Family of Variable Area Flowmeter

Flowmeter for measuring the flow rate of liquids and gases

Armored Flowmeter
Small Flowmeter
Glass Tube Flowmeter
### Metering Principle

The variable area metering principle is described in the VDE/VDI Guidelines in the following manner:

"The Variable Area Flowmeter is an instrument for measuring the flow rate of liquids and gases in pipelines. It includes a vertical, upward expanding metering tube through which the fluid to be metered flows from the bottom to the top, and in which a movable float is located. This float rises as the flow rate increases in such a manner that the hydraulic forces are always balanced by the opposing force due to the float weight, which is always constant regardless of the flow rate. The height of the float is a measure of the flow rate. The flow rate value can be read from a scale."

There are three different forces:
- The constant float weight "W"
- The force of buoyance "B"
- The steamforce "F"

Therefore the position of the float is a direct indication of the flow rate:

\[ W = B + F = 0 \]

### Accuracy Classes

The accuracy of the Variable Area Flowmeter is defined by various accuracy classes listed in VDE/VDI Guideline 3513, Sheet 2, where an error range is associated with each accuracy class.

<table>
<thead>
<tr>
<th>Flow Rate in %</th>
<th>Accuracy class 1</th>
<th>1.6</th>
<th>2.5</th>
<th>4</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td>100</td>
<td>1.000</td>
<td>2.500</td>
<td>4.000</td>
<td>6.000</td>
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</tr>
<tr>
<td>90</td>
<td>1.028</td>
<td>2.569</td>
<td>4.111</td>
<td>6.167</td>
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<td>80</td>
<td>1.063</td>
<td>2.656</td>
<td>4.250</td>
<td>6.375</td>
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</tr>
<tr>
<td>70</td>
<td>1.107</td>
<td>2.768</td>
<td>4.429</td>
<td>6.643</td>
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<tr>
<td>60</td>
<td>1.167</td>
<td>2.917</td>
<td>4.667</td>
<td>7.000</td>
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</tr>
<tr>
<td>50</td>
<td>1.250</td>
<td>3.125</td>
<td>5.000</td>
<td>7.500</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>1.375</td>
<td>3.438</td>
<td>5.500</td>
<td>8.250</td>
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</tr>
<tr>
<td>30</td>
<td>1.583</td>
<td>3.958</td>
<td>6.333</td>
<td>9.500</td>
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<tr>
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<td>2.000</td>
<td>5.000</td>
<td>8.000</td>
<td>12.000</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3.250</td>
<td>8.125</td>
<td>13.000</td>
<td>19.500</td>
<td></td>
</tr>
</tbody>
</table>

### Basic Design

In its simplest form a Variable Area Flowmeter consists of the components a float (1), meter tube (2), flow scale (3), flanged or threaded fittings (5) for installation in the pipeline and O-Ring (7) seals. The float travel in the meter tube is limited by the float stops (4) and the meter tube is surrounded by a protective housing (6). When glass meter tubes are used it is preferable to place the scale for reading the flowrates directly on the meter tube itself.

### Advantages of the Variable Area Metering

- Cost effective flow measurement system
- Local indication without external power
- Optical fluid monitoring (for glass VAF)
- Independent of the electrical conductivity
- Metering of the smallest gas and liquid flows
- 4...20 mA output signal, HART®-Communication
- Metering of minor gas or liquid flow rates
- High reproducibility

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A proven method – briefly shown
**Armored Flowmeter**

**Series AM54_7**

Rugged Armored Flowmeter with metal metering tube for metering liquids and gases, especially aggressive, cloudy and opaque fluids.

**Designs**

<table>
<thead>
<tr>
<th>Design</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM54_71</td>
<td>Indicator</td>
</tr>
<tr>
<td>AM54_72/73</td>
<td>Indicator with single alarm</td>
</tr>
<tr>
<td>AM54_74</td>
<td>Indicator with double alarm</td>
</tr>
</tbody>
</table>

**Armored Flowmeter**

**Series AM54_31/32**

2-Wire Converter 4…20 mA

**Designs**

<table>
<thead>
<tr>
<th>Design</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM54_31</td>
<td>2-Wire µP converter, 4…20 mA current output, pulse output, HART®-Protocol, without display</td>
</tr>
<tr>
<td>AM54_32</td>
<td>2-Wire µP converter, 4…20 mA current output, pulse output, HART®-Protocol, with display</td>
</tr>
</tbody>
</table>

**Technical Data**

**Flow Ranges**

- **Water**
  - Min. 3 to 30 l/h
  - Max. 12 to 120 m³/h
- **Air**
  - Min. 0.10 to 1.0 m³/h
  - Max. 360 to 3600 m³/h

Flow ranges can be changed utilizing multi-function floats DN 25 to DN 100

**Materials**

- Metering tube: Stn. stl.
- Float: Stn. stl., Hastelloy C, PTFE
- Flanges: Stn. stl.

**NACE MR0175**

- Max. allow. pressure: PN 40 standard, PN 64/100
- Max. allow. temperature: 400 °C standard

**Accuracy class**: 1.6 per VDE/VDI 3513

**EEEx-Design**

- **TÜV 00 ATEX 1576**
  - II 1/2G Ex c ib IIC T6
  - II 3G Ex nA [L] IIC T6
  - II 2D T85 °C...Tmed IP67
- **TÜV 00 ATEX 1636 X**
  - II 1/2G Ex c d IIC T6
  - II 1/2G Ex ib d IIC T6
  - II 3G Ex nA [L] IIC T6
  - II 2D T85 °C...Tmed IP67

Additional information see data sheet D1840321302
Armored Purgemeter
Small All Metal Flowmeter
Series 10A3220

The Armored Purgemeter offers possibilities for metering small gas and liquid flows. This meter is especially suited for meter applications with cloudy, opaque or aggressive fluids in chemical and pharmaceutical industries, gas analysis systems, processes, spring construction and wherever glass tubes cannot be utilized due to safety considerations.

**Designs**
- 10A3220: Horizontal, female threaded connections, needle valve in or outlet
- 10A3225: Vertical, female threaded connections
- 10A3250/55: 4…20mA current output (not to be used in hazardous areas)
- 10A3220/25: Alarms, max, min, max & min

**Technical Data**

**Flow Ranges**
- **Water**: Min. 0.25 to 2.5 l/h, Max. 80 to 800 l/h
- **Air**: Min. 9 to 90 l/h, Max. 2.4 to 24 m³/h (Qn)

**Materials**
- **Fluid wetted parts**: Stainless steel 1.4571/PVDF
- **Non-fluid wetted parts**: Polycarbonate/stainless steel frame with glass window
- **Base plate**: Anodized aluminum
- **O-Rings**: Viton-A

**Connections**
- **1/4…1” NPT**

**Accuracy Class**
- 6 (per VDE/VDI 3513)

**Max. Allow. Pressure**
- 100 bar (vertical installation)
- 40 bar with needle valve

**Ex-Design**
- **TÜV 03 ATEX 2151**
  - II 1/2G c T6
  - II 2D T115 °C or
  - II 1/2G EEx c ia IIC T6
  - II 2D T115 °C

Additional information see data sheet D1845042U01

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Purgemeter with Differential Pressure Regulator
Type 53R–2110

The differential pressure regulator is combined with the Purgemeters of the Series 10A6130 and 10A3220. It provides the means, in conjunction with a needle valve, to maintain a set flow rate constant even though the upstream pressure varies.

**Designs**
- 53RB2110: Brass construction
- 53RT2110: Stainless steel construction

**Technical Data**

**Flow Ranges**
- **Water**: Max. 75 l/h
- **Air**: Max. 2 m³/h

**Req’d upstream press.**
- ≥ 0.3 bar

**Max. allow. diff. press.**
- 7 bar

**Max. allow. oper. press.**
- 14 bar

**Max. allow. Operating temperature**
- 150 °C
- 120 °C

**Installation**
- Pipeline or wall mounting
- On- or in panel mounting
Glass Tube Flowmeter

FAG 1190 Series – Measuring even aggressive fluids

- Customer-specific flow units
- Alarm generator
- Safety protection tube
- Stainless steel housing
- Various connections

Glass tube variable area flowmeters are best suited for flow measurement in many industrial fields, e.g. apparatus engineering, food and beverages industry, water treatment, or chemical industry. They can even be adapted to aggressive fluids by combining various materials for the process-wetted parts.

Advantages
- Polycarbonate tube for gas measurement
- Stainless steel housing as a standard
- Easy tube disassembly through O-ring seals
- Tube and float can be replaced independently of each other

Technical features
- Robust stainless steel housing (standard)
- Customized tube scale
- Visual fluid control
- Maximum of two configurable alarm generators
- Identical device design, but individual standardized process connections
- II 3 G T6 or II 3 D T85 °C…Tmed
  EEx n A IIC T6 (alarm only)

Connection variants
- Female thread
- Flange connection
- Gasket variants conforming with FDA

FAG 6100 Series – Customized and easy to service

- Measuring, dosing, bubbling and monitoring
- Needle valves in the inlet or outlet
- Differential pressure regulator for constant fluid flow
- Flow range for air: 4.8 - 72000 cm³/min.
- Flow range for water: 0.05 - 3200 cm³/min
- Alarm generator

SNAP-IN purgemeters are designed for dosing and measuring very small gas and liquid flows. They are best suited to be used as bubbling instruments for level or density measurement and for rinsing differential pressure lines in the lab or in apparatus engineering.

Special features
- Compact, space saving assembly
- Alarm contacts
- Needle valve
- Differential pressure regulator
- Robust design
- II 2GD c 135 °C (without alarm)
  II 2G c 135 °C (with alarm)

Alarm contacts are essential components for flow-dependent process monitoring.

The built-in needle valve allows you to adjust and regulate the flow. A differential pressure regulator attached to the assembly together with the needle valve holds the flow rate at a constant value, independently of pressure variations. In the case of gas measurement the flow in standard volume flow units is held at a constant value, even with the pre-pressure changing.