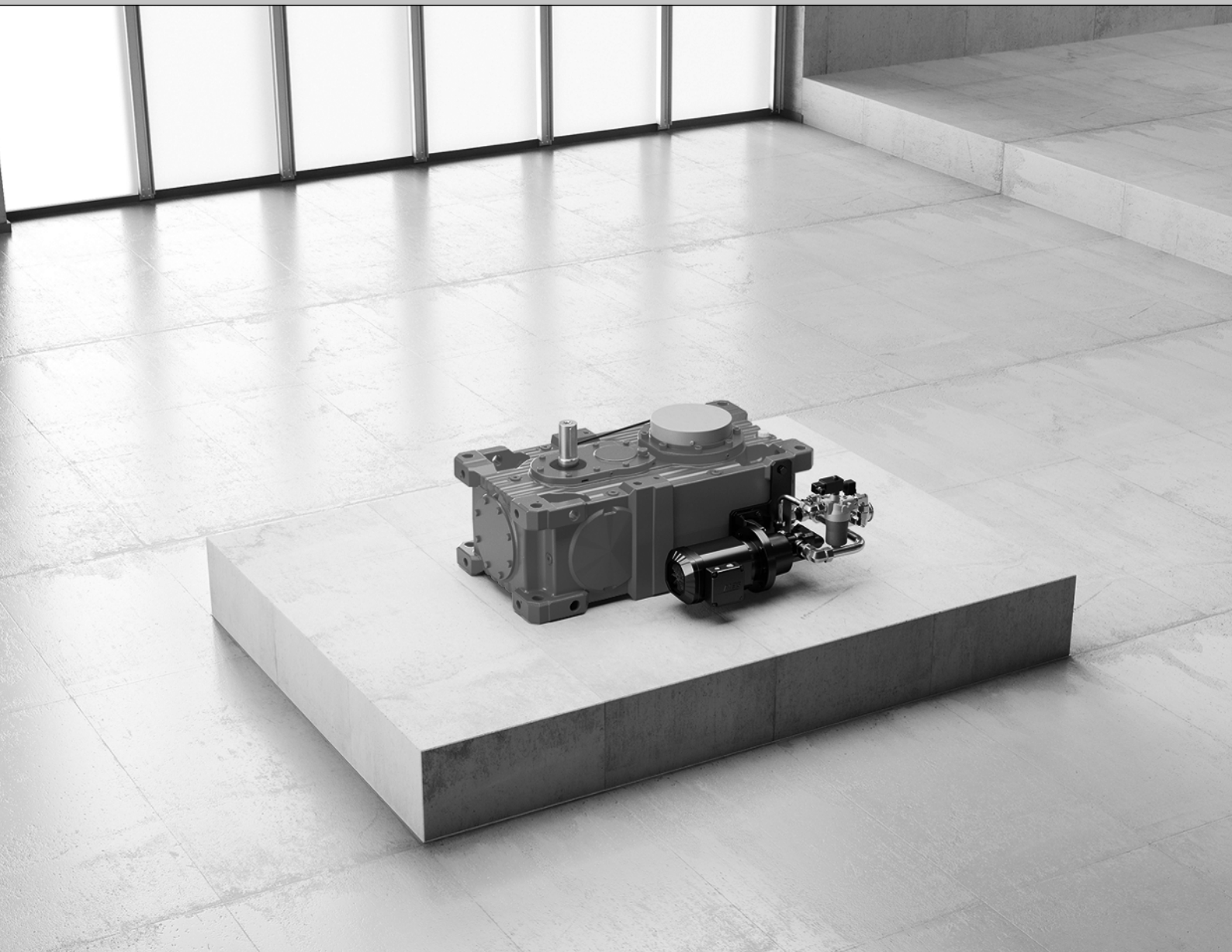




SEW
EURODRIVE

Assembly and Operating Instructions



Industrial Gear Units
Motor Pump for Pressure Lubrication /ONP1



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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 graduation and meaning of the signal words in the warnings:

Signal word	Meaning	Consequences if not observed
▲ DANGER	Imminent danger	Death or severe injuries
▲ WARNING	Possible, dangerous situation	Death or severe injuries
▲ CAUTION	Possible, dangerous situation	Slight 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 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 step.

This is the formal structure of an embedded safety note:

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

1.3 Decimal separator in numerical values

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

Example: 30.5 kg

1.4 Product names and trademarks

The product names mentioned in this documentation are trademarks or registered trademarks of the respective titleholders.

1.5 Recycling and re-use

SEW-EURODRIVE makes sure to keep the use of new natural resources as low as possible in the manufacture of its products. A key aspect of this is the recycling economy with recycling and re-use of components and materials. Recycling and re-use are only used at SEW-EURODRIVE if the parts obtained from these processes correspond to the quality of new parts.

1.6 Copyright notice

© 2023 SEW-EURODRIVE. All rights reserved. Copyright law prohibits the unauthorized reproduction, modification, distribution and use of this document – in whole or in part.

1.7 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.

1.8 Other applicable documentation

The following documentation should also be observed:

- Operating instructions X..e series helical and bevel-helical gear units
- Order documents, e.g. dimension sheet, order confirmation, etc.
- If required, the operating instructions of the options installed (e.g. DriveRadar®)

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 is 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:

- The national and regional regulations governing safety and the prevention of accidents
- The warning and safety signs on the product
- All other associated project planning documents, installation and startup instructions, as well as wiring diagrams
- Do not assemble, install or operate damaged products
- All system-specific specifications and regulations

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, and 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, and 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 transport, storage, installation, operation and waste disposal may only be carried out by persons who are trained and instructed appropriately. These instructions must enable the persons to carry out the required activities and work steps safely and in accordance with regulations.

2.4 Designated use

The motor pump supplies all bearing points and gearing above the oil sump with oil via a tube system inside 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 a partly completed machine for installation in machinery and systems. In the scope of the EU Directive, you must not put 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

The following documentation should also be observed:

- Operating instructions X..e series helical and bevel-helical gear units
- Order documents, e.g. dimension sheet, order confirmation, etc.
- If required, the operating instructions of the options installed (e.g. DriveRadar®)

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 cause damage.

Possible damage to property.

- During the storage period until startup, the system must be stored free of shocks to prevent damage to the pump, pipes or other mounting options.

INFORMATION



The external oil supply and 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.

Conservation + packaging	Storage location	Storage duration
Standard preservation + standard packaging	Under roof and enclosed at constant temperature and humidity (5 °C < ϑ < 60 °C, < 50% relative humidity). No sudden temperature fluctuations and controlled ventilation with filter (free of dirt and dust). No aggressive vapors or shocks.	Maximum 6 months with intact surface protection.
Long-term preservation + standard packaging	Under roof and enclosed at constant temperature and humidity (5 °C < ϑ < 60 °C, < 50% relative humidity). No sudden temperature fluctuations and controlled ventilation of the storage room with filter (free of dirt and dust). No aggressive vapors or shocks.	Maximum 3 years with regular inspection and checking for intactness.
Long-term preservation + long-term packaging	Under roof, protection against rain, vibration-free.	Maximum 3 years with regular inspection and checking for intactness.

INFORMATION



When storing in tropical areas, ensure adequate protection against insect damage. Contact SEW-EURODRIVE in case of deviating requirements.

3 Motor pump /ONP1

3.1 Functional description

ONP1L pressure lubrication draws the oil from the oil sump using a motor pump to supply all bearing points and gearing above the oil sump with oil via a pipe system inside the gear unit.

The oil pump is switched on shortly before gear unit start and ensures a sufficient oil volume flow during operation regardless of the speed of the gear unit.

The motor pump contains a bypass at the oil pump and at the filter element, which ensures the function of pressure lubrication even with high viscosities via an integrated pressure limiting valve.

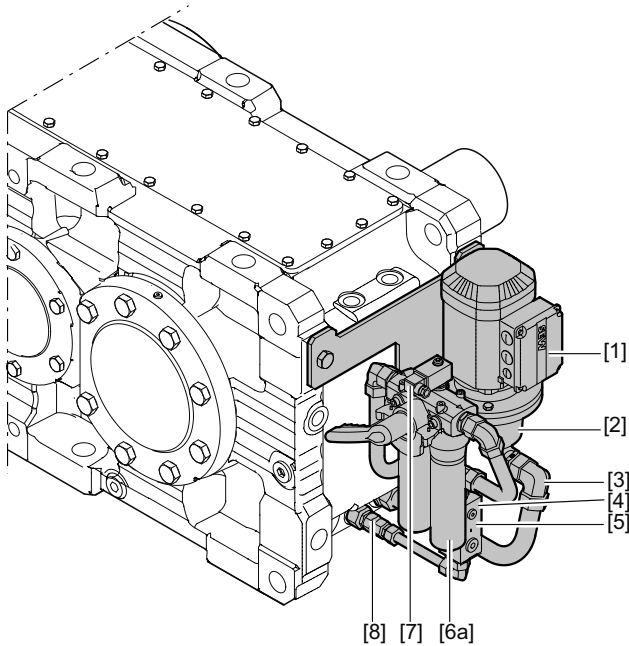
3.2 Structure

The following figures show the gear unit in mounting positions M1 and M5 with the standard mounting surfaces for the motor pump.

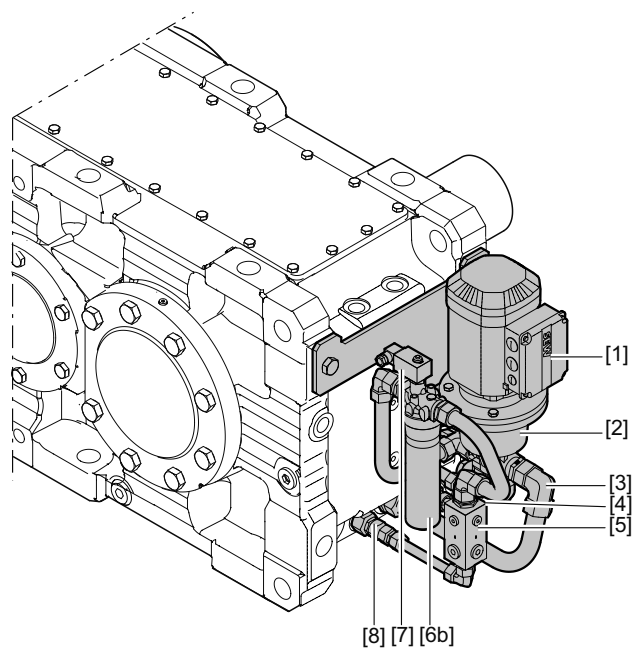
Mounting surfaces deviating from the standard require a new design. This may affect the minimum oil viscosity. A comprehensive individual check is required. Contact SEW-EURODRIVE.

The motor pump is a complete unit directly mounted on the gear unit as standard. The motor pump is delivered with the piping to the gear unit already installed. The electrical wiring must be performed by the user prior to startup.

3.2.1 Gear unit in mounting position M1 – mounting surface: Oil supply system on F6



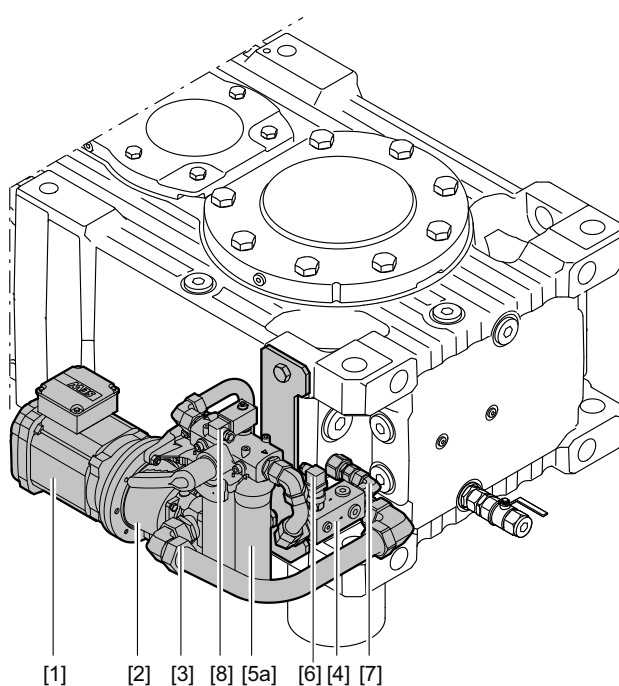
- [1] Motor
- [2] Pump
- [3] Suction pipe
- [4] Pressure switch
- [5] Gauge mounting block



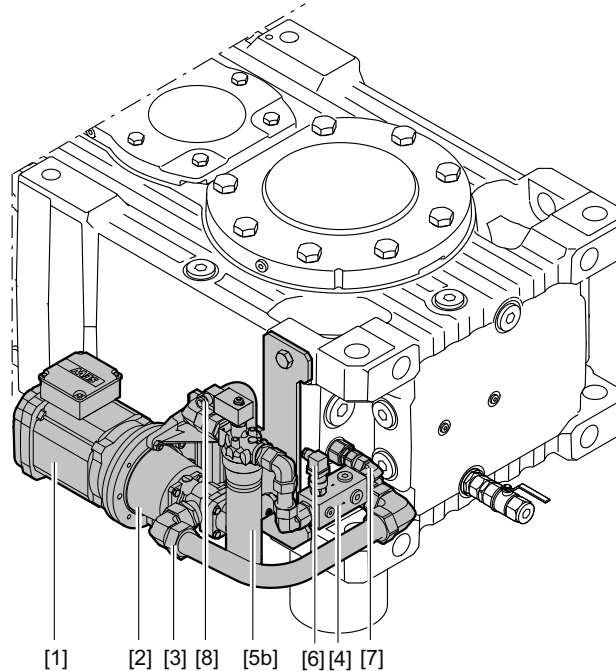
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- [6a] Duplex filter
- [6b] Single filter
- [7] Contamination indicator
- [8] Pressure pipe

3.2.2 Gear unit in mounting position M5 – mounting surface: Oil supply system on F1



- [1] Motor
- [2] Pump
- [3] Suction pipe
- [4] Gauge mounting block
- [5a] Duplex filter



- [5b] Single filter
- [6] Pressure switch
- [7] Pressure pipe
- [8] Contamination indicator

9007218537648651

3.2.3 Scope of delivery

The delivery includes the following:

- Oil pump with directly mounted asynchronous motor (**oil pump always running**)
- Pressure switch that monitors the pump pressure. Warning or switch-off signal when the oil pressure reaches < 0.5 bar.
- Gauge mounting block (pressure switch installed as standard). As standard, the motor pump always comes equipped with a gauge mounting block with pressure switch and integrated check valve.
- Oil filter as single filter with electrical/optical contamination indicator

Optional accessories

The motor pump can be equipped with the following components as an option:

- Temperature switch /NTB with trip point for monitoring the oil sump temperature, i.e. warning or gear unit shutdown at an oil temperature of > 90 °C.
- Oil filter as duplex filter
 - The oil filter is available as single filter or duplex filter. For pressure lubrication systems, a single filter is included as standard.
- For installation on the gauge mounting block, the following is available:
 - Flow switch
 - Manometer
 - Thermometer
 - Pressure sensor

3.3 Function

Observe the following control information for the individual components.

3.3.1 Oil pump

The pump motor has to be switched on 20 s prior to gear unit startup and is always running during operation of the gear unit.

The motor pump has several bypasses to limit the system pressure and maintain the function even at high viscosities; for more information, refer to chapter "Hydraulics plan" (→ 21).

3.3.2 Temperature switch /NTB (optional)

The temperature of the system is monitored using a temperature switch /NTB connected to the controller of the operator.

- At $T > 90\text{ °C}$ → **STOP GEAR UNIT/WARNING**

3.3.3 Filter

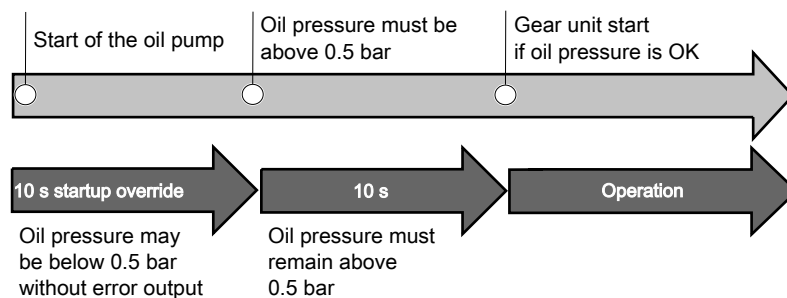
The filter is monitored visually by a pressure deviation indicator, and electrically by a pressure deviation monitoring device.

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

3.3.4 Pressure switch

The pressure switch ensures the function of the pressure lubrication. The latter must be connected and monitored by the customer to prevent serious gear unit damage.

The oil pump is switched on 20 s before the gear unit starts. Within 10 s after the pump starts, an oil pressure of 0.5 bar should be applied to the pressure switch, which indicates a sufficient oil volume flow for the pressure lubrication.

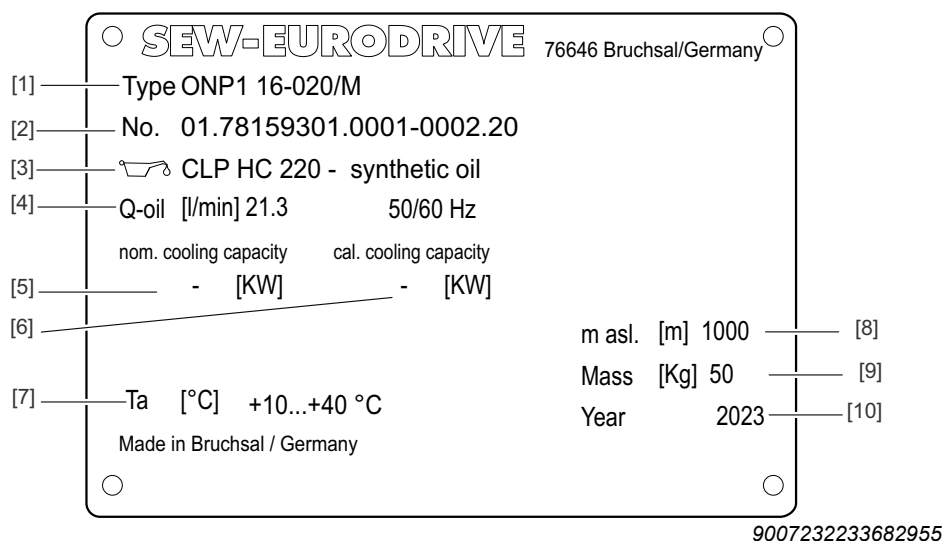


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→ If the oil pressure $p < 0.5\text{ bar}$ → **GEAR UNIT STOP/WARNING**

3.4 Nameplate

The following example shows the structure of the nameplate.



- [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

3.5 Type designation

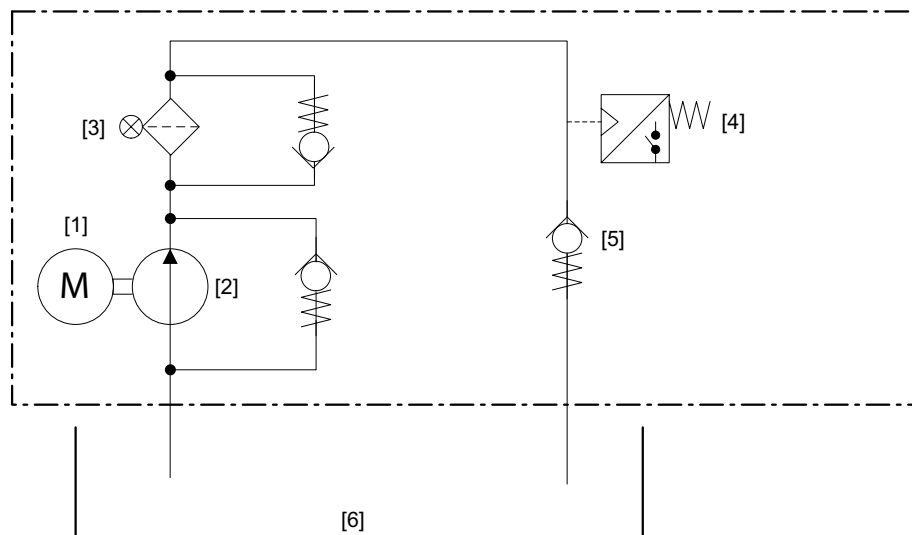
The following example shows the structure of the type designation.

ONP1 12 - 0 0 0 /M	
O	Oil supply system
N	Coolant N = No coolant
P	Type P = Pressure lubrication
1	Generation
12	Pump size 06 – 25
0	Mounting positions 0 = M1 1 = M5
0	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 = For separate installation

3.6 Hydraulics plan

3.6.1 Motor pump with single filter

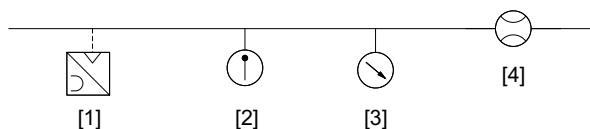
The following figure shows an example of the structure of the motor pump.
In the standard design the motor pump is designed with a single filter.



27021617061611787

- | | |
|-------------------|---------------------|
| [1] Motor | [4] Pressure switch |
| [2] Oil pump | [5] Check valve |
| [3] Single filter | [6] Gear unit |

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



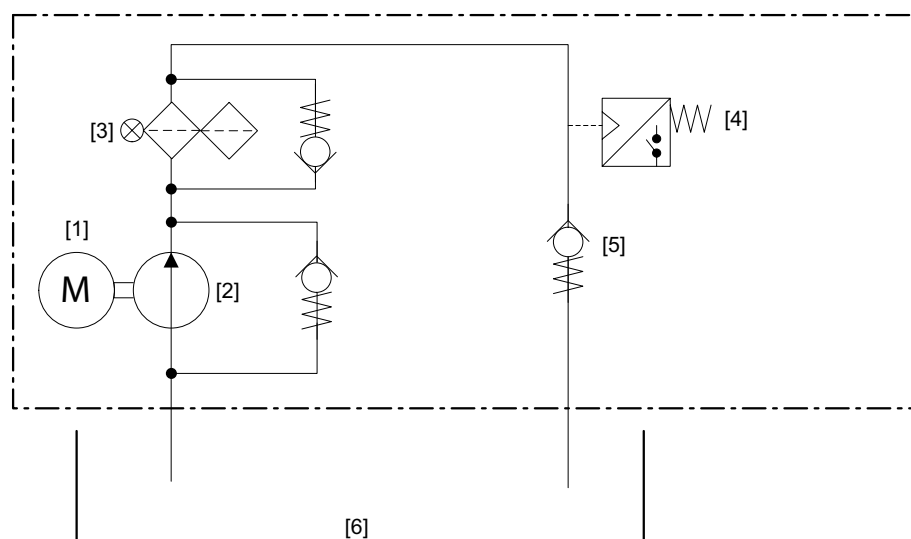
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- | | |
|---------------------|-----------------|
| [1] Pressure sensor | [3] Manometer |
| [2] Thermometer | [4] Flow switch |

3.6.2 Motor pump with duplex filter

The following figure shows an example of the structure of the motor pump.

The motor pump is optionally designed with a duplex filter.



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[1] Motor

[4] Pressure switch

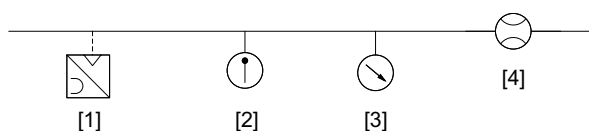
[2] Oil pump

[5] Check valve

[3] Duplex filter

[6] Gear unit

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



9007218072662539

[1] Pressure sensor

[3] Manometer

[2] Thermometer

[4] Flow switch

3.7 Technical data

The performance data of the standardized motor pump is summarized in the following table.

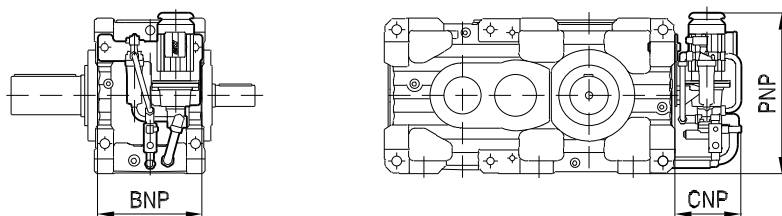
Size ONP1	Size oil pump	Motor data			Connected load motor oil pump in kW	Global motor in Hz	Pump capacity at 1500 1/min
		Type	IEC standard	Number of poles			
6	KF 6 RF	DRN	80MK	4	0.55	50/60	8.4
8	KF 8 RF	DRN	80MK	4	0.55	50/60	10.5
10	KF 10 RF	DRN	80M	4	0.75	50/60	13.7
12	KF 12 RF	DRN	90S	4	1.1	50/60	17.1
16	KF 16 RF	DRN	90S	4	1.1	50/60	21.8
20	KF 20 RF	DRN	90L	4	1.5	50/60	27.1
25	KF 25 RF	DRN	100ML	4	2.2	50/60	34.0

3.8 Dimension sheets

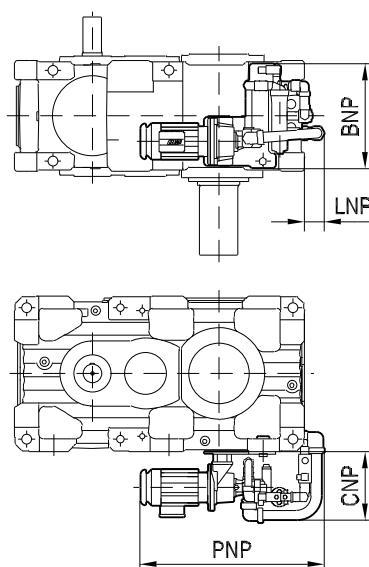
3.8.1 Motor pump /ONP1 [mm]

ONP1.. -00/M

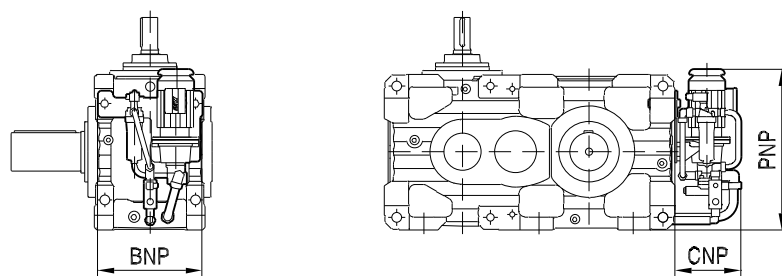
48 001 00 18

→  74**ONP1.. -10/M**

48 003 00 18

**ONP1.. -00/M**

48 005 00 18



Mounting position M1

Gear unit	ONP1	BNP	CNP	PNP	Weight kg
X160 – 170	08–00/M	395	284	596	28
X180 – 190	10–00/M	457	401	691	32
X200 – 210		497	401	705	
X220 – 230		519	401	772	
X240 – 250		604	415	954	
X260 – 270		680	415	956	
X280		680	415	956	
X160 – 170	12–00/M	395	293	596	32
X180 – 190		457	401	691	
X200 – 210		497	401	705	
X290 – 300		745	415	966	
X310 – 320		810	415	1014	
X160 – 170	16–00/M	395	293	596	38
X180 – 190		457	401	691	
X200 – 210		497	401	705	
X220 – 230		519	401	772	
X240 – 250		604	415	954	
X260 – 270		680	415	956	
X280		680	415	956	
X290 – 300		745	415	966	
X220 – 230	20–00/M	519	401	772	41
X240 – 250		604	415	954	
X260 – 270		680	415	956	
X280		680	415	956	
X310 – 320		810	415	1014	
X290 – 300	25–00/M	745	415	966	59
X310 – 320		810	415	1014	

Mounting position M5

Gear unit	ONP1	BNP	CNP	LNP	PNP	Weight kg
X140 – 150	06-10/M	350	267	68	659	28
X160 – 170	08-10/M	413	293	31	615	32
X180 – 190		460	366	66	942	
X200 – 210		500	366	70	982	
X220 – 230		510	366	70	996	
X240 – 250		585	366	70	1013	
X260 – 270		663	366	60	1002	
X280		663	366	60	1002	
X160 – 170	10-10/M	413	293	31	615	32
X180 – 190		460	258	40	866	
X200 – 210		500	366	70	982	
X220 – 230		510	366	70	996	
X240 – 250		585	366	70	1013	
X260 – 270		663	366	60	1002	
X280		663	366	60	1002	
X290 – 300	12-10/M	760	366	45	1031	37
X310 – 320		826	385	40	1043	
X160 – 170		413	293	31	615	
X180 – 190		460	258	40	866	
X200 – 210		500	366	70	982	
X220 – 230		510	366	70	996	
X240 – 250		585	366	70	1013	
X260 – 270	16-10/M	663	366	60	1002	38
X280		663	366	60	1002	
X290 – 300		760	366	45	1031	
X310 – 320		826	385	40	1043	
X180 – 190		460	258	40	866	
X200 – 210		500	366	70	982	
X220 – 230		510	366	70	996	
X240 – 250	20-10/M	585	366	70	1013	41
X260 – 270		663	366	60	1002	
X280		663	366	60	1002	
X290 – 300		760	366	45	1031	
X310 – 320	25-10/M	826	385	40	1043	59
X290 – 300		760	366	45	1031	
X310 – 320		826	385	40	1043	

3.9 Interlocking specifications

3.9.1 Gear unit enable

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

- Oil pressure $p > 0.5$ bar (startup delay of 10 s)
- Oil temperature $T < 90$ °C (optional)

3.9.2 STOP gear unit/warning

Gear unit STOP/warning if one of the following conditions is met:

- Oil pressure $p < 0.5$ bar
- Oil temperature $T > 90$ °C (optional)

4 Installation/assembly

4.1 Mechanical connection

Connect the motor pump to the lubrication circuit according to the identifying markings and observing local regulations.

In this respect, observe the following basic conditions:

- Do not reduce the specified cable cross section.
- It is important that you choose the correct wall thickness and material when selecting pipes, hoses and screw fittings.

4.2 Electrical connection

Observe country-specific regulations during the electrical connection.

With the standard design, connect the following components:

- Pump motor
- Pressure switch
- Contamination indicator of the oil filter

Observe the following notes.

- Ensure that the oil pump rotates in the correct direction.
- Observe the motor data sheet.
- The pump motor has to be switched on 20 s prior to gear unit startup and is always running during operation of the gear unit.
- The pressure switch issues a warning signal when the pressure drops below 0.5 bar.
- The contamination indicator of the oil filter indicates the replacement requirement of a dirty filter element and can also be electrically connected and monitored.
- When using a Pt100 temperature sensor, or a NTB temperature switch it must be integrated into the controller in such a way that the following conditions are met:
 - Either a warning signal is issued or the main drive is switched off when the oil temperature reaches 90 °C.

When using options:

- Connect the flow switch to the operator's control.

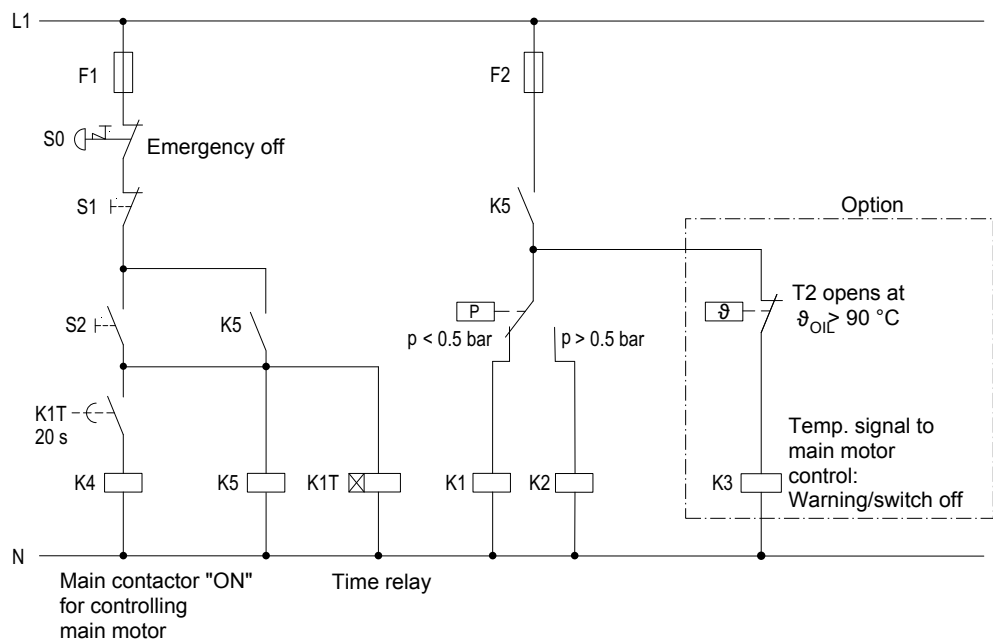
4.3 Wiring diagram (schematic illustration)

The wiring diagrams show an example of a possible structure of the control for the oil-water cooler when using a temperature switch /NTB or a Pt100 temperature sensor.

Use the wiring diagrams according to the structure of the oil-water cooler.

The pressure switch can be connected to the DriveRadar® condition monitoring system. This means that pressure lubrication can additionally be monitored via the DriveRadar® IoT Suite. For this purpose, connect an auxiliary contact (NO contact K2) to one of the digital inputs of the EPU-IG. For the corresponding wiring diagram of the digital inputs, refer to the "EdgeProcessingUnit for Industrial Gear Units" operating instructions.

4.3.1 Control circuit with optional temperature switch /NTB

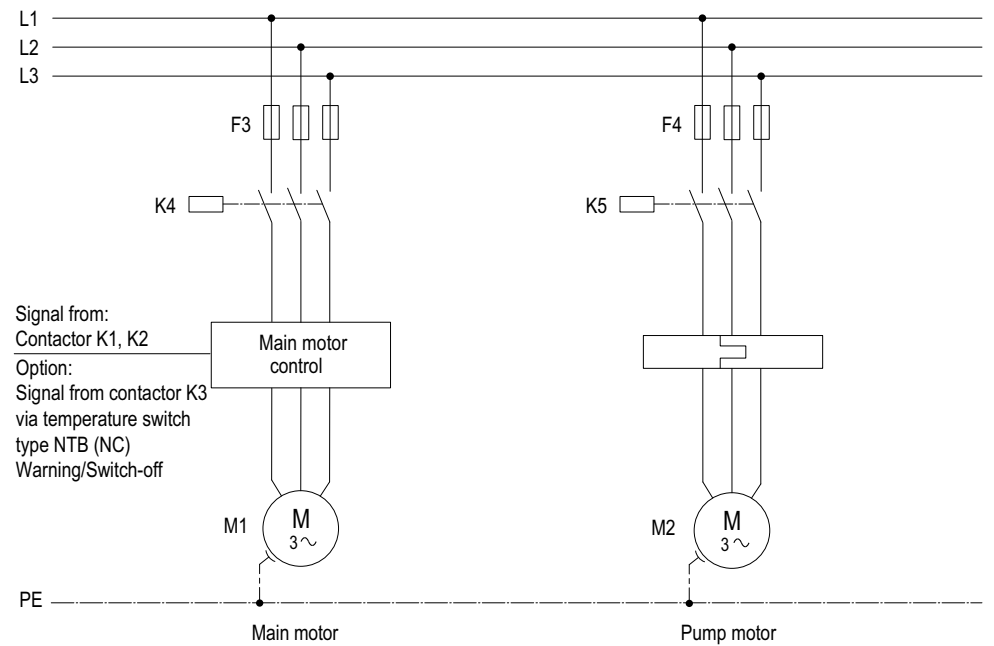


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4 Installation/assembly

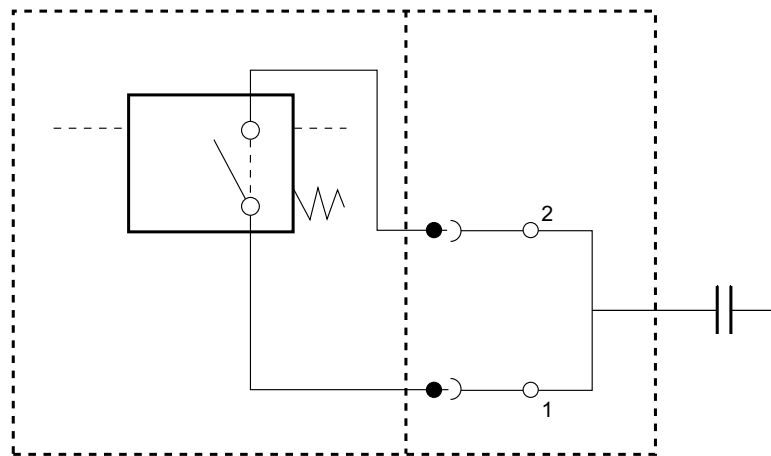
Wiring diagram (schematic illustration)

4.3.2 Main circuit



4.4 Electrical/optical contamination indicator of the oil filter

4.4.1 Electrical connection



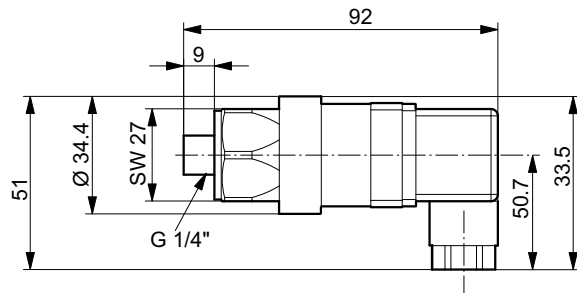
5900838539

4.4.2 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

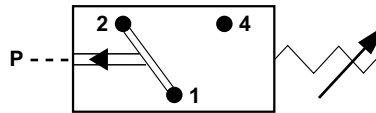
4.5 Pressure switch

4.5.1 Dimensions



721994635

4.5.2 Electrical connection



722003723

- [1] [2] NC contact
[1] [4] NO contact

4.5.3 Technical data

- Switching pressure: 0.5 ± 0.2 bar
- Maximum switching capacity: 4 A – AC 250 V; 4 A – DC 24 V
- Plug connector: DIN EN 175301-803
- The tightening torque for the retaining screw in the back of the plug connector for electrical connection is 0.25 Nm.

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 oil in use, and on the oil temperature in the oil pipes/hoses and in the oil pump. Observe chapter "Permitted lubricants" (→ 37).

When the oil cooling system is used at low ambient temperatures, the cooling system might have to be adjusted. 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 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 motor pump which has to be filled into the gear unit additionally.

Size	Lubricant fill quantity in liters
ONP1 6	1.0
ONP1 8	
ONP1 10	
ONP1 12	
ONP1 16	1.5
ONP1 20	
ONP1 25	

5 Startup

5.1 Notes

NOTICE

Improper startup of gear units with pressure lubrication can damage the gear unit.

Possible damage to property.

- Observe the following information

- Prior to startup, make sure that monitoring devices (pressure switch, flow switch, temperature switch /NTB etc.) are fully operational.
- Do not start up the gear unit if the pressure switch is not connected.
- Before starting up the gear unit for the first time and after each oil change, the oil pump must run for at least 10 minutes to fill all oil chambers. Then switch the oil pump off again and check the oil level within a short period of time. Correct the oil level if necessary.
- Note that the oil pump must run 20 seconds before starting up the gear unit.
- When operating the gear unit with oil pump at lower ambient temperatures, note that it might be necessary to use an oil heater. For more information, refer to chapter "Limit temperature for startup of the oil cooling system" (→ 33).

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.

6 Inspection/maintenance

6.1 Inspection and maintenance intervals

Adhere to the following inspection and maintenance intervals.

Time interval	What is to be done?
Depending on the operating conditions, at least every 12 months	Check the condition of the motor pump, replace 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 6 years from the date of manufacture printed on them.

6.2 Notes



▲ WARNING

Risk of crushing if the drive starts up unintentionally.
Severe or fatal injuries.

- Work on the gear unit only when the machine is not in use. Secure the drive unit against unintentional power-up. Attach 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 unit oil.
Severe injuries.

- Allow the gear unit and the oil cooling system to 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

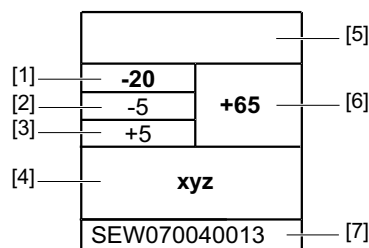
Hoses and hose pipes are subject to natural aging even if they are properly stored and used. This is why the period of use is limited.

- The period of use of hose pipes should not exceed 6 years from the date of manufacture printed on them.
- The operator of the system 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.

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 case of lower 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 chapter "Explanations on the oil supply system / oil cooling systems and oil viscosity".
- 2) Service life is significantly reduced when exceeded. Note the contents of the 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. Refer to www.sew-eurodrive.de/lubricants for the latest version of the table.

[1]	[2]	SEW EURODRIVE	Castrol	FUCHS	Mobil	KLÜBER LUBRICATION	SINOPEC	TOTAL
CLP	VG 150	SEW GearOil Base 150 E1 / US1 / CN1 / BR1	-20 -15 0 +5 +65 Optigear BM 150	-20 -15 0 +5 +65 Renolin CLP 150 Plus	-20 -15 0 +5 +65 Mobilgear 600 XP 150	-20 -15 0 +5 +65 Klüberoil GEM 1-150 N	-20 -15 0 +5 +65 AP-SGO 150	
		SEW070040013		SEW070030013	SEW070030013		SEW070030013	
	VG 220	SEW GearOil Base 220 E1 / US1 / CN1 / BR1	-15 0 +5 +75 Optigear BM 220	-15 0 +5 +75 Renolin CLP 220 Plus	-15 0 +5 +75 Mobilgear 600 XP 220	-15 0 +5 +75 Klüberoil GEM 1-220 N	-15 0 +5 +75 AP-SGO 220	Carter EP 220
		SEW070040013		SEW070030013	SEW070030013		SEW070030013	
	VG 320	SEW GearOil Base 320 E1 / US1 / CN1 / BR1	-10 -5 +5 +85 Optigear BM 320	-10 -5 +5 +85 Renolin CLP 320 Plus	-10 -5 +5 +85 Mobilgear 600 XP 320	-10 -5 +5 +85 Klüberoil GEM 1-320 N	-10 -5 +5 +85 AP-SGO 320	Carter EP 320
		SEW070040013		SEW070030013	SEW070030013		SEW070030013	
	VG 460	SEW GearOil Base 460 E1 / US1 / CN1 / BR1	-5 -10 +5 +90 Optigear BM 460	-5 -10 +5 +90 Renolin CLP 460 Plus	-5 -10 +5 +90 Mobilgear 600 XP 460	-5 -10 +5 +90 Klüberoil GEM 1-460 N	-5 -10 +5 +90 AP-SGO 460	Carter EP 460
		SEW070040013		SEW070030013	SEW070030013		SEW070030013	
	VG 680	SEW GearOil Base 680 E1 / US1 / CN1 / BR1	0 +5 +90 Optigear BM 680	0 +5 +90 Renolin CLP 680 Plus	0 +5 +90 Mobilgear 600 XP 680	0 +5 +90 Klüberoil GEM 1-680 N	0 +5 +90 AP-SGO 680	Carter EP 680
		SEW070040013		SEW070030013	SEW070030013		SEW070030013	
	VG 1000		+5 +20 +30 +90 Optigear BM 1000					

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

[1]	[2]								
	VG 32 ¹⁾				-40 -30 -25 +30 SHC 624				
	VG 68 ¹⁾				-40 -25 -15 +50 SHC 626	-35 -20 -10 +50 Klüber synth GEM 4-68 N			
	VG 150 ¹⁾	-35 -15 -5 +75 GearOil Synth 150 E1	-25 -10 0 +70 Alpha syn EP 150	-30 -10 0 +70 Optigear Synthetic X 150	-30 -10 0 +75 SHC 629	-25 -10 0 70 Klüber synth GEM 4-150 N	-30 -10 0 +75 Omala S4 GX 150	-35 -15 -5 +75 Carter SH 150	
	VG 220	-30 -10 0 +85 GearOil Synth 220 E1	-25 -5 +5 +80 Alpha syn EP 220	-25 -5 +5 +80 Optigear Synthetic X 220	-25 -5 +5 +85 SHC 630	-25 -5 +5 +80 Klüber synth GEM 4-220 N	-25 -5 +5 +85 Omala S4 GX 220	-25 -5 +5 +80 Carter SH 220	
CLP HC	VG 320	-25 -5 +5 +100 GearOil Synth 320 E1	-20 0 +10 +90 Alpha syn EP 320	-20 0 +10 +90 Optigear Synthetic X 320	-20 0 +10 +95 SHC 632	-20 -5 +10 +95 Klüber synth GEM 4-320 N	-20 0 +10 +95 Omala S4 GX 320	-20 0 +10 +90 Carter SH 320	
	VG 460	-20 0 +15 +110 GearOil Synth 460 E1	-15 +5 +15 +100 Alpha syn EP 460	-15 +5 +15 +100 Optigear Synthetic X 460	-15 +5 +15 +105 SHC 634	-15 +5 +20 +105 Klüber synth GEM 4-460 N	-15 +5 +15 +105 Omala S4 GX 460	-15 +5 +15 +100 Carter SH 460	
	VG 680	-15 +5 +20 +110 GearOil Synth 680 E1		-10 +10 +25 +110 Optigear Synthetic X 680	-10 +10 +25 +110 Renolin Unisyn CLP 680	-10 +10 +25 +110 SHC 636	-10 +10 +25 +110 Klüber synth GEM 4-680 N	-10 +10 +25 +110 Omala S4 GX 680	-10 +10 +25 +110 Carter SH 680
	VG 1000	SEW 070040313				-10 +15 +30 +110 SHC 639	-10 +15 +30 +110 SHC Gear 1000	0 +20 +30 +110 Klüber synth EG4-1000	

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

[1]	[2]	[3]	SEW EURODRIVE	bremser & leguit	Castrol	FUCHS	KLÜBER LUBRICATION
		VG 68 ¹⁾		-35 -20 -10 +45 Cassida Fluid HF 68	-40 -25 -15 +45 Optileb HY 68	-35 -20 -10 +45 Cassida Fluid HF 68	-35 -20 -10 +45 Klüberoil 4UH1-68 N
	CLP HC ₂ NSF H1	VG 220 ¹⁾	-30 -5 0 +80 SEW GearOil Synth 220 H1 E1 SEW 070040313	-20 -5 +5 +75 Cassida Fluid GL 220	-25 -5 +5 +75 Optileb GT 220 SEW 0700403113	-20 -5 +5 +75 Cassida Fluid GL 220	-25 -5 +5 +75 Klüberoil 4UH1-220 N
		VG 460 ¹⁾	-20 0 +15 +100 SEW GearOil Synth 460 H1 E1 SEW 070040313	-15 +5 +20 +90 Cassida Fluid GL 460	-15 +5 +20 +95 Optileb GT 460 SEW 070040313	-15 +5 +20 +90 Cassida Fluid GL 460	-15 +5 +15 +95 Klüberoil 4UH1-460 N
		VG 680 ¹⁾		-10 +10 +25 +105 Cassida Fluid GL 680		-10 +10 +25 +105 Cassida Fluid GL 680	-10 +10 +25 +105 Klüberoil 4UH1-680 N
		VG 320				-20 0 +10 +8a5 Plantogear 320 S	-20 0 +10 +85 Klüberbio EG2-320
	E	VG 460				-15 +5 +15 +95 Plantogear 460 S	-15 +5 +15 +95 Klüberoil 4UH1-460 N

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1) Lubricants may only be used if the service factor F_s and peak load factor $F_F \geq 1.6$.

The peak output torque M_{K2per} is limited as follows: $F_F \geq 1.6 \rightarrow M_{K2per} \leq 1.25 \times M_{N2}$ (nominal torque) $\rightarrow$

$$M_{K2per} \leq 2 \times M_{N2} / F_F = 2 / 1.6 \times M_{N2}$$

In case of deviations, contact SEW-EURODRIVE.

2) NSF-H1 registered oils for the food processing industry cannot be combined with the gear unit option "Extended storage" (a VCI anti-corrosion agent is added).

NOTICE:

The thermal operating limits of the oil seal materials must also be taken into account, see chapter "Lubricant compatibility with oil seal".

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 motor	- Fill 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 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
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
Pressure switch not switching	- Air in the suction line of the oil pump - Pressure switch connected incorrectly - Pressure switch defective - Oil pump defective	- Fill suction pipe and oil pump with oil - Vent the pump at the pressure side - Check the connection - Replace pressure switch - Contact SEW-EURODRIVE

8.3 Service

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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MAHLE Industrialfiltration is now Filtration Group. For more information, visit industrial.filtrationgroup.com

Low Pressure Filter Pi 200

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

1. Features

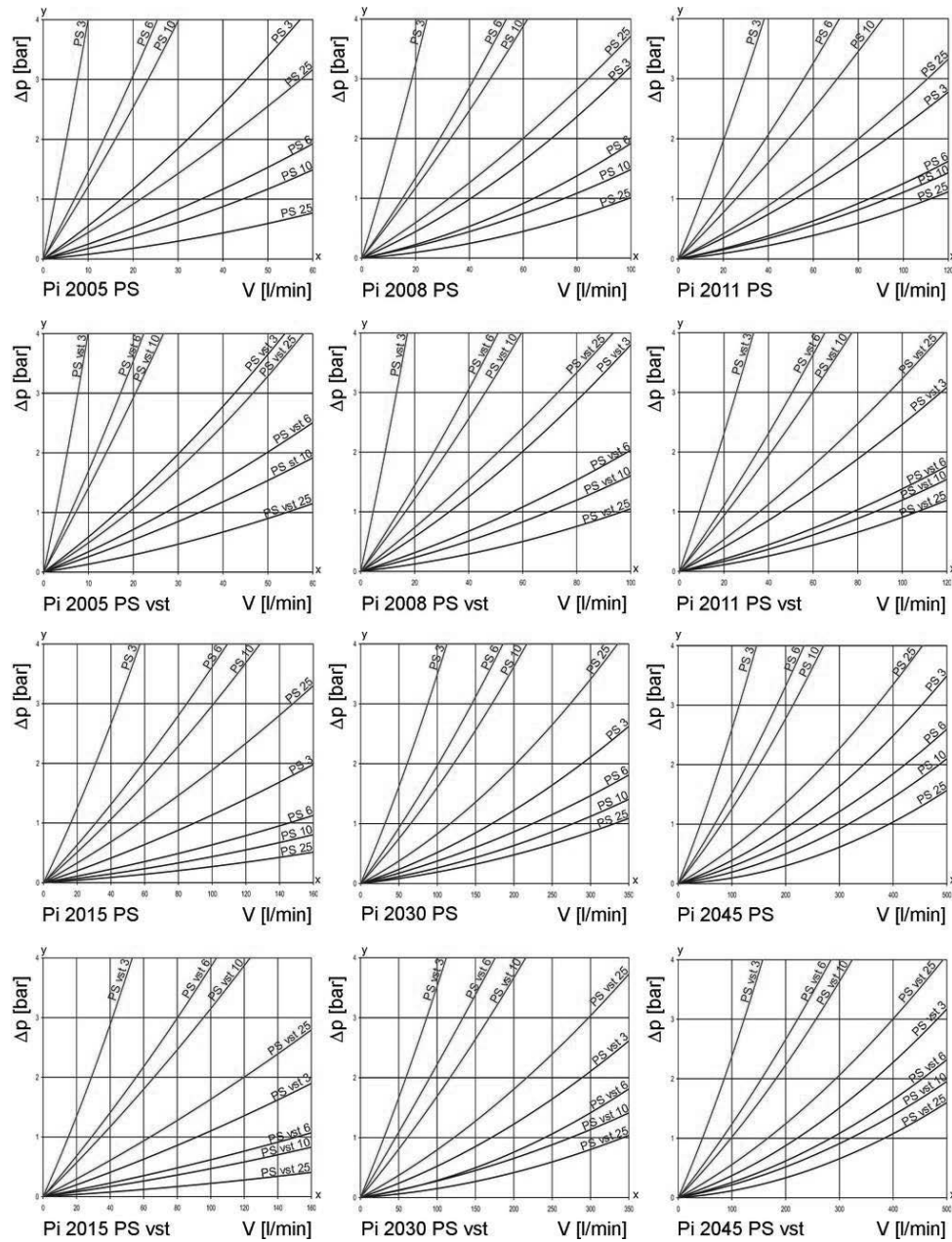
High performance filters for modern hydraulic systems

- 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

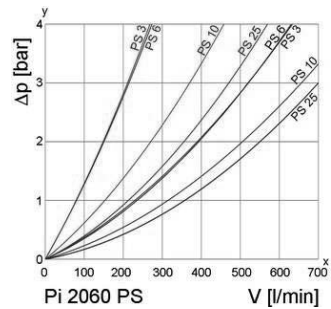


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 190 mm²/s
 33 mm²/s

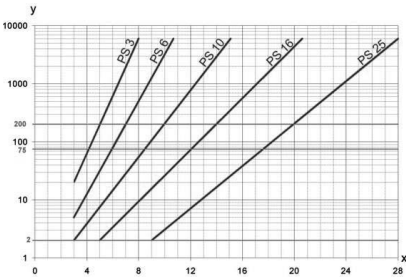


2



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

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

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

5. Quality assurance

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

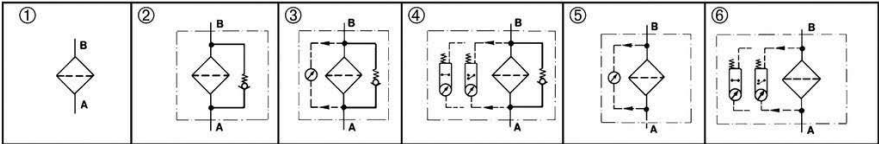
Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
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

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	β _{5(C)}	≥ 200	PS vst	3	β _{5(C)}	≥200
PS	6	β _{7(C)}	≥ 200	PS vst	6	β _{7(C)}	≥200
PS	10	β _{10(C)}	≥ 200	PS vst	10	β _{10(C)}	≥200
PS	25	β _{20(C)}	≥ 200	PS vst	25	β _{20(C)}	≥200
values guaranteed up to 10 bar differential pressure				values guaranteed up to 20 bar differential pressure			

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						

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.

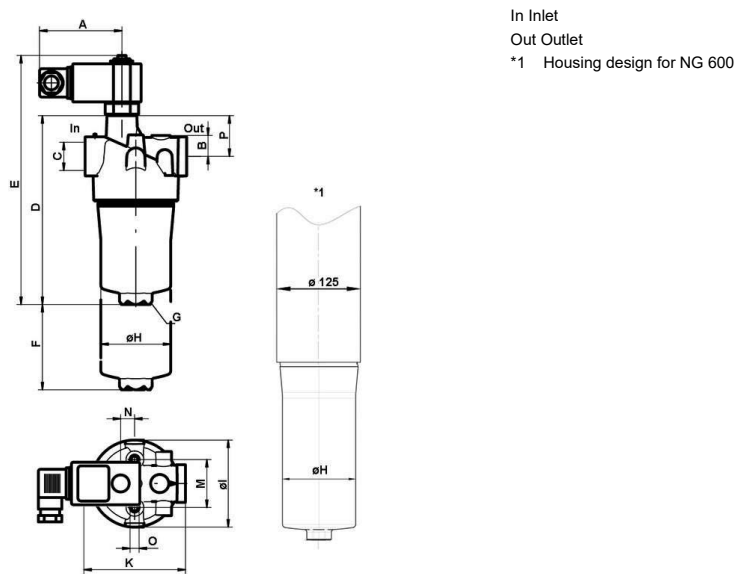
We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids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

Subject to technical alteration without prior notice.

Low Pressure Filter Pi 200 up to NG 600

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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	177	235	80	27	66	80	95	45	13.0	M8x10	37,5	0.9
Pi 2008	78	19	G¾	253	311	80	27	66	80	95	45	13.0	M8x10	37,5	1.0
Pi 2011	78	19	G¾	335	393	80	27	66	80	95	45	13.0	M8x10	37,5	1.2
Pi 2015	78	30	G1¼	244	302	110	32	109	128	150	60	24.5	M12x15	43,5	2.1
Pi 2030	78	30	G1¼	360	418	110	32	109	128	150	60	24.5	M12x15	43,5	2.4
Pi 2045	78	30	G1¼	475	533	110	24	109	128	150	60	24.5	M12x15	43,5	6.5
Pi 2060	78	30	G1¼	615	643	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?

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. 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.
3. Please always ensure that you have original Filtration Group spare elements in stock: Disposable elements cannot be cleaned.

10.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
3. Remove element by pulling down carefully.
4. Check O-ring on the filter housing for damage. Replace, if necessary.
5. 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.
6. 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 = 30 Nm, for NG 150 to 600 = 50 Nm.

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78356446.05/2020

Low Pressure Filter Pi 200 up to NG 600



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
	FPM	77845811
③	Maintenance indicator	
	Visual PIS 3098/2,2	77669971
	Electrical PIS 3097/2,2	77669948
	Electrical upper section only	77536550
④	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

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MAHLE Industrialfiltration is now Filtration Group. For more information, visit industrial.filtrationgroup.com

Duplex Filter Pi 210/Pi 212*

Nominal pressure 32/63 bar (460/900 psi), nominal size up to 600
* Direction of flow from right to left

1. Features

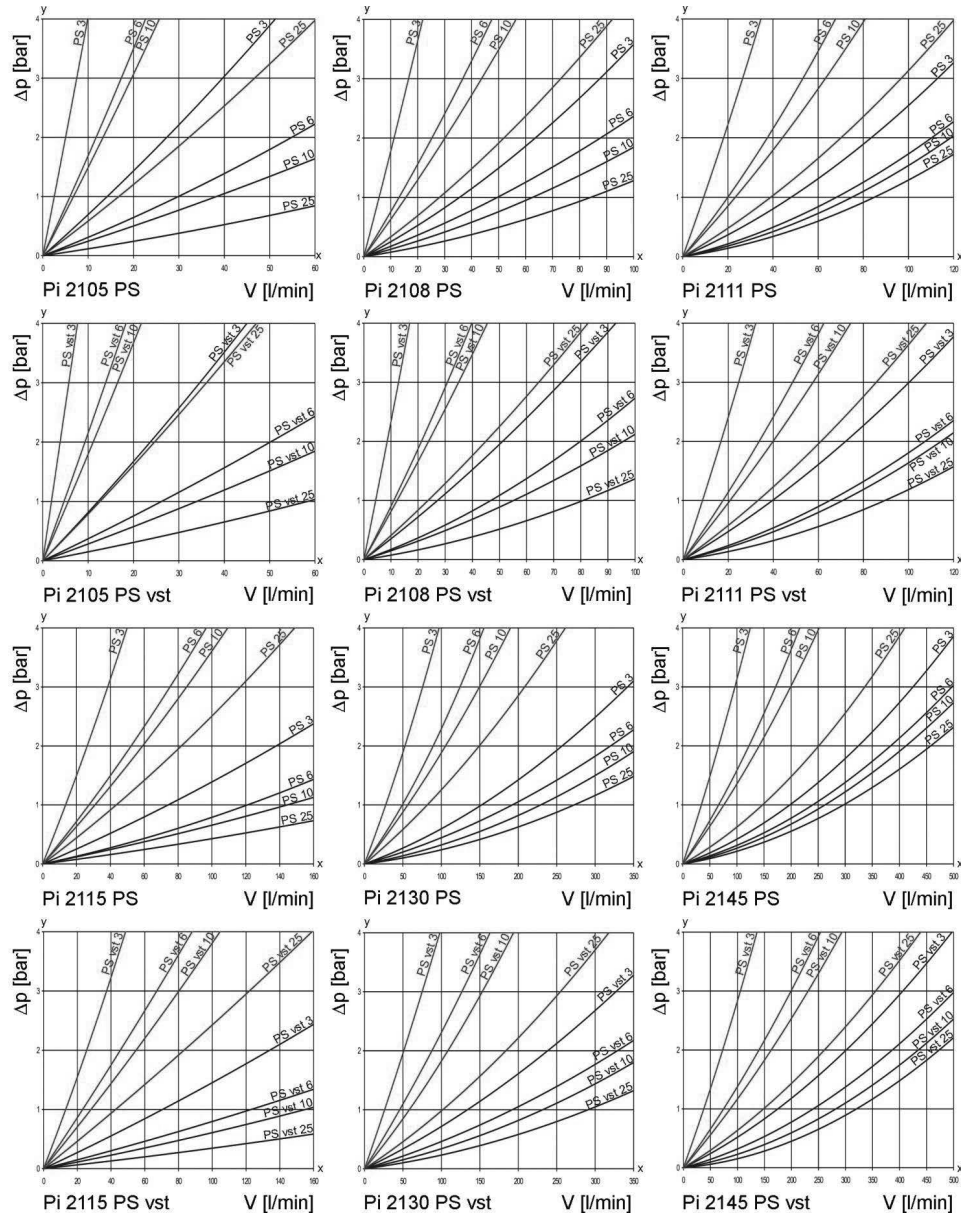
High performance filters for modern hydraulic systems

- 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

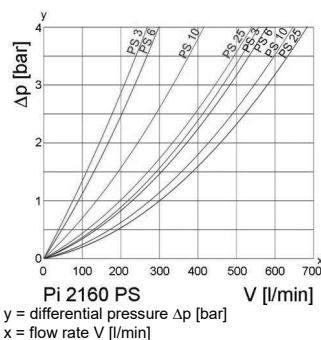
 190 mm²/s
 33 mm²/s



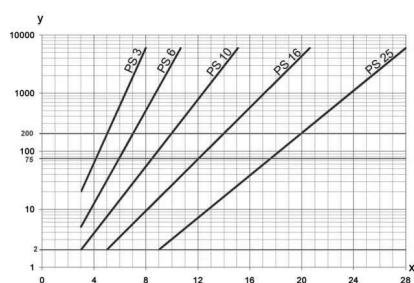
y = differential pressure Δp [bar]

x = flow rate V [l/min]

Pressure drop curves $P_{i2105}/P_{i2108}/P_{i2111}$ correspond to $P_{i21205}/P_{i21208}/P_{i21211}$ respectively.



3. Separation grade characteristics



determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

PS elements with max. Δp 20 bar			PS vst elements with max. Δp 210 bar		
PS	3 $\beta_{5/C}$	≥ 200	PS vst	3 $\beta_{5/C}$	≥ 200
PS	6 $\beta_{7/C}$	≥ 200	PS vst	6 $\beta_{7/C}$	≥ 200
PS	10 $\beta_{10/C}$	≥ 200	PS vst	10 $\beta_{10/C}$	≥ 200
PS	25 $\beta_{20/C}$	≥ 200	PS vst	25 $\beta_{20/C}$	≥ 200

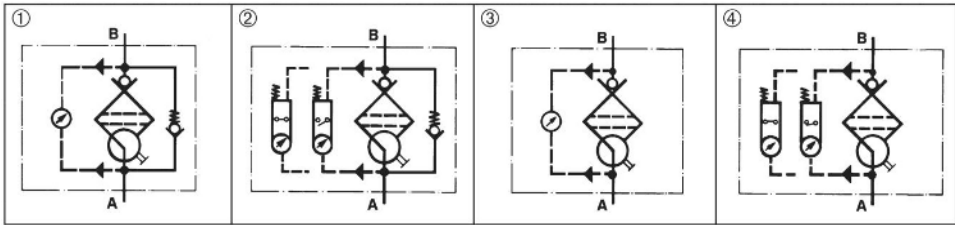
values guaranteed up to
10 bar differential pressure

values guaranteed up to
20 bar differential pressure

Filtration Group 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.
Housing versions Pi 212 on request.

7.2 Filter elements *					
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
	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

* a wider range of element types is available on request

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

Nominal pressure:

Pi 2105 - Pi 2111

Pi 21205 - Pi 21211

Pi 2115 - Pi 2160

10[^]7 load changes

63 bar (900 psi)

10[^]7 load changes

25 bar (360 psi)

2x 10[^]6 load changes

32 bar (460 psi)

Test pressure:

Pi 2105 - Pi 2111

Pi 21205 - Pi 21211

Pi 2115 - Pi 2160

95 bar (1370 psi)

48 bar (690 psi)

Temperature range:

-10 °C to +120 °C

survival temperature -40 °C

(other temperature ranges on request)

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 %

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

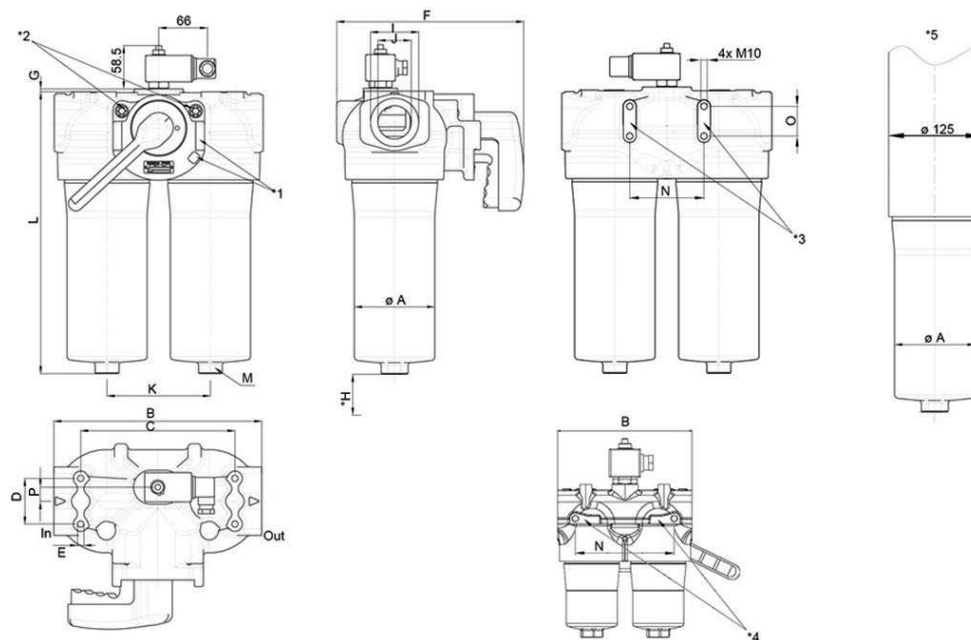
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance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

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 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.

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
(WB version)

*4 Optional fixing for NG 50 to 110
(WB version)

*5 Housing version for NG 600

All dimensions except "J" in mm

All dimensions except J in mm																	
Type	A	B	C	D	E	F	G	H	I	J*	K	L**	M SW	N	O	P	Wt. [kg]
Pi 2105	66	172	100	52	M8x16	189	-	80	47	G1	85	203	27	128	-	16	2.60
Pi 2108	66	172	100	52	M8x16	189	-	80	47	G1	85	261	27	128	-	16	2.90
Pi 2111	66	172	100	52	M8x16	189	-	80	47	G1	85	351	27	128	-	16	3.30
Pi 2115	109	283	210	62	M10x20	252	4	110	65	G1½	140	264	32	100	40	19	8.50
Pi 2130	109	283	210	62	M10x20	252	4	110	65	G1½	140	385	32	100	40	19	9.50
Pi 2145	109	283	210	62	M10x20	252	4	110	65	G1½	140	497	32	100	40	19	17.25
Pi 2160	109	283	210	62	M10x20	252	4	110	65	G1½	140	636	32	100	40	19	15.50

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

** Not shown drain screw at NG 450 and NG 600 is part of dimension "L"

Dimensions Pi 21205/Pi 21208/Pi 21211 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. 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 Filtration Group spare elements cleaned.

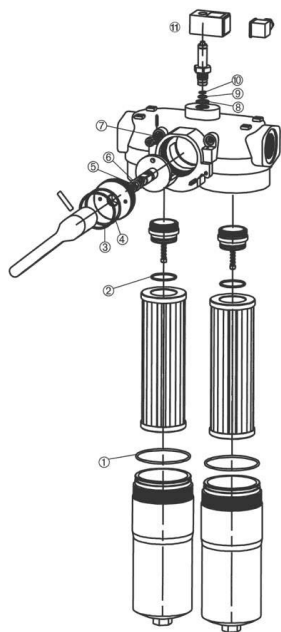
10.4 Element replacement

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 the filter element by gently moving it back and forth downwards.
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 = 30 Nm, for NG 150 to 600 = 50 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 - ⑦	Seal kit for housing Pi 2105 - Pi 2111 Pi 21205 - Pi 21211	
	NBR	79761271
	FPM	79761289
	EPDM	79761297
	Pi 2115 - Pi 2160	
	NBR	79761230
	FPM	79761248
⑧ - ⑩	EPDM	79761255
	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
⑪	EPDM	77760325
	Maintenance indicator	
	Visual PIS 3098/2.2	77669971
	Electrical PIS 3097/2.2	77669948
	Electrical upper section only	77536550

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 78356552.08/2020
 Duplex Filter Pi 210/Pi 212 up to NG 600



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Maintenance Indicators

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 maintenance indicator.

Filtration Group manufactures maintenance indicators of the following designs:

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

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 is 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 exists on the downstream side of the filter element is measured analog. With suction filters the vacuum is measured downstream.

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 magnets mutually repel, until finally the red button on the indicator pops out.

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

This optical function may also be used for generating contactless electrical signals. For this purpose an electrical upper part is pushed over the hydraulic/optical part. This 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
- Rugged, non-bypass design
- Optimal element exploitation
- Worldwide distribution



2. Differential pressure indicators

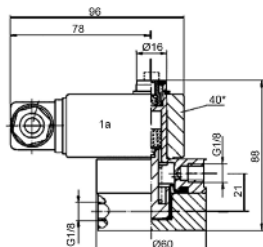


Fig. 1

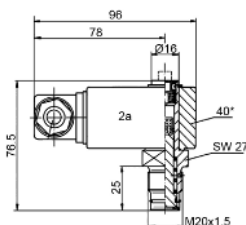


Fig. 2

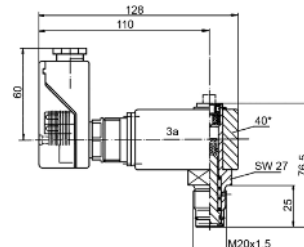


Fig. 3

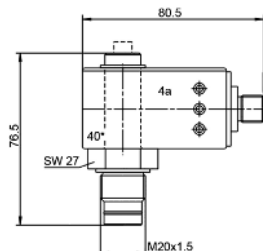


Fig. 4

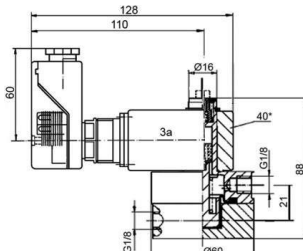


Fig. 15

40° = 40 mm wide

Differential pressure indicators									
Nominal pressure [bar]	Temperature [°C]	Type	Order number	Indicator setting [bar]	Indication	Contact type*	Fig.	Material lower section	Material upper section
10	-30 - +120	PiS 3087	77738990	1.2	visual	-	1	Al	PA 6
		PiS 3086	77737513		visual/electr.	1	1 + 1a		
		PiS 3104	78236994		visual/electr.	4	1 + 3a (15)		
160	-30 - +120	PiS 3097	70328693	1.25	visual/electr.	1	2 + 2a	Al	PA 6
160	-30 - +120	PiS 3098	77669971	2.2	visual	-	2	Al	PA 6
		PiS 3097	77669948		visual/electr.	1	2 + 2a		
		PiS 3116	78308074		visual/electr.	3	2 + 2a		
160	-30 - +120	PiS 3119	78309122	1.7/2.2	visual/electr.	2	2 + 2a	Al	PA 6
		PiS 3012	78308454		visual/electr.	4	3 + 3a		
		PiS 3131	79760869		visual/electr.	5	3 + 3a		
		PiS 3141	79761859		visual/electr.	6	3 + 3a		
		PiS 3151	79761909		visual/electr.	8	4 + 4a		
		PiS 3154	76300339		visual/electr.	9	4 + 4a		
		PiS 3157	76326706		visual/electr.	11	4 + 4a		
160	-30 - +120	PiS 3098	77938582	3.5	visual	-	2	Al	PA 6
		PiS 3097	78236648		visual/electr.	1	2 + 2a		
160	-30 - +120	PiS 3098	77669989	5.0	visual	-	2	Al	PA 6
		PiS 3097	77669955		visual/electr.	1	2 + 2a		
		PiS 3116	78308082		visual/electr.	3	2 + 2a		
160	-30 - +120	PiS 3119	78309130	3.7/5.0	visual/electr.	2	2 + 2a	Al	PA 6
		PiS 3012	78308447		visual/electr.	4	3 + 3a		
		PiS 3157	76326714		visual/electr.	11	4 + 4a		
		PiS 3131	79760877		visual/electr.	5	3 + 3a		
		PiS 3141	79761867		visual/electr.	6	3 + 3a		
		PiS 3151	79761917		visual/electr.	8	4 + 4a		
		PiS 3154	76300321		visual/electr.	9	4 + 4a		

Maintenance Indicators

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Differential pressure indicators									
Nominal pressure [bar]	Temperature [°C]	Type	Order number	Indicator setting [bar]	Indication	Contact-type*	Fig.	Material lower section	Material upper section
400	-30 - +120	PiS 3093	77669898	2.2	visual	-	2	CuZn	PA 6
		PiS 3092	77669856		visual/electr.	1	2 + 2a		
		PiS 3115	78308041		visual/electr.	3	2 + 2a		
400	-30 - +120	PiS 3105	77970387	1.7/2.2	visual/electr.	2	2 + 2a	CuZn	PA 6
		PiS 3102	77942139		visual/electr.	4	3 + 3a		
		PiS 3132	79760919		visual/electr.	5	3 + 3a		
		PiS 3142	79761875		visual/electr.	6	3 + 3a		
		PiS 3152	79761925		visual/electr.	8	4 + 4a		
		PiS 3155	76300354		visual/electr.	9	4 + 4a		
		PiS 3158	76326722		visual/electr.	11	4 + 4a		
400	-30 - +120	PiS 3093	77669914	5.0	visual	-	2	CuZn	PA 6
		PiS 3092	77669864		visual/electr.	1	2 + 2a		
		PiS 3115	78308058		visual/electr.	3	2 + 2a		
		PiS 3115 M12	79764010		visual/electr.	10	4 + 4a		
400	-30 - +120	PiS 3105	77970395	3.7/5.0	visual/electr.	2	2 + 2a	CuZn	PA 6
		PiS 3102	77942147		visual/electr.	4	3 + 3a		
		PiS 3155	76300362		visual/electr.	9	4 + 4a		
		PiS 3132	79760919		visual/electr.	5	3 + 3a		
		PiS 3142	79761883		visual/electr.	6	3 + 3a		
		PiS 3152	79761933		visual/electr.	8	4 + 4a		
		PiS 3158	76326730		visual/electr.	11	4 + 4a		
400	-30 - +120	PiS 3093	77669880	8	visual	-	2	CuZn	PA 6
		PiS 3092	77669872		visual/electr.	1	2 + 2a		
		PiS 3115	78308066		visual/electr.	3	2 + 2a		
450	-30 - +120	PiS 3193	77844061	2.2	visual	-	2	1.4301	PA 6
		PiS 3192	78308488		visual/electr.	1	2 + 2a		
		PiS 3110	79353574		visual/electr.	7	3 + 3a		
450	-30 - +120	PiS 3193	78308538	5.0	visual	-	2	1.4301	PA 6
		PiS 3192	78308546		visual/electr.	1	2 + 2a		
		PiS 3110	79353582		electrical	7	3 + 3a		

*Contact type

- 1 Normally open/normally closed; 1 setting point; wiring box DIN EN 175301-803; max. 250 V AC/200 V DC; max. 1 A
- 2 Normally closed; 2 setting points; wiring box DIN EN 175301-803; max. 150 V; max. 1 A
- 3 Change-over contact; 1 setting point; 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. 10-30 V; max. 1 A
- 5 Change-over contact; 2 setting points; LED; signal suppression; time delay; wiring box DIN EN 175201-804; 10-30 V; max. 1 A
- 6 Change-over contact; 2 setting points; LED; signal suppression; wiring box DIN EN 175201-804; 10-30 V; max. 1 A
- 7 Analog signal 4-20 mA; 2 setting points; LED; signal cold start; wiring box DIN EN 175201-804; 24 V; max. 1 A
- 8 Normally open/normally closed; 2 setting points; LED; signal suppression; plug connection M12x1; 10-30 V; max. 1 A
- 9 Normally open/normally closed; 2 setting points; LED; plug connection M12x1; 10-30 V; max. 1 A
- 10 Change-over contact; 1 setting point; plug connection M12x1; 150 V; max. 1 A
- 11 Normally closed/normally closed; 2 setting points; LED; plug connection M12x1; 150 V; max. 1 A

3. Pressure indicators/pressure switches

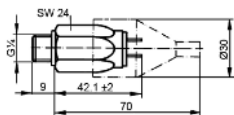


Fig. 5

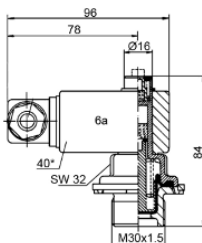


Fig. 6

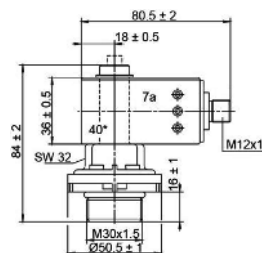


Fig. 7

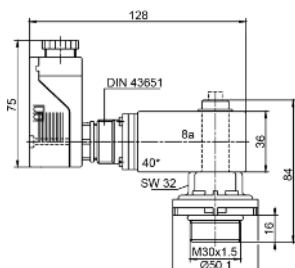


Fig. 8

40° = 40 mm wide

Pressure indicators/pressure switches									
Nominal pressure [bar]	Temperature [°C]	Type	Order number	Indicator setting [bar]	Indication	Contact type*	Fig.	Material lower section	Material upper section
10	-10 - +80	PiS 3084	77669781	1.2	visual	-	6	PA 66	PA 6
		PiS 3085	77669807		visual/electr.	1	6 + 6a		
		PiS 3125	78308033		visual/electr.	3	6 + 6a		
10	-10 - +80	PiS 3106	78309155	0.9/1.2	visual/electr.	2	6 + 6a	PA 66	PA 6
		PiS 3103	77942170		visual/electr.	4	8 + 8a		
10	-10 - +80	PiS 3084	77737802	2.2	visual	-	6	PA 66	PA 6
		PiS 3085	77738032		visual/electr.	1	6 + 6a		
		PiS 3125	78308108		visual/electr.	3	6 + 6a		
		PiS 3125 M12	79764747		visual/electr.	10	7 + 7a		
10	-10 - +80	PiS 3156	76300370	1.7/2.2	opt./elektr.	9	7 + 7a	PA 66	PA 6
		PiS 3159	76326748		visual/electr.	11	7 + 7a		
		PiS 3143	79761891		visual/electr.	6	8 + 8a		
		PiS 3153	79761941		visual/electr.	8	7 + 7a		
		PiS 3133	79760927		visual/electr.	5	6 + 3a		
		PiS 3106	78308850		visual/electr.	2	6 + 6a		
		PiS 3103	77970429		visual/electr.	4	8 + 8a		
10	-25 - +85	DSS/1.2	77863814	1.2	electrical	norm. open	5	galvanized steel	delivered with protection cap
		DSO/1.2	77870587		electrical	n. closed	5		
10	-25 - +85	DSS/2.2	77845845	2.2	electrical	norm. open	5		
		DSO/2.2	77870595		electrical	n. closed	5		
10	-25 - +85	DSS/5	77863822	5.0	electrical	norm. open	5		
		DSO/5	77870603		electrical	n. closed	5		

*Contact type

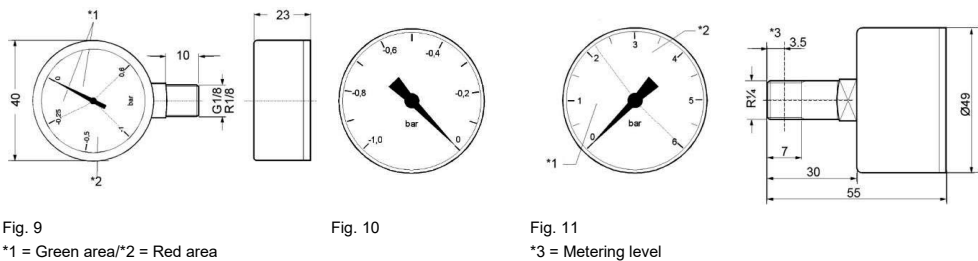
see remarks below 2. Differential pressure indicators

Maintenance Indicators

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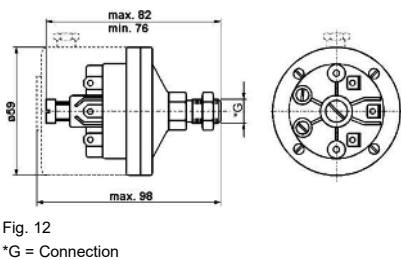
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4. Vacuum/pressure gauges



Vacuum/pressure gauges							
Nominal size [NG]	Type	Order number	Indicating range [bar]	Connection size	Fig.	Class	Dial face
40	Vacuum gauge	76345763	-1 - +0.6	R1/8 conical	9	min. 2.5	Red/Green area sep. line -0.25 bar
		77545908		G1/8	9		
50		77617558	-1 - 0	R¼ conical	10		white
50	Pressure gauge	78381998	0 - 6	R¼ conical	11		Red/Green area sep. line 2.2 bar

5. Vacuum switches



Vacuum switches									
Permissible over-pressure [bar]	Temperature [°C]	Type	Order number	Switch setting[mbar]	Contact type	Fig.	Connection *G	Material lower section	Material upper section
0.5	-10 - +70	PiS 3070	77669690	-15 - -80	single pole change-over switch, snap-in joint	12	G¼	GD-Al	PA 6
1			77669724	-50 - -600			G1/8		

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6. Vacuum indicators/air filters

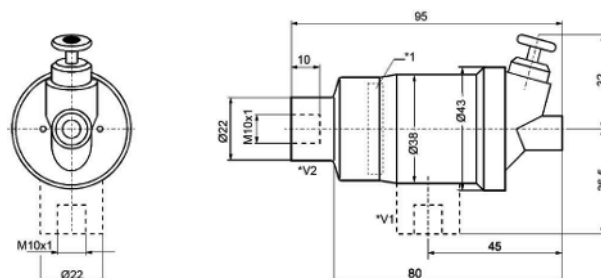


Fig. 14

*1 = Indication: position of display in mbar

*V1 = Version 1

*V2 = Version 2

Vacuum indicators/air filters						
Temperature [°C]	Type	Order number	Indicator setting ±10 % [mbar]	Indication type	Fig.	Version
-40 - +110	TB 745	78309056	-50	optical self locking	14	1
	TB 745/1	78309064	-50			2

7. Accessories

7.1 Seal kits			
Type	NBR	FPM	EPDM
Order number			
PiS 3092, 3093, 3102, 3105, 3115, 3132, 3142, 3152, 3155, 3192, 3193, 3158	77760275	77760283	77760291
PiS 3012, 3097, 3098, 3116, 3119, 3131, 3141, 3151, 3154, 3157	77760309	77760317	77760325
PiS 3084, 3085, 3103, 3106, 3125, 3133, 3143, 3153, 3156, 3159	78383382	78383390	78383408
PiS 3086, 3087, 3104	77760242	77760259	-

7.2 Electrical expansion kit/spare parts	
Designation	Order number
Electrical upper section normally open/closed for PiS 3084, 3087, 3093, 3098, 3193 (contact type 1)	77536550
Wiring box with lamp insert 12 - 230 V for electrical upper section normally open (acc. to DIN EN 175301-803)	78307548
Electrical upper section change-over contact for PiS 3084, 3087, 3093, 3098, 3193 (contact type 3)	78308017
Wiring box with 2 LEDs 10 - 30 V for electrical upper section change over contact (acc. to DIN EN 175301-803)	78308025

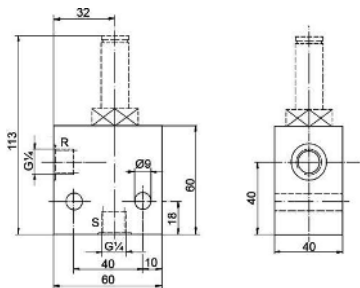
Designation	Order number
Electrical upper section change-over contact M12x1 für PiS 3084, 3087, 3093, 3098, 3193 (contact type 10)	79764036
Electrical upper section 2SP-LED-M12x1-SU (contact type 8) spare part for 2 setting points indicator!	76116651
Electrical upper section 2SP-LED-M12x1 (contact type 9) spare part for 2 setting points indicator!	76300412
Electrical upper section W-2SP-LED-SU-VERZ (contact type 5) spare part for 2 setting points indicator!	79760943
Electrical upper section W-2SP-LED-SU (contact type 6) spare part for 2 setting points indicator!	76118590
Electrical upper section W-2SP/Ö-LED-M12x1 (contact type 11) spare part for 2 setting points indicator!	76326755
Electrical upper section normally closed with signal suppression PiS 3003	77765357
Electrical upper section normally open with signal suppression PiS 3002	77765365

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7.3 Mounting block for differential pressure indicators (M20x1.5)	
Designation	Order number
Mounting block (St)	77809098
Mounting block (1.4301), 450 bar	77698517

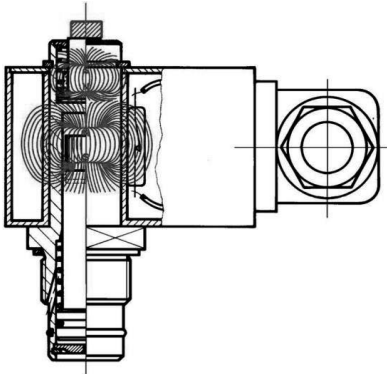


R = clean side
S = dirt side

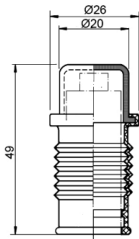
8. Function

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.

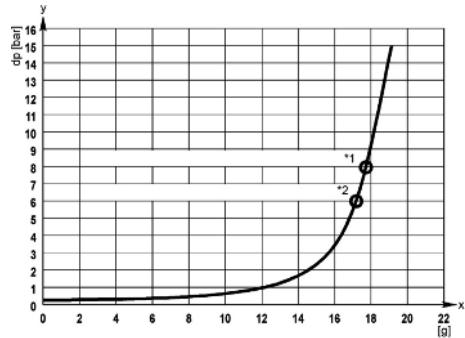


7.4 Protection cap	
Designation	Order number
Protection cap for all visual pressure and differential pressure indicators, -20 °C to +80 °C Resistant to: gasoil, purifying agent, insolation, dust, salt, water, concret	78285330



Pressure/vacuum gauges 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
x = dirt holding capacity [g]
y = differential pressure Δp [bar]
*1 = signal step maintenance indicator 100 %
*2 = signal step maintenance indicator 75 %

9. Technical specifications

9.1 Contact type normally open/normally closed

Contact type 1

Types PiS 3085, 3086, 3092, 3097, 3192

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

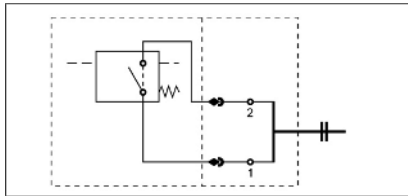
Contact type : normally open/normally closed

Cable sleeve: M20x1.5

Wiring box: DIN EN 175 301-803

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. Electrical parts are insulated (plastic material housing).



9.2 Contact type normally closed or open with signal suppression

Contact type normally closed

Type PiS 3003 (expansion kit)

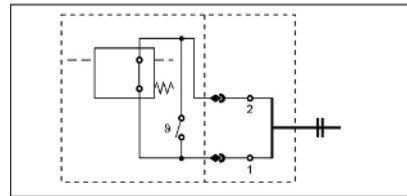
Contact type normally open

Type PiS 3002 (expansion kit)

Signal suppression by thermorelay

Signal is released at +30 °C

for further technical details see 9.1



9.3 Contact type normally closed 2 setting points

Contact type 2

Types PiS 3105, 3106, 3119

1. setting point at 75 % of the indicating pressure

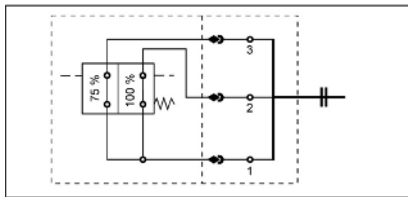
2. setting point at 100 % of the indicating pressure

Max. voltage: 150 V AC/DC

Max. current: 1 A

Contact load: 20 VA/20W

for further technical details see 9.1



9.4 Contact type Change-over contact

Contact type 3

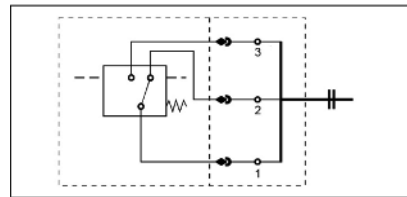
Types PiS 3115, 3116, 3125

Max. voltage: 150 V AC/DC

Max. current: 1 A

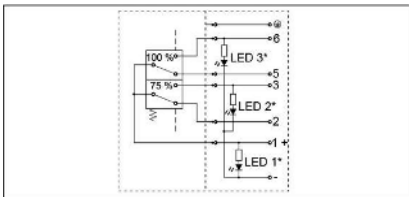
Contact load: 20 VA/20W

for further technical details see 9.1



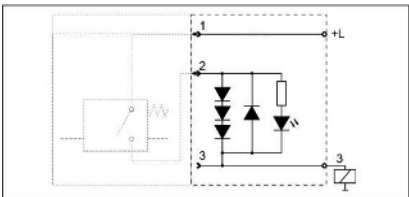
9.5 Contact type change-over contact, 2 setting points LED

Contact type 4
Types PiS 3012, 3102, 3103, 3104
1. setting point at 75 % of the indicating pressure
2. setting point at 100 % of the indicating pressure
Max. voltage: 10 - 30 V DC
Max. current: 1 A
Contact load: 20 VA/20 W
Type of protection: IP 65 in inserted and secured status
Plug connection: DIN EN 175201-804



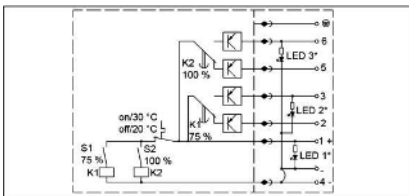
9.6 Wiring box with insert lamp

Will be supplied instead of standard connection.
Not to be combined with indicators with 2 setting points.
Max. voltage: 12-230 V AC/DC



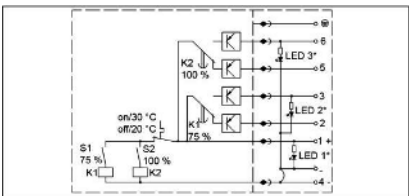
9.7 Contact type change-over contact, 2 setting points, LED, signal suppression, time delay

Contact type 5
Types PiS 3131, 3132, 3133
1. setting point at 75 % of the indicating pressure
2. setting point at 100 % of the indicating pressure
Max. voltage: 10 - 30 V DC
Max. current: 1 A
Contact load: 20 W
Type of protection: IP 65 in inserted and secured status
Plug connection: DIN EN 175201-804
Signal suppression: by thermorelay
Signal released: at + 30 °C
Signal change down: at + 20 °C
Impulse suppression K1 and K2 time delay 10 s



9.8 Contact type change-over contact, 2 setting points, LED, signal suppression

Contact type 6
Types PiS 3141, 3142, 3143
1. setting point at 75 % of the indicating pressure
2. setting point at 100 % of the indicating pressure
Max. voltage: 10 - 30 V DC
Max. current: 1 A
Contact load: 20 W
Type of protection: IP 65 in inserted and secured status
Plug connection: DIN EN 175201-804
Signal suppression: by thermorelay
Signal released: at + 30 °C
Signal change down: at + 20 °C



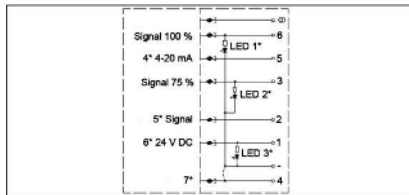
LED 1* = Operating LED green
LED 2* = Setting point 75 % LED yellow
LED 3* = Setting point 100 % LED red

9.9 Contact type analog 4-20 mA, 2 setting points, LED, signal suppression

Contact type 7

Types PiS 3110, 3120

Max. voltage: 24 V DC
 Max. current: 200 mA
 Resistance: 500 Ω
 Type of protection: IP 65 in inserted and secured status
 Plug connection: nach DIN EN 175201-804
 Output signal: 4-20 mA
 Outputs (PNP, max. 200 mA): cold start signal
 75 % setting point
 100 % setting point
 Signal damping: 20 s



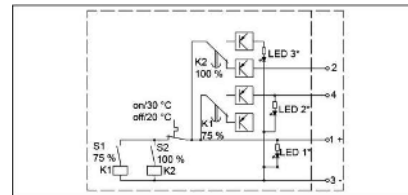
9.10 Contact type normally open/normally closed, 2 setting points, LED, signal suppression

Contact type 8

Types PiS 3151, 3152, 3153

1. setting point at 75 % of the indicating pressure (normally open)
2. setting point at 100 % of the indicating pressure (normally closed)

Max. voltage: 10 - 30 V DC
 Max. current: 1 A
 Contact load: 20 W
 Type of protection: IP 65 in inserted and secured status
 Plug connection: M12x1, 4 pole
 Signal suppression: by thermorelay
 Signal release: at + 30 °C
 Signal change down: at + 20 °C



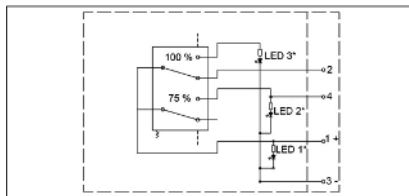
9.11 Contact type normally open/normally closed, 2 setting points

Contact type 9

PiS 3154, 3155, 3156

1. setting point at 75 % of the indicating pressure (normally open)
2. setting point at 100 % of the indicating pressure (normally closed)

Max. voltage: 10-30 V DC
 Max. current: 1 A
 Contact load: 20 W
 Type of protection: IP 65 in inserted and secured status
 Plug connection: M12x1, 4 pole

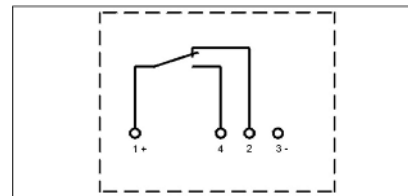


9.12 Contact type change-over contact

Contact type 10

PiS 3115-M12x1, 3116-M12x1, 3125-M12x1

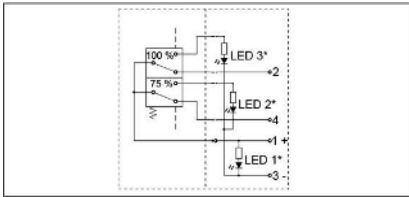
Max. voltage: 150 V
 Max. current: 1 A
 Contact load: 20 W
 Type of protection: IP 65 in inserted and secured status
 Plug connection: M12x1, 4 pole



LED 1* = Operating LED green
 LED 2* = Setting point 75 % LED yellow
 LED 3* = Setting point 100 % LED red

9.13 Contact type normally closed, 2 setting points

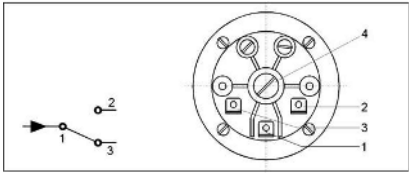
Contact type 11
Types PIS 3157, 3158, 3159
1. setting point at 75 % of the indicating pressure (normally closed)
2. setting point at 100 % of the indicating pressure (normally closed)
Max. voltage: 10-30 V DC
Max. current: 1 A
Contact load: 20 W
Type of protection: IP 65 in inserted and secured status
Plug connection: M12x1, 4 pole



LED 1* = Operating LED green
LED 2* = Setting point 75 % LED yellow
LED 3* = Setting point 100 % LED red

9.14 Vacuum switch PIS 3070

Contact type 1 pole change-over contact
Electrical connection: AMP 6,3 DIN 43248 bushings DIN 46247
Max. voltage: 230 V AC/DC
Max. current: 6 A
Type of protection: IP 00 without cover IP 54 with cover
Position of installation: individual (position of installation is to be advised if setting point is adjusted)



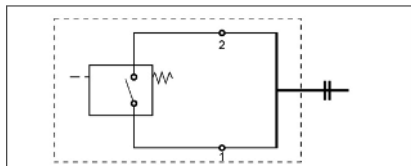
1 = Supply line
2 = Operating contact
3 = Normally closed contact
4 = Adjusting screw

9.15 Pressure switch DSS

Contact type: normally open

Electrical Connection: AMP 6,3 DIN 46248
bushings DIN 46247
switch type 2 pole

Max. voltage: 42 V
Max. current: 2 A
Contact load: 100 VA
Duty classification: 200/min



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

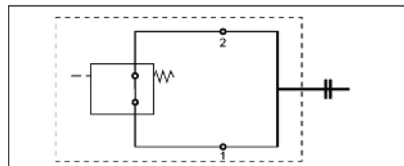
Tightening torque:

Maintenance indicator aluminum with threat M20x1.5
60 Nm
Maintenance indicator CuZn with threat M20x1.5
90 Nm
Maintenance indicator stainless steel with threat M20x1.5
90 Nm
Maintenance indicator plastic with threat M30x1.5
3 Nm

9.16 Pressure Switch DSO

Contact type: normally closed

for further technical details see 9.17



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 2014/34/EU (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.

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industrial.sales@filtrationgroup.com
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78357428.05/2020
Maintenance Indicators

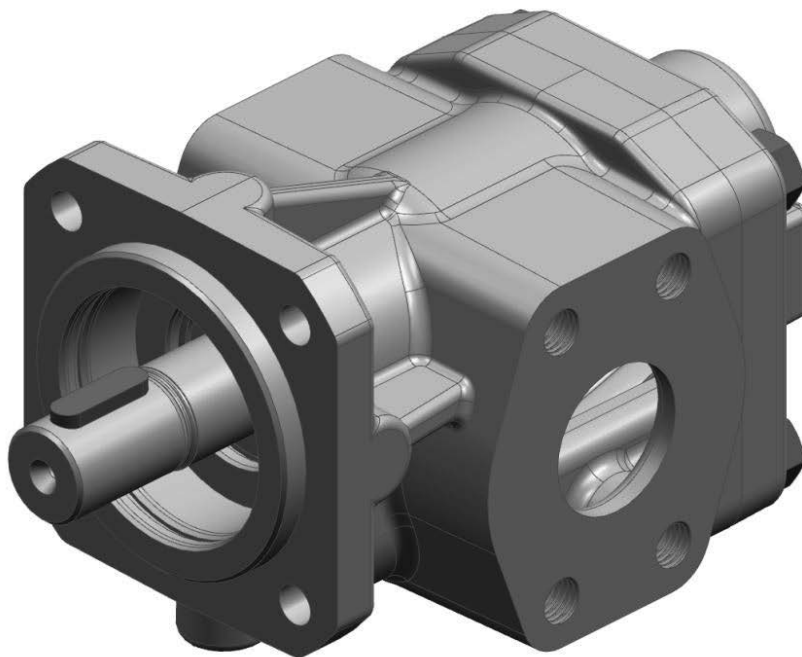
12

27805972/EN – 05/2023

KRACHT

D.0024710002

Operating instructions (Translation)



Gear pump 2.5-630
English

27805972/EN – 05/2023

29 • 20/05/2021

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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

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

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.

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

1.2 Manufacturer address

KRACHT GmbH
Gewerbestraße 20
DE 58791 Werdohl
Tel: +49 2392 935-0
Fax: +49 2392 935-209
E-Mail: info@kracht.eu
Web: www.kracht.eu

1.3 Applicable documents

In addition to these instructions, also observe the corresponding instructions for the existing or planned systems or system parts.

1.4 Symbols



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.

ATTENTION

Flagging of notices to prevent property damage.



NOTICE

Identification of basic safety instructions.
Non-compliance can lead to hazards for people and the device.



TIPP

Flagging of special user tips and other especially useful or important information.

2 Safety

2.1 Intended use

1. The device has been designed for operation with fluid.
Dry operation is not permitted.
2. The product may only be operated when completely filled.
3. The fluid must be compatible with the materials used in the product. Chemical expertise is required for that. Be careful with ethylene oxide or other catalytically or exothermically reacting or self-decomposing substances. Please consult the manufacturer in cases of doubt.
4. The product may only be used in normal industrial atmospheres.
If there are any aggressive substances in the air, always consult the manufacturer.
5. The product may only be operated in compliance with these operating instructions and the applicable documents.
Deviating operating conditions require the express approval of the manufacturer.
6. Use of the product for purposes other than those for which it is intended invalidates any warranty.

2.2 Foreseeable misuse

The manufacturer is not liable for damage resulting from non-intended or improper use.

2.3 Personnel qualification and training

The personnel 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.



NOTICE

Read the operating instructions thoroughly before use.

2.4 Basic safety instructions



NOTICE

Basic safety instructions

Non-compliance can lead to hazards for people and the unit.

- a) Follow existing regulations for accident prevention and safety at work as well as the internal regulations of the operating company.
- b) Ensure the greatest possible cleanliness.
- c) Wear suitable personal protective equipment.
- d) Do not remove type plates or other information or make them illegible or unrecognisable.
- e) Do not make any technical modifications.
- f) Comply with maintenance intervals.
- g) Only use spare parts approved by the manufacturer.

2.5 Fundamental hazards



⚠ DANGER

Hazardous fluids

Danger to life when handling hazardous fluids.

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



⚠ DANGER

Hazardous fluids

Danger to life when handling hazardous fluids.

- a) Defective components and connection lines must be replaced or fixed without delay.
- b) Use only components and connection lines approved for the expected pressure range.



⚠ DANGER

Rotating parts!

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

- a) Before all work, ensure that existing drives are voltage-free and pressure-free.
- b) Securely prevent restarting during all work.



DANGER

Rotating parts

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

- a) Take measures against accidental touching of rotating parts.



WARNING

Rotating parts!

Danger of injury from flying parts.

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



WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Depressurize the system before all work.
- b) Securely prevent the pressure from being restored during work.



WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to fluid spurting out.

- a) Use only connections and lines approved for the expected pressure range.
- b) Securely prevent the permissible pressures from being exceeded, e.g. by using pressure relief valves or bursting discs.
- c) Pipelines must be designed in such a way that no tension e.g. caused by changes in length due to fluctuations in temperature can be transferred to the product.



WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

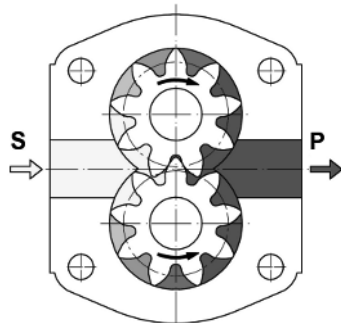
Risk of injury due to fluid spurting out.

- a) Do not operate the product with shut-off devices closed.
- b) Securely prevent the restoration of pressure while working on the device.

3 Device description

3.1 Functional principle

Pumps of this series are external gear pump types that work according to the positive displacement principle.



- S Suction connection
- P Pressure connection

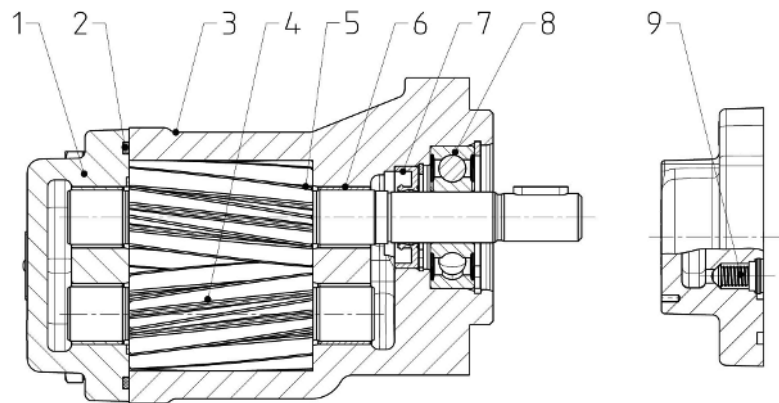
When rotated, two gearwheels meshing together produce a volume enlargement as a result of the opening of the tooth spaces on the suction side (S), so that medium can flow in and so that a corresponding volume is displaced simultaneously by immersion of the teeth into the filled tooth spaces on the pressure 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 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.

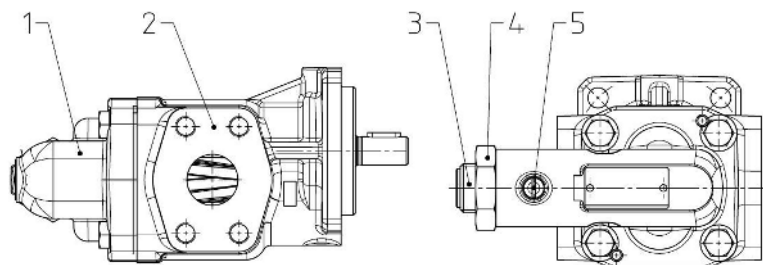
The pressure occurring at the shaft seal therefore corresponds to the pressure at the suction connection of the device. The permissible pressure is determined by the type of sealing.

3.2 Possible versions

Gear pump

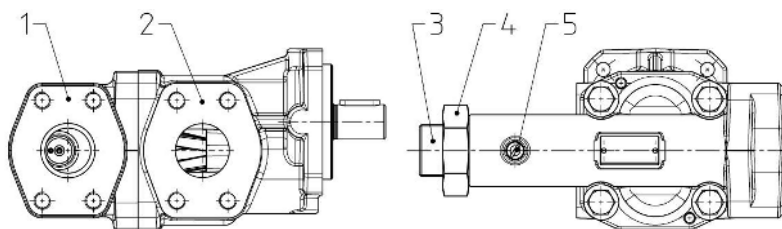


- | | |
|---|---|
| 1 End cover | 2 O-ring |
| 3 Housing | 4 Driven shaft |
| 5 Driving shaft | 6 Plain bearing bush |
| 7 Shaft seal
(Type of seals ▶ 16)) | 8 Outbord bearing
(Fixing type : G; X) |
| 9 Valve
(only Direction of rotation : B) | |

Gear pump with pressure relief valve

- 1 Pressure relief valve
- 3 Adjustment screw
- 5 Retaining screw

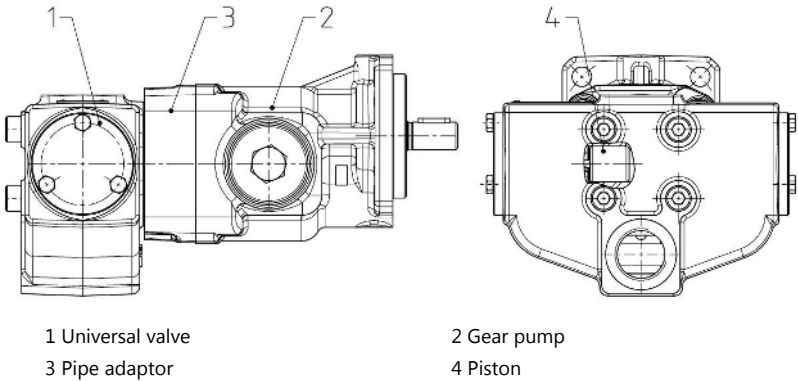
- 2 Gear pump
- 4 Hexagonal nut

Gear pump KF 32-80 with pressure relief valve (T-valve)

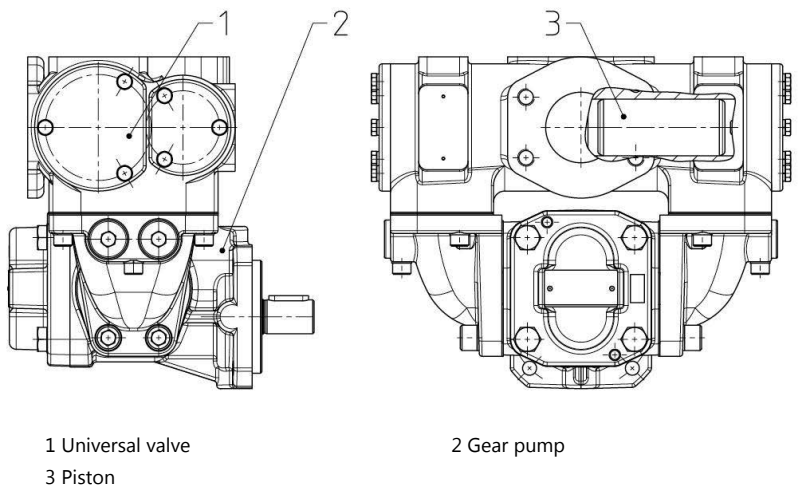
- 1 Pressure relief valve with Tank connection
- 3 Adjustment screw
- 5 Retaining screw

- 2 Gear pump
- 4 Hexagonal nut

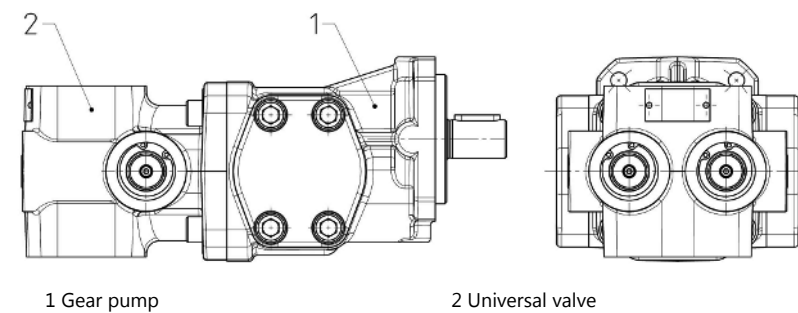
Gear pump KF 2.5-25 with universal valve



Gear pump KF 32-80 with universal valve



Gear pump KF 32-112 with universal valve U2



3.3 Type key

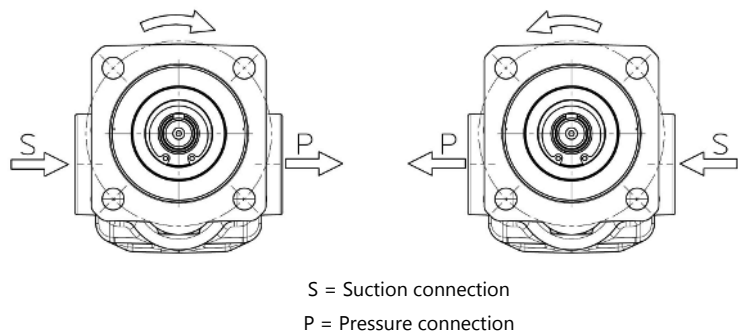
Ordering example												
KF		40		R	F		1	/...	-	D15	-	...
1.		2.		3.	4.		5.	6.		7.		8.

Explanation of type key			
1. Product name			
2. Nominal size			
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
G	DIN flange with outboard bearing	X	Mounting angle with outboard bearing
5. Seal type			
1	Rotary shaft seal NBR (BABSL)	23	Rotary shaft seal FKM (MSS1) (Low temperature)
2	Rotary shaft seal FKM (BABSL)	30	Without shaft seal O-ring FKM
3	Rotary shaft seal PTFE (HN2390)	31	Rotary shaft seal FKM (BABSL) (Low temperature) (KF 32-200)
4	Double rotary shaft seal PTFE (HN2390)	32	Double rotary shaft seal EPDM (R02-R) (not resistant to mineral oil)
5	Mechanical seal with FKM secondary seals (AX15) C2S2V1G3G1 (KF 2.5-200) B10SV1G3G1 (KF 250-630)	33	Mechanical seal CR secondary seals Q3ANFE (KF 32-630) (For compressor applications)
6	Mechanical seal with FFKM secondary seals (AX30) Q2Q2K1G3 (KF 2.5-80) Q2B2K1G3 (KF 32-200)	34	Mechanical seal with HNBR secondary seals Q3AP1FE (KF 32-630) (For compressor applications)
7	Double rotary shaft seal FKM (BABSL)	35	Mechanical seal with FKM secondary seals Q3AVFE (KF 32-630) (For compressor applications)

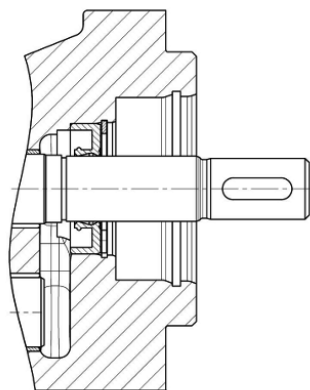
Explanation of type key			
9	Rotary shaft seal EPDM (R02-R) (not resistant to mineral oil)	36	Without shaft seal O-ring NBR
18	Rotary shaft seal FKM (BAUMX7)	37	Rotary shaft seal FKM (BABSL) O-ring FKM (Low temperature) (KF 100-112)
19	Double rotary shaft seal NBR (BABSL)	40	Mechanical seal with FKM secondary seals (L4) AQ2VFF
6. Special number			
Special number [► 18]			
7. Valve option			
Pressure relief valve			
D15	Pressure setting ranges 0 – 15 bar	D25	Pressure setting ranges 15 – 25 bar
D30	Pressure setting ranges 15 – 30 bar		
Universal valve			
U2	new type		
Pressure relief valve with Tank connection			
T15	Pressure setting ranges 0 – 15 bar	T25	Pressure setting ranges 15 – 25 bar
Viscosity range Pressure relief valve with Tank connection [mm²/s]			
No specification	12 - 300	B	1000 - 5000
A	300 - 1000		
8. Housing and cover material			
No specification	EN-GJL-250 (GG-25)	GJS	EN-GJS-400-15 (GGG-40)

3.4 Rotation and delivery direction

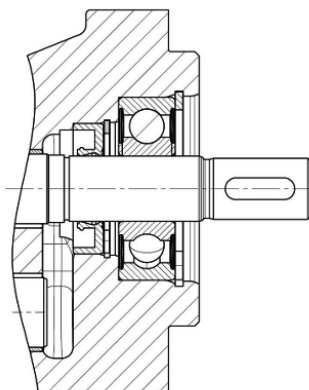
The direction of rotation is indicated by the bent arrow, Looking at the end of drive shaft.
The flow direction is indicated by the straight arrows.



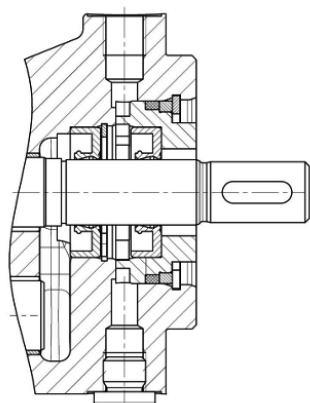
3.5 Type of seals



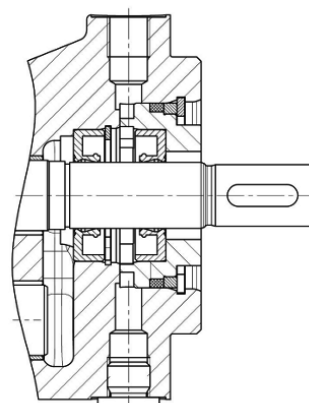
Rotary shaft seal
Seal type : 1; 2; 3; 9; 18; 23; 31



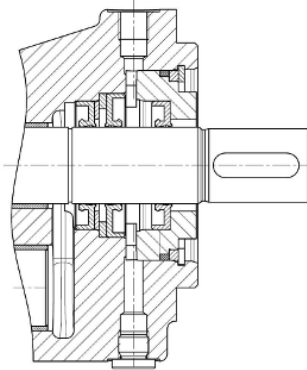
Rotary shaft seal with Outbord bearing
Seal type : 1; 2; 3; 9; 18; 31; 37



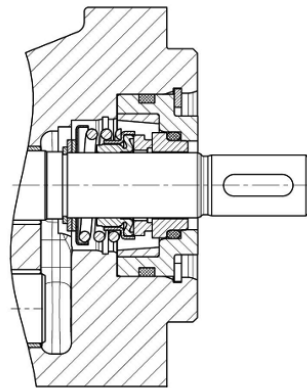
Double rotary shaft seal
Connection borehole G1/8
(for fluid buffer)
Seal type : 4; 7; 19; 32



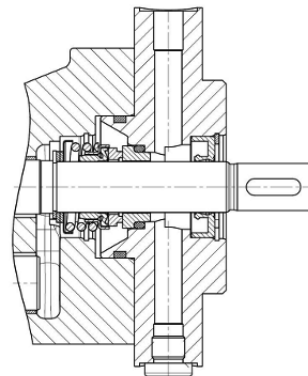
Double rotary shaft seal
(for vacuum operation)
Connection borehole G1/8
(for fluid buffer)
Seal type : 4; 7; 19; 32
Special number : 74



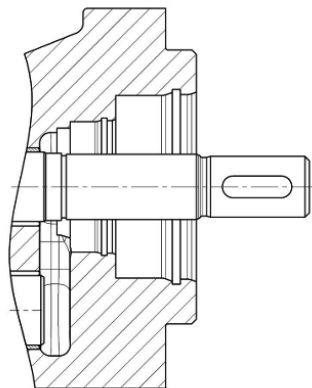
Triple rotary shaft seal
(for vacuum operation + for normal operation)
Connection borehole G1/8 (for fluid buffer)
Seal type : 7
Special number : 322 (KF 100-112)



Mechanical seal
Seal type : 5; 6; 33; 34; 35; 40



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



Without shaft seal
(Leak oil drain through shaft sealing chamber)
Seal type : 30; 36

3.6 Special number

Special number	Description
45	Driving shaft cylindrical - with centre bore DIN 332-2 Typ D
51	Driving shaft cylindrical - with centre bore DIN 332-2 Typ D
74	Double rotary shaft seal for vacuum operation
156	For compressor applications O-ring CR Plastic plain bearings (non-ferrous metal-free)
158	Housing connection KF 2.5-12 : Flange connection SAE ¾" KF 16-25 : Flange connection SAE 1"
166	Without shaft seal O-ring CR Plastic plain bearings (non-ferrous metal-free)
168	Without shaft seal With outboard bearing and additional outboard flange Flat plug with coupling Driving shaft with fine screw thread M12x1,25
173	Housing connection KF 2.5-12: Flange connection 3/4-14 NPT KF 16-25: Flange connection 1-11-1/2 NPT

Special number	Description
175	Valve is flowed through the other way round
182	Mechanical seal and additional rotary shaft seal
191	Rotary shaft seal for vacuum operation + Special number 197
197	Noise-optimized version for aerated oils
198	Special number 182 KF 100-150 Mechanical seal : AX 15 S-015 Q2Q2V1G3G1 (5) KF 100-150 Mechanical seal : L4BD015DINA10Q20VFF-B4CC (40) KF 100-112 Mechanical seal : AX 15 SL025 Q2Q2V1G3G1 (5)
206	For compressor applications Special number 156 O-ring HNBR
232	Housing connection KF 50-80 Flange connection SAE 2" KF 100-112 Flange connection SAE 2 ½" KF 125-150 Flange connection SAE 3" KF 180-200 Flange connection SAE 3 1/2" KF 250-315 Flange connection SAE 3 1/2" KF 400-630 Flange connection SAE 5"
236	Special number 168 Without outboard flange Flat plug
245	Double rotary shaft seal BAUMX7 with grease filling
251	Special number 166 O-ring FKM
252	Special number 166 Housing/End cover nitrocarburized
255	Use under water Double rotary shaft seal BABSL + Grease filling Fastening screws: Stainless steel (A4) + Special number 197
271	Special number 74 O-ring CR Plastic plain bearings (non-ferrous metal-free)
289	Rotary shaft seal BAUM X

Special number	Description
291	stainless steel type plate and rivet
297	Inner rotary shaft seal Turcon Roto Variseal ($p_{max}=10$ bar at 700 1/min) external rotary shaft seal BABSL Plastic plain bearings (non-ferrous metal-free) Hennecke – Type plate
304	Plastic plain bearings (non-ferrous metal-free)
306	Plastic plain bearings (non-ferrous metal-free) Hennecke – Type plate + Special number 197
307	Without shaft seal without rinsing Cover with suction bore
309	Combination of Special number 74 + 197
313	Without shaft seal O-ring CR Plastic plain bearings (non-ferrous metal-free) Housing/End cover nitrocarburized Driving shaft with flat plug
316	Combination of Special number 197 + 232 Driving shaft with gear shaft profile
317	Combination of Special number 197 + 304
318	Driving shaft mit gear shaft profile + Special number 197
322	Triple rotary shaft seal Plastic plain bearings (non-ferrous metal-free) + Special number 232
326	Combination of Special number 45 + 197 KF 150 + KF 200: Driving shaft bore M8 / 19 mm deep.
331	Special number 198 Housing with suction hole to suction side
332	Special number 304
343	with universal valve Gear pump mounted in position "0 degrees" between connection flange and universal valve. For the version with universal valve U2, the pump is mounted rotated 180. (Gear pump horizontal, shaft end below the connections!)

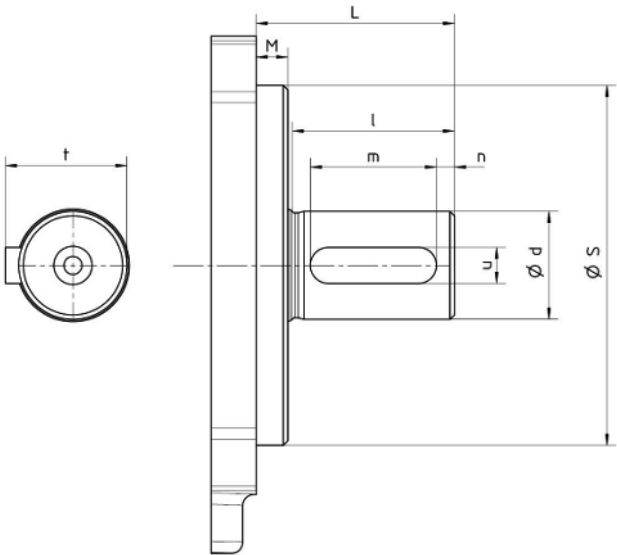
Special number	Description
344	Driving shaft with gear shaft profile + Special number 197
345	Without shaft seal O-ring CR Plastic plain bearings (non-ferrous metal-free)
353	Multi layer friction bearings non-ferrous metal-free + Special number 197
358	Special number 297 without customized type plate
359	Combination of Special number 158 + 197
363	Plastic plain bearings (non-ferrous metal-free) + Special number 158
375	For compressor applications Plastic plain bearings (non-ferrous metal-free) special shaft special flange
376	For compressor applications Special number 375 End cover as suction connection with adapter plate
380	Fastening screws: Stainless steel
387	With Universal valve Suction connection at the bottom of the valve housing
391	Combination of Special number 197 + 232
397	Use under water with universal valve Fastening screws: Stainless steel
398	Use under water Fastening screws: Stainless steel + Special number 197
401	With SAE-B-2-hole flange Driving shaft with gear shaft profile Plastic plain bearings (non-ferrous metal-free) + Special number 197
402	Combination of Special number 74 + 158 bzw. 232
408	Special grooves in the housing (KF 2.5)

Special number	Description
409	Additional adapter flange Driving shaft cylindrical - with centre bore DIN 332-2 Typ D
414	Without shaft seal + Special number 197 With stated preferred direction of rotation
424	Gear pump with polierten Lagerstellen Housing material: EN-GJS-400-15 (GGG-40)
429	Snap ring on the shaft end
430	Driving shaft with gear shaft profile
433	Driving shaft with plug M25x1,5 + Special number 197
437	For compressor applications O-ring FKM Plastic plain bearings (non-ferrous metal-free)
441	Special number 424 Plastic plain bearings (non-ferrous metal-free)
442	With SAE-B-2-hole flange Driving shaft with gear shaft profile
443	Combination of Special number 156 + 158
444	With SAE-B-2-hole flange Driving shaft with gear shaft profile + Special number 197
450	Driving shaft with bore for fitted pin
452	Thread holes 4x M8 / 16 deep in the housing KF 125-150 : Suction connection 3" und Pressure connection 2 ½" KF 180-200 : Suction connection 3 1/2" und Pressure connection 3" + Special number 197
453	Plastic plain bearings (non-ferrous metal-free) + Special number 158
458	Standard KF 12 With special dimensions and special driving shaft
459	Combination of Special number 74 + 197 158 bzw. 232
460	Combination of Special number 206 + 158
464	Combination of Special number 401 + 232

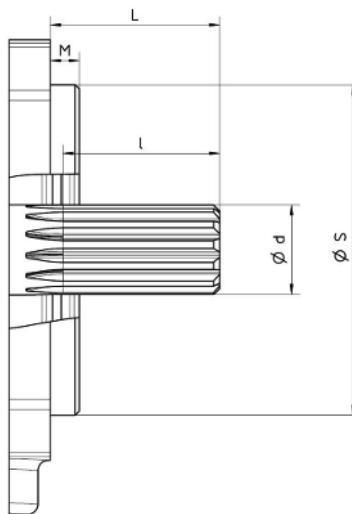
Special number	Description
466	Housing deburred
468	Without shaft seal Driving shaft with nozzle + Special number 197
471	B-Cover + Special number 197 stated preferred direction of rotation
473	Special paint
475	Combination of Special number 401 + 232
477	Driving shaft with gear shaft profile
478	With SAE-D-2-hole flange Driving shaft with gear shaft profile + Special number 197
481	Housing with screw-mounted lubrication bore and lubrication hole
482	Special number 481 + Special number 158
483	Special number 481 KF 32-80: Standardmäßig Schmierölbohrung
485	Special number 444 Outer rotary shaft seal mounted with sealing lip to the shaft end + retainer ring
488	With SAE-C-2-hole flange Driving shaft with gear shaft profile
492	With SAE-B-2-hole flange installed rotated 90° Driving shaft with gear shaft profile
496	Combination of Special number 444 + 232
497	Combination of Special number 477 + 197
503	With forced feed lubrication Plain bearings 3/4 grooved + Special number 197
505	See Special number 444 Without Special number 197
506	With SAE-A-4-hole flange Driving shaft with gear shaft profile
510	O-ring CR White metal bearing + Special number 158

Special number	Description
511	Universal valve + Special number 197 Preferential direction of rotation Clockwise
512	Special number 511 Preferential direction of rotation Counterclockwise
513	Special number 511 Driving shaft with stuck in nozzle
514	Special number 391 Thread holes M6 / 15 mm deep in the Housing (for heating system)
515	With SAE-B-2-hole flange Driving shaft with gear shaft profile
517	Combination of Special number 255 + 391
518	Rotary shaft seal for vacuum operation + Special number 158
521	Combination of Special number 391 + 503
523	Special number 468 Fastening screws: Stainless steel
526	With SAE-B-2-hole flange Driving shaft with gear shaft profile
529	Double rotary shaft seal Outer rotary shaft seal mounted with sealing lip to the shaft end! Leak oil hole open from below With SAE-C-2-hole flange Driving shaft with gear shaft profile + Special number 197

3.7 Free shaft end



Nominal size	Special number	L	S _{h8}	M	d ₆	l	m	n	t	u
KF 2.5-25	-	33	63	7	14	25	16	4	16	5
	156/206/437									
KF 32-80	-	44	80		24	36	28	4	27	8
	156/206	40								
	375									
KF 100-200	-	60	110	8	28	50	40	5	31	8
KF 125-200	375									
KF 100-112	375				24	50	40	5	27	8
KF 100-150	-	46								
Seal number: 31	-				90	160	38	80	63	8
KF 250-630	-									
KF 400-630	375	32								
KF 250-315	375									



Nominal size	Special number	L	S _{h8}	M	Profil	Diametral pitch (DP)	Number of teeth	d _{h11}	I		
KF 32	506	31.75	82.17	7	SAE A	16/32	9	15.26	16		
KF 32-80	401/464/475 /526/515	41.2	101.6		SAE B		13	21.81	38		
KF 32-50	442/492	46								45	
KF 63-80	316/318/477	41									80
KF 63-150	444/505/485 /496	41.15									
KF 100-112	344	41	110								
KF 112	430	73		110							
KF 200	442	41.15			101.6						
KF 200	477/497	41					110				
KF 100 ; KF 200	488	46	127								
KF 250-630	477/497	55		160							
KF 250	478/529	55.4			152.4						

3.8 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.

4 Technical data

4.1 General

General information		
Housing connection ⁽¹⁾	KF 2.5-12	Whitworth pipe thread G 3/4
	KF 2.5-12.../158	Flange connection SAE 3/4"
	KF 16-25	Whitworth pipe thread G 1
	KF 16-25.../158	Flange connection SAE 1"
	KF 32-80	Flange connection SAE 1 1/2"
	KF 32-80	Tank connection SAE 1 1/2"
	KF 50-80.../232	Flange connection SAE 2"
	KF 100-112	
	KF 50-80.../232	Tank connection SAE 1 1/2"
	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 G 3/4
		Pressure connection : Whitworth pipe thread G 1/2
Mounting position	KF.R/L/B , U2 Without fluid buffer	Suction connection : Flange connection SAE 2"
		Pressure connection : Flange connection SAE 2"
	KF.U	Piston horizontal , Pressure connection on top
External loads on shaft end	F_{axial}	Axial forces are not permissible.
	F_{radial}	Radial forces are not permissible.
Speed	n	Nominal sizes [► 29] + Viscosity - Rotation speed assignment [► 30]
Operating pressure	p_e p_b	Permissible pressure range [► 31]

General information		
Viscosity	v_{min}	Differential pressure - viscosity assignment [► 32]
	v_{max}	Consult the manufacturer
Fluid temperature	ϑ_m	Permissible temperature range [► 33]
Ambient temperature	ϑ_u	Permissible temperature range [► 33]
Filtering	β	$\leq 60 \mu m$
Material		Material data [► 34]
Permissible media		Lubricating fluids without abrasive components (Petrols, solvents, etc. are not permissible)
		For compressor applications : Refrigerator oil ; Hydraulic oil ; Mineral oil
⁽¹⁾ Pipe thread : ISO 228-1; Flange connection : ISO 6162-1 (SAE J518)		



TIPP

A reduced service life must be expected for the shaft seal in the case of vertical installation (shaft end top).

4.2 Nominal sizes

Nominal size V _{gn}	Geom. displacement V _g [cm³/rev.]	Speed n		perm. radial force F _{radial} [N] (n =1500 rpm]	Sound pressure level L _{pA} [dBA]	Mass inertia x 10 ⁻⁶ J [kg m²]
		n _{min} [rpm]	n _{max} [rpm]			
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			1500	≤ 68	217
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		2000	2500	≤ 75	4133
315	312.9				≤ 77	5011
400	399.5					6618
500	496.5					7830
630	622.5				≤ 80	9591
32 U2	32.12		3000	1500	≤ 68	217
40 U2	40.21					254
50 U2	50.2					299
63 U2	63.18					368
80 U2	80.5		2200		≤ 69	443
100 U2	101.5					741
112 U2	113.5					806

4.3 Viscosity - Rotation speed assignment

Kinematic viscosity ν [mm ² /s]	Recommended rpm n [rpm]
100	3600
200	2900
300	2300
500	1800
1000	1200
2000	800
3000	650
6000	450
10000	300
20000	200

**TIPP**

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 $p_{e \text{ min.}}$

4.4 Permissible pressure range

4.4.1 Operating pressure of suction side and pressure side

Seal type	Special number	Operating pressure			
		suction side		pressure side	
		$p_{e\ min}$ [bar abs.] ⁽¹⁾	$p_{e\ max}$ [bar rel.]	p_b [bar rel.] (perm. continuous pressure)	p_b [bar rel.] (Pressure peaks)
1	-	0.6 ⁽²⁾	Max. suction side operating pressure for sealing type 1, 2, 7 and 19 [► 32]	25	40
2	-				
3	-		2		
4	-				
74		0.1	0.2		
5	-	0.6 ⁽²⁾	10	35	-
6	-		25		
7	-		Max. suction side operating pressure for sealing type 1, 2, 7 and 19 [► 32]		
74		0.1	0.2		
9	-	0.6 ⁽²⁾	0.5	25	40
18	-				
19	-		Max. suction side operating pressure for sealing type 1, 2, 7 and 19 [► 32]		
74		0.1	0.2		
23	-	0.6 ⁽²⁾	0.5	25 ⁽³⁾	-
30	-		25	25	40
31	-		0.5	25 ⁽³⁾	-
32	-		0.5	25	40
74			0.2		
36	-		25	25	40
37	-		0.5	16 ⁽⁴⁾	
40	-		10	25	

⁽¹⁾ KF . U: $p_{e\ min} = 0.65$ bar abs.
⁽²⁾ Start-up condition: 0.4 bar absolute (max. 30 minutes)
⁽³⁾ $\vartheta_m < -20^\circ\text{C}$; Housing material GJL: 16 bar
⁽⁴⁾ Housing material GJS: 25 bar

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	-	-	-	-	-

4.4.3 Compressor applications

Seal type	Special number	Operating pressure			
		suction side		pressure side	
		$p_{e\ min}$ [bar abs.]	$p_{e\ max}$ [bar rel.]	p_o [bar rel.] (perm. continuous pressure)	p_o [bar rel.] (Pressure peaks)
6	156	0.6 ⁽¹⁾	10	25	40
	206				
	437				
33	375	0.6 ⁽¹⁾	25	35	-
34					
35					

⁽¹⁾ Start-up condition: 0.4 bar absolute (max. 30 minutes)

4.5 Differential pressure - viscosity assignment

Bearing	Δp_{max} [bar]		
	$v = 1,4\ mm^2/s$	$v = 6\ mm^2/s$	$v = 12\ mm^2/s$
Multi layer friction bearings contains lead (Standard) DU , P10	3	12	25
Multi layer friction bearings non-ferrous metal-free DP4			
Plastic plain bearings Iglidur® G ; Iglidur® X ; H370	-	6	10 ⁽¹⁾
White metal bearing TEGO® V738			

⁽¹⁾ For compressor applications $\geq 7\ mm^2/s$

4.6 Permissible temperature range

Sealing material	Fluid temperature ϑ_m	
	$\vartheta_{m \min}$ [°C]	$\vartheta_{m \max}$ [°C]
CR	-20	100
EPDM		120
FEP with FKM-core		200
FFKM / FEP with FKM-core		200
FKM		150
HNBR		90
NBR		90
PTFE / FEP with FKM-core		200
FKM (Low temperature)	-30	150

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



NOTICE

Comply with media-specific properties

4.7 Material data

Seal type	Material				
	Shaft seal	O-ring	Housing/End cover	Gears	Bearing
1	NBR	NBR	EN-GJL-250 (GG-25) - - - EN-GJS-400-15 (GGG-40)	Case-hardened steel (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 non-ferrous metal-free DP4 (Steel , CuSn , PTFE) - - - White metal bearing TEGO® V738 (Steel , Cu , Sn , Sb , Cd , Ni , As)
2	FKM	FKM			
3	PTFE	FEP with FKM-core			
4	PTFE	FEP with FKM-core			
5	C2S2V1G3G1 (KF 2.5-200)	FKM			
	B10SV1G3G1 (KF 250-630)				
6	Q2Q2K1G3 (KF 2.5-25)	FEP with FKM-core			
	Q2B2K1G3 (KF 32-200)	FEP with FKM-core			
7	FKM	FKM			
9	EPDM	EPDM			
18	FKM	FKM			
19	NBR	NBR			
23	FKM (Low temperature)	FKM (Low temperature)			
30	-	FKM			
31	FKM (Low temperature)	FKM (Low temperature)			
32	EPDM	EPDM			
36	-	NBR			
40	AQ2VFF	FKM			

4.7.1 Compressor applications

Seal type	Material				
	Shaft seal	O-ring	Housing/End cover	Gears	Bearing
6	Q2Q2K1G3	Special number 156: CR	EN-GJL-250 (GG-25) - - - EN-GJS-400-15 (GGG-40)	Case-hardened steel (Steel 1.7139)	Plastic plain bearings non-ferrous metal-free Iglidur® X
		Special number 206: HNBR			
		Special number 437: FKM			
33	Q3AVFE	Special number 375: FKM			
34	Q3AP1FE	Special number 375: FKM			
35	Q3AVFE	Special number 375: FKM			

Refrigerant		Oil							
		M	M*	M* - PAO	AB	E	PAO	AB - PAO	PAG
R717 (NH3)	Ammonia	CR / HNBR	CR / HNBR	CR / HNBR	CR	-	CR ⁽¹⁾ / HNBR	CR	CR / HNBR
R290 (C3H8)	Propane	-	-	-	-	-	HNBR	-	HNBR
R1270 (C3H6)	Propylene	-	-	-	-	-	HNBR	-	HNBR
R744 (CO2)	Carbon dioxide	-	-	-	-	CR	HNBR	-	CR
R22	HCFCs	CR	-	-	CR	CR	-	CR	-
R134a, R404a, R407C, R410A, R507, R23	HPFCs	-	-	-	-	HNBR	-	-	-

⁽¹⁾ only for oils: Fuchs Reniso Synth 68, Klüber Summit R100/R150/R200

M = Mineral oil

M* = Mineral oil with special treatment (hydrocracked oil)

AB = Alkylbenzene

E = Polyester

PAO = Polyalphaolefin

PAG = Polyalkylglycol

4.8 Weight

Nominal size V _{gn}	Gear pump [kg]					Added weight Mounting angle [kg]					
	with end cover	with D-valve	with T-valve	with uni- versal valve	with uni- versal valve U2						
2.5	2.9 ⁽¹⁾	3.7 ⁽¹⁾	-	6.9	-	1.3					
4											
5											
6											
8											
10											
12	3.5 ⁽¹⁾	4.3 ⁽¹⁾	-	7.5	-	1.3					
16											
20											
25											
32	7.7	9.5	12.4	27.5	15.5	1.6					
40											
50											
63	9.4	11.2	14.3	29.5	17.5	1.6					
80											
100	16.0	18.7	-	-	21.6	3.3					
112					-						
125	22.2	26.5									
150											
180	24.8	29.1				-					
200											
250	44.2	47.2									
315											
400	54.7	57.9									
500											
630	60.8	64.0									

⁽¹⁾ Special number 158: +1.3 kg

⁽¹⁾ Special number 158: +1.3 kg

4.9 Dimensions

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

5 Transport and storage

5.1 General

- a) After receipt, check the device for transport damages.
- b) If transport damage is noticed, report this immediately to the manufacturer and the carrier. The device must then be replaced or repaired.
- c) 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.

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



NOTICE

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

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.



NOTICE

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

⚠ ATTENTION

Corrosion/chemical impact

Improper storage can render the device useless.

- a) Protect endangered surfaces by means of suitable conservation measures.
- b) Comply with recommended storage conditions.

5.4 Storage conditions



TIPP

Recommended storage conditions

- a) Storage temperature: 5 °C – 25 °C
- b) Relative air humidity: < 70 %
- c) Protect elastomer parts from light, especially direct sunlight.
- d) Protect elastomer parts from oxygen and ozone.
- e) Comply with maximum storage times of elastomeric parts:
 - ⇒ 5 Jahre: AU (Polyurethan-Kautschuk)
 - ⇒ 7 Jahre: NBR, HNBR, CR
 - ⇒ 10 Years: EPM, EPDM, FEP/PFTE, FEP, FKM, FFKM, VMQ, FVMQ

6 Installation

6.1 Safety instructions for installation



⚠ DANGER

Hazardous fluids

Danger to life when handling hazardous fluids.

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



⚠ DANGER

Rotating parts!

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

- a) Before all work, ensure that existing drives are voltage-free and pressure-free.
- b) Securely prevent restarting during all work.



⚠ DANGER

Rotating parts

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

- a) Take measures against accidental touching of rotating parts.



⚠ WARNING

Rotating parts!

Danger of injury from flying parts.

- a) 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.

- a) Do not engage gearwheels.



WARNING

Failure of load-carrying parts due to overload!

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

- a) Depressurise the device and all connection lines before doing any work.
- b) Securely prevent the restoration of pressure while working on the device.



WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.
Risk of injury due to fluid spurting out.

- a) Use only connections and lines approved for the expected pressure range.
- b) Securely prevent the permissible pressures from being exceeded, e.g. by using pressure relief valves or bursting discs.
- c) Pipelines must be designed in such a way that no tension e.g. caused by changes in length due to fluctuations in temperature can be transferred to the product.

6.2 Noise reduction



TIPP

Measures for noise reduction

- a) Use suction and pressure hoses.
- b) Use bell housings with high damping properties (plastic or cast iron).
- c) Use of damping rings and damping rods for separation of structureborne noise.

6.3 Mechanical installation

6.3.1 Preparation

- a) Check the device for transport damage and dirt.
- b) Check the device for freedom of movement.
- c) Remove existing preservatives.
 - ⇒ Use only those cleaning agents that are compatible with the materials used in the device.
 - ⇒ Do not use cleaning wool.
- d) 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.
- e) Position the product and secure them against slipping.
 - ⇒ Comply with the manufacturer's information.
 - ⇒ Do not use any sealing materials such as hemp, Teflon tape or putty.

6.3.2 Gear Pump 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 is used for this.

- a) Pre-mount coupling parts as per manufacturer's specifications.
- b) Position the pumps and the drive with respect to each other.
 - ⇒ Comply with the permissible mounting position.
 - ⇒ Comply with the permissible direction of rotation.
- c) Tighten all fastening screws with the specified torque.



⚠ DANGER

Rotating parts

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

- a) Take measures against accidental touching of rotating parts.



CAUTION

Hot surfaces

Burn injury to skin if touched.

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

Tightening torques [Nm]

Thread size	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



TIPP

- a) Keep to the permissible displacement values of the coupling.
- b) Rule out any distortion of the device.
- c) Pay attention to sufficient screw-in depth of the fastening screws.



NOTICE

- a) 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.
- b) Make sure no foreign bodies can get into the device.
- 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.

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.

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



NOTICE

Additional connections

- a) Provide measurement connections for pressure and temperature as close as possible to device.
- b) If necessary, provide a facility to fill or empty the device and the line system.
- c) 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:

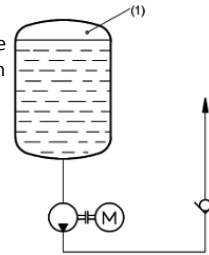
The suction line must be piped as short as possible and in a straight line.

- 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 pipe-work and the pump have been filled with liquid. For this application, only pumps suitable for vacuum operation may be used.

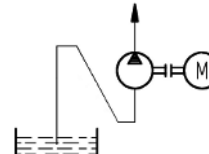
**NOTICE****Cavitation damage**

Undercutting the permissible suction port pressure results in cavitation.

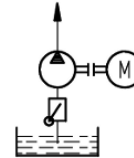
- Design the suction line so that the pressure arising in operation on the suction side is always higher than the vapour pressure of the pumped medium. At the same time, comply with the installation altitude of the device above mean sea level.
- For aqueous fluids, mount the device underneath the fluid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

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.



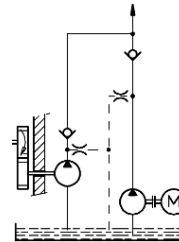
It is appropriate to employ a foot valve or a non-return valve in case of longer suction lines that can run dry while the pump is at rest. These must have been designed for use in suction lines and should offer as low a flow resistance as possible.



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 Tank line T-valve

Specify the nominal width of the tank line so that the delivery volume can be discharged at low or no pressure. The tank line must be passed directly into the supply tank.

6.4.5 Mounting Connection lines

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



TIPP

Position of the device connections: **Rotation and delivery direction** ► 15]

6.5 Change of the direction of rotation

Depending on the version a change in the direction of rotation is possible.

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



TIPP

Gear pumps in noise-optimized version cannot be converted.

7 Operation start-up

7.1 Safety instructions for start-up



⚠ DANGER

Hazardous fluids

Danger to life when handling hazardous fluids.

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



⚠ WARNING

Failure of load-carrying parts due to overload

Danger of injury from flying parts.

Danger of injury from spurting fluids.

- a) Do not operate the device against closed shut-off devices.
- b) Do not operate the device in the false direction of rotation.



⚠ CAUTION

Hot surfaces

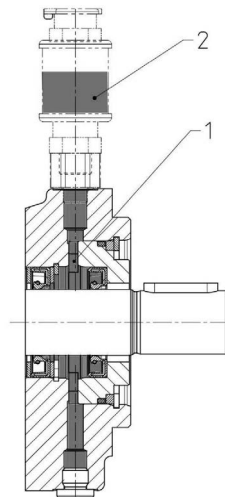
Burn injury to skin if touched.

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

7.2 Preparation

- a) Before starting the product, make sure that a sufficient quantity of the service fluid is ex-
tant to avoid dry running. This must be taken into account especially with large line
volumes.
- b) Check all fastening screws on the product.
- c) Fill pump and the suction line with medium.

7.3 Filling the quench chamber



- 1 Quench chamber
2 Container for quench-liquid

- a) 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.



NOTICE

Seal failure due to dry run

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

- a) Do not put pumps without quench liquid into operation.

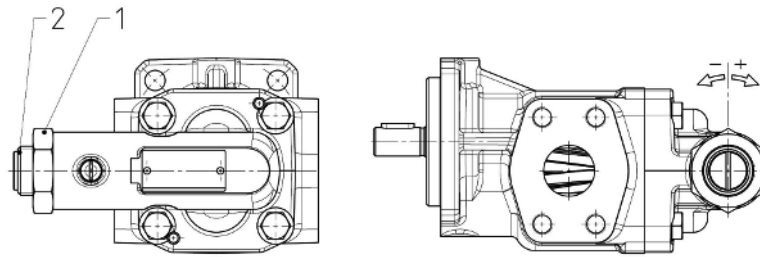


TIPP

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

7.4 Pressure relief valve adjustment

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.



- response pressure lower
- + response pressure higher

- 1 Hexagonal nut
- 2 Adjustment screw

- a) Remove hexagon nut.
- b) Set the response pressure using the adjusting screw.
- c) 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.

- a) Consider the permissible pressure setting range of the valve.
- b) Check the pressure setting (the valve must not block).

7.4.1 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.



NOTICE

Failure of the pump

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

- a) Only allow intermittent triggering of the valve.

Directly attached pressure relief valves of the series "T" are used exclusively for protection of the gear pump. The valve can also be used to control the pressure of the gear pump thus allowing to keep the system pressure constant.



NOTICE

Overheating of the gear pump

A direct return flow into the suction line may increase the temperature at the gear pump beyond the permissible level.

- a) For heat dissipation, the pumping medium passing through the T-valve must be discharged directly into the storage tank.

7.5 Further operation start-up

- a) Open existing shut-off elements upstream and downstream of the device.
- b) Adjust pressure relief valves in the system installed for lowest opening pressure.
- c) Allow the device start without or with a low pressure load (jog mode).
 - ⇒ Flow should have developed after 30 s at the latest.
- d) Run the device for a few minutes depressurised or with low pressure.
- e) Vent the system at the highest possible point.
- f) Gradually increase the pressure load up to the desired operating pressure.
- g) Operate the system for so long until the final operating state is achieved.
- h) Check the operating data.
 - ⇒ **Maintenance table** [p. 54]
- i) Document the operating data of the initial start-up for later comparison.
- j) Check the level of the operating medium in the system.
- k) Check the filling level of the liquid seal (if existing).
- l) Check the device for leaks.
- m) Check all threaded connections for leaks and retighten if necessary.



TIPP

In order to ensure a constant and reliable function of the product, an initial maintenance of the product is recommended after several hours warm-up time (max. 24 h). This allows faults to be detected at an early stage.

8 Removal

8.1 Safety instructions for removal



⚠ DANGER

Hazardous fluids

Danger to life when handling hazardous fluids.

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



⚠ DANGER

Rotating parts!

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

- a) Before all work, ensure that existing drives are voltage-free and pressure-free.
- b) Securely prevent restarting during all work.



⚠ WARNING

Unshielded gearwheels

Gearwheels can trap and crush fingers and hands.

- a) Do not engage gearwheels.



⚠ WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

- a) Depressurise the device and all connection lines before doing any work.
- b) Securely prevent the restoration of pressure while working on the device.



⚠ CAUTION

Hot surfaces

Burns of the skin on contact.

- a) At temperatures $\geq 48^{\circ}\text{C}$ the product must be allowed to cool down first.

⚠ ATTENTION**Blocking of the product due to curing media**

Curing media can mechanically block the product and make it unusable.

- a) Clean the product immediately after operation with curing media.

8.2 Removal

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

**NOTICE**

The concrete procedure for cleaning depends on the media being used.

- a) See the safety data sheet of the media in use.

9 Maintenance

9.1 Important notes about explosion protection



⚠ DANGER

Hazardous fluids

Danger to life when handling hazardous fluids.

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



⚠ DANGER

Rotating parts!

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

- a) Before all work, ensure that existing drives are voltage-free and pressure-free.
- b) 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.

- a) Depressurise the device and all connection lines before doing any work.
- b) Securely prevent the restoration of pressure while working on the device.



⚠ CAUTION

Hot surfaces

Burns of the skin on contact.

- a) At temperatures $\geq 48^{\circ}\text{C}$ the product must be allowed to cool down first.

9.2 Maintenance work



TIPP

Checking and documentation of the operating data

Regular checking and documentation of all operating data helps to detect faults at an early stage.

- 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.



NOTICE

Protective equipment and notices

After maintenance and/or repair, reattach all protective devices and notices removed in the process to their original position.

9.3 Maintenance instructions

The following information provides recommendations for maintenance work and maintenance intervals for the product in use.

Depending on the actual loads occurring during operation, the type, scope and interval of the maintenance work may deviate from the recommendations. A mandatory maintenance plan must be drawn up by the installer/operating company.



TIPP

In the course of preventive maintenance, it is advisable to replace wearing parts before the wear limit is reached.

With the appropriate expertise and sufficient equipment, the repair can also be carried out by the installer/operating company.

If necessary, request spare parts lists and assembly drawings from the manufacturer. Please consult the manufacturer for this purpose.



NOTICE

Warranty

Any warranty will be void if not executed properly.

9.4 Maintenance table

Maintenance table

		Firstly: after max. 24 h	Daily	3000 Operating hours	6000 Operating hours	As required	Additional information
9.4.1	Inspection: Discharge flow	2					
9.4.2	Inspection: Operating pressure	2					
9.4.3	Inspection: Media temperature	2					
9.4.5	Inspection: Add-on valve function (if existing)	2					
9.4.6	Inspection: Check the potential compensation (if existing)	2					
9.4.7	Inspection: Condition of operating fluid	2					
9.4.8	Audiometric monitoring: Unusual noise		1				
9.4.9	Cleaning		1				
9.4.10	Visual inspection: Leakages		1				
9.4.11	Visual inspection: Filling level of liquid seal (if existing)		2				
9.4.1	Inspection: Discharge flow			2			
9.4.2	Inspection: Operating pressure			2			
9.4.3	Inspection: Media temperature			2			
9.4.4	Inspection: Device temperature			2			
9.4.5	Inspection: Add-on valve function (if existing)			2			
9.4.6	Inspection: Check the potential compensation (if existing)			2			
9.4.7	Inspection: Condition of operating fluid			2			
9.4.12	Visual inspection: Condition gears				3		
9.4.13	Visual inspection: Condition of housing parts				3		
9.4.14	Visual inspection: Condition of plain bearings				3		
9.4.15	Visual inspection: Condition of shaft seal				3		
9.4.16	Visual inspection: Condition of outboard bearings				3		
9.4.17	Replacing: Outboard bearings					3	
9.4.19	Replacing: Shaft seal					3	
9.4.20	Replacing: Other seals					3	

1 - 0,1 h; 2 - 0,2 h; 3 - 0,75 h

9.4.1 Inspection: Discharge flow

The discharge flow is measured via the flow rate volume counters.

The values are displayed by the built-in controller in the electrical control system.

- If there is no discharge flow, check the individual components of the product.
- Comply with the product-specific data sheets/operating instructions.

9.4.2 Inspection: Operating pressure

The operating pressure is indicated by the pressure gauges

- If there is no operating pressure, check the individual components of the product
- Comply with the product-specific data sheets/operating instructions.

9.4.3 Inspection: Media temperature

The media temperature is measured through the temperature sensor.

The values are displayed by the built-in controller in the electrical control system.

- If the media temperature is too high or too low, check the product components.
- Comply with the product-specific data sheets/operating instructions.

9.4.4 Inspection: Device temperature

Measure the surface temperature in the area of the bearings.

9.4.5 Inspection: Add-on valve function (if existing)

Pressure relief valves must be actuated at regular intervals. This is the only way to ensure proper functioning.

9.4.6 Inspection: Check the potential compensation (if existing)

Check potential equalization for tight fit and function.

9.4.7 Inspection: Condition of operating fluid

Pay attention to colour (dark colouring), odour and milky turbidity.

- Replace operating fluid if necessary.

9.4.8 Audiometric monitoring: Unusual noise

In this case, attention must be paid to increased noise or uneven operation (pump unit).

- In case of unusual noises, check the individual components of the product, line attachments and the operating media for foam formation.
- Comply with the product-specific data sheets/operating instructions.

9.4.9 Cleaning

Remove dust deposits and dirt with a damp, clean cloth.

9.4.10 Visual inspection: Leakages

Care must be taken here to ensure that there is no leakage from the connections.

- In the event of leaks in the connections, the glands must be tightened and, if necessary, the seals replaced.

9.4.11 Visual inspection: Filling level of liquid seal (if existing)

Checking the confining fluid filling level is mandatory for safe pump operation. Top up the confining fluid as required.

If there is no automatic monitoring, the filling level must be checked at least before each shift begins.

If the filling level drops unusually fast within a short period of time, the outer but also the inner shaft seal could be leaking.

If the filling level should rise, the inner shaft seal may probably be leaking and the confining fluid is begin mixed with the pressurised medium.

- Stop plant operation immediately in both cases.

9.4.12 Visual inspection: Condition gears

Like shaft gear are wear items. In the event of excessive wear, the parts or the pump must be replaced.

Important control points are the mating surfaces of the shaft sealing ring and bearing bushes, the end faces of the shaft and pin wheels and the tooth flanks.

9.4.13 Visual inspection: Condition of housing parts

Like shaft gear are wear items. In the event of excessive wear, the parts or the pump must be replaced.

Important control points are the mating surfaces of the shaft sealing ring and bearing bushes, the end faces of the shaft and pin wheels and the tooth flanks.

9.4.14 Visual inspection: Condition of plain bearings

Like plain bearings are wear items. In the event of excessive wear, the parts or the pump must be replaced..

The wear limit of multi-layer plain bearings is reached when the bronze layer of the bearings is exposed to 50-70%.

The drive shaft and driven shaft are supported on the suction side under load in the bearings, so that the wear can be seen there first.

9.4.15 Visual inspection: Condition of shaft seal

Check on increased and impermissible temperature rises

- Small amounts of leakage, however, are indispensable for function.
- If there are excessive amounts of leakage, stop pump operation immediately.
Replace: Shaft seal.

9.4.16 Visual inspection: Condition of outboard bearings

Like outboard bearings are wear items.

The service life of the bearings depends primarily on the operating conditions.

The bearing should therefore be checked for damage after 4,000 hours at the latest. If the wear is unacceptable, the bearing must be replaced.

The beginning of wear or an imminent failure can become noticeable through increasing heating of the bearing, increased power consumption, imperfect running behavior or the development of noise.

9.4.17 Replacing: Outboard bearings

With corresponding expertise and sufficient equipment, the replacement can be carried out by the equipment builder/operator.

If required, request spare parts lists and assembly drawings from the manufacturer.

Use spare parts approved by the manufacturer only.

9.4.18 Replacing: Plain bearings (only by manufacturer)

The replacement is carried out only by the manufacturer.

Consult the manufacturer

9.4.19 Replacing: Shaft seal

With corresponding expertise and sufficient equipment, the replacement can be carried out by the equipment builder/operator.

If required, request spare parts lists and assembly drawings from the manufacturer.

Use spare parts approved by the manufacturer only.

9.4.20 Replacing: Other seals

With corresponding expertise and sufficient equipment, the replacement can be carried out by the equipment builder/operator.

If required, request spare parts lists and assembly drawings from the manufacturer.

Use spare parts approved by the manufacturer only.

10 Repairs

10.1 Safety instructions for repair



⚠ DANGER

Hazardous fluids

Danger to life when handling hazardous fluids.

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



⚠ DANGER

Rotating parts!

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

- a) Before all work, ensure that existing drives are voltage-free and pressure-free.
- b) Securely prevent restarting during all work.



⚠ WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Depressurize the system before all work.
- b) Securely prevent the pressure from being restored during work.



⚠ CAUTION

Hot surfaces

Burns of the skin on contact.

- a) At temperatures $\geq 48^{\circ}\text{C}$ the product must be allowed to cool down first.

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 on-line and is available as a pdf file download.



NOTICE

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.

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



NOTICE

Warranty

Any warranty will be void if not executed properly.



NOTICE

Protective equipment and notices

After maintenance and/or repair, reattach all protective devices and notices removed in the process to their original position.

10.3 Detecting and eliminating failures

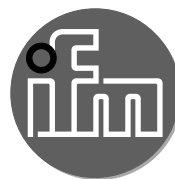
Fault	Potential causes	Possible measures
Increased noise		
Pump cavitation	Excessive negative pressure (not complete filling of the pump)	Check suction line design Use noise-optimised pump
	Suction line clogged	Clean the suction line
	Suction filter plugged or too small	Clean suction filter or use a 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
Foaming or air in media	Pump does not suck	Check the oil level in the tank Check suction line Check the shaft seal
		Replace seals
		Tighten or replace the screw connections Replace seals
	Suction connection leaking	
	System not vented	Vent the system
	Return line ends above the fluid level	Extend return line
Mechanical vibrations	Heavy foaming in the system, e.g. in gears	Use noise-optimised pump
	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	Increase valve opening pressure
	Not a noise-reducing setup	Use dampers

Pump does not suck		
	Dry run	Fill pump and the suction line with medium
	Minimum filling level in the reservoir tank undercut	Refill media
	Wrong direction of rotation	Correct the direction of rotation
	Throttled/closed shut-off element in the suction line	Open the shut-off element
	Suction line clogged	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	
Insufficient pressure		
Insufficient pumping flow rate		
	Excessive negative pressure (not complete filling of the pump)	Check suction line design
	Too high media viscosity	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/closed shut-off element in the suction line	Open the shut-off element
	Suction line clogged	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
	No response of a pressure relief valve	Increase valve opening pressure
	Pump does not suck	Check the oil level in the tank
		Check suction line
		Check the shaft seal
Wear	Replace the device	

Excessive operating temperature		
	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
Impermissible pump heating		
	No response of a pressure relief valve	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
Leakage		
Seal failure	Lack of maintenance	Comply with maintenance intervals Replace seals
	Mechanical damage	Replace seals
	Thermal overload	Check operating data Replace seals
	Pressure too high	Check operating data Replace seals
	Gas content in media too high	Check operating data Replace seals
	Corrosion/chemical degradation	Check 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 screw connection	Tighten or replace the screw connections

Coupling		
Coupling wear	Alignment error	Correct the alignment of the coupling and secure the coupling halves
	Spider overloaded	Check operating data Use harder spider
Cam break	Spider wear Torque transmission due to metal contact	Adapt maintenance intervals Replace coupling
Premature spider wear	Alignment error	Correct the alignment of the coupling and secure the coupling halves Replace spider
	Spider failure due to chemical corrosion	Check material compatibility Replace spider
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 operating data
		Check direction of rotation
	Motor circuit breaker incorrectly designed	Check operating data
Consult the manufacturer in the event of unidentifiable faults		

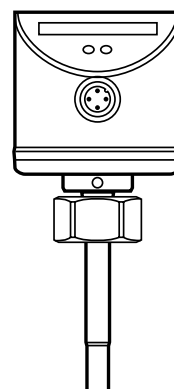
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Operating instructions
Flow monitors

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

704056 / 03 08 / 2010



27805972/EN – 05/2023

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12 Technical data.....	12

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.

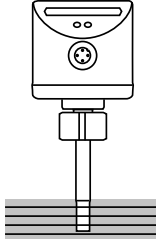
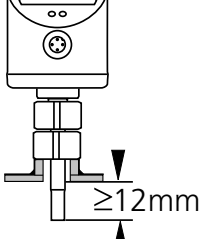
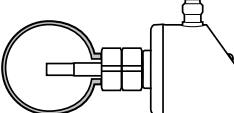
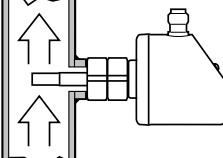
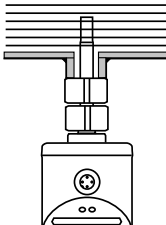
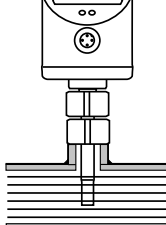
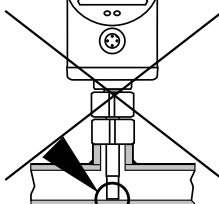
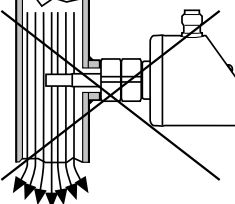
It is 2...5 cm/s for the setting 5...100 cm/s (= factory setting), it increases with higher flow speeds.
- The typical response time of the unit is 1...10 s. It can be influenced by the setting of the switch point:
 - Low switch point = quick reaction with rising flow.
 - High switch point = quick reaction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

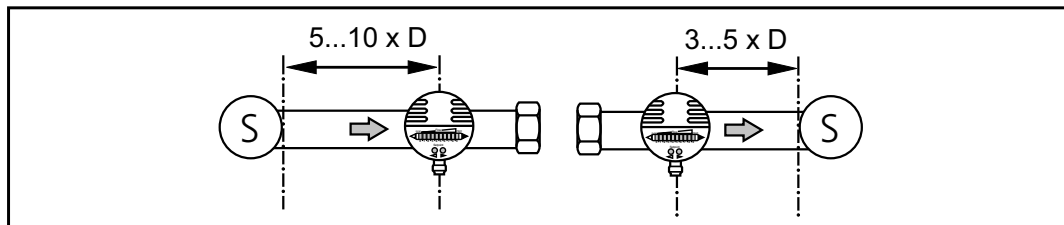
3.1 Installation location

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:

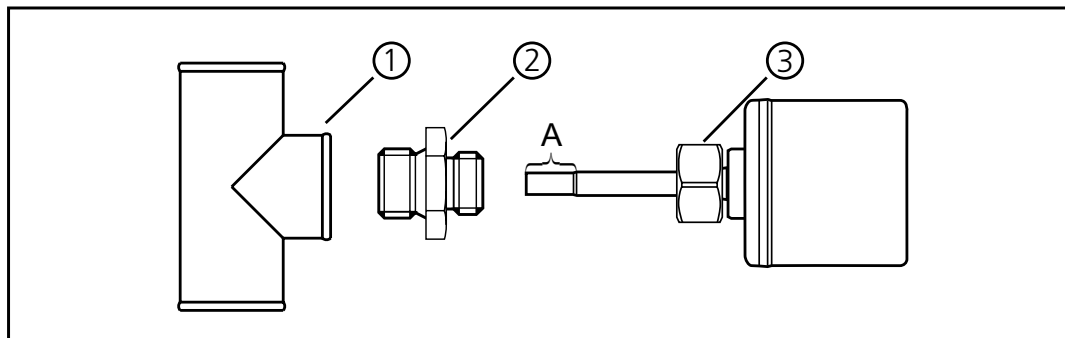


D = pipe diameter; S = sources of interference

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

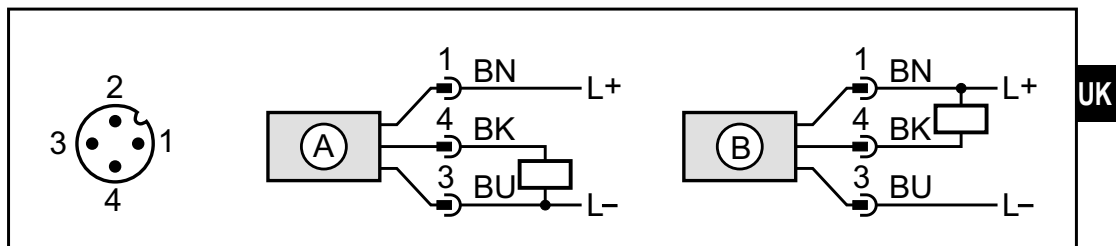


The unit must be connected by a qualified electrician.

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:

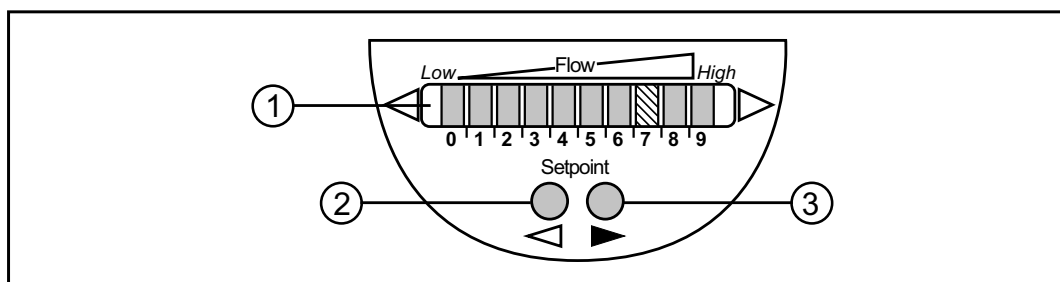


A: SI5000 (positive switching); B: SI5001 (negative switching)

Core colours of ifm sockets:

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

5 Operating and display elements



1: Operation display

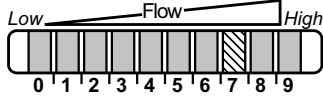
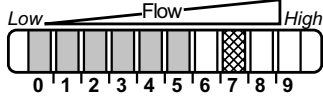
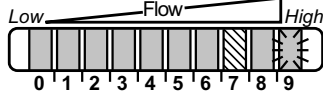
- The green LEDs indicate the current flow (the LEDs 0 to 9 represent the range between no flow and maximum flow).
- A lighting LED indicates the position of the switch point (orange = output closed, red = output open).

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.

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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.

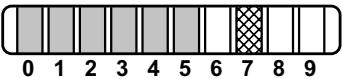
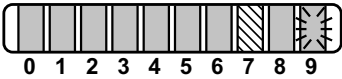
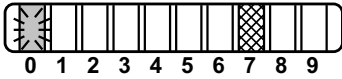
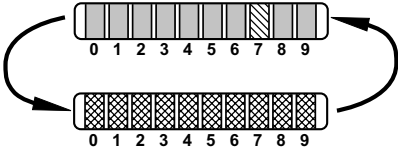
Possible cause /aid:

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.

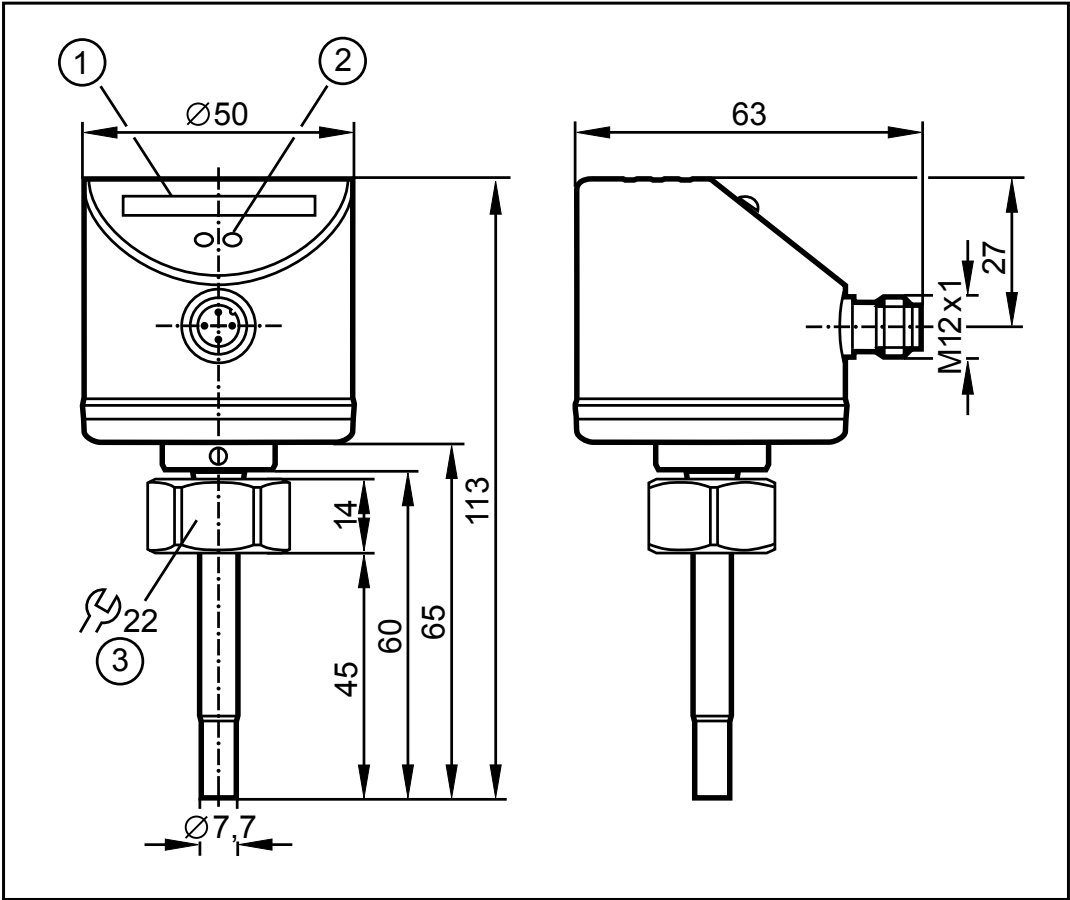
UK

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

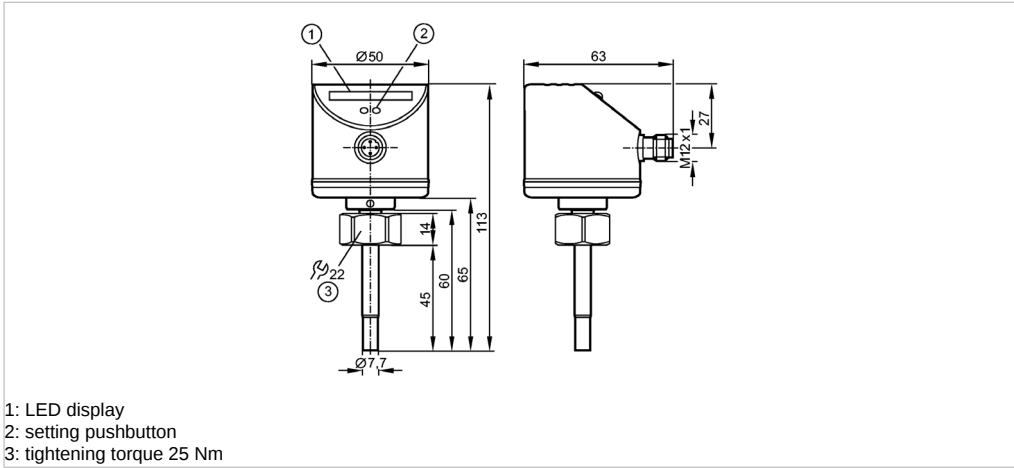
More information at www.ifm.com

efector300®

SI5000
SID10ABBPKG/US-100



Flow sensors



Product characteristics		
Flow monitor		
Compact type for adapter		
Process connection: internal thread M18 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

27805972/EN – 05/2023

efector300**SI5000**

SID10ABBFPG/US-100



Flow sensors

Accuracy / deviations		
Switch point accuracy	[cm/s]	$\pm 2... \pm 10$ *)
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

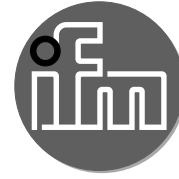
efector300**SI5000**

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

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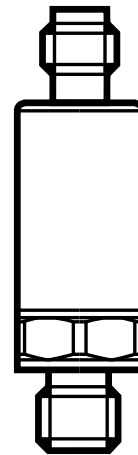


Operating instructions
Electronic pressure sensor
for industrial applications
PT54xx/PU54xx

UK

10 / 2021

11421203 / 00



27805972/EN – 05/2023

Contents

1 Preliminary note.....2

2 Safety instructions3

3 Functions and features4

 3.1 Applications4

4 Functions5

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.



CAUTION

Warning of personal injury.
Slight reversible injuries may result.

2

27805972/EN – 05/2023

2 Safety instructions

- The device described is a subcomponent for integration into a system.
 - The manufacturer is responsible for the safety of the system.
 - The system manufacturer undertakes to perform a risk assessment and to create a documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the manufacturer of the system.
- 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 (→ Technical data).
- 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.
- Installation, electrical connection, set-up, programming, configuration, operation and maintenance of the product must be carried out by personnel qualified and authorised for the respective activity.
- Protect units and cables against damage.

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CAUTION

For high medium temperatures, parts of the unit may heat up.

> Risk of burns

► Do not touch the unit

► Protect the housing against contact with flammable substances and unintentional contact.

3 Functions and features

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

3.1 Applications

- Type of pressure: relative pressure



Information on pressure rating and bursting pressure → data sheet.



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!



The units are vacuum resistant.



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!



If the cable length exceeds 30 m or if used outside buildings, there is a risk of overvoltage pulses from external sources. We recommend to use the unit in protected operating environments and to limit overvoltage pulses to max. 500 V.

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.

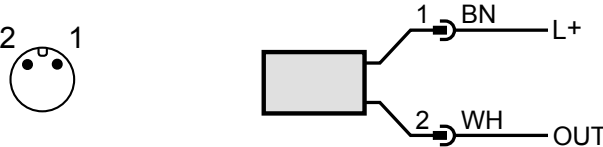
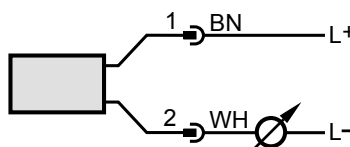
The national and international regulations for the installation of electrical equipment must be adhered to.

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

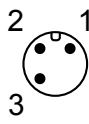
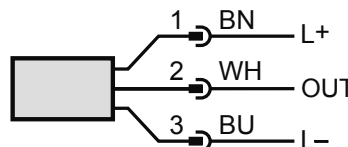
For marine applications (if approval available for the device), additional surge protection is required.

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

PT54xx (4...20 mA analogue)

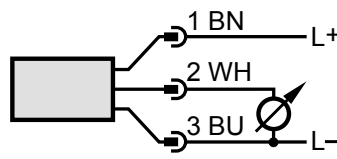
Core colours		
BN	brown	
WH	white	
		OUT: analogue output 4...20 mA Colours to DIN EN 60947-5-2
Example circuit		
		

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	
------------------------	--

	
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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

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27805972/EN – 05/2023

Temperature

Bimetal thermometer For industrial applications Models A52, R52

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 A52, R52 bimetal thermometers are 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 · 02/2019

Page 1 of 6



Specifications

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⁾

other connection designs on request

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	

Unit (scale range)

°C

Option: °F, °C/°F (dual scale)

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

Pointer

NS 25, 33, 40: Aluminium, black
 NS 50, 63, 80, 100, 160: Aluminium, black, adjustable pointer

Window

Instrument glass
 NS 33: polycarbonate

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

1) Not for NS 25, 33, 40, 50

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

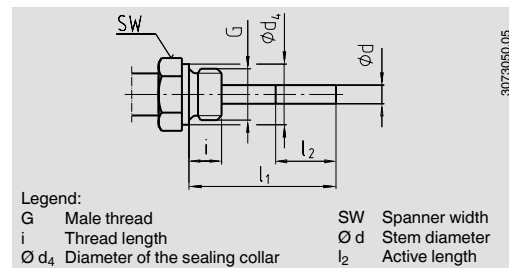
other scale ranges on request

Connection designs

Standard design (male thread connection)

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

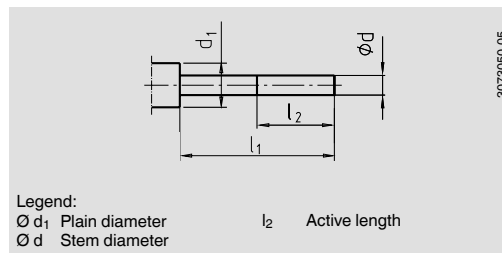
Nominal size	Process connection		Dimensions in mm		
	G	i	SW	Ø d ₄	Ø d
25, 33	M8 x 1.25	8	12	-	4
	G 1/8 B	8	12	-	4
	G 1/4 B	8	17	-	4
40, 50	M8 x 1.25	8	12	-	4
	G 1/8 B	8	17	-	4
	G 1/4 B	8	17	-	4
	G 1/2 B	12	22	-	4
63, 80, 100, 160	G 1/4 B	12	19	18	6 or 8
	G 1/2 B	14	27	26	6 or 8
	M18 x 1.5	12	24	23	6 or 8
	1/2 NPT	19	22	-	6 or 8



Design 1, plain stem (without thread)

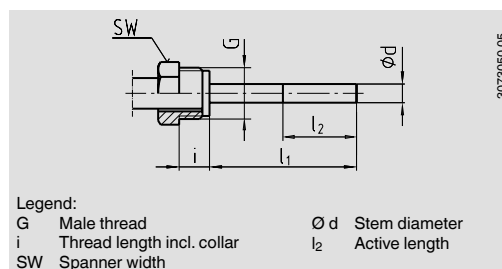
Standard insertion length $l_1 = 45, 63, 100, 140, 160, 200, 240, 290$ mm

Nominal size	Dimensions in mm	
NS	d_1	$\varnothing d$
25, 33	8	4
40, 50	12	4
63, 80, 100, 160	18	6 or 8

**Design 2, male nut**

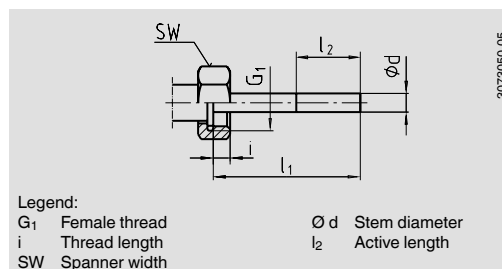
Standard insertion length $l_1 = 80, 140, 180, 230$ mm

Nominal size	Process connection		Dimensions in mm	
NS	G	i	SW	$\varnothing d$
63, 80, 100, 160	G ½ 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

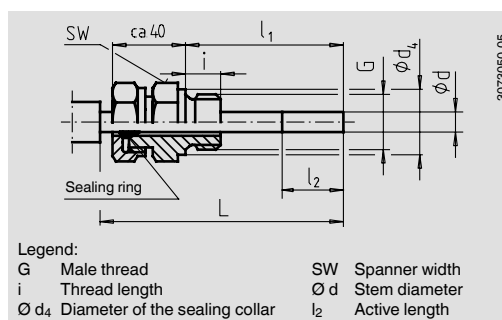
Nominal size	Process connection		Dimensions in mm	
NS	G	i	SW	$\varnothing d$
63, 80, 100, 160	G ½	8.5	27	6 or 8
	G ¾	9.5	32	6 or 8

**Design 4, compression fitting (sliding on stem)**

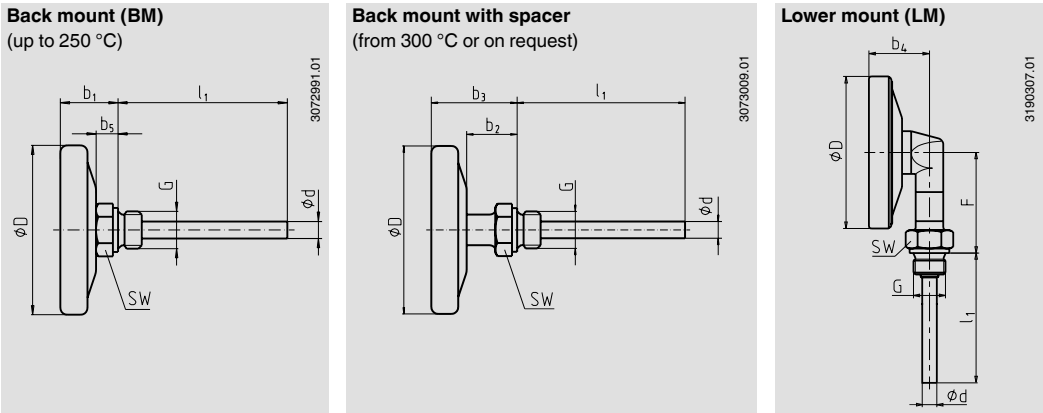
Insertion length $l_1 =$ variable

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 ¼ B	8	22	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
	G ¾ B	16	32	32	6 or 8
	¾ 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
	KazInMetr (option) Metrology, measurement technology	Kazakhstan
-	MTSCHS (option) Permission for commissioning	Kazakhstan
	BelGIM (option) Metrology, measurement technology	Belarus
	UkrSEPRO (option) Metrology, measurement technology	Ukraine
	Uzstandard (option) Metrology, measurement technology	Uzbekistan
-	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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02/2019 EN

WIKA data sheet TM 52.01 · 02/2019

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27805972/EN – 05/2023

Pressure

Bourdon tube pressure gauge, copper alloy Stainless steel case, liquid filling, NS 50, 63 and 100 Model 213.53

WIKA data sheet PM 02.12

for further approvals see
page 3

Applications

- For measuring points with high dynamic pressure loads and 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 robust design
- Type approval for the shipbuilding industry
- Scale ranges up to 0 ... 1,000 bar



Bourdon tube pressure gauge, model 213.53.100,
lower mount

Description

The liquid-filled model 213.53 Bourdon tube pressure gauge is constructed with a case from stainless steel and wetted parts from copper alloy.

The model 213.53 meets the requirements of the international industry standard EN 837-1 for Bourdon tube pressure gauges.

Due to the liquid filling in the case, the pressure element and movement are efficiently damped. Therefore, these instruments are particularly suited to measuring points with high dynamic loads, such as fast load cycles or vibrations.

The cases of the model 213.53 are available in nominal sizes of 50, 63 and 100 mm and fulfil IP65 ingress protection. With an accuracy of up to class 1.0, this pressure gauge is suitable for a wide range of applications in industry.

For mounting in control panels, the pressure gauges with a back mount process connection can be fitted with a mounting flange or with a triangular bezel and mounting bracket.

WIKA data sheet PM 02.12 · 07/2019

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Data sheets showing similar products:
Stainless steel case, liquid filling, NS 40, 80 and 100; model 113.53; see data sheet PM 01.08



Specifications

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 ... 1,000 bar

NS 63, 100: 0 ... 0.6 to 0 ... 1,000 bar

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. $\pm 0.4 \text{ } \%/10 \text{ } ^\circ\text{K}$ of the span

Ingress protection per IEC/EN 60529

IP65

Process connection

Copper alloy

Lower mount or back mount

NS 50, 63: G 1/4 B (male), SW 14

NS 100: G 1/2 B (male), SW 22

Pressure element

NS 50:

Copper alloy, C-type or helical type

NS 63:

$\leq 400 \text{ bar}$: Copper alloy, C-type or helical type

$> 400 \text{ bar}$: $\geq 400 \text{ bar}$: Stainless steel 316L, helical type

NS 100:

$< 100 \text{ bar}$: Copper alloy, C-type

$\geq 100 \text{ bar}$: 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

Case

Stainless steel, natural finish

Sealing towards process connection with O-ring

With all scale ranges, the filling plug can be vented for internal pressure compensation.

Position of blow-out device

NS 50: Case back, at 12 o'clock

NS 63, 100: Case circumference, at 12 o'clock

Window

Plastic, crystal-clear

Ring

Crimped triangular bezel, stainless steel, glossy finish

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 point adjustment (in front)
- Increased medium temperature with special soft solder
 - NS 50, 63: 100 °C
 - NS 100: 150 °C
- Extended ambient temperature range -40 ... +60 °C with silicone oil filling
- Panel mounting flange, stainless steel, for back mount connection
- Surface mounting flange, stainless steel (only NS 63, 100)
- Mounting clamp, for back mount

Approvals

Logo	Description	Country
	EU declaration of conformity Pressure equipment directive PS > 200 bar, module A, pressure accessory	European Union
	GOST (option) Metrology, measurement technology	Russia
	KazInMetr (option) Metrology, measurement technology	Kazakhstan
-	MTSCHS (option) Permission for commissioning	Kazakhstan
	BelGIM (option) Metrology, measurement technology	Belarus
	UkrSEPRO (option) Metrology, measurement technology	Ukraine
	Uzstandard (option) Metrology, measurement technology	Uzbekistan
-	CPA Metrology, measurement technology	China
	GL Ships, shipbuilding (e.g. offshore)	International
-	CRN Safety (e.g. electr. safety, overpressure, ...)	Canada

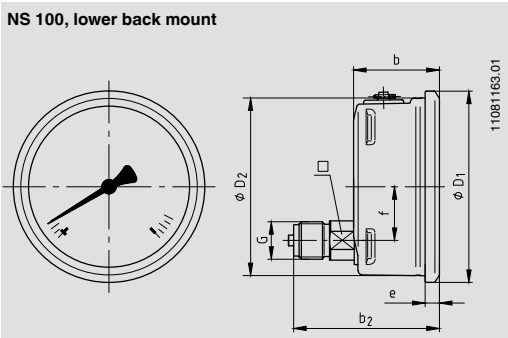
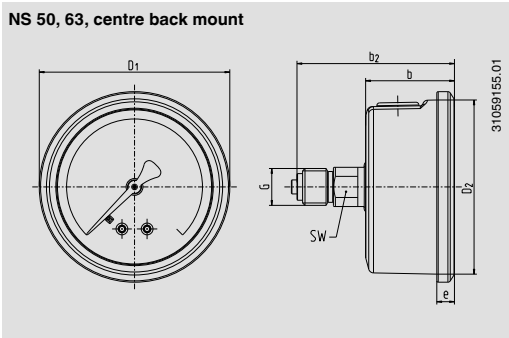
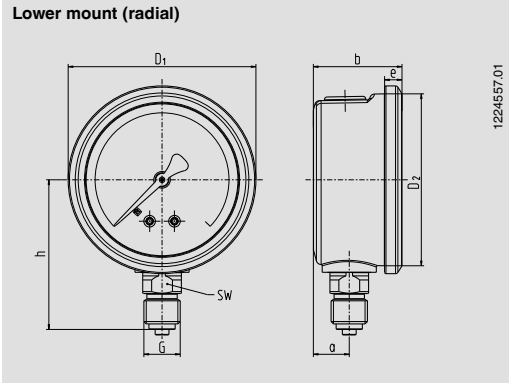
Certificates (option)

- 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)

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 / Process connection / Connection location / Options

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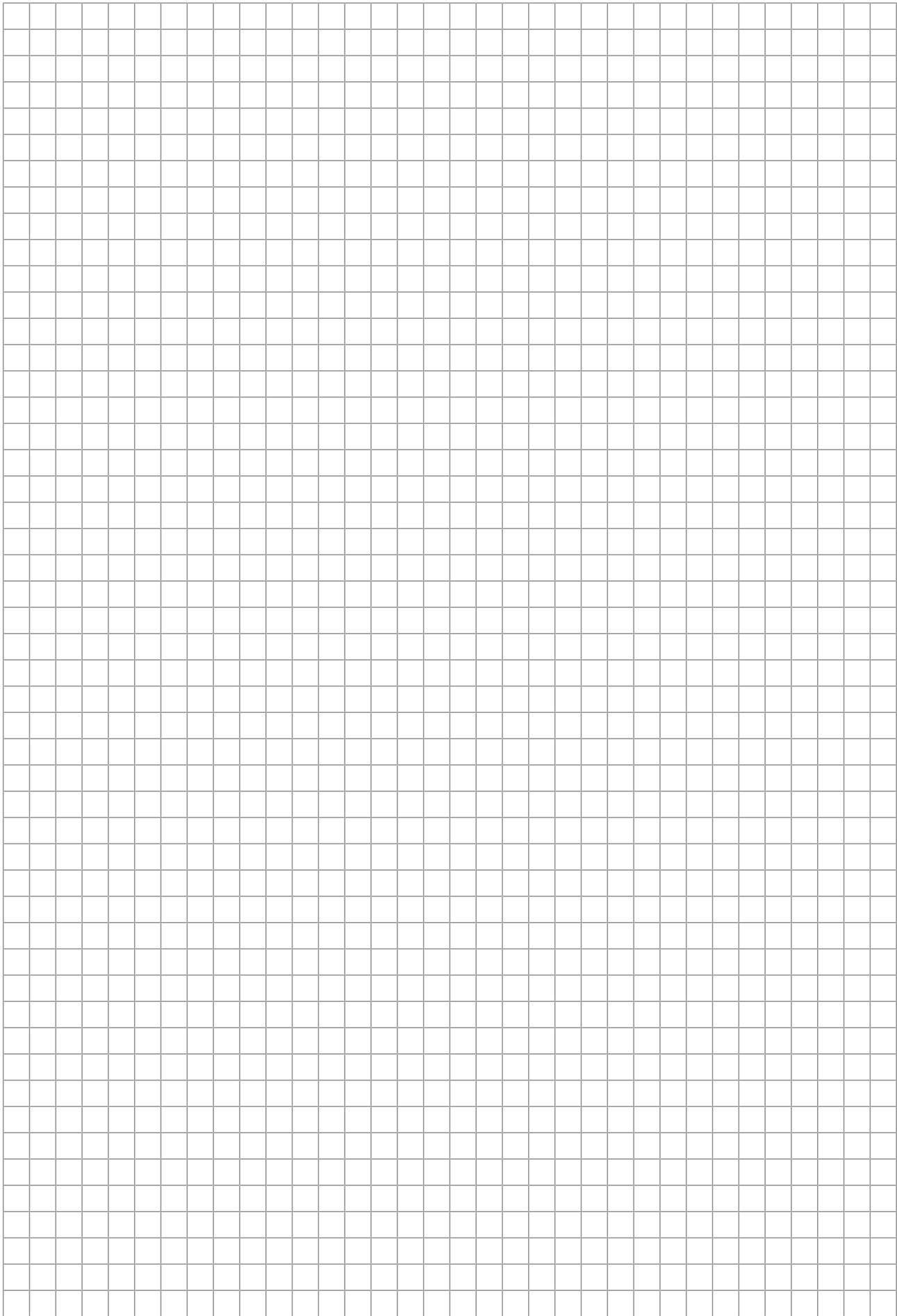
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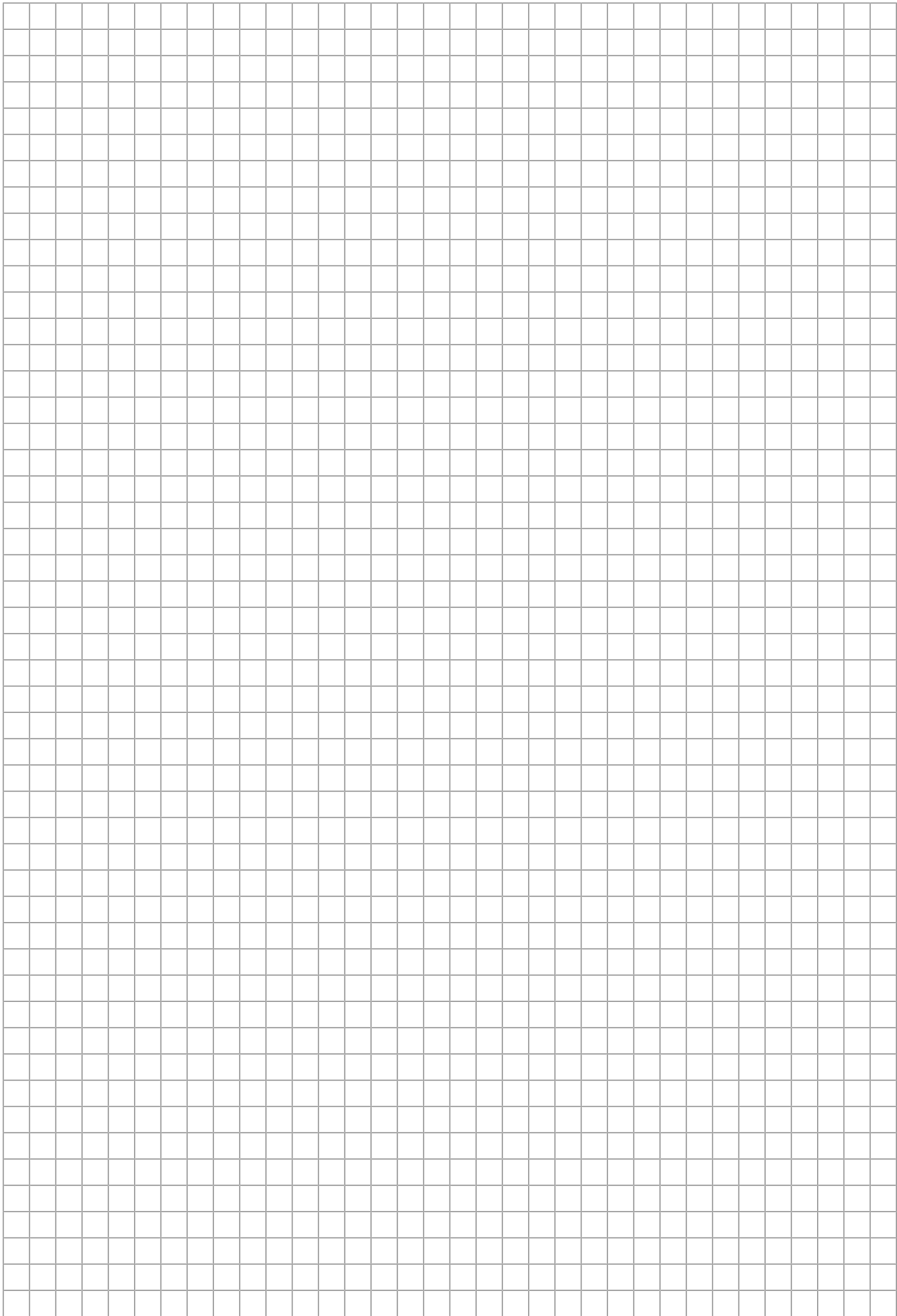
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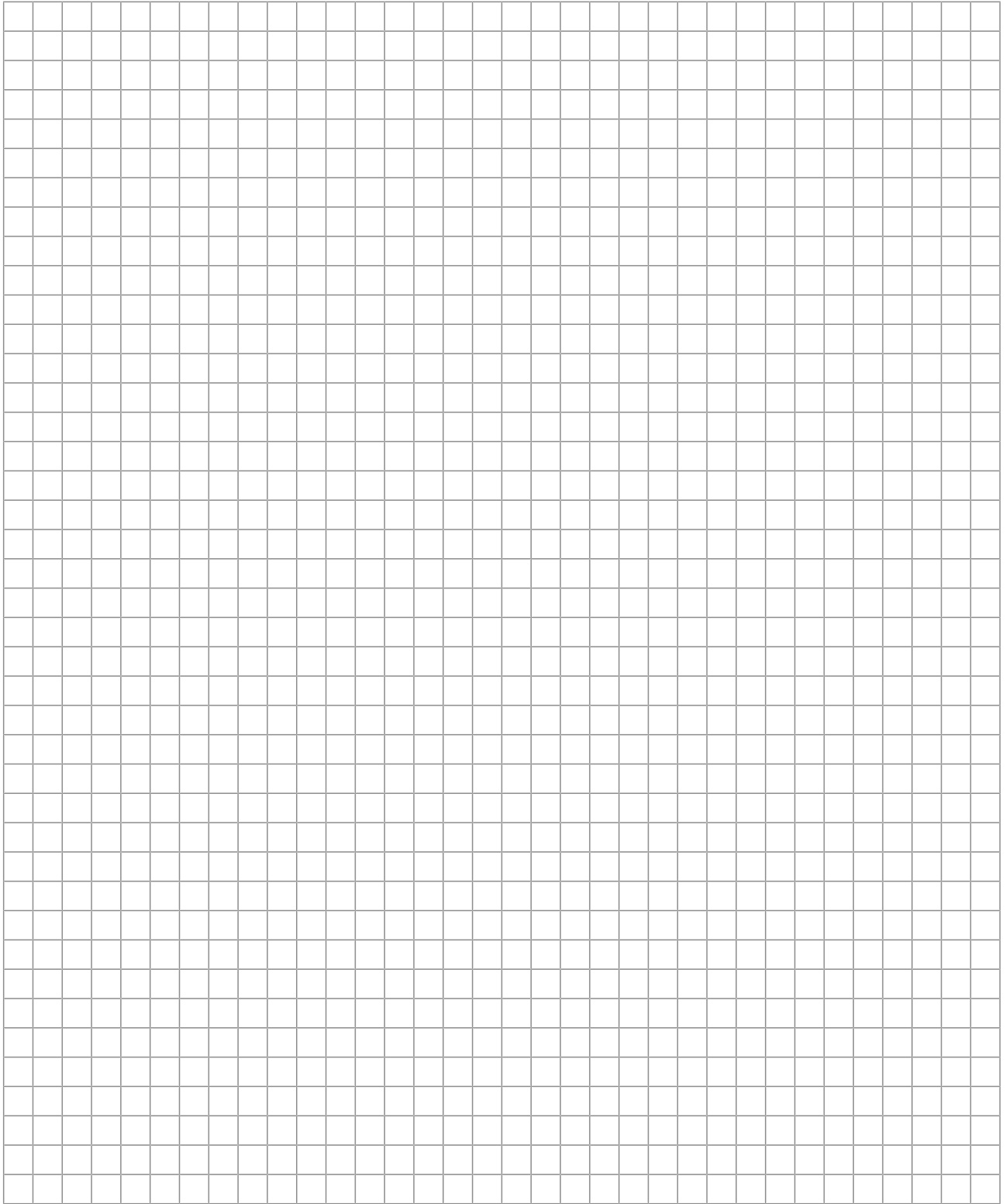


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