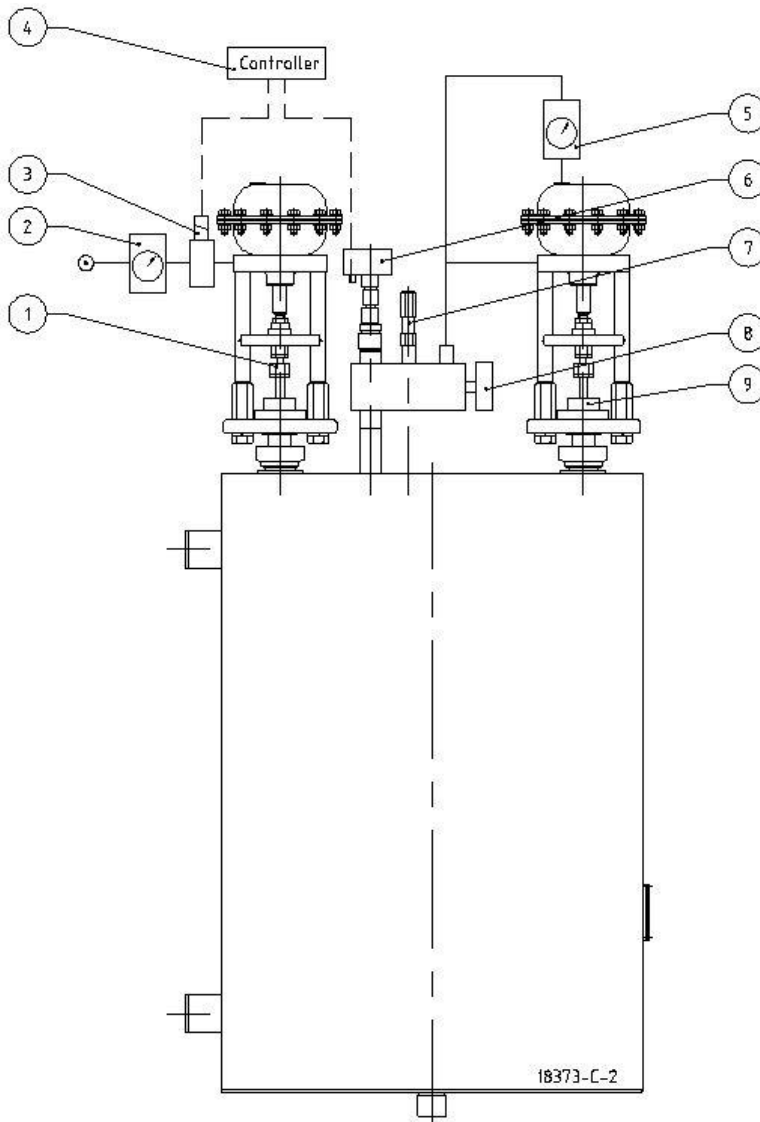
=> travel way decreases.



=> travel way increases.

The rubber cover must be replaced carefully after adjustment to maintain an IP65 rating.



8 SURVEY SPARE PARTS


1. Filling valve
2. Pressure regulator
3. Pneumatic valve
4. Level controller
5. Pressure regulator
6. Level sensor
7. Safety relief valve
8. Pressure gauge
9. Exhaust valve

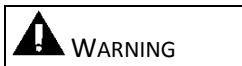
Operating Manual Phase Separator DC-PS-40

9 MAINTENANCE OF THE PHASE SEPARATOR

A phase separator is a maintenance free product. However, we recommend to periodically check a number of points in order to eliminate possible wear in the earliest possible stage.

We recommend thorough checking of the following points monthly:

1. If the outer jacket of the phase separator shows severe condensation, it may indicate a high degree of humidity in the building. If this is not the case, then there's a possibility that the insulation vacuum in the phase separator has degraded. Please contact Demaco Holland bv. Un insulated parts of course always show condensation or ice forming.
2. Check whether the VIP piping of the phase separator is free of condensation and ice. Perform the same inspection as described at point 1 when condensation is visible.
3. Check the connections of the fittings at the top side of the phase separator for ice deposits. No ice deposits may be visible.
4. Check whether the pressure gauge at the top of the phase separator indicates the correct pressure. Refer to the order data for the correct setting. When this deviates, you can set the pressure of the phase separator conform section 5. This does not apply to non-pressurised phase separators.
5. Check whether the glands of the filling valve and exhaust valve are free of ice. When ice is visible, the gland nut must be slightly tightened. (See maintenance instruction valve). Before commencing any maintenance, make sure the valve is warm.
6. Check whether the opening of the exhaust valve/piping and the opening of the safety valve are free of any obstacles.



When these glands are over tightened, the valves could stick in the open position. Therefore act carefully and check the proper function.

10 INTERVALS AND SCOPE OF INSPECTION OF SAFETY FACILITIES.

The phase separator is equipped with a safety relief valve which must undergo regular inspection in accordance with the local regulations.