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Maximum Pressure.

High Pressure Technology • Testing Equipment

Hydraulics • Pneumatics

LGP-series

»Liquified Gas Pumps

»For filling and draining refrigeration systems

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Pumps for refrigerants

Applications LGP-series

The Maximator LGP (Liquified Gas Pump) series was developed for use with refrigerants. The design of these pumps is based on the mode of operation of gas compressors in combination with proven high-pressure pump technology. The technology has been optimized for the compression of liquid and gaseous media, so that the pumps of the LGP series can compress and convey both aggregate states.

Another special feature of this series is its suitability for the compression and delivery of flammable media. A flameproof enclosure according to DIN EN 60079-1 including a TÜV test has been implemented. Thus, the pumps of the LGP series can be used for a variety of media.

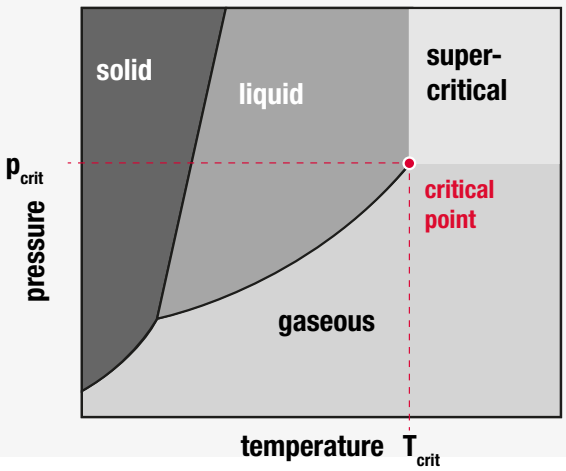
The phase diagram

A phase diagram shows the states of a substance, either as a p-T diagram or as a T-s diagram. A p-T diagram shows the phases as a function of pressure and temperature, while a T-s diagram shows the phases as a function of temperature and entropy. The three best known phases are: solid, liquid and gas. There is also another phase, which is called "supercritical". In this state, no clear distinction can be made between gaseous and liquid states of aggregation. The principle of the phase model is an important building block for understanding how compression refrigeration systems work.

The principle of operation of compression refrigeration systems

Among other things, a wide range of tasks for the LGP series lies in the filling and draining of compression refrigeration systems. Here, the effect of the entropy change under change of the pressure is used. In the evaporator, the refrigerant absorbs energy (heat) from the environment and thus cools it down. The cold refrigerant vapor is drawn in by the compressor and pressurized. This increases the temperature of the medium and it is then cooled at the condenser. The refrigerant condenses and gives off heat to the environment. This changes the phase from gaseous to liquid. The pressurized refrigerant is expanded to a low pressure by means of an expansion valve and returned to the evaporator.

Refrigeration systems can be operated with a variety of different refrigerants. The specific task of the refrigerant in the cycle is to transport heat or energy. A quantitative assessment of the harmfulness of gases to the climate can be made using the GWP value. This Greenhouse warming potential value indicates how much more harmful the gas is to the climate compared to carbon dioxide. However, replacing climate-damaging refrigerants with equivalent media presents a challenge. Often, substitutes are toxic, flammable and/or the efficiency is insufficient. In addition, existing systems must be renewed or at least retrofitted to operate with other refrigerants.



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Liquified Gas Pumps

Safety classes of refrigerants

All flammable refrigerants have a lower and upper flammability limit. This is the minimum or maximum concentration of the substance in the air that can cause flame spread. Above the limit, there is too little oxygen and below, too little substance in the air for flame maintenance.

These flammability limits form the basis for the safety classes of refrigerants.

High flammability	A3	B3
reduced flammability	A2	B2
low flammability	A2L	B2L
no flammability	A1	B1
	low toxicity	**high toxicity**

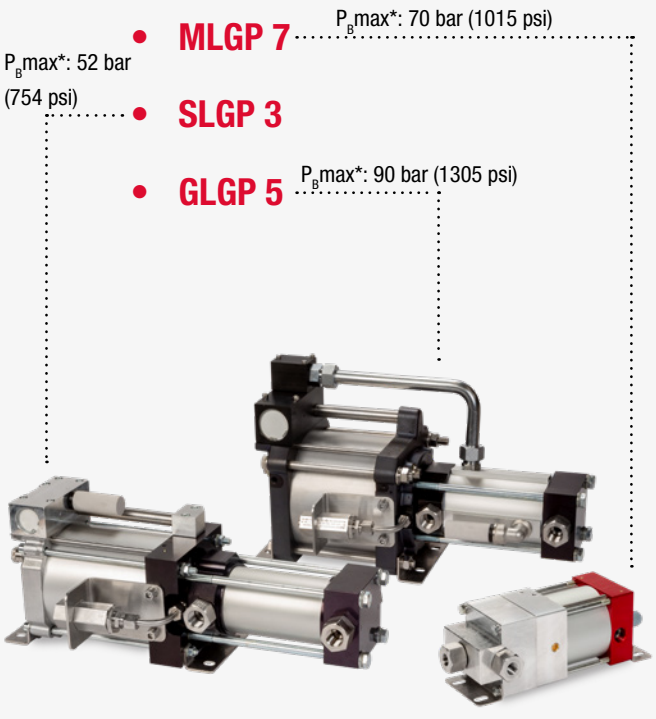
Liquified Gas Pumps

The phase transition already described occurs as a function of pressure and temperature. Accordingly, pumps for filling and draining refrigerant systems must be able to handle possible phase transitions. The Maximator LGP series (Liquified Gas Pump) meets this requirement. Design-wise, this pump is based on the operation of gas compressors and has been optimized for the compression of refrigerants.

To reduce pressure peaks and promote a uniform volume flow, the SLGP and GLGP pumps are double-acting. This means that during a suction stroke, a pressure stroke takes place simultaneously. The medium is thus continuously conveyed and compressed. The double-acting design ensures that the pump runs slowly and smoothly and helps to prevent any undesirable phase transition.

The SLGP and GLGP pumps are also optionally available with reduced stroke. On the one hand, this reduces the size of the pump and, on the other hand, this reduces the likelyhood of icing on the muffler. Should a phase transition nevertheless occur, the pumps of the Maximator LGP series can also pump the fluid in the gas phase without impairing functionality.

The LGP series comprises 3 different versions:



* $P_B$max: max. working pressure

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Liquified Gas Pump
Pump selection

The following parameters are neccessary for a correct design of the pump:

- Max. working pressure
- Flow capacity
- Available air drive pressure
- Medium, medium temperature
- Ambient temperature
- Information on requirements regarding size, weight, etc.
- Desired options and seal materials

Note: On request, the Maximator team will provide the design and advise on the selection. For many applications, there are special requirements; consultation with experienced Maximator employees is therefore recommended.

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Liquified Gas Pump

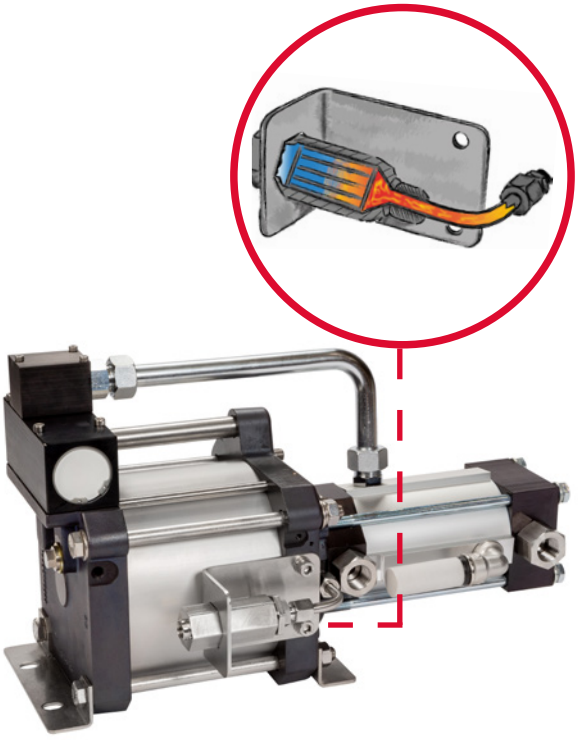
Flame arrester

Common climate-friendly refrigerants are mostly flammable. Should a flammable mixture of the refrigerant and oxygen form inside the pump, ignition can occur. In the event of a leak on the high pressure side, a flammable gas mixture could form in the combined leakage hole that has a connection to the air drive. This can trigger an explosion in the event of ignition. The resulting flame is stopped immediately in the flame arrester, which prevents the thermal energy from spreading. In addition, the space of the combined leakage line is designed and tested according to DIN EN 60079-1, so that no flame can escape. There is a flameproof enclosure in accordance with gas group IIB.
The pumps may be operated in potentially explosive atmospheres with appropriate precautions.

Versions & Options*

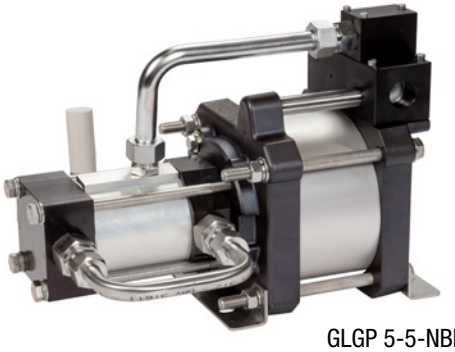
FS – Flame safety device, see flame arrester.
RS – **R**educed **S**troke. The stroke volume of the pump is split in half.
two stage (3-3, 5-5) – The medium is compressed via two pressure stages.
FEC – **F**or **E**xtreme **C**ycling. For drive with dry compressed air or nitrogen
LT – **L**ow **T**emperature. The media temperature can be as low as -40°C. Special sealing materials are used for this purpose.
LTA – **L**ow **T**emperature **A**mbient. The media and ambient temperatures can be as low as -40°C. Special sealing materials are used for this purpose.
SS – **S**tainless **S**teel. Wetted parts made of stainless steel.

*These options/ variants cannot be retrofitted and must therefore be specified when ordering.



GLGP 5-NBR-FS

GLGP 5-5-NBR



GLGP 5-5-NBR-RS

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Liquified Gas Pump

Model	Version	Flame arrester*	Options	available sealing materials**
MLGP 7-NBR	standard	without FS		
SLGP 3-NBR	RS -3 -3-RS standard	with FS without FS	LT LTA SS FEC	HWBR CR EPDM FFKM PTFE FKM HNBR
GLGP 5-NBR	RS -5 -5-RS standard			

* the flame arrester cannot be retrofitted.

**The sealing material used in the standard can be found in the product name.

Note: further technical information is available on the product data sheets or in the catalog.

Sealing materials

NBR – Nitrile rubber,good cold and deformation behavior at -30°C to 100°C, media compatibility: low, elastic.

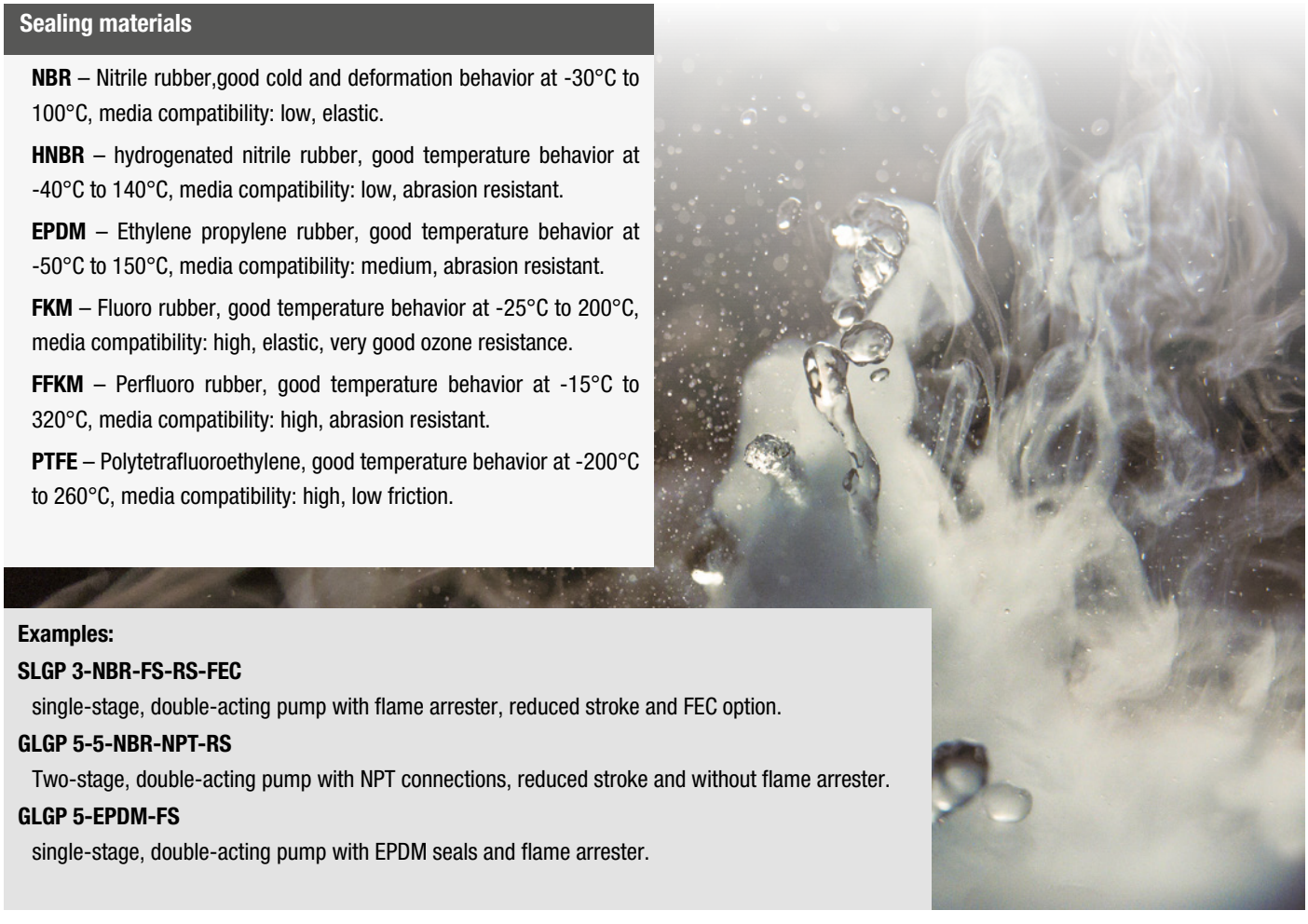
HNBR – hydrogenated nitrile rubber, good temperature behavior at -40°C to 140°C, media compatibility: low, abrasion resistant.

EPDM – Ethylene propylene rubber, good temperature behavior at -50°C to 150°C, media compatibility: medium, abrasion resistant.

FKM – Fluoro rubber, good temperature behavior at -25°C to 200°C, media compatibility: high, elastic, very good ozone resistance.

FFKM – Perfluoro rubber, good temperature behavior at -15°C to 320°C, media compatibility: high, abrasion resistant.

PTFE – Polytetrafluoroethylene, good temperature behavior at -200°C to 260°C, media compatibility: high, low friction.



Examples:

SLGP 3-NBR-FS-RS-FEC

single-stage, double-acting pump with flame arrester, reduced stroke and FEC option.

GLGP 5-5-NBR-NPT-RS

Two-stage, double-acting pump with NPT connections, reduced stroke and without flame arrester.

GLGP 5-EPDM-FS

single-stage, double-acting pump with EPDM seals and flame arrester.

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Liquified Gas Pump
Common refrigerants

refrigerant	medium	GWP	Safety class	Recommended sealing material and notes	
R32	Difluoromethane	675	A2L		EPDM + PTFE + NBR + FFKM
R50	Methane	25	A2		see operating instructions
R170	Ethane	6	A3		see operating instructions
R290	Propane	3	A3		see operating instructions
R454a/b	Mixture R32 + R1234yf	239	A2L		CRL+ HNBR
R513a	Tetrafluoropropene/ ethane mixture	631	A1	Reacts with aluminum; however, almost all compressors for R134a are approved for R513a.	EPDM + PTFE + HNBR
R600/A	Butane/Isobutane	3	A3		EPDM + PTFE
R717	Ammonia	0	B2L	Stainless steel required, no use of non-ferrous metals, high system pressures required	EPDM/ CRL + PTFE
R718	Water	0	A1	Covered by gas compressors of the DLE series	EPDM + PTFE
R723	Ammonia dimethylether	8	B2	See ammonia, no NBR, no FKM	EPDM/CRL + PTFE
R744	Carbon dioxide	1	A1	High operating pressures necessary	NBR + PTFE
R1150	Ethene	0	A3	partial transfer to high pressure vessel necessary/ emergency cooling;covered by DLE	see operating instructions
R1234yf	Tetrafluoropropene	4	A2L		EPDM + PTFE (HNBR) + FFKM
R1234ze	Tetra-fluoropropene	7	A2L		EPDM + PTFE (HNBR) + FFKM
R1270	Propene/propylene	3	A3		FKM/ FFKM + PTFE
R1336mzz	Hexafluorobutene	2	A1	Higher pressure levels + discharge gas temperatures	NBR + FFKM

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Liquified Gas Pump
Refrigerants

Refrigerant	GWP	Safety Class	Recommended sealing material and notes
FCKW HFCKW	>4750 >1182		please contact the factory
R11	400	A1	NBR + PTFE
R22	1810	A1	please contact the factory
R23	14800	A1	EPDM + PTFE
R116	9200	A2	please contact the factory
R134a	1430	A1	EPDM + PTFE (HNBR)
R245fa	1030	B1	EPDM + PTFE
R404a	3922	A1	please contact the factory
R407C	1744	A1	please contact the factory
R407F	1825	A1	please contact the factory
R410a	2088	A1	EPDM + PTFE
R438A	2265	A1	please contact the factory
R442D	2729	A1	please contact the factory
R448A	1386	A1	EPDM + PTFE
R449A	1396	A1	EPDM + PTFE
R452A	2140	A1	EPDM + PTFE
R507	3990	A1	EPDM + PTFE

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Liquified Gas Pump

The pressure remains in focus - not the phase.

What are the advantages of the Maximator LGP series?

- Proven high pressure technology
- Combined compression technology of liquids and gases
- Specially designed for filling, draining and maintenance of refrigeration systems
- Extensive seal material selection
- Optional: reduced strokes
- Versions: double-acting and two-stage (does not apply to MLGP7)
- Optional: flame arrester

Your benefits

Phase transitions
Easy handling of occurring phase transitions

Increase availability
Media-resistant material selection

Application orientation
Application-optimized technology to avoid icing or phase transitions

EX-Zone
Design of the technology for safe operation in EX zones

Safety
Flame arrester and flameproof enclosure for the use of flammable media

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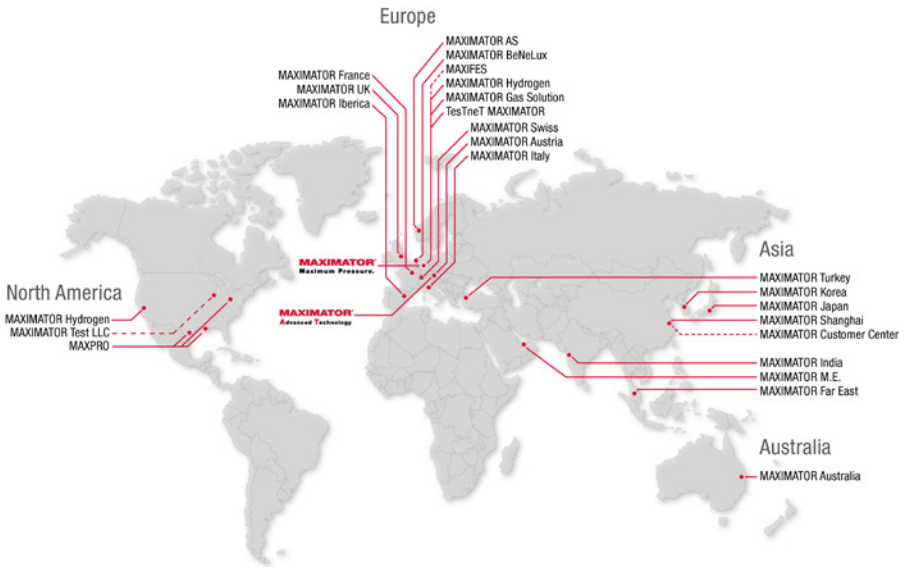
On your side everywhere

Maximator is one of the leading companies providing high pressure equipment up to 25,000 bar. The standard air driven Maximator boosters have been used in hydrogen applications for over 20 years.

Maximator GmbH, with its company headquarter in Nordhausen, has been extremely successful worldwide for more than five decades.

With our products and innovative system solutions, we are the long-standing partner of companies of repute in the automotive and supplier industry, as well as the life sience, chemical and mechanical engineering, energy, oil and gas industry sectors.

With our international partner companies, experienced experts in high-pressure technology are always ready to assist you. We have compiled detailed contact information for our international partners which you can find on our website at:
www.maximator.de/worldwide+distribution



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Lange Strasse 6, 99734 Nordhausen
Telefon +49 (0) 3631 9533 -0
Telefax +49 (0) 3631 9533 -5010
info@maximator.de

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