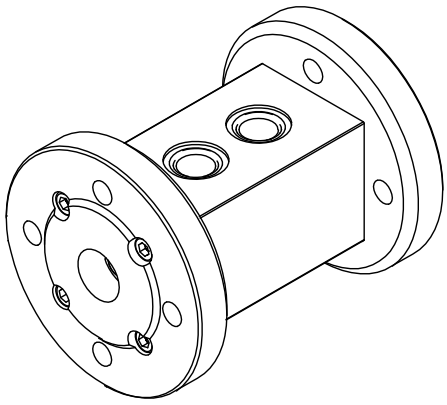
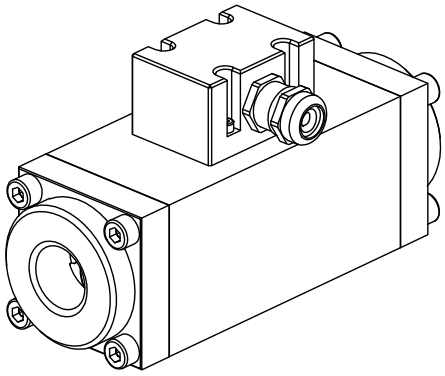
Operating instructions





KRAL Flowmeter.

OME Series

OIO 15en
Edition 2020-05
Original instructions

Table of contents

Target groups

The operating instructions form part of the flowmeter. The operating instructions 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 installation 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 used

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

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

Further associated documents

Further associated documents

Calibration certificate
Declaration of conformity according to EU Directive 2006/42/EC
Manufacturer's declaration as per EU Directive 2014/68/EU
Corresponding operating instructions for pick ups
Corresponding operating instructions for temperature sensor
Corresponding operating instructions for electronic equipment

Proper use

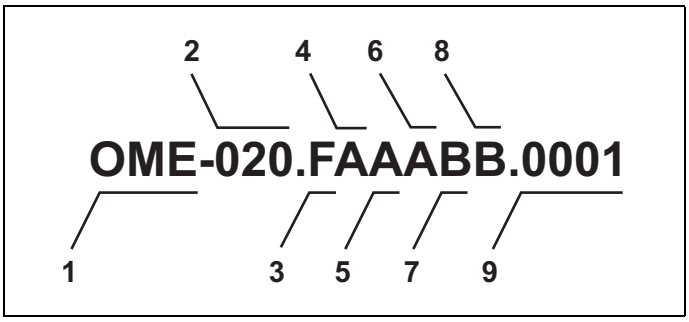
- ☐ Use KRAL flowmeters of the OME series solely for flow measurement of lubricating liquids that are chemically neutral and do not contain any gas or solids content.
- ☐ Do not use flowmeters outside the operating limits specified on the rating plate and in the "Technical data" section. Deviating operating 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 capacity", page 12.

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

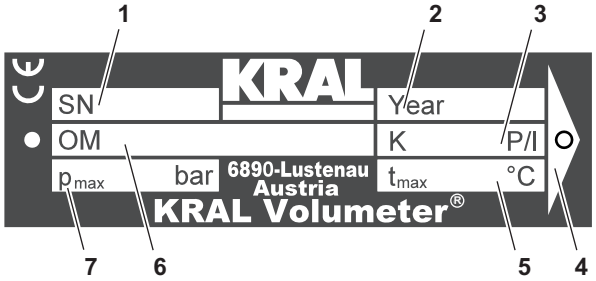


1 Series
2 Size
3 Sensor technology
4 Function of sensor technology
5 Material of bearing
6 Material of seal
7 Mechanical connection
8 Electrical connection
9 Version index

Fig. 1 Type code

Item	Designation	Description
1	Series	OME: Economy
2	Size	Corresponds to the diameter of the measuring screw large in [mm]
3	Sensor technology	F: BEG 47
		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	A: Steel
		X: Special design
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	B: Cable gland junction box
		X: Special design
9	Version index	For internal administration

Rating plate



1 Serial number
2 Construction year
3 K-factor
4 Preferred flow direction
5 Maximum temperature
6 Type
7 Maximum pressure

Fig. 2 Rating plate

Operational 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

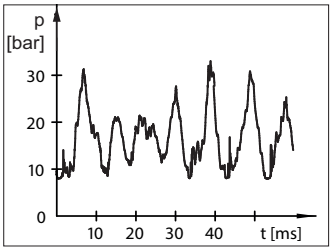


Fig. 1 Pressure pulses

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 end connection, of the sealing material of the pick up and of the temperature sensor are to be observed.

	Sizes			
	OME 13	OME 20	OME 32	OME 52
Flow rate [l/min]				
Q_{max}	15	45	150	525
Q_{nom}	10	30	100	350
Q_{min}	0.1	0.3	1	3.5
Pressure max. [bar]	40	40	40	40
Temperature [°C]				
min.–max.	-20...+125			
Viscosity [mm^2/s]				
min.–max.	1 – 1 000 000			
Measuring chamber volume [ml/U]	1.65	6.24	25.6	112.8
Rotation speed [1/min]				
n (Q_{max})	9120	7260	5850	4658
n (Q_{nom})	6060	4830	3900	3105
n (Q_{min})	61	48	39	31
Number of poles [p] K1	2	2	2	2
K-factor [P/l] K1	1214	321	78	17.73
Milliliters per pulse [ml/P] K1	0.824	3.12	12.8	56.4
Pulse frequency [Hz]				
f1 (Q_{max})	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 end connection, of the sealing material of the pick up and of the temperature sensor are to be observed.

	Sizes			
	OME 13	OME 20	OME 32	OME 52
Flow rate [l/min]				
Q_{max}	10	30	100	350
Q_{nom}	10	30	100	350
Q_{min}	0.2	0.6	2	7
Pressure max. [bar]	40			
Temperature [°C]				
min.–max.	-20...+100			
Viscosity [mm^2/s]				
min.–max.	1 – 50			

Tab. 2 Substitute operating data

Noise levels

KRAL flowmeters operate almost silently.

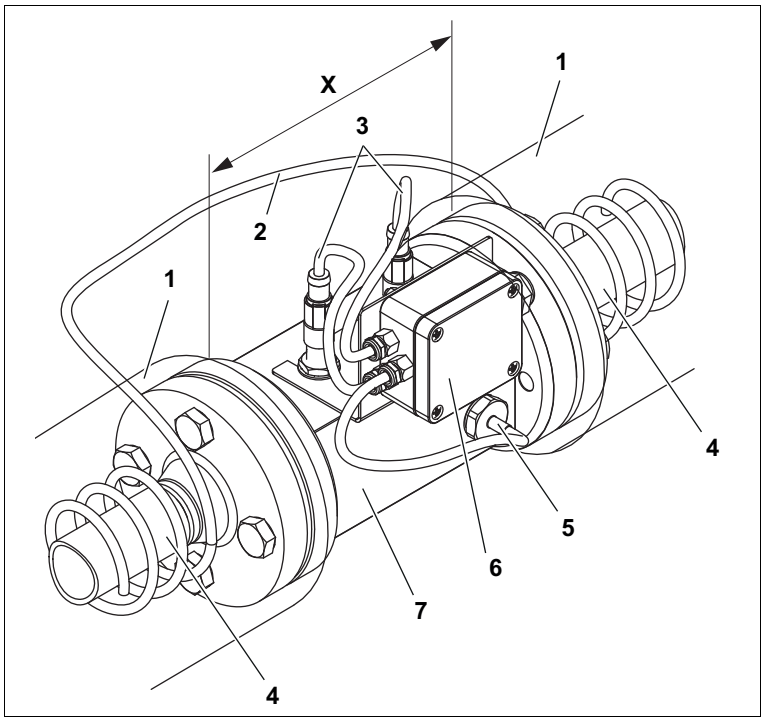
Heating system

A heating system is not installed at the factory. The customer can optionally fit OME-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 destructive of the device may otherwise result.

Trace heating system

Contact the manufacturer before installing a trace heating system.

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

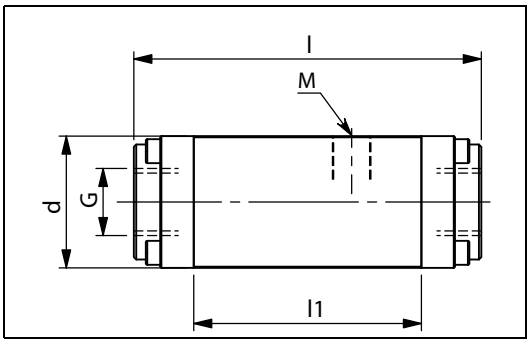
Fig. 2 Flowmeter with trace heating system

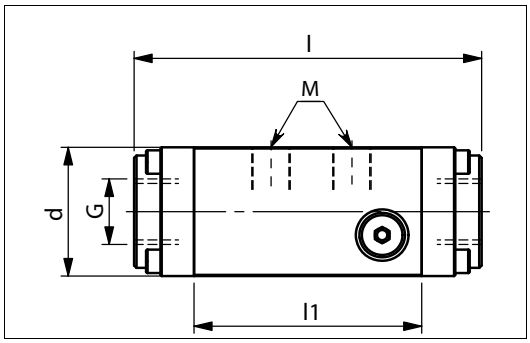
CAUTION
Defective pick up, temperature sensor or cabling due to exceeding of the maximum temperature.

► 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 10.

Dimensions and weights of OME with pipe thread connection



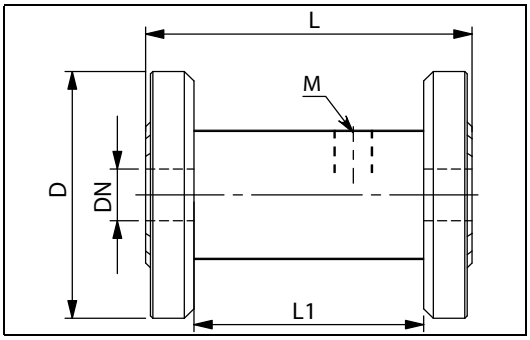


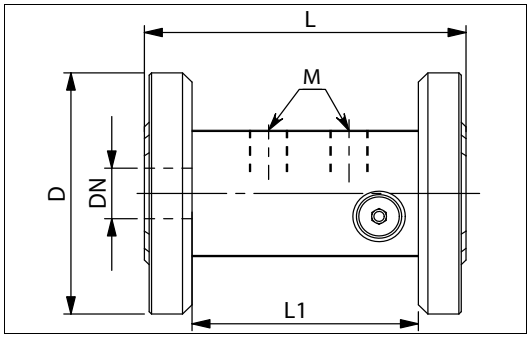
G Pipe thread
M Pick up hole
d Outside dimension
I1 Flowmeter length without end connection
I Total length

		OME 13	OME 20	OME 32	OME 52
G	**[inch]**	1/2"	3/4"	1"	1 1/2"
Pressure stage	**[bar]**	40	40	40	40
I	**[mm]**	110	145	200	310
d	**[mm]**	45 x 45	55 x 55	70 x 70	110 x 110
I1	**[mm]**	65	95	140	225
Mass	**[kg]**	0.6	1.1	2.7	9.0

Tab. 3 Dimensions and weights, pipe thread connection

Dimensions and weights of OME with flange connection





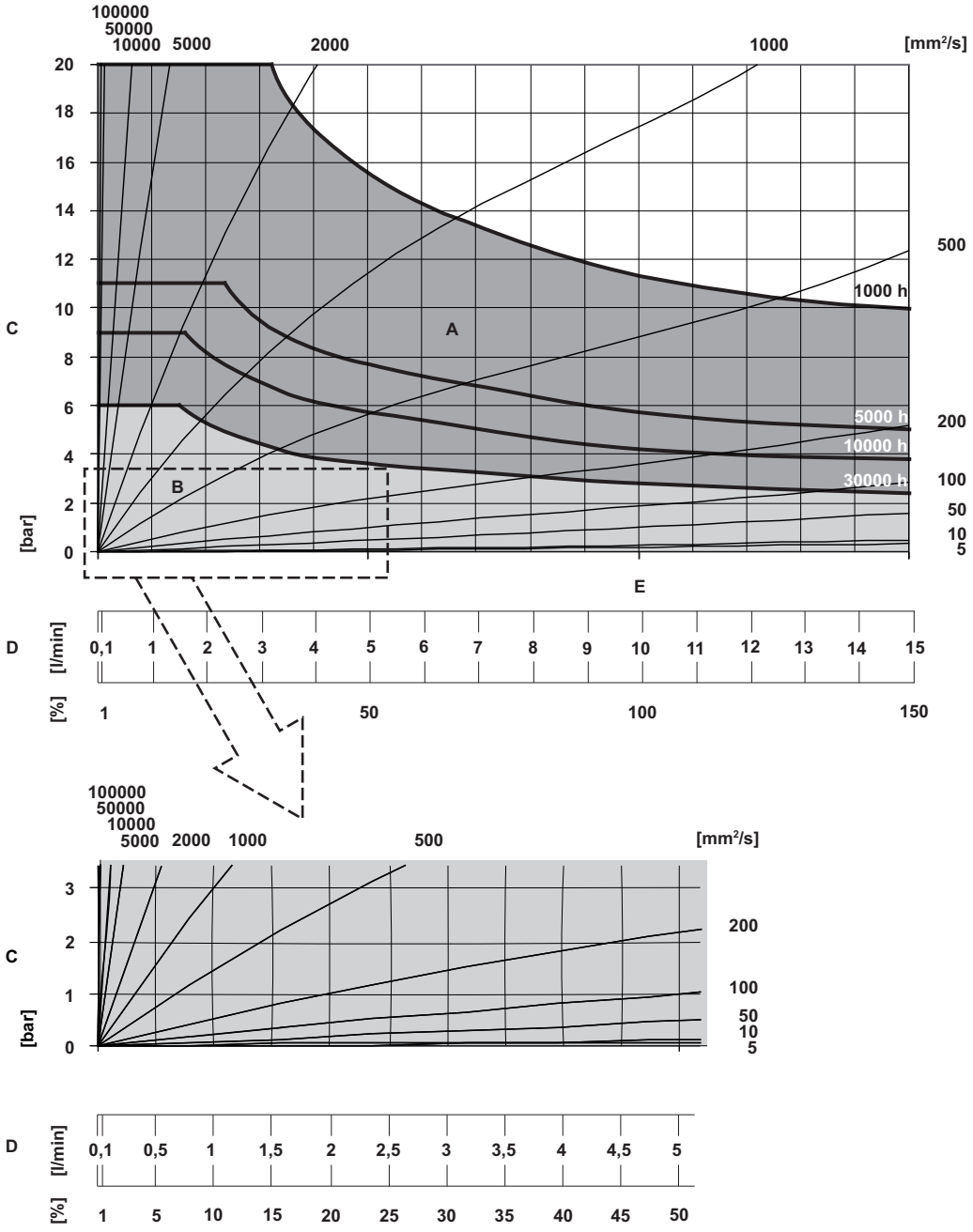
DN Nominal diameter flange
M Pick up hole
D Outer diameter
L1 Flowmeter length without end connection
L Total length

		OME 13	OME 20	OME 32	OME 52
DN	**[mm]**	15	20	25	40
Pressure stage	**[bar]**	40	40	40	40
L	**[mm]**	105	135	185	325
D	**[mm]**	95	105	115	150
L1	**[mm]**	65	95	140	225
Mass	**[kg]**	1.1	1.6	3.1	11.4

Tab. 4 Dimensions and weights, flanged connection

Load capacity

Load capacity OME 13

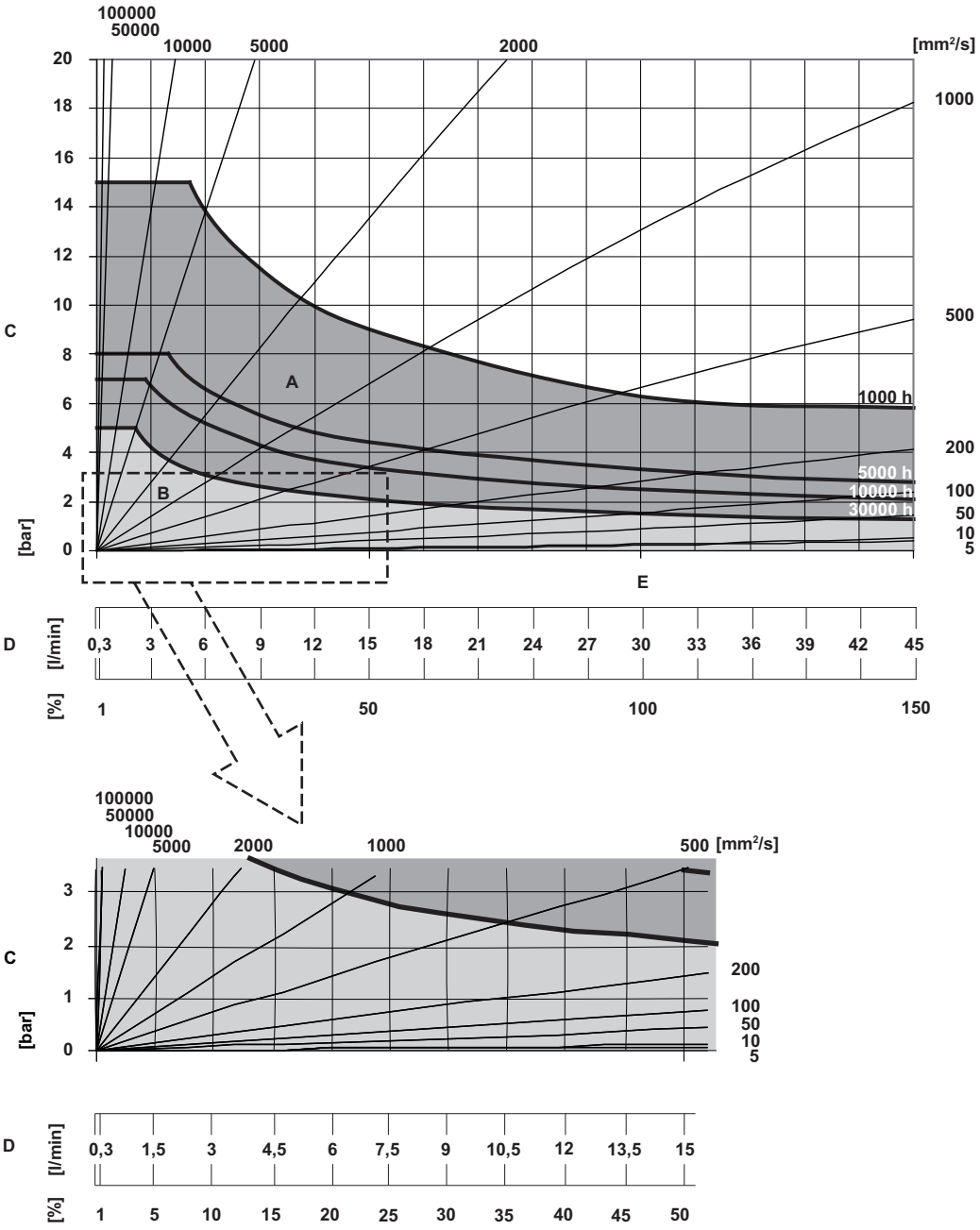


A Short-time operation
B Continuous operation
C Pressure loss
D Flow
E Q_{nom}

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

Load capacity

Load capacity OME 20

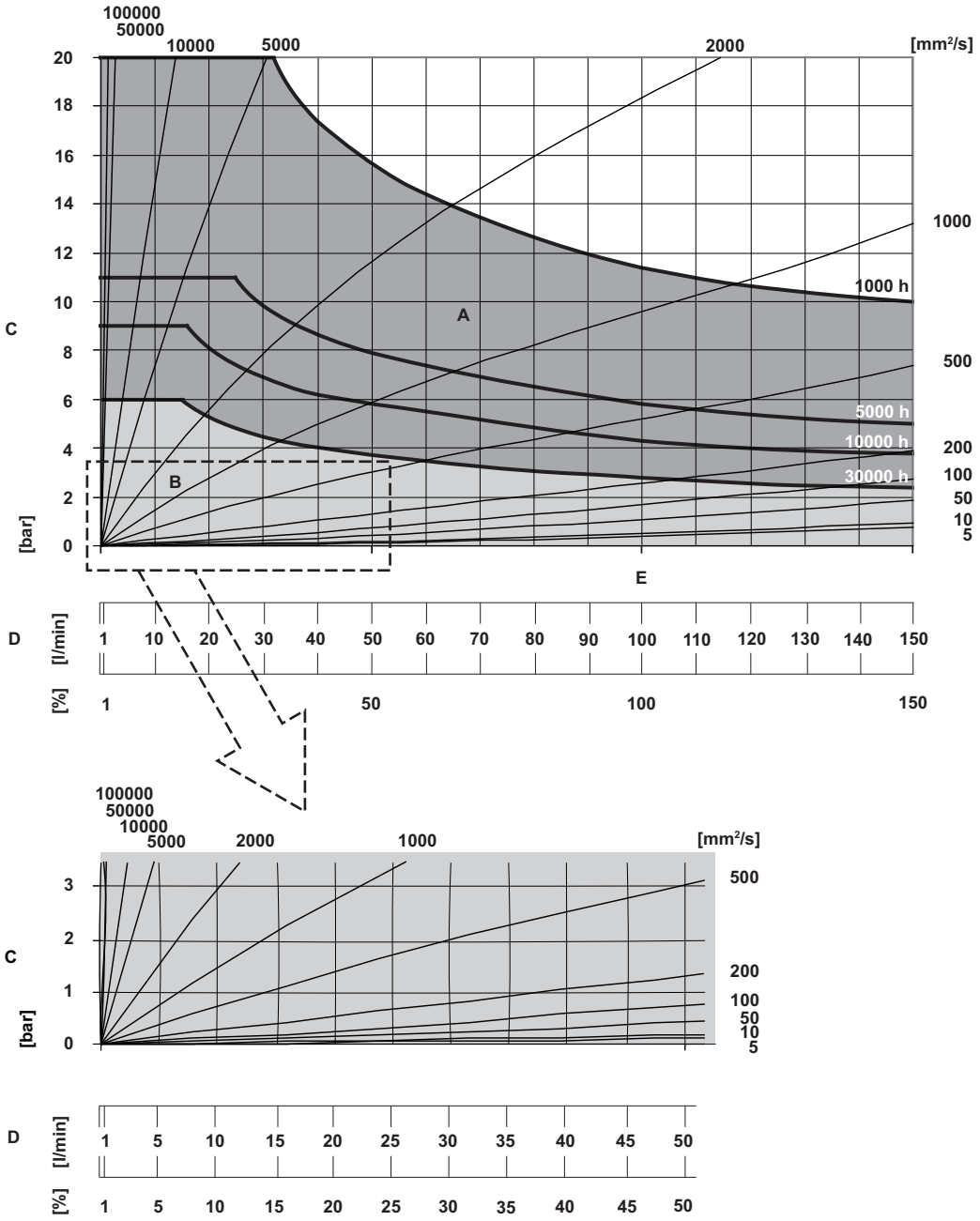


A Short-time operation
B Continuous operation
C Pressure loss
D Flow
E Q_{nom}

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

Load capacity

Load capacity OME 32

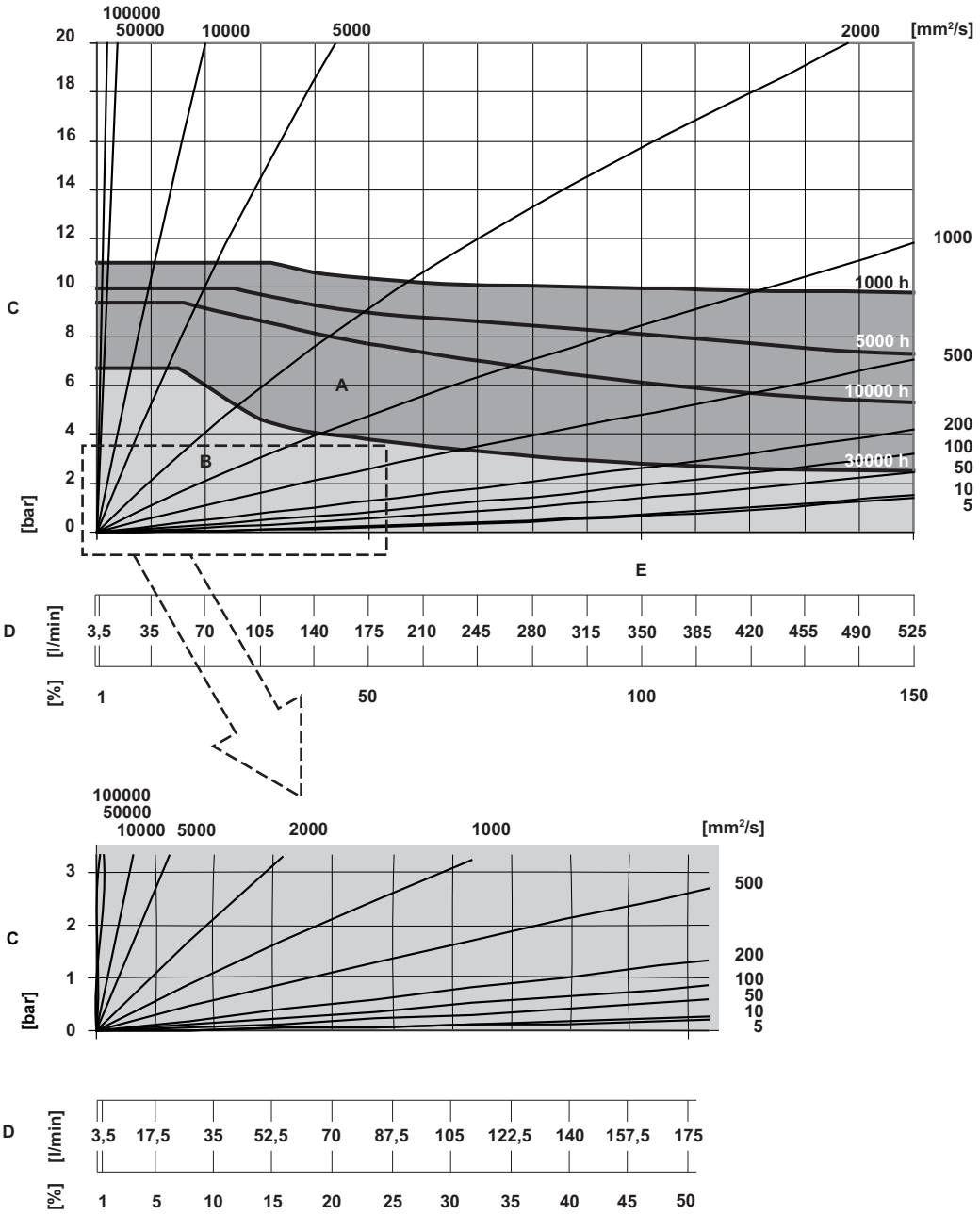


A Short-time operation
B Continuous operation
C Pressure loss
D Flow
E Q_{nom}

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

Load capacity

Load capacity OME 52



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

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

Description

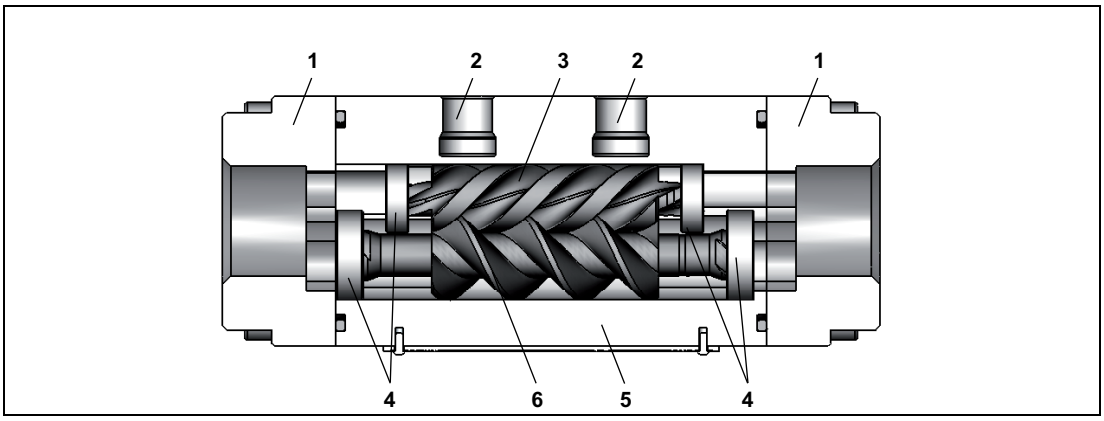


Fig. 1 Flowmeter design, OME Series, Version BEG 56

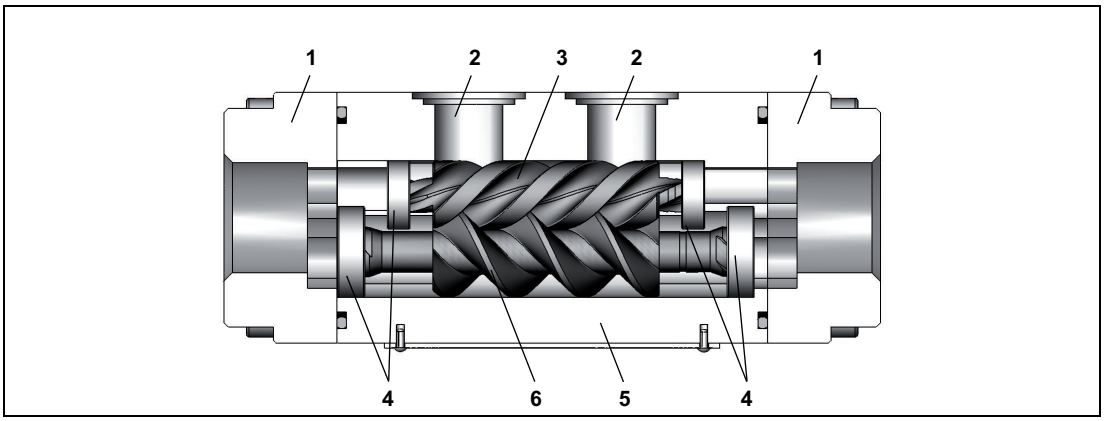


Fig. 2 Flowmeter design, OME Series, Version BEG 47C

1 Connection
2 Pick up hole
3 Measuring screw small
4 Ball bearing
5 Measuring housing
6 Measuring screw large

KRAL flowmeters belong as screw meters to the group of rotating displacement meters. In a screw meter a special form allows an almost tight engagement of two intermeshing screws **3, 6** to be achieved. Together with the measuring housing **5** that encompasses the measuring unit, closed volumes are achieved by this means. The fluid current makes the measuring unit rotate. The displacement effect results from the continuous filling, axial displacement and discharge of the volumes described above. The free cross-section of the measuring unit is constant throughout its length so that the flow rate can be calculated simply from the product of the free cross-section, rotation speed and pitch of the screws. The measured liquid flows around and lubricates all the rotating parts. The liquid is supplied and discharges axially and almost without deflection. Thanks to the displacement principle described here, the flowmeter does not require inlet and smoothing sections in its supply and discharge. The flowmeter can be operated in any installation position and flow direction. The preferred direction of flow is indicated on the rating plate by means of a bright arrow. Depending on the customer requirements, the flowmeters can be equipped with correspondingly adapted end connections for connection to various flanges.

Rolling bearing

The measuring unit is maintained without contact and with a low degree of friction in the housing of the KRAL flowmeter by means of a precision rolling bearing. Single-row deep-groove ball bearings are used for Series OME KRAL flowmeters.

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:

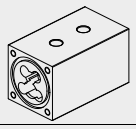
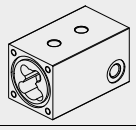
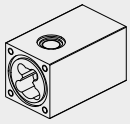
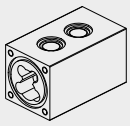
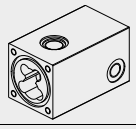
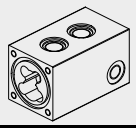
- ☐ PNP
- ☐ NAMUR

As a consequence of the mode of assembly the pick up can be mounted 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

Housing variants

A variety of housing variants is available, depending on the application:

Application	Housing variant	Sensors
Standard Signal: PNP		☐ 1 pick up or ☐ 2 pick ups
		☐ 1 pick up ☐ 1 temperature sensor or ☐ 2 pick ups ☐ 1 temperature sensor
Use in areas where there is an explosion hazard Signal: Namur		☐ 1 pick up
		☐ 2 pick ups
		☐ 1 pick up ☐ 1 temperature sensor
		☐ 2 pick ups ☐ 1 temperature sensor

Tab. 1 Housing variants

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 flow management 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 KRAL 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 OME series. For further information see "Accessories", page 35.

Unpacking and checking the state of delivery

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

Transportation

Safety instruction for transportation

Pay attention to the following when transporting the flowmeter:
☐ Lift and transport the flowmeter in accordance with the locally applicable regulations.

Transporting the flowmeter

Depending on the locally applicable regulations, Series OME flowmeters can be transported either manually or using suitable lifting gear.

Storage

As a result of the calibration, the internal components of the flowmeter are wetted with calibration fluid that has a preservative effect. In addition, a special anticorrosive agent is sprayed onto the interior of the devices before being dispatched. The connections of the flowmeter are fitted with protective caps. Unless otherwise specified, the external parts of the flowmeters are anodized. 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.

Preservation

Preservation has to be carried out in the following cases:

- ☐ **Standard delivery:** For storage periods exceeding six weeks and in case of adverse storage conditions such as high humidity, salty air, etc.
- ☐ **Delivery with long-term preservation:** If the packaging has been opened or damaged

Preserving the flowmeter

1. Close a connection of the flowmeter with a blind flange.
2. Place 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, that also the measuring unit is wetted.
4. Close the connection with a blind flange.

After about 6 months storage check the oil level in the flowmeter and if necessary top up oil.

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

Notice:
After a longer storage time we recommend a re-calibration of the flowmeter, see "Re-calibration of the flowmeters", page 28.

Disposal

Removing the preservation

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

WARNING
Risk of injury through emitted preservative oil.

- ► Wear protective clothing during all the work on the flowmeter.
- ► 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 on the flowmeter.
- ► 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 aluminum and steel parts.

Safety instructions for installation and removal

The following safety instructions must be observed:
☐ KRAL 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. ▪ Installation: Only remove the screw plugs in order to insert the temperature sensors. ▪ Removal: Screw in the screw plugs again after the temperature sensors have 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.

Installation

KRAL flowmeters can be operated in any installation 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

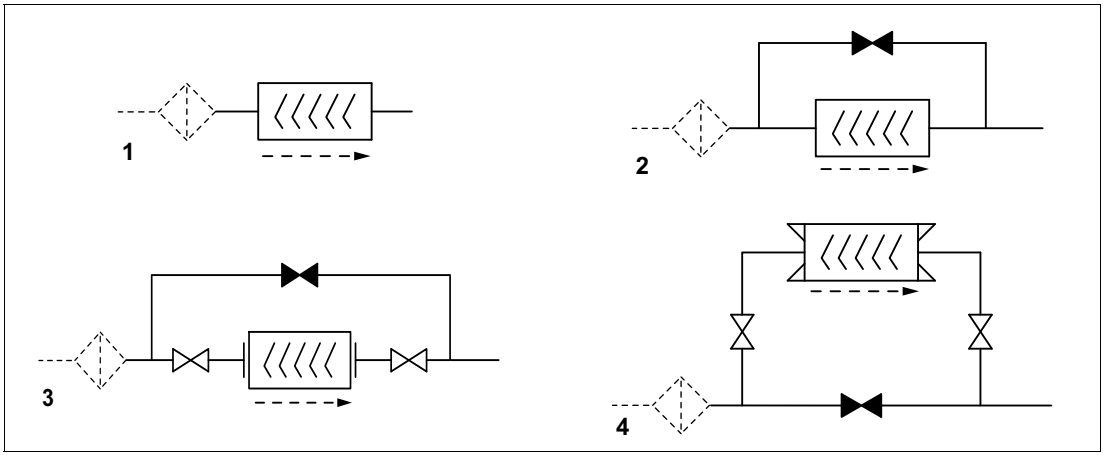
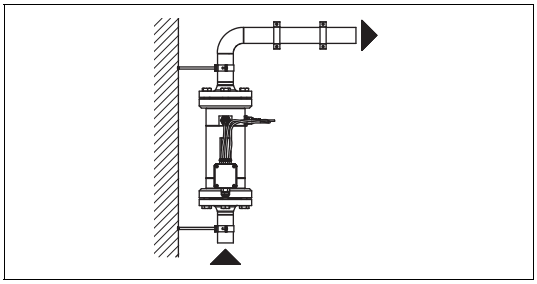


Fig. 1 OME installation types

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 non-return valves for flange connection ☐ With or without operating filter	☐ Dismantling of the flowmeter without interruption of operation
4	☐ Bypass with 3 non-return valves for pipe thread connection ☐ With or without operating filter	☐ Dismantling of the flowmeter without interruption of operation ☐ Minimally higher pressure loss

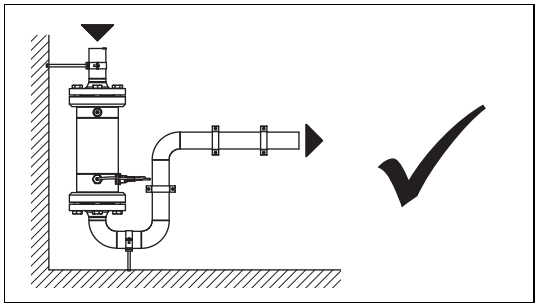
Preferred installation variant



Flow vertically from bottom to top

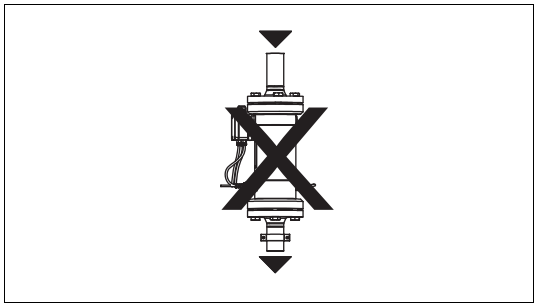
► Preferred installation variant.

Recommendations for alternative installation variants



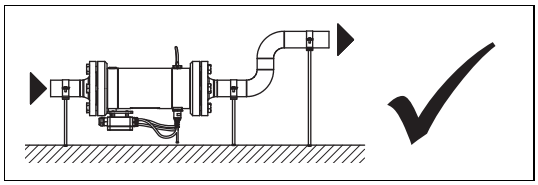
Flow vertically from top to bottom

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



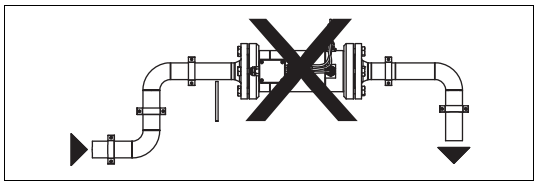
No vertical installation with open outlet

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



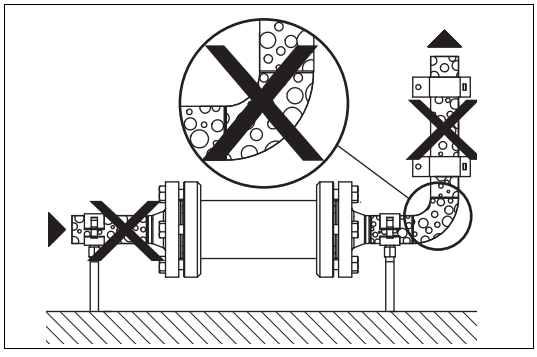
Horizontal flow

► 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.

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 "Installation", page 21.

Protect the flowmeter against soiling

KRAL flowmeter as rotating displacement meters need pure liquids for operation. In case of impurities, solid content or abrasive fine particles in the liquid during operation, the flowmeter has to be protected additionally by a correspondingly dimensioned operating filter in the pipe system. The mesh width of the operating filter depends on the size of the flowmeter.

Flowmeter size	Mesh width max. [mm]
OME 13	0.1
OME 20	0.1
OME 32	0.25
OME 52	0.25

Tab. 1 Mesh width of the operating filter

Pipe thread connection

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.

Flanged connection

The flowmeter connections to the pipe system must be stress-free, as otherwise there is no guarantee that the flowmeter will operate safely. The following drawings show how a flange is connected stress-free to the flowmeter.

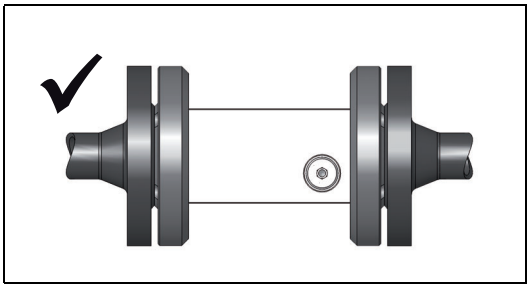
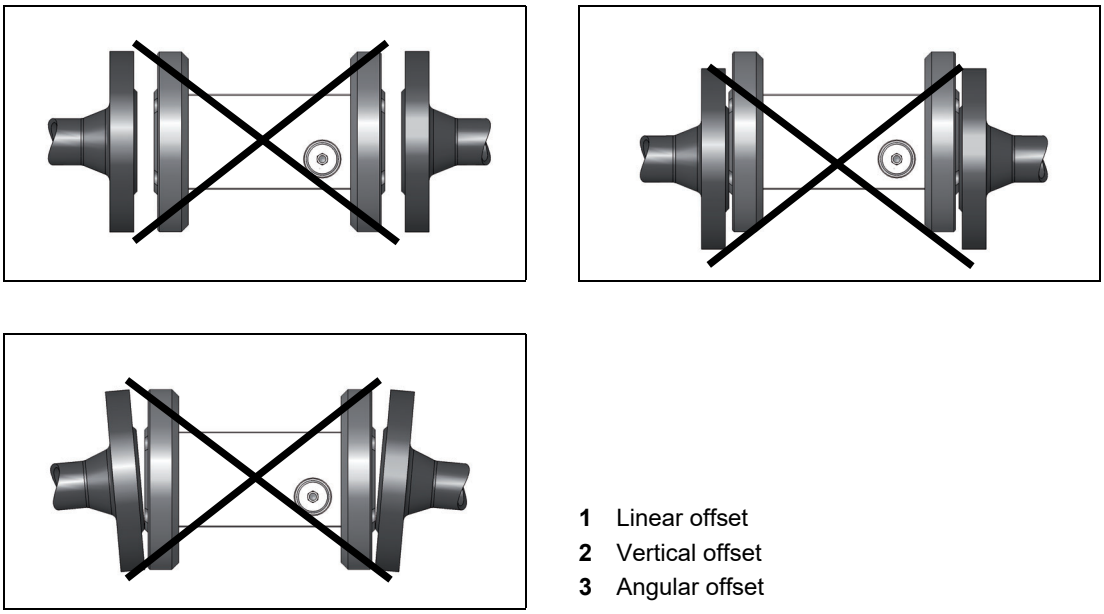


Fig. 2 Correct flange connection



1 Linear offset
2 Vertical offset
3 Angular offset

Fig. 3 Incorrect flange connections

Installing the flowmeter

CAUTION
Damage to the flowmeter through impurities in the pipe system.

- ► Ensure that the pipe system has been cleaned carefully.
- ► During welding work attach cover plates in front of the connecting flanges.
- ► Ensure when welding that welding beads and abrasive dust cannot get into the pipe system and the flowmeter.
- ► Ensure that a pressure relief valve or bypass of the flowmeter is installed.
- ► Before operating the flowmeter rinse the pipe system via the bypass. Under no circumstances may water or superheated steam be used!
- ► Observe the mesh width of the start-up filter, see "Protect the flowmeter against soiling", page 23.

CAUTION
Danger of damage to the device or impaired functionality through mechanical stresses.

- ► Ensure that the flowmeter mounting on the pipe system is free of mechanical stress, see "Flanged connection", page 23.

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

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

1. Remove the protective covers and store them.
2. Install the flowmeter stress-free in the circular pipeline. Take the preferred flow direction into consideration.
3. Ensure that the connections of the pick ups and temperature sensors remain accessible.

Electrical connection

Safety instructions for electrical installation

The following safety instructions must be observed during the electrical installation:
☐ The following qualifications are required for the electrical connection: ▪ Practical electrotechnical training ▪ Knowledge of the safety guidelines at the workplace ▪ Knowledge of the electrotechnical safety guidelines ☐ The connecting lines of the connections for pick ups and temperature sensors are to be shielded and laid separately from the supply and measuring lines. ☐ Ensure that the supply voltage is correct.

► Observe the corresponding operating instructions for pick ups, temperature sensors and electronic equipment.

Removing the flowmeter

Prerequisite:
☐ System switched off

Aids:
☐ Vessels for leaking pumped liquid

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

► Observe the safety regulations for handling dangerous fluids.
► 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 closed circular pipeline or divert the liquid via a bypass.
3. Dismantle the flowmeter.
4. Apply the protective covers.
5. Observe the sections "Storage" and "Preserving the flowmeter" on the subject of storing the flowmeter.

Function test

Test	Procedure
Installation	► Check the installation position of the flowmeter with regard to the flow direction. ► Check the installation and installation 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 corresponding operating instructions for pick ups, temperature sensors and electronic equipment.
Power supply	► Observe the corresponding operating instructions for pick ups, temperature sensors and electronic equipment.

Tab. 1 Test table

First commissioning

Prerequisite:

☐ The ambient conditions correspond to the operating data, see "Technical data", page 8
☐ Flowmeter correctly installed into the pipe system, see "Installation", page 21
☐ Flowmeter connection to the pipe system is free of mechanical stress
☐ Pipe system is free of contamination
☐ Pipe system deaerated
☐ Any shut-off devices in the supply and discharge lines opened

CAUTION
Measuring error through gas inclusion in the pipe system.

► Before commissioning, make sure that the flowmeter is filled.
► Deaerate 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 capacity", page 12. ▪ The limit values shown in the following table must not be exceeded even for a short time.

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:

☐ The requirements for initial commissioning are met, see "First commissioning", page 26.

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
   - or -
   ► Heat up the liquid during standstill by means of a heating system, see "Heating system", page 9.
2. Switch on the system.
   Under the requirements mentioned above, the flowmeter is ready for operation at any time.

Re-calibration of the flowmeters

KRAL flowmeters are fundamentally maintenance-free. However, despite the robust design flowmeters, as mechanical meters, are also subject to a certain wear as time passes. In order to maintain the high degree of precision, the manufacturer recommends carrying out the first recalibration after about one year of operation in order to ensure the technical functionality. Further specifications can be made in your quality management system. The results of the recalibration reveal the wear starting at the measuring unit.
The interval at which recalibration is actually required depends strongly on the operating conditions of the device. Under favorable conditions 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. Changes in the cross-section due to deposits or corrosive/abrasive wear at the elements coming into contact with the flow are further factors that can result in a change to the characteristics.
Recalibration and maintenance of your KRAL flowmeter ensures its measuring precision and technical functionality. 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.

General information about mounting instructions

The following instructions are to be observed:
☐ Any mounting work may only be carried out by qualified personnel. ☐ Replacement of the measuring unit consisting of the set of screws, rolling bearings and pole wheel may only be carried out in the factory. ☐ The flowmeter has to be recalibrated after the measuring housing or the rolling bearing has been replaced. ☐ Observe the pick up operating instructions when replacing the pick up insert. ☐ Observe the temperature sensor operating instructions when replacing the temperature sensor.

Mounting instructions

General drawing

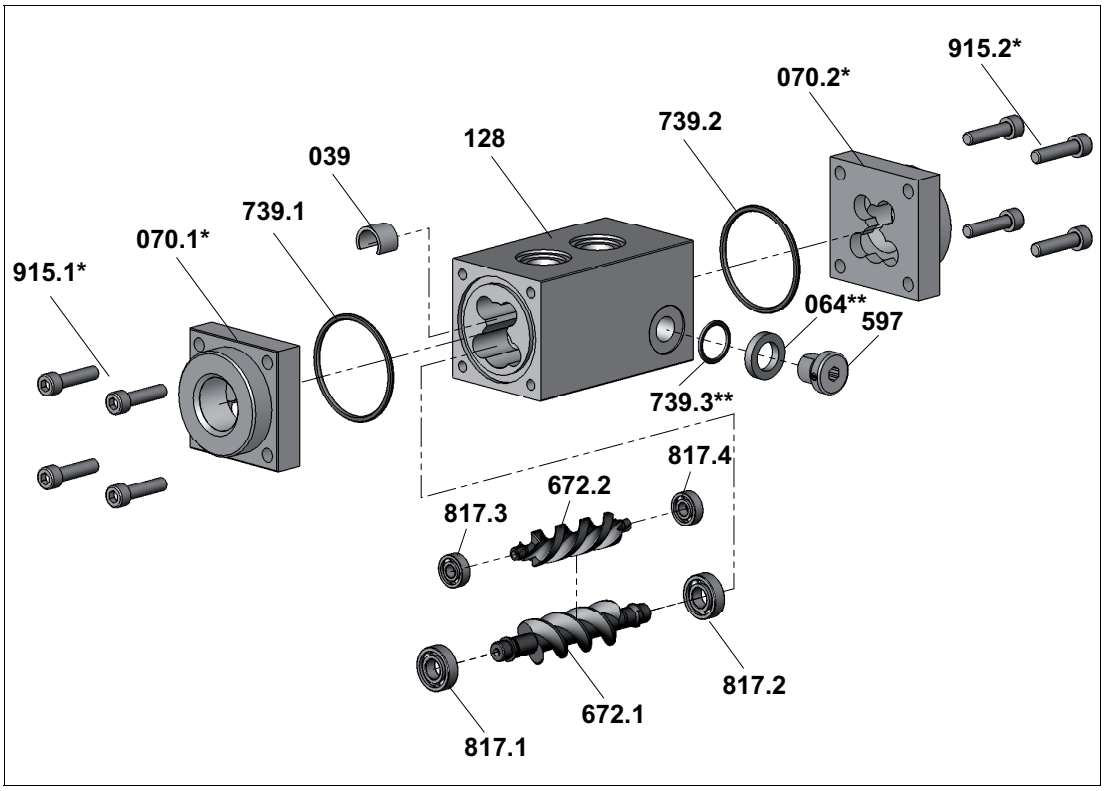


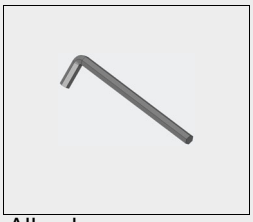
Fig. 1 Exploded view OME 13 / 20 / 32 / 52

039	Distance sleeve	**739.2**	O-ring
064**	Supporting ring	**739.3****	O-ring
070.1*	End cover	**817.1**	Deep-groove ball bearing
070.2*	End cover	**817.2**	Deep-groove ball bearing
128	Measuring housing	**817.3**	Deep-groove ball bearing
597	Screw plug	**817.4**	Deep-groove ball bearing
672.1	Measuring screw large	**915.1***	Socket screws
672.2	Measuring screw small	**915.2***	Socket screws
739.1	O-ring		

* Parts for pipe threading or flange connection alternatively

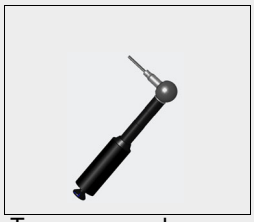
** not contained at size OME 52

Required mounting tools



Allen key

Extractor



Torque wrench
Hexagon socket

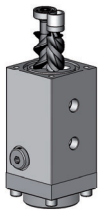
Removing seals and bearings

Prerequisites:

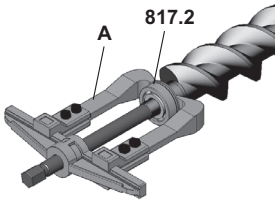
☐ Flowmeter removed from system

☐ Sensors removed

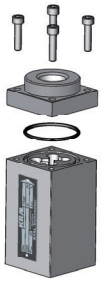
1. Remove the socket screws **915.1***, then remove the end cover **070.1*** and O-ring **739.1**.



2. Pull the screw set with the ball bearings and distance sleeve **039** out of the measuring housing **128**, paying attention to the configuration for later assembly. Remove the distance sleeve.



3. Pull the ball bearings **817.1 + 817.3** and **817.2 + 817.4** off the measuring spindle (large and small), using the pull-off device to do so.

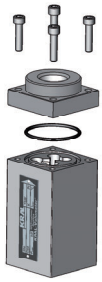


4. Remove the socket screws **915.2***, then remove the end cover **070.2*** and O-ring **739.2**.
5. Clean all the parts using a suitable detergent.

Installing seals and bearings

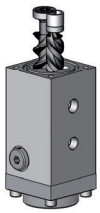
Prerequisites:

☐ Replacement parts available

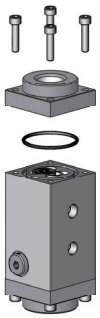


1. Insert the O-ring **739.2** into the measuring housing **128**. Place on the end cover **070.2***, tighten the socket screws **915.2*** with torque, see Tab. 2, page 34.

2. Press the ball bearings **817.1 + 817.3** and **817.2 + 817.4** onto the measuring screws. **Notice**: Press on only over the inner ring!



3. Push the screw set into the measuring housing **128**, paying attention to the configuration. Slide the distance sleeve **039** flush into the hole of the measuring screw small **672.2**.



4. Insert the O-ring **739.1** into the measuring housing, place on the end cover **070.1***. Tighten the socket screws **915.1*** with torque, see Tab. 2, page 34.

Possible faults

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

Possible faults

Fault	Possible cause / Remedy
☐ Flowmeter leaks	1, 2, 10
☐ No flow	3, 11, 12, 24, 26, 27
☐ Negative flow	5, 19, 21
☐ Flowmeter does not generate a pulse	3, 5, 6, 9, 10, 12, 15, 22, 24, 26, 27
☐ Pressure loss too high	13, 16, 24, 25
☐ Measured values not realistic	3, 5, 6, 7, 9, 11, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25
☐ No signal of the temperature sensor	7, 8

Tab. 1 Possible faults

Troubleshooting

No.	Possible 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	► Disassemble the flowmeter and clean it. ► Use the commissioning filter.
5	Pick up not connected correctly	► Check the connection of the pick up. ► Check the supply voltage for the pick up, while observing the pick up operating instructions.
6	Pick up defective	► Check the function of the pick up, while observing the pick up operating instructions. ► Replace the pick up.
7	Temperature sensor mounted incorrectly	► Install the temperature sensor correctly, while observing the temperature sensor operating instructions.
8	Temperature sensor defective	► Check the function of the temperature sensor, while observing the temperature sensor operating instructions. ► Replace the temperature sensor.
9	Dry sleeve not adjusted correctly	► Set the dry sleeve correctly, while observing the pick up operating instructions.
10	Dry sleeve destroyed	► Replace dry sleeve, please contact the manufacturer for information.
11	Liquid lubricates too little	► Use the OMK series.
12	Feed pressure too low	► Increase the feed pressure.
13	Viscosity of the liquid too high	► Increase the temperature, while observing the permissible temperature range.
14	Viscosity of the liquid too low	► Use the OMK series.

Troubleshooting

No.	Possible cause	Remedy
15	Flow rate too low	► Increase the flow rate - or - ► Use a suitable flowmeter size - or - ► Use linearization, while observing the electronic operating instructions.
16	Flow rate too high	► Reduce the flow rate - or - ► Use a suitable flowmeter size.
17	Airlocks	► Deaerate the system and check for leaks.
18	Outgassing	► Increase the system pressure. ► Reduce the temperature.
19	Pulsations too high	► Use another feed pump. ► Carry out changes to the system. ► Use the OMG series.
20	Back pressure too low	► Increase the back pressure.
21	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.
22	Filling amount too low	► Use a suitable flowmeter size. ► Use the OMG series.
23	Strongly deviating operating data	► Use a suitable flowmeter. ► Adapt the operating data to the flowmeter.
24	Wear at the measuring unit and bearing	► Renew the measuring unit. ► Renew the bearing. ► Filter out the abrasive materials.
25	Sluggishness through deposits	► Disassemble the flowmeter and clean it carefully.
26	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.
27	Flowmeter switched to bypass	► Switch the flowmeter to through-flow.

Tab. 2 Troubleshooting

General drawings

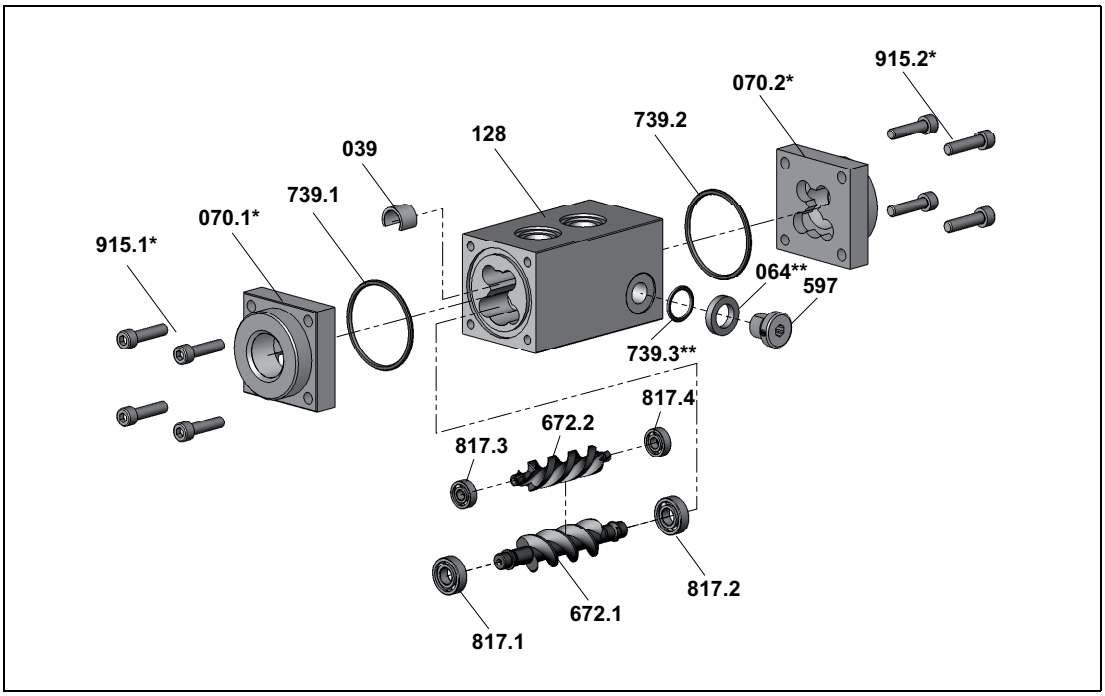


Fig. 1 Exploded view OME 13 – 52 Pipe thread connection

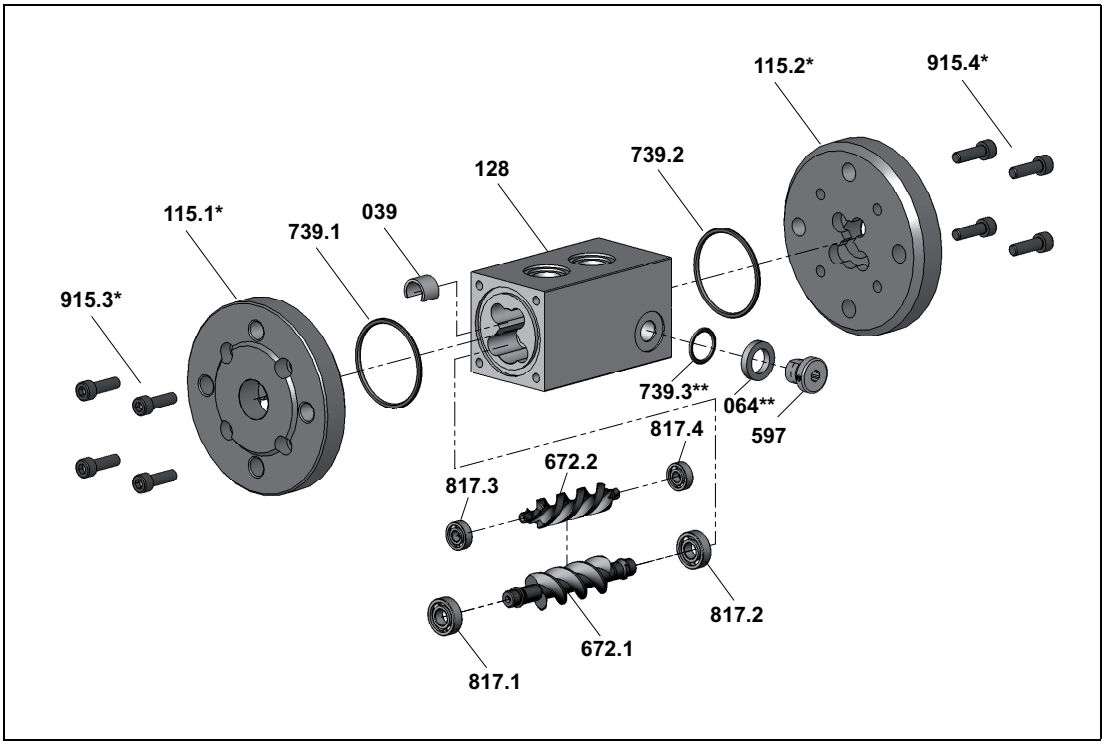


Fig. 2 Exploded view OME 13 – 52 Flange connection

Spare parts

Pos. no.	Part	Pos. no.	Part
039	Distance sleeve	**739.2**	O-ring
064**	Supporting ring	**739.3****	O-ring
070.1*	End cover	**817.1**	Deep-groove ball bearing
070.2*	End cover	**817.2**	Deep-groove ball bearing
115.1*	Flange	**817.3**	Deep-groove ball bearing
115.2*	Flange	**817.4**	Deep-groove ball bearing
128	Measuring housing	**915.1***	Socket screws
597	Screw plug	**915.2***	Socket screws
672.1	Measuring screw large	**915.3***	Socket screws
672.2	Measuring screw small	**915.4***	Socket screws
739.1	O-ring		

* Parts for pipe threading or flange connection alternatively
** Not contained at size OME 52

Tab. 1 Pos. no.

Tightening torques

Tightening torque [Nm] for screws with metric threads + head contact surfaces							
					Stainless steel screws A2 and A4		Countersunk screws
Thread	5.6	8.8	10.9	8.8 + Alu*	Property class 70	Property class 80	8.8
M 3	0.6	1.5	–	1.2	1.1	1.3	1.0
M 4	1.4	3.0	4.1	2.3	2.0	2.3	2.0
M 5	2.7	6.0	8.0	4.8	3.9	4.7	5.0
M 6	4.7	10.3	14.0	7.6	6.9	8.0	9.0
M 8	11.3	25.0	34.0	18.4	17.0	22.0	14.0
M 10	23.0	47.0	68.0	36.8	33.0	43.0	36.0
M 12	39.0	84.0	117	64.0	56.0	75.0	60.0
M 14	62.0	133	186	101	89.0	–	90.0
M 16	96.0	204	285	155	136	180	100
M 18	133	284	390	224	191	–	–
M 20	187	399	558	313	267	370	135
M 24	322	687	960	540	460	605	360

With thread measured in inches	
Screw plugs with elastomer seal	
Thread	Galvanized + stainless steel
G 1/8"	13.0
G 1/4"	30.0
G 3/8"	60.0
G 1/2"	80.0
G 3/4"	120
G 1"	200
G 1 1/4"	400
G 1 1/2"	450

* Reduced tightening torque when screwing into aluminum

Tab. 2 Tightening torques

Accessories

Junction box

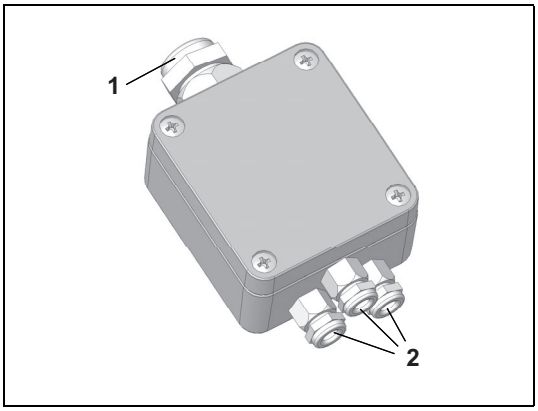


Fig. 3 Junction box UZA 70

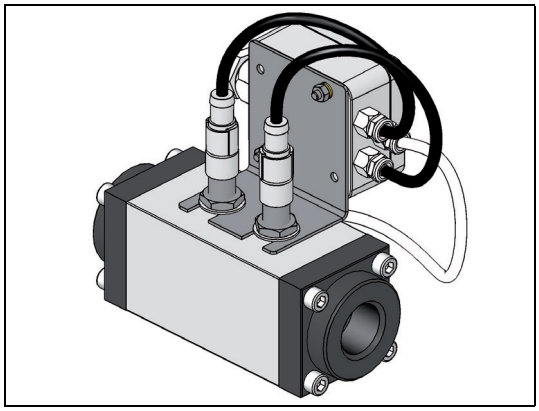


Fig. 4 OME 20 with installed UZA 57

1 Output
2 Sensor inputs

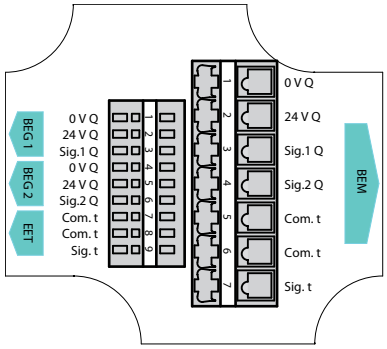


Fig. 5 Connection circuit diagram junction box

As an option the manufacturer offers a junction box that facilitates the electrical connection of the various sensors for the flowmeters of the OME 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 used with the pick up BEG 56.

	UZA			
Use for size	OME 13	OME 20	OME 32	OME 52
Electrical specification				
☐ 1 sensor input	UZA 52	UZA 55	UZA 58	UZA 68
☐ 2 sensor inputs	UZA 53	UZA 56	UZA 59	UZA 69
☐ 3 sensor inputs	UZA 54	UZA 57	UZA 60	UZA 70
☐ Outputs	1			
Mechanical specification				
☐ Housing material	Aluminum			
☐ Connection thread	M6			
☐ Fastening type	with base plate			directly on device

Accessories

Mounting the junction box

Mounting the junction box on OME 13 - 32

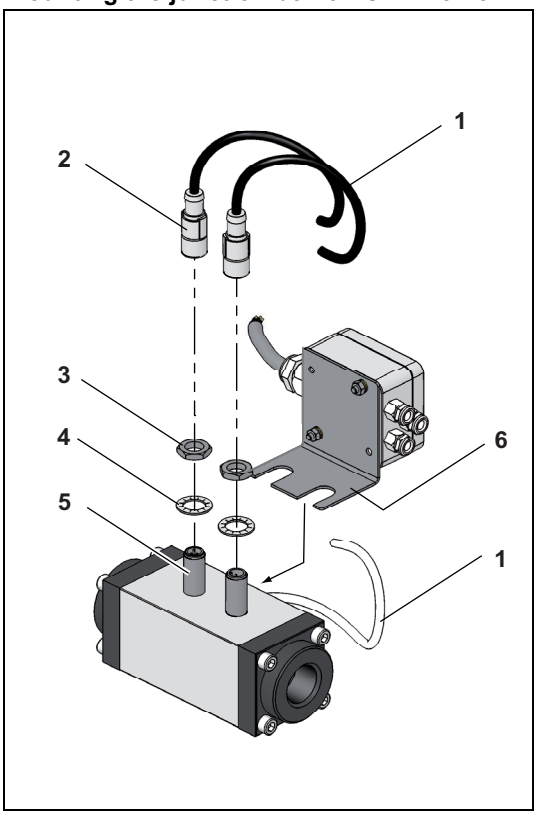
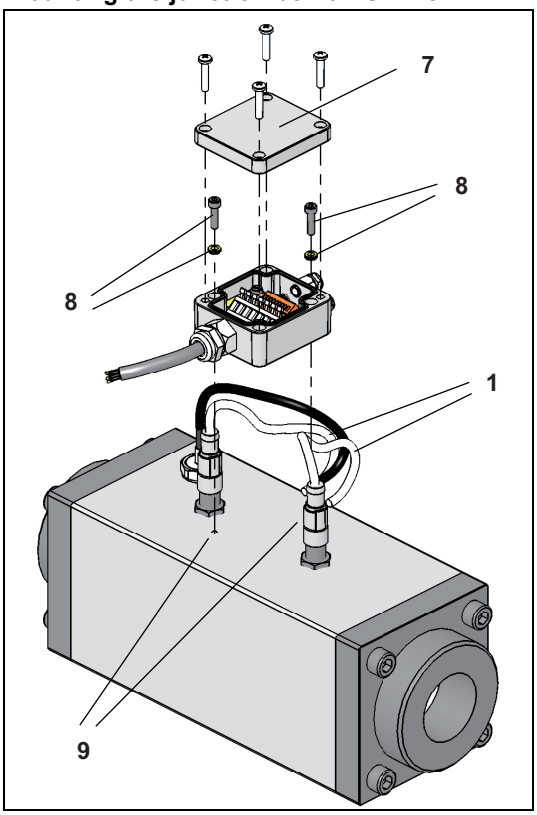


Figure shows OME 20 as an example

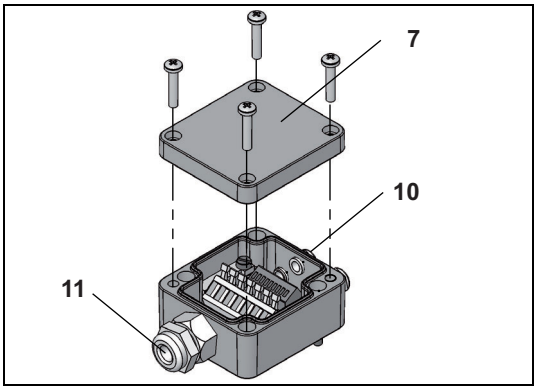
1. Disconnect the cables of the pick up and the temperature sensor **1**. Ensure that the cable length is sufficient.
2. Unplug the connectors of the pick ups **2**.
3. Turn out the hexagon of the pick ups **3**.
4. Place the washers of the junction box **4** over the pick up inserts **5**.
5. Slide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

Mounting the junction box on OME 52



1. Dismantle the junction box lid **7**.
2. Screw the box with screws **8** directly onto the OME 52 in the provided holes **9**.
3. Disconnect the cables of the pick up and the temperature sensor **1**. Ensure that the cable length is sufficient.

Connecting the junction box



1. For OME 13 – 32: Dismantle the junction box lid **7**.
2. Carry out the cabling of the pick up and of the temperature sensor through the cable glands **10** in the junction box. Observe the connection circuit diagram, see Fig. 5, page 35.
3. Connect the connecting cable at the box outlet **11** .
4. Screw tight the box lid **7**.

Connecting the extension cable

Normally the line length does not influence the functional efficiency of the sensors. However, we recommend 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		
☐ Length max.	[m]	100
☐ Cable diameter min. – max.	[mm^2]	6.0 –10.5
☐ 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.

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. 3 Directives observed

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