Bopp & Reuther
Messtechnik GmbH

Compact orifice Oriflow

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Contents

Operation of the Oriflow compact orifice is based on the measurement of differential pressure and is used in industrial systems. This measuring system is wellproven and most reliable when in need of a continuous flow measurement system for liquids, gases and vapours in closed pipe systems. Orifices have been standardised both nationally and internationally. Before entering into production, the calculations for the orifices and their designs are based on these standards.

The modern concept of this product concedes the use of all common differential pressure transmitters (connection type Coplanar or according to DIN/EN 61518).

Oriflow, the modern compact orifice

solves your flow measurement task in a most economical way

- Volume or mass flow measurements
- Integrated counter
- Modular design concept
- High reproducibility
- No moving parts
- Extremely rugged and stable
- Suited also for extreme applications
- Dry calibration is possible (with reference to ISO 5167)
- Easy to install without pulse piping
- Simple change of measurement range

Applications

The measurement of flows is, in industry, one of the most demanding and complex tasks. Even today there does not exist a universal measuring instrument for all applications. Here both manufacturers and the users face the task selecting the right method of measurement for each application. Owing to their simplicity and reliability, flow meters operating according to the differential pressure method are rated highly. The compact design of the Oriflow series results in considerable cost savings in the areas of fitting and maintenance. The Oriflow compact orifice is used in many branches of industry for the purpose of measuring the flow of liquids, gases and vapours.

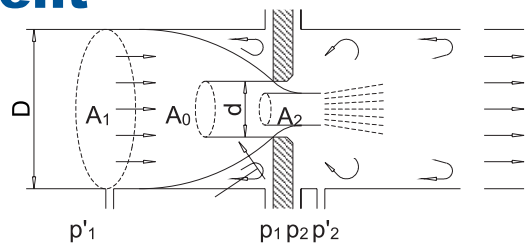
⇒Use at locations where other principles of measurement fail or redundant use in series to instruments which are based on other principles (for example orifice and vortex meter or orifice and turbine)
⇒Use at locations which are exposed to considerable vibrations
⇒Flow measurement (volume/mass) for balancing (for example, steam measurements, heat carriers, chemical products ...)
⇒Process control

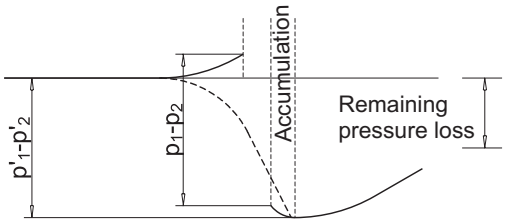
Principle of measurement

The principle of measuring the differential pressure is based on the fact that a differential pressure is created across that section of a pipe where its cross section is reduced. This is then taken as a measure for the flow. For the differential pressure produced (differential pressure Δp at the point where the pressure is read) and the flow q, the flowing equation applies:

$$q = k \cdot \sqrt{\Delta p}$$

This principle of measurement is so popular because related terms, definitions and equipment characteristics have been laid down by way of standards already at a very early stage. The agreement between theoretical calculations and measured values has been proven through comprehensive experiments. This has been the basis for wide-spread acceptance throughout the industry. Today, about 50% of all flow meters rely on the principle of measuring the differential pressure.





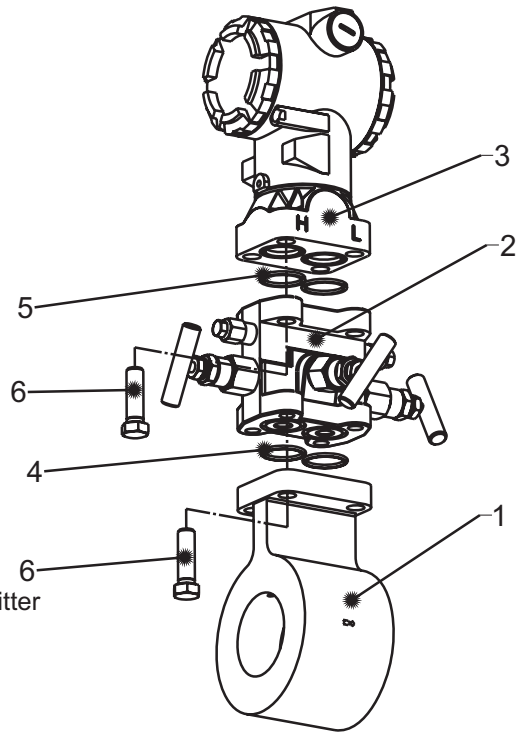
Pressure level
in the middle of the pipe (dashed)
at the wall of the pipe (solid)

Design

Generally the Oriflow compact orifice will be composed of three principal components:

- a differential pressure sensor with throttle,
- a valve manifold (optional) and
- a differential pressure transmitter

The geometrical arrangement is calculated and optimised individually for each application. For nominal widths from 6 to 150 mm the differential pressure sensor consists of one part as standard; those for greater nominal widths are also manufactured as one or two part units.
A differential pressure transmitter is mounted to the differential pressure sensor.
As a recommended option, a valve manifold may be fitted for testing, venting and shutting off. In the case of measurements involving water vapour, a bend for the purpose of forming condensate is integrated between differential pressure sensor and differential pressure transmitter.



1	Differential pressure sensor
2	Valve manifold
3	Differential pressure transmitter
4+5	Gaskets
6	Bolts

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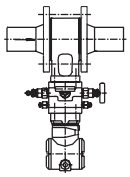
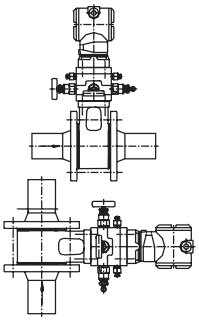
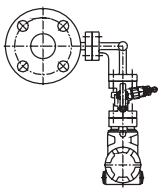
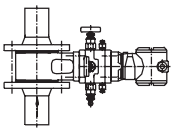
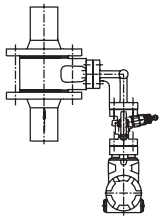
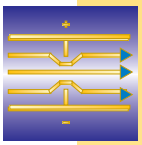
Fitting position

In general, the following needs to be observed:

- sufficiently long inlet and outlet
- avoidance of sudden changes in diameter
- centering so as to avoid offsets
- no projecting welded seams
- direction of flow (also correct fitting of the orifice)
- correct gaskets which do not extend into the measurement chamber

Recommended fitting positions for:

	liquid media	gaseous media	steam
horizontal pipe			
vertical pipe			

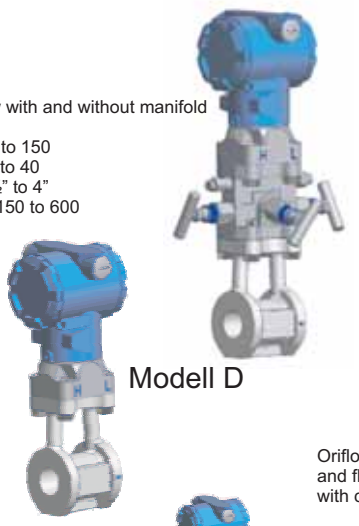


Variants of the compact orifice Oriflow

The compact orifice works according the differential pressure measurement principle.
Diameter ratio 0,1 bis 0,75
Connection: 2-wire HART®-Communication

Oriflow with and without manifold

DN 15 to 150
PN 10 to 40
NPS ½" to 4"
Class 150 to 600



Modell D

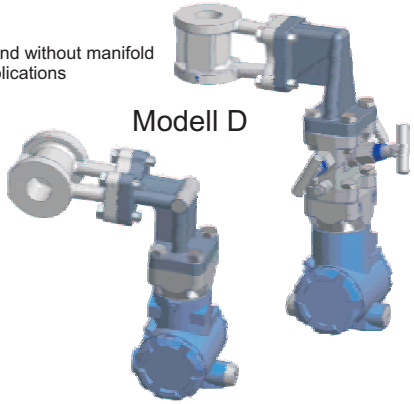
Oriflow with flanges
and temperature extension
for high temperatures up to 400°C

DN 15 to 500
PN 10 to 40

Modell U

Oriflow with and without manifold
for steam applications

DN 15 to 150
PN 10 to 40



Modell D

Oriflow for large nominal width

DN 200 to 1000
NPS 5" to 24"
Class 150 to 600
length 40mm

Modell D

Oriflow with flanges

DN 15 to 500
PN 10 to 40

Modell T

Oriflow for small nominal width
and flow rates
with changeable orifice

Modell G

Oriflow for large nominal width and
redundant measurements

DN 200 to 1000
length 40mm

Modell D Triple

Oriflow with 2 transmitters
for redundant measurements, for forward
and backward measurement, and for
measurements of small and large amounts
in the processs

DN 15 to 200
PN 10 to 160

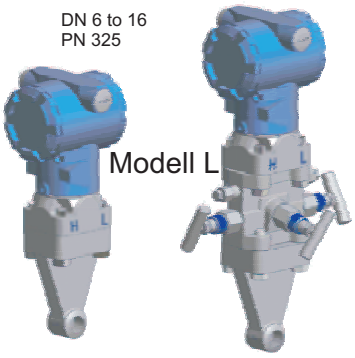
Modell D Double

Oriflow mit temperature measurement
and pressure measurement

Transmitter 3095 MV
with
absolut pressure,
differential pressure,
gauge pressure
and temperature input
for mass flow measurement

Oriflow for high pressure applications

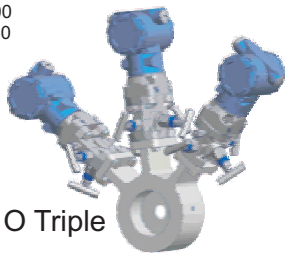
DN 6 to 16
PN 325



Modell L

Oriflow mit 3 transmitters
for redundant measurements in the process

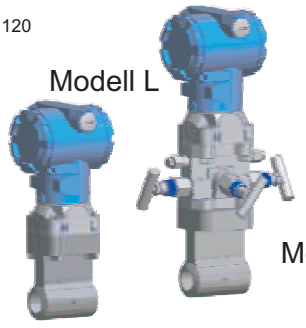
DN 15 to 200
PN 10 to 160



Modell O Triple

Oriflow for high pressure applications

DN 24 to 120
PN 325



Modell L

Oriflow for high pressure applications
with redundant measurements

DN 6 to 120
PN 325

Modell M Double

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Specifications

Measurement range	1 - 150000 m³/h gas/vapour 0,2 - 9000 m³/h for liquids
Output	4-20 mA, HART (Profibus, Field Bus upon request)
Deviation of the measurements	± 0,8 % of meas. value for dry calibration (>= DN 50) ± 0,6 % of meas. value for wet calibration
Conditions of usage	as to the conditions of usage the guidelines of ISO 5167 must be taken in to account
Fitting position	horizontal or vertical
Ambient temperature limits	- 40 °C bis + 70 °C
Stocking temperature	- 40 °C bis + 85 °C
Humidity	0-100% rel. humidity of the air
System of protection	IP 65
Temperature limits for the material measured	- 40 °C bis + 400 °C (depending on model)
Inlet and outlet	acc. to ISO 5167
State of aggregate of the medium	for liquid, gaseous and vapour phase media
Viscosity	max. approx. 30 mPas (higher viscosities upon request)
Pressure loss	remaining pressure loss is calculated for each orifice (typical max. 150mbar)
Weight	Differential pressure sensor: DN 10 1,8 kg … DN 200 16 kg Valve manifold: 2,1 kg Differential pressure transmitter: 2,3 kg
Material	Pressure sensor: 1.4571, 1.4404, 1.4408, 1.4409, PVDF (Hastelloy and others upon request)
Process connection	DN 10 - 150 (bis DN 1000 upon request, other connections like ANSI can be specified) PN 40 (up to PN 325 upon request)
Electrical connection	Power supply 24 VDC, 2 - two-wire system M20x1,5, ½ -14 NPT, PG 13,5
Display	five digit LC display
Certificates and approvals	CE conformity Ex approvals in accordance with ATEX / FM / CENELEC / JIS / CSA / SAA

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Orifice profile

Project	TAG – Nr.
Company	Country
Name	Tel.
Dept.	Fax
Post code, city	Date

Medium ☐ Liquid ☐ Gas ☐ Vapour

Designation

Only required for gases

Isentropic exponent | compressibility factor

Relative humidity % r.F.

Operating conditions

Volume flow	Min.		Max.		m³/h
Mass flow	Min.		Max.		kg/h
Pressure	Operation		Max.		☐ bar ☐ mbar ☐ abs. ☐ rel.
Temperature	Operation		Max.		°C
Density	Operation		Std.		kg/m³
Viscosity			mPas		

Piping

Nominal widths		Material	
Max. Length	mm	factory standards	
Pipe I.D.	mm	wall thickness	

Pipe orientation ☐ Horizontal ☐ Vertical

Output

Output signal ☐ EExe ☐ EExi ☐ EExd IP ☐

☐ 4..20 mA ☐ HART ☐ Profibus ☐ Field Bus

Optimisation criteria

☐ Maximum dynamics (small diameter ratio ß)

☐ Lowest remaining pressure loss (large diameter ratio ß)

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