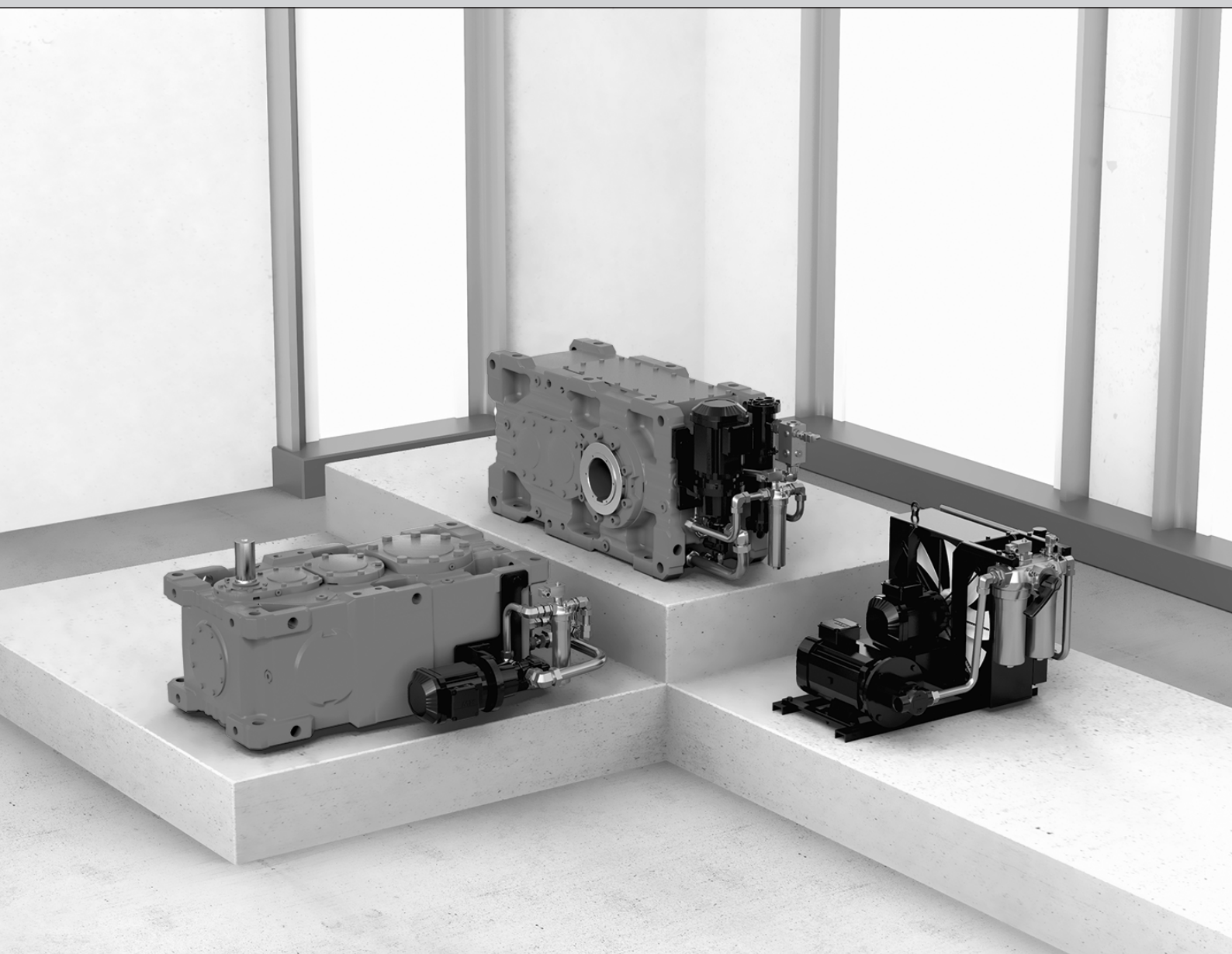




SEW
EURODRIVE

Assembly and Operating Instructions



Industrial Gear Units

Oil-Air Cooler for Splash or Bath Lubrication /OAC1



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1 General information

1.1 About this documentation

The documentation at hand is the original.

This documentation is an integral part of the product. The documentation is intended for all employees who perform work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the systems and their operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation or if you require further information, contact SEW-EURODRIVE.

1.2 Structure of the safety notes

1.2.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
▲ DANGER	Imminent hazard	Severe or fatal injuries
▲ WARNING	Possible dangerous situation	Severe or fatal injuries
▲ CAUTION	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the product or its environment
INFORMATION	Useful information or tip: Simplifies handling of the product.	

1.2.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:



SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of hot surfaces
	Warning about suspended load
	Warning of automatic restart

1.2.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

▲ SIGNAL WORD! Type and source of hazard. Possible consequence(s) if disregarded. Measure(s) to prevent the hazard.

1.3 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

1.4 Decimal separator in numerical values

In this document, a period is used to indicate the decimal separator.

Example: 30.5 kg

1.5 Product names and trademarks

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.6 Copyright notice

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2 Safety notes

2.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

2.2 Duties of the user

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it.

As the user, you must ensure that all of the work listed in the following may be carried out only by qualified specialists:

- Setup and installation
- Installation and connection
- Startup
- Maintenance and repairs
- Shutdown
- Disassembly

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- National and regional safety and accident prevention regulations
- Warning and safety signs on the product
- All other relevant project planning documents, installation and startup instructions, and wiring diagrams
- Do not assemble, install or operate damaged products
- All system-specific specifications and conditions

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.

2.3 Target group

Specialist for mechanical work	Any mechanical work may be performed only by adequately qualified specialists. Specialists in the context of this documentation are persons who are familiar with the design, mechanical installation, troubleshooting, and maintenance of the product who possess the following qualifications: • Qualifications in the field of mechanics in accordance with the national regulations • Familiarity with this documentation
Specialist for electrotechnical work	Any electrotechnical work may be performed only by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons who are familiar with electrical installation, startup, troubleshooting, and maintenance of the product who possess the following qualifications: • Qualifications in the field of electrical engineering in accordance with the national regulations • Familiarity with this documentation
Additional qualifications	In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation. The persons must have the express authorization of the company to operate, program, parameterize, label, and ground devices, systems, and circuits in accordance with the standards of safety technology.
Instructed persons	All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately. The purpose of the training is to give persons the ability to perform the required tasks and work steps in a safe and correct manner.

2.4 Designated use

The oil-air cooler /OAC1 is used for conveying and air-cooling the gear unit oil in the lubrication circuit of the gear unit. Adhere to the permitted technical data on the nameplate.

Using these products in potentially explosive atmospheres is prohibited, unless specifically designated otherwise.

In compliance with the EC Machinery Directive 2006/42/EC, the oil cooling system is an incomplete machine for installation in machinery and systems. In the scope of the EU Directive, you must not take the machinery into operation in the designated fashion until you have established that the end product complies with Machinery Directive 2006/42/EC.

2.5 Other applicable documentation

Note also the following documentation:

- "Helical and Bevel-Helical X.. Series Gear Units" operating instructions
- Order documents, e.g. dimension sheet, order confirmation, etc.
- If required, the operating instructions of the mounted components

2.6 Safety symbols



⚠ CAUTION

Safety/caution signs and safety symbols can become dirty or illegible over time.

Risk of injury due to illegible symbols.

- Always make sure that safety, warning, and operating notes are legible.
- Replace damaged safety/caution signs and safety symbols.

The safety symbols on the oil cooling system must be observed. They have the following meaning:

Safety symbol	Meaning
	Indicates the oil supply and serves to locate the connection option.
	Indicates the oil return and serves to locate the connection option.

2.7 Storage and transport conditions

Oil cooling systems can be provided with the following protection and packaging types, depending on the storage and transport conditions.

2.7.1 Internal conservation

Standard corrosion protection

After the test run, the test oil filling is drained out of the oil cooling system. The remaining oil film protects the oil cooling system against corrosion for a limited period of time.

Long-term corrosion protection

After the test run, the test oil filling is drained out of the oil cooling system and the interior space is filled with a vapor phase inhibitor.

Corrosion protection with VCI anti-corrosion agent is not permitted for oil cooling systems that are operated with food grade lubricants. Contact SEW-EURODRIVE in such cases.

2.7.2 Exterior corrosion protection

The following measures are taken for exterior corrosion protection:

- Small spare parts and loose pieces, such as bolts, nuts, etc., are packed in corrosion protection plastic bags (VCI corrosion protection bags).
- Threaded holes and blind holes are covered with plastic plugs.
- If the oil cooling system is stored for longer than six months, regularly check the protective coating of unpainted areas as well as the paint coating. Areas with protective coating and/or paint that has been damaged may have to be repainted.

2.7.3 Packaging

Standard packaging

The system is packaged on a pallet without any covering.

Application: Land transport

Long-term packaging

Packaging in a wooden box that is also appropriate for sea transport.

Application: Sea transport and/or for extended storage

2.7.4 Storage conditions

NOTICE

Improper storage can lead to damage.

Possible damage to property.

- During the storage duration up to startup, the system must be stored free of shocks in order to prevent damage to the pump, the pipes, or other mounting options.

INFORMATION



The oil cooling system is delivered without any oil filling as standard; different protection systems are required depending on the storage period and storage conditions as shown in the following table.

Corrosion protection + packaging	Storage location	Storage duration
Standard corrosion protection + standard packaging	Under a roof and enclosed at constant temperature and atmospheric humidity ($5\text{ °C} < \vartheta < 60\text{ °C}$, $< 50\%$ relative humidity). No sudden temperature fluctuations. Controlled ventilation with filter (free from dust and dirt). No aggressive vapors and no shocks.	Max. 6 months with intact surface protection.
Long-term corrosion protection + standard packaging	Under a roof and enclosed at constant temperature and atmospheric humidity ($5\text{ °C} < \vartheta < 60\text{ °C}$, $< 50\%$ relative humidity). No sudden temperature fluctuations. Controlled ventilation of the storage location with filter (free from dust and dirt). No aggressive vapors and no shocks.	Max. 3 years with regular inspection and checking for intactness.
Long-term corrosion protection + long-term packaging	Under a roof, protected against rain and free from shocks.	Max. 3 years with regular inspection and checking for intactness.

INFORMATION



If stored in tropical zones, provide for sufficient protection against insect damage. Contact SEW-EURODRIVE in the case of differing requirements.

2.8 Transportation

If the oil-air cooler is delivered on a base frame, observe the following information about transport.

If the oil-air cooler is mounted on the gear unit, observe the information about transport in the "Helical and Bevel-Helical X.. Series Gear Units" operating instructions.



▲ WARNING

Suspended loads can fall.

Severe or fatal injuries.

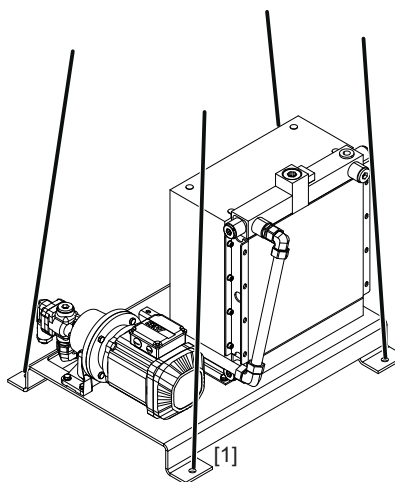
- Do not stand under the suspended load.
- Secure the danger zone.
- Use suitable, sufficiently rated, and undamaged handling equipment.
- Consider the dimensions, the center of gravity, and the weight that has to be moved when selecting lifting equipment or crane (see dimension drawing).

NOTICE

Improper transport may result in damage to the oil-air cooler.

Possible damage to property.

- Observe the following information.
- Inspect the shipment for any possible transport damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. In the event of damage, do not start up the gear unit.
- The oil-air cooler must only be transported in its original packaging or in a suitable replacement. Ensure that the shipment is securely fastened and tied down.
- The weight of the oil-air cooler (without oil) is indicated on the nameplate or on the dimension sheet. Observe the specified loads and regulations.
- Do not transport the oil-air cooler on the piping.
- For transport purposes, the oil-air cooler is suspended at the following four points [1].



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3 Oil-air cooler /OAC1

3.1 Functional description

An oil-air cooler /OAC1 is used if the thermal rating of a naturally cooled gear unit or the cooling via a fan on the input shaft is not sufficient.

The motor pump pumps the gear unit oil out of the gear unit and to the oil-air heat exchanger. The oil is cooled down there and is returned to the gear unit via a return cable.

The oil-air coolers /OAC1 are used in gear units with splash or bath lubrication.

3.2 Structure

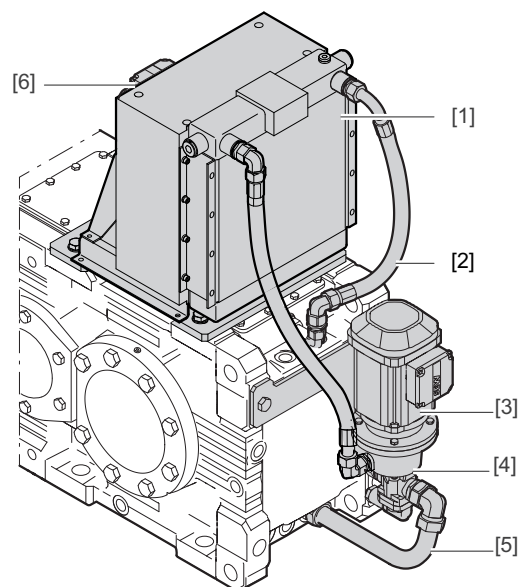
3.2.1 Gear unit in mounting position M1 – mounting surface: Oil-air heat exchanger F2/oil pump F6

The following figures show the gear units in mounting position M1 with the standard mounting surfaces for the oil pump and oil-air heat exchanger.

Mounting surfaces deviating from the standard require a new design. This may affect the minimum oil viscosity. A comprehensive individual check is required. Contact SEW-EURODRIVE.

The oil cooling system is a complete unit mounted directly on the gear unit. The oil cooling system is delivered without any electrical wiring but with piping to the gear unit.

Oil-air cooler /
OAC1 without oil
filter



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[1] Oil-air heat exchanger

[2] Pressure pipe

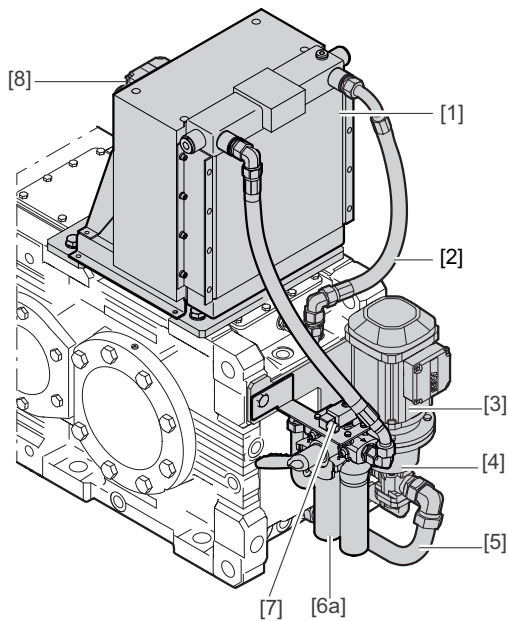
[3] Pump motor

[4] Oil pump

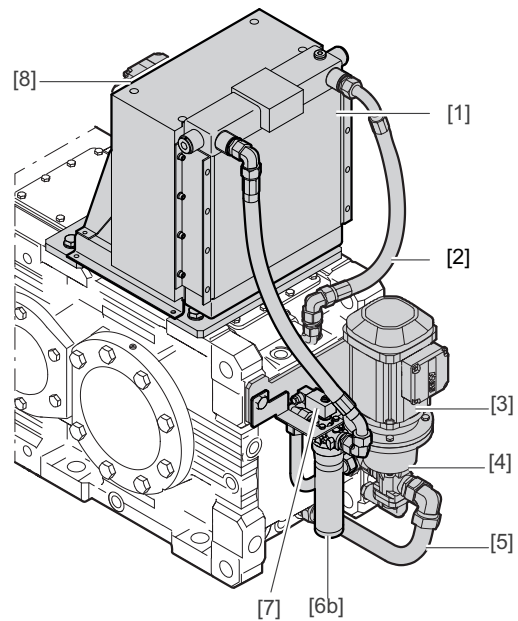
[5] Suction pipe

[6] Fan motor

Oil-air cooler /OAC1 with oil filter



- [1] Oil-air heat exchanger
- [2] Pressure pipe
- [3] Pump motor
- [4] Oil pump
- [5] Suction pipe



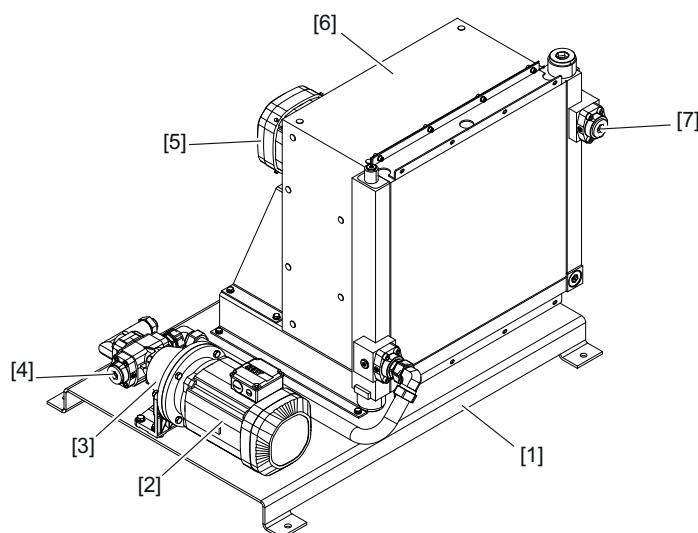
- [6a] Duplex filter
- [6b] Single filter
- [7] Contamination indicator
- [8] Fan motor

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3.2.2 Oil-air cooler /OAC1 on a base frame

The oil cooling system is mounted as a complete unit on a base frame and is set up separately from the gear unit.

The oil cooling system is delivered without any electrical wiring and without piping to the gear unit.



32483397131

- | | |
|---------------------------------|----------------------------------|
| [1] Base frame | [5] Fan motor |
| [2] Pump motor | [6] Oil-air heat exchanger |
| [3] Oil pump | [7] Connection for pressure pipe |
| [4] Connection for suction pipe | |

3.3 Scope of delivery

3.3.1 Standard design

The scope of delivery consists of the following:

- Oil pump with directly mounted asynchronous motor
- Fan with directly mounted asynchronous motor
- Oil-air heat exchanger
- Temperature switch /TSK2 with 2 switching points for
 - Controlled start of the oil pump motor and oil-air heat exchanger motors at an oil temperature > 60 °C.
 - Monitoring of the oil-air cooler, i.e. warning or gear unit shutdown at an oil temperature > 90 °C.

The temperature switch /TSK2 is mounted in the gear unit's oil sump.

3.3.2 Optional accessories

The oil cooling system can be equipped with the following components as an option:

- PT100 temperature sensor
- Oil filter with electrical/optical contamination indicator
 - Single filter
 - Duplex filter
- Gauge mounting block; for installation on the gauge mounting block, the following are available:
 - Flow switch
 - Manometer
 - Thermometer
 - Pressure sensor

3.4 Function

3.4.1 Oil pump/Oil-air heat exchanger

The drive motor of the oil pump and the oil-air heat exchanger is switched on and off depending on the temperature.

When the oil pump is operated, a pressure control valve integrated in the oil-air heat exchanger limits the plant pressure.

INFORMATION



Do not change the default setting of the pressure control valve at the oil pump.

3.4.2 Temperature monitoring

The temperature of the oil cooling system is monitored via a temperature switch /TSK2 with defined switching points.

Optionally, a PT100 temperature sensor can be used instead of a temperature switch / TSK2 to control the oil cooling system. The evaluation of the temperature signal and the controlling of the operator's switching devices are performed by the operator's controller.

Observe the following switching points:

- At $T_{Oil} > 60\text{ °C}$ → **Motors of the oil-air cooler – ON**
- At $T_{Oil} < 50\text{ °C}$ → **Motors of the oil-air cooler – OFF**
- At $T_{Oil} > 90\text{ °C}$ → **GEAR UNIT STOP/WARNING**

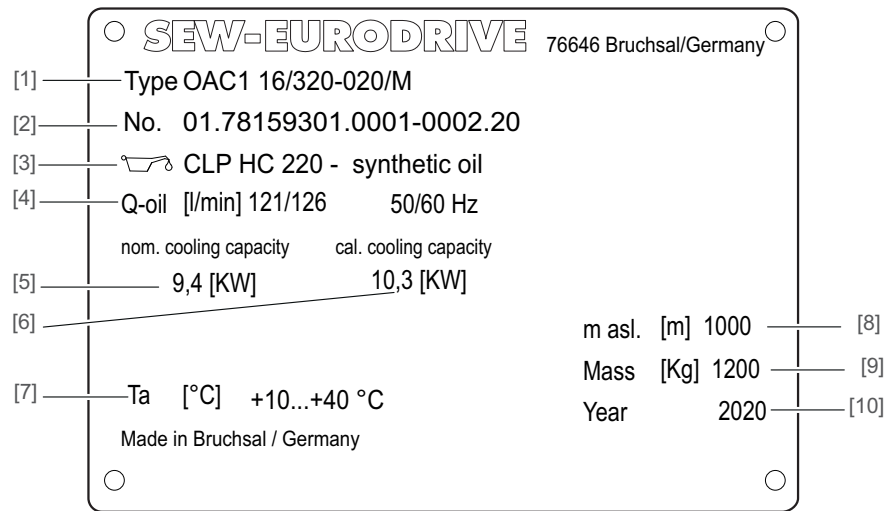
3.4.3 Filter (optional)

The filter is monitored visually by a pressure deviation indicator, and electrically by a pressure deviation monitoring device.

When $\Delta p > 2.2\text{ bar}$ → **WARNING** (clean filter)

3.5 Nameplate

The following example shows the structure of the nameplate.



32250765195

- [1] Type designation
- [2] Serial number
- [3] Oil grade and viscosity class
- [4] Volume flow 50/60 Hz
- [5] Cooling capacity:
Nominal cooling capacity at an ambient temperature of 40 °C
and an oil temperature of 70 °C.
- [6] Cooling capacity:
Calculated cooling capacity with deviating temperatures
- [7] Ambient temperature range
- [8] Installation altitude
- [9] Mass
- [10] Year of manufacture

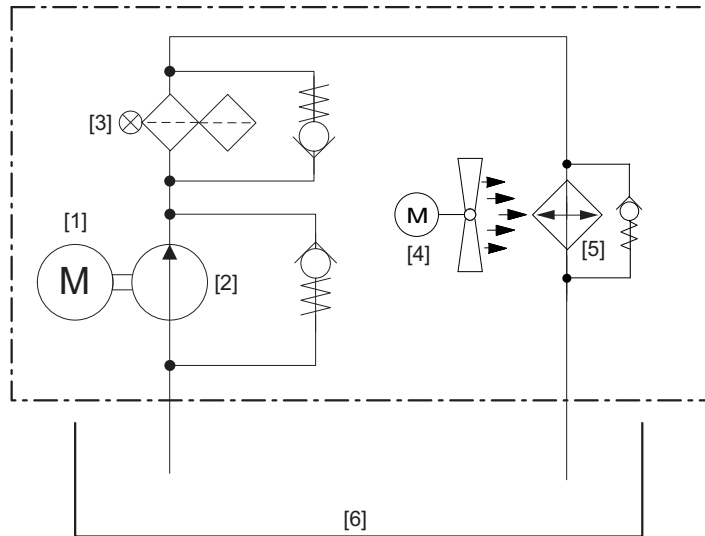
3.6 Type designation

OAC1 16/120-020/M	
O	Oil cooling system
A	Cooling medium - W = Water - A = Air
C	Type - C = Circulation cooling - P = Pressure lubrication
1	Generation
16	Pump size 06 – 63
120	Air heat exchanger 120 – 810
0	Mounting positions 0 = M1 1 = M5
2	Line frequency 0 = 50 Hz 1 = 60 Hz 2 = 50 Hz / 60 Hz
0	Options 0 = No filter 1 = Single filter 2 = Duplex filter 9 = Special design
M	Mounting type - M = Mounted on the gear unit - S = Mounted separately

3.7 Hydraulics plan

3.7.1 Oil cooling system with duplex filter

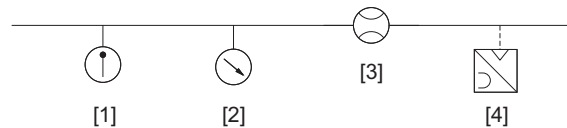
The following figure shows an example of the standard device structure of the oil cooling system.



36028817842783755

- | | |
|-------------------|----------------------------|
| [1] Pump motor | [4] Fan motor |
| [2] Oil pump | [5] Oil-air heat exchanger |
| [3] Duplex filter | [6] Gear unit |

The following figure shows at a glance the possible options that can be installed.

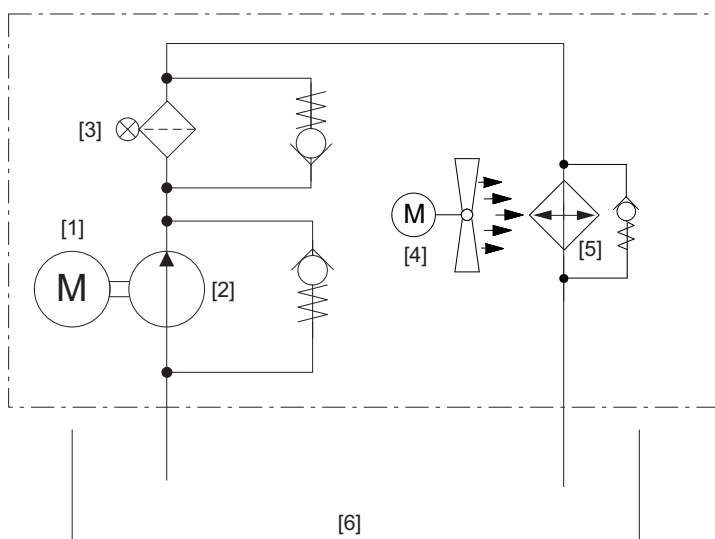


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- | |
|---------------------|
| [1] Thermometer |
| [2] Manometer |
| [3] Flow switch |
| [4] Pressure sensor |

3.7.2 Oil cooling system with single filter

The following figure shows an example of the standard device structure of the oil cooling system.



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[1] Pump motor

[2] Oil pump

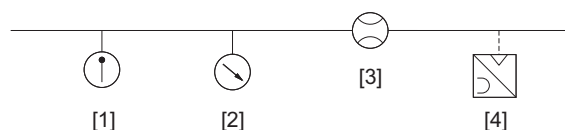
[3] Single filter

[4] Fan motor

[6] Oil-air heat exchanger

[6] Gear unit

The following figure shows at a glance the possible options that can be installed.



22845975563

[1] Thermometer

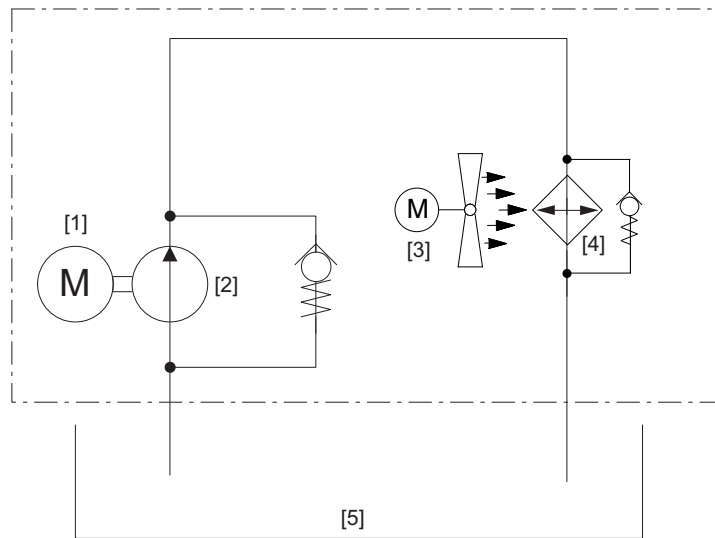
[2] Manometer

[3] Flow switch

[4] Pressure sensor

3.7.3 Oil cooling system without filter

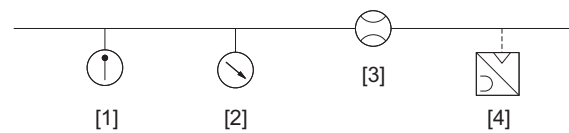
The following figure shows an example of the standard device structure of the oil supply systems.



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- [1] Pump motor
- [2] Oil pump
- [3] Fan motor
- [4] Oil-air heat exchanger
- [5] Gear unit

The following figure shows possible options that can be installed.



22845975563

- [1] Thermometer
- [2] Manometer
- [3] Flow switch
- [4] Pressure sensor

3.8 Technical data

The performance data of the standardized oil pump and oil-air heat exchanger is summarized in the following tables.

Motor data: Oil pump

Size	Oil pump size	Motor type	IEC standard	Number of poles	Motor power kW	Pump capacity at 1500 1/min	Global motor Hz
OAC1 06-120	KF 6	DRN	80MK	4	0.55	8.4	50/60
OAC1 10-220	KF 10	DRN	80M	4	0.75	13.7	
OAC1 16-320	KF 16	DRN	90S	4	1.1	21.8	
OAC1 20-420	KF 20	DRN	90L	4	1.5	27.1	
OAC1 32-420	KF 32	DRN	100ML	4	2.2	43.8	
OAC1 32-520	KF 32	DRN	100ML	4	2.2	43.8	
OAC1 50-710	KF 50	DRN	100L	4	4.0	68.2	
OAC1 63-810	KF 63	DRN	132S	4	5.5	86.2	

Motor data: Oil-air heat exchanger

Size	Oil-air heat exchanger	Motor type	IEC standard	Number of poles	Motor power kW	Global motor Hz
OAC1 06-120	LKI-120	DRN	63M	4	0.18	50/60
OAC1 10-220	LKI-220	DRN	63M	4	0.18	
OAC1 16-320	LKI-320	DRN	71M	4	0.37	
OAC1 20-420	LKI-420	DRN	80M	4	0.75	
OAC1 32-420	LKI-420	DRN	80M	4	0.75	
OAC1 32-520	LKI-520	DRN	90S	4	1.1	
OAC1 50-710	LKI-710	DRN	112M	6	1.1	
OAC1 63-810	LKI-810	DRN	132S	6	2.2	

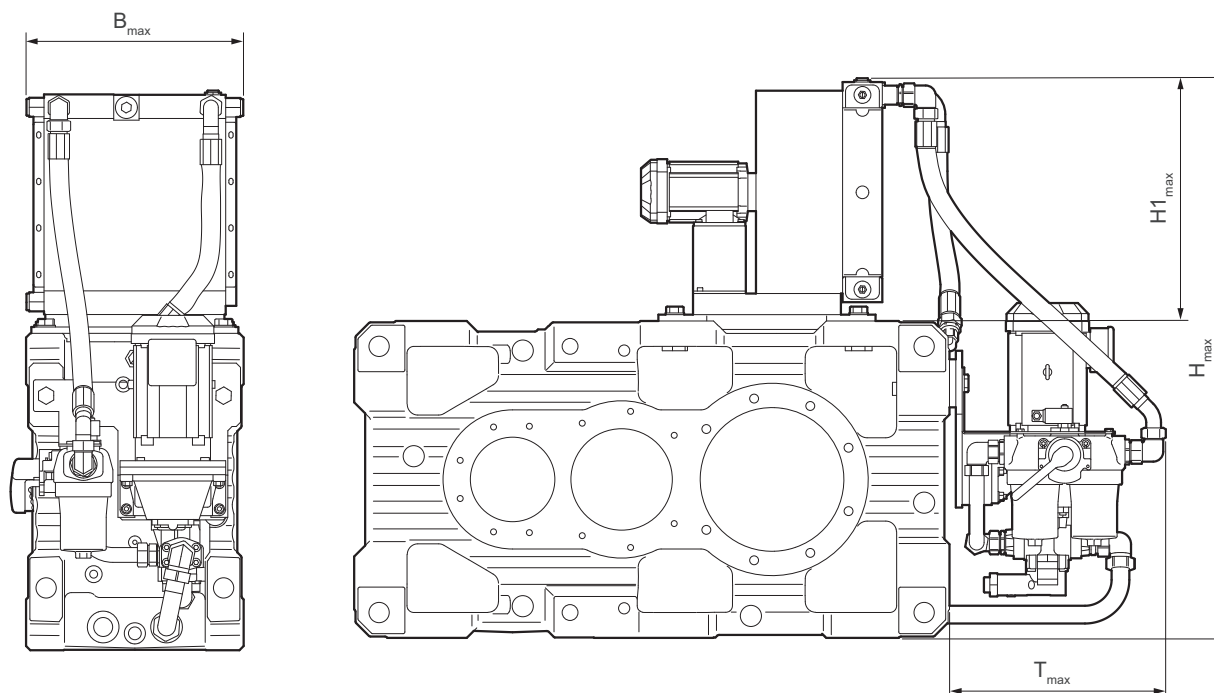
Performance data: Oil-air cooler /OAC1

The cooling capacity values given in the table apply to an air temperature of 40 °C, an oil temperature of 70 °C, equivalent volume flow of oil and cooling water, mineral oil CLP-CC-320, and 50 Hz line frequency.

Size	Cooling capacity at 40 °C air/70 °C oil kW	Specific cooling capacity at 40 °C air/70 °C oil kW/°C	Noise dB(A)
OAC1 06-120	4.0	0.13	64
OAC1 10-220	4.8	0.16	64
OAC1 16-320	9.4	0.31	73
OAC1 20-420	10.8	0.36	75
OAC1 32-420	13.0	0.43	75
OAC1 32-520	20.3	0.68	80
OAC1 50-710	27.7	0.92	77
OAC1 63-810	40.4	1.35	79

3.9 Dimension sheets

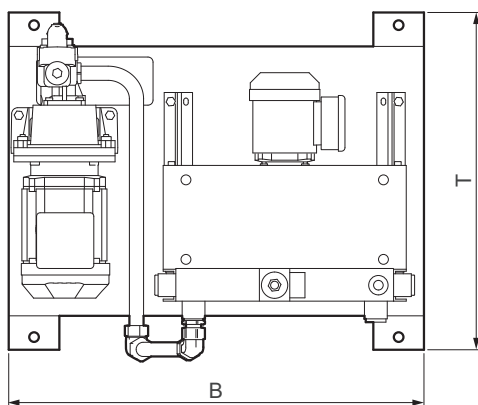
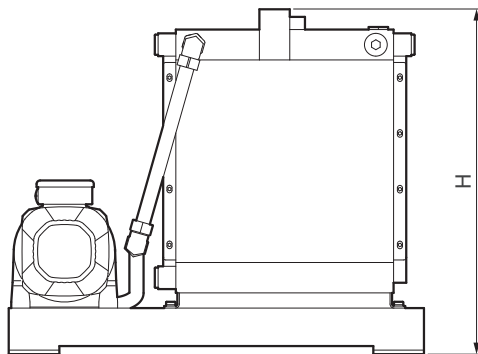
3.9.1 Standard mounting surfaces for the oil cooling system



Gear unit size	OAC1 size	Dmax	Wmax	Hmax	H1max
X140 – 150	OAC1 06/120	340	363	1015	485
	OAC1 10/220				
X160 – 170	OAC1 10/220	344	513	1235	605
	OAC1 16/320				
	OAC1 20/420				
X180 – 190	OAC1 10/220	514	513	1275	766
	OAC1 16/320				
	OAC1 20/420				
	OAC1 32/420				
X200 – 210	OAC1 10/220	514	515	1355	766
	OAC1 16/320				
	OAC1 20/420				
	OAC1 32/420				
X220 – 230	OAC1 16/320	514	684	1616	766
	OAC1 20/420				
	OAC1 32/420				
	OAC1 32/520				
X240 – 250	OAC1 16/320	514	684	1666	766
	OAC1 20/420				
	OAC1 32/420				
	OAC1 32/520				
X2K240 – 250	OAC1 16/320	514	700	1666	766
	OAC1 20/420				
	OAC1 32/420				
	OAC1 32/520				
X260 – 270	OAC1 32/420	550	750	1750	750
	OAC1 32/520		1000	2050	1050
	OAC1 50/710				
	OAC1 63/810				

Gear unit size	OAC1 size	Dmax	Wmax	Hmax	H1max
X280	OAC1 32/420	550	750	1850	750
	OAC1 32/520				
	OAC1 50/710		1000	2150	1050
	OAC1 63/810				
X290 – 300	OAC1 32/420	550	800	1950	750
	OAC1 32/520				
	OAC1 50/710		1000	2200	1050
	OAC1 63/810				
X310 – 320	OAC1 32/420	550	850	2050	750
	OAC1 32/520				
	OAC1 50/710		1000	2300	1050
	OAC1 63/810				

3.9.2 Oil cooling system on a base frame



OAC1 size	D	W	H
OAC1 06/120	692	820	561
OAC1 10/220	722	820	552
OAC1 16/320	689	820	681
OAC1 20/420	725	820	681
OAC1 32/420	790	1000	678
OAC1 32/520	759	1000	842
OAC1 50/710	1040	1280	988
OAC1 63/810	1040	1280	1102

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3.10 Interlocking specifications

3.10.1 Enabling of the gear unit

The gear unit is enabled if the following condition is met:

- Oil temperature $T < 90\text{ }^{\circ}\text{C}$

3.10.2 STOP gear unit/warning

STOP gear unit/warning if the following condition is met:

- Oil temperature $T > 90\text{ }^{\circ}\text{C}$

4 Installation/assembly

4.1 Mechanical connection

Connect the oil cooling system to the gear unit according to the identifying markings and local regulations.

In this respect, observe the following:

- Do not reduce the specified pipe cross sections.
- It is important that you choose the correct wall thickness and material when selecting pipes, hoses and screw fittings. Preferably use screw fittings with non-metallic gaskets.

4.2 Separate installation

4.2.1 Notes

Optionally, the oil-air heat exchanger and the gear unit can be installed separately. In this case, the oil cooling system is delivered without piping and without electrical wiring.

Provide for a low-vibration installation site. Install the oil cooling system at the same level as the gear unit or lower. If this is not possible, contact SEW-EURODRIVE.

Install the oil cooling system in such a way that input and output air can flow without any obstruction. Provide for sufficient ventilation and protection against dirt.

INFORMATION



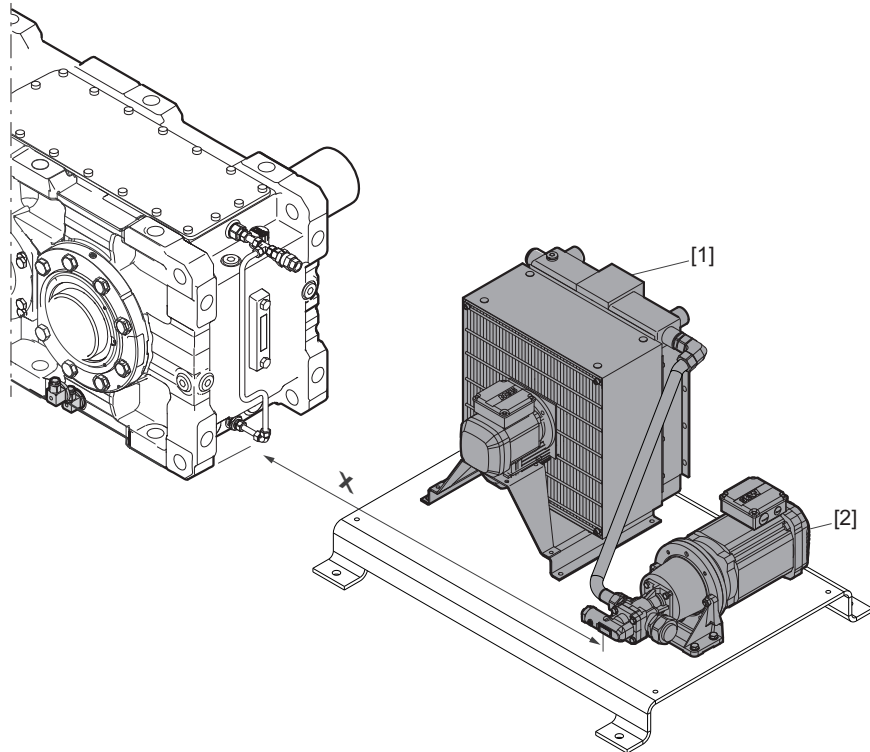
For the dimensions of the cooler and detailed technical data, refer to the order documents.

SEW-EURODRIVE differentiates between the following designs for separate installation.

4.2.2 Oil pump mounted on the oil-air heat exchanger

The oil pump [2] is mounted on the oil-air heat exchanger [1]. The maximum cable length **X** between gear unit and oil pump on the oil-air heat exchanger is available from SEW-EURODRIVE on request.

SEW-EURODRIVE recommends hose pipes between gear unit and oil pump.



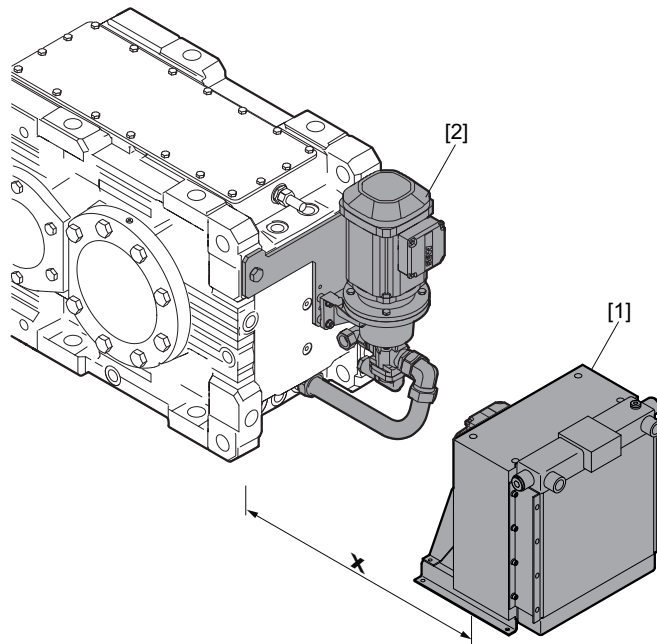
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4.2.3 Oil pump mounted on the gear unit

The oil pump [2] is mounted on the gear unit. The oil-air heat exchanger [1] and the gear unit are installed separately. This requires a new design and may impact the delivery times and costs.

The maximum cable length **X** between the oil pump and oil-air heat exchanger is available from SEW-EURODRIVE on request

SEW-EURODRIVE recommends hose pipes between the oil pump and the oil-air heat exchanger.



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4.3 Electrical connection

Observe country-specific regulations during the electrical connection.

With the standard design, connect the following components:

- Fan motor
- Pump motor
- Temperature switch/temperature sensor

Observe the following information.

- Make sure that the oil pump and the oil-air heat exchanger rotate in the correct direction.
- Observe the motor data sheet.
- If a temperature switch /TSK2 is used, it must be integrated in the controller in such a way that:
 - The oil pump and oil-air heat exchanger are switched on at the first switching point (at 60 °C oil temperature).
 - Either a warning signal is activated or the main drive is switched off at the second switching point (at 90 °C oil temperature).
- If a PT100 temperature sensor is used, it must be integrated in the controller in such a way that:
 - The oil pump and the oil-air heat exchanger are switched on at an oil temperature of 60 °C.
 - The oil pump and the oil-air heat exchanger are switched off if the oil temperature drops below 50 °C.
 - Either a warning signal is issued or the main drive is switched off when the oil temperature reaches 90 °C.
- The contamination indicator of the oil filter indicates when a dirty filter element needs to be replaced.

When using options:

- Connect the flow rate sensor to the customer-provided control.

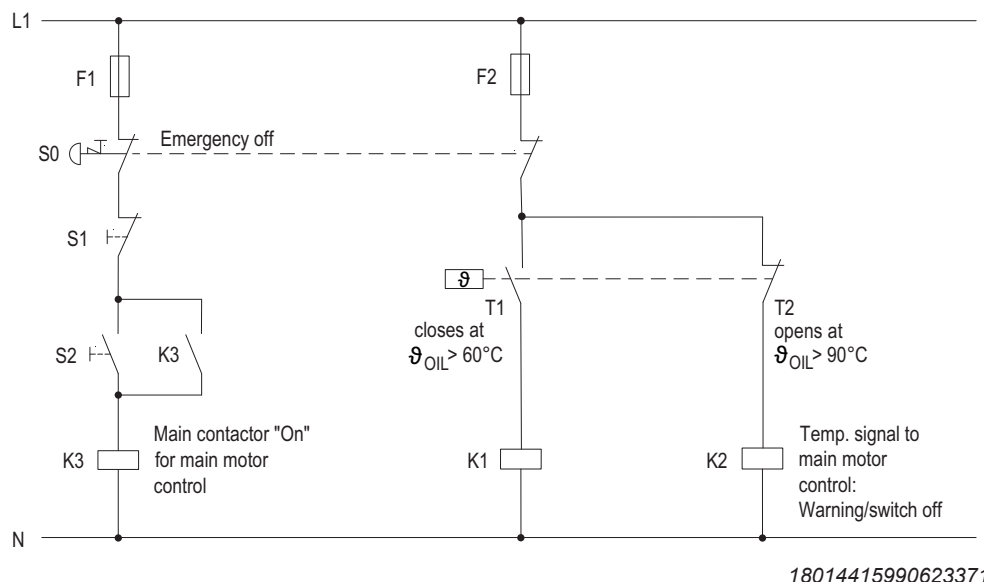
Installation/assembly

Wiring diagram (schematic illustration)

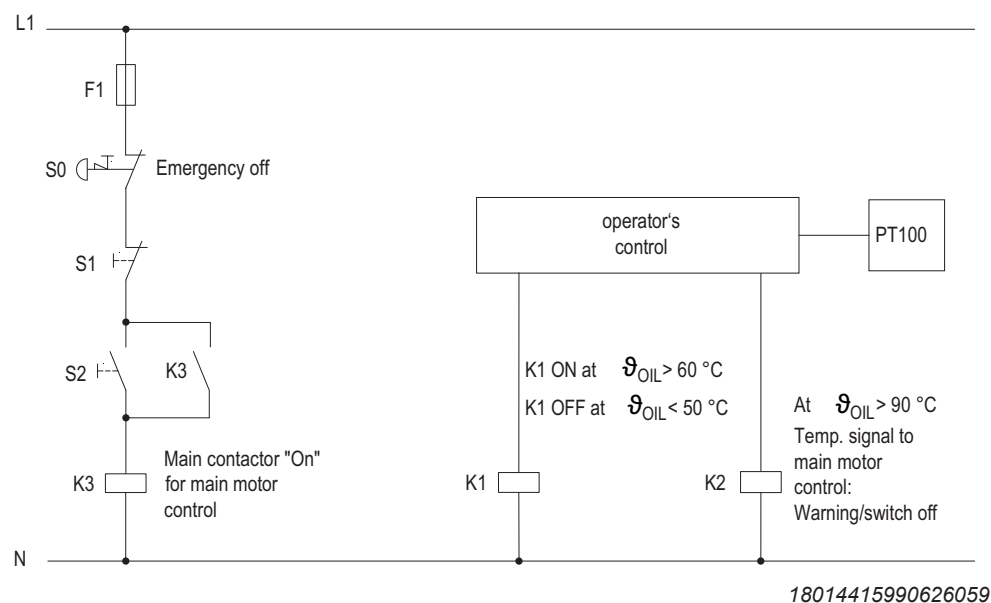
4.4 Wiring diagram (schematic illustration)

The wiring diagrams show a possible setup of the control for the cooling system when a temperature switch /TSK2 and, optionally, a PT100 temperature sensor are used. Use the wiring diagrams according to the structure of the cooling system.

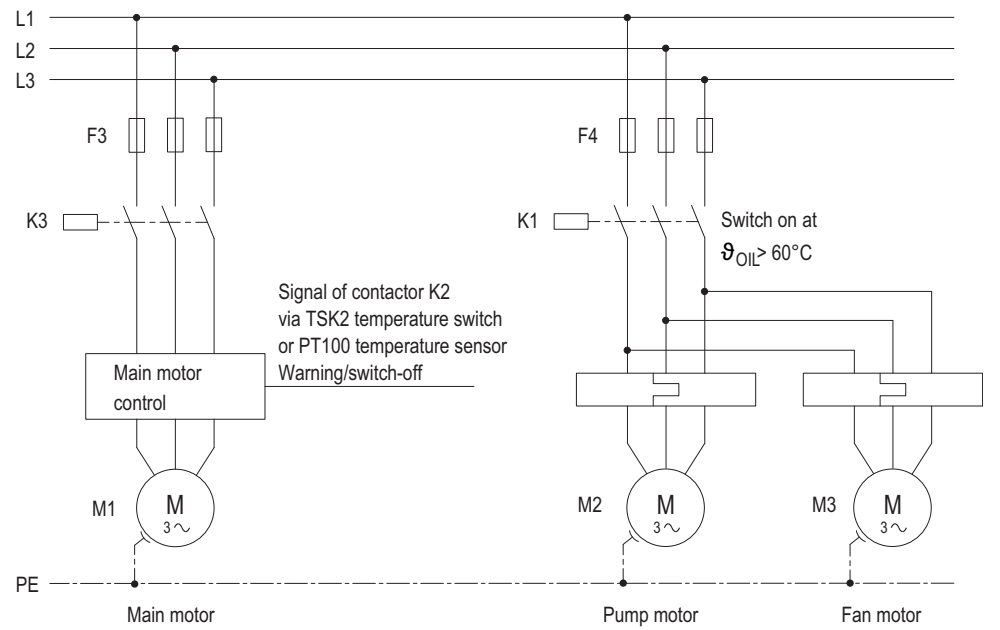
4.4.1 Control circuit with control via temperature switch /TSK2



4.4.2 Control circuit with control via PT100 temperature sensor

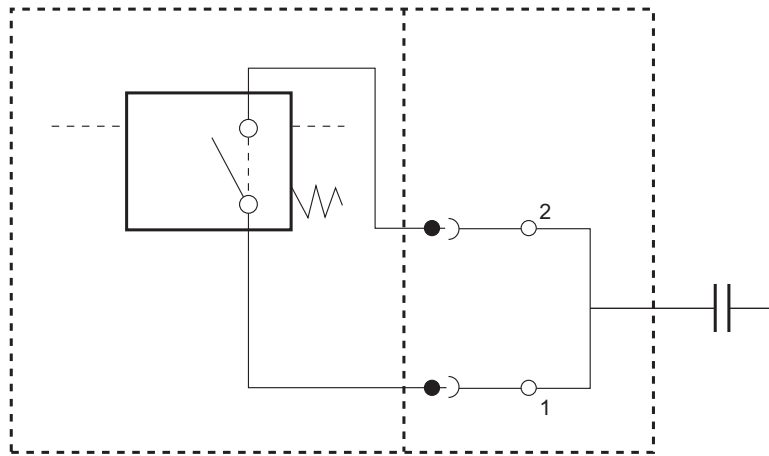


4.4.3 Main circuit with separate motors for pump and fan



4.5 Electrical/optical contamination indicator

4.5.1 Electrical connection



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4.5.2 Technical data

Max. voltage	AC 250 V / DC 200 V
Max. switching current	1.0 A
Max. switching capacity	70 W
Degree of protection	IP 65 in plugged and secured condition
Contact type	NO contact / NC contact

4.6 Limit temperature for startup of the oil cooling system

To ensure a correct function of the oil cooling system, the gear unit oil must not exceed a maximum oil viscosity. The viscosity depends on the used oil, and on the oil temperature in the oil pipes/hoses and in the oil pump. Observe chapter "Permitted lubricants" (→ 40).

When the oil cooling system is used at low ambient temperatures, it may be required to adjust the cooling system. Contact SEW-EURODRIVE, if required.

4.7 Notes on checking the oil level

Using an oil cooling system might influence the oil level. The fill quantities specified on the nameplate are guide values and refer only to the gear unit. The mark on the oil dipstick, oil level glass or oil sight glass is the decisive indicator of the correct oil quantity.

Observe the chapter "Checking the oil level" in the operating instructions for the gear unit.

4.7.1 Additionally required gear unit oil

The following table shows the lubricant fill quantity for the oil cooling system that has to be filled into the gear unit additionally.

The information is based on the standard cross section of the pipes for a suction pipe length of 1.5 m and a pressure pipe length of 2.5 m.

Size	Additional oil quantity in the gear unit in l
OA.1 06-120	6
OA.1 10-220	8
OA.1 16-320	10
OA.1 20-420	13
OA.1 32-420	15
OA.1 32-520	15
OA.1 50-710	23
OA.1 63-810	28

5 Startup

5.1 Notes



NOTICE

Improper startup may result in damage to the gear unit or the oil cooling system.

Possible damage to property.

- Observe the following information.
- Before startup, check the functionality of the monitoring devices. (Depending on the types of pressure switch, flow monitor, temperature switch/temperature sensor, contamination indicator, etc.)
- Before starting up the gear unit for the first time and after each oil change, run the oil pump for at least 10 minutes to ensure that all oil chambers are filled with oil. Then switch the oil pump off again and check the oil level within a short period of time. If necessary, correct the oil level.
- Note that an oil heater is mandatory when operating the oil cooling system at relatively low ambient temperatures. For further information, refer to chapter "Limit temperature for startup of the oil cooling system" (→ 35).

5.2 Venting the oil pump



⚠ WARNING

Danger due to leaking and squirting gear unit oil.

Serious injury.

- You must wear safety goggles.
- Be very careful when you vent the oil pump.

If the oil pump does not supply oil immediately after the start, do the following:

- Fill the oil pump with oil.
- Vent the oil supply system on the pressure side during start, if possible at the highest point.

5.3 Flow switch

Observe the following procedure:

1. Connect the flow switch.
2. Start up the oil pump.
3. Perform the high-flow adjustment and observe the notes in the manufacturer documentation (see attachment).
4. Set the switch-off point of the flow switch to LED 4 or 5 and observe the notes in the manufacturer documentation.
5. Integrate the switching point into the controller in such a way that the gear unit is switched off if the set switching point (see point 4) is not reached.

6 Inspection/maintenance

6.1 Inspection and maintenance intervals

Adhere to the following inspection and maintenance intervals.

Time interval	What to do?
Depending on the operating conditions, at the latest every 12 months	Check the condition of the motor pump, and replace the filter element if necessary.
Varying (depending on external factors)	- Check all hose pipes for tightness. The period of use of hose pipes should not exceed six years from the date of manufacture printed on them. - Clean the cooler matrix of the oil-air heat exchanger.

6.2 Notes



⚠ WARNING

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Any work must be performed at standstill only. Secure the gear unit against unintentional power-up. Place an information sign near the ON switch to warn that the gear unit is being worked on.



⚠ WARNING

Risk of burns due to hot gear oil.

Serious injury.

- Let the gear unit and the oil cooling system cool down before you start working on them.
- Maintenance and repair work on the oil circuit must not be performed while it is under pressure.
- Be careful when opening the screw plugs, oil drain plug, and oil drain valve.

6.3 Checking hose pipes

NOTICE

Hoses and hose pipes are subject to natural aging even if they are properly stored and used. This is why the period of use is limited.

- The period of use of hose pipes should not exceed 6 years from the date of manufacture printed on them.
- The operator of the plant is responsible for making sure that hose pipes are replaced at adequate intervals even if they do not show any signs of safety-related defects.
- Have hose pipes checked by a specialist at least once a year to ensure operational safety.

7 Permitted lubricants

This chapter describes the permitted lubricants and the permitted temperatures for industrial gear units from SEW-EURODRIVE.

INFORMATION



- The standard for viscosity and oil grade is the type of oil that is specified by SEW-EURODRIVE in the order (see order confirmation and nameplate).
- Contact SEW-EURODRIVE if you use bio and food grade lubricants or polyglycol oils.
- Check the compatibility of the greases and oils used.
- The tables contain the lubricants approved by SEW-EURODRIVE.
- Oils of the same viscosity class from different manufacturers do not have the same characteristics. In particular, the minimum permitted oil bath temperatures are manufacturer-specific. These temperatures are specified in the lubricant tables.
- The minimum permitted oil bath temperatures depend on the lubrication type used. These temperatures are specified in the lubricant tables. The values correspond to the maximum viscosity of the individual lubricants.
- The values specified in the lubricant tables apply as of the time of printing of this document. The data of the lubricants are subject to dynamic change on the part of the lubricant manufacturers. For the latest information about the lubricants, visit: www.sew-eurodrive.de/lubricants

7.1 Structure of the tables and abbreviations

		DIN (ISO) API	ISO,SAE NLGI					
[2]				-20	+65	-20	+65	
			-5	-5				
			+5	+5				
		VG 150 ¹⁾		Optigear BM 150	Alpha SP 150			
			S0		S0			
[1]				-15	+75	-15	+75	
			0	0				
			+10	+10				
		VG 220		Optigear BM 220	Alpha SP 220			
				S0		S0		
				-10	+85	-10	+80	
			+5	+5				
			+15	+15				
		VG 320		Optigear BM 320	Alpha SP 320			
			S0		S0			

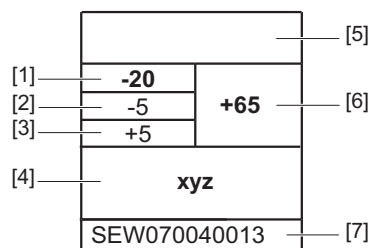
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- [1] Lubricant type
[2] Viscosity class

Abbreviations

Icons	Designation
CLP	= Mineral oil
CLP HC	= Synthetic polyalphaolefin (PAO)
E	= Ester-based oil
	= Mineral lubricant
	= Synthetic lubricant
	= Lubricant for the food industry (NSF H1 -compliant)
	= Biodegradable oil (lubricant for agriculture, forestry, and water management)
1)	= Lubricants may only be used if service factor $F_s \geq 1.3$

7.2 Explanation of the various lubricants



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- [1] Lowest cold start temperature in °C for splash lubrication¹⁾
- [2] Lowest cold start temperature in °C for drives with pumps up to a max. oil viscosity of 5000 cSt¹⁾
- [3] Lowest cold start temperature in °C for drives with pumps up to a max. oil viscosity of 2000 cSt¹⁾
- [4] Trade name
- [5] Manufacturer
- [6] Highest oil bath temperature in °C²⁾
- [7] Approvals

1) In the case of low temperatures, the oil must be heated to the specified minimum temperature, for example by using an oil heater. For the maximum permitted oil viscosity per pump type, refer to the following chapter.

2) Service life is significantly reduced when exceeded. Observe chapter "Lubricant change intervals".

7.3 Explanation of the oil supply systems and the oil viscosity

The motor pump is designed for an oil viscosity of **5000 cSt**.

7.4 Lubricant tables

This lubricant table is valid when the document is published. Please refer to www.sew-eurodrive.de/lubricants for the latest version of the table.

[1]	[2]									
	VG 150 ¹⁾	SEW GearOil Base 150 E1 SEW070040013	Optigear BM 150 -20 -5 +5 +65	Alpha SP 150 -20 -5 +5 +65	Renolin CLP 150 Plus -20 -5 +5 +65	Renolin HighGear 150 -20 -5 +5 +65	Mobilgear 600 XP 150 -20 -5 +5 +65	Kluberoil GEM 1-150 N -20 -5 +5 +65		
	VG 220	SEW GearOil Base 220 E1 SEW070040013	Optigear BM 220 -15 0 +10 +75	Alpha SP 220 -15 0 +10 +75	Renolin CLP 220 Plus -15 0 +10 +75	Renolin HighGear 220 -15 0 +10 +75	Mobilgear 600 XP 220 -15 0 +10 +75	Kluberoil GEM 1-220 N -15 0 +10 +75	Shell Omala Oil F 220 -15 0 +10 +75	Carter EP 220 -15 0 +10 +75
	VG 320	SEW GearOil Base 320 E1 SEW070040013	Optigear BM 320 -10 +5 +15 +85	Alpha SP 320 -10 +5 +15 +85	Renolin CLP 320 Plus -10 +5 +15 +85	Renolin HighGear 320 -10 +5 +15 +85	Mobilgear 600 XP 320 -10 +5 +15 +85	Kluberoil GEM 1-320 N -10 +5 +15 +85	Shell Omala Oil F 320 -10 +5 +15 +85	Carter EP 320 -10 +5 +15 +85
CLP	VG 460	SEW GearOil Base 460 E1 SEW070040013	Optigear BM 460 -5 +10 +20 +90	Alpha SP 460 -5 +10 +20 +90	Renolin CLP 460 Plus -5 +10 +20 +90	Renolin HighGear 460 -5 +10 +20 +90	Mobilgear 600 XP 460 -5 +10 +20 +90	Kluberoil GEM 1-460 N -5 +10 +20 +90	Shell Omala Oil F 460 -5 +10 +20 +90	Carter EP 460 -5 +10 +20 +90
	VG 680	SEW GearOil Base 680 E1 SEW070040013	Optigear BM 680 0 +15 +25 +90	Alpha SP 680 0 +15 +25 +90	Renolin CLP 680 Plus 0 +15 +25 +90	Renolin HighGear 680 0 +15 +25 +90	Mobilgear 600 XP 680 0 +15 +25 +90	Kluberoil GEM 1-680 N 0 +15 +25 +90		Carter EP 680 0 +15 +25 +90
	VG 1000		Optigear BM 1000 +5 +20 +30 +90							

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This lubricant table is valid when the document is published. Please refer to www.sew-eurodrive.de/lubricants for the latest version of the table.

[1]	[2]	SEW EURODRIVE	Castrol	FUCHS	Mobil®	KLÜBERS LUBRICATION	Shell	TOTAL
CLP HC	VG 32 ¹⁾				SHC 624			
	VG 68 ¹⁾				SHC 626			
	VG 150 ¹⁾	SEW GearOil Synth 150 E1	Alphasyn EP 150	Renolin Unisyn CLP 68				
		SEW 070040313						
	VG 220	SEW GearOil Synth 220 E1	Optigear Synthetic X 150	Renolin Unisyn CLP 150				
		SEW 070040313						
	VG 320	SEW GearOil Synth 320 E1	Optigear Synthetic X 220	Renolin Unisyn CLP 220				
		SEW 070040313						
	VG 460	SEW GearOil Synth 460 E1	Optigear Synthetic X 320	Renolin Unisyn CLP 320				
		SEW 070040313						
	VG 680	SEW GearOil Synth 680 E1	Optigear Synthetic X 460	Renolin Unisyn CLP 460				
		SEW 070040313						
	VG 1000							

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This lubricant table is valid when the document is published. Please refer to www.sew-eurodrive.de/lubricants for the latest version of the table.

[1]	[2]	[3]	SEW EURODRIVE	bremner & legrini	Castrol	FUCHS	KLÜBER LUBRICATION
	CLP HC NSF H1	VG 68 ¹⁾		Cassida Fluid HF 68	Optileb HY 68	Cassida Fluid HF 68	Klüberoil 4UH1-68 N
		VG 220 ¹⁾	SEW GearOil Synth 220 H1 E1	Cassida Fluid GL 220	Optileb GT 220	Cassida Fluid GL 220	Klüberoil 4UH1-220 N
		VG 460 ¹⁾	SEW GearOil Synth 460 H1 E1	Cassida Fluid GL 460	Optileb GT 460	Cassida Fluid GL 460	Klüberoil 4UH1-460 N
	E	VG 460	SEW 070040313			Plantogear 460 S	Klüberbio CA2-460

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8 Malfunctions/remedy

8.1 Notes



⚠ WARNING

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Any work must be performed at standstill only. Secure the gear unit against unintentional power-up. Place an information sign near the ON switch to warn that the gear unit is being worked on.



⚠ WARNING

Risk of burns due to hot gear oil.

Serious injury.

- Let the gear unit and the oil cooling system cool down before you start working on them.
- Maintenance and repair work on the oil circuit must not be performed while it is under pressure.
- Be careful when opening the screw plugs, oil drain plug, and oil drain valve.

8.2 Possible failures/remedy

Fault	Possible cause	Measure
No oil pump suction	- Air in the pipes - Not enough oil in the gear unit - Wrong oil grade in the gear unit - Motor not running - Wrong direction of rotation of the motor	- Fill the suction line and oil pump with oil - Vent pressure pipe on startup - Check oil level in gear unit - Check oil grade (in particular when temperatures are low) - Check electrical connections - Change the direction of rotation
Delivery rate of oil pump not sufficient	- Oil circulation clogged - Wrong oil grade - Wrong motor speed - Negative pressure at pump suction side too high	- Open valves and plugs - Check oil grade (in particular when temperatures are low) - Check pump motor speed - Increase cross section of suction line - Decrease suction lift
Oil pump very loud	Negative pressure at pump suction side too high	- Increase cross section of suction line - Decrease suction lift - Avoid distortion of the suction line - Avoid reductions in the suction pipes

Fault	Possible cause	Measure
Oil pump delivers froth	• Not enough oil in the gear unit • Suction line leaking	• Check oil level in gear unit • Check screw fittings for leaks
Oil leakage at oil pump	• Wear on the oil seal • Wrong direction of rotation • Wrong sealing material	• Renew oil seal • Check direction of rotation • Check operating conditions
Cooling capacity is not reached	• Air temperature higher than dimensioned	• Use larger cooler
Insufficient air flow	• Lamella blocked • Obstacles in the vicinity	• Clean cooler matrix • Adhere to minimum clearance

8.3 Service

Please have the following information available if you require customer service assistance:

- Complete nameplate data
- Type and extent of the malfunction
- Time the problem occurred and any accompanying circumstances
- Assumed cause
- If possible video and audio recordings

8.4 Waste disposal

Dispose of the product and all parts separately in accordance with their material structure and the national regulations. Put the product through a recycling process or contact a specialist waste disposal company. If possible, divide the product into the following categories:

- Iron, steel or cast iron
- Stainless steel
- Aluminum
- Copper
- Plastics

The following materials are hazardous to health and the environment. These materials must be collected and disposed of separately.

- Oil and grease

Collect used oil and grease separately according to type. Ensure that the used oil is not mixed with solvent. Dispose of used oil and grease correctly.

9 **Supplier documentation**

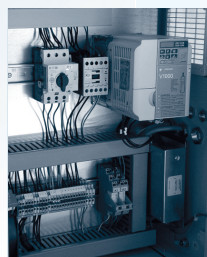
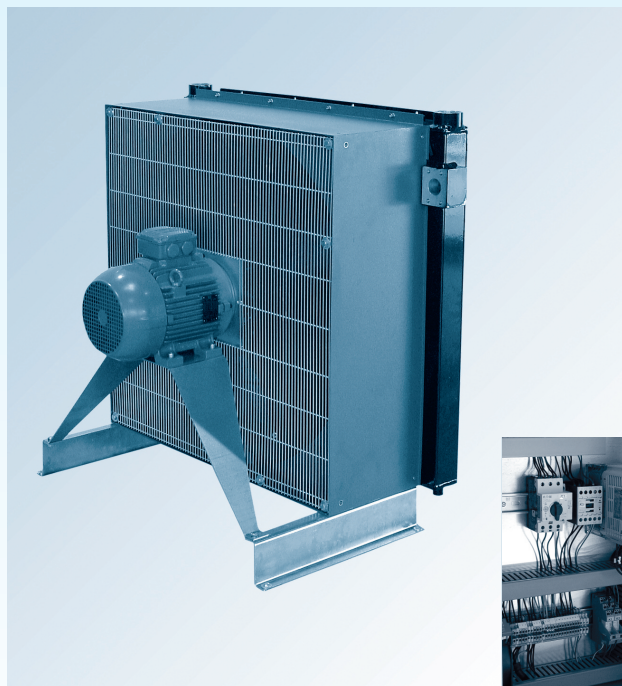
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Serie

LKI

Für den industriellen Einsatz

For industrial use

A usage industriel



NEU:

- Jetzt auch als Baukastensystem mit Steuerung erhältlich! Auf die Leistung angepasste Drehzahlregelung für optimierten Energieverbrauch und verringerte Lärmemission
- Atex-Zertifikat
- US-Version (NEMA-Motor)
- Edelstahlversion

NEW:

- Now also available in a modular system with a power control! Speed control attuned to the power in order to reduce noise level and energy consumption
- ATEX certificate
- US-version (NEMA-motor)
- Stainless steel version

NOUVEAU:

- Maintenant aussi disponible en tant que système modulaire avec commande! A la puissance une régulation de vitesse adaptée pour une consommation d'énergie optimisée et une réduction de bruit
- Certificat ATEX
- Version US (Moteur NEMA)
- Version acier inoxydable



Produktbeschreibung / Product description / Description du produit

Mit dieser neuen Generation der Universal Hydraulik LKI Ölkühler ist es gelungen, den Geräuschpegel zu reduzieren. Diese Kühler sind sehr gut für stationäre Installationen geeignet - für die Kühlung von Hydraulik- oder Schmieröl. Das Programm ist mit langsam laufenden Lüftern ausgebaut worden, bzw. wurde gehäuseoptimiert, was den sehr niedrigen Geräuschpegel gewährleistet. Um das Kühlerprogramm so komplett wie möglich zu bekommen, können die kleinen Typen sowohl in einer eingängigen als in einer zweigängigen Konstruktion geliefert werden. Dadurch wird der Bedarf für Ölkühlung sowohl bei niedrigen als auch bei hohen Öldurchströmungen gedeckt.

With this new generation of Universal Hydraulik LKI oil-coolers, the manufacturers have succeeded in reducing the noise level. These coolers are ideally suited for stationary installations - for the cooling of hydraulic or lubricating oils. The range has been extended to include slow-running ventilators, and the housings have been optimised, in order to produce the very low noise level. In order to make the cooler range as comprehensive as possible, the smaller models are also available as single or dual versions, thus covering oil-cooling requirements for both low and high oil throughflow volumes.

Avec sa nouvelle génération de refroidisseurs d'huile LKI, Universal Hydraulik a réussi à réduire le niveau de bruit. Ces refroidisseurs conviennent parfaitement pour l'huile hydraulique ou de graissage dans des installations stationnaires. La gamme a été complétée avec des ventilateurs à fonctionnement lent, et les boîtiers ont été optimisés pour réduire le niveau de bruit. Les modèles de petite taille peuvent être livrés en version une ou deux voies, couvrant ainsi toutes les applications selon que le débit d'huile est faible ou élevé.

Produktmerkmale

- Testdruck: 25 bar statisch nach DIN 50104
- Arbeitsdruck: 16 bar (mind. 2 Mill. Zyklen von 0-16 bar bei 2 Hz und 60 °C)
- Kompakte Ölkühler
- Große Kühlleistung
- Niedriger Druckverlust
- Max. Betriebstemperatur: 120 °C
- Hohe Flexibilität
- 2" SAE-Flansch zusätzlich ab LKI 700 aufwärts
- Kühlung von: Öl, HFA, HFB, HFC, HFD-Flüssigkeiten bis $v = 100 \times 10^{-6} \text{ m}^3/\text{s}$, Wasser/Glycol mind. 65:35 - keinesfalls Wasser ohne Korrosionsschutzmittel
- Kühlmittel: Luft
- Variabler Motor; Hydro / 12/24V

Option

- Testdruck 40 bar
- Filtermatte auf Anfrage
- Thermo-Bypass
- Thermoschalter
- Seewasser-Ausführung (off-shore)

Product highlights

- Testing pressure: 25 bar static according to DIN 50104
- Operating pressure: 16 bar (min. 2 Mill. Cycles from 0-16 bar at 2 Hz and 60 °C)
- Compact oil-cooler
- High cooling performance
- Low pressure loss
- Max. operating temperature: 120 °C
- High flexibility
- 2" SAE flange from LKI 700 upward
- Cooling of: Oil, HFA, HFB, HFC, HFD-fluids up to $v = 100 \times 10^{-6} \text{ m}^3/\text{s}$, water/glycol min. 65:35 - under no circumstances water without corrosion prevention
- Coolant: air
- Variable motor; Hydro / 12/24V

Option

- Testing pressure 40 bar
- Filter pad available on request
- Thermo-bypass
- Thermo-switch
- Seawater version also available (off-shore)

Caractéristiques produit

- Pression de test: 25 bar statique après DIN 50104
- Pression de service: 16 bar (min. 2 Mill. Cycles de 0-16 bar à 2 Hz et 60 °C)
- Refroidisseur d'huile compact
- Grande capacité de refroidissement
- Faible perte de pression
- Faible niveau de bruit
- Température max. de service: 120 °C
- Bride SAE 2" à partir de la version LKI 700
- Refroidissement de: Huile, HFA, HFB, HFC, HFD- liquides jusqu'à $v = 100 \times 10^{-6} \text{ m}^3/\text{s}$, eau/glycol 65:35 du moins - point du tout eau sans anticorrosifs
- Medium de refroidissement: air
- Moteur variable, hydro / 12/24V

Options

- Pression de test 40 bar
- Matelas filtrant sur demande
- By-pass thermique
- Interrupteur thermique
- Version eau de mer (off-shore)

Berechnungsbeispiel / Example calculation / Exemple de calcul
Beispiel 1:

(wenn die Kühlleistung bekannt ist)

Kühlleistung	=	65 kW
Max. Öltemperatur	=	70 °C
Umgebungstemperatur	=	30 °C
Öldurchströmung	=	250 l/min
Spez. Kühlleistung:		

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{65}{70 - 30} = 1,63 \text{ kW/°C}$$

 Wahl: LKI-710-400-6 oder LKI 810-400-8.
 Die Wahl hängt von eventuellen Geräuschbegrenzungen ab.

Beispiel 2:

 (wenn die Kühlleistung nicht bekannt ist)
 Normalerweise gibt es eine Wärmeabgabe zum Öl von 25-30% der Motorleistung (Dieselmotor oder E-Motor)

Motorleistung	=	30 kW
Kühlleistung (0,3 x 30kW)	=	9,0 kW
Max. Öltemperatur	=	60 °C
Umgebungstemperatur	=	30 °C
Öldurchströmung	=	250 l/min
Spez. Kühlleistung:		

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{9}{60 - 30} = 0,3 \text{ kW/°C}$$

 Wahl: LKI-210-400-2 oder LKI 310-400-6.
 Die Wahl hängt von eventuellen Geräuschbegrenzungen ab.

Ölakkühlung:

$$\Delta t_{\text{Öl}} = \frac{36 \times Q}{V_{\text{Öl}}} = \frac{36 \times 9}{35} = 9,26 \text{ °C}$$

Q	=	Kühlleistung	[kW]
T _{Öl}	=	max. Öltemperatur	[°C]
T _{umg}	=	Umgebungstemperatur	[°C]
V _{Öl}	=	Öldurchströmung	[l/min]

Example 1:

(if required cooling performance is known)

Cooling performance	=	65 kW
Max. oil temperature	=	70 °C
Ambient temperature	=	30 °C
Oil throughflow	=	250 l/min
Special cooling performance:		

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{65}{70 - 30} = 1,63 \text{ kW/°C}$$

 Options: LKI-710-400-6 or LKI 810-400-8.
 The choice depends on any possible noise restrictions.

Example 2:

(if the required cooling performance is not known). Normally there is a heat transfer to the oil of 25-30% of the motor performance (diesel motor or electric motor)

Motor performance	=	30 kW
Cooling performance (0,3 x 30kW)	=	9,0 kW
Max. oil temperature	=	60 °C
Ambient temperature	=	30 °C
Oil throughflow	=	250 l/min
Special cooling performance:		

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{9}{60 - 30} = 0,3 \text{ kW/°C}$$

 Options: LKI-210-400-2 or LKI 310-400-6.
 The choice depends on any possible noise restrictions.

Oil cooling:

$$\Delta t_{\text{Öl}} = \frac{36 \times Q}{V_{\text{Öl}}} = \frac{36 \times 9}{35} = 9,26 \text{ °C}$$

Q	=	Cooling performance	[kW]
T _{Öl}	=	max. oil temperature	[°C]
T _{umg}	=	Ambient temperature	[°C]
V _{Öl}	=	Oil throughflow	[l/min]

Exemple 1:

(la capacité de refroidissement est connue)

Capacité de refroidissement	=	65 kW
Température d'huile max.	=	70 °C
Température ambiante	=	30 °C
Débit d'huile	=	250 l/min
Capacité de refroidissement spéc.:		

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{65}{70 - 30} = 1,63 \text{ kW/°C}$$

 Modèle: LKI-710-400-6 ou LKI 810-400-8.
 Le choix dépend du niveau de bruit requis.

Exemple 2:

(la capacité de refroidissement n'est pas connue). En règle générale, le dégagement de chaleur vers l'huile est de 25-30% du rendement du moteur (moteur diesel ou moteur électrique)

Rendement moteur	=	30 kW
Capacité de refroidissement (0,3 x 30 kW)	=	9,0 kW
Température d'huile max.	=	60 °C
Température ambiante	=	30 °C
Débit d'huile	=	250 l/min
Capacité de refroidissement spéciale:		

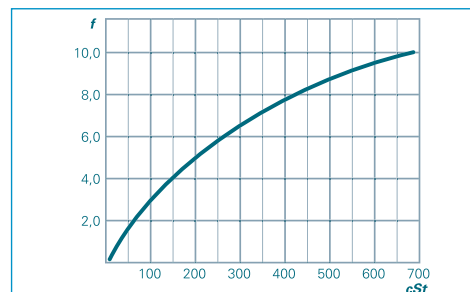
$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{9}{60 - 30} = 0,3 \text{ kW/°C}$$

 Modèle: LKI-210-400-2 ou LKI 310-400-6.
 Le choix dépend du niveau de bruit requis.

Refroidissement d'huile:

$$\Delta t_{\text{Öl}} = \frac{36 \times Q}{V_{\text{Öl}}} = \frac{36 \times 9}{35} = 9,26 \text{ °C}$$

Q	=	Refroidissement de l'huile	[kW]
T _{Öl}	=	Température d'huile max.	[°C]
T _{umg}	=	Température ambiante	[°C]
V _{Öl}	=	Débit d'huile	[l/min]



Korrekturfaktor für den Druckverlust bei anderen Viskositäten:

$$\Delta p_{\text{Öl}} = \Delta p_{30\text{cSt}} \times f$$

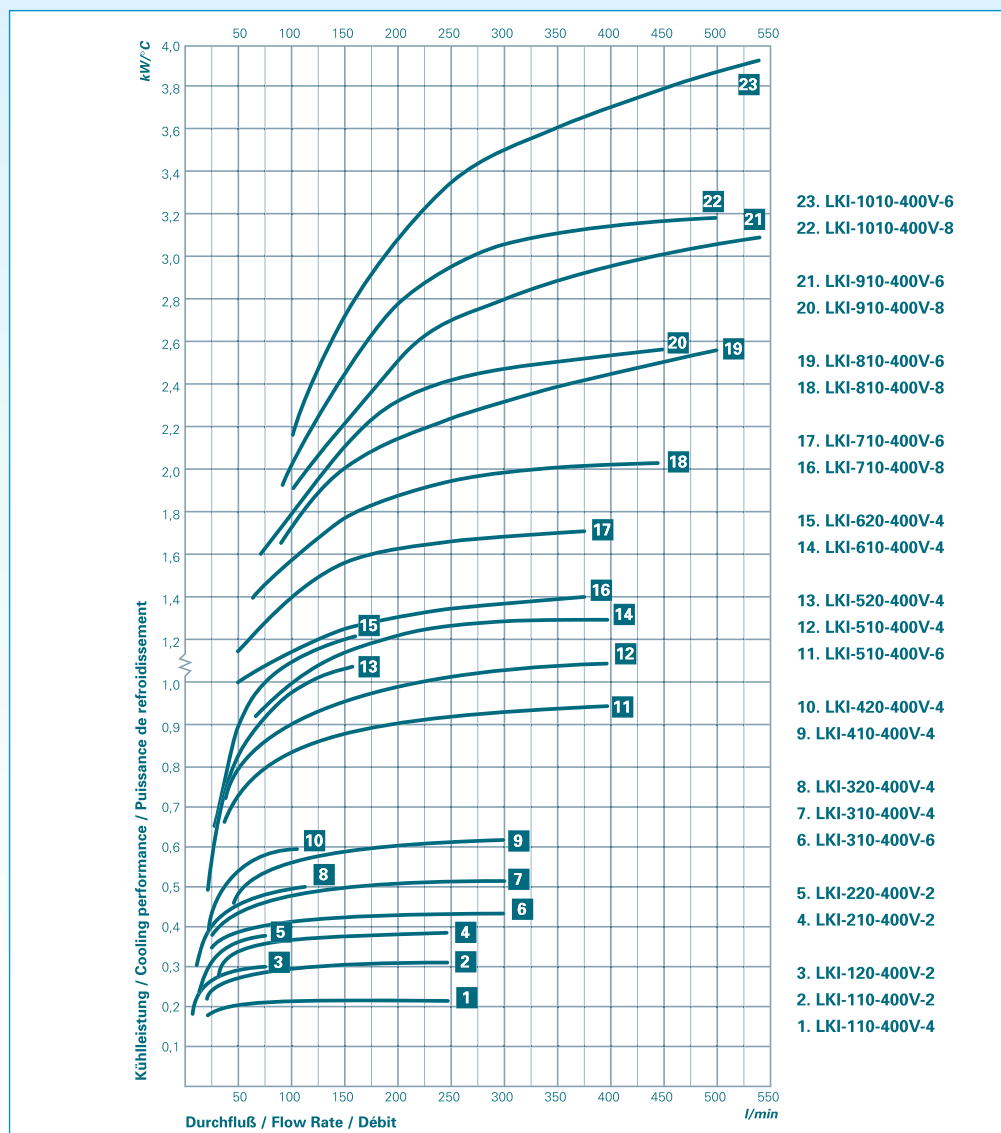
Correction factor for the pressure loss for other viscosities:

$$\Delta p_{\text{Öl}} = \Delta p_{30\text{cSt}} \times f$$

Facteur de correction de la perte de pression pour d'autres viscosités:

$$\Delta p_{\text{Öl}} = \Delta p_{30\text{cSt}} \times f$$

Kennlinien / Performance Data / Courbes caractéristiques LKI 110 - 1010



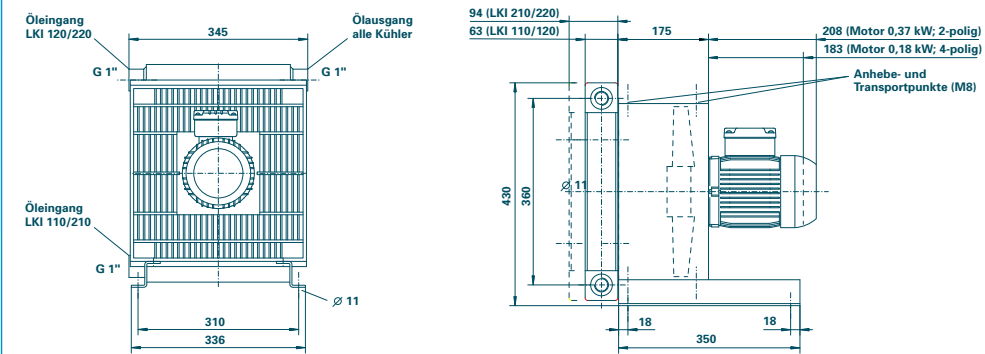
Die Berechnung der spezifischen Kühlleistungen gründet auf einer Öltemperatur von 60°C, einer Umgebungstemperatur von 20°C – und damit einem Temperaturunterschied von 40°C. Die Werte gelten für Hydrauliköl ISO VG32 mit 30 cSt. Für Abweichungen wird Δp mit dem Korrekturfaktor f aus dem Diagramm auf Seite 3 multipliziert.

The calculation of the specific cooling performance is based on an oil temperature of 60°C, an ambient temperature of 20°C – and therefore a temperature difference of 40°C. The figures apply to ISO VG32 hydraulic oil with 30 cSt. For variances, Δp is multiplied by the correction factor f from the diagram on Page 3.

Le calcul des capacités de refroidissement est basé sur une température d'huile de 60° C et une température ambiante de 20° C, soit une différence de température de 40°C. Les valeurs correspondent à l'utilisation d'huile hydraulique ISO VG32, viscosité 30 cSt. Pour d'autres valeurs, on multiplie Δp par le facteur de correction f du diagramme de la page 3.

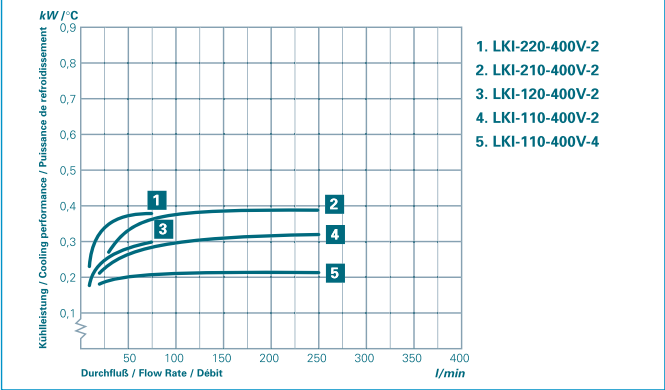
LKI-100/200

Abmessungen / Dimensions

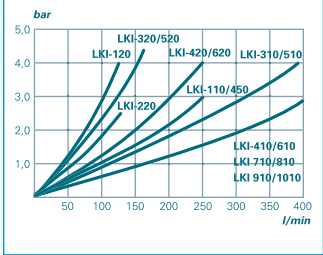


LKI 100 - 600: Öl-Anschlüsse Innengewinde seitlich / lateral internal-thread oil connections / Raccordements d'huile à filetage intérieur latéral

Kühlleistung / Cooling performance / Puissance de refroidissement



Druckabfall / Pressure loss / Baisse de pression



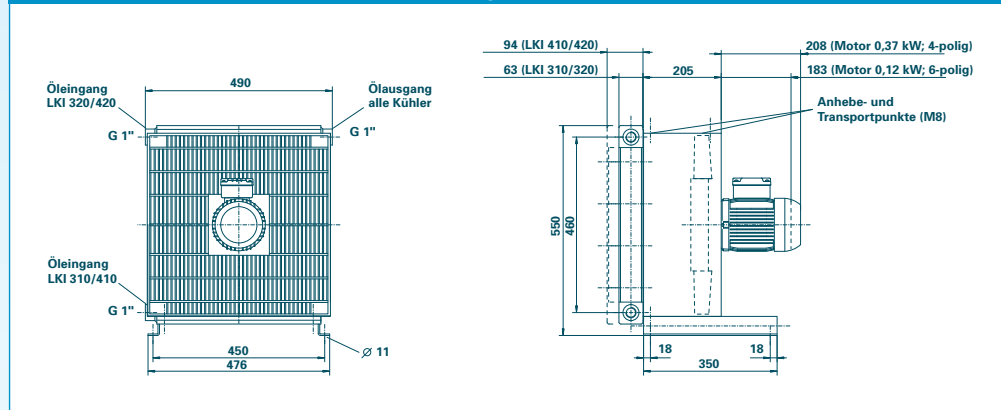
Technische Daten / Technical data / Données techniques

Typ model modele	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-110-400V-2	0,37	0,88	3000	1,29	77/62	17
LKI-120-400V-2	0,37	0,88	3000	1,29	77/62	17
LKI-110-400V-4	0,18	0,58	1500	0,49	64/50	17
LKI-120-400V-4	0,18	0,58	1500	0,49	64/50	17
LKI-210-400V-2	0,37	0,88	3000	1,18	79/64	20
LKI-220-400V-2	0,37	0,88	3000	1,18	79/64	20
LKI-210-400V-4	0,18	0,58	1500	0,50	64/50	20
LKI-220-400V-4	0,18	0,58	1500	0,50	64/50	20

* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ±3 dB(A) variieren.
* may vary by ±3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.
* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ±3 dB(A).

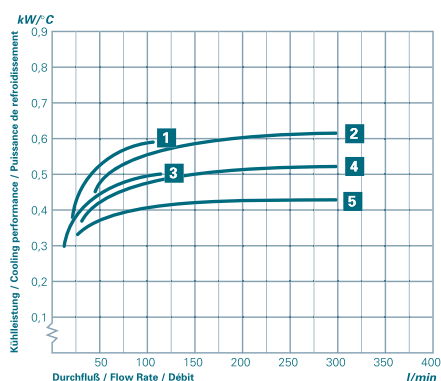
LKI-300/400

Abmessungen / Dimensions



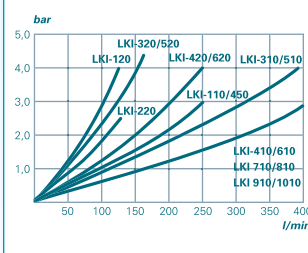
LKI 100 - 600: Öl-Anschlüsse Innengewinde seitlich / lateral internal-thread oil connections / Raccordements d'huile à filetage intérieur latéral

Kühlleistung / Cooling performance / Puissance de refroidissement



1. LKI-420-400V-4
2. LKI-410-400V-4
3. LKI-320-400V-4
4. LKI-310-400V-4
5. LKI-310-400V-6

Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

Typ model modele kW	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-310-400V-4	0,37	0,89	1500	0,74	73/58	25
LKI-320-400V-4	0,37	0,89	1500	0,74	73/58	25
LKI-310-400V-6	0,12	0,48	1000	0,59	65/51	26
LKI-320-400V-6	0,12	0,48	1000	0,59	65/51	26
LKI-410-400V-4	0,37	0,48	1500	0,76	75/63	32
LKI-420-400V-4	0,37	0,48	1500	0,76	75/63	32
LKI-410-400V-6	0,12	0,48	1000	0,55	67/53	33
LKI-420-400V-6	0,12	0,48	1000	0,55	67/53	33

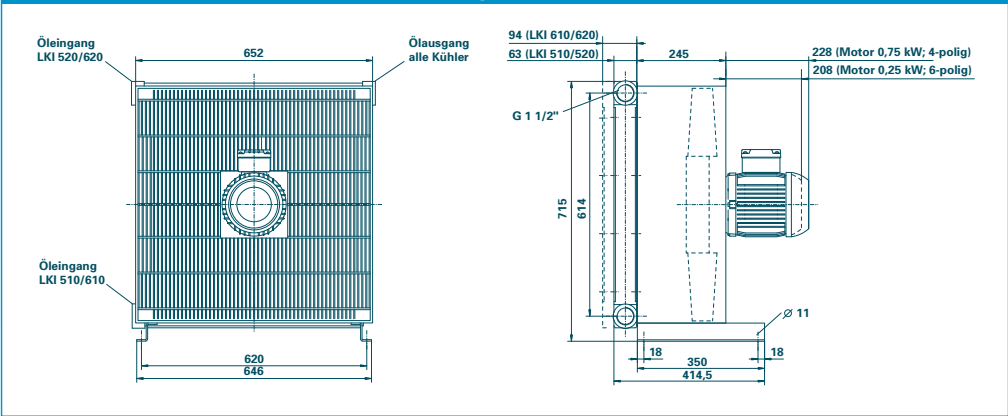
* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ± 3 dB(A) variieren.

* may vary by ± 3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ± 3 dB(A).

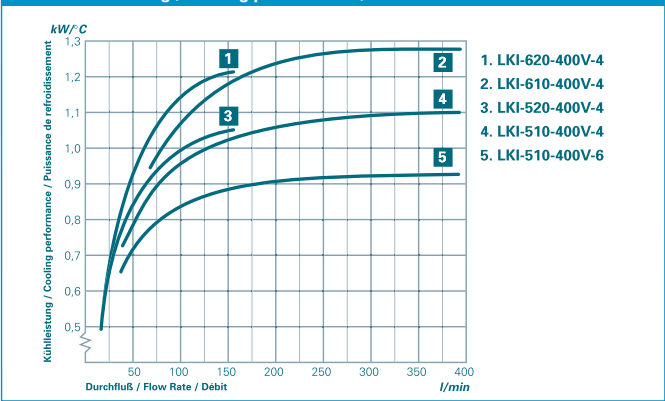
LKI - 500 / 600

Abmessungen / Dimensions

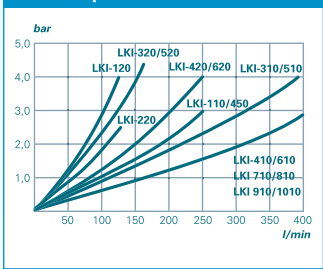


LKI 100 - 600: Öl-Anschlüsse Innengewinde seitlich / lateral internal-thread oil connections / Raccordements d'huile à filetage intérieur latéral

Kühlleistung / Cooling performance / Puissance de refroidissement



Druckabfall / Pressure loss / Baisse de pression



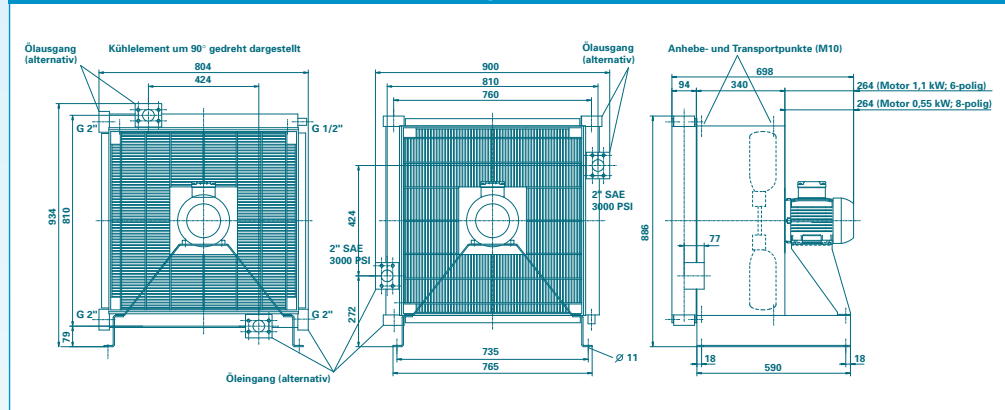
Technische Daten / Technical data / Données techniques

Typ model modele	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-510-400V-4	0,75	1,71	1500	1,70	80/70	40
LKI-520-400V-4	0,75	1,71	1500	1,70	80/70	40
LKI-510-400V-6	0,25	0,99	1000	1,06	70/57	37
LKI-520-400V-6	0,25	0,99	1000	1,06	70/57	37
LKI-610-400V-4	0,75	1,71	1500	1,50	80/70	49
LKI-620-400V-4	0,75	1,71	1500	1,50	80/70	49
LKI-610-400V-6	0,25	0,99	1000	0,95	70/57	49
LKI-620-400V-6	0,25	0,99	1000	0,95	70/57	49

* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ±3 dB(A) variieren.
* may vary by ±3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.
* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ±3 dB(A).

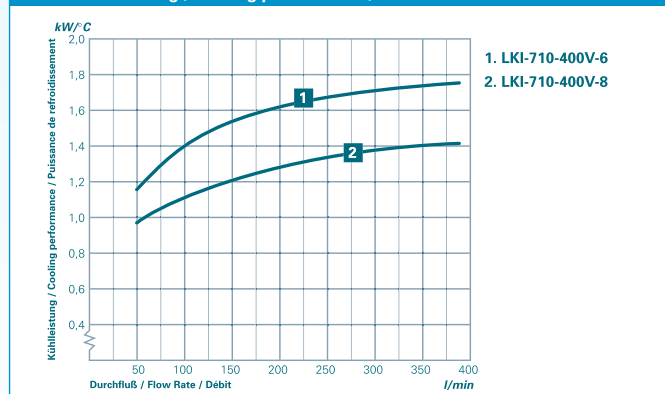
LKI-700

Abmessungen / Dimensions

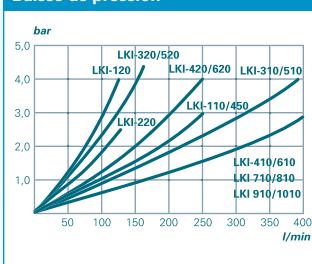


LKI 700 - 1000: Öl-Anschlüsse Innengewinde seitlich und SAE -Flansch hinten oder vorne / lateral internal-thread oil connections and SAE flange at front or rear / Raccordements d'huile à filetage intérieur latéral et bride SAE avant ou arrière

Kühlleistung / Cooling performance / Puissance de refroidissement



Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

Typ model modele kW	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-710-400V-6	1,1	2,56	1000	2,14	77/64	91
LKI-710-400V-8	0,55	2,56	750	1,56	69/56	91

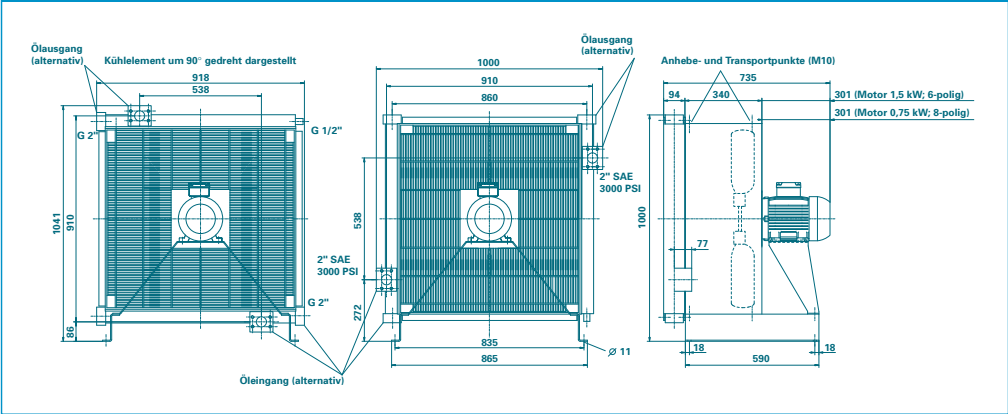
* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ±3 dB(A) variieren.

* may vary by ±3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ±3 dB(A).

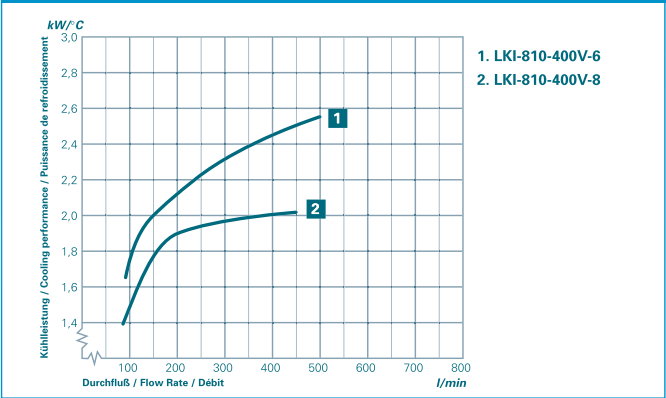
LKI-800

Abmessungen / Dimensions

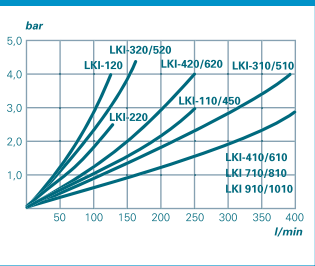


LKI 700 - 1000: Öl-Anschlüsse Innengewinde seitlich und SAE -Flansch hinten oder vorne / lateral internal-thread oil connections and SAE flange at front or rear / Raccordements d'huile à filetage intérieur latéral et bride SAE avant ou arrière

Kühlleistung / Cooling performance / Puissance de refroidissement



Druckabfall / Pressure loss / Baisse de pression



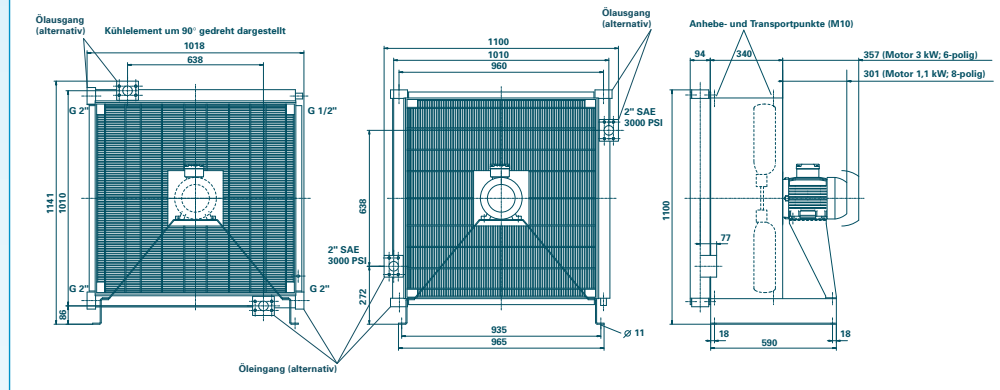
Technische Daten / Technical data / Données techniques

Typ model modele	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-810-400V-6	1,5	3,78	1000	3,38	79/68	111
LKI-810-400V-8	0,75	2,42	750	2,64	72/60	111

* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ±3 dB(A) variieren.
* may vary by ±3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.
* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ±3 dB(A).

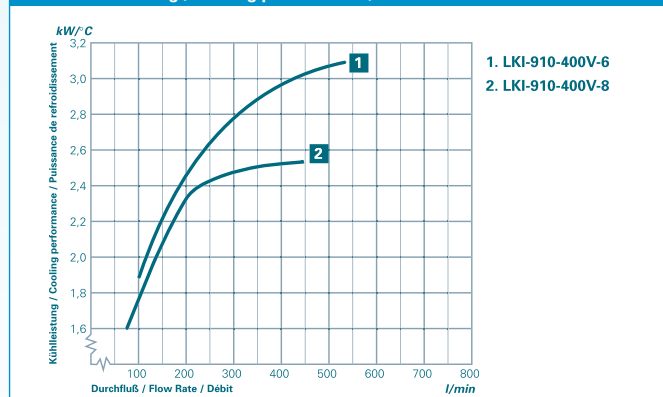
LKI-900

Abmessungen / Dimensions

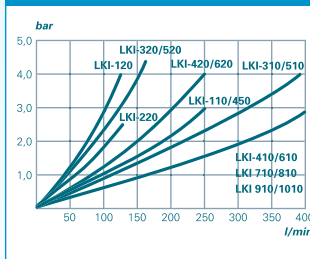


LKI 700 - 1000: Öl-Anschlüsse Innengewinde seitlich und SAE -Flansch hinten oder vorne / lateral internal-thread oil connections and SAE flange at front or rear / Raccordements d'huile à filetage intérieur latéral et bride SAE avant ou arrière

Kühlleistung / Cooling performance / Puissance de refroidissement



Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

Typ model modele kW	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-910-400V-6	3	7,2	1000	4,32	85/72	137
LKI-910-400V-8	1,1	3,78	750	3,07	76/64	131

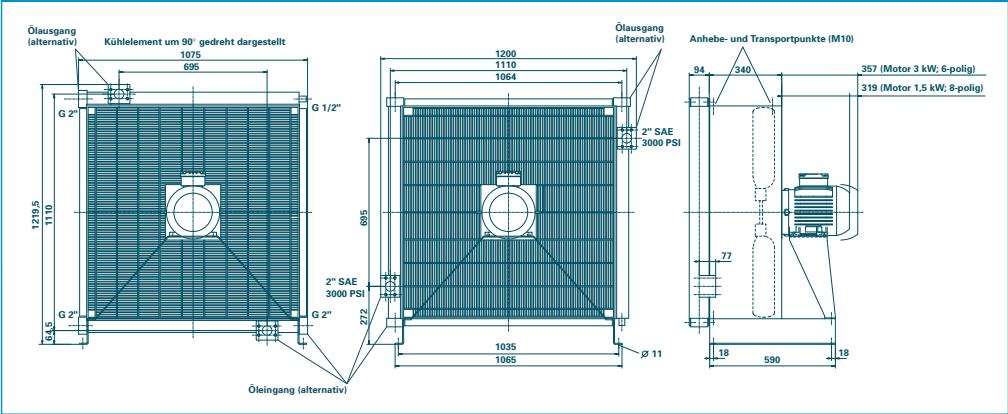
* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ± 3 dB(A) variieren.

* may vary by ± 3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ± 3 dB(A).

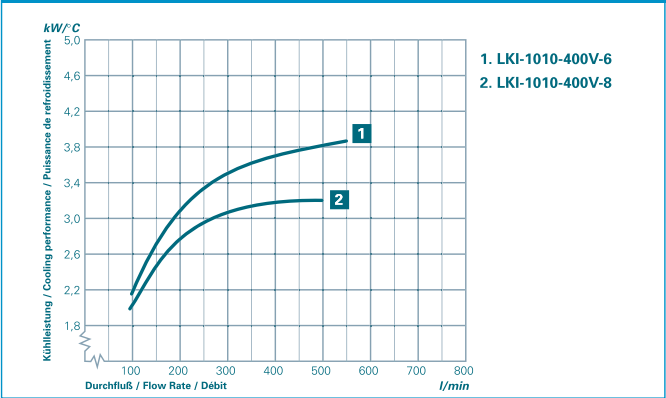
LKI-1000

Abmessungen / Dimensions

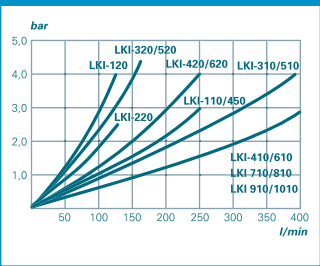


LKI 700 - 1000: Öl-Anschlusse Innengewinde seitlich und SAE -Flansch hinten oder vorne / lateral internal-thread oil connections and SAE flange at front or rear / Raccordements d'huile à filetage intérieur latéral et bride SAE avant ou arrière

Kühlleistung / Cooling performance / Puissance de refroidissement



Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

Typ model modele	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-1010-400V-6	3	7,2	1000	5,38	84/71	157
LKI-1010-400V-8	1,5	3,78	750	3,84	76/64	151

* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ±3 dB(A) variieren.
* may vary by ±3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.
* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ±3 dB(A).

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LKI - 110 - 400V - 2 - G - L			
Anwendung / Application / Application Industriekühler / Cooler for industrial use / refroidisseur a usage industrielles = LKI Kühler mit Hydraulikmotor* / Cooler with hydraulic motor* / refroidisseur avec moteur hydraulique* = LKI-HYD *(auf Anfrage / on request / sur demande)		- = Standard L = Liegende Version, ohne Füße, mit Haltebügel / flat version, no feet, with mounting / Version, sans pieds, avec fortification	
Baugröße / Unit Size / Taille 1 2 3 4 5 6 7 8 9 10		- = Standard G 90 = Kühlpaket 90° gedreht / Cooling block turned 90° / Bloc refroidisseur tournée 90° G 180 = Kühlpaket 180° gedreht / Cooling block turned 180° / Bloc refroidisseur tournée 180°	
Ausführung / Version / Exposé 1 Wege / 1 Way / 1 Voie = 10 2 Wege / 2 Way / 2 Voies = 20		Drehzahl / Revolutions per minute / Nombre de tours 2 = 2 polig / 3000 min ⁻¹ 4 = 4 polig / 1500 min ⁻¹ 6 = 6 polig / 1000 min ⁻¹ 8 = 8 polig / 750 min ⁻¹ Motortyp / Motor type / Type de moteur 400 V = 400 V Mehrbereichsmotor / 400 V multi-stage motor / Moteur multigrade 400 V Motore mit Sonderspannungen, hydraulisch und explosionsgeschützt auf Anfrage erhältlich. Motors with special voltages, hydraulic and explosion protection available on request. Moteurs avec tensions particulières, hydrauliques et à protection contre les explosions disponibles sur demande.	

Materialien / Materials / Matériaux

	Standard	Seewasser / Sea water / Eau de mer
Kühlblock / Cooling block / Bloc refroidisseur	Aluminium, Edelstahl/Aluminum, Stainless Steel/Aluminium, Inox	Komponenten in Edelstahl und Sonderbeschichtungen möglich/ Components in Stainless and with special coating available/ Composants en Inox et avec de vernis spécial est possible
Gehäuse / Housing / Boîtier	Stahl / Steel / Acier	
Schutzgitter / Safety barrier / Grille de protection	Stahl, blau-chromatiert / Steel with blue-chrome finish / Acier, chromé bleu	
Füße / Feet / Pieds	Verzinkt / Galvanized / Zinguée	
Lüfter / Fan / Ventilateur	PPG	Schutzlackbeschichtung/ protective coating/verniss protecteur

Die technischen Angaben in diesem Datenblatt beziehen sich auf die beschriebenen Betriebsbedingungen und Einsatzfälle. Bei abweichenden Betriebsbedingungen und Einsatzfällen wenden Sie sich bitte an Universal Hydraulik.

Technische Änderungen vorbehalten. Bitte beachten Sie auch unsere Wartungs- und Bedienungsanleitung.

The technical data of this sheet is depending on the described operational conditions and individual cases. At different operational conditions and differing individual cases contact UniversalHydraulik.

Technical modifications reserved. Please also pay attention to our operation manuals and maintenance documentations.

Vertrieb / Sales / Distribution

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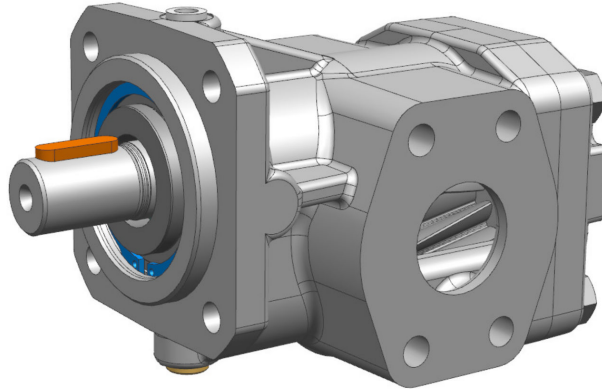
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Operating instructions (Translation)



Gear pump KF 2.5 - 630

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Englisch

2017-09-12

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Gear pump KF 2.5 - 630

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1 General

1.1 About the documentation

These operating instructions describe the installation, operation and maintenance of the following device:

Gear pump KF 2.5 - 630

The device is manufactured in different versions. Information about the version concerned in the individual case can be found on the device's type plate.

These operating instructions are a component of the device and must be kept accessible for the personnel near the device at all times.

If you have any questions about these operating instructions, please contact the manufacturer.

1.2 Manufacturer's address

KRACHT GmbH
 Gewerbestraße 20
 DE 58791 Werdohl
 phone: +49 2392 935-0
 fax: +49 2392 935-209
 email: info@kracht.eu
 web: www.kracht.eu

1.3 Applicable documents

1. KTR Kupplungstechnik GmbH, DE 48407 Rheine
 - KTR-N 40210: Coupling operating/assembly instruction Rotex

Excerpts from these documents are included in these operating instructions.

If required, the original documents can be requested from the respective manufacturer.

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1.4 Symbolism

	 DANGER Identification of an immediate hazard, which would result in death or severe bodily injury if not avoided.
	 WARNING Identification of a potential medium risk hazard, which would lead to death or severe bodily injury if not avoided.
	 CAUTION Identification of a low risk hazard, which could lead to minor or medium bodily injury if not avoided.
	 NOTICE Flagging of notices to prevent property damage.
	Identification of basic safety instructions. Non-compliance can lead to hazards for people and the device.
	Flagging of special user tips and other especially useful or important information.

Gear pump KF 2.5 - 630

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2 Safety

2.1 Intended use

1. The device has been designed for operation with fluid. Dry operation is not permitted.
2. The device may be operated in filled condition only.
The medium must be compatible with the materials used in the device. The chemical competence is necessary for this. Be careful with ethylene oxide or other cathalytic or exothermic or self-decomposing materials. Please consult the manufacturer in cases of doubt.
3. The device may be operated only in usual industrial atmospheres. If there are any aggressive substances in the air, always ask the manufacturer.
4. Operation of the device is only permissible when complying with the operating instructions and applicable documents.
Deviating operating conditions require the express approval of the manufacturer.
5. In case of any use of the device not according to specification, any warranty is voided.

2.2 Personnel qualification and training

The staff designated to assemble, operate and service the device must be properly qualified. This can be through training or specific instruction. Personnel must be familiar with the contents of this operating instructions.



Read the operating instructions thoroughly before use.

2.3 Basic safety instructions



1. Comply with existing regulations on accident prevention and safety at work along with any possible internal operator regulations.
2. Pay attention to the greatest possible cleanliness.
3. Wear suitable personal protection equipment.
4. Do not remove, make illegible or obliterate type plates or other references on the device.
5. Do not make any technical changes on the device.
6. Maintain and clean the device regularly.
7. Use spare parts approved by the manufacturer only.

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Gear pump KF 2.5 - 630

2.4 Basic hazards

**DANGER****Hazardous fluids!**

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

**DANGER****Rotating parts!**

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.

**DANGER****Rotating parts!**

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Take measures against accidental touching of rotating parts.

**WARNING****Rotating parts!**

Danger of injury from flying parts.

1. Enclose rotating parts so as to avoid any danger from flying parts in the event of breakage or malfunction.

**WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

Gear pump KF 2.5 - 630

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**WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.

**WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Do not operate the device against closed shut-off devices.
2. Do not operate the device in the false direction of rotation.

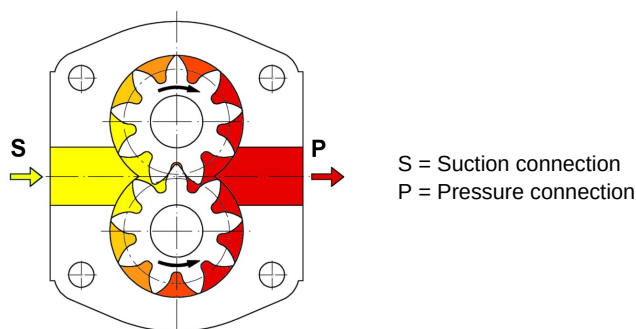
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Gear pump KF 2.5 - 630

3 Device description

3.1 Functional principle

KF/KFF series pumps are external gear pump types that work according to the positive displacement principle.



When rotated, two gearwheels meshing together produce a volume enlargement as a result of the opening of the tooth spaces on the suction side (S), so that medium can flow in and so that a corresponding volume is displaced simultaneously by immersion of the teeth into the filled tooth spaces on the pressure side (P). Fluid transport takes place through entrainment in the tooth gaps along the wall of the wheel chamber. The so-called geometric flow rate V_g is being displaced per wheel rotation. A value that is stated in technical documents as rated volume V_{gn} to specify the pump size.

The actually delivered amount of liquid does not correspond with the theoretical value, it is being reduced through losses due to the necessary tolerances. The losses are less the lower the operating pressure and the higher the viscosity of the medium.

Gear pumps are self-priming within wide limits. The displacement cycle describe initially takes place without exhibiting appreciable pressure build-up. Only after setting external loads, for example, through delivery heights, flow resistances, line elements, etc. will the required working pressure arise to overcome these resistances.

As usual with non-axial play compensated pumps, the lateral clearance between gear and front face has been set in such a way that the maximum allowable operating pressure is managed in an adequate and secure way.

Bearing and shaft seal of the device are lubricated by the media. The device's operating life will be reduced if the medium contains abrasive ingredients.

The shaft seal chamber is connected to the device's suction side. The pressure occurring at the shaft seal therefore corresponds to the pressure at the

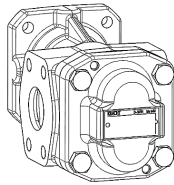
Gear pump KF 2.5 - 630

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suction connection of the device. The permissible pressure is determined by the type of sealing.

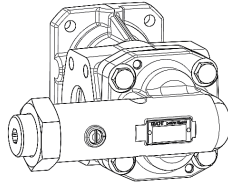
3.2 Possible versions

Gear pump with end cover



Standard

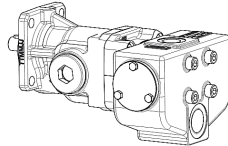
Gear pump with pressure relief valve



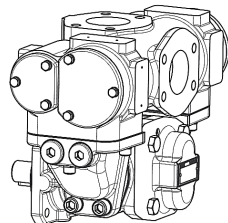
Directly attached pressure relief valves of the series "D" are used exclusively for protection of the gear pumps and may respond on a short-term basis only. Constant triggering of the valve can destroy the gear pump due to overheating.

Gear pump with universal valve

KF 2.5 - 25 U



KF 32 - 80 U



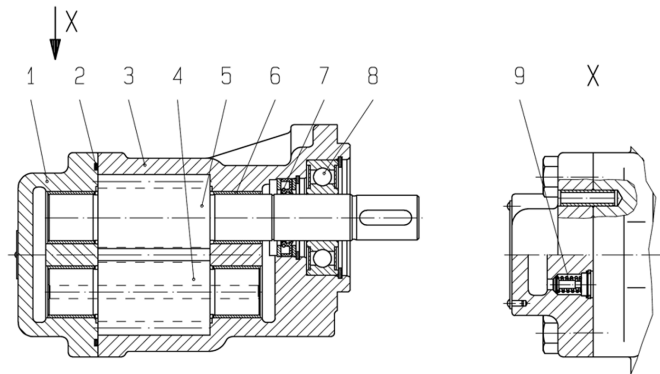
Pumps with universal valve pump to the same pressure connection even when the direction of rotation of the drive shaft changes. Because of the operating principle, the pressure and suction connections remain the same under any direction of rotation. Select the mounting position so that the piston is in a horizontal position and the pressure port is at the top.

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Gear pump KF 2.5 - 630

3.3 Basic design

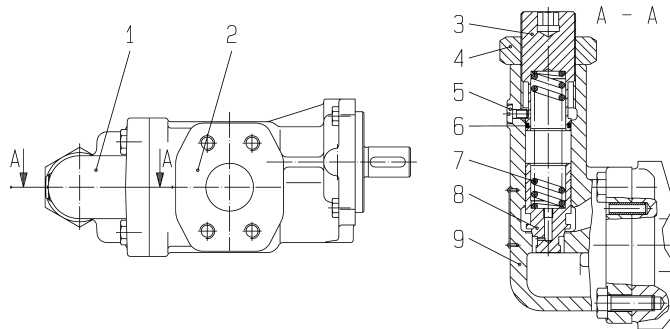
3.3.1 KF 2.5 - 630 R/L/B (with end cover)



Explanation

- | | |
|-----------------------|---------------------------------|
| 1. End cover | 7. Shaft seal |
| 2. O-Ring | (see "Section: Seal types") |
| 3. Housing | 8. Outboard bearing |
| 4. Driven shaft | (Mounting only: G; X) |
| 5. Driving shaft | 9. Valve |
| 6. Plain bearing bush | (Direction of rotation only: B) |

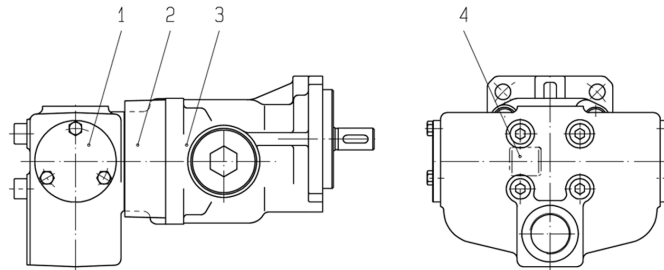
Gear pump KF 2.5 - 630

KRACHT**3.3.2 KF 2.5 - 630 R/L. .-D. (with pressure relief valve)****Explanation**

- | | |
|--------------------------|-----------------------|
| 1. Pressure relief valve | 6. O-Ring |
| 2. Pump | 7. Compression spring |
| 3. Adjustment screw | 8. Valve cone |
| 4. Hexagonal nut | 9. Housing |
| 5. Retaining screw | |

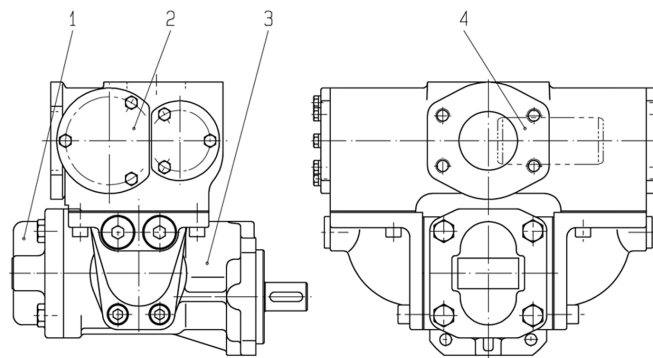
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Gear pump KF 2.5 - 630

3.3.3 KF 2.5 - 25 U (with universal valve)**Explanation**

- 1. Universal valve
- 2. Adapter

- 3. Pump
- 4. Piston

3.3.4 KF 32 - 80 U (with universal valve)**Explanation**

- 1. End cover
- 2. Universal valve

- 3. Pump
- 4. Piston

Gear pump KF 2.5 - 630

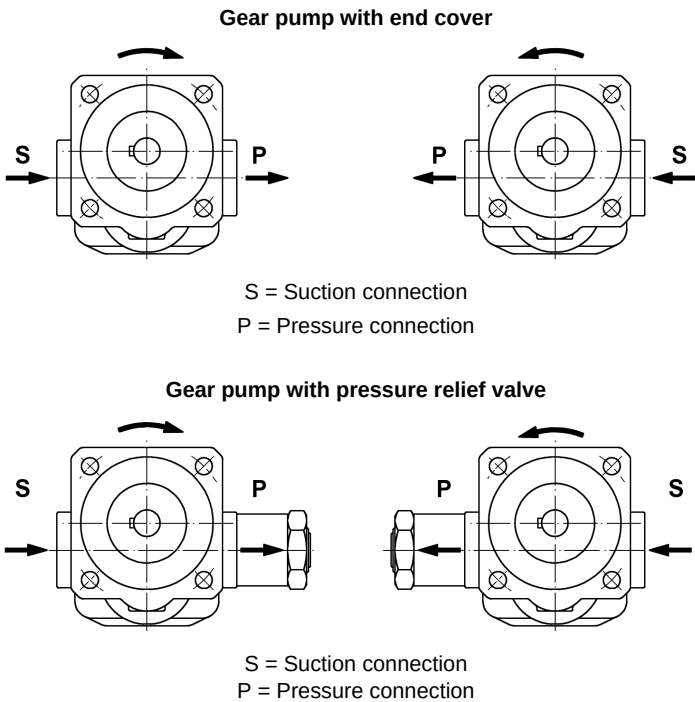


3.4 Rotation and delivery direction

The following definition applies with respect to the rotation and delivery direction of external gear pumps for pump connections positioned below the drive shaft:

Looking at the pump shaft end, the pumping flow is from left to right when the shaft is moving clockwise.

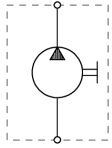
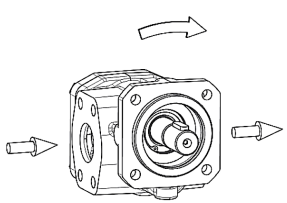
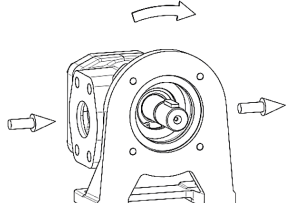
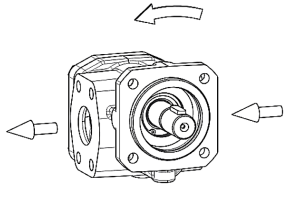
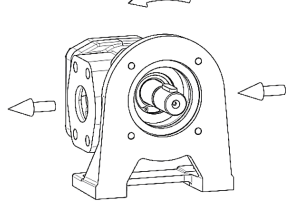
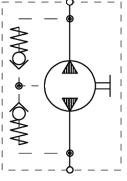
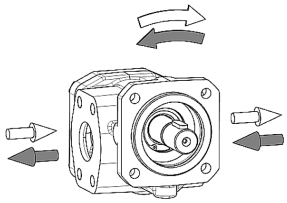
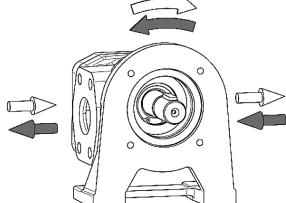
Looking at the pump shaft end, the pumping flow is from right to left when the shaft is moving counter-clockwise.



The direction of rotation is indicated by the bent arrow.
The flow direction is indicated by the straight arrows.

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Gear pump KF 2.5 - 630

Hydraulic symbol	Flange mounting	Foot mounting
	Gear pump with end cover	
		
	KF . R F/G	KF . R W/X
		
	KF . L F/G	KF . L W/X
		
	KF . B F/G	KF . B W/X

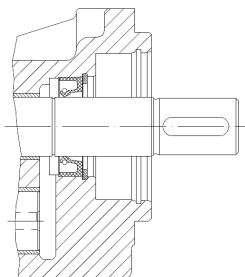
Gear pump KF 2.5 - 630



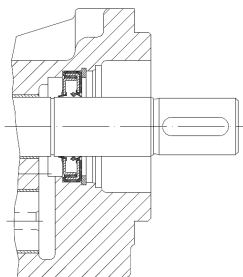
Hydraulic symbol	Flange mounting	Foot mounting
	Gear pump with pressure relief valve	
	KF . R F/G. .-D.	KF . R W/X. .-D.
	KF . L F/G. .-D.	KF . L W/X. .-D.
	Gear pump with universal valve	
	KF 2.5 - 25 U F/G	-
	KF 32 - 80 U F/G	-

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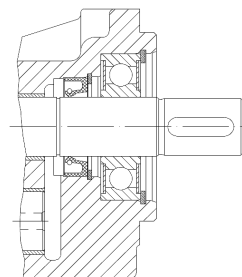
Gear pump KF 2.5 - 630

3.5 Types of seals

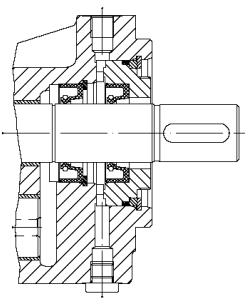
Rotary shaft seal
Seal type: 1; 2; 3; 9; 18; 31



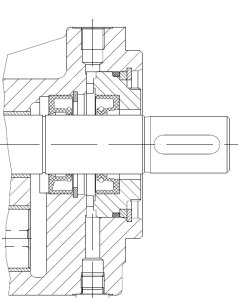
Rotary shaft seal
Seal type: 23



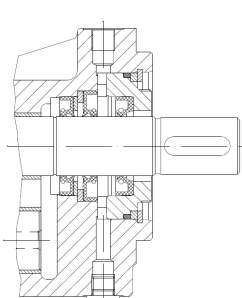
Rotary shaft seal
with outboard bearing
Seal type: 1; 2; 3; 9; 18; 31



Double rotary shaft seal
Connection borehole G1/8 (for
Quench) ⁽¹⁾
Seal type: 4; 7; 19; 32

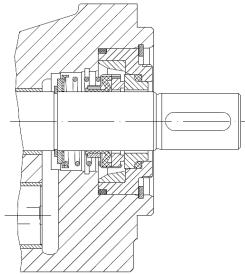


Double rotary shaft seal (for vac-
uum operation)
Connection borehole G1/8 (for
Quench) ⁽¹⁾
Seal type: 4; 7; 19; 32
Special number 74

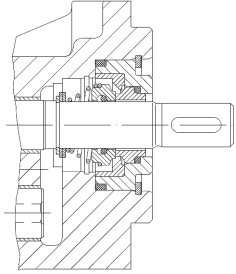


Triple rotary shaft seal (for vac-
uum operation + for normal oper-
ation)
Connection borehole G1/8 (for
Quench) ⁽¹⁾
Seal type: 7
Special number 322
(only KF 32 - 80)

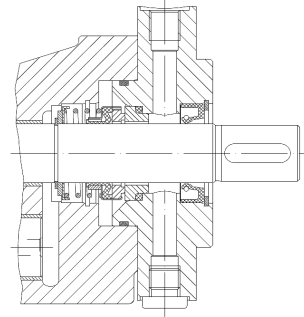
Gear pump KF 2.5 - 630

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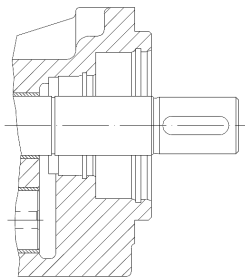
Mechanical seal
Seal type: 5; 40



Mechanical seal
Seal type: 6



Mechanical seal with Quench ⁽¹⁾
KF 2.5 - 25: Connection borehole
G1/8 (for Quench) ⁽¹⁾
KF 32 - 80: Connection borehole
G1/4 (for Quench) ⁽¹⁾
Seal type: 5
Special number 198



without shaft seal
(Leak oil drain through shaft seal-
ing chamber)
Seal type: 30; 36

⁽¹⁾ See [section 3.6 "Quench"](#)

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KRACHTGear pump KF 2.5 - 630

3.6 Quench

Versions with quench are used when absolute leak tightness is required on the shaft seal, e.g. when pumping media

- which cures upon contact with air.
- which crystallises upon contact with air humidity.
- the leakage of which must not be released into the environment.
- are under vacuum and their seal shall be gastight.

Select the mounting position so that the connection for the quench faces up.

Gear pump KF 2.5 - 630

KRACHT**3.7 Type key**

Ordering example KF 2.5 - 630													
KF		40		R		F		1	/...	-	D15	-	...
1.		2.		3.		4.		5.	6.		7.		8.

Explanation of type key KF 2.5 - 630										
1.	Product name									
2.	Nominal size (Rated volume)									
	V _{gn}	Size 1: 2.5; 4; 5; 6; 8; 10; 12; 16; 20; 25 Size 2: 32; 40; 50; 63; 80 Size 3: 100; 112; 125; 150; 180; 200 Size 4: 250; 315; 400; 500; 630								
3.	Direction of rotation									
	R	Clockwise						B	Clockwise and counterclockwise Flow direction alternating	
	L	Counterclockwise						U	Clockwise and counterclockwise Flow direction consistent	
4.	Fixing type									
	F	DIN flange without outboard bearing						W	Mounting angle without outboard bearing (KF 2.5 - 200)	
	G	DIN flange with outboard bearing						X	Mounting angle with outboard bearing (KF 2.5 - 200)	

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Gear pump KF 2.5 - 630

Explanation of type key KF 2.5 - 630				
5.	Seal type			
	1	Rotary shaft seal NBR (BABSL)	18	Rotary shaft seal FKM (BAUMX7)
	2	Rotary shaft seal FKM (BABSL)	19	Double rotary shaft seal NBR (BABSL)
	3	Rotary shaft seal PTFE (HN2390)	23	Rotary shaft seal FKM (MSS1) (Low temperature) (KF 2.5 - 80)
	4	Double rotary shaft seal PTFE (HN2390)	30	without shaft seal O-Ring FKM
	5	Mechanical seal with FKM secondary seals (AX15) C2S2V1G3G1 (KF 2.5 - 200) B10SV1G3G1 (KF 250 - 630)	31	Rotary shaft seal FKM (BABSL) (Low temperature) (KF 32 - 200)
	6	Mechanical contact seal with FFKM secondary seals (AX30) Q2Q2K1G3 (KF 2.5 - 25) Q2B2K1G3 (KF 32 - 200)	32	Double rotary shaft seal EPDM (R02-R) (not resistant to mineral oil)
	7	Double rotary shaft seal FKM (BABSL)	36	without shaft seal O-Ring NBR
	9	Rotary shaft seal EPDM (R02-R) (not resistant to mineral oil)	40	Mechanical seal with FKM secondary seals (L4) AQ2VFF
6. Special number for special versions				
	See section 3.8 "Important special numbers"			
7. Pressure relief valve (only for direction of rotation R or L)				
D15	Adjustable from 0 - 15 bar	D25	Adjustable from 15 - 25 bar	
D30	Adjustable from 15 - 30 bar			
8. Housing and cover material				
No specification	EN-GJL-250 (GG-25)			
GJS	EN-GJS-400-15 (GGG-40)			

Gear pump KF 2.5 - 630

KRACHT**3.8 Important special numbers**

Special number	Description
74	Double rotary shaft seal (for vacuum operation) Connection borehole G1/8 (for Quench)
158	Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" KF 16 - 25: Flange connection SAE 1"
197	Noise-optimized version for aerated oils ⁽¹⁾
198	Mechanical seal with Quench
232	Housing connection: KF 50 - 80: Flange connection SAE 2" KF 100 - 112: Flange connection SAE 2 1/2" KF 125 - 150: Flange connection SAE 3" KF 180 - 200: Flange connection SAE 3 1/2"
277	Vertical mounting position (shaft end above) Separate lubrication for rotating shaft seal (reduced pumping rate) (Size 4: on request)
304	Plastic plain bearings Iglidur® X (non-ferrous metal-free), $\Delta p_{\max} = 10$ bar (Size 4: on request)
317	Noise-optimized version for aerated oils ⁽¹⁾ (197) Plastic plain bearings Iglidur® X (non-ferrous metal-free), $\Delta p_{\max} = 10$ bar (304)
322	Triple rotary shaft seal (for normal operation + for vacuum operation) Connection borehole G1/8 (for Quench) Plastic plain bearings Iglidur® X (non-ferrous metal-free), $\Delta p_{\max} = 10$ bar (304) Housing connection: KF 32; 40: Flange connection SAE 1 1/2" (Standard) KF 50 - 80: Flange connection SAE 2" (232)
353	Noise-optimized version for aerated oils ⁽¹⁾ (197) Multi layer friction bearings DP4 (lead free) (Size 4: on request)
359	Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" (158) KF 16 - 25: Flange connection SAE 1" (158) Noise-optimized version for aerated oils ⁽¹⁾ (197)
363	Plastic plain bearings Iglidur® X (non-ferrous metal-free), $\Delta p_{\max} = 10$ bar (304) Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" (158) KF 16 - 25: Flange connection SAE 1" (158)

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Special number	Description
391	Noise-optimized version for aerated oils ⁽¹⁾ (197) Housing connection: KF 50 - 80: Flange connection SAE 2" (232) KF 100 - 112: Flange connection SAE 2 1/2" (232) KF 125 - 150: Flange connection SAE 3" (232) KF 180 - 200: Flange connection SAE 3 1/2" (232)
402	Double rotary shaft seal (for vacuum operation) (74) Connection borehole G1/8 (for Quench) (74) Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" (158) KF 16 - 25: Flange connection SAE 1" (158) KF 50 - 80: Flange connection SAE 2" (232) KF 100 - 112: Flange connection SAE 2 1/2" (232) KF 125 - 150: Flange connection SAE 3" (232) KF 180 - 200: Flange connection SAE 3 1/2" (232)
455	Noise-optimized version for aerated oils ⁽¹⁾ (197) Vertical mounting position (shaft end above) Separate lubrication for rotating shaft seal (reduced pumping rate) (277)
459	Double rotary shaft seal (for vacuum operation) (74) Connection borehole G1/8 (for Quench) (74) Noise-optimized version for aerated oils ⁽¹⁾ (197) Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" (158) KF 16 - 25: Flange connection SAE 1" (158) KF 50 - 80: Flange connection SAE 2" (232) KF 100 - 112: Flange connection SAE 2 1/2" (232) KF 125 - 150: Flange connection SAE 3" (232) KF 180 - 200: Flange connection SAE 3 1/2" (232)
⁽¹⁾ Measures for noise optimisation are only possible for one rotational direction and only effective for aerated oils or vacuum (only in connection with seal versions that are suitable for vacuum operation). Can lead to a reduction of delivery rate.	

Gear pump KF 2.5 - 630

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4 Technical data

4.1 General

General information KF 2.5 - 630		
Design	External gear pump	
Fixing type	Flange similar DIN ISO 3019 or Foot mounting	
End of drive shaft	ISO R 775 short-cylindrical	
Housing connection ⁽¹⁾	KF 2.5 - 12	Whitworth pipe thread G3/4
	KF 2.5 - 12 .. /158	Flange connection SAE 3/4"
	KF 16 - 25	Whitworth pipe thread G1
	KF 16 - 25 .. /158	Flange connection SAE 1"
	KF 32 - 80	Flange connection SAE 1 1/2"
	KF 50 - 80 .. /232	Flange connection SAE 2"
	KF 100 - 112	
	KF 100 - 112 .. /232	Flange connection SAE 2 1/2"
	KF 125 - 150	
	KF 125 - 150 .. /232	Flange connection SAE 3"
	KF 180 - 200	
	KF 180 - 200 .. /232	Flange connection SAE 3 1/2"
	KF 250 - 315	Flange connection SAE 3"
	KF 400 - 630	Flange connection SAE 4"
	KF 2.5 - 25 U	Suction connection: Whitworth pipe thread G3/4
		Pressure connection: Whitworth pipe thread G1/2
Mounting position	KF . R/L/B without fluid buffer	Any ⁽²⁾
		Shaft end horizontal, fluid buffer connection top
	KF . U	Piston horizontal Pressure connection on top
External loads on shaft end		See section 4.2 "Overview nominal sizes"
Speed	n	See section 4.2 "Overview nominal sizes" + section 4.3 "Viscosity - Rotation speed assignment"

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Gear pump KF 2.5 - 630

General information KF 2.5 - 630		
Operating pressure	p_e p_b	See section 4.4 "Permissible pressure range"
Viscosity	v_{min}	See section 4.4.3 "Differential pressure - viscosity assignment"
	v_{max}	20000 mm ² /s
Fluid temperature	ϑ_m	See section 4.5 "Permissible temperature range"
Ambient temperature	ϑ_u	
Material		See section 4.6 "Material data"
Filtering		Filter porosity $\leq 60 \mu m$
Permissible media		Lubricating fluids without abrasive components. (Petrols, solvents, etc. are not permissible.)
⁽¹⁾ Pipe thread: ISO 228-1; Flange connection: ISO 6162-1 (SAE J518) ⁽²⁾ A reduced service life must be expected for the shaft seal in the case of vertical installation (shaft end top).		

Gear pump KF 2.5 - 630

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4.2 Overview nominal sizes

Nominal size V _{gn}	Geom. displacement V _g [cm³/rev.]	Speed n		Perm. radial force ⁽¹⁾ F _{radial} [N] (n = 1500 rpm)	Permissible axial force F _{axial} [N] (n = 1500 rpm)	Sound pressure level ⁽²⁾ L _{pA} [dBA]	Mass inertia x10 ⁻⁶ J [kg m²]
		n _{min} [rpm]	n _{max} [rpm] ⁽³⁾				
2,5	2.55	200	3600	700	-	≤ 67	14.0
4	4.03						15.9
5	5.05						17.8
6	6.38						20.5
8	8.05						24.0
10	10.11						28.4
12	12.58						33.7
16	16.09						42.3
20	20.1						50.8
25	25.1						61.7
32	32.12						≤ 68
40	40.21					254	
50	50.2					299	
63	63.18					368	
80	80.5					443	
100	101.5		≤ 69	741			
112	113.5			806			
125	129.4			≤ 65		1418	
150	155.6					1637	
180	186.6					1911	
200	206.2		2072				
250	245.1		≤ 75			4133	
315	312.9			5011			
400	399.5			≤ 77		6618	
500	496.5					7830	
630	622.5					≤ 80	9591

⁽¹⁾ Outside forces are only permissible in combination with an outboard bearing. F_{radial} on central shaft end.

⁽²⁾ n = 1500 rpm ; v = 34 mm²/s ; p = 5 - 25 bar.

⁽³⁾ Pay attention to the viscosity.

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Gear pump KF 2.5 - 630

4.3 Viscosity - Rotation speed assignment

Kinematic viscosity ν [mm²/s]									
100	200	300	500	1000	2000	3000	6000	10000	20000
3600	2900	2300	1800	1200	800	650	450	300	200
Recommended rpm n [rpm]									



Select the speed of rotation so that complete filling of the pump is ensured. This is given if the pressure on the suction side does not fall below the permissible pressure $p_{e \text{ min.}}$

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4.4 Permissible pressure range

4.4.1 Operating pressure of suction side and pressure side

Seal type ⁽¹⁾		Special number	Operating pressure ⁽²⁾			
			Suction side		Pressure side	
			$p_{e \min}$ [bar abs.] ⁽³⁾	$p_{e \max}$ [bar]	p_b [bar] (perm. continuous pressure)	$p_{b \max}$ [bar] (Pressure peaks)
1	WDR (BABSL)	-	0.6 ⁽⁴⁾	See section 4.4.2 "Max. suction side operating pressure for sealing type 1, 2, 7 and 19"	25	40
2	WDR (BABSL)	-				
3	WDR (HN2390)	-		2		
4	DRWDR (HN2390)	-				
		74	0.1	0.2		
5	GLRD (AX15)	-	0.6 ⁽⁴⁾	10		
6	GLRD (AX30)	-				
7	DRWDR (BABSL)	-		See section 4.4.2 "Max. suction side operating pressure for sealing type 1, 2, 7 and 19"		
		74	0.1	0.2		
9	WDR (R02-R)	-	0.6 ⁽⁴⁾	0.5		
18	WDR (BAUMX7)	-				
19	DRWDR (BABSL)	-		See section 4.4.2 "Max. suction side operating pressure for sealing type 1, 2, 7 and 19"		
		74	0.1	0.2		

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Seal type ⁽¹⁾		Special number	Operating pressure ⁽²⁾			
			Suction side		Pressure side	
			$p_{e \min}$ [bar abs.] ⁽³⁾	$p_{e \max}$ [bar]	p_b [bar] (perm. continuous pressure)	$p_{b \max}$ [bar] (Pressure peaks)
23	WDR (MSS1)	-	0.6 ⁽⁴⁾	0.5	25 ⁽⁵⁾	-
30	-	-		25	25	40
31	WDR (BABSL)	-		0.5	25 ⁽⁵⁾	-
32	DRWDR (R02-R)	-		0.5	25	40
		74		0.2		
36	-	-		25		
40	GLRD (L4)	-		10		

⁽¹⁾ WDR: Rotary shaft seal, DRWDR: Double rotary shaft seal, GLRD: Mechanical seal
⁽²⁾ bar abs.: absolute pressure, bar: relative pressure
⁽³⁾ KF . U: $p_{e \min} = 0.65$ bar abs.
⁽⁴⁾ Start-up condition: 0.4 bar absolute (max. 30 minutes).
⁽⁵⁾ $\vartheta_m < -20$ °C: 16 bar (Housing material GJL).

4.4.2 Max. suction side operating pressure for sealing type 1, 2, 7 and 19

Speed n [rpm]	$p_{e \max}$ [bar]					
	KF 2.5 - 63	KF 80	KF 100 - 180	KF 200	KF 250 - 315	KF 400 - 630
≤ 750	6	6	6	6	5.5	5
≤ 1000	5	5	5	5	4.5	4
≤ 1500	4	4	3.5	3.5	3	2.5
≤ 2000	3	3	2.5	2.5	2	1.5
≤ 2500	2.5	2.5	2	2	-	-
≤ 3000	2	2	1.5	-	-	-
≤ 3600	1.5	-	-	-	-	-

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KRACHT**4.4.3 Differential pressure - viscosity assignment**

Bearing	$\Delta p_{\max}$ [bar]		
	$v \geq 1.4 \text{ mm}^2/\text{s}$	$v \geq 6 \text{ mm}^2/\text{s}$	$v \geq 12 \text{ mm}^2/\text{s}$
Multi layer friction bearings contains lead (Standard) DU, P10	3	12	25
Multi layer friction bearings lead free DP4			
Plastic plain bearings Iglidur® G; X; H370	-	6	10
White-metalled bearing TEGO® V738			

4.5 Permissible temperature range

Sealing material	Fluid temperature ϑ_m ⁽¹⁾	
	$\vartheta_{m \text{ min}}$ [°C]	$\vartheta_{m \text{ max}}$ [°C]
NBR	-20	90
PTFE / FEP with FKM-core		200
EPDM		120
FKM		150
FFKM / FEP with FKM-core		200
FKM (Low temperature)	-30	150

⁽¹⁾ Comply with media-specific properties.

Sealing material	Ambient temperature ϑ_u	
	$\vartheta_{u \text{ min.}}$ [°C]	$\vartheta_{u \text{ max.}}$ [°C]
NBR	-20	60
PTFE / FEP with FKM-core		
EPDM		
FKM		
FFKM / FEP with FKM-core		
FKM (Low temperature)	-30	

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4.6 Material data

Seal type ⁽¹⁾		Material				
		Shaft seal	O-rings	Housing/End cover	Gears	Bearing
1	WDR (BABSL)	NBR	NBR	EN-GJL-250 (GG-25) - - - EN-GJS-400-15 (GGG-40)	Case-hardened steel (1.7139)	Multi layer friction bearings contains lead (Standard) DU, P10 (Steel, CuSn, PTFE, Pb) - - - Plastic plain bearings non-ferrous metal-free Iglidur® X - - - Multi layer friction bearings lead free DP4 (Steel, CuSn, PTFE) - - - White-metalled bearing TEGO® V738 (Steel, Cu, Sn, Sb, Cd, Ni, As) (only KF 2.5 - 80)
2	WDR (BABSL)	FKM	FKM			
3	WDR (HN2390)	PTFE	FEP with FKM-core			
4	DRWDR (HN2390)	PTFE	FEP with FKM-core			
5	GLRD with FKM secondary seals (AX15)	C2S2V1G3G1 ⁽²⁾ (KF 2.5 - 200)	FKM			
		B10SV1G3G1 ⁽³⁾ (KF 250 - 630)				
6	GLRD with FFKM secondary seals (AX30)	Q2Q2K1G3 ⁽⁴⁾ (KF 2.5 - 25)	FEP with FKM-core			
		Q2B2K1G3 ⁽⁵⁾ (KF 32 - 200)				
7	DRWDR (BABSL)	FKM	FKM			
9	WDR (R02-R)	EPDM	EPDM			
18	WDR (BAUMX7)	FKM	FKM			
19	DRWDR (BABSL)	NBR	NBR			
23	WDR (MSS1)	FKM (Low temperature)	FKM (Low temperature)			

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Seal type ⁽¹⁾		Material				
		Shaft seal	O-rings	Housing/End cover	Gears	Bearing
30	-	-	FKM	EN-GJL-250 (GG-25) --- EN-GJS-400-15 (GGG-40)	Case-hardened steel (1.7139)	Multi layer friction bearings contains lead (Standard) DU, P10 (Steel, CuSn, PTFE, Pb) ---
31	WDR (BABSL)	FKM (Low temperature)	FKM (Low temperature)			Plastic plain bearings non-ferrous metal-free Iglidur® X ---
32	DRWDR (R02-R)	EPDM	EPDM			Multi layer friction bearings lead free DP4 (Steel, CuSn, PTFE) ---
36	-	-	NBR			White-metalled bearing TEGO® V738 (Steel, Cu, Sn, Sb, Cd, Ni, As) (only KF 2.5 - 80)
40	GLRD with FKM secondary seals (L4)	AQ2VFF ⁽⁶⁾	FKM			

⁽¹⁾ WDR: Rotary shaft seal, DRWDR: Double rotary shaft seal, GLRD: Mechanical seal
⁽²⁾ Metal-impregnated carbon /CrMo-Steel, FKM, CrNiMo-Steel
⁽³⁾ Resin-impregnated carbon , Cr-casting, FKM, CrNiMo-Steel
⁽⁴⁾ SiC/SiC, FFKM, CrNiMo-Steel
⁽⁵⁾ SiC/Resin-impregnated carbon , FFKM, CrNiMo-Steel
⁽⁶⁾ Metal-impregnated carbon /SiC, FKM, CrNi-Steel

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4.7 Weight

Nominal size V_{gn}	Gear pump [kg]			Added weight Mounting angle [kg]
	with end cover	with D - valve	with universal valve	
2.5	2.9 (KF . /158: +1.3)	3.7 (KF . /158: +1.3)	6.9	1.3
4				
5				
6				
8				
10	3.5 (KF . /158: +1.3)	4.3 (KF . /158: +1.3)	7.5	
12				
16				
20				
25	7.7	9.5	27.5	1.6
32				
40				
50				
63				
80	9.4	11.2	29.5	
100				
112				
125				
150	22.2	26.5		3.3
180				
200				
250				
315				
400	44.2	47.2		
500				
630				
	54.7	57.9		-
	60.8	64.0		

4.8 Dimensions

Dimensions of the device can be found in the relevant technical data sheets.

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5 Transport and storage

5.1 General

- After receipt, check the device for transport damages.
- If transport damage is noticed, report this immediately to the manufacturer and the carrier. The device must then be replaced or repaired.
- Dispose of packing material and used parts in accordance with the local stipulations.

5.2 Transport



WARNING

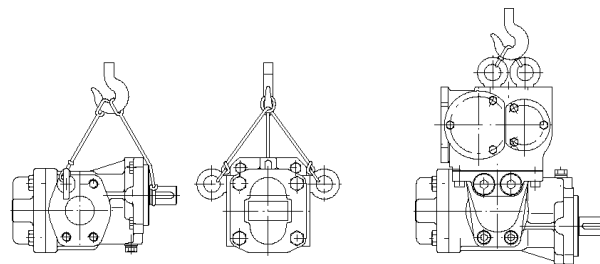
Falling or overturning loads!

Danger of injury while transporting large and heavy loads.

1. Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
2. Attach lifting tackle only to suitable load points.
3. Attach the lifting tackle in such a manner that it cannot slip.
4. Pay attention to the load balance point.
5. Always avoid jerks, impacts and strong vibrations during transportation.
6. Never walk under suspended loads, never work under suspended loads.



To transport the device, eyebolts can be screwed into the flange connections.



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5.3 Storage

The device's function is tested in the plant with mineral hydraulic oil. Then all connections are closed. The remaining residual oil preserves the interior parts for up to 6 months.

Metallic exposed exterior parts are protected against corrosion by suitable conservation measures, also up to 6 months.

In case of storage, a dry, dust-free and low-vibration environment is to be ensured. The device is to be protected against influences from weather, moisture and strong fluctuations of temperature. The recommended storage conditions are to be adhered to.

Below the permissible ambient temperature ϑ_u , elastomer seals lose their elasticity and mechanical loading capacity, since the glass transition temperature is fallen below. This procedure is reversible. A force action on the device is to be avoided in case of storage below the permissible ambient temperature ϑ_u .

Devices with EPDM seals are not mineral-oil resistant and are not tested for their function. There is no preservation of the interior parts. If the device is not taken into operation immediately, all corrosion-prone surfaces are to be protected by suitable conservation measures. The same applies for devices which are not tested for other reasons.

When storing for a long period of time (> 6 months), treat all surfaces at risk of corrosion again with suitable preserving agents.

If high air humidity or aggressive atmospheres are expected, take additional corrosion-preventing measures.



Storage in corrosion protection bags (VCI) maximum of 6 months.



NOTICE

Corrosion/chemical impact

Improper storage can render the device useless.

1. Protect endangered surfaces by means of suitable conservation measures.
2. Comply with recommended storage conditions.

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**Recommended storage conditions**

1. Storage temperature: 5 °C - 25 °C
2. Relative air humidity: < 70 %
3. Protect elastomer parts from light, especially direct sunlight.
4. Protect elastomer parts from oxygen and ozone.
5. Comply with maximum storage times of elastomeric parts:
 - 5 Years: AU (Polyurethane rubber)
 - 7 Years: NBR, HNBR, CR
 - 10 Years: EPM, EPDM, FEP/PTFE, FEPM, FKM, FFKM, VMQ, FVMQ

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6 Installation

6.1 Safety instructions for installation



DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.



DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.



DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Take measures against accidental touching of rotating parts.



WARNING

Rotating parts!

Danger of injury from flying parts.

1. Enclose rotating parts so as to avoid any danger from flying parts in the event of breakage or malfunction.



WARNING

Unshielded gearwheels!

Gearwheels can trap and crush fingers and hands.

1. Do not engage gearwheels.

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KRACHT**WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

6.2 Noise reduction**Measures for noise reduction**

1. Use suction and pressure hoses.
2. Use bell housings with high damping properties (plastic or cast iron).
3. Use of damping rings and damping rods for separation of structure-borne noise.

6.3 Mechanical installation**6.3.1 Preparation**

- Check the device for transport damage and dirt.
- Check the device for freedom of movement.
- Remove existing preservatives.
 - Use only those cleaning agents that are compatible with the materials used in the device.
 - Do not use cleaning wool.
- Compare the environmental and ambient conditions at the place of installation to the permissible conditions.
 - Ensure a sufficiently stable and level foundation.
 - Expose the device only to small vibrations, see IEC 60034-14.
 - Secure sufficient access for maintenance and repair.

6.3.2 Pumps with free shaft end

The prerequisite for trouble-free operation is suitable load transmission between the pump and the drive. By default a torsionally flexible claw coupling Type "R" is used for this.

- Pre-mount coupling parts as per manufacturer's specifications.



Torsionally flexible claw coupling type "R.": See [section 6.3.3 "Coupling Type "R.""](#)

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- Position the pumps and the drive with respect to each other.
 - Comply with the permissible mounting position.
 - Comply with the permissible direction of rotation.



Rotation and delivery direction: See [chapter 3 "Device description"](#)

- Tighten all fastening screws with the specified torque.
 - Keep to the permissible displacement values of the coupling.
 - Rule out any distortion of the device.
 - Pay attention to sufficient screw-in depth of the fastening screws.

Tightening torques [Nm]

Thread size ⁽¹⁾	M6	M8	M10	M12	M16	M20	M24
Counter-thread Aluminium	4.6	11	22	39	95	184	315
Counter-thread Cast iron/Steel	10	25	49	85	210	425	730

⁽¹⁾ Screws/Nuts with min. strength class 8.8/8

- For devices without shaft seals, ensure that the leak oil from the shaft sealing chamber is specifically drained off and cannot get into the environment.
- Make sure no foreign bodies can get into the device.
- Take measures against accidental touching of rotating parts.
- Take measures against accidental touching of hot surfaces (> 60 °C).
- On devices with quench, mount a tank for the liquid seal.
 - Mount the tank above the device.
 - The connection on the device must point upward.
 - Checking the fluid level must be possible at any time.

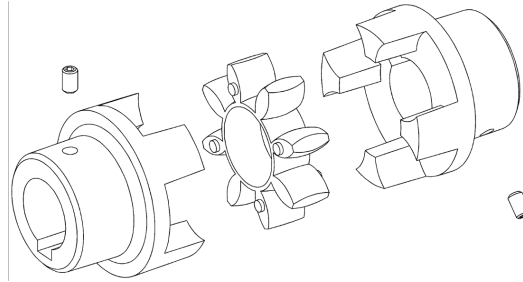


A second port on the unit enables purging of the quench chamber and draining of the liquid seal.

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KRACHT**6.3.3 Coupling Type "R."**

Claw couplings Type "R." are torsionally flexible and transmit the torque positive. They are fail-safe. The vibrations and impacts that occur during operation are effectively dampened and reduced.

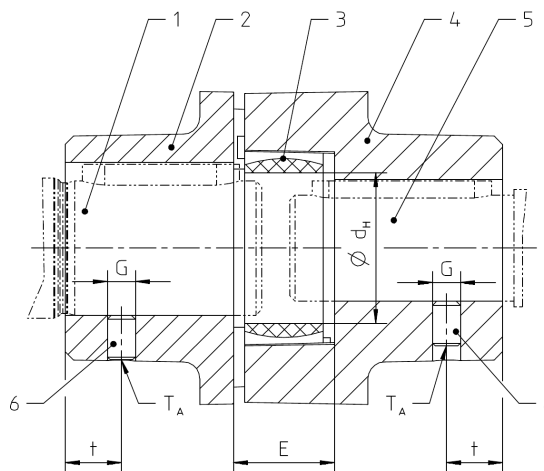
Claw coupling Type "R."**NOTICE****Coupling breakage or increased wear**

An overload can lead to premature failure of the coupling.

1. Ensure safe dimensioning when designing the coupling. Take vibrations, torque peaks and temperatures into account.

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Gear pump KF 2.5 - 630

Assembly data**Explanation**

- | | |
|-------------------------------|---|
| 1. Shaft projects into spider | 4. Coupling halve |
| 2. Coupling halve | 5. Shaft with parallel key projects into spider |
| 3. Spider | 6. Setscrew |

When installing the coupling, maintain the "E" gap dimension so that the spider remains free during operation. If the shaft diameters are less than (also with parallel key) the dimension d_H of the spider, the shaft ends can protrude out into the spider.

Coupling size ⁽¹⁾	14	19	24	28	38	42	48	55	65	75
	-	19/24	24/28	28/38	38/45	42/55	48/60	55/70	65/75	75/90
Coupling clearance E [mm]	13	16	18	20	24	26	28	30	35	40
d_H [mm]	10	18	27	30	38	46	51	60	68	80
G	M4	M5	M5	M8	M8	M8	M8	M10	M10	M10
t [mm]	5	10	10	15	15	20	20	20	20	25
Tightening torque T_A [Nm]	1.5	2	2	10	10	10	10	17	17	17

⁽¹⁾ Example: R.19-Z25/14-Z25/19 or R.19/24-Z25/14-Z25/24.

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For assembly, the coupling halves can be heated to approx. 80 °C and pushed onto the shaft ends while warm.

**CAUTION****Hot surfaces!**

Burn injury to skin if touched.

1. Wear protective gloves at temperatures $\geq 48^{\circ}\text{C}$.

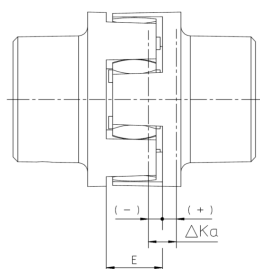
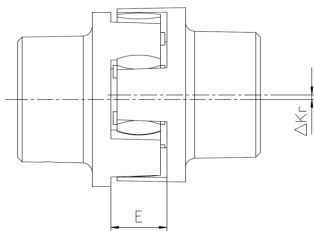
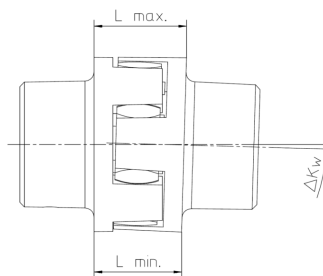
- Mount the coupling halves on the shaft ends but avoid impacts on the components.
- Position the coupling halves on the shaft ends so that in later operation the "E" gap dimension is maintained.
- Secure the coupling halves by tightening the setscrews.
- Insert the spider in a coupling half.

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Displacement values**Axial displacement**
 ΔK_a **Radial displacement**
 ΔK_r **Angular displacement**
 $\Delta K_w/\Delta K_L$ 

$$\Delta K_L \triangleq L_{max} - L_{min}$$

Coupling size		14	19	24	28	38	42	48	55	65	75
		-	19/24	24/28	28/38	38/45	42/55	48/60	55/70	65/75	75/90
Coupling clearance E [mm]		13	16	18	20	24	26	28	30	35	40
ΔK_a [mm]		+1.0 -0.5	+1.2 -0.5	+1.4 -0.5	+1.5 -0.7	+1.8 -0.7	+2.0 -1.0	+2.1 -1.0	+2.2 -1.0	+2.6 -1.0	+3.0 -1.5
ΔK_r [mm]	1500 rpm	0.11	0.13	0.15	0.18	0.21	0.23	0.25	0.27	0.30	0.34
	3000 rpm	0.08	0.09	0.1	0.13	0.15	0.16	0.18	0.19	0.21	0.24
ΔK_w [Degree]	1500 rpm	1.1	1.1	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1
	3000 rpm	1.0	1.0	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0
ΔK_L [mm]	1500 rpm	0.57	0.77	0.77	0.90	1.25	1.40	1.80	2.00	2.50	3.00
	3000 rpm	0.52	0.7	0.67	0.80	1.00	1.30	1.60	1.80	2.20	2.70

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Displacement combinations

Examples for displacement combinations shown in the photo opposite:

Example 1:

$\Delta K_r = 30\%$

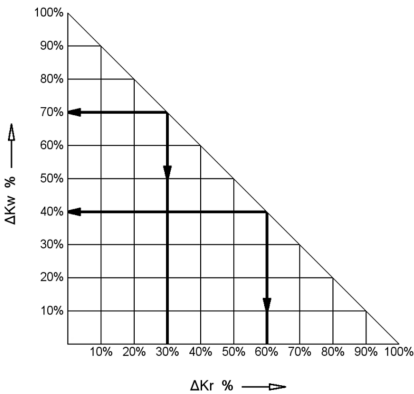
$\Delta K_w = 70\%$

Example 2:

$\Delta K_r = 60\%$

$\Delta K_w = 40\%$

$\Delta K_r + \Delta K_w \leq 100\%$



6.4 Connection lines

6.4.1 General



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.
Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.



Additional connections

1. Provide measurement connections for pressure and temperature as close as possible to device.
2. If necessary, provide a facility to fill or empty the device and the line system.
3. If necessary, provide a facility to vent the device and the line system.

6.4.2 Suction line

A less than optimally planned suction line can lead to increased noise emission, cavitation as well as reduction of the delivery rate (caused by not complete filling of the pump).

When designing the line, take the following points into consideration:

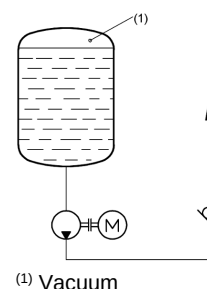
- The suction line must be piped as short as possible and in a straight line.
- Stipulate the nominal width of the suction line so that the permissible operating pressure $p_{e\ min}$ is not exceeded on the suction side.
- Avoid large suction heights.
- Avoid additional pressure loss through line resistances such as fittings, screwed connections, formed parts or suction filters/suction baskets. Ensure that all technically required suction filters/suction baskets are appropriately dimensioned.
- Make sure there is sufficient clearance of the suction port to the bottom and walls of the media container.
- Make sure that the suction opening lies underneath the lowest fluid level in all operating situations.
- When hose lines are used, ensure sufficient stability of the hoses so that they cannot become constricted through the sucking action.
- Comply with the recommended flow velocity in the suction line (max. 1.5 m/s).

Suction line at vacuum operation

If suction from a tank under vacuum is desired, the pump must be arranged approx. 1 m below the tank. The suction line must run in a straight line and without any resistances.

The tank may be subjected to vacuum only then when the pipework and the pump have been filled with liquid.

For this application, only pumps suitable for vacuum operation may be used.



NOTICE

Cavitation damage

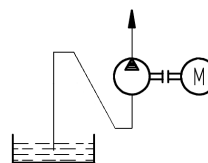
Undercutting the permissible suction port pressure results in cavitation.

1. Design the suction line so that the pressure arising in operation on the suction side is always higher than the vapour pressure of the pumped medium. At the same time, comply with the installation altitude of the device above mean sea level.
2. For aqueous fluids, mount the device underneath the fluid level, set the operating temperature to 50 °C and limit the speed to 1500 rpm.

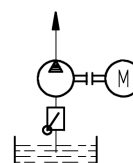
Gear pump KF 2.5 - 630

KRACHT**Prevention of suction problems**

If there is a possibility that the suction line can run dry if the pump stops, piping the suction line as siphon is an option to avoid suction problems. This way, the pump will remain permanently filled after initial commissioning.



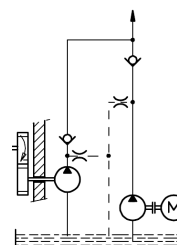
It is appropriate to employ a foot valve or a non-return valve in case of longer suction lines that can run dry while the pump is at rest. These must have been designed for use in suction lines and should offer as low a flow resistance as possible.



During operation of a pump that has to pump media via a non-return valve in a pressurized circuit (e.g. reserve pump in a lubricant circuit), suction problems can occur if the suction line is filled with air.

In this case the pressure pipe must be bled directly upstream of the non-return valve.

If no vent nozzle is used, the volume of the pressure pipe between the pump and the non-return valve must be at least 75 % of the suction line volume.

**6.4.3 Pressure line**

When designing the line, take the following points into consideration:

- Select the nominal width of the pressure line so that the maximum permissible pressures are not exceeded.
- If necessary, provide a vent nozzle to prevent suction problems.

6.4.4 Mounting Connection lines

Position of the device connections: See [chapter 3 "Device description"](#)

- Clean all lines.
 - Do not use cleaning wool.
 - Pickle and flush welded pipes.
- Remove the protective plugs.
- Mount the lines.
 - Comply with the manufacturer's information.
 - Do not use any sealing materials such as hemp, Teflon tape or putty.

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6.5 Change of the direction of rotation

For pump types KF . R and KF . L, a change of the direction of rotation is only possible by converting.

The manufacturer normally carries out the conversion work and the customer should do this only in exceptional cases. Please consult the manufacturer about this.



Gear pumps in noise-optimized version cannot be converted. (e.g. special number **197**)



DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.
Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.



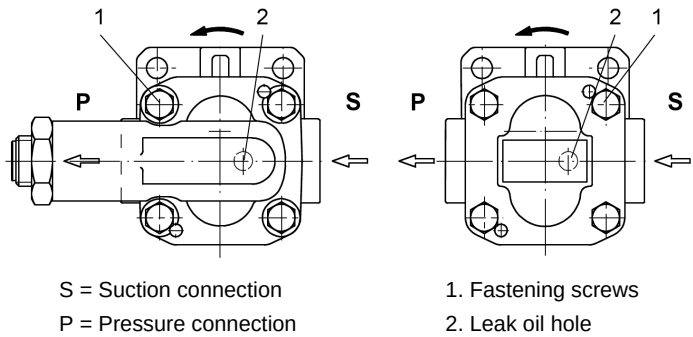
NOTICE

Leaks or increased wear

Damaged sealing surfaces or supports lead to lack of sealing and/or faults in later operation.

1. When assembling or disassembling housing components, be sure not to damage the bearings, e.g. by tilting.
2. When disassembling housing components, do not use screwdrivers or the like as a lever to separate the joints.
3. Do not remove, damage or jam seals.

Gear pump KF 2.5 - 630



To change the direction of rotation of the gear pump, turn the end cover or the pressure relief valve 180°.

- Loose fastening screws.
- Unscrew the end cover or the pressure relief valve of the pump housing and replace it rotated 180°.
- Tighten the fastening screws with the stated torque.

Fastening screws KF 2.5 - 630				
Gear pump	KF 2.5 - 25	KF 32 - 80	KF 100 - 200	KF 250 - 630
Tightening torques [Nm]	25	49	85	215



For pumps with sealing type 6, the lip-type seal must be replaced in addition. During this process, the spring coiling direction must be observed.

When checking, pay attention to the following points:

1. For gear pumps without pressure relief valve, the leak oil hole in the end cover must be placed at the pump's suction side.
2. Gear pumps with pressure relief valve must have their pressure relief valve adjusting screw point toward the pump's pressure side.

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7 Operation start-up

7.1 Safety instructions for start-up

 DANGER
Hazardous fluids! Danger of death when handling hazardous fluids. 1. Comply with the safety data sheets and regulations on handling hazardous fluids. 2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.
 WARNING
Failure of load-carrying parts due to overload! Danger of injury from flying parts. Danger of injury from spurting fluids. 1. Do not operate the device against closed shut-off devices. 2. Do not operate the device in the false direction of rotation.
 CAUTION
Hot surfaces! Burn injury to skin if touched. 1. Wear protective gloves at temperatures $\geq 48^{\circ}\text{C}$.

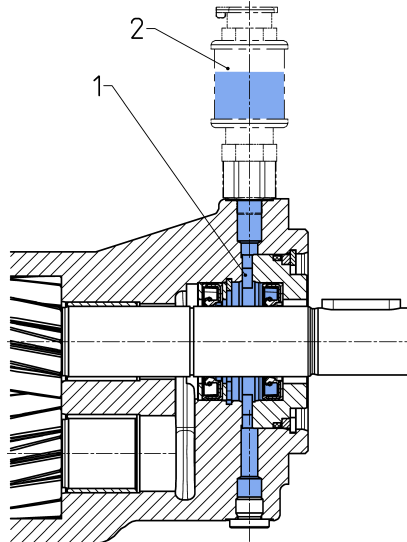
7.2 Preparation

- Before starting the system make sure that a sufficient quantity of the operating fluid is extant to avoid dry running.
Take this into consideration especially with high output volumes.
- Check all fastening screws on the device.
- Fill pump and the suction line with medium.

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7.3 Filling the quench chamber



1. Quench chamber
2. Container for quench-liquid (Accessories)

- For versions with quench, fill the quench chamber with a suitable quench liquid.
 - The filling is implemented through the tank provided for that.
 - Fill fluid until the quench chamber is completely full and the tank is half full.
- Do not apply pressure or vacuum to the quench chamber.



NOTICE

Seal failure due to dry run

A lack of quench liquid can lead to a failure of the seal.

1. Do not put pumps without quench liquid into operation.



A second port on the unit enables purging of the quench chamber and draining of the liquid seal.

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7.4 Pressure relief valve adjustment

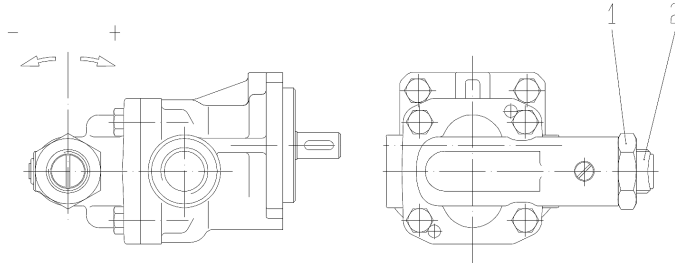
Directly attached pressure relief valves of the series "D" are used exclusively for protection of the gear pumps and may respond on a short-term basis only.

The valves are factory set to the rated pressure of each pressure stage. Setting pressures that deviate from this are stated on the rating plate.

**NOTICE****Failure of the pump**

Long triggering of the valve can cause the pump to overheat.

1. Only allow intermittent triggering of the valve.



- Lower response pressure
- + Higher response pressure

1. Hexagonal nut
2. Adjustment screw

Pressure setting:

- Remove hexagon nut
- Set the response pressure using the adjusting screw
- Secure the adjusting screw with hexagon nut

**WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Consider the permissible pressure setting range of the valve.
2. Check the pressure setting (the valve must not block).

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7.5 Further operation start-up

- Open existing shut-off elements upstream and downstream of the device.
- Adjust pressure relief valves in the system installed for lowest opening pressure.
- Allow the device start without or with a low pressure load (jog mode).
 - Flow should have developed after 30 s at the latest.
- Run the device for a few minutes depressurised or with low pressure.
- Vent the system at the highest possible point.
- Gradually increase the pressure load up to the desired operating pressure.
- Operate the system for so long until the final operating state is achieved.
- Check the operating data such as:
 - Discharge flow
 - Operating pressure (as close as possible to device)
 - Fluid temperature (as close as possible to device)
 - Device temperature (in particular in the area of the bearing points)
 - ...
- Document the operating data of the initial start-up for later comparison.
- Check the level of the operating medium in the system.
- Check the filling level of the liquid seal (if existing).
- Check the device for leaks.
- Check all threaded connections for leaks and retighten if necessary.



In order to ensure a constant and reliable function of the device, an initial maintenance of the device is recommended after several hours warm-up time (max. 24 h). Faults can thus be identified at an early stage.

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8 Removal

8.1 Safety instructions for removal



Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.



Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.



Unshielded gearwheels!

Gearwheels can trap and crush fingers and hands.

1. Do not engage gearwheels.



Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.



Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

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KRACHT**NOTICE****Blocking of the device through hardening medium**

Hardening medium can mechanically jam the device and make it unusable.

1. Clean device immediately after operating with a hardening medium.

8.2 Removal

- Depressurise and de-energize the system.
- Close existing shut-off elements upstream and downstream of the device.
- Open existing drain elements and loosen connection lines. Collect and dispose of discharging medium so that no hazard arises for persons or environment.
- Dismantle the device.
- Clean the device.
- Close the device connections and lines to prevent dirt penetration.

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9 Maintenance

9.1 Safety instructions for maintenance



Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.



Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.



Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.



Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

9.2 Maintenance work



Checking and documentation of the operating data

Regular checking and documentation of all operating data such as pressure, temperature, current consumption, degree of filter soiling, etc. contributes to early problem detection.

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- Perform maintenance according to specification.
- Replace defective and worn components.
- If required, request spare parts lists and assembly drawings from the manufacturer.
- Document the type and scope of the maintenance work along with the operating data.
- Compare the operating data with the values of the first commissioning. Determine the cause in case of major non-compliances (> 10 %).
- Dispose of packing material and used parts in accordance with the local stipulations.



Barriers and instructions

All barriers and warning signs removed during this must be attached to their original position on completing maintenance and/or repairs.

9.3 Maintenance instructions

The following information provides recommendations on maintenance work and maintenance intervals for the device being used.

Depending on the actually occurring loads in operation, the type, scope and interval of the maintenance work can deviate from the recommendations. The equipment builder/operator shall write an obligatory maintenance plan.



Within the framework of preventive maintenance, it is appropriate to replace wear parts before reaching the wear limit.

With corresponding expertise and sufficient equipment, the replacement can be carried out by the equipment builder/operator. Please consult the manufacturer about this.



Warranty

In case of improper implementation, any warranty is voided.

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Maintenance recommendations Gear pump			
Interval	Maintenance work	Employ-ees	Duration approx. [h]
Firstly: after max. 24 h	Inspection: Discharge flow	1	1
	Inspection: Operating pressure		
	Inspection: Fluid temperature		
	Inspection: Device temperature		
	Inspection: Add-on valve function (if existing)		
	Inspection: Check potential equalisation for firm seating and functionality (if existing)		
	Inspection: Condition of operating fluid		
Daily	Audiometric monitoring: Unusual noise	1	0.1
	Cleaning: Remove dust deposits and dirt with a moist cloth		
	Visual inspection: Leakages		
	Visual inspection: Filling level of liquid seal (if existing)		
3000 Operating hours	Inspection: Discharge flow	1	1
	Inspection: Operating pressure		
	Inspection: Fluid temperature		
	Inspection: Device temperature		
	Inspection: Add-on valve function (if existing)		
	Inspection: Check potential equalisation for firm seating and functionality (if existing)		
	Inspection: Condition of operating fluid		
6000 Operating hours	Visual inspection: Condition of gears	1	2
	Visual inspection: Condition of housing parts		
	Visual inspection: Condition of plain bearings		
	Visual inspection: Condition of shaft seal		
	Visual inspection: Condition of outboard bearings (if existing)		
As required	Replace: Plain bearings (only by manufacturer)	1	2
	Replace: Outboard bearing (if existing)		
	Replace: Shaft seal		
	Replace: Other seals		

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10 Repairs

10.1 Safety instructions for repair

 DANGER Hazardous fluids! Danger of death when handling hazardous fluids. 1. Comply with the safety data sheets and regulations on handling hazardous fluids. 2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.
 DANGER Rotating parts! Danger of death due to body parts, hair or clothing getting trapped or entangled. 1. Before all work, ensure that existing drives are voltage-free and pressure-free. 2. Securely prevent restarting during all work.
 WARNING Failure of load-carrying parts due to overload! Danger of injury from flying parts. Danger of injury from spurting fluids. 1. Depressurise the device and all connection lines before doing any work. 2. Securely prevent the restoration of pressure while working on the device.
 CAUTION Hot surfaces! Burn injury to skin if touched. 1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

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10.2 General

The repairs covers:

1. Troubleshooting
Determination of damage, pinpointing and localisation of the damage cause.
2. Elimination of damage
Elimination of the primary causes and replacement or repair of defective components. The repair is generally made by the manufacturer.

Repairs by manufacturer

- Before returning the device, fill in the *return notification* form. The form can be filled in online and is available as a pdf file download.

**Device contains hazardous material**

If the device was operated with dangerous liquids, it must be cleaned before the return. If this should not be possible, the safety data sheet of the hazardous material is to be provided beforehand.

Repair by equipment builder/operator

If corresponding expertise and sufficient equipment is available, the equipment builder/operator can also make the repairs. Please consult the manufacturer about this.

- If required, request spare parts lists and assembly drawings from the manufacturer.
- Use spare parts approved by the manufacturer only.
- Dispose of packing material and used parts in accordance with the local stipulations.

**Warranty**

In case of improper implementation, any warranty is voided.

**Barriers and instructions**

All barriers and warning signs removed during this must be attached to their original position on completing maintenance and/or repairs.

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KRACHT**10.3 Detecting and eliminating failures**

Failure	Potential causes	Possible measures
1.1 Increased noise <i>Pump cavitation</i>	Excessive negative pressure (not complete filling of the pump)	Check suction line design Use noise-optimised pump
	Suction line plugged	Clean the suction line
	Suction filter plugged or too small	Clean suction filter or use a larger filter Replace filter element
	Suction basket plugged or too small	Clean intake strainer or dimension larger
	Fluid temperature too low	Adjust the temperature of medium
1.2 Increased noise <i>Foaming or air in medium</i>	Pump sucks air	Check oil level in the tank Check suction line Check the shaft seal
	Shaft seal defective	Replace shaft seal
	Suction connection leaking	Retighten or replace threaded connections Replace seals
	System not vented	Vent system
	Return line ends above the fluid level	Extend return line
	Heavy foaming in the system, e.g. in gears	Use noise-optimised pump
1.3 Increased noise <i>Mechanical vibrations</i>	Incorrectly aligned and/or loose coupling	Correct the alignment of the coupling and secure the coupling halves
	Incorrectly and/or insufficient line fastening	Fixate lines with suitable fastening material (e.g. pipe clamps)
	Wobbling pressure relief valve (if existing)	Increase valve opening pressure
	Not a noise-reducing setup	Use dampers

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Failure		Potential causes	Possible measures
2	Pump does not suck	Dry run	Fill pump and the suction line with medium.
		Minimum filling level in the supply tank undercut	Top up medium
		False direction of rotation of the pump	Correct the direction of rotation
		Closed shut-off element in the suction line	Open the shut-off element
		Suction line plugged	Clean the suction line
		The air in the suction line cannot be compressed in the pressure line	Reduce the start-up pressure
			Vent the pressure line
			Increase volume of the pressure line
		Speed of the pump is too low	Check the pump design
			During frequency inverter operation: Check the operation/line frequency
		Geodetic suction head too high	Check installation location
			Provide pre-filling pump

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Failure	Potential causes	Possible measures
3 Insufficient pressure Insufficient pumping flow rate	Excessive negative pressure (not complete filling of the pump)	Check suction line design
	Viscosity too high	Provide pre-filling pump
	Speed of the pump is too low	Check the pump design
		During frequency inverter operation: Check the operation/line frequency
	Throttled shut-off element in the suction line	Open the shut-off element
	Suction line plugged	Clean the suction line
	Suction filter plugged or too small	Clean suction filter or use a larger filter
		Replace filter element
	Suction bascet plugged or too small	Clean intake strainer or dimension larger
	Constant triggering of pressure relief valve (if existing)	Increase valve opening pressure
	Pump sucks air	Check oil level in the tank
		Check suction line
		Check the shaft seal
4 Excessive operating temperature	Wear	Replace the device
	Cooling and heat dissipation insufficient	Increase the cooling capacity
	Not sufficient oil in the system	Check the container layout
	Excess fluid is being delivered into the supply tank via pressure relief valve under load	Check the pump design
5 Impermissible pump heating	Constant triggering of a directly attached pressure relief valve (if existing)	Increase valve opening pressure
	Pressure too high in association with a media viscosity that is too low	Check the system design
	Speed too fast in connection with media viscosity that is too high	Check the system design
	Gland lid overtightened (for gland seal)	Unscrew gland lid and readjust leakage
	Suction pressure too high	Reduce the pressure
	Wear	Replace the device

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Failure	Potential causes	Possible measures
6 Leakages <i>Seal failure</i>	Poor maintenance	Comply with maintenance plan Replace seals
	Mechanical damage	Replace seals
	Thermal overload	Check the operating datas Replace seals
	Pressure too high	Check the operating datas Replace seals
	Gas content in medium too high	Check the operating datas Replace seals
	Corrosion/chemical impact	Check the material compatibility Replace seals
	Wrong direction of rotation	Correct the direction of rotation Replace seals
	Contaminated medium	Provide filtration Replace seals
	Gland lid not sufficiently tightened (for gland seal)	Retighten gland lid
	Loose threaded connections	Retighten or replace threaded connections
7.1 Coupling <i>Coupling wear</i>	Alignment error	Correct the alignment of the coupling and secure the coupling halves
	Spider overloaded	Check the operating datas Use harder spider
7.2 Coupling <i>Cam break</i>	Spider wear Torque transmission due to metal contact	Adapt maintenance intervals Replace coupling
7.3 Coupling <i>Premature spider wear</i>	Alignment error	Correct the alignment of the coupling and secure the coupling halves Replace spider
	Spider failure due to chemical corrosion	Check the material compatibility Replace spider

Gear pump KF 2.5 - 630

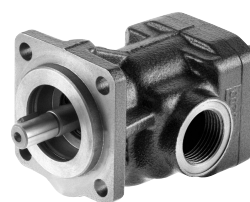
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Failure		Potential causes	Possible measures
8	Motor protection switch tripped	Driving power too low	Check the drive design
		Motor incorrectly connected	Check motor connection
		Phase failure	Check feed/supply
		Current consumption too high	Check the operating datas
			Check direction of rotation
		Motor circuit breaker incorrectly designed	Check the operating datas
Consult the manufacturer for all unidentifiable failures.			

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Transfer Gear Pumps

KF 2.5...200

Transfer Gear Pumps KF 2.5...200

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Transfer Gear Pumps KF 2.5...200

KRACHT**Contents****Technical Data**

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Transfer Gear Pumps KF 2.5...200

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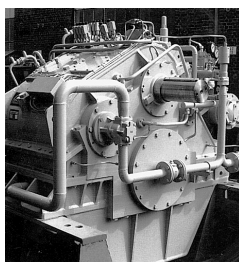
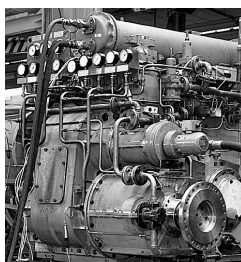
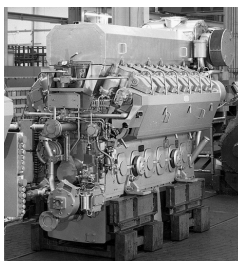
Applications, Suitable Fluids

Applications

Centrifuge construction,
Coating machines, Compressors
Engine construction
Filling stations, Filter systems
Generator construction
Heat transfer systems, Heavy electrical machines
Lubricant manufacturers, Lubricating oil systems
Machine-building industry, Machine tools,
Manufacture of apparatus,
Marine engine construction,
Metal-forming machines, Metering systems
Paint industry, Plain metal bearing production,
Printing machines, PUR machinery
Refrigerators, Rubber and tire manufacturing
Tank plant construction,
Transmission building
Turbine construction
Vacuum machinery
Waste oil - disposal
- transport
- treatment

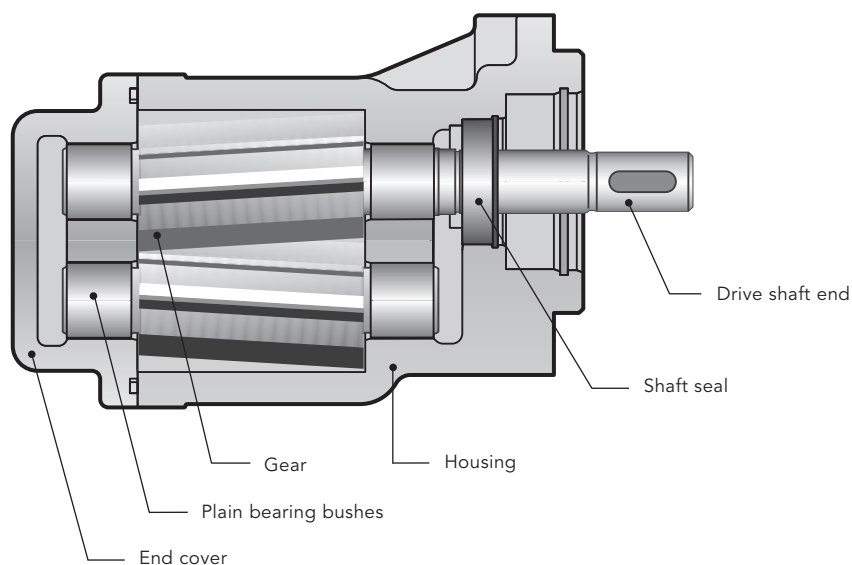
Suitable fluids

Adhesives, Antifreeze
Bore oils
Cutting oils
Diesel oils, Drawing compound
Emulsions
Fuel oils, L, EL, H
Gear oils, Grease
Hardening oils, Heat transfer media,
Heavy oils, Hydraulic fluids
Isocyanate
Lubricating oils, Lacquers
Motor oils
Paint, Paraffins, Plastics, Polyols
Printing inks, Processing oils
Resins, Rolling oils
Waste oils, Waxes



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Transfer Gear Pumps KF 2.5...200

KRACHT**Construction****Product Features**

Transfer gear pumps KF are used for pumping a wide variety of fluids.

Transfer gear pumps KF are distinguished especially by their wide range of variants which are assembled as required on the modular principle and also permit subsequent upgrade.

The pumps are also suitable for media with low lubricating properties.

The standard housing sections are of grey cast iron.

The gear units are manufactured from high-strength case-hardening steel, hardened and mounted in special multi-compound plain bearing bushes.

The standard drive shaft is sealed by rotary shaft lip-type seal.

All pump sizes incorporate helical tooth system. This feature, combined with special gear geometry, results in extremely low noise levels and reduced pressure pulsation.

Working Notes

- The fluids should ensure a certain minimum lubricating properties, should not contain solids and should be chemically compatible.
- Avoid dry operation.
- The pumps may only be operated in the specified direction of rotation, as otherwise the shaft seal will be destroyed.
- In order to prevent excessive overpressure, a safety valve should be provided in the system or on the pump.
- The pressure relief valve attached to the pump may only be used as safety valve for short-term operation.
- A separate pressure relief valve with return line to the reservoir must be foreseen, if a partial discharge flow has to be drained over a prolonged period.

Transfer Gear Pumps KF 2.5...200

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Variants

- Sealing of the drive shaft:
 - Rotary shaft lip-type seal
 - Double rotary shaft lip-type seal (Quench)
 - Mechanical seal
- Outboard bearing to take up input drive-side radial load
- Pressure relief valve for pump and system
- Uniform discharge flow direction with changing direction of rotation by means of flange-mounting valve combination (universal device).

Special Design

Various shafts ends and gear units, as well as flange mounted versions, bearing alternatives, multi-stage pump combinations for your special application are available on request.

Our Sales engineers will be pleased to advise you.

Accessories

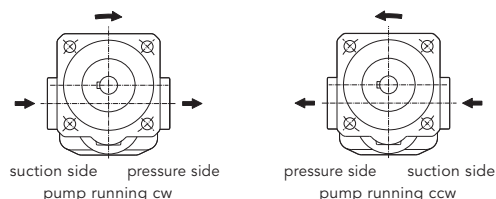
- Connecting flanges
- Couplings
- Bell housing
- Quench tank
- Attenuation elements

Direction of Rotation

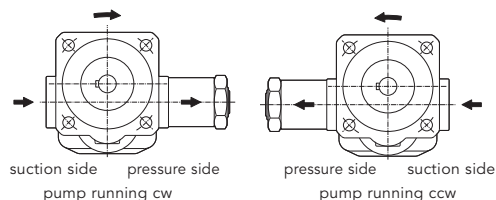
The following should be note for direction of rotation:

- when looking at the pump shaft end, the direction of pumping is from left to right if the shaft rotates **clockwise**.
- when looking at the pump shaft end, the direction of pumping is from right to left if the shaft rotates **counterclockwise**.

Without pressure relief valve



With pressure relief valve



With universal device

Direction of rotation right and left

Direction of rotation consistent, see dimension sheets page 18 to 21.

ATEX-Version

	KF 2,5...112 with lip-type seal	KF 2,5...112 with double lip-type seal
In Ex-area max. suitable for category	EX II 2G T4 EX II 2D T135 °C	EX II 2G T4
Perm. working pressure inlet port in bar	– 0.4 ... + 0.5	– 0.4 ... + 0.5
Perm. working pressure outlet port in bar	25	25
Perm. viscosity in mm ² /s	12 ... 20 000	12 ... 20 000
Max. speed in 1/min (viscosity dependent)	3 000	3 000
Perm. mounting position	Horizontal or shaft end toward bottom	Horizontal quencher up
Perm. media temperatures in °C	– 10 ... + 80	– 10 ... + 80
Perm. ambient temperatures in °C	– 20 ... + 60	– 20 ... + 60
Comments	Vertical mounting with shaft end up on request. In executing with outboard bearing max. speed 1500 1/min. In dust Ex-area, permissible only with non-conductive dusts. Dust-proof capsuling of pump shaft and coupling required.	Not suitable for dust-Ex. Execution with quench feed and quencher.

Additional products available on request.

Transfer Gear Pumps KF 2.5...200

KRACHT**Materials**

Housing and cover	EN-GJL-250 (GG 25) EN-GJS-400-15 (GGG 40) on request
Gear	Steel 1.7139
Plain bearing bushes	DU (multi-layer friction-type bearings P 10, DP 4) Bearings free of nonferrous metal on request
Shaft end seals	NBR, FKM, PTFE, EPDM (other sealing materials on request. E.g. HNBR / CR)
O-ring	NBR, FKM, PTFE, EPDM (other sealing materials on request. E.g. HNBR / CR)

Characteristics

Nominal sizes 2.5...200 cm ³	$V_g =$	2.5 / 4 / 5 / 6 / 8 / 10 / 12 / 16 / 20 / 25 / 32 / 40 / 50 / 63 / 80 / 100 / 112 / 125 / 150 / 180 / 200
Mounting position		KF... R/L/B ... without Quench optional KF... R/L/B ... with Quench horizontal, Quench connection above KF... U ... horizontal, Pressure connection above KF... U2...optional
Direction of rotation		right or left right and left
Fixing type		flange
Pipe connection	KF 2.5...25 KF 32...200	Whitworth pipe thread, SAE flange SAE flange
Drive shaft end		ISO R 775 short-cylindrical
Working pressure suction side		see chart page 8
Working pressure pressure side	P_n	25 bar (higher pressures on request)
Speed	KF 2.5... 63 KF 80... 180 KF 200	200 ... 3 600 1/min 200 ... 3 000 1/min 200 ... 2 500 1/min
Recommended speed		The speed of the pump must be chosen in such a way that complete pump filling is guaranteed. This is given if the relative pressure at the pump inlet does not fall below -0.4 bar (-0.6 bar briefly e.g. during cold start).
Viscosity (dependent on pressure and rotational speed)	V_{min} V_{max}	1.4... 12 mm ² /s (see table "permissible differential pressure") 20 000 mm ² /s
Fluid temperature		see chart page 8
Ambient temperature	$\vartheta_u =$	-20 °C ... 60 °C (-4 °F ... 140 °F) -30 °C... 60 °C Sealing type 23 (KF 2.5...80) -30 °C... 60 °C Sealing type 31 (KF 32...200)

Permissible Differential Pressure

Bearing	Δp_{max} [bar]		
	≥ 1.4 mm ² /s	≥ 6 mm ² /s	≥ 12 mm ² /s
Multi-layer plain bearing containing lead ⁽¹⁾ : DU®, P10	3	12	25
Multi-layer plain bearing lead-free ⁽²⁾ : DP4			
Polymer plain bearing ⁽²⁾ : Iglidur® X	–	3	10
White metal plain bearing ⁽²⁾			

⁽¹⁾ Standard ⁽²⁾ Is defined in the special number

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Transfer Gear Pumps KF 2.5...200

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Shaft End Seals

	Sealing material	Pressure suction side* (bar)		Fluid temperature	
		KF 2,5...80	KF 100...200	°C	°F
Pump with single rotary shaft lip	NBR/ max. 750 1/min	-0.4...6.0	-0.4...6.0	-10...90-NBR	14...194-NBR
	FKM max. 1000 1/min	-0.4...5.0	-0.4...5.0		
	max. 1500 1/min	-0.4...4.0	-0.4...3.5	-10...150-FKM	14...302-FKM
	max. 2000 1/min	-0.4...3.0	-0.4...2.5		
	max. 3000 1/min	-0.4...2.0	-0.4...1.5		
	FKM (low temperature)	-0.4...0.5		-30**...150	-22**...302
Pump with outboard bearing and single rotary shaft lip	EPDM	-0.4...0.5		-10...120	14...248
	PTFE	-0.4...2.0		-10...200	14...392
	NBR/ max. 750 1/min	-0.4...6.0	-0.4...6.0	-10...90-NBR	14...194-NBR
	FKM max. 1000 1/min	-0.4...5.0	-0.4...5.0		
	max. 1500 1/min	-0.4...4.0	-0.4...3.5	-10...150-FKM	14...302-FKM
	max. 2000 1/min	-0.4...3.0	-0.4...5.5		
Pump with double rotary shaft seal with connection borehole for liquid seal (quench)	max. 3000 1/min	-0.4...2.0	-0.4...1.5		
	PTFE	-0.4...2.0		-10...200	14...392
	NBR/ max. 750 1/min	-0.4...6.0	-0.4...6.0	-10...90-NBR	14...194-NBR
	FKM max. 1000 1/min	-0.4...5.0	-0.4...5.0		
	max. 1500 1/min	-0.4...4.0	-0.4...3.5	-10...150-FKM	14...302-FKM
	max. 2000 1/min	-0.4...3.0	-0.4...2.5		
Pump with double rotary shaft seal for vacuum operation with connection borehole for liquid seal (quench)	max. 3000 1/min	-0.4...2.0	-0.4...1.5		
	PTFE	-0.4...2.0		-10...200	14...392
	NBR	-0.9...0.2		-10...90	14...194
	FKM	-0.9...0.2		-10...150	14...302
	PTFE	-0.9...0.2		-10...200	14...392
	NBR/ max. 750 1/min	-0.9...6.0	-0.9...6.0	-10...90-NBR	14...194-NBR
Pump with triple rotary shaft seal for vacuum and normal operation with connection borehole for liquid seal (quench)	FKM max. 1000 1/min	-0.9...5.0	-0.9...5.0		
	max. 1500 1/min	-0.9...4.0	-0.9...3.5	-10...150-FKM	14...302-FKM
	max. 2000 1/min	-0.9...3.0	-0.9...2.5		
	max. 3000 1/min	-0.9...2.0	-0.9...1.5		
	FKM	-0.4...10.0		-10...150	14...302
	PTFE	-0.4...10.0		-10...200	14...392
Pump with mechanical seal	EPDM	-0.4...10.0		-10...120	14...248
	FKM	-0.4...10.0		-10...150	14...302
	PTFE	-0.4...10.0		-10...200	14...392
Pump with mechanical seal and connection borehole for liquid seal (quench)	FKM	-0.4...10.0		-10...150	14...302

Speed: KF 2.5... 63 200 ... 3 600 1/min
 KF 80... 180 200 ... 3 000 1/min
 KF 200 200 ... 2 500 1/min

* short term during start-up status: -0.6 bar

** only in connection with housing and cover material EN-GJS-400 (GGG 40)

The indicated maximum values are dependent upon the remaining working conditions.

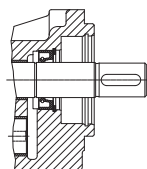
In case of universal devices, pay attention to limitation of $P_{e \text{ min.}}$

Other sealing materials on request.

Transfer Gear Pumps KF 2.5...200

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Variants Shaft End Seals



Pump with single
rotary shaft lip

Fixing type: F/W

Sealing materials:

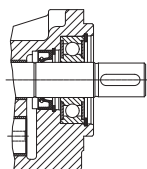
NBR = sealing type 1

FKM = sealing type 2

PTFE = sealing type 3

EPDM = sealing type 9

FKM low temperature
= sealing type 23/31



Pump with outboard
bearing and single
rotary shaft lip

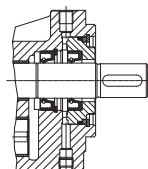
Fixing type: G/X

Sealing materials:

NBR = sealing type 1

FKM = sealing type 2

PTFE = sealing type 3



Pump with double rotary
shaft seal with connection
borehole for liquid seal
(quench)

Fixing type: F/W

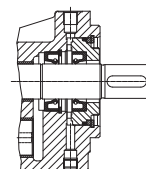
Sealing materials:

NBR = sealing type 19

FKM = sealing type 7

PTFE = sealing type 4

EPDM = sealing type 32



Pump with double rotary
shaft seal for vacuum
operation with connection
borehole for liquid seal
(quench)

Fixing type: F/W

Sealing materials:

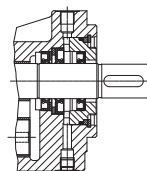
NBR = sealing type 19

FKM = sealing type 7

PTFE = sealing type 4

EPDM = sealing type 32

Special number: 74



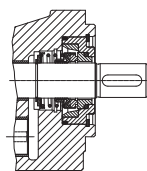
Pump with triple rotary
shaft seal for vacuum
and normal operation
with connection borehole
for liquid seal (quench)

Fixing type: F/W

Sealing materials:

NBR = on request

FKM = on request



Pump with
mechanical seal

Fixing type: F/W

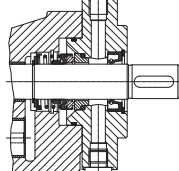
Sealing materials:

FKM = sealing type 5

PTFE = sealing type 6

mechanical seal

= sealing type 40



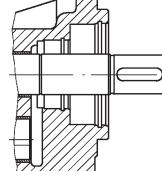
Pump with mechanical seal
and connection borehole
for liquid seal (quench)

Fixing type: F/W

Sealing materials:

FKM = sealing type 5

Special number: 198



Pump without shaft sealing

Fixing type: F/W

Sealing material:

FKM o-ring
= sealing type 30

Transfer Gear Pumps KF 2.5...200

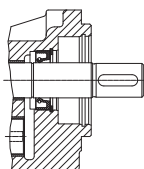
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KF 2.5...200 noise optimized for medias with increased air content

The noise optimized pumps in the KF series are designed for conveying for medias with increased air content, predominantly for use as lubricating oil pumps in transmissions. Special measures prevent the otherwise normally increased noise present in auriferous transmission oil. The noise levels do not exceed or only barely exceed the measurements with non-auriferous oils. Also, there is no noise spectrum shift to higher, unpleasant frequencies. In applications without auriferous portions in the media, it is not recommended to use this version as it will not bring about noise reduction effects there.

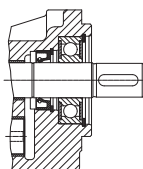
The noise optimized version of the KF pump is marked with the special number **197** at the end of the type key. Pumps with the special number **197** are built as pumps in combination with an electric motor or as mounted pumps. The pump in combination with an electric motor (Fig. 1) does not have an outboard bearing, so it has to be driven via an elastic coupling. The mounted pump (Fig. 2) comes equipped with an outboard bearing to absorb the centrifugal forces such as those which arise when using a flying pinion. Pumps for electric motor drives and mounted pumps are sealed at the shaft end using a lip-type shaft seal.

Fig. 1



Pump with
single rotary shaft lip
Fixing type: F/W
Sealing materials:
NBR = sealing type 1
FKM = sealing type 2
Special number: 197

Fig. 2



Pump with outboard bearing
and single rotary shaft lip
Fixing type: G/X
Sealing materials:
NBR = sealing type 1
FKM = sealing type 2
Special number: 197

The noise optimized version is also available in a ductile cast iron version. We can supply these pumps in the ATEX version also.

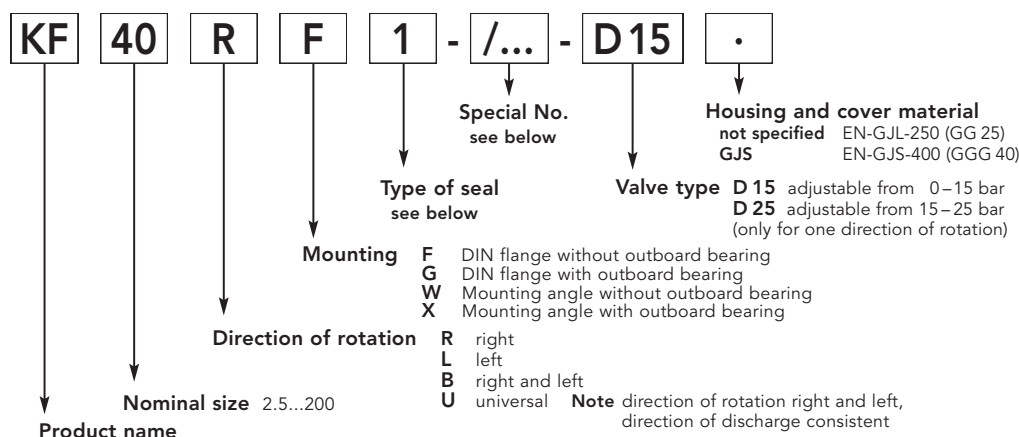
Note

Dimensions conformable standard pumps

Transfer Gear Pumps KF 2.5...200

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Type Key (Ordering example)



Type of seal

- 1 Rotary shaft seal BABSL NBR
- 2 Rotary shaft seal BABSL FKM
- 3 Rotary shaft seal PTFE
- 4 Double rotary shaft seal PTFE
- 5 Mechanical seal with FKM secondary seals (C2S2V1G3G1)
- 6 Mechanical seal with FFKM secondary seals
Q2Q2K1G3 (KF 2.5... 25) Q2B2K1G3 (KF 32... 200)
- 7 Double rotary shaft seal BABSL FKM
- 9 Rotary shaft seal EPDM (not resistant to mineral oils)
- 19 Double rotary shaft seal BABSL NBR
- 23 Rotary shaft seal MSS-1 FKM
(low temperature) (KF 2.5... 80)
- 30 Without shaft seal ⁽¹⁾ O-ring FKM
- 31 Rotary shaft seal BABSL FKM
(low temperature) (KF 32... 200)
- 32 Double rotary shaft seal EPDM
(not resistant to mineral oils)
- 36 Without shaft seal ⁽¹⁾ O-ring NBR
- 40 Mechanical seal with FKM secondary seals (AQ2VFF)

⁽¹⁾ Leak oil discharged through the gland pocket

Special No.

- 74 Double rotary shaft seal (for vacuum operation)
Connection bore G 1/8" (for liquid seal)
- 158 KF 2.5... 12: Flange connection SAE 3/4"
KF 16... 25: Flange connection SAE 1"
- 197 Noise-optimized version for aerated oils and vacuum⁽¹⁾
- 198 Mechanical seal
KF 2.5... 25: Connection bore G 1/8" (for liquid seal)
KF 32... 80: Connection bore G 1/4" (for liquid seal)
- 232 KF 50...80: Flange connection SAE 2"
KF 100...112: Flange connection SAE 2 1/2"
KF 125...150: Flange connection SAE 3"
KF 180...200: Flange connection SAE 3 1/2"
- 304 Polymer plain bearing iglidur®X
(free from non-ferrous metals), $\Delta p_{max} = 10$ bar
- 317 Noise-optimized version for aerated oils and vacuum⁽¹⁾
Polymer plain bearing iglidur®X
(free from non-ferrous metals), $\Delta p_{max} = 10$ bar
- 322 Triple rotary shaft seal (for normal operation + for vacuum operation)
Connection bore G 1/8" (for liquid seal)
Polymer plain bearing iglidur®X
(free from non-ferrous metals), $\Delta p_{max} = 10$ bar
KF 50... 80: Flange connection SAE 2"
- 353 Noise-optimized version for aerated oils and vacuum⁽¹⁾
Multi-layer plain bearing DP4 (lead-free)
- 355 Polymer plain bearing iglidur®X
(free from non-ferrous metals), $\Delta p_{max} = 10$ bar
Housing connection: KF 2.5... 25: as special number 158
- 363 Version for low-viscous media (housing and cover material = GJS)
Polymer plain bearing iglidur®X
(free from non-ferrous metals), $\Delta p_{max} = 10$ bar
Housing connection: KF 2.5... 25: as special number 158
KF 50... 200: as special number 232
- 391 Noise-optimized version for aerated oils and vacuum⁽¹⁾
Housing connection: KF 50... 200: as special number 232
- 425 Shaft end with centre hole DIN 322-D
Outboard bearing with steel cage

⁽¹⁾ There can be a reduction in pumping capacity. Measures for noise optimisation are only feasible for one rotational direction and only effective for aerated oils or vacuum.

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Transfer Gear Pumps KF 2.5...200

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Technical Data

Nominal size	geom. displacement	Working pressure*	Maximum pressure (pressure peaks)	Speed range		Permissible load ** (n = 1500 1/min)	Sound level dB (A)				
	V _g cm ³ /r			p _b bar	p _{max} bar		n _{min} 1/min	n _{max} 1/min	F _{radial} N	p = 5 bar	p = 15 bar
2.5	2.55	25	40	200	3600	700	≤ 65	≤ 66	≤ 67		
4	4.03										
5	5.05										
6	6.38										
8	8.05										
10	10.11										
12	12.58										
16	16.09										
20	20.1										
25	25.1										
32	32.12										
40	40.21										
50	50.2										
63	63.18										
80	80.5										
100	101.5										
112	113.5										
125	129.4										
150	155.6										
180	186.6										
200	206.2	1500	≤ 67	≤ 68	≤ 68						
						≤ 67	≤ 68	≤ 69			
						≤ 65	≤ 65	≤ 65			
					2500						

Remark

* Working pressure p_b = perm. sustained pressure (higher pressures on request)

** Permissible load only for version with outboard bearing. F_{radial} at centre of shaft end.

For certain working conditions, the minimum or maximum characteristics should not be used.

For example, the max. working pressure is not permissible in combination with low speed and low viscosity.

In such limit ranges, please consult us.

Sound level measured in dB(A) at 1 m distance

Sound level measured with drive motor, installation site:

Works hall, quiet sound level = 40 dB(A)

Pump assembly on rigid fastening angle,

Suction and pressure conduits: Hose

Measured with transmission oil,

Oil viscosity $\nu = 34 \text{ mm}^2/\text{s}$,

Speed $n = 1500 \text{ 1/min}$.

Transfer Gear Pumps KF 2.5...200

KRACHT

Power Consumption

Speed $n = 950$ 1/min

	Pressure p_b in bar								Nominal size	Pressure p_b in bar								Power consumption P in kW
	2	4	6	8	10	15	20	25		2	4	6	8	10	15	20	25	
	Discharge Q in l/min																	
2.5	2.4	2.4	2.3	2.2	2.1	2	1.8		2.5	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	
3.7	3.7	3.6	3.6	3.6	3.5	3.4	3.3		4	0.04	0.05	0.07	0.08	0.09	0.13	0.16	0.2	
4.6	4.6	4.5	4.5	4.4	4.2	4.1	3.9		5	0.04	0.06	0.08	0.1	0.11	0.16	0.2	0.25	
5.8	5.7	5.6	5.5	5.5	5.3	5.1	4.9		6	0.05	0.07	0.09	0.12	0.14	0.19	0.25	0.3	
7.3	7.3	7.2	7.1	7	6.8	6.6	6.4		8	0.06	0.09	0.11	0.14	0.17	0.24	0.31	0.38	
9.2	9.1	9	8.9	8.8	8.5	8.2	7.9		10	0.07	0.1	0.14	0.17	0.21	0.29	0.38	0.47	
11.4	11.3	11.2	11.1	11	10.8	10.5	10.3		12	0.08	0.12	0.16	0.21	0.25	0.36	0.47	0.58	
14.2	14	13.8	13.6	13.4	12.9	12.3	11.8		16	0.09	0.15	0.2	0.26	0.31	0.45	0.6	0.74	
18	17.6	17.3	16.9	16.6	15.7	14.9	14		20	0.1	0.18	0.25	0.32	0.39	0.56	0.74	0.92	
22.8	22.5	22.3	22	21.7	21.1	20.4	19.8		25	0.12	0.21	0.3	0.39	0.48	0.7	0.92	1.14	
29	28	27	27	26	25	23	22		32	0.16	0.3	0.4	0.5	0.6	0.9	1.2	1.5	
36	36	35	34	34	32	30	28		40	0.25	0.4	0.5	0.6	0.8	1.1	1.5	1.8	
45	44	43	42	41	39	36	34		50	0.3	0.5	0.6	0.8	1	1.4	1.9	2.3	
57	56	54	53	52	50	46	43		63	0.4	0.6	0.8	1	1.2	1.8	2.4	2.9	
74	73	72	71	70	67	65	62		80	0.6	0.8	1.1	1.4	1.6	2.3	3	3.7	
92	90	88	86	84	79	73	67		100	0.7	1	1.3	1.6	1.9	2.7	3.6	4.5	
102	99	97	94	91	84	77	70		112	0.9	1.2	1.6	2	2.4	3.3	4.3	5.2	
114	112	109	106	103	96	89	82		125	1	1.4	1.8	2.3	2.8	3.9	5	6.1	
139	137	134	132	129	123	116	110		150	1.1	1.6	2.1	2.6	3.2	4.5	5.8	7.2	
169	166	163	160	156	148	140	132		180	1.2	1.8	2.4	3	3.6	5.1	6.6	8.1	
187	184	180	177	174	167	159	151		200	1.4	2.1	2.8	3.4	4	5.7	7.3	9	

Speed $n = 1450$ 1/min

	Pressure p_b in bar								Nominal size	Pressure p_b in bar								Power consumption P in kW
	2	4	6	8	10	15	20	25		2	4	6	8	10	15	20	25	
	Discharge Q in l/min																	
3.6	3.6	3.5	3.5	3.5	3.4	3.3	3.2		2.5	0.04	0.05	0.08	0.1	0.12	0.14	0.16	0.2	
5.7	5.7	5.6	5.6	5.5	5.4	5.4	5.3		4	0.06	0.08	0.16	0.12	0.15	0.2	0.25	0.3	
6.9	6.8	6.8	6.7	6.7	6.6	6.5	6.4		5	0.07	0.1	0.12	0.15	0.19	0.27	0.35	0.43	
8.9	8.8	8.8	8.7	8.6	8.4	8.2	8		6	0.08	0.11	0.115	0.18	0.22	0.32	0.39	0.47	
11.3	11.2	11.1	11	10.9	10.8	10.6	10.4		8	0.09	0.14	0.18	0.22	0.26	0.37	0.47	0.58	
14.2	14.1	14.1	13.8	13.7	13.4	13.1	12.8		10	0.11	0.16	0.21	0.27	0.32	0.45	0.58	0.72	
17.6	17.5	17.4	17.3	17.2	16.9	16.7	16.5		12	0.12	0.19	0.26	0.32	0.39	0.55	0.72	0.89	
22.2	21.9	21.7	21.4	21.2	20.5	19.9	19.3		16	0.16	0.26	0.37	0.47	0.57	0.82	1.08	1.33	
27.9	27.5	27.1	26.8	26.4	25.5	24.5	23.6		20	0.17	0.28	0.39	0.49	0.6	0.87	1.14	1.41	
35.3	35	34.7	34.4	34.1	33.3	32.6	31.8		25	0.24	0.34	0.47	0.61	0.74	1.08	1.41	1.75	
45	44	43	43	42	41	39	37		32	0.3	0.5	0.7	0.8	1	1.4	1.9	2.3	
57	56	55	55	54	52	50	48		40	0.4	0.6	0.9	1.1	1.3	1.8	2.3	2.9	
70	69	68	67	66	64	61	58		50	0.5	0.8	1.1	1.3	1.6	2.3	2.9	3.6	
88	87	86	85	84	81	78	75		63	0.7	1	1.3	1.7	2	2.9	3.7	4.5	
114	113	112	111	110	107	105	103		80	0.94	1.35	1.8	2.2	2.6	3.6	4.6	5.7	
144	142	140	138	137	131	128	126		100	1.2	1.6	2	2.5	3	4.3	5.7	7	
161	159	157	154	152	147	142	138		112	1.4	2	2.6	3.1	3.7	5.2	6.7	8.2	
181	178	175	172	169	162	155	147		125	1.7	2.3	2.9	3.6	4.2	5.8	7.4	9	
218	216	213	211	209	203	197	191		150	2	2.7	3.5	4.2	5	6.9	8.9	11	
264	261	257	254	251	242	234	226		180	2.3	3.2	4.1	5	5.9	8.2	10.4	12.7	
293	290	287	283	280	272	264	256		200	2.6	3.6	4.6	5.6	6.6	9.1	11.6	14	

The ratings refer to a mineral oil with a viscosity of 34 mm²/s.

Margin of error for the flow Q + 2.5 % ... - 5 % of the tabular value. For viscosity < 30 mm²/s, take a reduction of the rated flow Q into account.

The output of the drive motor should be selected 20 % higher than tabular value P.

For viscosity > 100 mm²/s, an increase in the required power is necessary, in this case proceed as per description on page 15.

Transfer Gear Pumps KF 2.5...200

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Discharge Flow / Input Power

Calculation

$$P_{1Pu} = P_{tab} \cdot \frac{n}{1450} + f_v \cdot Q$$

P_{1Pu} = pump power consumption (kW)
 P_{tab} = power consumption per table (kW) at 1450 1/min
 n = speed (1/min)
 dependent on viscosity!
 (see speed recommendation)
 f_v = viscosity factor $\left[\frac{\text{kW}}{\text{l/min}} \right]$
 (see diagram)
 Q = discharge flow (l/min) with $Q = \frac{V_g \cdot n}{1000}$
 V_g = geometrical displacement (cm³/r)

Example: Pump type KF 80

Viscosity $v = 3000 \text{ mm}^2/\text{s}$
 Working pressure $p = 15 \text{ bar}$
 at $P_{tab} = 3.6 \text{ kW}$
 $n = 500 \text{ 1/min}$
 $f_v = 0.017 \frac{\text{kW}}{\text{l/min}}$
 $Q = \frac{80.5 \cdot 500}{1000} = 40 \text{ l/min}$
 becomes
 $P_{1Pu} = \left(3.6 \cdot \frac{500}{1450} + 0.017 \cdot 40 \right) \text{ kW}$
 $P_{1Pu} = 1.92 \text{ kW}$
 Motorpower output: $P_{2Mot} = 1.2 \cdot P_{1Pu} = 2.3 \text{ kW}$
 Select helical geared motor with
 $P = 3.0 \text{ kW}$
 $n = 500 \text{ 1/min}$

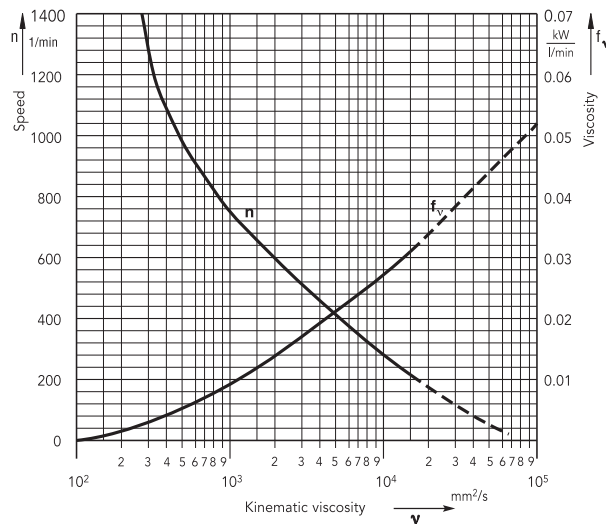
Conversion factors

$$1 \text{ bar} \triangleq 14.5 \frac{\text{lb}}{\text{in}^2} = 14.5 \text{ psi}$$

$$1 \frac{\text{l}}{\text{min}} \triangleq 0.220 \frac{\text{gal}}{\text{min}} = [\text{U.K.}]$$

$$1 \frac{\text{l}}{\text{min}} \triangleq 0.264 \frac{\text{gal}}{\text{min}} = [\text{US}]$$

Input Power

Diagramm: $n, f_v = f(v)$ **Note:**

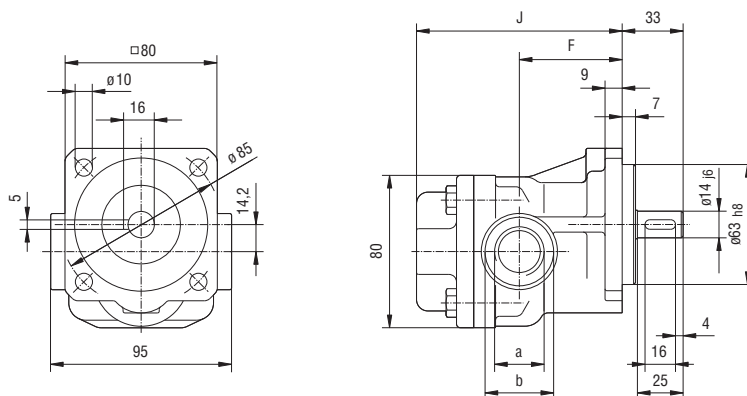
To determine the power consumption, always take the max. working viscosity at starting state into consideration. The power of the drive motor should be selected 20 % higher than the value determined.

Transfer Gear Pumps KF 2.5...200

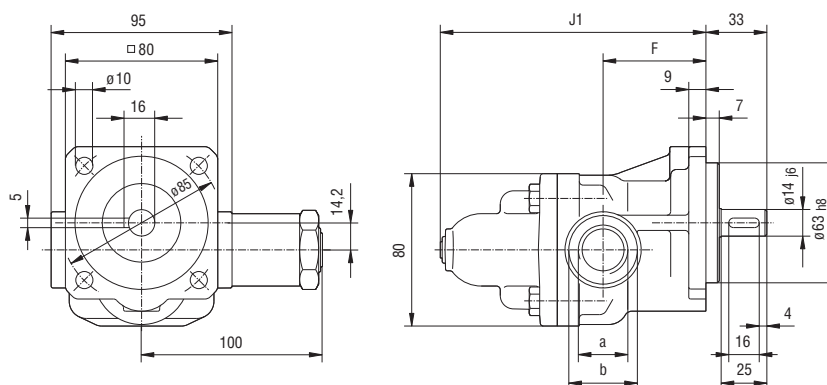
KRACHT

Flange-Mounting Version with Pipe Thread

KF 2.5...25



KF 2.5...25 with pressure relief valve



Nominal size	Suction and pressure connection		F	J	J ₁	Weight in kg	
	a	b				without valve	with valve
2,5...12	G 3/4 17 deep	Ø 36	54	109	140	2.9	3.7
16...25	G 1 19 deep	Ø 42	63	131	161	3.5	4.3

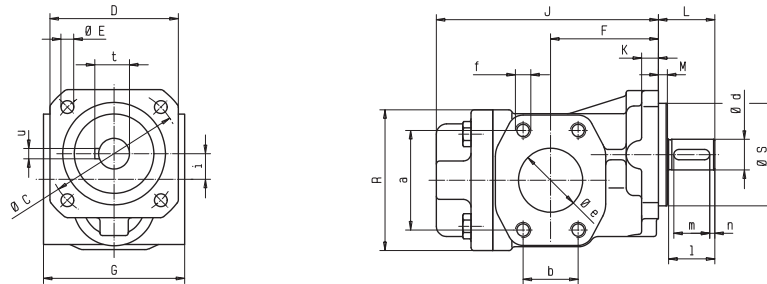
(Dimensions in mm)

Transfer Gear Pumps KF 2.5...200

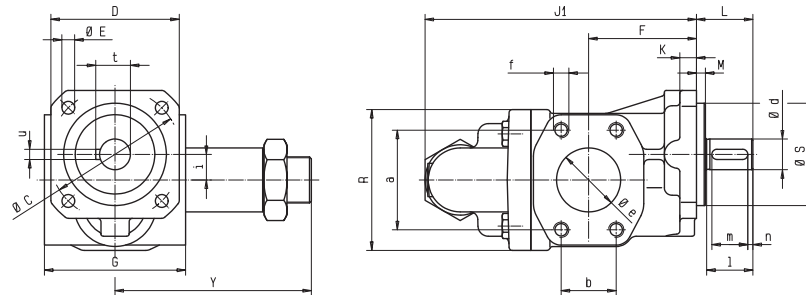
KRACHT

Flange-Mounting Version with SAE-Connection

KF 2.5...200



KF 2.5...200 with pressure relief valve



Nominal size	Sp.-No.	SAE	Seal	Suction- and pressure connection				Pump sizes														Shaft end						Weight in kg	
				a	b	e	f	C	D	E	F	G	J	J ₁	K	L	M	R	S _{h8}	i	Y	d _{h6}	l	m	n	t	u	without valve	with valve
2.5...12	158	3/4"	-	47.6	22.2	19.5	M10-15 deep	85	80	10	54	109	140		9	33	7	80	63	14,2	100	14	25	16	4	16	5	4.2	5.0
16...25	158	1"	-	52.4	26.2	25.0	M10-17 deep				63	100	131	162														4.8	5.6
32...50	-	1 1/2"	-	69.9	35.7	38.0					84	110	173	212														7.7	9.5
63/80	-	1 1/2"	-					103	100	10	100		208	247	13	44	7	110	80	20	153	24	36	28	4	27	8	9.4	11.2
50	232	2"	-			50.0					84		173	212														7.7	9.5
63/80	232	2"	-	77.8	42.9						100		208	247														9.4	11.2
100/112	-	2"	-			50.8									60							28	50	40	5	31			
100/112	-	2"	31												46							24	36	28	4	27			
100/112	232	2 1/2"	-								102	130	220.5	262.5	17							28	50	40	5	31		16.0	18.7
100/112	232	2 1/2"	31	88.9	50.8	63.5									60							24	36	28	4	27			
125/150	-	2 1/2"	-												46							28	50	40	5	31			
125/150	-	2 1/2"	31												46							24	36	28	4	27			
125/150	232	3"	-					145	135	14	120		245.0	282.0	60							28	50	40	5	31		22.2	24.9
125/150	232	3"	31	106.4	61.9	76.2						150			18	46		159				24	36	28	4	27			
180/200	-	3"	-																			28				31			
180/200	-	3"	31																			24				27			
180/200	232	3 1/2"	-	120.7	69.9	88.9					130		262	299	60							28	50	40	5	31		24.8	27.5
180/200	232	3 1/2"	31																			24				27			

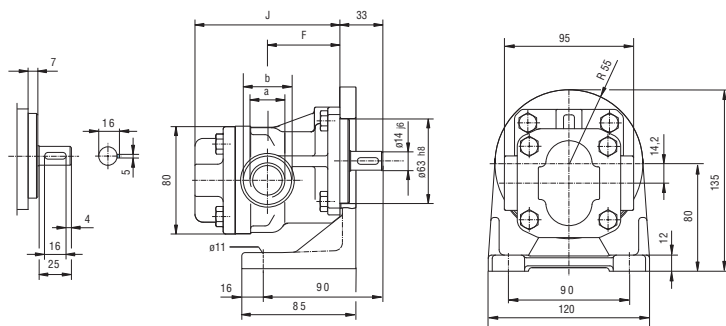
(Dimensions in mm)

Transfer Gear Pumps KF 2.5...200

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Pump with Mounting Angle, Pipe Thread

KF 2,5...25

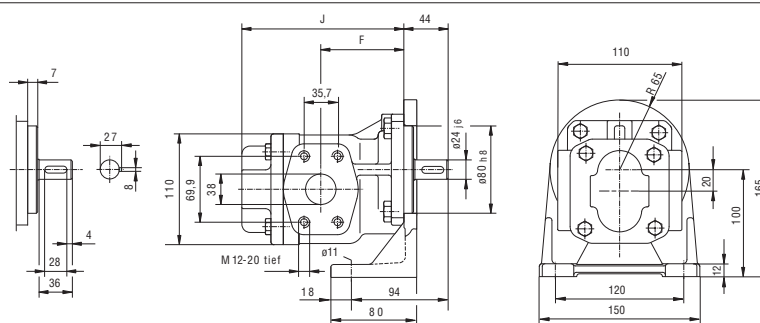


Nominal size	Suction and pressure connection		F	J	Weight in kg
	a	b			
2,5...12	G 3/4 17 deep	Ø 36	54	109	4,2
16...25	G 1 19 deep	Ø 42	63	131	4,8

(Dimensions in mm)

Pump with Mounting Angle, Pipe Thread, SAE 1 1/2-connection

KF 32...80



Nominal-size		F	J	Weight in kg
32...50	SAE 1½	84	173	9.5
63 / 80	SAE 1½	100	208	11.2

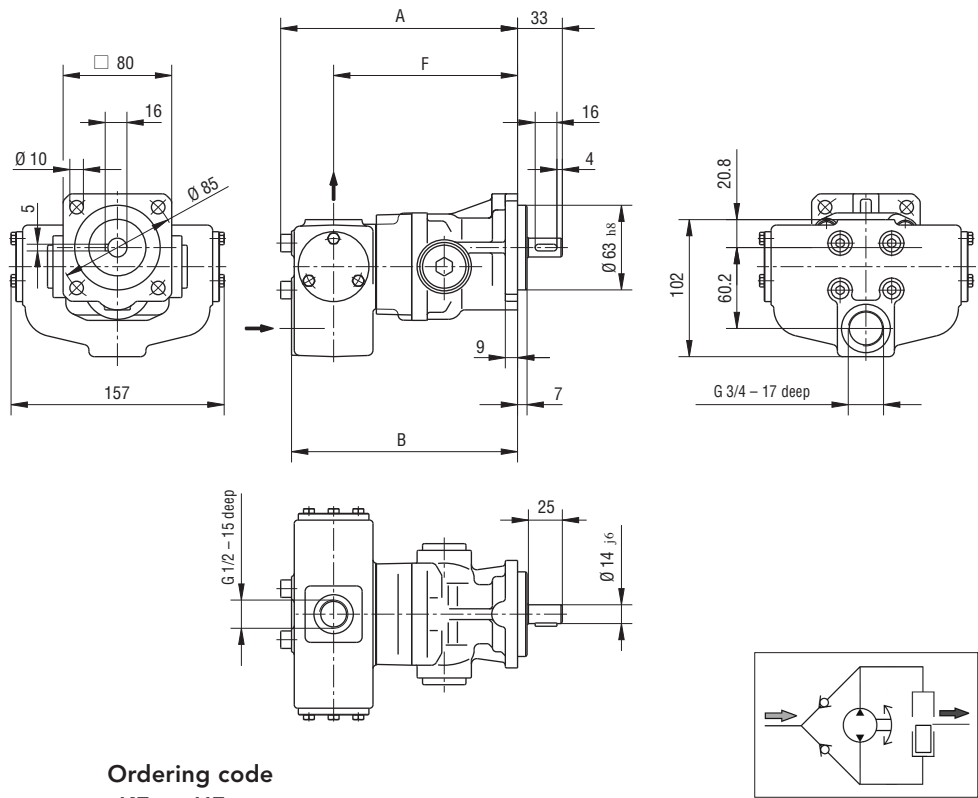
(Dimensions in mm)

Transfer Gear Pumps KF 2.5...200

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Flange-Mounting Version with Universal Arrangement

KF 2.5...25



Ordering code

KF . UF .
Seals 1/2

Nominal size	A	B	F	Weight in kg	Perm. manometr. low pressure at the pump suction connection p _e bar
2.5	174.5	166.5	135.5	6.9	0.35
4					
5					
6					
8					
10					
12					
16	196.5	188.5	157.5	7.5	
20					
25					

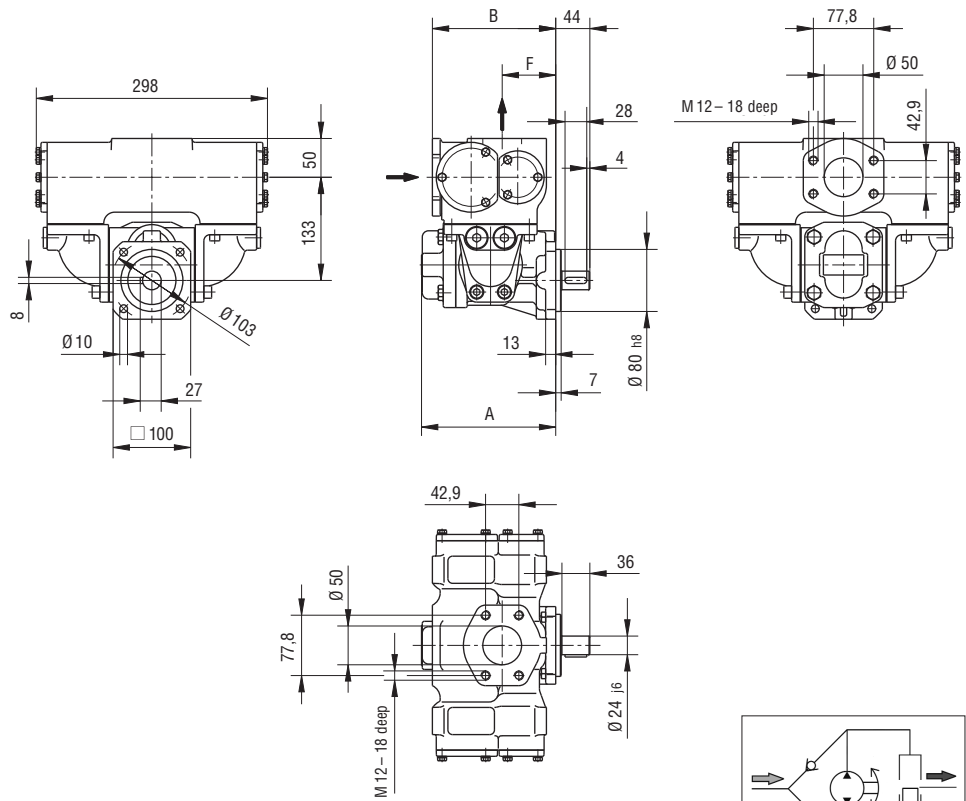
(Dimensions in mm)
Mounting position horizontal, Pressure connection above

Transfer Gear Pumps KF 2.5...200

KRACHT

Flange-Mounting Version with Universal Arrangement

KF 32 ... 80



Ordering code

KF . UF .

Seals $\frac{1}{2}$

Nominal size	A	B	F	Weight in kg	Perm. manometr. low pressure at the pump suction connection p_e bar
32 40 50	173	159	69	27.5	0.35
63 80	208	175	85	29.5	

(Dimensions in mm)

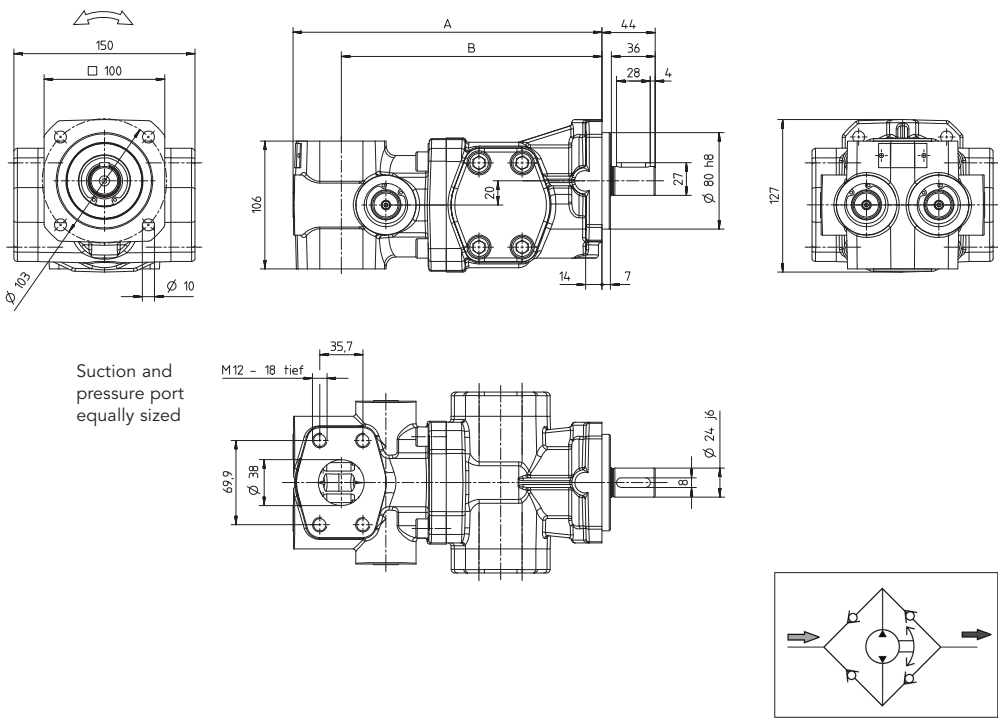
Mounting position horizontal, Pressure connection above

Transfer Gear Pumps KF 2.5...200

KRACHT

Flange-Mounting Version with Universal Arrangement U2

KF 32...80



Nominal displacement	A	B	Weight in kg
32	256	216	15.5
40			
50			
63	291	251	17.5
80			

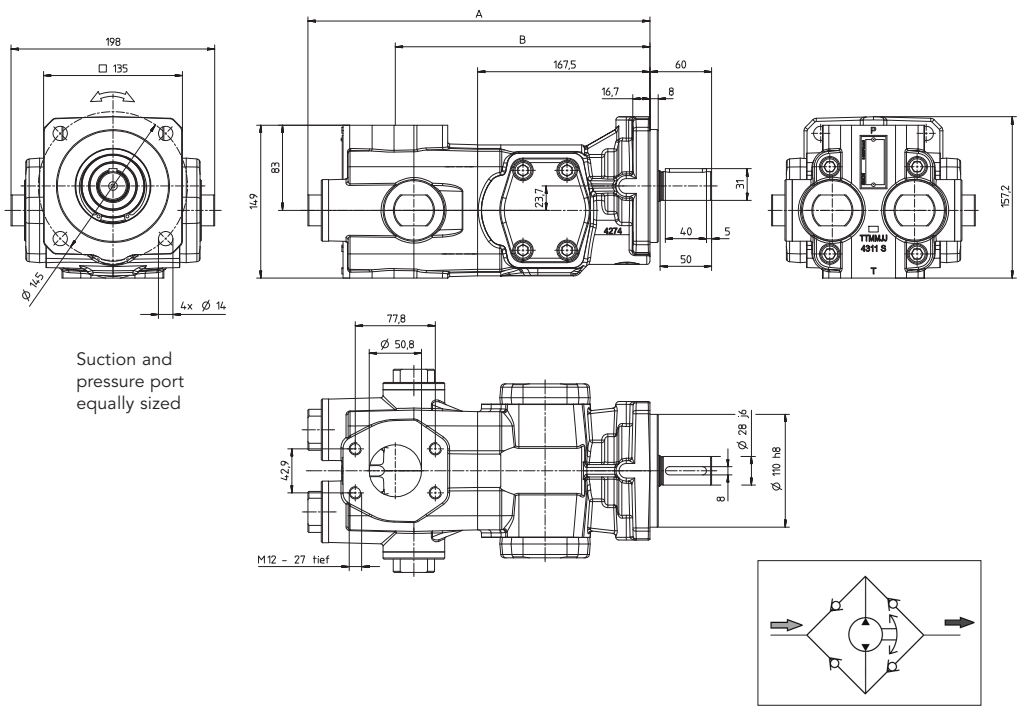
(Dimensions in mm)
Mounting position optional

Transfer Gear Pumps KF 2.5...200

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Flange-Mounting Version with Universal Arrangement U2

KF 100/112



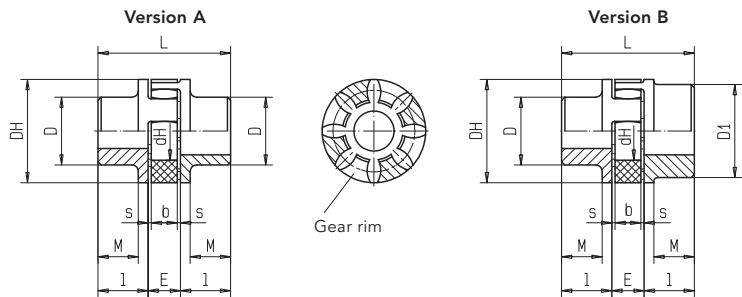
Nominal displacement	A	B	Weight in kg
100	312,5	247,5	21.6
112			

(Dimensions in mm)
Mounting position optional

Transfer Gear Pumps KF 2.5...200

KRACHT

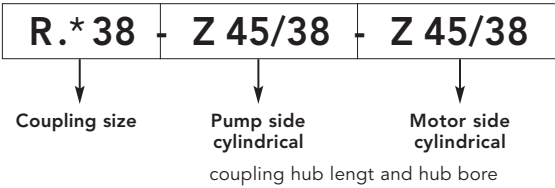
Accessory Couplings



	Ordering code	Coupling size	Weight kg	Moment of inertia kgm²	Pre bore		Finished bore		Dimensions (in mm)													
					part 1	part 2	min.		max.		l	E	s	b	L	M	DH	D	D ₁	dh		
							part 1	part 2	part 1	part 2												
Version A	RA 19-Z25/...Z25/..	19	0.117	0.00003	4	–	6	–	19	–	25	16	2	12	66	20	40	32	–	18		
	RA 24-Z30/...Z30/..	24	0.24	0.00008	6	–	8	–	24	–	30	18	2	14	78	24	55	40	–	27		
	RA 28-Z30/...Z30/..	28	0.39	0.0002	8	–	10	–	28	–	30	20	2.5	15	80	28	65	48	–	30		
Version B	RA 19/24-Z25/...Z25/..	19/24	0.129	0.00004	4	17	6	19	19	24	25	16	2	12	66	20	40	32	–	18		
	RA 24/28-Z30/...Z30/..	24/28	0.26	0.0001	6	22	8	24	24	28	30	18	2	14	78	24	55	40	–	27		
	RA 28/38-Z35/...Z35/..	28/38	0.46	0.0003	8	26	10	28	28	38	35	20	2.5	15	90	28	65	48	–	30		
	RA 38/45-Z45/...Z45/..	38/45	0.89	0.0008	10	36	12	38	38	45	45	24	3	18	114	37	80	66	–	38		
	RA 42/55-Z50/...Z50/..	42/55	1.39	0.0018	12	40	14	42	42	55	50	26	3	20	126	40	95	75	–	46		
	RG 42/55-Z50/...Z75/..	42/55	3.57	0.005	12	40	14	42	42	55	50/75	26	3	20	151	40	95	75	–	46		

Type Key KF Coupling

Ordering example



.*	Hub material
A	AL
G	GG

Working temperature:
–20 °C to +80 °C (–4 °F to 176 °F)
(short duration temperature peaks
up to 120 °C / 248 °F are permissible).

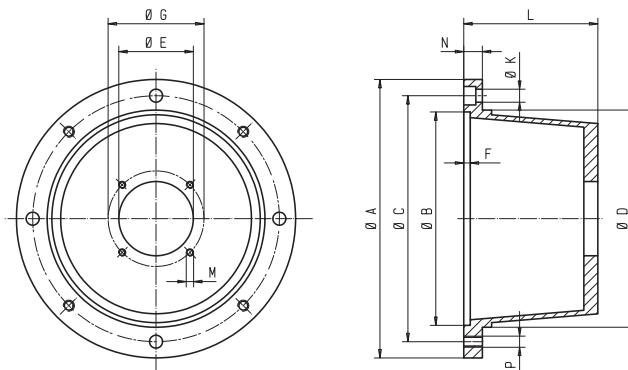
Weights and mass moments of inertia refer
to max. finish machined bore without slot.
Finish-machined bores to ISO Fit H7,
parallel key slots in accordance with DIN 6886 Sh.1.

Transfer Gear Pumps KF 2.5...200

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Bell Housing

KF 2,5 ... 25 Aluminum bell housing



	Motor size	Bell housing	Coupling	Dimensions (in mm)													Weight
				A	B	C	D	E	F	G	K	L	M	N	P	kg	
KF 2,5...25	71 S	PT160-A-063-80	RA19-Z25/14-Z25/14	160	110	130	110	63	7	85	9	80	M8	13	M8	1.01	
	71																
	80 S	PT200-A-063-100	RA19-Z25/14-Z25/19	200	130	165	145	63	7	85	11	100	M8	16	M10	1.06	
	80																
	90 S	PT200-A-063-100	RA19/24-Z25/14-Z25/24	200	130	165	145	63	7	85	11	100	M8	16	M10	1.06	
	90 L																
	100 L S	PT250-A-063-120	RA24/28-Z30/14-Z30/28	250	180	215	190	63	7	85	14	120	M8	19	M12	1.75	
100 L																	
112 M																	
KF 32...80	80 S	PT200-A-080-100	RA19/24-Z25/24-Z25/19	200	130	165	145	80	7	103	11	100	M8	16	M10	1.41	
	80																
	90 S	PT200-A-080-110	RA24-Z30/24-Z30/24	200	130	165	145	80	7	103	11	110	M8	16	M10	1.19	
	90 L																
	100 L S	PT250-A-080-124	RA24/28-Z30/24-Z30/28	250	180	215	190	80	7	103	14	124	M8	19	M12	1.42	
	100 L																
	112 M																
	132 S	PT300-A-080-144	RA28/38-Z35/24-Z35/38	300	230	265	234	80	7	103	14	144	M8	20	M12	2.10	
	132 M																
160 M	PT350-A-080-188	RA38/45-Z45/24-Z45/42	350	250	300	260	80	7	103	18	188	M8	26	M16	3.05		
160 L																	
KF 100...200	100 L	PT250-A-110-135	RA24/28-Z30/28-Z30/28 * RS24/28-Z30/24-Z30/28	250	180	215	190	110	7	145	14	135	M12	18	M12	1.4	
	112 M																
	132 S	PT300-A-110-168 * PT300-A-110-144 ** PT300-A-110-168	RA28/38-Z35/28-Z35/38 * RS28/38-Z35/24-Z35/38 ** RS28-Z35/24-Z60/38	300	230	265	234	110	7	145	14	168 * 144	M12	20	M12	2.0 * 1.6	
	132 M																
	160 M	PT350-A-110-188	RA38/45-Z45/28-Z45/42 * RS38/45-Z45/24-Z45/42	350	250	300	260	110	7	145	18	188	M12	26	M16	2.9	
	160 L																
	180 M	PT350-A-110-204	RA42/55-Z50/28-Z50/48 * RG42/55-Z50/24-Z75/48 ** RG42/55-Z50/24-Z50/48	350	250	300	260	110	7	145	18	204	M12	26	M16	3.0	
	180 L																
180																	

* Version seal 31 (KF 100... 150)

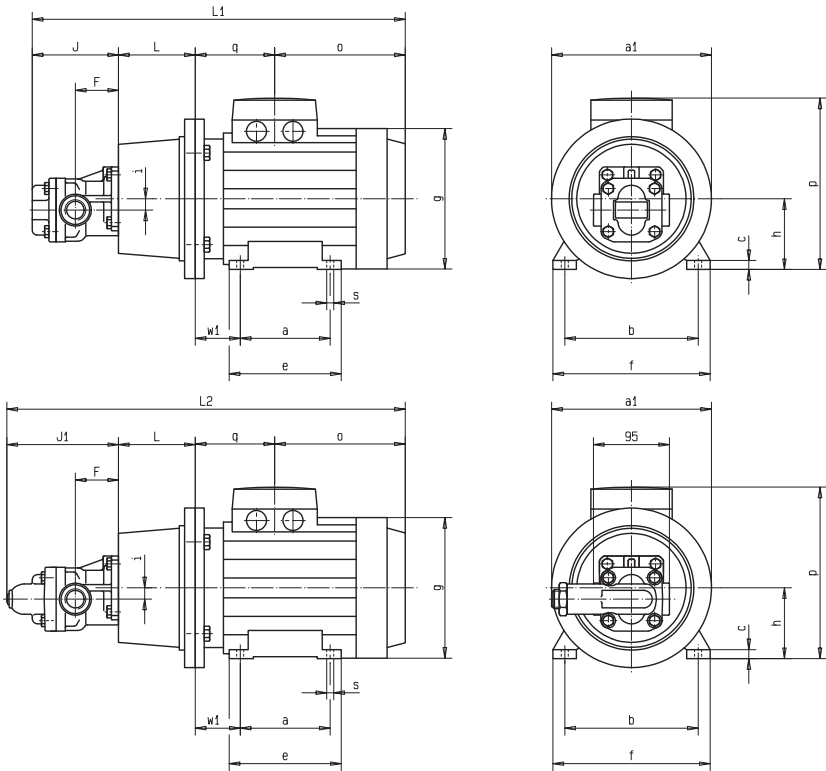
** Version seal 31 (KF 180... 200)

Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with Pipe Thread

KF 2.5 ... 25



with pressure relief valve

KF 2.5 ... 25 Pump sizes (in mm)

Nominal size	Pump sizes		
	F	J	J ₁
2.5 ... 12	54	109	140
16...25	63	131	162

Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with Pipe Thread

KF 2.5 ... 25

Frame size	Power Motor 6 pole		Speed 1/min		Bell housing	Coupling	Total weight * kg	
	kW	1/min	kW	1/min			Nominal size 4...12	16...25
71	0.18	880	0.25	1350	PT160-A-063-80	RA19-Z25/14-Z25/14	11.5	12.1
71	0.25	900	0.37	1370			11.5	12.1
80	0.37	900	0.55	1370	PT200-A-063-100	RA19-Z25/14-Z25/19	13.5	14.1
80	0.55	900	0.75	1420			15.5	16.1
90 S	0.75	935	1.1	1425	PT200-A-063-100	RA19/24-Z25/14-Z25/24	17.5	18.1
90 L	1.1	935	1.5	1420			20.5	21.1
100	1.5	940	2.2	1430	PT250-A-063-120	RA24/28-Z30/14-Z30/28	25.5	26.1
100	–	–	3	1430			28.5	29.1
112	2.2	940	4	1435			35	35.6

* with pressure relief valve add, weight 0.8 kg

KF 2.5 ... 25 Dimensions

Frame size	Dimensions (in mm)																			
	4...12 16...25		4...12 16...25																	
	L ₁ *	L ₁ *	L ₂ *	L ₂ *	L	i	a ₁	a	b	c*	e*	f*	g*	h	o*	p*	q*	ø s*	w ₁	
71	414	436	445	467	80	14.2	160	90	112	10	105	132	145	71	158	188	67	7	45	
80	459	481	490	512	100	14.2	200	100	125	10	130	160	165	80	170.5	217	79.5	10	50	
90 S	469	491	500	522	100	14.2	200	100	140	12	130	175	185	90	177.5	235	82.5	10	56	
90 L	494	516	525	547	100	14.2	200	125	140	12	155	175	185	90	202.5	235	82.5	10	56	
100	555	577	586	608	120	14.2	250	140	160	14	176	196	205	100	247.5	252	78.5	12	63	
112	564	586	595	617	120	14.2	250	140	190	14	180	220	230	112	247.0	292	88	12	70	

Note: Flange connection same outer dimensions as for pipe connection

Note

* Dimensions dependent on motor typ (drawing: manufacture ADDA).

Other manufactures motors can be supplied on request.

Motor frame sizes are based on DIN 42673/677.

All pump and motor sizes can be combined.

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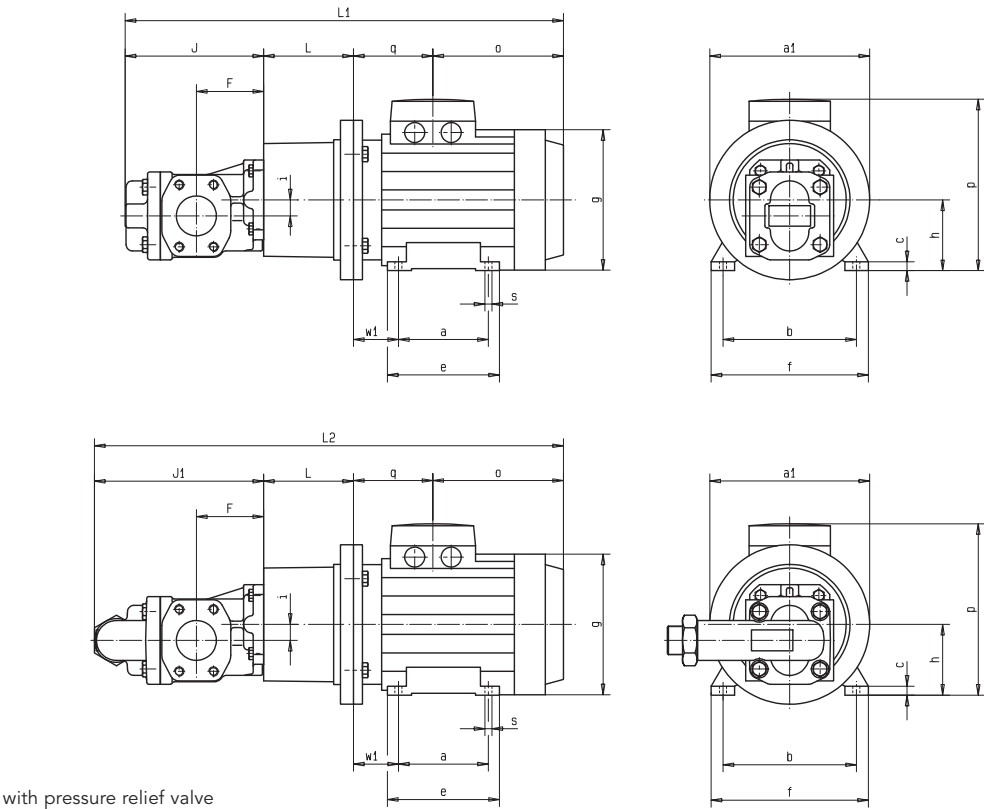
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Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with SAE-Connection

KF 32 ... 80



KF 32 ... 80 Pump sizes (in mm)

Nominal size	F	J	J ₁
32...50	84	173	212
63 / 80	100	208	247

Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with SAE-Connection

KF 32... 80

Frame size	Power Motor 6 pole		Speed Motor 4 pole		Bell housing	Coupling	Total weight * kg	
	kW	1/min	kW	1/min			Nominal size 32...50 63...80	
80	0.37	900	0.55	1370	PT200-A-080-100	RA19/24-Z25/24-Z25/19	18.5	19.5
80	0.55	900	0.75	1420			19.5	21
90 S	0.75	935	1.1	1425	PT200-A-080-110	RA24-Z30/24-Z30/24	21	23
90 L	1.1	935	1.5	1420			23.5	25.5
100	–	–	2.2	1430	PT250-A-080-124	RA24/28-Z30/24-Z30/28	29.5	31
100	1.5	940	3	1430			32	34
112	2.2	940	4	1435			38.5	40
132 S	3	940	5.5	1430	PT300-A-080-144	RA28/38-Z35/24-Z35/38	49.5	51.5
132 M	4	945	7.5	1430			59	60.5
132 L	5.5	945	–	–			61	62.5
160 M	7.5	955	11	1440	PT350-A-080-188	RA38/45-Z45/24-Z45/42	81	82.5
160 L	11	960	15	1445			101	102.5

* with pressure relief valve add. weight 1.8 kg

KF 32... 80 Dimensions

Frame size	Dimensions (in mm)																			
	32...50 63...80				32 - 80															
	L ₁ *	L ₁ *	L ₂ *	L ₂ *	L	i	a ₁	a	b	c*	e*	f*	g*	h	o*	p*	q*	ø s*	w ₁	
80	523	558	562	597	100	20	200	100	125	10	130	160	165	80	170.5	217	79.5	10	50	
90 S	543	578	582	617	110	20	200	100	140	12	130	175	185	90	177.5	235	82.5	10	56	
90 L	568	603	607	642	110	20	200	125	140	12	155	175	185	90	202.5	235	82.5	10	56	
100	623	658	662	697	124	20	250	140	160	14	176	196	205	100	247.5	252	78.5	12	63	
112	532	567	571	606	124	20	250	140	190	14	180	220	230	112	247	252	88	12	70	
132 S	673	708	712	747	144	20	300	140	216	16	176	252	270	132	262	325	94	12	89	
132 M	712	747	751	786	144	20	300	178	216	16	213	252	270	132	301	325	94	12	89	
160 M	891	926	930	965	188	20	350	210	254	17	262	290	320	160	394	390	136	14.5	108	
160 L	891	926	930	965	188	20	350	254	254	17	306	290	320	160	394	390	136	14.5	108	

Note

* Dimensions dependent on motor typ
(drawing: manufacture ADDA).
Other manufactures motors can be supplied on request.
Motor frame sizes are based on DIN 42673/677.

All pump and motor sizes can be combined.

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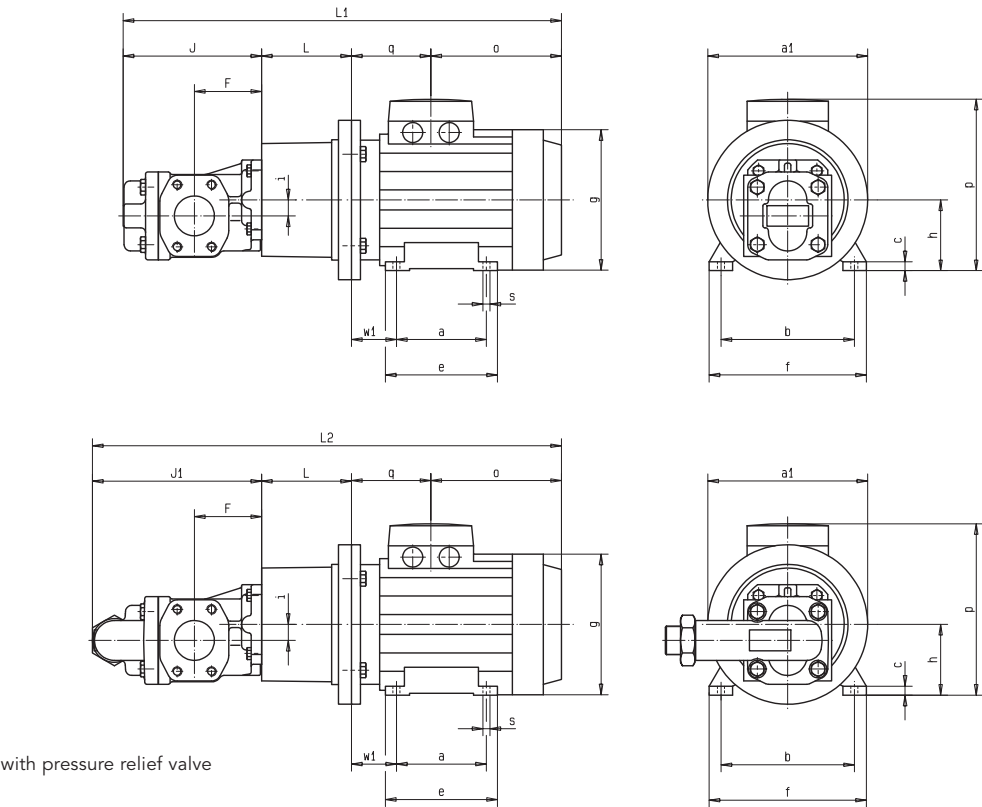
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Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with SAE-Connection

KF 100...200



KF 100...200 Pump sizes (in mm)

Nominal-size	F	J	J ₁
100/112	102	220.5	262.5
125/150	120	245	282
180/200	130	261.5	298.5

Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with SAE-Connection

KF 100...200

Frame size	Power Motor 6 pole	Speed 1/min	Power Motor 4 pole	Speed 1/min	Bell housing	Coupling	Total weight * kg		
	kW	1/min	kW	1/min			Nominal size		
							100/112	125/150	180/200
100 L	–	–	2.2	1430	PT250-A-110-135	RA24/28-Z30/28-Z30/28	37.5	43.5	46.5
100 L	1.5	940	3	1430		**RA24/28-Z30/24-Z30/28	40.5	46.5	49.5
112 M	2.2	940	4	1435			47.5	53.5	56.5
132 S	3	940	5.5	1430	PT300-A-110-168	RA28/38-Z35/28-Z35/38	58	64	67
132 M	4	945	7.5	1430		**PT300-A-110-144	**RA28/38-Z35/24-Z35/38	67	73
132 L	5.5	945	–	–			69	75	78
160 M	7.5	955	11	1430	PT350-A-110-188	RA38/45-Z45/28-Z45/42	89	95	98
160 L	11	960	15	1140		**RA38/45-Z45/24-Z45/42	109	115	118
180 M	–	–	18.5	1445	PT350-A-110-204	RA42/55-Z50/28-Z50/48	129	135	138
180 L	15	960	22	1460		**RG42/55-Z50/24-Z50/48	139	145	148

* * with pressure relief valve KF 100-200 add. weight 2.7 kg

** Sealing version 31

KF 100 ... 200 Dimensions

Frame size	Dimensions (in mm)																			
	100/112 125/150 180/200						100/112 125/150 180/200													
	L ₁ *	L ₁ *	L ₁ *	L ₂ *	L ₂ *	L ₂ *	L	a ₁	a	b	c*	e*	f*	g*	h	o*	p*	q*	ø s*	w ₁
100	670.5	695	711.5	712.5	754	770.5	124	250	140	160	14	176	196	205	100	247.5	252	78.5	12	63
112	579.5	604	620.5	621.5	663	679.5	124	250	140	190	14	180	220	230	112	147	292	88	12	70
132 S	720.5	745	761.5	762.5	804	820.5	144	300	140	216	16	176	252	270	132	262	325	94	12	89
132 M	759.5	784	800.5	801.5	843	859.5	144	300	178	216	16	213	252	270	132	301	325	94	12	89
160 M	938.5	963	979.5	980.5	1022	1038.5	188	350	210	254	17	262	290	320	160	394	390	136	14.5	108
160 L	938.5	963	979.5	980.5	1022	1038.5	188	350	254	254	17	306	290	320	160	394	390	136	14.5	108
180 M	1001.5	1026	1042.5	1043.5	1085	1101.5	204	350	279	279	27	300	348	360	180	336	450	241	15	121
180 L	1039.5	1064	1080.5	1081.5	1123	1139.5	204	350	279	279	27	338	348	360	180	354	450	261	15	121

Note

* Dimensions dependent on motor typ
(drawing: manufacture ADDA).

Other manufactures motors can be supplied on request.

Motor frame sizes are based on DIN 42673/677.

All pump and motor sizes can be combined.

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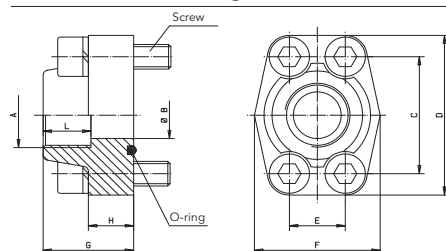
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Transfer Gear Pumps KF 2.5...200

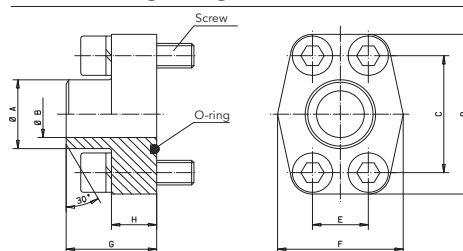
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Accessory Connections

SAE-Threaded Flange



SAE-Welding Flange



SAE-Threaded Flange Dimensions (in mm)

Nominal size SAE	DN	A	B max.	C	D*	E	F*	G	H*	L min.	Screws 10.9	O-ring	Working pressure max.**	Weight ca. [kg]
3/4"	13	G 1/2"	13	47.63	65	22.23	50	36	18	14	M 10 x 35	24.99 x 3.53	350	0.54
	19	G 3/4"	19							16				0.51
1"	13	G 1/2"	13							14				0.64
	19	G 3/4"	19	52.37	70	26.19	55	38	18	16	M 10 x 35	32.92 x 3.53	315	0.61
	25	G 1"	25							18				0.58
1 1/4"	19	G 3/4"	19							16				0.92
	25	G 1"	25	58.72	79	30.18	68	41	21	18	M 10 x 40	37.69 x 3.53	250	0.88
	32	G 1 1/4"	32							20				0.79
1 1/2"	25	G 1"	25							18				1.36
	32	G 1 1/4"	32	69.85	93	35.71	78	45	27	20	M 12 x 45	47.22 x 3.53	200	1.30
	38	G 1 1/2"	38							22				1.25
2"	25	G 1"	25							18				1.64
	32	G 1 1/4"	32	77.77	102	42.88	90	45	25	20	M 12 x 45	56.74 x 3.53	200	1.60
	38	G 1 1/2"	38							22				1.45
	51	G 2"	51							26				1.39
2 1/2"	51	G 2"	51	88.90	114	50.80	105	50	25	26	M 12 x 45	69.44 x 3.53	160	1.65
	64	G 2 1/2"	63							30				1.60
3"	64	G 2 1/2"	63	106.38	134	61.93	124	50	27	30	M 16 x 50	85.32 x 3.53	138	2.68
	76	G 3"	73											2.58
3 1/2"	76	G 3"	73	120.65	152	69.85	136	48	27	30	M 16 x 50	98.02 x 3.53	35	2.93
	89	G 3 1/2"	89											2.83

SAE-Welding Flange Dimensions (in mm)

Nominal size SAE	DN	A*	B max.	C	D*	E	F*	G	H*	Screws 10.9	O-ring	Working pressure max.**	Weight ca. [kg]
3/4"	19	28.0	19	47.63	65	22.23	50	36	18	M 10 x 35	24.99 x 3.53	350	0.51
1"	25	34.0	25	52.37	70	26.19	55	38	18	M 10 x 35	32.92 x 3.53	315	0.58
1 1/4"	32	42.8	32	58.72	79	30.18	68	41	21	M 10 x 40	37.69 x 3.53	250	0.79
1 1/2"	38	48.6	38	69.85	93	35.71	78	44	25	M 12 x 45	47.22 x 3.53	200	1.25
2"	51	61.0	51	77.77	102	42.88	90	45	25	M 12 x 45	56.74 x 3.53	200	1.39
2 1/2"	64	77.0	63	88.90	114	50.80	105	50	25	M 12 x 45	69.44 x 3.53	160	1.60
3"	76	92.0	73	106.38	134	61.93	124	50	27	M 16 x 50	85.32 x 3.53	138	2.58
3 1/2"	89	103.0	89	120.65	152	69.85	136	48	27	M 16 x 50	98.02 x 3.53	35	2.83

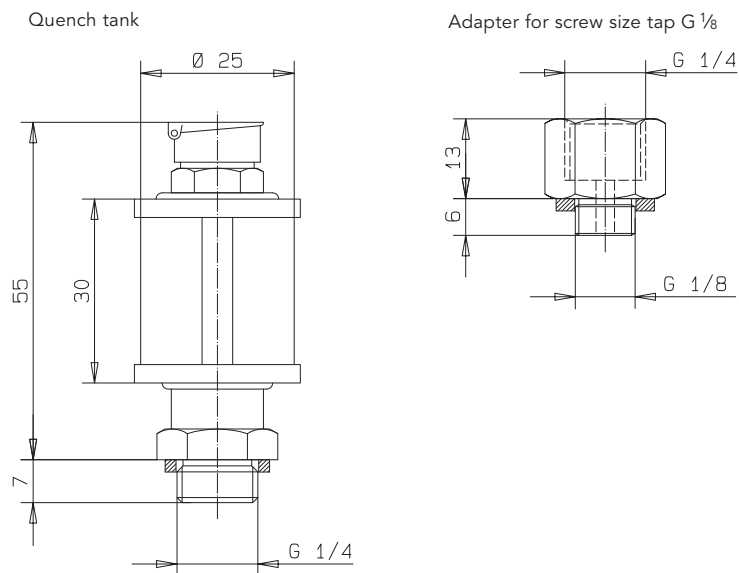
* Dimensions depending on the manufacturer
Material: Steel S355J2G3 or equivalent

** O-ring material with hardness 90 Shore A
Stainless steel 1.4404 or equivalent 316L

Transfer Gear Pumps KF 2.5...200

KRACHT

Accessory Quench Chamber



Product Portfolio

Transfer Pumps

Transfer pumps for lubricating oil supply equipment, low pressure filling and feed systems, dosing and mixing systems.

Mobile Hydraulics

Single and multistage high pressure gear pumps, hydraulic motors and valves for construction machinery, vehicle-mounted machines.

Flow Measurement

Gear and turbine flow meters and electronics for volume and flow metering technology in hydraulics, processing and laquering technology.

Industrial Hydraulics / Test Bench Construction

Cetop directional control and proportional valves, hydraulic cylinders, pressure, quantity and stop valves for pipe and slab construction, hydraulic accessories for industrial hydraulics (mobile and stationary use).

Technology Test benches / Fluid Test benches.



KF2.5...200/GB/06.14

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Mechanical temperature measurement

Bimetal thermometer Model 52, industrial series

WIKA data sheet TM 52.01



for further approvals
see page 6

Applications

- A wide range of applications in machine building, vessel, piping and apparatus construction
- Heating technology

Special features

- Scale ranges from -30 ... +500 °C
- Large choice of nominal sizes from 25 ... 160 mm
- Case and stem from stainless steel
- 5 different connection designs



Fig. left: model A52.100, back mount
Fig. right: model R52.100, lower mount

Description

The model 52 bimetal thermometer is the entry-level model among process thermometers. The target markets of this thermometer are air-conditioning and machine building.

Model 52 is manufactured in accordance with EN 13190 and already offers a stainless steel case and accuracy class 1 for nominal sizes > 60 mm.

Especially noteworthy is the large number of stem lengths and nominal sizes. This enables the individual adaptation to the target applications.

WIKA data sheet TM 52.01 · 01/2016

Page 1 of 6



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Standard version

Measuring element

Bimetal coil

Nominal size in mm

25, 33, 40, 50, 63, 80, 100, 160

Connection designs

- S Standard (male threaded connection)
- 1 Plain stem (without thread)
- 2 Male nut ¹⁾
- 3 Union nut ¹⁾
- 4 Compression fitting (sliding on stem) ¹⁾

¹⁾ Not for NS 25, 33, 40, 50

Model overview

Model	NS	Design
A52.025	25	Back mount (axial)
A52.033	33	
A52.040	40	
A52.050	50	
A52.063	63	
A52.080	80	
A52.100	100	
A52.160	160	
R52.063	63	Lower mount (radial)
R52.080	80	
R52.100	100	
R52.160	160	

Accuracy class

NS 25, 33: ±5 % of scale range
 NS 40, 50: 2 per EN 13190
 NS 63, 80, 100, 160: 1 per EN 13190

Working range

Continuous loading: Measuring range per EN 13190
 Short time (24 h max.): Scale range per EN 13190

Case, bezel ring, stem, process connection and spacer

Stainless steel

Elbow behind the case

Aluminium, only with lower mount version

Dial

Aluminium, white, black lettering

Window

Instrument glass

NS 33: polycarbonate

Pointer

NS 25, 33, 40: Aluminium, black

NS 50, 63, 80, 100, 160: Aluminium, black, adjustable pointer

Permissible operating pressure at the stem

NS 25, 33, 40, 50: max. 6 bar, static

NS 63, 80, 100, 160: max. 25 bar, static

Ingress protection

NS 25, 33, 40: IP54 per EN 60529 / IEC 529

NS 50, 63, 80, 100, 160: IP43 per EN 60529 / IEC 529

Options

- Scale range °F, °C/°F (dual scale)
- Other scale ranges
- Other connection types

Scale ranges, measuring ranges ²⁾, error limit (EN 13190)

Scale graduation per WIKA standard

Scale range in °C	Measuring range in °C	Scale spacing in °C		Error limit ±°C	
		up to NS 63	from NS 80	up to NS 50	from NS 63
-30 ... +50	-20 ... +40	1	1	2	1
-20 ... +60	-10 ... +50	1	1	2	1
0 ... 60	10 ... 50	1	1	2	1
0 ... 80	10 ... 70	1	1	2	1
0 ... 100	10 ... 90	2	1	2	1
0 ... 120	10 ... 110	2	1	4	2
0 ... 160	20 ... 140	2	2	4	2
0 ... 200 ³⁾	20 ... 180	5	2	4	2
0 ... 250 ³⁾	30 ... 220	5	2	5	2.5
0 ... 300 ⁴⁾	30 ... 270	5	2	-	5
0 ... 400 ⁴⁾	50 ... 350	5	5	-	5
0 ... 500 ⁴⁾	50 ... 450	5	5	-	5

2) The limits of the measuring range are indicated on the dial by two triangular marks.
Only within this range is the stated error limit valid per EN 13190.

3) Not for NS 33

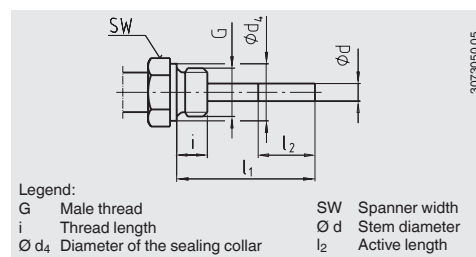
4) Not for NS 25 to NS 50

Connection designs

Standard design (male thread connection)

Standard insertion length l_1 = 63, 100, 160, 200, 250 mm

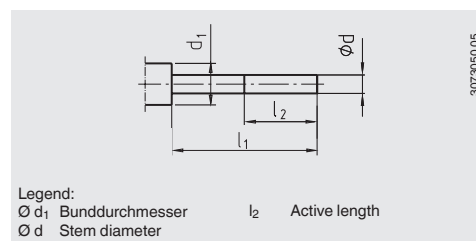
Nominal size	Process connection		Dimensions in mm			
	G	i	SW	Ø d ₄	Ø d	
25, 33	M8 x 1.25	8	12	-	4	
	G ½ B	8	12	-	4	
	G ¼ B	8	17	-	4	
40, 50	M8 x 1.25	8	12	-	4	
	G ½ B	8	17	-	4	
	G ¼ B	8	17	-	4	
	G ½ B	12	22	-	4	
63, 80, 100, 160	G ¼ B	12	19	18	6 or 8	
	G ½ B	14	27	26	6 or 8	
	M18 x 1.5	12	24	23	6 or 8	
	½ NPT	19	22	-	6 or 8	



Bauform 1, Anschluss glatt (ohne Gewinde)

Standard-Einbaulänge l_1 = 45, 63, 100, 140, 160, 200, 240, 290 mm

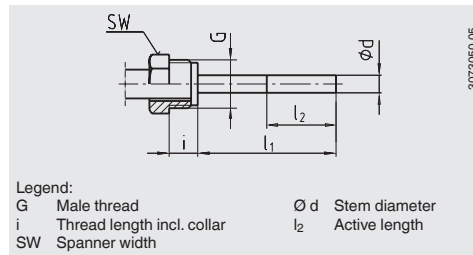
Nominal size	Dimensions in mm	
	d ₁	Ø d
25, 33	8	4
40, 50	12	4
63, 80, 100, 160	18	6 or 8



Design 2, male nut

Standard insertion length $l_1 = 80, 140, 180, 230$ mm

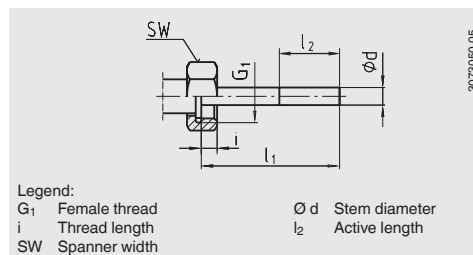
Nominal size	Process connection		Dimensions in mm		
NS	G	i	SW	$\varnothing d$	
63, 80, 100, 160	G $\frac{1}{2}$ B	20	27	6 or 8	
	M18 x 1.5	17	22	6 or 8	



Design 3, union nut

Standard insertion length $l_1 = 89, 126, 186, 226, 276$ mm

Nominal size	Process connection		Dimensions in mm		
NS	G	i	SW	$\varnothing d$	
63, 80, 100, 160	G $\frac{1}{2}$	8.5	27	6 or 8	
	G $\frac{3}{4}$	9.5	32	6 or 8	

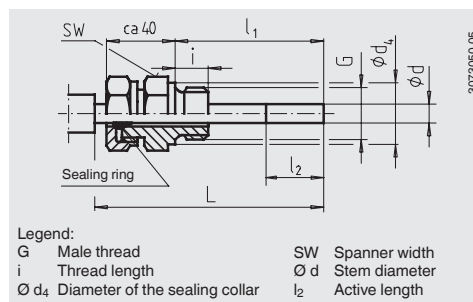


Design 4, compression fitting (sliding on stem)

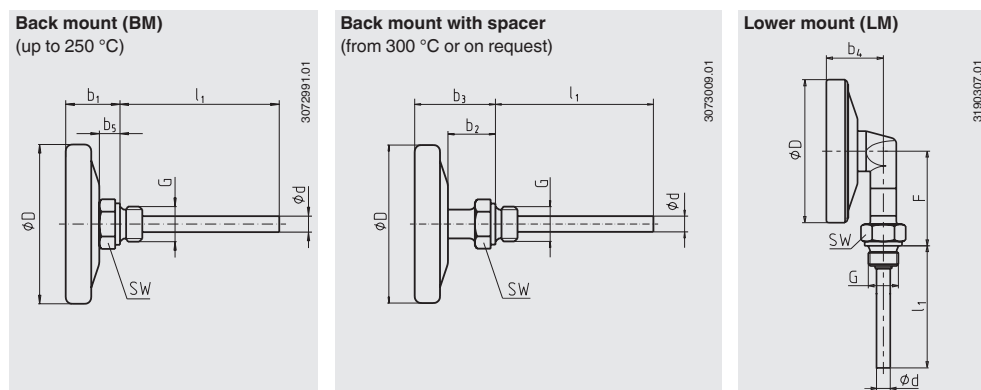
Insertion length l_1 = variable

Length $L = l_1 + 40$ mm

Nominal size	Process connection		Dimensions in mm		
NS	G	i	SW	$\varnothing d_4$	$\varnothing d$
63, 80, 100, 160	G $\frac{1}{4}$ B	8	22	18	6 or 8
	G $\frac{1}{2}$ B	14	27	26	6 or 8
	M18 x 1.5	12	24	23	6 or 8
	$\frac{1}{2}$ NPT	19	22	-	6 or 8
	G $\frac{3}{4}$ B	16	32	32	6 or 8
	$\frac{3}{4}$ NPT	20	30	-	6 or 8



Dimensions in mm



NS	Dimensions in mm							Weight in kg		
	b ₁	b ₂	b ₃	b ₄	b ₅	Ø D	F	R	RD	U
25	16	-	-	-	6	25	-	0.035	-	-
33	16	-	-	-	6	33	-	0.040	-	-
40	21	-	-	-	8	40	-	0.050	-	-
50	21	-	-	-	8	50	-	0.060	-	-
63	29	30 ¹⁾	46	34	13	63	47	0.160	0.200	0.220
80	30	30 ¹⁾	47	36	13	80	56	0.200	0.240	0.270
100	35	30 ¹⁾	52	40	13	100	66	0.250	0.290	0.330
160	39	30 ¹⁾	57	42.5	13	160	96	0.450	0.490	0.560

1) from 300 °C or on request
R Back mount (BM)
RD Back mount with spacer
U Lower mount (LM)

Thermowell

In principle, the operation of a mechanical thermometer without a thermowell with low process-side loading (low pressure, low viscosity and low flow velocities) is possible.

However, in order to enable exchanging the thermometer during operation (e.g. instrument replacement or calibration) and to ensure a better protection of the instrument and also the plant and the environment, it is advisable to use a thermowell from the extensive WIKA thermowell portfolio.

For further information on the calculation of the thermowell, see Technical information IN 00.15.

Approvals

Logo	Description	Country
	GOST (option) Metrology, measurement technology	Russia
-	CRN (option) Safety (e.g. electr. safety, overpressure, ...)	Canada

Certificates (option)

2.2 test report

Approvals and certificates, see website

Ordering information

Model / Connection design / Scale range / Process connection / Stem diameter, material / Insertion length / Options

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The specifications given in this document represent the state of engineering at the time of publishing.
We reserve the right to make modifications to the specifications and materials.



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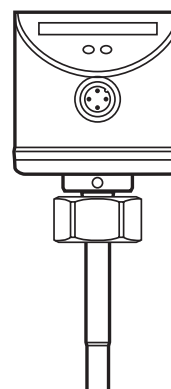
ifm electronic



Operating instructions
Flow monitors

efector300[®]**SI5000****SI5001****UK**

704056 / 03 08 / 2010



26609398/EN – 10/2020

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Preliminary note

- An instruction is indicated by "►":
Example: ► Check whether the unit operates correctly.
- A reaction to the action is indicated by ">":
Example: > LED 9 lights.

1 Safety instructions

- Please read the product description prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- The unit conforms to the relevant regulations and EC directives.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application.
- That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.

UK

For the scope of validity cULus:

The device shall be supplied from an isolating transformer having a secondary Listed fuse rated as noted in the following table.

Overcurrent protection		
Control-circuit wire size		Maximum protective device rating Ampere
AWG	(mm ²)	
26	(0.13)	1
24	(0.20)	2
22	(0.32)	3
20	(0.52)	5
18	(0.82)	7
16	(1.3)	10

2 Functions and features

2.1 Application area

The unit monitors the flow of liquid and gaseous media.

2.2 Operating principle flow monitoring

- The unit detects the flow speed to the calorimetric measuring principle and switches the output:
 - output closed if medium is flowing / output open if no medium is flowing.This applies to the unit on delivery: output = normally open. In case of need you can change the output to normally closed (→ 7.2). It then applies: output open if medium is flowing.
- If the flow speed increases, the switching status changes when the switch point is reached.
- If the flow speed falls again, the switching status changes if the value "SP minus hysteresis" is reached.

The hysteresis changes with the flow speed and it is essentially influenced by the set monitoring range.

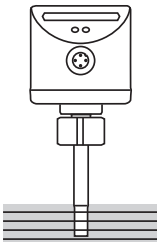
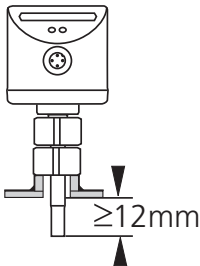
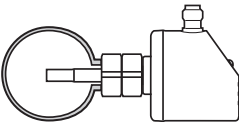
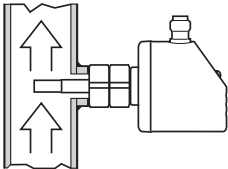
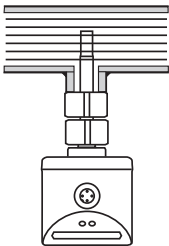
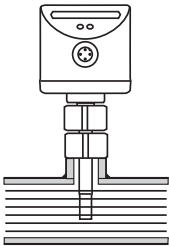
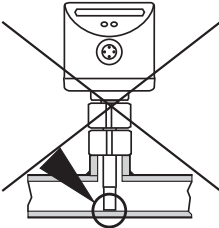
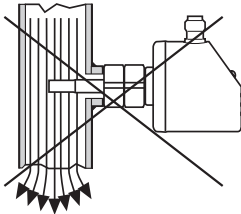
It is 2...5 cm/s for the setting 5...100 cm/s (= factory setting), it increases with higher flow speeds.
- The typical response time of the unit is 1...10 s. It can be influenced by the setting of the switch point:
 - Low switch point = quick reaction with rising flow.
 - High switch point = quick reaction with falling flow.

3 Installation

Using process adapters the unit can be adapted to different process connections.

- Adapters have to be ordered separately as accessories.
A correct fit of the unit and ingress resistance of the connection are only ensured using ifm adapters.
- For small flow rates ifm adapter blocks are available.

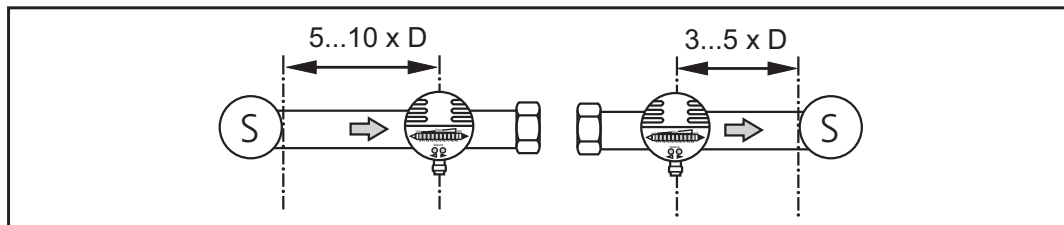
3.1 Installation location

General • The sensor tip is to be completely surrounded by the medium. • Insertion depth of the sensor: minimum 12 mm.			UK
Recommended • For horizontal pipes: mounting from the side. • For vertical pipes: mounting in the rising pipe.			
Conditional • Horizontal pipe /mounting from the bottom: if the pipe is free from build-up. • Horizontal pipe /mounting from the top: if the pipe is completely filled with medium.			
To avoid • The sensor tip must not be in contact with the pipe wall. • Do not mount in downpipes that are open at the bottom!			

3.2 Sources of interference in the pipe system

Components integrated in the pipes, bends, valves, reductions, etc. lead to turbulence of the medium. This affects the function of the unit.

Recommendation: Adhere to the distances between sensor and sources of interference:

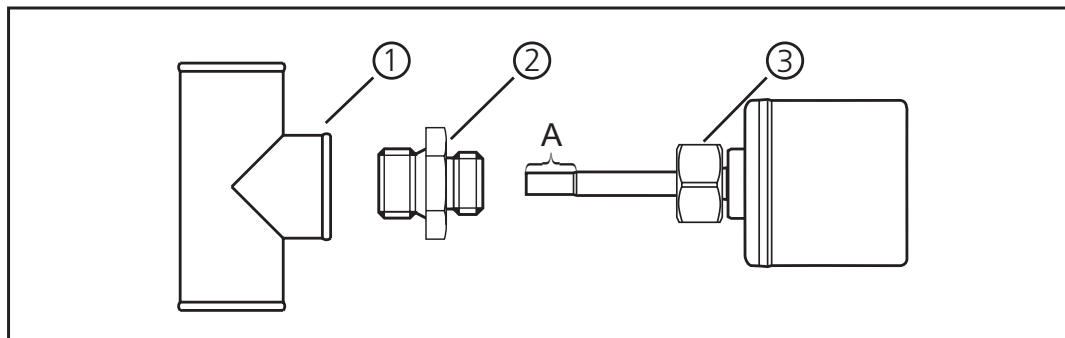


D = pipe diameter; S = sources of interference

3.3. Mounting operation



- ▶ Ensure that the system is free of pressure during installation.
- ▶ Ensure that no media can leak at the mounting location during installation.



- ▶ Grease the threads of the process connection (1), adapter (2) and nut (3).
Note: The sensor tip (A) must not be in contact with grease.
- ▶ Screw the suitable adapter into the process connection.
- ▶ Place the flow monitor onto the adapter and tighten the nut. Tightening torque 25 Nm. Ensure that the unit is correctly oriented.

4 Electrical connection

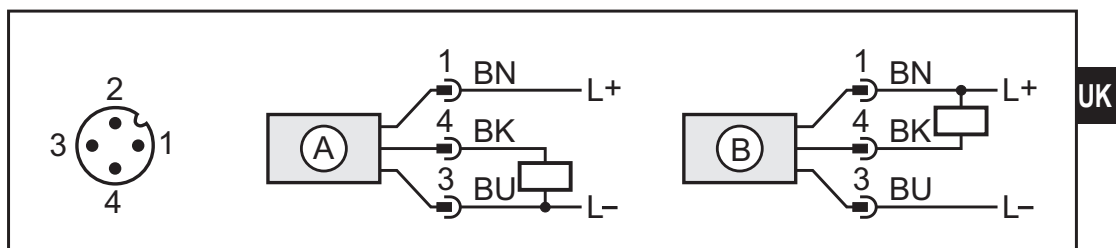


The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply to EN 50178, SELV, PELV.

- ▶ Disconnect power.
- ▶ Connect the unit as follows:

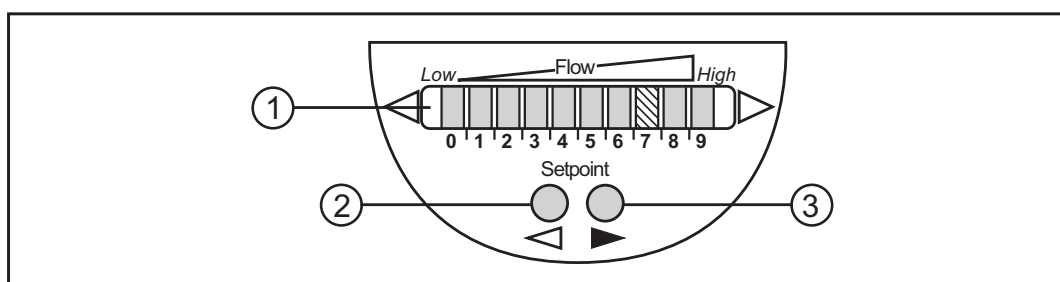


A: SI5000 (positive switching); B: SI5001 (negative switching)

Core colours of ifm sockets:

1 = BN (brown), 3 = BU (blue), 4 = BK (black)

5 Operating and display elements



1: Operation display

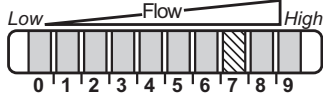
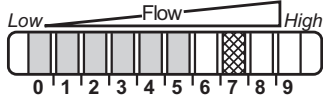
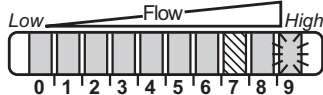
- The green LEDs indicate the current flow (the LEDs 0 to 9 represent the range between no flow and maximum flow).
- A lighting LED indicates the position of the switch point (orange = output closed, red = output open).

2, 3: Setting buttons for adjustment and configuration

6 Set-up and settings for water

(For media other than water → 7.1: Low flow adjustment).

- ▶ Switch on the supply voltage.
- > All LEDs light and go out again step by step. During this time the output is closed (if configured as normally open). The unit is in the operating mode.
- ▶ Let the normal flow circulate in the installation.
- ▶ Check the display and determine further actions.

1		The factory setting is suitable for the application. ▶ No further settings are required.
2		Your normal flow is below the representation range of the display. 2 setting options: ▶ Change the switch point (→ 6.1). ▶ Carry out high flow adjustment (→ 6.2).
3		Your normal flow exceeds the representation range of the display (LED 9 flashes). ▶ Carry out high flow adjustment (→ 6.2).

You can restore the factory setting any time. (→ 7.3).

6.1 Change the switch point (optional)

For the factory setting the switch point is at LED 7. A change makes sense if:

- the display shows example 2.
- the flow fluctuates much or pulsates.
- if a faster response time of the unit is requested (low switch point = fast response with rising flow, high switch point = fast response with falling flow).
- ▶ Briefly press the pushbutton ◀ or ▶.
- > The switch point LED flashes.
- ▶ Press the pushbutton ◀ or ▶ as often as required. Each press of the pushbutton shifts the LED by one position in the indicated direction.

Note: If no pushbutton is pressed for 2 s, the unit returns to the operating mode with the newly set value.

6.2 High flow adjustment (optional)

The unit determines the existing flow as normal flow and adapts the display representation (all LEDs except the switch point LED light green).

- ▶ Let the normal flow circulate in the installation.
- ▶ Press the pushbutton  and keep it pressed.
- > LED 9 lights, after approx. 5 s it flashes.
- ▶ Release the pushbutton.

The unit is now adapted to your flow conditions. It passes into the operating mode, the display should now show example 1.

UK

Note: The adjustment affects the switch point: It is increased proportionally (maximum up to LED 7).

7 Additional settings (optional)

7.1 Low flow adjustment

If the unit is used in media other than water, you should additionally adapt the unit to the minimum flow.

Note: The following adjustment must only be carried out after the high flow adjustment.

- ▶ Let the minimum flow circulate in the installation or ensure flow standstill.
- ▶ Press the pushbutton  and keep it pressed.
- > LED 0 lights, after approx. 5 s it flashes.
- ▶ Release the pushbutton. The unit adopts the new value and passes into the operating mode.

7.2 Configure the switching output

The unit is delivered as normally open. In case of need you can change the output to normally closed:

- ▶ Press the pushbutton  for at least 15 s.
- > LED 0 lights, after approx. 5 s it flashes.
- > After 10 s the current setting is displayed: LEDs 5...9 light orange (= output normally open).
- > After approx. 15 s LEDs 0...4 flash orange.
- ▶ Release the pushbutton. The output is changed to normally closed operation.

For a new changeover repeat the operation.

7.3 Restore the factory setting (reset)

- ▶ Press the pushbutton ► for at least 15 s.
- > LED 9 lights, after approx. 5 s it flashes.
- > After approx. 15 s LEDs 0...9 flash orange.
- ▶ Release the pushbutton. All settings are reset to the factory setting:
 - operating area: 5 ... 100 cm/s for water
 - switch point: LED 7
 - output function: NO
 - unlocked.

7.4 Lock / unlock the unit

The unit can be locked electronically to prevent unintentional settings.

- ▶ Press both setting pushbuttons simultaneously for at least 10 s in the operating mode.
- > The indication goes out, the unit locks or unlocks.

On delivery: unlocked.

8 Error during adjustment

If no adjustment is possible, all LEDs flash red. The unit then passes into the operating mode with unchanged values.

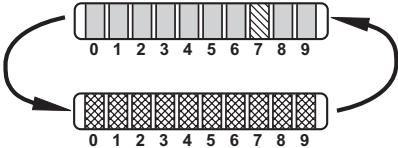
Possible cause /aid:

Error during installation.	▶ Read chapter 3 Installation. Check whether all requirements have been met.
The difference between maximum flow and minimum flow is too small.	▶ Increase the flow difference and carry out the adjustment once again.
The sequence high flow /low flow adjustment was not adhered to.	▶ Carry out the two adjustment operations again in the right sequence.

9 Operation

After every power on all LEDs light and go out again step by step (during this time the output is closed if configured as normally open). The unit is then ready for operation.

In case of power failure or interruption all settings remain.

Operating indicators	
	Green LED bar: Current flow within the representation range. Indication of the switch point (SP): - LED orange: output closed. - LED red: output open.
	LED 9 flashes: current flow above the representation range.
	LED 0 flashes: current flow far below the representation range.
Interference indicators	
	Short circuit at the switching output: The operating indicator and red LEDs light alternately. If the short circuit has been rectified, the unit immediately passes into the normal operating state. The current operating state is displayed.
Display OFF (no LED lights):	Operating voltage too low (< 19 V) or failed. Ensure a correct voltage supply.

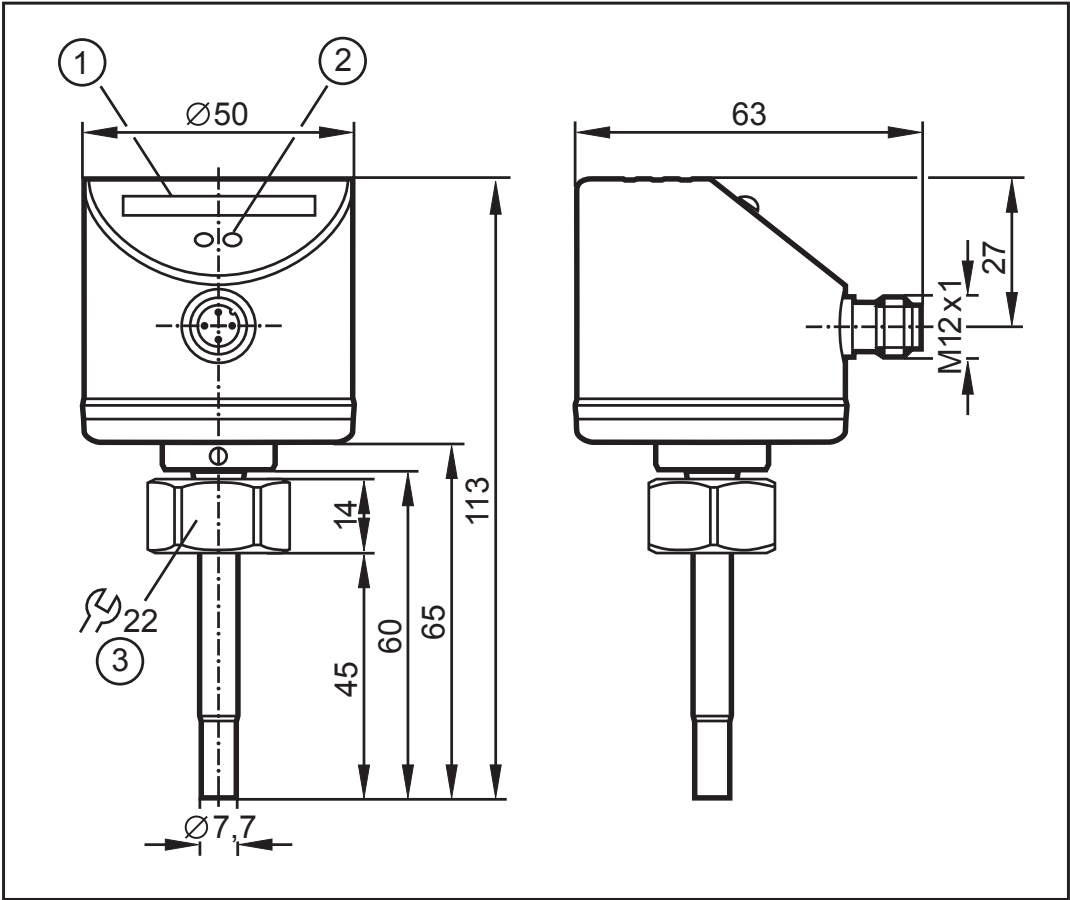
UK

10 Maintenance

Recommended maintenance:

- Check the sensor tip for build-up from time to time.
- Clean it using a soft cloth. Stubborn build-up (e.g. lime) can be removed using a common vinegar cleaning agent.

11 Scale drawing



- 1: LED bar display
- 2: set button
- 3: tightening torque 25 Nm

12 Technical data

Application area.....	Liquids and gases
Operating voltage [V].....	19 ... 36 DC ¹⁾
Current rating [mA]	250
Short-circuit protection, pulsed; reverse polarity / overload protection	
Voltage drop [V]	< 2.5
Current consumption [mA]	< 60
Power-on delay time [s].....	10, optically indicated

Liquids	
Medium temperature [°C]	-25 ... +80
Setting range [cm/s].....	3 ... 300
Greatest sensitivity [cm/s]	3...100
Temperature gradient [K/min]	300
Gases	
Medium temperature [°C]	-25 ... +80
Setting range [cm/s].....	200 ... 3000
Greatest sensitivity [cm/s].....	200 ... 800
Switch point accuracy [cm/s]	$\pm 2 \dots \pm 10^{(2)}$
Hysteresis [cm/s]	2...5 ²⁾
Repeatability [cm/s]	1...5 ²⁾
Temperature drift [cm/s x 1/K].....	0.1 ³⁾
Response time [s].....	1 ... 10
Pressure resistance [bar].....	30
Operating temperature [°C]	-25 ... +80
Protection rating	IP 67
Protection class	III
Shock resistance [g]	50 (DIN / IEC 68-2-27, 11 ms)
Vibration resistance [g]	20 (DIN / IEC 68-2-6, 55-2000 Hz)
Housing materials.....	stainless steel 316L / 1.4404; stainless steel 304 / 1.4301; PC (Makrolon); PBT-GF 20; EPDM/X (Santoprene)
Materials (wetted parts).....	stainless steel 316L / 1.4404; O-ring: FPM 8x1.5 gr 80° Shore A
EMC	
EN 61000-4-2 ESD:	4 kV CD / 8 kV AD
EN 61000-4-3 HF radiated:	10 V/m
EN 61000-4-4 Burst:	2 kV
EN 61000-4-6 HF conducted:	10 V

UK

¹⁾ to EN50178, SELV, PELV;

²⁾ for water; 5...100 cm/s; 25°C (factory setting)

³⁾ for water; 5...100 cm/s; 10...70°C

The sensor conforms to the standard EN 61000-6-2

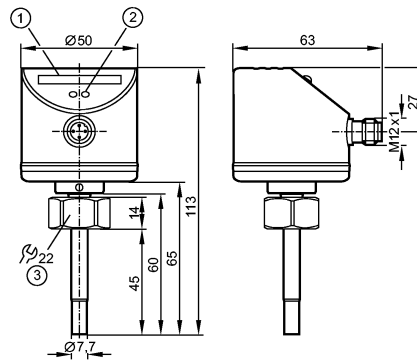
More information at www.ifm.com

efector300**SI5000**

SID10ABBFPG/US-100



Flow sensors



- 1: LED display
 2: setting pushbutton
 3: tightening torque 25 Nm

**Product characteristics**

Flow monitor	
Compact type for adapter	
Process connection: internal thread M12 x 1.5 for adapter	
Probe length: 45 mm	
Setting range: 3...300 cm/s (liquids)	

Application

Application	liquids and gases
Pressure rating [bar]	30
Medium temperature [°C]	-25...80

Electrical data

Electrical design	DC PNP
Operating voltage [V]	19...36 DC
Current consumption [mA]	< 60
Protection class	III
Reverse polarity protection	yes

Outputs

Output function	normally open / closed programmable
Current rating [mA]	250
Voltage drop [V]	< 2.5
Short-circuit protection	pulsed
Overload protection	yes

Measuring / setting range

Liquids	
Setting range [cm/s]	3...300
Greatest sensitivity [cm/s]	3...100
Gases	
Setting range [cm/s]	200...3000
Greatest sensitivity [cm/s]	200...800

efector300**SI5000**

SID10ABBFPG/US-100



Flow sensors

Accuracy / deviations		
Switch point accuracy	[cm/s]	± 2...± 10 *)
Hysteresis	[cm/s]	2...5 *)
Repeatability	[cm/s]	1...5 *)
Temperature drift	[cm/s x 1/K]	0.1 **)
Max. temperature gradient of medium	[K/min]	300
Reaction times		
Power-on delay time	[s]	10
Response time	[s]	1...10
Software / programming		
Adjustment of the switch point		pushbuttons
Environment		
Ambient temperature	[°C]	-25...80
Storage temperature	[°C]	-25...100
Protection		IP 67
Tests / approvals		
EMC	EN 61000-4-2 ESD: EN 61000-4-3 HF radiated: EN 61000-4-4 Burst: EN 61000-4-6 HF conducted:	4 kV CD / 8 kV AD 10 V/m 2 kV 10 V
Shock resistance	DIN IEC 68-2-27:	50 g (11 ms)
Vibration resistance	DIN EN 60068-2-6	20 g (55...2000 Hz)
MTTF	[Years]	298
Mechanical data		
Process connection		internal thread M18 x 1.5 for adapter
Materials (wetted parts)		stainless steel 316L / 1.4404; O-ring: FKM 8 x 1.5 gr 80° Shore A
Housing materials		stainless steel 316L / 1.4404; stainless steel / 301 / 1.4310; PC (polycarbonate); PBT-GF 20; EPDM/X
Probe length L	[mm]	45
Weight	[kg]	0.235
Displays / operating elements		
Function display	LED	10 LEDs, three-colour
Electrical connection		
Connection		M12 connector
Wiring 		
Remarks		
Remarks		*) for water; 5...100 cm/s; 25°C (factory setting) **) for water; 5...100 cm/s; 10...70°C
Pack quantity	[piece]	1

efector300**SI5000**

SID10ABBFPKG/US-100

**Flow sensors**

ifm electronic gmbh • Friedrichstraße 1 • 45128 Essen — We reserve the right to make technical alterations without prior notice. — GB — SI5000 — 09.07.2013

Mechanical pressure measurement

Bourdon tube pressure gauge Model 213.53, liquid filling, stainless steel case

WIKA data sheet PM 02.12



for further approvals
see page 2

Applications

- For measuring points with high dynamic pressure loads or vibrations
- For gaseous and liquid media that are not highly viscous or crystallising and will not attack copper alloy parts
- Hydraulics
- Compressors, shipbuilding

Special features

- Vibration and shock resistant
- Especially sturdy design
- NS 63 and 100 with German Lloyd and Gosstandart approval
- Scale ranges up to 0 ... 1,000 bar



Bourdon tube pressure gauge, model 213.53.100,
lower mount

Description

Design
EN 837-1

Nominal size in mm
50, 63, 100

Accuracy class
NS 50, 63: 1.6
NS 100: 1.0

Scale ranges
NS 50: 0 ... 1 to 0 ... 400 bar
NS 63, 100: 0 ... 0.6 to 0 ... 1,000 bar
or all other equivalent vacuum or combined pressure and vacuum ranges

Pressure limitation

NS 50, 63: Steady: 3/4 x full scale value
Fluctuating: 2/3 x full scale value
Short time: Full scale value
NS 100: Steady: Full scale value
Fluctuating: 0.9 x full scale value
Short time: 1.3 x full scale value

Permissible temperature

Ambient: -20 ... +60 °C
Medium: +60 °C maximum

Temperature effect

When the temperature of the measuring system deviates from the reference temperature (+20 °C):
Max. ±0.4 %/10 K of the span

Ingress protection

IP 65 per EN 60529 / IEC 60529

WIKA data sheet PM 02.12 · 03/2015

Page 1 of 3

Data sheets showing similar products:
Standard version with liquid filling; model 113.53; see data sheet PM 01.08



26609398/EN – 10/2020

Standard version

Process connection

Copper alloy,
lower mount (LM) or back mount (BM),
NS 50, 63: G ¼ B (male), 14 mm flats
NS 100: G ½ B (male), 22 mm flats

Pressure element

NS 50:
Copper alloy, C-type or helical type

NS 63:
≤ 400 bar: Copper alloy, C-type or helical type
> 400 bar: Stainless steel 316L, helical type

NS 100:
< 100 bar: Copper alloy, C-type
≥ 100 bar: Stainless steel 316L, helical type

Movement

Copper alloy

Dial

NS 50, 63: Plastic ABS, white, with pointer stop pin
NS 100: Aluminium, white, black lettering

Pointer

NS 50, 63: Plastic, black
NS 100: Aluminium, black

Window

Plastic, crystal-clear

Case

Natural finish stainless steel, with blow-out device with
NS 50: in case back, 12 o'clock
NS 63, 100: at case circumference, 12 o'clock
O-ring seal between case and connection.
Scale ranges ≤ 0 ... 16 bar with compensating valve to vent case.

Bezel ring

Crimp ring, glossy finish stainless steel, triangular bezel

Filling liquid

Glycerine

Options

- Other process connection
- Sealings (model 910.17, see data sheet AC 09.08)
- Measuring system and movement from stainless steel (model 233.53)
- NS 100: Zero adjustment (in front)
- Increased medium temperature with special soft solder
 - NS 50, 63: 100 °C
 - NS 100: 150 °C
- Ambient temperature resistant -40 ... +60 °C with silicone oil filling
- NS 50: Higher scale ranges up to 0 ... 1,000 bar
- Panel mounting flange, stainless steel, for back connection
- Surface mounting flange, stainless steel (not NS 50)
- Mounting clamp (for back connection)

CE conformity

Pressure equipment directive

97/23/EC, PS > 200 bar, module A, pressure accessory

Approvals

- GL, ships, shipbuilding (e.g. offshore), Germany
- EAC, import certificate, customs union Russia/Belarus/Kazakhstan
- GOST, metrology/measurement technology, Russia
- KBA, automotive, European Community
- CRN, safety (e.g. electr. safety, overpressure, ...), Canada

Certificates ¹⁾

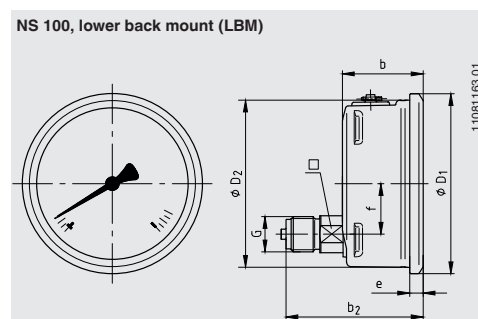
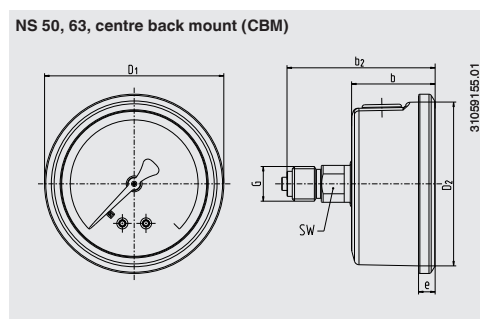
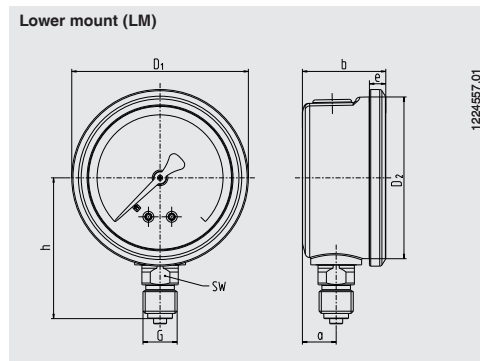
- 2.2 test report per EN 10204 (e.g. state-of-the-art manufacturing, material proof, indication accuracy)
- 3.1 inspection certificate per EN 10204 (e.g. indication accuracy)

¹⁾ Option

Approvals and certificates, see website

Dimensions in mm

Standard version



NS	Dimensions in mm										Weight in kg
	a	b ±0.5	b ₂ ±0.5	D ₁	D ₂	e	f	G	h ±1	SW	
50	12	30	55	55	50	5.5	-	G ¼ B	48	14	0.15
63	13	32	56	68	62	6.5	-	G ¼ B	54	14	0.21
100	15.5	48	81.5	107	100	8	30	G ½ B	87	22	0.80

Process connection per EN 837-1 / 7.3

Ordering information

Model / Nominal size / Scale range / Connection size / Connection location / Options

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We reserve the right to make modifications to the specifications and materials.

WIKA data sheet PM 02.12 · 03/2015

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MAHLE

Industrial Filtration

Contamination Indicator

1. Features

Filter elements are economically used only if their dirt holding capacity is fully exploited. This is achieved by using filter housings with a contamination indicator.

MAHLE manufactures contamination indicators of the following designs:

- Differential pressure indicators
- Pressure indicators/Pressure switches
- Vacuum switches/manometers

With any filter element the collection of dirt particles continuously reduces the number of open pores or, in other words: The open cross section for allowing the liquid to flow continuously reduced. Thus the pressure on the upstream side of the element (dirt side) increases continuously.

With pressure filters, the pressure is measured upstream and downstream of the filter element (differential pressure). With return line filters the pressure is measured only on the upstream side because, depending on the tank design, atmospheric pressure exits on the downstream side of the filter element is measured analog.

A piston with attached magnet is moved against the force of a spring, with which the indicating point is determined by the piston surface.

A homopolar poled magnet is fitted in the outer part in the indicating button.

The closer the pole-springs move towards each other, the stronger is the force with the magnet mutually repel, until finally the red button on the indicator pops out.

This red button remains visible until it is pushed in during daily check which is to be performed while the plant is at operating temperature. If the red button pops out immediately after being pushed in, the filter element must be replaced after the end of the shift.

This optical function may also be used for generating contactless electrical signals. For this purpose an electrical upper part incorporates all electrical switching elements.

- Optical and electrical indicator with standard check function
- Normally open/normally closed combination - standard feature
- Electrical function, easy to install at a later time
- Two-step indication, at 75 % and 100 % optional
- Signal lock out up to approx. 30 °C optional
- Pressure resistance, up to 10 bar (pressure/differential pressure), up to 160 bar (differential pressure), up to 450 bar (differential pressure)
- Rugged, non-bypass design
- Optimal element exploitation

Worldwide distribution



2. Differential pressure indicator

Differential pressure indicator									
Operating pressure	Temperature resistance	Type	Order number	Indicator setting [bar]	Indication	Contact type*	Fig.	Material lower section	Material upper section
10	- 10 to + 120 °C	PiS 3087	77738990	1.2	opt.	-	1	Al	PA 6
		PiS 3086	77737513		opt./electr.	1	1 + 1a		
		PiS 3104	78236994		opt./electr.	4	1 + 3a		
160	- 10 to + 120 °C	PiS 3098	77669971	2.2	opt.	-	2 + 2a	Al	PA 6
		PiS 3097	77669948		opt./electr.	1	2 + 2a		
		PiS 3116	78308074		opt./electr.	3	2 + 2a		
		PiS 3119	78309122	1.7/2.2	opt./electr.	2	2 + 2a		
		PiS 3012	78308454		opt./electr.	4	3 + 3a		
		PiS 3124	78383655		opt./electr.	5	3 + 3a		
		PiS 3098	77938582	3.5	opt.	-	2		
		PiS 3097	78236648		opt./electr.	1	2 + 2a		
		PiS 3098	77669989	5.0	opt.	-	2 + 2a		
		PiS 3097	77669955		opt./electr.	1	2 + 2a		
		PiS 3116	78308082		opt./electr.	3	2 + 2a		
		PiS 3119	78309130	3.7/5.0	opt./electr.	2	2 + 2a		
		PiS 3012	78308447		opt./electr.	4	2 + 2a		
		PiS 3124	78383663		opt./electr.	5	2 + 2a		
400	- 10 to + 120 °C	PiS 3093	77669898	2.2	opt.	-	2 + 2a	CuZn	PA 6
		PiS 3092	77669856		opt./electr.	1	3 + 3a		
		PiS 3115	78308041		opt./electr.	3	3 + 3a		
		PiS 3105	77970387	1.7/2.2	opt./electr.	2	3 + 3a		
		PiS 3102	77942139		opt./electr.	4	3 + 3a		
		PiS 3122	78383630		opt./electr.	5	3 + 3a		
		PiS 3093	77669914	5.0	opt.	-	2		
		PiS 3092	77669864		opt./electr.	1	2 + 2a		
		PiS 3115	78308058		opt./electr.	3	2 + 2a		
		PiS 3105	77970395	3.7/5.0	opt./electr.	2	2 + 2a		
		PiS 3102	77942147		opt./electr.	4	3 + 3a		
		PiS 3122	78383648		opt./electr.	5	3 + 3a		
		PiS 3093	77669880	8.0	opt.	-	2		
		PiS 3092	77669872		opt./electr.	1	2 + 2a		
		PiS 3115	78308066		opt./electr.	3	2 + 2a		
450	- 10 to + 120 °C	PiS 3193	77844061	2.2	opt.	-	2	1.4301	PA 6
		PiS 3192	78308488		opt./electr.	1	2 + 2a		
		PiS 3193	78308538	5.0	opt.	-	2		
		PiS 3192	78308546		opt./electr.	1	2 + 2a		

* Contact type:

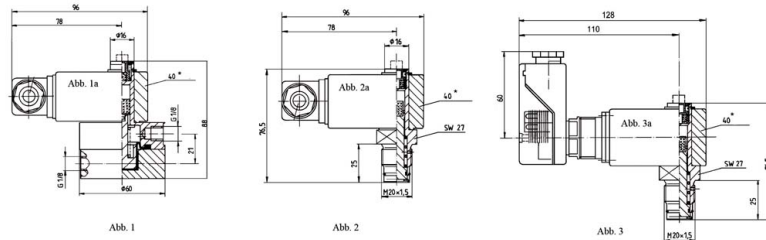
- 1) Normally open/normally closed, wiring box DIN EN 175301-803, max. 250 V AC/200 V DC, max. 1 A
- 2) Normally closed, 2 setting points (75 %/100 %); wiring box DIN EN 175301-803, max. 150 V, max. 1 A
- 3) Change over contact; wiring box DIN EN 175301-803, max. 150 V, max. 1 A
- 4) Change over contact; 2 setting points; LED; Mercedes-Benz-Norm DBL 9666 EA; wiring box DIN EN 175201-804, max. 150 V, max. 1 A
- 5) Normally closed; 2 setting points, signal suppression; wiring box DIN EN 175201-804, max. 10-30 V, max. 1 A

Contamination Indicator

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2. Differential pressure indicator



*wide

3. Pressure indicator/pressure switch

Pressure indicator/pressure switch									
Operating pressure	Temperature resistance	Type	Order number	Indicator setting [bar]	Indication	Contact type*	Fig.	Material Lower section	Material upper section
10	- 10 to + 80 °C	PiS 3084	77669781	1.2	opt.	-	4	PA 66	PA 6
		PiS 3085	77669807		opt./electr.	1	4 + 4a		
		PiS 3125	78308033		opt./electr.	3	4 + 4a		
		PiS 3106	78309155	0.9/1.2	opt./electr.	2	4 + 4a		
		PiS 3103	77942170		opt./electr.	4	4 + 3a		
		PiS 3123	78383671		opt./electr.	5	4 + 3a		
		PiS 3084	77737802	2.2	opt.	-	4		
		PiS 3085	77738032		opt./electr.	1	4 + 4a		
		PiS 3125	78308108		opt./electr.	3	4 + 4a		
		PiS 3106	78308850	1.7/2.2	opt./electr.	2	4 + 4a		
		PiS 3103	77970429		opt./electr.	4	4 + 3a		
		PiS 3123	78383689		opt./electr.	5	4 + 3a		
10	- 25 to + 85 °C	DSS/1.2	77863814	1.2	electr.	normally open	5	galvanized steel	delivered with protection cap
		DSO/1.2	77870587		electr.	normally closed	5		
		DSS/2.2	77845845	2.2	electr.	normally open	5		
		DSO/2.2	77870595		electr.	normally closed	5		
		DSS/5	77863822	5.0	electr.	normally open	5		
		DSO/5	77870603		electr.	normally closed	5		

*Contact type:

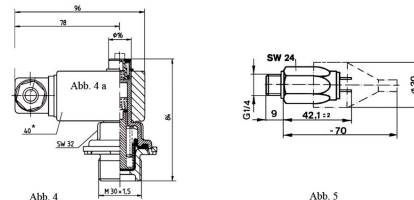
1) normally open/normally closed, wiring box DIN 43650, max. 230 V, max. 2.5 A

2) normally closed, 2 setting points (75 %/100 %); wiring box DIN 43650, max. 150 V, max. 1 A

3) change over contact; wiring box DIN 43650, max. 150 V, max. 1 A

4) change over contact; 2 setting points (75 %/100 %); 3 LED; wiring box DIN 43651, 10–30 V, max. 1 A

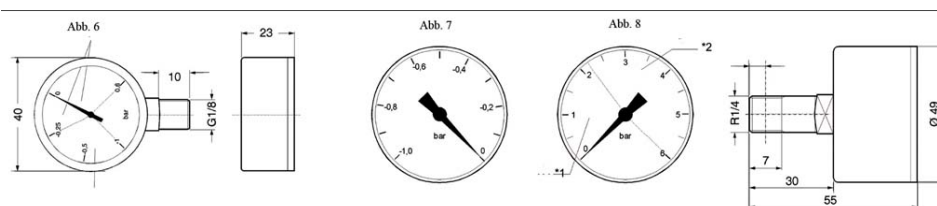
5) normally closed, 2 setting points (75 %/100 %), signal suppression;
wiring box DIN 43651, 10–30 V, max. 1 A



Contamination Indicator

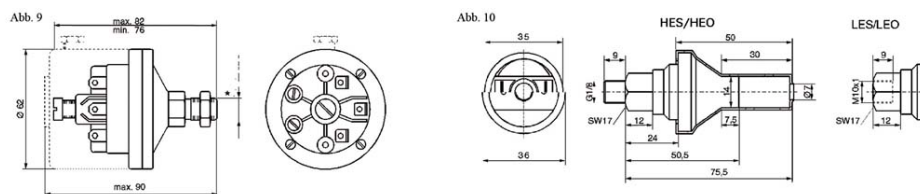
4. Vacuum meter/manometer

Vacuum meter/manometer							
Nominal size (NG) [mm]	Specification	Indicating range [bar]	Fig.	Connection size	Order-number	Class	Dial face
40	Vacuum meter	- 1 to + 1.5	6	R 1/8 (conical)	76388714	min 2.5	white
		- 1 to + 0.6		G 1/8	77545908		Red/Green area, sep. line 0.25 bar
50	Manometer	0 to - 1	7	R 1/4 (conical)	77617558		white
		0 to 6	8		78381998		Red/Green area, sep. line 0.25 bar



5. Vacuum switch

Vacuum switch									
Permissible over-pressure max.	Temperature resistance	Indicator setting	Contact type	Fig.	Connection size	Type	Order Number	Material lower section	Material upper section
0.5 bar	- 10 to + 70 °C	- 10 to - 80 mbar	single pole	9	G 1/4	PiS 3070	77669690	GD-Al	PA 6
1 bar		- 50 to - 600 mbar	double-throw cut-out switch		G 1/8		77669724	GD-Al	PA 6
0.1 bar	- 20 to + 80 °C, 120 °C	- 200 mbar ± 10	normally open	10	G 1/8 (outside)	HES 2200 BP	78308892	GD-ZnAl	Polycarbonat
		- 200 mbar ± 10	normally closed			HEO 2200 BP	78308900	GD-ZnAl	Polycarbonat
		- 50 mbar ± 4	normally open		M 10 x 1 (inside)	LES 250 I	78308918	GD-ZnAl	Polycarbonat
		- 50 mbar ± 4	normally closed			LEO 250 I	78308926	GD-ZnAl	Polycarbonat



* connection G

Types HES/HEO for hydraulic application, Types LES/LEO for air application

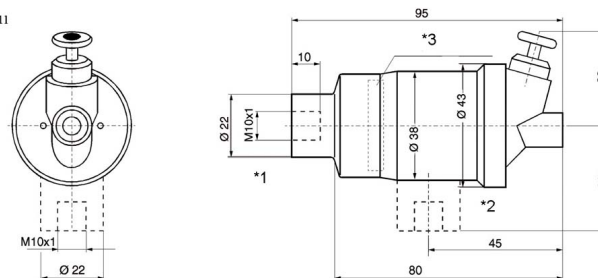
Contamination Indicator

4

6. Vacuum indicator/air filter

Vacuum indicator/air filter						
Indicator setting ± 10 %	Temperature resistance	Fig.	Execution	Type	Order-number	Indication
- 50 mbar	- 40 to + 110 °C	11	1	TB 745	78309056	optical indication - self locking -
- 65 mbar			2	TB 745/1	78309064	
				TB 746/1	78309049	

Abb. 11



*1 Execution 2

*2 Execution 1

*3 Indication: Position of display at nominal value in mbar

Standard sealing material: NBR

Sealing material types LES/LEO: Silicone rubber

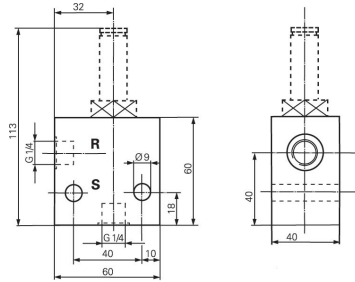
7. Accessories

7.1 Seal kits			
Type	Order number NBR	Order number FPM	Order number EPDM
PiS 3092, 3093, 3102, 3105, 3115, 3122, 3192, 3193	77760275	77760283	77760291
PiS 3012, 3019, 3024, 3097, 3098, 3116	77760309	77760317	77760325
PiS 3084, 3085, 3103, 3106, 3123, 3125	78383382	78383390	78383408
PiS 3086, 3087, 3104	77760242	77760259	

7.2 Electrical upper sections	
Specification	Order number
Electrical upper section normally open/ normally closed for PiS 3084, 3087, 3093, 3098, 3193 (Contact type 1)	7536550
Wiring box with lamp insert 12 - 230 V for electrical upper section normally open (according to DIN EN 175301-803)	8307548
Electrical upper section Change over contact for PiS 3084, 3087, 3093, 3098, 3193 (Contact type 3)	8308017
Wiring box with 2 LEDs 10 - 30 V for electrical upper section Change over contact (according to DIN EN 175301-803)	8308025
Electrical upper section normally closed with signal suppression PiS 3003	7765357

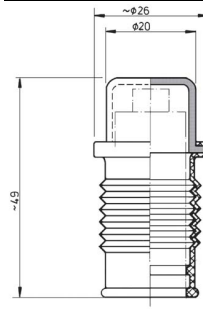
7. Accessories

7.3 Mounting block for differential pressure indicators (M 20 x 1,5)	
Specification	Order number
Mounting block (Material St)	77809098
Mounting block (Material 1.4301), 450 bar	77698517



R = clean side
S = dirt side

7.4 Protection cap	
Specification	Order number
Protection cap for all optical differential pressure and pressure indicators: Resistant to: gasoil, purifying agent, insolation, dust, salt, water, concret Temperature range: - 20 °C to + 80 °C	78285330

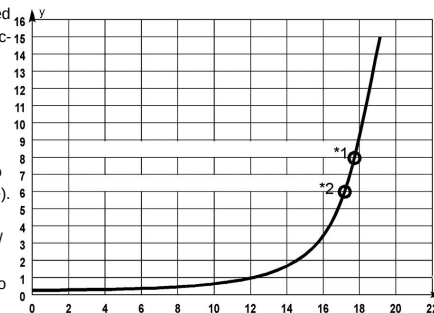


8. Function

The magnetic field as previously described, contactless operates reed contacts in the electrical upper part. The desired contact type is selected by inverting upper part. Another option keeping the electrical signal electronically suppressed up to 30 °C operating temperature is also available. This eliminates false electrical signal during the cold start phase.

For efficient servicing it is desirable to have a pre-warning device (so that the filter element can be replaced, e.g. with the next tool change). For this purpose electrical upper parts with two indicating points, i.e. at 75 % and at 100 % of the indicator setting are available. Pressure/vacuum manometers give an analog reading of the existing state of contamination of the filter elements. They require continuous control to ensure that the service time and reserve capacity are not unduly exceeded. If the contamination signal is disregarded, the filter element may collapse or, if a bypass valve is installed, part of the contamination fluid may reach the hydraulic components via the bypass valve and cause failure of the hydraulics.

Pressure/vacuum switches are provided with snap action switches, which ascertains that signal are issued only when the limit values have been fully reached.



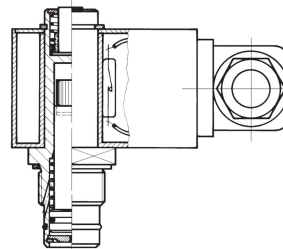
Dirt holding capacity - Δp curve

Dirt holding capacity x = dirt holding capacity [g]

y = differential pressure Δp

*1 signal step contamination indicator 100 %

*2 signal step contamination indicator 75 %



Contamination Indicator

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9. Specifications

9.1 Contact type normally open/ normally closed

Types PiS 3085, 3086, 3092, 3097,
3192

Maximum voltage:

Maximum current on contact:

Maximum contact load:

Protection type:

Contact type:

Cable connection:

250 V AC/200 V DC

1 A

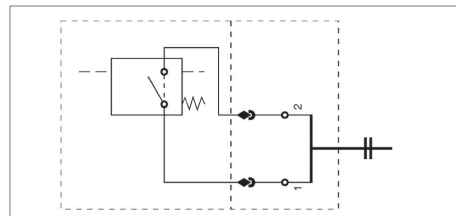
70 W

IP 65 when inserted
and secured

normally open/
normally closed

M 20 x 1,5

The switching function can be changed by turning the electric upper part by 180° (normally open contact or normally closed contact). The state on delivery is a normally closed contact. The use of quenching circuits must be checked in case of inductivity in the DC current circuit. Electrical parts are isolated (plastic casing).

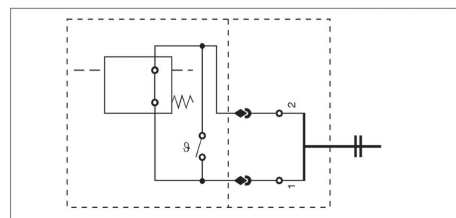


9.2 Contact type normally closed/signal lock-out

Type PiS 3003

Signal lock-out by thermorelay.

Signal is released at + 30 °C,
for further technical detail see 9.1



9.3. Contact type normally closed 2 step

Types PiS 3105, 3106, 3199

1. Indicating at 75 %

2. Indicating at 100 % of the indica-
ting pressure

Maximum voltage:

Maximum current on contact:

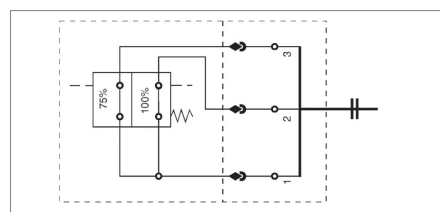
Maximum contact load:

for further technical details see 9.1

150 V AC/DC

1 A

20 VA/20 W



9.4 Contact type normally closed 2 step/signal lock-out

Types PiS 3122, 3123, 3124

Maximum voltage:

Maximum current on contact:

Maximum contact load:

Signal lock-out by thermorelay

Signal is released at + 30 °C

Reset at + 20 °C

1. Indicating at 75 %

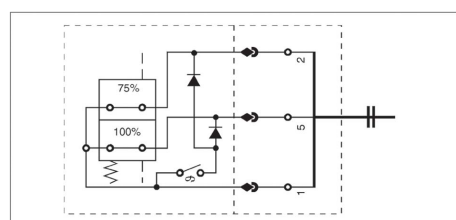
2. Indicating at 100 % of the indica-
ting pressure

for further details see 9.1

10 - 30 V AC/DC

1 A

20 W



Contamination Indicator

7

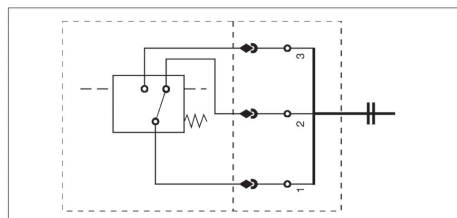
9. Technische Daten

9.5 Contact type change-over contact

Types PiS 3115, 3116, 3125

Maximum voltage:
Maximum current on contact:
Maximum contact load:
for further details see 9.1

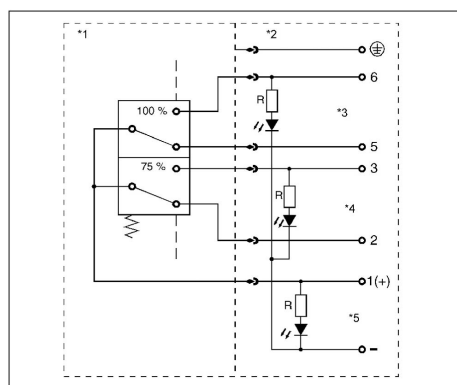
150 V AC/DC
1 A
20 VA/20 W

**9.6 Contact type change-over contact/2step LED**

Types PiS 3012, 3102, 3103

Maximum voltage:
Maximum current on contact:
Maximum contact load:
1. Indicating at 75 %
2. Indicating at 100 % of the indicating pressure
for further details see 9.1

10 - 30 V DC
1 A
20 VA/20 W

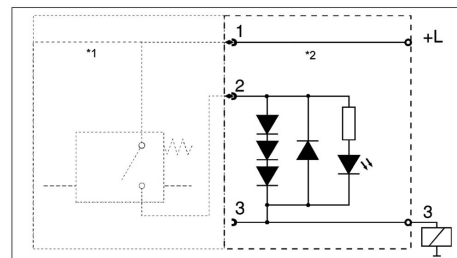


*1 switch over *2 connector
*3 indicator setting 100 % LED red
*4 indicator setting 75 % LED red
*5 stand-by indication LED green

9.7 Wiring box with lamp insert

Will be supplied instead of standard connection.
Voltage:
Not to combine with indicators with 2 setting points

12 - 230 V AC/DC

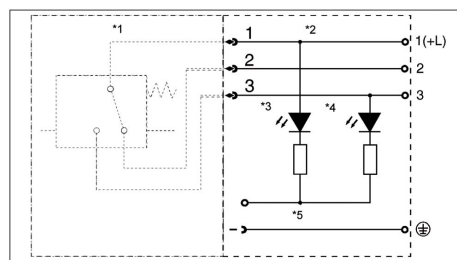


*1 switch cover
*2 connector

9.8 Wiring box with lamp insert

Will be supplied instead of standard connection plug.
Voltage:
To combine with PiS 3115, 3116, 3125

10 - 30 V DC



*1 switch cover
*2 connector
*3 green
*4 yellow
*5 screw clamp

Contamination Indicator

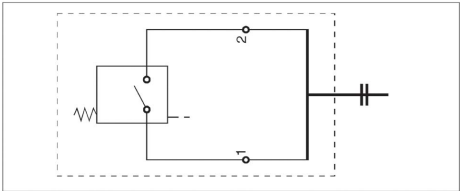
8

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9. Specifications

9.9 Vacuum switch HES/LES

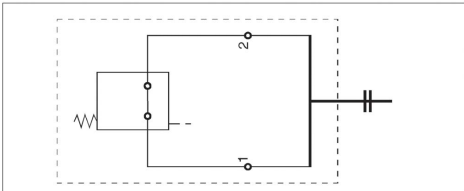
Contact type: normally open
Contact load: HES: 42 V/6W at resistive load
Maximum contact load: LES: 24 V/6W at resistive load
Type of protection: IP 54 - with protecting cap
Electrical connection: AMP 6.3 DIN 46248, DIN 46247



9.10 Vacuum switch HEO/LEO

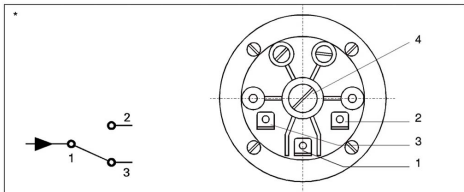
Contact type: normally closed
Contact load: HEO: 42 V/6W at resistive load
LEO: 24 V/6W at resistive load

for further technical detail see 9.9



9.11 Vacuum switch PiS 3070

Maximum voltage: 230 V AC/DC
Maximum current on contact.: 6A
Contact type: single pole changeover switch
Electrical connection: AMP 6,3 DIN 46248, DIN 46247
Position of installation: individual (with adjusted setting point, position of installation needs to be advised)
Type of protection: IP 00 - without cover
IP 54 - with cover



* Connection scheme:

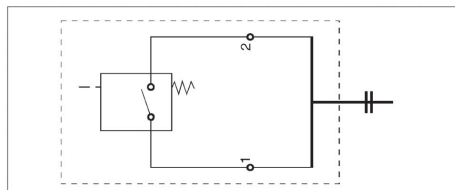
- 1. Supply line
- 2. Operating contact
- 3. Normally closed contact
- 4. Adjusting screw

Contamination Indicator

9. Specification

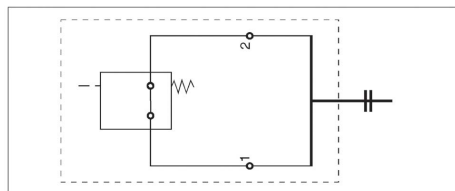
9.12 Pressure switch DSS

Contact type: normally open
 Maximum voltage: 42 V
 Maximum current on contact: 2 A
 Contact load: 100 VA
 Duty classification: 200 / min
 Type of protection: IP 65 - with protecting cap
 Electrical connections: AMP 6,3 DIN 46248
 for attachable sleeve
 according to DIN 46247,
 (switching mode bi-pole)



9.13 Pressure switch DSO

Contact type: normally closed
 for further information see 9.12



Contamination indicators PiS 3084, 3087, 3093, 3098, 3193 can be mounted in 45°.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application: Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

When using our filters in areas which are to be classified according to EU directive 94/9 EG (ATEX), we recommend prior discussion with us. The standard version can be used for liquids based on mineral oil /corresponding to the fluids in Group 2 of Directive 97/23 EG Article 9). Please consult with us if using other media.

Subject to technical alterations without prior notice.

MAHLE Filtersysteme GmbH
 Industriefiltration
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 industriefiltration@mahle.com
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 78357428.11/2006

Contamination Indicator

10

MAHLE

Driven by performance

Low Pressure Filter

Pi 200

Nominal pressure 32/63 bar (460/910 psi), nominal size up to 600

1. Features

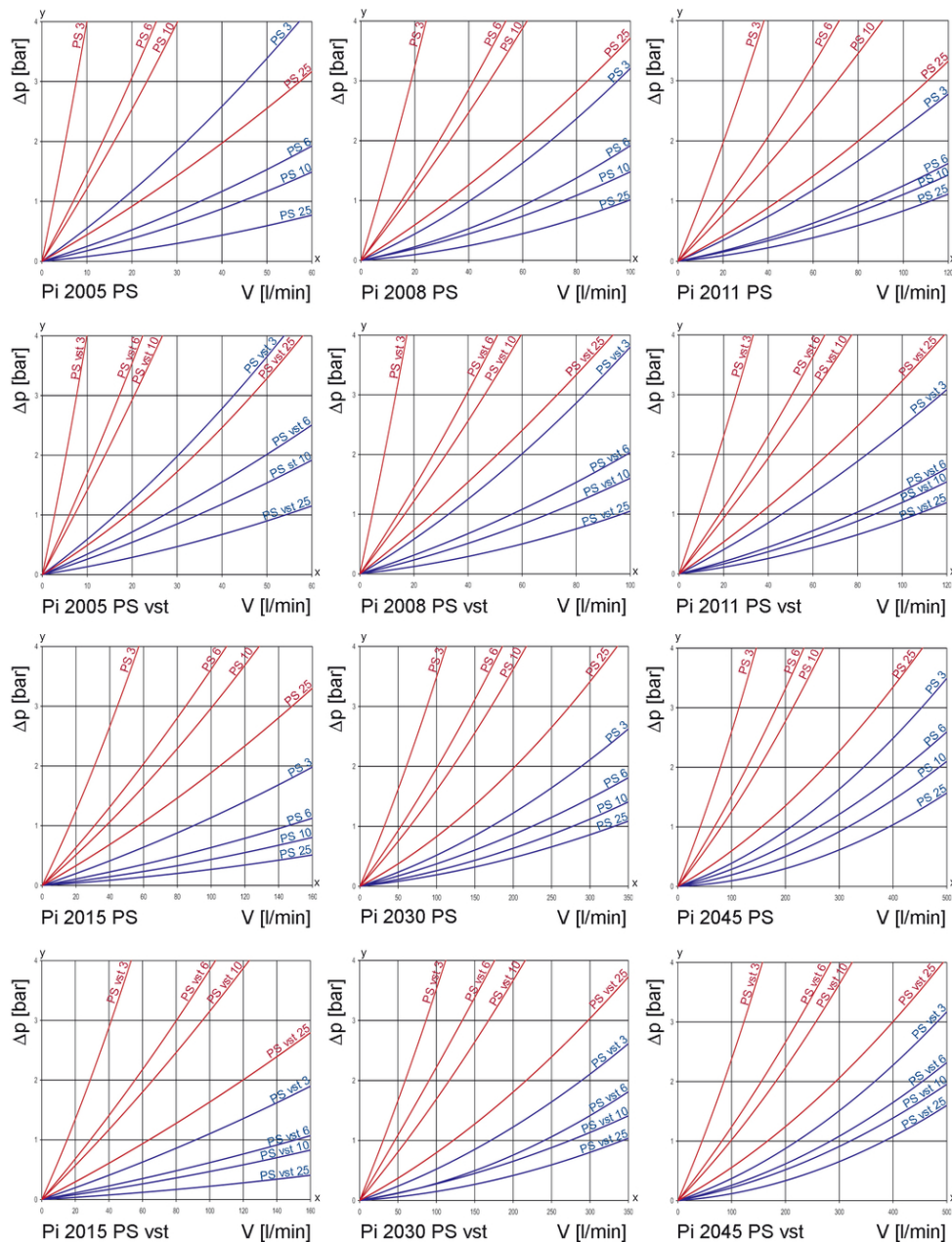
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Other connections on request
- Worldwide distribution



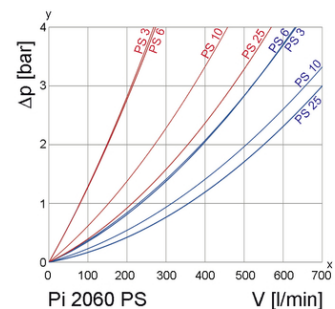
2. Flow rate/pressure drop curve (filter housing incl. element)

190 mm²/s
33 mm²/s



Low Pressure Filter Pi 200 up to NG 600

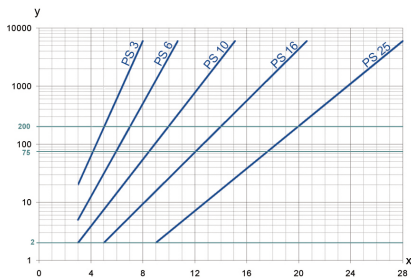
2



y = differential pressure Δ p [bar]
x = flow rate V [l/min]

Calculation of individual filter under www.industrialfiltration-catalogue.mahle.com

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

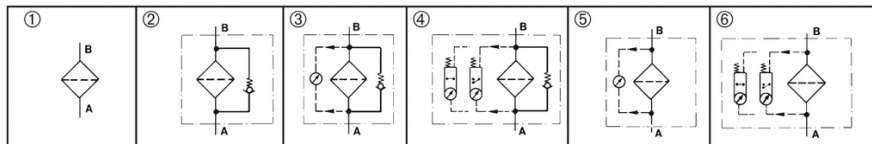
PS elements with				PS vst elements with			
max. Δ p 20 bar				max. Δ p 210 bar			
PS	3	$\beta_{5(C)} \geq 200$		PS vst	3	$\beta_{5(C)} \geq 200$	
PS	6	$\beta_{7(C)} \geq 200$		PS vst	6	$\beta_{7(C)} \geq 200$	
PS	10	$\beta_{10(C)} \geq 200$		PS vst	10	$\beta_{10(C)} \geq 200$	
PS	25	$\beta_{20(C)} \geq 200$		PS vst	25	$\beta_{20(C)} \geq 200$	
values guaranteed up to 10 bar differential pressure				values guaranteed up to 20 bar differential pressure			

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
V = 80 l/min and visual/electrical maintenance indicator	PS vst 3
Type: Pi 2008-069	Type: Pi 2208 PS vst 3
Order number: 77665284	Order number: 77680200

7.1 Housing design								
Nominal size NG [l/min]	Order number	Type	① no options	② with bypass valve	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
50	77665144	Pi 2005-060						
	77665110	Pi 2005-056						
	77665128	Pi 2005-057						
	77665136	Pi 2005-058						
	77665169	Pi 2005-068						
	77665177	Pi 2005-069						
80	77665235	Pi 2008-060						
	77665201	Pi 2008-056						
	77665219	Pi 2008-057						
	77665227	Pi 2008-058						
	77665276	Pi 2008-068						
	77665284	Pi 2008-069						
110	78205114	Pi 2011-060						
	78205122	Pi 2011-056						
	78205130	Pi 2011-057						
	78205148	Pi 2011-058						
	78205155	Pi 2011-068						
	78205163	Pi 2011-069						
150	77840580	Pi 2015-060						
	76165203	Pi 2015-056						
	76165211	Pi 2015-057						
	79320748	Pi 2015-058						
	76165229	Pi 2015-068						
	78396616	Pi 2015-069						
300	77665474	Pi 2030-060						
	77665441	Pi 2030-056						
	77665458	Pi 2030-057						
	77665466	Pi 2030-058						
	77665516	Pi 2030-068						
	77665532	Pi 2030-069						

Low Pressure Filter Pi 200 up to NG 600

4

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass valve	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
450	77664881	Pi 2045-060						
	77664873	Pi 2045-056						
	77664865	Pi 2045-057						
	77664857	Pi 2045-058						
	77664923	Pi 2045-068						
	77664931	Pi 2045-069						
600	70576046	Pi 2060-060						
	70576045	Pi 2060-056						
	70534876	Pi 2060-057						
	79714171	Pi 2060-058						
	78205254	Pi 2060-068						
	70576047	Pi 2060-069						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements (a wider range of element types is available on request)

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm²]
50	77680135	Pi 2105 PS 3	PS 3	20	590
	77943509	Pi 5105 PS 6	PS 6		590
	77680325	Pi 3105 PS 10	PS 10		590
	77680440	Pi 4105 PS 25	PS 25		590
	77680192	Pi 2205 PS vst 3	PS vst 3	210	425
	77943533	Pi 5205 PS vst 6	PS vst 6		425
	77680382	Pi 3205 PS vst 10	PS vst 10		425
	77680507	Pi 4205 PS vst 25	PS vst 25		425
80	77680143	Pi 2108 PS 3	PS 3	20	1150
	77943517	Pi 5108 PS 6	PS 6		1150
	77680341	Pi 3108 PS 10	PS 10		1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680200	Pi 2208 PS vst 3	PS vst 3	210	850
	77943541	Pi 5208 PS vst 6	PS vst 6		850
	77681190	Pi 3208 PS vst 10	PS vst 10		850
	77680515	Pi 4208 PS vst 25	PS vst 25		850
110	77680150	Pi 2111 PS 3	PS 3	20	1700
	77943525	Pi 5111 PS 6	PS 6		1700
	77680333	Pi 3111 PS 10	PS 10		1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680218	Pi 2211 PS vst 3	PS vst 3	210	1275
	77943558	Pi 5211 PS vst 6	PS vst 6		1275
	77680390	Pi 3211 PS vst 10	PS vst 10		1275
	77680523	Pi 4211 PS vst 25	PS vst 25		1275
150	77680168	Pi 2115 PS 3	PS 3	20	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425

Low Pressure Filter Pi 200 up to NG 600

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7.2 Filter elements (a wider range of element types is available on request)					
Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
150	77680226	Pi 2215 PS vst 3	PS vst 3	210	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	20	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	210	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
	77680416	Pi 3230 PS vst 10	PS vst 10		3800
	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	20	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	210	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS vst 25		5600
600	70346506	Pi 2160 PS 3	PS 3	20	9398
	76114318	Pi 5160 PS 6	PS 6		9398
	79393380	Pi 3160 PS 10	PS 10		9398
	79748047	Pi 4160 PS 25	PS 25		9398

8. Technical specifications

Design: in-line filter

Nominal pressure:

Pi 2005 - 2011 10⁷ load changes 63 bar (900 psi)

Pi 2015 - 2060 10⁷ load changes 25 bar (360 psi)

2x 10⁶ load changes 32 bar (460 psi)

Test pressure:

Pi 2005 - 2011 95 bar (1370 psi)

Pi 2015 - 2060 48 bar (690 psi)

Temperature range: -30 °C to +120 °C

survival temperature -40 °C (other temperature ranges on request)

Bypass setting: Δp 3.5 bar $\pm$ 10 %

Filter head material: GDAL

Filter housing material: AL/St

Sealing material: NBR/AL

Maintenance indicator setting: Δp 2.2 bar $\pm$ 10 %

Electrical data of maintenance indicator:

Max. voltage: 250 V AC/200 V DC

Max. current: 1 A

Max. current: 70 W

Type of protection: IP 65 in inserted and secured status

Contact: normally open/closed

Cable sleeve: M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

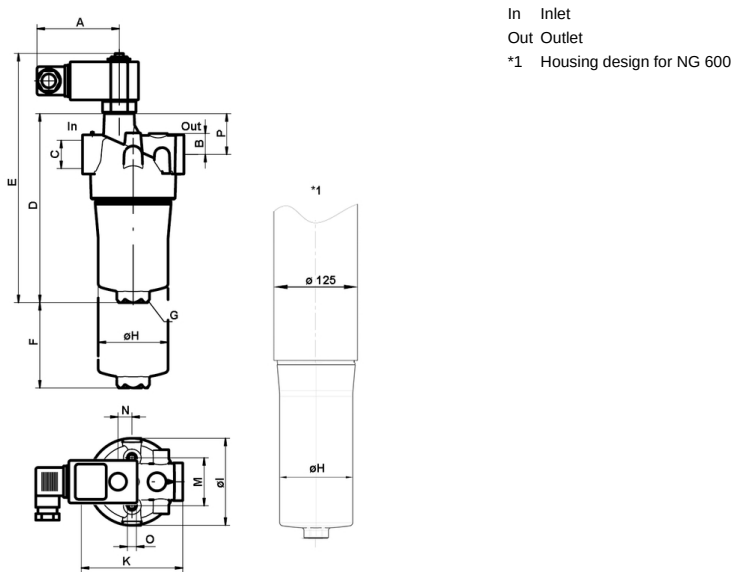
We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

Low Pressure Filter Pi 200 up to NG 600

6

9. Dimensions



All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G SW	H	I	K	M	N	O	P	Weight [kg]
Pi 2005	78	19	G½	186	240	80	27	66	80	95	45	13.0	M8x10	37.5	0.9
Pi 2008	78	19	G¾	243	300	80	27	66	80	95	45	13.0	M8x10	37.5	1.0
Pi 2011	78	19	G¾	333	393	80	27	66	80	95	45	13.0	M8x10	37.5	1.1
Pi 2015	78	30	G1¼	268	326	110	32	109	128	150	60	24.5	M12x15	43.5	2.3
Pi 2030	78	30	G1¼	363	421	110	32	109	128	150	60	24.5	M12x15	43.5	2.5
Pi 2045	78	30	G1¼	509	566	110	32	109	128	150	60	24.5	M12x15	43.5	7.4
Pi 2060	78	30	G1¼	615	672	110	32	109	128	150	60	24.5	M12x15	43.5	5.5

* NPT and SAE connections on request

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing.

Preferably the filter should be installed with the filter housing pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

The state on delivery is a normally closed contact

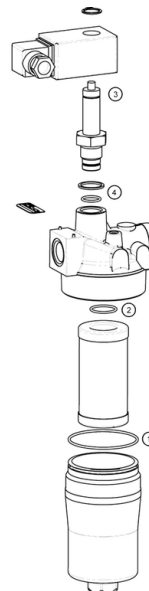
10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove element by pulling down carefully.
- Check O-ring on the filter housing for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 600 = 100 Nm.

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industriefiltration@mahle.com
www.mahle.com
78356446.04/2015



11. Spare parts list

Order numbers of spare parts		
Position	Type	Order number
① - ②	Seal kit for filter	
	Pi 2005 - Pi 2011	
	NBR	77550213
	FPM	77845795
	EPDM	77845803
	Pi 2015 - Pi 2060	
	NBR	77550221
③	FPM	77845811
	EPDM	77845829
	Maintenance indicator	
	Visual PiS 3098/2,2	77669971
④	Electrical PiS 3097/2,2	77669948
	Electrical upper section only	77536550
	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

Low Pressure Filter Pi 200 up to NG 600

8

MAHLE

Industry

Duplex Filter Pi 210

Nominal pressure 32/63 bar (460/900 psi), nominal size up to 600

1. Features

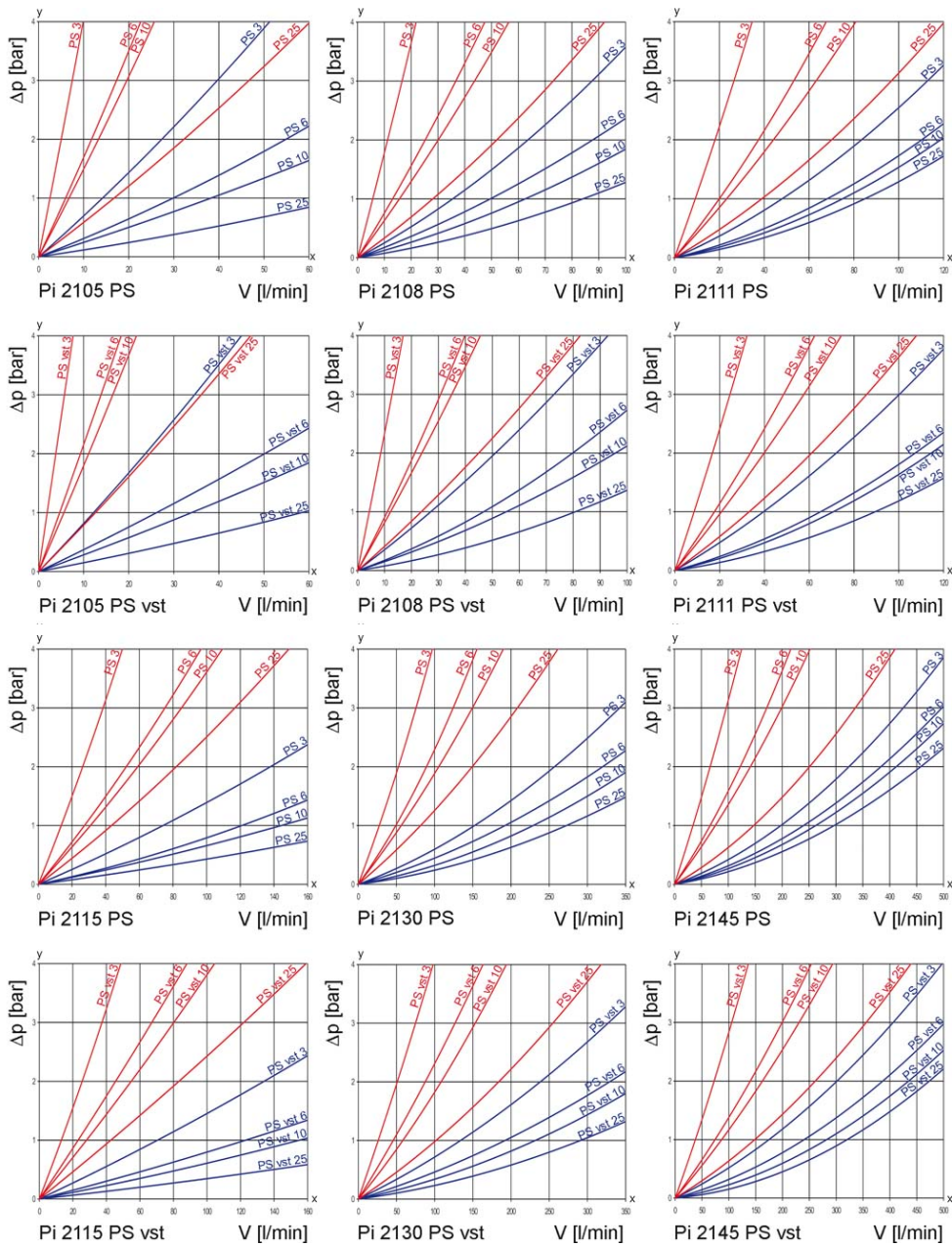
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Change over valve on upstream side
- Ergonomic switch-over handle with safety lock and pressure compensation
- User-optimized one-hand-operation
- Equipped with highly efficient glass fibre PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Other connections on request
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

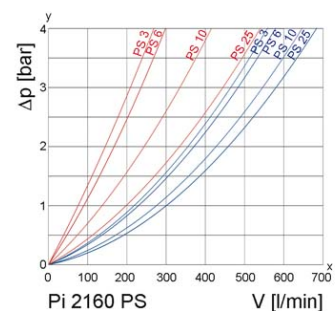
190 mm²/s
33 mm²/s



Duplex Filter Pi 210 up to NG 600

2

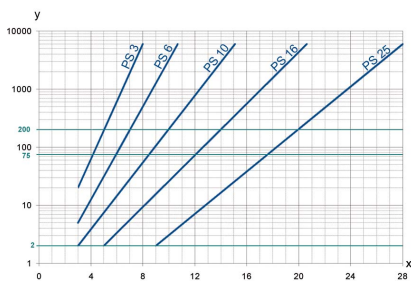
26609398/EN – 10/2020



y = differential pressure Δ p [bar]
x = flow rate V [l/min]

Calculation of individual filter under www.industrialfiltration-catalogue.mahle.com

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

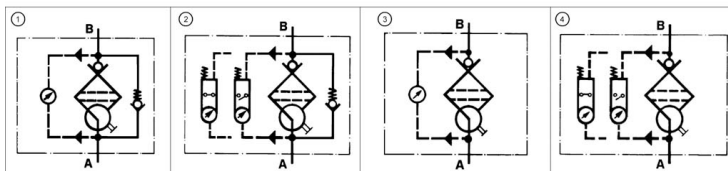
PS elements with			PS vst elements with		
max. Δ p 20 bar			max. Δ p 210 bar		
PS	3	$\beta_{5(C)} \geq 200$	PS vst	3	$\beta_{5(C)} \geq 200$
PS	6	$\beta_{7(C)} \geq 200$	PS vst	6	$\beta_{7(C)} \geq 200$
PS	10	$\beta_{10(C)} \geq 200$	PS vst	10	$\beta_{10(C)} \geq 200$
PS	25	$\beta_{20(C)} \geq 200$	PS vst	25	$\beta_{20(C)} \geq 200$
values guaranteed up to 10 bar differential pressure			values guaranteed up to 20 bar differential pressure		

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
V = 80 l/min and visual/electrical indicator Type: Pi 2108-069 Order number: 77810286	PS vst 3 Type: Pi 2208 PS vst 3 Order number: 77680200

7.1 Housing design						
Nominal size NG [l/min]	Order number	Type	① with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ with electrical indicator
50	77810211	Pi 2105-057				
	77810229	Pi 2105-058				
	77810237	Pi 2105-068				
	77810245	Pi 2105-069				
80	77810252	Pi 2108-057				
	77810260	Pi 2108-058				
	77810278	Pi 2108-068				
	77810286	Pi 2108-069				
110	78204083	Pi 2111-057				
	78204091	Pi 2111-058				
	78204109	Pi 2111-068				
	78204117	Pi 2111-069				
150	77774573	Pi 2115-057				
	77774565	Pi 2115-058				
	77774557	Pi 2115-068				
	77774540	Pi 2115-069				
300	77774532	Pi 2130-057				
	77774524	Pi 2130-058				
	77774516	Pi 2130-068				
	77774508	Pi 2130-069				
450	77774490	Pi 2145-057				
	77774482	Pi 2145-058				
	77774474	Pi 2145-068				
	77774466	Pi 2145-069				
600	70574769	Pi 2160-057				
	70574768	Pi 2160-058				
	70574767	Pi 2160-068				
	70574766	Pi 2160-069				

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

Duplex Filter Pi 210 up to NG 600

4

26609398/EN – 10/2020

7.2 Filter elements*					
Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
50	77680135	Pi 2105 PS 3	PS 3	20	590
	77943509	Pi 5105 PS 6	PS 6		590
	77680325	Pi 3105 PS 10	PS 10		590
	77680440	Pi 4105 PS 25	PS 25		590
	77680192	Pi 2205 PS vst 3	PS vst 3	210	425
	77943533	Pi 5205 PS vst 6	PS vst 6		425
	77680382	Pi 3205 PS vst 10	PS vst 10		425
	77680507	Pi 4205 PS vst 25	PS vst 25		425
80	77680143	Pi 2108 PS 3	PS 3	20	1150
	77943517	Pi 5108 PS 6	PS 6		1150
	77680341	Pi 3108 PS 10	PS 10		1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680200	Pi 2208 PS vst 3	PS vst 3	210	850
	77943541	Pi 5208 PS vst 6	PS vst 6		850
	77681190	Pi 3208 PS vst 10	PS vst 10		850
	77680515	Pi 4208 PS vst 25	PS vst 25		850
110	77680150	Pi 2111 PS 3	PS 3	20	1700
	77943525	Pi 5111 PS 6	PS 6		1700
	77680333	Pi 3111 PS 10	PS 10		1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680218	Pi 2211 PS vst 3	PS vst 3	210	1275
	77943558	Pi 5211 PS vst 6	PS vst 6		1275
	77680390	Pi 3211 PS vst 10	PS vst 10		1275
	77680523	Pi 4211 PS vst 25	PS vst 25		1275
150	77680168	Pi 2115 PS 3	PS 3	20	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425
	77680226	Pi 2215 PS vst 3	PS vst 3	210	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	20	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	210	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
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	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	20	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	210	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS vst 25		5600

*a wider range of element types is available on request

Duplex Filter Pi 210 up to NG 600

5

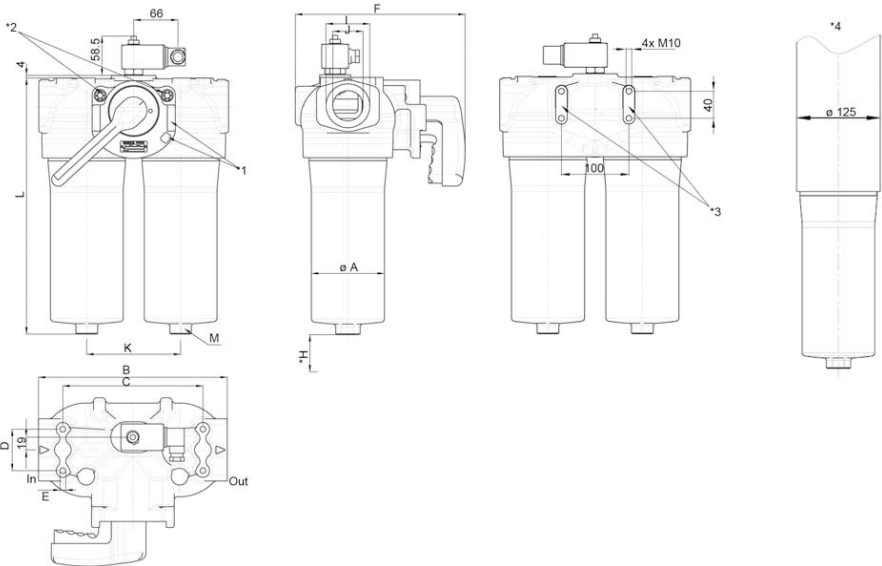
7.2 Filter elements*					
Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
600	70346506	Pi 2160 PS 3	PS 3	20	9398
	76114318	Pi 5160 PS 6	PS 6		9398
	79393380	Pi 3160 PS 10	PS 10		9398
	79748047	Pi 4160 PS 25	PS 25		9398

*a wider range of element types is available on request

8. Technical specifications

Design:	line mounting filter	The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.
Nominal pressure:		
Pi 2105 - Pi 2111	10 [^] 7 load changes 63 bar (900 psi)	
Pi 2115 - Pi 2160	10 [^] 7 load changes 25 bar (360 psi) 2x 10 [^] 6 load changes 32 bar (460 psi)	We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.
Test pressure:		
Pi 2105 - Pi 2111	95 bar (1370 psi)	
Pi 2115 - Pi 2160	48 bar (690 psi)	
Temperature range:	-10 °C to +120 °C survival temperature -40 °C (other temperature ranges on request)	We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Goup 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.
Bypass setting:	Δp 3.5 bar $\pm$ 10	
Filter head material:	GAL	
Filter housing material:	AL/St	
Sealing material:	NBR/AL	
Maintenance indicator setting:	Δp 2.2 bar $\pm$ 10 %	Subject to technical alteration without prior notice.
Electrical data of maintenance indicator:		
Max. voltage:	250 V AC/200 V DC	
Max. current:	1 A	
Contact load:	70 W	
Type of protection:	IP 65 in inserted and secured status	
Contact:	normally open/closed	
Cable connection:	M20x1.5	

9. Dimensions



- In Inlet

Out Outlet

*H Minimum clearance required for element change
- *1 Lever locking and arresting

*2 Venting screws

*3 Optional fixing for NG 150 to 600

*4 Housing version NG 600

All dimensions except "J" in mm

Type	øA	B	C	D	E	F	G	H	øI	J*	K	L	M SW	Wt. [kg]
Pi 2105	66	172	100	52	M8x16	189	130	80	47	G1	85	203	27	2.60
Pi 2108	66	172	100	52	M8x16	189	130	80	47	G1	85	261	27	2.90
Pi 2111	66	172	100	52	M8x16	189	130	80	47	G1	85	351	27	3.30
Pi 2115	109	283	210	62	M10x20	252	194	110	65	G1½	140	264	32	8.50
Pi 2130	109	283	210	62	M10x20	252	194	110	65	G1½	140	385	32	9.50
Pi 2145	109	283	210	62	M10x20	252	194	110	65	G1½	140	497	32	17.25
Pi 2160	109	283	210	62	M10x20	252	194	110	65	G1½	140	636	32	15.50

* SAE flange connections (3000 psi), NPT and SAE connections on request

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

The state on delivery is a normally closed contact

10.3 When should the filter element be replaced?

1. Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
2. Please always ensure that you have original MAHLE spare elements in stock: Disposable elements cannot be cleaned.

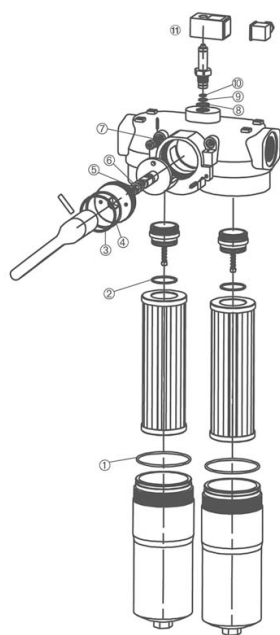
10.4 Element replacement

Note: Elements may only be replaced by people who are familiar with the function of the filter. When replacing elements, appropriate safety clothing (protective goggles, gloves, safety shoes) must be worn.

Note: The maintenance indicator monitors the filter side in operation, which is identified by the position of the switching lever catch. The change-over transfer valve must be switched prior filter servicing. Now the signal of the maintenance indicators cancelled and the red button can be repressed again.

1. Operate and hold pressure equalizing lever located behind switching lever. Pull catch knob and swivel switching lever. Engage the catch on the clear filter side. Place through or drip pan underneath to collect leaving oil.
2. Loosen vent screw of the filter side not in use by 2-3 turns; max. until contact is made with the safety stop.
3. Unscrew filter housing by rotating same counter-clockwise and clean with a suitable medium.
Warning: The shift lever may not, from now until the screwing back in of the filter housing (7.), be activated under any circumstances!
4. Remove filter element with a side-to-side motion.
5. Check O-ring on the filter house for damage. Replace, if necessary.
6. Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
7. Lightly lubricate the threads of the filter housing and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 600 = 100 Nm.
8. To refill the filter chamber, operate only the pressure equalizing lever (leave the switching lever arrested in its catch) long enough for the medium to emerge bubble-free from the vent bore.
9. Tighten vent screw. Check filter for leaks by operating the pressure equalizing lever once again.

11. Spare parts list



Order number for spare parts		
Position	Type	Order number
① - ⑪	Seal kit for housing	
	Pi 2105 - Pi 2111	
	NBR	79761271
	FPM	79761289
	EPDM	79761297
	Pi 2115 - Pi 2160	
	NBR	79761230
	FPM	79761248
	EPDM	79761255
③ - ⑩	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325
⑪	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550

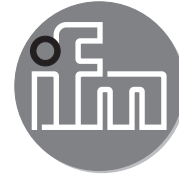


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Duplex Filter Pi 210 up to NG 600

10

26609398/EN – 10/2020



Installation instructions
Electronic pressure sensor
for industrial applications
PT54xx/PU54xx

UK

12 / 2018

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3 Functions and features	3
3.1 Applications	3
4 Functions	5
5 Installation.....	5
6 Electrical connection.....	6
7 Technical data.....	7

1 Preliminary note

Symbols used

► Instructions

→ Cross-reference



Important note

Non-compliance can result in malfunction or interference.



Information

Supplementary note.

2 Safety instructions

- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Functions and features).
- Only use the product for permissible media (→ Applications).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.

2

- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

3 Functions and features

The pressure sensor detects the system pressure and converts it into an analogue output signal.

3.1 Applications

UK

- Type of pressure: relative pressure

Order number	Measuring range		Pressure resistance (max. permissible pressure)		Bursting pressure	
	bar	psi	bar	psi	bar	psi
PT5415 / PU5415	0...6	0...87	15	215	200	2900
PT5404 / PU5404	0...10	0...145	25	360	300	4350
PT5494	-1...10	-14.5...145	25	360	300	4350
PT5414 / PU5414	0...16	0...232	40	580	450	6525
PT5403 / PU5403	0...25	0...360	65	940	600	8700
PT5453	0...30	0...435	65	940	600	8700
PT5443 / PU5443	0...40	0...580	100	1450	800	11600
PT5423 / PU5423	0...60	0...870	150	2175	900	13050
PT5402 / PU5402	0...100	0...1450	250	3625	1000	14500
PT5412 / PU5412	0...160	0...2320	400	5800	1100	15950
PT5401 / PU5401	0...250	0...3625	625	9060	1200	17400
PT5400 / PU5400	0...400	0...5800	1000	14500	1700	24650
PT5460 / PU5460	0...600	0...8700	1500	21750	2400	34800

$$\text{MPa} = \text{bar} \div 10 / \text{kPa} = \text{bar} \times 100$$



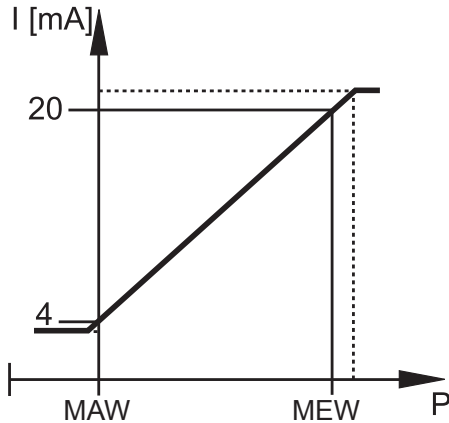
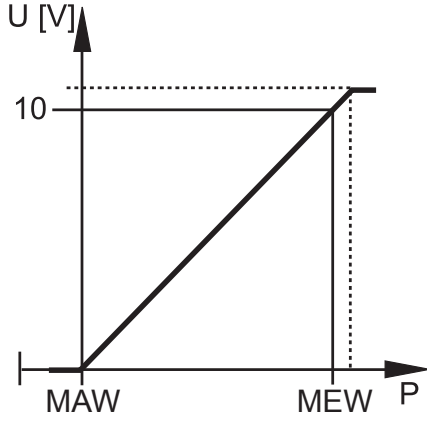
Avoid static and dynamic overpressure exceeding the specified overload pressure by taking appropriate measures.

The indicated bursting pressure must not be exceeded.

Even if the bursting pressure is exceeded only for a short time, the unit may be destroyed. ATTENTION: Risk of injury!

-  For units with a final value of the measuring range of 600 bar the limits of the pressure cycles across the lifetime apply. (→ Technical data).
-  Pressure Equipment Directive (PED):
Units with a final value of the measuring range of 6...400 bar comply with the Pressure Equipment Directive and are designed and manufactured for group 2 fluids in accordance with the sound engineering practice.
Use of group 1 fluids on request!
-  Pressure Equipment Directive (PED):
The units with a final value of the measuring range of 600 bar comply with the Pressure Equipment Directive. They are designed for group 2 fluids and manufactured and tested according to Module A.
Use of group 1 fluids on request!
-  The units are vacuum resistant.

4 Functions

Current output 4...20 mA (PT54xx)	Voltage output 0...10 V (PU54xx)
	
P = system pressure, MAW = Initial value of the measuring range, MEW = final value of the measuring range	
In the measuring range the output signal is between 4 and 20 mA. If the system pressure is above or below the measuring range, the analogue output behaves, without achieving the accuracy, as follows: • System pressure above the measuring range: 20...25 mA. • System pressure below the measuring range: 4...3 mA.	In the measuring range the output signal is between 0 and 10 V. If the system pressure is above the measuring range, the analogue output behaves, without achieving the accuracy, as follows: • System pressure above the measuring range: 10...11.5 V.

UK

5 Installation

! Before installing and removing the unit: make sure that no pressure is applied to the system.

- ▶ Insert the unit in a G ¼ process connection.
- ▶ Tighten firmly. Recommended tightening torque:

Pressure range in bar	Tightening torque in Nm
6...400	25...35
600	30...50
Depends on lubrication, seal and pressure load!	

5

6 Electrical connection

- !

The unit must be connected by a qualified electrician.

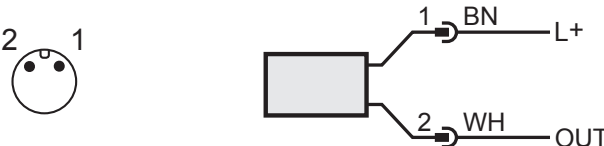
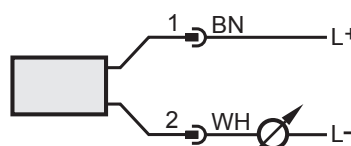
The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply to EN 50178, SELV, PELV.
- !

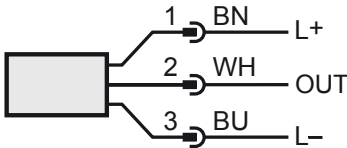
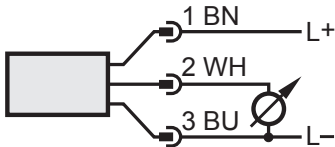
For marine applications (if approval available for the device), additional surge protection is required.

- ▶ Disconnect power.
- ▶ Connect the unit as follows:

PT54xx (4...20 mA analogue)

Core colours		
BN	brown	
WH	white	
		OUT: analogue output 4...20 mA Colours to DIN EN 60947-5-2
Example circuit		
		

PU54xx (0...10 V analogue)

Core colours			
BN	brown		
WH	white		
BU	blue		
		OUT: analogue output 0...10 V Colours to DIN EN 60947-5-2	
Example circuit			
			

UK

7 Technical data

 Directive 97/23/EC (pressure equipment directive) stipulates that the following technical data must be provided for units with a final value of the measuring range of 600 bar.

PT5460	
Operating voltage [V].....	8.5...36 DC
Analogue output	4...20 mA
PU5460	
Operating voltage [V].....	16...36 DC
Analogue output	0...10 V
Medium temperature [°C]	-40...90
Ambient temperature [°C]	-40...90
Storage temperature [°C].....	-40...100
Pressure cycles (min.) across lifetime	60 million for 1.2 x nominal pressure
Shock resistance [g]	50 (DIN EN 60068-2-27, 11 ms)
Vibration resistance [g]	20 (DIN EN 60068-2-6, 10...2000 Hz)

More information at www.ifm.com

PT5403

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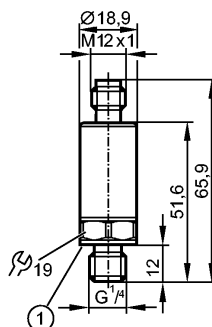
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PT5403

PT-025-SEG14-A-ZVG/US/ /W

Pressure sensors



1: Process connection sealing FKM / DIN 3869



Product characteristics	
Electronic pressure sensor	
for industrial applications	
Process connection: G 1/4 A (according to DIN EN ISO 1179-2)	
Analog output	
Measuring range: 0...25 bar	
Application	
Application	Type of pressure: relative pressure Group 2 fluids according to the Pressure Equipment Directive (PED), group 1 fluids on request
Pressure rating [bar]	65 (static)
Bursting pressure min. [bar]	600
Vacuum resistance [mbar]	-1000
Medium temperature [°C]	-40...90
Electrical data	
Electrical design	DC
Operating voltage [V]	8.5...36 DC
Insulation resistance [MΩ]	> 100 (500 V DC)
Protection class	III
Reverse polarity protection	yes
Outputs	
Output	Analog output
Output function	4...20 mA analog
Short-circuit proof	yes
Overload protection	yes
Analog output	4...20 mA
Max. load [Ω]	(Ub - 8.5 V) / 21.5 mA; 720 at Ub = 24 V
Measuring / setting range	
Measuring range [bar]	0...25
Accuracy / deviations	

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17.11.2016

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PT5403

Seite 2 von 3

**Accuracy / deviations
(in % of the span)**

Characteristics deviation *)	< ± 0.5
Linearity	< ± 0.1 (BFSL) / < ± 0.2 (LS)
Hysteresis	< ± 0.2
Repeatability **)	< ± 0.05
Long-term stability ***)	< ± 0.1

Temperature coefficients (TEMPCO) in the temperature range -40...90° C (in % of the span per 10 K)

Greatest TEMPCO of the zero point + span	< 0.1 (-25...90 °C) / < 0.2 (-40...-25 °C)
--	--

Reaction times

Step response time analogue output [ms]	1
---	---

Environment

Ambient temperature [°C]	-40...90
Storage temperature [°C]	-40...100
Protection	IP 67 / IP 69K

Tests / approvals

Pressure equipment directive	sound engineering practice	
EMC	DIN EN 61000-6-2	
	DIN EN 61000-6-3	
Shock resistance	DIN EN 60068-2-27	50 g (11 ms)
Vibration resistance	DIN EN 60068-2-6	20 g (10...2000 Hz)
MTTF [Years]	686	

Mechanical data

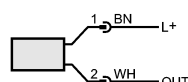
Process connection	G ¼ A (according to DIN EN ISO 1179-2)	
Process connection sealing	FKM (to DIN 3869)	
Materials (wetted parts)	1.4542 (17-4 PH / 630) ²	
Housing materials	1.4542 (17-4 PH / 630) ² ; stainless steel (316L / 1.4404); PEI	
Min. pressure cycles	60 millions in the course of the lifetime (at 1.2 times the nominal pressure)	
Tightening torque [Nm]	25...35 (recommended tightening torque ¹)	
Restrictor element integrated	no	
Weight [kg]	0.056	

Electrical connection

Connection	M12 connector
------------	---------------

Wiring

Core colors
BN brown
WH white



OUT: 4...20 mA

The following pin connection is available on request:

pin 1: L+, pin 3: OUT

Colours to DIN EN 60947-5-2

Remarks

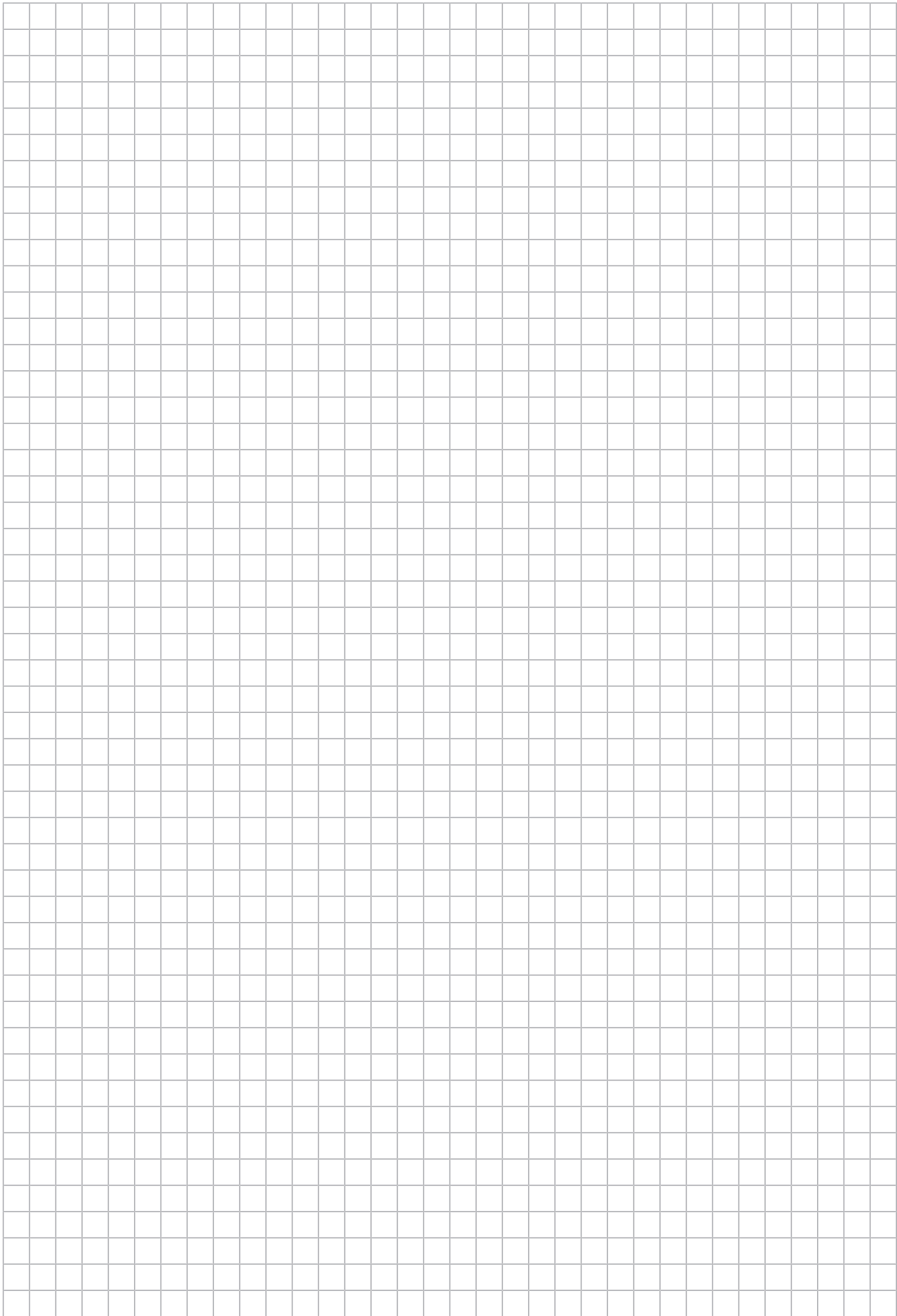
Remarks	*) incl. drift when overtightened, zero point and span error, non-linearity, hysteresis **) with temperature fluctuations < 10 K ***) in% of the span / 6 months
---------	--

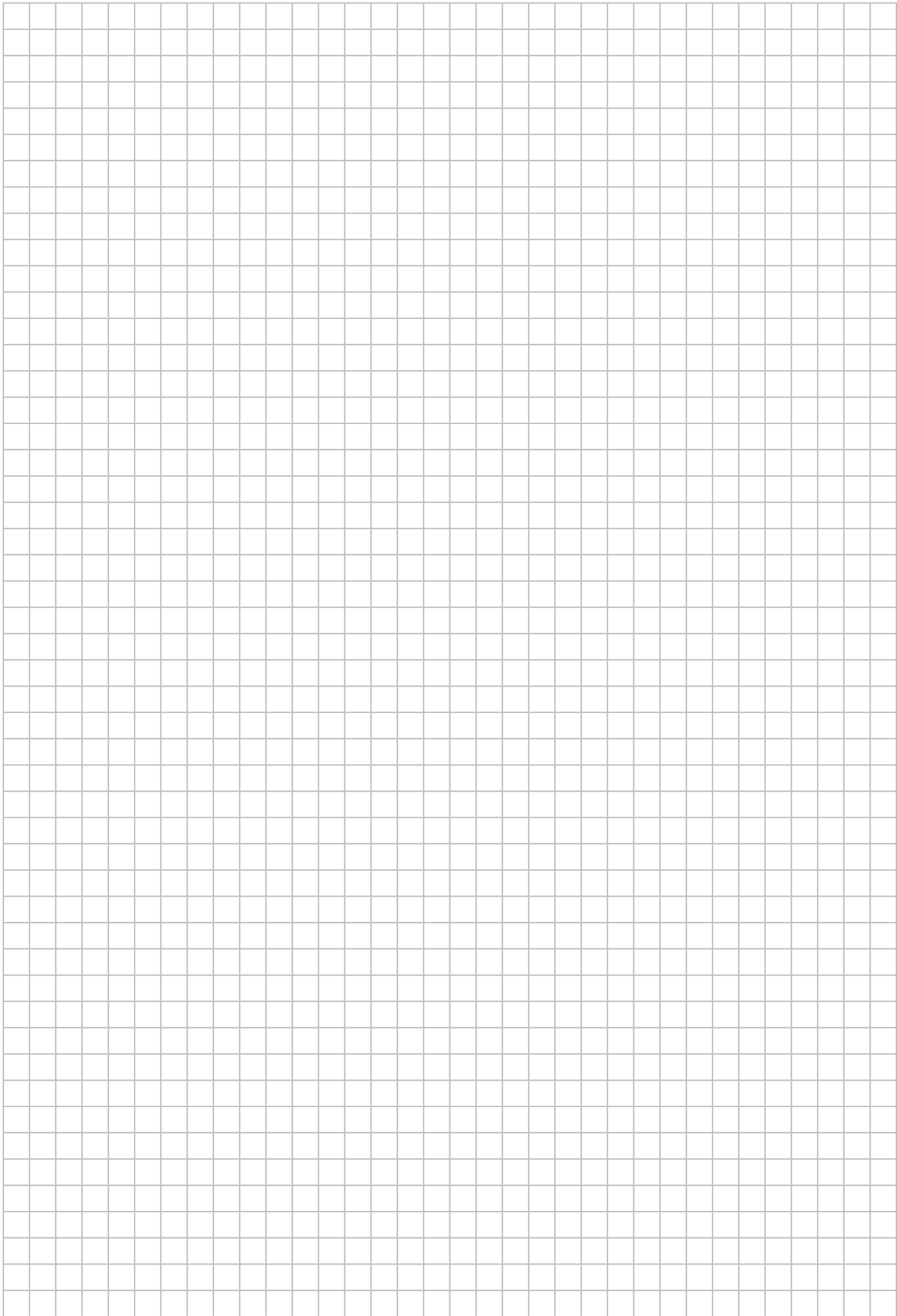
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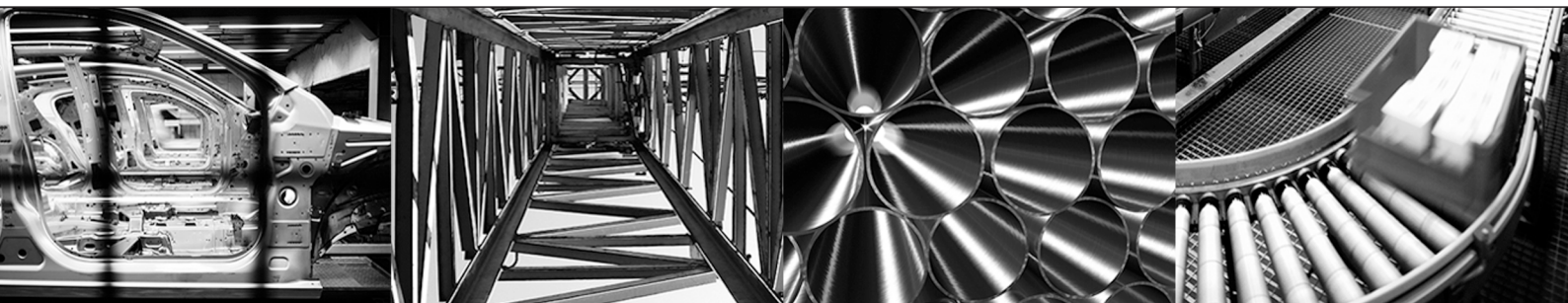
17.11.2016

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		¹⁾ Depends on lubrication, seal and pressure rating ²⁾ Characteristics similar to stainless steel (e.g. 304/1.4301) but higher strength. BFSL = Best Fit Straight Line / LS = Limit Value Setting
Pack quantity	[piece]	1
ifm efector, inc. • 1100 Atwater Drive • Malvern • PA 19355 — We reserve the right to make technical alterations without prior notice. — US — PT5403-01 — 07.09.2015		









SEW-EURODRIVE
Driving the world

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EURODRIVE

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