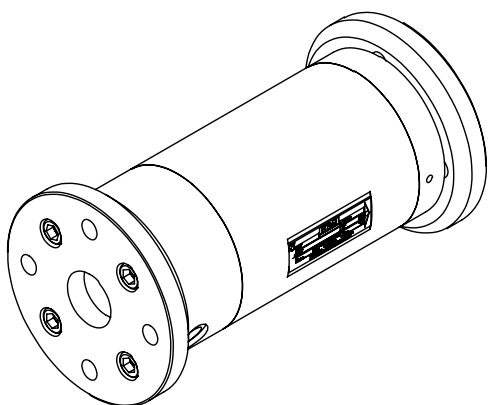
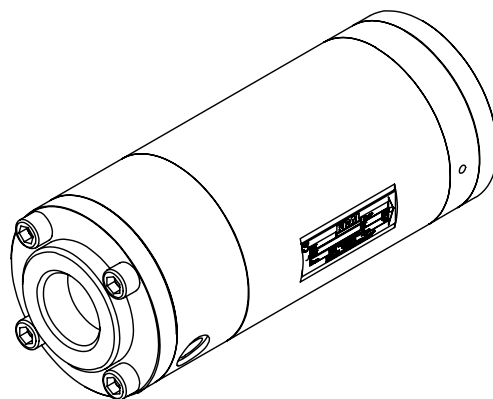




## Operating instructions

# KRAL



## KRAL flowmeters.

Series OMS

Low-viscosity liquids

OIO 30en-GB  
Edition 2019-04  
Original instructions

<b>1 About this document</b>	<b>4</b>	<b>7 Installation, removal</b>	<b>21</b>
1.1 General information	4	7.1 Dangers during installation	21
1.2 Target groups	4	7.2 Dangers during removal	21
1.3 Symbols	4	7.3 Installing the flowmeter	21
1.3.1 Danger levels	4	7.3.1 Protecting the flowmeter against soiling	21
1.3.2 Danger signs	5	7.3.2 Installation types	22
1.3.3 Symbols in this document	5	7.3.3 Installation recommendation	23
1.4 Associated documents	5	7.3.4 Installing the flowmeter	24
<b>2 Safety</b>	<b>6</b>	7.4 Removing the flowmeter	24
2.1 Proper use	6	<b>8 Connection</b>	<b>25</b>
2.2 Foreseeable misuse	6	8.1 Dangers during connection work	25
2.3 Obligations of the operator-owner	6	8.2 Connecting the flowmeter to the pipe system	25
2.4 Dangers during transportation	7	8.3 Connecting the pick up	26
2.5 Dangers during storage	7	<b>9 Operation</b>	<b>26</b>
2.6 Dangers during installation	7	9.1 Dangers during operation	26
2.7 Dangers during removal	7	9.2 Commissioning	26
2.8 Dangers during connection work	7	9.2.1 Cleaning the pipe system	26
2.9 Dangers during operation	7	9.2.2 Checking the function	27
2.10 Dangers during servicing	8	9.2.3 Commissioning the flowmeter	27
2.11 Dangers during disposal	8	9.3 Decommissioning	28
<b>3 Identification</b>	<b>9</b>	9.3.1 Switching off the flowmeter	28
3.1 Type code	9	9.4 Recommissioning	28
3.2 Rating plate	10	9.4.1 Recommissioning the flowmeter	28
<b>4 Technical data</b>	<b>10</b>	<b>10 Maintenance</b>	<b>29</b>
4.1 Operating limits	10	10.1 Required maintenance	29
4.2 Pressure pulsation	10	10.2 Maintaining flowmeters	29
4.3 Maximum values	10	10.3 Recalibration of the flowmeter	29
4.4 Substitute operating data	11	<b>11 Servicing</b>	<b>30</b>
4.5 Sound pressure level	11	11.1 Dangers during servicing	30
4.6 Dimensions and weights	12	11.2 Replacing seals and bearings	30
4.6.1 Pipe thread (BSPP thread)	12	11.2.1 Removing seals and bearings OMS-020/ OMS-032	30
4.6.2 DIN flange	12	11.2.2 Installing seals and bearings OMS-020/ OMS-032	31
4.7 Pressure bearing capacity	13	11.2.3 Removing seals and bearings OMS-052	32
4.7.1 Pressure bearing capacity OMS-020	13	11.2.4 Installing seals and bearings OMS-052	34
4.7.2 Pressure bearing capacity OMS-032	14	<b>12 Disposal</b>	<b>35</b>
4.7.3 Pressure bearing capacity OMS-052	15	12.1 Dangers during disposal	35
<b>5 Function description</b>	<b>16</b>	12.2 Dismantling and disposing of the flowmeter	35
5.1 Structure	16	<b>13 Troubleshooting</b>	<b>36</b>
5.2 Functional principle	16	13.1 Possible faults	36
5.3 Rolling bearings	16	13.2 Troubleshooting	36
5.4 Signal generation	17	<b>14 Spare parts</b>	<b>38</b>
5.5 Linearization	17	14.1 Spare parts	38
5.6 Temperature compensation	17	<b>15 Accessories</b>	<b>40</b>
5.7 Recognition of flow direction	17	15.1 Heating	40
<b>6 Transportation, storage</b>	<b>18</b>	15.1.1 Possible types of heating	40
6.1 Dangers during transportation	18	15.1.2 Technical data of the electrical heating system	41
6.2 Dangers during storage	18	15.1.3 Technical data of the fluid heating system	41
6.3 Unpacking and checking the state of delivery	18	15.1.4 Installing the heating system	41
6.4 Transporting flowmeters	18	15.2 Junction box	43
6.5 Storing the flowmeter	19	15.2.1 Function description	43
6.6 Preservation	19	15.2.2 Technical data	43
6.6.1 Preservation table	19	15.2.3 Installing the junction box	43
6.6.2 Preserving the inner surfaces	20		
6.6.3 Preserving the outer surfaces	20		
6.6.4 Removing the preservation	20		

15.3	Extension cable .....	44
15.3.1	Function description.....	44
15.3.2	Technical data.....	44
15.3.3	Connecting the extension cable.....	44
<b>16</b>	<b>Appendix.....</b>	<b>45</b>
16.1	Tightening torque for screws with metric screw threads and head contact surfaces .....	45
16.2	Tightening torques for screw plugs with thread meas- ured in inches and elastomer seal.....	46
16.3	Tightening torques and widths for threaded rings .....	46
16.4	Contents of the Declaration of Conformity.....	46

# 1 About this document

## 1.1 General information

### 1 About this document

#### 1.1 General information

These instructions form part of the product and must be kept for future reference. Furthermore please observe the associated documents.

#### 1.2 Target groups

The instructions are intended for the following persons:

- ☐ Persons who work with the product
- ☐ Operator-owners who are responsible for the use of the product


Information on the required qualification of the personnel is provided separately at the beginning of the individual chapters in these instructions. The following table provides an overview.

Target group	Activity	Qualification
Transport personnel	Transportation, unloading	Transport personnel are qualified personnel who carry out the transportation of products properly due to their training, knowledge and experience and on the basis of the relevant provisions. Transport personnel recognize and avoid possible dangers and damage to property that are connected with this activity.
Mobile crane operators, crane operators, forklift operators	Unloading, positioning	Mobile crane operators, crane operators and forklift operators are qualified personnel who carry out work with cranes and forklifts properly due to their training, knowledge and experience and on the basis of the relevant provisions. Mobile crane operators, crane operators and forklift operators recognize and avoid possible dangers and damage to property that are connected with this activity.
Fitter	Mounting, connection	Fitters are qualified personnel who carry out the mounting work properly due to their training, knowledge and experience and on the basis of the relevant provisions. Fitters recognize and avoid possible dangers and damage to property that are connected with this activity.
Electrician	Electrical connection	Electricians are qualified personnel who carry out work on electrical equipment and installations properly due to their training, knowledge and experience and on the basis of the relevant provisions. Electricians recognize and avoid possible dangers and damage to property that are connected with this activity.
Trained personnel	Delegated task	Trained personnel were instructed by the operator-owner in the task delegated to them and the possible dangers arising through improper behaviour.







Tab. 1: Target groups

#### 1.3 Symbols







##### 1.3.1 Danger levels

	Signal word	Danger level	Consequences of non-observance
	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
	ATTENTION	Potentially dangerous situation	Material damage

## 1.3.2 Danger signs

	Meaning	Source and possible consequences of non-observance
	Electrical voltage	Electrical voltage causes serious physical injury or death.
	Raised load	Falling objects can result in serious physical injury or death.
	Heavy load	Heavy loads can result in serious back problems.
	Risk of slipping	Discharging pumped liquid and oils on the foundation or tread surfaces can cause falls with serious physical injury or death.
	Flammable substances	Discharging pumped liquid and oils can be easily inflammable and can result in serious burns.
	Hot surface	Hot surfaces can cause burns.

## 1.3.3 Symbols in this document

	Meaning
	Warning personal injury
	Safety instruction
	Request for action
	Multi-step instructions for actions
	Action result
	Cross-reference

## 1.4 Associated documents

- ☐ Calibration certificate
- ☐ Declaration of conformity according to EU Directive 2006/42/EC
- ☐ Manufacturer's declaration according to EU Directive 2014/68/EU
- ☐ Corresponding operating instructions for accessories

Additional documents for ATEX version

- ☐ Manufacturer's declaration according to EU Directive 2014/34/EU
- ☐ ATEX supplementary instructions for usage in potentially explosive areas

## 2 Safety

### 2.1 Proper use

- ☐ Use the flowmeter solely for measuring the flow of liquids that do not contain any gas components or solid particles.
- ☐ 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.
- ☐ Use the flowmeter only within the operating limits specified on the rating plate and in the chapter "Technical data". Deviating operating data can result in damage to the flowmeter. In the case of operating data that do not agree with the specifications on the rating plate, please contact the manufacturer.
- ☐ Strong changes in the flow rate (for example rapid shutdown, pulsations, etc.) cause marked pressure differences in the flowmeter and can damage the measuring unit. The pressure loss of the flowmeter must not exceed the values shown in the chapter "Technical data".

### 2.2 Foreseeable misuse

- ☐ Any use that extends beyond the proper use or any other use is misuse.
- ☐ The product is not suitable for pumping liquids outside the operational limits.
- ☐ Any bypassing or deactivation of safety equipment during operation is prohibited.

### 2.3 Obligations of the operator-owner

The operator-owner is the person who operates the product commercially or permits a third party to use it and who bears the legal responsibility for the product, the protection of the personnel and third parties during its operation.

The product is used in industrial applications. The operator-owner is therefore subject to the statutory obligations concerning occupational health and safety.

In addition to the safety instructions in these instructions, the regulations on safety, accident prevention and environmental protection respectively valid for the range of application of the product are to be observed.

This results in the following obligations for the operator-owner:

- ☐ Observe the rules and regulations such as national standards, international standards and provisions applicable at the site of use.
- ☐ Observe the obligations arising from occupational safety and from safety, accident protection and environmental protection.
- ☐ Draw up a hazard assessment for the utilization of the product at the site of use.
- ☐ Draw up the operating guidelines for the operation of the product on the basis of the hazard assessment.
- ☐ Keep the operating guidelines up-to-date during the entire operating life of the product, by ensuring that the current version of the applicable rules and regulations are integrated.
- ☐ Ensure the qualification, instruction, information on dangers as well as regular training of the personnel.
- ☐ Specify clear responsibilities for all work on the product, for example for the installation, operation, maintenance, troubleshooting.
- ☐ Keep the operating instructions available at the site of use - also for future use.
- ☐ Ensure that the operating instructions as well as the associated documents are read, understood and observed by the personnel.
- ☐ Observe the safety regulations for handling dangerous pumped liquids and comply with the safety data sheets. Pumped liquids can, for example, be hot, poisonous, combustible and caustic.
- ☐ Make personal protective equipment available and instruct their use.
- ☐ Equip systems with an increased potential of danger with protective equipment and/or alarm equipment. The failure of a component may not result in injury and/or damage to property.
- ☐ Maintain and check protective equipment and alarm equipment regularly.
- ☐ Ensure the technically flawless state of the product during its entire operating life.

## 2.4 Dangers during transportation



### The following safety instructions must be observed:

- ☐ Have all work only carried out by authorized transport personnel.
- ☐ Use intact and correctly dimensioned hoisting equipment.
- ☐ Ensure that the means of transport is in a flawless state.
- ☐ Ensure that the centre of gravity of the load is taken into consideration.
- ☐ Do not stand under raised loads.

## 2.5 Dangers during storage



### The following safety instructions must be observed:

- ☐ Observe the storage conditions.

## 2.6 Dangers during installation



### The following safety instructions must be observed strictly:

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Do not take apart the flowmeter.
- ☐ Do not remove the protective caps from the dry sleeves.

## 2.7 Dangers during removal



### The following safety instructions must be observed strictly:

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Ensure that the collection tank for emitted liquids is sufficiently large.
- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ☐ Place the protective caps onto dry sleeves.

## 2.8 Dangers during connection work



### The following safety instructions must be observed strictly:

- ☐ Have all the work on the flowmeter and pipe system only carried out by authorized qualified personnel.
- ☐ Ensure that solid particles cannot get into the flowmeter and pipe system.
- ☐ Ensure that mechanical connections are mounted free of stress.
- ☐ Observe the tightening torques.
- ☐ Have all the work on the electrical equipment only carried out by electricians.
- ☐ Before beginning work on the flowmeter ensure that the electrical power supply is deenergized and is secured against being switched back on.
- ☐ If the insulation of the electrical cables or wires is damaged, disconnect the power supply immediately.
- ☐ The connecting line of the pick up/temperature sensor connection is to be shielded and laid separately from the supply lines.

## 2.9 Dangers during operation



### The following safety instructions must be observed strictly:

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Ensure that the flowmeter is only operated within the operating limits.
- ☐ Ensure that during cooling down or heating up the flowmeter is only subjected to slow temperature changes.
- ☐ Ensure that existing safety equipment is not bypassed or activated during operation.

#### 2.10 Dangers during servicing



**The following safety instructions must be observed strictly:**

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ To ensure the measuring precision, the measuring unit may only be replaced by the manufacturer.
- ☐ Before beginning work, let the flowmeter cool down slowly to the ambient temperature. Avoid rapid temperature changes.
- ☐ Pumped liquids can be hot, poisonous, combustible and caustic.
- ☐ Observe the tightening torques ↗ Appendix, Page 45.
- ☐ Observe the operating instructions and data sheets of the sensors.

#### 2.11 Dangers during disposal



**The following safety instructions must be observed strictly:**

- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ☐ Ensure that the collection tank for emitted liquids is sufficiently large.
- ☐ Neutralize residues.



### 3 Identification

#### 3.1 Type code

**OMS-020.CACABA.0001**

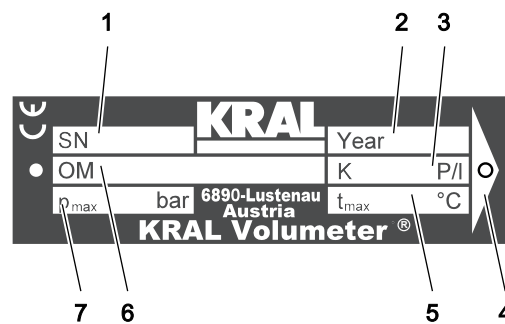
Fig. 1: Type code

- 1 Series
- 2 Size
- 3 Sensor equipment (pick up)
- 4 Function of the sensor equipment
- 5 Material of bearing
- 6 Material of seal
- 7 Mechanical connection
- 8 Electrical connection
- 9 Version index

Item	Designation	Description	
1	Series	OMS	Stainless steel
2	Size		Corresponds to the diameter of the large measuring screw in [mm]
3	Sensor equipment (pick up)	C	BEG 44
		F	BEG 47
		X	Special design
4	Function of the sensor equipment	A	Without recognition of flow direction
		B	With recognition of flow direction
		C	Without recognition of flow direction, with temperature compensation
		D	With recognition of flow direction, with temperature compensation
		X	Special design
5	Material of bearing	C	Stainless 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	Thread connection BSPP
		B	Flange connection DIN
		C	Thread connection NPT
		D	Flange connection ANSI
		E	Flange connection JIS
		F	Flange connection SAE
		X	Special design
8	Electrical connection	A	Loose cable end
		B	Cable connection junction box
		X	Special design
9	Version index		For internal administration

Tab. 2: Type code

#### 3.2 Rating plate



- 1 Serial number
- 2 Construction year
- 3 K-factor
- 4 Preferred flow direction
- 5 Max. temperature
- 6 Series
- 7 Max. pressure

Fig. 2: Rating plate

## 4 Technical data

### 4.1 Operating limits

The values specified on the rating plate and the calibration certificate apply. The permissible operating 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.

### 4.2 Pressure pulsation

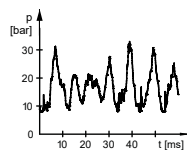


Fig. 3: Pressure pulses

Strong pressure pulsations in the system can reduce the service life of the flowmeter.

### 4.3 Maximum values

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

	Unit	OMS-020	OMS-032	OMS-052
Flow rate				
Q <sub>max</sub>	[l/min]	45	150	525
Q <sub>rated</sub>	[l/min]	30	100	350
Q <sub>min</sub>	[l/min]	0.6	2.0	7.0
Max. pressure	[bar]	185	185	120
Temperature				
min - max	[°C]	-20 ... +150		
Viscosity				
min - max	[mm <sup>2</sup> /s]	1–100		
Measuring chamber volume	[ml/U]	6.25	25.6	112.7
Rotation speed				
N (Q <sub>max</sub> )	[min <sup>-1</sup> ]	7200	5800	4658
N (Q <sub>rated</sub> )	[min <sup>-1</sup> ]	4800	3900	3105
N (Q <sub>min</sub> )	[min <sup>-1</sup> ]	96	78	62

Tab. 3: Maximum values

K2	Unit	OMS-020	OMS-032	OMS-052
Pole number		8	12	16
K-factor	[P/l]	1280	468	142
Millimetres/pulse	[ml/P]	0.782	2.14	7.04
Pulse frequency				
f2 (Q <sub>max</sub> )	[Hz]	960	1170	1243
f2 (Q <sub>rated</sub> )	[Hz]	640	780	828
f2 (Q <sub>min</sub> )	[Hz]	12.8	15.6	16.6

Tab. 4: Additional maximum values when BEG 44 is used

K1	Unit	OMS-020	OMS-032	OMS-052
Pole number		4	6	8
K-factor	[P/l]	640	234	71
Millimetres/pulse	[ml/P]	1.56	4.27	14.08
Pulse frequency				
f1 (Q <sub>max</sub> )	[Hz]	480	585	621
f1 (Q <sub>rated</sub> )	[Hz]	320	390	414
f1 (Q <sub>min</sub> )	[Hz]	6.4	7.8	8.2

Tab. 5: Additional maximum values when BEG 47D is used

#### 4.4 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 operating limits of the corresponding completion, of the sealing material of the pick up and of the temperature sensor are to be observed.

	Unit	OMS-020	OMS-032	OMS-052
Flow rate				
Q <sub>max</sub>	[l/min]	30	100	350
Q <sub>rated</sub>	[l/min]	30	100	350
Q <sub>min</sub>	[l/min]	0.6	2.0	7.0
Max. pressure	[bar]	250	250	160
Temperature				
min - max	[°C]	-20 ... +120		
Viscosity				
min - max	[mm <sup>2</sup> /s]	1–100		

Tab. 6: Substitute operating data

#### 4.5 Sound pressure level

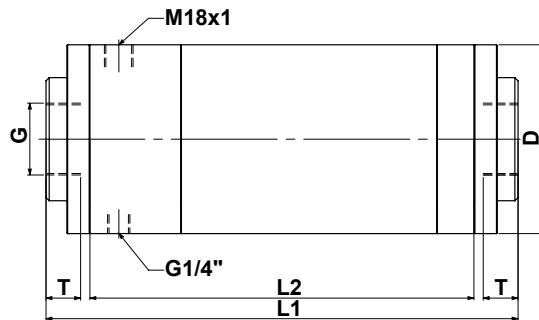
The sound pressure level of the flowmeters amounts to less than 70 dB(A).

## 4 Technical data

### 4.6 Dimensions and weights

#### 4.6 Dimensions and weights

##### 4.6.1 Pipe thread (BSPP thread)



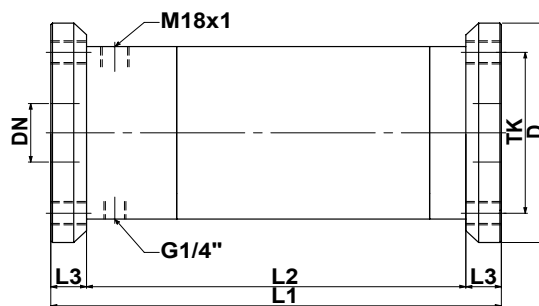
<b>G</b>	Pipe thread
<b>M18x1</b>	Pick up hole
<b>G1/4"</b>	Temperature sensor hole
<b>D</b>	Outer diameter
<b>L1</b>	Total length
<b>L2</b>	Length of the flowmeter without connections
<b>T</b>	Max. screw-in depth

Fig. 4: Dimensional drawing pipe thread

	Unit	OMS-020	OMS-032	OMS-052
G	[inch]	3/4	1	1 1/2
Pressure stage	[bar]	185	185	120
D	[mm]	74	104	118
L1	[mm]	145	215	295
L2	[mm]	145	215	240
T	[mm]	16.0	18.0	27.5
Weight	[kg]	4.1	11.0	18.0

Tab. 7: Dimensions and weights - pipe thread connection

##### 4.6.2 DIN flange



<b>DN</b>	Nominal diameter flange
<b>M18x1</b>	Pick up hole
<b>G1/4"</b>	Temperature sensor hole
<b>D</b>	Outer diameter
<b>L1</b>	Total length
<b>L2</b>	Length of the flowmeter without connections
<b>L3</b>	Flange thickness
<b>TK</b>	Pitch circle

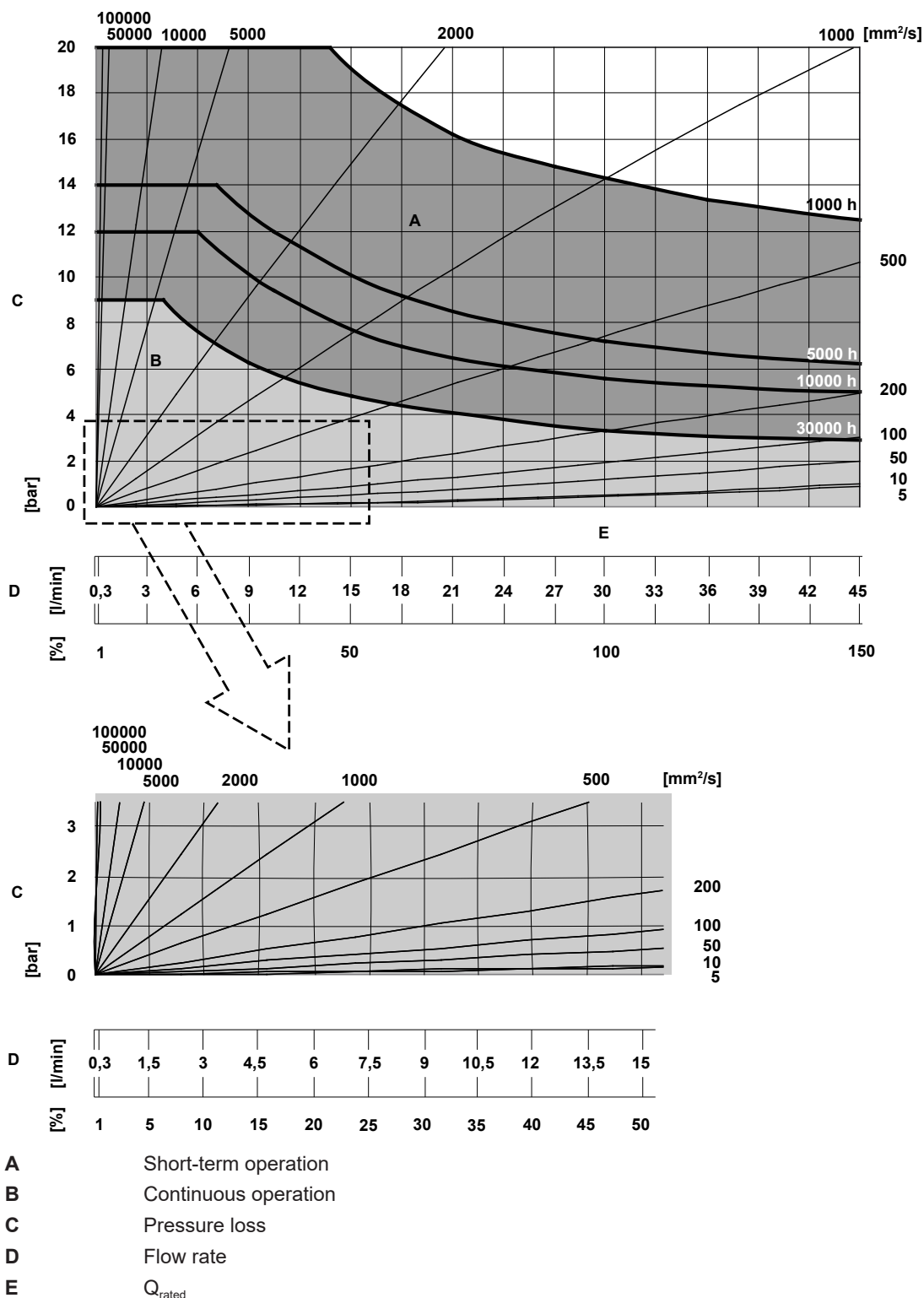
Fig. 5: Dimensional drawing DIN flange

	Unit	OMS-020	OMS-032	OMS-052
DN		20	32	25
Pressure stage	[bar]	40	40	160
D	[mm]	105	140	140
L1	[mm]	185	265	265
L2	[mm]	145	215	215
L3	[mm]	20.5	25.0	25.0
TK	[mm]	75	100	100
Weight	[kg]	6.0	16.0	16.0

Tab. 8: Dimensions and weights – DIN flange connection

## 4.7 Pressure bearing capacity

### 4.7.1 Pressure bearing capacity OMS-020

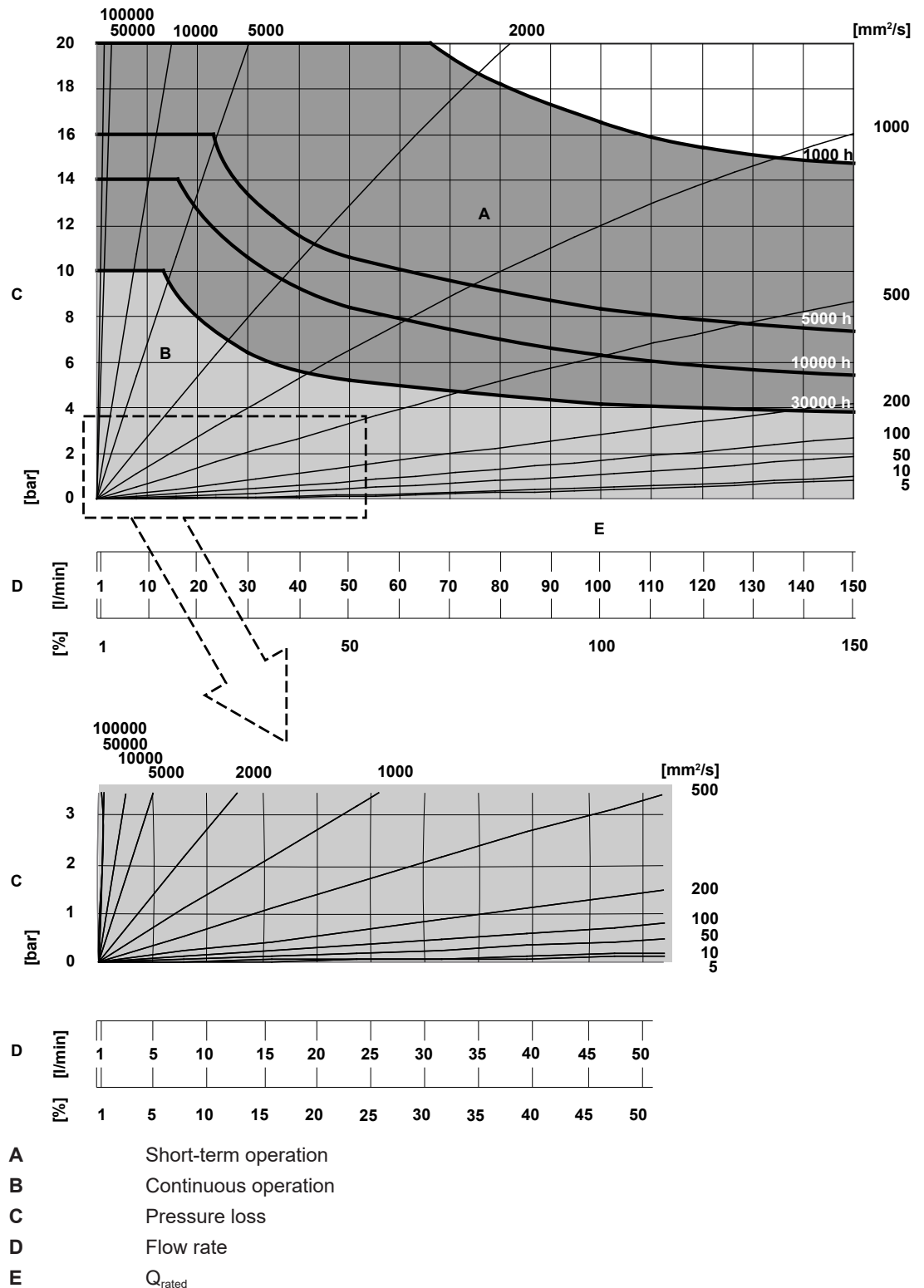


The values apply for lubricating liquids at temperatures up to 120 °C. Abrasive and aggressive liquids reduce the service life.

## 4 Technical data

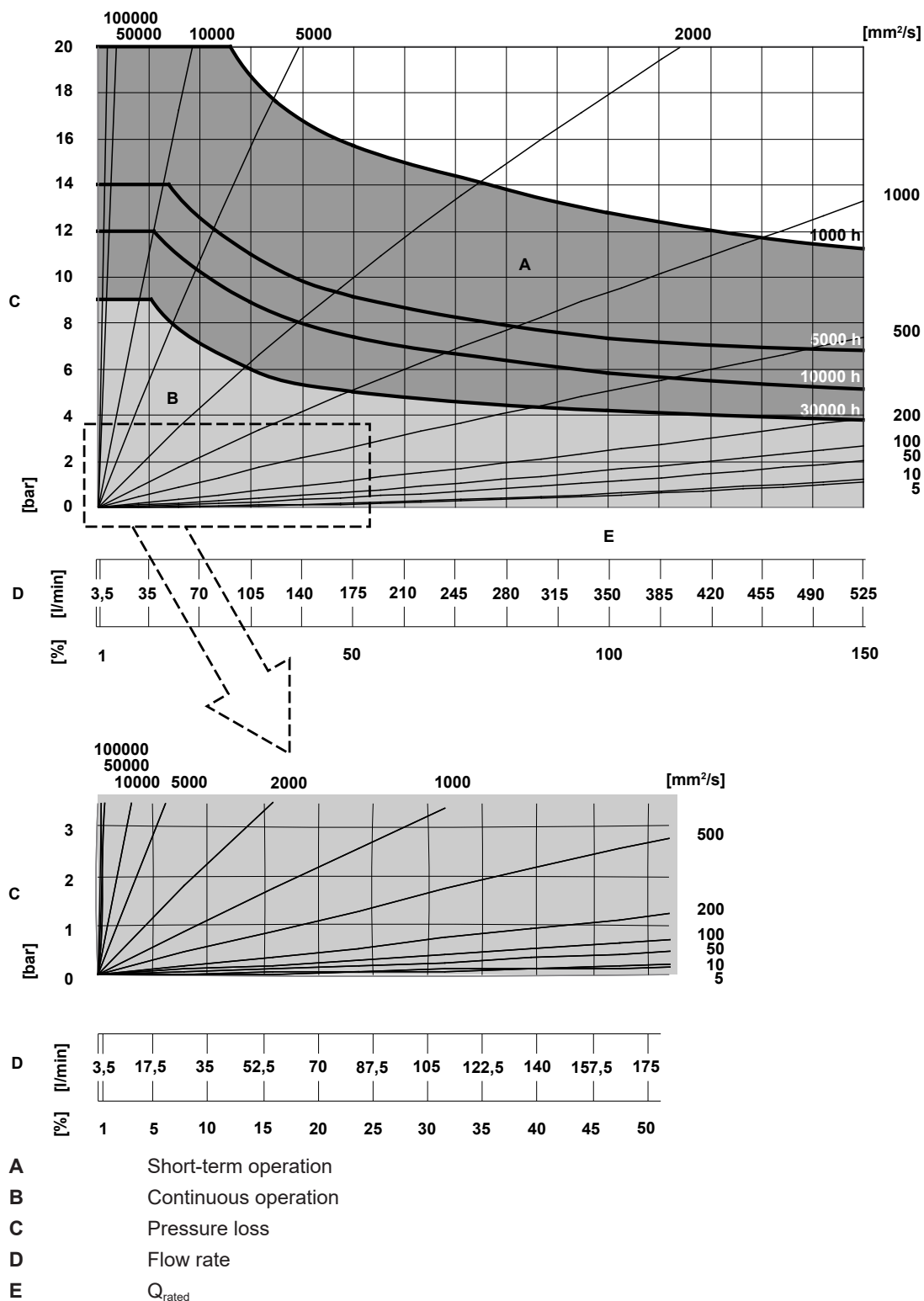
### 4.7 Pressure bearing capacity

#### 4.7.2 Pressure bearing capacity OMS-032



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

### 4.7.3 Pressure bearing capacity OMS-052



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

## 5 Function description

### 5.1 Structure

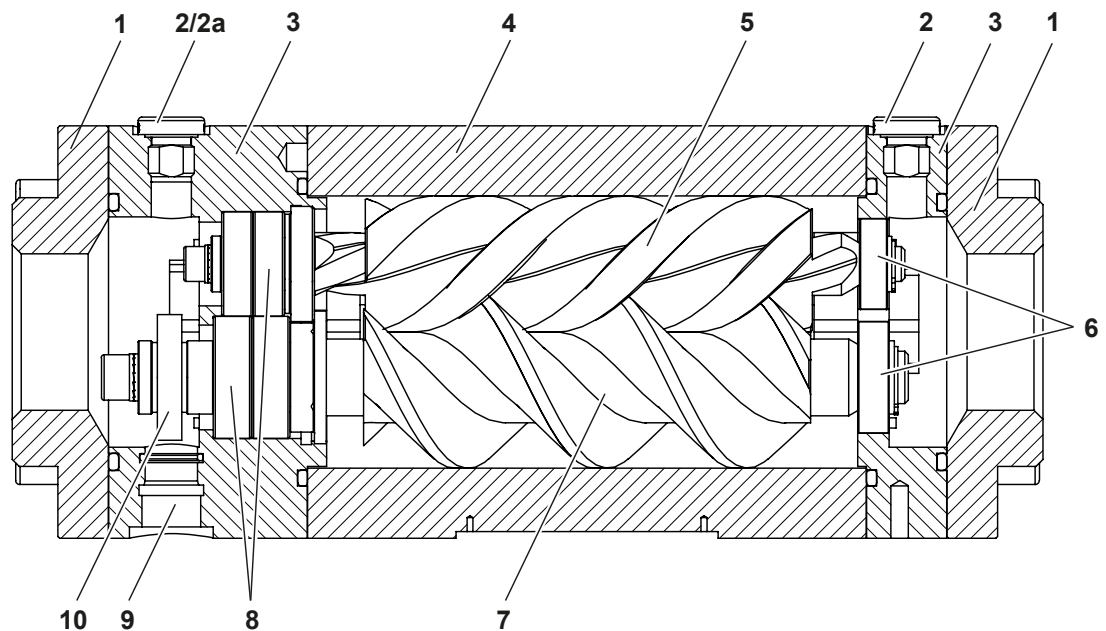


Fig. 6: Structure of the flowmeter

1	Connection	6	Ball bearing floating bearing end
2	Screw plug	7	Measuring screw large
2a	Connection of temperature sensor	8	Ball bearing fixed bearing end
3	Bearing cover	9	Pick up hole
4	Measuring housing	10	Pole wheel
5	Measuring screw small		

### 5.2 Functional principle

Flowmeters belong to the group of rotating displacement meters as screw meters. The pumped liquid 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 pumped liquid flows around and lubricates all the rotating parts. Thanks to the displacement principle, the flowmeter does not require inlet sections and smoothing sections at the feed line and outlet.

Depending on the customer requirements, the flowmeters can be equipped with suitable end connections for connection to various flanges.

### 5.3 Rolling bearings

Thanks to precision rolling bearings the measuring unit operates contact-free and with low friction in the housing of the flowmeter.

The bearing on the side of the pole wheel is realized with a single-row deep-groove ball bearing as a fixed bearing. The bearing on the opposite side of the measuring unit is realized with a displaceable deep-groove ball bearing as a floating bearing.



### 5.4 Signal generation

A pole wheel **10** whose pole is sampled by a pick up is affixed at the end of the large measuring screw **7**. This 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/litre) and is specified on the rating plate as well as the enclosed calibration certificate.

Possible formats of the signals are:

- ☐ PNP
- ☐ NAMUR

Depending on the version of the pick up, cylindrical pole wheels with embedded magnets or toothed metal disks with different tooth densities can be used (higher pole number = higher K-factor).

The mounting method of the pick-up allows mounting without contact with the liquid 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 ups based on the Hall effect
- ☐ Inductive pick up

The preferred flow direction is specified on the rating plate of the flowmeter. When this flow direction is observed, the pick up is located on the low-pressure end (outlet) in the case of blocking.

### 5.5 Linearization

The calibration certificate of the flowmeter 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 stored in a suitable electronic unit by means of 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 mm<sup>2</sup>/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.

### 5.6 Temperature compensation

Flowmeters of the series OMS can additionally be equipped with a temperature sensor. The current density of the flowing liquid can be calculated from the measured values of the temperature sensor by using a density table stored in the electronic unit. This allows standardised volume measurement in 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.

### 5.7 Recognition of flow direction

Systems with a changing flow direction require the usage of a second pick up to recognize the change in direction. In the case of systems with pressure pulsation a reversal of the flow direction can also occur briefly.

The flow direction can be determined by means of the additional phase-shifted signal and the incremental encoder positions available in the KRAL electronic unit and then taken into account for the calculation of the total values.

## 6 Transportation, storage

### 6.1 Dangers during transportation

## 6 Transportation, storage

### 6.1 Dangers during transportation



**The following safety instructions must be observed:**

- ☐ Have all work only carried out by authorized transport personnel.
- ☐ Use intact and correctly dimensioned hoisting equipment.
- ☐ Ensure that the means of transport is in a flawless state.
- ☐ Ensure that the centre of gravity of the load is taken into consideration.
- ☐ Do not stand under raised loads.

### 6.2 Dangers during storage



**The following safety instructions must be observed:**

- ☐ Observe the storage conditions.

### 6.3 Unpacking and checking the state of delivery

1. ➤ Upon delivery unpack the flowmeter and check it for damage during transportation.
2. ➤ Report damage during transportation immediately to the manufacturer.
3. ➤ Store the supplied sensors for the installation.
4. ➤ Dispose of packaging material in accordance with the locally applicable regulations.

### 6.4 Transporting flowmeters



#### **WARNING**

**Risk of injury and damage to equipment through falling and toppling parts.**

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

#### **ATTENTION**

**Damage to equipment through improper transportation.**

- ▶ Protect the flowmeter against damage, heat, sunlight, dust and moisture.

Requirement:

- ✓ Sufficiently dimensioned hoisting equipment
- ✓ The used hoisting equipment corresponding to the local rules and regulations for the prevention of accidents

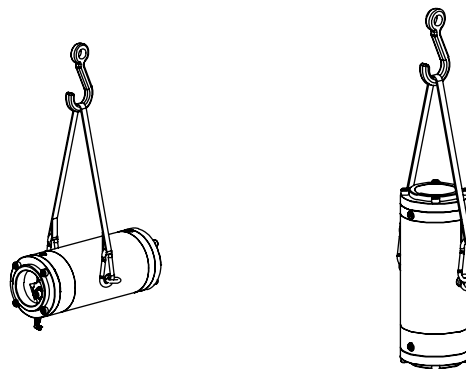


Fig. 7: Fastening of hoisting equipment - principle diagram

➔ Fasten hoisting equipment on the flowmeter.

## 6.5 Storing the flowmeter

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 flowmeter before being dispatched. The connections of the flowmeter are fitted with protective covers. 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 optionally offers a long-term preservation for storage times of up to 60 months. The flowmeter is additionally packed in hermetically sealing anti-corrosion paper.

### ATTENTION

**Damage to equipment and corrosion if stored improperly and during longer standstills.**

- ▶ Protect the flowmeter against damage, heat, sunlight, dust and moisture.
- ▶ Protect against corrosion during longer standstill.
- ▶ Observe measures for storing and preservation.

1. ➔ Store cool and dry and protect against sunlight.
2. ➔ Observe the information on preservation.

## 6.6 Preservation

### 6.6.1 Preservation table

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

Type of delivery	Condition
Standard delivery	<input type="checkbox"/> Storage time exceeding six weeks <input type="checkbox"/> Unfavourable storage conditions such as high humidity, salty air, etc.
Delivery with long-term preservation	<input type="checkbox"/> Opened or damaged packaging

Tab. 9: Conditions for additional preservation

**Notice** After a longer storage time the manufacturer recommends that you have the flowmeter recalibrated ➔ Maintenance, Page 29.

#### 6.6.2 Preserving the inner surfaces

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

1. ➤ Close a connection of the flowmeter with a blind flange.
2. ➤ Position the flowmeter vertically.
3. ➤ Fill non-corrosive and resin-free oil into the pressure connection up to approx. 1 cm under the flange at the top, while turning the measuring unit slowly, so that the measuring unit is also wetted.
4. ➤ Close the upper connection with a blind flange.
5. ➤ After about six months storage check the filling level of the oil and if necessary top up.

#### 6.6.3 Preserving the outer surfaces

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

1. ➤ Paint or spray the preservative onto all plain and unpainted parts.
2. ➤ At intervals of about six months check the preservation and if necessary repeat.

#### 6.6.4 Removing the preservation

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Solvent <input type="checkbox"/> Collection tank



#### CAUTION

##### **Risk of injury through emitted preservative.**

- ▶ Wear personal protective clothing during all the work.
- ▶ Collect any discharging preservative safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

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. ➤ Either remove the residual oil with solvent or flush the flowmeter with pumped liquid.

## 7 Installation, removal

### 7.1 Dangers during installation



**The following safety instructions must be observed strictly:**

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Do not take apart the flowmeter.
- ☐ Do not remove the protective caps from the dry sleeves.

### 7.2 Dangers during removal



**The following safety instructions must be observed strictly:**

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Ensure that the collection tank for emitted liquids is sufficiently large.
- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ☐ Place the protective caps onto dry sleeves.

### 7.3 Installing the flowmeter

#### 7.3.1 Protecting the flowmeter against soiling

**Notice** Soiling in the pipe system impairs the service life of the flowmeter. In order to protect the flowmeter against soiling the manufacturer generally recommends the installation of an operating filter.

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

## ATTENTION

**Damage to device through solid particles 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.
- ▶ Ensure that an operating filter is installed when the pipe system is flushed and cleaned using the flowmeter.

1. ▶ Install the operating filter in front of the flowmeter, mesh width ↗ Commissioning, Page 26.
2. ▶ After the connecting work clean the pipe system thoroughly ↗ Commissioning, Page 26.

#### 7.3.2 Installation types

Flowmeters can be operated in different mounting positions.

Both flow directions are possible. The preferred flow direction is indicated on the rating plate by means of a bright arrow ➔ Identification, Page 9.

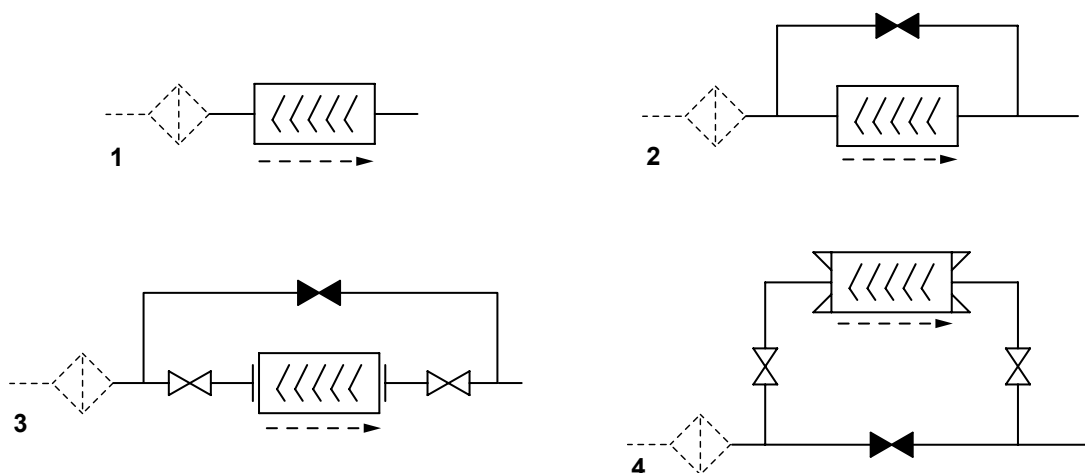


Fig. 8: Installation types

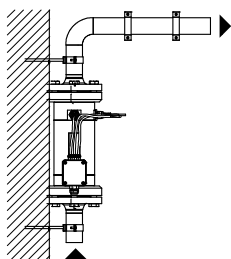
The arrow with dashed line identifies the preferred flow direction when an operating filter is used.

Installation type		Properties
1	<input type="checkbox"/> Without bypass <input type="checkbox"/> With or without operating filter	<input type="checkbox"/> Small space requirements <input type="checkbox"/> Dismantling of the flowmeter only with operation interruption
2	<input type="checkbox"/> Manual bypass <input type="checkbox"/> With or without operating filter	<input type="checkbox"/> Manual opening of the bypass <input type="checkbox"/> Dismantling of the flowmeter only with operation interruption
3	<input type="checkbox"/> Bypass with 3 shut-off valves for flange connection <input type="checkbox"/> With or without operating filter	<input type="checkbox"/> Dismantling of the flowmeter without operation interruption
4	<input type="checkbox"/> Bypass with 3 shut-off valves for pipe thread connection <input type="checkbox"/> With or without operating filter	<input type="checkbox"/> Dismantling of the flowmeter without operation interruption <input type="checkbox"/> Minimal higher pressure loss

Tab. 10: Installation types

### 7.3.3 Installation recommendation

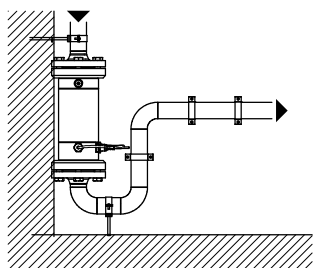
In order to avoid measuring errors observe the following recommendations of the manufacturer when installing the flowmeter in the pipe system.



**Preferred installation variant:**

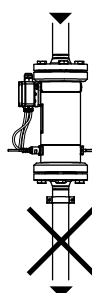
- Install the flowmeter vertically.
- Route the flow from the bottom upwards.

#### Recommendations for alternative installation variants



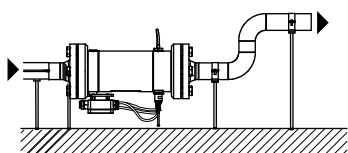
**Alternative installation variant:**

- Install the flowmeter vertically.
- Route the flow from the top downwards.
- Route the piping at the outlet upwards.



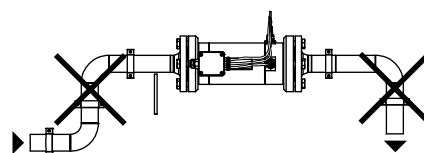
**Source for measuring error:**

- Lack of counter-pressure at the outlet through downward routing of the piping.



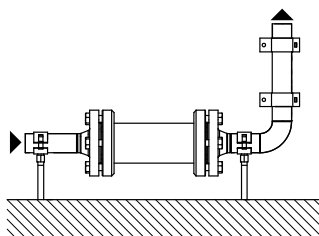
**Alternative installation variant:**

- Install the flowmeter horizontally.
- Route the piping at the outlet upwards.



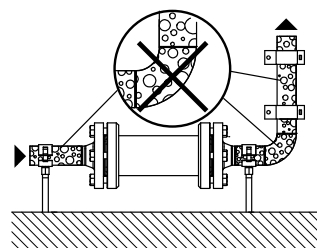
**Source for measuring error:**

- Formation of an air pocket through the installation of the flowmeter at the highest point of the piping.



**Recommendation:**

- Carefully vent the pipe system during commissioning.



**Source for measuring error:**

- Gas inclusions in the pipe system

## 7 Installation, removal

### 7.4 Removing the flowmeter

#### 7.3.4 Installing the flowmeter

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

#### ATTENTION

##### Measuring error through air pocket in the flowmeter.

- During installation ensure that the flowmeter is not installed at the highest point in the pipe system.

#### ATTENTION

##### Measuring error through a lack of counter-pressure.

- During the installation ensure that the piping at the outlet of the flowmeter runs upwards or that the pipe diameter is reduced through a reducer so that the liquid generates a counter-pressure.

- During the installation of the flowmeter observe the recommendations for the installation variants and avoid error sources.

#### 7.4 Removing the flowmeter

Personnel qualification:	<input type="checkbox"/> Fitter <input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Collection tank



#### DANGER

##### Risk of death resulting from electric shock.

- Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- Observe the operating instructions of the electrical components.



#### DANGER

##### Risk of death through emitted pumped liquid.

Pumped liquids can be hot, poisonous, combustible and caustic and can spray out under high pressure.

- Wear personal protective equipment during all the work. Ensure face protection.
- Before beginning work, let the flowmeter cool down to the ambient temperature.
- Ensure that the flowmeter is depressurized.
- Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

##### Requirement:

- ✓ System switched off
- ✓ Disconnect the system from the power supply and secure it against being switched back on
- ✓ Flowmeter cooled down to the ambient temperature



1. ➤ Drain the pipe system or divert the pumped liquid via bypass.
2. ➤ Remove the flowmeter.
3. ➤ Attach protective covers in front of connecting flanges.
4. ➤ For storage of the flowmeter ↪ Transportation, storage, Page 18 and ↪ Preservation, Page 19.

## 8 Connection

### 8.1 Dangers during connection work



**The following safety instructions must be observed strictly:**

- ☐ Have all the work on the flowmeter and pipe system only carried out by authorized qualified personnel.
- ☐ Ensure that solid particles cannot get into the flowmeter and pipe system.
- ☐ Ensure that mechanical connections are mounted free of stress.
- ☐ Observe the tightening torques.
- ☐ Have all the work on the electrical equipment only carried out by electricians.
- ☐ Before beginning work on the flowmeter ensure that the electrical power supply is deenergized and is secured against being switched back on.
- ☐ If the insulation of the electrical cables or wires is damaged, disconnect the power supply immediately.
- ☐ The connecting line of the pick up/temperature sensor connection is to be shielded and laid separately from the supply lines.

### 8.2 Connecting the flowmeter to the pipe system

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Protective helmet <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Hoisting equipment

#### ATTENTION

**Damage to device through mechanical stress.**

- ▶ Ensure that the flowmeter is mounted free of mechanical stresses in the pipe system.
- ▶ Observe the tightening torques.

#### ATTENTION

**Damage to device through solid particles 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.
- ▶ Ensure that an operating filter is installed when the pipe system is flushed and cleaned using the flowmeter.

#### ATTENTION

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

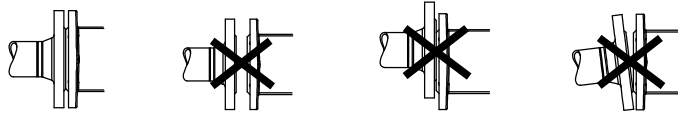
- ▶ Observe the thread length of the flowmeter.
- ▶ Use a standard cutting ring screw connection.

## 9 Operation

### 8.3 Connecting the pick up

**Notice** 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.

1. ➤ Remove the protective covers and store them.
2. ➤ Place the piping in position and support the weight of the piping.
3. ➤ Install the flowmeter stress-free into the pipe system. In the process take the preferred flow direction into account and ensure that the connections of the pick up remain accessible.



4. ➤ Check the linear offset, lateral offset and angular offset and correct if necessary. If the screws tighten easily, this is a sure sign that the installation is stress-free.
5. ➤ Tighten the connecting screws crosswise with torque ↪ Appendix, Page 45.

### 8.3 Connecting the pick up

The flowmeter is equipped with two pick ups to enable recognition of the flow direction. The first signal measures the flow rate, the second signal determines the flow direction. In order to obtain correct values the pick ups must be connected correctly. The connections are identified with "1" and "2" on the housing of the flowmeter. This marking depends on the preferred flow direction according to the arrow on the rating plate ↪ Identification, Page 9.

In the case of a flow direction contrary to the preferred flow direction the connections have to be swapped in order to obtain a correct signal.

## ATTENTION

### Measuring error through incorrectly installed pick ups.

- ▶ Ensure that pick ups are installed at the correct position.

- Connect pick ups in accordance with the identification on the flowmeter. Observe the associated operating instructions for pick ups.

## 9 Operation

### 9.1 Dangers during operation



#### The following safety instructions must be observed strictly:

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Ensure that the flowmeter is only operated within the operating limits.
- ☐ Ensure that during cooling down or heating up the flowmeter is only subjected to slow temperature changes.
- ☐ Ensure that existing safety equipment is not bypassed or activated during operation.

### 9.2 Commissioning

#### 9.2.1 Cleaning the pipe system

**Notice** Soiling in the pipe system impairs the service life of the flowmeter. In order to protect the flowmeter against soiling the manufacturer generally recommends the installation of an operating filter.

**Notice** Through the calibration, the internal components of the flowmeter are wetted with calibration liquid. If required, use an appropriate solvent to flush the flowmeter.

## ATTENTION

### Damage to device through usage of an incorrect flushing liquid.

- Under no circumstances may water or superheated steam be used to flush the pipe system.

—► Flushing via bypass:

Close the shut-off devices before and after the flowmeter.

- or -

—► Flushing via flowmeter:

Install the operating filter in front of the flowmeter, while observing the mesh width of the operating filter, see the following table.

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

Size of the flowmeter	Unit	Max. mesh width
OMS-020	[mm]	0.1
OMS-032, OMS-052	[mm]	0.25

Tab. 11: Mesh width of the operating filter

### 9.2.2 Checking the function

1. ► Check the flow direction of the flowmeter.
2. ► Check the installation and installation position of the pick up and of the temperature sensor.
3. ► Check leaks at the pipe thread/connecting flange.
4. ► Check the electrical installation. Observe the operating instructions for pick up and electronic unit.
5. ► Check the power supply. Observe the operating instructions for pick up and electronic unit.

### 9.2.3 Commissioning the flowmeter

## ATTENTION

### Increased wear and/or blockade through solid particles or abrasive fine particles in the liquid.

- Protect the flowmeter through correspondingly dimensioned operating filters in the pipe system.

## ATTENTION

### Measuring error when the pressure drops below the minimum pressure outlet at the outlet.

- Ensure that sufficient counter-pressure exists at the outlet by routing the piping upwards.

## ATTENTION

### Measuring error through gas inclusion in the pipe system.

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

Requirement:

- ✓ The ambient conditions correspond to the operating data
- ✓ Flowmeter installed correctly in the pipe system ↪ Installation, removal, Page 21
- ✓ Flowmeter connection to the pipe system is stress-free
- ✓ Pipe system is free of impurities
- ✓ Pipe system vented
- ✓ Shut-off devices in the feed line and outlet opened

—► Switch on the measuring system.

⇒ The flowmeter measures when the pick up generates a signal.

#### 9.3 Decommissioning

##### 9.3.1 Switching off the flowmeter

### ATTENTION

#### Damage to the measuring unit.

In the case of strong changes to the flow rate (for example, rapid shutdown, pulsations, etc.) there is a danger of excessive pressure differences.

- ▶ Ensure that the pressure loss of the flowmeter does not exceed the values specified on the rating plate or the substitute operating data.

- ▶ Ensure that the pressure loss of the flowmeter does not exceed the values specified on the rating plate or the standardized substitute operating data ↪ Technical data, Page 10.
- ⇒ When the flow through the flowmeter is stopped, the generation of the signal stops automatically. No further measures are required to switch off.

#### 9.4 Recommissioning

##### 9.4.1 Recommissioning the flowmeter

### ATTENTION

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

- ▶ Before recommissioning, ensure that there is no hard, gummy or crystallized pumped liquid in the flowmeter.

#### Requirement:

- ✓ The ambient conditions correspond to the operating data
- ✓ Flowmeter connection to the pipe system is stress-free
- ✓ Pipe system is free of solid particles
- ✓ Pipe system vented
- ✓ Shut-off devices in the feed line and outlet opened

- ▶ Switch on the system.

- ⇒ The flowmeter is ready to operate.

## 10 Maintenance

### 10.1 Required maintenance

Flowmeters are fundamentally maintenance-free. Under observance of the operating limits ↗ Technical data, Page 10, no significant change in the characteristics could be established, even after years of use in many cases. Stresses lying clearly above the rated flow rate can, however, result in excessive wear. In the case of liquids with higher abrasiveness (for example heavy fuel 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 after twelve weeks operation time.

### 10.2 Maintaining flowmeters

The following table lists signs of progressive wear of individual elements of the flowmeter:

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	↗ Troubleshooting, Page 36	➡ ↗ Troubleshooting, Page 36

Tab. 12: Check table for required maintenance

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots



#### **WARNING**

##### **Risk of injury through emitted pumped liquid.**

Pumped liquids can be hot, poisonous, combustible and caustic.

- ▶ Wear personal protective clothing during all the work. Ensure face protection.
- ▶ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

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.

### 10.3 Recalibration of the flowmeter

In order to maintain the high measuring precision of the flowmeter, the manufacturer recommends carrying out the first recalibration after about one year of operation. The results reveal any wear starting on the measuring unit. The interval at which recalibrations are actually required depends strongly on the operating conditions of the flowmeter.

The manufacturer provides the factory calibration as standard. If higher requirements are placed on the flowmeter, accredited calibration in accordance with EN/ISO/IEC 17025 is also possible.

## 11 Servicing

### 11.1 Dangers during servicing



**The following safety instructions must be observed strictly:**

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ To ensure the measuring precision, the measuring unit may only be replaced by the manufacturer.
- ☐ Before beginning work, let the flowmeter cool down slowly to the ambient temperature. Avoid rapid temperature changes.
- ☐ Pumped liquids can be hot, poisonous, combustible and caustic.
- ☐ Observe the tightening torques ↗ Appendix, Page 45.
- ☐ Observe the operating instructions and data sheets of the sensors.

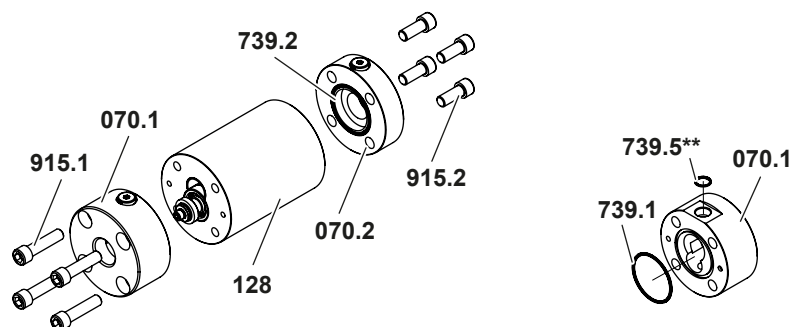
### 11.2 Replacing seals and bearings

#### 11.2.1 Removing seals and bearings OMS-020/OMS-032

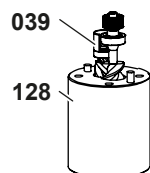
Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Extractor

Requirement:

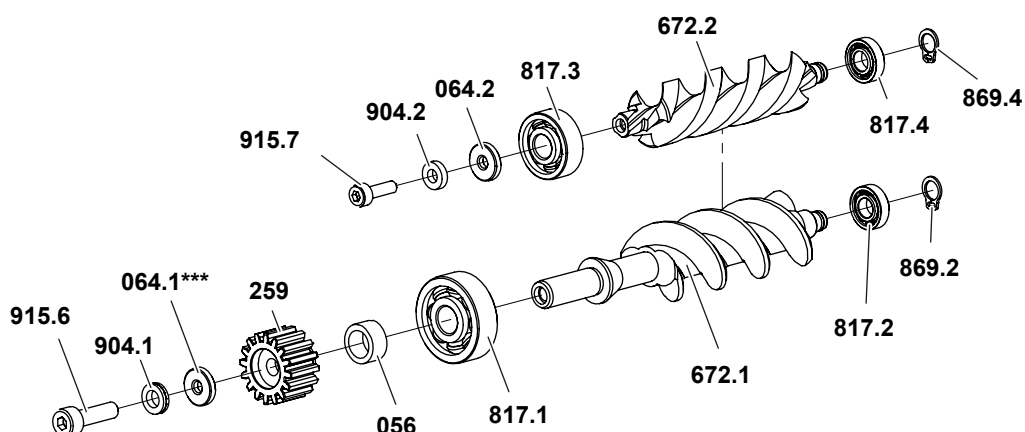
- ✓ Flowmeter removed from system
- ✓ Completion consisting of socket screws, flanges and seals removed
- ✓ Pick up inserts removed



1. ➔ Remove the socket screws **915.1** and **915.2**, take off the end covers **070.1** and **070.2**.
2. ➔ Remove the O-rings **739.1**, **739.2** and **739.5\*\*** (1 x per pick up hole).



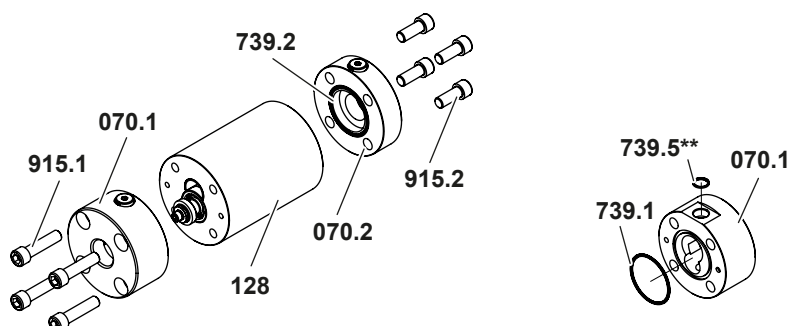
3. ➔ Pull the distance sleeve **039** together with the screw set out of the measuring housing **128**.



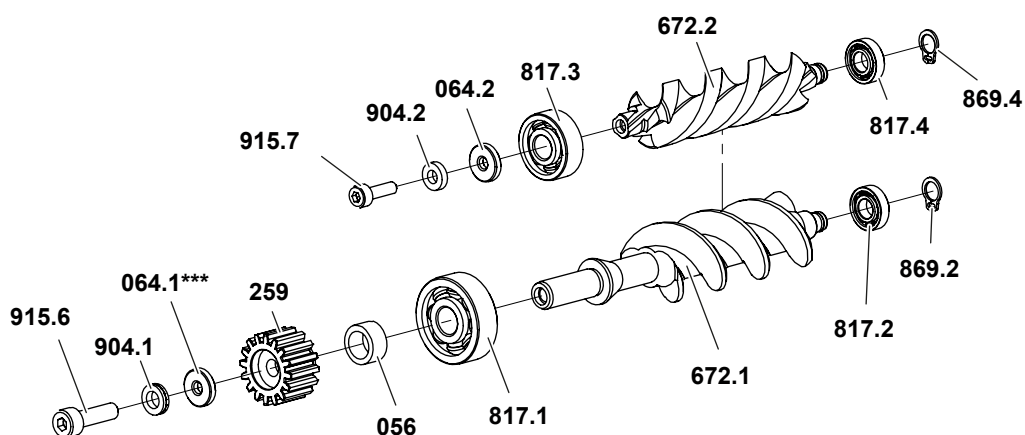
4. ➔ Remove the circlips **869.2** and **869.4** from the measuring screw large **672.1** and measuring screw small **672.2**.
5. ➔ Screw out the socket screws **915.6** and **915.7** and remove the wedge lock washers **904.1**, **904.2** and supporting rings **064.1\*\*\*** (only OMS-032) **064.2**.
6. ➔ Screw the socket screw **915.6** completely back in, in order to pull the pole wheel **259** and distance ring **056** from the measuring screw large **672.1** by using an extractor. Remove the socket screw **915.6** again.
7. ➔ Pull the ball bearings **817.1**, **817.2**, **817.3** and **817.4** from the measuring screws by using the extractor.

### 11.2.2 Installing seals and bearings OMS-020/OMS-032

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots



1. ➔ Insert the O-rings **739.1** and **739.2** into the end covers **070.1** and **070.2**.
2. ➔ Insert the O-ring **739.5\*\*** into the pick up hole (1 x je per pick up hole).

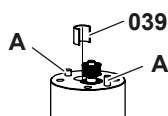


3. ➔ Press on the ball bearings **817.1** and **817.2** only over the inner rings on the measuring screw large **672.1**.

## 11 Servicing

### 11.2 Replacing seals and bearings

4. ➤ Press on the ball bearings **817.3** and **817.4** only over the inner rings on the measuring screw small **672.2**.
5. ➤ Slide the distance ring **056** on the measuring screw large **672.1**, press on the pole wheel **259**.
6. ➤ Pull the wedge lock washers **904.1** and **904.2** and supporting rings **064.1\*\*\*** (only OMS-032) and **064.2** onto the socket screws **915.6** and **915.7**.
7. ➤ Apply Loctite 242 to the socket screws **915.6** and **915.7**, install on the measuring screw large and measuring screw small with mounted washers and tighten with torque ↻ Appendix, Page 45.
8. ➤ Install the circlips **869.2** and **869.4** respectively on the floating bearing end.
9. ➤ At a BSPP connection: Place the end cover **070.2** on the measuring housing, lay ready the socket screws **915.2**.  
-or-  
At a flange connection: Place the end cover **070.2** and flange cover **115.2\*** with O-ring **739.4\*** on the measuring housing, lay ready the socket screws **915.4\***.
10. ➤ Pretension the oiled screws crosswise and tighten with torque.



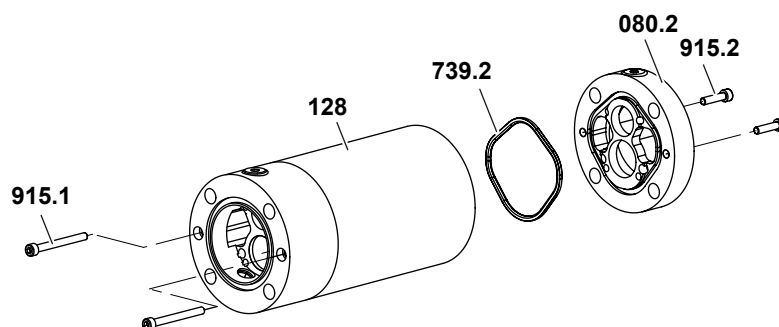
11. ➤ Slide the screw set into the measuring housing. Slide the distance sleeve **039** into the hole of the measuring screw small **672.2**.
12. ➤ Place the end cover **070.1** on the measuring housing. Ensure that the tapered dowel pins **A** in the measuring housing match the fitting holes.
13. ➤ At a BSPP connection: Lay ready the socket screws **915.1**.  
-or-  
At a flange connection: Place on the flange cover **115.1\*** with O-ring **739.3\*** and lay ready the socket screws **915.3**.
14. ➤ Pretension the oiled screws crosswise and tighten with torque.

#### 11.2.3 Removing seals and bearings OMS-052

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Extractor

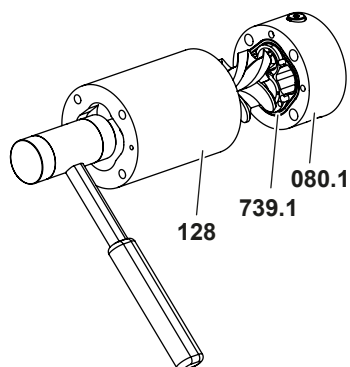
##### Requirement:

- ✓ Flowmeter removed from system
- ✓ Completion consisting of socket screws, flanges and seals removed
- ✓ Pick up inserts removed

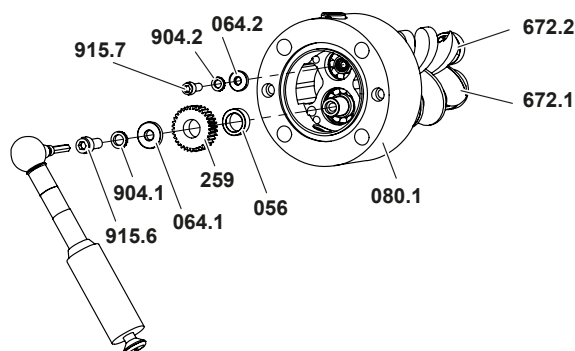


1. ➤ Remove the socket screws **915.1** and **915.2**, take off the bearing cover **080.2**. Remove the O-ring **739.2**.

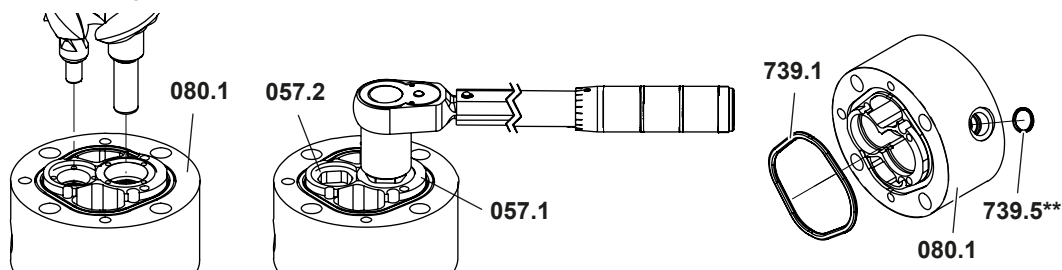




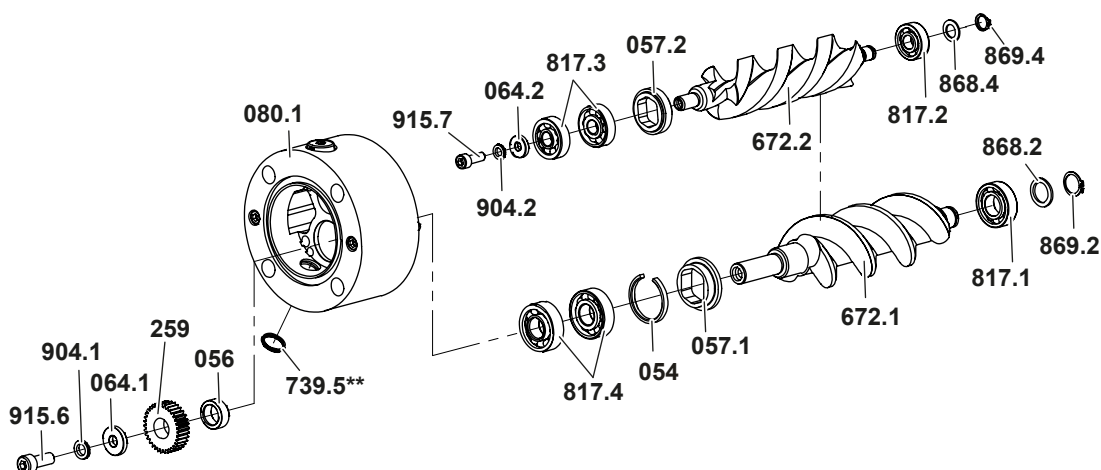
2. ➔ Drive the screw set together with the bearing cover **080.1** out of the measuring housing **128** using light blows of a plastic hammer and pull out.



3. ➔ Screw out the socket screw **915.6** with wedge lock washer **904.1** and supporting ring **064.1** at the measuring screw large **672.1**. Pull off the pole wheel **259** and distance ring **056**.
4. ➔ Screw out the socket screw **915.7** with wedge lock washer **904.2** and supporting ring **064.2** at the measuring screw small **672.2**.



5. ➔ Pull out the screw set from the bearing cover **080.1** with extractor.
6. ➔ Screw the threaded rings **057.1** and **057.2** out of the bearing cover. Widths of the threaded rings  
 ↳ Appendix, Page 45.
7. ➔ Remove the O-rings **739.1** and **739.5\*\*** (1 x per pick up hole).



## 11 Servicing

### 11.2 Replacing seals and bearings

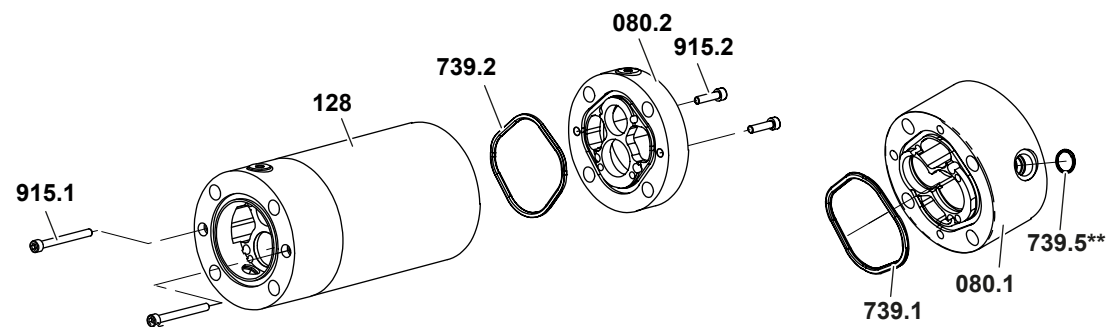
8. ➤ Take out the distance ring **054** and pull the ball bearings **817.3** and **817.4** out of the bearing cover using an extractor.
9. ➤ Remove the circlips **869.2** and **869.4** and the support rings **868.2** and **868.4** from the measuring screws.
10. ➤ Pull the ball bearings **817.1** and **817.2** from the measuring screws by using the extractor.

#### 11.2.4 Installing seals and bearings OMS-052

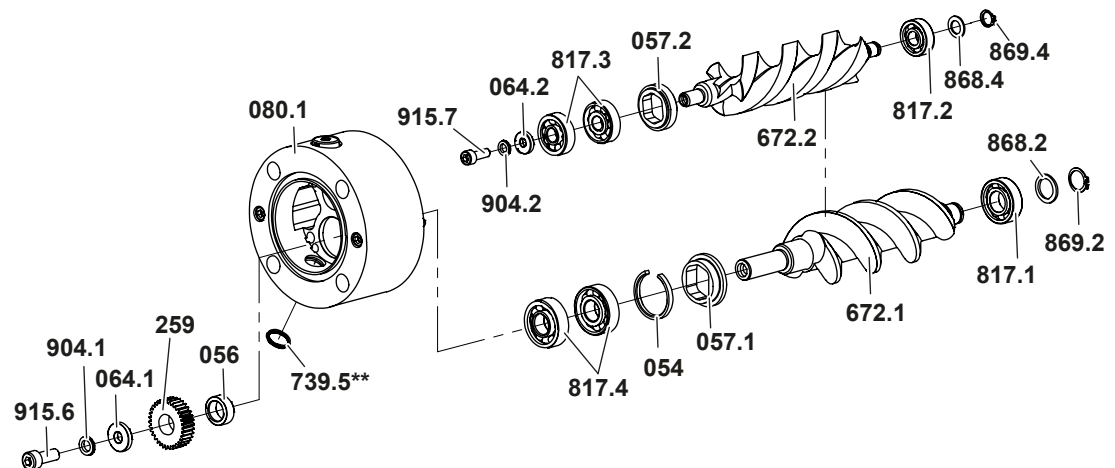
Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

Requirement:

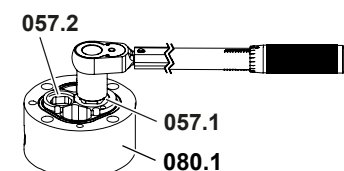
- ✓ Replacement parts available



1. ➤ Insert the O-rings **739.1** and **739.2** into the bearing covers **080.1** and **080.2**.
2. ➤ Insert the O-ring **739.5\*\*** into the pick up hole (1 x je per pick up hole).

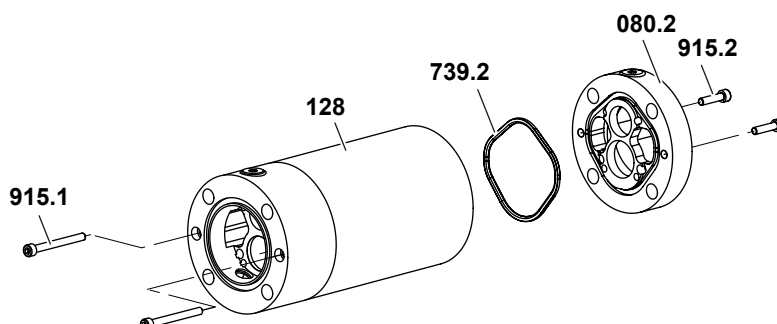


3. ➤ Press in the ball bearings **817.3** and **817.4** only over the outer rings in the bearing cover **080.1**.
4. ➤ Press the distance ring **054** onto the ball bearings **817.3**.
5. ➤ Press the ball bearings **817.1** on only over the inner ring on the measuring screw large **672.1**.
6. ➤ Press the ball bearings **817.2** on only over the inner ring on the measuring screw small **672.2**.



7. ➤ First screw in the threaded ring **057.2**, then the threaded ring **057.1** into the bearing cover **080.1** using a torque wrench. For the widths and tightening torques ➤ Appendix, Page 45.
8. ➤ Press the measuring screws into the ball bearings in the bearing cover. Support the respective inner ring in the process.
9. ➤ Pull the wedge lock washers **904.2** and supporting rings **064.2** onto the socket screw **915.7**. Ensure a tight connection of the wedge lock washers.

10. ➤ Apply Loctite 242 to the socket screws **915.7**, install on the measuring screw small with mounted washers and tighten with torque ➤ Appendix, Page 45.
11. ➤ Slide the distance ring **056** on the measuring screw large **672.1**. Press on the pole wheel **259**.
12. ➤ Pull the wedge lock washer **904.1** and supporting ring **064.1** onto the socket screw **915.6**. Ensure a tight connection of the wedge lock washers.
13. ➤ Apply Loctite 242 to the socket screw **915.6**, install on the measuring screw large **672.1** with mounted washers and tighten with torque ➤ Appendix, Page 45.
14. ➤ Install the support rings **868.2** and **868.4** and the circlips **869.2** and **869.4** on the floating bearing end.



15. ➤ Place the bearing cover **080.2** onto the measuring housing **128** and tighten the socket screws **915.2** with torque.
16. ➤ Slide the bearing cover **080.1** with bearings and premounted measuring unit, consisting of screw set and pole wheel, into the measuring housing, tighten the socket screws **915.1** with torque ➤ Appendix, Page 45.
17. ➤ Install the flange cover. In the process pre-tighten the oiled screws crosswise and tighten with torque ➤ Appendix, Page 45.

## 12 Disposal

### 12.1 Dangers during disposal



The following safety instructions must be observed strictly:

- ☐ Neutralize residues.

### 12.2 Dismantling and disposing of the flowmeter

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Solvents or industrial cleaners suitable for the pumped liquid <input type="checkbox"/> Collection tank



### **⚠ DANGER**

**Risk of death resulting from electric shock when removing the optional electrical heating system.**

- ▶ Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- ▶ The flowmeter may only be disconnected from the power supply by an authorized electrician.

## 13 Troubleshooting

### 13.1 Possible faults



#### **WARNING**

##### **Danger of poisoning and environmental damage through residues.**

- ▶ Wear personal protective clothing during all the work. Ensure face protection.
- ▶ Before disposal collect any pumped liquid still present safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ▶ Before disposing neutralize the residues.

##### Requirement:

- ✓ Flowmeter cooled down to the ambient temperature and disconnected from the pipe system
  - ✓ Flowmeter drained completely
  - ✓ Flowmeter placed at a location suitable for dismantling
1. ▶ Dismantle the flowmeter and disassemble it into its individual parts.
  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 separately.
  4. ▶ Recycle iron parts.

## 13 Troubleshooting

### 13.1 Possible faults

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

In the case of faults please contact the manufacturer. Under [services@kral.at](mailto:services@kral.at).

Identification	Fault
1	Flowmeter leaks
2	No flow rate
3	Flowmeter does not generate a pulse
4	Pressure loss too high
5	Measured values not realistic

### 13.2 Troubleshooting

Fault identification					Cause	Remedy
1	–	–	–	–	Seal preload too low	<div>▶ Preload the screws.</div>
1	–	–	–	–	Seal damaged	<div>▶ Replace the seal.</div> <div>▶ Check the chemical resistance of the seal.</div>
–	2	3	–	5	Foreign particles in the liquid and/or flowmeter	<div>▶ Dismantle the flowmeter and clean it.</div> <div>▶ Use the commissioning filter.</div>
–	–	3	–	5	Pick up not connected correctly	<div>▶ Check the power supply for the pick up. In the process observe the operating instructions of the pick up.</div>
–	–	3	–	5	Pick up defective	<div>▶ Check the function of the pick up. In the process observe the operating instructions of the pick up.</div>
1	–	3	–	–	Dry sleeve destroyed	<div>▶ Replace the dry sleeve. Contact the manufacturer in the process.</div>
–	2	3	–	–	Inlet pressure too low	

Fault identification					Cause	Remedy
						—> Increase the inlet pressure.
–	–	–	4	–	Viscosity of the liquid too high	—> Increase the temperature. When doing so observe the temperature range.
–	–	3	–	–	Flow rate too low	—> Increase the flow rate. -or- Use a flowmeter with a suitable size. -or- Use linearization. In the process observe the operating instructions of the electronic equipment.
–	–	–	4	–	Flow rate too high	—> Reduce the flow. -or- Use a flowmeter with a suitable size.
–	–	–	–	5	Airlocks	—> Deaerate the system and check for leaks.
–	–	–	–	5	Outgassing	—> Increase the system pressure. —> Reduce the temperature.
–	–	–	–	5	Pulsations too high	—> Use another feed pump. —> Carry out changes to the system.
–	–	–	–	5	Back pressure too low	—> Increase the back pressure.
–	–	–	–	5	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. In the process observe the operating instructions of the electronic equipment.
–	–	3	–	5	Filling amount too low	—> Use a flowmeter with a suitable size. —> Use a flowmeter from a suitable series.
–	–	–	–	5	Strongly deviating operating data	—> Use a flowmeter from a suitable series. —> Adapt the operating data to the flowmeter.
–	2	3	4	5	Wear at the measuring unit and bearings	—> Replace the measuring unit. —> Replace the bearings. —> Filter out the abrasive materials.
–	–	–	4	5	Sluggishness through deposits	—> Disassemble the flowmeter and clean it carefully.
–	2	3	–	–	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.
–	2	3	–	–	Flowmeter switched to bypass	—> Switch the flowmeter to through-flow.

Tab. 13: Fault table

### 14 Spare parts

#### 14.1 Spare parts

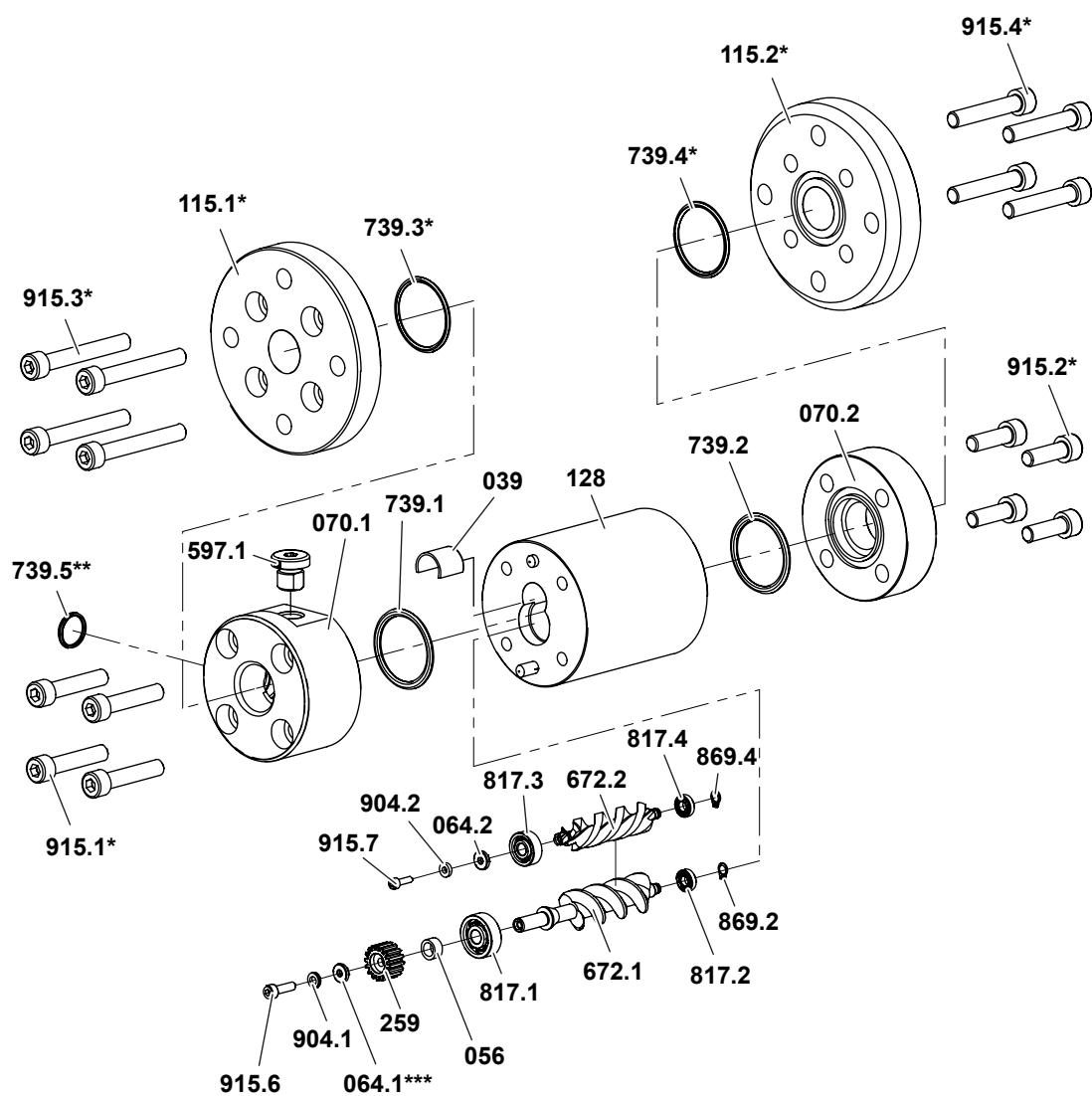


Fig. 9: Exploded drawing OMS-020 and OMS-032



## 15 Accessories

### 15.1 Heating

Item No.	Part	Item No.	Part
039	Distance sleeve	739.4	O-ring
041	Sleeve	739.4*	O-ring
054	Distance ring	739.5**	O-ring
056	Distance ring	817.1	Deep-groove ball bearing
057.1	Threaded ring	817.2	Deep-groove ball bearing
057.2	Threaded ring	817.3	Deep-groove ball bearing
062	Spacer	817.4	Deep-groove ball bearing
064.1	Supporting ring	868.1	Support ring
064.1****	Supporting ring	868.2	Support ring
064.2	Supporting ring	868.3	Support ring
070.1	End cover	868.4	Support ring
070.2	End cover	869.2	Circlip
080.1	Bearing cover	869.4	Circlip
080.2	Bearing cover	870.1	Circlip
107.1*	Pipe thread connection	870.2	Circlip
107.2*	Pipe thread connection	904.1	Wedge lock washer
115.1*	Flange	904.2	Wedge lock washer
115.2*	Flange	915.1	Socket screw
128	Measuring housing	915.1*	Socket screw
259	Pole wheel	915.2	Socket screw
597.1	Screw plug	915.2*	Socket screw
597.2	Screw plug	915.3	Socket screw
672.1	Measuring screw large	915.3*	Socket screw
672.2	Measuring screw small	915.4	Socket screw
739.1	O-ring	915.4*	Socket screw
739.2	O-ring	915.5	Socket screw
739.3	O-ring	915.6	Socket screw
739.3*	O-ring	915.7	Socket screw
*	Parts alternatively for pipe thread connection or flange connection		
**	Exist twice at two pick up holes		
****	Only for OMS-032		

Tab. 14: List of parts

## 15 Accessories

### 15.1 Heating

#### 15.1.1 Possible types of heating

The flowmeter can optionally be equipped with a heating system. The manufacturer recommends a heating system at high-viscosity liquids that do not flow sufficiently if not heated. This can result in bearing damage and destruction of the device.

Type of heating	Note
Electrical heating system	The electrical heating system consists of a tubular pipe cartridge with a heating sleeve.
Fluid heating system	The fluid heating system consists of a heating jacket and pipe thread connections.
Trace heating provided by the customer	Before installing trace heating provided by the customer, contact the manufacturer.



**15.1.2 Technical data of the electrical heating system**

	Unit	OMS-020	OMS-032	OMS-052
Heating output	[W]	180	180	800
Voltage	[V AC]	230		
Frequency	[Hz]	50		
Wire cross-section	[mm <sup>2</sup> ]	3 x 0.75		
Cable length for tubular pipe cartridge	[m]	1		

Tab. 15: Electrical heating system

**15.1.3 Technical data of the fluid heating system**

	Unit	OMS-020	OMS-032	OMS-052
Max. pressure	[bar]	16		
Max. temperature of the liquid	[°C]	200		

Tab. 16: Fluid heating system

**15.1.4 Installing the heating system****Installing the electrical heating system**

Personnel qualification:	<input type="checkbox"/> Fitter <input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

**⚠ DANGER****Risk of death resulting from electric shock.**

- ▶ Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- ▶ Observe the operating instructions of the electrical components.



Fig. 11: Tubular pipe cartridge with heating sleeve

—▶ Envelop the flowmeter with the heating sleeve with tubular pipe cartridge lying on the inside.

**Notice** If a tubular pipe cartridge is used, the manufacturer recommends insulating the flowmeter and heating system in order to avoid radiation losses.

#### Installing the fluid heating system

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

#### ATTENTION

**Damage to equipment through the use of water or steam as a heating liquid.**

- Use a suitable heating liquid, such as heat transfer oil.

► Envelop the flowmeter with heating jack.

#### Installing the trace heating

**Notice** Before installing trace heating provided by the customer, contact the manufacturer.

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

#### ATTENTION

**Defective components through the maximum temperature being exceeded.**

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

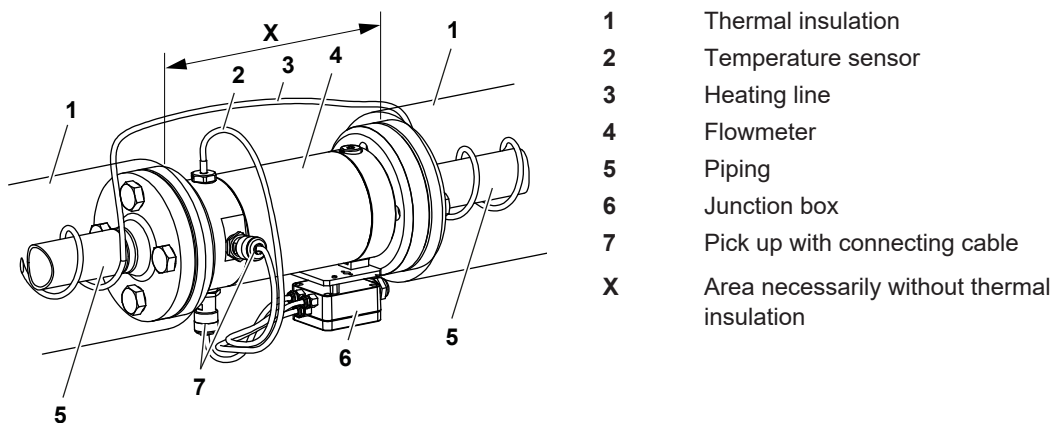


Fig. 12: Flowmeter with trace heating

► Wind the heating line 3 around the piping 5. Ensure that the pick up 7, temperature sensor 2, junction box 6 and associated cables are not thermally insulated. The area X must remain free of thermal insulation.

## 15.2 Junction box

### 15.2.1 Function description

For the flowmeters of the series OMS the manufacturer offers a junction box. This simplifies the electrical connection of the various sensors.

### 15.2.2 Technical data

	Unit	UZA 09	UZA 10	UZA 11
<b>Suitable for</b>		Pick up BEG 44 Temperature sensor EET 32, EET 33, EET 34		
<b>Electrical specification</b>				
Number of sensor inputs		1	2	3
Number of outputs		1	1	1
<b>Mechanical specification</b>				
Max. liquid temperature	[°C]	150		
Housing material		Aluminium		
Connection thread		M6		
Fastening		Direct installation on the flowmeter		

Tab. 17: Junction box

### 15.2.3 Installing the junction box

Personnel qualification:	<input type="checkbox"/> Fitter <input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots



### DANGER

#### Risk of death resulting from electric shock.

- Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- Observe the operating instructions of the electrical components.

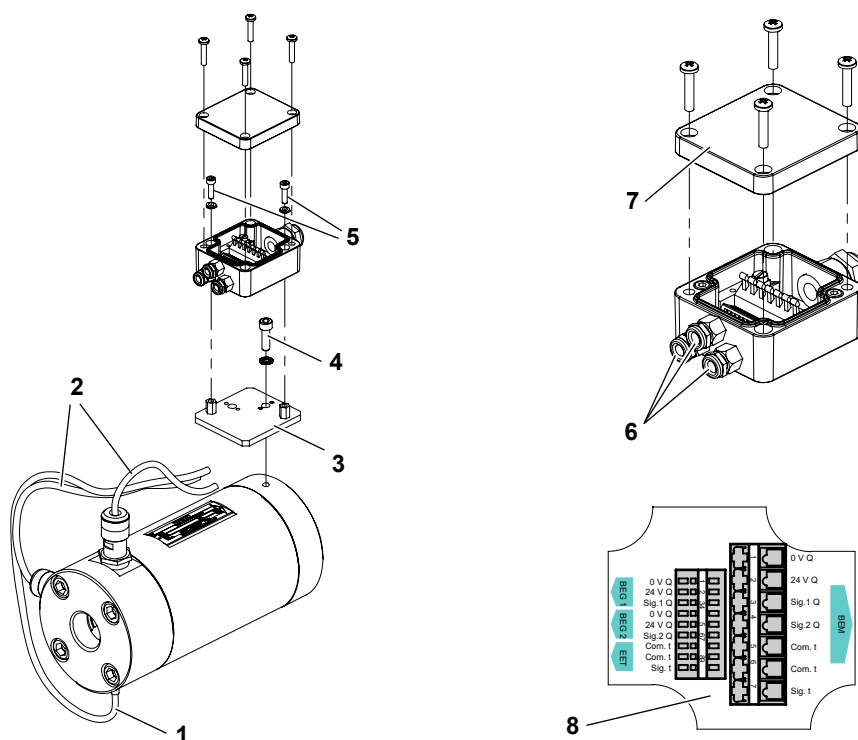


Fig. 13: Installing and connecting the junction box

- |   |                          |   |                           |
|---|--------------------------|---|---------------------------|
| 1 | Temperature sensor cable | 5 | Socket screw and washer   |
| 2 | Pick up cable            | 6 | Cable gland sensor inputs |
| 3 | Junction box base plate  | 7 | Junction box cover        |
| 4 | Socket screw and washer  | 8 | Connection diagram        |

1. ➡ Pinch off the pick up cable 2 and temperature sensor cable 1. Ensure sufficient cable length.
2. ➡ Fasten the base plate 3 of the junction box to the flowmeter using the socket screw and washer 4.
3. ➡ Fasten the lower part of the junction box to the base plate using socket screws 5.
4. ➡ Carry out the cabling through the cable gland 6. Observe the connection diagram 8.
5. ➡ Screw tight the cover 7 of the junction box.

## 15.3 Extension cable

### 15.3.1 Function description

Normally the cable length does not influence the functionality of the sensors. Nevertheless the manufacturer recommends that connecting cables of the junction box be extended to a maximum length of 100 m. Extension cables as well cable connectors and cable box are available as accessories from the manufacturer.

### 15.3.2 Technical data

	Unit	
Max. length	[m]	100
Cable diameter	[mm]	6.0 – 10.5
Wire cross-section min. – max.	[mm <sup>2</sup> ]	0.25 – 2.50 (single wire)
	[mm <sup>2</sup> ]	0.25 – 1.50 (multiple wires)

Tab. 18: Extension cable

### 15.3.3 Connecting the extension cable

Personnel qualification:	<input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing

## 16.1 Tightening torque for screws with metric screw threads and head contact surfaces


**⚠ DANGER**
**Risk of death resulting from electric shock.**

- ▶ Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- ▶ Observe the operating instructions of the electrical components.

**ATTENTION**
**Damage to equipment through incorrect connecting of the extension cable.**

- ▶ Use only a shielded extension cable.
- ▶ Lay extension cables separately from the supply lines.

1. ▶ Solder the cable connector onto the sensor cable.
2. ▶ Solder the cable box to the extension cable.
3. ▶ Connect the sensor cable and extension cable.
4. ▶ Connect the extension cable in accordance with the connection diagram. Connection diagram ↗ Installation, removal, Page 21.

## 16 Appendix

### 16.1 Tightening torque for screws with metric screw threads and head contact surfaces

Tightening torque [Nm]								
Thread	5.6	5.8	10.9	8.8+ Alu*	+ Wedge lock wash- ers		Stainless steel screws A2 and A4	
					8.8	Rust- proof A4-70	Property class 70	Property class 80
M 3	0.6	1.5	—	1.2	1.5	1.1	—	—
M 4	1.4	2.9	4.1	2.3	3.0	2.0	—	—
M 5	2.7	6.0	8.0	4.8	6.0	3.9	3.5	4.7
M 6	4.7	9.5	14.0	7.6	10.3	6.9	6.0	8.0
M 8	11.3	23.1	34.0	18.4	25.0	17.0	16.0	22.0
M 10	23.0	46.0	68.0	36.8	47.0	33.0	32.0	43.0
M 12	39.0	80.0	117	64.0	84.0	56.0	56.0	75.0
M 14	62.0	127	186	101	133	89.0	—	—
M 16	96.0	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
M 24	322	675	960	540	687	460	455	605

Tab. 19: Tightening torques metric screw thread

\* Reduced tightening torque when screwing into aluminium

**16.2 Tightening torques for screw plugs with thread measured in inches and elastomer seal**

Tightening torque [Nm]	
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

Tab. 20: Tightening torques, thread measured in inches

**16.3 Tightening torques and widths for threaded rings**

Size	Measuring screw	Item No.	Width [mm]	Tightening torque [Nm]
OMS-052	Large	<b>057.1</b>	22	82
	Small	<b>057.2</b>	19	68

Tab. 21: Tightening torques and widths for threaded rings

**16.4 Contents of the Declaration of Conformity**

The products described in these 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 fulfils 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. 22: Directives observed

## Directory of figures

Fig. 1	Type code.....	9
Fig. 2	Rating plate .....	10
Fig. 3	Pressure pulses.....	10
Fig. 4	Dimensional drawing pipe thread .....	12
Fig. 5	Dimensional drawing DIN flange .....	12
Fig. 6	Structure of the flowmeter .....	16
Fig. 7	Fastening of hoisting equipment - principle diagram.....	19
Fig. 8	Installation types.....	22
Fig. 9	Exploded drawing OMS-020 and OMS-032 .....	38
Fig. 10	Exploded drawing OMS-052 .....	39
Fig. 11	Tubular pipe cartridge with heating sleeve .....	41
Fig. 12	Flowmeter with trace heating .....	42
Fig. 13	Installing and connecting the junction box.....	44

## Directory of tables

Tab. 1	Target groups .....	4
Tab. 2	Type code.....	9
Tab. 3	Maximum values.....	10
Tab. 4	Additional maximum values when BEG 44 is used .....	11
Tab. 5	Additional maximum values when BEG 47D is used .....	11
Tab. 6	Substitute operating data .....	11
Tab. 7	Dimensions and weights - pipe thread connection .....	12
Tab. 8	Dimensions and weights – DIN flange connection .....	12
Tab. 9	Conditions for additional preservation .....	19
Tab. 10	Installation types.....	22
Tab. 11	Mesh width of the operating filter .....	27
Tab. 12	Check table for required maintenance .....	29
Tab. 13	Fault table.....	36
Tab. 14	List of parts .....	40
Tab. 15	Electrical heating system.....	41
Tab. 16	Fluid heating system .....	41
Tab. 17	Junction box .....	43
Tab. 18	Extension cable .....	44
Tab. 19	Tightening torques metric screw thread .....	45
Tab. 20	Tightening torques, thread measured in inches .....	46
Tab. 21	Tightening torques and widths for threaded rings .....	46
Tab. 22	Directives observed.....	46



# KRAL

