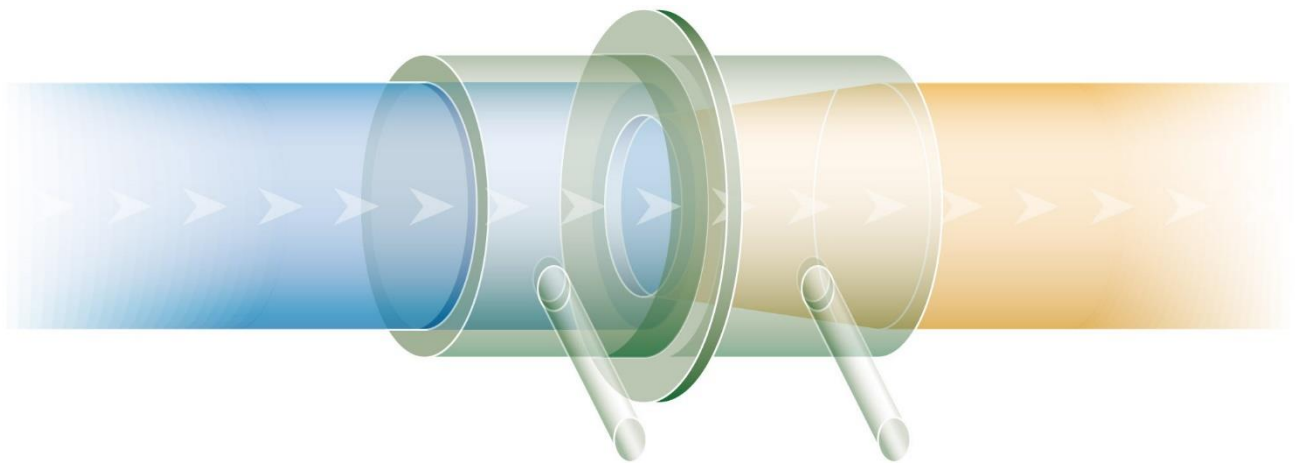


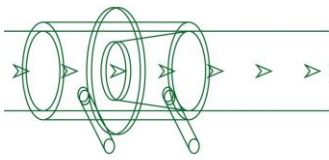
# Installation & Operating Instructions

for

## Differential Pressure Flowelements

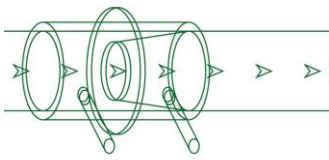
acc. to ISO 5167





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## 1. Safety Notes

### 1.1 Intended Use

Differential pressure flow elements serve measurement of the volume or mass flow rate of gases, liquids and steam. The operating safety may be revoked for improper or other than intended use. The manufacturer is not liable for resulting damage.

The chemical material compatibility towards the medium must be reviewed by the orderer and is subject to his responsibility.

### 1.2 Assembly, Commissioning, Operation

Differential pressure flow elements are built operationally safe according to the state of the art, and consider the relevant provisions and EC directives. However, if they are used improperly or other than intended, they may cause application-related dangers, e.g. product overflow from incorrect assembly or setting. Therefore, assembly, commissioning, operation and maintenance of the measuring device is only permitted by trained specialists that were authorised by the plant operator. The specialists must have read and understood these operating instructions and observe the instructions. Changes and repairs of the device must only be performed when this is expressly permitted in the operating instructions.

## 2. Identification

### 2.1 Marking

Generally you can find the following identification on the instrument: Tag-number

- Measuring point number
- Pipe inner diameter "D"
- Throttle opening diameter "d"
- Nominal pressure of DP-flow element "PN"
- Material of DP-flow element / Material of throttle opening
- Flow direction by means of an arrow

Additionally customer relevant data and heat-number for material tracing and tag-numbers according to "DGLR" may be added.

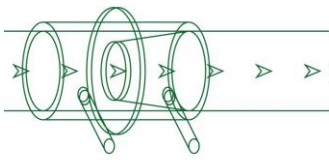
### 2.2 Certificates and Approvals

#### 2.2.1 CE-Mark, Declaration of Conformity

The device has been built operationally safe according to the state of the art and has left the factory in safety-technically impeccable condition. The device considers the relevant standards and provisions that are listed in the EC declaration of conformity and thus meets the statutory requirements of the EC directives. Dosch Messapparate GmbH confirms successful inspection of the device with application of the CE mark.

If a pressure test in the manufacture's plant is not possible in exceptions, e.g. for technical or economic reasons, it must be performed at the construction site, with the differential pressure flow element installed. For the test pressure height, see the technical documentation.

The differential pressure flow element is delivered without CE mark in this case. The CE mark sign is only sent to the orderer after documentation of a successful pressure test. He is responsible for correct and secure application of the sign.



## 2.2.2 European Pressure Equipment Directive (DGRL)

Differential pressure flowelements are classified according to the European Pressure Equipment Directive 97/23/EC (DGRL) resp. DGRL 2014/68/EC depending on the rated width, medium, pressure and temperature:

- **Section 3.3 resp. 4.3** : no CE marking
- **Category I** : CE mark without ID number of the designated office for QS-monitoring
- **Category II/III/IV** : CE mark with ID-number of the designated office for QS-monitoring

Measuring flanges are produced according to relevant standards pursuant to DGRL.

Plug-on covers are subject to Section 3.3 resp. 4.3 and therefore do not bear any CE-mark.

## 3 Assembly

### 3.1 Goods Receipt, Transport, Storage

Differential pressure flowelements have to be handled with care to prevent damage. Especially flange finish and painting have to be protected against scratching.

#### 3.1.1 Goods Receipt

Check if packaging or content are damaged.

Check the delivered goods for completeness and compare the scope of delivery to your order.

#### 3.1.2 Transport to the Measuring Point

The measuring device must only be lifted by the intended transport devices for transport; no tapping sockets and fittings are intended for lifting the devices.

#### 3.1.3 Storage

The measuring device must be packed impact-proof for storage and transport. The original packaging offers best protection for this. It can be stored outside, but should be in a roofed-over area.

### 3.2 Size/Dimensions

See technical documentation

### 3.3 Installation Position for Measurement in Liquids

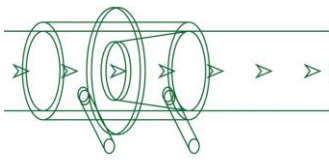
For flow rate measurement in liquids, the differential pressure transmitter (not always included in the delivery) should be installed below the pipe at all times. All differential pressure lines must be placed with a rise of at least 1:15 to the process from the differential pressure transmitter. This ensures that air inclusions in the pipe will rise and not falsify the measurement.

For measurements with solids shares, such as contaminated liquids, installation of separators and discharge valves is sensible to catch and remove deposits.

For flow measurement at vertical pipes, an assembly position should be chosen at which the flow is upwards. This avoids partial filling of the pipe during the measurement.

### 3.4 Installation Position for Measurement in Gases

For flow rate measurement in gases, the differential pressure transmitter (not always included in the delivery) should be installed above the pipe at all times. Any condensation that arises then flows back into the process line. All differential pressure lines must be placed with a drop of at least 1:15 to the



process from the differential pressure transmitter. This ensures that condensation in the pipe will flow off and not falsify the measurement.

When measuring moist gases, it is sensible to install condensate separators and discharge valves to collect and drain the condensation.

### 3.5 Installation Position for Measurement in Steam

For flow rate measurement in steam, use two condensation vessels. They must be at the same height. The differential pressure transmitter (not always included in the delivery) should be installed below the pipe. The lines between the differential pressure transmitter and condensate vessels must be completely filled with water on either side (water seal).

A 5-fold valve block permits simple piping and can be used instead of the Tees and the additional condensate drain valves.

The differential pressure lines must be placed with a rise of 1:15 to ensure reliable rising of air inclusions into the water seal of the differential pressure transmitter.

We also recommend using flange pairs, or rather, welded connections, in the steam area. Ermeto piping can be used behind the shutoff valve.

When measuring steam, it is sensible to install separators and blow-off or discharge valves to collect and remove any contamination.

For more information on the socket position and placement, see DIN 19205 or DIN19216 or ISO 2186.

#### **Note!**

In cases above mentioned recommended applications are not possible, see chapter 6 for further applications.

### 3.6 General Installation Conditions

#### 3.6.1 In- and Outlet Routes

To warrant an even flow profile, the differential pressure flowelement must be applied at a sufficient distance from the pipe bends or pipe bottlenecks. The required supply routes for different installation interferences can be taken from ISO 5167.

The requirements from ISO 5167 to the pipes must be met (weld seams, roughness, etc.).

#### 3.6.2 Homogeneity

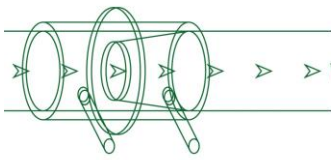
The fluid must be homogeneous. There must not be any change of the physical condition (liquid/gas/steam) and the process line and differential pressure lines must always be filled completely.

### 3.7 Installation Notes

#### 3.7.1 General Notes

The differential pressure flowelement is calculated for specific pipe lines and operating data. Check before installation if the data from the calculation according to ISO 5167 matches the actual operating data.

Before installation, check that the required supply and discharge routes are complied with.



Observe the required installation position:

- For liquids (see item 3.3)
- For gases (see item 3.4)
- For steam (see item 3.5)

Any included shutoff valves are mounted to the tapping nozzles of the differential pressure flowelement or (for steam) to the condensation vessels.

The differential pressure lines must be placed with a drop of at least 1:15.

- With steam and liquids, a pressure release has to be provided at the highest point.
- With gas, a drainage has to be provided at the lowest point.

The differential pressure circuits (+) respectively (-) must be led into the corresponding inlets (screws) of the valve block.

Measuring flanges/covers with pre-welding flanges/measuring routes with flange-connected blinds are usually only delivered pre-installed. The screws/bolts must be finally tightened with the corresponding correct tightening torques. Pre-installed devices are marked accordingly (packing slip).

This does not include devices that have been subjected to a pressure test in the factory.

Observe that the differential pressure flowelements must be transported with appropriate lifting gear to avoid any damage.

### 3.7.2 Installation of Differential pressure flowelement for Flange Connection (Sandwich or with End Flanges)

Observe alignment of the differential pressure flowelements:

- The inflow side is marked by "+" on the fitting ring.
- The installation of the differential pressure flowelement between flanges has to be done with two seals which are adapted to pressure, temperature and media. The seals must not protrude into the pipe.

#### **Attention!**

Before installation, make sure that the opposing flanges are arranged plane parallel to one another.

#### 3.7.2.1 Differential pressure flowelement with End Flanges

The seals must not protrude into the pipe.

At horizontal assembly, the lower flange screws are installed loosely first, then the seal is inserted from above. The last screws can be mounted and lightly tightened. Place the differential pressure flowelement centred. Finally, tighten the screw bolts. Torques are determined by the type of screws and the seal. Information on this is available from the seal or screw manufacturer.

#### 3.7.2.2 Differential pressure flowelements in Sandwich-Build

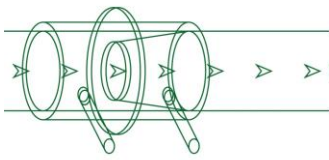
Neither seals nor the fitting ring must protrude into the pipe line.

Therefore, the inner diameter of the fitting rings is designed a little larger for sandwich versions according to DIN 19205.

Fitting rings with even sealing surface are centred by the flange screws.

At horizontal assembly, the lower flange screws are installed loosely first, then the fitting ring and seals are inserted from above. The remaining screws are installed and slightly tightened.





Place the fitting ring centrally (may be measured from the outer flange diameter).

Finally, tighten the screw bolts. Torques are determined by the type of screws and the seal. Information on this is available from the seal or screw manufacturer.

### 3.7.2.3 Measuring Routes:

Observe alignment of the cover:

The longer pipe piece (inlet) must be on the inflow side.

The measuring route is installed into the process pipe with the end flanges.

### 3.7.2.4 Plug-in Covers:

#### 3.7.2.4.1 Flange Removal

The device is delivered with measuring flanges. The device may have to be disassembled for welding in the flanges. Welding in and inspecting the flange weld must be performed according to the state of the art and under consideration of the applicable welding provisions.

The removal flanges must correspond to DIN19214 or ANSI16.36.

#### 3.7.2.4.2 D-D/2-Tapping

The following conditions must be met for D-D/2-tapping:

- Distance between cover disc and "+"-tapping:  $0.9 D \dots 1.1 D$
- Distance between cover disc and "-"-tapping:
  - $0.48D \dots 0.52D$  for  $\beta < 0.6$
  - $0.49D \dots 0.51D$  for  $\beta > 0.6$

Both distances are measured from the front of the cover disc (the "+"-side).

The centre line of pressure tapping must intersect the centre of the pipe axis under an angle of  $90^\circ$  if possible, but in any case be within  $3^\circ$  to the perpendicular line.

The diameter of the pressure tapping bores must be less than  $0.13D$  and less than 13 mm.

### 3.7.3 Installation of Differential pressure flowelement for Welding-In

Welding in and inspection of the weld of the differential pressure flowelement is, according to the state-of-the-art, under observation of the applicable welding provisions.

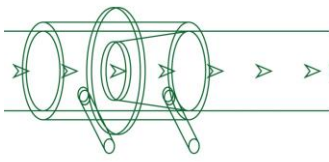
Any required pressure tests must be performed after any required heat treatment and inspection of the weld seams.

The requirements from ISO 5167 to the pipes must be met (weld seams, roughness, etc.).

### 3.8 Installation Inspection

Perform the following inspections before/during/after installation of the measuring device:

- Is the producer damaged (visual inspection)?
- Do process temperature/pressure, ambient temperature, measuring range, etc. correspond to the specifications of the measuring device?
- Does the specification of the flow direction on the differential pressure flowelement correspond to the actual flow direction?



- Are measuring point number and label correct (visual inspection)?
- Was the correct installation position chosen for the measuring feeder, according to measuring feeder type?
- Application and measured medium properties, specifically measured medium temperature?
- Are all screws tightened firmly?

## 4 Operation and Commissioning

### 4.1 Use of Accessories

#### 4.1.1 Condensate Vessels (for Steam Applications)

(if included – scope of supply)

##### **Use**

Use of condensate vessels is recommended for gaseous media that turn liquid when cooling off in the differential pressure lines. This is mainly the case for steam; depending on pressure and temperature, however, it may also happen in other media (e.g. alcohols).

##### **Function Installation and Commissioning**

During installation, observe that the two condensate vessels are at the same height; otherwise, zero reconciliation is difficult.

The condensate vessels, including the differential pressure lines to the differential pressure transmitter, must be filled with water before commissioning the measurement. They may be filled in different manners:

Through fill sockets at the condensate vessels (if present)

Through the condensate drain valves or vent of the differential pressure transmitter

For this, the differential pressure lines must be connected to the water supply, e.g. by a hose screw connection.

After commissioning of the steam line, wait until the differential pressure lines and condensate vessels have filled with condensation on their own. All valves at the valve block must be closed for this.

##### **Attention!**

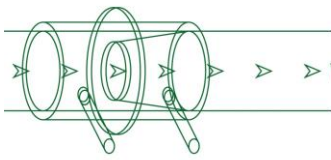
Overheating of the differential pressure transmitter must be avoided. Depending on steam temperature, the temperature at the valve block must be monitored. Close the shutoff valves in the differential pressure lines when there is any danger of overheating.

The condensate vessels ensure that the differential pressure lines are always filled with water and that no hot steam can reach the diaphragm of the differential pressure transmitter. Condensing steam ensures that the water column is retained. Excess condensation flows back and evaporates again. Using condensate vessels in steam applications considerably reduces fluctuations of the water column. The evened measuring signal and increased zero stability warrant even measuring accuracy. The water column transfers the effective pressure DP to the transmitter.

##### **Note!**

In any case, wait for a stable condition to be reached after filling and commissioning of the steel supply, before setting the zero point.





#### 4.1.2 Shutoff Valves

(if included – scope of supply)

##### Use

Shutoff valves are used for initial shutoff of the measuring point. For high-pressure and high-temperature applications double initial shutoff may be recommended or prescribed depending on state regulation.

##### Function

Initial shutoff serves separation of the measuring system from the measuring line close to the process in case of a leak or maintenance work at the differential pressure lines.

##### Installation and Commissioning

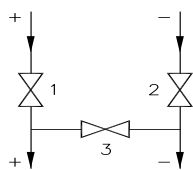
After completion of installation, the shutoff valves must be closed. In the scope of commissioning, first carefully open the shutoff valves and check the entire measuring system for leaks.

#### 4.1.3 Valve Block

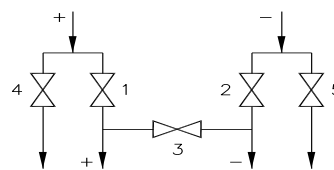
(if included – scope of supply)

##### Versions

3-fold valve block  
(chart)



5-fold valve block  
(chart)



Valve	Use
1 and 2	Separation of the differential pressure transmitter from the process
3	Pressure balancing valve (zero setting of the differential pressure transmitter)
4, 5	Venting (for liquids and steam) <ul style="list-style-type: none"> <li>• Drainage (for gases)</li> <li>• Complete emptying of the differential pressure lines (e.g. for maintenance work)</li> </ul>

##### Use

The valve block separates the differential pressure transmitter from the process or is used for regular zero setting of the differential pressure transmitter.

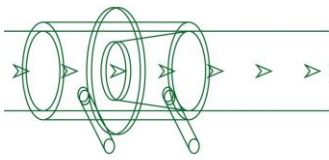
##### Function

If the differential pressure transmitter must be removed from the measuring point (e.g. for replacement or repair) closing of all three valves permits separating the transmitter completely from the process and removing it.

##### Commissioning

In the scope of commissioning, a zero point adjustment of the differential pressure flowelement must be provided for in all cases. At initial commissioning, all valves should be closed when starting up the process. Then the valves of the plus and minus sides must be opened carefully. The balancing valve remains closed.

Then ensure that effective pressure links, valve block and transmitter are completely vented (for liquids and steam) or drained (for gas).



### Zero Point Adjustment

For zero point adjustment, first close the valve of the minus side and then open the balancing valve so that both the minus and the plus sides of the transmitter are subject to the same static pressure. In this condition, the zero reconciliation of the differential pressure transmitter can be performed (see transmitter's operating instructions). After zero point adjustment, the measuring system is commissioned again in reverse order. Zero point setting should be inspected or corrected at regular intervals. The measuring system should also be inspected for complete venting or drainage at regular intervals.

### Venting/Drainage

For 5-fold valve blocks, the additional valves are used for venting or drainage or complete emptying of the differential pressure lines, e.g. for maintenance work. For steam applications, the valves are used to blow off the differential pressure lines.

#### Note!

Complete venting/drainage of the differential pressure transmitter is always performed using the corresponding devices at the side of the transmitter flanges that is across from the valve block.

#### Attention!

If all three valves at the valve block are opened concurrently, the present differential pressure permits a medium flow through the valve block. This can lead to overheating of the valve block and the differential pressure transmitter in hot media. Therefore, concurrent opening of all three valves must be avoided in operation.

## 5 Maintenance and Repair

### 5.1 Maintenance

Perform the following maintenance work at regular intervals:

- Check the zero setting
- For moist gas: Drain the condensation
- For contaminated media: Drain the sediment
- For abrasive media: Check the differential pressure flowelement for wear
- If deposits form: Check and clean the differential pressure flowelement, replace seals

#### Note!

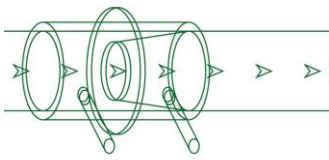
Differential pressure transducers do not require any other maintenance works if used in a workmanlike way. When having standard revisions of the material it is recommended to examine the differential pressure transducer intensively to ensure the functionality (material / edge sharpness, traces of tool wear).

For multi-part ring chamber covers:

To remove the cover disc, the measuring device must be removed from the measuring line completely and the lateral connection tabs must be opened.

For plug-in covers:

To remove the cover disc, the flanges according to ANSI can be carefully pushed apart with the ejector screw.



**Attention!**

Required maintenance works must be carried out with consideration of corresponding field and/or trained staff. Security advises of these departments and the staff have definitely taken into account (checking pressure/temperature / Valves have to be closed).

**Attention!**

For any required maintenance work (e.g. replacement of the transmitter or valve block) under process conditions, observe that all valves are closed so that there is no danger from escaping medium. If required, check the temperature before disassembly and determine freeness from pressure.

## 5.2 Outside Cleaning

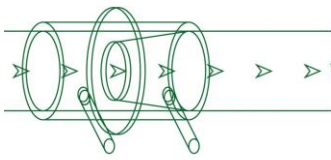
When cleaning the outside, observe that the cleaning agent used does not attack the housing surface and seals.

## 5.3 Replacement of Seals

Measuring media contracting seams usually do not need to be replaced. Replacement is only required in special cases, e.g. when aggressive or corrosive measuring media are not compatible with the sealing material.

## 5.4 Spare Parts

Spare parts generally are not required for the differential pressure flowelement.



**6. Basic arrangement of differential pressure devices acc. ISO 5167**

