MAXIMATOR®

Maximum Pressure.

Air driven liquefied gas pump

SLGP 3-..., SLGP 3-3-..., GLGP 5-..., GLGP 5-5-...

Installation and operating manual

Key information!
Follow the manual for safe and proper use.
Keep the manual near the machine for later reference.

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Warranty and liability:

As a general rule, the “General Terms and Conditions” of Maximator GmbH shall apply. These terms and conditions are available at http://www.maximator.de.

Warranty and liability claims shall not be accepted if they can be attributed to one or more of the causes mentioned in this manual or explicitly stipulated below:

– Any use other than the intended use indicated in this manual
– Improper commissioning, operation or maintenance
– Operation with faulty safety equipment or incorrectly installed safety equipment and safeguards
– Failure to observe the commissioning, operation and maintenance instructions in this manual
– Insufficient monitoring of wear parts
– Wear on seals, guiding elements, etc. due to ageing and operation

02/03/2023 Translation

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1 General information

1.1 Information regarding this manual

The air driven liquefied gas pump from Maximator is used for oil-free delivery and compression of refrigerants and other compatible operating fluids. This manual applies to the following types of air driven pumps: SLGP 3-..., SLGP 3-3..., GLGP 5-..., GLGP 5-5-... (referred to as "pump" in subsequent sections) and a serial number above 22000001.
The general drawing included is an integral part of this manual and must be stored with it.

1.2 Order code

The order code for the liquefied gas pump is structured as follows:

XLGP X-X - X - X

a b c

a	Model for example: SLGP 3, GLGP 5-5, ...
b	O-ring material HP side for example: -FKM, -EPDM
c	additional codes for device options and/or variants for example: -FS, -NPT, -FEC

1.3 Rating plate

The rating plate is located on the drive unit of the pump and contains the following specifications:

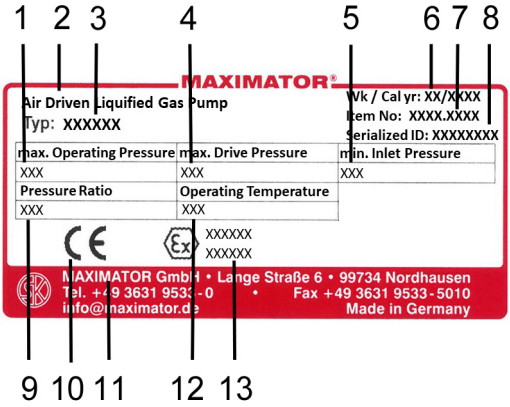


Fig. 1-1 Liquefied gas pump rating plate

1 Max. permitted operating pressure
2 Air driven liquefied gas pump
3 Type (specifications from the order code)
4 Maximum drive pressure
5 Minimum inlet pressure
6 Calendar week/year of manufacture
7 Article number
8 Serial number
9 Pressure ratio
10 CE label
11 Manufacturer contact information
12 Operating temperature range
13 ATEX label

1.4 Explanation of symbols

DANGER

This combination of symbol and signal word indicates a hazardous situation which - if not avoided - may lead to severe injuries or death.

WARNING

This combination of symbol and signal word indicates a potentially hazardous situation which - if not avoided - may lead to severe injuries or death.

CAUTION

This combination of symbol and signal word indicates a potentially hazardous situation which - if not avoided - may lead to light or minor injuries.

NOTICE

This combination of symbol and signal word indicates a potentially hazardous situation which - if not avoided - may lead to property damage or damage to the environment.

WARNING

This combination of symbol and signal word characterises contents and instructions for the intended use in potentially explosive areas. If failing to comply with instructions marked as such, an increased risk of explosion will be posed and may result in severe or fatal injuries.

1.5 List of abbreviations and formula signs used

Abbreviation	Description
Fig.	Figure
Tab.	Table
max.	maximum
min.	minimum
pcs.	pieces
No.	Number
s	seconds
PPE	Personal protective equipment
ex.)	for example
CE	EU mark of conformity
DGRL	EU pressure equipment directive
ATEX	EU explosion prevention directive
EPL	Equipment Protection Level
CET	Central European Time

Tab. 1-1 List of abbreviations

Formula symbol	Description
i	Pressure ratio
p_B	Operating pressure
p_L	Drive pressure
p_A	Primary gas pressure
T	Temperature
T_A	Input temperature
T_B	Output temperature
κ	Isentropic exponent

Tab. 1-2 Formula symbol

1.6 Qualification of the personnel

Only appropriate, qualified and instructed specialist personnel should be permitted to work with the liquefied gas pump. Allowing unqualified personnel to work on the pump or enter the danger zone creates hazards which could lead to death, severe injuries and significant property damage.

2 Safety and protection measures

The following sections stipulate the residual risks associated with the product, even when used as intended. In order to reduce the risk of personal injuries and material damage, and to prevent hazardous situations, you must observe the safety information listed in this section and the warnings in all other sections of this manual.

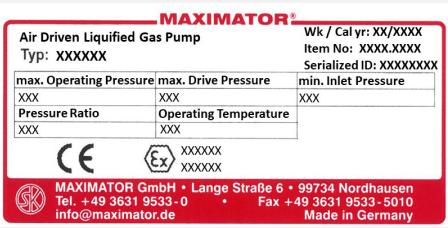
2.1 Personal protective equipment

Personal protective equipment (in other sections also referred to as PPE) protects personnel from occupational safety and health hazards while at work.

Wearing personal protective equipment may be required during work on the product. Wherever possible, this personal protective equipment is listed in these instructions for the individual work steps.
However, detailed specifications of the required protective equipment can only be determined with full knowledge of the system. The required personal protective equipment should therefore be determined by the user.

2.2 Signs and labels

The following signs are found on the pump.
Over time, labels can become unrecognisable due to dirt or other causes. As a result, hazards cannot be identified, or necessary operating indications cannot be followed. Resulting errors can lead to severe injuries or death.
Keep the labels in good, legible condition and replace any damaged labels.

Signs and labels	Graphic display
Rating plate: The rating plate is affixed to the drive unit of the pump. The rating plate indicates the operating characteristics of the pump.	

Tab. 2-1 Overview of labels

2.3 Work and danger zone

The danger zone comprises the entire area surrounding the product. The hazards associated with the product and the danger zone depend on the application and the installation location. The danger zone should therefore be determined by the user.

During assessment, check the following leak points:

leak point	leak type	leak source	Comment
bleed port	Minor release	high-pressure seal, rod seal on drive side	On the -FS version, the bleed port is equipped with a flame safeguard.
Booster head/cylinder	Unexpected	Sealing on booster head and cylinder	
Connection screw fitting	Unexpected	Loose screw connection	
Connecting line drive/HP	Unexpected	connection line/ fitting/O-ring	
drive housing parts	Unexpected	seals in drive unit	

Tab. 2-2 leak point danger zone

The hazards are due to the high pressure and extreme temperatures of the conveyed medium and/or the hazardous substances used.

As part of their work, the plant design engineer must define detailed danger zones in the high-pressure equipment and has the specialised knowledge necessary in order to do so.

2.4 Non obvious hazards

Using asphyxiant operating fluids can lead to severe injuries or death by asphyxiation. Assess the risk for the equipment in the risk assessment. The following are some potential corrective actions:

– Operate the pump in an adequately ventilated space.
– Check the pump for leaks on a regular basis.
– Ensure that lines are connected in such a way as to remain leak-tight for a long time.
– If necessary, use connecting lines to remove the escaping operating fluids.

2.5 Residual risks

2.5.1 Start-up and shut down

When the pneumatic power supply is restored or the operating parameters are modified, the pump can start up unexpectedly. This can lead to severe injuries or death.

Assess the risk for the equipment in the risk assessment.

There is no command device for safe shut-down (E-stop). This can lead to severe injuries or death.

Assess the risk for the equipment in the risk assessment.

2.5.2 Risk of injury posed by noise

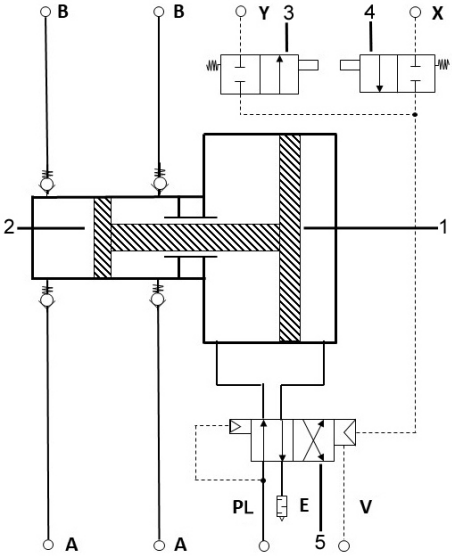
The noise level emitted in the work area depends on the mounting and application.

Assess the risk for the equipment in the risk assessment.

3 Product description

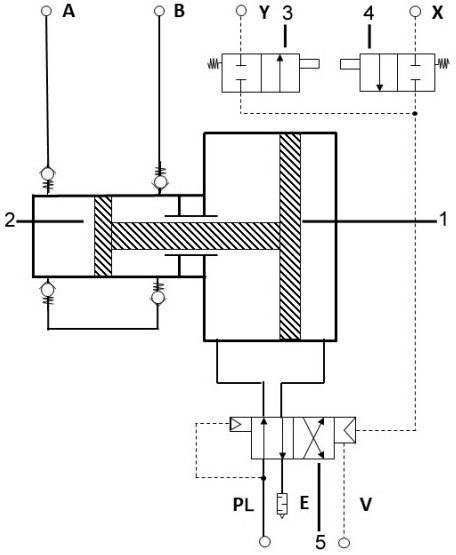
3.1 Design and function

Design of SLGP 3 and GLGP 5 (air reversal, with control air, double-acting)



1	Air piston	A	Gas inlet
2	High-pressure piston	B	Gas outlet
3	Pilot valve lower cap	PL	Drive air port
4	Pilot valve top cap	E	Exhaust port
5	Control slide valve	V	Spool valve air supply port
		Y	Pilot valve air supply port
		X	Pilot port

Design of SLGP 3-3 and GLGP 5-5 (air reversal, with control air, two-stage)



1	Air piston	A	Gas inlet
2	High-pressure piston	B	Gas outlet
3	Pilot valve lower cap	PL	Drive air port
4	Pilot valve top cap	E	Exhaust port
5	Control slide valve	V	Spool valve air supply port
		Y	Pilot valve air supply port
		X	Pilot port

Functional description SLGP 3, SLGP 3-3, GLGP 5, GLGP 5-5

The operating principle of a liquefied gas pump is similar to that of a pressure intensifier. Low pressure is applied to the large area of the air piston (1) which applies high-pressure to the small area of the high-pressure piston (2).

The piston of the pump performs oscillating movements until the stall pressure is reached. In so doing, the high pressure piston delivers and compresses the conveyed fluid by means of the check valves in gas inlet (A) and gas outlet (B).

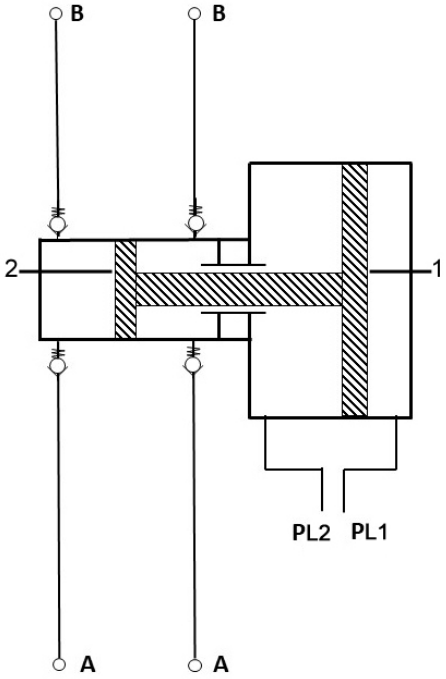
The outlet pressure results from the set drive pressure, primary pressure and volume flow.

The continuous supply is achieved by means of an internally controlled directional valve, the spool valve (5). The spool valve alternately guides the drive fluid to the two sides of the air piston.

The spool valve is controlled by two directional valves, the pilot valves (3, 4), which are operated mechanically by the air piston in its stop positions. The pilot valves aerate and vent the operating area of the control slide valve.

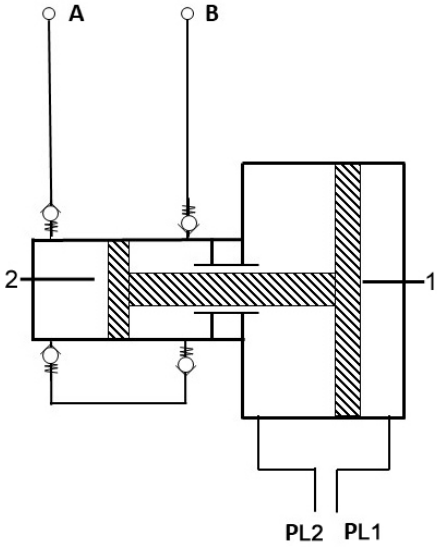
An equilibrium of forces on the drive and high-pressure side is generated as soon as the stall pressure is reached. The liquefied gas pump stops and no longer consumes drive fluid. A pressure drop on the high-pressure side or a pressure increase on the drive side result in an automatic restart of the liquefied gas pump while the compressed fluid is compressed until an equilibrium of forces is restored.

Design of pressure intensifiers SLGP 3-DÜ and GLGP 5-DÜ (double-acting)



1	Air piston	A	Gas inlet
2	High-pressure piston	B	Gas outlet
		PL1	Drive air port 1
		PL2	Drive air port 2

Design of pressure intensifiers SLGP 3-3-DÜ and GLGP 5-5-DÜ (two-stage)



1	Air piston	A	Gas inlet
2	High-pressure piston	B	Gas outlet
		PL1	Drive air port 1
		PL2	Drive air port 2

Functional description SLGP 3-DÜ, SLGP 3-3-DÜ, GLGP 5-DÜ, GLGP 5-5-DÜ

The operating principle of a liquefied gas pump is similar to that of a pressure intensifier. Low pressure is applied to the large area of the air piston (1) which applies high-pressure to the small area of the high-pressure piston (2).

Continuous discharge is achieved by actuating the air piston side in alternation via the drive air ports (PL1, PL2).

The piston of the pump performs oscillating movements until the stall pressure is reached. In so doing, the high pressure piston delivers and compresses the conveyed fluid by means of the check valves in gas inlet (A) and gas outlet (B).

The outlet pressure results from the set drive pressure, primary pressure and volume flow.

An equilibrium of forces on the drive and high-pressure side is generated as soon as the stall pressure is reached. The liquefied gas pump stops and no longer consumes drive fluid.

3.2 Intended use

Within their technical limits, liquefied gas pumps are used to deliver and compress compatible refrigerants and other compatible operating fluids.
If the liquefied gas pump bears an ATEX label and comes with a declaration of conformity, it is designated for use in corresponding potentially explosive areas.

3.3 Foreseeable misuse

The product may only be used in accordance with the indications in this manual.

The product cannot be used for:

– sealing containers
– producing/processing food with direct contact
– producing pharmaceutical products in direct contact

3.4 Misuse

Unauthorised modifications or technical changes to the product may lead to accidents with serious or fatal injuries.
Never carry out unauthorised modifications or technical changes to the product!

3.5 Ports

Comply with the connected load specifications for all interface connections. Refer to the enclosed general drawing for the connection ports available on the respective pump.

The following interfaces are standard on the pumps:

Drive air inlet "P_L"

Input of drive fluid.

Inlet port "A"

Input of operating fluid.

Outlet port "B"

Output of operating fluid.

Exhaust port "E"

Output of expanding drive fluid.

Pilot air port "X"

Port for pilot air. The pump will only operate if the pilot air connection is pressurised. The pressure of the pilot air must always be larger or equal to the drive pressure to ensure trouble-free function. The same requirements regarding compressed air quality apply to the pilot air as to the drive air.

Spool valve “V” ventilation port

Ventilation and bleeding of the spool valve. The port must not be obstructed.

Pilot valve "Y" exhaust port

Bleeding of the spool valve actuator chamber. An air pulse escapes here after each stroke. The port must not be obstructed.

This port can be used to connect a stroke counter.

Bleed port high-pressure side “Z”

Discharge of the leakage from the high-pressure unit and the pneumatic drive. A bleed pipe can be connected. The bleed port opening must not be obstructed.

3.6 Technical specifications

3.6.1 Operating conditions

Ambiance

Specification	Value	Unit
Ambient temperature, min.	- 20	°C
Ambient temperature, max.	+ 60	°C
Installation area	protected against climatic exposure	

Tab. 3-1 Ambient conditions

Operating fluids (based on ISO 8573-1)

Specification	Value	Unit
Operating temperature, minimum[a]	- 20	°C
Operating temperature, maximum.[b]	+ 60	°C
max. particle count at 0.1 - 0.5 µm size	not indicated (Class 3)	pcs.
max. particle count at 0.5 - 1.0 µm size	90,000 (Class 3)	pcs.
max. particle count at 1.0 - 5.0 µm size	1,000 (Class 3)	pcs.
max. solids, particle concentration	5 (Class 6)	mg/m³
Particle size, max.	10	µm

a. Depending on the design of the liquefied gas pump (see enclosed general drawing)

b. Depending on the design of the liquefied gas pump (see enclosed general drawing)

Tab. 3-2 Operating fluids

The liquefied gas pump can be used with all refrigerant of class A1, A2, A2L or A3 as per DIN EN 378-1, as well as all other operating fluids, provided they are not chemically or physically corrosive to the pump materials. The refrigerants and other operating fluids should not pose any danger to the personnel. The pump is not suitable for use with unstable, ignitable or oxidising operating fluids. The materials used can be found on the enclosed general drawing. Special versions of the liquefied gas pump can be suitable for other operating fluids. If you are unsure regarding the use of a special fluid, please don't hesitate to contact Maximator.

The most common operating fluids of the approved safety classes are shown in the following table:

Refrigerant number	Formula symbol	Safety class
R 12	CCl_2F_2	A1
R 134a	CH_2FCF_3	A1
R 142b	CH_3CClF_2	A2
R 32	CH_2F_2	A2L
R 1234yf	$CF_3CF=CH_2$	A2L
R 290	$CH_3CH_2CH_3$	A3
R 600a	$CH(CH_3)_3$	A3

Tab. 3-3 Examples of approved operating fluids

In case of applications with special fluid quality specifications beyond those typically used in high pressure systems engineering, the equipment manufacturer must verify that the pump is suitable for the application. Such applications include (but are not limited to):

– Compression of auxiliary fluids in food processing
– Applications in the pharmaceutical industry without direct contact
– etc.

Drive fluids (based on ISO 8573-1)

Specification	Value	Unit
Drive pressure p_L, min.	1	bar
Drive pressure p_L, max.	10	bar
Drive fluid	Compressed air[a] or nitrogen	
Drive fluid temperature, min.	- 20	°C
Drive fluid temperature, max.	+ 60	°C
Max. compressed air purity class of oil	5 (Class 4)	mg/m³
Max. particle count of 0.1 - 0.5 µm size	not indicated (Class 3)	pcs.
Max. particle count of 0.5 - 1.0 µm size	90,000 (Class 3)	pcs.
Max. particle count of 1.0 - 5.0 µm size	1,000 (Class 3)	pcs.
Max. solids, particle concentration	5 (Class 6)	mg/m³
Max. pressure dew point for humidity	+ 3[b] (Class 4)	°C
Max. particle size	10	µm

a. Maximator pumps generally do not need a compressed air oiler as they are treated with special grease during installation. However, after the first time an oiler is used, the drive fluid should always be oiled, since the oil washes the special grease out. In case a compressed air oiler is used, the oil must comply with DIN 51524 - ISO VG 32 specifications.

b. For drive fluid temperature of 20 °C. Depending on the temperature of the drive fluid, different values may be required.

Tab. 3-4 Drive fluid requirements

Drive with compressed air

Maximator liquefied gas pumps generally do not need a compressed air oiler as they are treated with special grease during installation. However, after the first time an oiler is used, the drive fluid should always be oiled, since the oil washes the special grease out. In case a compressed air oiler is used, the oil must comply with DIN 51524 - ISO VG 32 specifications.

If dry or very dry compressed air is used, a pump with FEC option will be recommended.

Drive with nitrogen

As standard, all Maximator liquefied gas pumps can be operated with nitrogen. This is equivalent to operation with dry or very dry compressed air.

Drive with other gases

A drive using other gases or gas mixtures (e.g. natural gas) is principally possible. The gas mixtures used must not be ignitable. The gas mixtures used must not be chemically unstable. The suitability of the drive fluid must be checked. Special materials or drive variants must possibly be used (e.g. drive with exhaust air port line). Maximator will be happy to support you with this.

3.6.2 Dimensions and weight

The dimensions and weight of the liquefied gas pump are indicated on the general drawing.

3.6.3 Performance values

The performance values of the liquefied gas pump can be found on the rating plate and general drawing.

For more detailed information on the respective pump, including characteristic curve and connection diagram, please refer to the respective data sheet on the Maximator website at http://www.maximator.de.

Permissible leakage rate

The following leakage rate thresholds apply to the pumps in as-delivered condition. Leakage from bleed port "Z" and leakage from the check valves are assessed separately. Refer to the "Maintenance" section for instructions on measuring leakage.

Leakage point	Leakage rate threshold	Unit
Bleed port "Z"	60[a]	cm^3/min
Check valves	30[b]	cm^3/min

a. static

b. static, measured from port B to port A, both check valves in series

Tab. 3-5 Permissible leakage rate in as-delivered condition

The following leakage rate thresholds must be observed to ensure operational safety. Lower leakage rate thresholds might apply, depending on the equipment:

Measuring point	Leakage rate threshold	Unit
Bleed port "Z"	0.5% of discharge[a]	-
Check valves	90[b]	cm^3/min

a. measured at port

b. static, measured from port B to port A, both check valves in series

Tab. 3-6 Permissible leakage for operational safety

3.6.4 Service life

The service life of the product depends on the conditions of use. The service life should therefore be determined and defined by the user.

4 Transport, packaging and storage

4.1 Dimensions and weight

The dimensions and weight of the product are indicated in the general drawing.

4.2 Delivery

Scope of delivery

Designation	Quantity
Liquefied gas pump	1
Installation and operating manual including Declaration of Incorporation and EU Declaration of Conformity	1
General drawing	1

Tab. 4-1 Scope of delivery

4.3 Packaging

The individual packages are packed according to the conditions expected for transport. Separate packaging should be used for transport and dust protection. The packaging is supposed to protect the individual components against transport damage, corrosion and other damage up to its place of use.

Do not remove the dust protection until shortly before installation.
Dispose of the packaging materials in an environmentally friendly manner.

4.4 Storage

Note the following with regard to package storage:

- Do not store the packages out of doors.
- Keep the packages dry and dust-free.
- Do not expose the packages to corrosive media.
- Keep the packages protected from sunlight.
- Prevent mechanical vibrations.
- Maintain a storage temperature of -20°C to +60°C.
- The relative humidity should not exceed 60%.

Storage instructions in addition to the specifications mentioned here may be attached to the packages.

Maintenance during storage

Even under the aforementioned storage conditions, the pump cannot be stored indefinitely.

– If in storage for longer than 3 months: Inspect the packaging and the pump for damage on a regular basis.
– Replace all the seals at least every 6 years.
– The pump must be briefly operated every 6 weeks. In doing so, connect drive air of at least 3 bar. A resistance of 2 bar at the outlet is sufficient to briefly activate the sealing element.

5 Installation

5.1 Prerequisites for installation

Observe the manual and general drawing of the product.
In addition, the following conditions must be met:

– The product must be free of damage.
– The product must be easily accessible from all sides.
– Install the product in a clean environment.

5.2 Installing the pump

The product is enclosed in dust-protection packaging. Do not remove this packaging until shortly before installation. Dispose of this packaging in an environmentally friendly manner.

Attach the pump to the fastening holes provided using screws or bolts with a strength of at least 4.6. Determine the adequate screw or bolt size using the enclosed general drawing.

The preferred installation position is vertical.

5.3 Installation of connecting lines

The liquefied gas pump is delivered without any connection screw fittings or connecting lines. For this purpose, observe the specifications in section “Connections” and on the general drawing. To prevent malfunctions, the cross-sections of the connecting lines must be designed for the corresponding volume flows.

5.3.1 Connecting the drive air

Connect the connecting line for the drive air to the drive air port (P_L) of the spool valve housing. Observe the connection specifications on the general drawing.

5.3.2 Control air connection

Using a tube or a pipe, connect the control air to the pilot port (X) of the pump. Observe the connection specifications on the general drawing.

5.3.3 Connecting the inlet line and outlet line

Connect the inlet and outlet lines to the corresponding pump ports (A and B) as appropriate. Observe the connection specifications on the general drawing.

5.3.4 Connecting a separate bleed pipe

If necessary, connect the bleed pipe to the bleed port (Z) as appropriate. Observe the connection specifications on the general drawing.

5.3.5 Exhaust silencer installation

If the exhaust air connection pipe of the liquefied gas pump is not installed separately, the enclosed exhaust air silencer must be installed at the corresponding port.

5.4 Commissioning

5.4.1 Prerequisites for commissioning

Observe the manual and general drawing of the product.
In addition, the following conditions must be met:

- The product must be free of damage.
- The product must be securely attached.
- The equipment-specific stall pressure has been calculated.
- The connections must be installed correctly.
- Connecting cables/pipes must be free from damage.
- The bleed ports must be unobstructed or connected to leakage lines.

WARNING

Risk of injury posed by improper installation of the liquefied gas pump!

Improper installation of the liquefied gas pump can lead to accidents resulting in severe or fatal injuries.

- ► The stall pressure of the pump, which depends on the system parameters, must not exceed the maximum permitted operating pressure.
- ► The stall pressure, which depends on the system parameters, must be calculated before commissioning.
- ► Secure system accordingly, if necessary.

Prior to commissioning the pump, the system-specific stall pressure must be calculated. The stall pressure of the pump is calculated for the respective pump type using the following formula:

Design of the liquefied gas pump	Stall pressure
Single-stage, double-acting	$p_B = i * p_L + p_A$
Two-stage	$p_B = i_2 * p_L + i_2/i_1 * p_A$

Tab. 5-1 Calculation of the stall pressure

Legend:

p_L = drive pressure
p_B = operating pressure
p_A = primary gas pressure
i_1 = pressure ratio for stage 1
i_2 = pressure ratio for stage 2

5.4.2 Commissioning

WARNING

Risk of injury due to extreme temperatures!

The surfaces of the product can be very hot or very cold. This can lead to accidents resulting in severe injuries or death.

► Before working on the product, please ensure that the product is at ambient temperature.

Details about how to start up the pump is described in the following:

1) Check all connections for proper installation.
2) Check all connecting lines for mechanical damage.
3) Slowly open the supply line.
   – The compressed fluid flows in.
4) Slowly open the compressed air line of the compressed air line system to the pump.
   – The pump automatically starts to deliver.

We recommend slowly increasing the pressure of the drive air to keep the stress on the pump components low during commissioning.
The stroke frequency of the pump is kept low this way. Otherwise, during the ramp-up phase, until the required operating pressure is reached, operating phases with very high cycle frequencies can occur.

6 Operation

6.1 Prerequisites for operation

Observe the manual and general drawing of the product.
In addition, the following conditions must be met:

- The product must be free of damage.
- The product must be securely attached.
- The product is not subject to any vibrations greater than those typically occurring in high-pressure systems.
- A risk assessment has been compiled for the system, and all basic health and safety requirements have been met.

6.2 Normal, safe operation

Normal, safe pump operation must be defined in the context of overall system.

WARNING

Risks of sustaining injuries are posed by improper handling of operating fluids!

Improper handling of operating fluids can lead to accidents resulting in severe injuries or death.

- ► Comply with the safety data sheets of the operating fluids.
- ► Dispose of operating fluid residues in an appropriate manner.
- ► Notify other people (for example: repair department) of hazardous operating fluids.

WARNING

Danger due to operating fluid residues!

The high pressure unit and the bleed chamber can contain operating fluid residues. Depending on the operating fluid, these residues can be hazardous. Improper handling of operating fluids can lead to accidents resulting in severe injuries or death.

- ► Flush the high pressure unit.
- ► The bleed chamber cannot be flushed. Take precautionary measures to protect workers.
- ► Assess the risk for the equipment in the overall risk assessment.

6.3 Abnormal situations during operation

Refer to the general system documentation for measures to consider or implement in case of abnormal operation.

6.4 Signs indicating the product is no longer safe to use

The following signs indicate that the pump is no longer safe to use. In such cases, the pump must be put into a safe state immediately.

- Leaking high-pressure seal
- Leaking pump head
- Leaking high-pressure cylinder
- Leaking drive unit
- Leaking connections
- Visible damage

6.5 Put the pumps in a safe state

In a safe state, the pump is depressurised on the drive end and the high-pressure side. The steps necessary in order to achieve a safe state depend on the installation position in the system. Refer to the general system documentation for the required actions.

7 Maintenance

7.1 Maintenance intervals

To ensure safe and smooth operation, the pumps must be checked regularly and serviced, cleaned or repaired as necessary. The individual maintenance activities are described in the following section.

Maximator recommends the intervals listed below. These intervals are calculated based on 1,300,000 strokes/year.

The required maintenance intervals depend on the system and application. The intervals must be adjusted based on the given conditions of use.

Activity	before and after each use	daily	weekly	monthly	quarterly	semi-annually	annually	as needed
System inspection			x					
Leak-testing the connections			x					
Check screw fittings and connecting lines for damage			x					
Clean pump					x			
Check fastening elements and connecting elements					x			
Leak detection						x		
Repair pump								x

Tab. 7-1 Maintenance intervals

7.2 Maintenance work

WARNING

Risk of injury due to extreme temperatures!

The surfaces of the product can be very hot or very cold. This can lead to accidents resulting in severe injuries or death.

► Before working on the product, please ensure that the product is at ambient temperature.

WARNING

Risk of injury due to inappropriate spare parts!

Making repairs using inappropriate spare parts can lead to accidents resulting in severe injuries or death.

► Only use spare parts that comply with Maximator specifications.

WARNING

Risk of injury when handling lubricants!

Handling lubricants can lead to accidents resulting in severe or fatal injuries.

► Use protective gloves and goggles.

► Avoid contact with the skin.

► Observe the safety data sheet of the lubricant accordingly.

WARNING

Risk of injury due to dangerous system status!

Maintenance and inspection activities sometimes require that the pumps be operated with modified connection cables or without safety equipment. The operation of the pump may lead to accidents with serious or fatal injuries.

► When performing work, ensure that no hazards are created!

WARNING

Danger due to operating fluid residues!

The high pressure unit and the bleed chamber can contain operating fluid residues. Depending on the operating fluid, these residues can be hazardous. Improper handling of operating fluids can lead to accidents resulting in severe injuries or death.

► Flush the high pressure unit.

► The bleed chamber cannot be flushed. Take precautionary measures to protect workers.

► Assess the risk for the equipment in the overall risk assessment.

7.2.1 System inspection

The following section explains how to check the pump for proper function:

	Description
Qualifications	Operating the system
Type of maintenance	Check
Interval	weekly
PPE	– Safety goggles – Hearing protection
1.	Shut off the fluid outlet and adjust p_B to a value that is standard for the system. The pump stops automatically when the final pressure is reached (holding time 60 s).
2.	Vent p_L. p_B does not drop by more than 10% (holding time 30 s).
3.	Set p_L to approx. 50 % of the value from the first step and slowly relieve p_B. The pump starts up automatically.
4.	If the inspection does not reveal any abnormalities, it will be safe to continue using the pump. In case of abnormalities, consult with the maintenance staff.

7.2.2 Leak-testing the connections

The following section explains how to check the connections for leaks:

	Description
Qualifications	Operating the system
Type of maintenance	Check
Interval	weekly

	Description
Prerequisites	– The pump is easy to access. – All connections are pressurised.
Tools	– Torch – Cleaning cloth – Leak detection spray
PPE	Safety goggles
1.	Check connections for leaks. Use leak detection spray.
2.	If the inspection does not reveal any abnormalities, it will be safe to continue using the pump. In case of abnormalities, consult with the maintenance staff.

7.2.3 Inspect screws and connecting lines

The following section explains how to inspect the screw fittings and connecting lines:

	Description
Qualifications	Operating the system
Type of maintenance	Check
Interval	weekly
Prerequisites	The pump is easy to access.
Tools	– Torch – Cleaning cloth
1.	Visual inspection of the screw fittings and connecting lines. Is there any visible damage or other visible signs of wear?
2.	If the inspection does not reveal any abnormalities, it will be safe to continue using the pump. In case of abnormalities, consult with the maintenance staff.

7.2.4 Cleaning the pumps

The following section explains how to clean the pump:

	Description
Qualifications	Clean pump
Type of maintenance	Cleaning
Interval	quarterly
Prerequisites	– The pump is easy to access. – The pump is depressurised.
Tools	– Cotton cleaning cloth – Solvent-free cleaning product
1.  	**WARNING** **Risk of injury due to static electricity** Cleaning the pump may cause a charge to accumulate in non-conductive layers. Explosions with severe injuries or death can result. ► Only clean the pump with a damp cloth. ► Use cotton cleaning cloth. Clean pump.
2.	The cleaning process has been successful if: – The pump is free of dirt. – Ports and silencers are free of dirt.

7.2.5 Checking screw connections at the pump and connecting elements

The following section explains how to inspect the screw fittings on the pump and the connection ports:

	Description
Qualifications	Repair and service the pump
Type of maintenance	Check
Interval	quarterly
Prerequisites	– The pump is easy to access. – The pump is depressurised.
Tools	Torque spanner
1.	Check all fasteners and retighten if necessary.
2.	Check all connection ports and retighten if necessary.
3.	The inspection has been successful if: – all fasteners are properly tightened. – all connection ports are properly tightened.

7.2.6 Leak detection

The following section explains how to inspect for leaks:

	Description
Qualifications	Repair and service the pump
Type of maintenance	Check
Interval	semi-annually
Prerequisites	The pump is easy to access.
Tools	– Torch – Cleaning cloth – Leak detection spray – Leak detection system[a]
PPE	– Safety goggles – Hearing protection
1.	Check all connections for leaks. Use leak detection spray on the drive unit.
2.	Shut off gas outlet (B)
3.	Approach stall pressure

	Description
4.	Measure leak in the high pressure seal and piston seal of the drive piston via port "Z".
5.	Vent p_L p_B does not drop by more than 10% (holding time 30 s).
6.	Set p_L to approx. 50% of the value from the first step and slowly vent P_B. The pump starts up on its own.
7.	– Vent p_L – Vent p_B – Measure leakage from the check valves
8.	– Vent p_L – Vent p_B – Disassemble spool valve – Inspect spool valve – Are the seals worn out? – Is there still enough lubricant?
9.	The inspection has been successful if: – all leak tests have been carried out successfully. – the spool valve is OK. If the pump does not pass the inspection, it must be repaired or replaced.

a. The simplest way to measure leakage is by means of water displacement in a measuring cup.

7.2.7 Repairing the pumps

The following section explains how to repair the pump:

	Description
Qualifications	Repair and service the pump
Type of maintenance	Repair
Interval	as needed
Prerequisites	Clean, even work area with ample lighting
Tools	– Cleaning rags – Cleaning product – Torch – Lubricant as per drawing
PPE	– Safety goggles – Protective gloves
1.	Disassemble the pump.

	Description
2.	Clean the inside and outside of the pump.
3.	Replace all seals and guide elements.
4.	Replace damaged pump components as necessary.
5.	Assemble the pump. Apply a thin and even layer of lubricant to the following surfaces: – Contact surfaces of seals and guide elements – Seals Specially designated areas must be treated according to drawing indications.
6.	Check the pump. This includes the following maintenance work: – 7.2.1 - System check – 7.2.6 - Leak test
7.	If the pump has passed all tests, the repair is complete.

Maximator devices can be sent in for repairs to your local Maximator representative. All the necessary details are available on the Maximator website http://www.maximator.de

7.3 Spare parts and consumables

WARNING

Risk of injury due to inappropriate spare parts!

Making repairs using inappropriate spare parts can lead to accidents resulting in severe injuries or death.

► Only use spare parts that comply with Maximator specifications.

A list of the available spare parts, spare part kits and consumables can be found on the general drawing.

7.4 Accessories and special tools

A variety of special accessories are available for the liquefied gas pump.
Please consult with our sales department.

The tools used for the products are continuously being updated and supplemented.
An overview of the currently available tools is accessible upon request when contacting the Maximator customer service.

7.5 Customer service

Our customer service is also at your disposal for technical details and repairs:

Address	Maximator GmbH Ullrichstraße 1-2 99734 Nordhausen Germany
Customer service phone Mon. – Thurs.: 06:30 – 16:15 CET Fri.: 06:30 – 14:00 CET	+49 3631 9533-5444
Fax	+49 3631 9533-5065
Email	service@maximator.de
Website	www.maximator.de/service

Feedback and experiences resulting from the application of our products and potentially leading to an optimisation of such are appreciated.

8 Troubleshooting

The following is a list of typical liquefied gas pump faults, their causes, and the appropriate solutions.

If you experience any other specific or unexpected faults, please notify us at service@maximator.de

Fault	Cause of fault	Solution
The pump does not operate at low air pressure	Friction of the O-rings on the spool valve is too high	– Relubricate – Replace the O-rings on the spool valve
The pump does not operate at low air pressure	O-rings will swell if the wrong oil or lubricant is used	– Replace the O-rings – Use lubricant specified in drawing
Pump does not work	The control air is not connected	Control air connection
The pump does not work or works slowly.	The control air is not adequately pressurised	The control air must be at minimum p_L
The pump does not work or works slowly.	Ice has formed on the silencer or spool valve	Dehumidify the compressed air
The pump does not work or works slowly.	Formation of residue in the silencer	Clean the silencer; replace if necessary
The pump does not work; air escapes through the silencer	The O-rings on the spool valve are faulty	Replace and lubricate the O-rings
The pump does not work; air escapes through the silencer	The O-ring on the air piston is faulty or worn	Replace and lubricate the O-ring
The pump does not work; air flows through air supply port "V"	The spool valve is jammed.	– Clean the spool valve and sleeve – Check the O-rings and sleeves, and replace them if necessary – Lubricate
The pump operates with high frequency and short strokes	The pilot valve in the top or bottom cap is faulty	Clean, lubricate and, if necessary, replace the pilot valve

Tab. 8-1 Trouble shooting on the drive side

Fault	Cause of fault	Solution
The pump operates without delivering the gas, or it operates erratically. It does not reach the calculated operating pressure.	Check valve failure	Inspect the check valves and replace if necessary
Operating pressure escapes through bleed port "Z"	Worn out HP seal or seal and guide element	Replace seal kit
Operating fluid escapes through silencer or other designated leakage point	Worn out HP seal or seal and guide element	Replace seal kit

Tab. 8-2 Troubleshooting on the high-pressure side

9 Removal and disposal

9.1 Prerequisites for removal and disposal

Follow the manual and general drawing for the product.
In addition, the following conditions must be met:

– The product must be in a safe state.
– The product must be at ambient temperature.

9.2 Removal

WARNING

Danger due to operating fluid residues!

The high pressure unit and the bleed chamber can contain operating fluid residues. Depending on the operating fluid, these residues can be hazardous. Improper handling of operating fluids can lead to accidents resulting in severe injuries or death.

► Flush the high pressure unit.
► The bleed chamber cannot be flushed. Take precautionary measures to protect workers.
► Assess the risk for the equipment in the overall risk assessment.

WARNING

Risk of injury when handling lubricants!

Handling lubricants can lead to accidents resulting in severe or fatal injuries.

► Use protective gloves and goggles.
► Avoid contact with the skin.
► Observe the safety data sheet of the lubricant accordingly.

To remove the pump, carry out the following steps:

– Shut down the pump.
– Depressurise it.
– Loosen the fastening screws and connections.
– Dismantle the pump.

9.3 Disposal

If the service life has expired: Send the product back to Maximator, postage paid, for proper disposal.

10 Use in explosion-prone zones

10.1 General information

Pumps bearing an ATEX label and accompanied by a declaration of conformity in accordance with 2014/34/EU are designated for use in potentially explosive areas. They belong to equipment group II, equipment category 2G, explosion group IIB, safety by design.
With the -FS option (flame arrestor at the outlet of the bleed chamber), a potentially explosive atmosphere is also permitted in the bleed chamber. It corresponds to equipment group II, equipment category 2G, explosion group IIB, flame-proof enclosure.
Potentially explosive atmospheres are not permitted in the drive unit and high pressure unit.
Refer to the figure 10-2 "Diagram of ATEX zones" for the permissible zones.
The designation is indicated on the rating plate and on the general drawing.
The individual parts of the label are explained below.

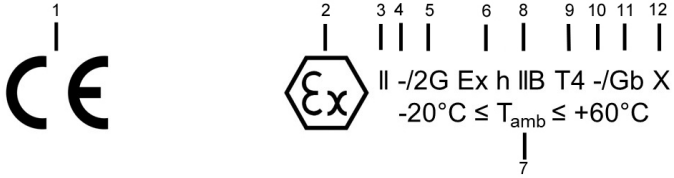


Fig. 10-1 Exemplary figure - ATEX label

1 CE symbol
2 Ex-symbol
3 Equipment group II: The pump may be used in potentially explosive atmospheres, except in mining.
4 -: Ignitable mixtures are not permitted in the drive or in the HP unit. The permissible zones are indicated in Figure 10-2 "Diagram of ATEX zones".
5 Equipment category 2G: The device ensures a high level of protection and may be used in Zone 1 and Zone 2. A Zone 1 or Zone 2 is also permitted in the bleed chamber with port "Z". Ignitable mixtures are not permitted in the drive or in the HP unit
6 Ex h marking: Designated for use as per DIN EN ISO 80079-36/37.
7 Designation of ambient temperature: Permissible range of ambient temperature.
8 Explosion group: The device is designated for use in potentially explosive gas atmospheres, with gases from Group IIB.
9 Temperature class: Under compliance with the indications in the operating manual, the device can be used in the temperature class indicated.
10 -: Ignitable mixtures are not permitted in the drive or in the HP unit. The permissible zones are indicated in Figure 10-2 "Diagram of ATEX zones".

11 Equipment protection level (EPL) Gb: Equipment in Group II for explosive zones generate vapours or mist due to mixing of air and gases; can be used in Zone 1 or Zone 2; sufficient protection for normal operation and in case of foreseeable errors. A Zone 1 or Zone 2 is also permitted in the bleed chamber with port "Z". Ignitable mixtures are not permitted in the drive or in the HP unit.

12 Additional marking X: The impact resistance test as per DIN ISO 80079-36, Section 8.3.1 has been conducted, indicating a low degree of mechanical danger.

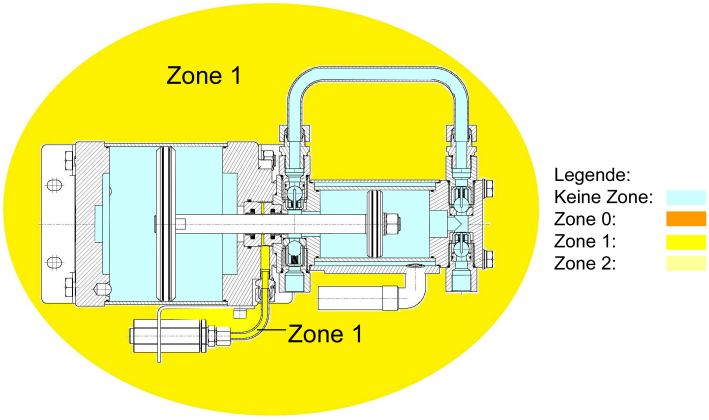


Fig. 10-2 Diagram of ATEX zones

10.2 Temperature class

The temperature of the liquefied gas pump mainly depends on the temperature of the operating fluid. The following table indicates the relationship of the operating fluid temperature and the temperature class of the pump:

Max. temperature of operating fluid	Temperature class
60°C	T4
120°C	T3

Tab. 10-1 Temperature classes

The liquefied gas pump must not be insulated. If it is insulated, however, the equipment manufacturer must determine the temperature class of the equipment accordingly.

For the compression of ideal gases, the maximum expected temperature can be calculated using the formula for adiabatic status change:

$$T_B = T_A \left(\frac{p_B}{p_A} \right)^{\frac{\kappa - 1}{\kappa}}$$

Legend:

T_A = input temperature
T_B = output temperature
p_A = inlet pressure
p_B = outlet pressure
κ = isentropic exponent

The isentropic exponent κ can be found in the corresponding tables for common gases.

Since the compression takes place as part of the heat exchange with the environment, the actual temperature will always be below the calculated temperature.

Consider the full range of operating conditions. A drop in the primary pressure p_A leads, for example, to an increase in the maximum expected temperature T_B.

10.3 Operation and maintenance

Static electricity on the product can lead to explosions. This may result in severe or fatal injuries.

Never use high-power mechanisms for charge generation on or near the product.

The possibility of an explosive atmosphere must be excluded before undertaking any and all work on the product – maintenance, cleaning or any other activity.

In order to ensure adequate safety during regular operation and in the event of foreseeable errors, the function of the product and compliance with the thresholds specified in these instructions must be monitored accordingly.

In doing so, the maintenance activities must be carried out at intervals that are appropriate for the application.

For safe operation, the devices may no longer be used after the leakage thresholds have been exceeded.

10.4 Operation with combustible operating fluids

WARNING

Risk of sustaining injury due to explosion!

An ignitable gas mixture in the pump may cause explosions. This can lead to accidents resulting in severe injuries or death.

- ► Take precautions to prevent the formation of ignitable gas mixtures in the pump during commissioning.
- ► Take precautions to prevent the formation of ignitable gas mixtures in the pump during commissioning.

During liquefied gas pump operation, the leaking fluid passes through the high pressure seal or sealing and guide elements into the bleed chamber. In case of combustible operating fluids, this may cause the formation of an ignitable mixture.

Only the "FS" version may be operated with flammable operating fluids! The bleed chamber is designed as a flame-proof enclosure (DIN EN 60079-1) and equipped with a flame arrestor at the outlet.

The ignitable mixture can be discharged through bleed port "Z".

11 Summary of ignition hazards

Ignition hazard Source of ignition	Cause	Protective measure implemented
Hot surface	Heating by the operating fluid and compression	Calculation formula Temperature class definition Insulation prohibited
Friction	Friction in the drive unit	Selection of materials and operating parameters Definition of maintenance intervals Definition of the compressed air quality
Friction	Friction in the high pressure unit	Selection of materials and operating parameters Definition of maintenance intervals
Friction	Friction in the spool valve	Selection of materials and operating parameters Definition of maintenance intervals
Mechanically generated sparks	Impact from the outside on the device	Selection of the materials
Mechanically generated sparks	Ignition caused by foreign objects that have entered	Prevent foreign objects from entering
Mechanically generated sparks	Ignition caused by dust in the equipment	Definition of maintenance intervals
Mechanically generated sparks	Impact from breakage of spring	Selection of the springs
Flames	Ignition of leaked fluid in the bleed port	Limitation of equipment category and EPL Flame-proof enclosure of the bleed chamber and flame arrestor at the outlet
Flames	Ignition of lubricants	Selection of the lubricants
Static electricity	Charging of insulated metal parts	All parts are conductively interconnected
Static electricity	Charging of non-conductive equipment parts	Design in accordance with component size specifications

Ignition hazard Source of ignition	Cause	Protective measure implemented
Static electricity	Charging of non-conductive layers	Design in accordance with layer thickness specifications
Static electricity	Charging due to powerful charge generating mechanisms	Exclusion of powerful charge generating mechanisms
Adiabatic compression	Temperature increase due to adiabatic compression of the operating fluid	Temperature increase taken into account
Chemical reaction	Reaction between operating fluid and valve sections generates heat	Resistance of the valve materials must be checked.
External influence	Damage due to external influence	Impact test

Tab. 11-1 Summary of the applicable ignition hazards identified and the protective measures implemented

Appendix

The appendix comprises the following documents:

- EU Declaration of Conformity – liquefied gas pumps
- Declaration of incorporation – liquefied gas pumps
- Description of the basic health and safety requirements

MAXIMATOR®
Maximum Pressure.

EU-Konformitätserklärung
Hiermit erklären wir, dass die Bauart von druckluftbetriebenen Flüssiggaspumpen der Baureihen:
SLGP3-..., SLGP3-3-..., GLGP5-...,GLGP5-5-...
mit einer Seriennummer von **23000001** und höher
in der gelieferten Ausführung folgende einschlägige Harmonisierungsrechtsvorschriften der Union erfüllt:

EU-Richtlinie Explosionsschutz 2014/34/EU
Angewendete harmonisierte Normen und technische Spezifikationen:
EN ISO 12100:2010
EN ISO 80079-36:2016
EN ISO 80079-37:2016
EN 60079-1:2014

Notifizierte Stelle eingeschaltet zur Aufbewahrung der Unterlagen nach 2014/34/EU:
0102 PTB - Braunschweig, (Bundesallee 100, 38116 Braunschweig)

Weitere einschlägige Bestimmungen: EG Maschinenrichtlinie (2006/42/EG) (Unvollständige Maschine)

Anschrift Hersteller: **MAXIMATOR GmbH, Lange Straße 6, 99734 Nordhausen / Deutschland**
Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller.

(Original)

EU Declaration of Conformity
Herewith, we declare that the model of air driven liquid gas pumps type:
SLGP3-..., SLGP3-3-..., GLGP5-...,GLGP5-5-...
with a serialized ID of **23000001** and above
as supplied are in conformity with the relevant Union harmonisation legislation:

EU Explosion Protection Directive 2014/34/EU
Harmonised standards and technical specifications applied:
EN ISO 12100:2010
EN ISO 80079-36:2016
EN ISO 80079-37:2016
EN 60079-1:2014

Notified body involved for preserving the documents in compliance with 2014/34/EU:
0102 PTB - Braunschweig (Bundesallee 100, 38116 Braunschweig)

Further likewise applicable directives: Machinery directive (2006/42/EC) (partly completed machinery)

Name and address of manufacturer: **MAXIMATOR GmbH, Lange Straße 6, 99734 Nordhausen / Germany**
This declaration of conformity is issued under the sole responsibility of the manufacturer.

(Translation)

Nordhausen, den 18.01.2023 (Nordhausen, 18.01.2023)

.....
Steffen Roloff (Divisionsleitung Components) (Division Manager Components)

MAXIMATOR GmbH, Lange Straße 6, 99734 Nordhausen, Telefon +49 (0) 3631 9533 – 0, Telefax +49 (0) 3631 9533 – 5010, www.maximator.de, info@maximator.de

MAXIMATOR®
Maximum Pressure.

Einbauerklärung nach 2006/42/EG, Anhang II, Nr.1 B
Inhalt gemäß 2006/42/EG, Anhang II, Nr.1 B.
Anschrift Hersteller: MAXIMATOR GmbH
Lange Straße 6
99734 Nordhausen / Deutschland

Der Dokumentationsbeauftragte ist bevollmächtigt, die speziellen technischen Unterlagen nach Anhang VII B zusammenzustellen: dokumentationsbeauftragter@maximator.de / Tel.: 03631-9533-0

Die Bauart von druckluftbetriebenen Flüssiggaspumpen der Baureihe:
SLGP3-..., SLGP3-3-..., GLGP5-...,GLGP5-5-...
mit einer Seriennummer von **23000001** und höher
ist eine unvollständige Maschine nach Artikel 2g und ausschließlich zum Einbau in oder zum Zusammenbau mit einer anderen Maschine oder Ausrüstung vorgesehen.

Grundlegende Sicherheits- und Gesundheitsschutzanforderung gemäß Anhang I dieser Richtlinie kommen zur Anwendung und wurden eingehalten: Auflistung siehe Montageanleitung

Die speziellen technischen Unterlagen gemäß Anhang VII B wurden erstellt und sie werden der zuständigen nationalen Behörde auf Verlangen in elektronischer Form übermittelt.

Diese unvollständige Maschine darf erst dann in Betrieb genommen werden, wenn festgestellt wurde, dass die Maschine, in die unvollständige Maschine eingebaut werden soll, den Bestimmungen der Maschinenrichtlinie entspricht.

(Original)

Declaration of Incorporation acc. to 2006/42/EC, Annex II, Nr.1 B
Contents acc. to 2006/42/EC, Annex II, Nr.1 B.
Name and address of manufacturer: MAXIMATOR GmbH
Lange Straße 6
99734 Nordhausen / Germany

The documentation officer is authorised to compile the relevant technical documentation as set forth in Annex VII B:
dokumentationsbeauftragter@maximator.de / Tel.: +49(0)3631-9533-0

The model of air driven liquid gas pumps type:
SLGP3-..., SLGP3-3-..., GLGP5-...,GLGP5-5-...
with a serialized ID of **23000001** and above
is a partly completed machinery as defined in Article 2g and exclusively envisaged for installation into or assembly with other machinery or equipment.

Essential health and safety requirements (EHSR) acc. to Annex I to this directive have been applied and complied with:
See Assembly Instructions

The relevant technical documentation according to Annex VII B was compiled and will be forwarded to the competent national authority in electronic format upon request.

The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive on Machinery.

(Translation)

Nordhausen, den 18.01.2023 (Nordhausen, 18.01.2023)

.....
Steffen Roloff (Divisionsleitung Components) (Division Manager Components)

MAXIMATOR GmbH, Lange Straße 6, 99734 Nordhausen, Telefon +49 (0) 3631 9533 – 0, Telefax +49 (0) 3631 9533 – 5010, www.maximator.de, info@maximator.de

Description of the basic health and safety requirements (Machinery Directive 2006/42/EC, Appendix I)

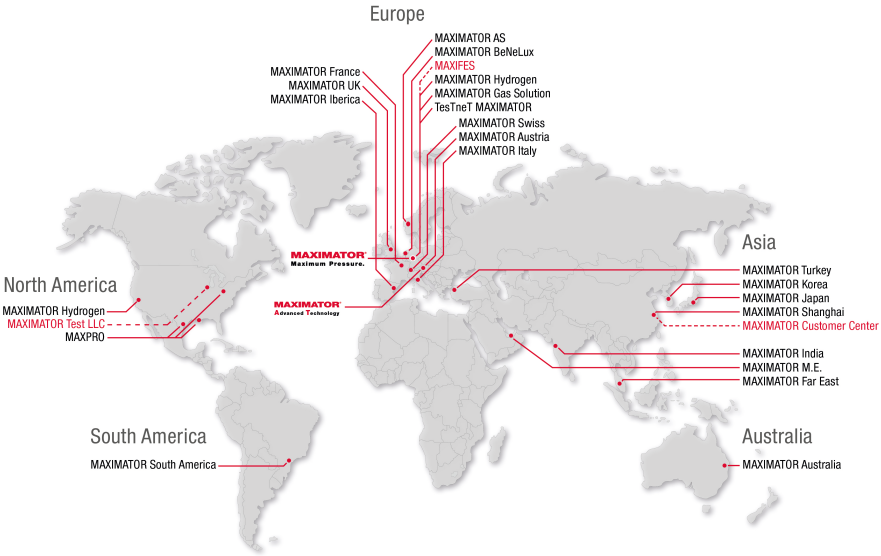
No.	Basic requirement	Applicable	Met	Comment
1.	BASIC HEALTH AND SAFETY REQUIREMENTS			
1.1	GENERAL INFORMATION			
1.1.1	Definitions	Yes	Yes	
1.1.2	Safety integration principles	Yes	Yes	
1.1.3	Materials and products	Yes	Yes	
1.1.4	Lighting	No		
1.1.5	Machine design regarding handling	Yes	Yes	Device corresponds to the conventional design
1.1.6	Ergonomics	No		
1.1.7	Operator's console	No		
1.1.8	Seats	No		
1.2	CONTROLS AND INSTRUCTION DEVICES			
1.2.1	Control safety and reliability	Yes	No	unintended start-up, changes to the parameters
1.2.2	Actuators	No		
1.2.3	Starting the system	Yes	No	unintended start-up, changes to the operating state
1.2.4	Shut-down			
1.2.4.1	Normal shut-down	Yes	No	no instruction device for shut-down
1.2.4.2	Operational shut-down	No		
1.2.4.3	Emergency shut-down	Yes	No	no emergency stop
1.2.4.4	Completeness of machines	No		
1.2.5	Selection of control or operating modes	No		
1.2.6	Fault in the energy supply	Yes	No	unintended start-up
1.3	PROTECTIVE MEASURES AGAINST MECHANICAL HAZARDS			
1.3.1	Risk of stability loss	Yes	Yes	Design uncritical
1.3.2	Risk of breakage during operation	Yes	Yes	

No.	Basic requirement	Applicable	Met	Comment
1.3.3	Risks posed by dropping or ejected objects	No		
1.3.4	Risks posed by surfaces, edges and corners	Yes	Yes	Deburring generally required
1.3.5	Risks posed by multiple machines combined	No		
1.3.6	Risks posed by changed usage conditions	Yes	No	
1.3.7	Risks posed by movable parts	Yes	Yes	no moving parts accessible from the outside
1.3.8	Selection of protective equipment against risks posed by movable parts	No		
1.3.8.1	Moving parts of the driveline	No		
1.3.8.2	Moving parts involved in the operating process	No		
1.3.9	Risk of uncontrolled movements	No		
1.4	PROTECTIVE EQUIPMENT REQUIREMENTS			
1.4.1	General requirements	No		
1.4.2	Special specifications for guards			
1.4.2.1	Fixed guards	No		
1.4.2.2	Movable guards with interlocks	No		
1.4.2.3	Access-restricting adjustable guards	No		
1.4.3	Special specifications for protective devices	No		
1.5	RISKS FROM OTHER HAZARDS			
1.5.1	Electrical energy supply	No		
1.5.2	Static electricity	Yes	Yes	see ATEX
1.5.3	Non-electrical power supply	Yes	No	Ice formation, flying ice, asphyxiation, noise
1.5.4	Assembly fault	Yes	Yes	Labelling of connection ports
1.5.5	Extreme temperatures	Yes	No	Machine may get hot or cold
1.5.6	Fire	Yes	No	

No.	Basic requirement	Applicable	Met	Comment
1.5.7	Explosion	Yes		assessed separately
1.5.8	Noise	Yes	No	depending on installation and application
1.5.9	Vibrations	Yes	Yes	vibrations in conventional range
1.5.10	Radiation	No		
1.5.11	Radiation from the outside	No		
1.5.12	Laser radiation	No		
1.5.13	Emission of hazardous materials and substances	Yes	No	Release and leakage of operating fluids
1.5.14	Risk of being locked into the machine	No		
1.5.15	Risk of slipping, tripping or falling	No		
1.5.16	Lightning strike	No		
1.6	MAINTENANCE			
1.6.1	Machine maintenance	Yes	No	in the context of the overall system
1.6.2	Access to the operator stations and the access points for maintenance	Yes	Yes	conventional design
1.6.3	Disconnection of the energy sources	Yes	No	unavailable
1.6.4	Operating personnel interventions	Yes	Yes	conventional design
1.6.5	Cleaning of machine parts in the interior	Yes	No	Bleed chamber cannot be flushed
1.7	INFORMATION			
1.7.1	Information and warnings on the machine	No		
1.7.1.1	Information and information devices	No		
1.7.1.2	Warning devices	No		
1.7.2	Warning of residual risks	Yes	No	in the context of the overall system
1.7.3	Machine labels	Yes	Yes	
1.7.4	Operating manual	Yes	Yes	Installation manual

No.	Basic requirement	Applicable	Met	Comment
1.7.4.1	General guidelines for the formulation of the operating manual	Yes	Yes	
1.7.4.2	Contents of the operating manual	Yes	Yes	
1.7.4.3	Sales brochures	Yes	Yes	
2.	ADDITIONAL BASIC HEALTH AND SAFETY REQUIREMENTS FOR CERTAIN CATEGORIES OF MACHINE	No		
3.	ADDITIONAL BASIC HEALTH AND SAFETY REQUIREMENTS TO ELIMINATE HAZARDS DUE TO THE MOBILITY OF THE MACHINERY	No		
4.	ADDITIONAL BASIC HEALTH AND SAFETY REQUIREMENTS TO ELIMINATE HAZARDS DURING LIFTING OPERATIONS	No		
5.	ADDITIONAL BASIC HEALTH AND SAFETY REQUIREMENTS FOR MACHINERY INTENDED FOR UNDERGROUND WORK	No		
6.	BASIC HEALTH AND SAFETY REQUIREMENTS FOR MACHINERY PRESENTING PARTICULAR HAZARDS DUE TO THE LIFTING OF PERSONS	No		


MAXIMATOR
Maximum Pressure



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