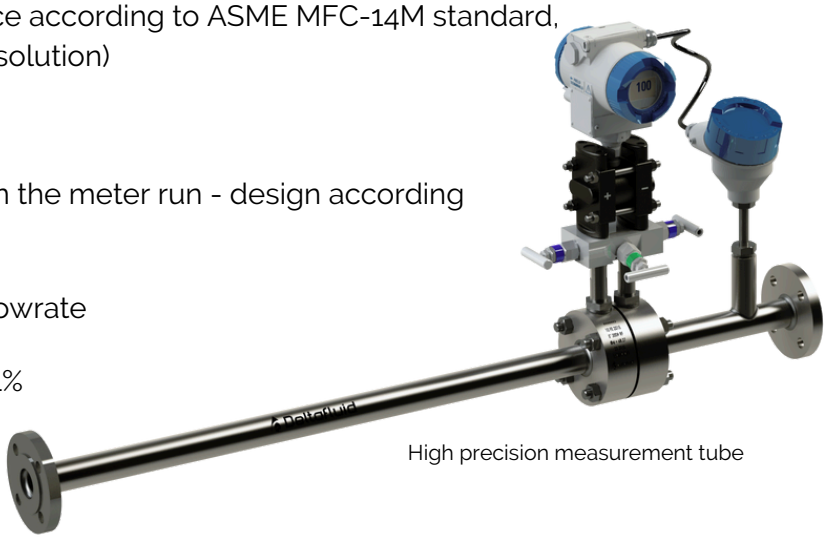
Datasheet

HIGH PRECISION MEASUREMENT TUBE, DeltaTMHP

FLOW MEASUREMENT

KEY DATA

- Design of the orifice plate integrated in the meter run according to ISO5167-1 & ISO5167-2 or ISO/TR 15377 or ASME MFC-3M or ASME MFC-14M standards
- Recommended for gas, liquid or steam
- Recommended internal pipe diameter from 15 mm to 300 mm (below, choose an integrated orifice according to ASME MFC-14M standard, beyond, choose an unassembled solution)
- Reynolds number from 80 to 10^8
- Possibility of integrating a nozzle in the meter run - design according to the ISO 5167-3 standard
- Accuracy : from 0,5% of the max flowrate
- Repeatability of measurement : 0,1%



High precision measurement tube

BENEFITS

- Complete and flexible measuring section for easy on-site installation and for a precise flow measurement - delivered assembled ready to install
- Integrated temperature and pressure adjustment to achieve very precise flow measurement (especially for a compressible fluid like gas)
- High measurement accuracy thanks to the adjustment of all components during manufacturing
- No need of calibration
- Cost-effective measurement system, very long life time

Deltafluid
MEASURING UP TO YOUR EXPECTATIONS

The high precision measurement tube is a one-piece assembly consisting of an orifice plate (or nozzle) mounted between flanges, with tie rods, gaskets and lengths of upstream and downstream piping. It also includes the pressure taps, the manifold and the differential pressure transmitter.

In case of variation of the fluid pressure and temperature, it is appropriate to offer a **multivariable pressure transmitter** and a **temperature probe** for correcting the density of the fluid and calculating the corresponding mass flow. This will ensure optimal precision.
If this is not the case, a differential pressure transmitter fits well.

The assembly is carried out in our workshops: **control of the entire measurement loop** (from the primary element to the transmitter) and **compliance in all respects with the criteria of the standard** (in particular with regard to the roughness of the upstream and downstream tubes, the centering of the primary element, the straight lengths, etc.) in order to **avoid measurement inaccuracies as much as possible**. All components are independently checked and are then optimally adjusted and assembled together, achieving high measuring accuracy (1) .

The high precision measurement tube is recommended for internal pipe diameters D from 15 mm to approximately 300 mm.
Beyond that, it is more difficult to carry and install this one-piece assembly (the lengths of the upstream and downstream pipes increase with this diameter D).
However, its manufacturing and assembly are still possible.
Below, choose an integrated orifice according to ASME MFC-14M (2).

(1) For more details on measurement accuracy, see page 5.

(2) An integrated orifice is a complete measuring element with orifice plate, gaskets, tie rods and special flanges (for direct mounting of the manifold and differential pressure transmitter) including upstream and downstream straight lengths.
Suitable for internal pipe diameters ≤ 40 mm. Standard: ASME MFC-14M. Consult us

STANDARDS

- ISO 5167-1 & ISO 5167-2 for the orifice plate or ISO 5167-3 for the nozzle
- ISO/TR 15377
- ASME MFC-3M
- ASME MFC-14M
- AGA3 / API MPMS 14.3

TECHNICAL CHARACTERISTICS

- Fluid temperature [3] : cryogenic to +800°C
- Fluid type : gas, steam, monophasic liquid
- Primary element materials [4] : carbon steel, stainless steel, monel, hastelloy, inconel, duplex, super duplex, titanium, tantalum, PVC, PTFE...
- Piping materials : carbon steel, stainless steel, monel, hastelloy, inconel, duplex, super duplex, titanium, tantalum, PVC, PTFE...
- Accuracy : from 0,5% of the max flowrate
- Maximum operating pressure : limited by the flange rating
- Connection of the measurement section to the pipe : connection with flanges recommended. After welding the flanges on the measurement section, honing of the upstream and downstream tubes is carried out to comply with the roughness and circularity criteria of the standard.

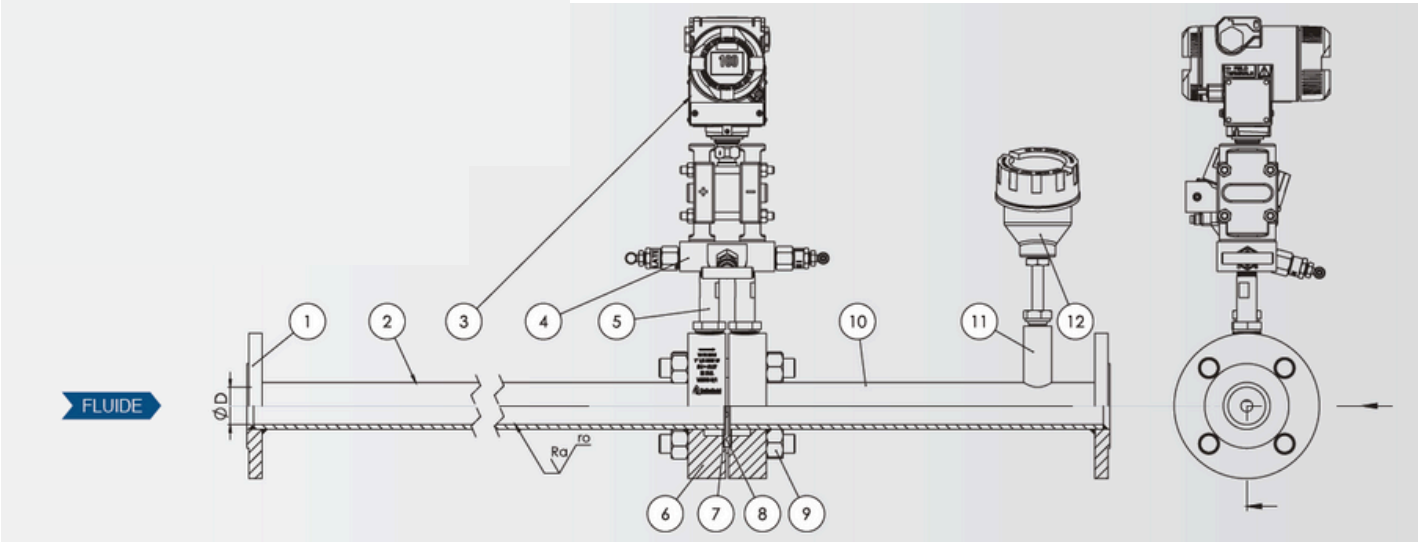
MOUNTING OF THE PRIMARY ELEMENT

- Mounting between flanges or inserted between 2 carrier rings with annular slots - monobloc version available as well (see page 4)
- Flange types : ISO PN 2,5 to PN 420, ASME 150# to 2500#, API flanges
- Connection between straight sections according to the standard:
  Variable upstream and downstream straight lengths according to β (β=d/D) and according to the upstream fittings - see upstream straight lengths table on page 6
  These lengths can be reduced with an additional uncertainty on the discharge coefficient of 0.5% - see page 6
- Gasket types : flat gasket (spiral wound, graphite, PTFE) or RTJ (soft iron, inox, monel...)

(3) No temperature restriction with remote-mounted transmitter, otherwise +125°C max

(4) For an agressive fluid, applying a specific coating on the part in contact with the fluid can increase the product lifetime

DRAWING

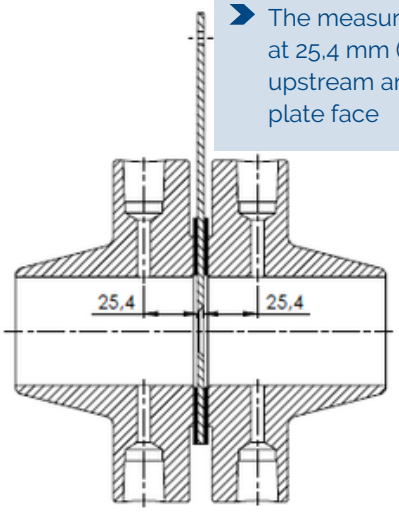


1 Flange
2 Upstream tube
3 Multivariable pressure transmitter
4 Manifold
5 Pressure taps
6 Carrier rings with annular slots (5)
7 Gasket
8 Orifice plate (6)
9 Boltings
10 Downstream tube
11 Fitting
12 Temperature sensor

PRESSURE TAPS TYPES

- flange tap (7) (or 1"/1")
  with orifice flanges
  ASME standard only from 300#

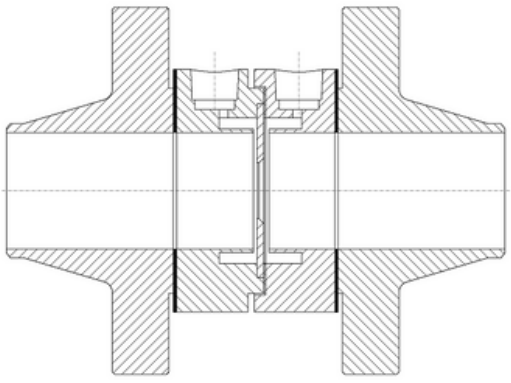
The measurement is executed at 25,4 mm (1 inch) from the upstream and downstream plate face



- Easily interchangeable measuring element
- Plate / flange materials can be different

- corner tap (7) (or 0/0)
  with annular slots

The measurement is executed at the upstream and downstream plate edge



- Assembly used for better accuracy : averaged upstream and downstream pressure taps
- Mounting between simple flanges (welding neck, slip-on...)
- Flange / annular slots materials can be different

- illustrations with a RF orifice plate - the same types of pressure taps also exst in RTJ . For a nozzle assembly, always consider corner pressure taps.

(5) Mounting also possible between orifice flanges or in monobloc version - see here under
(6) All types of orifice plates as well as nozzles can be mounted in a metre run
(7) A flange tap (1"/1") or corner tap (0/0) monobloc version is also possible

REQUIREMENTS FOR CIRCULARITY AND ROUGHNESS VALUES according to ISO 5167

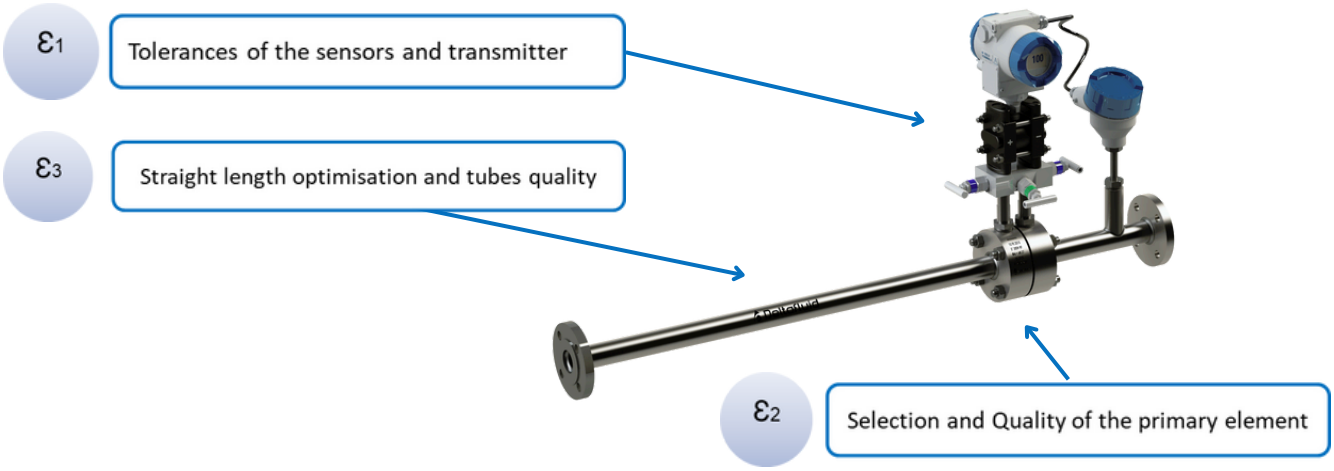
- Upstream pipe roughness: Ra roughness values specified in the standard (variable according to β and ReD) to be respected over a length of 10D upstream of the primary element
- Upstream pipe circularity: Value of the internal diameter D must be ≤ D ± 0.3% D to be respected over a length of 2D upstream of the primary element For a length between 2D and 10D, no additional uncertainty of the discharge coefficient if the maximum circularity tolerance remains less than ± 0.3% D
- Downstream pipe circularity: Value of the internal diameter D must be ≤ D ± 3% D to be respected over a length of 2D downstream of the primary element (measured from the upstream face of the primary element)

MEASUREMENT ACCURACY

- The overall uncertainty of the measurement device is assessed with the following formula:

$$\varepsilon_1 + \varepsilon_2 + \varepsilon_3 = \varepsilon$$

ε1 uncertainty is related to the installation requirements : optimized upstream and downstream straight lengths
ε2 uncertainty is related to the primary element and pipes quality: roughness, circularity of the pipe sections, centering and flatness of the orifice plate according to standards
ε3 uncertainty is related to the primary element type, to the temperature and pressure sensors quality, to the differential pressure transmitter, to their calibration and possible drifts



- Control of all the components of this measurement device, in accordance with the standards requirements, selection of reliable and high-quality products, close manufacturing control during assembly in order to offer a device intended to achieve a high accuracy measurement around 0,5%.

STRAIGHT LENGTHS

- Required straight lengths between orifice plate and fittings - without flow conditioner

- Values expressed as multiple of pipe internal diameter, D

	UPSTREAM SIDE OF ORIFICE PLATE																				Downstream side of orifice plate	
d/D	Single 90° bend or two 90° bends in any plane S>30S		Two 90° bends in the same plane 30D≥S≥10D		Two 90° bends in the same plane 10D≥S		Two 90° bends in perpendicular planes 30D≥S≥5D		Two 90° bends in perpendicular planes 5D>S		Single 90° tee with or without extension		Single 45° bend or two 45° bends in the same plane S≥22D		Concentric reducer 2D to D over a length of 1,5D to 3D		Concentric expander 0,5D to D over a length of D to 2D		Full bore ball valve or gate valve fully open		Abrupt symmetric reduction		Thermometer pocket or well of diameter ≤ 0,03D		ngs (columns 2 to 11) and densitometer pocket	
1	2		3		4		5		6		7		8		9		10		11		12		13			
≤0,2	6	3	10		10		19	18	34	17	3		7		5		6		12	6	30	15	5	3	4	2
0,40	16	3	10		10		44	18	50	25	9	3	30	9	5		12	8	12	6	30	15	5	3	6	3
0,50	22	9	18	10	22	10	44	18	75	34	19	9	30	18	8	5	20	9	12	6	30	15	5	3	6	3
0,60	42	13	30	18	42	18	44	18	65	25	29	18	30	18	9	5	26	11	14	7	30	15	5	3	7	3,5
0,67	44	20	44	18	44	20	44	20	60	18	36	18	44	18	12	6	28	14	18	9	30	15	5	3	7	3,5
0,75	44	20	44	18	44	22	44	20	75	18	44	18	44	18	13	8	36	18	24	12	30	15	5	3	8	4

NNota :
The minimum straight lengths required are the lengths between various fittings located upstream or downstream of the orifice plate and the orifice plate itself.
Straight lengths shall be measured from the downstream end of the curved / conical portion of the nearest bend or tee or reducer or expander to the upstream face of the orifice plate.
In the columns, left values give lengths corresponding to zero additional uncertainty (see ISO 5167-1 standard)
Right values give lengths corresponding to 0,5% additional uncertainty (see ISO 5167-1 standard). Empty cells when no available data.
S is the distance between two fittings..l

ACCESSORIES

For flow measurement, we offer a full range of accessories for assembly with high precision measurement tube.

- Transmitter

Differential pressure transmitter, multivariable transmitter

- Manifold

2-way / 3-way / 5-way manifold with or without direct mounting

- Condensation pot

- Valve

- Siphon

- Fittings

- Flow straightener or conditioner

- Temperature sensor and thermowell

FURTHER INFORMATION

All information on the mounting of the high precision measurement tubes (and their accessories) such as :

- pressure taps orientation
- mounting of the differential pressure transmitter
- flange tightening

can be found on the IOM notice "User guide - Installation, operation and maintenance manual" ref DTF-SMQ-P3-IOM-021 provided on request upon the delivery of components.

ITEM CODES

- High precision measurement tube: DTMHP-DN-PN-Face type-Material

DTMHP	ND (8)	NP	Face type	Material
Nominal diameter - ASME	1/2'' to 12''	150# to 2500#	RF RTJ SEM (9) SEF (9) DEM (9) DEF (9)	304L 316L Others
OU				
Nominal diameter - ISO	ND15 to 300	PN2,5 to 400		

- Examples high precision measurement tube codes:

  - DTMHP-3-600-RF-316
  - DTMHP-DN25-PN64-RF-304

(8) For diameters outside this range, there are solutions. See explanation on page 2.

(9) Specify large or small male/female face if flanges according to ASME B16-5 standard.

Deltafluid
MEASURING UP TO YOUR EXPECTATIONS

Chemin Les Augas – RD817
64170 LACQ
FRANCE

delta64@deltafluid.fr

+33 (0)5 59 30 85 20

www.deltafluid.fr

DELTAFLUID