Variable area flowmeter

Equipment category II 2 G and II 2 D, EPL Gb and Db
in protection type intrinsic safety "i"
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1.1 General notes

This additional instruction applies to explosion-protected versions of variable area flowmeter with electrical built-ins with protection type intrinsic safety “i”, equipment category II 2 G and II 2 D or EPL Gb and Db.

It completes the standard documentation for the non-explosion protected versions.

The information given in this instruction contains only the data relevant to explosion protection. The technical details given in the manual for the non-explosion protected versions remain unchanged unless excluded or superseded by this supplementary instruction.

1.2 EU conformity

The manufacturer declares with the EU declaration of conformity on his own responsibility conformity with the protection goals of directive 2014/34/EU for use in hazardous areas with gas and dust.

Conformity with harmonised standards was checked by a notified body in accordance with EN 60079-0:2012 and EN 60079-11:2012.

The EU declaration of conformity for the equipment category II 2 G and II 2 D is based on the EU type examination certificate:

KIWA 15 ATEX 0038 X

The “X” after the certificate number refers to special conditions for safe use of the device, which have been listed in these instructions.

If necessary, the EU type examination certificate can be downloaded from the manufacturer’s website.

1.3 Approval according to the IECEx scheme

Conformity for use in hazardous areas with gas and dust was tested in accordance with the “IECEx Certification Scheme for Explosive Atmospheres” according to IEC 60079-0:2011, IEC 60079-15:2010 and IEC 60079-31:2013.

The number of the IECEx certificate is:

IECEx KIWA 15.0020 X

The “X” after the certificate number refers to special conditions for safe use of the device, which have been listed in these instructions.

If needed, the IEC certificate can be downloaded from the manufacturer’s website.
1.4 Safety instructions

If these instructions are not followed, there is a risk of explosion.

Assembly, installation, start-up and maintenance may only be performed by personnel trained in explosion protection!

**CAUTION!**
The operator or his agent is responsible for observing any additional standards, directives or laws if required due to operating conditions or place of installation. This applies in particular to the use of easily detachable process connections when measuring flammable media.
2.1 Device description

Variable area flowmeters measure and display the volume flow of flammable and non-flammable gases and liquids.

Figure 2-1: Available indicators

1. Indicator M8E.: one signal output 4...20 mA with a bargraph indicator
2. Indicator M8M.: up to two separately adjustable electrical limit switches
2.2 Description code

Type series H250
The safety description code consists of the following elements:

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 2-2: Safety description code

1. **Type series of measuring unit H250**
2. **Materials / versions**
   - RR - stainless steel
   - C - PTFE or PTFE with ceramic liner
   - HC - Hastelloy®
   - Ti - Titanium
   - F - Food
3. **Type series of indicators**
   - M8 - Indicator M8
4. **Design of indicator M8**
   - MG - mechanical indicator
   - EG - electronic indicator with signal output 4...20 mA
5. **Design of indicator housing**
   - without - indicator housing in PPS
   - R - indicator housing in stainless steel
6. **Limit switch (M8MG version)**
   - K1 - one limit switch
   - K2 - two limit switches
7. **Version**
   - Ex - explosion-protected version
Type series DK37
The safety description code consists of the following elements*:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type series of measuring unit DK</td>
<td>Type series of signal converter 37</td>
<td>Type series of indicators</td>
<td>Design of indicator housing</td>
<td>Optional differential pressure regulator</td>
<td>Limit switch (M8M version)</td>
</tr>
</tbody>
</table>

M8M - mechanical indicator
M8E - electronic indicator

without – indicator housing in PPS
R - indicator housing in stainless steel

RE - inlet pressure regulator
RA - outlet pressure regulator

K1 - one limit switch
K2 - two limit switches

* positions which are not needed are omitted (no blank positions)
2.3 Marking

The marking of the entire device is clearly visible on the indication unit, in accordance with the designation code.

Additional markings on the housing cover:
- SN - serial number
- SO - sales order / item
- PA - order
- Vxxx - product configurator code
- AC - article code

Additional plate

The association of the housing cover to the device is confirmed by an additional plate with the serial number on the interior of the indicator part.
2.4 Flammable products

**Atmospheric conditions:**
The ATEX directive does not stipulate values for atmospheric conditions. However, for
determining the explosion characteristic parameters of temperature and pressure range, the
following is assumed as a basis:
\[ T_{\text{atm}} = -20...+60^\circ \text{C} / -4...+140^\circ \text{F} \text{ and } P_{\text{atm}} = 0.8...1.1 \text{ bar} / 11.6...15.9 \text{ psi} \]
Outside of these ranges, for most mixtures no key figures are available for the ignition
behaviour.

**Operating conditions:**
Variable area flowmeters operate outside of atmospheric conditions, which means that
explosion protection, regardless of the zone assignment, is fundamentally not applicable due to
the lack of key safety data for the interior of the measuring unit.

**WARNING!**
Operation with flammable products is only permitted as long as no explosive fuel/air mixture
builds up on the inside of the flowmeter under operating conditions. The operator is responsible
to ensure that the flowmeter is operated safely in terms of the temperature and pressure of the
products used. In case of operation with flammable products the measuring units must be
included in the periodic pressure tests of the system. When using the device version H250/C...
[PTFE version, non-conductive] the minimum conductivity of the media must be \(10^{-8} \text{ S/m}\), in
order to avoid danger from electrostatic charge.

2.5 Equipment category

Variable area flowmeters are designed in accordance with EN 60079-0 and EN 60079-11 in
category II 2 G or EPL Gb for use in zone 1.

Depending on the device version, variable area flowmeters are also designed in
category II 2 D or EPL Db for use in zone 21.

The inside of the measuring unit is also approved for zone 1.

**INFORMATION!**

**Definition of zone 1 according to EN 1127-1, Appendix B:**
An area in which an explosive atmosphere, as a result of the mixture of flammable substances in
the form of gas, steam or mist with air, under normal operation may occasionally occur.

**Definition of zone 21 according to EN 1127-1, Appendix B:**
An area in which an explosive atmosphere may occasionally occur in the form of a cloud of
flammable dust in the air under normal operation.
2.6 Types of protection

The variable area flowmeter is designed with protection type intrinsic safety "i" according to EN 60079-11.

The identification for equipment category II 2 G or EPL Gb is:
II 2 G Ex ia IIC T6...T3 Gb

The marking contains the following information:

| II | Explosion protection, group II |
| 2 | Equipment category 2 |
| G | Gas explosion protection |
| Ex ia | Explosion protection through intrinsic safety, protection level "ia" |
| IIC | Gas group, suitable for gas groups IIC, IIB and IIA |
| T6...T3 | Temperature class range, suitable for temperature classes T6...T1 |
| Gb | EPL, suitable for zone 1 and zone 2 |

INFORMATION!
For the equipment category II 2 G and EPL Gb, connection to an intrinsically safe circuit with protection level "ib" is required.
When connecting the variable area flowmeter to an intrinsically safe circuit with protection level "ia", a higher protection level is given.

The additional identification of the version for the equipment category II 2 D and EPL Db is:
II 2 D Ex ia IIIC T75°C ... T200°C Db

The marking contains the following information:

| II | Explosion protection, group II |
| 2 | Equipment category 2 |
| D | Dust ignition protection |
| Ex ia | Explosion protection through intrinsic safety, protection level "ia" |
| IIIC | Dust group, suitable for groups IIIC, IIB and IIA |
| T75°C ... T200°C | Maximum surface temperature at +65°C / +149°F ambient temperature |
| Db | EPL, suitable for zone 21 and zone 22 |

INFORMATION!
For the equipment category II 2 D and EPL Db, connection to an intrinsically safe circuit with protection level "ib" is required.
When connecting the variable area flowmeter to an intrinsically safe circuit with protection level "ia", a higher protection level is given.
2.7 Ambient temperature / temperature classes / product temperature

Due to the influence of the product temperature, variable area flowmeters with built-in electrical equipment (electric variants) are not assigned to any fixed temperature class. The temperature class of these devices is rather a function of the product temperature and ambient temperature that is present and the specific device version. The classification is outlined in the following tables.

The tables take into account the following parameters:
- built-in equipment
- Maximum values $I_i$ and $P_i$ for K1 and K2
- Ambient temperature $T_{amb}$
- Product temperature $T_m$
- Heat resistance of the connecting cable

When using more than one installed equipment, the data of the most unfavourable equipment should be used.

**INFORMATION!**
The maximum permissible product temperatures listed in the tables are valid under the following conditions:
- The measuring device is installed and operated in accordance with the manufacturer’s installation instructions.
- It must be ensured that the flowmeter is not heated by the effects of additional heat radiation (sunshine, neighbouring system components) and thus operated above the permissible ambient temperature range.
- Insulation must be limited to the piping.
- Unobstructed ventilation of the indicator part must be ensured.

For certain device versions, lower values apply due to differing boundary conditions (e.g. liner materials). Here the user should consult the technical data sheet.

The maximum product temperature is outlined in the following tables.

### DK37/M8../../.. permissible product and ambient temperatures

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Ambient temperature up to</th>
<th>Maximum permissible product temperature / maximum value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[°C]</td>
<td>[°F]</td>
</tr>
<tr>
<td></td>
<td>[°C]</td>
<td>[°F]</td>
</tr>
<tr>
<td>T6</td>
<td>+40</td>
<td>+104</td>
</tr>
<tr>
<td>+50</td>
<td>+122</td>
<td>-</td>
</tr>
<tr>
<td>+60</td>
<td>+140</td>
<td>-</td>
</tr>
<tr>
<td>T5</td>
<td>+40</td>
<td>+104</td>
</tr>
<tr>
<td>+50</td>
<td>+122</td>
<td>+95</td>
</tr>
<tr>
<td>+60</td>
<td>+140</td>
<td>+75</td>
</tr>
<tr>
<td>+65</td>
<td>+149</td>
<td>-</td>
</tr>
</tbody>
</table>
## DEVICE DESCRIPTION

### DK37/M8 - H250/M8

**Temperature class** | **Ambient temperature up to** | **Maximum permissible product temperature / maximum value** Type DK37/M8E/.. | **Type DK37/M8M/.. at 64 mW** | **Type DK37/M8M/.. at 169 mW** |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[°C]</td>
<td>[°F]</td>
<td>[°C]</td>
<td>[°F]</td>
<td>[°C]</td>
</tr>
<tr>
<td>T4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+40</td>
<td>+104</td>
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<tr>
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<td>+239 (2)</td>
<td>+135 (1)</td>
</tr>
<tr>
<td>+65</td>
<td>+149</td>
<td>+100 (1)</td>
<td>+212 (2)</td>
<td>+135 (1)</td>
</tr>
<tr>
<td>T3</td>
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<td></td>
</tr>
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<td>+50</td>
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<tr>
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<td>+140</td>
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<td>+239 (2)</td>
<td>+150 (1)</td>
</tr>
<tr>
<td>+65</td>
<td>+149</td>
<td>+100 (1)</td>
<td>+212 (2)</td>
<td>+135 (1)</td>
</tr>
</tbody>
</table>

1. Temperature resistance of the cable ≥ +80°C
2. Temperature resistance of the cable ≥ +176°F

### H250/../M8.G/.. permissible product and ambient temperatures

<table>
<thead>
<tr>
<th>Temperature class</th>
<th><strong>Ambient temperature up to</strong></th>
<th><strong>Maximum permissible product temperature / maximum value</strong> Type H250/../M8EG/..</th>
<th><strong>Type H250/../M8MG/.. at 64 mW</strong></th>
<th><strong>Type H250/../M8MG/.. at 169 mW</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>[°C]</td>
<td>[°F]</td>
<td>[°C]</td>
<td>[°F]</td>
<td>[°C]</td>
</tr>
<tr>
<td>T6</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>+40</td>
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<td>+185</td>
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<tr>
<td>+50</td>
<td>+122</td>
<td>-</td>
<td>-</td>
<td>+85</td>
</tr>
<tr>
<td>+60</td>
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<td>+85</td>
</tr>
<tr>
<td>T5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+40</td>
<td>+104</td>
<td>+100</td>
<td>+212</td>
<td>+100</td>
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</tr>
<tr>
<td>T4</td>
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</tr>
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<td>+104</td>
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<td>+149</td>
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<td>+257 (2)</td>
<td>+135 (1)</td>
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<td>T3</td>
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</tr>
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<td>+40</td>
<td>+104</td>
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<td>+392 (2)</td>
<td>+200</td>
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<td>+365 (2)</td>
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<td>+60</td>
<td>+140</td>
<td>+145 (1)</td>
<td>+293 (2)</td>
<td>+200 (1)</td>
</tr>
<tr>
<td>+65</td>
<td>+149</td>
<td>+125 (1)</td>
<td>+257 (2)</td>
<td>+190 (1)</td>
</tr>
</tbody>
</table>

1. Temperature resistance of the cable ≥ +80°C
2. Temperature resistance of the cable ≥ +176°F
The permitted ambient temperature range is indicated on the nameplate; depending on the device version it is $T_{\text{amb}} = -40...+65^\circ\text{C} / -40...+149^\circ\text{F}$ or $T_{\text{amb}} = -25...+65^\circ\text{C} / -13...+149^\circ\text{F}$.

The minimum product temperature is $-40^\circ\text{C} / -40^\circ\text{F}$.

<table>
<thead>
<tr>
<th>Type</th>
<th>Electrical built-ins</th>
<th>Min. ambient temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>H250/.../M8EG DK37/M8E/...</td>
<td>Signal output 4...20 mA</td>
<td>$-40^\circ\text{C} / -40^\circ\text{F}$</td>
</tr>
<tr>
<td>H250/.../M8MG DK37/M8M/...</td>
<td>SC2-N0</td>
<td>$-25^\circ\text{C} / -13^\circ\text{F}$</td>
</tr>
<tr>
<td>H250/.../M8MG DK37/M8M/...</td>
<td>I7S2002-N SJ2-SN</td>
<td>$-40^\circ\text{C} / -40^\circ\text{F}$</td>
</tr>
</tbody>
</table>

2.8 Surface temperature for equipment category II 2 D

For use in areas with flammable dust it should be noted that the indicated maximum surface temperature of T75 at an ambient temperature of $+65^\circ\text{C} / +149^\circ\text{F}$ and a product temperature of $+75^\circ\text{C} / +167^\circ\text{F}$ is valid without a dust coating.

For higher product temperatures the maximum surface temperature is defined by the product.

2.9 Electrical data

Built-in equipment for the variable area flowmeter may only be connected to separate intrinsically safe circuits with the following maximum values:

<table>
<thead>
<tr>
<th>Maximum values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>DK37/M8E/... or H250/.../M8EG</td>
</tr>
<tr>
<td>DK37/M8M/... or H250/.../M8MG SC2-N0...</td>
</tr>
<tr>
<td>DK37/M8M/... or H250/.../M8MG SJ2-SN</td>
</tr>
<tr>
<td>DK37/M8M/... or H250/.../M8MG I7S2002-N</td>
</tr>
</tbody>
</table>

**WARNING!**

Also, when operating the variable area flowmeter outside of the hazardous area, the connection must be made to an intrinsically safe circuit. When connecting to non-intrinsically safe circuits, there is a risk of damage to the safety-defining components.
3 INSTALLATION

3.1 Mounting

Mounting and setup must be carried out according to the applicable installation standards (e.g. EN 60079-14) by qualified personnel trained in explosion protection. The information given in the manuals and the supplementary instructions must be observed at all times.

Variable area flowmeters must be installed in such a way that
- there is no danger from mechanical impact effects.
- no external forces are affecting the indication unit.
- the device is accessible for any necessary visual inspections and can be viewed from all sides.
- the nameplate is clearly visible.
- it can be operated from a location with secure footing.

CAUTION!
The manufacturer is not liable for any damage resulting from improper use or use other than the intended purpose. This applies in particular to hazards due to insufficient corrosion resistance and suitability of the materials in contact with product.

DANGER!
Components made of titanium in oxygen applications
Variable area flowmeters with titanium components are NOT suitable for use in explosion-protected areas in conjunction with oxygen applications (products with an oxygen content which is significantly above the oxygen content in the earth’s atmosphere)!

3.2 Special conditions

Electrostatics
For painted versions, risks due to electrostatic charge must be minimized. Observe additional information regarding electrostatics. For further information refer to Electrostatic charge on page 18.

Wetted parts made of titanium
When dealing with device versions of the type series H250 with wetted parts made of titanium (Ti option), use the protected installation to prevent sparking due to external impact and friction between titanium and other materials.

Thermal and electrical data
Observe the maximum ambient and product temperatures and electrical data. For further information refer to Ambient temperature / temperature classes / product temperature on page 11 and refer to Surface temperature for equipment category II 2 D on page 13 and refer to Electrical data on page 13.
4.1 General notes

The built-in equipment is connected electrically in the indication unit. The circuits are designed in protection type “intrinsically safe” and galvanically isolated from ground (test voltage $\geq 500 \text{ V}_{\text{eff}}$).

The connecting cables should be selected according to the applicable installation standards (e.g. EN 60079-14) and the maximum operating temperature. Ensure that no residual current can form between separate intrinsically safe signal circuits.

- The connecting cables must be fixed and laid so they are sufficiently protected against damage.
- Not used cores must be securely connected to the earth potential of the hazardous area or carefully insulated against each other and against earth (test voltage $\geq 500 \text{ V}_{\text{eff}}$).
- Lay cables so as to ensure that there is sufficient distance between surfaces of the measuring unit and the connecting cable.
- Supplied blind plugs / cable entries guarantee protection against foreign objects and water (protection category) IP66/67 according to EN 60529.
- The outer diameter of the connecting cable must be within the sealing range of the cable entry (plastic PG 3...7 mm / 0.12...0.28”, metal PG 6...10 mm / 0.24...0.39”).
- Unused cable entries are to be closed (>IP66/67).

Ensure that the gaskets and incised gasket ring are tight.
4 ELECTRICAL CONNECTIONS

Connection diagrams

Figure 4-1: Indicator M8M - M8MG
① Connection Kmin
② Connection Kmax

Figure 4-2: Indicator M8E - M8EG
① Connection signal output 4...20 mA

4.2 Power supply

The variable area flowmeter does not require a separate power supply. The necessary power for the built-in electrical equipment is supplied via the signal circuits.

4.3 Inputs/Outputs

The terminal assignment of the built-in electrical equipment is described in the product documentation. The signal circuits of the variable area flowmeters may only be connected to certified intrinsically safe slave units or circuits. For more information refer to chapter "Electrical data".
4.4 Grounding and equipotential bonding

If the device is not sufficiently electrostatically grounded via the process pipes, an additional ground connection must be established using the ground terminal ①. The position of the ground terminal is illustrated below. The connection only ensures an electrostatic connection of the device and does not comply with the requirements of an equipotential bonding connection.

Figure 4-3: Position of the ground terminal and the mounting screw

For the H250/..../M8.G/.. designs also ensure proper fit of the mounting screws ②.

Any existing cable shields and all cores that are not used must be carefully insulated against each other and against ground (test voltage ≥ 500 V\text{eff}) according to applicable installation regulations (EN 60079-14).
5.1 Start-up

**Start-up is only permitted when the variable area flowmeter:**

- is correctly installed in the system and connected.
- has been checked for the proper state with regard to its installation and connection requirements.
- has been properly sealed in the electronic compartment or there is no explosive atmosphere present.

The user of the system must have it checked before start-up in compliance with the national regulations for checks before startup.

5.2 Operation

Variable area flowmeters must be operated in such a way that they remain within the maximum and minimum permissible temperatures and pressures and the electrical limit values.

Variable area flowmeters may only be operated if the equipment parts necessary for safety are effective in the long run, and are not rendered inoperable during operation.

Adjusting the limit switch and operating the display during operation is permitted. To do so, remove the housing cover. Close the housing cover immediately after the adjustment of the limit switches or the operation of the display.

For more information refer to chapter “Dismantling”.

**WARNING!**

*Ignition risks caused by pressure surges, impact or friction must particularly be avoided when titanium measuring units are used.*

5.3 Electrostatic charge

**INFORMATION!**

*Versions with plastic housing are equipped with an electrostatically conductive plastic.*

In order to avoid ignition hazards due to electrostatic charge, painted versions of the variable area flowmeter DK37 M8. R.... and H250.. M8.. R..Ex may not be used in areas where the following appear:

- processes that generate strong charges,
- mechanical friction and cutting processes,
- spraying of electrons (e.g. in the vicinity of electrostatic painting systems) or
- pneumatically conveyed dust is exposed.

**CAUTION!**

*Electrostatic charging of the housing surface by friction must be avoided. The devices must not be dry cleaned.*
6.1 Maintenance

Maintenance work of a safety-relevant nature within the meaning of explosion protection may only be carried out by the manufacturer, his authorised representative or under the supervision of authorised inspectors.

For systems in hazardous areas, regular tests are required in order to maintain the proper condition.

The following checks are recommended:

- Check the housing, the cable entries and the feed lines for corrosion and/or damage.
- Checking the piping connections and the measuring unit as well as the needle valve, if necessary, for leakage.
- Include the flowmeter in the regular pressure testing of the process line.

The cover is to be closed following maintenance work on the signal converter.

6.2 Dismantling

Replacing the display

Due to the modular design of the variable area flowmeters, from a safety perspective the complete display can be replaced with identical spare parts.

CAUTION!
There may be a loss of measuring accuracy!

Exchanging the entire device

The dismantling and installation is within the responsibility of the operator.

Exchanging and dismantling should take place in a de-energised state, if at all possible. If this is not possible, the basic conditions for intrinsic safety [e.g. no grounding or connection of different intrinsically safe circuits to one another] must be observed during dismantling.

CAUTION!

- Pressurised pipes have to be depressurised before removing the measuring unit.
- In the case of environmentally critical or hazardous products, appropriate safety precautions must be taken with regard to residual liquids in the measuring unit.
- New gaskets have to be used when re-installing the device in the piping.
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