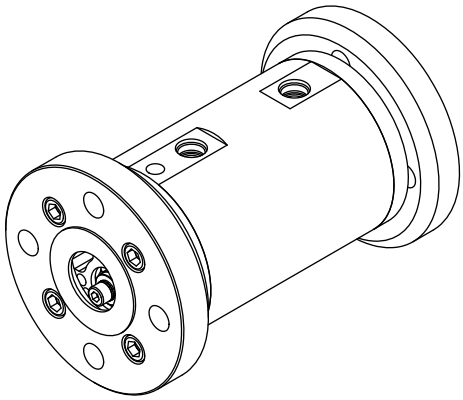
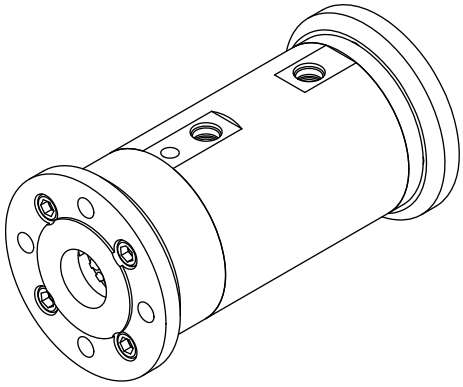
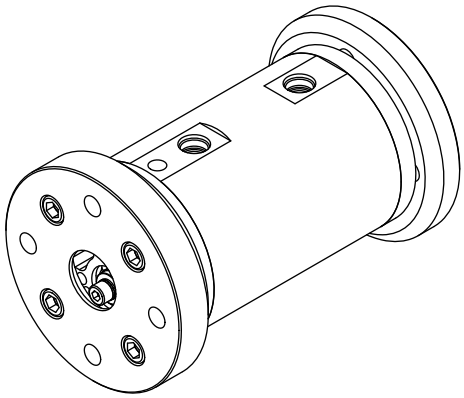
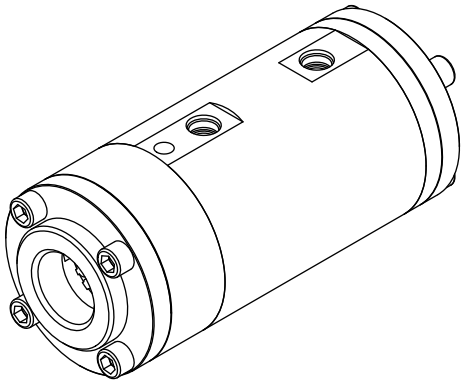
Operating Instructions









KRAL Flowmeter.

OMP Series

OIO 23en
Edition 10/2017
Original instructions

Table of contents

General information

The operating instructions form part of the KRAL flowmeter and must be kept for future reference. Furthermore please observe the associated documents.

Target groups

Target group	Tasks
Operator-owner	☐ Keep these instructions available at the system site for future reference. ☐ Ensure that employees read and observe these instructions and the associated documents, in particular the safety instructions and warnings. ☐ Observe additional system-specific directives and regulations.
Specialist personnel, fitters	☐ Read, observe and follow these instructions and the associated documents, in particular the safety instructions and warnings.

Symbols

Symbol	Meaning
	Warning personal injury
	Notice
	Procedures mechanical installation
	Procedures electrical installation
	Check or fault table
▶	Request for action

Danger levels

Danger levels

	Warning	Danger level	Consequences of non-observances
⚠	**Danger**	Immediate threat of danger	Serious personal injury, death
⚠	**Warning**	Possible threat of danger	Serious personal injury, invalidity
⚠	**Caution**	Potentially dangerous situation	Slight personal injury
	Caution	Potentially dangerous situation	Material damage

Associated documents

Calibration certificate
Declaration of conformity according to EU Directive 2006/42/EC
Declaration of conformity according to EU Directive 2014/34/EU
ATEX supplementary instructions for operation in potentially explosive areas
Manufacturer's declaration according to EU Directive 2014/68/EU
Corresponding operating instructions for pick up
Corresponding operating instructions for electronic equipment

Proper use

- ☐ Use flowmeters of the OMP series solely for flow measurement of lubricating liquids that are chemically neutral and do not contain any gas or solids content.
- ☐ Flowmeters require the operation with clean liquids. If coarse soiling, solid particles in the liquid or abrasive fine particles occur during operation, the flowmeter has to be protected additionally by a correspondingly dimensioned operating filter in the pipe system, see "Cleaning the pipe system", page 27.
- ☐ Only use flowmeters within the operational limits specified on the rating plate and in the "Technical data" section. Deviating operating data can result in damage to the flowmeter. In the case of operating data that does not agree with the specifications on the rating plate, please contact the manufacturer.
- ☐ Strong changes to the flow rate (e.g. rapid shutdown, pulsations ...) cause marked pressure differences on the flowmeter and can damage the measuring unit.
  - The pressure loss of the flowmeter must not exceed the values given in the chapter "Technical data", see "Load-bearing capacity", page 14.

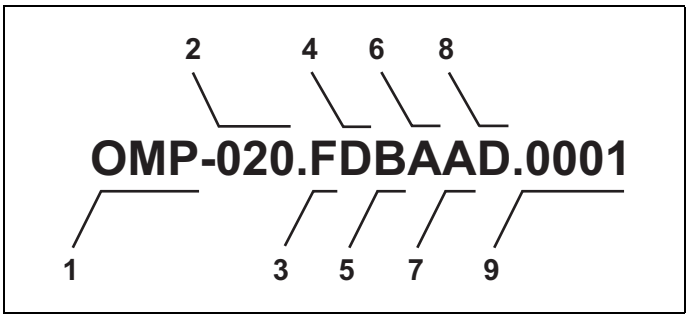
Safety information

The following safety instructions must be observed:

- ☐ No liability is accepted for damage arising through non-observance of the operating instructions.
  - Read the operating instructions carefully and observe them.
  - The operator-owner is responsible for the observance of the operating instructions.
  - Installation, removal and installation work may only be carried out by specialist personnel.
- ☐ Flowmeters wear to different degrees depending on the respective operating conditions (pulsations, temperature, …).
  - Do not continue to use flowmeters that are operated contrary to specifications or after damage.
  - Check the flowmeters regularly.
  - Shut down damaged flowmeters and replace worn flowmeters immediately.
- ☐ In order for the warranty to remain valid, corrective maintenance carried out during the warranty period requires the express permission of the manufacturer.
- ☐ Observe the general regulations for the prevention of accidents as well as the local safety and operating instructions.
- ☐ Observe the valid national and international standards and specifications of the installation location.
- ☐ In case of systems with an increased potential of danger to humans and/or machines the failure of a flowmeter may not lead to injuries or damage to property.
  - Always equip systems with an increased potential of danger with alarm equipment and/or bypass.
  - Maintain and check the protective/alarm equipment regularly.
- ☐ The pumped liquids can be dangerous (e.g. hot, dangerous to health, poisonous, combustible). Observe the safety conditions for handling dangerous materials.
- ☐ Pumped liquids can be subject to pressure and can cause damage and/or personal injury should leaks occur.

Type code

Type code

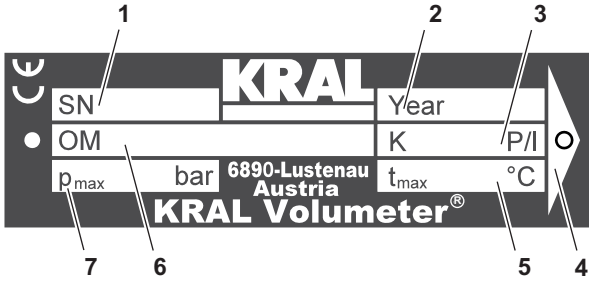


1 Series
2 Size
3 Sensor technology
4 Function of sensor technology
5 Material of bearing
6 Material of seal
7 Mechanical connection
8 Electrical connection
9 Version index

Fig. 1 Type code

Item	Designation	Description
1	Series	OMP: Universal
2	Size	Corresponds to the diameter of the measuring screw large in [mm]
3	Sensor technology	F: BEG 47
		I: BEG 56
		K: BEG 64
		X: Special design
4	Function of sensor technology	A: Without flow direction detection
		B: With flow direction detection
		C: Without flow direction detection, with temperature compensation
		D: With flow direction detection, with temperature compensation
		X: Special design
5	Material of bearing	B: Hybrid
6	Material of seal	A: FPM (FKM)
		B: FFPM
		C: Low temperature FPM
		D: EPDM
		X: Special design
7	Mechanical connection	A: Pipe thread connection BSPP
		B: Flange connection DIN
		C: Pipe thread connection NPT
		D: Flange connection ANSI
		E: Flange connection JIS
		X: Special design
8	Electrical connection	A: Loose cable head
		B: Cable gland junction box
		D: Mounting kit for electronic unit
		X: Special design
9	Version index	For internal administration

Rating plate



1 Serial number
2 Year of construction
3 K-factor
4 Preferred flow direction
5 Maximum temperature
6 Type
7 Maximum pressure

Fig. 2 Rating plate

Operating limits

The values specified on the rating plate and the calibration certificate apply. The permissible operational limits of individual values influence each other so that every application is checked individually by the manufacturer when selecting the flowmeter.
If no operating data are provided by the orderer, standardized substitute operating data are used.

Load due to pressure pulsation

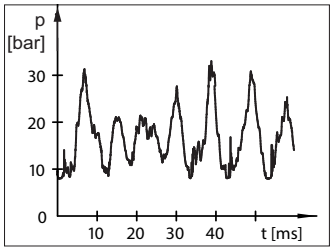


Fig. 1 Pressure pulses

Strong pressure pulses in the system can reduce the lifetime of the flowmeter.

Maximum values

The following table shows the respective maximum values that, however, may not occur simultaneously. In addition, the operational limits of the corresponding completion, of the sealing material and of the pick up are to be observed.

	Unit	OMP 13	OMP 20	OMP 32	OMP 52
Flow rate					
Q_{max}	[l/min]	15	45	150	525
Q_{nom}		10	30	100	350
Q_{min}		0,1	0.3	1.0	3.5
Max. pressure	[bar]	40			
Temperature					
min. – max.	[°C]	-20...+200			
Viscosity					
min. – max.	[mm^2/s]	1 – 1000000			
Measuring chamber volume	[ml/U]	1,65	6.25	25.6	112.7
Rotation speed					
n (Q_{max})	[min^{-1}]	9120	7200	5850	4658
n (Q_{nom})		6060	4800	3900	3105
n (Q_{min})		61	48	39	31
Pole number		2	2	2	2
K-factor	[P/l]	1214	321.0	78.0	17.73
Milliliters/pulse	[ml/P]	0,824	3.12	12.8	56.4
Pulse frequency					
f1 (Q_{max})	[Hz]	304	242	195	155
f1 (Q_{nom})		202	161	130	104
f1 (Q_{min})		2,0	1.6	1.3	1.0

Tab. 1 Maximum values

Substitute operating data

The following table shows standardized values for the flow rate, temperature and viscosity. These values can be used at the same time as maximum values without impairing the service life of the flowmeter. In addition, the operational limits of the corresponding completion, of the sealing material of the pick up and of the temperature sensor are to be observed.

	Unit	OMP 13	OMP 20	OMP 32	OMP 52
Flow rate					
Q_{max}	[l/min]	10	30	100	350
Q_{nom}		10	30	100	350
Q_{min}		0,2	0.6	2.0	7.0
Max. pressure	[bar]	40			
Temperature					
min. – max.	[°C]	-20...+125			
Viscosity					
min. – max.	[mm^2/s]	1 – 200			

Tab. 2 Substitute operating data

Sound pressure level

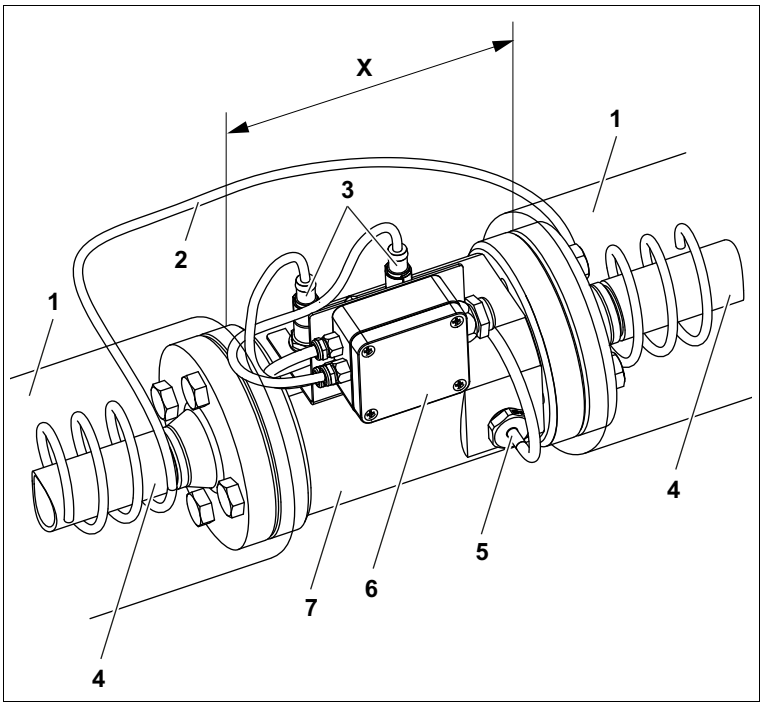
The sound pressure level of the flowmeter amounts to less than 70 dB(A).

Heating system

A heating system is not installed at the factory. The customer can optionally fit OMP-series KRAL flowmeters with a trace heating system. The manufacturer recommends heating systems for high-viscosity liquids that do not flow sufficiently if not heated, because bearing damage and destruction of the device may otherwise result.

Trace heating system

Contact the manufacturer before installing a trace heating system.



1 Heat insulation
2 Trace heating
3 Pick up with connecting cable
4 Piping
5 Temperature sensor with connecting cable
6 Junction box
7 Flowmeter

X Area stringently without heat insulation

Fig. 2 Flowmeter with trace heating system

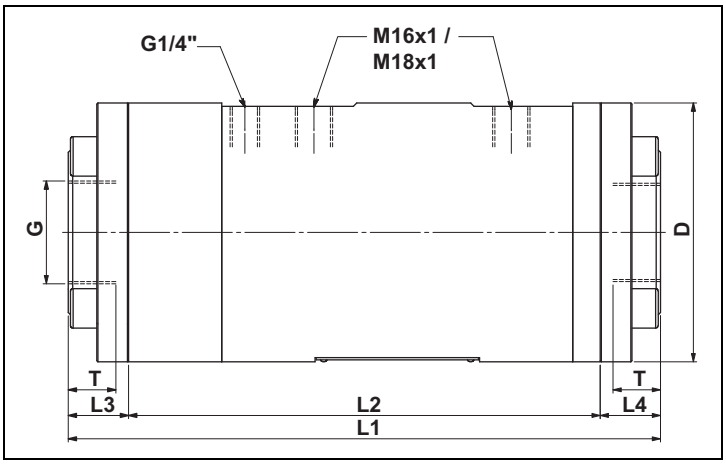
CAUTION
Defective pick up, temperature sensor or cabling due to exceeding of the maximum temperature.

► Do not heat the pick up, temperature sensor, junction box and corresponding cables above the temperature specified in the associated operating instructions.

► Ensure that pick up **3**, temperature sensor **5**, junction box **6** and corresponding cables are not heat insulated. The area **X** has to be free of heat insulation, see Fig. 2, page 9.

Dimensions and weights

OMP with pipe thread (BSPP thread)



G	Pipe thread
M16x1/	Pick up hole/
M18x1	Mounting connection element
G1/4"	Temperature sensor hole
D	Outer diameter
L1	Total length
L2	Flowmeter length without connections
L3, L4	Flange thickness
T	Max. screw-in depth

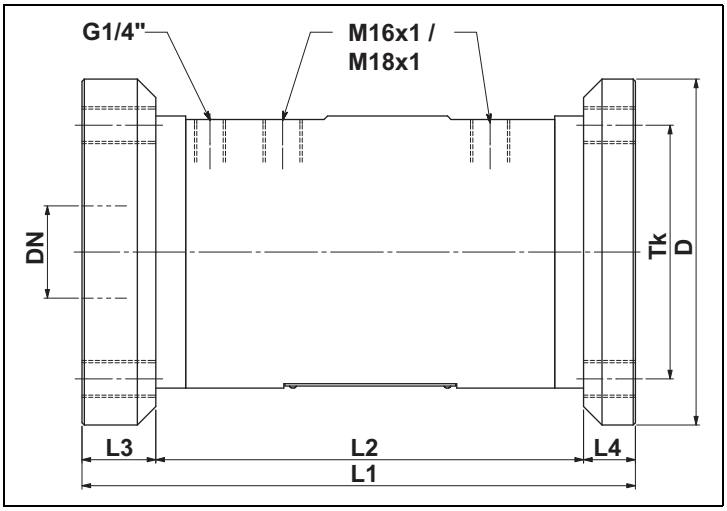
Fig. 3 Dimensional drawing OMP with pipe thread

	Unit	OMP 13	OMP 20	OMP 32	OMP 52
G	[inch]	1/2	3/4	1	1 1/2
Pressure stage	[bar]	40	40	40	40
D	[mm]	90	74	104	118
L1	[mm]	115	145	215	270
L2	[mm]	64	85	140	215
L3	[mm]	25,5	38.0	47.0	27.5
L4	[mm]	25,5	22.0	28.0	27.5
T	[mm]	15	16	18	22
Weight	[kg]	3,4	3.5	11.0	18.0

Tab. 3 Dimensions and weights – Pipe thread connection

Dimensions and weights

OMP with DIN flange



DN	Nominal diameter flange
M16x1/ M18x1	Pick up hole/ Mounting connection element
G1/4"	Temperature sensor hole
D	Outer diameter
L1	Total length
L2	Flowmeter length without connections
L3, L4	Flange thickness
TK	Pitch circle

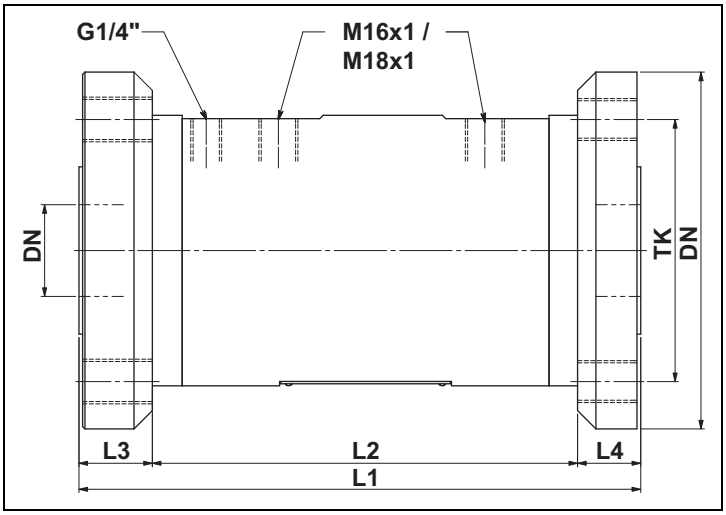
Fig. 4 Dimensional drawing OMP with DIN flange

	Unit	OMP 13	OMP 20	OMP 32	OMP 32	OMP 52
DN		15	20	25	32	40
Pressure stage	[bar]	40	40	40	40	40
D	[mm]	95	105	115	140	150
L1	[mm]	115	125	180	190	240
L2	[mm]	64	85.0	140.0	140.0	185.5
L3	[mm]	25,5	20	20	25	32
L4	[mm]	25,5	20.0	20.0	25.0	22.5
TK	[mm]	65	75	85	100	110
Weight	[kg]	3,7	5.0	11.2	13,5	19.2

Tab. 4 Dimensions and weights – DIN flange connection

Dimensions and weights

OMP with ANSI flange



DN	Nominal diameter flange
M16x1/ M18x1	Pick up hole/ Mounting connection element
G1/4"	Temperature sensor hole
D	Outer diameter
L1	Total length
L2	Flowmeter length without connections
L3, L4	Flange thickness
TK	Pitch circle

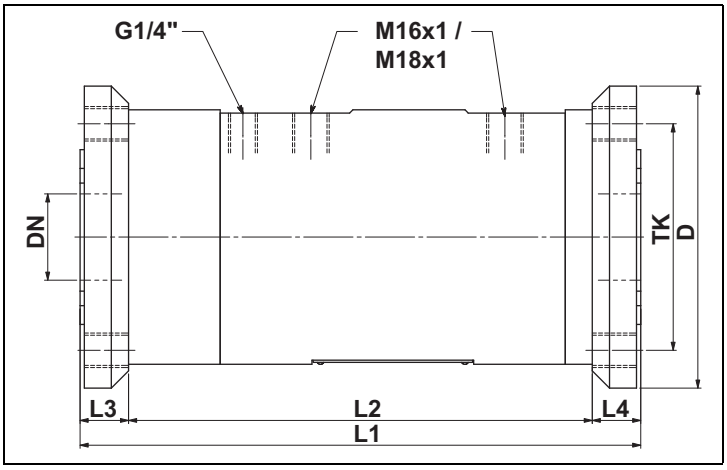
Fig. 5 Dimensional drawing OMP with ANSI flange

	Unit	OMP 20	OMP 32	OMP 52
DN	[inch]	3/4	1	1 1/2
Class		300	300	300
D	[mm]	117.5	123.8	155.6
L1	[mm]	134	195	245
L2	[mm]	85.0	140.0	185.5
L3	[mm]	24.5	27.5	32.0
L4	[mm]	24.5	27.5	27.5
TK	[mm]	82.5	88.9	114.3
Weight	[kg]	6.0	12.5	19.6

Tab. 5 Dimensions and weights – ANSI flange connection

Dimensions and weights

OMP with JIS flange



DN	Nominal diameter flange
M16x1/ M18x1	Pick up hole/ Mounting connection element
G1/4"	Temperature sensor hole
D	Outer diameter
L1	Total length
L2	Flowmeter length without connections
L3, L4	Flange thickness
TK	Pitch circle

Fig. 6 Dimensional drawing OMP with JIS flange

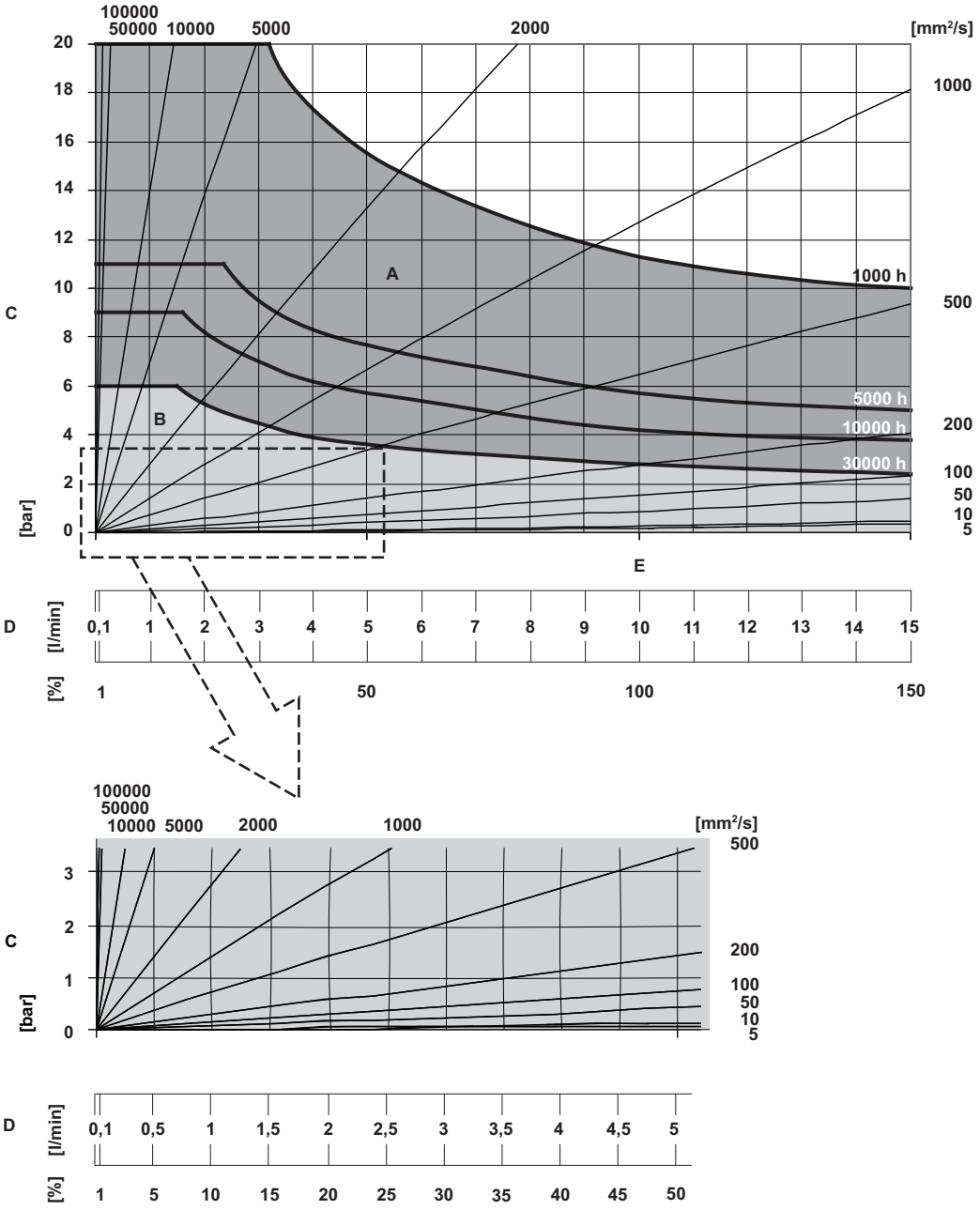
	Unit	OMP 20	OMP 32	OMP 52
DN		20	25	40
Pressure stage		16K	16K	16K
D	[mm]	100	125	140
L1	[mm]	125	190	260
L2	[mm]	85	140	215
L3	[mm]	20.0	25.0	22.5
L4	[mm]	20.0	25.0	22.5
TK	[mm]	75	90	105
Weight	[kg]	4.5	12.2	19.0

Tab. 6 Dimensions and weights – JIS flange connection

Load-bearing capacity

Load-bearing capacity

Load-bearing capacity OMP 13

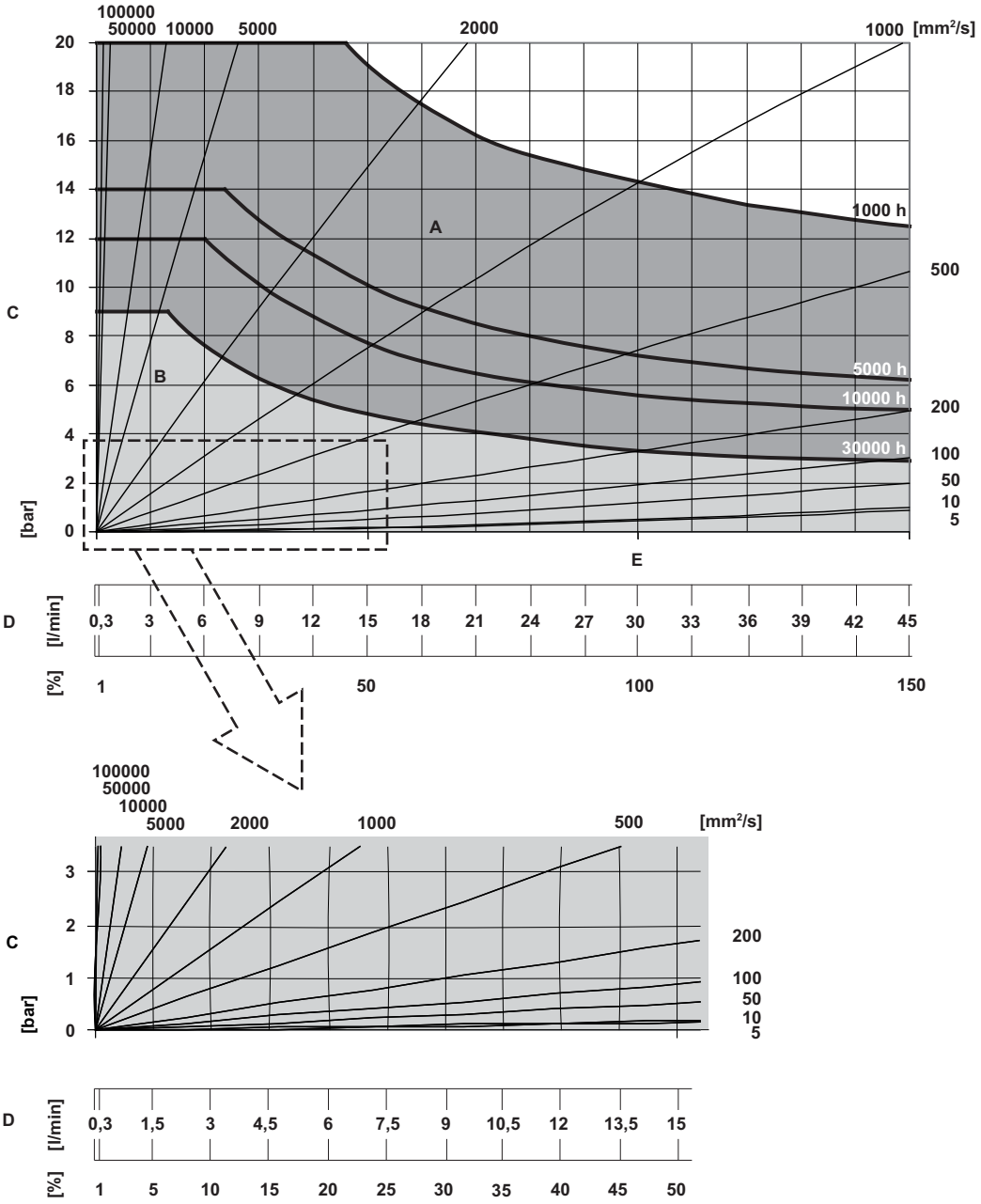


A Short-time operation
B Continuous operation
C Pressure loss
D Flow rate
E Q_{nom}

The values apply for lubricating liquids at temperatures of up to 120 °C. Abrasive and aggressive liquids reduce the durability.

Load-bearing capacity

Load-bearing capacity OMP 20

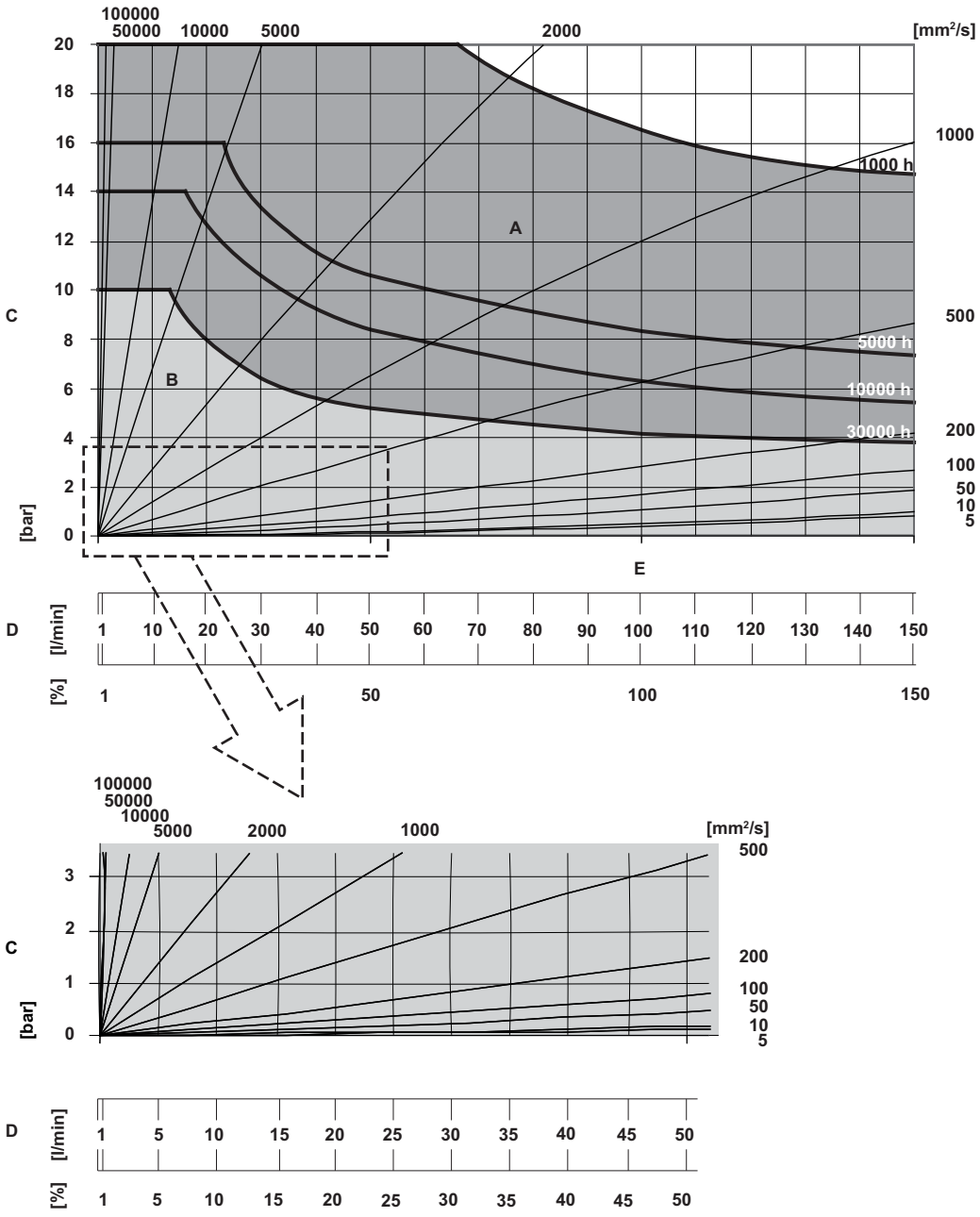


A Short-time operation
B Continuous operation
C Pressure loss
D Flow rate
E Q_{nom}

The values apply for lubricating liquids at temperatures of up to 120 °C. Abrasive and aggressive liquids reduce the durability.

Load-bearing capacity

Load-bearing capacity OMP 32

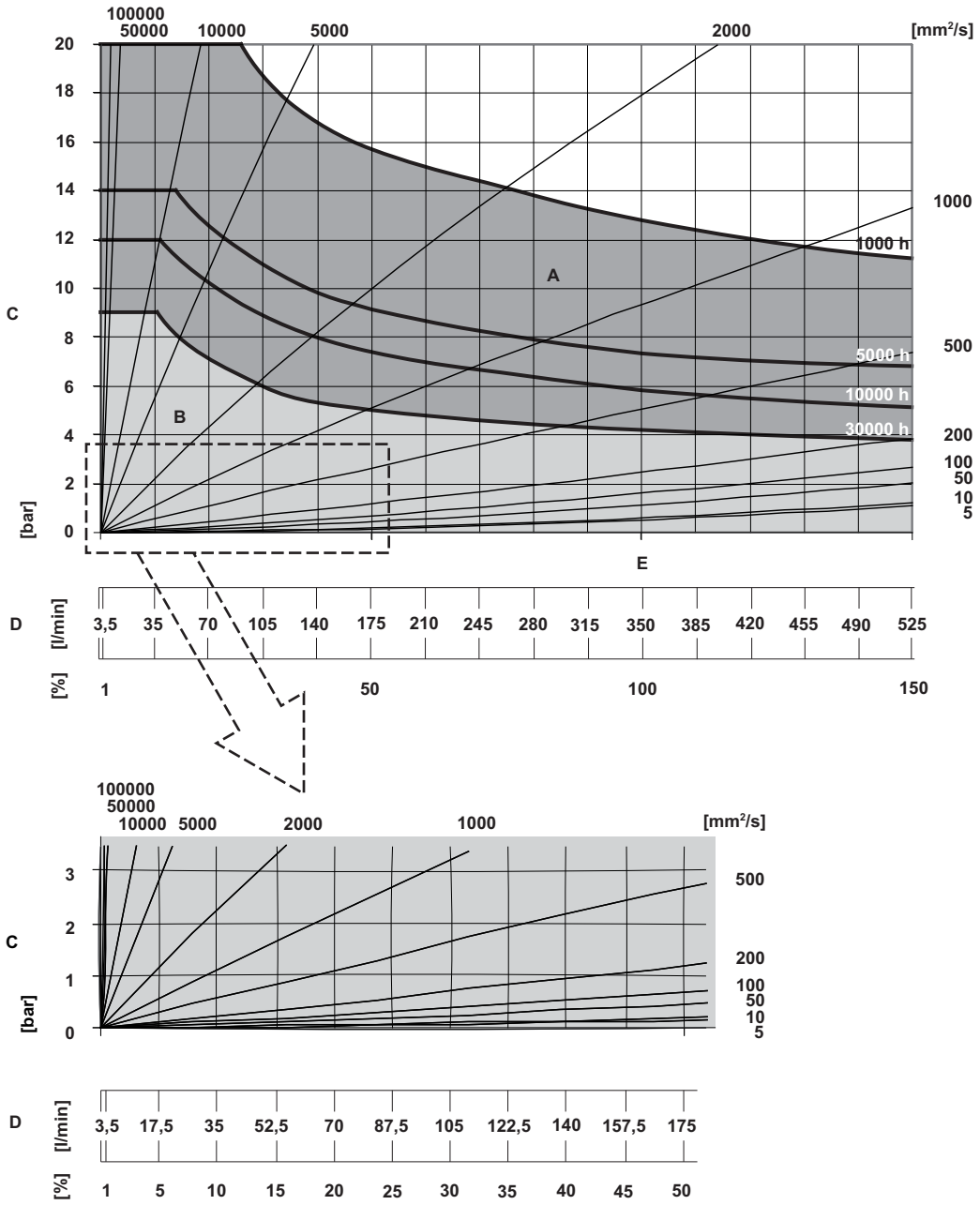


A Short-time operation
B Continuous operation
C Pressure loss
D Flow rate
E Q_{nom}

The values apply for lubricating liquids at temperatures of up to 120 °C. Abrasive and aggressive liquids reduce the durability.

Load-bearing capacity

Load-bearing capacity OMP 52



A Short-time operation
B Continuous operation
C Pressure loss
D Flow rate
E Q_{nom}

The values apply for lubricating liquids at temperatures of up to 120 °C. Abrasive and aggressive liquids reduce the durability.

Description

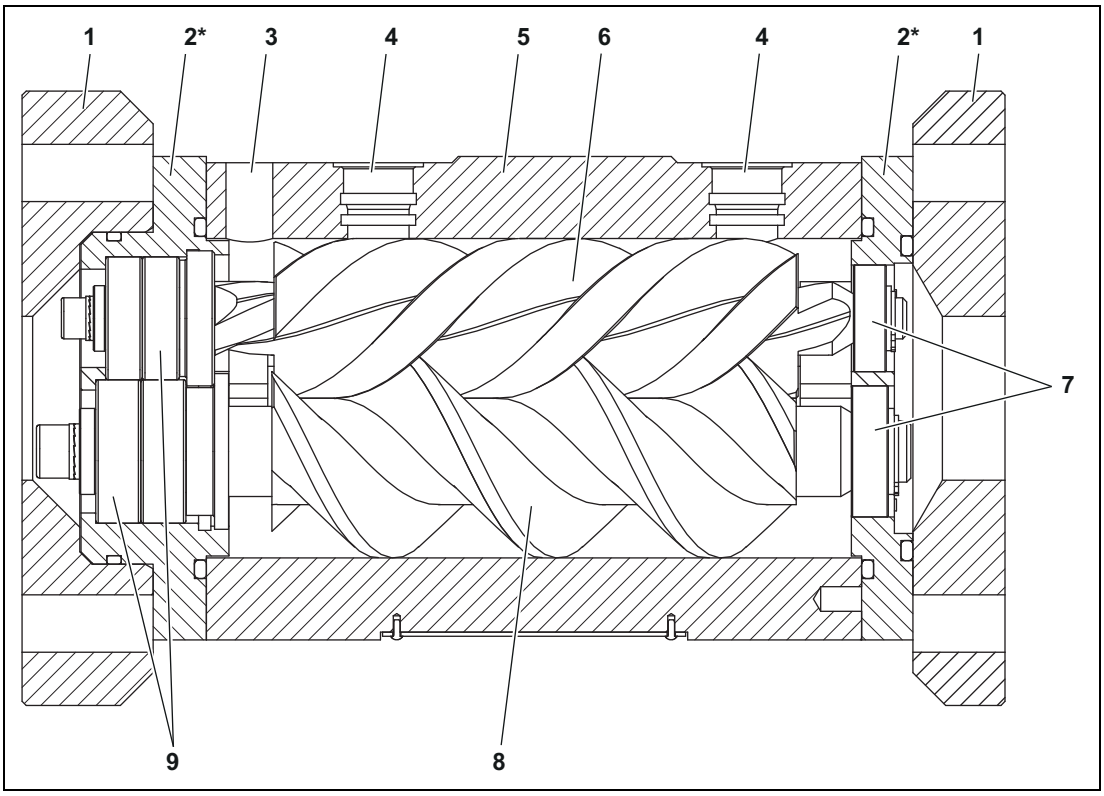


Fig. 1 Structure, flowmeter OMP series

1 Connection
2* Bearing cover
3 Temperature sensor hole
4 Pick up hole
5 Measuring housing
6 Measuring screw small
7 Ball bearing, floating bearing end
8 Measuring screw large
9 Ball bearing, fixed bearing end

* only for OMP 52

As screw meters flowmeters belong to the group of rotating displacement meters. The fluid current makes the measuring unit rotate. The displacement effect results from the continuous filling, axial displacement and discharge of the volumes that are formed by the measuring housing and measuring unit. The measured liquid flows around and lubricates all the rotating parts. Thanks to the displacement principle, the flowmeter does not require inlet and smoothing sections in its supply and discharge. Depending on the customer requirements, the flowmeters can be equipped with suitable end connections for connection to various flanges.

Rolling bearings

The measuring unit is maintained without contact and with a low degree of friction in the housing of the flowmeter by means of precision rolling bearings. Depending on the respective size, the following bearings are used:

- ☐ Single-row deep-groove ball bearings
- ☐ Paired angular-contact ball bearings

Signal generation

A pick up samples the measuring pulses directly on the screw. The pick up generates a specific number of pulses per flow volume unit – depending on the size and working point. This device-specific characteristic is called the K-factor (unit: Pulse/Liter) and can be found on the rating plate and the enclosed calibration certificate. Possible formats of the signals are:

- ☐ PNP
- ☐ NAMUR

The mounting method of the pick-up allows mounting without contact to the fluid to be measured. Two different pick ups are employed, depending on the application (standard, or for use in areas where there is an explosion hazard):

- ☐ Pick up based on the Hall effect
- ☐ Inductive pick up

Linearization

The calibration certificate contains a mean K-factor that has been determined for the flow range 10:1 and that can therefore be used across a wide flow range. However, the K-factor shows slightly different values at different flow rates. These are also documented in the enclosed calibration certificate. If highest measuring precision is required, it is therefore advisable, especially at strongly varying flow rates, to take these different values into consideration by means of a "Linearization". The K-factors are therefore fed into a suitable electronics unit across several interpolation values of the flow rate. The K-factor relevant for the flow rate being measured is then determined by means of linear interpolation between the two nearest interpolation values.
The viscosity dependence of the K-factors must also be taken into account. These are determined during calibration at a viscosity of approximately 4.2 mm²/s. The influence of the flow rate on the K-factor decreases at higher viscosities so that the mean K-factor can then also be used in a considerably larger flow range without noteworthy errors.

Temperature compensation

If the flowmeter is additionally equipped with a temperature sensor, the current density of the flowing liquid can be calculated from this measured value by means of a density table stored in the flow management unit. A normalized volume measurement is then possible at which the displayed values are converted to a reference temperature that can be selected freely. This ensures that measuring errors caused by changes in the density due to temperature variations are avoided.

Flow direction detection

Systems with a changing flow direction as well as systems with pressure pulsations - that can also cause a reversal of the flow direction - require the use of a second pick up. This additional signal (90° phase-offset) and the incremental encoding inputs available in the KRAL electronic unit can be used to determine the direction of flow and to take it into consideration when calculating the total values.

Junction box

The manufacturer offers a junction box that facilitates the electrical connection of the various sensors for the flowmeters of the OMP series. For further information see "Accessories", page 42.

Unpacking and checking the state of delivery

1. Upon delivery unpack the flowmeter and check for transport damage.
2. Report damage during transportation immediately to the manufacturer.
3. Store the supplied pick up and temperature sensor for the installation.
4. Dispose of packing material in accordance with the locally applicable regulations.

Lifting the flowmeter

WARNING
Risk of injury and/or damage to equipment should the flowmeter fall.

- ► Use intact and correctly dimensioned hoisting equipment in accordance with the total weight to be transported.
- ► Select the attachment points for the hoisting equipment in accordance with the center of gravity and the weight distribution.
- ► Use at least two load ropes.
- ► Do not stand under raised loads.

Storage

As a result of the calibration, the internal components of the flowmeter are wetted with calibration liquid that has a preservative effect. In addition, a special anticorrosive agent is sprayed onto the interior of the flowmeters before being dispatched. The connections of the flowmeter are fitted with protective caps. Unless otherwise specified, the external components of the flowmeter are preserved with a single-coat PU-based two-component paint. The preservation applied at the factory will protect the flowmeter for up to six weeks, if it is stored in a dry and clean location. The manufacturer offers a long-term preservation for storage times of up to 60 months. The flowmeter is additionally packed in hermetically sealing anti-corrosion paper.

CAUTION
Damage to device through corrosion if stored improperly and during longer standstills.

- ► Protect the flowmeters against corrosion during long standstills.

► Observe the chapters "Storage" and "Preservation".

Preservation

Preservation has to be carried out additionally under the following conditions:

Type of delivery	Condition
Standard delivery	☐ Storage time exceeding six weeks ☐ Unfavorable storage conditions such as high humidity, salty air, etc.
Delivery with long-term preservation	☐ Opened or damaged packaging

Tab. 1 Check table for preservation

Preserving the flowmeter

1. Close a connection of the flowmeter with a blind flange.
2. Position the flowmeter vertically.
3. Fill non-corrosive and resin-free oil up to approx. 1 cm under the connection at the top, while turning the measuring unit slowly, so that the measuring unit also comes into contact with it.
4. Close the upper connection with a blind flange.
5. Apply non-corrosive and resin-free oil to all the plain and unpainted parts of the outer housing.

Disposal

After about six months storage check the oil level in the flowmeter and if necessary top up oil. Check the preservation of the outer housing and if necessary apply oil to the parts again.

Notice:
Store the preserved flowmeter cool and dry and protect it against direct sunlight.

Notice:
After a longer storage time the manufacturer recommends that you have the flowmeter recalibrated, see "Re-calibration of the flowmeters", page 29.

Removing the preservation

Aids:
- ☐ Solvents suitable for the preservative oil
- ☐ Vessel to collect the preservative oil

WARNING
Risk of injury through emitted preservative oil.

- ► Wear protective clothing during all the work.
- ► Open the blind flange carefully in order to reduce any pressure that may exist in the flowmeter.
- ► Collect the emitted preservative oil safely and dispose of it in an environmentally compatible manner.

1. Remove one of the blind flanges.
2. Drain the flowmeter, collecting the preservative oil in a suitable vessel.
3. Remove the second blind flange.
4. Use a solvent to remove the residual oil.
   - or -
   ► Rinse the flowmeter with pumped liquid.

Disposal

Aids:
- ☐ Solvents or industrial cleaners suitable for the pumped liquid

WARNING
Danger of poisoning and environmental damage from the pumped liquid.

- ► Wear protective clothing during all the work.
- ► Before disposing of the flowmeter collect the discharging pumped liquid and dispose of in accordance with the locally applicable regulations.
- ► Before disposing of the flowmeter neutralize the residues of the pumped liquid in the flowmeter.

1. Disassemble the flowmeter.
2. Clean residues of the pumped liquid from the individual parts.
3. Separate sealing elements made of elastomer from the flowmeter and dispose of them in the residual waste.
4. Recycle cast-iron and steel parts.

Safety instructions for installation and removal

The following safety instructions must be observed:
☐ Flowmeters are precision measuring devices. ► Ensure cleanliness and take care during installation and removal. ► Do not take apart the flowmeter. ► Do not remove the protective caps from the dry sleeves during installation. Put the protective caps on the dry sleeves during removal. ► During installation only remove the screw plugs in order to insert the temperature sensor. Screw in the screw plugs again after the temperature sensor has been removed. ► If installing a trace heating system, pick up, temperature sensor, junction box and corresponding cables have to be free of heat insulation, see "Trace heating system", page 9.

Installing the flowmeter

Flowmeters of the OMP series can be operated in any mounting position.

Notice:

Both directions of flow are possible. The preferred flow direction is indicated on the rating plate by means of a bright arrow, see Fig. 2, page 7.

Installation types

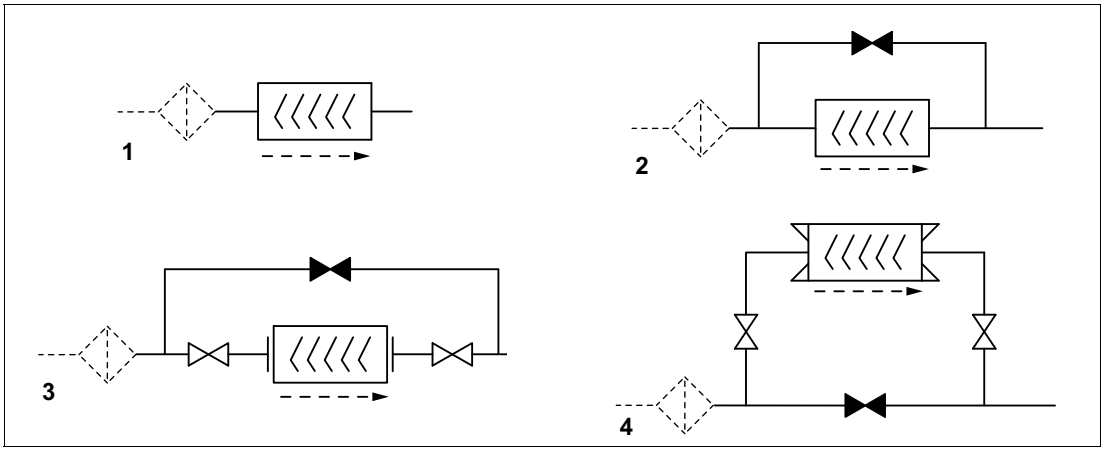


Fig. 1 OMP installation types

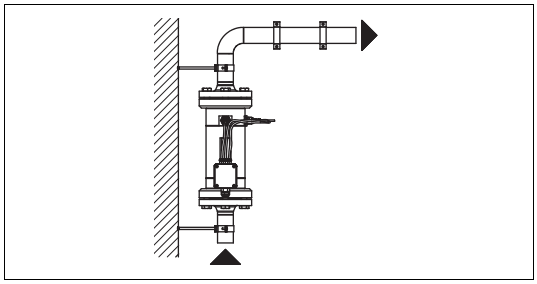
The arrow with dashed line identifies the preferred flow direction when an operating filter is used.

	Installation type	Properties
1	☐ Without bypass ☐ With or without operating filter	☐ Small space requirements ☐ Dismantling of the flowmeter only with interruption of operation
2	☐ Manual bypass ☐ With or without operating filter	☐ Bypass is opened manually ☐ Dismantling of the flowmeter only with interruption of operation
3	☐ Bypass with 3 stop valves for flange connection ☐ With or without operating filter	☐ Dismantling of the flowmeter without interruption of operation
4	☐ Bypass with 3 stop valves for pipe thread connection ☐ With or without operating filter	☐ Dismantling of the flowmeter without interruption of operation ☐ Minimally higher pressure loss

Tab. 1 OMP installation types

Installing the flowmeter

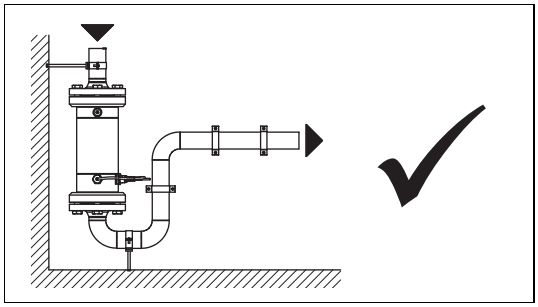
Preferred installation variant



Flow vertically from bottom to top

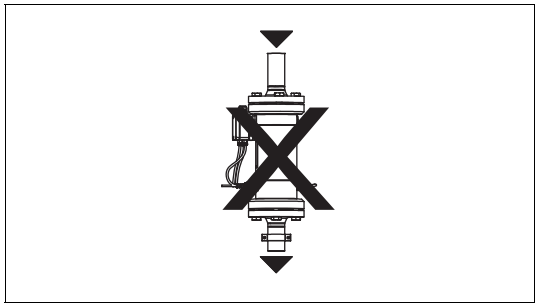
► Preferred installation variant.

Recommendations for alternative installation variants



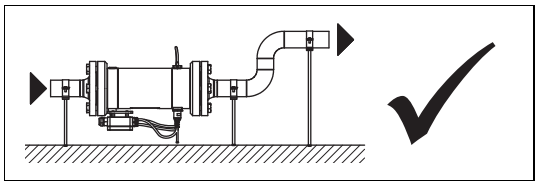
Flow vertically from top to bottom

► Ensure that the liquid does not flow freely out of the flowmeter, for example by routing the piping upwards.



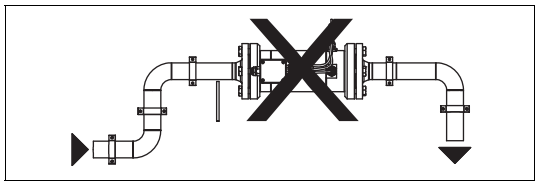
No vertical installation with open outlet

► Measuring error through free flowing of the liquid out of the flowmeter.



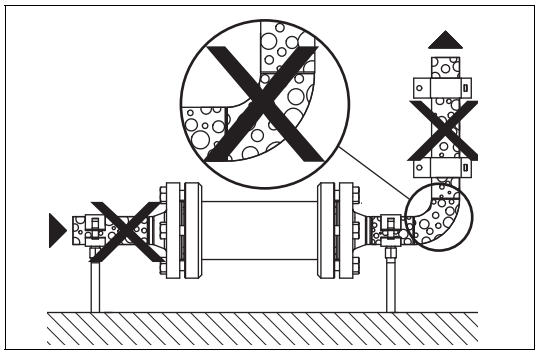
Horizontal flow

► Ensure that the liquid does not flow freely out of the flowmeter, for example by routing the piping upwards.



No horizontal installation at the highest point in the pipe system

► Avoid measuring error through formation of an air pocket in the flowmeter.



No air bubbles in the pipe system

► Measuring error through air bubbles in the pipe system. Vent the complete pipe system thoroughly during commissioning.

Installing the flowmeter

CAUTION
Measuring error through air in the pipe system and/or incorrect installation of the flowmeter.

- ► In the case of horizontal installation of the flowmeter at the highest point of the pipe system an air pocket can arise that results in measuring errors.
- ► Vent the pipe system thoroughly before commissioning.
- ► At a vertical installation of the flowmeter and the flow direction from top to bottom ensure that the liquid does not flow freely out of the flowmeter, for example by routing the pipe upwards or by reducing the pipe diameter with a reducer.

► During the installation of the flowmeter observe the recommendations for the installation variants and avoid error sources, see "Installing the flowmeter", page 22.

Protect the flowmeter against soiling

Notice:
In order to protect the flowmeter against soiling the manufacturer generally recommends the installation of an operating filter, mesh width see Tab. 1, page 27.

CAUTION
Damage to equipment through impurities in the pipe system.

- ► During welding work attach protective covers in front of the connecting flanges.
- ► Ensure when welding that welding beads and abrasive dust cannot get into the pipe system and the flowmeter.

► After the connecting work clean the pipe system thoroughly, see "Cleaning the pipe system", page 27.

Connecting the flowmeter to the pipe system

The connection of the flowmeter to the pipe system must be stress-free.

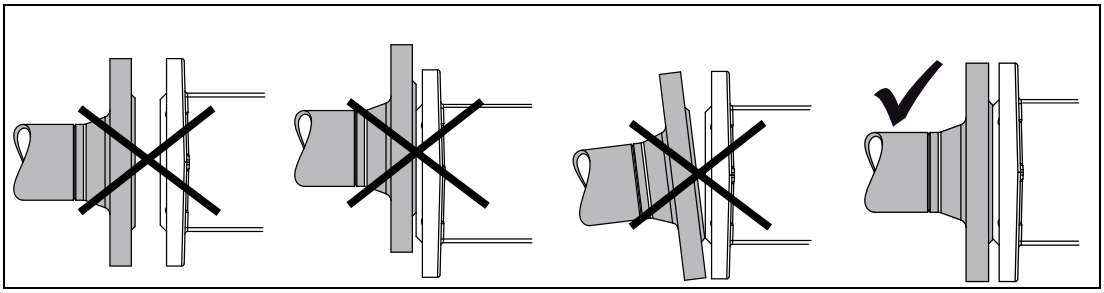


Fig. 2 Flange connections

CAUTION
Damage to equipment or impaired functionality through mechanical stresses.

- ► Ensure that the flowmeter mounting on the pipe system is free of mechanical stress.

CAUTION
Damage to device when the pipe threading is screwed in too far.

- ► Observe the thread length of the flowmeter.
- ► Use a standard cutting ring screwed connection.

1. Remove the protective covers and store them.
2. Install the flowmeter stress-free in the pipe system while taking the preferred direction of flow into account and ensure that the connections of the pick up remain accessible.
3. The screw-in length of the piping may not exceed the threaded length of the flowmeter, since the flow cross-section is narrowed and internal components can be damaged.

Electrical installation

Safety instructions for electrical installation

Observe the following safety instructions during the electrical installation:

☐ The following qualifications are required for the electrical installation:
- Practical electrotechnical training
- Knowledge of the safety guidelines at the workplace
- Knowledge of the electrotechnical safety guidelines

► The connecting line of the connections for pick ups and temperature sensor are to be shielded and laid separately from the supply lines.

► Ensure that the supply voltage is correct.

► Observe the operating instructions for pick up, temperature sensor and electronic equipment.

Connection for the pick ups

The flowmeter can be equipped with two pick ups for flow direction detection. The first signal measures the flow rate, the second signal determines the direction of flow. The pick ups have to be connected correctly in order to obtain the correct values. The connections are marked on the flowmeter housing with "1" and "2". This marking depends on the preferred direction of flow in accordance with the arrow on the rating plate, see Fig. 2, page 7. In the case of a direction of flow contrary to the preferred direction of flow the connections have to be swapped in order to obtain a correct signal.

CAUTION
Measuring error through incorrectly mounted pick ups.

► Ensure that the pick ups are mounted at the correct position.

► Observe the corresponding operating instructions for pick ups.

Removing the flowmeter

Prerequisite:
☐ System switched off

Aids:
☐ Vessel to collect pumped liquid

DANGER
Risk of death resulting from electric shock while the heating is being removed.

► Ensure that the supply voltage is de-energized.

► The flowmeter may only be separated from the power supply by an authorized electrician.

Removing the flowmeter

WARNING
Risk of injury through emitted hot, poisonous or corrosive pumped liquid when removing the flowmeter.

- ► Observe the safety regulations for handling dangerous liquids.
- ► Ensure that the flowmeter is not under pressure.
- ► Collect the emitted pumped liquid safely and dispose of it in an environmentally compatible manner.

1. In case of operation at higher temperatures wait until the device has cooled down to the ambient temperature.
2. Drain the pipe system or divert the fuel via the bypass.
3. Dismantle the flowmeter.
4. Apply the protective cover.
5. Observe the chapters "Storage" and "Preservation" on the subject of storing the flowmeter.

Commissioning

Cleaning the pipe system

To protect the flowmeter against soiling carefully clean the complete pipe system before commissioning.

Possibilities:

☐ Rinsing via bypass

☐ Rinsing with flowmeter

CAUTION
Damage to equipment through usage of an incorrect rinsing liquid.

► Under no circumstances may water or superheated steam be used to rinse the pipe system.

► Rinsing via bypass: Close the shut-off devices before and after the flowmeter.

- or -

► Rinsing with flowmeter: An operating filter has to be installed before the flowmeter. Take the mesh width of the filter into account, see Tab. 1, page 27.

The mesh width of the operating filter is relevant to the size of the flowmeter.

Flowmeter size	Unit	Max. mesh width
OMP 13, 20	[mm]	0.1
OMP 32, 52	[mm]	0.34

Tab. 1 Mesh width of the operating filter

Checking the function

Test	Procedure
Installation	► Check the direction of flow of the flowmeter. ► Check the installation and mounting position of the pick ups and of the temperature sensor. ► Check the pipe threading/flange and the temperature sensors for leaks under operating pressure.
Electrical installation	► Observe the operating instructions for pick ups, temperature sensor and electronic equipment.
Power supply	► Observe the operating instructions for pick ups, temperature sensor and electronic equipment.

Tab. 2 Function check table

Commissioning the flowmeter

Prerequisite:

☐ Ambient conditions correspond to the operating data, see "Technical data", page 8

☐ Flowmeter correctly installed into the pipe system, see "Installing the flowmeter", page 22

☐ Flowmeter connection to the pipe system is free of mechanical stress

☐ Pipe system is free of contamination

☐ Pipe system vented

☐ Shut-off devices in the supply and discharge lines opened

Switching off the flowmeter

CAUTION
Measuring error through gas inclusion in the pipe system.

► Before commissioning, make sure that the flowmeter is filled.
► Vent the pipe system.

CAUTION
Increased wear and/or blocking of the flowmeter due to solid particles or abrasive fine particles in the liquid.

► Protect the flowmeter by a correspondingly dimensioned operating filter in the pipe system.

► Switch on the system.
The flowmeter measures when the pick up generates a signal.

Switching off the flowmeter

Safety instruction for switching off the flowmeter

Pay attention to the following when switching off the flowmeter:

☐ Strong changes to the flow rate (e.g. rapid shutdown, pulsations ...) cause marked pressure differences on the flowmeter and can damage the measuring unit.
- The pressure loss of the flowmeter must not exceed the values given in the chapter "Technical data", see "Load-bearing capacity", page 14.

Switching off the flowmeter

When the flow through the flowmeter is stopped, the generation of the signal stops automatically. No further measures are required to switch off.

Recommissioning the flowmeter

Prerequisite:
☐ Requirements for commissioning are met, see "Commissioning", page 27

CAUTION
Damage to device through hard, gummy or crystallized liquid in the flowmeter.

► Before commissioning, ensure that there is no hard, gummy or crystallized liquid in the flowmeter.

1. Disassemble and clean the flowmeter before recommissioning.
2. Switch on the system.
   Under the requirements mentioned above, the flowmeter is ready for operation at any time.

Safety instructions on repairs

The following safety instructions must be observed during all the repair work:
► All the work may only be carried out by authorized qualified personnel. ► Wear protective clothing during all the work. ► The replacement of the measuring unit consisting of screw set and rolling bearing may only be carried out in the factory. ► The flowmeter has to be recalibrated after measuring unit or rolling bearing has been replaced. ► Observe the pick up operating instructions when replacing the pick up insert. ► Observe the corresponding operating instructions when replacing the temperature sensor insert.

Required maintenance

Flowmeters are fundamentally maintenance-free. Under observance of the operating limits, see "Technical data", page 8, no significant change in the characteristics could be established, even after years of use in many cases. Conditions lying clearly above the nominal flow rate can, however, result in excessive wear. In the case of liquids with higher abrasiveness (e.g. heavy oil with catalyst residues, plastic components with fillers, etc.) strongly accelerated wear can occur in the flowmeter.

Notice:
In cases of doubt the manufacturer recommends already carrying out the first inspection of the flowmeter after twelve weeks operation time.

Signs of progressive wear of individual flowmeter elements:

Finding	Cause	Elimination
Increased running noises	Incipient damage to bearing	Replace the bearing.
Leakage	Damage to sealing	Replace the seals or dry sleeve.
Measured values not realistic	see "Troubleshooting", page 37	see "Troubleshooting", page 37

Tab. 1 Check table for required maintenance

1. Check the flowmeter visually and acoustically every four weeks.
2. Check for signs of wear as listed in the table above and eliminate the cause.

Re-calibration of the flowmeters

In order to maintain the high measuring precision of the flowmeter, the manufacturer recommends carrying out the first re-calibration after about one year of operation. The results reveal any wear starting on the measuring unit. The interval at which recalibration is actually required depends strongly on the operating conditions of the device.
The manufacturer provides the factory calibration as standard. If higher requirements are placed on the measuring instrument, an accredited calibration according to EN ISO/IEC 17025 is also possible.

Mounting instructions OMP 13

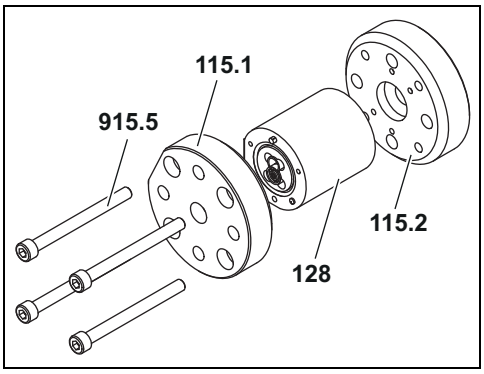


Fig. 1

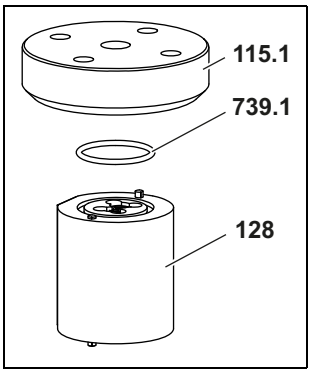


Fig. 2

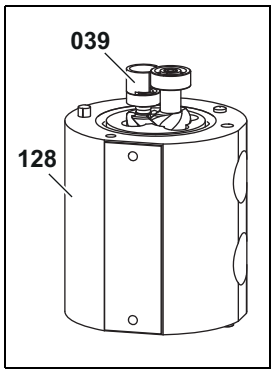


Fig. 3

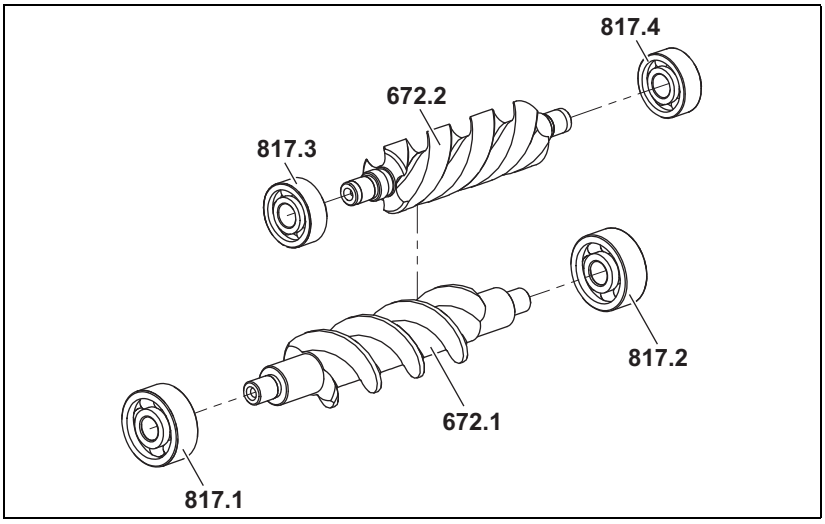


Fig. 4

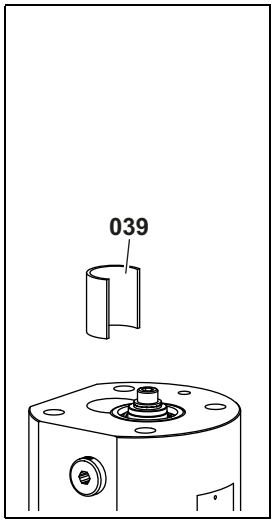


Fig. 5

039	Distance sleeve	**739.1**	O-ring	**915.5**	Socket screw
115.1	Flange	**739.2**	O-ring		
115.2	Flange	**817.1**	Deep-groove ball bearing		
128	Measuring housing	**817.2**	Deep-groove ball bearing		
672.1	Measuring screw large	**817.3**	Deep-groove ball bearing		
672.1	Measuring screw small	**817.4**	Deep-groove ball bearing		

Removing seals and bearings

Prerequisites:

☐ Flowmeter removed from system

☐ Pick up insert removed

1. Remove the socket screws **915.5** and the flanges **115.1** and **115.2**, see Fig. 1, page 30.
2. Remove the O-rings **739.1** and **739.2**, see Fig. 2, page 30.
3. Pull the distance sleeve **039** together with the set of screws out of the measuring housing **128**, see Fig. 3, page 30.
4. Pull the ball bearings **817.1**, **817.2**, **817.3** and **817.4** from the screws using the pulling-off device.

Installing seals and bearings

Prerequisites:

☐ Replacement parts available

1. Place the O-rings **739.1** and **739.2** onto both sides of the measuring housing **128**.
2. Press the ball bearings **817.1** and **817.2** onto the measuring screw large **672.1** and the ball bearings **817.3** and **817.4** onto the measuring screw small **672.2**.
   Notice: Press the ball bearings on only over the inner ring.
3. Place the flange **115.2** onto the measuring housing **128**.
4. Slide the set of screws in the measuring housing **128**. Slide the distance sleeve **039** into the hole of the measuring screw small **672.2**, see Fig. 5, page 30.
5. Place the flange **115.1** onto the measuring housing **128**.
6. Pretension the oiled socket screws **915.5** crosswise and tighten with torque, see Tab. 6, page 47.

Mounting instructions OMP 20/32

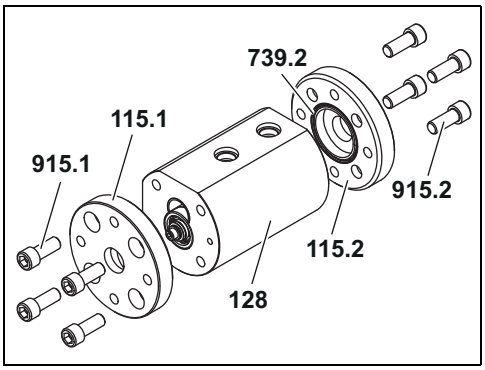


Fig. 6

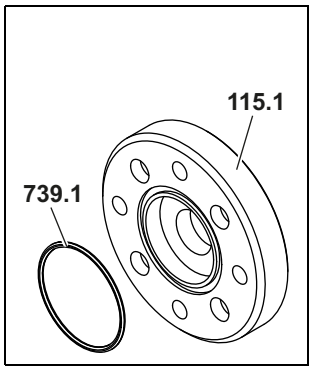


Fig. 7

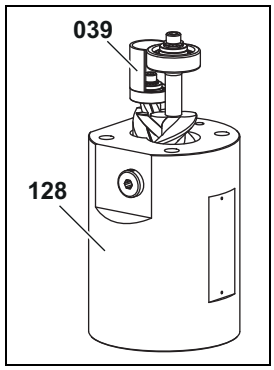


Fig. 8

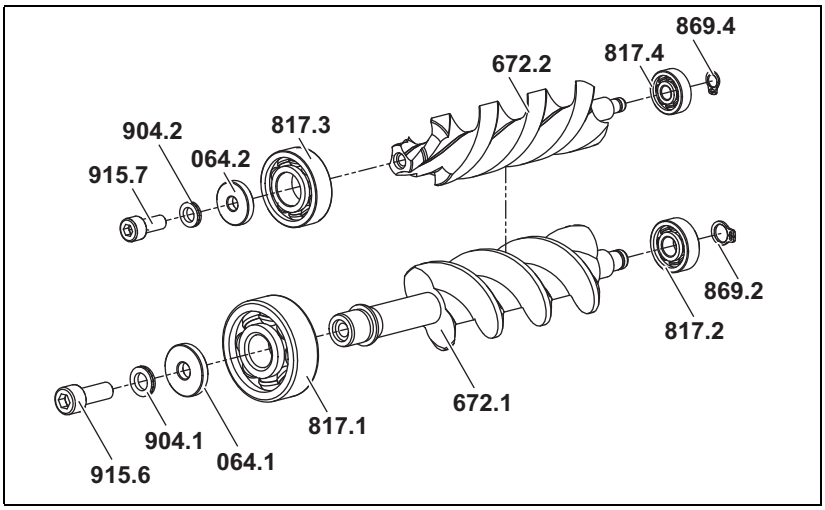


Fig. 10

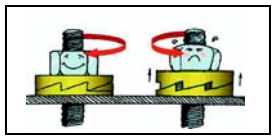


Fig. 9

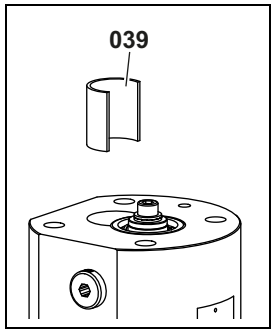


Fig. 11

039	Distance sleeve	**739.1**	O-ring	**904.1**	Wedge lock washer
064.1	Supporting ring	**739.2**	O-ring	**904.2**	Wedge lock washer
064.2	Supporting ring	**817.1**	Deep-groove ball bearing	**915.1**	Socket screw
115.1	Flange	**817.2**	Deep-groove ball bearing	**915.2**	Socket screw
115.2	Flange	**817.3**	Deep-groove ball bearing	**915.6**	Socket screw
128	Measuring housing	**817.4**	Deep-groove ball bearing	**915.7**	Socket screw
672.1	Measuring screw large	**869.2**	Circlip		
672.1	Measuring screw small	**869.4**	Circlip		

Removing seals and bearings

Prerequisites:

☐ Flowmeter removed from system

☐ Pick up insert removed

1. Remove the socket screws **915.1** and **915.2**, flanges **115.1** and **115.2**, see Fig. 6, page 32.
2. Remove the O-rings **739.1** and **739.2**, see Fig. 7, page 32.
3. Pull the distance sleeve **039** together with the set of screws out of the measuring housing **128**, see Fig. 8, page 32.
4. Remove the circlips **869.2** and **869.4** from the measuring screw large and measuring screw small. Overview see Fig. 10, page 32.
5. Screw out the socket screws **915.6** and **915.7** and remove the wedge lock washers **904.1**, **904.2** and support rings **064.1**, **064.2**.
6. Pull the ball bearings **817.1**, **817.2**, **817.3** and **817.4** from the screws using the pulling-off device.

Installing seals and bearings

Prerequisites:

☐ Replacement parts available

☐ Loctite 242

1. Insert the O-rings **739.1** and **739.2** into the flange **115.1** and **115.2**.
2. Press the ball bearings **817.1** and **817.2** onto the measuring screw large **672.1** and the ball bearings **817.3** and **817.4** onto the measuring screw small **672.2**.
   Notice: Press the ball bearings on only over the inner ring.
3. Pull the wedge lock washers **904.1** and **904.2** and support rings **064.1** and **064.2** onto the sockets screws **915.6** and **915.7**. Overview see Fig. 10, page 32.
   Notice: Ensure that the wedge lock washers are positioned correctly (wedge surface to wedge surface), see Fig. 9, page 32.
4. Mount the socket screws **915.6** and **915.7**, with Loctite 242 applied, with mounted washer and ring onto the measuring screw large and measuring screw small and tighten with torque, see Tab. 6, page 47.
5. Mount the circlips **869.2** and **869.4** on the floating bearing end.
6. Place the flange **115.2** onto the measuring housing **128**.
7. Pretension the oiled socket screws **915.2** crosswise and tighten with torque, see Tab. 6, page 47.
8. Slide the set of screws in the measuring housing **128**. Slide the distance sleeve **039** into the hole of the measuring screw small **672.2**, see Fig. 11, page 32.
9. Place the flange **115.1** onto the measuring housing **128**.
10. Pretension the oiled socket screws **915.1** crosswise and tighten with torque, see Tab. 6, page 47.

Mounting instructions OMP 52

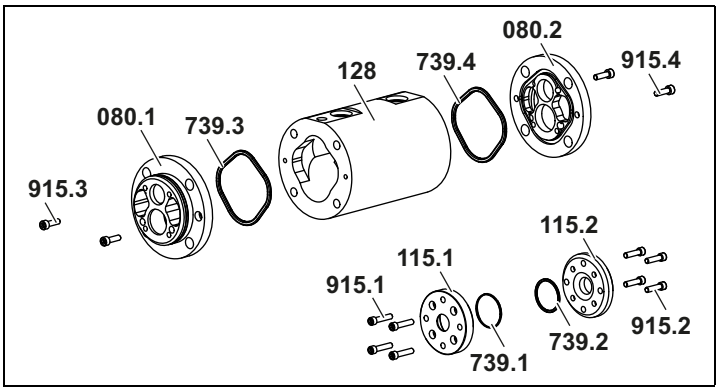


Fig. 12

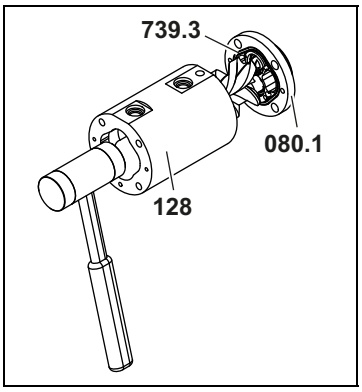


Fig. 13

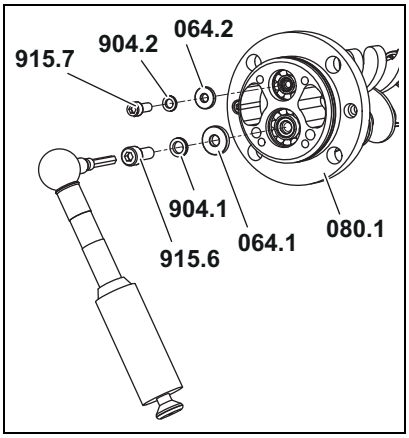


Fig. 14

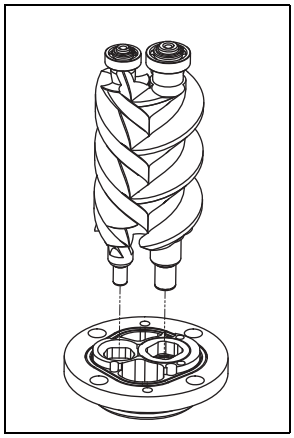


Fig. 15

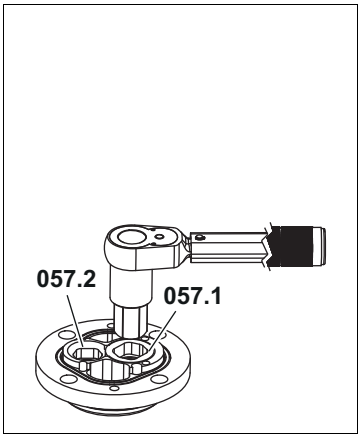


Fig. 16

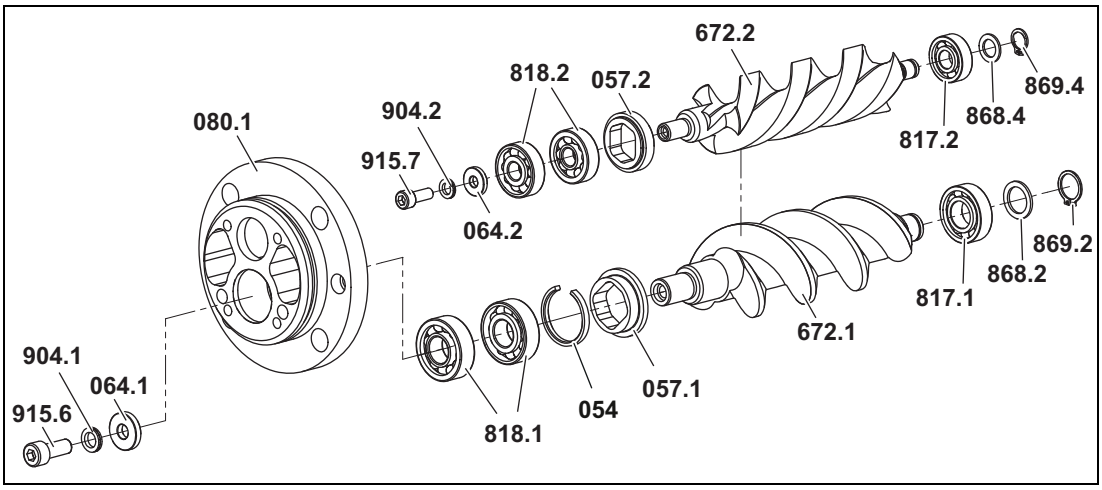


Fig. 17

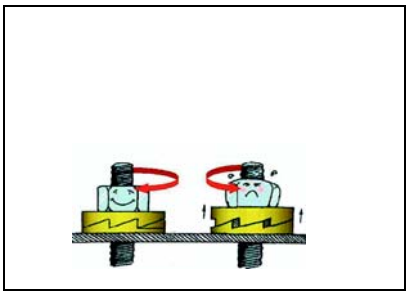


Fig. 18

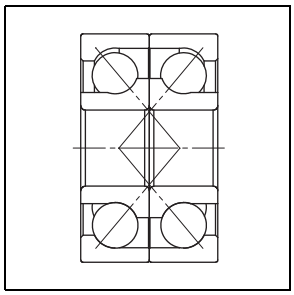


Fig. 19

054	Spacer	**739.1**	O-ring	**868.2**	Support ring
57.1	Threaded ring	**739.2**	O-ring (inlet)	**868.4**	Support ring
057.2	Threaded ring	**739.3**	O-ring	**869.2**	Circlip
064.1	Supporting ring	**739.4**	O-ring (inlet)	**869.4**	Circlip
064.2	Supporting ring	**817.1**	Deep-groove ball bearing	**904.1**	Wedge lock washers
080.1	Bearing cover			**904.2**	Wedge lock washers
080.2	Bearing cover (inlet)	**817.2**	Deep-groove ball bearing	**915.1**	Socket screw
115.1	Flange			**915.2**	Socket screw
115.2	Flange	**818.1**	Angular-contact ball bearing	**915.3**	Socket screw
128	Measuring housing			**915.4**	Socket screw
672.1	Measuring screw large	**818.2**	Angular-contact ball bearing	**915.6**	Socket screw
672.2	Measuring screw small			**915.7**	Socket screw

Removing seals and bearings

Prerequisites

- ☐ Flowmeter removed from the system
- ☐ Completion consisting of socket screws **915.1/915.2**, flanges **115.1/115.2** and seals **739.1/739.2** removed, overview see Fig. 12, page 34
- ☐ Pick up inserts removed

1. Remove the socket screws **915.3** and **915.4**, take off the bearing cover **080.2**. Remove the O-ring **739.4**, overview see Fig. 12, page 34.
2. Use light blows of a plastic tip hammer to drive the screw set together with the bearing cover **080.1** out of the measuring housing **128** and pull out, see Fig. 13, page 34.
3. Screw out the socket screw **915.6** with wedge lock washer **904.1** and supporting ring **064.1** from the measuring screw large **672.1**, see Fig. 14, page 34.
4. Screw out the socket screw **915.7** with wedge lock washer **904.2** and supporting ring **064.2** from the measuring screw small **672.2,** see Fig. 14, page 34.
5. Remove the screw set from the bearing cover **080.1** using an extractor.
6. Screw out the threaded rings **057.1** and **057.2** of the bearing cover, see Fig. 16, page 34. For allen key widths, see Tab. 2, page 36.
7. Take the spacer **054** out, and pull the bearings **818.1** and **818.2** out of the bearing cover using an extractor.
8. Remove the O-ring **739.3**.
9. Remove the circlips **869.2** and **869.4** and support rings **868.2** and **868.4** from the measuring screws, see Fig. 17, page 34.
10. Pull the bearings **817.1** and **817.2** from the measuring screws using an extractor.

Installing seals and bearings

Prerequisites:

☐ Replacement parts available

☐ Loctite 242

1. Insert the O-ring **739.3** and **739.4** into the bearing cover **080.1** and **080.2**.
2. Press the ball bearings **818.1** and **818.2** into the bearing cover **080.1**.
   Notice: Press the angular-contact ball bearings on in face-to-face arrangement, see Fig. 19, page 35. To avoid damages press the ball bearings on only over the outer ring.
3. Put spacer **054** on ball bearing **817.1**.
4. Press the ball bearing **817.1** onto the measuring screw large **672.1** and the ball bearing **817.2** onto measuring screw small **672.2**.
   Notice: Press the ball bearings on only over the inner ring.
5. First screw the threaded ring **057.2**, then the threaded ring **057.1** into the bearing cover using the allen key. Allen key widths and tightening torques, see Tab. 2, page 36.
6. Press the measuring screws into the bearings in the bearing cover.
   Notice: To avoid damages support the inner rings of the ball bearings.
7. Pull the wedge lock washer **904.2** and supporting ring **064.2** onto the socket screw **915.7**.
   Notice: Ensure that the wedge lock washers are positioned correctly (wedge surface to wedge surface), see Fig. 18, page 35.
8. Mount the socket screw **915.7**, with Loctite 242 applied, with mounted washer and ring onto the measuring screw small **672.2** and tighten with torque, see Tab. 6, page 47.
9. Pull the wedge lock washer **904.1** and supporting ring **064.1** onto the socket screw **915.6**.
10. Mount the socket screw **915.6**, with Loctite 242 applied, with mounted washer and ring onto the measuring screw large **672.1** and tighten with torque, see Tab. 6, page 47.
11. Mount the support rings **868.2** and **868.4** and circlips **869.2** and **869.4** on the floating bearing end.
12. Place the bearing cover **080.2** onto the measuring housing **128** and tighten with torque the socket screws **915.4**.
13. Slide the bearing cover **080.1** with pre-mounted measuring unit, consisting of screw set, into the measuring housing, tighten with torque the socket screws **915.3**.
14. Mount the flange cover while pretensioning the oiled screws crosswise. Tightening torque see Tab. 6, page 47.

Size	Measuring screw	Pos. no.	Allen key width [mm]	Tightening torque [Nm]
52	large	**057.1**	22	60
	small	**057.2**	19	52

Tab. 2 Allen key width and tightening torque for threaded ring

Possible faults

Faults can have different causes. The following tables list the symptoms of a fault, the possible causes and measures for troubleshooting.

Possible faults

Fault	Cause/Remedy
☐ Flowmeter leaks	1, 2, 6
☐ No flow rate	3, 7, 8, 20, 22, 23
☐ Flowmeter does not generate a pulse	3, 4, 5, 6, 8, 11, 18, 20, 22, 23
☐ Pressure loss too high	9, 12, 20, 21
☐ Measured values not realistic	3, 4, 5, 7, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21

Troubleshooting

No.	Cause	Remedy
1	Seal preload too low	► Preload the screws.
2	Seal damaged	► Replace the seal. ► Check the chemical resistance of the seal.
3	Foreign bodies in the liquid and/or flowmeter	► Dismantle the flowmeter and clean it. ► Use the commissioning filter.
4	Pick up not connected correctly	► Check the supply voltage for the pick up, while observing the pick up operating instructions.
5	Pick up defective	► Check the function of the pick up, while observing the pick up operating instructions.
6	Dry sleeve destroyed	► Replace the dry sleeve, contact the manufacturer for information.
7	Liquid lubricates too little	► Use the OMK series.
8	Feed pressure too low	► Increase the feed pressure.
9	Viscosity of the liquid too high	► Increase the temperature, while observing the permissible temperature range.
10	Viscosity of the liquid too low	► Use the OMK series.
11	Flow rate too low	► Increase the flow rate. - or - ► Use a suitable flowmeter size. - or - ► Use linearization, while observing the electronic operating instructions.
12	Flow rate too high	► Reduce the flow rate. - or - ► Use a suitable flowmeter size.
13	Airlocks	► Deaerate the system and check for leaks.
14	Outgassing	► Increase the system pressure. ► Reduce the temperature.
15	Pulsations too high	► Use another feed pump. ► Carry out changes to the system.
16	Back pressure too low	► Increase the back pressure.

Troubleshooting

No.	Cause	Remedy
17	Flow rate fluctuations too high	► Ensure a continuous flow rate by taking suitable measures (use of a different pump. valve, damper, etc.). - or - ► Smoothen the indication, while observing the electronic operating instructions.
18	Filling amount too low	► Use a suitable flowmeter size. ► Use a suitable flowmeter type.
19	Strongly deviating operating data	► Use a suitable flowmeter type. ► Adapt the operating data to the flowmeter.
20	Wear at the measuring unit and bearing	► Renew the measuring unit. ► Replace the bearing. ► Filter out the abrasive materials.
21	Sluggishness through deposits	► Disassemble the flowmeter and clean it carefully.
22	Flow impaired at the system end	► Check whether the fluid flows in the system (pump in operation, slide valve opened, etc.). ► Check whether shut-off devices before and after the flowmeter are opened.
23	Flowmeter switched to bypass	► Switch the flowmeter to through-flow.

Tab. 1 Fault table

Spare parts

Maintenance kits

Notice: The maintenance kits contain only the numbered parts and are only supplied complete.

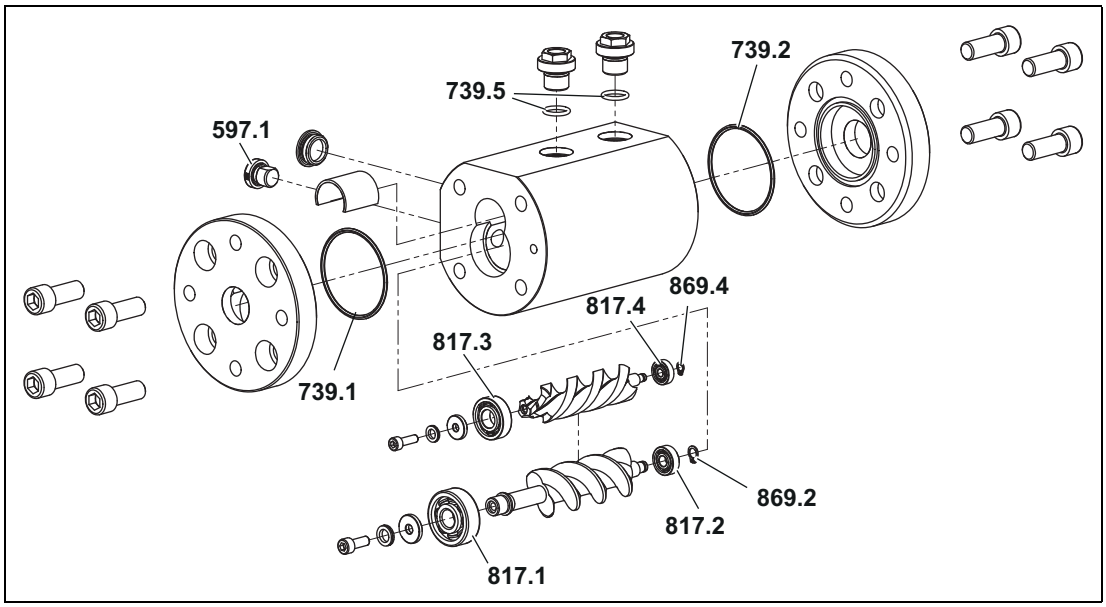


Fig. 1 Maintenance kit OMP 13

Qty.	Item No.	Part	Qty.	Item No.	Part
1	**739.1**	O-ring	1	**817.2**	Deep-groove ball bearing
1	**739.2**	O-ring	1	**817.3**	Deep-groove ball bearing
2	**739.5**	O-ring	1	**817.4**	Deep-groove ball bearing
1	**817.1**	Deep-groove ball bearing			

Tab. 1 Maintenance kit OMP 13

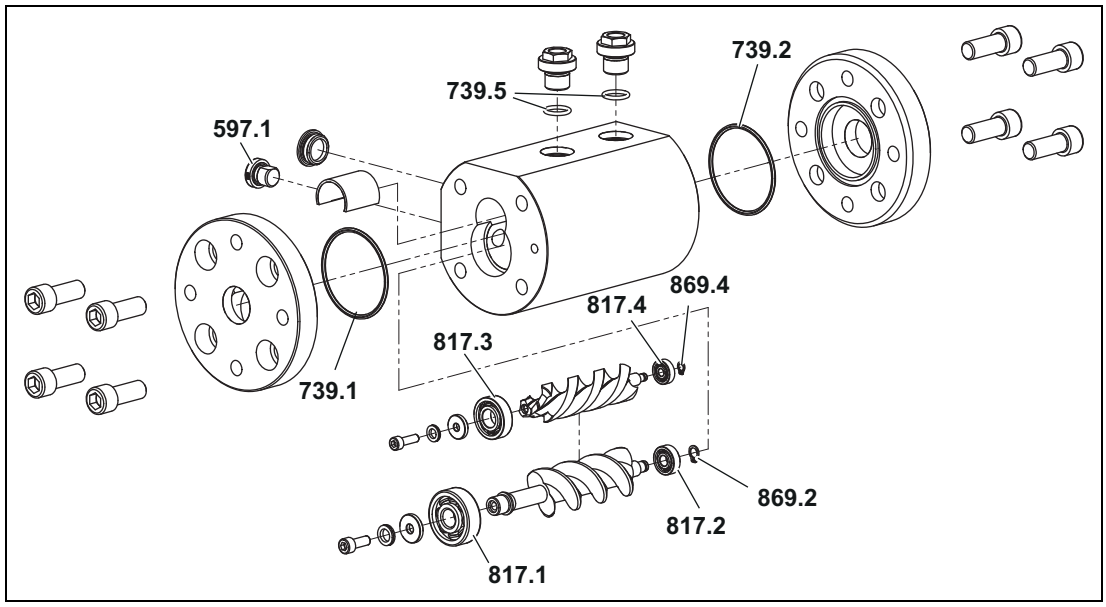


Fig. 2 Maintenance kit OMP 20/32

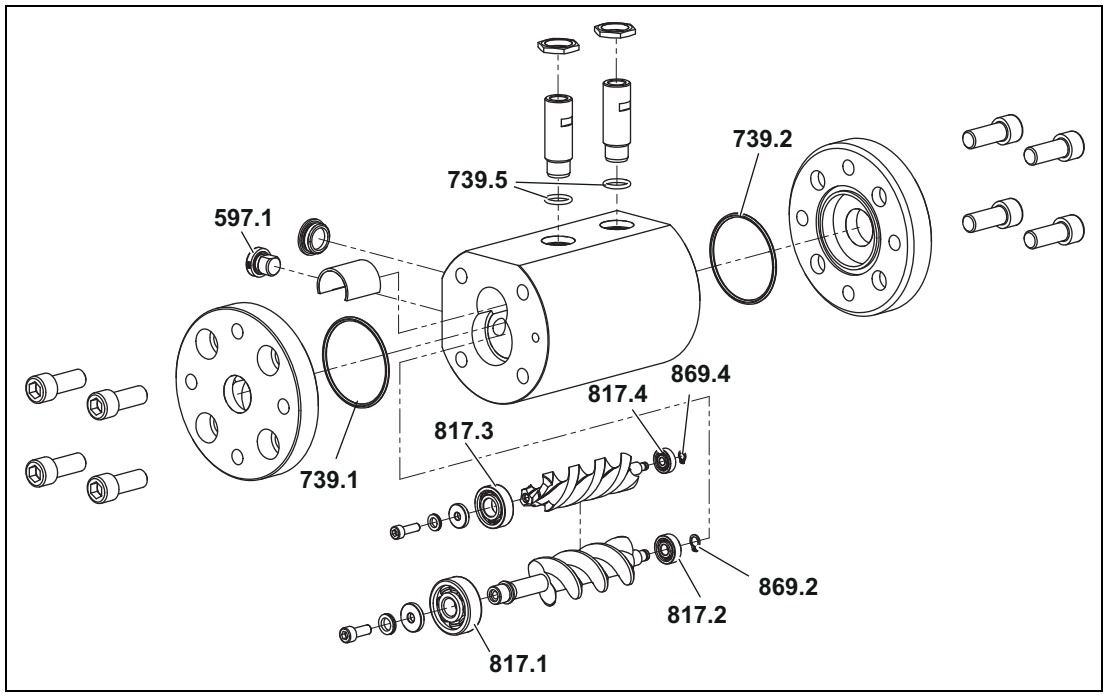


Fig. 3 Maintenance kit OMP 20/32 – high temperature

Qty.	Item No.	Part	Qty.	Item No.	Part
1	**597.1**	Screw plup	1	**817.2**	Deep-groove ball bearing
1	**739.1**	O-ring	1	**817.3**	Deep-groove ball bearing
1	**739.2**	O-ring	1	**817.4**	Deep-groove ball bearing
2	**739.5**	O-ring	1	**869.2**	Circlip
1	**817.1**	Deep-groove ball bearing	1	**869.4**	Circlip

Tab. 2 Maintenance kit OMP 20/32

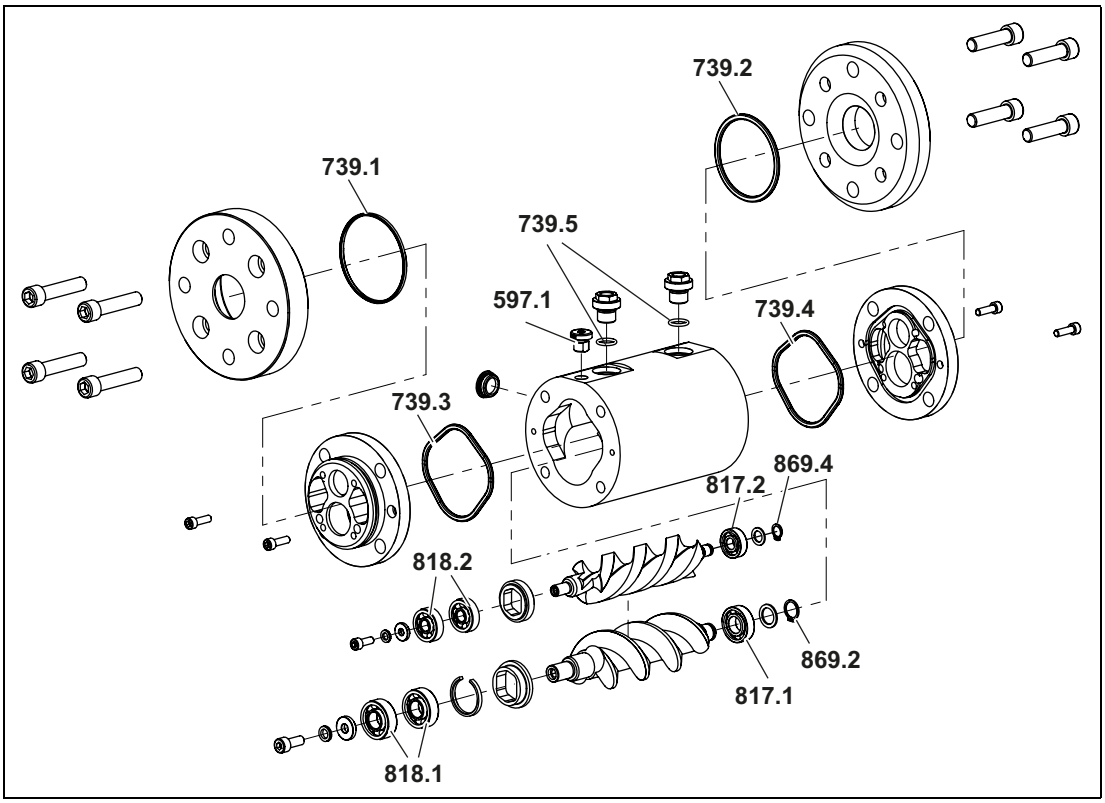


Fig. 4 Maintenance kit OMP 52

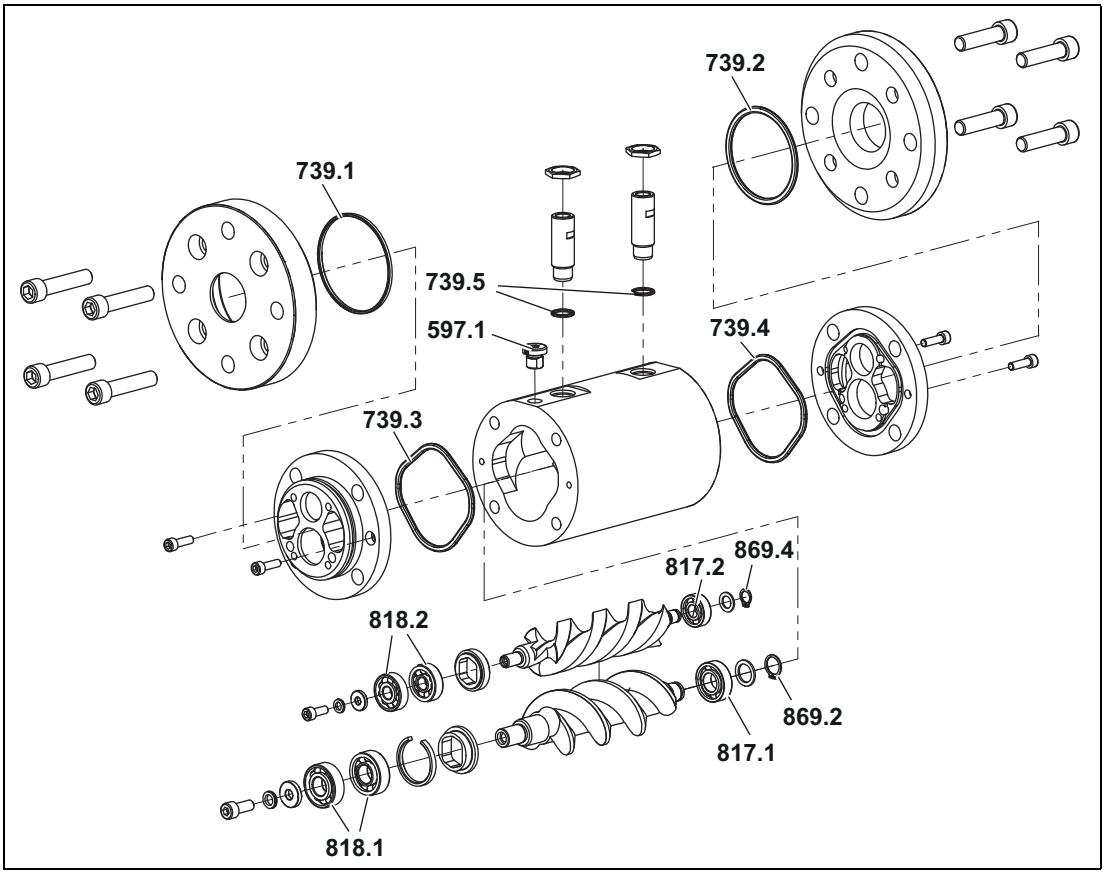


Fig. 5 Maintenance kit OMP 52 – high temperature

Qty.	Item No.	Part	Qty.	Item No.	Part
1	**597.1**	Screw plug	1	**817.2**	Deep-groove ball bearing
1	**739.1**	O-ring	2	**818.1**	Angular-contact ball bearings
1	**739.2**	O-ring	2	**818.2**	Angular-contact ball bearings
1	**739.3**	O-ring	1	**869.2**	Circlip
1	**739.4**	O-ring	1	**869.4**	Circlip
2	**739.5**	O-ring	1	**870.1**	Circlip
1	**817.1**	Deep-groove ball bearing	1	**870.2**	Circlip

Tab. 3 Maintenance kit OMP 52

Accessories

Junction box

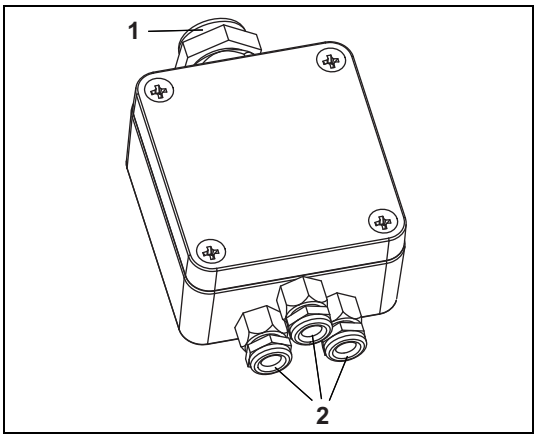


Fig. 6 Junction box

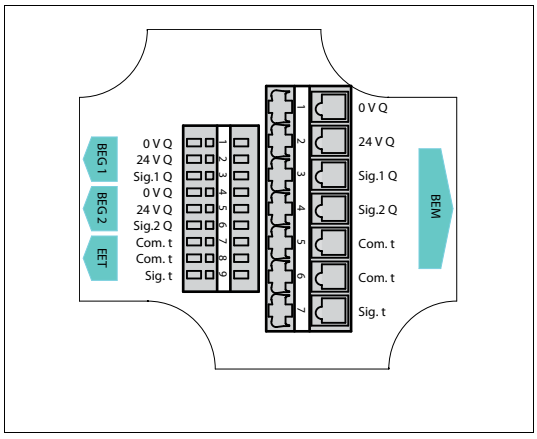


Fig. 7 Connection circuit diagram junction box

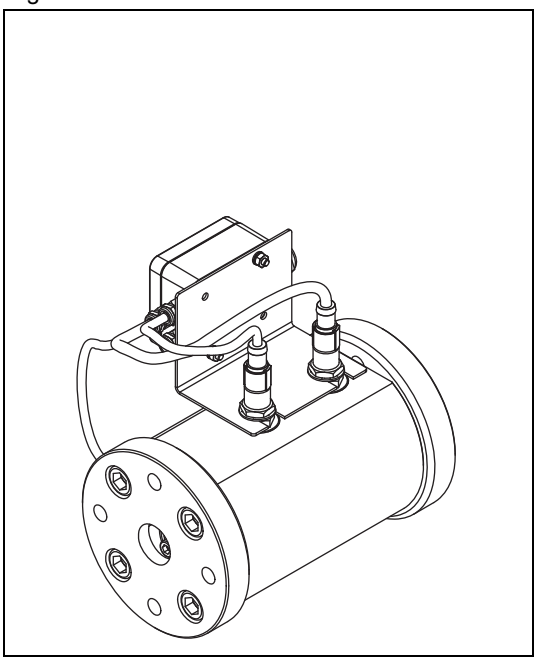


Fig. 8 OMP 32 with installed junction box standard

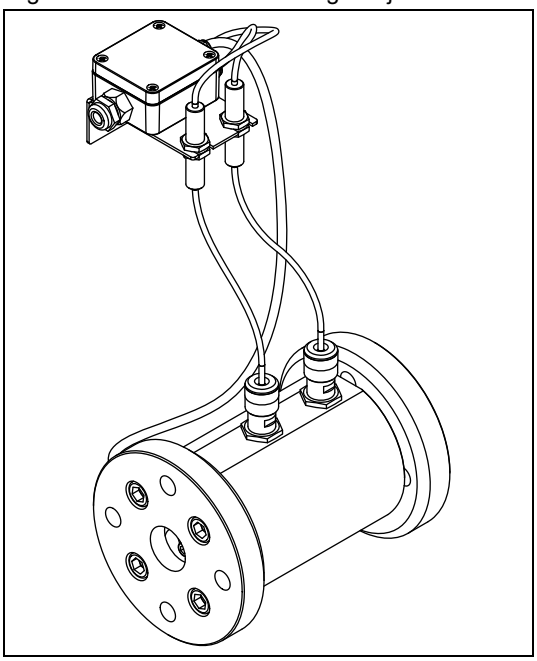


Fig. 9 OMP 32 with installed junction box high temperature

1 Output
2 Sensor inputs

As an option the manufacturer offers a junction box that facilitates the electrical connection of the various sensors for the flowmeters of the OMP series. Up to three sensors can be connected. The sensor cables are combined to form a multi-strand connecting cable which can be supplied as well optionally if required. The detailed assignment plan can be found on the inside of the junction box lid.

The junction boxes are offered in two variants:

	Unit	Junction box standard	Junction box high temperature
☐ Article no.		UZA 56, UZA 57, UZA 59, UZA 60, UZA 83, UZA 84 UZA103, UZA104	UZA 92
☐ Housing material		Aluminium	Steel/Aluminium
☐ Connection thread		M6	M6
☐ Fastening type		With base plate	With fastening angle
☐ Used pick up		BEG 56A	BEG 64
☐ Temperature max.	[°C]	125	200

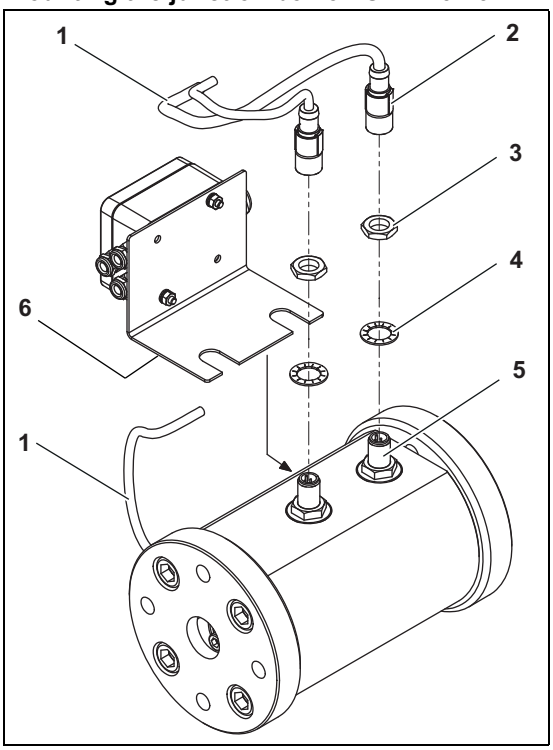
Tab. 4 Junction box – variants

	Junction box standard / junction box high temperature			
Use for size	OMP 13	OMP 20	OMP 32	OMP 52
Electrical specification				
☐ 2 sensor inputs	UZA103	UZA 56	UZA 59	UZA 84
☐ 3 sensor inputs	UZA104 / UZA 92	UZA 57 / UZA 92	UZA 60 / UZA 92	UZA 83 / UZA 92
☐ Outputs	1			

Tab. 5 Junction box – usage and electrical specification

Mounting the junction box

Mounting the junction box on OMP 13 - 52

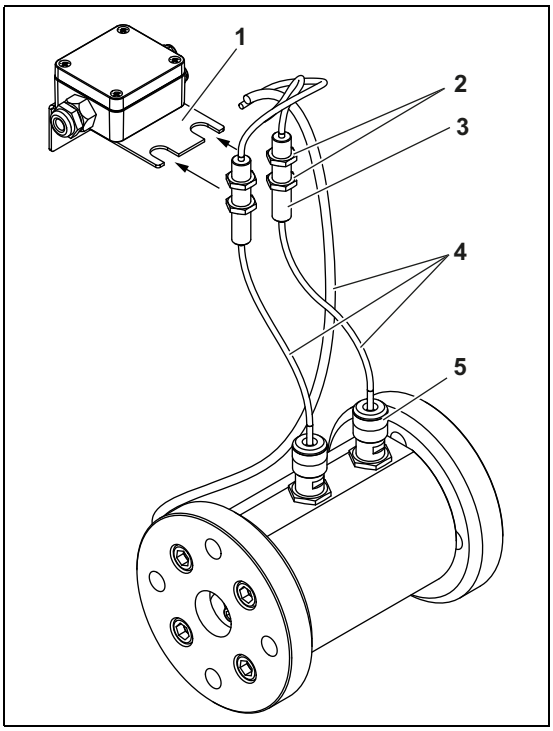


1 Cable pick up and temperature sensor
2 Connector pick up
3 Hexagon pick up
4 Washer junction box
5 Pick up inserts
6 Base plate junction box

Fig. 10 Example OMP 32

1. Disconnect the cables **1** of the pick up and the temperature sensor. Ensure that the cable length is sufficient.
2. Unplug the connectors **2** of the pick ups.
3. Turn out the hexagon **3** of the pick ups.
4. Place the washers **4** of the junction box over the pick up inserts **5**.
5. Slide the base plate **6** of the junction box under the washers **4,** screw the hexagon **3** back in.
6. Plug the connectors **2** of the pick ups back in.

Mounting the junction box for OMP 13 - 52 high temperature

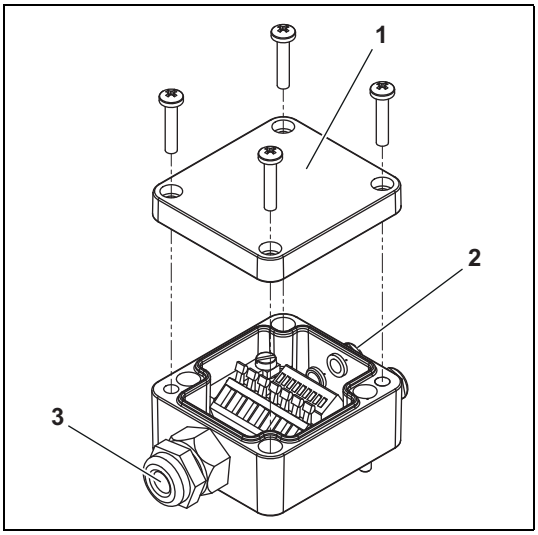


1 Fastening angle
2 Hexagon nut amplifier
3 Amplifier
4 Cable temperature sensor and pick up
5 Pick up insert

Fig. 11 Example OMP 32

1. Disconnect the cables **4** of the pick ups with amplifier and the temperature sensor. Ensure that the cable length is sufficient.
2. Loosen the hexagon nuts **2** of the amplifier **3**.
3. Slide the amplifier **3** in the cut-out of the fastening angle **1**. Ensure that the hexagon nuts lie above and below the fastening angle.
4. Tighten the hexagon nuts.

Connecting the junction box



1 Junction box lid
2 Cable glands
3 Box outlet

1. Dismantle the junction box lid **1**.
2. Carry out the cabling of the pick up and of the temperature sensor through the cable glands **2** in the junction box. Observe the connection circuit diagram, see Fig. 7, page 42.
3. Connect the connecting cable at the box outlet **3**.
4. Screw tight the box lid **1**.

Connecting the extension cable

Normally the line length does not influence the functional efficiency of the sensors. However, the manufacturer recommends not extending the connection cable of the junction box beyond a maximum length of 100 m. Extension cable as well as cable plug and cable box are available as accessories from the manufacturer.

Extension cable	Unit	
☐ Length max.	[m]	100
☐ Cable diameter max.	[mm^2]	9.5
☐ Wire cross section min. – max.	 [mm^2] [mm^2]	 0.25 – 2.5 with solid wire 0.25 – 1.5 with fine wire

Pay attention to the following when connecting the extension cable:
► Use only a shielded cable. ► Lay the cable separately from the supply and measuring lines, see "Safety instructions for electrical installation", page 25.

1. Solder cable plug to the sensor cable.
2. Solder cable box to the extension cable.
3. Connect sensor cable and extension cable.
4. Connect extension cable in accordance with the connection circuit diagram.

Tightening torques

Tightening torque [Nm] for screws with metric threads + head contact surfaces									With thread measured in inches	
					+ wedge lock washers		Stainless steel screws A2 and A4		Screw plugs with elastomer seal	
Thread	5.6	8.8	10.9	8.8 + Alu*	8.8	Rust-proof A4-70	Property class 70	Property class 80	Thread	Galvanized + stainless steel
M 3	0.6	1.5	–	1.2	1.5	1.1	–	–	G 1/8"	13
M 4	1.4	2.9	4.1	2.3	3	2	–	–	G 1/4"	30
M 5	2.7	6.0	8.0	4.8	6.0	3.9	3.5	4.7	G 3/8"	60
M 6	4.7	9.5	14	7.6	10.3	6.9	6	8	G 1/2"	80
M 8	11.3	23.1	34	18.4	25	17	16	22	G 3/4"	120
M 10	23	46	68	36.8	47	33	32	43	G 1"	200
M 12	39	80	117	64	84	56	56	75	G 1 1/4"	400
M 14	62	127	186	101	133	89	–	–	G 1 1/2"	450
M 16	96	194	285	155	204	136	135	180		
M 18	133	280	390	224	284	191	–	–		
M 20	187	392	558	313	399	267	280	370	* Reduced tightening torque when screwing into aluminum	
M 24	322	675	960	540	687	460	455	605		

Tab. 6 Tightening torques

Contents of the EC Declaration of Conformity

The flowmeters described in these operating instructions are machinery in the sense of the Directive 2006/42/EC. The original of the EC Declaration of Conformity is enclosed with the machinery at delivery.

The machinery fulfills all the relevant provisions of the following directives:

Number	Name	Remark
2006/42/EC	Machinery Directive	–
2014/68/EU	Pressure Equipment Directive	–
2014/30/EU	Directive on Electromagnetic Compatibility	Only for machinery with electrical components
2014/35/EU	Low Voltage Directive	Only for machinery with electrical components
2014/34/EU	Directive on Use in Potentially Explosive Areas (ATEX)	Only for machinery in ATEX version

Tab. 7 Directives observed

KRAL AG, 6890 Lustenau, Austria, Tel.: +43/5577/86644-0, E-Mail: kral@kral.at