Variable area flowmeters without electrical built-ins

Equipment category II 2 G, II 2 D
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INFORMATION!

These supplementary instructions apply to explosion-protected versions of variable area flowmeters without electrical built-ins:

- DK32, DK34
- DK37/M8M, DK37/M8M/R
- H250/M8MG, H250/M8MG/R
- H250/M9
- H250/M40
- DK46, DK47, DK48, DK800
- GA24
- VA40

In the categories
- II 2 G
- II 2 D

They complete the standard manual for the non-explosion protected versions. The information given in these supplementary instructions contain only the data relevant to explosion protection. The technical details given in the standard manual for the non-explosion protected versions remain unchanged unless they will be excluded or replaced by these instructions. The series of the non-electrical versions of variable area flowmeters listed above have been tested by the manufacturer in accordance with:


The testing documentation has been stored in accordance with item 13, section 1b (ii) of the directive 2014/34/EU (ATEX) at the Physikalisch- Technischen Bundesanstalt (PTB), Braunschweig, Germany under the registration number:

PTB 03 ATEX D127

The devices have identical designs in categories II 2 G and II 2 D.
2.1 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:

\[ T_{\text{atm}} = -20\ldots+60^\circ\text{C} / -4\ldots+140^\circ\text{F} \text{ and } P_{\text{atm}} = 0.8\ldots1.1 \text{ bar} / 11.6\ldots15.9 \text{ psi} \]

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 according to the ATEX directive, 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.

2.2 Equipment category

Variable area flowmeters are designed in category II 2 G / II 2 D for use in zone 1 or zone 2 or zone 21 or zone 22. The inside of the measuring unit is also approved for zone 1.

INFORMATION!
Definition of zone 1 acc. 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 acc. 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.
2.3 Protection types

Non-electrical variable area flowmeters are designed in the protection type "design safety c" in accordance with EN ISO 80079-37.

The marking of the non-electrical versions for the device type is:

<table>
<thead>
<tr>
<th>Device type</th>
<th>Gas range</th>
<th>Dust range</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK32 / DK34 / DK37</td>
<td>II 2G Ex h IIC T6...T3 Gb</td>
<td>II 2D Ex h IIC T150°C Db</td>
</tr>
<tr>
<td>H250/M8M</td>
<td>II 2G Ex h IIC T6...T3 Gb</td>
<td>II 2D Ex h IIC T200°C Db</td>
</tr>
<tr>
<td>DK46 / DK47 / DK48 / DK800 / VA40</td>
<td>II 2G Ex h IIC T6...T5 Gb</td>
<td>II 2D Ex h IIC T100°C Db</td>
</tr>
<tr>
<td>H250/M9 or H250/M40</td>
<td>II 2G Ex h IIC T6...T2 Gb</td>
<td>II 2D Ex h IIC T300°C Db</td>
</tr>
<tr>
<td>GA24</td>
<td>II 2G Ex h IIC T6...T4 Gb</td>
<td>II 2D Ex h IIC T120°C Db</td>
</tr>
</tbody>
</table>

The marking contains the following information:

- II: Explosion protection, group II
- 2: Equipment category 2
- G: Gas explosion protection
- D: Dust ignition protection
- Ex h: Non-electrical device - Protection through design safety
- IIC: Gas group, suitable for gas groups IIC, IIIB and IIA
- IIIC: Dust areas, suitable for groups IIIC, IIIB and IIA
- T6...T2: Temperature class range, suitable for temperature class T6...T1
- T300 °C: Maximum surface temperature of measuring unit
- Gb: EPL, suitable for zone 1 and zone 2
- Db: EPL, suitable for zone 21 and zone 22

2.4 Surface temperature

It is to be assumed that a combustible fuel / air mixture can be in contact with the outer wall of the measuring tube and process connections. Any temperature gradient between the internal wall in contact with the product (product temperature) and the outer surface is not taken into consideration.

The actual maximum surface temperature does not depend on the device itself, but instead on the operating conditions. The device itself does not generate heat and, for this reason, the surface temperature is determined by the product temperature and, in versions with heating jackets, by the heating medium temperature as well.

The nameplate shows the maximum values of the temperature classes and the maximum surface temperature. Depending on the device version, these values may not be reached. The maximum permitted ambient and product temperatures can be found in the standard manual.
2.5 Static electricity

2.5.1 Process dependent charging

In variable area flowmeters, it is possible under field conditions for charge separation to occur in the measuring tube due to the transport of non-conductive fluids and/or when the flow comes into contact with non-conductive built-ins (e.g. liners, floats).

For all metal devices, the measuring tube and the welded on process connections form a shield (Faraday cage) from which the electrical field cannot escape.

In glass devices, it is basically possible for the electrostatic field generated inside the measuring tube to “punch through” to the outside of the device. For that reason, variable area flowmeters need to be permanently grounded by the operator by way of the process connections in order to allow discharge of electrostatic charges.

The operator is also responsible for extending the ground continuity of the process pipeline. If grounding cannot be made via the process connections (plastic process connections or undefined connections), the measuring device should be connected to the described ground potential via the connection to ground. This connection only ensures the electrostatic grounding of the device and does not meet the requirements for equipotential bonding.

**CAUTION!**
Use of the equipment is not permitted in areas where the following occur: processes that generate strong charges, machine grinding and separation processes, electron spraying (e.g. near electrostatic painting systems) or pneumatically conveyed dust.

2.5.2 Charging non-conductive external parts by cleaning

Area limits are taken into consideration with respect to the chargeability of non-conductive external parts under atmospheric conditions. Devices for which it can be expected that combustible electrostatic charging will occur due to cleaning are marked with an adhesive label:

**CAUTION!**
Achtung! Gefahr elektrostatischer Aufladung! Nicht reiben!
Caution! Risk of electrostatic charge! Do not rub!

A cleaning cloth moistened with water, for example, should be use to clean surfaces that could be loaded with a charge.
2.6 Device-specific notes

If the device is not sufficiently electrostatically grounded via the process pipes, an additional ground connection must be established using the grounding screw ①.

**DK32 - DK34**

**DK37/M8M - DK37/M8M/R**

**INFORMATION!**

The indicator housing is made of conductive plastic. Friction cannot cause electrostatic charge.
H250/M9
In hazardous areas, only operate the indicator with a closed cover.

CAUTION!
When using a sight glass made of Polycarbonate, note the label information:

Achtung! Gefahr elektrostatischer Aufladung! Nicht reiben!
Caution! Risk of electrostatic charge! Do not rub!

H250/M40
In hazardous areas, only operate the indicator with a closed cover.

1. Grounding in the indicator
2. Grounding outside

INFORMATION!
Grounding 1 and 2 are equivalent.
When measuring gases or liquids that are not contaminated, risk of combustion due to electrostatic charge is not be expected if the flow rate does not exceed 20 times the nominal flow rate. The max. allowable operating pressure PS printed on the nameplate may not be exceeded!

**INFORMATION!**
The indicator housing is made of conductive plastic. Friction cannot cause electrostatic charge.
When measuring gases or liquids that are not contaminated, risk of combustion due to electrostatic charge is not be expected if the flow rate does not exceed 10 times the nominal flow rate. The max. allowable operating pressure $P_S$ printed on the nameplate may not be exceeded!

**CAUTION!**
The sight glass is made of Polycarbonate. Note the label information.

_Achtung! Gefahr elektrostatischer Aufladung! Nicht reiben! Caution! Risk of electrostatic charge! Do not rub!_
3.1 Safety description code

The description code stated in the standard manual applies.

3.2 Marking

The flowmeters are identified by the following nameplates: [examples are not to scale]

Nameplate DK32 - DK34

Example for DK3x

Nameplate H250/M9 - H250/M40 - DK37/M8M - DK37/M8M/R - H250/M8MG - H250/M8MG/R

Example for H250/M40
Nameplate VA40 - GA24 - DK46 - DK47 - DK48 - DK800

Example for VA40

CAUTION!
The values stated on the nameplates (indicated with xxx) vary according to the individual device versions and can be found on the respective nameplate or standard manual for the device.

- 0035 - identification number of the PED supervisory body
- SN - serial number and/or PA - production order number
- MD - manufacturing date
- PS - max. operating pressure (Pressure Specified)
- PT max. - max. test pressure (Pressure Test max.)
- TS - max. operating temperature (Temperature Specified)
- PED - Pressure Equipment Directive key
- Tag-No. - tag identifier
- Reg.No. - registration number of notified body
- Tamb. - max. ambient temperature
- VG - V number, Germany
- SO - order number
- PA - production order number
- AC - article code
4.1 Mounting

Mounting and setup must be carried out according to the applicable installation standards for hazardous areas by qualified personnel trained in explosion protection.

The information given in the manual and these supplementary instructions must be observed at all times.

Check the nameplate to ensure that the variable area flowmeters are suitable for the field of application. Check that the product is compatible with the wetted parts using the order information.

4.2 Special conditions

Mechanical tests
The flowmeters were subject to a shock test in accordance with EN ISO 80079-36.

- Equipment group - II
- Degree of mechanical risk - low
- Additional marking - X

If the degree of mechanical risk is greater, additional protective measures must be taken.

<table>
<thead>
<tr>
<th>Device</th>
<th>Measuring units, valves, regulators</th>
<th>Impact energy (Joule)</th>
<th>Sight glass, Protective cover, transparent</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK32, DK34</td>
<td>4</td>
<td>not applicable</td>
<td></td>
</tr>
<tr>
<td>DK37/M8M, DK37/M8M/R</td>
<td>4</td>
<td>not applicable</td>
<td></td>
</tr>
<tr>
<td>H250/M8MG, H250/M8MG/R</td>
<td>4</td>
<td>not applicable</td>
<td></td>
</tr>
<tr>
<td>H250/M9</td>
<td>4</td>
<td>not applicable</td>
<td></td>
</tr>
<tr>
<td>H250/M40</td>
<td>4</td>
<td>not applicable</td>
<td></td>
</tr>
<tr>
<td>DK46, DK47, DK48, DK800</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>GA24</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>VA40</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

**INFORMATION!**

Testing is not required for the sight glass for all metal variable area flowmeters. With regard to explosion protection for these devices, the integrity of the sight glass is not important.
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 requirements.
- has been tested to determine the suitability of the materials used for the measuring unit and for the gaskets for adequate resistance to corrosion from the process product.

The operator of the system has to check prior to start-up, if the start-up was in compliance with the national regulations for checks.

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.

When it comes to flammable products, the measuring sections must be included in the periodic pressure tests of the system.

Opening the housing of the electronics compartment (equipment protection by flameproof enclosure or dustproof housing) in hazardous areas is only permitted in a de-energised state.

WARNING!

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

Display
The indication unit requires no maintenance under normal operating conditions and when used for the intended purpose.

Measuring unit
The measuring unit requires no maintenance under normal operating conditions and when used for the intended purpose.

Depending on the application, worst-case operating conditions may lead to reduced measuring performance as a result of fouling of the measuring cone and/or float.

Clean the measuring unit in accordance with the standard manual for non-explosion protected versions.

The measuring unit must be dismantled for cleaning. To do this, follow the instructions for exchanging the entire device.

The following visual checks should be carried out at regular intervals in conjunction with the system inspections required in hazardous areas to keep equipment in good operating condition:

- Inspection of the measuring unit for leakage.
- Include the flowmeter in the regular pressure testing of the process line.

Preventive 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.
6.2 Dismantling

Replacing the indication unit
Due to the modular design of the variable area flowmeters, from a safety perspective the indication can be replaced with identical KROHNE spare parts. In this case, the measuring tube can remain in the pipeline. This also applies for pressurised pipes.

CAUTION!
There may be a loss of measuring accuracy!

Exchanging the entire device
CAUTION!
• Pressurised pipes have to be depressurised before removing the measuring unit.
• Avoid uncontrolled discharge of residual fluid from the measuring unit.
• Where environmentally critical products are concerned, carefully decontaminate the wetted parts of the measuring tube after dismantling.
• The dismantling and installation is within the responsibility of the operator.
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