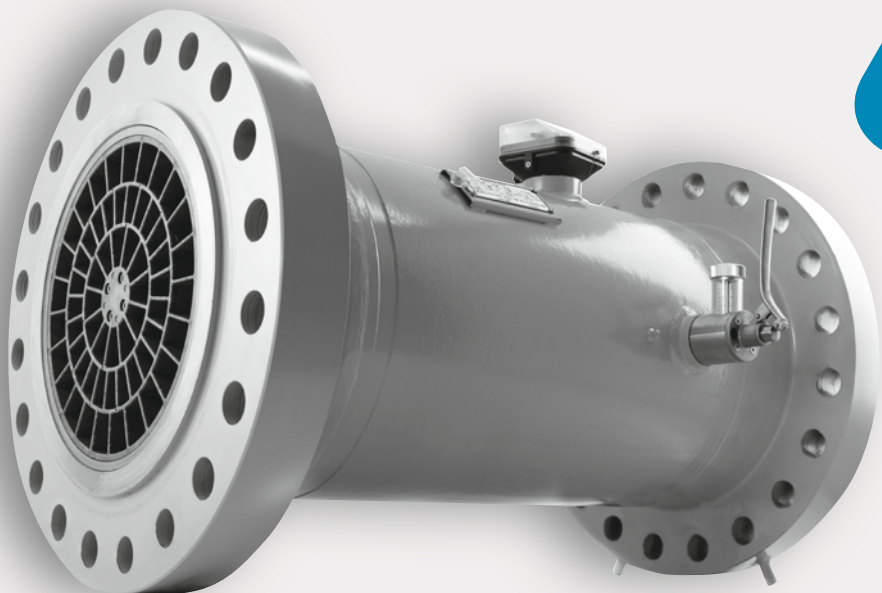


# DTM Turbine Gas Meters



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## 1. Purpose of this Manual

The instruction manual is dedicated to technical staff with adequate training and technical knowledge in the sector of gas distribution industry according to the applicable technical laws and requirements.

## 2. Basic safety instructions

### Requirements for the personnel

The operational staff must be qualified, instructed and authorized according the assigned functions. All service and maintenance work shall be performed exclusively by persons with proven expert knowledge, including knowledge of occupational safety and environmental protection.

Protective actions have to be defined according to the legal regulations.

### Designated use

The turbine meter DTM is designed for fiscal or in-plant volume measurement of combustible gases of the 1., 2. and 3. gas family (natural gas, town gas, propane, butane and others), purified and dried biogas as well as other inert, non-aggressive gases and non-explosive gases and gas mixtures. The permissible operating pressure range reaches up to 100 bar depends on the design of the meter, the temperature range runs from at least +5°C to +55°C.

The manufacturer is not liable for damage caused by unauthorised use or incorrect operation.

### Safety at work

Wear the required personal protective equipment according to national regulations.

### Operational safety

The device is permitted to operate in technical faultless and fail-safe condition only. Responsible is the operator.

### Product safety

This measuring device is designed, manufactured and tested according the state-of-art demands; meeting all legal requirements and complies with the EC directives. The manufacturer confirms the device specific EC Declaration of Conformity by attaching the CE label to the device.

### 3. Declaration

Declaration of Conformity (Annex A)

### 4. Use and Scope

The turbine meter DTM is designed for fiscal or in-plant metering of natural gas and approved according the European requirements of EN12261. The DTM turbine meter is suitable for installation in hazardous area of Category 2 (Zone 1 Ex II 2 G c IIC T4 X).

The DTM turbine meter is suitable for the following gases:

- Natural gas, town gas, propane, butane, ethylene, air, nitrogen, noble gases
- Hydrogen (with reduced measuring range)
- Conditioned biogas
- Further gases on request.

The DTM turbine meter cannot be used for: Oxygen, Acetylene and other aggressive gases as well as for explosive gases or gas mixtures. The meter should not be used in applications with the presence of strong pulsations. These conditions will result in an increased error and may significantly decrease the meter's lifetime.

### 5. Design of the DTM Turbine Gas Meter

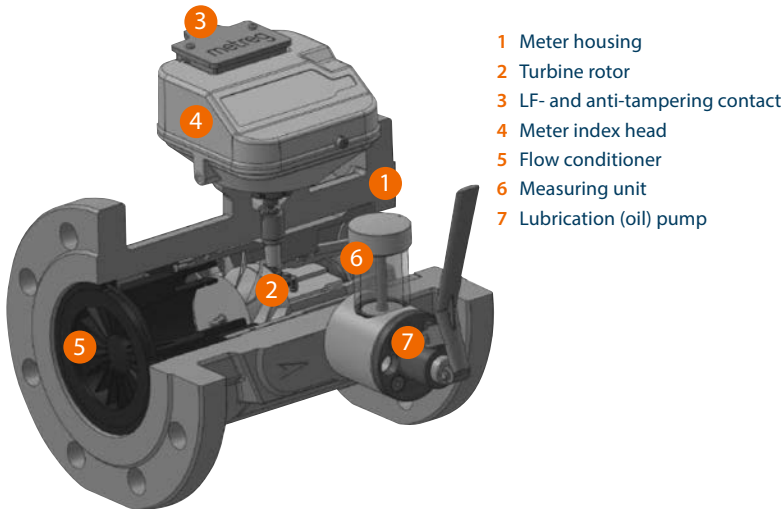


Fig. 1: Sectional view of DTM turbine gas meter

**Note:** In case of failure or damage: Repairs are only allowed to be done by authorized repair centers.

## 6. Technical Data

Meter type		DTM turbine meter	
<b>Approval:</b>	MID according DIN EN 12261:2002"Gas meters – Turbine gas meters";OIML R137-1&2: 2012„Gas meters“		
<b>Size:</b>	G 65 to G 4000DN 50 (2") to DN 150 (6")		
<b>Nominal diameter:</b>	PN 10 up to PN 100 and ANSI CLASS 150 up to ANSI CLASS 600		
<b>Pressure rating:</b>	20:1 or higher depending on the operation pressure		
<b>Rangeability:</b>			
<b>Temperature ranges:</b>			
• gas temperature	+5°C to +55°C		
• ambient temperature	+5°C to +55°C		
• storage temperature	+5°C to +55°C		
<b>Housing material:</b>	Aluminum, A105 forged Carbon Steel		
<b>Max. operation pressure:</b>	100 bar(g)		
<b>Accuracy:</b>	$Q_{\min} \leq Q < Q_t: \pm 2.0 \%$ $Q_t \leq Q \leq Q_{\max}: \pm 1.0 \%$		
	<b>Rangeability</b>	<b><math>Q_t</math></b>	
	1:10, 1:20	0,20 $Q_{\max}$	
	1:30	0,15 $Q_{\max}$	
	1:50	0,15 $Q_{\max}$	

Meter index	
Number of indexes:	1
Number of digit rollers per index:	8
Meter index head:	Composite (optional: Aluminum)
Protection class:	IP 65

Pulse generators	
<b>LF pulse generator:</b>	1 LF (reed contact), add. 1 LF as option
Contact type:	make contact (normally open)
Max. contact load:	10 W
Max. switching voltage:	50 VDC / 200 VDC
Max. switching current:	0.1 A / 0.5 A
Resistance:	100 $\Omega$ in series to reed contact
$f_{\max}$ :	500 Hz
<b>HF-pulse generator:</b>	1 HF (inductive sensor, acc. NAMUR specs)
Supply voltage:	8.2 VDC (internal resistance of 1k $\Omega$ )
Current consumption (sensor covered):	< 1 mA
Current consumption (sensor free):	> 2.1 mA
Max. switching frequency $f_{\max}$ :	1500 Hz
<b>Anti tampering contact:</b>	1 Reed contact
Contact type:	Normally closed
Max. contact load:	10 W
Max. switching voltage:	175 VDC
Max. switching current:	0.25 A
Resistance:	100 $\Omega$ in series to reed contact

## Rangeability and pulse weighting data

DN [mm]	G-type	Q <sub>min</sub> [m <sup>3</sup> /h]	Q <sub>max</sub> [m <sup>3</sup> /h]	HF <sup>*)</sup> [imp/m <sup>3</sup> ]	NF [imp/m <sup>3</sup> ]
50	65	10	100	105000	10
80	100	8	160	26000	1
80	160	13	250	26000	1
80	250	20	400	26000	1
100	160	13	250	13500	1
100	250	20	400	13500	1
100	400	32	650	13500	1
150	400	32	650	5000	1
150	650	50	1000	5000	1
150	1000	80	1600	5000	1
200	650	50	1000	2200	1
200	1000	80	1600	2200	1
200	1600	130	2500	2200	1
250	1000	80	1600	1900	0,1
250	1600	130	2500	1900	0,1
250	2500	200	4000	1900	0,1
300	1600	130	2500	1200	0,1
300	2500	200	4000	1200	0,1
300	4000	320	6500	1200	0,1

\*)The absolute number of the pulses depends on the meter size and the individual meter itself. The stated values are of typical size. Exact values determined by calibration of the meter are located on the nameplate.

## 7. Installation

### Recommendations and requirements for the installation of the DTM turbine meter:

- Straight Inlet pipe  $\geq 2DN$  and outlet pipe  $\geq 1DN$  is required for fiscal metering in case of low level perturbations. In case of high level perturbations a straight inlet pipe  $\geq 4DN$  is required.
- Avoid heavy vibrations and pulsations in the point of measurement. Installation of a suitable compensator can effectively damp down this kind of disturbance.
- Drastic changes in the gas flow as well as strongly pulsating flow will increase the measuring error. They arise for example during frequently switching on-off of solenoid valves. The pressure impulses by opening the valve very fast may damage the ball bearings of the turbine rotor and cause failure of the turbine meter.
- Filter (small mesh size) should be installed upstream of the meter to protect it from any contamination (suspended particles  $> 50 \mu m$ ) during start-up and operation.

- The gas should be dry. If condensate may be occur then the installation of a condensation trap upstream of the meter is recommended (in some filter types it is integrated).  
In this case choose
  - o Flow direction from top to bottom
  - o Do Not install the meter at the lowest point of the piping

**Attention:** The DTM turbine meter is not suitable for oxygen and other highly corrosive gases as well as for explosive gases and gas mixtures.

## 8. Mounting Position / Direction of Flow

There are two positions of installation possible for the turbine gas meter:  
Horizontal installation or vertical installation

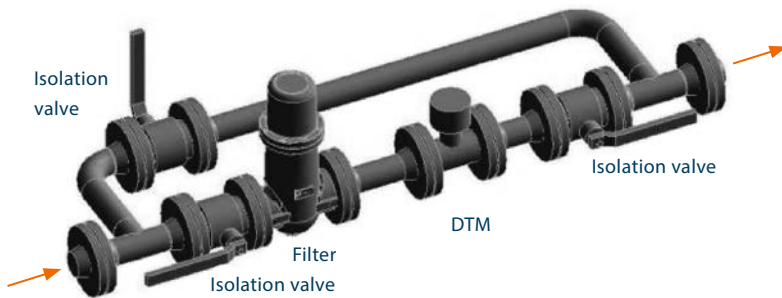


Figure 2: Typical horizontal installation of the DTM turbine gas meter (recommended)

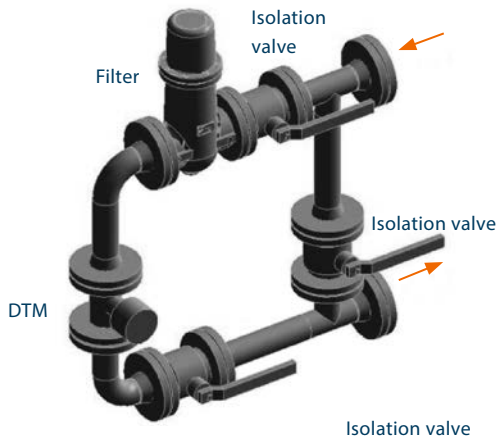


Figure 3: Typical vertical installation of the DTM turbine gas meter (only DN ≤ 150)

**Notice:** Preferably, the meter should be installed horizontally, with index head upward. Ensure that the gas flow is in the same direction as shown by the arrow at the meter housing.

## 9. Preliminary work

**Before the installation of the meter make sure that the following steps has been observed:**

1. Remove the plastic cover sheets at the inlet and outlet of the meter.
2. Inspect the meter for completeness (e. g. plugs, provided oil volume) and for absence of any transport damages.
3. Clean the flange surfaces (e. g. with petroleum).
4. Check by blowing into the meter that turbine rotor rotates easily and stops smoothly.
5. Prior to the meter's installation check that no contaminations, condensate, dirt and debris are in the pipe. Especially the cleaning of elbows in vertical installations is important to prevent damage of the meter by contaminations, dirt and debris passing. A cone-shaped start-up sieve may be installed for initial operation. After 4-6 weeks it should be removed to avoid perturbations of the flow profile with resulting decrease of the accuracy.
6. Make sure that there is no intrusion of the sealing element into the pipe during installation and operation (concentric mounting).
7. Check that in addition to the meter-length there is enough installation space for the two seals between inlet and outlet flanges.
8. The meter must be installed stress-free. Therefore in addition to point 7 observe strictly the proper alignment of the turbine meter's inlet to outlet axis with the connecting piping axis.

**Necessary equipment for the meter installation:**

1. Suitable and certificated gaskets:
  - Dimensions according DIN EN 1514-1 or DIN 2690
2. Screws according DIN ISO 4014 and ASME B 1.1
3. Nuts according DIN EN ISO 4032 and ASME B 1.1

DN [mm]	Pressure Class PN	Flanges according DIN EN 1092-1		
		Min. operating temperature of the screws and nuts	Hexagon screws and nuts	
				Strength class screws
25	40	- 10°C	5.6 / 8.8	5 / 8
50	40	- 10°C	5.6 / 8.8	5 / 8
80	40	- 10°C	5.6 / 8.8	5 / 8
100	40	- 10°C	5.6 / 8.8	5 / 8
150	40	- 10°C	5.6 / 8.8	5 / 8
200	40	- 10°C	5.6 / 8.8	5 / 8
250	40	- 10°C	5.6 / 8.8	5 / 8
300	40	- 10°C	5.6 / 8.8	5 / 8



DN [mm]	Pressure Class PN	Flanges according DIN EN 1092-1 Hexagon screws and nuts		
		Min. operating temperature of the screws and nuts	screw material	nut material
25	100	- 40°C	25CrMo4	25CrMo4
50	100	- 40°C	25CrMo4	25CrMo4
80	100	- 40°C	25CrMo4	25CrMo4
100	100	- 40°C	25CrMo4	25CrMo4
150	100	- 40°C	25CrMo4	25CrMo4
200	100	- 40°C	25CrMo4	25CrMo4
250	100	- 40°C	25CrMo4	25CrMo4
300	100	- 40°C	25CrMo4	25CrMo4

DN [mm]	Pressure ANSI Class	Flanges according ANSI B 16.5 Stud bolts with continuous thread and nuts		
		Operating conditions of the screws and nuts	Strength class screws	Strength class nuts
25	600	- 25°C	ASTM A 193 Grade B7	ASTM A 194 Grade 2H
50	600	- 25°C	ASTM A 193 Grade B7	ASTM A 194 Grade 2H
80	600	- 25°C	ASTM A 193 Grade B7	ASTM A 194 Grade 2H
100	600	- 25°C	ASTM A 193 Grade B7	ASTM A 194 Grade 2H
150	600	- 25°C	ASTM A 193 Grade B7	ASTM A 194 Grade 2H
200	600	- 25°C	ASTM A 193 Grade B7	ASTM A 194 Grade 2H
250	600	- 25°C	ASTM A 193 Grade B7	ASTM A 194 Grade 2H
300	600	- 25°C	ASTM A 193 Grade B7	ASTM A 194 Grade 2H

### During Installation of the meter itself:

1. Make sure that the meter is mounted in the right flow direction.
2. Make sure that the meter is installed gas-tight.
3. Make sure that the meter is installed stress-free.
  - In horizontal pipes install the meter with the index head upright.  
In case of vertical installations make sure that the oil pump is in the right position (if the meter is equipped with an oil pump).
  - Connecting screws and nuts must be tightened crosswise.
  - For connecting the pressure test point please refer to chapter 15.
  - For connecting the temperature test point please refer to chapter 16.

A protective cover is recommended for outdoor installation especially when the meter is mounted together with a volume corrector.

### After installation of the meter:

**Welding of piping and flanges nearby the turbine meter is not allowed.**

## 10. Lubrication and Maintenance of the DTM turbine meter

1. Turbine meters with permanent lubricated ball bearings (no oil pump) are maintenance-free.
2. Turbine meters with an oil pump need periodic lubrication.  
The initial lubrication procedure is:
  - a. Use only oil recommended and supplied by Delta Gas Mobin Group.  
One set of oil for commissioning is delivered with the meter.
  - b. Specified oil: Shell Morlina S2 BL 5 or Shell Morlina S2 BL 10.
  - c. Fill in the oil before commissioning the meter and after the correct installation of the meter described in chapter 7 and 8.
  - d. Fill an adequate quantity of oil in the supply tank, and then horizontally pull the hand lever dependent on the size of the meter:  
DN 50: 3 strokes  
DN 80: 5 strokes  
DN 100: 5 strokes  
DN 150: 9 strokes  
DN 200: 18 strokes  
DN 250: 28 strokes  
DN 300: 28 strokes
  - e. When the lubrication procedure is finished, close the cover of the supply tank to avoid any dirt or impurities to enter the lubrication system.

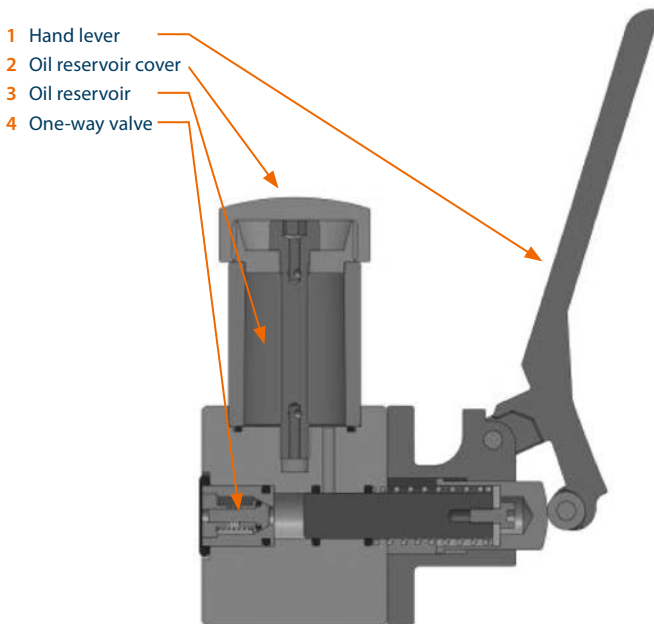


Figure 4: Sectional drawing of the oil pump

## 11. Maintenance of DTM turbine gas meters

1. Turbine meters without oil pump do not require special services. They are maintenance-free.
2. Turbine meters with an oil pump require periodically maintenance:
  - 2.1. Lubrication every 2 to 3 months if the gas is clean and filtered upstream the meter:

DN 50: 2 strokes	DN 80: 4 strokes
DN 100: 4 strokes	DN 150: 7 strokes
DN 200: 9 strokes	DN 250: 14 strokes
DN 300: 14 strokes	

For higher pressures it is recommended to choose the lubrication intervals shorter, e. g. as shown in point 2.2
  - 2.2. If the gas is carrying dust and/or moisture then the lubrication has to be done at least every month.
3. A repair of the turbine meter has only to be done by competent and authorized personnel like the Service Engineers from Delta Gas Mobin Group.
4. Don't break any seals. If only one of the seals is damaged or broken the meter cannot be used for custody transfer measurements of natural gas according MID (2004 / 22 / EG).

## 12. Commissioning of the DTM turbine meter

1. The work has to be done under survey of an appointed person who coordinates and controls the activities.
2. Open slowly the upstream valve (fig. 2 and fig. 3) to pressurize the pipe until operation pressure is achieved.
3. The rate of pressure increase shall not exceed 350 mbar/s.
4. At operation pressure level open the upstream valve completely.
5. Slightly open the downstream valve (fig. 21 and fig. 3).
6. At operation pressure level the downstream valve can be opened completely.
7. Perform a leakage test on the meter at operation pressure.
8. Remove the startup sieve after 4 to 6 weeks (if installed).

## 13. Decommissioning procedure of the DTM turbine meter

1. The work has to be done under survey of an appointed person who coordinates and controls the activities.
2. Take care of appropriate ventilation of the installation room.
3. Depressurize to atmosphere only to areas with no active ignition sources.
4. Reduce the operating pressure slowly (e. g. < 350 mbar/s).
5. Open the bolts and nuts of the flanges only if the pipe is completely depressurized.
6. Carefully take out the meter from the pipe connection.

## 14. Pulse Generators

Two low frequency (LF) pulse generators are plugged to the meter index head in standard delivery. A third low frequency (LF) pulse generator is optional. The function of these three LF-pulsers is:

- 1 LF-pulsers for flow measurement
- 1 additional LF-pulsers for flow measurement (option)
- 1 LF-pulsers as anti tampering contact.



Figure 5: The LF assembly:



Figure 6: Installed LF assembly with the DTM turbine meter

As an option up to two high frequency (HF) pulse generators can be installed onto the meter. The function of these two HF pulsers is the determination of the actual gas flow in high resolution. The HF-pulsers follow NAMUR specification and are typically connected to the inputs of flow computers or appropriately equipped volume correctors. For the connection use shielded cable.

The blades of the turbine rotor are scanned by the high-frequency sensor. Each blade passing the HF-sensor creates a pulse. Figure 7 shows a DTM turbine meter with fitted HF-sensor.



Figure 7: DTM turbine meter fitted with HF-sensor

The connection of the LF pulse transmitter unit is different depending on whether the meter head is made of composite or aluminum.

#### Index head out of composite:

The LF-pulser unit comes standard with three meter cable.

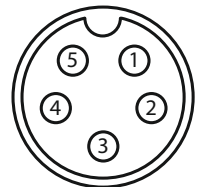
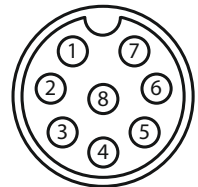
The cable configuration is as follows:

- 1 LF-pulser for flow measurement
  - Black (-)
  - Red (+)
  - Blue (+)
- 2 LF-pulser for flow measurement (option)
  - Black (-)
  - Red (+)
  - Blue (+)
- 1 LF-pulser as anti tampering contact
  - Yellow (-)
  - White (+)

#### Index head out of aluminium:

The connection of the LF-pulser unit is designed via a plug connection:

- 1 LF-pulser for flow measurement
  - Pin 5 – Blue (+)
  - Pin 6 – Grey (-)
  - Pin 7 – Pink (+)
- 2 LF-pulser for flow measurement (option)
  - Pin 5 – Blue (+)
  - Pin 6 – Grey (-)
  - Pin 7 – Pink (+)
- 1 LF-pulser as anti tampering contact
  - Pin 1 – Yellow (-)
  - Pin 2 – White (+)



The connection of the HF-pulser (option) is designed via a plug connection:

- Pin 4 – Red (+)
- Pin 3 – Black (-)

#### Warning:

All pulse generators are intrinsically safe. If the meter is installed in hazardous area they should be connected to external devices like electronic volume correctors (EVC's) only via intrinsically safe circuits.

## 15. Pressure Measuring Point

There is a pressure test point within the DTM turbine meter as shown in figure 8. The pressure tap is marked with "p<sub>m</sub>". The pressure test point is designed for a connection of steel tubing with a diameter of 6 mm.

The steel tubing should be according DIN EN 10305-1 and not made of stainless steel or nonmetallic materials like plastics. The pipe connection or fitting should be in accordance to DIN 2353.

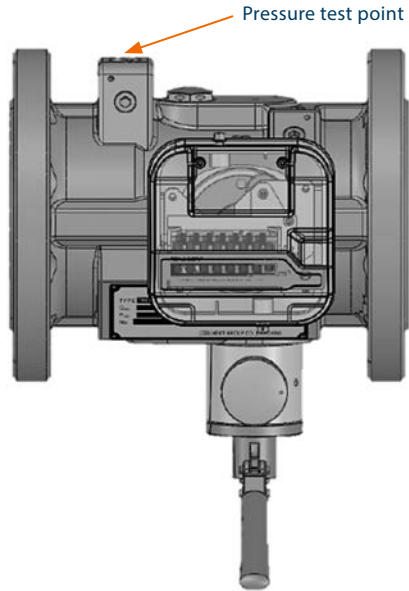


Figure 8: Location of the pressure test point

## 16. Temperature Measuring Point

There is one temperature test point as shown in figure 9. The temperature tap is marked with "t<sub>m</sub>". The temperature tap is locked with a screw (G 1/4"). In case of using the temperature tap remove the plug screw and replace it by a temperature pocket with an integral thread of G 1/4".

The temperature pocket is designed for a temperature sensor with a diameter of 6 mm.

**Notice:** If the temperature tap of the turbine meter is not used the temperature measurement point must be located 1-3 DN (but no more than 600 mm) downstream of the meter.

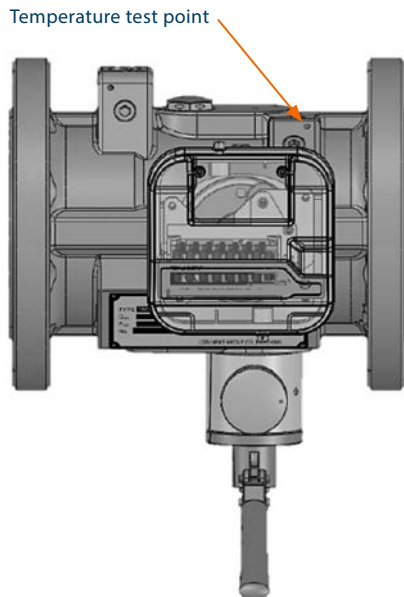


Figure 9: Location of the temperature test point

## 17. Cleaning

For cleaning the meter from dust and dirt please do not use any solvents. It is suitable to use a damp cloth only for that purpose.

## 18. Transport and Storage

The turbine meter and accessories shall be stored in the original packaging. Secure the measuring device from rotating or slipping. Be careful during loading and transportation to or from the measuring point.

**Some requirements for transportation and storage of the meter are:**

- The meter is on both flanges covered with a protection cover.
- For transportation the oil pump (if installed) is not filled with oil.
- Prevent from rain and moisture.
- Prevent from mechanical vibrations or impacts.
- Unpack and check:
  - The packing list to account for all items received.
  - Inspect each item for damage.

## Your contacts:

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